

Stäubli Robotics Suite 2022 (SRS)

User's manual

A "readme.pdf" document may be delivered on the robot DVD. It contains the documentation addenda and errata.

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1 - SYSTEM REQUIREMENTS

1.1 - HARDWARE REQUIREMENTS

The minimum required hardware for SRS is:

- 2 Ghz processor or equivalent,
- 2 GB ram,
- 4 GB virtual memory,
- A graphics card with 128 MB of dedicated video ram and support for DirectX 11.

The minimum recommended hardware to use 3D VIEW is:

- 2 Ghz processor or equivalent,
- 12 GB ram,
- 6 GB virtual memory,
- A graphics card with 256 MB of dedicated video ram and support for DirectX 11.



SRS uses a powerful 3D engine. To take full advantage of all the features and specifically while using large CAD models, it is highly recommended to use a PC with enhanced graphic resources (for example, AMD or NVIDIA professional graphic cards).

1.2 - SOFTWARE REQUIREMENTS

SRS operates with:

- WINDOWS 8.1 (64 bits only),
- WINDOWS 10 version 1607+ (64 bits only).

SRS does not support:

- WINDOWS 10 version 1511-:
 - WINDOWS 10 version 1511 support has ended on October 10, 2017.
<https://docs.microsoft.com/fr-fr/lifecycle/products/windows-10-enterprise-and-education>
- WINDOWS 8:
 - WINDOWS 8 support has ended on January 12, 2016.
<https://docs.microsoft.com/fr-fr/lifecycle/products/windows-8>
- WINDOWS 7:
 - WINDOWS 7 support has ended on January 14, 2020:
<https://www.microsoft.com/en-us/windows/windows-7-end-of-life-support-information>
- WINDOWS VISTA:
 - WINDOWS VISTA support has ended on April 11, 2017:
<https://support.microsoft.com/en-gb/help/22882/windows-vista-end-of-support>
- WINDOWS XP:
 - WINDOWS XP support has ended on April 8, 2014:
<https://support.microsoft.com/en-us/help/14223/windows-xp-end-of-support>
- Virtual machines (VmWare, Virtual box...).

SRS has been tested with the following versions:

- WINDOWS 10.

SRS is based on WINDOWS DOT NET FRAMEWORK 4.8.

The correct version of FRAMEWORK is installed with the SRS, if necessary.

1.3 - FIREWALL CONFIGURATION

Many tools of Stäubli Robotics Suite (SRS) open TCP ports in order to exchange data.



If you have a FIREWALL installed on your PC, ensure that the following ports are opened.

Tool	TCP port	Remarks
Transfer manager	21 443 5653 ⁽¹⁾	Used for FTP file transfer Used by SRS to read controller version
Remote maintenance	443 800 ⁽¹⁾ 850 to 853 ⁽¹⁾	Socket connection for remote maintenance
	5900	Port used by VNC
Communication with emulators	443 5653 ⁽¹⁾ 5660 to 5680 ⁽¹⁾	Used to exchange data between SRS and emulators
Online debugger	5653 ⁽¹⁾	Used by the PC to connect on the controller
	5656	 Used by the controller to connect on the PC during a debug session. This port must be opened for outgoing and incoming connections.
HASP network dongle	1947 (TCP + UDP)	Used to access to a remote license located on a network dongle

(1) Ports numbers can be configured in SRS settings.

2 - STARTING SRS

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2.1 - INSTALLING SRS

M0006100.1

2.1.1 - INSTALLATION DETAILS

M0004846.1

User must have administrator rights in order to install Stäubli Robotics Suite (SRS):

- If necessary, the Microsoft Windows Dot Net Framework will be updated by the Stäubli Robotics Suite (SRS) setup. If the update failed, it is possible to find a version on the Microsoft website or with the Windows live update.
- The driver of the dongle may also be installed during setup: it can take a long time depending on your computer. Do not stop the installation.

2.1.2 - STANDARD SETUP

M0004847.1

Navigate to the installation folder or DVD, and execute the setup.exe program using Windows explorer.

Once the setup is running, select the language and follow the installation wizard.

2.1.3 - SILENT MODE

M0004848.1

Run a command line "as Administrator":

- To install SRS, execute: InstallSRS.exe /S.
- To install cad files, execute: setup.exe /S.
- To install the emulator, execute: InstallCs9.exe /S.

Remarks:

- /S must be in uppercase.
- The setup is executed without any message even if there is an error.
- If the setup is copied on a disk, the folder "Tool" must also be copied in the same directory as "InstallSRS.exe".
- If the "dotnetfx" folder is in the same directory as "InstallSRS.exe", the Microsoft Dot Net Framework will be installed if needed (Or execute dotnetfx\ndp48-x86-x64-allos-enu.exe" /q /norestart).
- If the "hasp" folder is in the same directory as "InstallSRS.exe", the Aladdin dongle driver will be installed if needed.

2.1.4 - ONLINE INSTALLER

M0004849.1

Retrieve the online installer executable (contact Stäubli) and run it.

Enter the path where you want the software installer to download into.

Click the DOWNLOAD button to start downloading the software installer. The setup will start automatically right after the download completes, select the language and follow the installation wizard.

2.2 - LAUNCHING THE SOFTWARE

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- SRS is started via the WINDOWS start menu, then Stäubli Robotics Suite XXXX where XXXX represents the SRS version. Depending on the installation, it is also possible to set up a shortcut to the latest SRS version installed, on the desktop and in the quick launch toolbar.
- In WINDOWS explorer, SRS can be opened by double-clicking on a ".CELL" file.

2.3 - FILE MENU (MAIN PAGE)

The first column on the left-hand side of the main page contains:

- The cell management functions (create a new cell, save, open, close, recent cells).
- Link to the HELP features, when selected:
 - The second column contains links to the various help documents.
 - The third column contains information and link to software versions and update, including the SRC emulators download/installation center (SHOW EMULATOR UPDATES), see chapter 11 of this manual for more details.

Note: Make sure that the URL <http://srsupdate.staubli.com> is accessible from your computer.

- Link to SRS SETTINGS:
 - Opens up the SETTINGS window, with detailed explanations of each parameter.
- Link to exit the software.

3 - SETTINGS

To access SRS SETTINGS, click on the FILE tab, and select SETTINGS.

3.1 - SWITCHING FROM ONE LANGUAGE TO ANOTHER

- Click on the FILE tab.
- Select SETTINGS.
- Choose the language in the ENVIRONMENT section.

4 - TOOL WINDOWS

All the SRS tool windows can be used floating or anchored on the edge of the main window.

Available windows are:

CELL EXPLORER (Shortcut CTRL + W, C)

Displays programs, libraries, user types and user pages for each open application.

DATA (Shortcut CTRL + W, D)

Display the global data of each application. Data is grouped by type. Double click on a data to edit values.

GEOMETRY (Shortcut CTRL + W, G)

Display the points, joints, frames and tools in a geometrical view. The points and frames are located under their parent frame and the tools under their parent tool.

Two specific nodes:

- The Orphans Node displays the frames, tools, and points that have no parent frame or an incorrect one,
- The external fathers node displays the tools, frames and points that have a father that is in a library of the VAL 3 application.

PROPERTIES (F4)

This window tool displays the properties of the current selected object.

ERROR LIST (Shortcut CTRL + W, E)

Display the list of the messages, errors and warnings that occur during load, save, check syntax, etc.. Double click on an error line to point out the error in the program or DATA TAB.

It is possible to filter messages by clicking on the category buttons:

OUTPUT (Shortcut CTRL + W, O)

Another view of the error list tab.

Messages are filtered by category that can be selected using the combo-box.

FIND RESULT LIST (Shortcut CTRL + W, F)

Displays the results of the FIND ALL or REPLACE ALL actions. Each line corresponds to a found occurrence. Double click on a line to open the corresponding program or DATA TAB.

CONTROL PAD STATUS

Displays various statuses during simulation to give the user a quick overview of the major elements involved in the robots' cycles, such as robots (arm power, move/hold, monitor speed, etc...), tools (feedback and control IOs, grasp status, etc...), and part consumers (number of consumed components in current session).

CATALOG

Library of 3D components that can be inserted into a 3D scene (robots, controllers 3D models, 3D primitives, etc...). Components in the catalog can be grouped by type, or sources (libraries). It is also possible to add components into the catalog. To insert a component from a catalog into the 3D View, simply drag it from the catalog into the scene.

COLLISION EXCLUSION

Displays a list of all the pairs of 3D objects excluded from the collision detection. It is possible from this window to add new exclusions or remove existing ones.

EMULATOR

Displays a functional virtual teaching pendant for a given robot in the cell.

ONLINE UPDATER

Download and install SRC emulators and Safety versions.

I/O STATES

Visualizes the status and VAL 3 variables links of IOs. IOs can be added or removed from the visualization list.

5 - CELL EDITION

- A cell can contain several controllers.
- A controller can contain:
 - 1 robot,
 - VAL 3 applications,
 - Records.

5.1 - CELL CREATION

M0003933.1

To create a new cell, select the NEW command in the FILE tab and follow instructions in the wizard.

To delete a cell, simply remove it from the disk using WINDOWS explorer.

Once a cell has been removed it will still appear in the recent cell list on the main page. Right click on the entry to remove it from the list.

5.2 - ADD NEW ROBOT

M0003934.1

In the CELL EXPLORER, right click on the CELL and select ADD\NEW ROBOT.

This will add a new local controller with a robot. Corresponding files are stored on the hard drive, as in this case the controller is emulated.

It is also possible to add a new local robot via the CATALOG, by simply dragging a robot from the corresponding section into the 3D VIEW.

5.3 - ADD EXISTING LOCAL ROBOT (IMPORT CONTROLLER)

M0003989.1

In the CELL EXPLORER, right click on the CELL node and select ADD\EXISTING LOCAL ROBOT. This feature allows importing an existing controller (for example, an SRS7 cell) and its robot into the cell.

During the import process, it is possible to convert applications from earlier versions of SRC.

- Applications prior to the s4.0 version of VAL 3 are not compatible with SRS.
 - They must be converted before they can be imported and benefit from the various SRS features.
- Automatic conversion: When an s6.x application is loaded into an emulator or a controller, it is converted automatically without user confirmation.



Only libraries with the AUTO LOAD attribute set to true are converted automatically. The others must be converted manually (by opening them in SRS).

- Applications prior to the s3.0 version must be converted to s3.0 beforehand using the VAL 3UP tool, to enable their use by SRS. This tool is supplied on an SRS CD starting with 3.0 version (MISC\VAL 3 CONVERTER directory). This tool requires an I/O VAL 3 library (in s3.x format, .DAT extension) containing the cell I/Os used by the program to be converted. This library can be created with a 3.x version emulator or by using the example supplied on the SRS CD (MISC\VAL 3 CONVERTER directory).

5.4 - ADD EXISTING REMOTE ROBOT

M0003935.1

In the cell explorer, right click on the CELL node and select ADD\EXISTING REMOTE ROBOT. This command opens up a connection window. Click the button  to (create and) select a host (IP address or hostname, username, password). Specify a name and destination version, and click OK.

A local robot will then be created based on the one for which the connection parameters were previously specified.

5.5 - ADDING AN ADD-ON

The add-on management depends on the SRC version.

5.5.1 - FOR CONTROLLERS WITH SRC VERSION EARLIER THAN S6.2

M0003938.1

- 1) Stop the emulator.
- 2) Close SRS.
- 3) Install the add-on dll in the USR/APP folder of the cell (If this folder doesn't exist, create it).
- 4) Restart SRS and the emulator.
- 5) Open an application or create a new one.
- 6) Go in the command line (menu F2).
- 7) Execute the command: export("").
- 8) A val3.cfx file is created in the USR/APP folder of the cell.
- 9) Overwrite the val3.cfx file that is on the root of cell with this new one.
- 10) Now, add-on keywords are recognized in SRS and VAL 3 checker.

5.5.2 - FOR CONTROLLERS WITH SRC VERSIONS BETWEEN S6.2 AND S6.4

M0003937.1

- 1) Stop the emulator.
- 2) Close SRS.
- 3) Put the add-on files (DLL and CFX) in the USR/APP folder of the install directory of the VAL 3 version (usually program files\staubli\cs8\sx.y).
- 4) Open the cell manager, select the cell in the right VAL 3 version (or create it) and choose the desired add-on in the ADD-ONS section.
- 5) Save the cell.
- 6) Now, add-on keywords are recognized in SRS and VAL 3 checker.

5.5.3 - FOR CONTROLLERS WITH SRC VERSIONS S6.4 AND LATER

M0003939.1

- 1) Stop the emulator.
- 2) Close SRS.
- 3) Run the add-on installation program (If the VAL 3 emulator corresponding to the VAL 3 version of the add-on is not installed on the PC an error message box will appear).
- 4) Restart SRS.
- 5) Open the cell manager, select the cell in the right VAL 3 version (or create it) and choose the desired add-on in the ADD-ONS section.
- 6) Save the cell.
- 7) Now, add-on keywords are recognized in SRS and VAL 3 checker.

6 - LOCAL CONTROLLER EDITION

M0006097.1

6.1 - ROBOT TYPE

M0003940.1

Right click on a controller and select the CONTROLLER CONFIGURATION command. Select the robot model or the ROBOT SKIN and validate your choice with OK.

- For controllers with a version SRC earlier than s7.6, running emulators must be restarted manually to see the new arm type.
- For controllers with a version later than or equal to s7.6, SRS automatically restart the emulators.

6.2 - I/O CONFIGURATION

M0003941.1

Right click on a controller and select the CONTROLLER CONFIGURATION command. Move to the I/O section (Right click then PHYSICAL IOs) and select the cards that you want to use on the controller.

- For controllers with a SRC version earlier than s7.6, running emulators must be restarted manually to see the new selected I/Os.
- For controllers with a version greater than or equal to s7.6, SRS automatically restarts the emulators.

6.3 - I/O EDITION

M0003942.1

It is possible to edit the PHYSICAL IOs descriptions by running the HOME\PHYSICAL I/Os command.

Use the SAVE command to save your modifications.

6.3.1 - IO MAP EDITOR

M0004851.1

The purpose of the IOMAP is to map some of the robot system functionalities (arm power, move/hold, jog keys, etc...) to input and output signals, so that these functionalities can be controlled by an external device (such as a PLC). Note that some of these mapping will only work under certain conditions (teach pendant replaced by the dummy plug), or might require a runtime license to be installed on the robot controller (remoteMCP option).

The first step in editing the IOMAP configuration on an emulated controller is to open the PHYSICAL IOs panel. To do so, right-click on the controller in the CELL EXPLORER, DATA, or GEOMETRY panels, and select PHYSICAL IOs . This option is also available in the HOME tab of the ribbon when the controller is selected.

When the PHYSICAL IOs panel opens up, a contextual tab of the same name also opens up in the

main ribbon. From there, click the SHOW IO MAP EDITOR button .

The IO MAP EDITOR panel opens up. This panel contains a list of functions, with 3 columns.

Starting from the left:

- Column 1 is the name of the function.
- Column 2 contains a description of this function.
- Column 3 is meant to receive the physical address of the input or output signal that will control this function.

To set the physical address in column 3 for a specific function, simply double-click on the corresponding cell. This opens up a selection window that shows all the available IOs of the corresponding controller. Navigate to the signal by unfolding the nodes, and select the one to assign to the function by double-clicking it. The selection window will then close, and the signal's address appears in column 3.

Once the IOMAP configuration is finished, save it by clicking the SAVE or SAVE ALL buttons  at the top of SRS main window.

Your configuration can now be transferred to the real controller (See chapter 10.3 for more details on this topic).

6.3.2 - POWERLINK OR ETHERCAT FIELDBUS CONFIGURATION (ON CS8)

M0003943.1

To create a Powerlink or Ethercat configuration, select ADD I/O BOARD command then select the fieldbus protocol (Powerlink or Ethercat). Validate your choice with OK. Before adding input or output, you need to add a module using the ADD MODULE command.

6.3.3 - MODBUS I/O CONFIGURATION (ON CS8)

M0003944.1

This tool is used to create the modbus.XML file containing the declarations for the modbus server I/Os. To transfer the modbus.XML file to or from a controller, use the TRANSFER MANAGER tool (See: Transfer to or from a controller).

To create or modify the file, execute the tool via the HOME\PHYSICAL I/Os\MODBUS I/O CONFIG command. Click on the NEW button to create a new MODBUS configuration or open an existing one with the OPEN button. If a MODBUS file already exists in the cell it is opened automatically. Click on the SAVE button to save the configuration. Note that the name of the file must be "modbus.XML" to be taken into account by the controller.

To add an item, click on the new button on the item toolbar. Then choose the name, the type, the size and the access. Items can be inserted through the insert button or deleted with the DELETE button. The order of items can be changed by dragging and dropping the entry. It is possible to append an existing MODBUS configuration file with the APPEND FILE button. The corresponding CSV file can be created through the EXPORT TO CSV button. This file is needed to configure the Applicom OPC server (APPLICOM IMPSYMB).

6.3.4 - FIELDBUS I/O CONFIGURATION (ON CS9)

M0004852.1

The first step in creating a fieldbus configuration on an emulated CS9 is to open the PHYSICAL IOs panel. To do so, right-click on the controller in the CELL EXPLORER, DADA, or GEOMETRY panels, and select PHYSICAL IOs . This option is also available in the HOME tab of the ribbon when the controller is selected.

When the PHYSICAL IOs panel opens up, a contextual tab of the same name also opens up in the main ribbon. From there, click the ADD I/O BOARD button .

A window opens up, select the type (protocol, device type, hardware type) and press OK. In some cases, a checkbox to add a safety profile may also appear. Check it if needed.

You may also in some rare cases have to select a configuration software, which by default is Sycon.net.

Sycon.net will then launch and display a login prompt, leave the username and password fields as they are and simply press Ok.

For assistance in using Sycon.net to build the IO configuration, please refer to the embedded manual accessible from the Help menu of the software.

Once the configuration is built, save it in Sycon.net, then close the software.

Return to the PHYSICAL IOs panel of SRS, and if necessary refresh it with the REFRESH button  in the PHYSICAL IOs tab of the main ribbon.

Your configuration should now appear in the PHYSICAL IOs panel. It can now be transferred to the real CS9 (See chapter 10.3 for more details on this topic).

Note: The entire Sycon.net project folder is transferred to the real CS9 along with the configuration files. The purpose of this is to keep a backup of the configuration, that can later be retrieved from the CS9 in case it ever needs to be modified.

6.3.5 - TCP/IP AND UDP SOCKETS CREATION (CS9 ONLY)

M0004853.1

The first step in creating sockets on an emulated CS9 is to open the PHYSICAL IOs panel. To do so, right-click on the controller in the CELL EXPLORER, DADA, or GEOMETRY panels, and select PHYSICAL IOs . This option is also available in the HOME tab of the ribbon when the controller is selected.

When the PHYSICAL IOs panel opens up, right-click on the SOCKETS node, and select EDIT BOARD  from the contextual menu. This opens up the SOCKET EDITION window.

To add a socket, click on the corresponding button  at the bottom left of the SOCKET EDITION window. Select a type of socket from the list, and the socket will be immediately created. Set the socket's parameters in the right half of the SOCKET EDITION window.

To delete a socket, select it from the list, and click the DELETE button  at the bottom left of the SOCKET EDITION window.

You may add as many sockets as necessary, when you are finished, click the OK button. The created sockets will then appear under the SOCKETS node of the PHYSICAL IOs panel. The sockets can now be transferred to the real CS9 (See chapter 10.3 for more details on this topic).

6.4 - OPTIONS MANAGEMENT

M0003945.1

Right click on a controller and select the CONTROLLER CONFIGURATION command. Move to the Option section and select the options that you want to use on the controller.

- For controllers with a SRC version earlier than s7.6, running emulators must be restarted manually to see the new option.
- For controllers with a version later than or equal to s7.6, SRS automatically restart the emulators.

6.5 - PROPERTIES

M0003946.1

Right click on a controller and select the PROPERTIES  command (F4).

6.5.1 - MISC SECTION

M0004854.1

This section contains all the basic parameters of the emulated controller and the SRS cell it belongs to (name, path of the cell, type of robot, and SRC version of emulator, description).

6.5.2 - REMOTE PROPERTIES SECTION

M0004855.1

These properties come from the TARGETS window.

See chapter 10.1 for more details.

7 - WORKING WITH THE 3D

M0006101.1

7.1 - 3D OBJECTS

M0006096.1

7.1.1 - CATALOG AND COMPONENTS

M0006077.1

The CATALOG contains COMPONENT libraries. The COMPONENTS within can be grouped by type, or by source (library). COMPONENTS can be dragged from the CATALOG into the 3D VIEW in order to add the corresponding model to the scene.

COMPONENTS are the most basic type of 3D solid available in SRS. Some components are readily available in the CATALOG, more COMPONENTS can be created by importing CAD models into the 3D VIEW, and exporting them into the catalog (right-click on the model in

the 3D VIEW or in the 3D TREEVIEW, and click the EXPORT COMPONENT command , then fill in the EXPORT COMPONENT form: version of component, specific catalog, etc...).

7.1.1.1 - Importing CAD models

M0006078.1

CAD models of several different formats (XCGM, STEP, IGES, STL, 3DXML, HSF, SAT, CADPART) can be imported into the 3D VIEW. These models can then be edited, to some extent.

Two different CAD formats can be imported:

- Tessellated (stl, hsf, vrml, sat, 3dxml).
- BREPS: Boundary Representation (step, catpart, igs, xcgm).

To take advantage of the power of the new 3D engine (especially snap functionality) use BREPS CAD formats

	Brep	Read	Write	Supported by SRS 2022
STL		X	X	X
HSF		X	X	X
Collada		X		
SAT		X		
3DXML		X	X	
Step	X	X	X	X
Catpart	X	X		X
IGS	X	X		X
XCGM	X	X	X	X

Importing a CAD file is done through the 3D\INSERT CAD command . Browse to and select the file to import and click OPEN.

7.1.1.2 - Editing a COMPONENT

M0006079.1

The edition of a COMPONENT is performed in a separate 3D VIEW. Individual GEOMETRIES of the model can be edited. To do so, right-click on the component in the 3D VIEW or in the 3D TREEVIEW,

and select the EDIT COMPONENT command . It is also possible to set its physical properties by

clicking on the EDIT MASS AND DENSITY command  in the 3D tab of the ribbon.

7.1.1.3 - Editing the reference frame of a COMPONENT

M0003992.1

The reference frame is the point of reference on a geometry that is used to determine the position and orientation of this geometry in the 3D space.

To edit the reference frame of a geometry, select it and use

the MODELING\EDIT REFERENCE FRAME command .

Once in edition mode, the reference frame of the selected component is selected, and a confirmation bar appears at the top of the 3D VIEW. The reference frame can then be repositioned with any OBJECT POSITIONER in the position edition panel (see chapter 7.2.1).

Once finished, exit edit mode by either confirming  or cancelling  from the confirmation bar.

7.1.1.4 - LINKING A GEOMETRY TO A ROBOT JOINT

M0003995.1

To link a geometry to a joint of a robot, proceed as follows:

- Position the geometry where it needs to be in relation to the robot joint it needs to be attached to by using any OBJECT POSITIONER in the edit position panel (see chapter 7.2.1).
- Perform a multiple selection of the robot joint and the geometry (hold down CTRL key while clicking on both).
- Right click and select the GROUP command .

To remove the link, right click on the linked geometry and select the UNGROUP command .

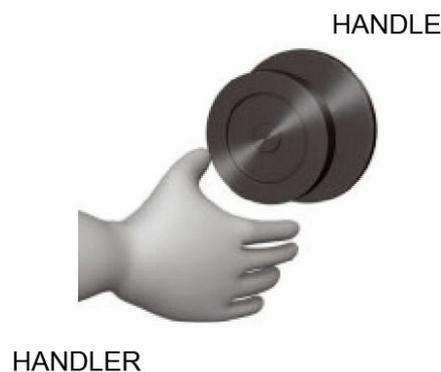
7.1.2 - HANDLES AND HANDLERS: BASIC PRINCIPLES

M0003997.1

HANDLES and HANDLERS are 3D objects used to attach/detach GEOMETRIES to each other.

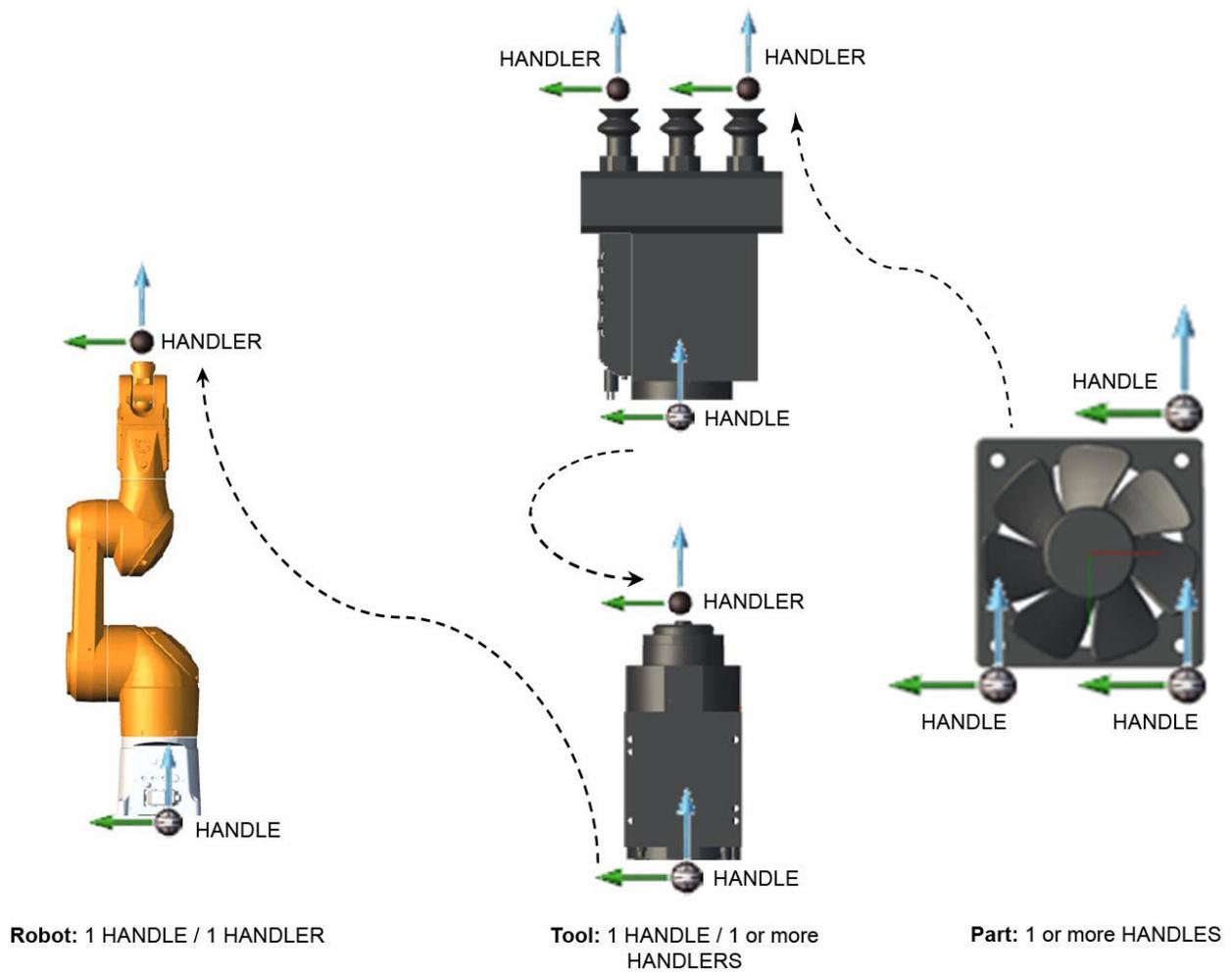
- A HANDLER can be attached to a HANDLE,
- A HANDLER can be attached to only one HANDLE at the same time,
- A HANDLE cannot be attached to 2 HANDLERS.

HANDLES and HANDLERS can be found in:



10001854

Figure 7.1



I0003543

Figure 7.2

7.1.2.1 - Robots

M0003998.1

A robot is considered as a 3D device. Robots have a HANDLE and a HANDLER.

Robot creation

See chapters 5.2, 5.3 and 5.4.

Robot selection

It is possible to select a robot:

- In the 3D tree view in the ROBOTS node,
- In the 3D SCENE by clicking on one of its segments.

Robot edition

To change the 3D ROBOT SKIN:

- Select the robot (see Robot selection above).
 - To edit the colors of the robot's segments, select the EDIT COLORS command .
 - For external elements, go to the PROPERTIES panel (HOME\GENERAL\PROPERTIES ).
- The hard stops, UL lamp, base type, transparency, clearance (for collision detection), and locked attribute can be changed from the corresponding field.
- To display the work envelope of a robot, right-click on it, and select the SHOW WORKSPACE <RIGHTY/LEFTY> command .



For more robot edition options (software options, I/O cards, ...): See chapter 6.

7.1.2.2 - Tools

M0006080.1

A graphic tool contains one HANDLE, one or more HANDLERS, and one or more TCP.

Tool creation

To create a graphic tool, select a COMPONENT in the 3D VIEW and click on the 3D\CREATE\TOOL command .

It is also possible to assign more specific properties to a tool by using the 3D\CREATE\GRIPPER ,

or the 3D\CREATE\SUCTION CUP  command after creating the tool with the first command. All these commands create a tool with properties (joint controller, grasp control and events, etc...).

Once turned into a TOOL, the COMPONENT disappears from the corresponding node, and a new tool with one HANDLE, one HANDLER is added in the TOOLS node. Only GRIPPERS and SUCTION CUPS have grasping capabilities.

It is then possible to rename the tool from the PROPERTIES window (F4).

Tool selection

It is possible to select a tool:

- In the 3D tree view in the TOOLS node.
- In the 3D SCENE by clicking on one of its geometry.

Tool edition

To start a tool edition, right-click on it and select the EDIT COMPONENT command .

A 3D edition window will then open, through which the tool geometries can be edited.

It is also possible to add, remove and edit the positions of the HANDLE, HANDLERS, and TCP.

On SUCTION CUPS and GRIPPERS, a HANDLER or a TCP can be selected in the PROPERTIES as the grasping point of the tool.



HANDLE and HANDLERS can be moved either manually with OBJECT POSITIONERS from the HOME\3D VIEW\EDIT POSITION window.

- To end tool edition, simply save and close the 3D edition window.

Attach/Detach a tool

A tool can be attached to a robot or to another tool by its HANDLE.

- To attach a tool, select it, activate the 3D\MAGNET MODE command , then select the tool in the 3D VIEW, and move it close to the robot flange, or to another TOOL's HANDLER. When the magnet icon appears, release the tool, it will automatically attach to the corresponding HANDLER.
- To detach a tool, right-click on it in the 3D VIEW, then select the command DETACH .
- While the tool is attached, it is possible to test its grasping capabilities by activating the 3D\GRASP MODE command , and jogging the robot to any COMPONENT in the cell. Once a HANDLER is close enough to a COMPONENT (less than the tool's grasp distance), the COMPONENT in question can now be grasped.

Define the current TCP

When a tool is attached to a device, it is possible to change the current TCP. Right-click on a HANDLER or TCP in the 3D VIEW and select the SET AS CURRENT TCP command .

The Cartesian mover is now positioned on this HANDLER or TCP. The transformation value of the handler can also be copied with the COPY TOOL DATA command , so it can be pasted into a VAL 3 tool variable.

7.1.3 - FEEDERS AND CONSUMERS

M0006081.1

COMPONENTS used as parts can be fed into the 3D VIEW by using a FEEDER.

These COMPONENTS can then be consumed by a CONSUMER after being handled by the robot.

These items are available in the MISC section of the CATALOG (when grouped by type).

FEEDERS and CONSUMERS are graphically represented as editable 3D blocks.

To configure the part to feed, right-click onto the FEEDER in the 3D VIEW, then select the SET PART TO GENERATE command, then click on the COMPONENT.

Properties of a FEEDER can then be set in the PROPERTIES window. Among them, an activation signal (controller output), and a feeding interval can be defined.

When the signal is on, the feeder will generate the COMPONENT at its defined location, every time a robot removes it, after expiration of the feeding interval.

A CONSUMER will automatically consume a part that is placed on or inside of it, as long as its enabling signal is on (set in PROPERTIES window).

7.1.4 - GRAPHIC FRAMES

M0006082.1

A GRAPHIC FRAME is a purely graphical object in the 3D environment, that can be used as a positioning reference, or a robot location. Graphic frames are saved in the 3D CELL (Not in a VAL 3 application).

A GRAPHIC FRAME is created by dragging the corresponding object from the CATALOG, BASIC GEOMETRIES section, into the 3D VIEW. It can then be positioned as any other 3D object, by using the tools of the EDIT POSITION window.

To move a robot's current TCP to a GRAPHIC FRAME, right-click on the GRAPHIC FRAME, select the MOVE HERE command , and then select the robot from the list.

7.2 - 3D OPERATIONS

M0006102.1

7.2.1 - MOVING 3D OBJECTS

M0006083.1

Edit absolute and relative position

Open the windows HOME\3D VIEW\EDIT POSITION and select an object in the 3D VIEW. It is possible to edit relative position (relatively to the position of the object at the moment it was selected) or the absolute position (relative to the zero of the cell).

To restore the initial position, press the escape key.

7.2.2 - OBJECT POSITIONERS

M0006115.1

Several object positioning commands are available in the EDIT POSITION window.

These commands apply to the currently selected 3D object (geometry or device), as a consequence it is necessary to select an object in the 3D SCENE before activating a mover.

The reference on the selected object is its reference frame. This reference is the point of the selected object that will move with the move destination defined by the chosen object positioner.

During the positioning procedure, a shadow of the current selection is shown at the position where it will be moved once the positioning is confirmed.

The final positioning of the current selection is confirmed either by clicking the confirmation

mark  in the bar at the top of the 3D VIEW, or by double-clicking the last selected point of the procedure.

During the positioning procedure, the feature snapping can be configured via the panel located at the bottom right of the 3D VIEW:

-  Toggle the direction of the Z-axis of the destination point.
-  Toggle the detection of face-type features.
-  Toggle the detection of edge-type features.
-  Toggle the detection of the center of the feature.
-  Toggle the detection of the centers of the feature's holes.
-  Toggle the detection of the feature's corners.
-  Lock/unlock the position of the current selection (only its orientation will be affected by the positioner).
-  Lock/unlock the orientation of the current selection (only its position will be affected by the positioner).

Available positioning procedures:

- **SNAP**  : Generic, configurable snapping tool: Move the current selection to a feature (face or edge), by snapping it either to the feature's center, one of its corners, or the center of one of its holes.
- **SNAP REPLACE**  : Move the current selection to another object by snapping it to its reference frame.
- **SNAP TWO POINTS**  : Two points are selected based on feature snapping. The first point redefines temporarily the reference frame of the current selection, and the second the destination of the move.
- **MIDDLE OF SEGMENT**: Moves the current selection to the middle of a segment defined by selecting two points based on feature snapping.
- **MOVE FROM VECTOR**: Moves the current selection by a 3D offset defined by two points, each selected based on feature snapping.
- **ORIGIN, X, Y**: Moves the current selection to a destination defined through the position of its origin (first point selected based on feature snapping), the direction of its X axis (second point selected based on feature snapping), and the supporting plane for its Y axis (third point selected based on feature snapping).
- **ARC CENTER**: Moves the current selection to the center of a circle defined by 3 points selected successively, each based on feature snapping.

7.2.3 - GROUP/UNGROUPING GEOMETRIES

M0004012.1

Select several objects (hold down CTRL key on keyboard and successively click on multiple objects in the 3D SCENE or the 3D tree view), right click and select the GROUP command .

7.2.4 - COPY / PASTE / UNDO / REDO

M0004013.1

Select an object in the 3D SCENE or in the 3D tree view, press CTRL+C for copy, and CTRL+V for paste.

It is also possible to undo / redo one or more operations in the 3D SCENE by using the corresponding buttons in the top left corner of the main window  . The traditional keyboard shortcuts CTRL+Z and CTRL+Y are also available.

7.2.5 - EXPORTING

M0006084.1

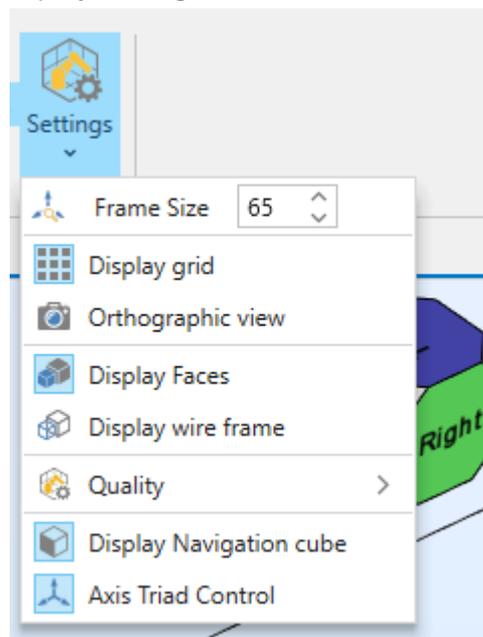
From the 3D tab of the ribbon, the 3D models can be exported , in the following formats: XCGM, STEP, STL, HSF, 3DXML.

It is also possible to export individual components to the catalog .

7.2.6 - DISPLAY SETTINGS

M0006085.1

In the 3D tab of the ribbon, the display settings menu is located at the far right.



I0006352

Figure 7.3

From this menu, several parameters can be set, such as:

- Size of frames: VAL 3 Frames, Graphics frames, Record frames Handlers, Handles, TCPs.
- The display of the ground plane grid.
- The display of Orthographic/Perspective view.
- The display of the faces and wireframe.
- The level of quality.
- The display of the navigation cube, and the axis triad control.

7.3 - 3D TREE VIEW

M0003993.1

The tree view embedded in the 3D VIEW is used to select the 3D objects. By default the treeview is unpinned, meaning that only its root node is displayed at the top left corner of the 3D VIEW. Hovering the mouse over this node will display the full treeview. It can also be pinned to remain visible by right-clicking on the root node, and selecting the PIN TREEVIEW command .

Component node also reflect the state of the component itself such as visible and lock state.

7.3.1 - TREE VIEW NODES CONTENT

M0006086.1

- ROBOTS node : Contains all the robots in the cell, one node per robot, with imbricated subnodes for the joints, flange and connected tools. See chapter 7.1 for more details on ROBOTS.
- TOOLS node : Contains all the tools in the cell, one node per tool with sub-nodes for the various elements (geometry, handle, handler, TCP). See chapter 7.1 for more details on TOOLS.
- COMPONENTS node : Contains all the COMPONENTS in the cell. See chapter 7.1 for more details on COMPONENTS.

- CAMERAS node : Contains the user-defined points of view. To define a CAMERA, right click on the CAMERAS node and select the NEW CAMERA command . The CAMERA can be renamed within the TREEVIEW, updated by right-clicking on it and selecting the USE CAMERA command , or used by double clicking on it or selecting the USE CAMERA command .
- SAFETY node : Contains all the graphically editable SAFETY features (safe zones, control points, etc...) of each robot in the cell. See chapter 9 for more details on SAFETY.

7.4 - 3D NAVIGATION

M0006087.1

- To pan: Middle mouse click and move mouse.
- To rotate: Right mouse click and move mouse.
- To zoom at screen center: Wheel scroll.
- To zoom at mouse position: Alt + wheel scroll.
- To select with area: Shift + left mouse click.
- To resize frames/handles/handlers: Shift + wheel scroll.
- Choose left camera: Press the L key.
- Choose right camera: Press the R key.
- Choose front camera: Press the F key.
- Choose back camera: Press the B key.
- Choose top camera: Press the T key.
- Choose bottom camera: Press the O key.
- Choose perspective camera: Press P or Home key.
- To select a view: Click on a face of a cube.
- To select a view + best fit: Double click on a face of a cube.

7.5 - SIMULATION

M0006103.1

7.5.1 - ROBOT FREE JOG

M0006088.1

- JOINT JOG: Simply click and drag on a robot joint in the 3D VIEW to jog it.
- CARTESIAN JOG: Select the robot by clicking on anyone of its joints to activate the cartesian jogger on its current TCP, then click and drag the axis of the cartesian jogger for cartesian translations, and the arcs for cartesian rotations of the current TCP.
- MOVE HERE : Move the robot to a position (if reachable) using the selected device. Select first a GRAPHIC FRAME or a VAL 3 geometric data in the 3D VIEW and click on the command.

7.5.2 - JOG PANEL

M0004856.1

The multifunction JOG panel can be accessed by right-clicking on a robot and selecting JOG in the contextual menu.

Once opened, this panel presents a combo box of all the robots in the cell.

The selection of the robot to use the JOG panel onto can also be done graphically, by selecting a robot in the 3D VIEW after opening up the JOG panel panel.

The JOG panel is composed of 4 sections:

ARM CONFIGURATION, CARTESIAN POSITION, JOINTS POSITION, and SNAP TOOLS, each described in the following chapters.

Each section can be expanded or collapsed by clicking the section's title line.

7.5.2.1 - First section: ARM CONFIGURATION management

M0004857.1

The configurable arm elements vary based on the type of robot:

- 4- axis SCARA: Shoulder only.
- 6-axis anthropomorphic: Shoulder, elbow, and wrist.

For each element of the arm, up to two possible configuration values can be selected from:

- Shoulder: Lefty or righty.
- Elbow: Negative or positive.
- Wrist: Negative or positive.

Locking the configuration: To lock the configuration of one of those elements, use the corresponding locking button . Locking an element prevents it from changing configuration unexpectedly while jogging the robot graphically with the CARTESIAN MOVER (see chapter 7.5.1).

Toggling the configuration: To toggle the configuration of one of those elements, use the corresponding toggling button . This will toggle the configuration on the selected element, if the current arm position allows it.

The current configuration of each of the arm's element is displayed next to the corresponding lock and toggle buttons.

Selecting a configuration for all arm elements: Pressing the CONFIGURATION DETAILS button  displays a table of all possible combinations for the current arm position (up to 8 for a 6-axis anthropomorphic robot, up to 2 for a 4-axis SCARA). A single click on one of these combinations will apply it to the corresponding robot arm.

7.5.2.2 - Second section: CARTESIAN POSITION of the robot TOOL CENTER POINT

M0004858.1

This section contains 6 editable fields (X, Y, Z in mm, Rx, Ry, Rz in degrees) representing the cartesian position of the current TCP of the robot in respect to the robot WORLD frame or TCP frame. These values are refreshed when the robot is jog graphically with the JOINT MOVER of the CARTESIAN MOVER (see chapter 7.5.1).

It is also possible to enter values in the fields directly, or to use the embedded calculator by clicking on the EXPAND button  attached to each field. The calculated value will be applied to the robot (if applicable) when the calculator is collapsed (new click on the EXPAND button or outside of the calculator in the JOG panel).

To select the current TCP, use the pull down list containing all the available TCPs.

7.5.2.3 - Third section: JOINTS POSITION of the robot

M0004859.1

This section contains up to 6 adjustable range-type inputs, one for each joint of the selected robot. A slider  on each one shows the current position of the corresponding joint. This slider can be moved with the mouse (click and drag) to jog the corresponding robot joint.

The current value of a joint can also be entered manually in the editable field, on the right-hand side of the corresponding range.

Hovering the mouse on a slider or on a field displays a tooltip containing the limits of the corresponding joint, as well as its current position with up to 9 decimal places.

The covered range for each joint can also be displayed by clicking the CYCLE RANGE button  at the top of the JOG panel. The color of the covered range for each joint indicates:

- Red  when joint value has reached one of the limits.
- Orange  when joint value has been close to one of the limits (5%).
- Otherwise, the covered range remains light blue .

7.5.2.4 - Fourth section: SNAP TOOLS

This section contains 4 movers based on feature snapping selection, and similar (but not identical) to the first 4 OBJECT POSITIONERS of the EDIT POSITION window.

These movers will bring the current TCP of the selected robot to a point defined by the corresponding procedure.

The procedures are:

- SNAP
- CENTER ON MIDDLE OF SEGMENT
- ARC CENTER
- CENTER ON ORIGIN, X, Y

To position the robot's TCP with one of these procedures, first click the corresponding button, then execute the procedure by clicking the necessary number of points/features in the 3D VIEW.

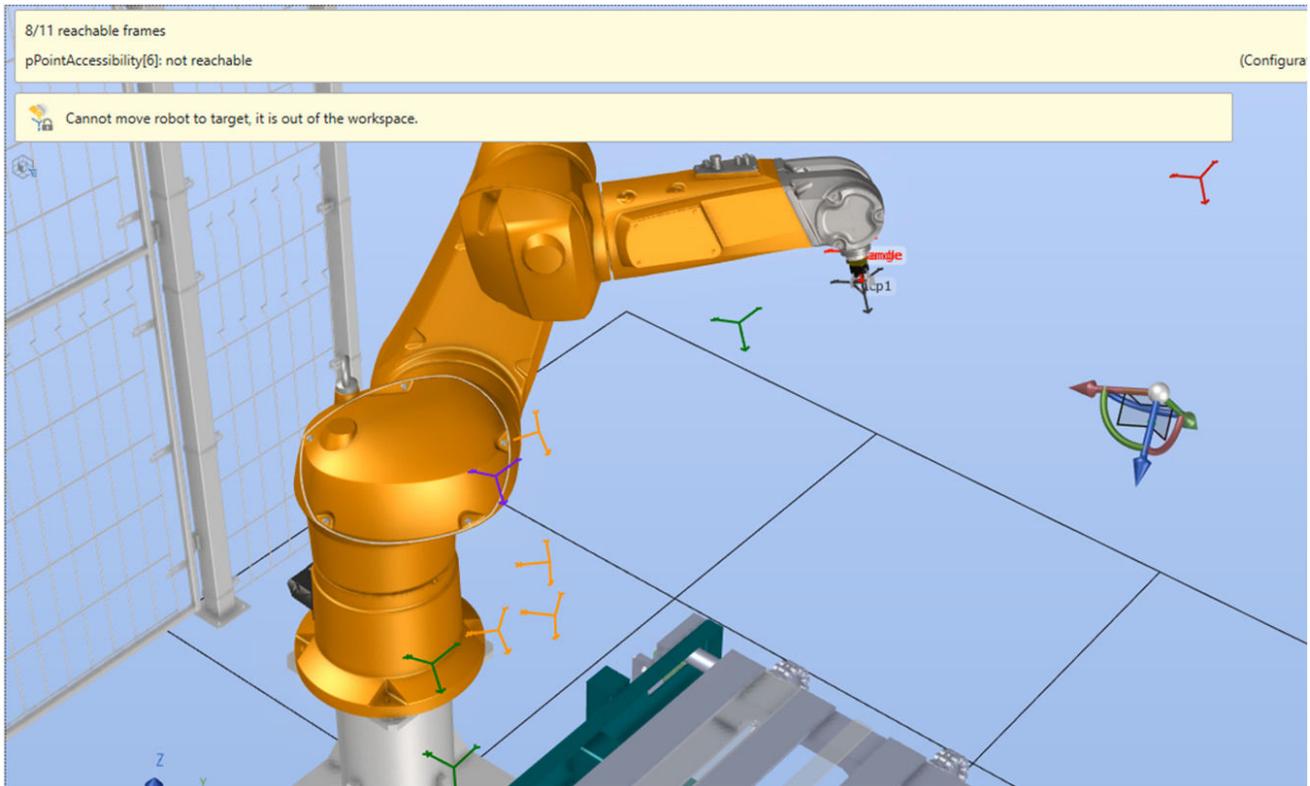
For more details on these procedures, see chapter 7.2.1 of this manual.

7.5.3 - VAL 3 DATA

When a VAL 3 geometric value is selected, it is possible to use the following commands:

- MOVE TO  : Moves the robot to the selected VAL 3 position value (if reachable).
- MOVE TO LOCK  : When activated, brings the current TCP of the robot to which the point or joint belongs directly to it by simply clicking on:
 - The aforementioned VAL3 point or joint, either in the VAL 3 DATA or GEOMETRY tree views.
 - The graphical representation of the aforementioned VAL3 point in the 3D VIEW.
- SET AS CURRENT TCP  : Sets the currently selected value as the current TCP of the robot.
- HERE  : Records the current position of the robot into the selected VAL 3 position value.
- HERE WITH CONFIGURATION: Only applicable on cartesian points. Records the Cartesian position of the current TCP into the TRSF of the selected VAL 3 point, and the current configuration of the robot arm into the CONFIG of the selected VAL 3 point.
- SHOW/HIDE  : Displays the VAL 3 variable in the 3D SCENE.
- SHOW ALL\HIDE ALL  : Displays the VAL 3 variable and its children in the 3D SCENE.
- SELECT IN 3D VIEW: This command does the following:
 - Displays the VAL 3 variable in the 3D VIEW,
 - Makes it the current selection.
- ACCESSIBILITY:
 - Once the function is activated from the SIMULATION ribbon, the color of each VAL 3 point displayed in the 3D VIEW changes based on whether or not the corresponding point or frame is reachable, taking into account the configuration of the arm, and the one of the point itself:
 - Green means the VAL 3 point is reachable with the current arm configuration.
 - Orange means the VAL 3 point is reachable, but its internal configuration settings are not compatible with the arm's current config. The arm configuration needs to be unlocked, and in some cases manually changed via the JOG window, to match the one from the point, before reaching it.
 - Purple means the VAL 3 point coordinates are not compatible with its own, internal configuration settings.
 - Red means the VAL 3 point is not reachable.

- Example in the image below:
 - The purple point has its internal shoulder configuration field set to LEFTY, but its coordinates are only reachable in RIGHTY shoulder configuration.
 - The orange points all have their 3 internal configuration fields set to SAME, but reaching them would require the robot to switch its shoulder and elbow configurations from its current posture, which the point themselves will in this case forbid (because of their configuration fields settings). To reach one of them, the robot configuration must first be unlocked and changed from the JOG panel to one compatible with the point's internal configuration setting.



I0006296

Figure 7.4

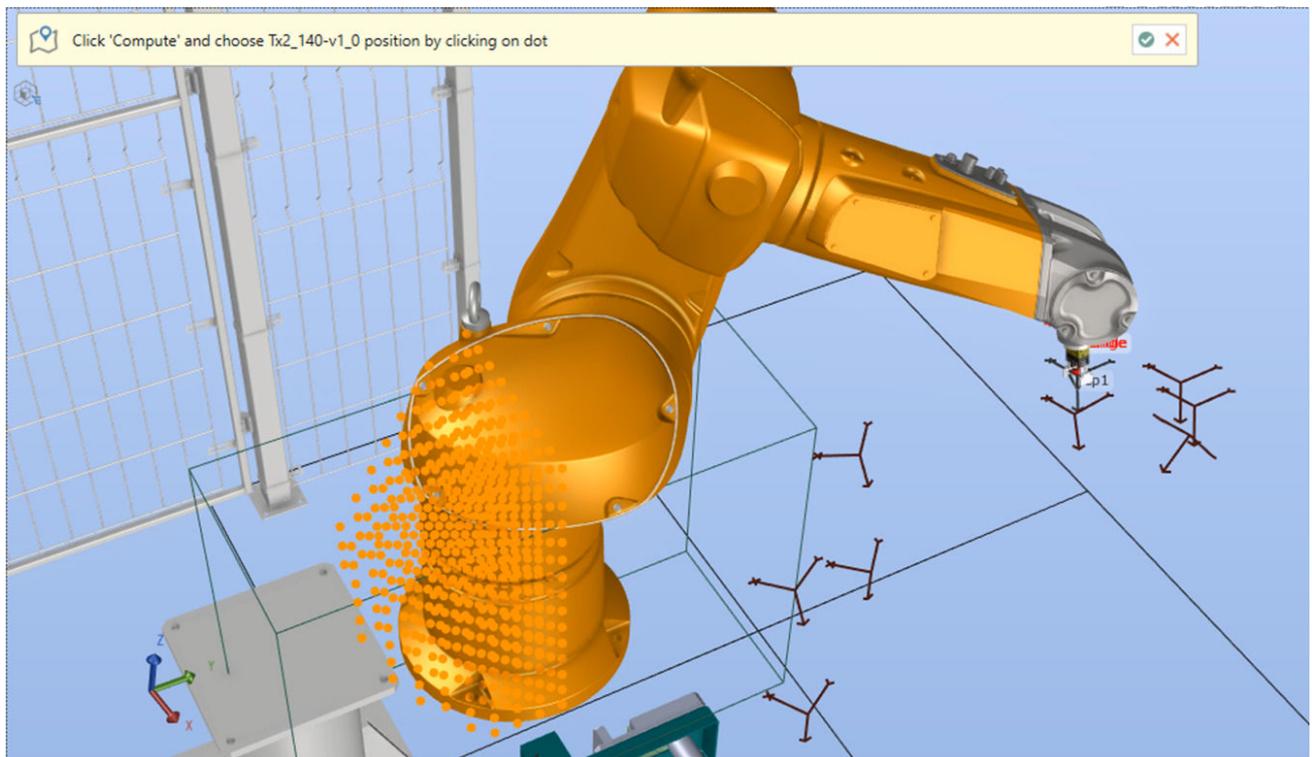
ROBOT POSITION OPTIMIZER

The goal of the ROBOT POSITION OPTIMIZER is to offer alternative robot positions that still allow to reach all the points in a given frame.

To start the function, right-click on a VAL 3 frame in the GEOMETRY or DATA tree views, and select the START ROBOT POSITION OPTIMIZER command .

Specify the size of the search volume with the X Area, Y Area, and Z Area sliders, as well as the search step size.

Click on COMPUTE to start the search. The results are displayed in the 3D VIEW as dots, simply click one to reposition the robot onto it, and confirm by clicking the green confirmation mark, in the bar at the top of the 3D VIEW. The coordinates of the VAL 3 frame onto which the function was executed will be updated by the function, so that the points that are relative to it remain in their positions.



I0006297

Figure 7.5

7.5.4 - TRACES

M0004018.1

SHOW TRACES command displays a frame at the TCP position when the robot moves. To erase TRACES, use the CLEAR TRACES command.

7.5.5 - COLLISION DETECTION

M0004019.1

By default, collisions are detected between:

- Every robot, connected tool, and grasped component and COMPONENTS of the cell.
- Current selection (Example: When moving a cube in the 3D).

If a collision is detected, the colliding parts are colored in red. If geometry is within a part's clearance zone, the objects are colored in yellow.

To Start/Stop the detection of collisions, activate the ENABLE COLLISION DETECTION command in the CONTROL PAD tab of the ribbon.

7.5.5.1 - COLLISIONS SETTINGS

M0006091.1

EXCLUSIONS

All exclusions are listed in the COLLISION EXCLUSION window, that can be opened by clicking the COLLISIONS SETTINGS button from the CONTROL PAD tab of the ribbon.

It is possible to exclude objects from the collision detection.

To do so, select two objects by using the CTRL key. Right click and select the ADD COLLISION EXCLUSION command .

Selecting a rule in the COLLISION EXCLUSION window will highlight the corresponding objects in purple in the 3D VIEW.

To remove a rule, select it in the COLLISION EXCLUSION window and press the REMOVE SELECTED EXCLUSIONS button .

CLEARANCE

The clearance is the warning zone around an object.

This parameter can be edited from the PROPERTIES windows (F4) of an object.

Note that if the shape of the object is complex, a high clearance value might reduce the performance of the 3D SCENE.

DISPLAY

- SHOW COLLISION INTERSECTIONS: Displays intersection lines between colliding objects in yellow.
- SHOW COLLIDING NODES: Highlights in red all colliding objects.
- CLEARANCE VISIBLE: Shows the current selection's warning volume if it has one (set in its PROPERTIES, CLEARANCE parameter).

7.5.6 - CONTROL PAD

M0006092.1

The CONTROL PAD allows the complete setup of all actions that need to happen during the simulation of the cycle on the robots of the cell.

To setup a simulation, click on the edit button  at the left of the CONTROL PAD tab of the ribbon.

The CONTROL PAD configuration window opens up.

To create a new simulation setup, click on the ADD button  in the toolbar at the top of the window, and enter a name for the setup. It is also possible to copy , rename , or delete  an existing setup.

GENERAL PARAMETERS

In the top section of the window, select what needs to be activated at simulation startup. These functions will apply to all the robots in the cell:

- COLLISION CHECK: Visual highlighting of colliding objects.
- STOP ON FIRST COLLISION: Simulation pauses as soon as two objects collide.
- SHOW TRACES: Activate traces of robots' current TCPs.
- OPEN 3D VIEW: Will open up the 3D VIEW window.

ROBOT SPECIFIC PARAMETERS

In the lower section of the window are located the parameters that will apply to each specific robot in the cell:

- **SYNCHRONIZATION ENABLED:** Specifies whether or not the robot must be driven by a controller during the simulation (if not, it will not move).
- **SYNCHRONIZATION MODE:** Specifies whether the robot will be driven by an emulated or a real controller during the simulation.
- **ATTACH DEBUGGER:** Specifies whether or not the application will start in debug mode (can only be done on one robot at any given time).
- **SHOW TRACES:** Specifies whether or not the traces will be turned on on this specific robot, the color of the trace can also be set.
- **STARTUP APPLICATION:** Specifies which application needs to be started on this robot at simulation start (only available if the robot is driven by an emulated controller).
- **WORKING MODE:** Specifies which working mode must be set on the controller at simulation startup (only available if the robot is driven by an emulated controller).
- **SPEED:** Specifies the monitor speed that must be set on the controller at simulation startup (only available if the robot is driven by an emulated controller).

Once all the parameters are set, simply press the run START button  to run the simulation.

During the simulation cycle, it is possible to visualize the status of the tools and consumers in the CONTROL PAD STATUS window , as well as the IOs of the robots in the I/O STATES window  (the signals to monitor need to be added manually into the window via the buttons at the top).

To stop the simulation, press the STOP button . When a simulation is stopped, all the objects that were moved during the simulation cycle will return automatically to their starting positions.

7.5.7 - CONTROL PAD STATUS

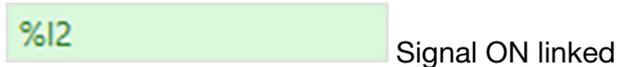
M0006357.1

The CONTROL PAD STATUS is a global visualization of CONTROLLERS and components defined by a state machine. Different properties can be visualized for each kind:

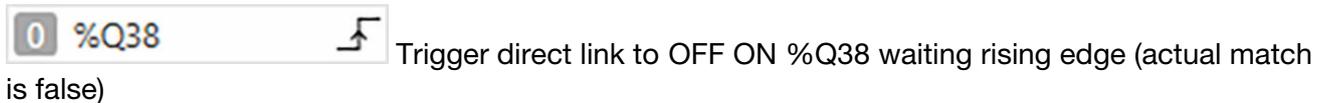
- Events: (Output signals) display their linked IO (if any) and are green when true.

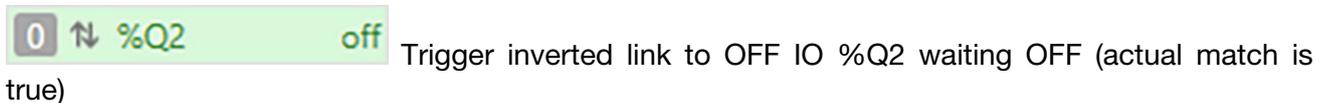
 (no I/O attached) Signal OFF not linked

 %I3 Signal OFF linked

 %I2 Signal ON linked

- Triggers: (Input signals) display in order, the current state of the linked IO, an icon if this link is inverted, the name of the linked IO, the type of trigger (ON, OFF, Rising or Falling Edge).

 0 %Q38 Trigger direct link to OFF ON %Q38 waiting rising edge (actual match is false)

 0 %Q2 off Trigger inverted link to OFF IO %Q2 waiting OFF (actual match is true)

- Component detected (grippers, suction cups and consumers).
- Distance of detection (grippers and suction cups).
- Current State of the state machine.

7.5.8 - RECORD PLAYER

M0004861.1

To play a record with a robot, it must first be loaded. To do so, expand a controller node in the GEOMETRY panel, right-click on the RECORDER node, and select LOAD RECORD from the contextual menu.

Once it is loaded, the record appears under the RECORDER node with one of two icons:

- Correct kinematics (the current 3D arm driven by the selected controller matches the one the record was performed on): 
- Incorrect kinematics (the current 3D arm driven by the selected controller is different from the one the record was performed on): 
 - In this case, the path corresponding to the joint positions of the records the will not be correct in 3D VIEW as it will be calculated with the kinematics of the current 3D arm.

To play a set of positions from this record, expand the record's node, right-click on one of the Joint position data sets  (command or feedback), and select PLAY A RECORD  in the contextual menu. You can also from this same menu display or hide  the record in the 3D VIEW, and COPY  the record (this action sends the recorded samples into the clipboard).

The RECORD PLAYER panel will then open, from which:

- The path can be:
 - Played forward ▶ or backward ◀
 - Paused ||
 - Stepped through forward ► or backward ◄
- The current index can be viewed / set via the corresponding editable field.
- The current time can be viewed / set via the corresponding editable field.
- The speed scale multiplier can be set from the corresponding pulldown list.
- The current index and the current time can be also set together by dragging the corresponding range slider . . .
- A graphical MoveTo on one of the recording points in the 3D VIEW will also cause the slider to be repositioned on the corresponding point.

If the record was exported from the Optimize Lab cycle analyzer, the analysis results can be displayed as a varying coloration of the path points.

This coloration can be controlled from the PROPERTIES panel. First, select a record data set in the GEOMETRY panel and press F4 to open the PROPERTIES panel. Go to the CUSTOM COLOR DISTRIBUTION PROPERTY and select an option from the pulldown list (only the parameters exceeding limits will be available). A detailed explanation of the meaning of the colors opens up when hovering the mouse over the question mark icon ? next to the property name.

Examples:

- Joint velocity variation over the path:

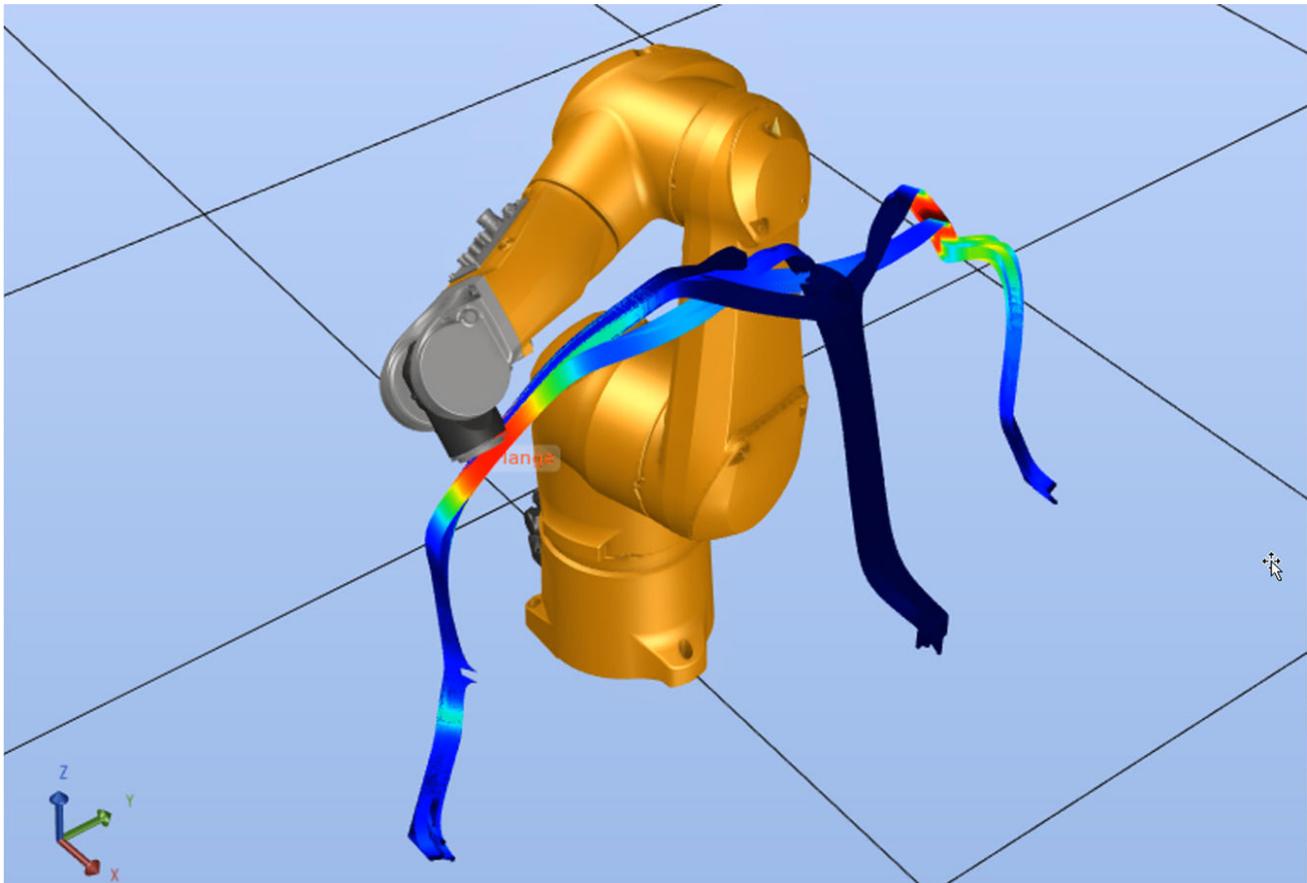
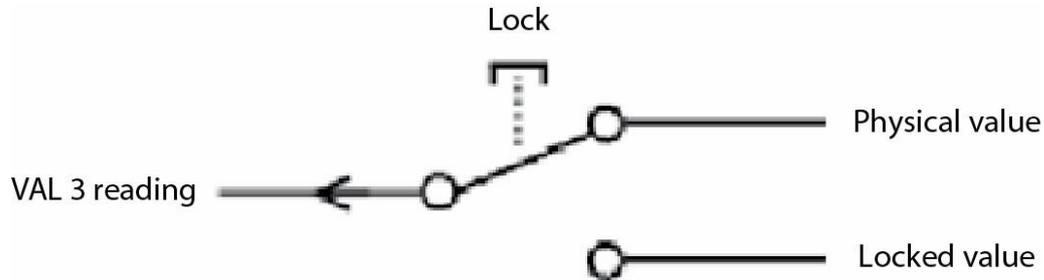


Figure 7.6

7.5.8.1 - I/O STATES

- I/O STATES is refreshed automatically.
- An input/output can only be locked via the control panel.
- Locked I/Os are in bold font with a blue background.

Input

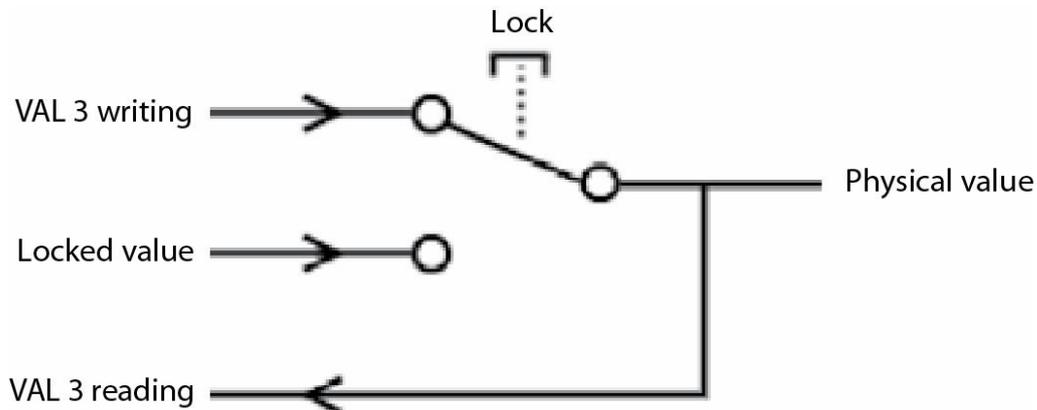


I0004414

Figure 7.7

- VAL 3 can read an input value.
- VAL 3 can write in a simulated input if it is not locked.
- To change the value of a physical input (not simulated) input, it is necessary to lock it beforehand.
- When an input is unlocked, it takes on its current physical value again.

Output



I0004415

Figure 7.8

- VAL 3 can read an output value.
- VAL 3 can write in an output if it is not locked.
- VAL 3 writing sequence in a locked output is ignored.

7.5.9 - GRASPING/RELEASING AN OBJECT WITH A TOOL

To grasp an object, the following conditions need to be met:

- The object's reference frame is within the specified GRASP DISTANCE of a TOOL grasping point (selected HANDLER or TCP in the TOOL edition step).
- The ACTION SIGNAL of the corresponding TOOL HANDLER is set.

If these conditions are met, the part will be grasped accordingly to the type of tool: grippers will grasp the object as is, and suction cups will attract object to themselves.

To release a part, simply trigger a different state on the TOOL HANDLER currently holding it. If no 3D object is present below the part (along the cell Z-axis, in the negative direction), the part will be released and remain in its current position. Otherwise, the part drops until it collides with the 3D object below it (along the cell Z-axis, in the negative direction).

7.5.10 - CHECKING THE PAYLOAD

Once the tools, parts, and additional loads are all in place on the robot arm, SRS can automatically calculate the moments of inertia on joints 5 and 6 (anthropomorphic robots) or joint 4 (SCARA).

The first step is to correctly define the mass or material density for each element attached to the robot (tools, parts, additional loads). This is done by first selecting the object in the 3D VIEW, then clicking

on EDIT MASS AND DENSITY command  in the 3D tab of the ribbon, and then by setting either the density attribute or the mass attribute.

The second step is to attach the tools and parts to the robot, and to link the additional loads to the corresponding robot joints (see chapter 7.1.1.4).

The third step is to perform the actual calculations. To do so, right-click on the robot arm in the 3D VIEW and select the CHECK PAYLOAD command . This opens the PAYLOAD panel, which displays a summary of the inertia.

For anthropomorphic robots, this summary shows the moments of inertia on joints 5 and 6. The value for joint 5 is calculated based on the current position of joint 6. For the worst case joint 5 value, it is given in the lower section of the panel, next to the graph.

For SCARA robots, only the inertia on joint 4 is calculated.

You may also view the detailed calculation for each tool, part, additional load.

The fourth and optional last step is to transfer this PAYLOAD information to the robot to improve its dynamic behavior. This can be done in 2 possible ways:

- Update the PAYLOAD configuration file on the controller. This is usually done for the elements that remain on the robot arm at all times (fixed tools, additional loads). To do so, click on the SEND button  at the top of the PAYLOAD panel, then select the load elements that need to be taken into account. The parameters will be injected into the emulated controller, and sent to the corresponding controller if the IP address is specified in its properties and if the UPDATE TARGET checkbox is activated at the bottom of the panel.
- Generate the VAL 3 code to programmatically apply the PAYLOAD parameters on the fly. This is usually done for the elements that are not always attached to the robot arm (tools with tool changers, parts). To do so, click on the GENERATE VAL3 button  at the top of the PAYLOAD panel, specify from where to where the calculations needs to be done, and select one of two options:
 - CREATE A VAL3 FUNCTION TO SET PAYLOAD: Select in the pulldown list the application into which this function needs to be created, customize the name of the program, and press FINISH,
 - COPY VAL3 CODE INTO AN EXISTING FUNCTION: Opens a viewer that contains the VAL 3 code that you can then copy and paste into a program of your choice.

Note: If the quality of the 3D model is too poor (too many missing or incorrectly oriented surfaces), the payload calculation will not be performed. In this case, an error message is displayed in the PAYLOAD panel.

7.5.11 - CONNECTING I/Os BETWEEN CONTROLLERS

M0004030.1

It is possible to connect output signals of one given controller to input signals of another, and vice versa. The purpose of this mechanism is to reproduce in the virtual world the IO wiring of the real cell as closely as possible.

To do so, right-click on the cell name in the CELL EXPLORER, and select CELL I/O LINKER .

Click on CELL I/O LINKER\ADD LINK  to create a new link. You may also open a PHYSICAL IOs panel for one of the controllers (see chapter 8.8.1) and drag and drop signals from this panel into the top section of the CELL I/O LINKER.

Once a link is created, you can insert I/Os into it by either double-clicking on the corresponding field (input on the right, output on the left) and select the signal, or drag and drop it from a PHYSICAL IOs panel .

It is also possible to remove a link or remove all links by using the corresponding command.

7.5.12 - RECORDING MOVIES

M0006094.1

To record a movie, click on the RECORD button  in the CONTROL PAD tab of the ribbon.

During recording, a Rec icon  appears at the bottom right corner of the 3D VIEW.

To stop recording, click on the same button used to start the recording. At that moment, a file explorer window will open up on the folder where the video is located.

7.6 - COMPONENT EDITOR

M0006305.1

The COMPONENT EDITOR allows to model a COMPONENT, change its features and its properties.

7.6.1 - COMPONENT STRUCTURE

M0006306.1

A COMPONENT is a tree structure of several nodes. The main structure of a component is made of a JOINTs that can contain a hierarchy of JOINTS and GEOMETRIES. Each JOINT (except the root JOINT) has also an axis and TCPS.

A COMPONENT has a REFERENCE FRAME and can be attached to another COMPONENT with a HANDLE. A COMPONENT can have only one HANDLE.

It is then composed of BEHAVIORS and PROPERTIES. All commands to add features to a COMPONENT are in the tab COMPONENT EDITOR.

7.6.2 - REFERENCE FRAME

M0006307.1

The COMPONENT and GEOMETRIES have both a REFERENCE FRAME that can be edited with the

command EDIT REFERENCE FRAME  in the COMPONENT ribbon or in the GEOMETRY context menu.

In the REFERENCE FRAME edition mode, you can use the mover or the edit position tool window with the snap to place your REFERENCE FRAME.

Once the REFERENCE FRAME edition mode validated, the REFERENCE FRAME is reset to the world position.

7.6.3 - GEOMETRIES

A GEOMETRY can be either a SIMPLE GEOMETRY (SPHERE , BOX , CYLINDER ) or a CAD GEOMETRY .

A SIMPLE GEOMETRY can be deleted, moved, and all its properties can be edited.

A CAD GEOMETRY is a file corresponding to a CAD model (XCGM, STEP, IGES, STL, 3DXML, HSF, SAT, CADPART) which is made of a GEOMETRY  (the file) and a hierarchy of other GEOMETRIES  (the content of the file).

The CAD GEOMETRY can also be deleted (with all its hierarchy), moved or edited.

GEOMETRIES included into the CAD GEOMETRY can only be deleted or moved, you cannot change its color for example. To edit its properties, it must be converted into GEOMETRY.

To convert these GEOMETRIES, you can use EXTRACT GEOMETRY  command or EXTRACT AS JOINT  command.

EXTRACT GEOMETRY creates a new GEOMETRY into the same JOINT of the CAD GEOMETRY. All the GEOMETRIES included into the extracted GEOMETRY are also extracted so the hierarchy is preserved.

EXTRACT AS JOINT creates a new GEOMETRY into a new JOINT.

7.6.4 - PROPERTIES

COMPONENT PROPERTIES  are used as parameters accessible from the 3D TREE to configure the COMPONENT. A COMPONENT PROPERTIES can be used by other items inside a COMPONENT such as BEHAVIORS, GEOMETRY, JOINT... to be able to edit the given value outside the COMPONENT EDITOR.

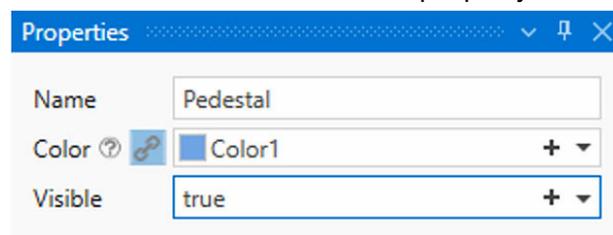
Back in the 3D VIEW, COMPONENT PROPERTIES are visible in the PROPERTIES VIEW once the COMPONENT is selected.

A COMPONENT PROPERTY can be added by clicking on the desired type in the COMPONENT EDITOR ribbon, in the PROPERTIES section, or by right clicking on the PROPERTIES node in the 3D TREE.

COMPONENT PROPERTY types are Length, TimeSpan, Integer, Color, Bool, Aio and Dio.

For each property of each item of the COMPONENT, for example the property "Visible" of a GEOMETRY, you can choose to use a COMPONENT PROPERTY or a constant value.

The following image shows a GEOMETRY with the Visible property set with a constant value (true).

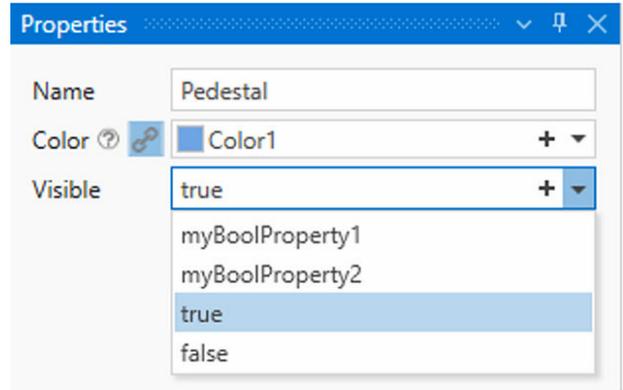


10006639

Figure 7.9

If you want to bind a COMPONENT PROPERTY to this Visible property, you have two choices: Selecting a COMPONENT PROPERTY by expanding the Visible list and choosing it or clicking on the "+". This action automatically adds the COMPONENT PROPERTY to the COMPONENT and sets the Visible property.

The following image shows the Visible property list with constant value (true, false) in COMPONENT PROPERTIES (myBoolProperty1, myBoolProperty2).



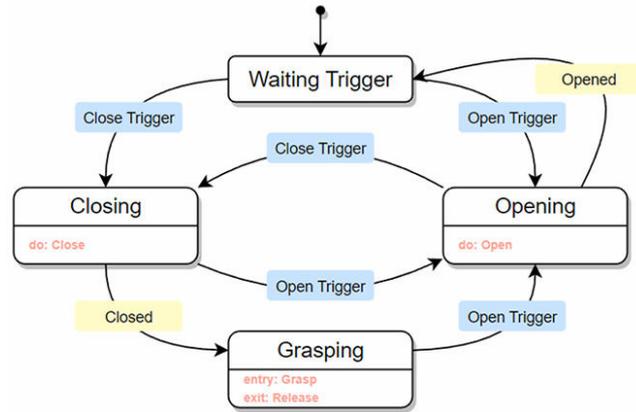
I0006640

Figure 7.10

7.6.5 - BEHAVIOR

A BEHAVIOR is an attribute of a component which gives it a set of functionalities and actions that can be performed into the 3D during simulation. Each BEHAVIOR has a list of properties and can be customized. You can find BEHAVIORS you created into the 3D TREE, under the node BEHAVIORS.

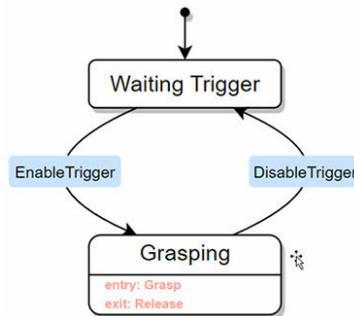
- JOINT CONTROLLER:** Used to animate a set of JOINTS from 3D VIEW. You can see all joints associated to a JOINT CONTROLLER by clicking on it, in the 3D TREE, under the node BEHAVIORS.
- GRIPPER:** Defines a generic grasp behavior on a COMPONENT that allows one of its TCP to grasp another COMPONENT. The grasp mode is AS IS. The GRIPPER can be animated if it is associated with a JOINT CONTROLLER. State machine:



I0006670

Figure 7.11

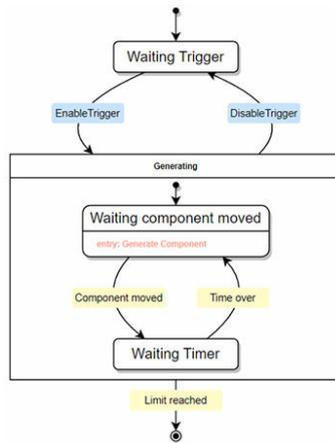
- SUCTION CUP:** Defines a generic SUCTION CUP behavior on a COMPONENT that allows one of its TCP to grasp another COMPONENT. The grasp mode is MAGNETIC. State machine:



I0006671

Figure 7.12

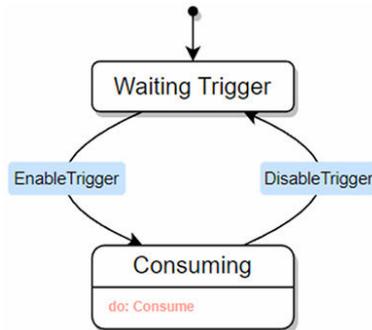
- 🔧 **FEEDER:** Allows the COMPONENT to generate another COMPONENT multiple times while in SIMULATION. State machine:



I0006672

Figure 7.13

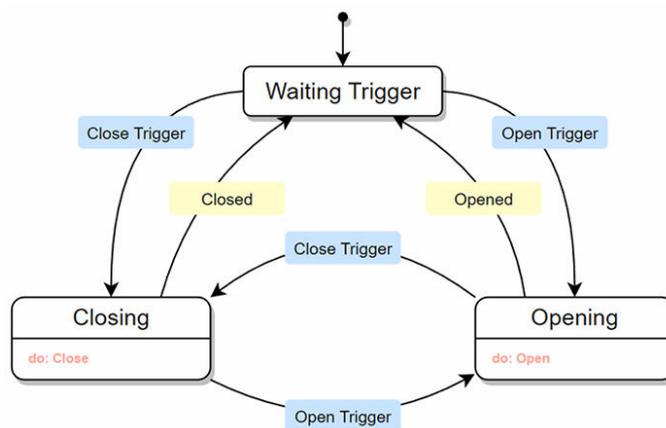
- 🔧 **CONSUMER:** Defines an area that deletes all COMPONENTS that have previously been generated by a FEEDER BEHAVIOR. State machine:



I0006673

Figure 7.14

- 🔧 **SWITCH:** Defines an open/closed behavior on a COMPONENT to simulate a door or a press for example. The SWITCH can be animated with a JOINT CONTROLLER. State machine:



I0006674

Figure 7.15

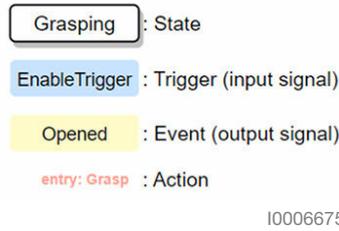


Figure 7.16 : State machine caption

Each behavior has its set of properties that can be configured with constant values or component properties.

Instead of using a behavior to animate your JOINT (such as a GRIPPER or a SWITCH), you can choose to bind its value to an existing AIO from your controller. In the following image, the value property of the JOINT is set on "binding mode" (i.e. the link image) and the COMPONENT PROPERTY "MyAioProperty" is selected.

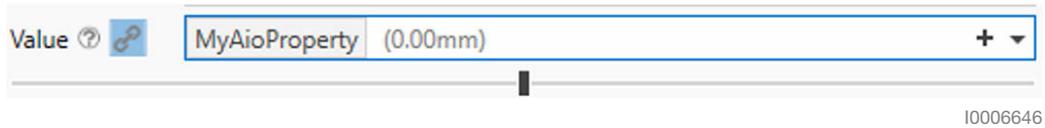


Figure 7.17

Thus, in the 3D VIEW, you can select an Aio of your controller to control "MyAioProperty" which can animate your JOINT.



Figure 7.18

Triggers (input signals) have a mode indicating which state of the linked signal should activate the signal.

Examples:

"Close Trigger" is switching from OFF to ON when the property "ActionSignal" is on a rising edge.

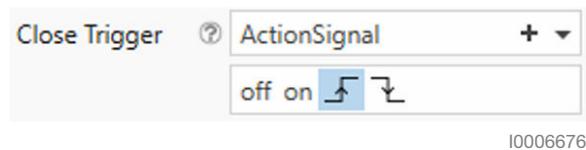


Figure 7.19

"Close Trigger" is OFF when the property ON is "ActionSignal".

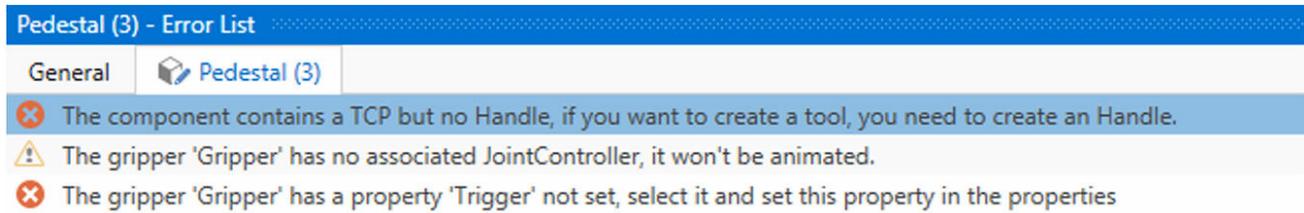


Figure 7.20

7.6.6 - CHECKING COMPONENT

M0006311.1

As a COMPONENT can have a complex architecture and must be valid to be exported in your 3D SCENE, a checking is performed at each time you modify your component. If the COMPONENT is not valid, it can't be exported in the 3D SCENE. You can see all the errors or warnings in the Error List window.



I0006648

Figure 7.21

7.6.7 - SELECTION AND NAVIGATION INTO THE COMPONENT

M0006312.1

A COMPONENT can have a complex hierarchy of nodes, so selecting nodes into the COMPONENT and navigate through it can be performed with the 3D, the component tree, or the breadcrumb.

Only these following nodes have a 3D representation and can be selected into the 3D: JOINT, AXIS, FRAME and GEOMETRY.

7.6.7.1 - SELECTION and NAVIGATION with the 3D

M0006313.1

ASCENDING Selection

To navigate easily through the component in the 3D, the selection works DESCENDING by default and follows the structure of the component. Thus, a first click always leads to a JOINT selection.

Once a JOINT is selected, you can choose to go deeper in the JOINT hierarchy by clicking at the same position and thus select the following node.

You also can switch to another JOINT by clicking to another location which correspond to another JOINT.

DESCENDING Selection

Sometimes, you may also need to get back to a higher node in your structure. By clicking and press ALT key, the selection becomes ASCENDING, and you can get back to all your previous selected nodes.

JOINTS multi selection

You can select several nodes by clicking with CTRL key pressed. You cannot navigate through the component if you choose to perform multi selection, so only JOINTS can be selected.

GEOMETRIES multi selection

You can select several GEOMETRIES by clicking with ALT+CTRL key pressed. Only last level GEOMETRIES can be selected with this selection mode.

AREA Selection

You can quickly select a bunch of nodes by clicking and pressing SHIFT key and while moving the mouse to draw a selection area. Once you release the click, it performs a selection including all the GEOMETRIES and FRAMES contained entirely in the area.

7.6.7.2 - SELECTION and NAVIGATION with the COMPONENT TREE

M0006314.1

The component tree corresponds to the component structure. You can easily navigate by expanding and collapsing a node and clicking on a node to select it.

Selecting a JOINT, an AXIS, a GEOMETRY or a FRAME performs also a selection in the 3D.

You can also select several nodes by clicking on it while CTRL key pressed.

If you mouse over on a node while CTRL key is pressed, the corresponding node into the 3D is highlighted.

7.6.7.3 - SELECTION and NAVIGATION into the BREADCRUMB

M0006315.1

The breadcrumb is helpful to show the current path of the selection, from the ROOT JOINT to the current selected node.

You can navigate through it and for each node, see and select its direct children.

7.6.8 - SAVE AND EXPORT

M0006316.1

Use EXPORT  to export the COMPONENT into a CATALOG.

Saving the COMPONENT replaces the original one in the 3D VIEW.

All errors and warning linked to the new COMPONENT are logged in the Error List .

8 - VAL 3 APPLICATION MANAGEMENT

M0006104.1

8.1 - IMPORTING APPLICATIONS INTO A CONTROLLER

M0004032.1

To import an application, right-click on a local controller and select the IMPORT VAL3 APPLICATIONS command.

It is possible to import application coming:

- From a cell: Select the ".cell" file containing the applications that you want to import and follow the instructions in the wizard.
- From a directory: Select a directory that contains at least one controller.

The import sequence starts. If the applications require a conversion, the import software does it automatically.

The converted applications are placed in the cell directory. If any errors occur, they are displayed at the end of the conversion procedure.

8.2 - CREATING VAL 3 APPLICATIONS

M0003952.1

An application is created on the basis of a template. Templates are applications that are stored in a specific directory (USR\TEMPLATES) in the controller.

To create an application, select a controller and execute the VAL 3\NEW APPLICATION menu.

Select a name for the application, a location, then select a template from the list and validate your choice by clicking on OK.

An application name must start with a letter or an underlined space (a-z, A-Z, _).

The new application is created in the USR\USRAPP directory of the current controller.

8.3 - EDITING DATA

M0003953.1

From the browser tree, select the DATA tab (CTRL+W, D). Then double-click on the desired data.



For the frames, tools and points, the GEOMETRY tab can be used to select the data. The icons in the browser tree are shown with a small padlock if the variable is private.

8.3.1 - CREATING A VARIABLE

M0003954.1

Click on the pop-up menu of the data tree view or press shortcut CTRL+N, D.

Filling the form:

- TYPES:
 - The Stäubli types depend on the controller's SRC version. For example, SCARA types didn't exist before s5.2.
 - The User types are created when adding a type in application (see editing library and type). User types are only available for controllers with SRC s7.0 version or later.
- CONTAINER: Select the way the variable will be stored.
 - ARRAY: Indexed with numbers (3 dimensions max.).
 - COLLECTION: Indexed with a string.
- NAME: The name of the variable must start with a letter or an underscore character (a-z, A-Z, _).
- ACCESS: Check the box to make the variable public.

- **SIZES:** Enter the sizes of each dimension separated with a comma. The maximum number of dimensions is 3. Keep in mind that for cells in versions earlier than s7.0, only one dimension is allowed for arrays.



To change the size of a dimension of an array, use the properties tool window.

See also: VAL 3 documentation for more information on Collections, Multidimensional arrays, and user data types.

To delete a data, select it in the browser tree, right click to display the pop-up menu, and select DELETE or press the del key.



To copy a data item from one project to another, it is necessary to use the clipboard (CTRL+C, CTRL+V) and not the drag-and-drop tool.

The mouse can be used to drag and drop geometrical data of point, frame or tool type in the geometrical tree view and change the father/child relation.

See also: VAL 3 reference manual (VAL 3 language element).

8.3.2 - EDITING VALUES

M0003955.1

A variable can contain one or more values.

It is possible to add and insert values using the commands located in the contextual ribbon.

To select several values, use the mouse click + shift combination.

It's possible to copy/paste values in the datagrid. To do so, select values with the mouse, press CTRL+C, select the destination cell and press CTRL+V.

It is also possible to reset the content of one or more cells by proceeding as follow:

- Select the cell(s).
- Right click on the selection.
- Select DELETE  in the contextual menu.

To change the size of a dimension of an array, use the properties tool window. It is not possible to change the number of dimensions of an array.

8.4 - EDITING PROGRAMS

M0004041.1

To access the list of programs, select the CELL EXPLORER tab and navigate to the tree node corresponding to the program to edit (CELL EXPLORER\CONTROLLER\APPLICATION\PROGRAM).

The code is entered via the central editing area. The main features are syntax highlighting, automatic indentation, auto-completion (via the space shortcut) and online help (space on the keyboard). It is possible to edit several programs at the same time. A tab bar shows all the currently open programs for easier navigation.

To create a new program, execute the NEW PROGRAM pop-up menu (right click) on the program tree view (CTRL+N, P).

Expand the PROGRAM node to see the parameters and local variables of the program. Add a parameter by using the pop-up menu on the PARAMETERS node or (CTRL+N, X) and then fill in the form.

The drag-and-drop tool can be used to change the order of the parameters. Add a local variable by using the pop-up menu on the LOCALS node or (CTRL+N, L) and then fill in the form. See chapters below for more details.

It is possible to zoom in (up to 3x) and out in the body of a program by holding the CTRL key while spinning the mouse wheel.

8.4.1 - CREATE A PARAMETER

Click on the pop-up menu of the PROGRAM node in the program tree view or press short-cut (CTRL+N, X). The following form appears.

Filling the form:

- TYPES:
 - The Stäubli types depend on the controller's SRC version. For example, SCARA types didn't exist before s5.2.
 - The User types are created when adding a type in application (see editing library and type). User types are only available for cells in s7.0 version or later.
- CONTAINER: Select the way the parameter will be passed.
 - ELEMENT: Passing only on element of an array or a collection. Check the box for passing the parameter by reference.
 - ARRAY: Passing the entire array as a parameter. Arrays are always passed by reference. Choose the array numbers of dimensions in list box. Note that for cell version lower than s7.0 the dimensions choice is greyed because only single dimensional arrays existed.
 - COLLECTION: Passing an entire collection as a parameter. Pay attention that collections are not available for version lower than s7.0. Collections are always passed by reference.
- NAME: The name of the data. Maximum 15 characters and must start with a letter or an under-score character (a-z, A-Z, _).

8.4.2 - CREATE A LOCAL VARIABLE

Click on the pop-up menu of the program node in the PROGRAM tab or press short cut (CTRL+N, L).

Filling the form:

- TYPES:
 - The Stäubli types depend on the controller's SRC version. For example, SCARA types didn't exist before s5.2.
 - The User types are created when adding a type in application (see editing library and type). User types are only available for cells in s7.0 version or later.
- CONTAINER: Select the way the variable will be stored.
 - ARRAY: Creates a local array (indexed with numbers). Enter the sizes of each dimension separated with a comma. The maximum number of dimensions is 3. Keep in mind that for cells in versions earlier than s7.0, only one dimension is allowed for arrays.
 - COLLECTION: Creates a local collection (indexed with string). Note that collections are not available for versions earlier than s7.0.
- NAME: The name of the data. Maximum 15 characters and must start with a letter or an under-score character (a-z, A-Z, _).

See also: VAL 3 documentation for more information on Collections, Multidimensional arrays, and user data types.

8.4.3 - DISPLAY CALL TREE

The CALL TREE of a specific program can be displayed by right clicking on it and selecting the SHOW CALL TREE command .

The CALL TREE panel opens up and the selected program appears as the top node of the tree.

Expanding a node shows you the programs called by the parent node, either through a CALL instruction, or a TASKCREATE.

This operation can be repeated to the very bottom of the branch, meaning until you reach a program that calls no other.

8.5 - EDITING LIBRARIES AND USER'S TYPES

M0003958.1

To access the list of libraries and user types used by an application, select the CELL EXPLORER tab (CTRL+W, C) and open the REFERENCES node (CELL EXPLORER\CONTROLLER\APPLICATION\REFERENCES).

Each LIBRARY node shows a list of its public data and programs. The hierarchy, Father/Child of geometrical data (frames, tools, points), is not shown. Data are categorized by type. The tree view contains one node for each user defined type. This node doesn't contain any information but when it is selected the properties windows reflects the application path that defined this user type.

To add a library or a user defined type, use the new command in the corresponding pop-up menu of the libraries tree view or press CTRL+N, R for a library and CTRL+N, T for a type.

To remove a library or a user's type, select it and press del key or use the Del menu from the pop-up menu (right click).

8.6 - USERPAGE DESIGNER (CS9 ONLY)

M0004862.1

The TX2-CS9 range of robots comes with the SP2 teach pendant, which is equipped with graphical touch-screen.

As with the previous TX-CS8C range, users can define their own user interfaces to be displayed on the screen of the pendant.

In addition, some (or all) of the user interface pages of an application can be defined in different formats, in order to be used on other types of displays (such as, but not limited to tablets, smartphones, PC, etc...).

SRS integrates a new ergonomic and intuitive graphical designer aimed at easily creating HMI pages within the user's VAL 3 application.

Creating an HMI for a VAL 3 application consists of five major steps:

- 1) Creating the page with the desired format.
- 2) Creating, positioning, and dimensioning the interface elements (widgets), such as pulldown lists, editable fields, labels, etc....
- 3) Binding some of the properties of these widgets to global variables of the VAL 3 application to create an intrinsic link between the HMI and the current detailed status of the robot operations, represented by these global variables.
- 4) Defining callback VAL 3 programs on widget-related events.
- 5) Managing the HMI at runtime: displaying specific pages or controlling/changing bindings from the VAL 3 application can be done via dedicated language instructions.

8.6.1 - CREATING A NEW PAGE

M0004863.1

From the CELL EXPLORER panel , expand the node corresponding to the application you want to add an HMI into, and right-click on the INTERFACE section. Then select ADD  and NEW USER PAGE  from the contextual menu. This will open a page creation window.

Note: From the ADD submenu, it is also possible to create a NEW FOLDER  to better organize the HMI pages within the VAL 3 application's structure, or to import an EXISTING IMAGE  into the VAL 3 application's HMI, meant to be displayed on one of the HMI pages.

The second step is to choose for two different format options in the page creation window:

- SP2 display in portrait orientation.
- Custom format for other display:
 - In this case, the width and height of the page to create need to be specified in pixels, in the corresponding editable fields.

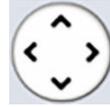
Once the format is specified, click on OK. Two panels open up:

- The first one contains the newly created blank page.
- The second one, named TOOLBOX , contains all the supported widgets.

A specific, contextual USERPAGE tab containing page edition tools also opens up at the top of the window, in the ribbon.

The page edition panel includes controls on the left-hand side to:

- Move around the page (the scrollbars can also be used to fulfill this purpose):



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- Zoom in and out within the page:



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This panel also includes tabs (bottom left) offering different views of the page:

- DESIGNER: Graphical placement and dimensioning of the interface elements.
- PREVIEW: Display of what the page will look like on the real display.
- HTML: Source code of the page.

8.6.2 - CREATING WIDGETS

M0004864.1

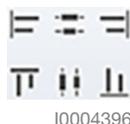
To create a new widget, simply select it from the TOOLBOX panel , and either drag it into the page edition panel, or simply click into it to make it appear.

After appearing into the page, the widget can be:

- Repositioned: simple click and drag.
- Resized: drag a corner or a side to adjust the corresponding dimensions; alternatively enter the dimensions in the LAYOUT section of the PROPERTIES panel .
- Edited for contents: double-click the widget:
 - In the case of a simple widget, the edition is done directly within the widget (example: changing the text of a button).
 - In the case of a more complex widget, a setting window specific to the widget opens up (example: double-clicking an image widget will open up an image selection window).

For easier organization of the widgets on the page, the contextual USERPAGE tab in the ribbon provides several sets of tools:

- Alignment: can be used to align the widgets with one another:



- Arrange: can be used to distribute widgets evenly in a specific direction, and to control the relative depth of the widgets:



- Settings: can be used to toggle and set the snaplines (auto-snap between widgets) and snapgrid (auto-snap widgets to a grid):



- Views: can be used to open up:

- The TOOLBOX panel  : see details above.
- The DOCUMENT OUTLINE panel  : shows an organizational tree view of the widgets, as well as a full list of bindings. The incorrect bindings (VAL 3 variable deleted or renamed, widget ID changed,...) are highlighted in red.

8.6.3 - BINDING WIDGET PARAMETERS TO VAL 3 GLOBAL VARIABLES

M0004865.1

Some properties of the interface widgets can be bound to global variables of the VAL 3 application.

This binding will be unidirectional (from the VAL 3 application variable to the HMI) for widget properties that cannot be edited from within the HMI page, such as the color of a button or text.

The binding can also be bidirectional (from the VAL 3 application variable to the HMI, and vice-versa) for widget properties that can be changed from within the HMI page, such as a text input, or a pulldown list.

To bind a widget property, select it and open the PROPERTIES panel (F4). This panel presents all the editable properties of the selected widget, among which the ones that can be bound to a VAL 3 global variable are accompanied by a link icon . Click this icon to open up the BINDING EDITOR window.

At the bottom of this window, a text in a red frame indicates which type(s) of VAL 3 global variable can be bound to the previously selected widget property. A variable element of one of the listed types must be selected via double-click in the tree view at the left of the BINDING EDITOR.

Once the variable is selected, the binding mode must be set via the pulldown list located at the bottom of the right section of the BINDING EDITOR. There are up to five binding modes:

- Read: the widget property is updated constantly based on the value of the VAL 3 variable.
- Write: the VAL 3 variable is updated constantly based on the value of the widget property.
- Read Once: the widget property is updated once at every page load based on the value of the VAL 3 variable.
- Read Once then Write:
 - The widget property is updated once at every page load based on the value of the VAL 3 variable.
 - The VAL 3 variable is then updated constantly based on the value of the widget property.
- Read or Write:
 - The widget property is updated constantly based on the value of the VAL 3 variable.
 - The VAL 3 variable is updated constantly based on the value of the widget property.

At the top of the right section of the BINDING EDITOR, two more pieces of information are also displayed:

- CONTROL ID: Unique identifier of the widget.
- CONTROL PROPERTY: HTML name of the property being bound.

8.6.4 - DEFINING EVENT-BASED CALLBACKS

M0004866.1

To setup an event-based callback on a widget, first select the widget in the page edition panel, and open the PROPERTIES panel (F4).

Scroll the PROPERTIES panel to the EVENTS section, three types of events are available:

- MouseDown: this event is fired when the mouse button or a finger is pressed down onto the widget.
- MouseUp: this event is fired when the mouse button or a finger is released onto the widget.
- Click: this event is fired when the corresponding widget is clicked or tapped on (MouseDown followed by MouseUp).

For each event, a callback program can be selected from the pulldown list by clicking the corresponding expand button : Note that:

- The programs in the list all belong to the same VAL 3 application as the HMI itself.
- The programs in the list are only the ones from this VAL 3 application that have no parameters.

8.6.5 - MANAGING THE HMI AT RUNTIME

M0004867.1

First, the PREVIEW tab in the interface panel displays a preview of the end result, without having to run the application. This allows, for example, verifying that the contents of a CONTAINER widget function and display properly.

On a real or emulated SP2 display, to bring up a specific page at runtime, the following VAL 3 language instruction must be called from within a program of the running VAL 3 application:

- num userPage(string sPageName).

To bind a VAL 3 variable to a property of a graphical widget programmatically, the following VAL 3 language instruction must be called from within a program of the running VAL 3 application:

- void userPageBind (string sPageName, string sGraphicalObjectId, string sGraphicalObjectProperty, varType& varToBind, num nSize, string sBindingDirection, num nRefresh).

varType can be any of the following (depending on the widget property to bind the variable to):

- num
- string
- bool
- dio
- aio

To unbind a VAL 3 variable from a property of a graphical widget programmatically, the following VAL 3 language instruction must be called from within a program of the running VAL 3 application:

```
bool userPageUnbind(string sPage, string sGraphicalObjectId, string sGraphicalObjectAttrib).
```

Finally, anytime a mouse or tap event is fired on a widget, the corresponding VAL 3 program will be spawned in a system-created parallel task.

For more details on HMI-related VAL 3 instructions, please refer to the VAL 3 Reference Manual.

8.7 - ZIP LIBRARIES AND RUNTIME LICENSES

M0004039.1

To generate a password for a zipped library, use the Tool "EncryptTools.exe" located in the SRS directory. Enter the password that has been used to zip the library, press the Generate button and use the given password to be able to load zipped library.

To generate a runtime license for a controller, select the TOOL\GENERATE RUNTIME LICENSE tab. Enter the license name, the mac-address of the controller (can be found in the CONTROL PANEL\NETWORK PROPERTIES), press generate and use the given license to install it on the controller (can be done through the CONTROLLER\OPTION MANAGER OF SRS).

The DEVELOPPER PACK license must be present on the USB dongle to enable these two features.

See also: VAL 3 reference manual (Libraries and User's type).

8.8 - I/O MANAGEMENT IN VAL 3 APPLICATION

M0006105.1

8.8.1 - IMPORTING PHYSICAL IOS

M0003960.1

To see the PHYSICAL IOs available on a controller, select a controller in the cell tree view and click on HOME\PHYSICAL I/Os command (SRS uses the parameters of the current controller to display the list of the available I/Os. To add or remove boards, right click on a controller and select the PROPERTIES menu).

It is possible to import physical I/Os into an application by using the I/Os menu in the IMPORT contextual ribbon. This is used to automatically declare VAL 3 variables linked to the PHYSICAL IOs selected.

To do so:

- Select all the I/Os that you want to import.
- Click on the IMPORT button.
- Select an option for the name of the VAL 3 variables.
 - Automatic generation with the VAL 3 naming rules (Default option).
 - Using the previous library format (compatibility with 6.x versions). Generates the same VAL variable name as those used in 6.x versions and earlier (In the I/O library). This option can be used to re-generate an I/O library under the previous format and it can be used to upgrade an application more easily.

8.9 - CHECKING SYNTAX

This tool checks the syntax for each application and displays errors in the message window. During the checking sequence, the libraries are also checked, even if they have not been loaded in SRS.

To check the syntax for an application, select the CHECK SYNTAX option in the pop-up menu for the application node in the browser tree or press SHIFT+F6. To check all the applications loaded in SRS, press the F6 key.

If errors are displayed, you can go to the program by double-clicking on it. To move from one error to another, press the CTRL+F8 or SHIFT+CTRL+F8 keys.

If an error is found in a data item, SRS moves to the data item, but not to the data value that has generated the error.

The VAL 3 version used to check the syntax is the one that corresponds to the current controller (See the chapter on: VAL 3 language).

Even though it is integrated in the SRS environment the syntax checking tool is standalone. Seeing that it works on the application files, for safety reasons (to avoid file corruption) SRS saves the application before checking it.

See also: VAL 3 language.

8.10 - DEBUGGING A VAL 3 APPLICATION

Only one debugging session can be carried out at a time.

When a debugger is connected to a controller, a message is displayed on the teach pendant.

The controller debugger takes priority:

- If a debugging session is active on the teach pendant, SRS cannot log on.
- If a debugging session is active in SRS, and if a user goes to the debugging page of the teach pendant, SRS is disconnected automatically.

8.10.1 - DEBUG ON COMMAND

This command allows debugging an application on a controller. A controller is either a real controller or an emulator.

Before attaching to a real controller, it is necessary to synchronize the code between the current cell and the controller.

- Save the application on the controller.
- Upload the application to the controller using TRANSFER MANAGER.

8.10.2 - RUN AND DEBUG APPLICATION COMMAND

This command allows to run and debug an application locally.

This command only works on controllers with a version greater than or equal to SRC s7.6.

SRS automatically saves the application, loads it in an emulator, runs the application and attaches the debugger to the emulator.

8.10.3 - DEBUGGER BEHAVIOUR

M0003965.1

On connection to a controller:

- SRS switches to debugger mode: The edition menus are greyed out and the window positions are updated.
- The debugger automatically displays the task list. If no applications are running, the task list is empty and a 'No application started' message is displayed for the user.
- If a task is in pause status, the debugger displays its execution context and updates the call stack, the list of local variables, the list of parameters and the execution pointer.



If several tasks are in pause status at the time of connection, the context of the first task is displayed.

STOP:

- Cuts off the debugging session. SRS switches to editing mode and restores the window positions.

All the panels described in the following chapters can be opened from the DEBUG tab in the main ribbon.

8.10.3.1 - TASKS panel

M0003966.1

Display the list of the currently running tasks. Double-click on a task in pause status or press the 'Enter' key to update the call stack, the list of local variables, the list of parameters and the execution pointer for the selected task.

8.10.3.2 - Control of execution

M0003967.1

The execution control commands apply to the task selected in the task list.

- SUSPEND TASK : Suspends the selected task. The call stack, the list of local variables, the list of parameters and the execution pointer are updated.
- RESUME TASK : Resumes execution as from the current pointer.
- KILL TASK : Deletes the selected task after confirmation by the user.

Step by step code execution commands:

- STEP OVER : Executes the instruction without exiting the current program. It is used to execute a call without entering the called program (which is then executed in continuous mode).
- STEP INTO : On a call, enters the called program execute its code in step-by-step mode.
- STEP OUT OF : Resumes execution of the current program in continuous mode. When returning to the calling program, execution mode goes back to step by step.

Before executing a step, the debugger compares the current local line with the current line on the controller. If the two lines are not identical, the debugging sequence stops and cell synchronization is necessary.

Defining the next instruction:

It is possible to move the execution pointer in the current program.

To do so:

- Click on the execution pointer and move it to the next instruction.
- Right-click on a line of code and select the DEFINE THE NEXT INSTRUCTION pop-up menu.

8.10.3.3 - CALL STACK panel

The CALL STACK window displays the program call order.

- For each program call, a new context is created and added to the stack.
- Each context memorizes the values at the time of the call (application, program name, line number, local variables, parameters...).
- The current execution pointer ( symbolized by a yellow arrow in the code) is in the latest context (top of the stack).
- It is possible to go through the call stack and view the corresponding context by double-clicking on an element in the stack or pressing the enter key. The execution pointer at the time of the call is symbolized by a green arrow .

8.10.3.4 - LOCALS AND PARAMETERS / WATCH panels

LOCALS AND PARAMETERS panel: Automatically displays the values (parameters + local variables) linked to the current execution context. It is not possible to add variables to the window or remove variables from it.

WATCH panel: This is used to view the values of the global variables for an application.

To add a watch item:

- In the DATA tree view, right-click on a VAL 3 data and then select the ADD WATCH menu.
- In a VAL 3 program, right-click on the name of a global data and select the ADD WATCH menu.

Online variable WATCH: hovering the mouse over a variable during a step by step execution session displays its value in a tooltip.

Online expression WATCH: selecting an expression and hovering the mouse over it displays its calculated value in a tooltip.

An expression can also be added in the WATCH panel by selecting it, right-clicking it, and selecting the ADD EXPRESSION WATCH command in the contextual menu. Note: In the WATCH panel, expressions are not refreshed automatically.

To manually refresh an expression, click the REFRESH WATCHES  button next to its value, or the one at the top of the WATCH panel.

Note: Expression watches do not work on some expressions, such as:

- VAL 3 instructions that involve the robots (such as moves, enable power, etc...).
- VAL 3 instructions that involve file access (such as loading or saving libraries).
- Expression returning an obvious result (such as simple variable assignments).

The value of the watches is refreshed each time a task switches to pause status (at a breakpoint, in step by step mode, etc.) or at the user's initiative by clicking on the REFRESH WATCHES command .

It is possible to refresh the watch items automatically (except expressions, once per second) by clicking on the AUTO REFRESH WATCHES command .

The contents of the WATCH panel are saved at the end of each debug session.

Modifying a variable:

It is possible to change the value of a local variable or a watch item by clicking in the 'value' column.

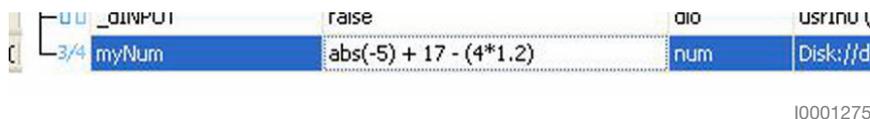


Figure 8.1



- The new value is evaluated by the VAL 3 interpreter before being assigned, to prevent use of any invalid content and authorize entry of complex VAL 3 instructions directly in the 'value' column.
- During modification of an Input/Output, a truncated view of the 'CONTROL PANEL' is displayed (For more detailed information, see the 'Input/Output control panel' paragraph).

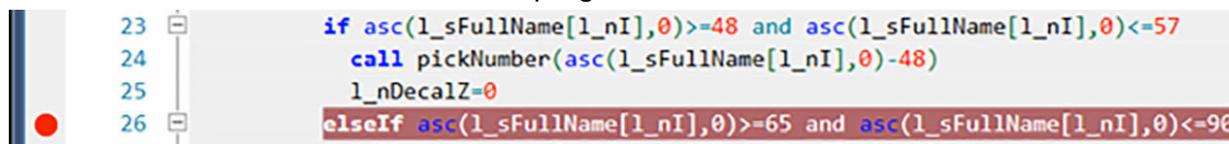
8.10.3.5 - BREAKPOINTS panel

M0003970.1

Adding / Deleting:

To add or delete a breakpoint, either:

- Click in the left-hand column in a VAL 3 program.



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Figure 8.2

- Right click on a code line and click on the TOGGLE BREAKPOINT contextual menu.



It is possible to add and delete breakpoints without being connected to a controller.

Each time the VAL 3 debugger connects up to a controller it automatically synchronizes the breakpoints (in both directions).

Each time the VAL 3 debugger disconnects from a controller it automatically deletes all the controller breakpoints.

A breakpoint is not linked to a particular task (i.e. a breakpoint suspends all the tasks that execute the instruction on which it is placed).

Go to source code:

It is possible to return to the code line on which the breakpoint has been placed, using the command

**8.10.3.6 - Modifying a line while debugging**

M0003971.1

Starting edition:

Select a code line and then use the EDIT LINE  command (or press the enter key).

An icon shows that you are in editing mode .

It is then possible to make modifications, copy and paste text, use completion, etc.



I0004412

Validating a modification:

Press the enter key to validate a modification. The VAL 3 interpreter then validates the entered text.

- If the text is correct: It is taken into account.
- If the text is invalid: An error message is displayed to the user and the original code line is restored.

Cancelling a modification:

It is possible to cancel the current modification and restore the original line by pressing the escape key.

A line can only be modified in the context of the execution pointer .

Only one line can be edited at a time.

No new lines can be added.

8.10.3.7 - COMMAND LINE panel

M0003972.1

To display the window, click on the DEBUG\COMMAND LINE command . If a debug session is active, it is possible to send VAL 3 commands.

The command history is stored and the commands can be recalled using the up/down keys on the keyboard.

8.11 - APPLICATION PROPERTIES

M0003988.1

To display or modify the properties of a VAL 3 application, select it and display the tool HOME\GENERAL\PROPERTIES or press F4.

For further information on the properties of an application, see the VAL 3 help section.

8.12 - PRINTING A VAL 3 APPLICATION

M0003986.1

To print an application, select it in the browser tree, and then select the print command (CTRL+P) from the VAL 3 ribbon.

For printing only a single program, put the mouse cursor in the code and then select the print command (CTRL+P) from the VAL 3 ribbon.

8.13 - FIND AND REPLACE

FIND IN FILES / REPLACE IN FILES (SHIFT+CTRL+F), (SHIFT+CTRL+H):

Search a text in the context of the cell. In a VAL 3 application the text is searched in:

- Global data name.
- Global data string value.
- Program name.
- Program description.
- Program source code.
- Program parameters name.
- Program local data name.
- Libraries alias.

The search engine can look in:

- Current program: The current program is the program tab page that is selected. In this case the engine searches in the program name, the description, the source code, the parameters name and the local variables name.
- All opened programs: Search in all opened program tab pages.
- Current application: Current application is the application that is in bold in the tree view (Data, program or library tree view).
- Current application and libraries: Search in the current application and all the libraries recursively.
- All opened applications: Search in all applications that have been loaded in the VAL 3 Studio.
- All opened applications and libraries: Search in all applications that have been loaded in the VAL 3 Studio and their libraries recursively.
- All applications of the controller: Search in all the applications that are located in the 'USR\USRAPP' folder of the cell folder.

The engine works in same way for the REPLACES IN FILES (SHIFT+CTRL+H).

QUICK FIND / REPLACE (CTRL+F), (CTRL+H):

The quick search engine searches text only in the source code of the current program.

9 - SAFETY CONFIGURATION (CS9 ONLY)

To open the SAFETY CONFIGURATION panel, two possibilities:

- First possibility:
 - Expand the controller  and robot  nodes in the GEOMETRY Tree view .
 - Right-click on the SAFETY node  and select CONFIG .
- Second possibility:
 - Click the SAFETY tab in the main ribbon.
 - Click the CONFIG pulldown button  (far left).
 - Select the controller in the pulldown list.

In both cases, the dockable SAFETY configuration panel opens up. This panel contains three main sections:

- The CONFIGURATION WIZARD.
- The ERRORS/WARNINGS messages.
- The SAFETY RESOURCES summary.

Note: This document will not provide detailed information about all of the SAFETY-related parameters and functionalities. Please refer to the safety manual for more details on these features.

9.1 - CONFIGURATION WIZARD

M0006095.1

The CONFIGURATION WIZARD panel opens up on the SAFETY versions tab and displays the various steps in the SAFETY configuration in numbered tabs, from the left to the right of the wizard. The total number of steps depends on the selected version of SAFETY.

The SAFETY version must first be selected in the VERSIONS tab. To select a version, click on it in the version list, and click the APPLY button. At that moment, the number of steps in the CONFIGURATION WIZARD will automatically adapt, varying from 3 to 8.

The SAFETY versions tab is also used to reset safety parameters, or import a safety from another cell.

In the various steps of the wizard, some configurable SAFETY items are followed by a link icon . This means that the corresponding item can also be configured differently, in another step of the wizard. Clicking the link icon  will switch the view to the step in question.

Details on the various steps:

- 1) ELECTRICAL INTERFACES: This tab is used to configure the behavior of the SAFE I/Os of the CS9 controller (pulse check or not, cross circuit check or not for safety versions 202.x (Initial), 102.x (SAFECELL), and 2.x (SAFECELL+), this affects the selection of the basic SAFEPMT file).
- 2) WORKING MODE: This tab is used to configure the type of WORKING MODE selection, and an optional SAFE output for WORKING MODE feedback.
- 3) RESTART CONTROL: This tab is used to configure the type of RESTART, as well as the related SAFETY delays, and the optional RESTART feedback on a SAFE output.
- 4) EMERGENCY STOP: This tab is used to configure the use of EMERGENCY STOP input, as well as an optional safe output for EMERGENCY STOP feedback.

- 5) **RESTRICTED WORKSPACES:** This tab includes subtabs used to configure SAFE restrictions to the robot workspace, and the related verification points and tests:
- **REFERENCE POSITION** subtab: Configuration of the SAFE REFERENCING, and the joint values of the two reference positions to be used for this SAFE feature. These reference positions can be taught from the 3D VIEW, via the 3D TREEVIEW's Safety node, right-click on a reference position  and select TEACH SAFE POSITION.
 - **CARTESIAN** subtab:
 - Configuration of the permanent and activable (via SAFE inputs) CARTESIAN SAFE ZONES. The positioning and dimensioning of the volumes composing a SAFE ZONE (activated via the corresponding pulldown button ) can be done either via the editable dimension fields in the wizard, or graphically in the 3D VIEW. To do so, right-click on the zone under the SAFETY node of the 3D TREEVIEW, and select EDIT .
 - Configuration of the no speed control zone (inside or outside the zone).
 - Activation of the zone also in manual mode.
 - Configuration of the SAFETY volumes main orientation. Each type of volumes is linked to this orientation. Additionally, vertical planes have also their own orientation.
 - **JOINT** subtab: Configuration of joint SAFE position limits and SAFE maximum decelerations.
 - **TCP AND POINTS:** Configuration of end effector and arm (elbow) safe control points (5 for the end effector, one for the arm).
 - Configuration of the SAFE control points can be done either via the editable dimension fields in the wizard, or graphically in the 3D VIEW.
 - **BRAKE TESTS** subtab: Parameters of the SAFE BRAKE TEST designed to verify the mechanical brakes embedded in the robot arm.
- 6) **SPEED LIMIT:** Set the JOINT and CARTESIAN speed limits. Some are permanent, some are associated to CARTESIAN SAFE ZONES, and some are associated to SAFE inputs. Some of them (the non-permanent ones) also have an associated SAFETY DELAY, which corresponds to the time the robot will have to slow down after activation of the corresponding speed limit before a safety fault occurs.
- 7) **PROTECTED STOP:** For each safe input, activate/configure the corresponding SAFE STOP mode and SAFETY DELAY (which corresponds to the time the robot will have to stop after activation of the corresponding input before a safety fault occurs).
- 8) **OUTPUTS:** Configure the information associated with every SAFE OUTPUT.

9.2 - SAFETY RESOURCES

M0004871.1

This section displays a summary of all the SAFETY functions and limits associated to each SAFE input, and all the SAFE feedbacks associated to each SAFE output. In some cases, links to the CONFIGURATION WIZARD are displayed, pointing to the specific step where the corresponding configuration is located.

9.3 - ERRORS/WARNINGS

M0004872.1

This section of the SAFETY configuration panel provides error and warning messages about the current SAFETY configuration, such as, but not limited to:

- Potential functional conflicts between selected SAFETY functions.
- Potential functional risks associated with certain SAFETY functions.
- Potential oversights by the user (a SAFETY function required by the use of another one, that the user failed to activate).



It is very important to pay close attention to the messages displayed in this section. Please refer to the safety manual, or contact Stäubli for more details on these messages.

9.4 - EXPORTING THE CONFIGURATION

Once the SAFETY CONFIGURATION is finalized, it must be exported. To do so, two possibilities:

- Click the SAFETY tab in the main ribbon.
- Click the EXPORT SAFETY CONFIGURATION pulldown button  (far left).
- Select the controller in the pulldown list.

In both cases, the SAFETY PARAMETERS window opens up. This window mimics the looks and ergonomomy of the SAFEPMT configuration software.

For safety versions 202.x (Initial), 102.x (SAFECELL), and 2.x (SAFECELL+)

SRS can send directly the safety configuration to the flash memory of the CS9 (for backup purposes) and into the safety PLC of the CS9 (RSI9). Simply press Next at the bottom right of the Export window, and initiate the transfer by clicking Finish.

For safety versions 200.x (Initial), 100.x (SAFECELL), and 1.x (SAFECELL+)

The next step is to start the SAFEPMT configuration software alongside SRS, load the standard SAFETY version and configuration, and copy and paste each parameter from the SAFETY PARAMETERS window to SAFEPMT.

To make this task easier, the SAFETY PARAMETERS window displays in bold all the parameters for which the value is different from the standard configuration of the selected SAFETY version.

It is also possible to copy all the parameters into a text file (for easier comparison between two configurations).

Once the manual transfer of the parameters into SAFEPMT is done, press Next in the SRS Export window, and initiate the transfer of the configuration to the flash memory of the CS9 (for backup purposes) by clicking finish.



For more details on the SAFEPMT software, please refer to the safety manual.

10 - REMOTE CONNECTION AND MAINTENANCE TOOLS

M0004874.1

SRS integrates multiple features allowing the remote access, configuration, partial control, and diagnostics of a real robot over Ethernet TCP/IP (either in direct P2P connection or over a network).

The first step to use these features, is to configure the connection parameters to the robot(s).

10.1 - CONFIGURATION OF CONNECTION PARAMETERS

M0004875.1

SRS offers a configuration window called TARGETS, dedicated for the definition and setup of connection parameters for multiple targets (real robots).

This window can be accessed via the properties of a controller (right-click a controller in the CELL EXPLORER, DATA, or GEOMETRY panels, then select PROPERTIES  in the contextual menu). In the PROPERTIES panel, edit the HOSTNAME in the REMOTE PROPERTIES section by clicking on the  button at the right end of the line.

Once opened, the TARGETS window present a list of already defined targets on the left-hand side, from which you can add, delete, or edit the name of a target by selecting it and clicking the corresponding button at the bottom of the list   .

The connection parameters of the selected target are presented on the right-hand side sections of the TARGETS window:

- Host: address or hostname of the real controller.
- Comment: Free comment field.
- Controller Version: SRC version of the real controller (retrieved upon automatic connection, as soon as the Host parameter has been set).
- Tabs that can be (depending on whether the host is a CS8 or a CS9):
 - Remote connection: TRANSFER MANAGER connection parameters (CS8 and CS9).
 - Remote Access: CS8 REMOTE ACCESS connection parameters.
 - VNC: CS9 REMOTE ACCESS connection parameters.
 - Web: CS9 WEB SESSION connection parameters.
- In each tab, the following parameters can be specified:
 - User name: The user name of a valid profile for the selected host (see [10.2](#) chapter).
 - Password: The connection password of the specified user name.
 - Port: Default port number for the corresponding tool (use  button to restore default number if necessary).

10.2 - PROFILE EDITOR

M0004876.1

The controller provides the possibility of having several users with different rights.

To use the system, it is necessary to create user profiles and enter the desired rights for each profile.

For full documentation on profile rights, refer to the "software configuration" chapter of the controller user manual.



There are two versions of the PROFILE EDITOR, local and remote:

- The local PROFILE EDITOR is aimed at managing profiles to be used within the SRC EMULATOR, these profiles can then be transferred to the real robot(s) by using the TRANSFER MANAGER (See chapter 10.3 for more details).
 - The local PROFILE EDITOR can be started by selecting a controller first, then using the corresponding command either in the HOME\CONTROLLER ribbon, or in the contextual menu (right-click on the controller in the CELL EXPLORER, DATA, or GEOMETRY panels).
- The remote PROFILE EDITOR allows to manage directly profiles on a real robot. This version will start by connecting to the real controller via the connection parameters of the virtual one it was started onto.
 - The remote PROFILE EDITOR can be started by selecting a controller first, then using the corresponding command in the contextual menu (right-click on the controller in the CELL EXPLORER, DATA, or GEOMETRY panels).

Once started, this tool can be used to create, modify or delete profiles for a controller.

The left-hand panel is used to list the profiles, and the current profile access rights are displayed in the right-hand panel.

To modify the values for a profile, double-click on the desired value.

The PROFILE menu is used to:

- Create a new profile (NEW) (CTRL+N),
- Delete the selected profile (DELETE),
- Make a copy of the selected profile (COPY) (CTRL+C),
- Import a profile from the current SRS cell (IMPORT) (CTRL+I),
- Export a profile (EXPORT) (CTRL+E).

To rename a profile, change the name in the editing box at the top of the right-hand panel and then validate the name by pressing the tab key. Then accept the change of name by saving the profile.

10.3 - TRANSFER MANAGER

M0004868.1

SRS can be used to transfer VAL 3 applications and various configuration files from and to a real robot controller. This is done using the TRANSFER MANAGER.

The TRANSFER MANAGER enables configurations and applications to be copied to a controller and vice versa.



The TRANSFER MANAGER can be executed on a controller via the command located in the HOME\CONTROLLER ribbon. The controller needs to be first selected in the CELL EXPLORER, DATA, or GEOMETRY panels. It can also be started by right-clicking on the controller, and selecting TRANSFER MANAGER.

The TRANSFER MANAGER can also be used for a direct transfer of an opened VAL 3 application. To do this, select the application in the CELL EXPLORER, DATA, or GEOMETRY panels, and click on



the UPLOAD APPLICATION command either in the VAL3\TRANSFER ribbon, or in the contextual menu (right-click on the application). This will open the TRANSFER MANAGER on the controller the application belongs to, and start the transfer automatically. The VAL3\TRANSFER ribbon also offers



the possibility to transfer all opened VAL 3 applications (UPLOAD ALL APPLICATIONS).

A network connection to the controller is required (see chapter 10.1). TRANSFER MANAGER will use the connection parameters of the selected controller to connect.

Once it has been connected, the tool displays the emulator contents in the left-hand panel , and the real controller contents in the right-hand panel .

Once it has been connected, the tool displays the emulator cell in the left-hand panel, and the controller cell in the right-hand panel.

To select items (VAL 3, I/Os, applications, profiles, etc...), check the corresponding boxes.

The arrows on each side of the TRANSFER button show the direction in which the transfer is to be made. Transfers can only be done in one direction at a time, the arrows on the TRANSFER button change direction depending on the side of the selected items. Press the TRANSFER button to start the transfer.

The REFRESH button is used to refresh the corresponding display. The DELETE button is used to delete the selected elements.

10.3.1 - BACKUP

M0003975.1

It is possible to make a full backup copy of the controller by clicking on the BACKUP button.

The name of the backup folder is composed of the directory chosen by the user (by default : MY DOCUMENTS\STAUBLI BACKUPS), into which is created a subfolder named after the serial number of the controller (this subfolder will contain all the backups made on this specific robot), into which is created a subfolder named after the date and time of the backup that contains the actual files.

The SYS partition is saved in the SYS directory, the USR partition in the USR directory and the LOG partition in the LOG directory.

The USR\CONFIGS\ARM.CFX file is renamed arm.<serial number of arm>.cfx in the backup.



- If the order number of controller is not filled in the option.cfx file, it is replaced by the IP address of the controller.
- If the order number of arm is not filled in the arm.cfx file, it is replaced by the IP address of the controller.

10.3.2 - COMMAND LINE

M0004036.1

The transfer tool can be started using a command line instruction to carry out automatic transfers. All the available commands are also summarized in the help menu button:

TransferManager options where options are (Carefull, options are case sensitive):

- Hhost
- Uftp user login
- Wftp password
- TSoap port
- CRoot path on the local controller

- I[mbBsofcCeiyh*]
 - m = mio
 - b = bio
 - B = bio2
 - s = sio
 - o = modbus
 - f = fieldbus
 - c = can
 - C = cio
 - e = encoder
 - i = iomap
 - y = CoDeSys
 - h = Hilscher
 - * = all
- A Select Arm config file (Only for download)
- L Select logger (Only for download)
- p[*plc application name]
- e[*profile name]
- a[DiskTemplates://[val 3 application or template name][*]
Only the nodes Disk:// and Templates:// are managed by TRANSFER MANAGER.
See examples below.
- * Select all
- q Quiet mode
- B[pDdCc] Backup options
 - p = Backup folder
 - C = Add the controller name in the folder (by default)
 - c = Do not add the controller name in the folder
 - D = Add date in folder (by default)
 - d = Do not add date in the folder
- F[cbdu]
 - c = Connect
 - b = Backup
 - d = Download
 - u = Upload

Example:

Download applications foo and foo2 and all I/Os in c:\backup\sample1 folder:

```
TransferManager -H127.1.1.2 -Uuser -Wpassword -Pc:\backup\sample1 -afoo -afoo2 -I* -Fd
```

Download only application named foo:

```
TransferManager -H127.1.1.2 -Uuser -Wpassword -aDisk://foo -Fd
```

Download application named foo and all subapplications of the folder foo:

```
TransferManager -H127.1.1.2 -Uuser -Wpassword -aDisk://foo* -Fd
```

Download template Default:

```
TransferManager -H127.1.1.2 -Uuser -Wpassword -aTemplates://Default -Fd
```

Download all templates:

```
TransferManager -H127.1.1.2 -Uuser -Wpassword -aTemplates://* -Fd
```

Backup controller in folder c:\backups\

```
TransferManager -H127.1.1.2 -Uuser -Wpassword -Bpc:\backups -Fb
```

Backup controller in folder c:\backups\toto without any questions:

```
TransferManager -H127.1.1.2 -Uuser -Wpassword -Bpc:\backups\toto -Bd -Bc -q -Fb
```



The online command, used with WINDOWS task manager, can be used to make regular scheduled backups of controller data (See: Scheduled tasks in the WINDOWS help menu).

10.4 - REMOTE ACCESS

M0004877.1

This tool is used to log on to a controller using the graphical interface from the emulator.

To connect to a controller, the REMOTE ACCESS tool uses the connection parameters of the virtual controller it was started from (See chapter 10.1 for more details).

To log on, start the tool by right-clicking on a controller in the CELL EXPLORER, DATA, or GEOMETRY panels, and select the REMOTE ACCESS  menu command. It can also be started from the HOME\CONTROLLERS ribbon by clicking the corresponding button, after selecting a controller in the CELL EXPLORER, DATA, or GEOMETRY panels.

Once connected, the simulated manual control pendant displays exactly the same interface as the real pendant. The two pendants remain connected in parallel, and all the actions carried out on one are reflected in the other. The actions prohibited on the simulated pendant are as follows:

- Switching arm power on.
- Changing the working mode.
- Starting a VAL 3 application using the START button.
- Stopping a VAL 3 application using the STOP button.
- Changing the movement mode.
- Using the MOVE/HOLD button.
- Using the manual movement keys.
- Changing the monitor speed.
- Using buttons 1, 2 and 3.

On CS8 controllers, only one version of the REMOTE ACCESS tool is available. This version provides a live connection to the robot teaching pendant, allowing for each party to see the other's actions.

On CS9 controllers, it is also possible to connect via the CS9 WEB SESSION tool. In this case, the two parties each have a distinct, not synchronized, user interface.

To exit REMOTE ACCESS, close the simulated manual control pendant.



This option only functions on controllers with SRC s5.0 or later.

The use of these tools requires at least one of two licenses:

- An SRS MAINTENANCE STUDIO license (USB dongle) allows to use the REMOTE ACCESS on any controller (Versions greater than or equal to s5.0). To use this license, see: Licenses and dongle management.
- A VAL 3 runtime license installed on the controller allows to use REMOTE ACCESS without a USB dongle (See: Adding an option to a controller).

10.5 - REMOTE OPTIONS

M0004878.1

To start the REMOTE OPTIONS right-click on a controller and select the REMOTE OPTIONS  menu command. It can also be started from the HOME\CONTROLLERS ribbon by clicking the corresponding button, after selecting a controller in the CELL EXPLORER, DATA, or GEOMETRY panels.

Once started, the REMOTE OPTIONS tool connects to the selected controller via the connection parameters defined in the local controller (see chapter 10.1 for more details), and an OPTIONS panel opens up.

If applicable, start by selecting an option pack in the SELECT A PACK pulldown list. This list might or might not be present in the panel, depending on the generation and SRC version of the controller⁽¹⁾.

To activate a specific option, look for it in the list, and either:

- Activate it in demo mode by checking the corresponding box in the DEMO MODE column.
- Install the license key by entering in the LICENSE column, pressing Enter, and accepting the terms and conditions.
- Save by clicking the SAVE or SAVE ALL button   in SRS main title bar.
- Restart the controller.

The list of available options may vary, depending on the generation and SRC version of the controller⁽¹⁾.

⁽¹⁾ Consult Stäubli for more details.

10.6 - LOGGER VIEWER (CS9 ONLY)

From the CS9 MAINTENANCE tab in the ribbon, three options:

- Click the OPEN LOG button  to open a log archive previously retrieved from a real CS9.
- Click the top half of the OPEN REMOTE LOG button  to open the TARGETS window and select/create a target from which the log file will be loaded (See chapter 10.1 for more details).
- Click the bottom half of the OPEN REMOTE LOG button  then select a controller from the list (only emulated CS9 controllers will be selectable) to open the log directly from the real CS9. In this case, SRS will use the connection parameters from the selected controller (See chapter 10.1 for more details).

The log file will then be loaded, and the LOG FILE VIEWER panel will open.

The log messages are shown in a list in this panel, divided in sections, with a color code:

- Each section corresponds to a boot of the real CS9. These sections can be expanded or collapsed individually by clicking the corresponding button  or  on the left hand side of the list. A right click in the message list also gives access to the Copy, Expand all, and Collapse All functions.
- The colors correspond to the level of the message: Light blue for Info, yellow for warnings, light red for errors, and dark red for critical messages.

The title fields of the list are either sortable only (Time, Timestamp, Text), or both sortable and filterable.

When hovering the mouse over a filterable field, a small filter icon  will appear near the field name. Simply click on it to setup the corresponding filter.

It is also possible to create an advanced filter by using the FILTER EDITOR by clicking on the EDIT FILTER  at the bottom right of the LOG FILE VIEWER panel (FILTER panel). From this FILTER EDITOR, combinations of tests (based on multiple value comparison operators) can be created by using logic operators.

When a field is only sortable, a simple click on it will toggle the filtering order.

A search field at the top of the panel can also be used to perform a free word search in the list. This search engine can be combined with the current filters (if any) by checking the Search and filter checkbox.

From within the event list, it is possible to perform a multiple selection with the SHIFT or CTRL key, and to copy and paste the current selection in a text format.

From the CS9 MAINTENANCE ribbon, it is also possible to:

- Save the log under another path/name (SAVE LOG AS .
- Download the full log into a local folder (DOWNLOAD LOG .
- Show/hide some of the features of the LOG FILE VIEWER panel (SETTINGS .
- Change the language of the log (LANGUAGES .

10.7 - USB DISK TOOLS (CS9 ONLY)

This feature gives access to maintenance software tools so that they can be executed remotely on a real CS9. First, the DISK TOOLS feature needs to be started by clicking the corresponding

button  in the CS9 MAINTENANCE tab in the main ribbon. This opens up the DISK TOOLS panel. This panel includes a step by step procedure.

First, the CS9 needs to be booted up on a specific boot device hosted on a USB stick. This stick is created from an image, with the USBIT software. For more details on this process, please contact Stäubli service.

The next step is to connect to the CS9 over Ethernet TCP/IP, either on the J204 or the J205 Ethernet ports. J204 is set to DHCP by the boot device, its IP address is indicated on the small LCD display on the CS9's logic drawer (the middle one) front panel. J205 is set to the default IP address. See CS9 Instructions manual for more details on these Ethernet ports and their settings.

Connect the PC running SRS to one of these two ports (direct connection or over a network), select the port the PC is connected to in the DISK TOOLS panel:

- If you select J204, you need to enter the IP address displayed on the LCD panel on the CS9 controller.
- If you select J205, its default address is already entered in the field, and cannot be modified.

Click on the get tool list button  to retrieve the list of maintenance tools from the CS9. The version of the maintenance package will be displayed in the center of the DISK TOOLS panel, and the list of maintenance tools is right below it.

Select a maintenance tool from the pulldown list, and click on the Start button  next to it. If the tool is not an official Stäubli maintenance tool, or if the version of the maintenance package is earlier than your version of SRS, a warning will be displayed.

The execution log of the started maintenance tool will be displayed in the output section, in the bottom half of the DISK TOOLS panel. This log can be copied  or cleared  by clicking the corresponding button at the bottom right of the DISK TOOLS panel.

When the maintenance operations are finished, remove the USB stick from the CS9, and restart it.

11 - SRC EMULATORS

This tool can be used to emulate a controller.

The EMULATOR acts as a controller and provides the same interface via a simulation of the manual control pendant.

It can be used to:

- Load, execute, or debug a VAL 3 application.
- Display and toggle the I/Os.
- Display events.
- Simulate arm movements.

Emulator with a version earlier than s7.6 must be launched manually.

Emulators with a version greater than or equal to s7.6 are launched automatically by SRS when opening a cell.

It is very important that the virtual robots in your SRS cell have SRC versions identical to the ones equipping the controllers of their real counterparts.

11.1 - INSTALLING A NEW VERSION OF SRC EMULATOR

Several SRC emulators (one per major SRC version) are supplied on each SRS installation DVD. Although they can be unchecked in the installation wizard, they will by default be installed by the SRS installer.

SRC emulators can also be found on the SRC installation CD provided with each Stäubli robots (in the Emulator directory).

All the published versions of SRC emulators are also available from a download/install center⁽¹⁾, accessible through the EMULATOR UPDATES⁽¹⁾ page.

This page is accessible from SRS main page (File tab in the ribbon, HELP\SHOW EMULATOR UPDATES command in the third column, right-hand side of the page), and from HOME\GENERAL\SHOW EMULATOR UPDATES in the ribbon.

This page contains one main section for each generation of controller (CS8/CS8C, CS9), each containing a subsection per major SRC version. Navigate these subsections to find the exact version you need, then:

- Click **DOWNLOAD** , the download progress will be shown via a progress bar.
- Click **INSTALL**  and follow the on-screen instructions.
- You may also click **EXPLORE**  to open a WINDOWS explorer in the download folder.

This page is also accessible after opening a cell containing robot(s) for which the SRC emulator version is not yet installed. In this case, the controller name in the CELL EXPLORER panel  will be followed by a warning message:

 **Controller3 (The SRC version 's7.10' is not installed.)**

I0004457

Simply right-click on the corresponding controller, and select **DOWNLOAD AND INSTALL EMULATOR** , this will open the EMULATOR UPDATES⁽¹⁾ page, and start the download process. Once downloaded, the setup will start automatically, simply follow the on-screen instructions from this point forward.

⁽¹⁾ This feature requires an Internet connection.

11.2 - UNINSTALLING A VERSION OF SRC EMULATOR

From the EMULATOR UPDATES page, navigate to the version of SRC emulator you wish to uninstall, and click UNINSTALL .

12 - LICENSES AND DONGLE MANAGEMENT

M0004882.1

The SRC licenses are protected with a USB dongle.

The licenses are installed on the dongle and the connecting this dongle to a computer enables the licenses on it.

12.1 - DONGLES

M0003979.1

There are 2 types of dongle:

- Local dongle: This dongle is used for a single PC. When it is plugged into the USB port, all the licenses that are installed on this dongle are enabled for this PC.



I0004459

Figure 12.1

- Network-50 dongle: This dongle grants floating licenses on a network. This dongle is limited to a maximum of 50 users.



I0004460

Figure 12.2

12.2 - THE LICENSE MANAGER

M0003980.1

This tool scans all the dongles that are visible from the PC: The local plugged dongles and the accessible network dongles. It displays the identifier of each dongle and their firmware version.

For each licence, following information are displayed:

- Name of the licence.
- Identifier of the licence (unique number).
- Firmware version of the license: 2.16 means that this license is usable by SRS 6.x and further. From the 3.21 version, the license is usable by SRS 7.x and further.
- Type of the License: Local or Network.
- Maximum executions of the license: This is the maximum number of uses of the license. Once this number is reached, the license is invalid. The value "perpetual" means there is no limit.
- Already done executions: This is the number of times the license has been used. Set to "-" if the license is perpetual.
- Concurrency user's limit: Only for network licenses. This is the number of users that can simultaneously use the license.

12.2.1 - UPDATE FIRMWARE

M0003981.1

If the firmware version is prior to 3.21, it is necessary to update it. To do so, unplug all the other dongles, select the UPDATE\UPDATE FIRMWARE menu and follow the prompts.

12.2.2 - ADD A LICENSE ON A DONGLE

M0003982.1

To update a dongle with a new license, follow these steps:

- 1) Connect the dongle into the USB port of a PC equipped with SRS.
- 2) Run the SRS license manager (from menu TOOLS\SRS LICENSES MANAGER).
- 3) In the SRS license manager, use the UPDATE\GENERATE THE DONGLE IDENTIFICATION FILE menu to create the C2V file (C2V = customer to vendor).
- 4) Contact Stäubli and order the desired license.
- 5) Email the C2V file to Stäubli.
- 6) You will receive a V2C file from Stäubli by email (V2C = vendor to customer).
- 7) Connect the dongle into the USB port of a PC with SRS.
- 8) Run the SRS license manager (from menu TOOLS\SRS LICENSES MANAGER).
- 9) Update the dongle using the UPDATE\UPDATE LICENSES command.



Once you have generated a C2V file, you must apply the related V2C file before being able to generate a new C2V file.

12.3 - AVAILABLE LICENSES

12.3.1 - DEVELOPMENT STUDIO

M0003984.1

Available features:

- Save VAL 3 applications in the editor.
- On-line debugger.
- 3D modeling: CAD files import, save.
- Collision detection.
- CHECK PAYLOAD.
- JOG panel.
- USERPAGE DESIGNER (CS9 only).
- Points accessibility.
- IOMAP Editor.
- SAFETY CONFIGURATION WIZARD (CS9 only).
- I/Os Configuration with Sycon.NET (CS9 only).
- TCP/IP and UDP sockets creation.
- RECORD PLAYER.

12.3.2 - MAINTENANCE STUDIO (NEEDS DEVELOPMENT STUDIO)

M0004883.1

Available features:

- REMOTE ACCESS to a controller.
- Loading of the 3D cell.
- Logger viewer (CS9 only).
- USB DISK TOOLS (CS9 only).

Please note that it is not possible to save the cell (VAL 3 applications and 3D) with this license.

12.4 - SHARING/DISABLING A LICENSE

When a dongle is detected, SRS always uses the license with the most options for the corresponding features.

For example, when opening the 3D viewer with a dongle containing the DEVELOPMENT STUDIO and the MAINTENANCE STUDIO licenses, SRS will use the DEVELOPMENT STUDIO license.

Users who are sharing licenses on a network dongle may want to prevent their session of SRS from using a specific option.

To do so, open the SRS SETTINGS, select the ENVIRONMENTLICENCES section and uncheck the licenses that you do not want your current session of SRS to use.

Please note that it is necessary to restart SRS in order to take those modifications into account.

13 - QUESTIONS AND ANSWERS

Can I install more than one major version of SRS on my PC

Yes, the major versions of SRS are installed in different default directories.

The Online debugger does not connect.

Make sure that:

- The controller version is at least s7.0.
- Ports 5653 and 5656 are opened on your firewall.
- You can ping the IP address of the controller from your computer.
- The profile's user name and password are correct.

The REMOTE ACCESS tool does not connect.

Make sure that:

- The controller version is at least s5.0.
- The port number entered in the tool connection information corresponds to that of the controller.
- Your controller is connected to the network.
- You can ping the IP address of the controller from your computer.
- The profile's user name and password are correct.
- There is no firewall software preventing the connection.

The TRANSFER MANAGER does not connect.

Make sure that:

- Your controller is connected to the network.
- You can ping the IP address of the controller from your computer.
- The profile's user name and password are correct.
- There is no firewall software preventing the connection.

