# FANUC - Robot Configuration for MachineLogic Applications

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## Overview

This document outlines the steps necessary to get up and running with robot programming in MachineLogic using a Fanuc CRX robot. This will enable seamless integration of your robot alongside Vention's entire motion components ecosystem.

## Supported Models

- CRX-5iA
- CRX-10iA
- CRX-10i/L
- CRX-20iA/L
- CRX-25iA

## Required Software and Hardware

## Software Options

- Remote Motion Interface (R912) - (PR-FA-002-0022)

## Hardware Options

- CRX Safe I/O - (PR-FA-002-0021)

# Installation Steps

## Robot Configuration and System Connection

### System Connection

This section describes the connection of a MachineMotion V2 to a Fanuc robot controller by way of the Robot Safety Module, in order to program the robot through MachineLogic. The Robot Safety Module acts as a 3-port Ethernet switch to enable seamless communication between the MachineMotion, the pendant, and the robot controller (see Figure 1).

Make sure that the required safety components are properly connected.
Follow the steps detailed in the Robot Safety Module User Manual.

A typical installation (Figure 1) will require the following components:

- MachineMotion Pendant V3
  - Firmware Version v3.4 or later
- E-Stop Module with Reset
- Robot Safety Module
- Fanuc CRX robot controller (R-30iB Mini Plus)
- MachineMotion 2 - Four Drive or MachineMotion 2 - One Drive
  - Firmware Version v2.14.0 or later
- 3 x MachineMotion 2 Safety Extension Cable – 5m (CE-CA-102-5001)

**NOTE**: If your system has more than one controller set up in a Multi-Controller configuration, the safety chain which includes the Robot Safety Module and the Pendant must be connected to the parent controller.
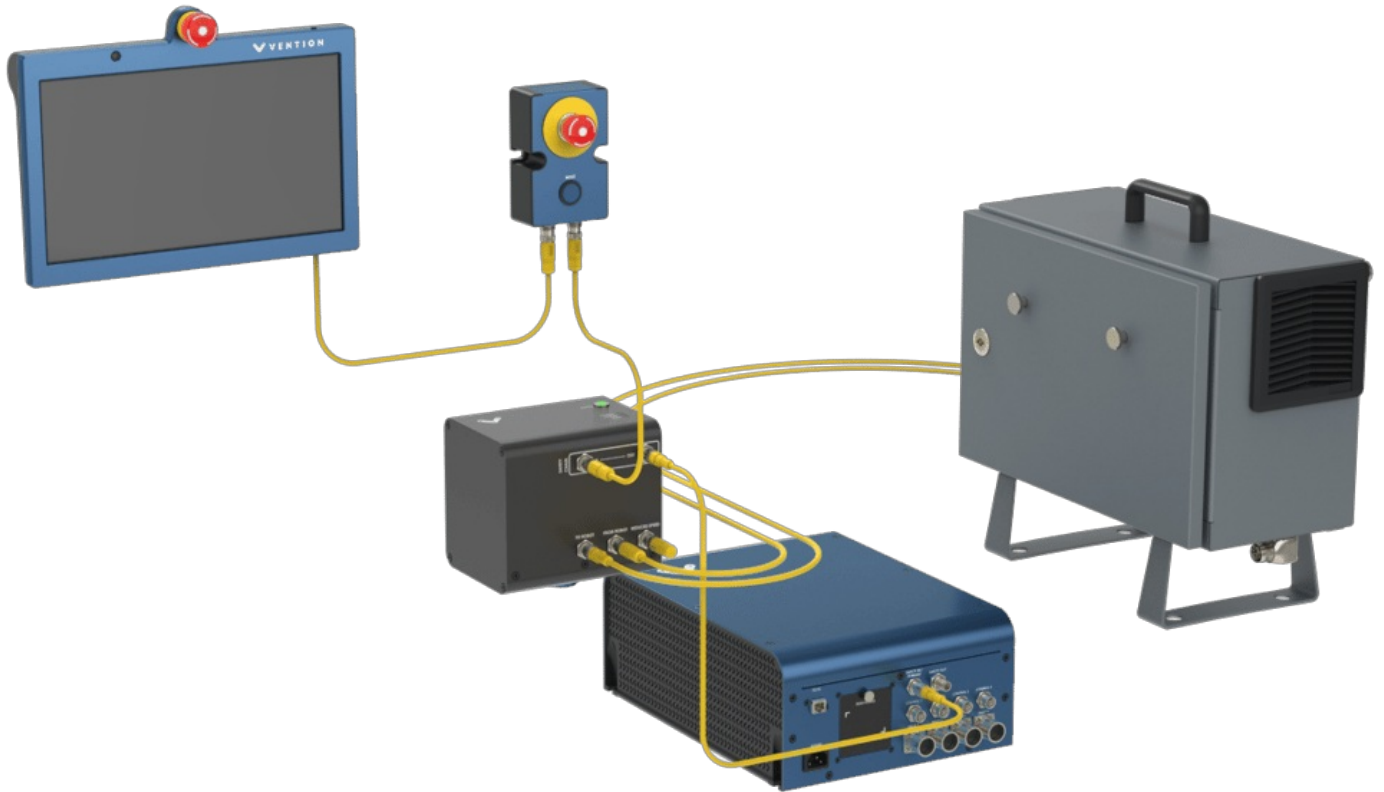
*Figure 1. Safety Components Connection*

# Configuring Your Robot

Following the connection of all required components, configure the robot controller as detailed in the steps below:

## Initial steps

1. Connect the provided teach pendant from Fanuc to the robot controller
2. Turn On the robot controller by turning the switch to On position
3. On the FANUC tablet, open the **Tablet TP** app. Wait for the tablet to connect
4. Wait until the controller is fully powered up
5. **Verify Payload**: User must verify the payload of the robot at startup. Payload included the weight of the end effector and any object that the gripper might hold.
   1. On Boot up Screen, user must verify Payload

2.  Enter Code Number (Master): 1111 \

### Payload Confirmation

Confirm payload.
Please enter code number (master).

[ OK ]     [ Cancel ]
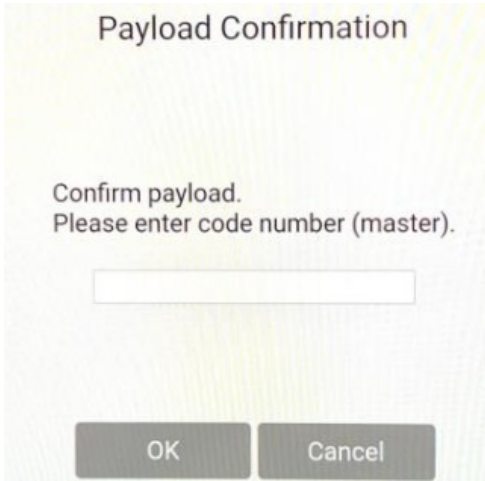
3.  Make sure the proper Payload is set. Otherwise, there may be faults when trying to move the robot ->**Select Yes if correct**

4.  Make sure no one is around the robot. Robot may move if in a specific position and may cause injury ->**Select OK**

### Payload Confirmation

Make sure that the robot is not in contact with people or peripherals.

[ OK ]

5.  **Select OK**

### Payload Confirmation

Payload confirmation success.
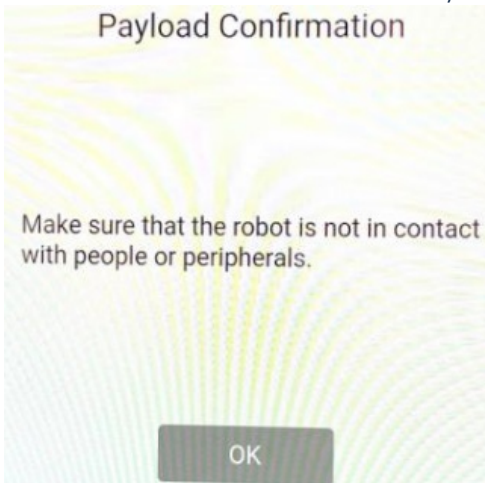
[ OK ]
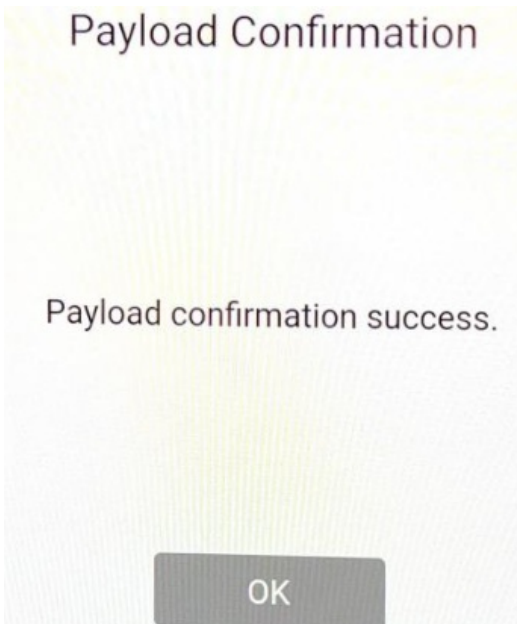
6.  Click on the iPendant icon in the lower right corner to open the virtual iPendant



7.  Enable the tablet teach pendant by clicking on the icon in the upper right corner of the screen.

TP Disabled        TP Enabled

## Payload Creation

This section will outline the steps required to create the different payloads on the robot controller.

1. **Controlled Start of the Robot Controller:**
   1. Enable the Teach Pendant by putting it in TP Enabled mode
   2. FCNT → 0 → 8 → CTRL
   3. Turn power off of the controller then turn it back on
   4. Navigate through the menu: [MENU] → 4 Variables
   5. Look for $PLST_SCHNUM and change it to 256.
      **Tip** Use SHIFT + Down Arrow to speed up the search.

```
MAIN_SAMPLE          LINE 0     AUTO ABORTED
SYSTEM Variables          CTRL START
                                   610/965
608  $PLST_PARNUM    [8] of INTEGER
609  $PLST_SCHMAD    10
610  $PLST_SCHNUM    256
611  $PLST_UPDNUM    [8] of INTEGER
612  $PLS_CMP_LIM    1
613  $PLS_ER_CHK     0
614  $PLS_ER_LIM     1
615  $PLS_ER_RST     FALSE
616  $PL_MOD         FALSE
617  $PL_MOD_ST      TRUE

[ TYPE ]
```

6. Continue to: [MENU]→ 0 [NEXT] → 1 Program Setup → Numeric Registers and change it to 256.

```
MAIN_SAMPLE          LINE 0     AUTO ABORTED
Program Limits            CTRL START
   Program Limits Setup               2/16

   1  User Tasks              4
   2  Numeric Registers       256
   3  Position Registers      100
   4  String Registers        25
   5  Macros                  150
   6  User Alarms             10
   7  Trace Length            200
   8  Num. Dig. Ports         512
   9  Error Severity Table    20

[ TYPE ]                        HELP
```

7. Perform a cold restart: FCTN → Start (COLD).
8. Verify payload sequence.
9. Press on the iPendant icon in the lower right corner.



10. Download the TP program from this link.

11. Another TP program is also required in order to properly use the driver and can be downloaded from the following link:
    Download GET_PARAMS.TP link

12. Insert a USB key in your computer and create a folder to store the previously downloaded programs. (For example, VentionProgram)

13. Add the programs to the VentionProgram folder.

14. Insert the USB key into the robot controller.

15. Navigate to the following menu:
    1. [MENU] → 7 [FILE]
    2. [UTIL] → 1 [Set Device]
    3. Select 6 [USB Disk (UD1:)]
    4. You should see the folder name you previously created
    5. To go inside the directory, select it using the arrows and then press ENTER

```
UD1:\*.*                                    6/33
    1 VENTIONPROGRAM            <DIR>            VENTIONPROGRAM
    2 *            *     (all files)
    3 *            KL   (all KAREL source)
    4 *            CF   (all command files)
    5 *            TX   (all text files)
```

16. Select all TP programs: 8 * TP.

17. Load the programs: [LOAD] → YES and click SET_PAYLOADS.

18. Same thing again but this time with the GET_PARAMS program.

19. Press on the SELECT button → F1 [TYPE] → 4 TP Programs

20. Search for SET_PAYLOADS program and then press ENTER

21. Run the program: [SHIFT] + [FWD].

22. Run until you receive a message indicating "SYST-212 Need to apply to DCS param".

23. [MENU]→ 0 [NEXT] → 6 [SYSTEM] → [TYPE]→ 8 [DCS]



24.

25. F2 APPLY

26. Code number (master): 1111
27. Ok
28. Wait until completion, you should see that collaborative robot: changed to PEND

```
DCS            SYST-290  Cycle power to use new DCS parameter      V    RESET

                                                                    1/16
    1 Collaborative robot:              PEND
    2 Safe I/O Status:
    3 Safe I/O connect:                 OK
    4 Joint position check:     ----    OK
    5 Joint speed check:        ----    OK
    6 Cart. position check:     ----    OK
    7 User model:                       OK
    8 Tool frame:                       OK
    9 Stop position prediction:         OK
   10 Robot setup:                      OK
   11 Mastering parameter:              OK
   12 Pos./Speed check setup:           OK
   13 Safe I/O consistency check:       OK
   14 Safe I/O device:                  OK
   15 Signature number:
   16 Code number setup:



         ⊞          [ TYPE ]      APPLY        DETAIL              UNDO        >
```
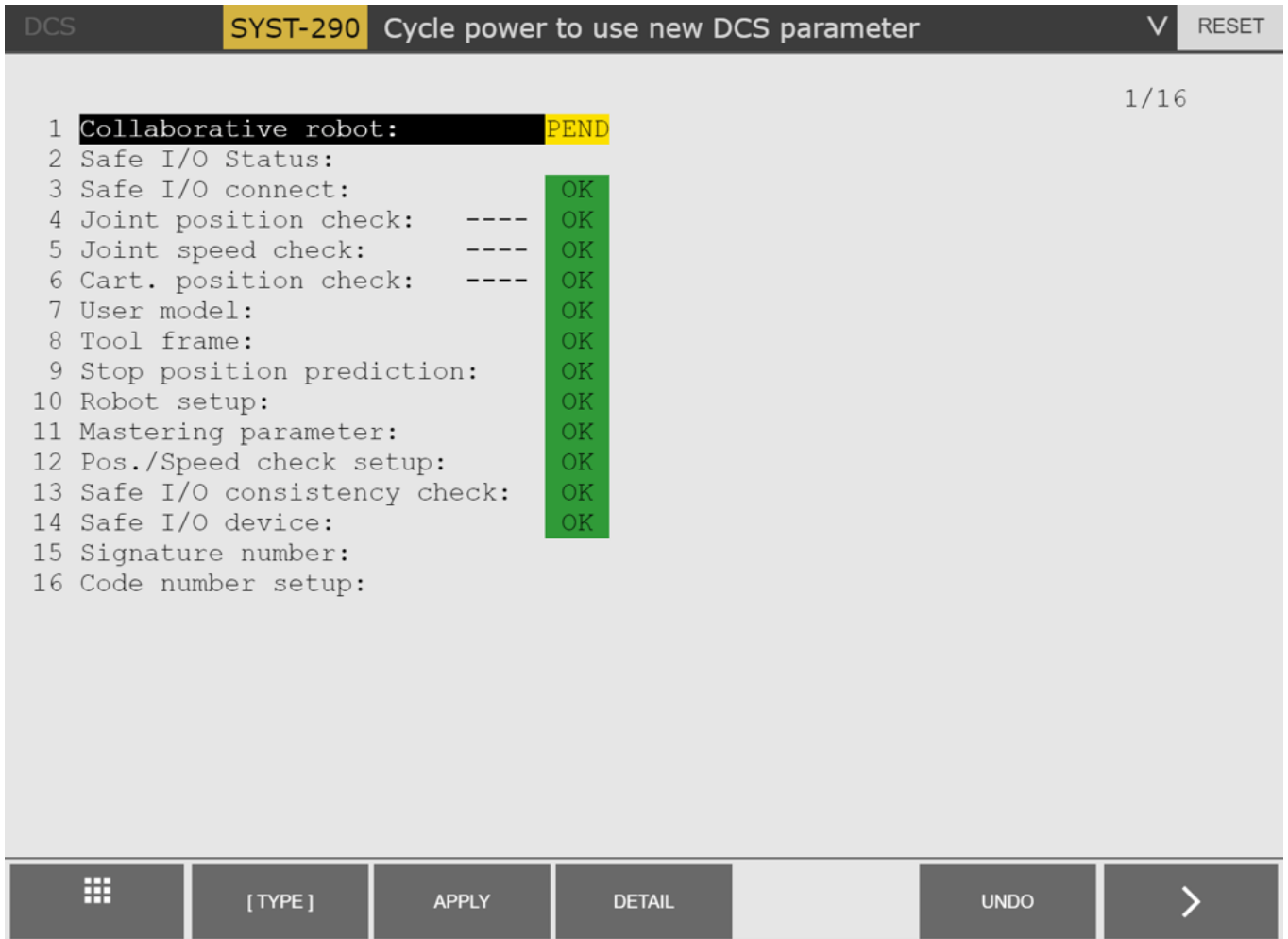
29.

30. Cycle power, turn power Off and the On of the robot controller.

## I/O Setup

This section will details the step required to configure the I/O on the robot controller to ensure functionality with the robot controller.

##### UOP Outputs:

1. Menu → 5 I/O
2. F1 [TYPE] → 7 UOP
3. Ensure that you currently see a table showing UO [1] …
4. If it's displayed UI instead of UO, press F3 (IN/OUT)
5. F2 (Config)
6. You should see something similar to this screen.

```
I/O UOP Out

                                                          1/3
    #       RANGE       RACK SLOT START STAT.
    1  UO[    1-    8]    0    1     1  ACTIV
    2  UO[    9-   16]    0    1     9  ACTIV
    3  UO[   17-   20]    0    1    17  ACTIV
```

7. To change the range max value, go to the value and change it to the value you required. For the first one, we would change the value from 8 to 5. (See following image for the values to input)
8. Here's the expected result:

```
I/O UOP Out

 #          RANGE        RACK  SLOT  START  STAT.
 1   UO[     1-    5]      0     0      0   UNASG
 2   UO[     6-    6]      0     0      1   PEND
 3   UO[     7-   20]      0     0      0   UNASG
```

##### UOP Inputs:

1. F3 (IN/OUT) to switch in UI view
2. Change the values for these values:

```
 #          RANGE        RACK  SLOT  START  STAT.
 1   UI[     1-    3]     35     1      1   PEND
 2   UI[     4-    4]      0     0      0   UNASG
 3   UI[     5-    5]     48     1      1   PEND
 4   UI[     6-    7]      0     0      0   UNASG
 5   UI[     8-    8]     35     1      1   PEND
 6   UI[     9-   18]      0     0      0   UNASG
```
3.

## Digital Outputs:

1. F1 [TYPE] → 3 Digital
2. Click F3 (IN/OUT) to be in DO view if not already
3. F2 (Config)
4. See following image for the values to input. Only the first two range of DO needs to be changed (Range 1-1 and Range 2-3). The others can stay the way they currently are.

```
 #          RANGE        RACK  SLOT  START  STAT.
 1   DO[     1-    1]      0     0      0   UNASG
 2   DO[     2-    3]      0     0      2   PEND
 3   DO[     4-    8]      0     0      0   UNASG
```
5.

## Digital Inputs:

1. Click F3 (IN/OUT) to be in DI view
2. Change the values for the Range DI [1-3] only with the following. The other values can stay the same:

```
 #          RANGE        RACK  SLOT  START  STAT.
 1   DI[     1-    3]      0     0      1   PEND
 2   DI[     4-    8]      0     0      0   UNASG
```
3.

## Collaborative Robot Setup:

1. [MENU]→ 0 [NEXT] → 6 [SYSTEM] → F1 [TYPE] → 8 [DCS]
2. Select Collaborative robot and [ENTER]
3. Line 28, **Collaborative Speed:** set it to the desired value (Default is 250)



4. Line 29, **Disabling Input:** Enable TP  → [Choice] → [YES] → [CHOICE] → 2 DI and the set number 3.

5. It should result into this DI[3]
6. Line 30 set Max Speed to the desired speed (Default is 1000)

7. Line 36 STOP: F4 [CHOICE] → 4 SIR → SIR[1]
8. Line 59 Manual Guided Teaching and Enter
9. Enabling input, Enable TP, Choice, 2 DI, and set the number 2 DI[2]

## Safety IO Configuration

*Safety I/O module (CRX Safe I/O) must be installed in the controller prior to following these steps.*

1. **Safety Configuration:**
   1. [MENU]→ 0 [NEXT] → 6 [SYSTEM] → 8 [DCS]
   2. PREV → PREV, You should come back to this menu:



3.

4. Safe I/O device (Line 16) and Enter
5. F3 INIT → YES → F3 INIT → YES two times
6. [PREV]
7. Safe I/O connect (Line 3) and Enter
8. @SPO[9] =! SIR[1]
9. @SSO[3] =! SIR[1]
10. [PREV]
11. Apply. Set the master code to 1111
12. Ok
13. Cycle power, turn power Off and the On of the robot controller.

## Network Configuration

Make sure the Ethernet Cable coming from Vention's Robot Safety Module is connected to the second Ethernet port.

1. **Ethernet Setup:**
    1. Navigate to: [MENU] → 6 [SETUP] → [TYPE] → 0 [NEXT] → 6 [Host Comm].
    2. Select 1 [TCP/IP] and then [DETAIL].
    3. Ensure Line 2 indicates Port #2.
        1. If Line 2 indicates Port #1, select [PORT].
    4. You should see something similar to this:
    5.
    ```
    TCP/IP
        Robot name:                        ROBOT
        Port#2 IP addr:********************
        Subnet Mask:          255.255.255.0
        Board address:  ******************
        Router IP addr:          192.168.1.1
        PC Jog IP addr:                    *
        OP Panel IP addr:    192.168.0.100
    ```

    6. Configure the IP settings for Port #2:
        1. Line 2 IP Address → ENTER: Write this IP address: 192.168.5.3 → ENTER
        2. Subnet Mask: 255.255.255.0
        3. Router IP Address: 192.168.5.1

    ```
    TCP/IP
        Robot name:                        ROBOT
        Port#2 IP addr:          192.168.5.3
        Subnet Mask:          255.255.255.0
        Board address:  ******************
        Router IP addr:          192.168.5.1
        PC Jog IP addr:                    *
        OP Panel IP addr:    192.168.0.100
    ```

        4. You should see this:

    7. Make sure the Port #1 is not in the same subnet as port #2 to ensure no network conflict problems will occur.
        1. If the third section of the IP address contains a 5 (For example 192.168**5**.2) Change it to 192.168.2.1
    8. Cycle power, turn power Off and the On of the robot controller.

## Control Center

1. Power Cycle of the robot
2. Power Up MachineMotion
3. Make sure wiring is properly connected in the safety chain
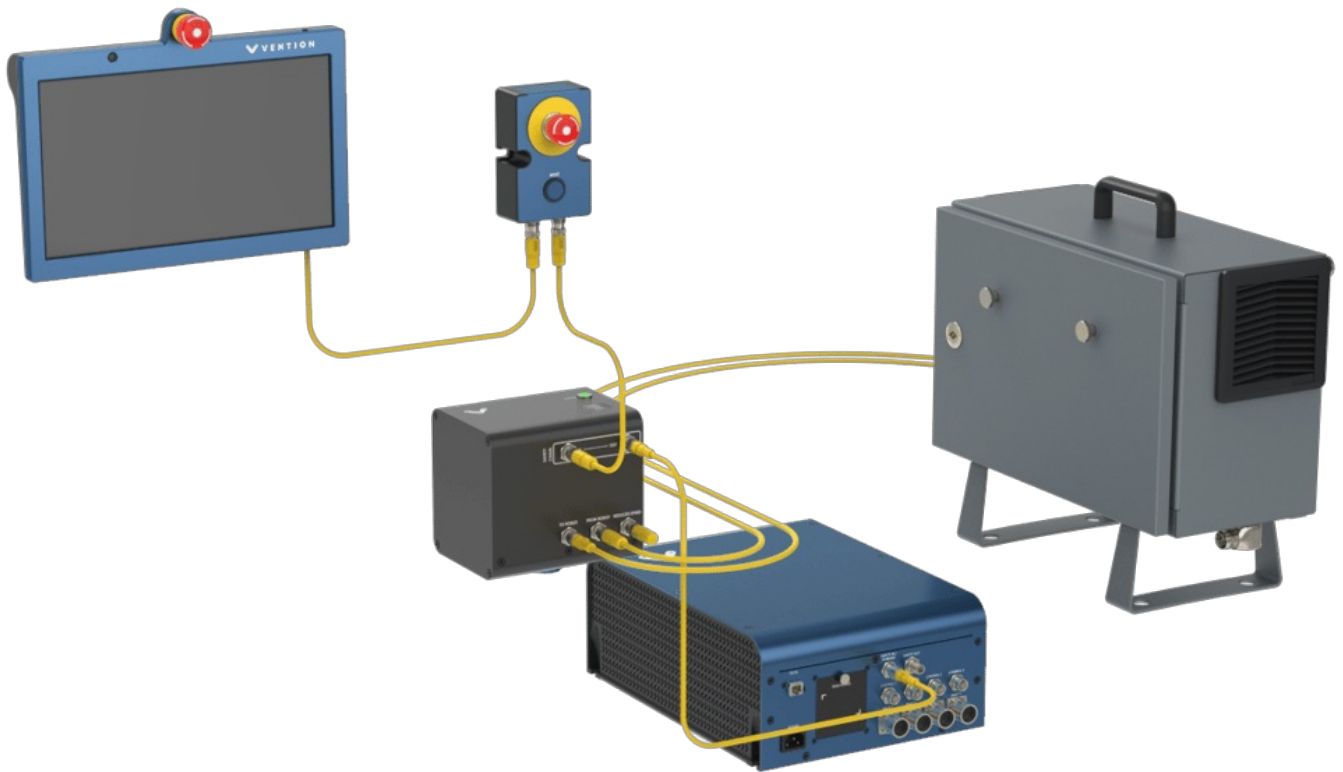
4. Wait for the Fanuc Teach Pendant to be powered up
5. Clear error message if needed
6. Confirm payload sequence
7. Using the Vention Pendant, go to the configuration Page
8. Add robot to your configuration
9. Select the robot you've purchased
   - Example: Select CRX 10iA/L
10. Apply Configuration
11. Wait for connection to be established
12. You are now ready to use your robot with a MachineLogic application!

# Backup and Restore your Controller

It is normally good practice to backup your controller to ensure you can always come back to a known functional version of your controller.

## Backup creation Steps

1. FCTN → Abort All

2. Menu → 7 File → Util → Set device → 6 USB Disk

3. You should have UD1 on the top left.

4. Make sure you don't have a robot configured on your MachineMotion Pendant before continuing.

5. Util - 4 Make DIR - Define the name you need (e.g., BackUp Controller) - GO

6. You should have on the top left UD1/"Name you chose".

7. Backup → 8 All of Above → YES → Then Wait until completion.

## Restore your Backup Steps

1. **Obtain a Thumb Drive:**
   - Obtain a thumb drive with a previous MD backup for the robot you're working on.
2. **Insert the Thumb Drive:**
   - Insert the thumb drive into either the USB port in the black door on the controller (UD1:) or the USB port on the right side of the teach pendant (UT1:).
3. **Perform a Controlled Start:**
   - Cycle power to the controller.
   - As soon as the robot starts to power back up, hold PREV and NEXT on the teach pendant to be taken to the Configuration Menu.
   - Type 3 and press ENTER to initiate a Controlled Start.
4. **Access the File Menu:**
   - Once the teach pendant boots back up, press the MENU button then select File -› File.
   - On the FILE menu, press F5 [UTIL]. If [UTIL] is not shown above F5, press NEXT until [UTIL] is shown and then press F5.
   - Select Set Device.
   - Select either USB Disk (UD1:) or USB on TP (UT1:), depending on where you inserted your thumb drive.
   - Navigate to the directory in which your MD backup is stored. If no files or directories are shown, you will have to press ENTER on (* * (all files)) to see the thumb drive's contents.
5. **Restore the Backup:**
   - If [RESTOR] is not shown above F4, press FCTN, then select RESTORE/BACKUP to toggle between restore and backup.
   - Press F4 [RESTOR].
   - Select the type of restore action that you want:
     - System files (system variables, servo parameter data, and mastering data)
     - TP programs (.TP, .DF, and .MN files)
     - Application ("Non-program application files".
     - Applic.-TP (All of the above, except system files)
     - Vision data
     - All of above
6. **Confirm and Start Restore:**
   - You will be prompted with "Restore from UT1: (or UD1:) (OVERWRT)?". Press F4 YES.
   - The TP will show "Accessing device. PREV to exit." for about 30-60 seconds, then the restore will commence. Once it begins, typical restore time is ~2-6 minutes, depending on the contents of your robot.
   - As many files as possible will be restored. Once the restore is complete, you will need to perform a Cold Start.
7. **Perform a Cold Start:**
   - Press FCTN.
   - Select START (COLD).

## Glossary

- **DCS:** Dual Check Safety
- **SIR, SPO, SSO:** Safety related registers and outputs.
- **I/O:** Input/Output

## Support

For further assistance, please contact our support team at support@vention.io or calling +1-1800-940-3617 (ext. 2).