Configuring TwinCAT 3
For use with the Class 6 EtherCAT SmartMotor™

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Configuring TwinCAT 3 for use with the Class 6 EtherCAT SmartMotor™, Revised: 11/9/2016.

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NOTE: After this guide was ECN released, the Americas - East contact information was updated to the Murphy, NC, location on 1/15/2020.
Purpose

This document describes the connections, configuration and communication between a PC and Class 6 SmartMotor™ over EtherCAT using Beckhoff’s TwinCAT 3 software. It assumes the user has a basic understanding of both the SmartMotor Interface (SMI™) software from Moog Animatics and the TwinCAT 3 software from Beckhoff.

Additional Resources

The following are additional resources that you may find helpful for this procedure:

- For more details on the SmartMotor and the SMI software, see the *Class 6 SmartMotor User’s Guide*. The latest version of the SMI software can be downloaded from the Moog Animatics website at:
  http://www.animatics.com/support/download-center.html
- For more details on the SmartMotor implementation of the EtherCAT protocol, see the *Class 6 SmartMotor EtherCAT Guide*.
- For more details on the TwinCAT software, see the Beckhoff website at:
  http://www.beckhoff.com

Equipment Required

You will need the following equipment for this procedure:

**HARDWARE**

- Class 6 EtherCAT SmartMotor
- Moog Animatics 24 VDC power supply or equivalent for motor control power
- Moog Animatics 24-48 VDC power supply or equivalent for motor drive power
- Moog Animatics RS-485 or micro-USB communications cable or equivalent
- Moog Animatics Industrial Ethernet (IE) cable or equivalent
- Microsoft® Windows® based PC

**SOFTWARE**

- TwinCAT 3 software
- Moog Animatics SMI software
- Moog Animatics EtherCAT device description XML file
Connections to the SmartMotor

The following figure illustrates the connectors and pinouts available on the Class 6 SmartMotor. For Status LED (LEDs 0-5) information, see the Class 6 SmartMotor EtherCAT Guide.

**CAUTION:** When daisy-chaining SmartMotors for an EtherCAT network, you must connect the OUT port (right-hand port) of the upstream motor to the IN port (left-hand port) of the downstream motor.

The following figure illustrates a typical setup with one SmartMotor. In this setup, an I/O test box is used to satisfy the Drive Enable and Hardware Limit inputs of the motor for operation over EtherCAT using the CiA 402 Motion Profile.

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To configure your SmartMotor and TwinCAT system, refer to the configuration procedure in the following section.
Configuration Procedure

The following steps describe the SmartMotor and TwinCAT configuration procedure.

1. To configure the motor for Profile velocity mode, you must first satisfy the Drive Enable and Hardware Limit I/O with one of the following methods:
   a. Connect normally closed limit switches to the appropriate pins and driving the inputs to 24V.
   b. Disabling the limit switches in software by issuing “EIGN(W,0) ZS” commands to the motors; this can be done either through a user program or with SMI after each time the motor is power cycled.

2. Now you can verify the motor status through SMI. This motor has been powered up with 24 volts for both control and servo power.
3. Copy V16 of the Moog Animatics Device Description XML file into the TwinCAT directory. In this case, “SM6_0_EEC_D402P01_6v17.xml” would be copied. For a default TwinCAT installation, the folder name would be ‘C:\TwinCAT\3.1\Config\Io\EtherCAT’.

4. Start the TwinCAT System Manager.
5. In the TwinCAT System Manager, start a new project. From the TwinCAT menu bar, select File > New Project.
6. Place TwinCAT 3 into Config Mode by selecting the Restart TwinCAT (Config Mode) icon.

7. After Config Mode is set, then Scan for devices by selecting the I/O > Devices > Scan function.
a. When prompted to “Scan for boxes”, select Yes

b. When prompted to “Append linked axis to NC-Configuration”, select Yes.

c. When prompted to “Activate Free Run”, select Yes.

8. Under the settings for the discovered axis, change the units from mm to degree.

9. Select the Enc (Encoder) and then the Parameters tab, and change the Scaling Factor numerator.
and denominator to 360 and 4000, respectively.

10. Select Drive and the Parameter tab, and then set the Output Scaling Factor (Velocity) to 512.

11. Activate the configuration by selecting that icon from the tool bar.
12. When prompted to Restart TwinCAT System in Run Mode, select OK

![Restart TwinCAT System in Run Mode](image)

13. In the Device (EtherCAT) - Drive category, select the CoE-Online tab and then double-click on Index 6060 Modes of operation.

![Device (EtherCAT) - Drive](image)

The Set Value Dialog opens. Set the value to 3, then press OK to store the setting.

![Set Value Dialog](image)

14. Under the Drive control tabs of NC: Online and NC: Functions, you can now control the motor in velocity mode.

Make sure the Controller is enabled, and the status is ready.
The NC-Functions tab will let you drive the motor in velocity mode.
15. In the SMI software, you can verify settings that were transmitted through EtherCAT. To open the Motor View tool, select Tools > Motor View from the SMI menu, and then click the Calculations tab to view the Input values.

**NOTE:** The VT value is not equal to the TwinCAT setting due to the conversion of the scaling factors to common units.

16. The motor is now configured and ready for use with the TwinCAT software.
Document History

2013-07-07:
   1. Originated.

2013-07-30:
   2. Added notes for connecting more than one SmartMotor to EtherCAT.
   3. Denoted EtherCAT IN and OUT port to Appendix A figure.
   4. Further LED definitions in Appendix A.

2015-06-12:
   5. Added Additional Resources section.
   6. Added Connection to SmartMotor graphic.
   7. Revised some screen shots for TwinCAT3 and to show the Class 6 motor.
   8. Revised text for TwinCAT3 and for clarity.
   9. Removed Appendix A and referred user to the EtherCAT Guide.

2016-09-22:
   10. Updated Moog Animatics XML file name and related screen shot.

2016-11-09:
   11. Updated Moog Animatics contact info on Copyright page.