

# FlexiExpert

Start	<b>€</b> ⊞
Load Recipe	New Recipe
Edit Recipe	Delete Recipe

## **SOFTWARE MANUAL**



**ARS** Automation

ARS S.r.I. con Unico Socio via P. Gobetti, 19 AREZZO (AR)



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#### INTRODUCTION

This document is intended to describe all the functions of the "Flexi-Expert" Plug-In.

With the above mentioned software, adequately loaded in a Fanuc controller, it is possible to develop a complete application even for less experienced programming users.

Flexi-Expert is an intuitive Plug-In that allows you to have a recipe database with ample customisation, making it universal for most applications.



## Activating the Flexi-Expert licence

You must enable the licence before you can use the Flexi Expert Plug-In

Access the activation page by pressing:

Menu $\rightarrow$ 0 $\rightarrow$ Browser $\rightarrow$ License Code

Busy	Step	Hold	Fault		
Alarm	n : Act	ive:	тсус		
MENI	J 2			BROWSER 1	1/2
1 SEL	ECT			1 Browser	
2 EDI	Т			2 Panel setup	
3 DAT	A		►	3 Flexi-Expert	
4 STA	TUS		•	4 License Code	e alarms.
5 4D	GRAPH	IICS	►	(117.03)	·
6 SYS	TEM		►	(HIST) to	enter alarm
7 USE	R2			nis	tory screen.
8 BRO	OWSER		Þ		
9					
0 1	IEXT				

Contact ARS and provide the Serial Number found in the first box. An activation code will be provided to be entered in the "Your code" box, then press the "Activate" button to enable the licence.

License Code	۹ 🕀
	SOVVI <sup>®</sup> <b>Fanuc</b>
Serial No.	88340
Your code:	0
	Activate

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## Flexi-Expert main interface

Access the Flexi-Expert interface from the Fanuc keypad by pressing:

Menu→0→Browser→Flexi-Expert





#### Creating a new recipe



Use the "New Recipe" button, found on the first page of the interface, to access the submenus for creating a new recipe and therefore, a new product to be processed.





## Recipe name

You can choose the name of the new recipe according to your needs. To write the product name that will be entered, you must select the white textbox that by default contains \*\*\*\*\*.



As soon as the virtual keyboard appears, it will be possible to enter the recipe name.



Once the product name has been entered, you can proceed by pressing the "Next" button.



## Home Position

1_2	۵ 🕀
Place the robot in the Home position. position, select the frame and the tool to button.	Once the robot is in the Home that is used and press the Here
Select your Robot Tool	****
Select your Robot Frame	****
(Recipe Uninition	eFlb1]DataKarelFlb1.home_pos alized
	Back Next

The page that will be shown allows the "Home" point to be recorded as well as the starting or resting position of the robot. The number of the Tool and that of the Frame which the position will refer to must be set so as to record this position.

By selecting the boxes where \*\*\*\*\* is shown, you can set the Tool and Frame that will be used when the robot is moved to the "Home" point.





Once both the Tool and Frame have been set, you must move the robot to the desired position and then press the "Here" button. The Cartesian coordinates that describe the "Home" position will be displayed on the right.

You can access the next page by pressing "Next".



## Gripper emptying position

2_7_3	۹ 🖽
Empty position Gripper	Enable this point
Empty position Gripper, the position will be memorized with the Frame and the Tool of the Home position	DO Gripper ****
(Recip Uniniti	eFlb1]DataKarelFlb1.empty_pos alized
	Back Next

The page that will be shown allows the "Empty Gripper" point to be recorded as well as the emptying position in a given area. In order to record this position, you must only set the signal that will be reset once it reaches the position.

The robot will use the same frame and Tool that have been set for the "Home" position, and the standard cycle that will be performed will be the following:

- 1. From the Home position, the robot will reach the emptying position using the Tool and Frame set on the "Home" position recording page.
- 2. The robot will use the usual variable at which the "Home" position was recorded as the point approach Z variable.
- 3. After approaching the point, the robot will move to the gripper emptying point, reset the specified signal and rise to the usual Z variable of the "Home" position.
- 4. The emptying cycle ends by returning the robot to the "Home" position.

## **Selecting Flexibowl**

The displayed screen allows you to decide whether to work with a single Flexibowl or in a double configuration with two feeders:

2	• E	
FLEXBOVVĚ		
Flexibowl 1	Flexibowl 2	
Option	Save Recipe	
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In order to save a recipe correctly, it is essential to first enter all the required fields. The "Save Recipe" button will be discussed later.

Assuming that you need to create an application where the robot picks from a single feeder, you will only need to enable one Flexibowl.

Flexibowls are enabled by selecting the box next to "Flexibowl 1" and "Flexibowl 2". The green colour indicates enabling; once selected, it will then be possible to access the submenus that will allow all the points necessary for the application to be recorded.

The creation of a recipe that will have to work with a single Flexibowl will be analysed in this paragraph.

Depending on the requirements of the installer, if the application to be developed will require 2 Flexibowls to be used, the procedure will be the same as that shown below and must also be repeated for the second feeder.

In order to continue, at least one of the two Flexibowls must be enabled, otherwise an error will be generated.

After enabling the Flexibowl you want to use, you must press the "Flexibowl 1" or "Flexibowl 2" button to continue.



#### <u>Option</u>

By selecting the "Option" screen, you have access to 2 variables that can be set accordingly.

2_7_3	۵ 🔍 🕀	
There is possible to define the pallet index can be shared between the various models / flexibowl, and the strategy of using two flexibowls simultaneously		
Share index Pallet :		
Strategy for two Flexibowl :	****	
	Back Next	

• **Share index Pallet:** if you work with more than one model or with more than one Flexibowl, you can use the shared pallet index for the Flexibowls/Models.

Two application examples can be:

- By processing the same component in 2 different Flexibowls, you can enable this variable to always go to the next position of the pallet, regardless of where the piece is picked up.
- 2 different models are picked when using a single Flexibowl:
  - The first model is picked and placed directly on the pallet
  - After being picked, the second model is brought to a tipping station and then placed on the pallet.
- Strategy for two Flexibowls: allows you to select the operating strategy when using 2 Flexibowls:
  - **Best Result:** There is no picking order, however, the piece that is first available is picked from the relevant Flexibowl.
  - Flexibowl 1 → Flexibowl 2: the robot cycle implements the pick up first from Flexibowl 1 and then from Flexibowl 2.
  - Flexibowl 2 Flexibowl 1: the robot cycle implements the pick up first from Flexibowl 2 and then from Flexibowl 1



#### Flexibowl models and parameters



The next page shows 4 buttons, 3 of which show the item "Model": this refers to:

- One of the possible positions of the component to be handled
- A component, if there are 2 different parts inside the Flexibowl.

The pick and place points and any intermediate positions must be recorded for every model introduced in the recipe.

Q,		Model 1	
Model 1	Model 2	Model 2	



#### Flexibowl and hopper control

In addition to 3 buttons dedicated to the creation of the models, there is a last button that bears the wording "Flexibowl" – you must access it before proceeding with the creation of the recipe:

Flexibowl 🔍 🕀			
Here you can define the properties of the flexibowl and Hopper. The Histogram is for check the presence of parts, the sequence of move the flexibowl, the step of flexibowl from pick to hopper, thr hopper signal and time of hopper on			
Select the Histogram tool :	****	Hopper Enable:	
Sequence Flb:	****	Hopper On Time ms:	
Step Flb:	****	Hopper signal ***** DO:	
SpaceFunc.DO:	****	Back Next	

 Hopper Enable: this button enables the automatic control of a digital output which will control the loading hopper. Before carrying out a Flexibowl step, it is saved if sector 1 contains a sufficient number of pieces or if it needs to be loaded. At the end of each movement, the results are transferred from one sector to another so that sector number 3 can always be analysed and downloaded only if actually necessary.



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The following fields must be filled in if hopper control is enabled:

- Select the Histogram tool: by selecting the box found next to this item, you can choose the vision tool that will check the number of pieces inside the Flexibowl. How to create this vision program will be analysed further on.
- **Step Flb**: Specifies the number of steps needed to move a piece from the centre of the vision area to the hopper unloading area. This number will vary according to the advancement angle and the hopper position with respect to the vision area.
- **Hopper signal DO**: Specifies the number of the signal that will be activated to activate the hopper.
- **Hopper On Time ms**: Specifies the duration that the "Hopper signal DO" signal remains ON.

The other 2 items that are always mandatory, even if the hopper control is not enabled, are:

- Sequence Flb: by selecting the box found next to this item, you can specify a number from 1 to 6, which will recall a sequence of movements. To set this sequence, you must access the area reserved for configuring the Flexibowl.
- **SpaceFunc.DO**:Specifies the "DO" digital output number, which will be set or reset depending on the robot position. This digital output will indicate that the robot is out of the way with respect to the pick-up area and therefore from the vision area. The procedure for defining this area will be shown below

Once the settings have been completed, you must go back to the previous page by pressing "Back"

Flexibowl			۵. 🖽
Here you can define the properties of the flexibowl and Hopper. The Histogram is for check the presence of parts, the sequence of move the flexibowl, the step of flexibowl from pick to hopper, thr hopper signal and time of hopper on			
Select the Histogram tool :	HOPPER1.VD	Hopper Enable:	
Sequence Flb:	1	Hopper On Time ms:	800
Step Flb:	3	Hopper signal DO:	101
SpaceFunc.DO:	15	Back	Next



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#### Entering the Model



Assuming you must develop an application where the robot picks up a piece from a Flexibowl in a single position, item "Model One" must be selected.

The procedure for entering a model will be shown below. This procedure also applies for creating recipes with multiple models; simply repeat the usual steps and select the items "Model Two" and "Model Three".

Before moving on to this stage, it is important that there is a correctly calibrated camera and at least one vision process related to the object that will be fed with the Flexibowl.



After clicking the header box with \*\*\*\*\* you can select the vision process from the drop-down menu, which you want to associate with the recipe being created.

4		۹. 🖽
Place a piece m	nder the vision system in	the correct position, test your vision
1	that select your vision l	Recipe, and press the button take
1 CAMERA1.VD	this is done do not remo	ve the piece from under the vision
2 OBJECT1.VD	syste	m
3		
4	sion System	OBJECT1.VD
5		
6	Take P	hoto
7		1
8		*
Back Next		

After selecting it, you must place a single piece on the Flexibowl in the vision area. Once the component has been positioned, the robot must be taken out of the way so that the camera can take a photo and identify the position of the piece.

If the step was successful, the text "REFERENCE POSITION CAM SET" in the textbox at the bottom indicates that the camera has detected the piece and has saved its coordinates. Then press "Next" to continue.





#### Saving a pick-up point

The page that will be shown is that related to the recording of the pick-up point.



Just like the previously seen point recording pages, this page also offers the option of setting Tool and Frame.

Usually, if a standard calibration has been used, the number of Frames to be used corresponds to that used to define the Calibration frame.



Then bring the robot to the final pick-up point and press the "Here" button to record the pick-up point. Then press "Next" to proceed.

#### Pick-up parameters

The following screen is suggested after the pick-up point is recorded:

6	A. 🖽					
It is possible to select whether to automatically execute an appro and depart at the gripping point in mm along Z axis, the gripper activation signal DO and a DO for check for failure to grip the piece						
Enable The Appro/Depart Along z in mm	****					
Signal gripper DO & TIME ms	***** ****					
Signal check gripper	****					
	Back Next					

All the variables listed below must first be enabled in order to be used.

- Enable The Appro/Depart Along Z in mm: a value must be entered, which will be used as an offset to reach and then depart from the pick-up point. This value in standard configuration must be <u>negative</u>.
- **Signal gripper DO & TIME ms:** the first textbox specifies the number of the signal that will be activated when the robot finds the pick-up position. The second textbox instead represents the time in milliseconds that the robot will wait after activating the signal described above.
- **Signal check gripper:** the number of the signal that will be specified inside the textbox relating to this field indicates the digital input that will be checked to find out if the piece has been picked up correctly. If the check results negative, the robot will automatically try to pick up the next component.



## Intermediate points between pick and place

After having entered all the data relative to the pick-up phase, pressing "Next" will display the following page:



On this screen you can choose whether to enable or not the introduction of intermediate passage points between the pick and place phases.

In addition, it will be possible to pair a vision process to the recipe in use. This function allows to use the Fanuc camera as a quality check or re-centering system.



## Robot path

Select the enabling box and press the "Edit Point" button.



With the following procedure you can add up to 10 intermediate points, related to a particular model.





Enable the passage point using the relevant button found at the top right.

The recording method requires that you specify the number of the Tool and Frame associated with that point; then you can press the "Here" button to save the position.

Press "Next" to proceed.

7_1	۹ 🖽
Point ONE of PATH	Enable this point
Select your Robot Tool	1
Select your Robot Frame	3
Here	RecipeFlb1]DataKarelFlb1.p1[1,1] :ONF:N U T, 0, 0, 0 X: 1807.000 Y: 0.000 Z: 1300.000 W: 180.000 F: -90.000 R: 0.000 Back Next

With the same procedure, the following pages allow you to enter up to 10 passage points for the robot.





If there is no need to record other passage points, you can proceed forward by pressing "Next" until you get to the page shown below:



Press "Next" to access the place position saving screen.

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In the main screen is therefore possible to define a vision process or a reference position in order to carry out checks or centering with a Fanuc camera.

7						🕀 🕀
It is po	ssible to cho plac	oose whethe e, or add a	er to use pa vision syste	ssage point m for refer	s between p ence	ick and
Enable to place	Path poin	t from pi	ck		Edit P	ath
Enable System	Reference	e Vision			Edit Refe	erence
				(	Back	Next
	5 [ TYPE ]	Дени страна васк	ې FORWARD	() REFRESH	номе	>

Enable the option "Enable Reference Vision System" by using the dedicated button placed next to the entry "Edit Reference". Once you have selected the option, it will be possible to access the relative menus, then press the button "Edit Reference".

The page that will be shown allows to set the name of the vision process you wish to use; the selection allows to set a vision process among those present in the robot memory.



Following the selection of the vision process, it will be possible to press the "Take Photo" button to define the current position of the object as reference position. This function is particularly useful when using the camera to center the object held by the robot gripper. The vision tool must have already been defined.

By pressing the button "Next", it will be possible to move to the next screen, which allows to register the position where the check will be carried out; the registration modes stay the same as seen before.





#### Saving a place position

8	۹. 🖽
Place the robot in the place position. Once the select the frame and the tool that is used a	robot is in the place position, nd press the Here button.
Select your Robot Tool	****
Select your Robot Frame	****
[RecipeFlb1] Uninitialized	]DataKarelFlb1.place[1,1] i
	Back Next

The place position must be recorded on this page.

Enter the Tool and Frame numbers, move the robot to the desired position and press the "Here" button to save the position.

ace position, e button.
[1,1] 300.000 0.000 Next

Press "Next" to proceed.

#### Place parameters

The next screen is the following:



All the variables listed below must first be enabled in order to be used.

- Enable The Appro/Depart Along Z in mm: a value must be entered, which will be used as an offset to reach and then depart from the place position. This value in standard configuration must be <u>negative</u>.
- **Signal gripper DO & TIME ms:** the first textbox specifies the number of the signal that will be deactivated when the robot finds the place position. The second textbox instead represents the time in milliseconds that the robot will wait after deactivating the signal described above.
- Enable Place as pallet: Press the "Edit pallet" button to access a screen that allows you to create a pallet using the place position as a starting point.





## <u>Pallet</u>

There are two different possibilities when the application requires the use if a deposit called "Pallet"

- Standard pallet→The distance between the points is constant and defined precisely; just an origin point will be necessary since the other points will be calculated following the inserted information.
- Custom pallet →In this case the pallet will be consisting of maximum 8 positions, that will be registered singularly, as many independent placing points.



Press the enabling button according to the type of pallet you wish to create.

It is not possible to enable both pallets simultaneously.

After having enabled the pallets, press the "Edit Pallet" button connected to the type of pallet selected to access the dedicated configuration pages.



#### Standard Pallet

That shown below is the configuration page of the pallet which can be accessed by pressing the "Edit Pallet" button

9_1			۵ 🕀		
Here you can define the properties of the pallet, "X count" is the number of objects along x, while "X spacing" is the distance between the objects, this for the three coordinates x, y, z					
X count:	****	X spacing:	****		
Y count:	****	Y spacing:	****		
Z count:	****	Z spacing	****		
		Ba	ock Next		

- X count: specifies the number of rows that will make up the pallet.
- **Y count:** specifies the number of columns that will make up the pallet.
- **Z count:** specifies the number of layers that will make up the pallet.
- X spacing: specifies the distance between objects in the same row.
- **Y spacing:** specifies the distance between objects in the same column.
- **Z spacing:** specifies the distance between one layer and another.

Below is an example of creating a single layer pallet:

9_1			🖽 🗩		
Here you can define the properties of the pallet, "X count" is the number of objects along x, while "X spacing" is the distance between the objects, this for the three coordinates x, y, z					
X count:	5	X spacing:	25		
Y count:	4	Y spacing:	30		
Z count:	1	Z spacing	0		
		Ba	ck Next		

## Custom pallet

Move the robot in the placing position and press "Here P1" to register the first position, repeat this operation for all the desired positions.

Via the "X" button, placed next the entry "HERE P<sup>o</sup>", it will be possible to delete an existing position.

The dimension of the pallet will be defined by the number of positions registered; in the example below the pallet will consist of 3 positions





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## Saving the recipe



After clicking "Next", the system will show the above screen and it will now be possible to save the recipe.

The correct save message is "Recipe Saved!"; all other messages indicate an error while saving due to missing information.

2		- 🔍 田
	Info	
D	Recipe Saved!	
	ОК	
	CIS FANUC	



### Editing an existing recipe

Start	۹ 🖽
<b>S</b> CIS	
Load Recipe	New Recipe
Edit Recipe	Delete Recipe

Use the "Edit Recipe" button on the main page of the interface to select a recipe from those that already exist so as to access all the positions and variables relating to this recipe.

The methods to edit remain unchanged with respect to that described to create a new recipe.

After making the necessary changes, it will be mandatory to save so as not to lose the changes; answer "Yes" to confirm the save and overwrite the data.





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#### Loading an existing recipe

Start	A. 🖽
<b>CIS</b>	
Load Recipe	New Recipe
Edit Recipe	Delete Recipe

A recipe can be loaded manually without having to retrieve it from an external device.

After selecting the "Load Recipe" button, you can choose one of the recipes already entered and load it as the "current recipe".



Press "Next" to save.



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#### Deleting an existing recipe



A recipe can be deleted by using the "Delete Recipe" button.

After selecting the "Delete Recipe" button, you can choose one of the recipes already entered and delete it from the database.

## Space Function robot

The space function is used to define an area of encumbrance in the pick-up area so as to take the new photo only when the robot is actually out of the vision area.

To define a new space function, press the Pendant Menu $\rightarrow$ Setup $\rightarrow$ Space Fnct.

Rectangular Space				
MENU 1	SETUP 1		1/10	
1 UTILITIES	1 Prog Select	SETUP 2	Usage	
2 TEST CYCLE	2 ZDT Client	1 Error Table	Space	
3 MANUAL FCTNS	3 General	2 iPendant Setup	Space	
4 ALARM	4 Frames	3 BG Logic	Space	
5 1/0	5 Macro	4 Resume Offset	Space	
		5 Resume Tol.	Space	
o Setup	6 Ref Position	6 Space fnct.	Space	
7 FILE	7 Port Init	7 Diag Interface	Space	
8 iRVision	8 Ovrd Select	9 Heat Comm	Space	
9 USER	9 User Alarm	8 Host Comm	space	
0 NEXT	0 NEXT	9 Passwords	Space	
	La (	0 NEXT	Space	

Select the desired space function and press the "Detail" button to configure it

Rectangula	ar Space					🕀 🕀
LIS	<b>F</b> SCREE	N			1/1	0
No	.Enb/Ds	bl Co	omment	τ	Jsage	
1	DISAB	IE [		]Common	Space	
2	DISAB	LE [		]Common	Space	
3	DISAB	LE [		]Common	Space	
4	DISAB	LE [		]Common	Space	
5	DISAB	LE [		]Common	Space	
6	DISAB	LE [		]Common	Space	
7	DISAB	LE [		]Common	Space	
8	DISAB	LE [		]Common	Space	
9	DISAB	LE [		]Common	Space	
10	DISAB	LE [		]Common	Space	
	[ TYPE ]	GROUP	DETAIL	ENABLE	DISABLE	

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Rectangula	ar Space						🔍 田
DETAILED SCREEN							
	<b>a b b c b</b>	-					
	SPACE	:1	GRO	JOF :1	L		
	USAGE	: Com	non Spa	ce			
1	Enabl	e/Disak	ole:	DISAE	BLE		
2	Comme	nt:	[F]	lexibo	wl]		
3	Outpu	t Signa	al:	DO [	15]		
4	Input	Signa	al:	DI [	0]		
5	Prior	Priority: High					
6	Insid	Inside/Outside: Inside					
7	Commo	n Space	Num:	0			
	[ TYPE ]	SPACE	SETUP				

- 1. Enter a comment to define what it refers to
- 2. Specify the Digital Output signal that will be set at 1 when the robot is out of the "Space Function" and at 0 when it is within.
- 3. Press the "Space" button to define the area of encumbrance.

Rec				🕀 🕀
SPACE SETUP	1/4			
SPACE :1		GROUP	:1	
UFRAME :	0	UTOOL	:1	
1 : BASIS	VERTEX	[SIDE	LENGTH	]
2 :X 0.0	mm	0.0	mm	
3 :Y 0.0	mm	0.0	mm	
<b>4</b> : <b>Z</b> 0.0	mm	0.0	mm	
Move the cursor to the "Side Length" item, press the "Choice" key and select "Second Vertex" from the menu on the left.

Rec				÷. 🖽
SPACE SET	UP		1/4	
1         1       SIDE LENGTH         2       SECOND VERTEX         3       4         5       6         7       8	CE:2 AME:0 ASIS VERTEX 0 mm 0 mm	GROUP UTOOL [ <mark>SIDE</mark> 0.0 0.0 0.0	:1 <u>LENGTH</u> ] mm mm mm	
[ TYPE ]	OTHER	[CHOICE]	RECORD	

Move the robot to the first position while imagining to build a virtual parallelepiped by memorising the two opposite vertices.



To record the first point, move the cursor over the "Basic Vertex" item and press the "Record" button together with the "Shift" button on the keyboard.



Now move the robot to the second vertex



Rec	۵ 🖽
SPACE SETUP	1/4
SPACE :1 GI	ROUP :1
UFRAME : 0 U	TOOL :1
1 : BASIS VERTEX [S	SECOND VERTEX]
2 :X 65.1 mm 50	00.0 mm
3 :Y 180.0 mm 50	00.0 mm
4 :Z -96.9 mm 20	00.0 mm

After also recording the second point, an area similar to that shown in the photo will be generated.

The area must cover the entire pick-up area of the Flexibowl, keeping a minimum of extra margin so as to function correctly even in the most external points.



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Enable the "Space Function" by pressing "Enable".

To verify that the "Space Function" that you have set, works correctly, you must move the robot manually while simultaneously checking the status of the signal specified in the "Output Signal" item.

# Entering a robot User Tool

The TOOL is a reference system that defines the position and angle of the tool centre (TCP) and the angle referred to it. The origin of the system is usually the tool centre and Z is the tool axis. When this system is not defined, the origin is the centre of the flange.

To access the Robot Tool configuration menu, press Menu $\rightarrow$ Setup $\rightarrow$ Frames

SETUP Frames			🕀 🗮 🖽
MENU 1	SETUP 1	rect Entr	Y 4/7
1 UTILITIES	1 Prog Select		
2 TEST CYCLE	2 ZDT Client		pinter
3 MANUAL FCTNS	3 General	Pendant Setup	_000
4 ALARM	4 Frames	IG Logic	_000
5 I/O	5 Macro	Resume Offset	000
6 SETUP	6 Ref Position	Resume Tol.	000
7 FILE	7 Port Init		000
8 iRVision	8 Ovrd Select	-)iag Interface	000
9 USER	9 User Alarm	lost Comm	В, 0, 0, 0
0 NFXT	0 NEXT	asswords	

Press "Other" and select "Tool Frame"

SETUP Fra	ames					🔍 🗏 🖽
То	ol Fran	ne	/ Dire	ct Entr	y 1/1	0
	х	Y	Z	Commen	t	
1	0.0	0.0	0.0	0 [Poin	ter	]
2	0.0	0.0	0.0	0 [Eoat	2	]
3	0.0	0.0	0.0	0 [Eoat	3	]
4	0.0	0.0	0.0	0 [Eoat	4	]
5	0.0	) _0.(	<u>)</u> .(	0 [Eoat	5	]
6	0.0	) ОТН	IER 1	0 [Eoat	6	]
7	0.0	) 1 Too	ol Frame	0 [Eoat	7	]
8	0.0	) 2 Jog	Frame	0 [Eoat	8	]
9	0.0	) 3 Use	er Frame	0 [Eoat	9	]
10	0.0	) 4 Cel	l Frame	0 [Eoat	10	]
		5 Cel	l Floor			
	[ TYPE ]	DETAIL	other	CLEAR	SETIND	

SETUP Frame	S				÷.	≣⊞
Tool	Frame	/	Direct	: Entry	1/10	
	х	Y	Z C	Comment		
1	0.0	0.0	0.0	[Pointer	]	
2	0.0	0.0	0.0	[Eoat2	]	
3	0.0	0.0	0.0	[Eoat3	]	
4	0.0	0.0	0.0	[Eoat4	]	
5	0.0	0.0	0.0	[Eoat5	]	
6	0.0	0.0	0.0	[Eoat6	]	
7	0.0	0.0	0.0	[Eoat7	]	
8	0.0	0.0	0.0	[Eoat8	]	
9	0.0	0.0	0.0	[Eoat9	]	
10	0.0	0.0	0.0	[Eoat10	]	
Active	e TOOL	\$MNUTO	DLNUM[1	l] = 1		
III (1	TYPE ]	DETAIL [(	OTHER ]	CLEAR SET	TIND	

Press "Detail" to access the Tool configuration parameters

If you know the measurements of the TCP that will be applied to the robot, you can enter them manually (Method: Direct Entry)



If, on the other hand, you do not know the measurements of the Tool applied to the robot flange, you can use the 3-point method to define it. If the robot in question is a 4-axis scara robot, you must use the 2-point + Z method.



Use the three-point method to set the tool reference system. The three points must be memorised in reference to a common point with three approaches from different positions. As a result, the tool centre position is calculated.

To achieve high accuracy, the three points must be as different as possible from each other. With the 3-point method, only the X, Y, and Z coordinates can be set.

Assuming you need to create a Tool that will be indispensable to complete good calibration, secure the Calibration tool to the robot and place a tailstock in a plane that can be reached by the robot.



The 3 points to record are usually:

**drs** 

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- 1. Align the 2 tools by matching the position of the 2 ends. Record this as the first point.
- 2. Rotate joint 6 of the robot by about 180° and re-align the 2 tools by matching the position of the 2 points. Record this as the second point.
- 3. Turn joint 4 and joint 5 of the robot to a position similar to that shown in the photo below. Record this as the third point.



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To record the points described above, you must select the desired point by moving the cursor to it and then pressing "Shift" and "Record" simultaneously.





# Entering a robot User Frame

A user coordinate system is the geometric definition of the origin and orientation of the coordinates defined by the operator. If no coordinate system has been set for manual movements, the movements are based on the basic system.

For user coordinates, the position of the origin (in X, Y and Z), and the angle and the triad of the resulting axes (around the X, Y and Z axes) are specified with reference to the original Cartesian coordinates of the robot (World Frame).



Assuming you need to create a Frame based on a calibration grid, place the grid in the work area.



SETUP Frames			± (	Η
MENU 1	SETUP 1	tup o	y 4/7	
1 UTILITIES	1 Prog Select		-	
2 TEST CYCLE	2 ZDT Client	Desident Cotus	pinter	
3 MANUAL FCTNS	3 General	Pendant Setup	000	
4 ALARM	4 Frames	G Logic	000	
5 I/O	5 Macro	lesume Offset	000	
6 SETUP	6 Ref Position	Resume Tol.	000	
7 FILE	7 Port Init	Space fnct.	000	
8 iRVision	8 Ovrd Select		000	
9 USER	9 User Alarm	lost Comm	В, 0, 0, 0	
0 NFXT	0 NEXT	asswords		
	]	NEXT		

#### Press Menu $\rightarrow$ Setup $\rightarrow$ Frame on the pendant

Press "Other" and then select "User Frame".

SETUP Frai	mes					🕀 🗄 🖽
Тос	l Frame	/	Three	Point	1/1	0
	х	Y	Z C	Commen	t	
1	0.0	0.0	0.0	[		]
2	0.0	0.0	0.0	[Eoat	2	]
3	0.0	0.0	0.0	[Eoat	3	]
4	0.0	0.0	0.0	[Eoat	4	]
5	0.0	0.0	0.0	[Eoat	5	]
6	0.0	OTHER	<u> </u>	[Eoat	6	]
7	0.0	1 Tool Fr	ame .0	[Eoat	7	]
8	0.0	2 Jog Fra	ime .0	[Eoat	8	]
9	0.0	3 User Fi	rame <mark>. 0</mark>	[Eoat	9	]
10	0.0	4 Cell Fra	me .0	[Eoat]	10	]
		5 Cell Flo	or			
	[ TYPE ]	DETAIL (	DTHER	CLEAR	SETIND	

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SETUP Frame	s					€ Ξ 🖽
User	Frame	/	/ Direc	t Entry	r 1/9	
	ХУ	<u> </u>	Z	Comment	:	
1	0.0	0.0	0.0	[UFram	ne1	1
2	0.0	0.0	0.0	[UFram	ue2	1
3	0.0	0.0	0.0	[UFram	ue3	1
4	0.0	0.0	0.0	[UFram	ne4	]
5	0.0	0.0	0.0	[UFram	ue5	]
6	0.0	0.0	0.0	[UFram	ne6	]
7	0.0	0.0	0.0	[UFram	ne7	]
8	0.0	0.0	0.0	[UFram	ue8	]
9	0.0	0.0	0.0	[UFram	ne9	]
Active	UFRAME	SMNU	JFRAMEN	UM[1] =	= 0	
<b></b> [1	TYPE ] DI	TAIL	[other ]	CLEAR	SETIND	>

Press "Detail" to configure the selected Frame.

SETUP Fra	ames					€ ⊟ ⊞		
Us	er Fram	e	Direc	et Entr	y 1/	7		
Fr	ame Num	ber: 1	L					
1	Comme	nt:		U	Frame1			
2	<b>X</b> :			0.	000			
3	Y:			0.	000			
4	<b>Z</b> :			0.	000			
5	W:		0.000					
6	P:			0.000				
7	R <u>:</u>			0.	000			
	C METH	HOD 1 <mark>ic</mark>	on:	NDI	в, О, О	, 0		
	1 Thre	e Point						
	2 Fou	r Point						
	3 Dire	ct Entry						
	[ TYPE ]	METHOD	FRAME	MOVE_TO	RECORD			

Press "Method" and select "Four Point". Creating a frame with the 4-point method is ideal for creating frames on the calibration grids, whereas the 3-point one can be used to create reference systems for creating pallets, for example. The 4-point method will be shown on the following pages.

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Software Manual



#### Y Direction







Then activate the correct Tool and move the robot to the first point.

Then select the first point (Orient Origin Point) and press "Shift" + "Record" to save the position.

SETUP Fra	ames					🔍 🗄 🖽
Üs	er Fram	e	Four	Point	2/	5
Fr	ame Num	ber: 1				
	<b>x</b> : 0	.0 Y:	0.0	) Z:	0.0	
	W: 0	.0 P:	0.0	) R:	0.0	
C	omment: rient C	rigin P	ע oint:	Frame1 RECORD	ED	
x	Direct	ion Poi	nt:	UNINIT		
Y	Direct	ion Poi	nt:	UNINIT		
S	ystem C	rigin:		UNINIT		
Poi	nt Reco	rded				
	[ TYPE ]	[METHOD]	FRAME	MOVE_TO	RECORD	





Move the robot to the second point (X Direction Point) and record this too.

Be careful when saving the points for them to be as accurate as possible.



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Move the robot to the third position (Y Direction Point) and record this position.

Move the robot to the last position (System Origin) and also record this last one.



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After saving all 4 points, the Frame will be calculated and the XYZWPR values referring to the robot base will be written.





## Calibrating the 2D Camera

Knowing how the User Frame and User Tool can be entered is essential to be able to calibrate the camera; below are the main steps that are necessary for correct calibration.

To access the vision menu you can use the robot's keypad (Teach Pendant) or connect via an Ethernet cable to the robot controller for convenience and quick programming.

Press Menu $\rightarrow$ IRVision $\rightarrow$ Vision Setup on the Pendant



ARS S.r.I. con Unico Socio - Edition: January 2021 Page **54** of 93 Select "2D Camera" from the menu and press "OK"

Select the newly created object and press "Edit" to be able to edit it.



The following screen will be shown

iRVision Vision Setup - CAMERA				
	<sup>1</sup> 🗳	2	3	
	Camera Setup	Calibration	Calibration Result	
		Zoom <mark>50%</mark> 🔻	Camera Not Selecte	d 🔻
			Robot-Mounted Cam. Not Selecter	
			LED Type	
			Calibration Not Selected	d 🔽

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Place the calibration grid in line with the Flexibowl pick-up area and complete the fields on the right side of the page.



**Camera:** select the desired camera from the drop-down menu.

**Robot-Mounted.Cam:** this manual will analyse the "Standard" calibration, where the camera is placed above the vision area of the Flexibowl, at a height that varies from 850 to 1000 mm, depending on the application. Select "NO" for this type of calibration.

**Exposure Time:** this parameter indicates the exposure time of the camera; the image will become clearer by increasing its value.

**LED Type:** the Fanuc vision system is able to manage "Strobe" type lighting; the parameters relating to stroboscopic lighting can be set via this item. In the example given, the lighting is always on, therefore, "NO" will be selected.

**Calibration:** from the drop-down menu you can select 2 types of calibration; select the "Grid Pattern Calibration" item.

#### Select "Calibration" from the menus at the top

iRVision Vision Setup - CAMERA															
						1	c <sup>0</sup>	~	▶ 2			3		▶ 4 ≡	
						(	Came Setur	a D	C	alibra	ation	(	Calibratio Points	n Calibration Result	
	*	6ª			_				_	-	Zoom	50%		Robot to be offset Application Frame Grid Spacing Number of Planes	This Robot V Group 1 V UF 0: WF V Not Selected V 1 V
					0	0		0		•	•	0		Robot-Held Cal. Grid Cal. Grid Frame	D No V UF Not Selected V
	•	•	•	•	0	0	0	0	•	•	•			Projection Camera Distance	Perspective  Calculate Automatically
1	•		•	•	•	000	•	•	•	•	•	•		Fixture Position Star 1st Plane 2nd Plane	Not Found Find
	•	•	•	•	0	0	•	•	•	•	•	•	4		
	0	•					•	•	•	•	•	0			
	0	•	•	•	•	•	•	•	•	•	•	•	4		

Application Frame: set the User Frame number that will be recorded on the calibration grid.

Grid Spacing: set the centre-to-centre distance between the markers in the calibration grid.

**Cal. Grid Frame: set** the User Frame number that will be recorded on the calibration grid.

**Camera Distance:** for better calibration, select "Override Standoff Distance" and enter the distance between the calibration plane and the midpoint of the lens.

1     2     3       Camera Setup     Calibration Points     Calibration Points	4 Calibration Result
Camera Distance X Choose how the calibration tool should calculate the standoff distance and the focal distance shown in the diagram below. If there are multiple calibration planes, there is no choice. The Camera Distance line	Robot to be offset     This Robot < Group 1       Application Frame     UF 1: calib.       Grid Spacing     15.0mm <       Number of Planes     1
will be disabled and the software will calculate the camera distances automatically. For a single plane calibration, if the camera is tilted 10 degrees or more, use method 1 below. Otherwise, the software will display a warning message that the distances may be inaccurate. In this case you should use method 3. Method 2 is provided for compatibility with old software versions.	Robot-Held Cal. Grid     No        Cal. Grid Frame     UF       1: calib.        Projection     Perspective        Camera Distance     Override Standoff Distance
<ol> <li>Calculate Automatically</li> <li>Override Focal Distance - This distance will be slightly larger than the focal length marked on the lens and depends on what distance the lens is focused at. The closer you focus the lens, the larger it will be.</li> <li>Override Chardeff Distance Measure the distance from the collibration and acient</li> </ol>	Standoff Distance     850.0 mm       Fixture Position Status     Not Set       1st Plane     Not Found       2nd Plane
3. Override Standoff Distance - Measure the distance from the calibration grid origin to the mid-point of the lens (half way between the end of the lens and the threaded opening on the camera).	

Once the necessary parameters have been set in order to perform correct calibration, place and secure the grid in the vision area of the Flexibowl.

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Then press "Find" to select the search area. Resize the search rectangle to include the grid inside, as shown in the photo below,



The vision system will identify all the circles it will be able to recognise, with a cross reference.

For optimal calibration, all the points on the grid must be recognised.



From the moment the photo is taken and the markers of the calibration grid are identified, this must not be moved, otherwise the calibration will not be accurate.

iRVision Vision Setu	p - CAMERA							
	1 Came Setu	ra Calibi p	ration Calibre	ation nts	4 Calibratio Result	Dn		
	The calculated fo	cal distance is	Zoom 50% 🔻	R	Robot to be (	offset <b>D</b>	This Robot C UF 1: calib. 15.0mm C 1 C No C	Group 1 V
				P	Cal. Grid Fran Projection	me <b>D</b>	UF 1: calib.	
				S	amera Dista Standoff Dist ixture Positi	ance tance ion Status¶	Override Stando 845.0 mm Set	Set
				1	st Plane. Ind Plane			Find
				(	ок			

Press "SET" to check the lens calculated by the vision system.

If the data entered are correct, the data relating to the focal length of the lens used will be given. It is important to compare this data with the actual one of the lens used; if there are significant differences, check the entered data.

If the given value conforms to the lens used, save and close the vision process,

The last step to conclude the calibration procedure is to record the Frame on the calibration grid. It is important to <u>never</u> move the calibration grid before the end of the procedure.



## Creating a Model

The following will show how to create a model of the object that will need to be handled.

To access the vision menu you can use the robot's keypad (Teach Pendant) or connect via an Ethernet cable to the robot controller for convenience and quick programming.

After opening the vision page, you must create a new process relating to the object to be recognised.

<b>iRVision Visi</b>	on Setup						
Name	Comment	Туре	Create	d l	Modifie	ed Siz	e
Camera Data (	1)						
CAMERA		2D Camera	07-JAN-2020 08:54	:10 0	7-JAN-2020 08:54	1:10	57
		$\sim$					
				$\nabla$			
			)				
		CREATE	EDIT	FILTER			
		E	<u> </u>				
	COPY	DETAIL	DELETE				

Select "2-D Single-View Vision Process" and set a name for the product.



ARS S.r.I. con Unico Socio - Edition: January 2021 Page 60 of 93 Select the vision process and press "Edit"









Camera: set the correct camera.

Offset Mode: select "Fixed Frame Offset"

Offset Frame: choose and set the frame number on which the calibration was recorded

Then select the "Snap Tool 1" submenu

iRVision Vision Setup - RECIPE1						
A C C C C C C C C C C C C C C C C C C C	Zoom 100% 💌 🔲					
		2-D Single-View Vision Process				
		GPM Locator Tool 1				
		<b>[0</b> ]	Snap Tool 1			
		Snap Window	Full Window Set			
		Resolution Reduction	2X 🔻			
		Image Size	512×640 pix			
		Exposure Mode	Fixed <b>T</b>			
		Exposure Time	2.000 ms ♥ ♥ ^			
		Multi Exposures	1 <b>1</b> , 2.00 - 2.00 ms			
		LED Type	None 🔽			
		Image Display Mode	Snapped Image 🔽			
Time to Find: 51 ms						

From this page, you can adjust the exposure time of the image and the resolution you want to work on; the higher the resolution, the longer the processing time.

Select the "GPM Locator Tool 1" tab to proceed with the creation of the model.

Place a piece at the centre of the vision area and press "Teach" to learn the new model.



Resize the search rectangle, making sure to include the object model inside it





iRVision Vis	sion Se	etup - R	ECIPE1									
	1	30			Zoom <mark>400%</mark> 🔻	ÌX	0			<b>^</b>	¥	
								2-D Single-View	v Vision Process			
								Snap Tool 1	L			
							GPM Locator Tool 1					
			<u> </u>		-	1						
			100		-			🗭 GPI	M Locator Too	ol 1		
		-					Input I	[mage <b>Ø</b>	Snap Tool 1 💌			^
	-		_	-							Teach	
											GEdit	
											Set Org	
	-						T			<b>C</b>	Cen Org	
							Trainir		LUC. P Ang. G	Sca.	Edit	
-							Empha	sis Area			Fdit	
							Learni	ng <b>Ø</b>	Enable		Start	
							Model	Origin Bias	None		Set	
							Model	ID	1			~
Found	0	# 🔸	Row(V)	Colur	mn(H)	Score	e	Contrast	Fit Error		Angle	
Almost Found	0											
Time to Find	0 ms											_



Score Threshold: this parameter sets the minimum recognition percentage.

**Contrast Threshold:** this parameter establishes the minimum contrast threshold; transparent pieces require lower thresholds.

**Elasticity :** this parameter sets the recognition elasticity: the points that make up the model can deviate from the number of pixels specified in this variable, compared to the previously set master model.

Go to the home screen: "2-D Single-View Vision Process" and press "Snap+Find"

After checking that the vision system correctly recognises the objects, press "Set" to define the reference position of the object.



Save and exit from the vision process.



## Creating a second model

If the application requires recognition of multiple models, the following shows how to add the second-third model.

The addition of the models can be useful when there are pieces inside the Flexibowl or when the usual piece must be picked from multiple layouts.

From the previously created vision process, select the main tool "2D Single-View Vision Process" and press the "+" button to add a new "Locator Tool"



Specify value 2 in "Model ID", this is very important to distinguish the 2 models.



Place the new piece under the vision area and press "Teach" to create the model.

iRVision Vision Setup - RECIPE1				
	Zoom 100% 🔻	X 🔮 🖌 💵		<b>↑</b>
		2-D Single-V	iew Vision Process	
		Snap Too	l 1	
	Contraction of the local division of the loc	GPM Loca	tor Tool 1	
		🗩 GPM Loca	tor Tool 2	
	* + ( ) * ( + ) + (	<b>1</b> G	PM Locator To	ol 2
			Snan Tool 1	
				Toach
				GEdit
				Set Org
		Training Stability	Loc. N Ang. N	Sca. N
		Training Mask	Enable	
		Emphasis Area	Enable 📃	
		Learning	Enable 📃	
and the state of the		Model Origin Bias	None	Set
		Model ID	2	
		Score Threshold	70.0 %	

In this example, a model of a different component will be created but the procedure is the same even if 2 models must be created, associated with 2 different sides of the same piece.





Select "2D Single-View Vision Process" and edit "Ref data to Use" from "Static" to "Model ID"



Press the "+" button to add a new line associated to model 2



Specify the number 2 on Model ID; press "Snap+Find" and lastly, press "Set"



Increase the number of the variable "Number to Find" to 3.

By positioning both models in the vision area and pressing "Snap+Find", the components must be recognised and identified with their own "Model ID"



Save and exit.



## Pick-up clearance control

For applications where the gripper is used to pick up the piece, a check is usually carried out in the pick-up area so as to ensure that the piece can be picked up without bumping into other nearby objects.

From the vision process related to model recognition, select "GPM Locator Tool 1" and press the "+" button and add a "Histogram Tool"







Press "Set" and define the control area; this area must correspond to the overall dimensions of the grippers.



Press "OK" and go back to the previous menu




Then press "Edit" to mask the central zone so as to control only the external zones.

Use the pencil tool to colour the areas that do not need to be controlled in red.



By executing a "Snap+Find" command, the histogram will give the results relating to the analysed area.



Therefore, a control tool must be created, which identifies only the components that can actually be picked up as good parts.

Select "GPM Locator Tool 1" and press the "+" button to add a "Conditional Execution Tool"

iRVi	sion Vis	ion Setup - RECIPE1			
<b>F</b>			Zoom 100% 🔽		
	Create	new vision tool			
	Name*	Conditional Execution Tool 1		The name must be 34 characters or less.	
	Туре	Conditional Execution Tool			
		<ul> <li>✓ Ence Locator Foor</li> <li>✓ Inspection, Measurement</li> </ul>	^	Conditional Execution Tool is a tool to execute specified processes if and only if the measurements (results) of a command tool such as Histogram Tool satisfy certain evaluation criteria	
		Histogram Tool     Evolution entent:     A		ch.	
		Measurement Output Tool			Org
		Count Tool			t
		A Geometric Calculation Tool		an a	
		Htter Statistics Calculation Tool		et	t ×
Found Almost		Position Calculation Tool			ale
Time to		▼ Other	~		

After creating the Tool, specify:

- Value 1  $\rightarrow$  Histogram Tool 1 $\rightarrow$  Std. Dev.
- Cond.1→ Value1 > Constant that varies according to the defined area and brightness. In the specific case, the "Standard Deviation" (Std. Dev) values is about 10 when the piece is free, and the threshold value will therefore be set to 15.



Set the parameters shown in the picture below as parameters under Action.



Select the "2D Single-View Vision Process" main tool and press "Snap+Find"

The main tool executes all sub-tools and therefore, the relative controls.



Place another piece close to the part to be picked up and repeat the photo with the "Snap+Find" button; the vision system must discard the object.





Check by selecting the "Histogram Tool 1" tool and press "Snap+Find".

As can be seen from the photo below, the "Std.Dev" value is 49.6 and therefore, exceeds the set threshold.



Save and exit.



## Hopper Histogram Tool

A control tool called "Single View Inspection VisProc" is used to distinguish whether the Flexibowl has enough pieces inside it or not.

To access the vision menu you can use the robot's keypad (Teach Pendant) or connect via an Ethernet cable to the robot controller for convenience and quick programming.

Press Menu $\rightarrow$ IRVision $\rightarrow$ Vision Setup on the Pendant

<b>iRVision</b>	iRVision Vision Setup							
Name	Comment	Тур	e	Cr	eated	Modifi	ed	Siz
Camera Da	ita (1)							
CAMERA		2D Camera		07-JAN-20	020 08:54:10	07-JAN-2020	08:54:10	
Vision Pro	cess Tools	(1)						
RECIPE1		2-D Single-View	Vision Process	07-JAN-20	20 16:17:46	07-JAN-2020	16:47:16	e
<								>
		E.			$\mathbf{Y}$			
		CREATE	EDIT	F	TILTER			
			4					
	3							

Use the "Create" button to add the vision process required for the control

iRVi	iRVision Vision Setup								
Ν	ame	Comment	Туре		Created	Mo	dified s		
Cam	Create	e new visior	n data						
Visid	Name*	Hopper_Ctrl			×	The name must start contain no spaces, n characters \V:*?\"<:	with a letter, ot contain the > -, and be 34	57	
	Comment Type	Single V	iew Inspection Vi	sProc		]			
		im 2D 🖄 Floa	Calibration-free VisPr ting Frame Vision Pr e Line Offset Vis. Pro	roc 🔨	<ul> <li>Single View Inspection Vision Process is a vision process to determine acceptance of inspection result (OK/NG), unlike normal vision processs whose purpose is to compensate robot motions.</li> </ul>				
		▼ Others م <sub>لة</sub> Sing	Jle View Inspection \	/isProc					
		▼ Application	Setup Tools						
		(x) Vision (	Override						
		🗱 Limit Cl	neck Tool	~					
		_					_		
			-		-	-			
						×			
					ок	CANCEL			

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iRVision Visio	n Setup							
Name	Comment	Туре		Created		Мо	dified	Size
Camera Data (1	.)							
CAMERA		2D Camera		07-JAN-2020 08:54	:10	07-JAN-20	20 08:54:10	57
Vision Process	Fools (2)							
HOPPER_CTRL		Single View Inspect	ion VisProc	08-JAN-2020 08:51	:38	08-JAN-20	20 08:51:38	1082
RECIPE1		2-D Single-View Vis	ion Process	07-JAN-2020 16:17	<b>':4</b> 6	07-JAN-20	20 16:47:16	656
				$\nabla$				
		CREATE		FILTER				
	3							
	COPY	DETAIL	DELETE					

Press "Edit" to edit the process just created.

iRVision Vision S	iRVision Vision Setup - HOPPER_CTRL							
			Zoom 100% 💌	Э С				
				🔻 🔽	Single View Ins	pection VisProc		
					Snap Tool 1			
					د Evaluation T	ool 1		
					់ <sub>ផ</sub> Single Vie	w Inspection VisProc		
				Camer	aØ	Not Selected		
				Image	Logging Mode	Log Failed Images 🔽		
				Displa	y Image	Snap Tool 1 🔽		
				Measu	rements in mm			
Time to Find 0 ms	# C	ond.No	Conditio	n	Value	Cond. Result		
Kebure								
	<b>ر</b> _ک	<b>[</b> -7]		<b>F</b> -7	<b>7</b> .7			
	۳.	زف	+	ز+ن	i			
	LIVE	SNAP	FIND	SNAP+FIN	D CONT S+I			
					[-→			
			PLAYBACK	SAVE	END EDIT			

#### Select the camera

iRVision Vision Set	up - HOPPER						
n 🖓 📮 🔯 💉			Zoom 100% 🔽	Д 🗘 🔬	. 🧊 🔎		
				▼ <mark>A<sub>a</sub>t Sin</mark>	gle View Inspe Snap Tool 1 Evaluation Too	ection VisProc	
				da Camera Image Log Display Im Measureme	Single View	v Inspection VisPro CAMERA Log Failed Images V Snap Tool 1 V	
Time to Find 0 ms	# Co	nd. No	Conditio	n '	Value	Cond. Result	
Result							
		<b>SNAP</b>	FIND	SNAP+FIND	CONT S+F		
			PLAYBACK	SAVE			

Select "Snap Tool 1" and adjust exposure and resolution; reduced resolution promotes faster control.



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Select the "Single View Inspection VisProc" main vision process and press the red "+" button to add the control "Histogram Tool".



Press "Ok"

Select "Histogram Tool 1"

iRVision Vision Setup - HOPPE	R_CTRL		
a 🖉 🚑 😹	Zoom 200% 💌		
	Contraction	▼ Mata Single View Inspection VisProc	
	A STATISTICS	Snap Tool 1	
Constant of the second s	C. C. C. C. C. C. C. C.	Histogram Tool 1	
		د Evaluation Tool 1	
		Histogram Tool 1	
	· · · · · · · · · · · · · · · ·	Input Image Snap Tool 1	^
		Run-Time Mask Enable	
		Range of Interest 64 - 192	
			~
Time to Find 0.0 ms # Max. Min	n. Median Mode Mean	Std. Dev. In Range(%) Out of Range(%)	)
<b>C-2</b>	<b>C</b> - <b>D</b>		
i - 😳	נס) 🔫		
LIVE	SNAP FIND	SNAP+FIND CONT S+F	
	PLAYBACK	SAVE END EDIT	

Press "Set" and define the control area as shown in the image below



Pressing "Snap+Find" shows the values relating to the image; the value that can be used is the "Std.Dev." Assuming that you will consider the Flexibowl area as filled correctly with more than 3 pieces, the threshold value you will use is 28.

Select "Evaluation Tool 1" and then select the "Variable" tab

Then associate variable V1 with the "Std. Dev" variable of "Histogram Tool 1".



Then select the "Condition" tab and enable the "C1" condition: the control will only be successful if variable C1 is less than a constant, which specifies the threshold value.





By selecting the main vision tool and pressing "Snap+Find", you can check the outcome of the check.

3 pieces, area already filled correctly



1 piece, area with grey level less than the set threshold and therefore, to be loaded



# <u>Flexibowl</u>

This interface allows to set and test the parameters relative to FlexiBowl<sup>®</sup> by using the TCP/IP communication.

Before being able to use the interface, it will be necessary to:

- Power FlexiBowl<sup>®</sup> electrically and pneumatically.
- Set the IP addresses of the robot and FlexiBowl<sup>®</sup> in order to create a subnet to allow the communication.
- Connect FlexiBowl<sup>®</sup> and robot by an Ethernet cable.
- Having installed the FANUC "User Socket Messaging" option.

To access the Flexi-Expert interface for the FlexiBowl<sup>®</sup> parametrization from the FANUC pendant press: Menu $\rightarrow 0 \rightarrow$  Browser $\rightarrow$  Flexibowl

Busy	Step	Hold	Fault		<b>T2</b>	OINT	100			
Run	I/O	Prod	TCyc							
Initial	Setu	o					Ē			
MENU	2			BROWSER 1			~			
1 SELECT				1 Browser	rowser					
2 EDI	-			2 Panel setup	Panel setup Welcome to					
3 DAT	4		•	3 Flexi-Expert						
4 STAT	US		•	4 Flexibowl						
5 4D 0	GRAPH	ICS	•	5 License						
6 SYS	ГЕМ		•	•						
7 USE	R2			<b>1HMI</b> Guided Setup						
8 BRO	WSER		•							
9				A step-by-step quide to setting up your robot using FANUC's						
0 N	EXT			intuitive setup Guides.						
				Press NEXT STEP to begin or MORE INFO for more						
Menu Favorites (press and hold to set)										
							>			



Software Manual



Select the FlexiBowl<sup>®</sup> you intend to test or parametrize.

In the example shown below we will work with FlexiBowl 1, but everything that will be explained also counts for the pages relative to FlexiBowl 2.

Flexibowl 1	Ip				e 🖽		
	FL	EXIB	OWL	, IP			
	****	****	****	****			
		Set Up \$Ho	ostc_Cfg[7	7			
Test C	Test Communication Back Next						

Insert the IP address of the FlexiBowl you wish to configurate.

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Flexibowl 1	Ip				<b>€</b> []
	FL	EXIB	OWI	L IP	
	192	168	1	10	
		Set Up \$Ho	ostc_Cfg[7	7	
Test C	`ommunicati	ion	Bac	k Ne	xt

Once you have inserted the correct IP address, press "Set Up \$Hostc\_Cfg[7]" to configurate the communication client "C7". During the configuration of FlexiBowl 2, client "C8" will be set.

It is necessary to restart the controller before being able to use the client set up as above.

Following the restart of the FANUC controller, you will be able to run a communication test.

By pressing "Test Communication", if all operations were successful, the box indicationg the communication status will be green.

Flexibowl 1	Ip				€ <b>⊞</b>
	FL.	EXIB	OWL	, <mark>IP</mark>	
	192	168	1	10	
	(	Set Up \$Hd	ostc_Cfg[7	1	
Test C	ommunicati	ion	Back	Nex	ct

Press "Next" to move forward to the following page.



In the page shown above there are 2 choices:

- Parameters →
  - $\circ$   $\;$  It allows to set and check the movement parameters
  - It allows to set and check the single operations:
    - Backlight
    - Flip
    - Blow
- Sequence  $\rightarrow$  It allows to set sequences of movements that can be recalled by the program.



### **Parameters**

Inside the "Parameters" page there are 4 subpages:

**MOVE**  $\rightarrow$  In here it is possible to set the parameters for the **"MOVE"** movement of FlexiBowl; through the **"TEST MOVE"** button is possible to check the set parameters.

Flexibowl 1 Move		A 🖽
MOVE	SHAKE	OPTION INFO
ACCELERATION	150	
DECELERATION	150	
SPEED	20	TEST MOVE
ANGLE	50	

**SHAKE**  $\rightarrow$  In here it is possible to set the parameters for the **"SHAKE"** movement of FlexiBowl; through the **"TEST SHAKE"** button is possible to check the set parameters.

Flexibowl 1 Shake			• 🖽
MOVE	SHAKE	OPTION	INFO
ACCELERATION	200	COUNT SHAKE	3
DECELERATION	250		
SPEED	40	TES	ST SHAKE
ANGLE CW	40		
ANGLE CCW	60		

**OPTION**  $\rightarrow$  Here it will be possible to set up the parameters relative to the options of FlexiBowl; through the **"TEST"** buttons is possible to check the set parameters.

With the **"Save to Flexibowl"** key all parameters will be transferred and saved inside FlexiBowl's memory.

Flexibowl 1 Option		A 🖽
MOVE	SHAKE	OPTION INFO
FLIP COUNT	2	
FLIP DELAY	150	TEST FLIP
BLOW DELAY	200	TEST BLOW
LIGHT	1	TESTLIGHT
		Save to Flexibowl

#### INFO





## Sequence

Inside the page there are 6 sub-pages, all identical to one another; though these pages it is possible to create up to 6 movement sequences.

The example below shows the configuration of sequence 1, but everything that is explained is valid for the pages relative to other sequences as well.

Flexibowl 1 Sequence 1	۹ 🖽
Seq 1 Seq 2 Seq	3 Seq 4 Seq 5 Seq 6
****	
****	
****	Test Sequence 1
****	
****	

Select the first box of the list and choose the desired movement from it; if necessary, proceed with assigning the second box, so that the desired sequence can be defined.

Flexibowl 1 Seque	ence 1			۵ 🕀
Seg 1		3 Son 4	Sog 5	Son 6
1	<u> </u>	J Sey +	Sey S	Seyo
1 MOVE				
2 MOVE FLIP	┠─────┟┛			
3 MOVE BLOW	]	[		
4 MOVE BLOW FLIP	]			
5 SHAKE	1			
6 LIGHT ON	]		lest Sequence	ce 1
7 LIGHT OFF		Te	st Sequence 1	
8next page	ext page			
*	****			

It is possible to verify if the sequence works by using the button "Test Sequence"

Flexibowl 1 Sequence 1	et 🖽
Seq 1 Seq 2 Seq	3 Seq 4 Seq 5 Seq 6
MOVE FLIP	
SHAKE	
****	Test Sequence 1
****	
****	





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