Corecon User Guide Manual

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1. Safety

1) Introduction

This section describes rules and procedures to follow when controlling robots via Corecon.

For safety requirements related to robot operation, please refer to the document inside the product.

2) Safety Standards

Standards	Description
EN ISO 12100	Safety of machinery - General principles for design – Risk assessment and risk reduction
EN ISO 13849-1	Safety of machinery, safety related parts of control systems - Part 1: General principles for design
EN ISO 13850	Safety of machinery - Emergency stop - Principles for design
EN ISO 10218-1	Robots for industrial environments - Safety requirements –Part 1 Robot
EN ISO 9787	Robots and robotic devices -- Coordinate systems and motion nomenclatures
EN ISO 9283	Manipulating industrial robots, performance criteria, and related test methods
EN ISO 13732-1	Ergonomics of the thermal environment - Part 1
EN IEC 61000-6-4	EMC, Generic emission
EN IEC 61000-6-2	EMC, Generic immunity
EN IEC 60204-1	Safety of machinery - Electrical equipment of machines – Part 1 General requirements
IEC 60529	Degrees of protection provided by enclosures (IP code)

Corecon system is designed to fulfill requirements of various ISO standards.

3) Safety Signs

Safety signs used when controlling robots are listed below:

Signs	Name	Description
	Danger	Disregarding instructions written in the manual may cause lethal damage to either humans or the product.
	Warning	Disregarding instructions written in the manual may cause serious damage to either humans or the product.
	Electric Shock Hazard	Notifies a caution of serious damage due to electric shock

4) Danger

While operating robots, there can be unexpected or irregular movements observed. These robots are operating with massive forces, so such operations may cause harmful damages to workers and enviroments.

Before operating robots, you must check whether all the emergency devices

(ex. fixtures, emergency lights, emergency stop switch) and safety environments are settled.

5) Emergency Stop Switch

Priority of the emergency stop is higher than any other robot controlling commands.

- All the controls are stopped in order to prevent dangerous operations and the power of robot Servo drive is turned off.
- Only effective until releasing emergency stop and can be reconfigured through manual operation.
- Emergency stop notifies that all the powers to the robot expect manual brake circuit will be blocked.
- The system will be recovered only after reconfiguring emergency stop button and proceeding recovering process by clicking Motors Servo On button consecutively.

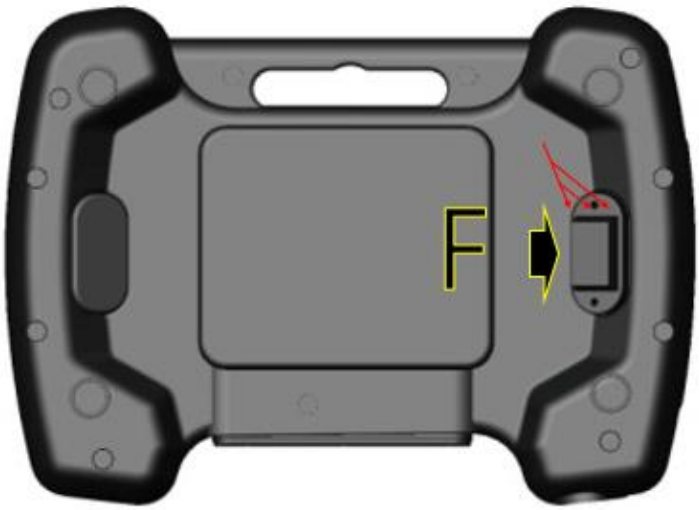
Basically, Corecon provides emergency stop button on the top right corner of TP. Also, external buttons can be added as emergency stop buttons via emergency stop I/O provided by Corecon system.

5-1) How to recover from emergency stop

There's latching feature provided to release emergency stop status. While pressing emergency stop switch in DTP7, you must spin the switch in order to release the status. Prior to recovery, you must proceed steps below.

- Check if current environment is no longer in danger.
- Spin the emergency stop switch to release latching feature
- Turn on the motor on button to activate power of the Servo motor

6) Enable switch



In order to activate the platform, you need to press a swich which has two levels. Level 0 and 2 are specified as inactivated stage while level 1 informs activated stage. You must push the switch really hard to stop the platform. Thus, when dangerous tasks are performed, you can stop the robot immediately.

7) How to extinguish a fire

- How to prevent

In order to prevent a fire, any flammable objects should not be around robots and controllers. Once a fire occurs, you must concern your and others' safety first before extinguishing a fire. If injury occurs, then it must be handled primarily.

- Selecting a fire extinguisher

Only CO2 fire extinguishers should be used to handle a fire. Do not use water or foam fire extinguishers.

8) Safe operation

Robots are extremely heavy and massive forces are required to move them. Even if moving directions are expected, the directions may change due to external signals. Therefore, safety area must be secured and safety rules must be obeyed before any operations.

8-1) Safety rules for workers

There are several rules which workers must follow in order to operate robots safely.

- If robots are operated manually, it must be done in a secured area
- If workers go inside the secured area, then they must carry jogging tools to control robot directly
- Be aware of contacting surfaces of materials or robots - after hours of operation, contacting them may cause burn injuries
- Be aware of grippers and objects stuck on grippers. Once released, the products may fall and it may cause injuries to humans or tools. Grippers are very powerful, so improper operations may cause severe damages.
- Be aware of system with oil or air pressure and parts where electric current flows. Even after power had been turned off, remained energy from those sources can be dangerous.

8-2) Separated Jogging Device

In order to prevent using separated devices like teaching pendant when stopping robots in harzardous condition, you must isolate safety device with distance from either robot cell or controller.

8-3) Connecting Customized Jogging Device

When customized cable is utilized, you must check whether emergency stop button operates properly prior to robot operation.

8-4) Safety in manual control

In order to control robots in manual mode, you must set activate button to be level 1. You may test your written code in manual mode.

- Speed in manual mode

  The maximum speed in manual mode is configured to be slower than the maximum speed which a motor can operate. It is designed such a way to prevent damages to humans and environments due to unexpected movements.

- Enable switch

  You must press the enable switch until it turns on as level 1 in order to utilize manual mode and check feature. Enable switch has two separate buttons and you may either release it or press harder to stop operations. Therefore, it supports immediate response to robotic movements.

- Check

  Check is a feature testing whether written code works properly. This feature operates with activate button on level 1. This feature can be operated via arrow buttons on left keypad. You may immediately stop the robot by using activate button when robot moves on unexpected directions.

8-5) Safety in automatic mode

- Robots must operate without any user interruptions on automatic mode. Therefore, activate feature is disabled.
- Emerge stop button is used to stop robots in automatic mode

9) How to manage a controller

The controller is a portable device with sensitive electronic device. To avoid damages done by incorrect operation, you must follow the rules below:

9-1) How to maintain and clean the controller

- You should manage the controller carefully. Do not drop or damage TP with external impacts.
- If TP is exposed to any damages, then you must always check whether safety features like enable switch work properly.
- You must keep the controller in safe shelter when it is not used.
- Please keep the controller safely so that no one can ...
- Do not touch screen with sharp object like drivers and pens.
- Clean the touch screen regularly. Malfunctions can be occurred through dusts or foreign substance on the screen.
- Any solvents, scouring agents or rough loofahs to wash TP. Instead, use soft fabric with neutral detergent.
- Close protect stopper on USB port when USB is not connected. Malfunctions may occur through exposing port with dust or foreign substances.

9-2) Wires and power supply

- Please turn of the power supply before opening the entrance area of pendant cable. Disobeying
- Be aware of damaging cables by pressing them with other heavy objects
- Do not set the cables on any places with sharp edges which may strip cable skins

2. Jogging

Jogging is defined as manual control of robots. Robot moves linearly on jogging mode.

1) Definition

Jogging only operates on manual mode. You may use left keypad of pendants to operate robots. (This feature is disabled while program is running.)

2) Major steps to activate jogging

– Caution sign for users

You must check whether workers or obstacles are around the robot
Accidents may occur due to unexpected movement.

- Turn on the power of Servo motor.
- If any programs are running, halt the running robot.
- Shift system to be in manual(Teach) mode.
- Press the enable switch to be level 1. Enable switch is a switch located on the back of the pendant and there are two levels of configuration. Therefore, if you press button again on level 1 status, it will shift its status to be level 2 which is considered as deactivate jogging mode.
- Use right keypad of TP to manipulate the robot.

3) Operation Mode and Coordinates System Information

Motions of robot are determined through selected operation mode and coordinates system. Basically jogging allows robot to operate linearly.

If additional axis is installed on robot, then jogging may operate within this axis.

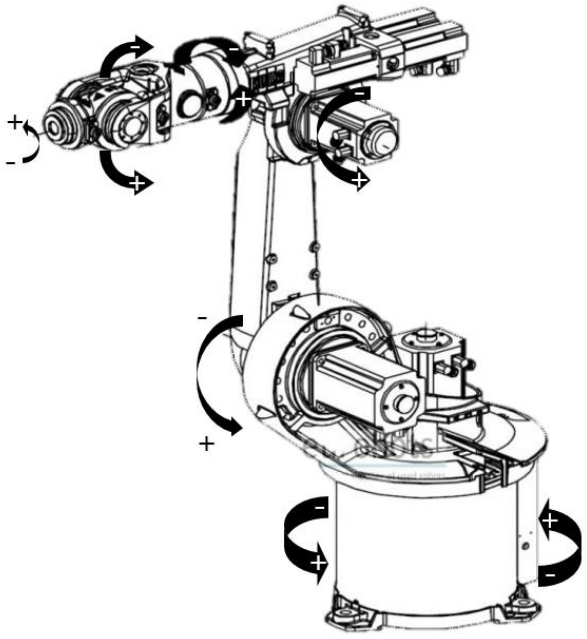
- Joint coordinates system : controls connected Servo motors individually. Easy to form shapes that user wants on jogging.
- Base coordinates system : Cartesian coordinates system settled on the center of first Servo motor of the robot. End point of the tool moves with this coordinates as a base on jogging
- Tool coordinates system : Cartesian coordinates system settled on the end point of the tool. The robot moves within this coordinates system on jogging.

If required, tool and base coordinates systems can be moved to different position.

4) Jogging Coordinates System

Coordinates system defines space by settling axis based on fixed origin. Therefore, the operating space of robot can be estimated via coordinates system. This section will demonstrate coordinates systems used in a robot system.

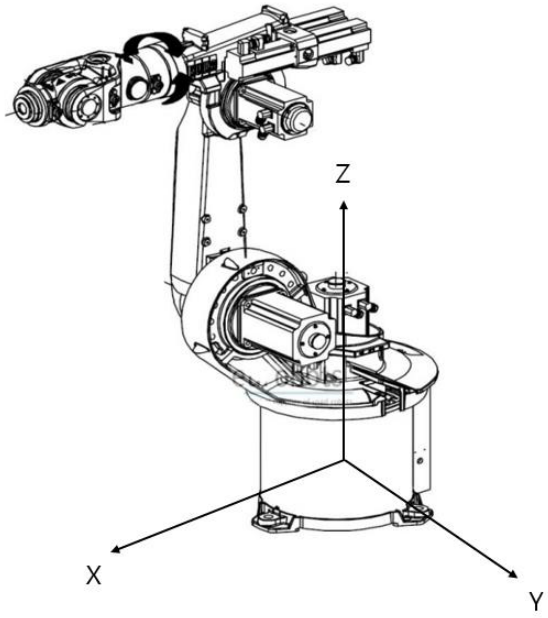
- Joint 좌표계 (Joint coordinates system)



Joint coordinates system is not designed to have just a single coordinates system. Rather each coordinates system controls one Servo motor. This is useful when testing each motor's direction. Also, this feature helps taking position so this coordinates system facilitates early settings.

처음 로봇 설치를 할 경우 조깅모드를 이용하여 로봇의 구동 향을 설정하며, 제로점을 찾을 수 있습니다.

- Base coordinates system

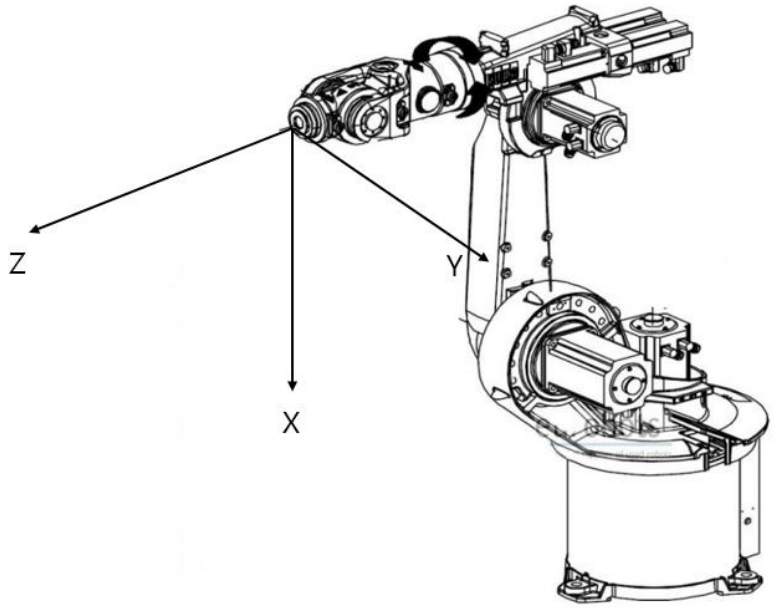


Base coordinates system takes its origin as the center of the first Servo motor.

This coordinates system is useful after recognizing TCP coordinates.

On basic configuration, button 1, 2 and 3 on keypad will make the robot to move on x-axis, y-axis and z-axis respectively.

- Tool coordinates system



The origin point of tool coordinates system is located at the center of the end of the tool. Locations and directions of the tool can be defined by using this coordinates system. The name of tool coordinates system can be shorten as TCPF(Tool Center Point Frame) and its center can be shorten as TCP(Tool Center Point)

If the tool and its coordinates system are modified, coordinates of the robot is shifted so that new TCP can be reached to the target.

Every axis of the robot has predefined tool coordinates system named tool0. You may define one or more new tool coordinates system offsets from tool0.

Tool coordinates system is useful when you have to move tool's position while its direction is remained the same during jogging mode.

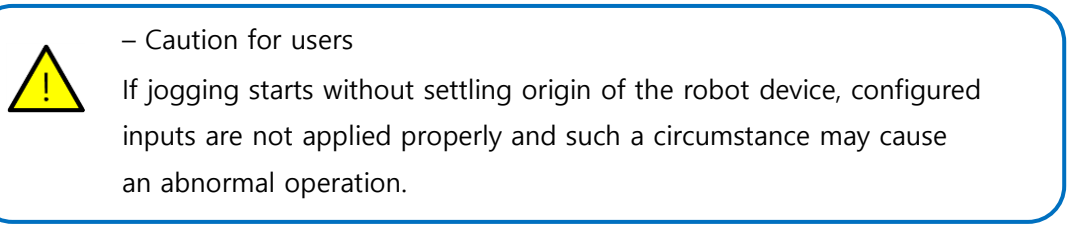
5) Keypads based on coordinates system

coordinates system	Keypad (On right side)	Description
Joint	(-) (+) : Rotates Joint 1 (-) (+) : Rotates Joint 2 (-) (+) : Rotates Joint 3 (-) (+) : Rotates Joint 4 (-) (+) : Rotates Joint 5 (-) (+) : Rotates Joint 6	Drives each Servo motor independently. You may check moving direction is appropriate.
Base	(-) (+) : Moves in x-axis (-) (+) : Moves in y-axis (-) (+) : Moves in z-axis (-) (+) : Rotates in x-axis (-) (+) : Rotates in y-axis (-) (+) : Rotates in z-axis	Moves and rotates in x, y, z direction based on created coordinates system on the first Servo motor.
Tool	(-) (+) : Moves in x-axis (-) (+) : Moves in y-axis (-) (+) : Moves in z-axis (-) (+) : Rotates in x-axis (-) (+) : Rotates in y-axis (-) (+) : Rotates in z-axis	. Moves and rotates in x, y, z direction based on created coordinates system on the tool

6) Limitations in Jogging Mode

There are limitations you must consider before jogging.

- Jogging on unadjusted device



  Please set the origin first for basic configured inputs before jogging.

- Jogging without setting loads on axis

  If loads on robot axis are not configured properly, errors may occur due to overload or shaking on jogging. Please configure input for loads correctly.

7) Proceeding Jogging

- Preferences on jog mode

  Please set robot mode to be 'teach.'

  You may start operating after pressing the activate button to be level 1.

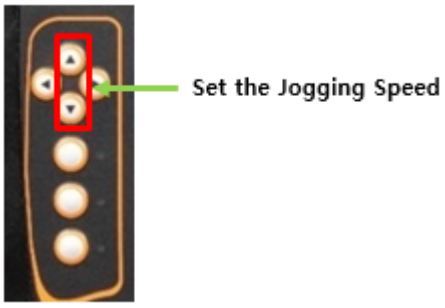
  You may shift from teach mode to repeat mode and vice versa by using select key locating on top-left corner. In order to activate enable switch, you must connect wires of pendant to I/O module and configure corresponding signal correctly. Please refer to wire manual for detailed usage.

- Setting jog speed

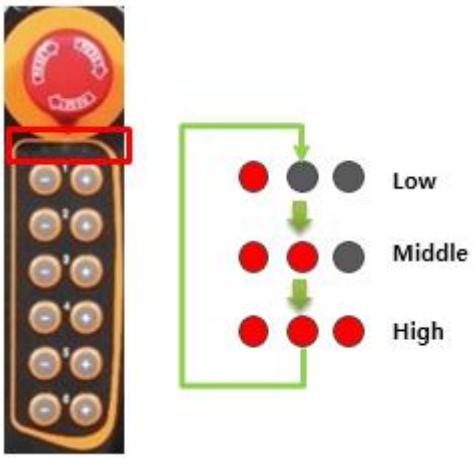
  The actual maximum speed of the robot is limited for safety issue. The limited speed can be configured through manual speed in a configuration file.

  조깅모드에서는 안정성을 고려하여 실제 로봇의 최대 속도를 제한하고 있습니다.
  제한된 속도는 설정파일의 Manual Speed 로 조정 가능합니다.

  You may set jogging speed with three steps: Low(5%), Mid(30%) and High(100%). The default value is set as Low and you may change its value by pressing up and down keys located on left side.

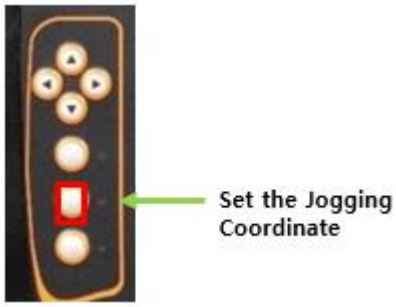


As you press keys controlling jog speed, number of LED lights turned on is changing correspondingly. Also, changed information is displayed on the screen with graphs and texts (Low, Mid, High).



- Converting coordinates system

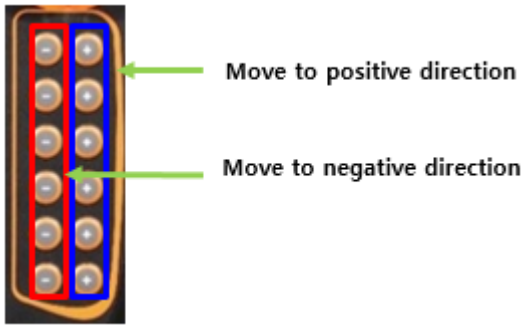
  Coordinates system can be modified via buttons for coordinates system converter on the pendant. There are three coordinates systems implemented – joint, base and tool.



As coordinates system is changed, LED color is changed as below.

- Jog operation

  You can operate a robot through jogging by using jog move button on pendant. You must check which coordinates system has been selected since operation may work differently based on selected coordinates system.

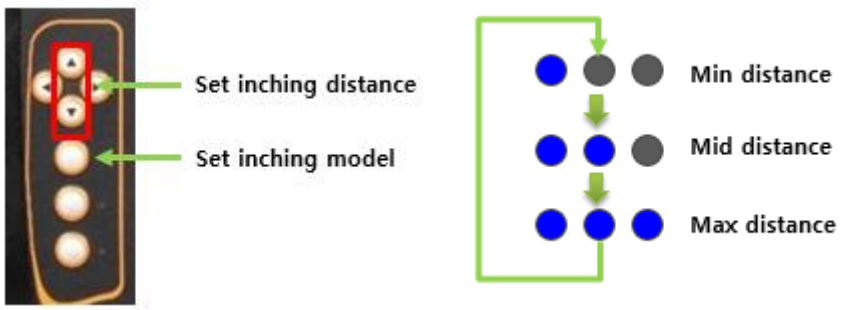


  You may press keypad button if you want to operate robot in various axes simultaneously. However, pressing plus, minus buttons on the same axis will not work.

- Setting inching mode

  In order to move precisely, you may use inching mode to move the robot with single pitch. Inching mode on jogging will not proceed serial motions, but pitch motion. You may activate inching mode via pressing inching button as shown below.

  Configuring motion range on inching mode is similar to changing speed; up and down arrow keys will be used to change the range. Once pressed, LED color on the top right corner will be changed from red to blue. This signal informs inching mode is currently operating.



- Home

  If Servo motor is used with an encoder which uses incremental format, this encoder must be reset after finding where the home is located. If Home options is activated after connecting all the sensors to the Servo motor, the device will find the home location with the given configuration.

  Please refer to manual for each driver for connection between Servo motor and sensors.

- Clear Output

  This feature will clear all the logs displayed on the top right corner of the main screen. Actual data is recorded inside the log files.

- Inching

  This feature helps setting pitch input on inching mode. You may set inching millimeters or degrees when speed is Low, Mid and High respectively.

- Lists of status displaying LED

<Jogging Screen>

LED location	LED Color		
	Black(Off)	**Red**	**Blue**
Coordinates system converter LED (Center of left key pad)	Joint coordinates system	Base coordinates system	Tool coordinates system

LED Colors	LED location		
	First B	**First and Second B**	**Both B**
Red	Velocity low	Velocity mid	Velocity high
Blue	Inching low	Inching mid	Inching high

3. Programming

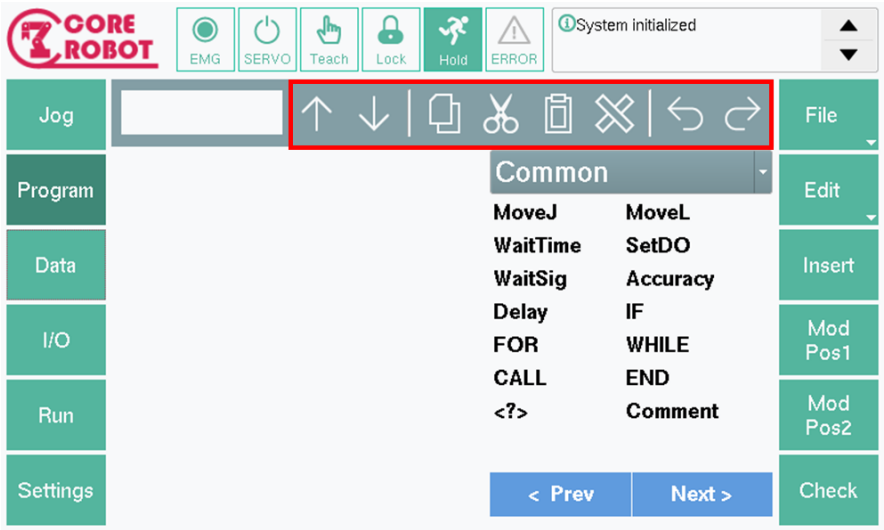
The term, Programming, is defined as constructing a program operating inside Corecon. Basically you may write code via selecting 'Program' from main menu inside Corecon. Additionally you may use vi or text editer to write codes for programming.

1) Programming procedure

- Write a program : use commands to write a program.
- Edit a program : if errors occurred, edit a program to fix them.

  If any unspecified languages are used, ';?' will be displayed in front of the written code. You must modify the code before proceeding.
- Save a program : Save a completely written program.
- Test a program : check any problems occurring while running the program manually.
- Edit a program: if any irregular motions are observed, then edit a program.
- Start a program: run the program with automation mode.

2) List of Edit Options



Tool Box	Role Description
Up/Down	Replace the position of the code to up/down side.
Copy	Copy the selected code.
Cut	Cut the selected code
Paste	Paste the copied or cut code.
Delete	Delete the selected code
Back key	Cancel the task
Forward key	Rewrite the cancelled task

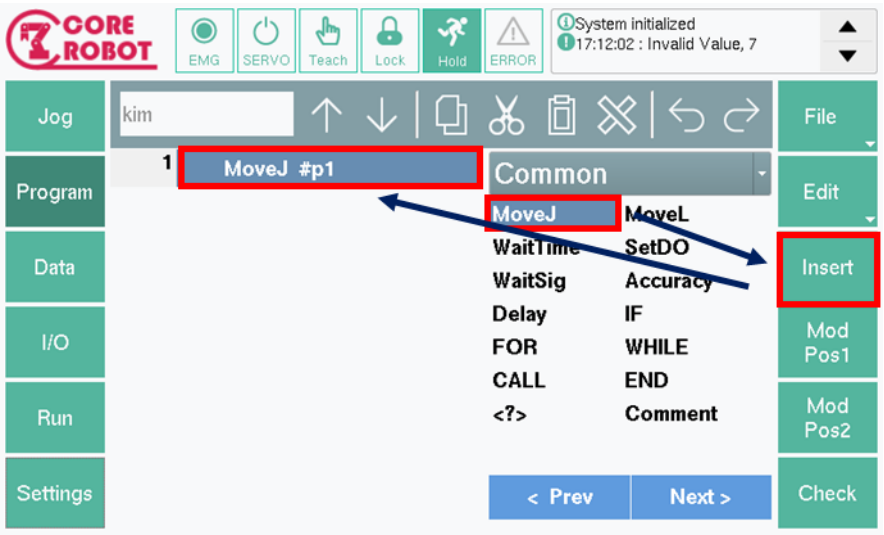
Sub Menu	Feature Description
File	You can create or select files. 1) New : Create a new program 2) Open : Open the previously written program 3) Save : Save the current status of a program. 4) Import : Import a program from USB. 5) Export : Export a program to USB.
Edit	You can edit a program. 1) Edit : Insert commands directly. 2) Insert Mode : From the cursor position, you can set whether you should insert code on the top line or bottom line. 3) Command : Enable/disable command window
Insert	Insert the selected command on current cursor position.
Mod.Pos1	Used for commands like MoveJ, MoveL which require a single position. Save current position of the robot.
Mod.Pos2	Used for commands which require positions of two points. (MoveC)

3) Program Execution

Name	Procedures
Create a new program	1. Click 'File' button → New → then write down file name New program file is created and you can edit a new program. 2. Select a specific command "<?>". Then you can use text editor to write codes via 'Insert' menu or 'Edit' → 'Edit' menu.
Open a program	1. 'File' Button → Open You may select one of the files saved (files are located at: mnt/mtd5/programs/), then press 'OK' button to open the program. 2. If any modifications are required, you must select the specific step, then edit it through 'Edit' button
Import a program from USB	1. Connect USB to the pendant 2. Select a program through 'File' button -> Import You may edit the program through 'Edit & Insert Mode' button.
Delete a program	1. Select the specific file to delete through 'File' button -> 'Open' button
Export a program to USB	1. Connect USB to the pendant 2. Select the specific file to save through 'File' button -> 'Export' button

4) Commands Execution

Corecon programs are composed of lists of commands. You may achieve desired motions via commands. Please refer to CL manual for more detailed information.



- Add a command: there are two ways to add a command
  - Add a command via command window

    Additional menu window will be displayed if 'Edit' options is selected from sub menu. You will see lists of CL commands by clicking 'Command' button from this window.

  - You may select a command and press 'Insert' button to add a command to the current cursor position.

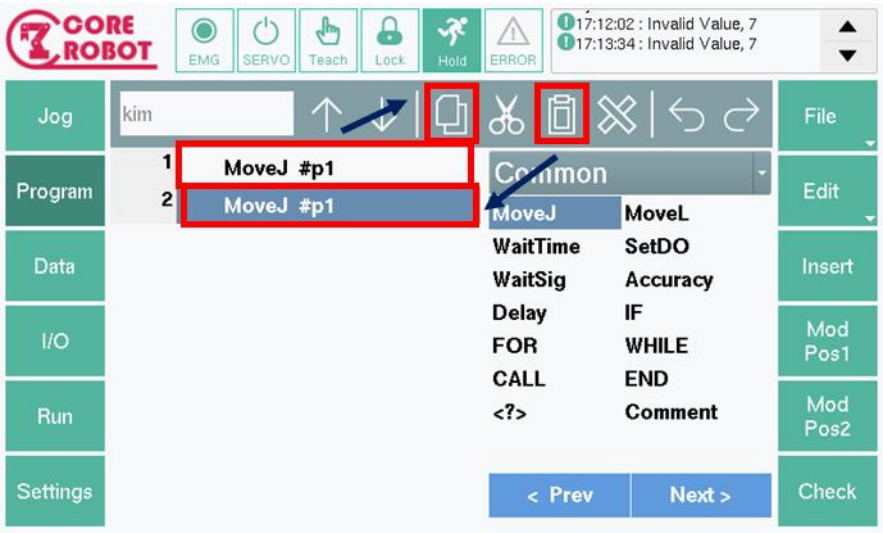
  - Insert a command directly

    Additional menu window will be displayed if 'Edit' options is selected from sub menu. If you want to insert command directly, please press '<?>' command from Common Tab.

  - You may insert a command to the current cursor position via text editor by pressing 'Insert' button.

- Edit a command : if any errors on command are found, you should edit them.
  - Place the cursor on the erroneous command.
  - Press ‘Edit’ button from additional menu window invoked by pressing ‘Edit’ button from sub menu.
  - Edit the command as program edit window is activated.

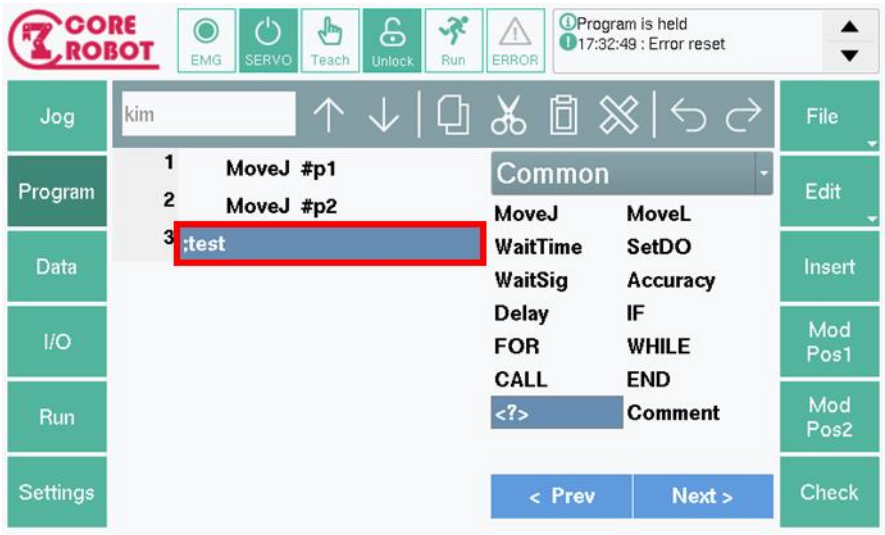
- Copy, cut and paste a command



You may use option from 'Program' page to copy, cut and paste a command.

- Select a code for editing.
- Press either copy or cut options from Tool box.
- Place the cursor on the desired location for paste.
- Press 'Paste' button.

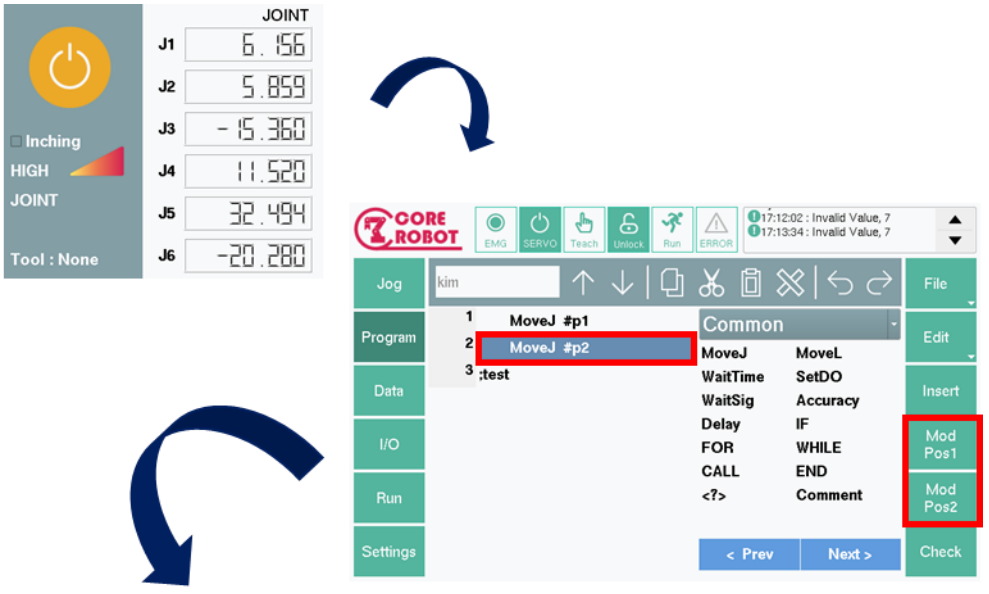
- Comment a command row



If ";" symbol is written on a program, then the rest of the code after this symbol on the same row will be commented. This is only applicable for codes on the same row.

- Save position via Mod Pos

Position of the robot can be defined directly by inserting coordinate values to either 'Joint' data or 'Trans' data. However, it is hard to obtain these specific coordinate values. In this case, you may jog the robot with specific position and use 'Mod Pos' option to read current position of the robot as coordinate values and convert them as variables.



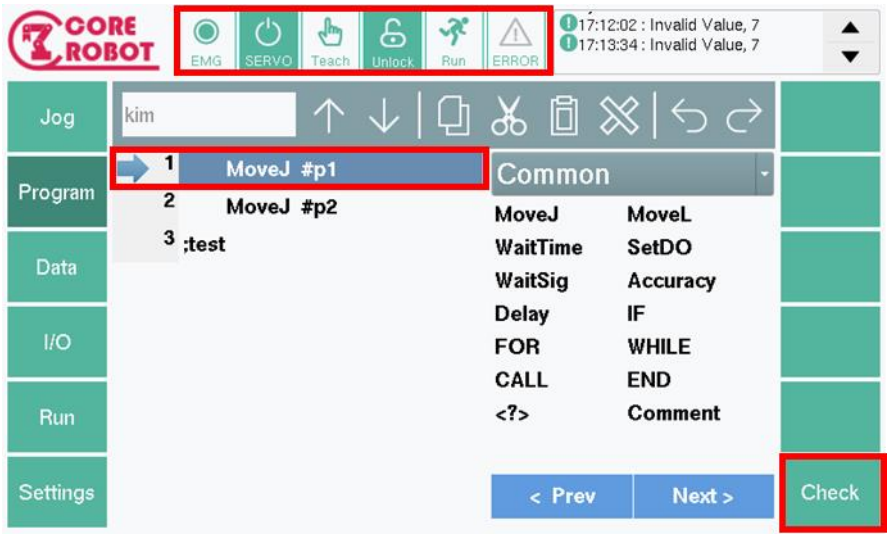
#p2	6.156	5.859	-15.360	11.520	32.494	-20.280

5) Test a program

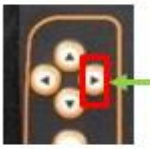
Corecon system provides 'Check' feature to avoid any accidents due to unexpected motions of the robots. This feature helps predicting robot motions running from the program.

> – Cautions for users
> If automate mode starts right after writing a program, unexpected motions may occur and result damages to human and surroundings.

- 'Check' feature



- Finish writing a program
- Check whether no obstacles or humans are around the robot.
- Turn on Servo.
- Turn mode switch to 'Teach' mode.
- Press 'Check' button.
- Run codes line by line by using keypads on left side.



- How to stop a program

  Once all the desired tasks are done, you should halt 'Check' feature.

  - Turn off power of Servo motor.
  - Modify operation mode of the robot.

- Purpose of using a manual mode

  - Checking motions with reduced speed

    In a manual mode, the robot motion will be performed with the speed defined in manual mode instead of performed with the maximum speed of the motor. Also, the default manual speed is set as Low, so the robot runs with much slower speed.

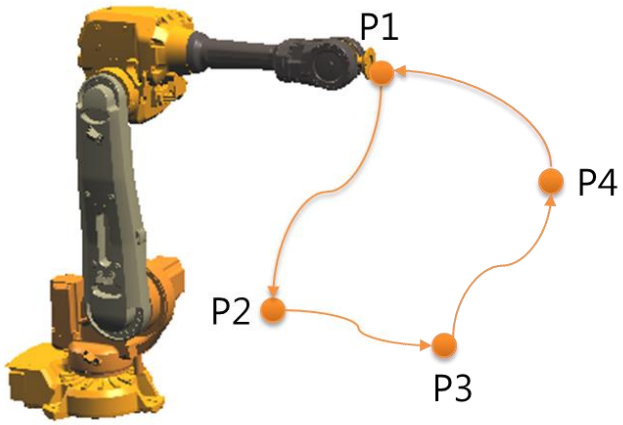
  - Immediate reaction by using enable switch

    'Check' feature is only acceptable when activate button is set as level 1. If any irregular motions are observed, you may stop the robot immediately.

6) Write an example program

You can write a simple program with steps below

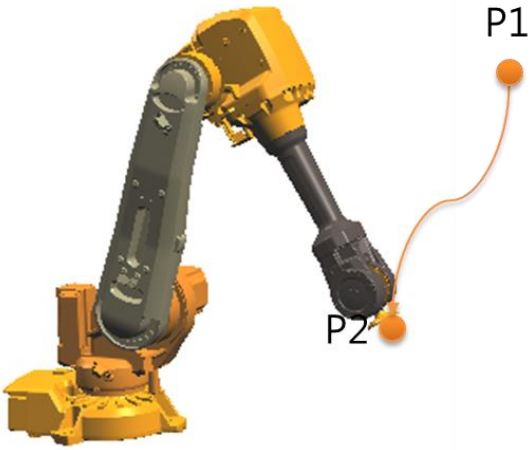
- **How to write a program which moves to four given coordinates**



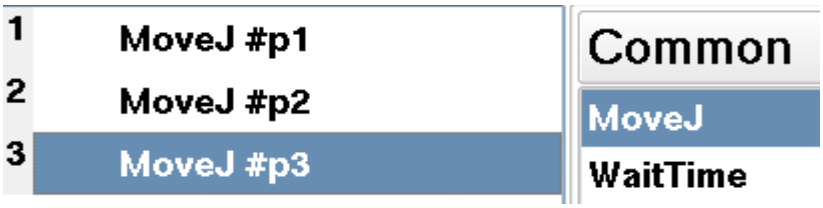
The main objective of this example is to write a program which moves four points via Joint Move. The motion starts from P1 which is the origin, then it goes to P2, P3 and P4 consecutively. If not stopped, the robot moves from P4 to P1 and continues to move on to P2. Thus, this program moves four points repeatedly.

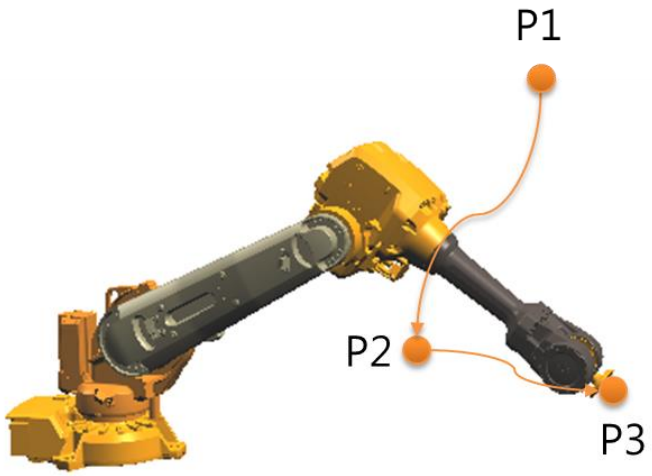
① Insert origin point via MoveJ.

② Move J1 -10 degrees, J2 +30 degrees, and J5 -45 degrees, then insert MoveJ.

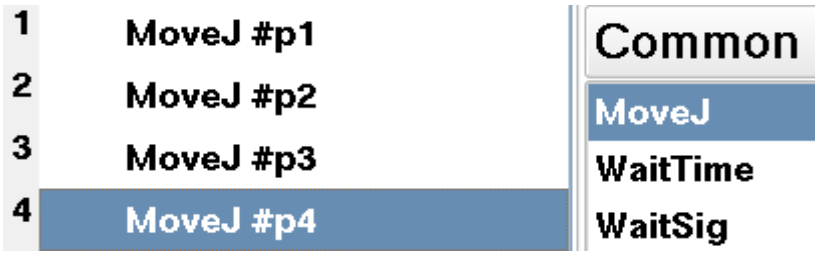


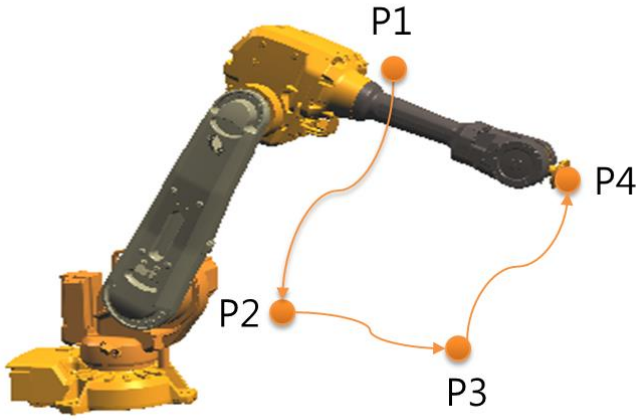
③ Move J1 +10 degrees and J3 -10 degrees, then insert MoveJ.





④ Move J1 +30 degrees, J3 +20 degrees then insert MoveJ.





⑤ Check each point information via ‘Data’ menu.

Joint | Transform | Numeric | String | Tool | Base

Name	J1	J2	J3	J4	J5
#p1	0.000	0.000	0.000	0.000	-45.287
#p2	-10.195	31.004	0.000	0.000	-45.287
#p3	10.464	31.004	-10.342	0.000	-45.287
#p4	31.661	31.004	30.413	20.141	-45.287

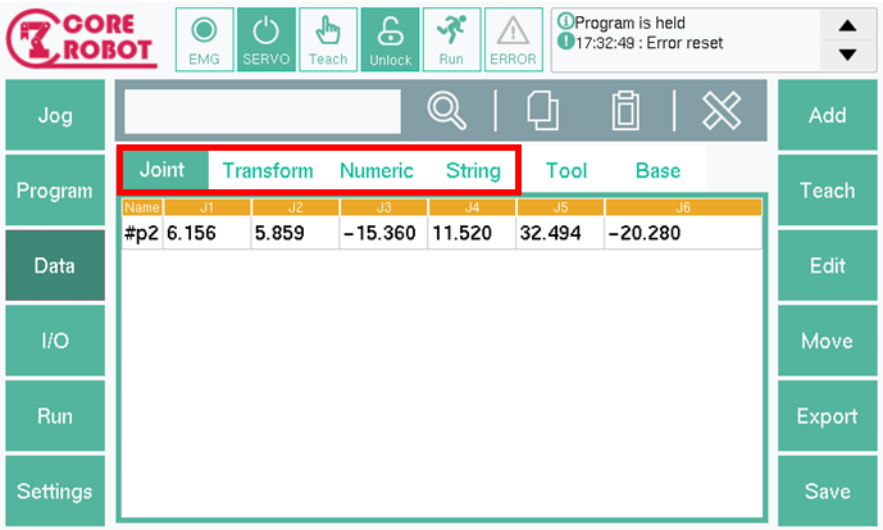
(Keep values of J5 in #p2, #p3 and #p4 to be about -45 degrees)

Notice : you may select a cell to modify if you want to change values to be specific degrees.

7) Data Types

There are four types of data format in this system: Numeric for numeric data, String for text data, Joint for degree values of Servo motor and Transform for position data of robot in terms of rectangular coordinates system.

You may observe those data via Data screen from Main menu during writing or running the program.



- Add data

  You may add new data through 'Add' menu from Sub menu after selecting desired data format from touchscreen.

  ■ Naming role

  There are naming limitations in Corecon system as shown below.

  ◆ First character of every variable names must be in String format. (ex: a111)

  ◆ For joint variable names, there must be hashtag(#) in front of the names (ex: #variable)

  ◆ For String variables, there must be Dollar sign($) in front of the names (ex: $variable)

  ■ How to declare arrays

  You may declare one dimensional array inside the program. However, you cannot declare any higher dimensional arrays.

배열선언 예시

- How to edit data

  After selecting the desired data for changes, press 'Edit' button from Sub menu to modify its value.

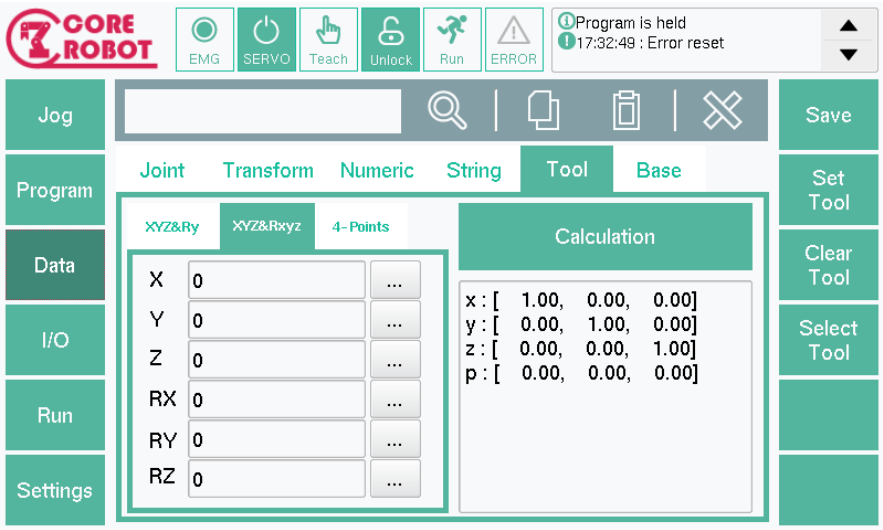
- How to delete data)

  After selecting the desired data for delete, press 'Delete' button from Sub menu to delete the data.

- How to move a robot with joint and transform data

  After selecting data with either joint or transform data format which expresses the robot's position, press 'Move' button to replace its position correspondingly with the given position from the data. This is applicable when Servo motor is turned on and the robot has been set in 'Repeat' mode.

8) Tool – Coordinate System



Tools are portable modules to a robot which can be detached. You may modify them accordingly with the desired task types.

In order to set position of the tools precisely, you must check and insert the basic information like size of the tools accurately.

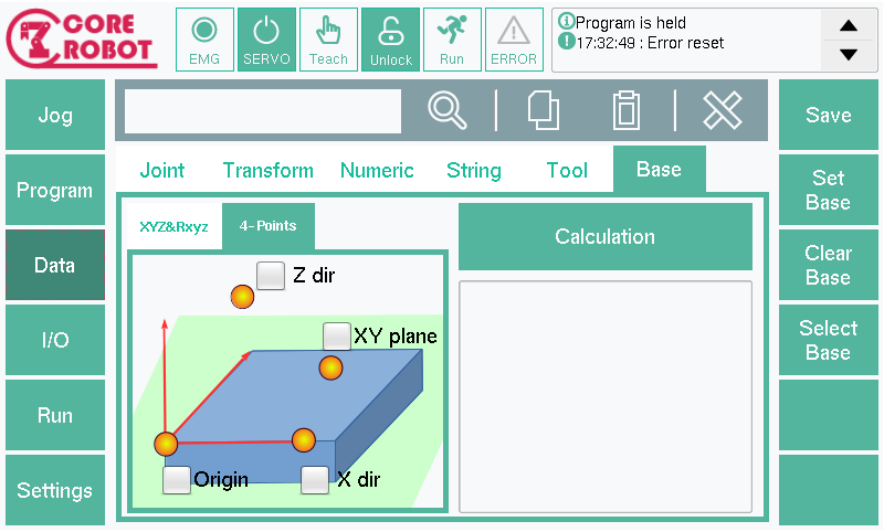
You may configure tools by inserting measured tool information. Also, you may utilize the robot to measure size of these tools directly.

- How to insert Tool information – Method Type 1
  - Move to 'Data' page from 'Main' menu.
  - Press 'Tool' tab.
  - Insert measured tool size and direction in XYZ&Rx, XYZ&Rxyz.
  - Convert inserted data to coordinate data(n, o, a, p) by pressing 'Calculation' button.
  - Press 'Save' button from Sub menu to save current tool information.
  - Press 'Select tool' from Sub menu to reflect current tool information to the robot.

- How to insert Tool information – Method Type 2
  - Move to 'Data' page from 'Main' menu.
  - Press '4-Points' from 'Tool' tab.
  - After selecting a certain point by using the robot with tool installed, press 'P1.'
  - By selecting the same point with different motions, insert P2, P3 and P4.
  - Convert inserted data to coordinate data(n, o, a, p) by pressing 'Calculation' button.
  - Press 'Save' button from Sub menu to save current tool information.
  - Press 'Select tool' from Sub menu to reflect current tool information to the robot.

- How to use saved tool data
  - Move to 'Data' page from 'Main' menu.
  - Press 'Select tool' from Sub menu inside 'Tool' tab.
  - Select one of the saved information of tool data.
  - Press 'Select tool' from Sub menu to reflect current tool information to the robot.

9) Base – Coordinates System



Base coordinates system is a Cartesian coordinate created based on the origin of the first Servo motor. In order to understand motions of the robot intuitively, Base coordinates system must be configured properly. Under some circumstances, Base coordinates have to be modified by using methods listed below.

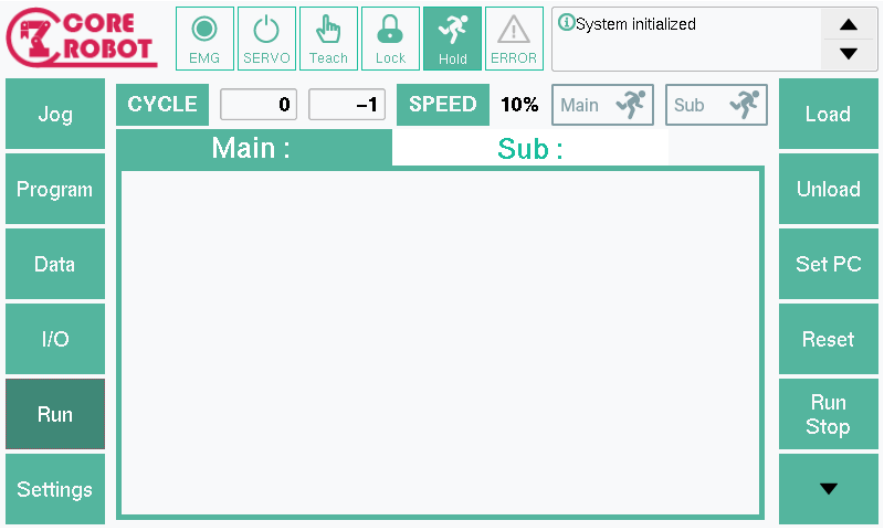
- How to insert Base coordinates information – Method type 1
  - Move to 'Data' page from 'Main' menu.
  - Press 'Base' tab.
  - Insert desired location to XYZ&Rxyz.
  - Convert inserted data to coordinate data(n, o, a, p) by pressing 'Calculation' button.
  - Press 'Save' button from Sub menu to save current Base coordinates information.
  - Press 'Select tool' from Sub menu to reflect current Base coordinates information to the robot.

- How to insert Base coordinates information – Method Type 2
  - Move to 'Data' page from 'Main' menu.
  - Press '4-Points' from 'Tool' tab.
  - After selecting a certain point by using the robot with tool installed, press 'P1.'
  - By selecting the same point with different motions, insert P2, P3 and P4.
  - Convert inserted data to coordinate data(n, o, a, p) by pressing 'Calculation' button.
  - Press 'Save' button from Sub menu to save current Base coordinates information.
  - Press 'Select tool' from Sub menu to reflect current Base coordinates information to the robot.

- How to use saved Base coordinates data
  - Move to 'Data' page from 'Main' menu.
  - Press 'Select Base' from Sub menu inside 'Base' tab.
  - Select one of the saved information of Base data.
  - Press 'Select tool' from Sub menu to reflect current Base coordinates information to the robot.

4. Running a Program

1) Running a Program



After finishing writing a program and testing, you may use Repeat mode to operate a robot. By clicking an arrow button on Sub Menu, you may move on to the next menu lists. In order to set the previous menu lists, you should click an arrow button again.

You may follow steps below for operation.

> – Caution for users
> You must check whether workers or obstacles are around the robot
> Accidents may occur due to unexpected movement.

- Turn on the power of the Servo motor.
- Shift robot operation mode to be repeat mode.
- Load the program you want to operate by clicking 'Load' button from 'Sub Menu' on 'Run' page.
- Operate the program by pressing 'Start' button or 'Run Stop' button.

(Front button of 'Start' button runs program on the main screen while back button of it runs program on the sub screen. 'Run Stop' button runs program on the currently activated screen.

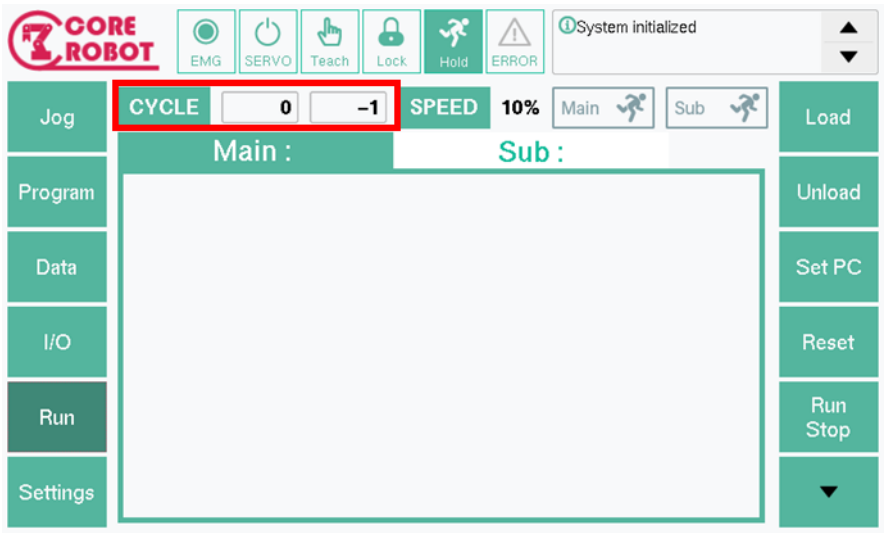
- Robot will operate the commands repeatedly.
- Stop the operation by clicking ‘Run Stop’ button.

2) Change a Program

You may modify some parts of program while operating a program and restart the program. The procedures are listed below.

- Stop the running program.
- Modify robot mode to be a ‘Teach’ mode.
- Modify codes in ‘Program’ page.
- Save the modified program.
- Move to ‘Run’ page (Changes have been saved in ‘Run’ page)
- Modify robot mode to be ‘Repeat’ mode.
- Press ‘Reset’ button
- Start the program.

3) Configuring Program Running Cycle



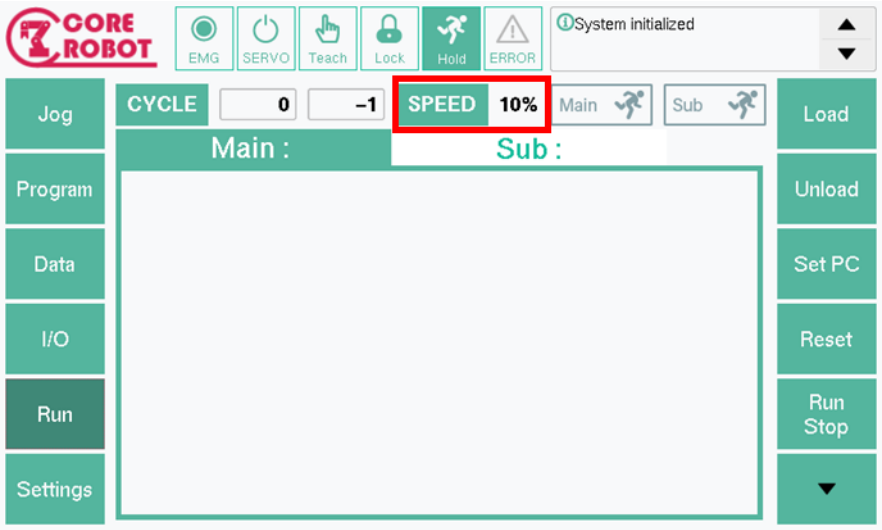
You may set the number of program running cycle.

Once 'CYCLE' button is pressed, edit window will be opened. You should set the desired number of cycles, then press 'OK' button.

As program starts running, you can check current number of cycles. When repeated number has been reached to the inserted number, then the program stops automatically.

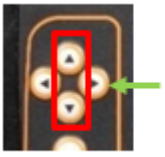
추가

4) Changing Program Speed



When the program runs for the first time in Corecon system, the default speed of the program is set as 10 percent of the maximum speed of the motor.

If no errors are found, you can modify speed rate by pressing 'Speed' button. The rate can be controlled by using up, down arrows of the left keypad.

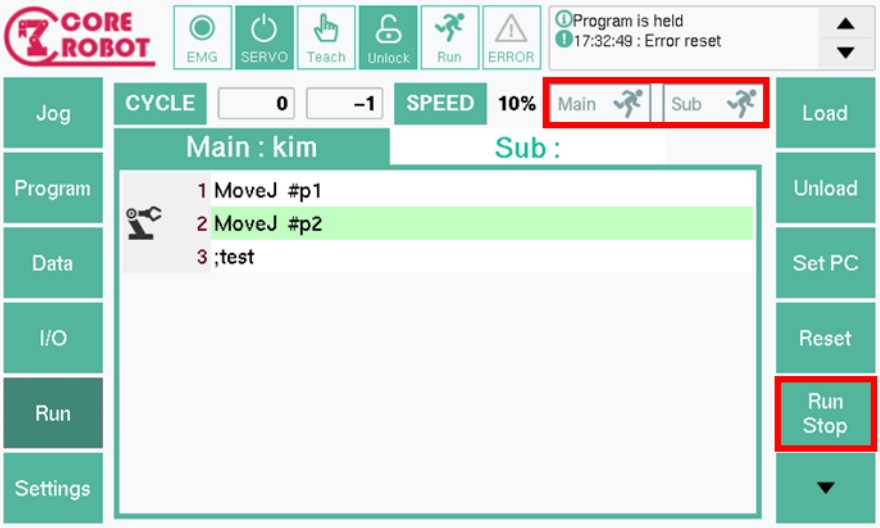


Function keypad
Up arrows: +10%
Down arrows : -10%

As shown above, each button press will increase or decrease the rate with 10 percent.

- Danger notice for users
Do not increase speed rate without finishing the test.
Please modify the speed rate after finishing the test and securing the safety area.

5) Stopping a Program

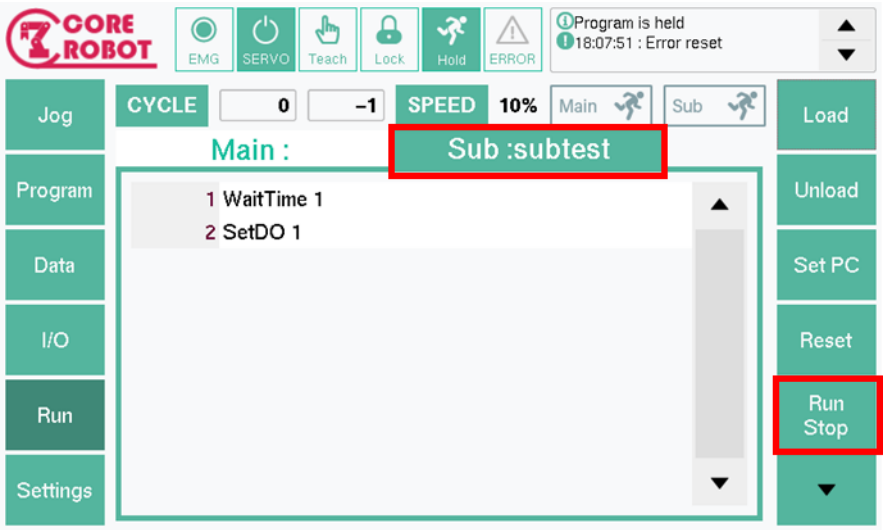


While the program is operating, 'Running' will be displayed on the top right corner of 'Run' page.

You may simply stop the program by clicking either 'Run Stop' button or button with 'Running' symbol. However, you must check whether stopping the current task will damage the robot or any objects around the robot.

Once the program stopped, 'Running' icon turns to 'Start' icon.

6) Multi task.



It is possible to connect some devices to the robot to run specific tasks together. Corecon supports such a circumstance and designed the system to run two separate tasks simultaneously. Each task is separated with a tab. You can press tab to shift to a different tab.

- Main task

  Main task can control motions of the connected robot. There are no limits for utilizing any supported features inside Corecon such as connections via TCP.

- Sub task

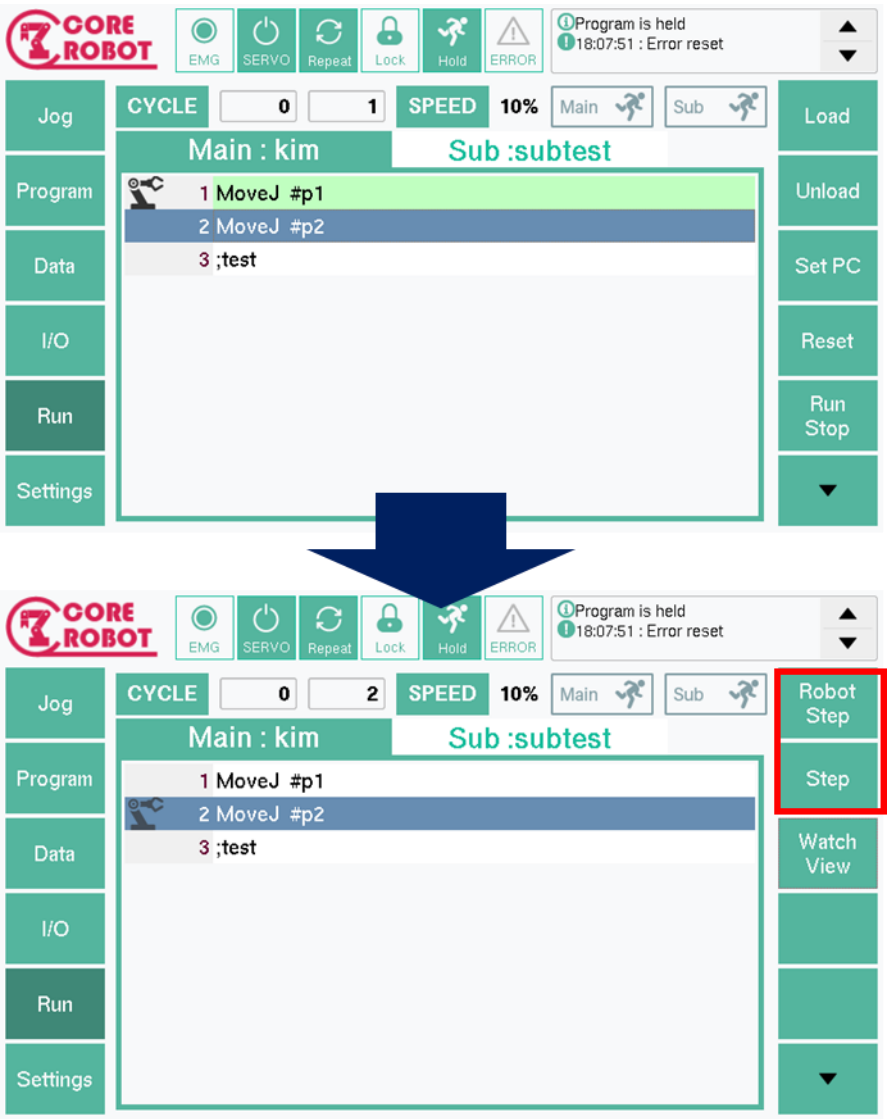
  Sub task can perform any tasks other than robot motions.

  To perform sub task, you must activate sub task first and press 'Run stop' button. If you want to stop the task, you should press 'Run stop' button again after activating 'Sub task' tab.

  For instance, while delta robot is used, you may convert coordinates received from vision camera via TCP/IP connection to coordinates that robot can operate.

7) Step Running

You can operate the robot in steps by using 'Step' feature.



First, you must load written program from 'Run' menu. Then you should turn on power of Servo motor and shift its mode to 'Repeat' mode.

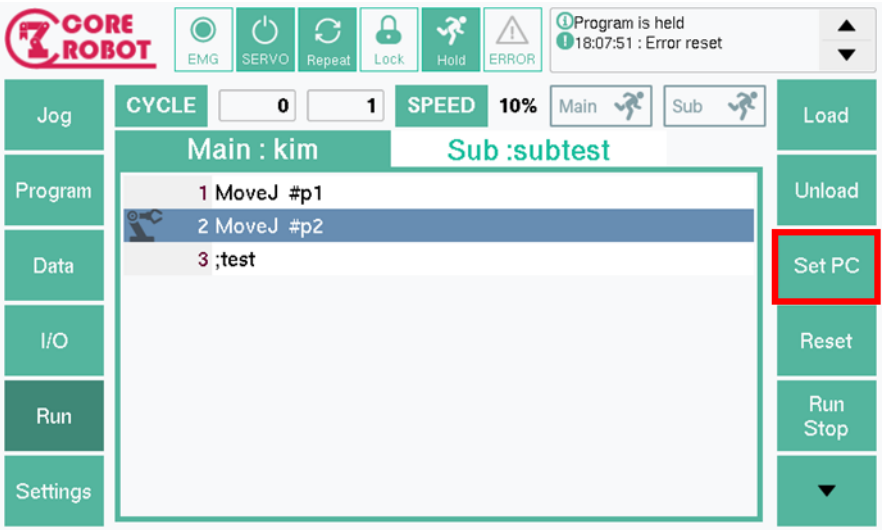
'Step' feature has two parts: 'Robot Step' and 'Step.' 'Step' part runs each line as shown above.

'Robot Step' runs with motion commands like 'Move.' Since this part moves along with

motion commands, this feature is not supported in 'Sub Task' as motion commands cannot be invoked in 'Sub Task.'

8) Changing Position While Running the Program

Location data stores location of the target in programs. You may change the location while running the program.



– Cautions for users

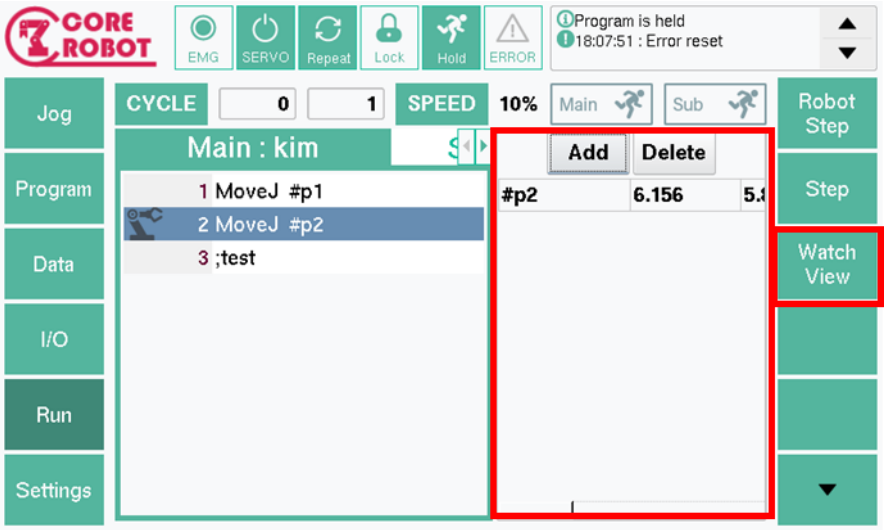
Changing the programmed position may affect the motions of robot significantly.

Please check any possible dangers exist before changing the position.

- Stop the running program.
- Modify location data from either 'Program' menu or 'Data' menu.
- Go back to 'Run' page and apply the changes via Set PC feature.
- Run the program again by pressing 'Run Stop' button.

9) Watch View

You may observe changes in variables on runtime via 'Watch View' feature.



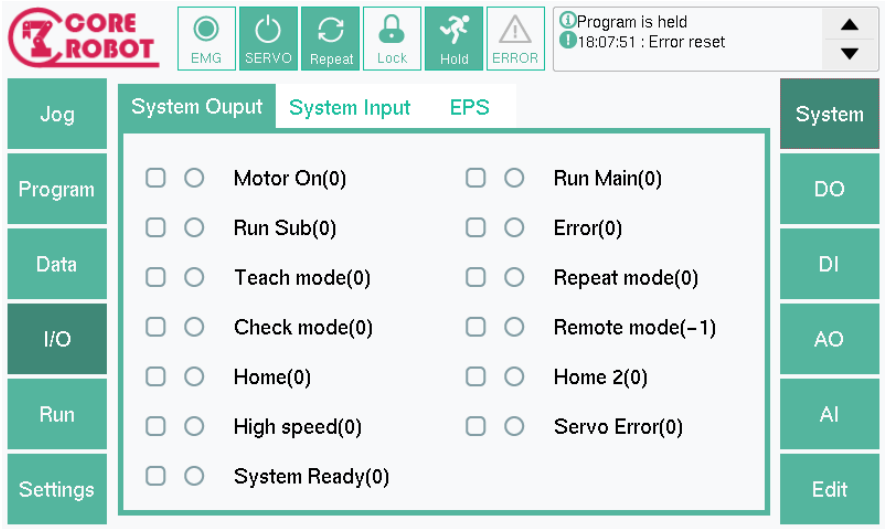
The desired variable for observation will be listed, if you insert the variable by clicking 'Add' button. You can also delete the desired variable by clicking 'Delete' button. If you want to remove 'Watch View' lists, then just press 'Watch View' menu again.

5. Input/Output

You may observer input/output signals on I/O page.

I/O are divided into input and output and expressed as DO(Digital Output), DI(Digital Input), AO(Analog Output), AI(Analog Input) respectively. You may check exclusive internal signals used in Corecon by checking them in system menu.

- System Output/Input/EPS



The screen above displays exclusive input/output signals defined for Corecon system as a default. These signals cannot be modified by users and set automatically based on internal condition of the system. You can set these signals through robot config file and only framed signals will be used.

Without defining signals, check symbol which indicates its availability will be deactivated, and the end word of each signal will be set as 0. After defining, check symbol will be activated as shown above and number of set signal will be set.

For EPS, you may check signal numbering to check availability since there's no check symbols as shown below.

Exclusive signals can be divided into inputs and outputs by separated tabs. If EPS (External Program Select) feature is used, related signals can be checked through EPS page.

- Types of exclusive system output signals

  Exclusive system output signals transfers its internal status externally. As these signals are configured, status of Corecon can be found via these signals externally.

  - Motor On : Displays status of the Servo Motor. If the status displays 'Off', LED is turned off as well, and vice versa.
  - Run Main : Displays whether main program is running. If the status displays 'Run,' LED is turned on, and vice versa.
  - Run Sub : Displays whether sub program is running. If the status displays 'Run,' LED is turned on, and vice versa.
  - Error : Displays whether an error is found. If an error is found, LED is turned on, and vice versa.
  - Teach mode : Displays whether Teach mode is activated. If Teach mode is on, LED is turned on, and vice versa.
  - Repeat mode : Displays whether Repeat mode is activated. If Repeat mode is on, LED is turned on, and vice versa.
  - Check mode : Displays whether Check mode is activated. If Check mode is on, LED is turned on, and vice versa.
  - Home : Displays whether a robot is at Home location. If the robot is located at Home location, LED is turned on, and vice versa.
  - Home2 : Displays whether a robot is at Home 2 location. If the robot's Joint is located at Home 2 location, LED is turned on, and vice versa.

- Types of exclusive system input signals

  System input signals can be utilized to control internal status externally. As these signals are configured, status of Corecon can be controlled externally.

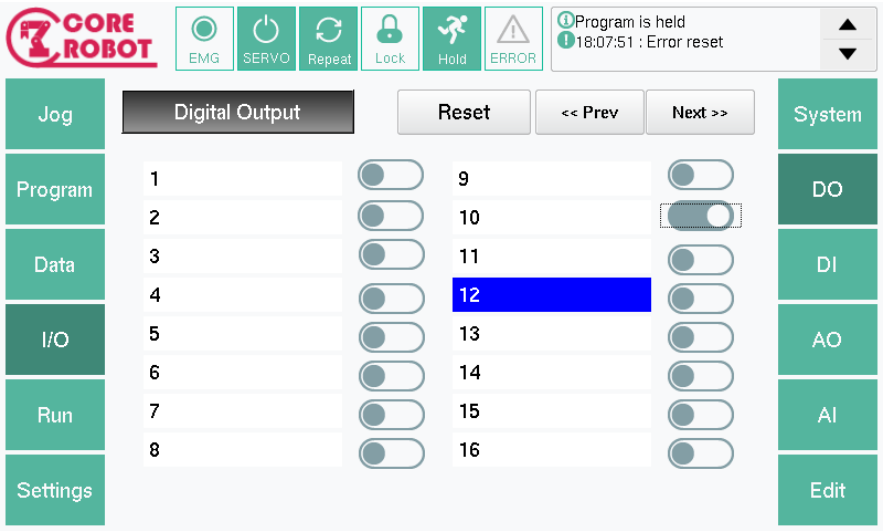
  - M.Pwr : Indicates Motor Power can be controlled externally. As a pulse signal which is higher than 100ms incomes, Motor Power is turned on.

- M.Pwr State : Monitors status of Motor Power. As long as Motor Power is activated, this signal should be turned on regularly. If it is turned off, there must be a problem on Motor signal.
- E.Stop : As long as this signal is activated, this signal should be turned on regularly. If it is turned off, there must be an emergency case.
- Repeat : Indicates that Teach/Repeat status can be controlled. As signal incomes from outside, LED is turned on which indicates the system is under Repeat mode. At the same time, if there's no external signal incoming, then LED is turned off which indicates the system is under Teach mode.
- E.Reset : Indicates error reset. Once an error occurred and signal comes externally, error is reset.
- TP Enable : Indicates that 'Enable' status can be controlled. If external signal is injected, LED is turned on and 'Enable' status is activated. At the same time, if there's no external signal incoming, LED is turned off and 'Enable' status is deactivated.
- Hold : Indicates whether 'Hold' status can be controlled. If external signal is injected, LED is turned on and 'Hold' status is activated. At the same time, if there's no external signal incoming, LED is turned off and 'Hold' status is deactivated.
- Program Start : Manages starting a program. If external signal controlling a program is injected, a program starts to run.
- Program Reset : Manages resetting a program. If external signal is injected, the program is reset.

- Types of exclusive EPS signals
  - EPS mode : Output signal for EPS mode. EPS mode can be shifted through macro. If EPS mode is on, LED is turned on, and vice versa.
  - EPS status : Output signal for EPS status. When EPSWait is activated through macro, LED is turned on. Then, it waits for Program number signal, EPS on or off signals externally. If EPS off signal is injected, EPS status is turned off.
  - EPS On : Indicates 'On' signal that an external program is used.
  - EPS Off : Indicates 'On' signal that an external program is not used and cancelled.

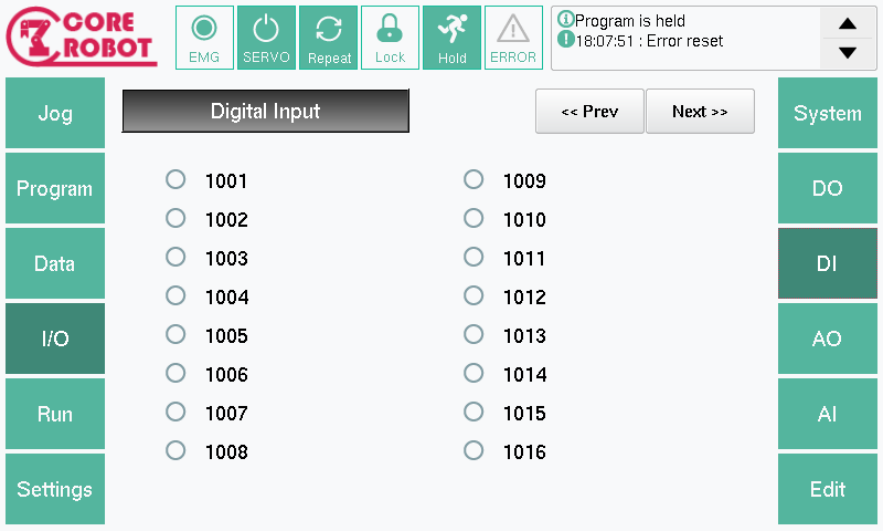
- Bit : Indicates a signal for program number as EPS On signal is activated. Number of Bit changes dynamically and can be set from Bit0 to Bit7 (maximum 8 bit). You can set desired program number through using this number. For example, if desired program number is 3, then Bit 0 and 1 is turned on. If desired program number is 5, then Bit 0 and 2 is turned on.

- Digital Output/Input(DO/DI)



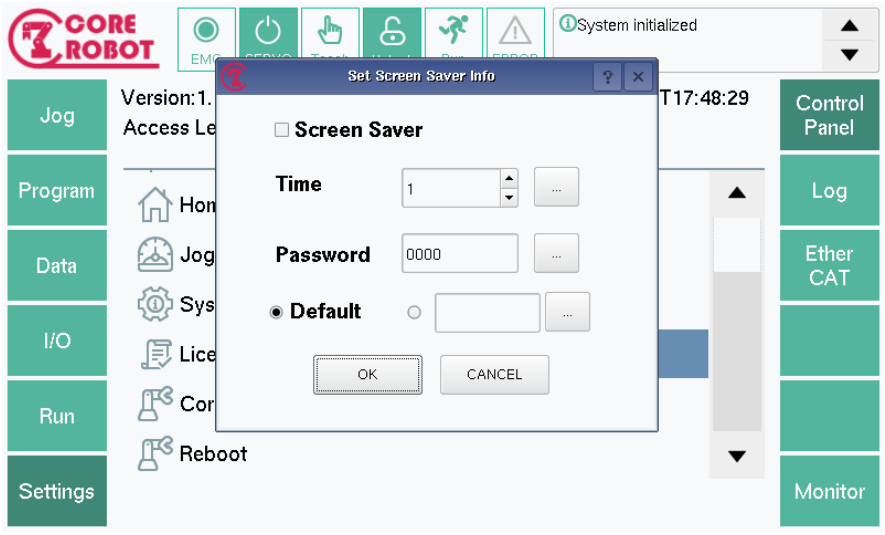
Digital Output/Input(DO/DI) can be observed through DO/DI menu from Sub menu. You may set custom digital input/output signals which are not defined in system. You can set 1 to 128 numbers of DO(Digital Output) including System I/O. You can set 1 to 128 numbers of DI(Digital Input) starting from address 1001 to 128.

You can set DO/DI on and off by pressing on/off switch as shown above. For DI, you must set I/O Device on device lists like BECKHOFF and it is possible only on Dry Run mode. If the device is turned on and Dry Run mode is activated, you may switch on/off by using LED shaped button for DI.



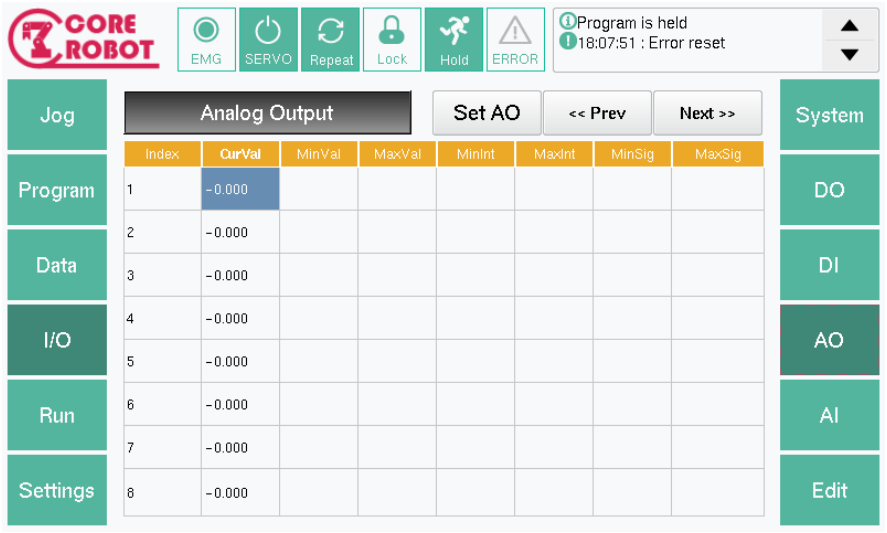
- Button description
  - Prev : There are 16 addresses of signals given for each page for DO and DI. Since 128 signals are available, the system has total 8 pages. You may press 'Prev' button to navigate to the previous page. If you are on the first page, this button will be deactivated.
  - Next : You can navigate to the next page by pressing 'Next' button. If you are on page 8, this button will be deactivated.
  - Reset : Turns off DO signal which is in 'On' status. However, you may not turn off the signal which is configured as system output.

  You can use Edit menu to name DO/DI signals. The signal name is limited to 19 characters.



- How to name a signal
  - Selected the desired number of a signal
  - Select 'Edit' menu
  - Once the desired index is found on a dialog, press blue button next to the name to insert the name you want.
  - Press OK button to check whether the name is set properly.

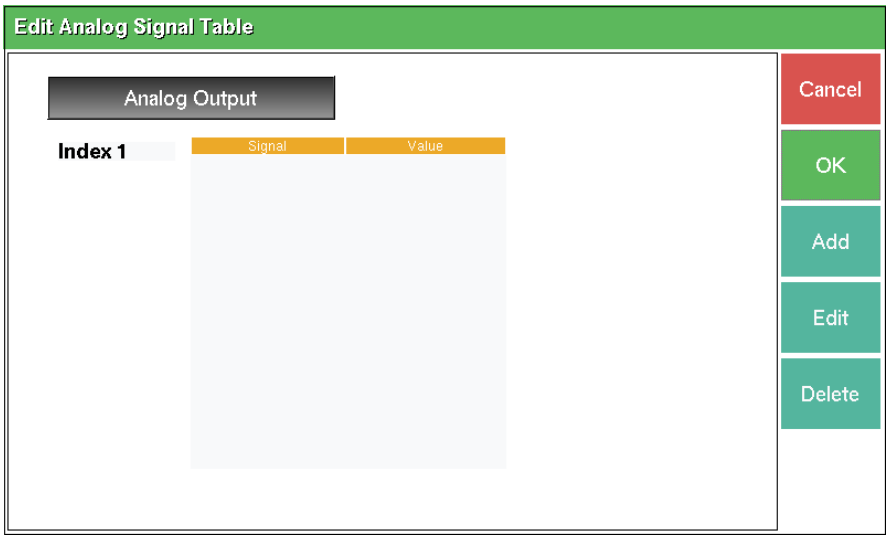
- Analog Output/Input(AO/AI)



By using AO/AI from Sub menu, you may check Analog signal status. For Analog status window, there are total 7 values: CurVal, MinInt, MaxInt, MinSig, MaxSig, MinVal and MaxVal. You can check voltage value of current AO and AI in real time by using CurVal.

The screen shown above does not include the information since Analog Output device is not attached. Once the device is attached, information is displayed accordingly with the number of devices attached.

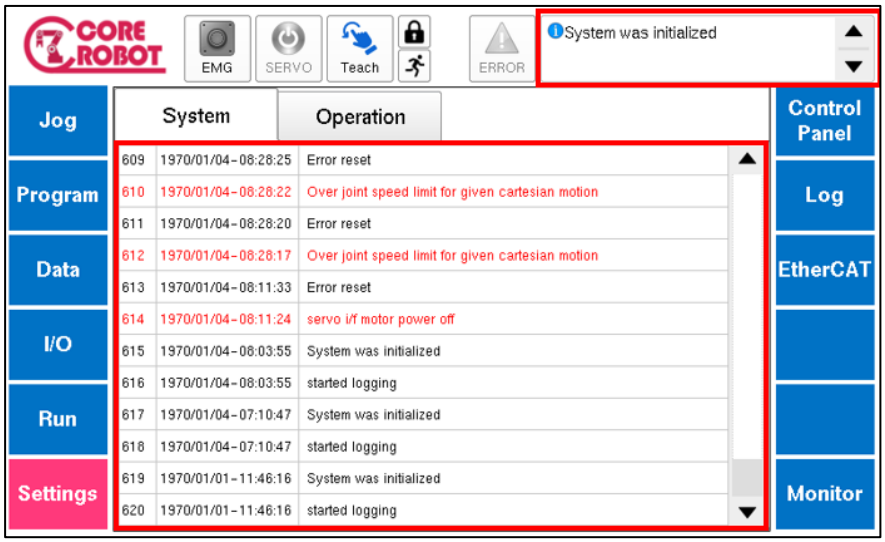
There are limited amount of signals you can edit from AO and AI menu. There are total 128 number of analog signals you can check including the number of signals in analog IO device attached on the robot. You can analyze analog signal value precisely after organizing a table via Edit menu.



After selecting the desired signal and selecting ‘Edit’ menu, you can see a table you can configure on a touchscreen. You can use ‘Add’, ‘Edit’ and ‘Delete’ button to manage signal values. From this table, you can check the desired signals in AO/AI menu in real-time.

6. Handling Event Logs

The page below displays all the events occurring from the controller and stores them internally. You may open and observe all the logs printed.



- How to save logs

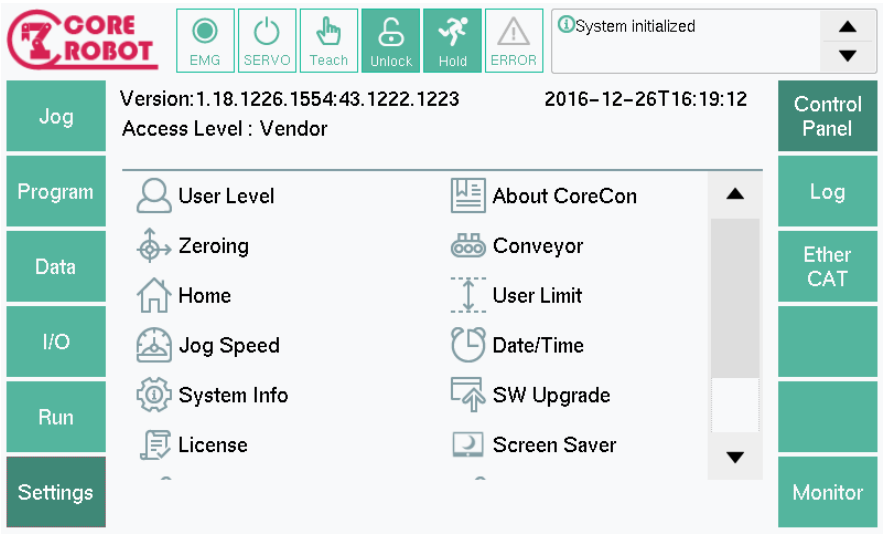
  Corecon system saves all the logs as a default. Also, you may see all of them through the display.

  These logs will be utilized for problem analysis when critical errors occurred and you have to send them to expert for further analysis. Also, they will be utilized as reference of histories for later.

7. Robot Calibration

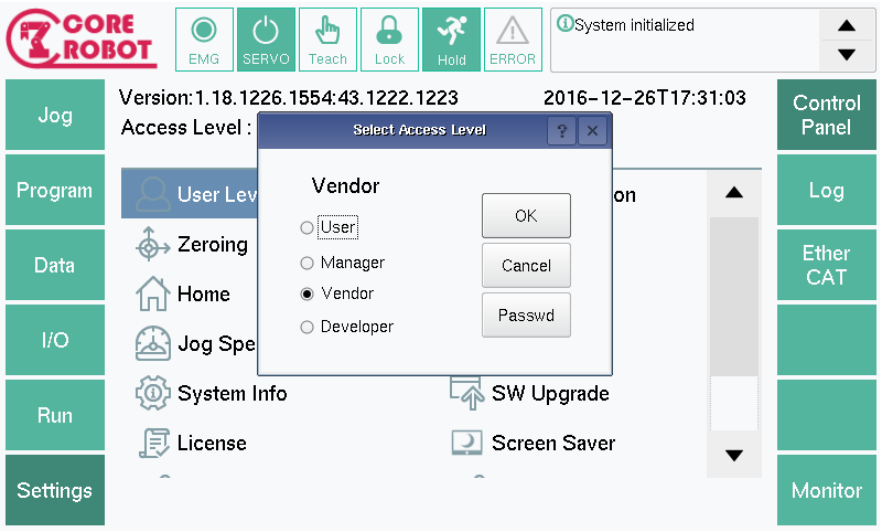
In this section, the methods to check and modify calibrated values in a robot and Corecon system will be desrbied.

Select 'Setting' from Main menu. You will be able to see setting options as below.



Please take a note that the available options on the screen above may change based on a user level.

1) User Level



Based on users, Corecon provides different permissions. Each level has a password. As level changes, calibration options can be changed respectively. Please set a proper level to users.

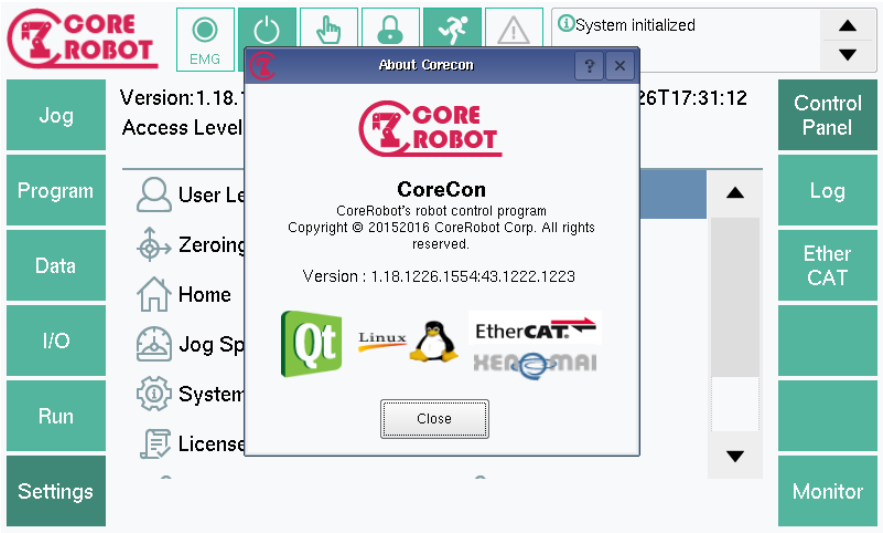
Permissions on each user level

Content	User Level			
	USER	MANAGER	VENDOR	DEVELOPER
Jog	O	O	O	O
Program	X	O	O	O
Run	X	O	O	O

Data Content	User Level			
	USER	MANAGER	VENDOR	DEVELOPER
View	O	O	O	O
Add	X	O	O	O
Teach	X	O	O	O
Edit	X	O	O	O
Delete	X	O	O	O
Move	X	O	O	O
Export	X	O	O	O

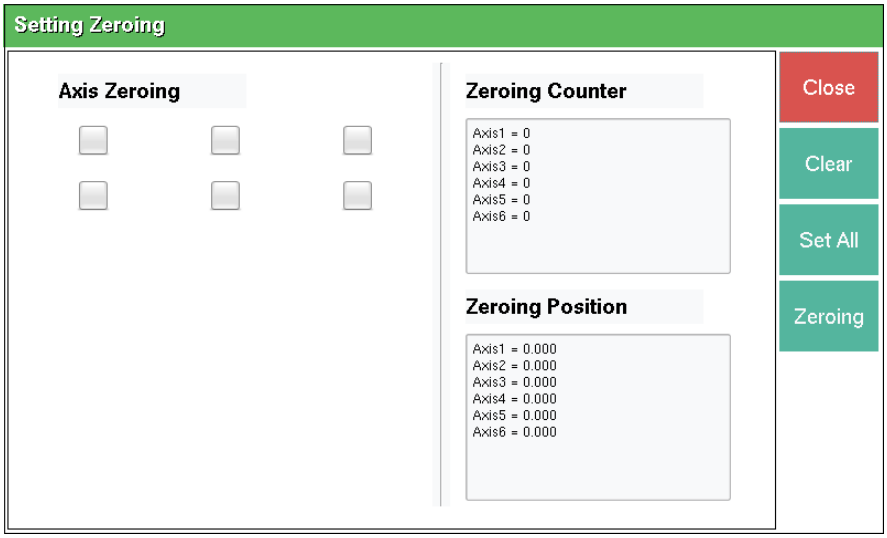
Setting Content	User Level			
	USER	MANAGER	VENDOR	DEVELOPER
User Level	O	O	O	O
About CoreCon	O	O	O	O
Zeroing	O	O	O	O
Conveyor	O	O	O	O
S/W upgrade	X	O	O	O
Home	X	O	O	O
User Limit	X	O	O	O
Date/Time	X	O	O	O
Jog Speed	X	O	O	O
System Info	X	O	O	O
License	X	O	O	O
Screen Saver	X	O	O	O
CoreCon	X	X	O	O
Robot Type	X	X	O	O

2) About CoreCon



The menu screen above demonstrates specs for current Corecon version. Corecon is a robot controlling program which is belonging tool for CoreRobot. You may check current version and origin of Open Sources.

3) Zeroing



You may use Zeroing from Control Panel menu in Setting page to set current position of the Servo motor as an origin.

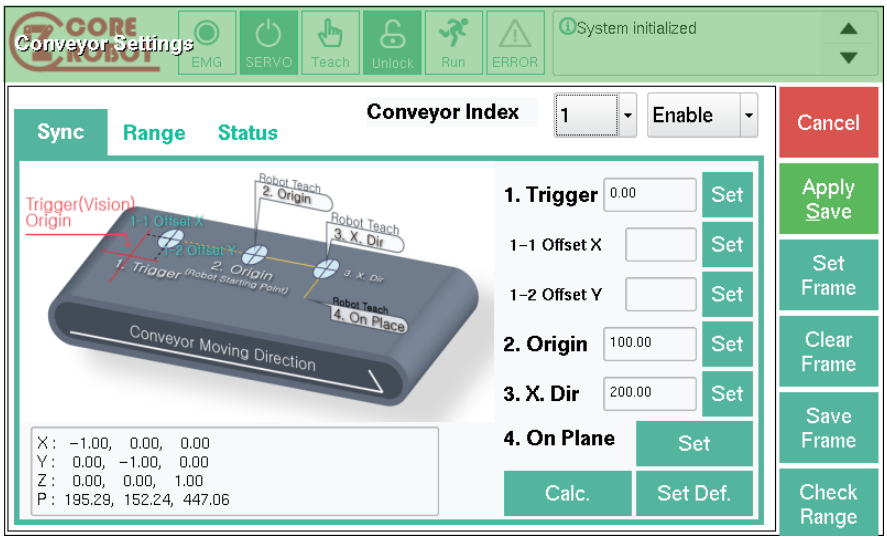
Prior to using zeroing, please replace your robot on the desired space through jogging.

> – Caution for users
>
> Be aware of damages on humans and surroundings due to unexpected operations caused by replacing the origin improperly.

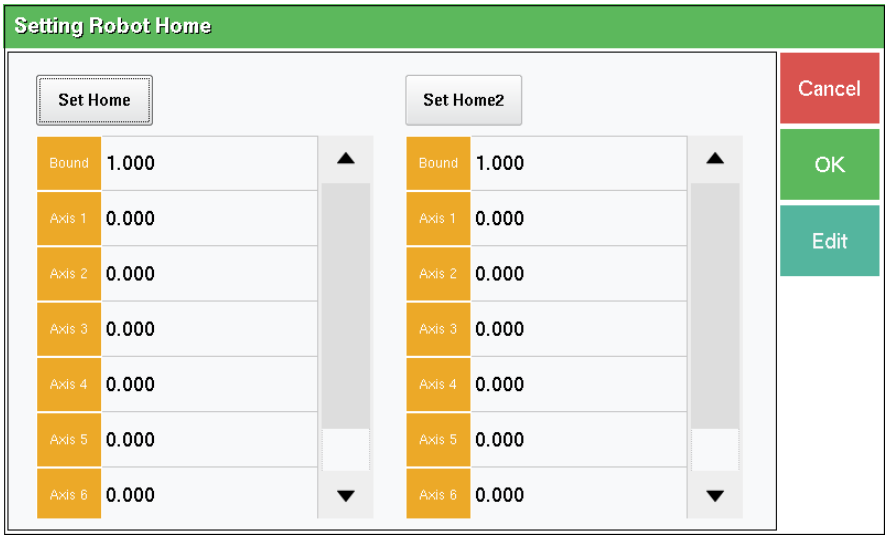
Corecon system is designed to enable zeroing on each axis. After selecting the desired axis for zeroing, you may press 'Zeroing' button to select current axis as the origin. You may check selected positon values and encoder counter values via Zeroing Counter and Zeroing Position.

4) Conveyor setting

You may modify movement and location of the installed conveyor through Coveyor Setting. For detailed information, please refer to a manual for Conveyor setting.



5) Home



Home location is utilized for various purposes.

You may set Home location via degree value of the motor. The motor is limited to ones using Absolute encoder format. The first value on the table shown above is boundary value of Home and you may change it with the desired value. Once Home is changed, the changed value will be applied and saved once Home is activated.

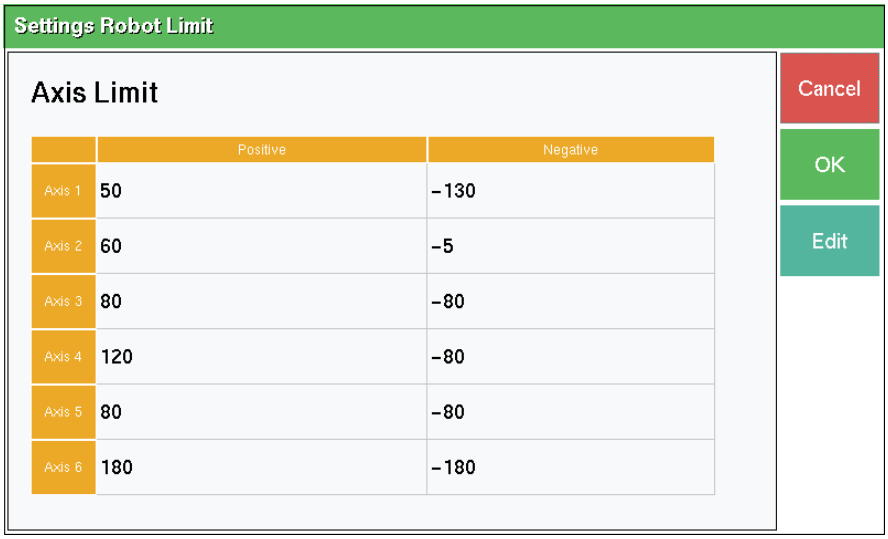
- Setting home via jogging

  Jog the robot to the desired location, press 'Set Home' button to set degree values of each motor on current positon as Home location.

- Inserting Home location directly

  By using 'Edit' button, you can set the desired values of each motor directly.

6) User Limit

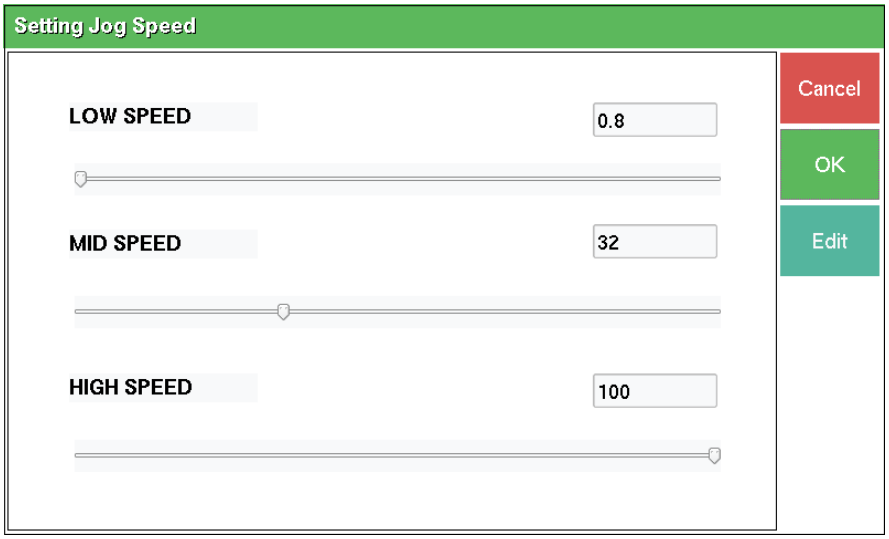


You may set additional maximum/minimum degree values for each Servo motor as these values are not exceeding axis limit values set in Configure file.

Please take a note that improper input of maximum/minimum degree values may result in unexpected movements or accidents.

You can modify data via 'Edit' button after selecting the desired one. Once limits are changed, these values will be applied in programs and jogging and saved.

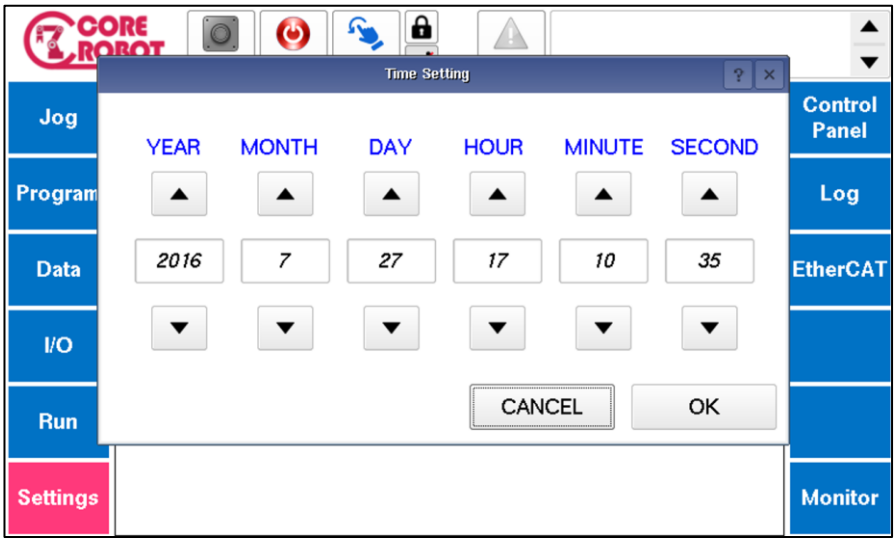
7) Jog Speed



You can configure low, mid, high speed of jog speed used as manual. You can change within a range of 0.8 to 100. The value of each level cannot be greater or lower than the next level.

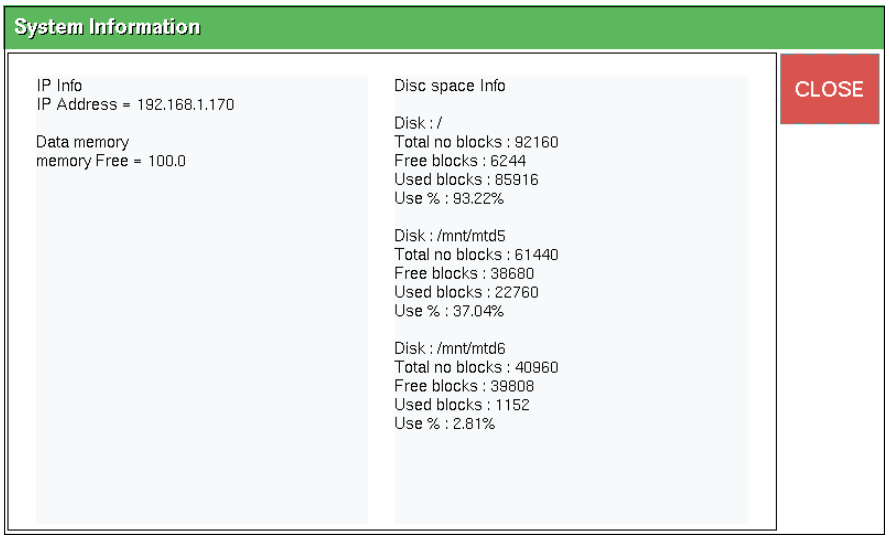
The number indicated percent value of the maximum speed of MSPEED. For example, if it is set as 20, then this value is configured as 20 percent of the maximum speed of MSPEED. After setting these values, you can jog the robot with the defined speeds on Jog mode. Changed values of jog speed will be applied on programs and jogging and saved.

8) Date/Time



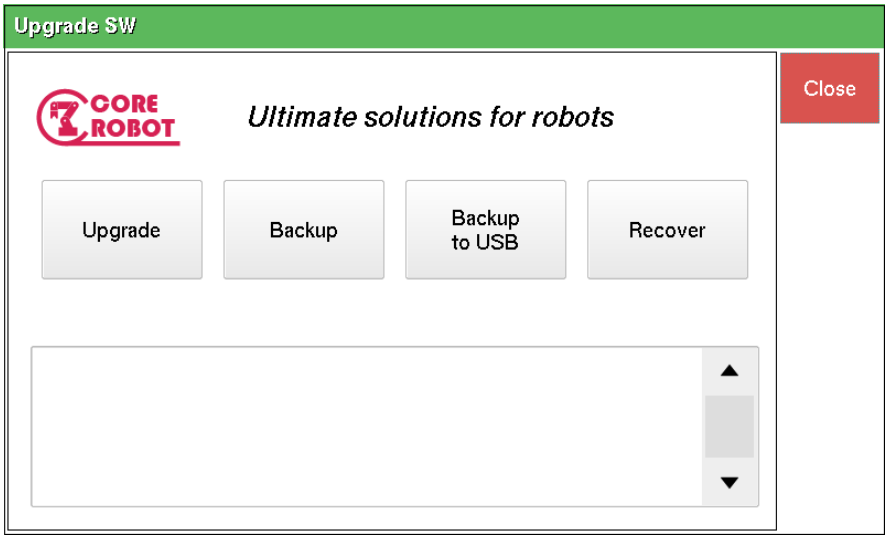
You can check and modify Corecon system time. You should insert the desired time, then press 'OK' button to apply it.

9) System Info



Through System Info menu, you can check internal system information about Corecon. You can check IP address, memory and disk usages in Corecon system.

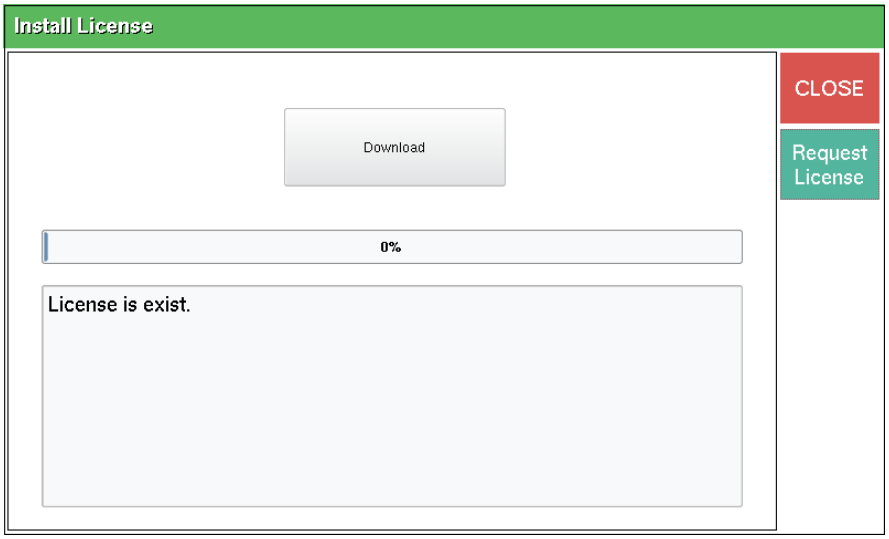
10) SW Upgrade



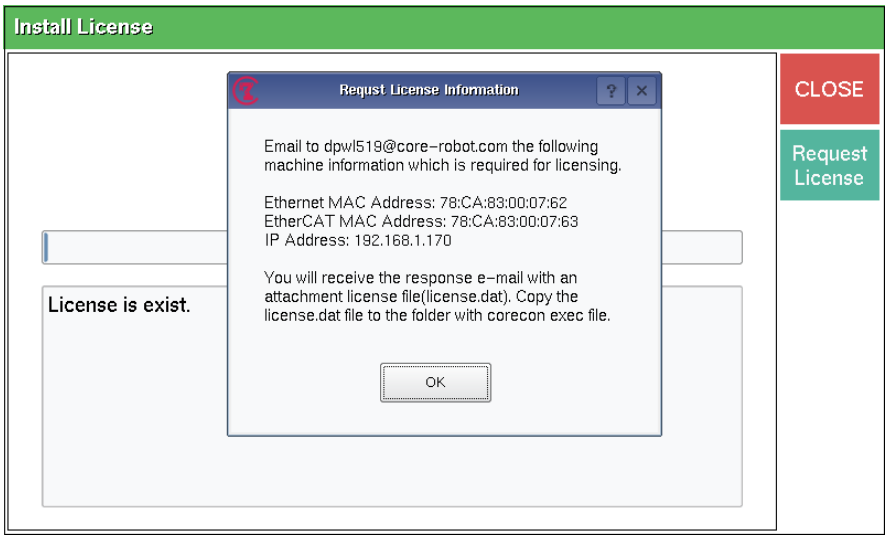
You can use features like Upgrade, Backup, Backup to USB, Recovery for software upgrade. As a default, cloader is used for upgrade. However, if cloader program cannot be used, you can upgrade the system via SW Upgrade menu.

Please refer to 'Backup and Restoring' section for more details.

11) License



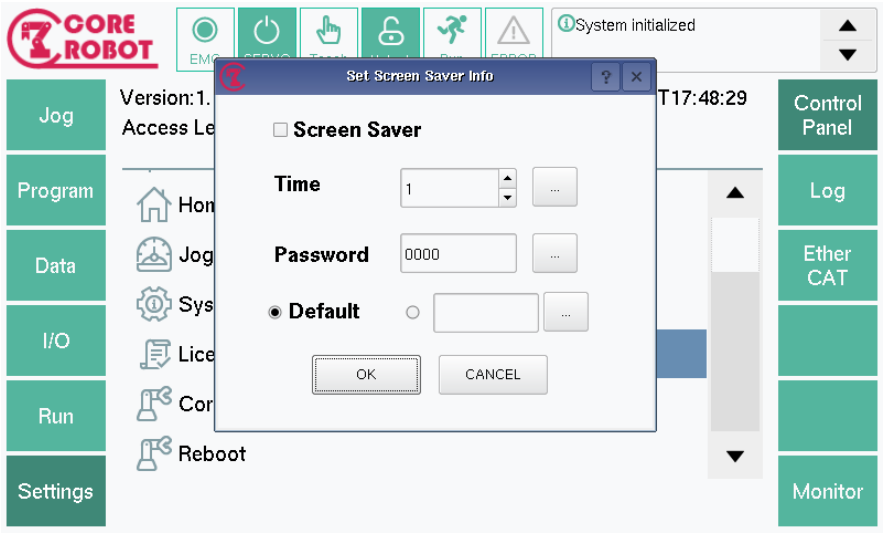
When using CoreCon, you must have a license for operation. Without a license, robot will only be operated on Jog mode and only setting menus will be activated. Other functions may require a license for usage.



In order to achieve a license, you should select 'License' menu and click 'Request License' menu on the right. Then you should send the output information to CoreRobot license manager through email. Once a license is received, you should store the license on USB

and insert the USB to Corecon. You should press ‘Download’ button on ‘License’ menu. Then, you can see CoreCon system operate properly after reboot.

12) Screen Saver

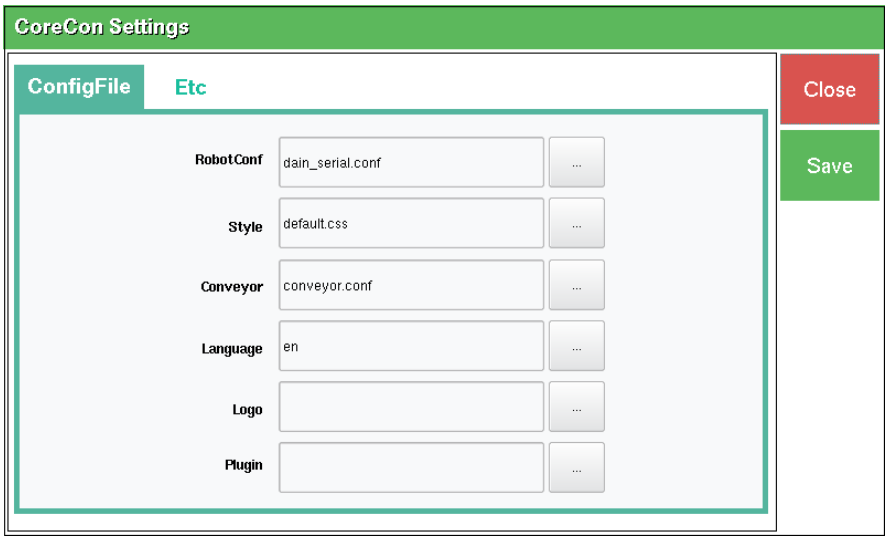


You may set screen saver of CoreCon on this page. You may activate/deactivate screen saver, screen saver duration time, set lock when deactivating screen saver and other functions related to screen saver. Duration time for screen saver can be set within minutes. If you want to switch default screen saver image, then you must save the image inside TP to use it.

13) CoreCon

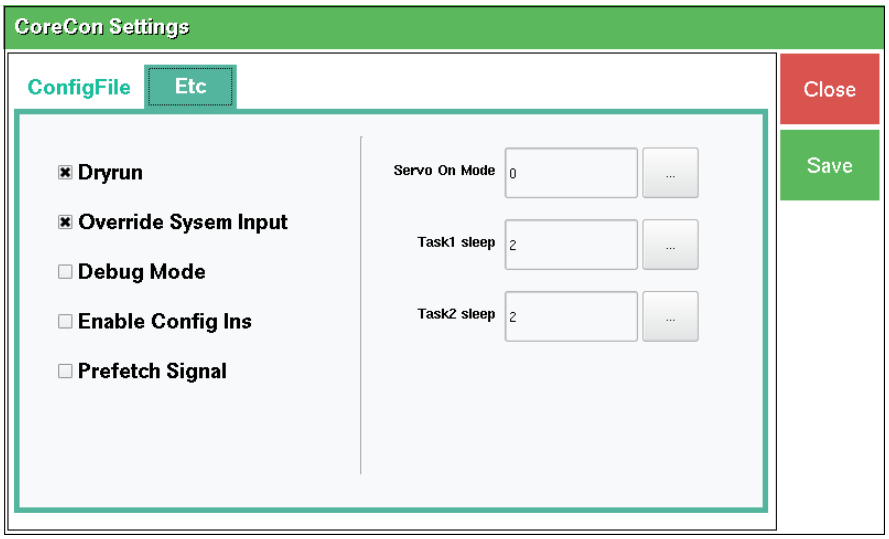
Displays all the parameters saved on corecon.conf file used. You may modify initial configuration values for CoreCon.

- Config File



You may edit various types of configuration files, language, logo and plugin on this page. Default values will be set if there are no values inserted for RobotConfig, Style and Conveyor. Default values will be found on quick manual. For language, English has been set as a default. For logo, CoreRobot log has been set. If there are images saved inside TP, you may select one of them for logo.

- Etc

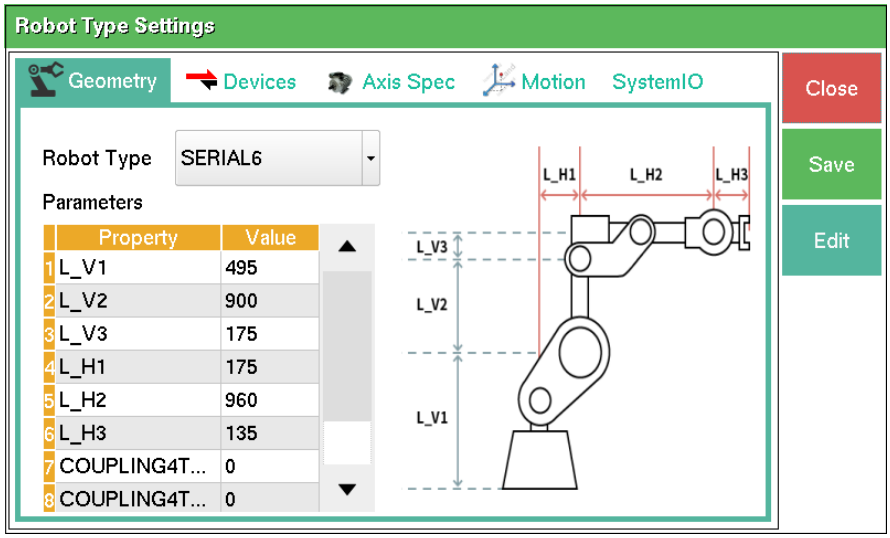


Other features than ConfigFile tab will be set on this page. The features listed on left can be TRUE/FALSE by pressing the desired checkboxes. The features listed on right can be modified by pressing the buttons. Appropriate description and default values for these features displayed on the picture above are listed on a quick manual.

14) Robot Type

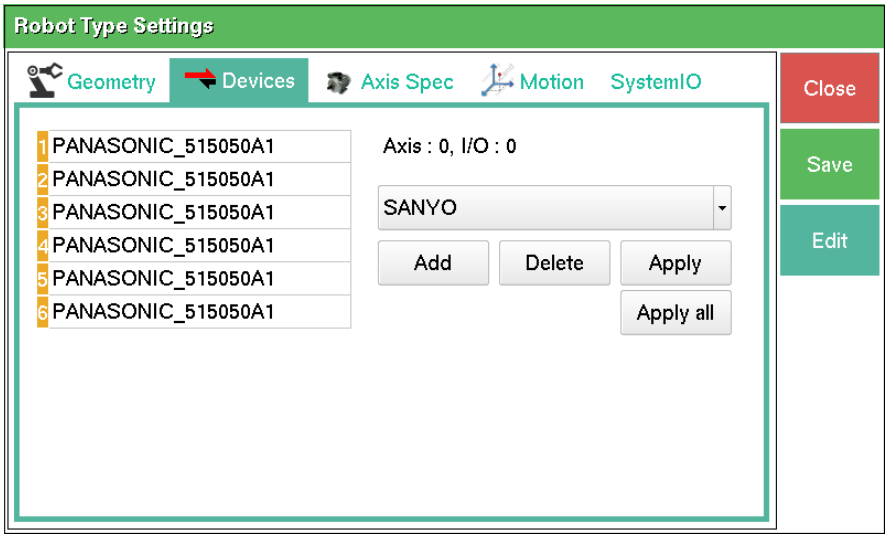
This page displays parameters with currently used robot types. You may edit forms of the robot and parameters on this page.

- Geometry



Types of robot can be selected and dimensions of the robot arm can be modified. You can select the desired data, then press 'Edit' button to modify parameters and save. Once saved, the system will reboot automatically.

- Devices

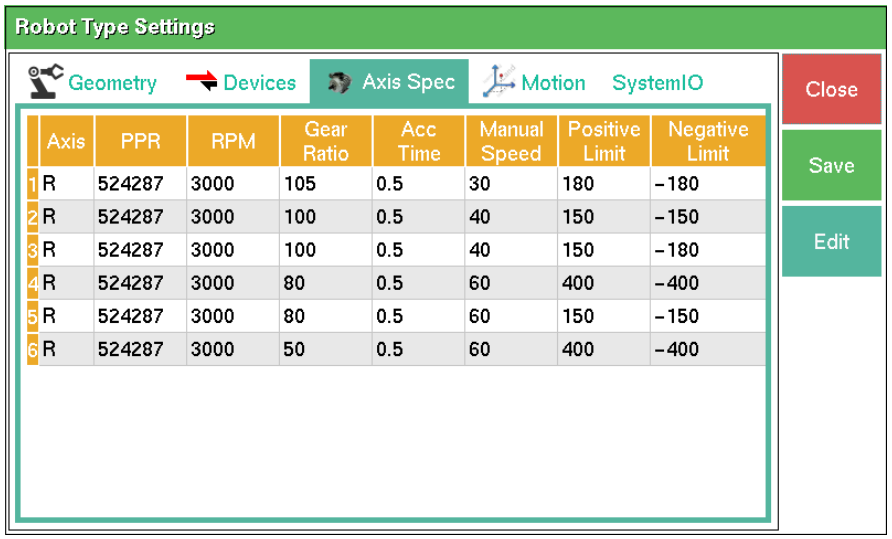


You can check EtherCAT slave devices inside Robot config file. You can also add, edit and delete them. You can append the desired device to the last index of the device list via 'Add' button. By pressing 'Delete' button, you can delete the device starting from the last index.

If you want to edit saved device, you should select the device, then press 'Apply' button for change. You can change all the listed devices with the selected device by pressing 'Apply all' button.

Once all the tasks are done, press 'OK' button to apply changes. Once saved, the system will reboot automatically.

- Axis Spec

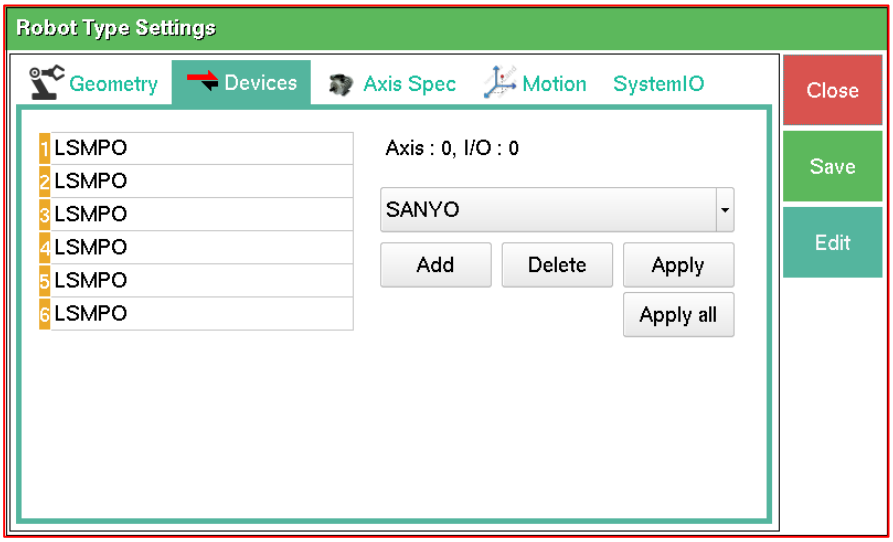


You may check and modify configured value of each Servo motor through this page.

Please take a note that improper input on this page may result in unexpected movements or accidents.

You should select the desired option for change, then press 'Edit' button to modify and save. Once saved, the system will reboot automatically.

- Motion

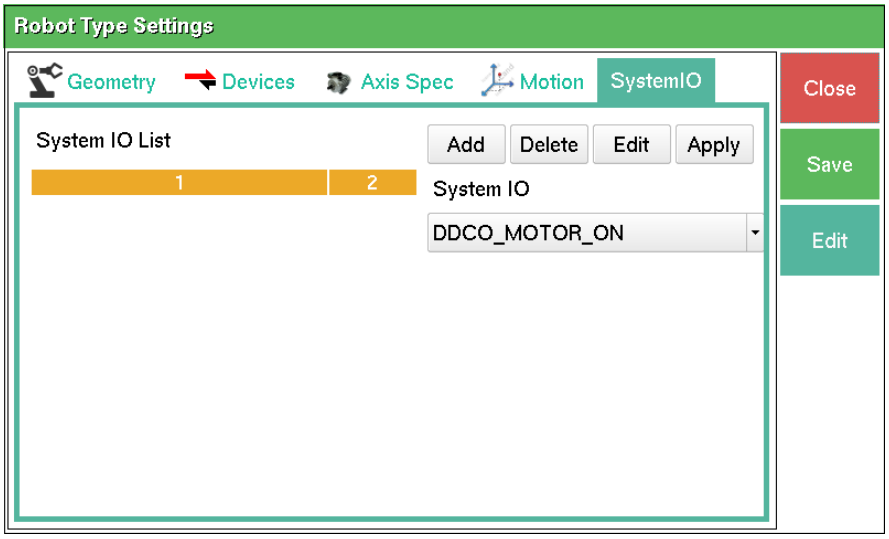


On 'Motion' tab, you can observe and modify speed and acceleration of the robot.

Please take a note that improper input of speed and acceleration may result in unexpected movements or accidents.

You should select the desired option for change, then press 'Edit' button to modify and save. Once saved, the system will reboot automatically.

- System IO

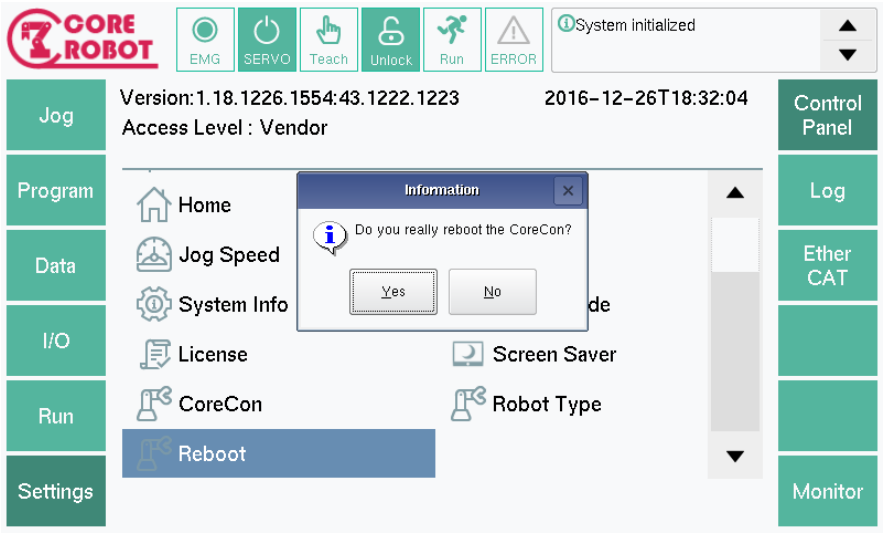


This tab is for configuring system I/O. This tab displays lists of the configured external system I/O which can invoke features like Motor On and EMG Stop without using Corecon UI. You may add, edit and delete System I/O from this tab.

As you press 'Add' button, selected I/O is inserted and the dialog for assigning I/O number will be displayed. Output signal can be assigned from 1 to 128 while input signal can be assigned from 1001 to 1128. You may delete system I/O by selecting the desired one and pressing 'Delete' button

You can shift the preassigned number of the system I/O signal via 'Edit' button. You may change named of the system I/O via 'Apply' button.

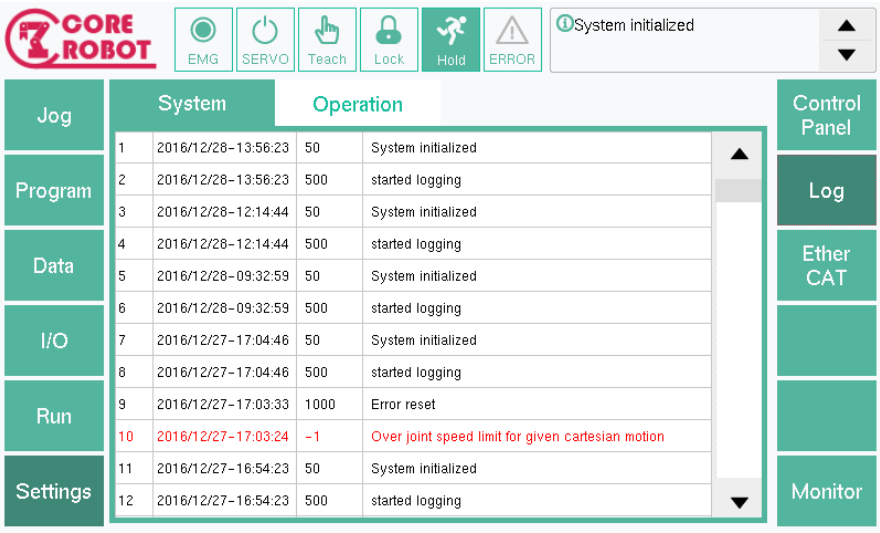
15) Reboot



You can reboot CoreCon by 'Reboot' menu. Once pressed, the popup will be displayed for confirming reboot. If you press 'Yes', CoreCon is turned off and the system will be restarted.

16) Log

After selecting ‘Log’ menu from right sub menu from Settings, you can observe system logs and operation logs.

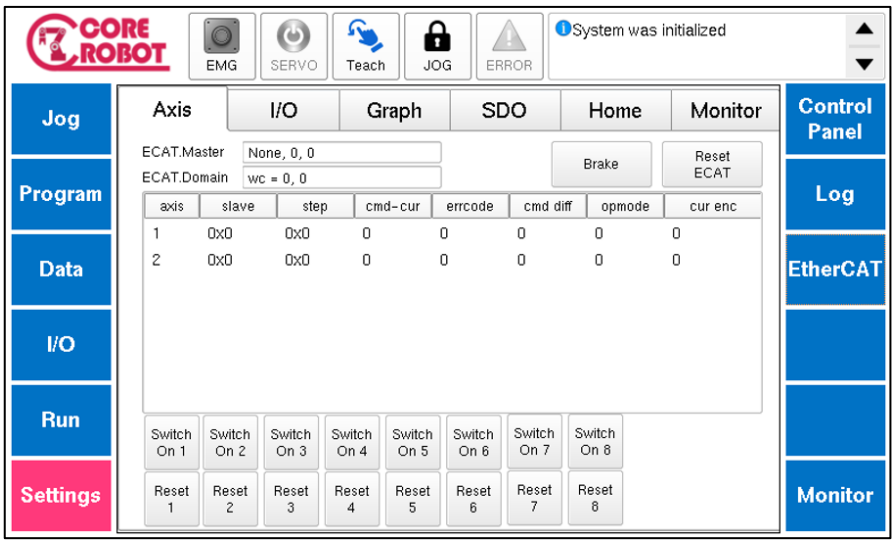


Warning and error messages related to the system are recorded in system logs while messages related to the system operation are recorded in operation logs. These logs can be separated easily by using code. Please refer to ‘Event Log Handling’ section for more details.

17) Ethercat

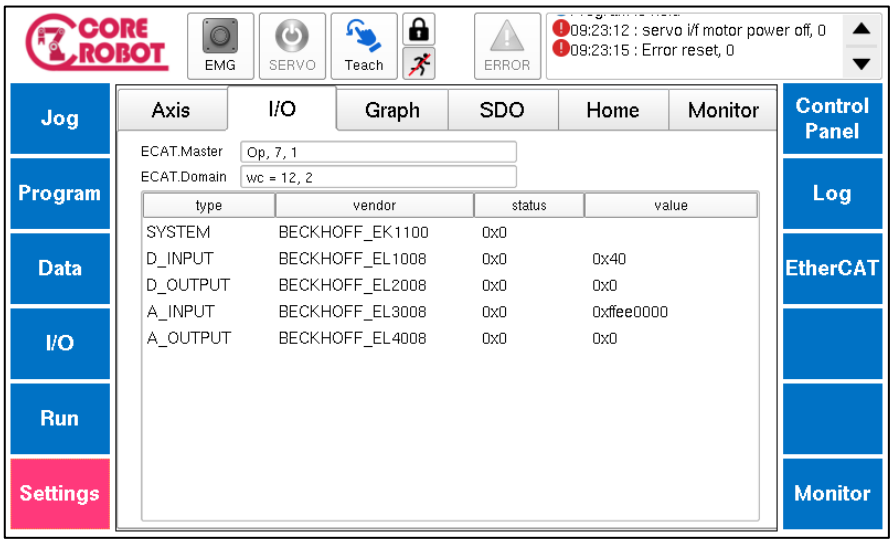
After selecting EtherCAT menu from right sub menu of Settings, you may observe status of EtherCAT, Slave and encoder.

- Axis



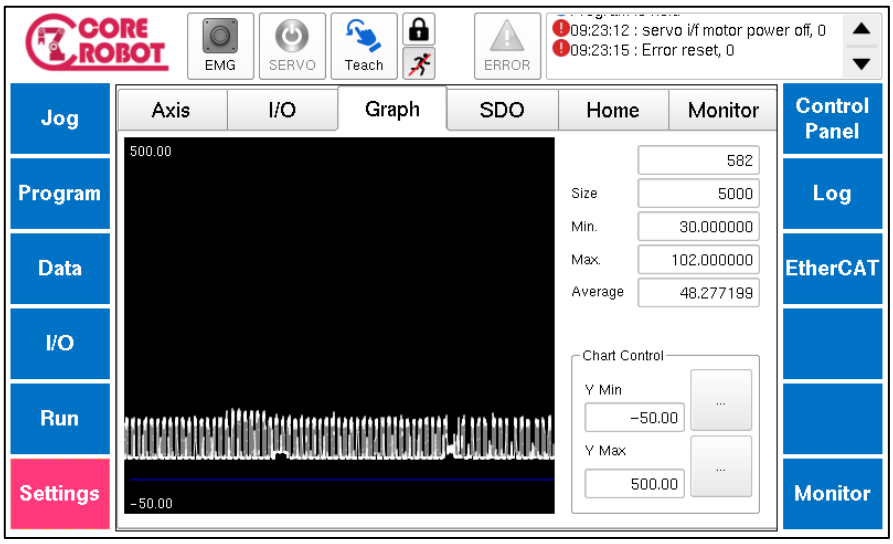
You can observe information of motor drive slaves connected to master. You can turn on the power of the connected motor on each axis.

- I/O



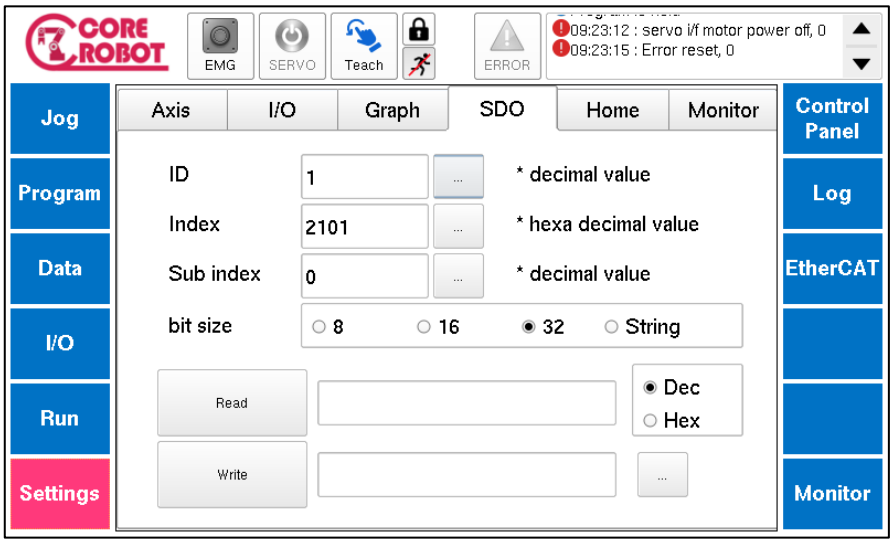
You can observe connected I/O information to Master.

- Graph



Displays task speed for activating motor of Corecon system. The unit used is μs and the maximum speed that can be displayed is 500μs.

- SDO



SDO stands for Service Data Object. SDO is composed of slave and master connection. You may transfer the desired data to the slave.

- Home

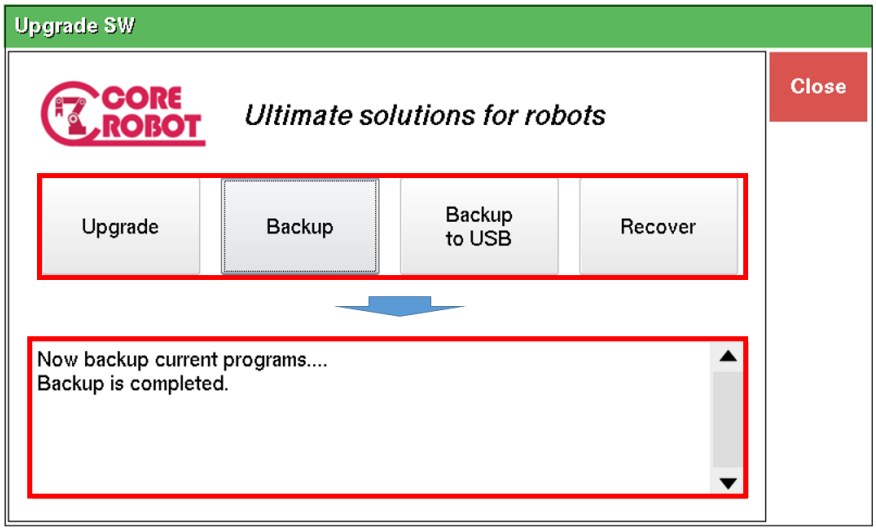
You can observe configured values through 'Homing (Home Searching).' Also, you may use home searching feature.

8. Backup and Restoring

You may prepare backup for unexpected problems or updating Corecon system to a newer version.

1) System backup

You may press 'Upgrade SW' button from Setting menu from Main menu to start system backup and system upgrade consecutively.



You can observe results and current step of the tasks through status display window.

- Backup (Internal backup of controller)

  This feature stores system backup inside controller. All the system files and program scripts written by users will be all stored.

- Backup to USB (USB backup)

  Backup procedures are similar to procedures of internal backup of controller. But, backup files will be saved in USB instead of the controller.

2) System restoration

If programs are seemed to be corrupted or some setting are incorrectly configured, then you may fix these problems via system restoration.

You may open backup files stored inside system via backup feature.

3) Upgrade

If you want to restore Corecon system to specific version desired, you can store the specific version of Corecon system inside USB.

Insert the USB to controller, then use 'Upgrade' feature to modify the system.

4) Cautions during backup

You should concern following warnings when proceeding backup.

- Backup directory

  Backup files will be saved in a default directory defined inside the system. If any attempts for changing this directory to arbitrary ones may cause problems. Therefore such an action is not recommended.

- Appropriate time for backup

  While programs are running, backup cannot be started. Please avoid such tasks as program start, stop and jogging before starting backup.

- Errors on backup

  Backup can be halted as there's no space inside the disk or power is turned off. Backup files on progress will be deleted as a result. Please redo the backup after problem is fixed.