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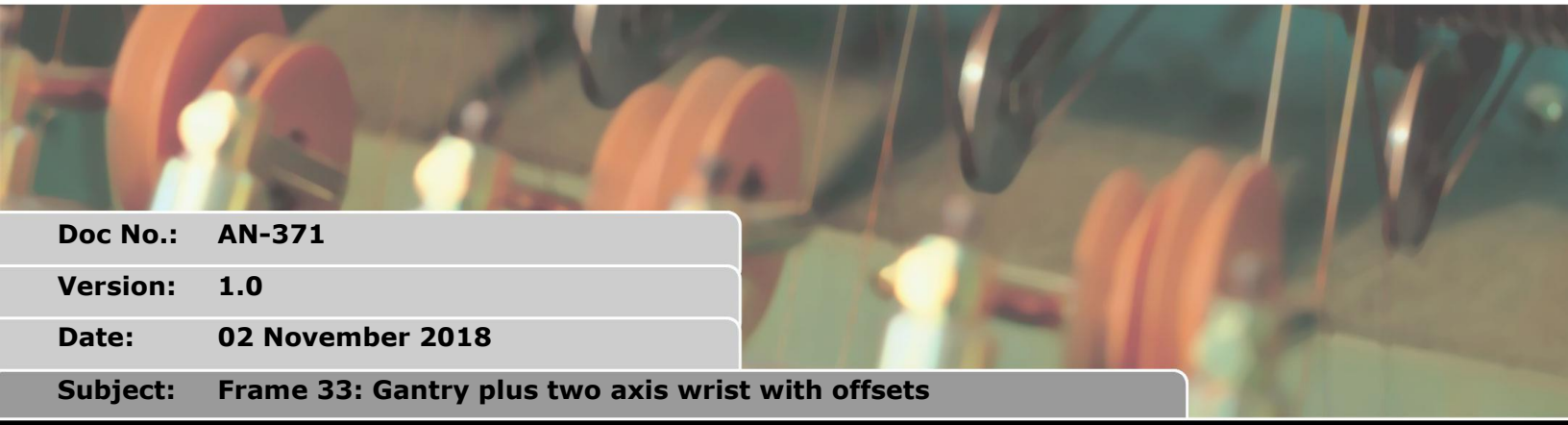


Doc No.: AN-371

Version: 1.0

Date: 02 November 2018

Subject: Frame 33: Gantry plus two axis wrist with offsets

APPLICATION NOTE

1. Changes:

Version 1.1: Creation of document.

Version 1.2: Axis direction arrows named.

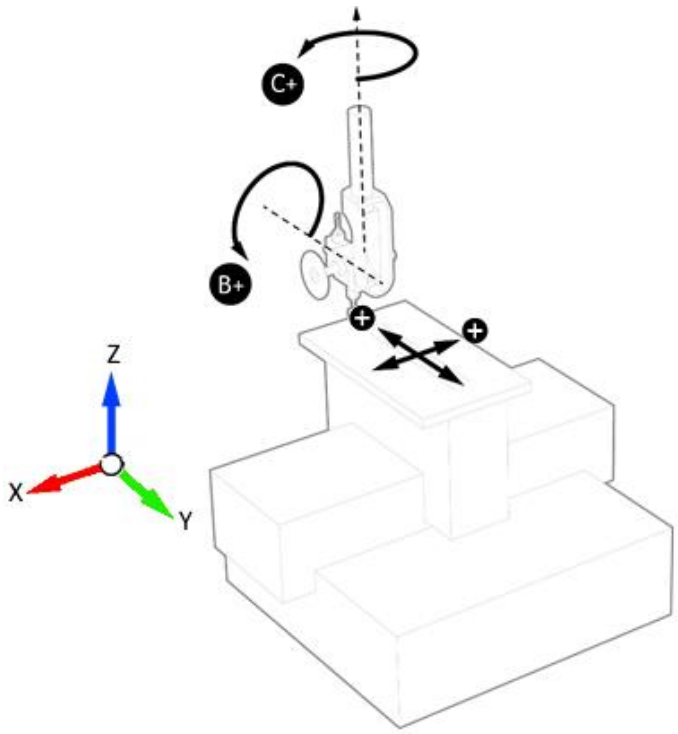
2. Introduction

The FRAME 33 transformation allows an XYZ Robot with 2 axis wrist to be easily programmed. The transformation function provides compensation in XYZ when the 2 wrist axis are rotated.

FRAME 33 is similar to FRAME 116 but with four offsets along the wrist axes. The order of the frame variables in TABLE is different to FRAME 116.

3. Diagram

The following picture shows the type of machine:



Once the frame is enabled DPOS on the X, Y and Z axes are measured in Millimetres.

4. Parameterization

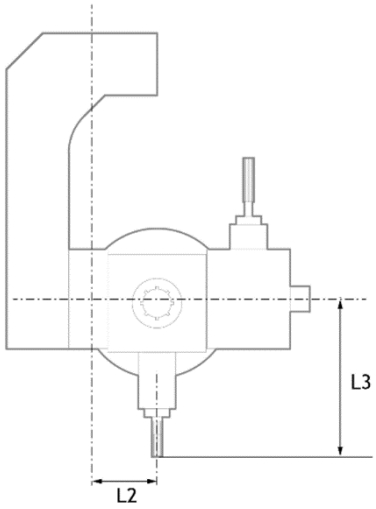
9 parameters needed to be set into a sequence of TABLE values for use by the transformation mathematics. The base TABLE position is set using KINEMATIC_GROUP.

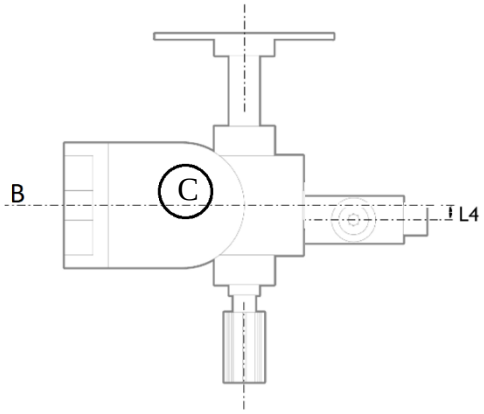
Offset		
0	X axis encoder edges / mm	
1	Y axis encoder edges / mm	
2	Z axis encoder edges / mm	
3	Encoder edges/radian Z rotation	C axis
4	Encoder edges/radian Y rotation	B axis
5	Distance from C to B in X direction (mm)	L1
6	Distance from C to TCP in Y direction (mm)	L2
7	Distance from B to TCP in Z direction (mm)	L3
8	Distance from B to TCP in X direction (mm)	L4
9	Angle from C to B (radians)	F

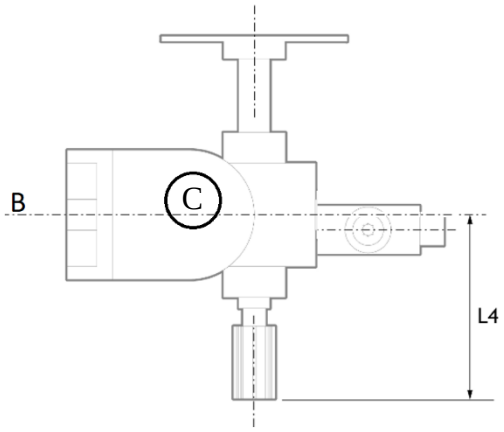
The selection of the different tools has to be done in frame = 0 due to the intrinsic relation between the offsets and rotation axis.

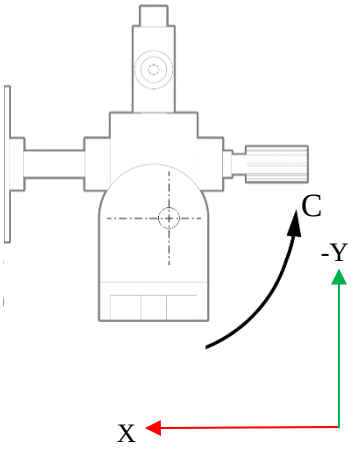
Some tools could have a negative value in Z or rotate 180 degrees and then set DEFPOS(0) for that axis.

For example, L3 is the length of the tool in Z. It could be -L3 following the drawing below, or a positive Z if we rotate 180 degrees the tool and a 0 as defined position.



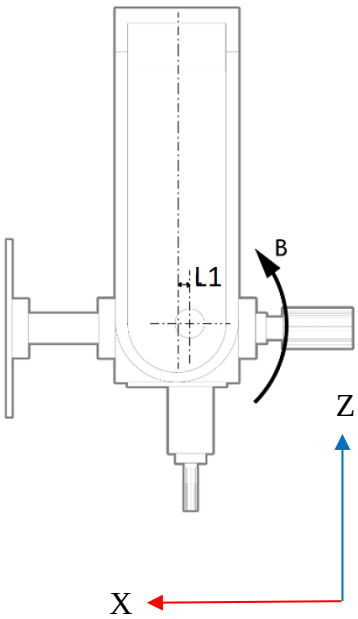






Both wrist axes MUST be datumed to the correct zero position for the FRAME 33 transformation to operate. The zero position of the XYZ axes is not used by the transformation.

The zero position on the C axis (rotation about Z) is when the offset arm is in line with the Z axis and L2 is in line with -Y.

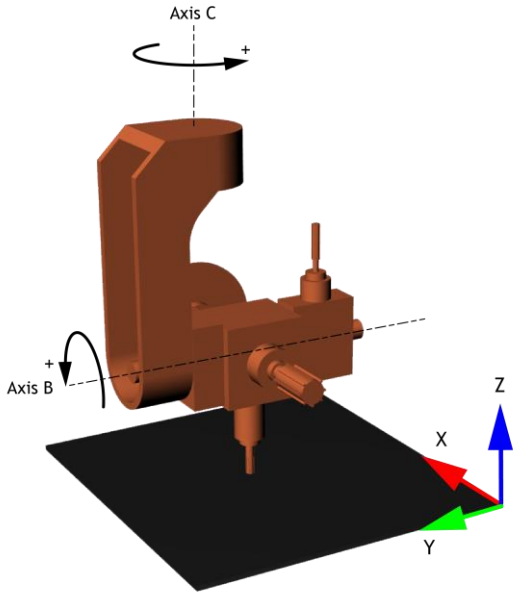


The zero position on the B axis (rotation about Y) is when L3 is the "straight down" position shown in the diagram.

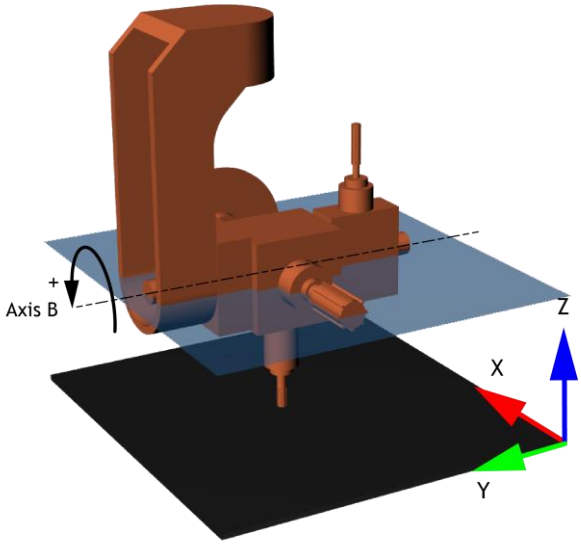
L1 is the offset distance between C axis and B axis.

4.1. Zero position of rotation axes B and C

The following picture represents the zero position of the rotation axes B and C:



Axis B will be at zero when it is parallel to the plane XY:



Axis C will be at zero when it is parallel to the plane ZY: