Data types

confdata - Robot configuration data

RobotWare - OS

Usage

`confdata` is used to define the axis configurations of the robot.

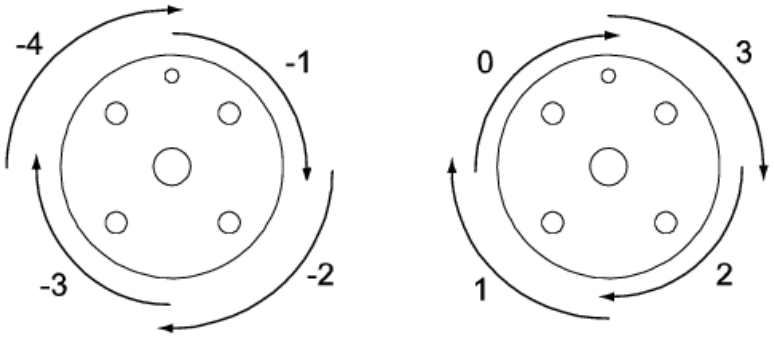
Description

All positions of the robot are defined and stored using rectangular coordinates. When calculating the corresponding axis positions, there will often be two or more possible solutions. This means that the robot is able to achieve the same position, that is, the tool is in the same position and with the same orientation, with several different positions or configurations of the robots axes.

Some robot types use iterative numerical methods to determine the robot axes positions. In these cases the configuration parameters may be used to define good starting values for the joints to be used by the iterative procedure.

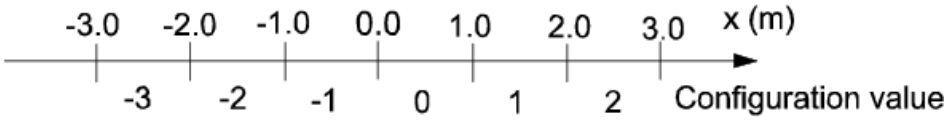
To unambiguously denote one of these possible configurations, the robot configuration is specified using four axis values. For a rotating axis, the value defines the current quadrant of the robot axis. The quadrants are numbered 0, 1, 2, and so on (they can also be negative). The quadrant number is connected to the current joint angle of the axis. For each axis, quadrant 0 is the first quarter revolution, 0 to 90°, in a positive direction from the zero position; quadrant 1 is the next revolution, 90 to 180°, and so on. Quadrant -1 is the revolution 0° to (-90°), and so on.

The figure shows the configuration quadrants for axis 6.



For a linear axis, the value defines a meter interval for the robot axis. For each axis, value 0 means a position between 0 and 1 meters and 1 means a position between 1 and 2 meters. For negative values, -1 means a position between -1 and 0 meters, and so on.

The figure shows configuration values for a linear axis.



Configuration supervision

For some robot models the configuration data (`confdata`) is also used to perform supervision of the programmed points for linear movements if `ConfL\On` is set.

Before an ordered movement is started, a verification is made to see if it is possible to achieve the programmed configuration. If it is not possible, the program is stopped. When the movement is finished (in a zone or in a finepoint), it is also verified that the robot has reached the programmed configuration.

The configuration supervision works differently for different robots. See the following sections for details.

6-axis robots
The configuration supervision will check that axes 1, 4, and 6 will not move more than 180 degrees, and that the ordered movement does not require a change in `cfx` (`cfx` is only used for serial link robots).

4-axis robots
The configuration supervision will check that axes 1 and 6 will not move more than 180 degrees.

Parallel arm robots
The configuration supervision will check that axis 4 will not move more than 180 degrees.

7-axis robots
The configuration supervision will check that axes 1, 4, and 6 will not move more than 180 degrees, and that the ordered movement does not require a change in `cfx`.

Paint robots
No configuration supervision is done.

Robot configuration data

6-axis robots with serial link
There are three singularities within the working range of the robot. For more information about singularities, see *Technical reference manual - RAPID overview*.

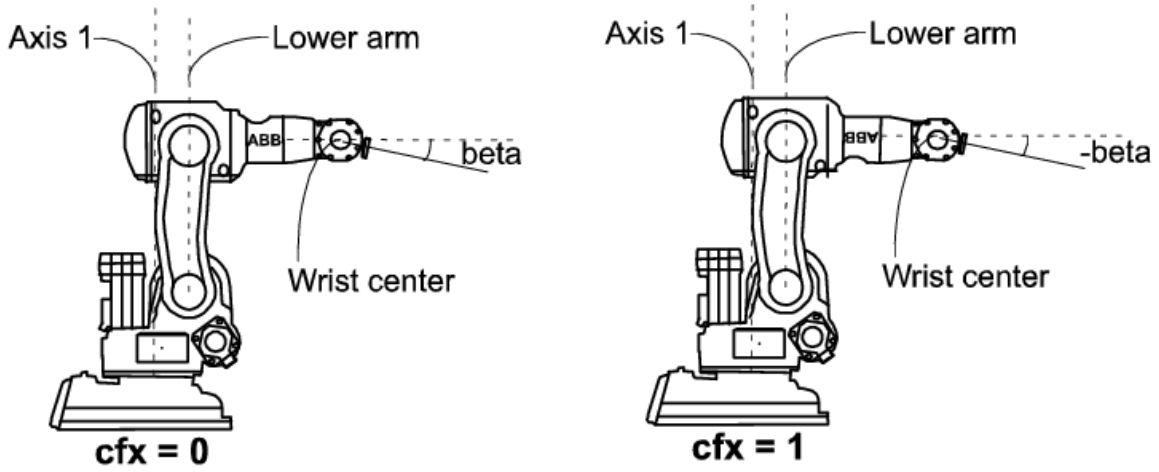
- `cf1` is the quadrant number for axis 1.
- `cf4` is the quadrant number for axis 4.
- `cf6` is the quadrant number for axis 6.

`cfx` is used to select one of eight possible robot configurations numbered from 0 through 7. The following table describes each one of them in terms of how the robot is positioned relative to the three singularities.

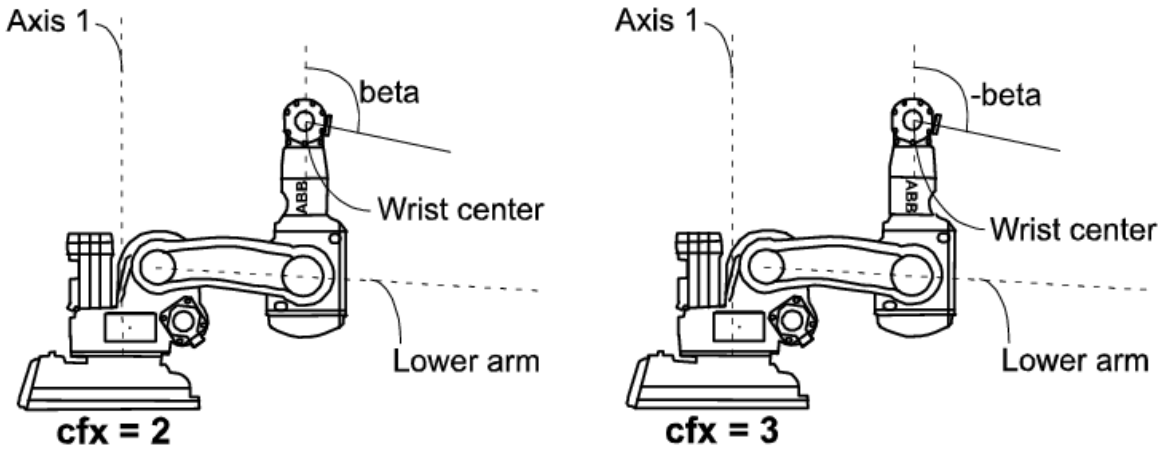
cfx	Wrist center relative to axis 1	Wrist center relative to lower arm	Axis 5 angle
0	In front of	In front of	Positive
1	In front of	In front of	Negative

cfx	Wrist center relative to axis 1	Wrist center relative to lower arm	Axis 5 angle
2	In front of	Behind	Positive
3	In front of	Behind	Negative
4	Behind	In front of	Positive
5	Behind	In front of	Negative
6	Behind	Behind	Positive
7	Behind	Behind	Negative

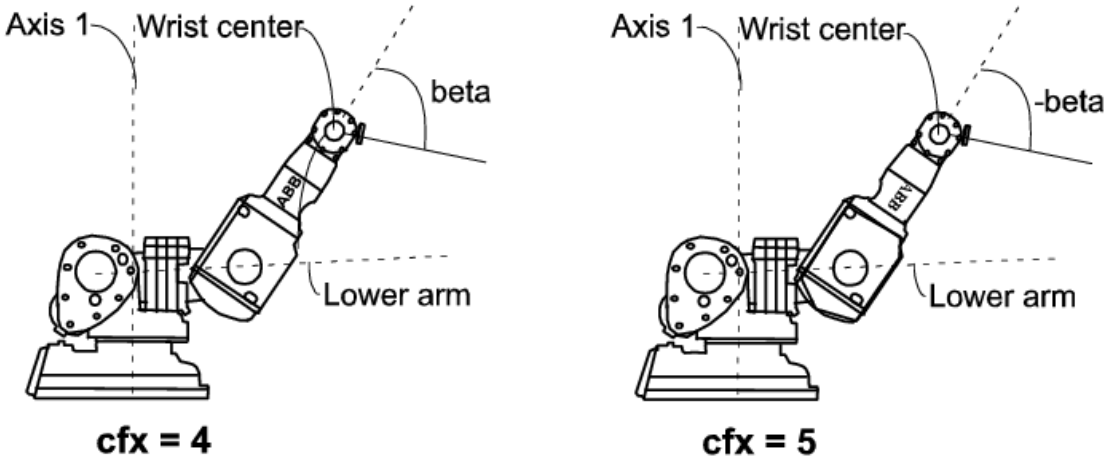
The following figures describe the eight different configurations with the same tool position and orientation.
The following figure shows an example of robot configuration 0 and 1. Note the different signs of the axis 5 angle.



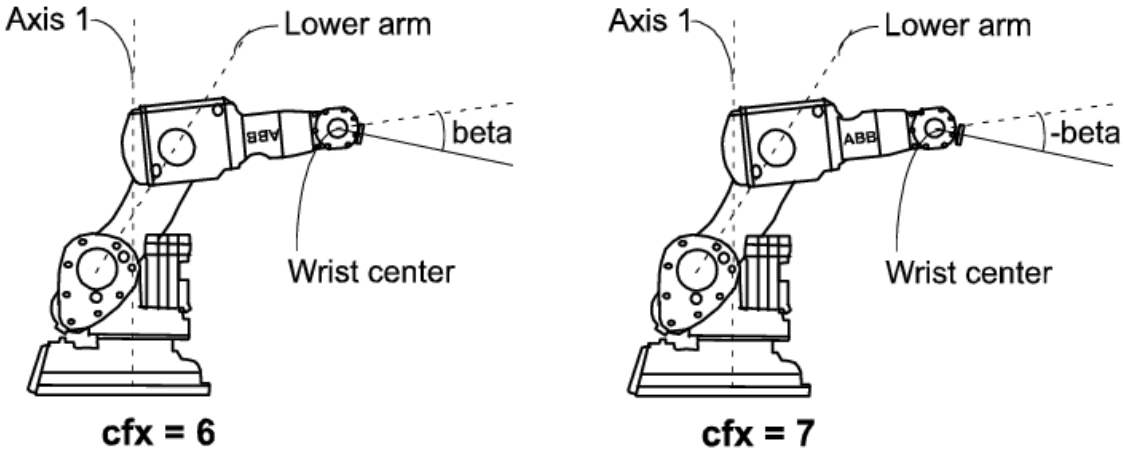
The following figure shows an example of robot configuration 2 and 3. Note the different signs of the axis 5 angle.



The following figure shows an example of robot configuration 4 and 5. Note the different signs of the axis 5 angle.



The following figure shows an example of robot configuration 6 and 7. Note the different signs of the axis 5 angle.



6-axis robots with parallel rod
Only the three configuration parameters `cf1`, `cf4`, and `cf6` are used.

4-axis robots
Only the configuration parameter `cf6` is used.

Parallel arm robots
Only the configuration parameter `cf4` is used.

7-axis robots
All four configuration parameters are used. `cf1`, `cf4`, `cf6` for joints 1, 4, and 6 respectively. `cfx` is used to select one of 16 possible robot configurations.

The `cfx` value is presented as a bit-string in decimal form from '0000' through '1111'. The following table describes each one of them in terms of how the robot is positioned.

cfx	**Description**
Fourth bit (1000)	The fourth bit is 0 if the angle of axis 5 is equal to zero, or has a positive value. Otherwise the fourth bit is 1.
Third bit (0100)	The third bit is 0 if the angle of axis 3 is larger than, or equal to, -90 degrees. Otherwise the third bit is 1.
Second bit (0010)	The second bit is 0 if the angle of axis 2 is equal to zero, or has a positive value. Otherwise the second bit is 1.
First bit (0001)	The first bit is a compatibility bit. When programming linear movements the compatibility bit shall be the same as the previous target.

Note
Note that leading zeros are not displayed, see example below.

Configuration examples for `cfx`:

- `cfx` = '0000' = 0
  Axis 5 = 15 degrees, axis 3 = -55 degrees, axis 2 = 0 degrees, compatibility bit = 0
- `cfx` = '0110' = 110
  Axis 5 = 15 degrees, axis 3 = -100 degrees, axis 2 = -1 degrees, compatibility bit = 0
- `cfx` = '1000' = 1000
  Axis 5 = -15 degrees, axis 3 = 100 degrees, axis 2 = 1 degrees, compatibility bit = 0

Paint robots
All four configuration parameters are used. `cf1`, `cf4`, `cf6` for joints 1, 4, and 6 respectively and `cfx` for joint 5.

IRB 5500
All four configuration parameters are used. `cf1`, `cf4`, `cf6` for joints 1, 4, and 6 respectively. The `cfx` parameter contains a combination of the joint 5 quadrant number and the four possible configurations for axes 2 and 3.

For more information see the *Product Manual - IRB 5500*.

IRB 5350
The robot have two rotation axes (arms 1 and 2) and one linear axis (arm 3).

- `cf1` is used for the rotating axis 1
- `cfx` is used for the rotating axis 2
- `cf4` and `cf6` are not used

Components

`cf1`
Data type: `num`

Rotating axis:

The current quadrant of axis 1, expressed as a positive or negative integer.

Linear axis:

The current meter interval of axis 1, expressed as a positive or negative integer.

`cf4`
Data type: `num`

Rotating axis:

The current quadrant of axis 4, expressed as a positive or negative integer.

Linear axis:

The current meter interval of axis 4, expressed as a positive or negative integer.

cf6

Data type: `num`

Rotating axis:

The current quadrant of axis 6, expressed as a positive or negative integer.

Linear axis:

The current meter interval of axis 6, expressed as a positive or negative integer.

cfx

Data type: `num`

Rotating axis:

For serial link robots, the current robot configuration, expressed as an integer in the range from 0 to 7.

For 7-axis robots, the the current robot configuration, expressed as an integer in the range from 0 to 1111, see 7-axis robots.

For paint robots, the current quadrant of axis 5, expressed as a positive or negative integer. For IRB 5500, see IRB 5500.

For other robots, using the current quadrant of axis 2, expressed as a positive or negative integer.

Linear axis:

The current meter interval of axis 2, expressed as a positive or negative integer.

Basic examples

The following example illustrates the data type `confdata`:

Example 1

```
VAR confdata conf15 := [1, -1, 0, 0]
```

A robot configuration `conf15` for a paint robot type is defined as follows:

- The axis configuration of the robot axis 1 is quadrant 1, i.e. 90-180º.
- The axis configuration of the robot axis 4 is quadrant `-1`, i.e. 0-(-90º).
- The axis configuration of the robot axis 6 is quadrant `0`, i.e. 0 - 90º.
- The axis configuration of the robot axis 5 is quadrant `0`, i.e. 0 - 90º.

Structure

```
< dataobject of confdata >
   < cf1 of num >
   < cf4 of num >
   < cf6 of num >
   < cfx of num >
```

Related information

For information about	See
Coordinate systems	*Technical reference manual - RAPID overview*
Handling configuration data	
Singularities	
Position data	robtarget - Position data