INTELLIGENT DRIVE SYSTEM - EXTERNAL ENCODERS ONCE OFF CALIBRATIONS Issue 1

RA MOTOR DRIVE RATE (DO FIRST)

The adjustment of the RA Drive Rate requires attaching the Intelligent Handset to the Microstep Drivebox by the standard RJ45 network cable.

Select a star or a planet (not the Moon) approx 45 degrees altitude in the southerly direction, centre on an illuminated cross hair eyepiece working at high power. You need to know the field of view in order to estimate the amount of drift over a known period of time.

If in ten minutes (600 seconds) the star has drifted by 20 arc seconds then the rate is out as follows:

600 seconds is 900 arc seconds and 20 arc second drift is 2.22% (20/900).

This percentage is the amount the FACTORY – USTEP - RA – RATIO has to be adjusted. If the telescope is running SLOW then the RATIO increases to increase the drive rate.

Using a planet is useful as you know the angular diameter of it.

The FACTORY mode in the IH is accessed by powering up with the 'M' key pressed or using the REBOOT option in INFO (or STATUS) screen with the 'M' key also pressed.

The RATIO is entered using the numeric keypad followed by 'E' for Enter.

The initial value of RATIO is a calculable value

= RA worm reduction * Gearbox ratio * 200 steps per rev of the motor.

and the IH automatically calculates the best rate (refraction corrected Sidereal) unless the polar axis is pointed to the refraction corrected pole, when you want Sidereal rate and so it needs altering.

Once you are happy with the drive rate jot down the value of RATIO and DIR for RA.

DEC MOTOR DRIVE RATE (DO SECOND)

Getting this right allows the telescope to move at a known arcsec per second when tracking is required. This illustrates the alternative way to calibrate this axis. Both RA and DEC can be done through the DEC axis input as the motors connectors are the same for both as fitted on the drivebox. Connect the axis to the DEC motor output. The IH will also read the DEC coordinate if the IH is plugged directly into the drivebox. If you drive the telescope through a known angle using the DEC button, then the amount the telescope moves should match the amount the DEC coordinate has moved. If they do not match then alter the DEC value for RATIO. Typically on smaller mounts you can rotate the axis through 360 degrees. This is the best way to do it.

Once you have the correct value for RATIO, transfer it to the RA if you have done the RA motor.

Finally check and adjust the motor sense direction with the DIR calibration.

ENCODER CALIBRATION

Each encoder needs the correct value for ERATIO. The value represents the number of encoder counts in a full circle. The encoders have 2048 counts per rev and the Quad decoder box provides x2 (it could be x4 with different software). The other variable is the mechanical gear ratio attached to each shaft. The exact numbered entered will be on the Factory Test sheet.

If the coordinate frame does not match when the telescope is moved over large distances then the values for ERATIO need to be altered. They are in menu FACTORY – USTEP - RA – ERATIO and similarly for DEC. You again need a high power cross hair eyepiece to get best accuracy in the measurements of the stars.

The IH should be plugged into the Quad Decoder box for this exercise.

RA is not easy but it should be done first. To stop the biased sidereal motion affecting the result, the RA encoder wire should be plugged into the DEC axis. This is by unplugging the Encoder wire into the DEC axis input of the Quad Decoder Box. Then the telescope must be moved between two known stars.

Star1 in East at Time1 with DEC display reading Position1.

Star2 in West at Time2 with DEC display reading Position2.

Distance moved by telescope = RA of STAR1 – RA of STAR2 + time difference between the two readings. Convert this to degrees.

Distance moved by IH is Position2 – Position1

These should match when in the same coordinate frame.

If exactly 6 hours difference for distance moved by telescope then this is 6*15 or 90 degrees.

If the coordinate frame only moved by 89 degrees then ERATIO (DEC) is out by 1.11%. You may have to experiment with a higher or lower value to ERATIO.

Check it. By moving the telescope again and re-measuring.

Once you have determined ERATIO for DEC using the RA axis as above then transfer this value to RA – ERATIO. Then swap the leads back on the Quad decoder back so the RA encoder goes to the RA Input.

Repeat for DEC using the DEC encoder lead plugged into the DEC Input of the Quad decoder box. Select two stars of known position and the DEC difference should be reflected in the coordinate change between the two positions. If the stars are 90 degrees apart and yet the IH DEC coordinate has only changed by 89 degrees then it is out 1 in 90 or 1.11% and this is the percentage to change ERATIO by. You may have to experiment with a higher value or a lower value.

Check it. By moving the telescope again and re-measuring.

Finally when everything appears happy try a GOTO. Sync on the first object, GOTO a second object of either entered coordinates in the IH or on the computer by point and click and SLEW button pressed, use the bars box, and check that the second star appears at the correct coordinates when it is centred.

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