

Set-Up of Kohzu Motion Stages at Beamline 27-ID

Under construction, last updated 08/13/2016, tg

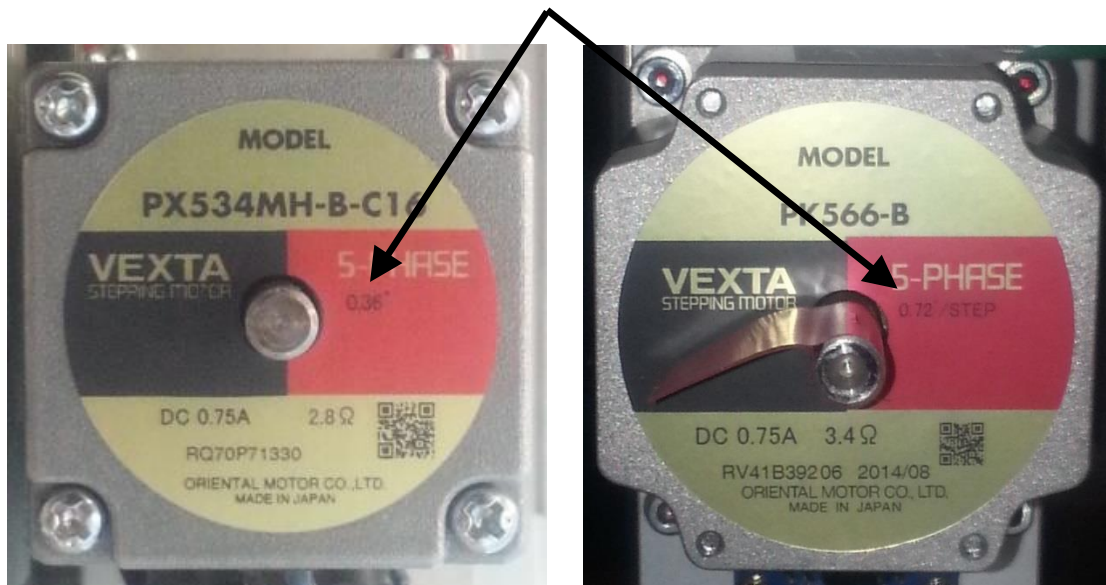
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0 EPICS Setup of Kohzu Stages

1 Determine type of motor / Full Step Angle

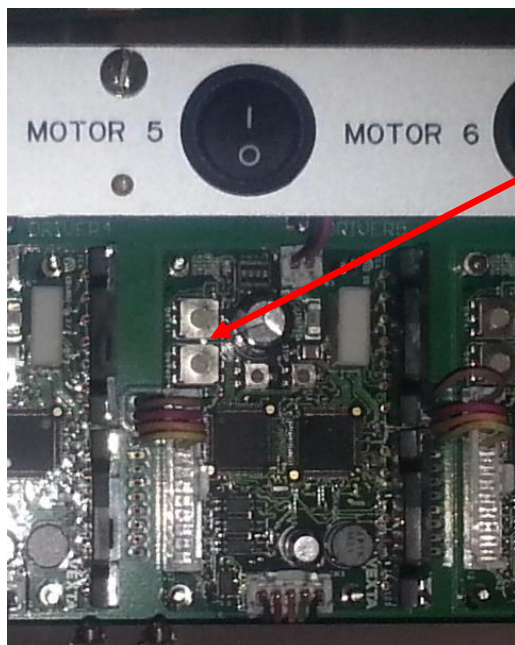
Full step angle can be found on motor label



Larger motors are typically 0.72°/step, smaller motors are typically 0.36°/step

2 Choose level of micro-stepping and set DATA1/DATA2 switches on drivers accordingly

(see figure and table below, (Resolution and Step Angle calculated for a 0.72° motor))



		R1	
DATA1 DATA2	Microsteps/ Step 1	Resolution 1	Step Angle 1
0	1	500	0.72°
1	2	1000	0.36°
2	2.5	1250	0.288°
3	4	2000	0.18°
4	5	2500	0.144°
5	8	4000	0.09°
6	10	5000	0.072°
7	20	10000	0.036°
8	25	12500	0.0288°
9	40	20000	0.018°
A	50	25000	0.0144°
B	80	40000	0.009°
C	100	50000	0.0072°
D	125	62500	0.00576°
E	200	100000	0.0036°
F	250	125000	0.00288°

Determine

Step Angle = Full Step Angle / Microsteps and

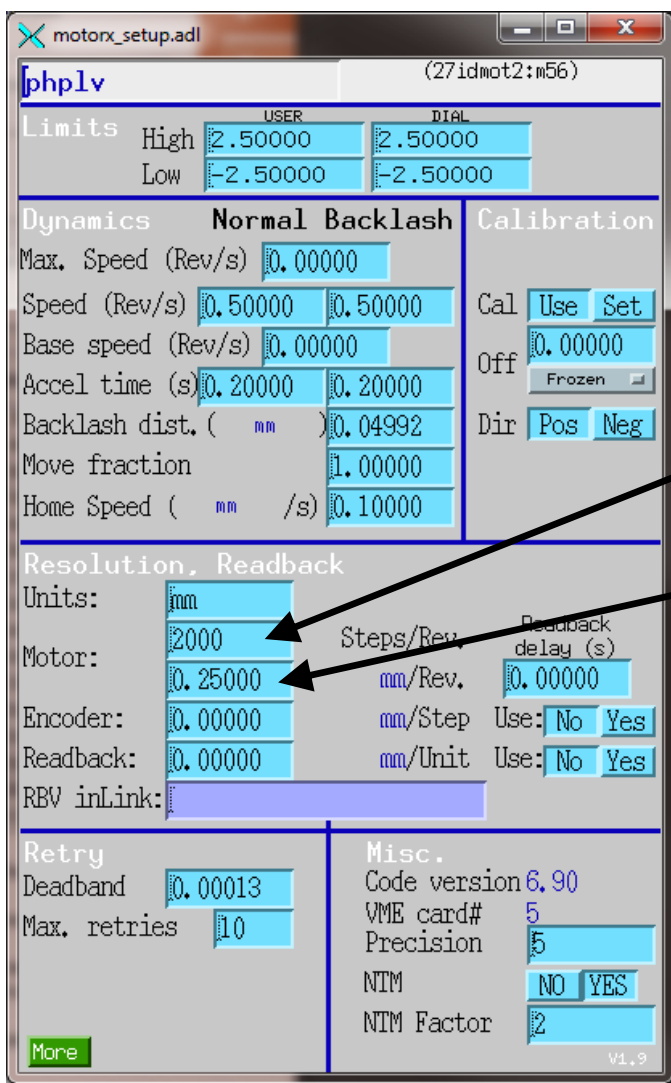
Resolution = 360° / Step Angle

Enter **Resolution** in the “Steps/Rev”-field of the EPICS setup screen (see below)

3 **Determine “Travel” of stage**

“Travel” is the distance travelled by the stage for one revolution of the motor shaft and can be found in the sections below.

Travel is entered in the “Units/rev”-field of the EPICS setup screen (see below)



Resolution goes here

Travel goes here

1 Kohzu Vertical Stages

1.1 ZA10A-W2C (Vertical, Table Size 100 × 100 mm²)

Motion Range: ±2.5 mm
 Lead Screw Pitch: 1 mm / rev
 Travel: 0.25 mm / rev (1:4 wedge)
 Home Position: End of wedge is about 3mm inside of end of base plate opposite to motor
 Motor Settings:

	DATA1 DATA2	Angle on Motor / Step	Steps / Motor Rev	Vertical Motion / Step
Full Step	0	0.36°	1000	0.25 μm
Half Step	1	0.18°	2000	0.125 μm
Micro Step (1/20)	7	0.018°	20000	0.0125 μm

Sample EPICS Motor Setup

Half Step (DATA1/DATA2: 1)

The screenshot shows the 'motorx_setup.adl' window with the following configuration:

- Limits:** High USER: 2.50000, DIAL: 2.50000; Low USER: -2.50000, DIAL: -2.50000
- Dynamics:** Max. Speed (Rev/s): 0.00000; Speed (Rev/s): 0.50000; Base speed (Rev/s): 0.00000; Accel time (s): 0.20000; Backlash dist. (mm): 0.04992; Move fraction: 1.00000; Home Speed (mm/s): 0.10000
- Normal Backlash:** (tab selected)
- Calibration:** Cal: Use Set; Off: 0.00000; Dir: Pos Neg
- Resolution, Readback:** Units: mm; Motor: 2000 Steps/Rev., 0.25000 mm/Rev., Readback delay (s): 0.00000; Encoder: 0.00000 mm/Step, Use: No Yes; Readback: 0.00000 mm/Unit, Use: No Yes; RBV inLink: []
- Retry:** Deadband: 0.00013; Max. retries: 10
- Misc.:** Code version: 6.90; VME card#: 5; Precision: 5; NTM: NO YES; NTM Factor: 2

A 'More' button is visible at the bottom left, and the version 'V1.9' is at the bottom right.

1.2 ZA16A-W2C (Vertical, Table Size 160 × 160 mm²)

Motion Range: ±8.0 mm

Lead Screw Pitch: 1 mm / rev

Vertical Travel: 0.25 mm / rev (1:4 wedge)

Home Position: End of wedge is about 3mm inside of end of base plate opposite to motor

Motor Settings:

	DATA1 DATA2	Angle on Motor / Step	Steps / Motor Rev	Vertical Motion / Step
Full Step	0	0.72°	500	0.5 μm
Half Step	1	0.36°	1000	0.25 μm
Micro Step (1/20)	7	0.036°	10000	0.025 μm

Sample EPICS Motor Setup

Half Step (DATA1/DATA2: 1)

2 Kohzu Linear Stages

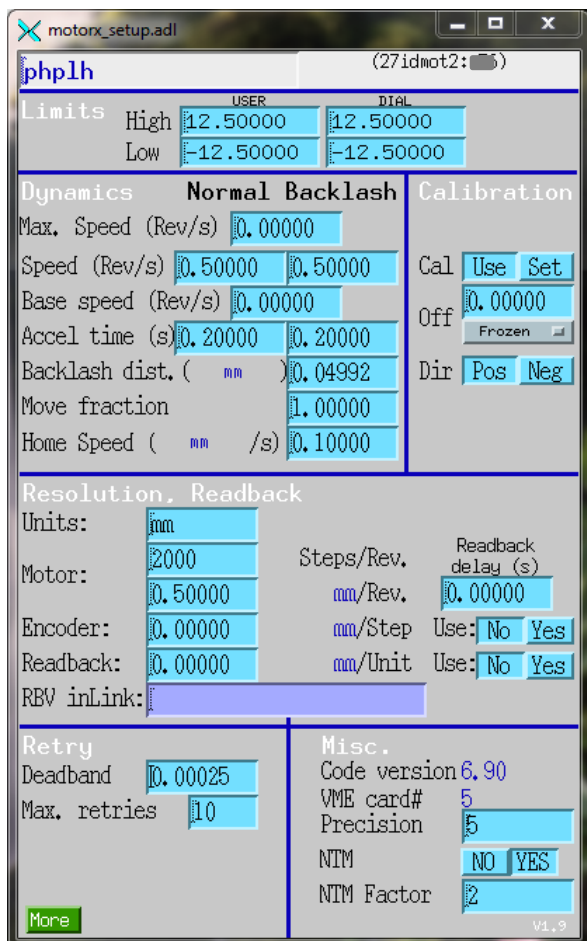
2.1 XA10A-R1 (Linear, Table Size 100 × 100 mm²)

Motion Range: ±12.5 mm
Lead Screw Pitch: 0.5 mm / rev
Travel: 0.5 mm / rev
Home Position: End of carriage is aligned with end of base plate opposite to motor
Motor Settings:

	DATA1 DATA2	Angle on Motor / Step	Steps / Motor Rev	Horizontal Motion / Step
Full Step	0	0.36°	1000	0.5 μm
Half Step	1	0.18°	2000	0.25 μm
Micro Step (1/20)	7	0.018°	20000	0.025 μm

Sample EPICS Motor Setup

Half Step (DATA1/DATA2: 1)



2.1 XA16A-R1 (Linear, Table Size 160 × 124 mm²)

Motion Range: ±25 mm
 Lead Screw Pitch: 1.0 mm / rev
 Motor Full Step: 0.72°/step, 500 steps/rev (DATA1/DATA2 switch on driver: 0)
 Motor Half Step: 0.36°/step, 1000 steps/rev (DATA1/DATA2 switch on driver: 1)
 Travel: 1.0 mm / rev
 Motor Settings:

	DATA1 DATA2	Angle on Motor / Step	Steps / Motor Rev	Horizontal Motion / Step
Full Step	0	0.72°	500	2.0 μm
Half Step	1	0.36°	1000	1.0 μm
Micro Step (1/20)	7	0.036°	10000	0.1 μm

3 Kohzu Rotation Stages

3.1 RA05A-W (Rotation, Table Size \varnothing 49 mm)

Motion Range: +174°, -84°

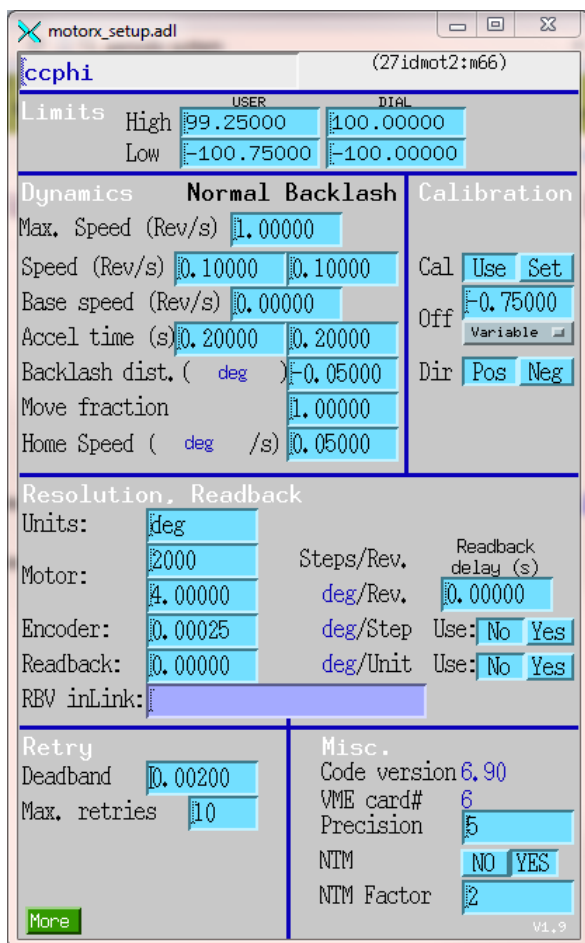
Travel: 4° / motor rev

Motor Settings:

	DATA1 DATA2	Angle on Motor / Step	Steps / Motor Rev	Angle on Table / Step
Full Step	0	0.36°	1000	0.004° / 69.8 μ rad
Half Step	1	0.18°	2000	0.002° / 34.9 μ rad
Micro Step (1/20)	7	0.018°	20000	0.0002° / 3.49 μ rad

Sample EPICS Motor Setup

Half Step (DATA1/DATA2: 1)



4 Kohzu Swivel (Tilt) Stages

4.1 SA05B-RL (Cross-Arc Swivel, Table Size 50 × 50 mm²)

The SA05B-RL cross arc stage consists of two separate swivel stages of type SA05B-**RM** on the top and SA05B-**RB** on the bottom

Motion Ranges: SA05B-**RM**: ±8° SA05B-**RB**: ±10°

Travel: SA05B-**RM**: 1.2° / rev SA05B-**RB**: 0.96° / motor rev

Motor:

	DATA1 DATA2	Motor- Angle / Step	Steps / Motor Rev	SA05B- RM Angle / Step	SA05B- RB Angle / Step
Full Step	0	0.36°	1000	0.0012° / 20.9 μrad	0.00096° / 16.8 μrad
Half Step	1	0.18°	2000	0.0006° / 10.4 μrad	0.00048° / 8.38 μrad
Micro Step (1/20)	7	0.018°	20000	0.00006° / 1.05 μrad	0.000048° / 0.84 μrad

Sample EPICS Motor Setup

Half Step (DATA1/DATA2: 1)

motorx_setup.adl (27idmot2:m59)

montelchi

Limits High: USER 100.00000, DIAL 100.00000
Low: USER -100.00000, DIAL -100.00000

Dynamics Normal Backlash Calibration
Max. Speed (Rev/s) 1.00000
Speed (Rev/s) 1.00000 1.00000 Cal Use Set
Base speed (Rev/s) 0.00000 Off 0.00000
Accel time (s) 0.20000 0.20000
Backlash dist. (deg) 0.04980 Dir Pos Neg
Move fraction 1.00000
Home Speed (deg /s) 0.05000

Resolution, Readback
Units: deg
Motor: 2000 Steps/Rev. Readback delay (s) 0.00000
Encoder: 1.20000 deg/Rev. Use: No Yes
Readback: 0.00000 deg/Step Use: No Yes
Readback: 0.00000 deg/Unit Use: No Yes
RBV inLink:

Retry Misc.
Deadband 0.00060 Code version 6.90
Max. retries 10 VME card# 5
Precision 5
NTM NO YES
NTM Factor 2

More V1.9

motorx_setup.adl (27idmot2:m60)

montelth

Limits High: USER 99.76144, DIAL 100.00000
Low: USER -100.23856, DIAL -100.00000

Dynamics Normal Backlash Calibration
Max. Speed (Rev/s) 1.00000
Speed (Rev/s) 1.00000 1.00000 Cal Use Set
Base speed (Rev/s) 0.00000 Off -0.23856
Accel time (s) 0.20000 0.20000
Backlash dist. (deg) 0.04992 Dir Pos Neg
Move fraction 1.00000
Home Speed (deg /s) 0.05000

Resolution, Readback
Units: deg
Motor: 2000 Steps/Rev. Readback delay (s) 0.00000
Encoder: 0.96000 deg/Rev. Use: No Yes
Readback: 0.00000 deg/Step Use: No Yes
Readback: 0.00000 deg/Unit Use: No Yes
RBV inLink:

Retry Misc.
Deadband 0.00048 Code version 6.90
Max. retries 10 VME card# 5
Precision 5
NTM NO YES
NTM Factor 2

More V1.9

4.2 SA16A-RS (Cross-Arc Swivel, Table Size $160 \times 160 \text{ mm}^2$)

The SA16A-RS cross arc stage consists of two separate swivel stages of type SA16A-RT on the top and SA16A-RM on the bottom

Motion Ranges: SA16A-RT: $\pm 10^\circ$ SA16A-RM: $\pm 10^\circ$

Travel: SA16A-RT: $0.706^\circ / \text{rev}$ SA16A-RM: $0.6^\circ / \text{motor rev}$

Motor:

	DATA1 DATA2	Motor Step Angle	Steps / Motor Rev	SA16A-RT Resolution	SA16A-RM Resolution
Full Step	0	0.72°	500	$0.001412^\circ / 24.6 \mu\text{rad}$	$0.0012^\circ / 20.9 \mu\text{rad}$
Half Step	1	0.36°	1000	$0.000706^\circ / 12.3 \mu\text{rad}$	$0.0006^\circ / 10.4 \mu\text{rad}$
Micro Step (1/20)	7	0.036°	10000	$0.0000706^\circ / 1.23 \mu\text{rad}$	$0.00006^\circ / 1.05 \mu\text{rad}$

Sample EPICS Motor Setup

Half Step (DATA1/DATA2: 1)

5 Appendix