

Chapter 3. Closed Loop Operation (Encoder Operation)

3.1. Encoder Operation

The IFX indexer drive is capable of interfacing with an optical encoder. Dual channel, incremental encoders with quadrature and with single-ended or differential TTL outputs may be used. The encoder may be used as a means of creating a closed-loop system or as an independent means of verifying position. The functions that are added when an encoder is used are as follows:

- A. Encoder referenced positioning
- B. Encoder position servoing
- C. Motor Stall detection
- D. Higher accuracy homing function
- E. Multi Axis stop

3.2. Hardware Installation

To implement the closed loop functions, it is necessary to connect an incremental optical encoder to the IFX. Encoder outputs must be 3-5 VDC, square wave, and TTL compatible. When encoders with single ended outputs are used, the unused Channel A-, B- and Z- are left unconnected.

Encoder connections are made on screw terminal connector as shown in Table 1-2. It is important to connect the encoder shield to enhance noise immunity.

3.3. Selecting Encoder Resolution Values

The number of encoder steps seen by the IFX is equal to four times the number of encoder "lines". For example, a 1000 line encoder mounted directly on the motor will generate 4000 encoder steps for each revolution of the motor shaft. A minimum of two motor steps per encoder step is required for successful operation of the Position Maintenance function. Ratios above three motor steps per encoder step insure stability of the Position Maintenance servo function. Positional resolution is determined by encoder resolution.

If a reducer is introduced between the motor shaft and the encoder, the number of encoder steps must be divided by the equivalent gear ratio to define the number of encoder steps received by the indexer. For example, using a 25,000-step/rev motor, a 1000 line encoder, and a 10:1 reducer, the ratio of motor revolutions to encoder steps would be changed as shown below:

Note: Set device address to 1.

The encoder resolution setting may be tested using interface commands. The idea is to move the motor open loop and verify that the number of feedback encoder counts meet with expectation.

Step 1 - "FR" status request to verify that all encoder functions are off for the test axis. The response should be: "00000000".

Set the internal position to zero: "PZ". Have the motor move one revolution. For a 25,000 step/rev motor: "MN A1 V2 D25000 G". Then report the encoder position: "FSB1 1PX".

Step 2 - Repeat the test to insure that the backlash or motor windup are not interfering with the test. The resulting encoder position report should yield a number very close to the parameter to be supplied with the ER command.

If the encoder position report is negative, encoder channels A and B are reversed! This can be corrected or by changing Encoder channel A+ with A-. If the encoder being used does not have complementary outputs, swap channel A with channel B.

Once the encoder resolution is set, it should be safe to enable Encoder Step Mode and Position Maintenance, and all other encoder functions except Stop on Stall. Verify proper operation of the Go Home function before enabling Stop on Stall.

3.4.2. Testing The Stop On Stall Function

The Stop on Stall function is dependent on the setting for Backlash to give optimum operation, as is the Position Loss Detection function. The factory default setting for this parameter is 1 motor revolution, a fairly large value. If the encoder is mounted on the motor, this parameter should be set to zero for the most timely response.

The actual backlash may be measured using interface commands. The idea is to move in one direction, stop, and make a series of one step moves in the opposite direction. No change in encoder position will occur while the Backlash is being taken up. The number of motor steps counted before any encoder counts are received is the measure of the backlash.

Move the motor in one direction, clear position counters:

"MN A10 V1 D-1000 G FSBO PZ "

Execute a series of one step moves and report both motor and encoder position each time:

"D1 PS L G 1PR T.2 1PX T.5 N C "

This command sequence will move one step, report both motor and encoder position, wait a half second and repeat. The "PS" command allows entering the entire sequence before any motion occurs. The "U" command may be used to pause the execution, "S" to stop.