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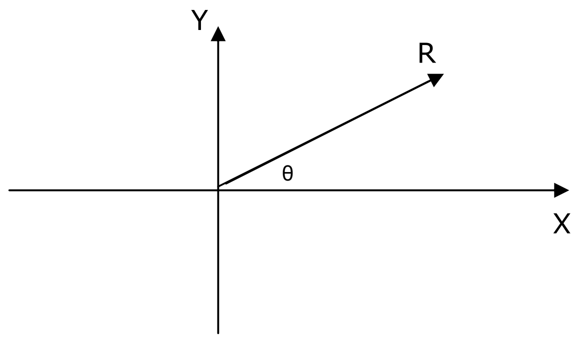
Subject: **Guide to using Frame Transform #10**

Application Note

FRAME Transform #10

Cartesian to polar transformation.

This FRAME transformation allows takes X and Y Cartesian coordinates and produces the equivalent R and θ polar values. All interpolated and single axis moves passed to axes 0 and 1 are followed by those 2 axes working in the polar domain.

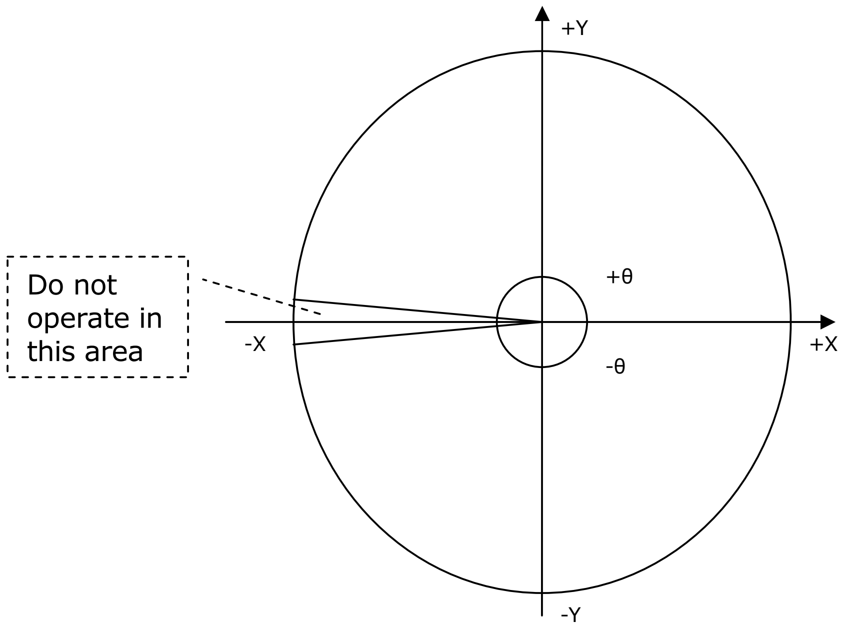


Axis 0 controls movement along the radius.

Axis 1 controls the angle theta. Axis 1 positions are held internally as integers and the axis is calibrated by entering the number of counts per radian into TABLE point 0.

Operating Envelope:
This FRAME is configured so that 0° is along the X axis and the angle θ increases +ve in the anti-clockwise direction. Operation is possible over approximately 358° of travel, from +179° to -179°.

Example transformed points				
X	Y	R	θ	(Deg.)
1000	0	1000	0	0
1000	1000	1414	Π/4	45
1000	-1000	1414	-Π/4	-45
0	-1000	1000	-Π/2	-90



Note:

Take care when executing moves that go close to the origin. (see small circle above) Moves that travel through the origin will require infinite speed and acceleration. This is usually not possible to achieve and the axes will trip out due to excessive following error.

Units Example:

Suppose an Rθ system has 400 edges/mm from the encoder system of axis 0. (the linear axis) Also, there are 160000 edges per revolution on axis 1. (the rotary axis) It is desired to program the axis in mm using X Y coordinates.

When using frame 10 there will be 160000/(2*PI) edges/radian. This value must be set in TABLE(0)

```
TABLE(0, 25464.79)
```

In FRAME=10 the units of both axes 0 and 1 can be set to the linear axis' units:

```
UNITS AXIS(0)=400
UNITS AXIS(1)=400
```

Note that this will affect the value of angle seen in MPOS AXIS(1). This will not represent angle in either radians or degrees, but if required, the angle in radians can be determined according to:

```
Angle = MPOS AXIS(1) * 400 / TABLE(0)
```

Both axes should first be homed with FRAME=0, then moved to a suitable start position. When the FRAME=10 command is run, the DPOS values for axes 0 and 1 will change to their corresponding X and Y values.

```
x_axis = 0
y_axis = 1
TABLE(0,25464.79)

FRAME=0
WA(10)

BASE(0)
UNITS=1
DATUM_IN=1
DATUM(3) ‘ home the linear axis
WAIT IDLE
BASE(1)
UNITS=1
DATUM_IN=6
DATUM(5) ‘ home the rotary axis (on to sensor and then Z)
WAIT IDLE

BASE(0)
MOVEABS(4000,20000) ‘ move to starting position
WAIT IDLE

FRAME = 10

UNITS AXIS(x_axis)=400
UNITS AXIS(y_axis)=400
‘ All moves can now be made in mm; X/Y coordinates.
```

Setting Absolute Positions:

The transformation mathematics assume that position (0,0) is the centre of the R-Theta system.

Note that the output of the transformation is in the axis parameter TRANS_DPOS. E.g.:

PRINT TRANS_DPOS AXIS(0)
PRINT TRANS_DPOS AXIS(1)