Manual

FlexiVision

ABB PLUG-IN

Feeding
Industrial
Robotics

INDEX

This Plugin was developed with the idea of communicating **quickly and safely with Flexivision 2.0** through ABB robots by using instructions in **RAPID.**
The Plugin requires **two additional licences** for socket management and multitasking:
-Pc interface.
-Multitasking
In order to run the FlexiVision server in a parallel task without having to block the robot's main cycle**.**

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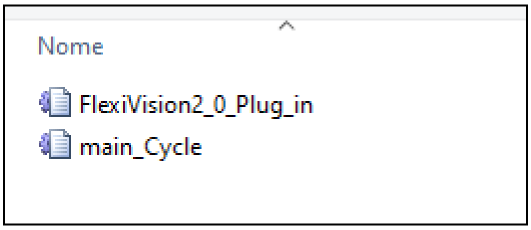
FlexiBowl® Plug-In

Plug-In Installation

Step 1.



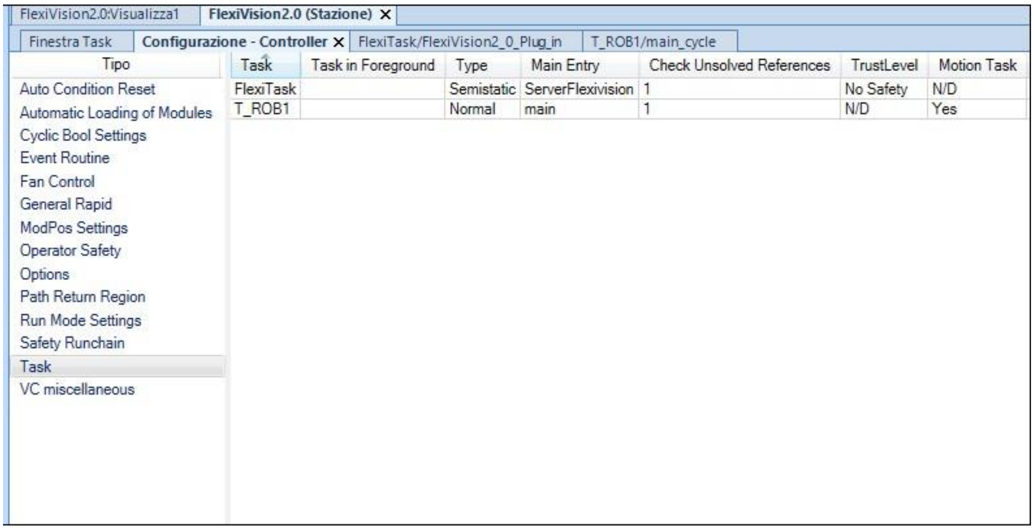
Nome

FlexiVision2_0_Plug_in

main_Cycle

Together with this guide, a basic example developed directly with **RobotStudio** is provided in order to understand the steps to implement the application

Step 2.



FlexiVision2.0:Visualizza1
FlexiVision2.0 (Stazione)
Finestra Task
Configurazione - Controller
FlexiTask/FlexiVision2_0_Plug_in
T_ROB1/main_cycle

Tipo

Auto Condition Reset
Automatic Loading of Modules
Cyclic Bool Settings
Event Routine
Fan Control
General Rapid
ModPos Settings
Operator Safety
Options
Path Return Region
Run Mode Settings
Safety Runchain
Task
VC miscellaneous

Task	Task in Foreground	Type	Main Entry	Check Unsolved References	TrustLevel	Motion Task
FlexiTask		Semistatic	ServerFlexivision	1	No Safety	N/D
T_ROB1		Normal	main	1	N/D	Yes

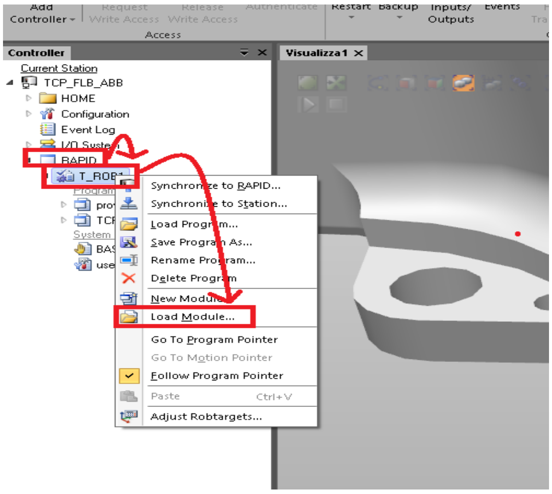
We must use two tasks, one for the main cycle and one parallel that will manage communication with **FlexiVision** without ever being stopped by stops or emergencies.

Controller/Configuration/Controller/task, Request Write Access dopoand create a new Task.

The task name is **“FLEXIVISION”.**

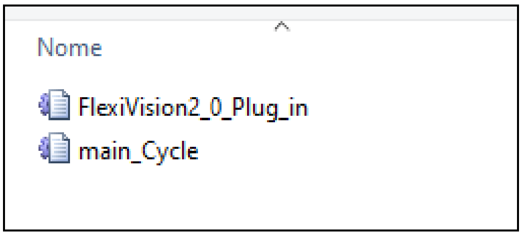
Plug-In Installation

Step 3.



Select the following in the ***Controller*** menu:
Rapid→T_ROB1
Right click on ***T_ROB1*** and select
Load Module

Step 4.

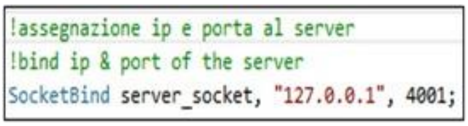


In the dialogue window that will appear, select the Plug-in "***main_Cycle"*** supplied by ARS.

Step 5.

Following the same approach load the module "***FlexiVision2_0_Plug_in***" into "FLEXIVISION" task.

Step 6.



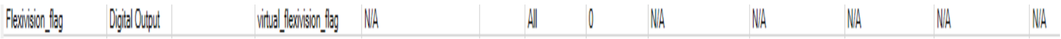
```
!assegnazione ip e porta al server
!bind ip & port of the server
SocketBind server_socket, "127.0.0.1", 4001;
```

After importing the **FlexiVision Plug-in**, simply modify this line of code by setting the **IP** of the robot and the port you intend to use.

Plug-In Installation

Step 7.

Create the virtual signal **"Flexivision_flag".** It is used to connect the two task. The path to create the signal is: **Controller/Configuration/I/O System/Signal**. The signal is shown below:



Flexivision_flag	Digital Output		virtual_flexivision_flag	N/A		All	0	N/A	N/A	N/A	N/A	N/A

Step 8.

To send the command to Flexivision you must modify the value of the "command" string.

FlexiVision Command List

To send the command to FlexiVision you must modify the value of the "command" string.

N_Mission	Command	Action
1	"start_Locator"	Starts the parts localization process by recalling the FlexiBowl handling routine in case there are no parts that can be picked up. ***Return:*** "Pattern1;x;y;r".
2	"stop_Locator"	Stops the process of locating the object with the aid of the FlexiBowl.
3	"turn_Locator"	If no parts are picked up, by this command the operator can make the Flexibowl rotate and the "start_Locator" routine start. ***Return:*** "Pattern1;x;y;r".
4	"test_Locator"	Starts the process of locating the object without the aid of the FlexiBowl. ***Return:*** "Pattern1;x;y;r".
5	"start_Control"	Starts the inspection cycle. ***Return:*** "Control1;x;y;r".
6	"state_Locator"	Locator status diagnostics is shown: ***Return:*** "Locator is Running" "Locator is in Error" "Locator is not Running".
7	"start_Empty"	Start the FlexiBowl® Quick-Emptying sequence. ***Return:*** "start_Empty ended"
8	"get_Recipe"	The name of the recipe currently loaded on FlexiVision is shown. ***Return:*** "recipe name".
9	"set_Recipe=recipe name"	The recipe corresponding to the sent "recipe name" is loaded.

Script

Let’s analyse the **“Flexivision2_0_Plug_in”** module.

```
MODULE FLEXIVISION

!Robtarget of the object to pick/control
    PERS robtarget pFlexi:=[[194,142,40],[6.12323E-
17,1,0,0],[0,0,0,0],[9E+9,9E+9,9E+9,9E+9,9E+9,9E+9]];
    PERS robtarget  pControl:=[[0,0,0],[1,0,0,0],[0,0,0,0],[9E9,9E9,9E9,9E9,9E9,9E9]];

            !Flexivision string returned  PERS string
    return_from_flexivision;

            !Command to send to Flexivision  PERS string
    command;

            !Time activation Hopper  PERS num
    time;

            !Z value of the pFlexi robtarget. Set fixed according to object height  PERS num z_pos := 40;


PROC main()
            !Set semaphore Flexivision (doFlexivision) to 0.
            !Flexivision: 0 -> Robot turn | Flexivision: 1 -> Flexivision turn
            SetDO doFlexivision, 0;
    WaitTime 0.5;

            !Start Flexivision server
    ServerFlexivision;
ENDPROC


PROC ServerFlexivision()
        VAR socketdev server_socket;
        VAR socketstatus status;
        VAR socketdev client_socket;
        VAR string client_ip;
        VAR string receive_string;
        VAR string X;
        VAR string Y;
         VAR string Z;
        VAR string RX;
```

Script

```
     VAR string partTmp;  VAR string
     mission;  VAR string mission_case;
     VAR num found;
     VAR num found_start;
     VAR num found_end;  VAR num
     found_len;  VAR num len;
     VAR num anglez;  VAR num
     x_pos;  VAR num y_pos;  VAR
     num z_pos:=40;  VAR bool ok;

     !Closing the previus socket instance
     SocketClose server_socket;

     !Creating new socket
     SocketCreate server_socket;

     !Bind ip & port of the server
     SocketBind server_socket, "127.0.0.1", 4001;

     !Start listening
     SocketListen server_socket;

     !Wait for a new connection
     SocketAccept server_socket, client_socket\ClientAddress:=client_ip
\Time:=WAIT_MAX;


     WHILE TRUE DO

       restart:
       !Wait until it's Flexivision turn (wait until doFlexivision is 1)
       WaitDO doFlexivision,1;
       mission := command;
       mission_case:= mission;
       IF(StrMatch(mission,1,"set_Recipe")<=StrLen(command)) THEN  mission_case:="set_Recipe=";
       ENDIF

restart_command:
       !Switch case according to the command to be sent
       TEST mission_case
```

Script

```
CASE "start_Locator":
    !Send the command according to the varible value
    SocketSend client_socket \Str := "start_Locator";

CASE "stop_Locator" :
    !Send the command according to the varible value
    SocketSend client_socket \Str := "stop_Locator";  GOTO
                    restart;

CASE "turn_Locator" :
    !Send the command according to the varible value
    SocketSend client_socket \Str := "turn_Locator";

CASE "test_Locator" :
    !Send the command according to the varible value
    SocketSend client_socket \Str := "test_Locator";

CASE "start_Control" :
    !Send the command according to the varible value
    SocketSend client_socket \Str := "start_Control";

CASE "state_Locator" :
    !Send the command according to the varible value
    SocketSend client_socket \Str := "state_Locator";

CASE "start_Empty" :
    !Send the command according to the varible value
    SocketSend client_socket \Str := "start_Empty";

CASE "get_Recipe" :
    !Send the command according to the varible value
    SocketSend client_socket \Str := "get_Recipe";

CASE "set_Recipe=" :
    !Send the command according to the varible value
    SocketSend client_socket \Str := mission;
    GOTO         restart;

DEFAULT :
    TPWrite "undefined command";  GOTO
    restart;

ENDTEST
```

Script

```
!Receive the data
SocketReceive client_socket \Str :=
receive_string\Time:=WAIT_MAX;

!Memorize the lenght of the string received
 len := StrLen(receive_string);

!Global return from flexivision
 return_from_flexivision:=receive_string;

IF(StrMatch(receive_string,1,"Pattern")<=len) THEN
    !Once received the string, split the position and create the point

    !Pattern
    found_start:=0;
    found_end:=StrMatch(receive_string,found_start+1,";");  found_len:=found_end-found_start-1;
    NameModel :=  StrPart(receive_string,found_start+1,found_len);

    !X
    found_start:=StrMatch(receive_string,1,";");
    found_end:=StrMatch(receive_string,found_start+1,";");  found_len:=found_end-found_start-1;
    X := StrPart(receive_string,found_start+1,found_len);  ok:=StrToVal(X,x_pos);

    !Y
    partTmp:= StrPart(receive_string,found_end,len-found_end);  found_start:=StrMatch(partTmp,1,";");
    found_end:=StrMatch(partTmp,found_start+1,";");  found_len:=found_end-found_start-1;
    Y := StrPart(partTmp,found_start+1,found_len);  ok:=StrToVal(Y,y_pos);

    !RZ
    len := StrLen(partTmp);
    partTmp:= StrPart(partTmp,found_end,len-found_end+1);  found_start:=StrMatch(partTmp,1,";");
    found_end:=StrMatch(partTmp,found_start+1,";");  found_len:=found_end-found_start-1;
    RZ := StrPart(partTmp,found_start+1,found_len);  ok:=StrToVal(RZ,anglez);

    !Create the cartesion point
     pFlexi.trans:= [x_pos, y_pos, z_pos];
```

Script

```
!Define the rotation vector
    pFlexi.rot := OrientZYX(anglez, 0, 180);

    SetDO doFlexivision, 0;  ENDIF

IF(StrMatch(receive_string,1,"Control")<=len) THEN

    !Once received the string, split the position and create the point

    !Pattern
    found_start:=0;
    found_end:=StrMatch(receive_string,found_start+1,";");  found_len:=found_end-found_start-1;
    NameModel :=  StrPart(receive_string,found_start+1,found_len);

    !X
    found_start:=StrMatch(receive_string,1,";");
    found_end:=StrMatch(receive_string,found_start+1,";");  found_len:=found_end-found_start-1;
    X := StrPart(receive_string,found_start+1,found_len);  ok:=StrToVal(X,x_pos);

    !Y
    partTmp:= StrPart(receive_string,found_end,len-found_end);  found_start:=StrMatch(partTmp,1,";");
    found_end:=StrMatch(partTmp,found_start+1,";");  found_len:=found_end-found_start-1;
    Y := StrPart(partTmp,found_start+1,found_len);  ok:=StrToVal(Y,y_pos);

    !RZ
    len := StrLen(partTmp);
    partTmp:= StrPart(partTmp,found_end,len-found_end+1);  found_start:=StrMatch(partTmp,1,";");
    found_end:=StrMatch(partTmp,found_start+1,";");  found_len:=found_end-found_start-1;
    RZ := StrPart(partTmp,found_start+1,found_len);  ok:=StrToVal(RZ,anglez);

    !Create the cartesion point
    pControl.trans:= [x_pos, y_pos,  z_pos];

    !Define the rotation vector
    pControl.rot := OrientZYX(anglez, 0, 180);
    SetDO doFlexivision, 0;
```

Script

```
IF(StrMatch(receive_string,1,"Hopper")<=len) THEN
                !Controll the hopper for a requested time without blocking the main
cycle
                found_start:=StrMatch(receive_string,8,";");
                found_end:=StrMatch(receive_string,found_start+1,";");
                found_len:=found_end-found_start;

                partTmp := StrPart(receive_string,found_start+1,found_len);  ok :=

                StrToVal(partTmp, time);


                HopperControll;

                GOTO restart_command;

            ENDIF


            GOTO

        restart;

        ENDWHILE

ERROR
    !In case of error:

    !Close the socket  SocketClose
    server_socket;

    !Restart the flexivision server
    ServerFlexivision;

ENDPROC

 PROC HopperControll()
    !Start the hopper for (time/1000) seconds whitout blocking the execution of  the program
    SetDO doHopper,1;
    SetDO \SDelay := time/1000, doHopper, 0;  ENDPROC

ENDMODULE
```

Script

Let’s analyse the **“main_Cycle”** module.

```
MODULE MAIN_CYCLE
            !Robtarget of the object to pick/control
    PERS robtarget pFlexi :=[[194,142,40],[6.12323E-
17,1,0,0],[0,0,0,0],[9E+9,9E+9,9E+9,9E+9,9E+9,9E+9]];
    PERS robtarget pControl
:=[[0,0,0],[1,0,0,0],[0,0,0,0],[9E9,9E9,9E9,9E9,9E9,9E9]];

            !Robtarget of the Home and Place  PERS robtarget
    pHome :=[[27.64,-0.14,-
841.88],[0,1,0,0],[0,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    PERS robtarget  pPlace:=[[-191.79,-79.74,-954.74],[0,-1,-5.52176E-38,-
2.76088E-38],[0,-1,0,0],[9E+9,9E+9,9E+9,9E+9,9E+9,9E+9]];

            !Command to send to Flexivision  PERS string
    command;

            !Reference frame Flexivision  PERS wobjdata
    wobjFlexivision
:=[FALSE,TRUE,"",[[0.567452,0.062766,-
1000.11],[1,0,0,0.00000005]],[[0,0,0],[1,0,0,0]]];

            !Trigger data to trigger some IO when something happens  VAR triggdata trigFlexi;

            !Speed
    PERS speeddata vJoint:=[100,50,0,0];
            PERS speeddata vLinear:=[300,80,0,0];

    PROC main()
        SetDO doFlexivision,0;
        command:="start_Locator";

!Setup trigFlexi: when 150mm far from start set doFlexivision to 1.
!In this way, Flexivision start working even before the placing action.
        TriggIO trigFlexi, 150 \Start, \DOp:=doFlexivision, 1;

        WaitTime(0.5);
```

Script

Let’s analyse the **“main_Cycle”** module.

```
      !First action: go home.
        go_home;

      !Now, at home, let Flexivision start  SetDO
      doFlexivision,1;

      !Pick and place continously
        WHILE TRUE DO
            pick_task;
            place_task
            ;
        ENDWHILE

    ENDPROC


    PROC go_home()
        MoveJ pHome,vJoint,fine,tool0;
    ENDPROC

    proc pick_task()
    !Wait for Flexivision to finish the detection of the object. Flexivision=0  means Flexivision finished.
        WaitDO doFlexivision,0;

     !Go above the picking point and activate doSucker  MoveJDO Offs
(pFlexi,0,0,30),vJoint,z30,tool1\WObj:=wobjFlexivision,doSucker,1;

     !Go to picking point linearly and go above again
        MoveL pFlexi,vLinear,fine,tool1\WObj:=wobjFlexivision;
        MoveL Offs (pFlexi,0,0,70),vLinear,z30,tool1\WObj:=wobjFlexivision;

    ENDPROC
```

Script

```
      !First action: go home.
        go_home;

      !Now, at home, let Flexivision start
      SetDO doFlexivision,1;

      !Pick and place continously
        WHILE TRUE DO
            pick_task;
            place_task;
        ENDWHILE

    ENDPROC


    PROC go_home()
        MoveJ pHome,vJoint,fine,tool0;
    ENDPROC

    proc pick_task()
    !Wait for Flexivision to finish the detection of the object. Flexivision=0  means
Flexivision finished.
        WaitDO doFlexivision,0;

     !Go above the picking point and activate doSucker
        MoveJDO Offs
(pFlexi,0,0,30),vJoint,z30,tool1\WObj:=wobjFlexivision,doSucker,1;

     !Go to picking point linearly and go above again
        MoveL pFlexi,vLinear,fine,tool1\WObj:=wobjFlexivision;
        MoveL Offs (pFlexi,0,0,70),vLinear,z30,tool1\WObj:=wobjFlexivision;

    ENDPROC
```

Script

```
    PROC place_task()
                        !Go above the placing point using TriggJ to trigger trigFlexi
                        !In this way, we let Flexivision start again (doFlexivision=1)  as soon
as the robot
                        !is 150mm far from the current point (picking point)
        TriggJ Offs(pPlace,0,0,70), vJoint, trigFlexi, z30, tool1  \WObj:=wobj0;

                        !Go to placing point linearly and go above again  MoveLDO
        pPlace,vLinear,fine,tool1 \WObj:=wobj0,doSucker,0;  MoveL Offs
        (pPlace,0,0,20),vLinear,z30,tool1  \WObj:=wobj0;
    ENDPROC
ENDMODULE
```