TEST PROJECT ROBOT SYSTEM INTEGRATION

INTRODUCTION & BASIC TASK

WSC2019_TPFS08_Intro_Basic

Submitted by:
FANUC Europe Corporation
Nigel Ramsden / Julie Debock

Contents

EDUCATION CELL

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.

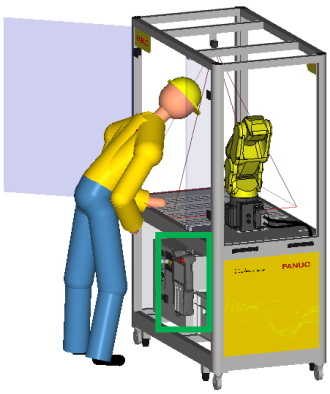
SAFETY

1) **Each Expert is responsible for the safety of their team**.

2) Competitors bodies should not enter the cell while moving/programming the robot

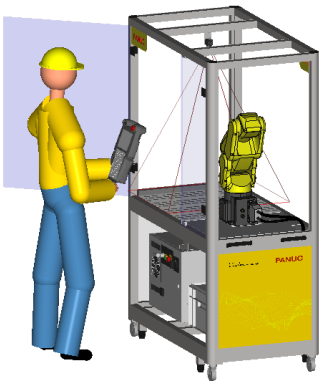
OK

Working in Cell **without Teach Pendant/ Servo OFF**



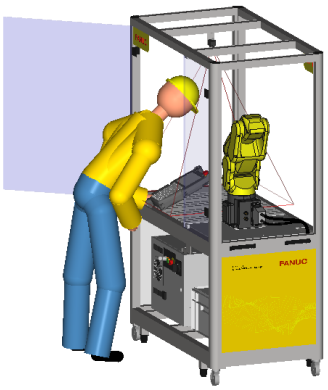
OK

Programming Outside Cell



NOK

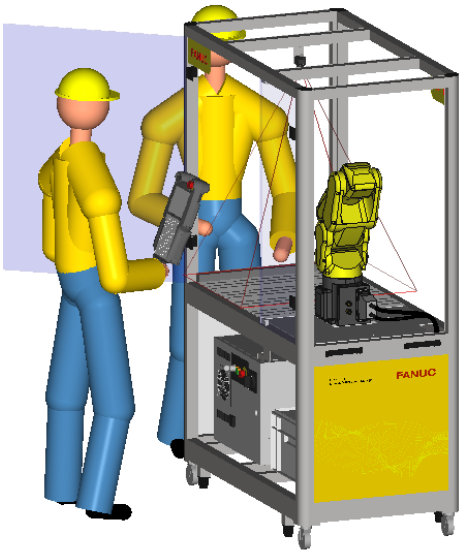
Programming with TP Inside Cell



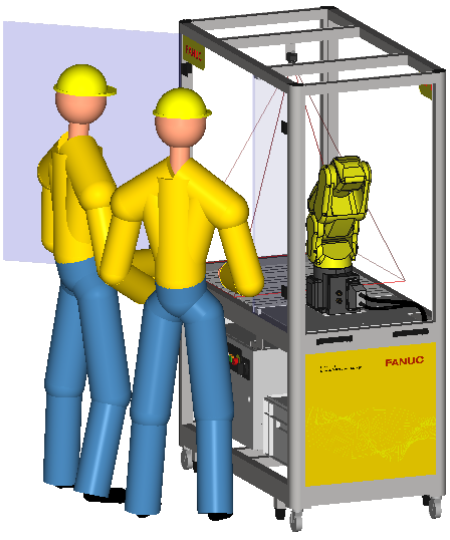
When installing, connecting peripherals etc, Servo power must be cut by E-Stop on Teach Pendant or Controller.

3) Competitors should not crowd around one another, especially in front of the cell door

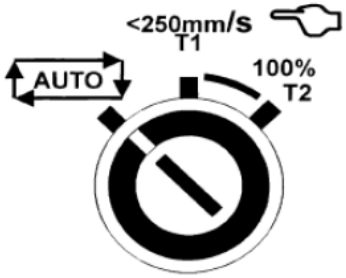
OK



NOK



4) AUTO/T1/T2 Switch



Competitors should do all setup / programming etc in T1 mode (<250mm/s)

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

The Auto / T1 / T2 switch position must be changed by the Experts (non Compatriot) only. The experts are responsible for the Auto / T1 / T2 key..

5) Gloves and Safety Glasses
Gloves and Safety Glasses must be worn during mechanical / electrical assembly tasks.
They are not generally required for other tasks, eg programming or testing.

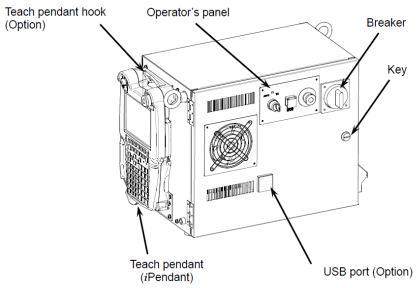
6) Deburring tool should only be used in Auto Mode with Cell Door closed.

7) Controller Access / Open Controller Door

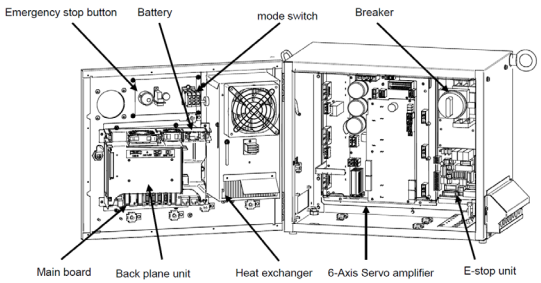
There is no specific reason foreseen for the Competitors to open the controller door.
But in case competitors request, for instance to check a proper Ethernet connection, the door may be opened **by FANUC Technical Support Staff or 2 non-compatriot Experts only**.

Power must be turned off before opening controller !

OK



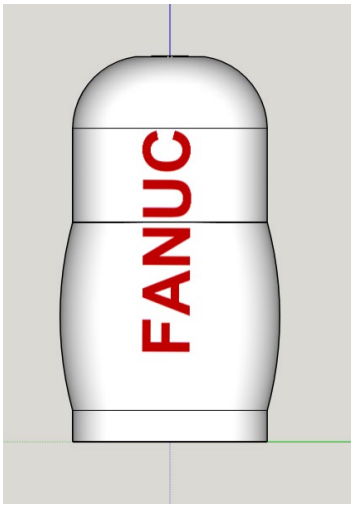
NOK



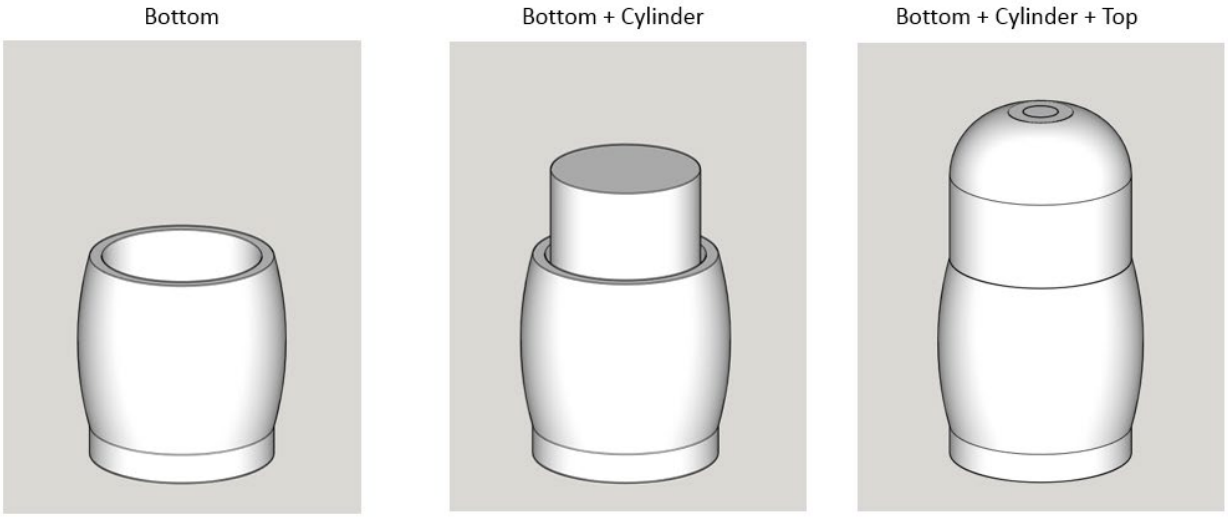
TEST PROJECT INTRODUCTION

The competition has been designed specifically for Worldskills Kazan 2019.

The project is to complete the Robot System Integration of a cell to produce Russian ‘Matryoshka’ Dolls with the FANUC logo on them:



The doll consists of 3 elements which must be assembled as shown:

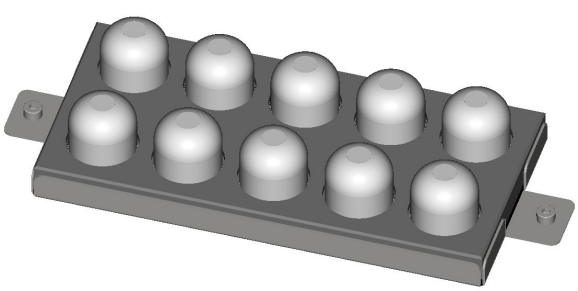


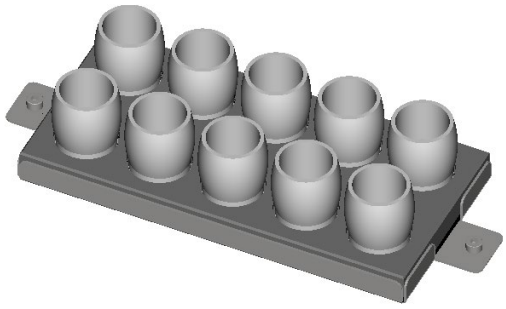
(The elements are held together with magnets)

APPLICATION EQUIPMENT

The necessary application equipment is supplied:

Input Trays for the Top and Bottom of the Test Project Parts:

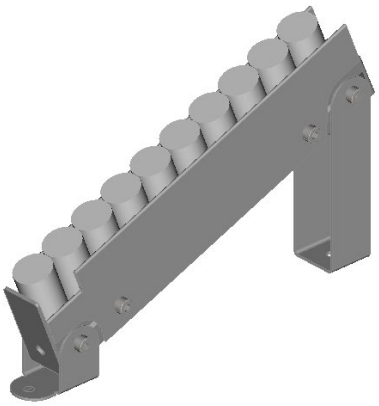




Output Trays for OK and NOK assembled Test Project Part:

Note: ‘OK’ / ‘NOK’ Labels are not provided – competitors can make these how they want to.

Magazine for the Cylinder inside the Doll, which holds the Top and Bottom parts together:

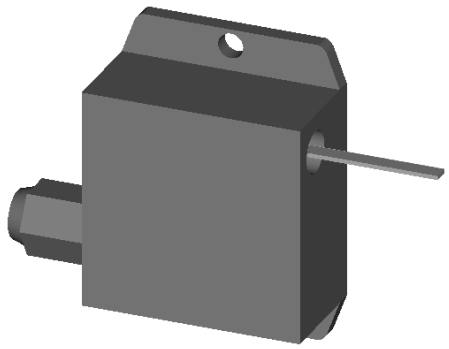


Two Servo Grippers, one to be mounted on the Robot and one to be used to simulate a Lathe, as well as a teaching pin:

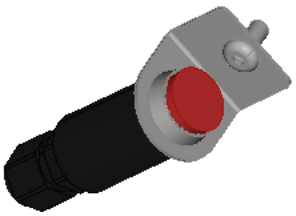
(Note that a proximity switch is supplied for the Lathe Gripper which can be used to check the open/closed state)

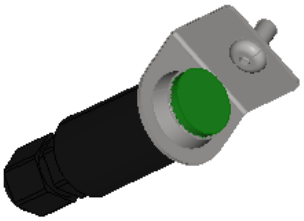
A Deburring Tool which is used to simulate deburring of the inside of the Top of the Doll:

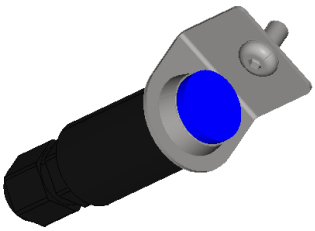
A Micro switch to be used as a sensor to check the correct assembly:



Different coloured LEDs to be used to indicate the Cell Status:

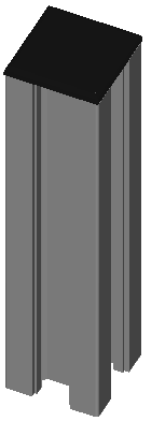






(Plus some extension cables if desired)

Various support pillars for mounting the process equipment in the cell:



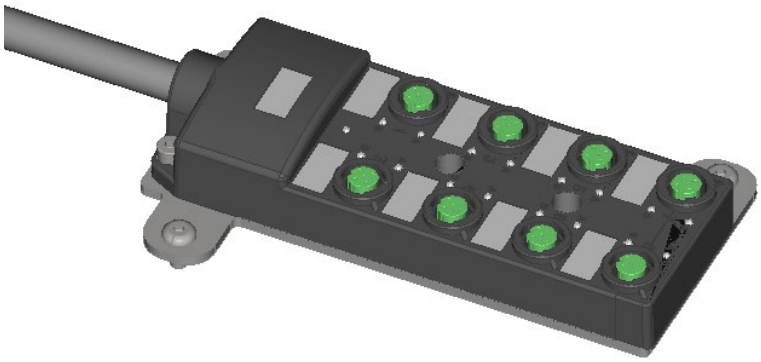
Competitors are supplied with:

2 x pillars 150 long, 2 x pillars 250 long, 2 x pillars 350 long

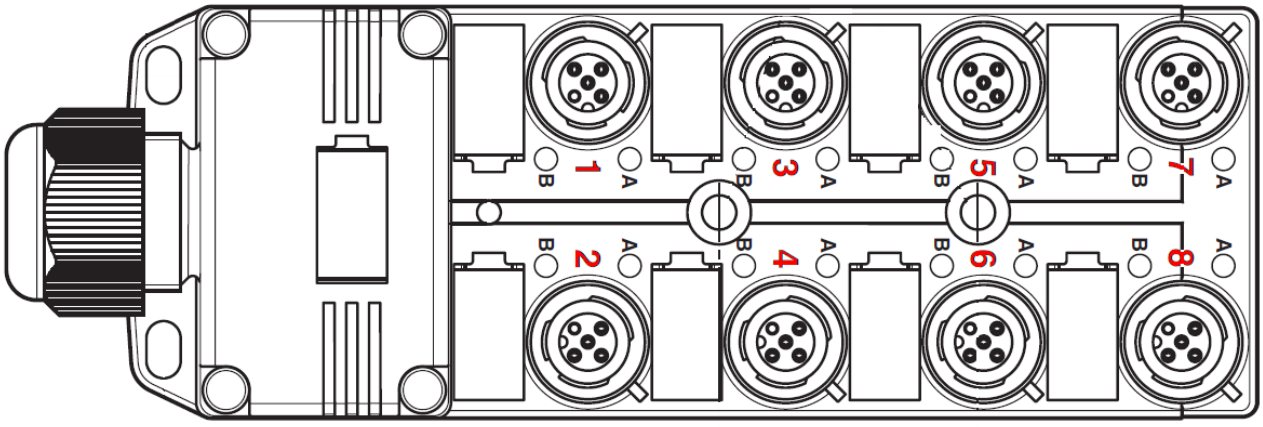
Competitors may use as many or as few of the pillars as they wish.

I/O CONNECTION BLOCK

An I/O Connection Block is supplied to connect LEDs, Chuck, Deburring Tool, Microswitch etc



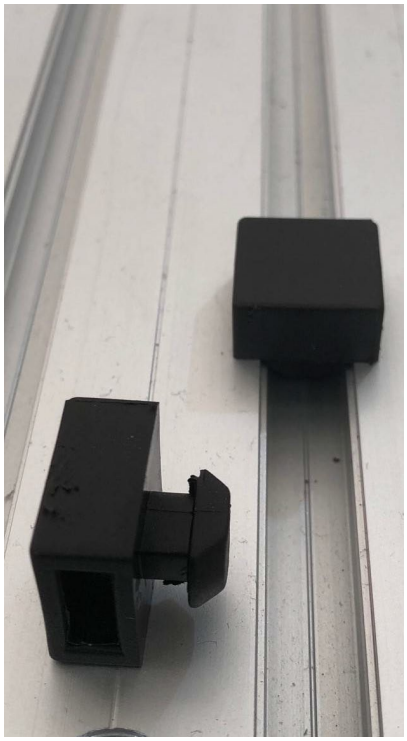
The I/O Block has sockets numbered 1 to 8 as shown below:



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 neede – see examples below:



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

PC EQUIPMENT / SOFTWARE

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
- Payload checker
- Autodesk Fusion 360 for simple CAD creation.
- One USB key for file transfer etc.
- Ethernet cable for connection to robot controller for iRVision etc.

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

Desktop folder “Resources” contains several subfolders:

- HTML Editor
- Manuals
- Payload Checker
- Roboguide

ETHERNET CONNECTION.

An Ethernet cable is supplied to connect from Laptop to Robot for setup 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.

Note that Robot IP addresses & Subnet Masks should be set as shown below

PLEASE DO NOT USE OTHER VALUES !

Robot	IP Address	IP Address PC	Subnet Mask
E-127512	192.168.1.12	192.168.1.112	255.255.255.0
E-127513	192.168.1.13	192.168.1.113	
E-127514	192.168.1.14	192.168.1.114	
E-127515	192.168.1.15	192.168.1.115	
E-128091	192.168.1.91	192.168.1.191	

TOOLS

A small number of hand tools are supplied for the mechanical and electrical installation of the process equipment.

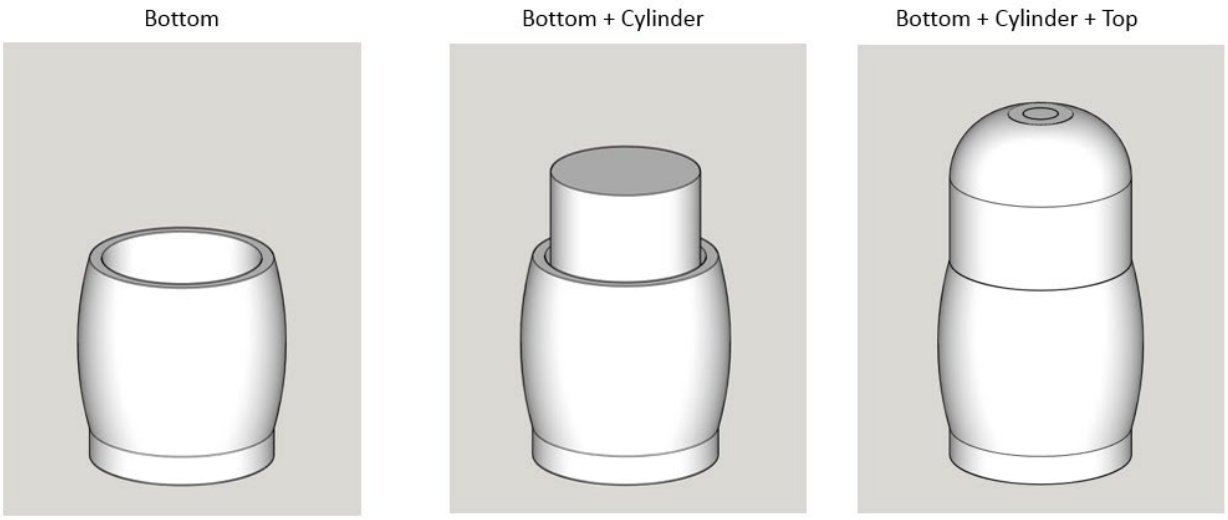
Additional tools may be provided during the competition if needed.

TOOL	QUANTITY
A label printer	1
Stylus (for Teach pendant)	1
Allen / Hex keys	3
7mm Bolt/Nut Driver	1
Small Screwdriver	Set
Cutter	1
Double sided tape	1
Cable ties	2 packs
Velcro ties	1 pack
150 mm steel ruler	1
300 mm steel ruler	1
Ethernet cable	1
Small Spirit (Bubble) level	1
A4 Laminator	One to be shared between all teams

PLEASE NOTE THAT NO ELECTRICAL CONNECTION OF BARE WIRES SHOULD BE REQUIRED. ALL COMPONENTS ARE READY TO USE AND CONNECT.

PROCESS INSTRUCTIONS

The objective of the Robot System Integration Test Project is to assemble the Doll as shown:



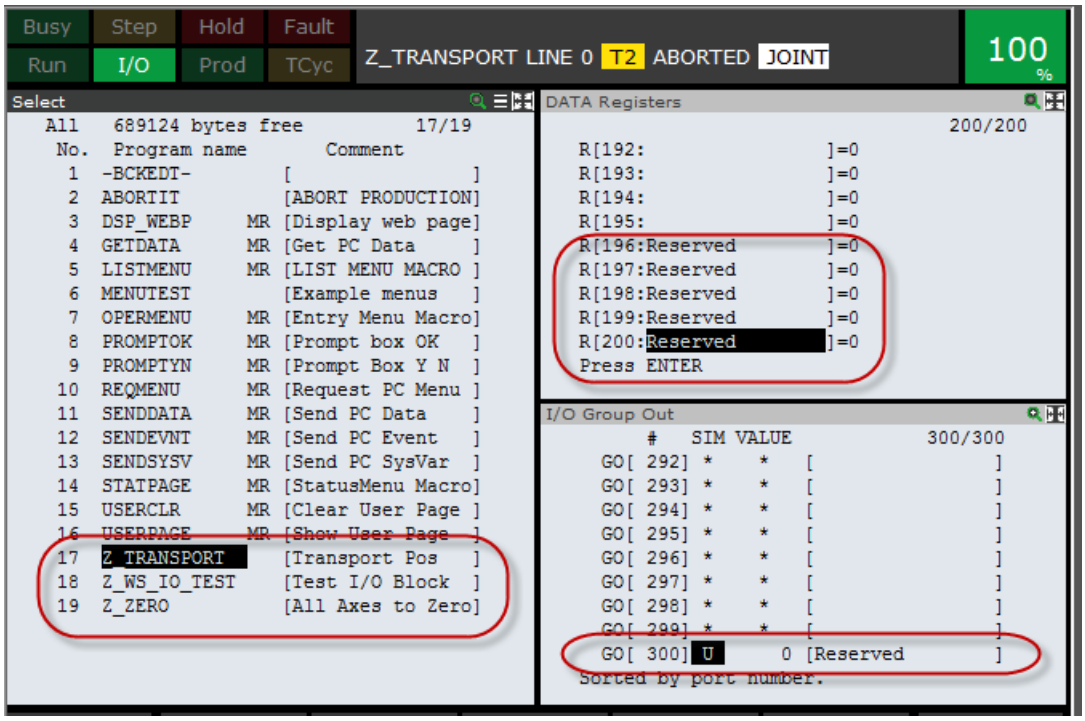
BASIC TASK

STEP	DESCRIPTION
Step 1	Pick the Cylinder from the Magazine
Step 2	Load the Cylinder into the Schunk Servo gripper to simulate a machining operation of 3 seconds, then Unload
Step 3	Assemble the Cylinder into the Bottom of the Doll
Step 4	Pick the Top of the Doll from the Input Tray
Step 5	Perform a simulated deburring operation on the Top of the Doll, Maximum deburring speed is 100mm/sec .
Step 6	Assemble the Top of the Doll onto the Cylinder and Bottom of the Doll
Step 7	Pick the fully assembled Doll up and check that it has been correctly assembled, using the microswitch sensor
Step 8	Depending on the result of the assembly check, place the Doll in the OK or NOK Output tray

Repeat steps 1-8 for all 10 Dolls.

RESERVED REGISTERS ETC

Don’t touch the reserved Registers, TP programs, and GO[] shown below:



PLANNING

Day	Time	Activity		Hours
C1 - Friday 23rd	08:00	Day 1 Test Project Translation		
	08:30	Basic Test Project Introduction		
	09:00	Expert <> Competitor Communication		
	09:30	Competition and Assessment		2.5
		Robot & Gripper Setup	**Cell Layout**	
	12:00	Assessment		
	13:00	Lunch		
	14:00	Competition and Assessment		4
		Cell Setup	**Offline Programming Basic Task**	
	18:00	Assessment		
	19:00	Dinner		
	20:00	End		
C2 - Saturday 24th	08:00	Extension TaskTranslation		
	08:30	Extenstion Task Introduction		
	08:45	Expert <> Competitor Communication		
	09:00	Competition and Assessment		3
		Installation / Touchup / Test Basic Task	**Offline Programming Extension Task**	
	12:00	Assessment		
	13:00	Lunch		
	14:00	Competition and Assessment		4
		Installation / Touchup / Test Extension Task	**Offline Programming User I/F**	
	18:00	Assessment		
	19:00	Dinner		
	20:00	End		
C3 - Sunday 25th	08:00	Translation		
	08:30	Test Project Introduction		
	08:45	Expert <> Competitor Communication		
	09:00	Competition and Assessment		4
		User I/F Installation and Test	**Start Documentation**	
		Finalise / Test / Demonstrate		
	13:00	Lunch		
	14:00	**Present Documentation & Simulation (Assessment)**		5
	19:00	Dinner		
	20:00	End		
			Total Competition Hours	22.5

MARKING SCHEME

WORLDSKILLS STANDARDS SPECIFICATION		
Section		WSSS Marks
1	Work organization and management	10.00
2	Communication and interpersonal skills	10.00
3	Layout and design	15.00
4	Installation and connectivity	13.00
5	Automation and programming	20.00
6	Commissioning, maintenance, and troubleshooting	20.00
7	Documentation, briefing, and reporting	12.00
	TOTAL	100

CRITERIA		WSSS MARKS
A	Day 1 AM: Setup Robot / Cell Layout - Day 1 PM: Setup Cell Equip / Offline sub-programs	30
B	Day 2 AM: Basic Program / Offline Ext-task - Day 2 PM: Ext Task Program / Offline UIF	35
C	Day 3 AM: UIF Install, Test / Doc - Day 3 PM: Test, Tune, Demo / Final Doc	35
	TOTAL	100