EuroSkills 2023 Gdańsk
Test Project

Robot Systems Integration

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Contents

Please note that each section is labelled "F /C1/C2/C3/C4"

This refers to the timing of the release of each part of the Test Project to the Competitors and Interpreters.

F – During Familiarization

Cn – At start of C1 / C2 / C3 /C4

Introduction to Test Project (F)

The project is to set up a system for automatically sanding various different types of painted panels.
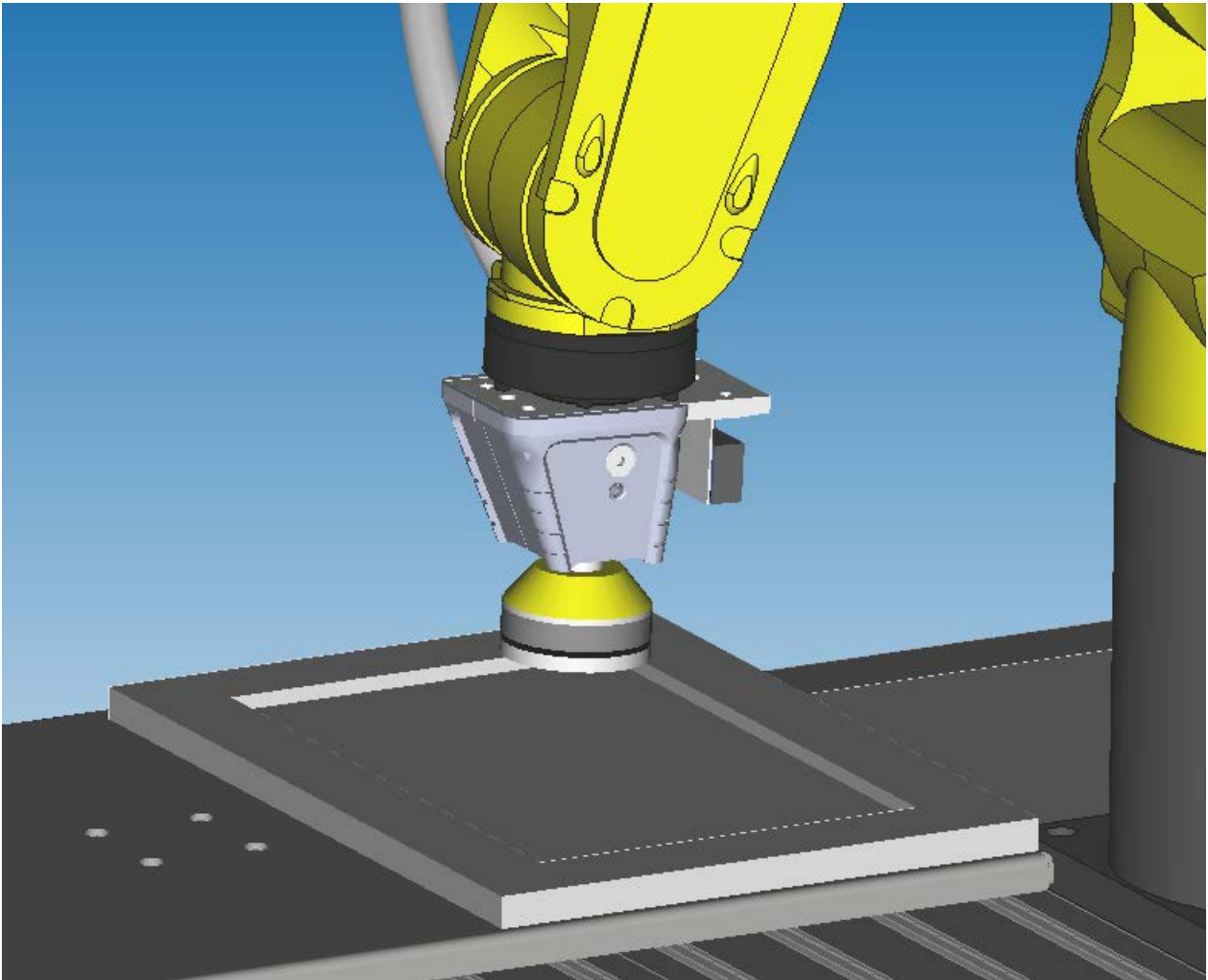
The panels will be loaded onto a turntable and rotated in and out of the robot work envelope.

The project is divided into stages, setting up the robot and cell, completing the basic task and then attempting extension tasks if the competitors have time.

Introduction – Education Cell (F)

The competition is based upon the standard FANUC Europe Education Cell:

The Education Cell is delivered 'ready to run' – there is no need for the Competitors to physically install the robot or connect input power.

But the Competitors must decide on the layout of the cell components and install, connect, and configure all cell equipment.

Introduction – Safety (F)

Each Expert is responsible for the safety of their team
Competitors bodies should not enter the cell while moving/programming the robot

OK	OK	NOK
Working in Cell **without**	Programming	Programming with TP
Teach Pendant/Servo OFF Outside Cell		Inside Cell
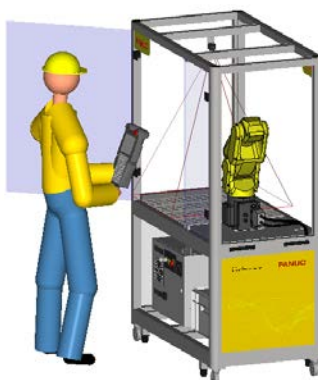
When installing, connecting peripherals etc, Servo power must be cut by E-Stop on Teach Pendant or Controller.

Competitors should not crowd around one another, especially in front of the cell door
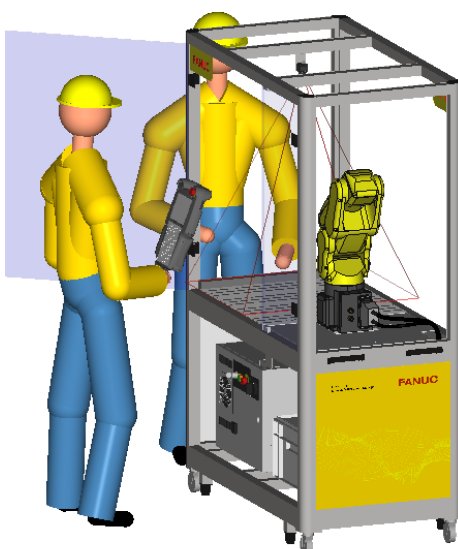
OK	NOK
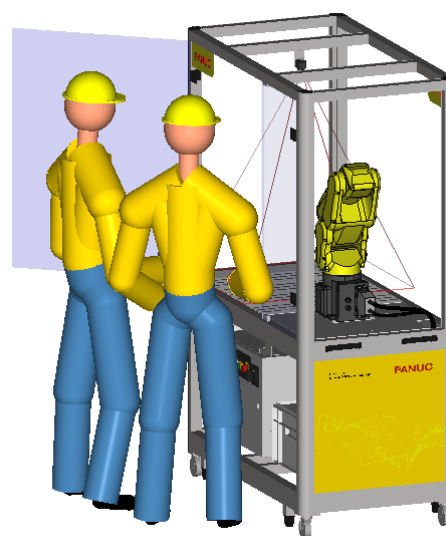
AUTO/T1/T2 Switch
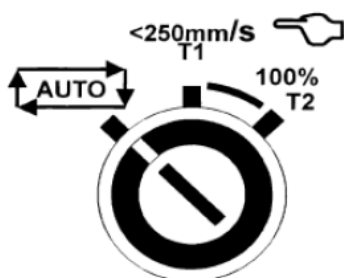
Competitors should do all setup/programming etc in T1 mode (<250 mm/s)

For Test Run, Auto, or T2 Mode can be used.

The Auto/T1/T2 switch position must be changed by the Experts only.
The Experts are responsible for the Auto/T1/T2 key.

Personal Protective Equipment

Safety shoes must be worn by Competitors and Experts while in the competition workshop. Safety glasses and gloves may be worn but are not required.

Controller Access/Open Controller Door

There is no specific reason foreseen for the Competitors to open the controller door.

But in case Competitors request, for instance to check a proper Ethernet connection, the door may be opened **by FANUC Technical Support Staff or two non-compatriot Experts only**.

Power must be turned off before opening controller!
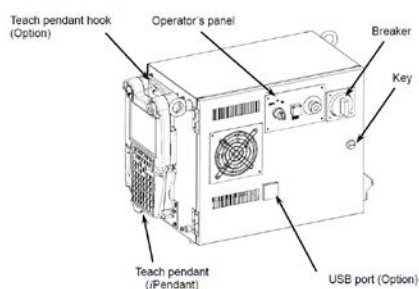
<div align="center">OK NOK</div>
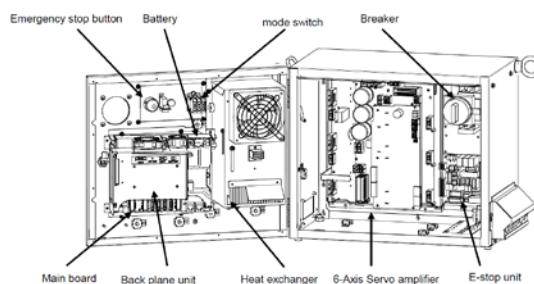
Description of project and tasks

Description – Basic Task Parts (C1)

For the Basic Task, 3 different parts will be provided for sanding.
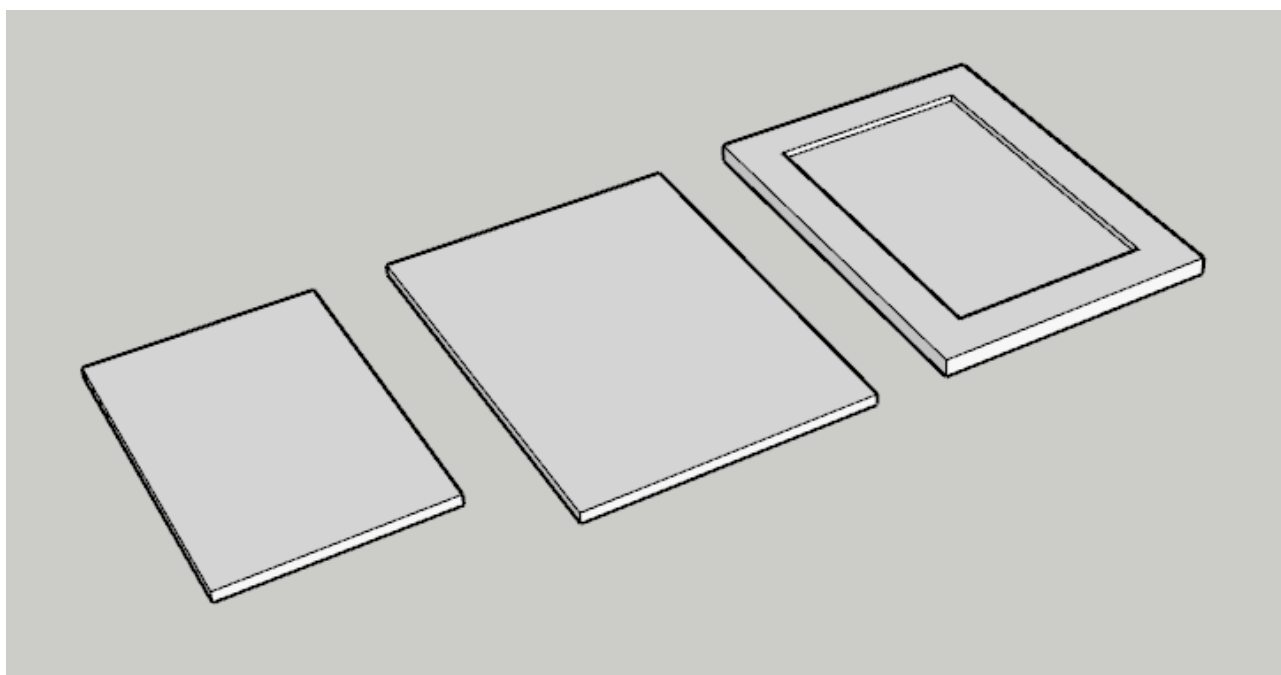
- One small flat plate 230mm x 150mm x 8mm
- One standard flat plate 280mm x 200mm x 8mm
- One panel/door plate 280mm x 200mm x 13mm with a 5mm deep recess in the centre

Each of these parts have magnetic strips attached to the back side of the part which will allow them to be placed securely on a metal (magnetic) plate.
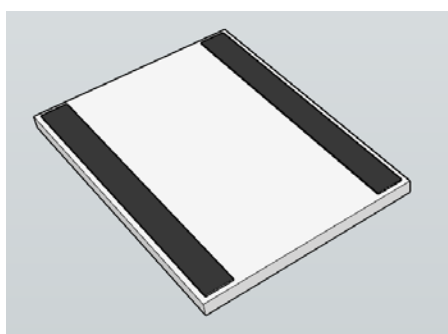
An additional part will be provided as part of the Extension Task

Description – Extension Task 2 Part (C3)

The Extension Task part has a curved surface with a radius of 220mm
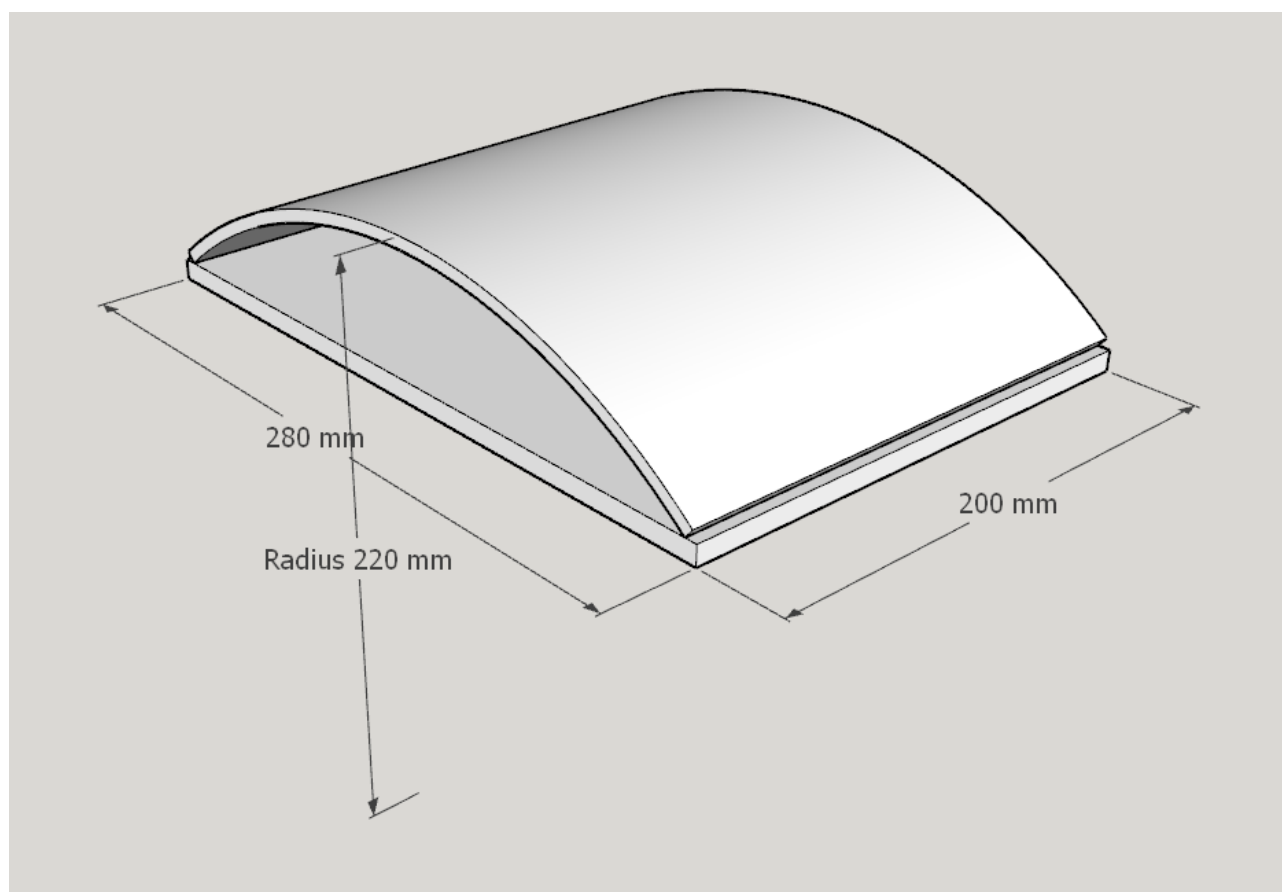
It is also equipped with the magnetic strips to hold it to the Turntable.

Description – Equipment (F)

The necessary equipment for the application is supplied:

A Sanding Head end-effector which simulates a real sanding head:
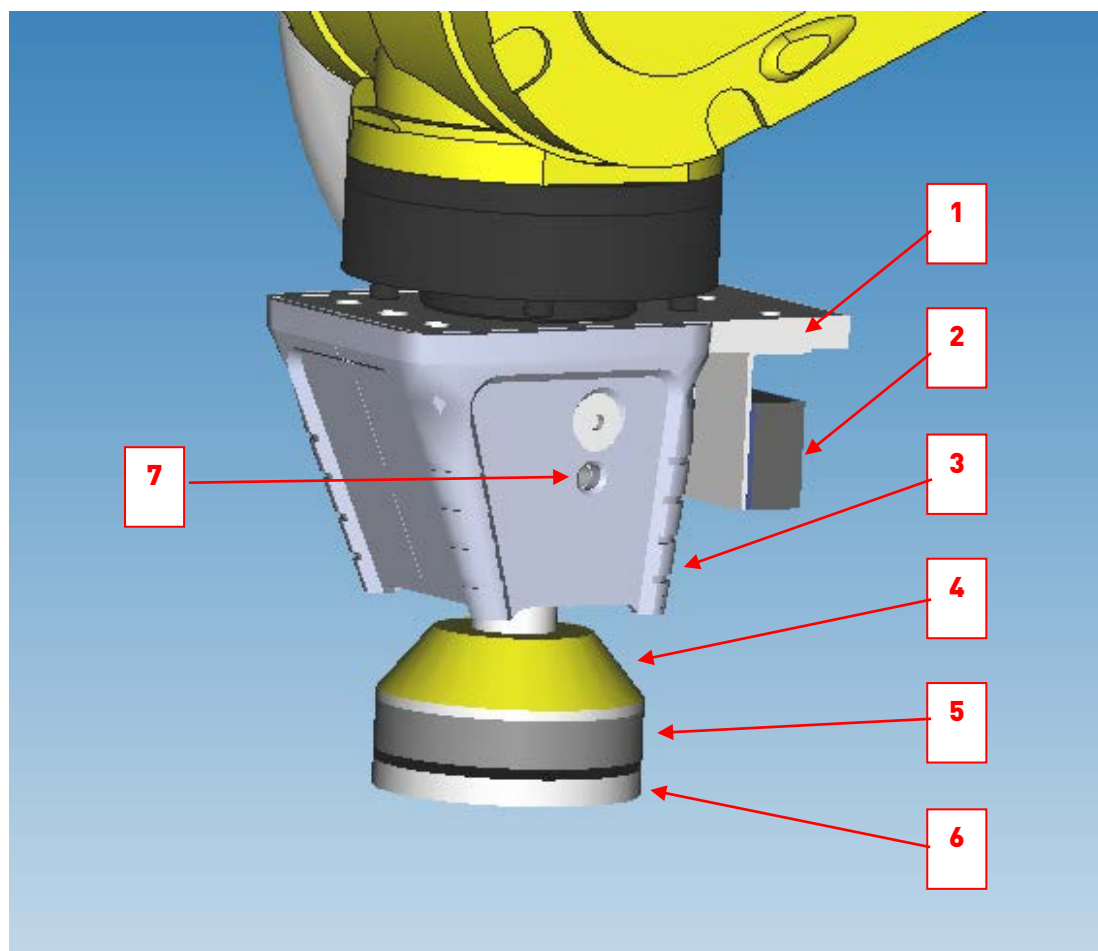
#	DESCRIPTION
1	J6 Mounting Plate – to mount the entire assembly onto J6
2	Laser Sensor – see later for instructions on how to use, and Data Sheet on how to adjust
3	Covers, Left and Right – can be removed by removing one screw from each side
4	Sanding Pad Backer – this is the part that would rotate / vibrate in a real sanding application
5	Sanding Pad Buffer – this gives some compliance to the sanding process
6	Sanding Pad – this is the part that will be used to simulate the sanding process
7	Set Screw – this holds the Sanding Pad /Buffer/Backer in place

Laser Sensor

A Laser Sensor is included in the End Effector. This sensor should be connected to an input and used to sense part presence or height. For details on how to use and adjust the sensor please refer to the provided documentation.
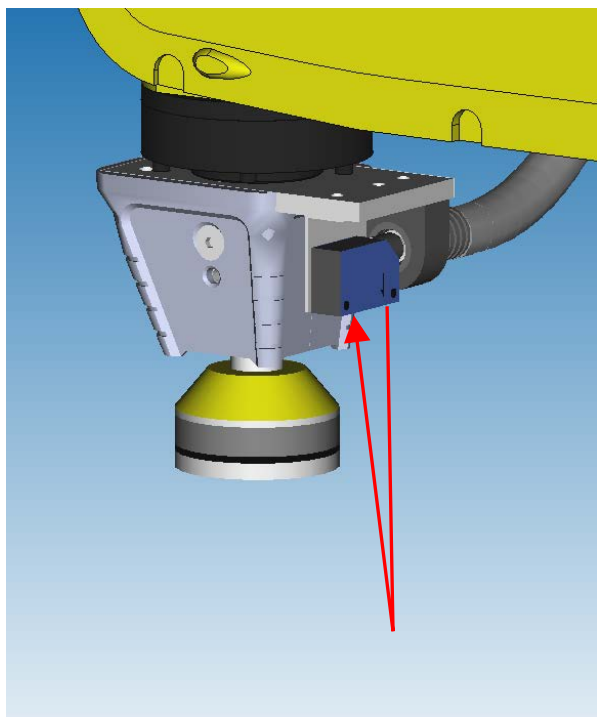
Teach Pin

The centre / TCP of the Sanding Tool is not clearly defined, so a Teach Pin is also provided – this can be installed without removing the covers, using the Set Screw.

The Teach Pin MUST be used to teach accurate reference positions and frames.
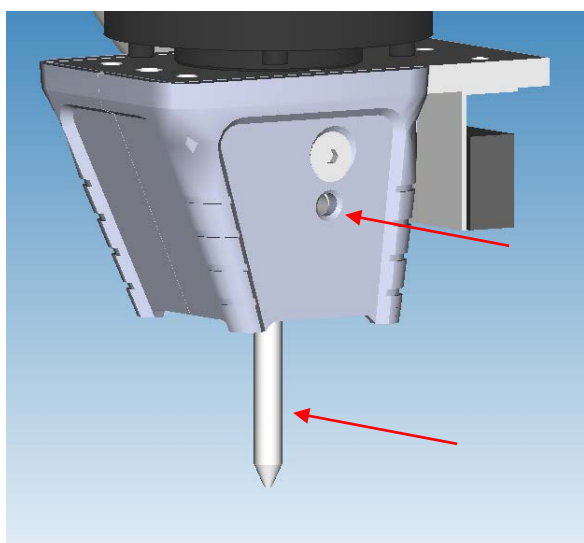
Dressout Conduit

A Conduit, Clamps, and Brackets are provided which should be attached to the Sanding Head, J3 and J1 Base as shown below:
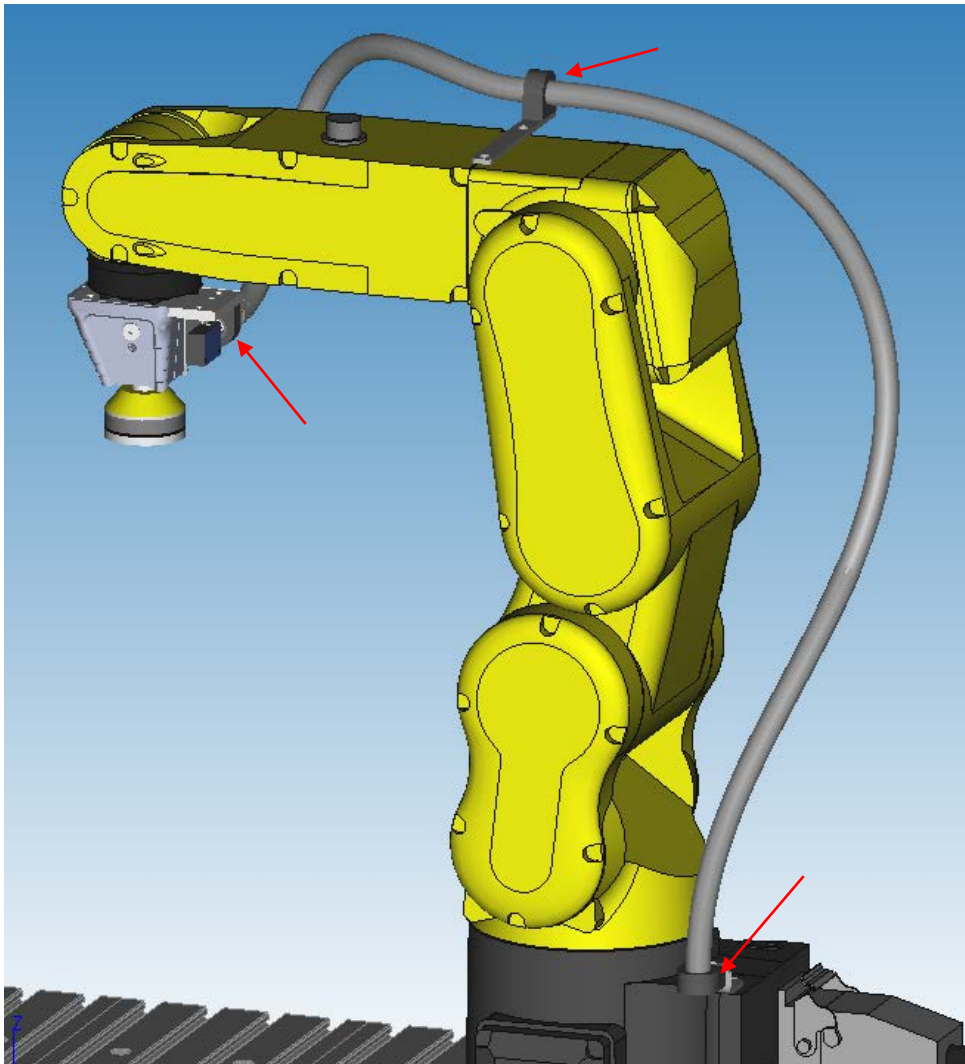
The Dressout is used to route the Laser Sensor cable to the I/O Module. It also simulates the dust extraction hose which would normally be used in such applications. Care must be taken to make sure that the robot motion does not damage this hose.

Level Mounting Plate, Quick Mastering Fixture and Feeler Guage

The competitors must set up an accurate Quick Mastering Reference Position – and special equipment is provided for this purpose:

By removing the side covers, the Level Mounting Plate can be attached:
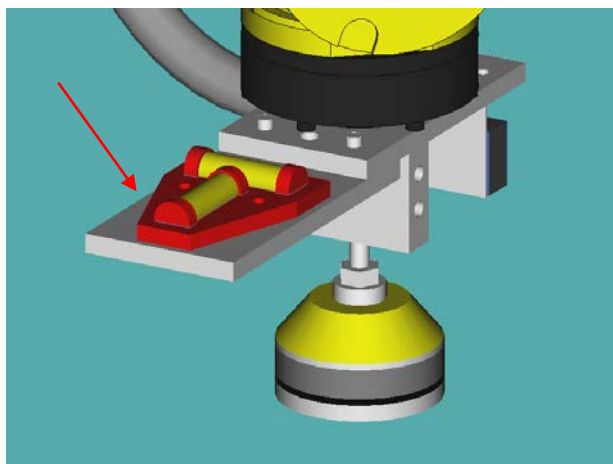
The Level Mounting Plate is used with the Quick Mastering Fixture:
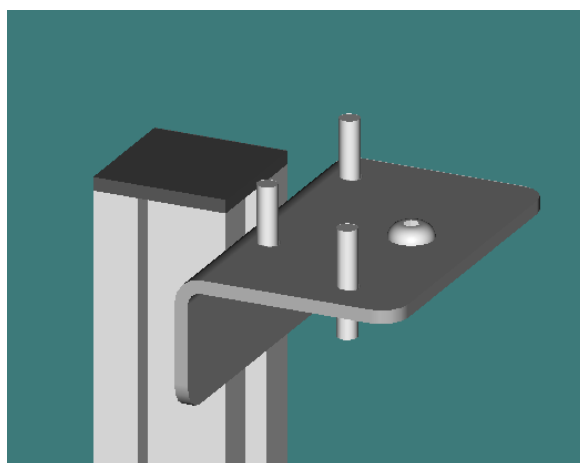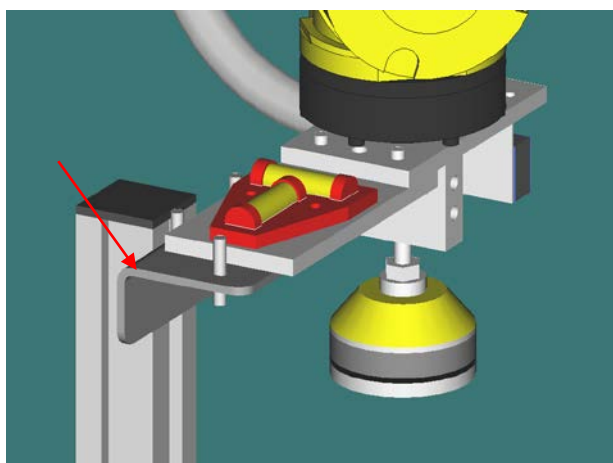
And a Feeler Guage is provided to allow accurate programming of the Quick Master Reference Position:
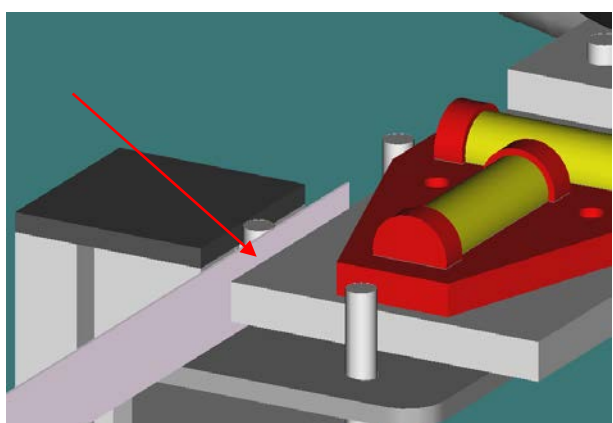
Turntable Unit:
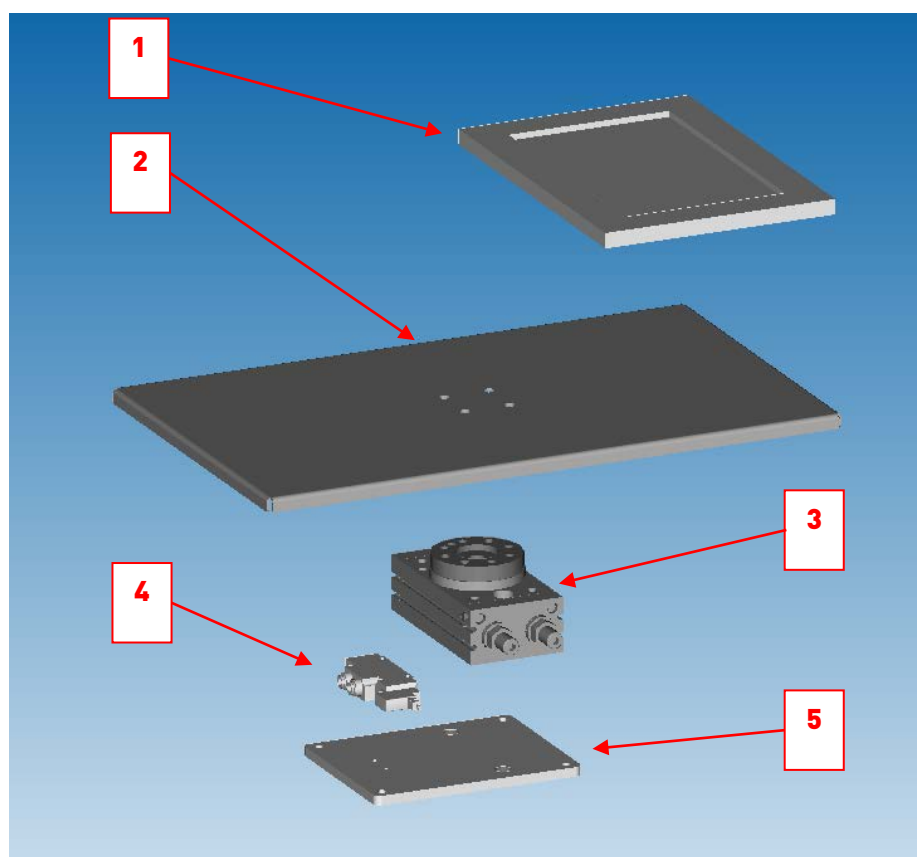
#	DESCRIPTION
1	Parts are held onto Turntable with Magnetic Strips
2	Turntable Top Plate (magnetic material)
3	SMC MSQB50R Rotator Unit
4	SMC Pneumatic Control Valve
5	Turntable Base Plate

The Turntable is supplied partially assembled – Competitors must finish assembly, connect and adjust it.

The Turntable should be installed in a position similar to that shown below.
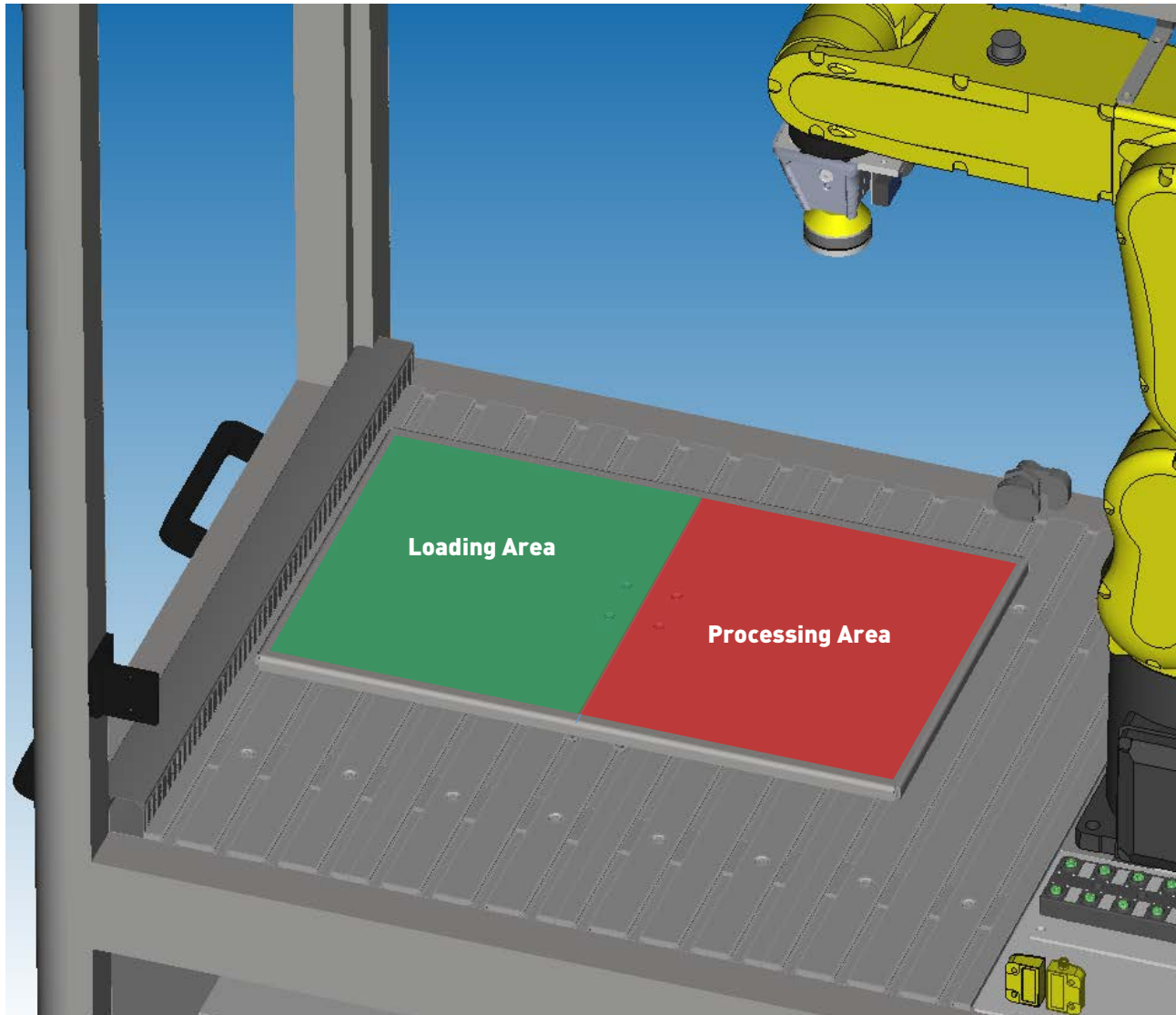
The area shaded green will be called the "Loading Area" and the area shaded red will be called the "Processing Area"

Parts placed in the Loading Area will be rotated into the Processing Area to be processed (sanded)

Description – I/O Block (F)

An I/O Connection Block is supplied to connect peripheral equipment:
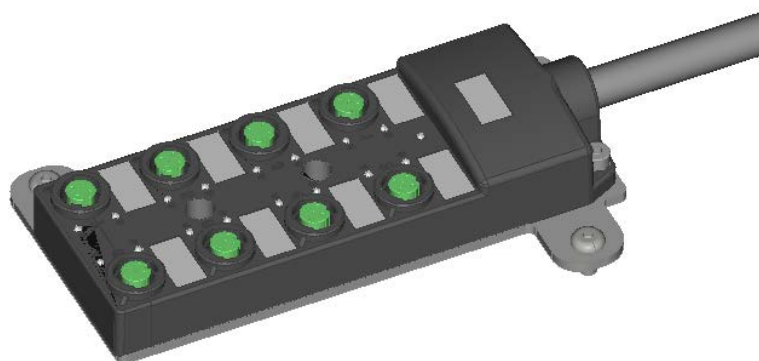
The I/O Block has sockets numbered 1 to 8 as shown below:
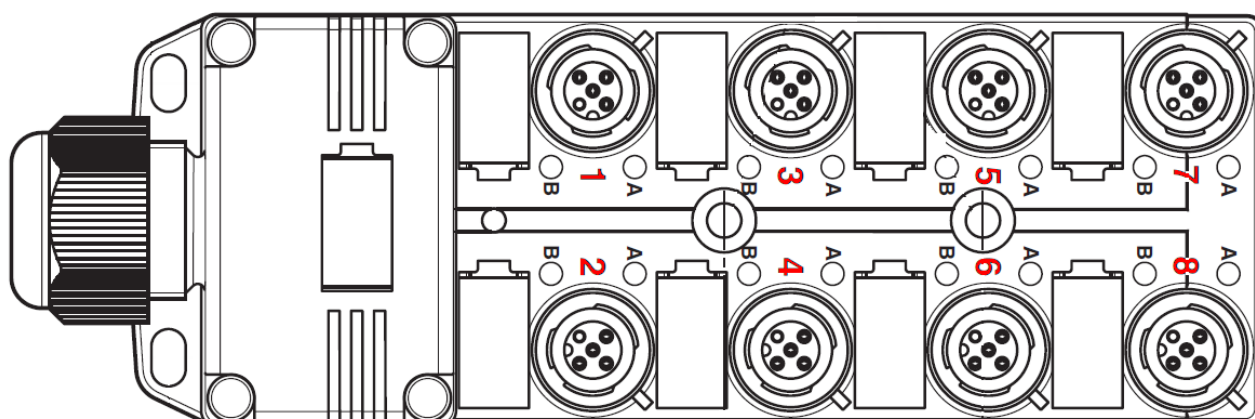
The robot I/O is pre-connected to the sockets as shown in the table below:

SOCKET	A (PIN 4)	B (PIN 2)
1	DI[101]	DI[102]
2	DI[103]	DI[104]
3	DI[105]	DI[106]
4	DI[107]	DI[108]
5	DO[101]	DO[102]
6	DO[103]	DO[104]
7	DO[105]	DO[106]
8	DO[107]	DO[108]

The Input and Output cables can be connected directly to the socket or via a Y-connector as shown below, to make the most efficient use of the available I/O. Plastic clips are supplied to clip cables to the table if needed – see examples below:

PLEASE NOTE THAT NO ELECTRICAL MODIFICATION OF CABLES OR CONNECTORS OR ANY OTHER COMPONENTS IS REQUIRED OR ALLOWED!

Description – UOP Box (F)

The UOP Box is already attached to the Education Cell and connected to the robot I/O:
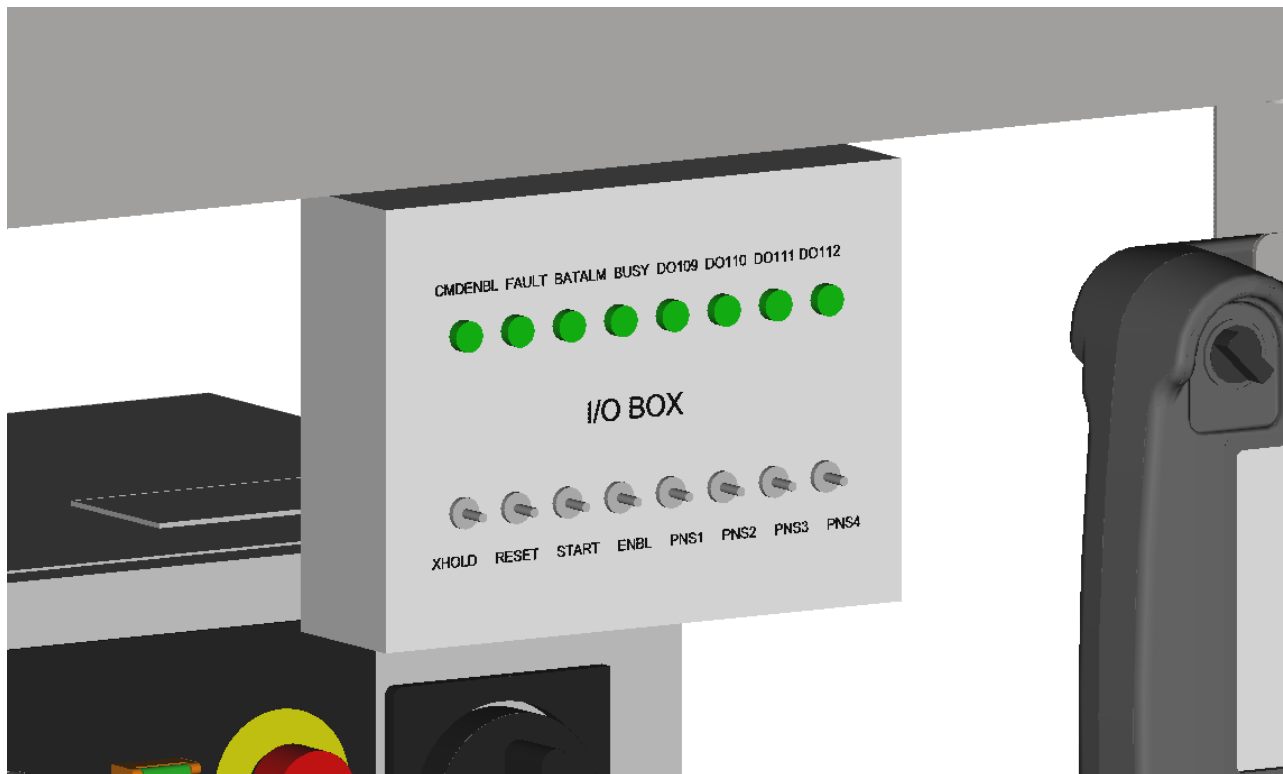
The I/O is configured as shown on the UOP Box.

DO[109..112] are available for the competitors to use for any purpose.

If they are used, they should be labelled appropriately.

For details please refer to the Robot Controller Manual B-83284EN/09 , Section 3. SETTING UP THE ROBOT SYSTEM

Description – PC and Software (F)

One laptop is supplied, equipped with:

- Mouse
- Microsoft Windows.
- Microsoft Office: Word, Excel, PowerPoint, acrobat reader etc – for Documentation
- Microsoft Office Sharepoint Designer for Web Page construction
- Microsoft Internet Explorer for connection to Robot Controller
- FANUC Roboguide for Simulation (and template RG Cell)
- Payload checker
- One USB key for file transfer etc.
- Ethernet cable for connection to robot controller for file transfer, iRVision etc.

All necessary FANUC Manuals are also supplied in PDF form on the PC

- HTML Editor
- Manuals
- Payload Checker
- Roboguide

Description – Ethernet (F)

An Ethernet cable is supplied to connect from Laptop to Robot for setup, entering comments, iRVision, etc. There is Ethernet connection cable already installed in robot controller with external connector so there is no specific need to open the controller to make the Ethernet connection.

PC and Robot IP addresses and Subnet Masks should be set as shown below

PLEASE DO NOT USE OTHER VALUES!

ROBOT	IP ADDRESS ROBOT	IP ADDRESS PC	SUBNET MASK
All	192.168.1.10	192.168.1.1	255.255.255.0

If competitors have trouble setting up the Ethernet connection then they can ask for assistance but they will only get points for setting it up themselves.

Description – Basic HMI (F)

A template Basic HMI (User Interface) file is provided - This file should be loaded and set up so that it can be displayed on the Teach Pendant.

It should be possible to display it manually whenever the operator wants to display it, and it should be automatically when the main program is started in Automatic mode.

The minimum functions of the HMI should be:

Display a Counter showing the number of the part being processed.
Display the Open/Closed status of the Gripper
Display the Error/Fault status of the Robot (equivalent to the Fault LED on the TP)
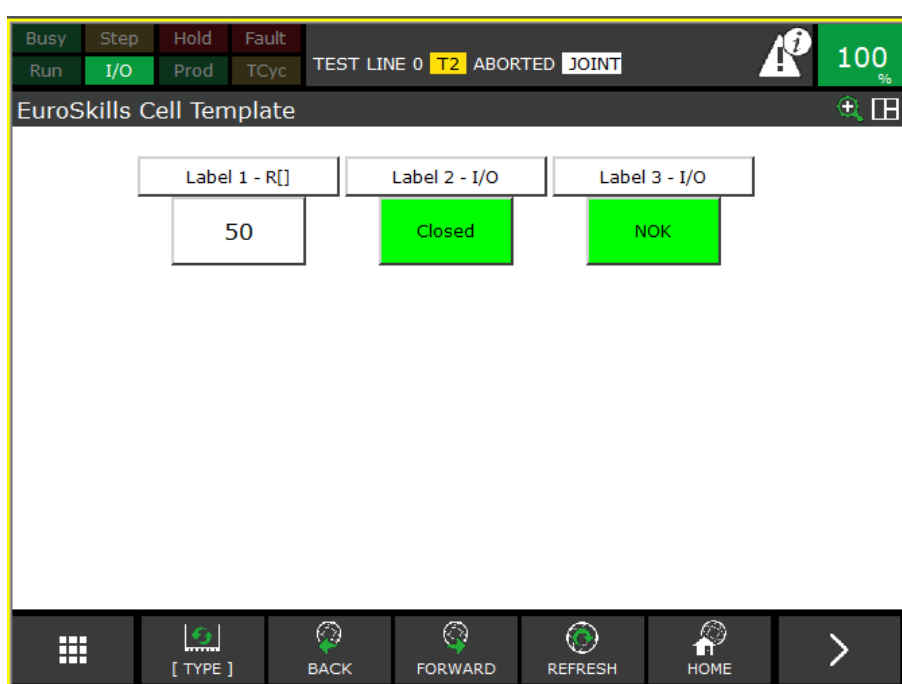
It is not enough to just load this file – it must be set up correctly with correct labels, I/O and Register values and Colours

Competitors can use Microsoft Sharepoint designer or a text editor or any other function installed on the PC to modify it.

Competitors may improve/extend this basic HMI as much as they wish.

For further information on the HMI / User Interface Setup please refer to the information on the standard Education Cell:
FEC_Ed_Cell_Technical_V5_4.pdf

Description – Advanced HMI (F)

A template Advanced HMI (User Interface) file is also provided.

This shows how to make a more sophisticated User Interface.
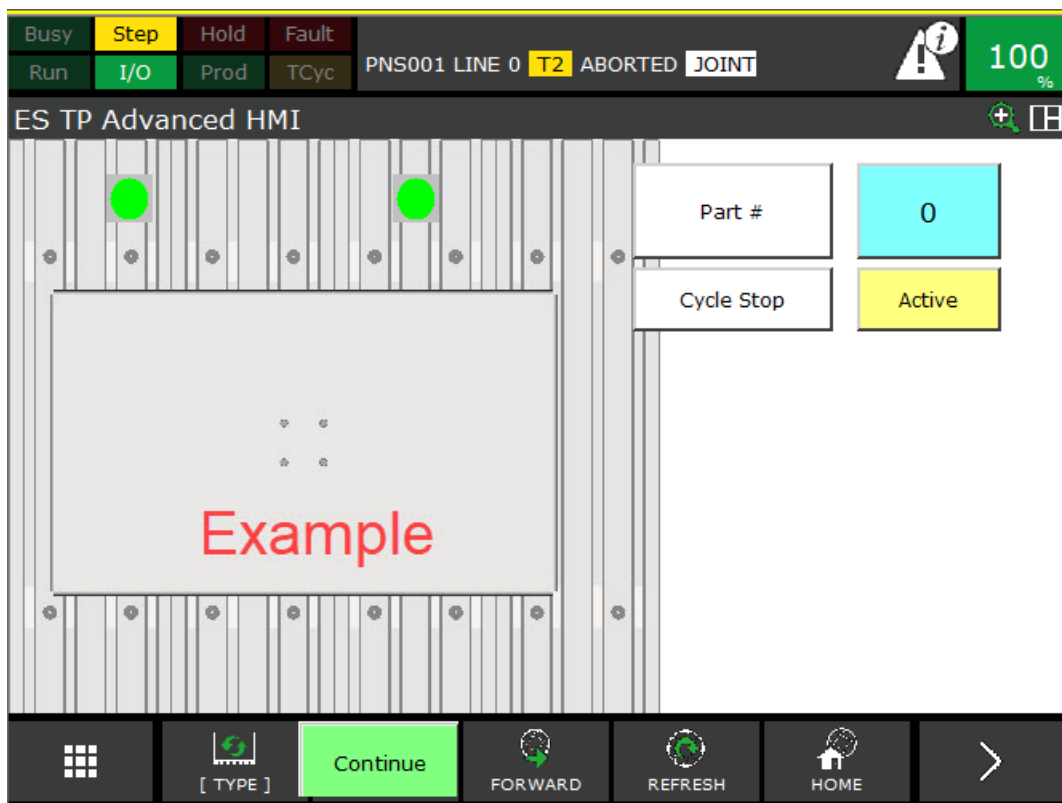
Competitors may include some of these advanced features into the HMI for additional points

Description – Reserved Programs (F)

There are two reserved programs:

Z_SHIP

Z_ZERO

These are for Workshop Manager / Assistants & SMT to use – please do not use/modify/delete these programs

Instructions to the Competitor

Instructions – Robot Cell Setup – Turntable (C1)

Mechanically, electrically, and pneumatically install and connect the Turntable and set up the robot system to use it.

Additional marks will be awarded for the most complete setup and for setup for Automatic and Manual Operation

Create a Robot program (with Select Screen program comment "UOP Test 1"),

```
9       PNS001        [UOP Test 1      ]
```

which rotates the Turntable first Clockwise 180 degrees and then AntiClockwise 180 degrees (as seen from above), with a definite stop at each end position.

Instructions – Robot Cell Setup – End Effector (C1)

Install the End Effector on the Robot J6 faceplate.

Install the Laser Sensor Cable Conduit.

Check the installation of the Level Plate for Quick Mastering.

Set appropriate Tool Centre Point(s) and Payload(s)
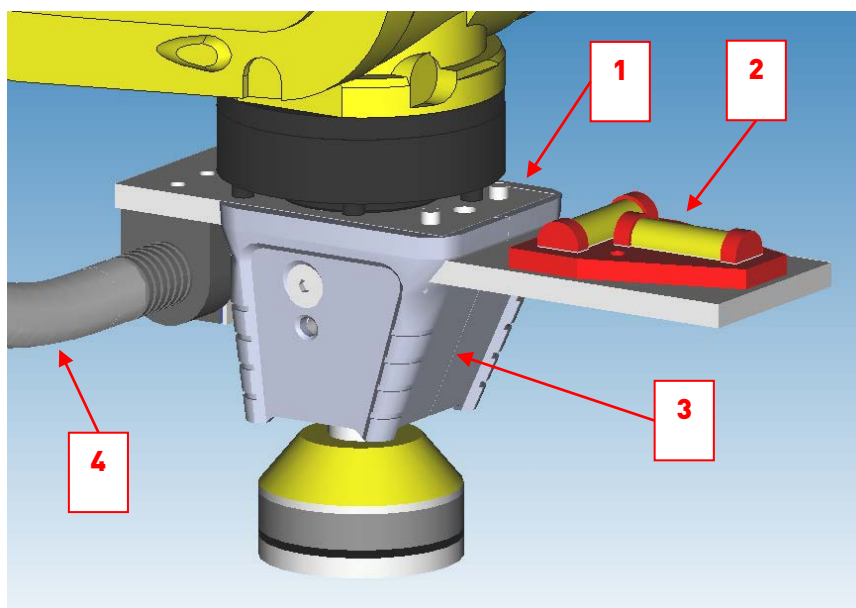
#	MASS	DESCRIPTION
1	0.27 kg	Mass of Complete End-Effector as shown – including Sanding Head, Level Plate and Covers
2	0.1 kg	Mass of Level Plate & screws
3	0.03 kg	Mass of 2 Covers & screws
4	0.15 kg	Mass of Cable and Conduit hanging from J3

Instructions – Robot Cell Setup – Phoenix I/O Module and UOP I/O Box (C1)

The default setup of the Phoenix I/O module uses DI[101 – 108] and DO[101 – 108]. This is not particularly convenient as this means that there are many unused I/O points between DO/DI [1] and DO/DI [100]

Additional marks will be awarded for configuring the Phoenix I/O Module to use DO/DI points in the range [1 – 8], and to delete any other unconnected I/O.

The configuration of the UOP I/O Box can also be changed if desired, but then I/O labels may need to be changed.

Set up the UOP I/O Box so that different test programs can be run from the UOP I/O Box in Automatic mode.

Create a Robot program (with Select Screen program comment "UOP Test 2") that moves from P[1] > P[2] > P[1]

```
P[1]  UF:1   UT:1                    P[2]  UF:1   UT:1
J1        0.000 deg   J4      0.000 deg    J1        0.000 deg   J4      0.000 deg
J2        0.000 deg   J5    -90.000 deg    J2       20.000 deg   J5    -94.000 deg
J3        0.000 deg   J6      0.000 deg    J3        4.000 deg   J6      0.000 deg
```

Create a Robot program (with Select Screen program comment "UOP Test 3") that moves from P[1] > P[2] > P[1]

```
P[1]  UF:1   UT:1                    P[2]  UF:1   UT:1
J1      -20.000 deg   J4      0.000 deg    J1       20.000 deg   J4      0.000 deg
J2        0.000 deg   J5    -90.000 deg    J2        0.000 deg   J5    -90.000 deg
J3        0.000 deg   J6      0.000 deg    J3        0.000 deg   J6      0.000 deg
```

Cycle time for each of these 3 programs (UOP Test 1-2-3) should be less than 30 seconds. No additional points will be given for cycle times less than 30 seconds.

Instructions – Robot Cell Setup – UOP I/O Box Test Run (C1)

Run these 3 programs (with Select Screen program comments "UOP Test 1-2-3"). **The program can be run in Auto or Manual mode, but additional points will be given for running from the UOP I/O Box in Auto mode.** The Marking Team will instruct the competitors which programs to run. All programs should be able to be run independently.

Test Run Conditions : 1 cycle for each of 3 programs, 3 attempts, total 5 minutes (per program)

Instructions – Robot Cell Setup – Quick Mastering Position (C1)

Set up a HOME position for the Robot in the usual way. Maximum points will be given for the most complete setup.

Set up a QUICK MASTER Reference Position using the Level Plate, Quick Mastering Fixture and Feeler Guage:
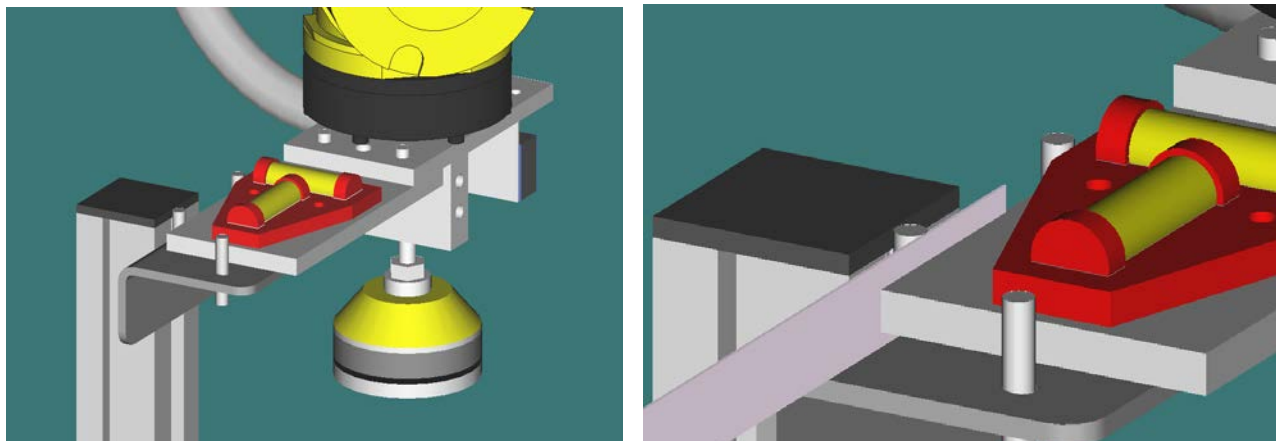
The Quick Mastering Fixture should be installed permanently in the robot cell, in a position where it does not interfere with the Sanding process, but also where there is easy access to check the position using the Feeler Guage.

Refer to Manual B-83284EN/09 APPENDIX B. SPECIAL OPERATION – Section B.2.3 Quick Mastering

BE CAREFUL – IT IS ONLY REQUIRED TO SET THE QUICK MASTERING REFERENCE POSITION – IT IS NOT REQUIRED TO MASTER / RE-MASTER/ QUICK-MASTER THE ROBOT !

Instructions – Robot Cell Setup – Quick Master Test Run (C1)

Create a test program which runs from a HOME position to the Quick Master Reference (QMR) position to demonstrate that the QMR position has been taught correctly. Program should use Joint and Linear motion to approach and move to the reference position safely and neatly. Program should not take more than 10 seconds to move to or from the QMR position

The program should PAUSE at the QMR position to allow the experts to evaluate it. **The program can be run in Auto or Manual mode, but additional points will be given for running from the UOP I/O Box in Auto mode.**

The HOME position can be chosen freely - but it must have J1 = 0 (zero degrees)

Test Run Conditions : 1 cycle, 3 attempts, total 5 minutes (excluding expert evaluation time)

Instructions – Robot Cell Setup – Roboguide (C1)

Import the provided CAD files into the basic Roboguide Cell and create the cell layout.

Create any missing CAD using the Roboguide Modeller or other Roboguide function.

Set up the Turntable as a Machine capable of rotating +/- 180 degrees depending on the state of the connected DO[ ]s

The Turntable must be positioned in the cell so that the robot can perform the sanding operation and rotate the turntable without the Robot running into motion problems – limits or singularities or the Turntable hitting the walls of the cell.

Demonstrate the rotation of the turntable – and therefore the correct positioning of the turntable - with a Roboguide program to set the I/O. Full +/- 180 degree motion should be shown.

Demonstrate the reachability of the Quick Mastering Fixture using another Roboguide program.

Instructions – Basic Task (C1)

The Basic Task is to simulate the Automation of Sanding the 3 parts provided.
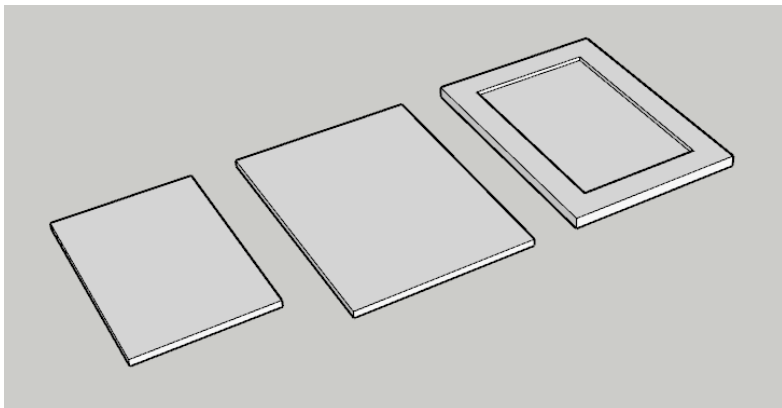
In the starting state, any one of the 3 parts can be in the Loading Area and any one of the 3 parts can be in the Processing Area :
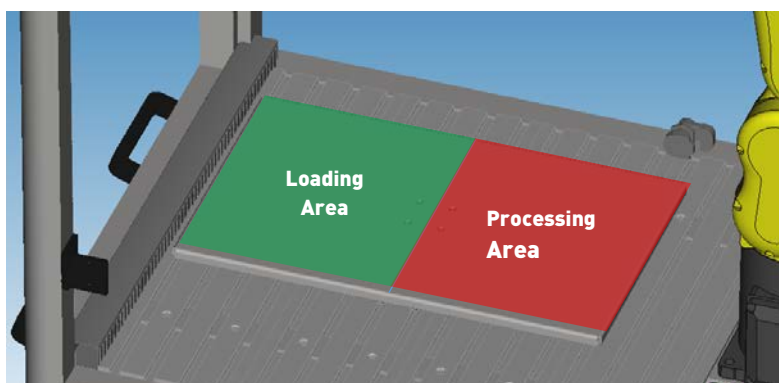
For the Basic Task, the parts will always be located along the edges of the Turntable as shown below (using the small part for clarity).
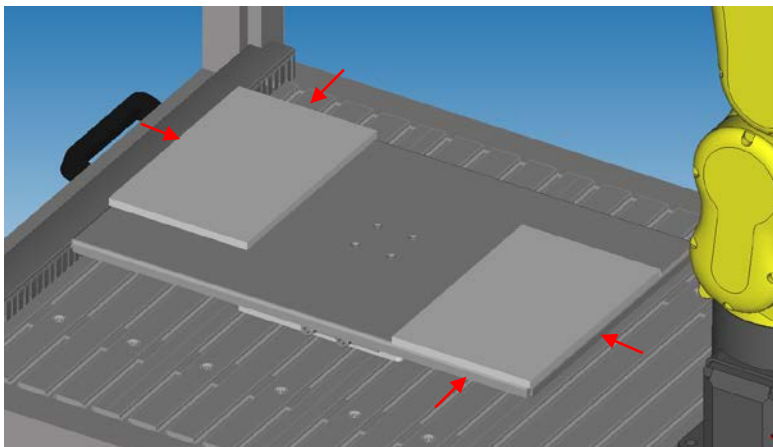
The Laser Sensor should be used to check which part(s) are on the Turntable and also take into account any errors which may occur when loading the part(s).

Basic Task Sequence:

STEP	ACTION
1	Start from HOME position. If robot is not at HOME position then take appropriate action before starting.
2	Use the Laser Sensor to detect which part is present in the Processing Area
3	Perform sanding operation on part in Processing Area
4	Move Robot above Processing Area (or to HOME position)
5	Rotate Turntable so that part in Loading Area is moved into Processing Area
6	Use the Laser Sensor to detect which part is present in the Processing Area
7	Perform sanding operation on new Part in Processing Area
8	Move Robot to HOME position and rotate Turntable to starting position.

Instructions – Sanding Assessment (C1)

There is no real Sanding in this Test Project.

To assess how well the Sanding process has been programmed, the parts will be marked with lines made with a Whiteboard Marker, something like shown below.
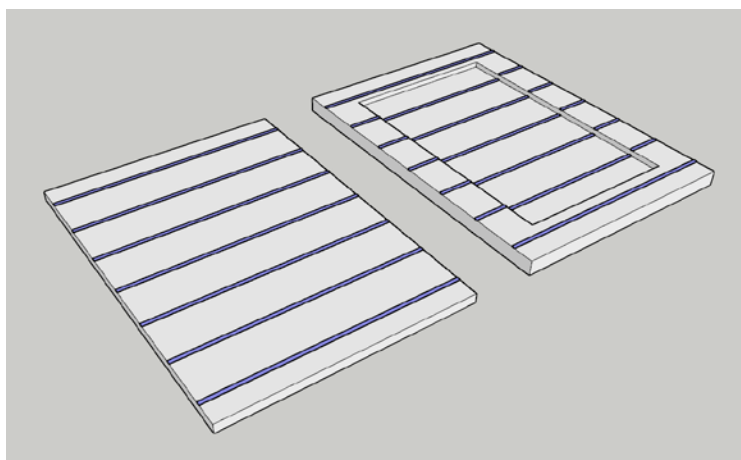
A whiteboard marker is provided to the Competitors for testing.

The exact pattern / colour that will be used is NOT provided to the Competitors. The Competitors should program the robot to clean the surface of the parts as thoroughly as possible.

Using the whiteboard marker, the Marking Teams can evaluate how well the parts have been sanded. Ideally there should be no marker ink visible on the part after sanding.

Instructions – Basic Task –Test Run (C1)

The Marking Team will instruct the Competitors which 2 of the 3 Basic Task parts to place on the Turntable and process according to the Basic Task Sequence described above.

The program can be run in Auto or Manual mode. Use of the UOP I/O Box is optional

Cycle Time will be measured.

<div style="color:red; text-align:center">

Test Run Conditions :
1 cycle for first set of 2 parts, 3 attempts, total 5 minutes.
1 cycle for second set of 2 parts, 3 attempts, total 5 minutes

</div>

Instructions – Extension Task 1A (C2)

In this application, the space above the Turntable is clear, so the robot can move freely and safely anywhere above the Turntable.

This means that the robot program could start safely if the robot TCP is anywhere in the space above the Turntable.

Make a program MOVE_HOME that operates as follows:

STEP	ACTION
1	Check to see if the robot TCP is anywhere in the safe volume above the Turntable as shown below. If not then do not move – prompt the operator to jog the robot into a safe position.
2	If the robot TCP is in this safe area, then move vertically upwards with Linear Motion and slow (100 mm/s speed) from the current robot position to Z = 100 mm in World Coordinates, with J6 vertical pointing downwards.
3	Move with Joint Motion to any HOME position.

Integrate this MOVE_HOME program into the Basic / Advanced Task Main Programs.

Tip – Refer to: OPERATOR'S MANUAL (Basic Function)B-83284EN/09 Section 4.5.2 Position Register Instructions

Safe Zone:
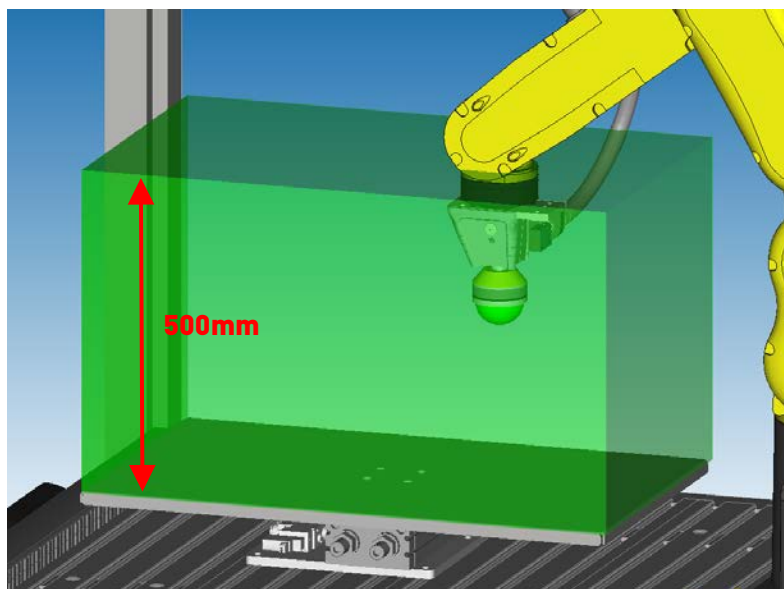
Instructions – Extension Task 1B (C2)

The Turntable is controlled by I/O.

The pneumatic valve is controlled by 2 Outputs, and there are 2 sensors which should be connected to 2 inputs to detect the 2 end positions.

Additional points will be awarded for making full use of the Outputs and Inputs available.

In an Emergency, the Robot can be stopped by pressing one of the red Emergency Stop buttons on the Teach Pendant or on the Controller.
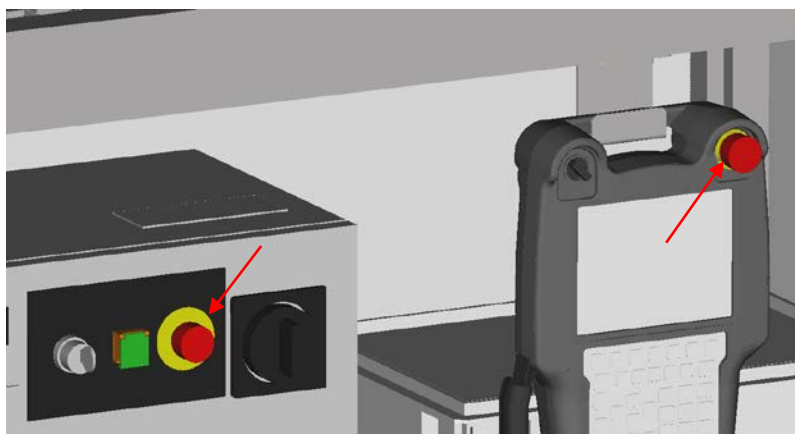
A Turntable can also be a dangerous piece of equipment, so in this case the Turntable should also stop, even if it is in the middle of a rotation.

Additional points will be awarded for linking control of the Turntable to the Emergency stop buttons – when pressed and when released.

Instructions – Extension Tasks 1A & 1B –Test Run (C2)

Extension Tasks 1A and 1B will be evaluated at the same time as the Basic Task Test Run.

Instructions – Extension Task 2 (C3)

The Basic Task used 3 parts - 2 flat parts and 1 panelled part. Extension Task 2 adds a 4th Curved part:
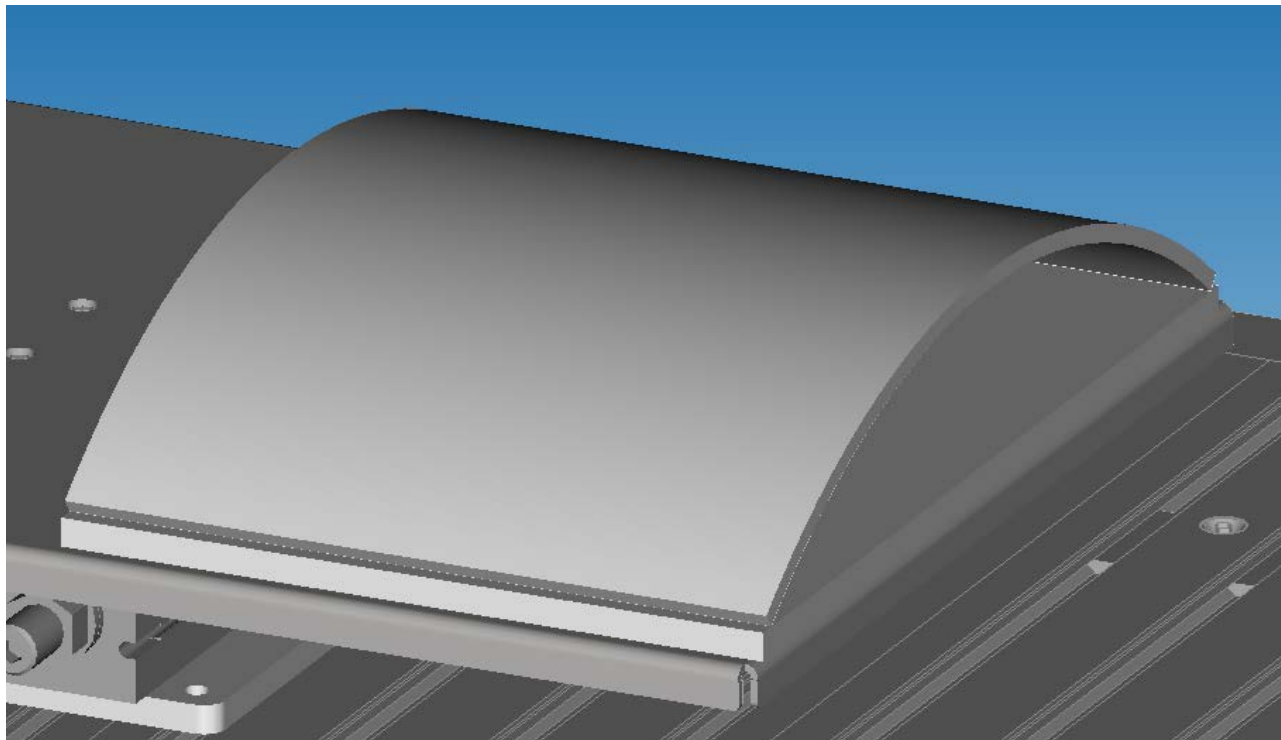
The same sanding process should be applied to the Curved part.

Additional marks will be awarded if the Competitors use the Roboguide Automatic Program Generation (CAD-To-Path) function to generate smooth sanding paths.
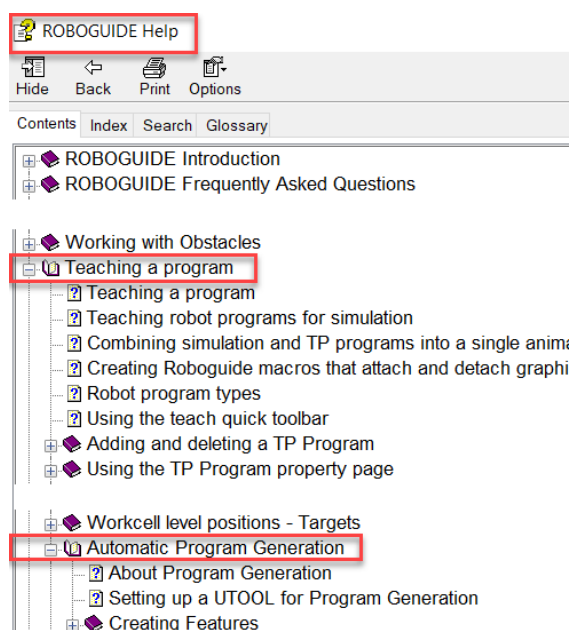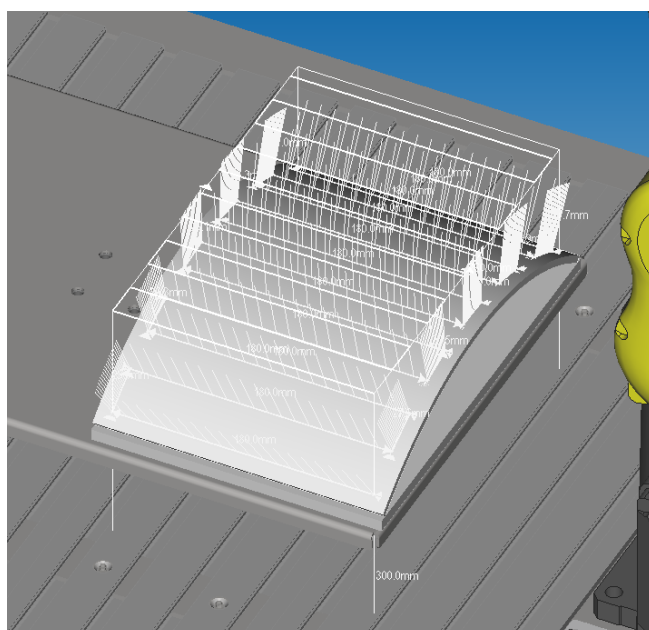
Instructions – ExtensionTask –Test Run (C3)

The Marking Team will instruct the Competitors which 2 of the 3 Basic Task parts and/or the Curved Part to placed on the Turntable and processed according to the Basic Task Sequence described above.

The quality of the 'sanding' will be assessed in a similar way as for the flat parts:
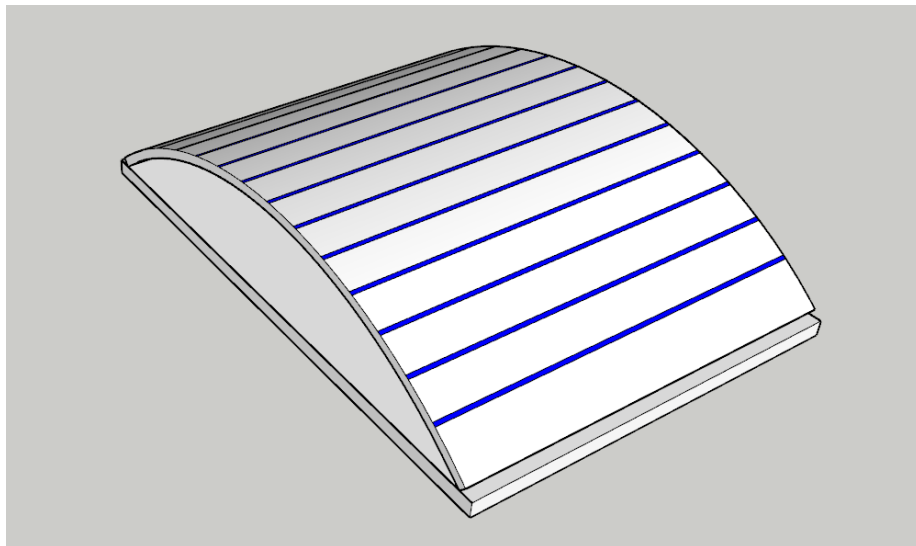
The program can be run in Auto or Manual mode. Use of the UOP I/O Box is optional

Test Run Conditions : 1 cycle for 2 parts, 3 attempts, total 5 minutes

Instructions – Working Style and Safety (F)

Throughout the Competition, Competitors will be expected to work as if they are in a real Industrial setting – installing and setting up a Robot System at a Customer site.

This means always working professionally and taking all normal precautions against events which may occur in a real industrial situation.

Instructions – Test Running (F)

During Marking, the Competitors will be asked to test run the different Tasks that have been set. As in industry, Reliability and Cycle Time are both important

The number of completed cycles and the cycle time will be marked separately. Marks will be given for cycle time only if all required cycles are completed.

The Competitors can choose Auto / T1 / T2 mode and Override % and change during test run if desired.

During marking the Competitors have THREE attempts ONLY to demonstrate the task.

The first successful attempt ends the marking, and the cycle time for that attempt will be used for the cycle time marking, if required.

Competitors may change whatever programs, data, settings they want to in between attempts, but the maximum time allowed for all test runs will be set for each task , for example 5 minutes.

Please note that changing between test runs is a risky activity and competitors are encouraged to make sure that their systems are reliable and will run correctly first time.

Instructions – Test Run Timer (F)

To measure the Cycle Time, insert the RUN START_TIMER command as shown below into each main program.
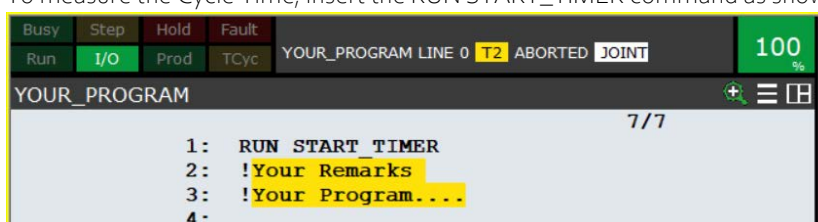
Hint : [INST] > Multiple control > RUN > COLLECT > KAREL Progs > START_TIMER
It may be necessary to enable KAREL to make the program START_TIMER visible:

The timer value will be shown in R[200] – this register is reserved for this purpose:

Instructions - Roboguide/Digital Twin (F)

Simulation plays an important role in this skill.

- Planning the layout of the cell
- Creating the basic task program structure while the equipment is being installed according to the layout
- Creating the extension task program structure while the basic task structure is being installed & tested

It is also important that any changes that are found during installation and testing are implemented in the Simulation as well as on the real cell – so that there is a Digital Twin of the actual cell – the layout, the programs – all aspects of the cell.
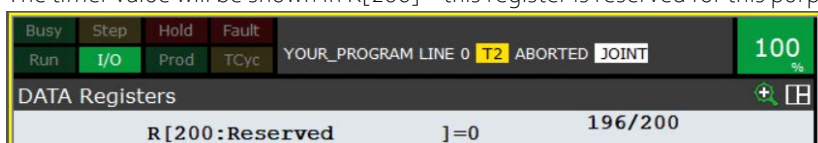
During marking it will be checked if the Roboguide simulation is really a Digital Twin of the real cell.

The Teach Pendant display should also be made as realistic as possible – for example with the 4D Graphics function. Competitors should work professionally with the Laptop as well as with the Robot.

Instructions –Documentation (F)

When the task is finished, a documentation package should be handed over to the end customer. This documentation should contain all the information necessary to run, maintain and troubleshoot the cell after you leave site.

A template document in English for the documentation package has been provided.

The contents by the Competitors do not need to be in English, but it would help the Marking Teams if at least the titles of the different sections of the documentation could be in English and own language
.

Equipment, machinery, installations, and materials required

It is expected that all Test Projects can be done by Competitors based on the equipment and materials specified in the Infrastructure List, except as detailed below.

Materials, Equipment, and tools supplied by competitors (F)

The Competitor PCs are equipped with US International standard Keyboards and basic mouse.

Competitors may bring their own keyboard and mouse to connect to the PC if they prefer. Hard-wired USB connections are recommended. The installation and functioning of these devices is the responsibility of the Competitors. It is permitted to install additional drivers, if necessary, after approval by SMT.

Neither WorldSkills nor the Global Partner or PC supplier can guarantee the compatibility or functioning of the Competitor supplied devices.

The competitors may also bring a paper dictionary. The dictionary may not have been modified in any way – handwriting, additional papers etc. It will be checked on C-1

There should be no other tools or equipment required to complete the Test Project – these are all provided in the Test Project Kit and Tool Trolley, and competitors are prohibited from bringing other tools and equipment.

Materials, equipment, and tools prohibited in the skill Area (F)

PERSONAL LAPTOPS – USB – MEMORY STICKS– MOBILE PHONES
Competitors are only allowed to use memory sticks provided by the Competition Organizer.

Memory sticks or any other portable memory devices cannot be taken outside the workshop.

Memory sticks or other portable memory devices are to be submitted to the Chief Expert or to the Deputy Chief Expert at the end of each day for safe keeping.

Experts are allowed to use personal laptops, tablets, and mobile phones in the Expert room only.

Competitors are not allowed to bring personal laptops, tablets, or mobile phones into the workshop.

PERSONAL PHOTO CAMERAS – VIDEO TAKING DEVICES
Competitors and Experts are allowed to use personal photo and video taking devices in the workshop at the conclusion of the competition only.

Marking Scheme (F)

ID	Description	Day 1
A	Day 1 AM: Setup Robot & End Effector (Payload, Input / Output etc) Home/Reference Positions & DCS. Demonstrate UOP Test Programs. Import CAD, Create Cell Layout, Tools, Uframes. Demonstrate Reachability of key components.	——— 13.80
A1	Create and Run 3 UOP Test Programs "UOP Test 1-2-3". Note Turntable installation can be preliminary for this test.	——— 4.90
A2	Setup End Effector: Mechanical, Cable, Electrical, Input etc	——— 1.20
A3	Setup Tool(s) / Payload(s) : TCP Coordinates, Payload Values, etc for ALL tools used.	——— 2.40
A4	Import CAD and Setup Roboguide Cell to match actual Cell layout accurately	——— 2.30
A5	Create missing CAD using Roboguide Modeller	——— 0.60
A6	Create Roboguide Programs to show Turntable rotation without collision according to real program specification, and access to Quick Reference Fixture..	——— 2.40
B	Day 1 PM: Install Equipment according to Roboguide Layout. Connect and setup Input / Output and Macros. Setup Tools and Frames. Offline Program Basic Task, Connect Ethernet, set R[], Input / Output Comments from PC.	——— 19.10
B1	Complete all Mechanical / Electrical Installation according to Roboguide Layout. Finalise Turntable stroke and speed adjustment. Label Cables, Frames etc	——— 2.30
B2	Complete Input / Output Setup, Comments, Macros, etc for all Electrical Equipment	——— 2.40
B3	Teach User Frame(s) - be prepared to show how this was done	——— 1.00
B4	Setup Reference Positions - Quick Master Reference Position & Home. Setup DCS. Create Program to demonstrate Quick Master Ref Pos.	——— 4.30
B5	Create Offline Programs for Basic Task - Program Structure will be checked, Main Program, Home Check, Sanding Sub-Programs, etc	——— 4.00
B6	Setup Host Comm according to Instructions, Set Comments for Registers - R[], PR[] etc	——— 2.10
B7	Follow correct Working Style & Safety	——— 3.00

C	Day 2 Install, Test Offline Programs. Demonstrate running Basic Task, Turntable control and HMI.	35.50
C1	Demonstrate Basic Task running, measure cycle time. Auto or T2	10.00
C2	Demonstrate Home Check - Including Extension Task 1A	2.40
C3	Check peripheral equipment control and error handling - including Extension Task 1B	6.00
C4	Demonstrate Teach Pendant User Interface Setup and Display	8.30
C5	Review Teach Pendant Program Internal User Commenting: Headers, Logic, Positions, etc	5.50
C6	Follow correct Working Style & Safety	3.00

D	Day 3: Demonstrate Running System with BOTH Basic Task and Extension Task. Create User Documentation & Simulation - "Digital Twin"	31.60
D1	Demonstrate BOTH Basic Task and Extension Tasks running	11.70
D2	Review User / Customer Documentation - Instructions and Reference Information	7.50
D3	Review Roboguide "Digital Twin" - how realistic it is compared to real cell. Show Automatic Path Generation if used. Show pre-recorded Roboguide Video of Basic or Advanced Task.	9.10
D4	Follow correct Working Style & Safety	3.30

Packing Lists (F)

Packing list 1.
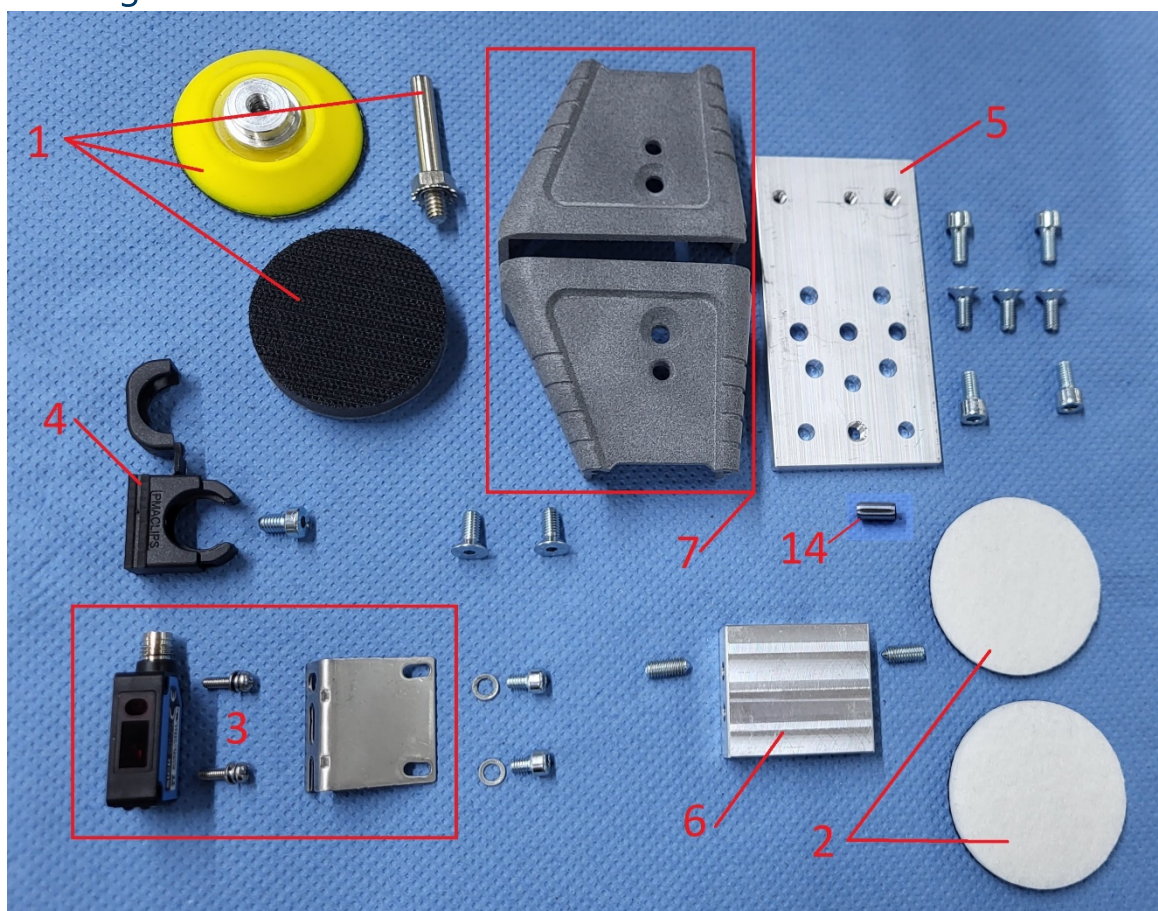
1) Sanding pad – 50mm diameter ¼ shaft.
2) 2x felt polishing pad.
3) Sick laser sensor with bracket and screws.
4) Pipe clamp.
5) J6 Mounting plate.
6) J6 Mounting block.
7) 3D printed cover.
8) 5x M5x12 countersunk screw.
9) 4x M5x10 cylinder head screw.
10) 1x M5x8 cylinder head screw.
11) 2x M4x8 cylinder head screw.
12) 2x lock washer M4.
13) M5x12 grub screw.
14) 1x Pin 5mm.

Packing list 2.

1) Level mounting plate
2) Spirit level
3) 2x M4x10 screw
4) 1x M6x12 screw

Packing list 3.

1) Mounting plate
2) M5 hex nut
3) 2x M6x8 screw
4) 1x M5x10 screw
5) Pipe clamp

Packing list 4.

1) Mounting bracket
2) 1x M5 hex nut
3) 1x M5x10 screw
4) 1x M8x10 screw
5) Pipe clamp

Packing list 5.

1) Mounting bracket
2) 1x M5 hex nut
3) 3x M4x10 screw
4) 2x M5x10 screw
5) 1x sliding block
6) 3x pin