ENGINEERING PUBLICATION
MOTION CONTROL DIVISION

SUBJECT: HANDLING SIGMA FSP MULTI-TURN ROLLOVER

CATEGORY: TECHNICAL NOTE

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This document describes how to set up an absolute encoder to handle the multi-turn limit rollover position loss issue.

The rollover position loss can be noticed by monitoring the Position_Demand_Value variable in the FlexWorks Watch window. This variable can change values when control power is cycled if the motor has rolled over the multi-turn limit. The details below describe a method to handle this issue.

In This Example:

- Motor is a 65536 count encoder (per rev).
- User units are in Encoder Counts (Pn2B0 = 1, Pn2B1 = 0, Pn2B2 = 1, Pn2B3 = 0).
- For 1 rev of the master, the slave (motor connected to FSP) moves 20 revs.

Equipment

- A battery is needed in the system either on:
  - CN1 pin 22 (BAT-) and pin 21 (BAT+).
  - OR using the adapter cable: AFADABS-P2(A) [Battery is included] which connects to the feedback CN2.

Setting Up The Absolute Encoder

1. Set the amplifier is in absolute encoder mode (Pn002.2 = 0)
2. Cycle control power if a setting change was made.
3. Reset the multi-turn counter.
   - Use the "Absolute Encoder Setting" function from "Maintenance" menu, and follow the on-screen instructions.
   - OR see section 5.7.3. Absolute Encoder Setup of the Sigma FSP Amplifier User's Manual (YEA-SIA-FSP-3).
4. Cycle control power.

Setting Up The Application

1. Enable the SEN signal: Put +5 Volts on CN1 pin 4, and SG on CN1 pin 2. For additional details, see section 5.7.1. Interface Circuit of manual YEA-SIA-FSP-3.
2. Set the Sigma FSP's variable called "Rotation_Base" to 1310720 (this is 65536 enc cts. * 20 slave revs per master).
   - Set Pn2A0 = 0, (Rotation base low), and Pn2A1 = 20, (Rotation base high).

- OR use the FlexWorks Wizard on the page titled “Default Profile”, in the “Advanced Settings” options. Set “Rotation Base” to 1310720.

By setting these parameters, the Sigma FSP variable “Rotation_Demand_Position” will range from 0 to 1310719 (1310720 total user units).

3. Set the multi-turn limit
   - Set Pn205 = 399 (or some multiple of 20, then minus 1)
     - 20 is the number of Sigma FSP motor revs per 1 rev of the master.
4. Run Fn013 to store the value of Pn205 into PnF04 (both parameters are multi-turn limit settings)

Setup Verification

1. The motor is jogged at 4400 rpm for 12 sec (making 880 total revs).
2. Control power is cycled.
3. Using the Watch window in FlexWorks,
   - Rotation_Demand_Position remains at the value it was before the power cycle.
   - Position_Demand_Value does not remain at the value it was before the power cycle.

This shows that some position distance has been lost (Position_Demand_Value changed), but can be handled by using the Rotation_Demand_Position to maintain the correct position.

Application

- For any MOVE command, the distance must first be calculated by the MATH command, using the variable Rotation_Demand_Position.
- Do not use any of the GO commands.
- For serial data, Rotation_Demand_Position has variable ID 81 (dec).

The next page is an example of how to do a move using Rotation_Demand_Position.
This is for a different application, but the method of calculation should be similar to what should be used for any application that involves multi-turn limit rollover.

This example application allows the user to find the shortest route to the desired position in a circle, or other rotational system that uses Rotation_Base.

In this example, the Rotation_Base = 3600. The user units correspond to 0.1 degrees to model a circle.

The program starts with analog positioning using SLIDE_ANALOG.

The program waits for input 6 rising edge to start the movement to the desired position.

The default end position is 0 and it is set by Var_01.

Var_01 can be changed using inputs 0,1,2,3, each of them gives it a different value.

The program uses the values 0, 900, 1800, and 2700, but any value can be set.

The program will do the movement to the desired end position with the shortest route possible.

This program is titled:

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```
1  SET_VAR Interrupt_mask 15
2  SET_VAR Var_01 0
3  MATH Var_05 = Rotation_base / 2
4  MATH Var_06 = Var_05 * -1
5  CONTROL ON
6  LABEL 1
7  SLIDE_ANALOG
8  WAIT_INPUT 6 = 0 -1
9  WAIT_INPUT 6 = 1 -1
10 STOP_EX Profile Servo ON
11 LABEL 20
12 MATH Var_10 = Var_01 - Rotation_demand_position
13 IF Var_10 > Var_05 THEN GO_TO 30
14 IF Var_10 < Var_06 THEN GO_TO 31
15 LABEL 19
16 MOVE_D Var_10 1000
17 DELAY 3000
18 GO_TO 1
19 LABEL 30
20 MATH Var_10 = Var_10 - Rotation_base
21 GO_TO 19
22 LABEL 31
23 MATH Var_10 = Var_10 + Rotation_base
24 GO_TO 19
25 EXT_INT 0 1 Rising
26 SET_VAR Var_01 900
27 INT_RETURN -1
28 EXT_INT 1 2 Rising
29 SET_VAR Var_01 1800
30 INT_RETURN -1
31 EXT_INT 2 3 Rising
32 SET_VAR Var_01 2700
33 INT_RETURN -1
34 EXT_INT 3 4 Rising
35 SET_VAR Var_01 0
36 INT_RETURN -1
37
```

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