POSITAL
FRABA

ABSOLUTE ROTARY ENCODER

OPTOCODE (OCD) CANOPEN

CANopen®

---APPLICATION NOTE---

OCD CANOPEN WITH SCHNEIDER TWIDO PLC

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OCD CANopen with Schneider Twido PLC

Main Features

- Compact and heavy-duty industrial designs
- Interface: CANopen / CAN
- Housing: 58 mm Ø
- Solid / hollow shaft: 6 or 10 mm Ø / 15 mm Ø
- Through hollow shaft: 12 mm Ø
- Max. 65536 steps per revolution (16 Bit)
- Max. 16384 revolutions (14 Bit)
- Velocity- and Acceleration- output
- LSS Services

Programmable Parameters

- Direction of rotation (complement)
- Resolution per revolution
- Total resolution
- Preset value
- Two limit switches and eight CAMs
- Baud rate and CAN-identifier
- Transmission modes: Polled mode, cyclic mode, sync mode

Mechanical Structure

- Aluminium flange and housing
- Stainless steel shaft
- Optional: Stainless steel flange/ housing
- Precision ball bearings with sealing or cover rings
- Code disc made of unbreakable and durable plastic

Electrical Features

- Temperature insensitive IR-opto-receiver-ASIC with integrated signal conditioning
- Connection cap: Status indication with two LEDs
- Highly integrated circuit in SMD-technology
- Polarity inversion protection
- Over-voltage-peak protection

OCD CANopen manual can be downloaded at:
http://www.posital.com/us/products/POSITAL/AbsoluteEncoders/AbsoluteEncoders_OCD_CANopen_base.html

For more information on **POSITAL**'s line of products visit our homepage:

www.posital.sg / www.posital.com / www.posital.eu

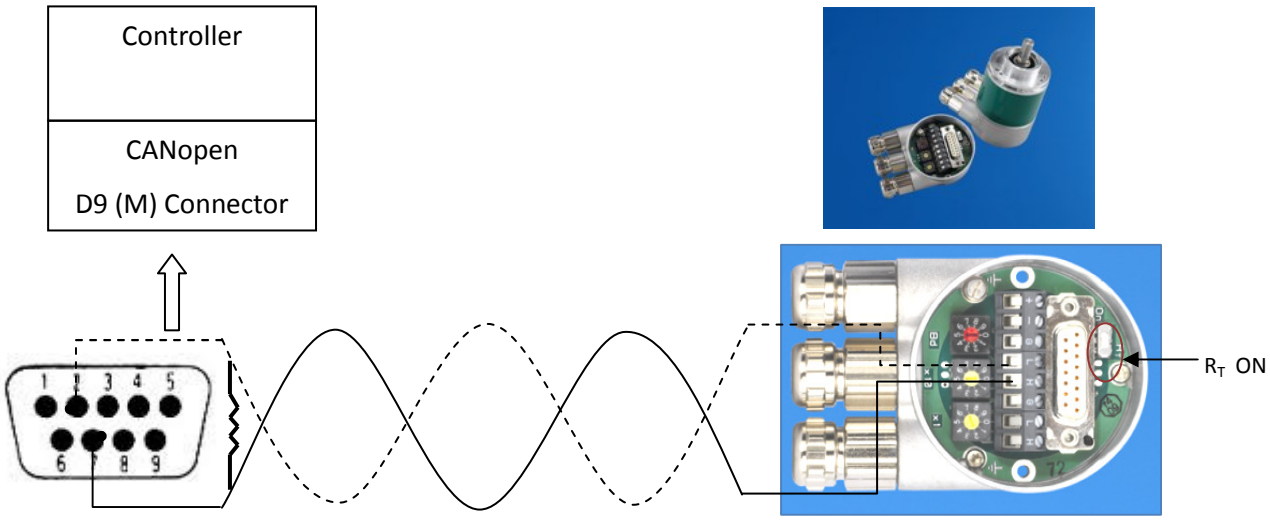
OCD CANopen with Schneider Twido PLC

1. INTRODUCTION

An OCD-CANopen 24-bit absolute, multiturn rotary encoder was connected to a Schneider-TWIDO programmable logic controller (PLC) through a CANopen communication interface. The step-by-step connection procedure and the working of encoder in a CAN bus are illustrated in the following sections.

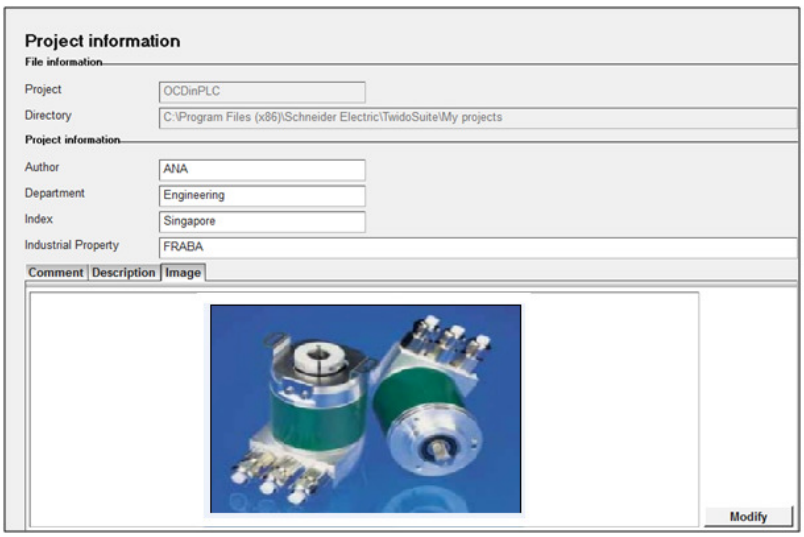
2. CONTROLLER NETWORK – SETUP AND INITIALISATION

- **HARDWARE**

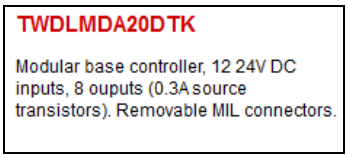


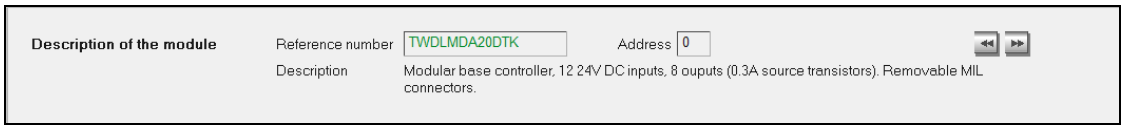
:CAN HIGH to Pin 7 **: CAN LOW to Pin 2** **: 120Ω Termination Resistor**

- **SOFTWARE PROJECT INFORMATION**

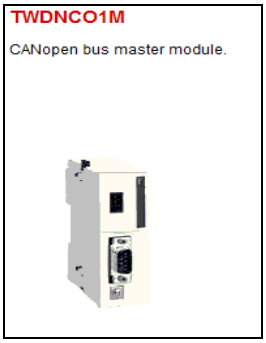


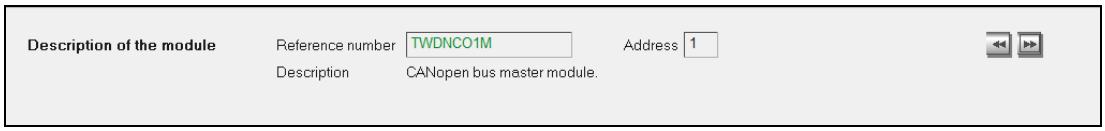
- **CONTROLLER DESCRIPTION**





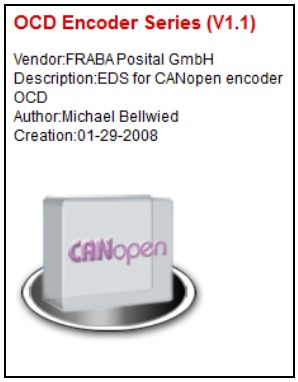
- **CANOPEN MASTER DESCRIPTION**



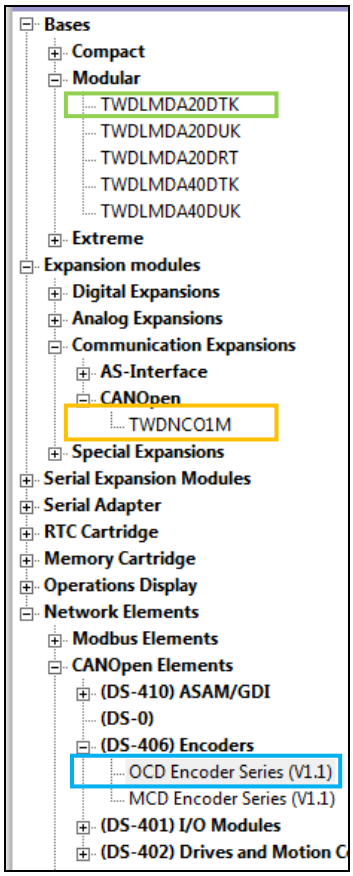


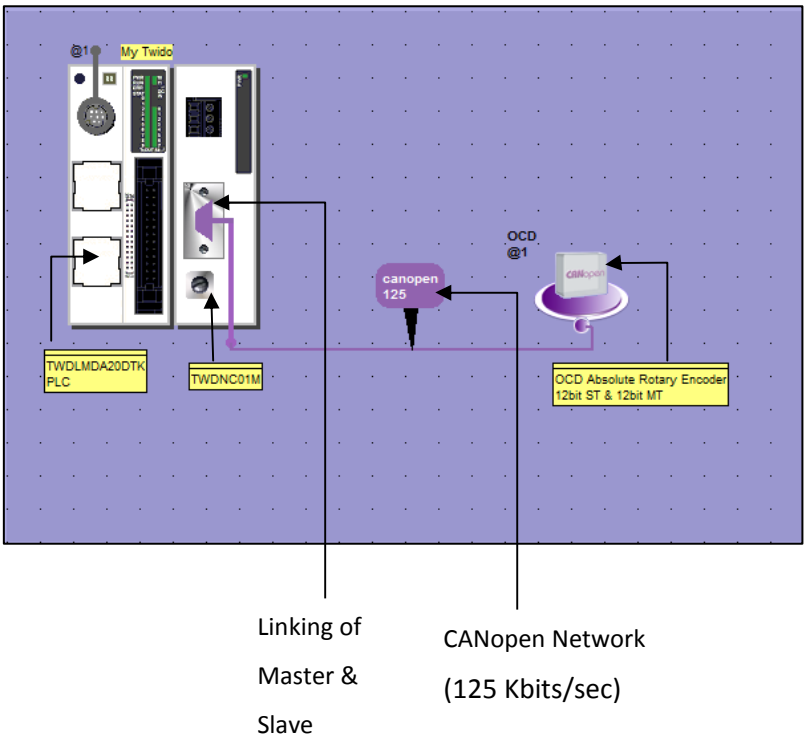
- **OCD ENCODER – ELECTRONIC DATA SHEET (EDS)**

The OCD EDS file, once uploaded will load all the objects including the PDOs to the controller. The Schneider system automatically identifies the PDOs and maps them on to the slave device.



- **CONNECTION NETWORK SETUP**





The above illustration shows the connection of elements in the CAN bus. At first, the CANOpen communication interface is connected to the main controller. Then the encoder is connected to the CANOpen communication interface.

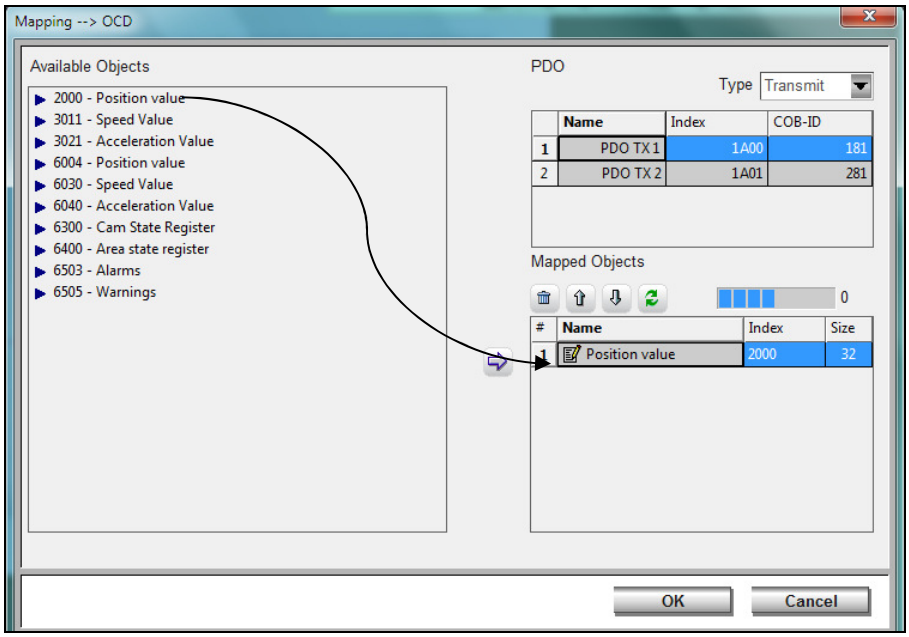
The next step after the setup of the network is the configuration of all the parameters and settings, to facilitate the communication between the master, slave and the controller.

3. CONFIGURATION

- **OCD PROCESS DATA OBJECTS (PDO) MAPPING**

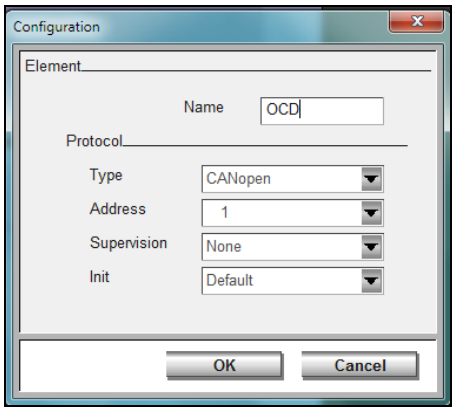
The list of all available objects is pre-programmed in the EDS file. Upon loading the EDS file, the PDOs can be accessed for configuration. Then, according to the need, the objects are mapped on to the Transmit-PDO's of the OCD.

In this case we will be loading the position values (Available in object 2000h) to the 1st transmit PDO, to read out the position values of the encoder through the PLC.



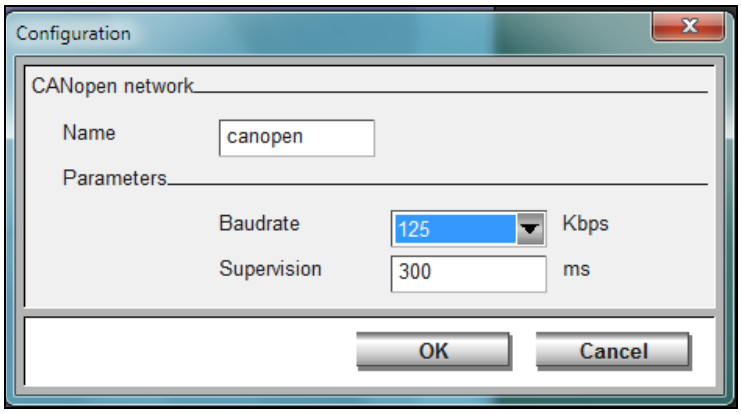
- **OCD CANOPEN NODE CONFIGURATION**

The baud rate is adjusted to 125 Kbaud and node number to 1 using the switches in the connection cap. Then the PLC's connection to the node (OCD) is configured.



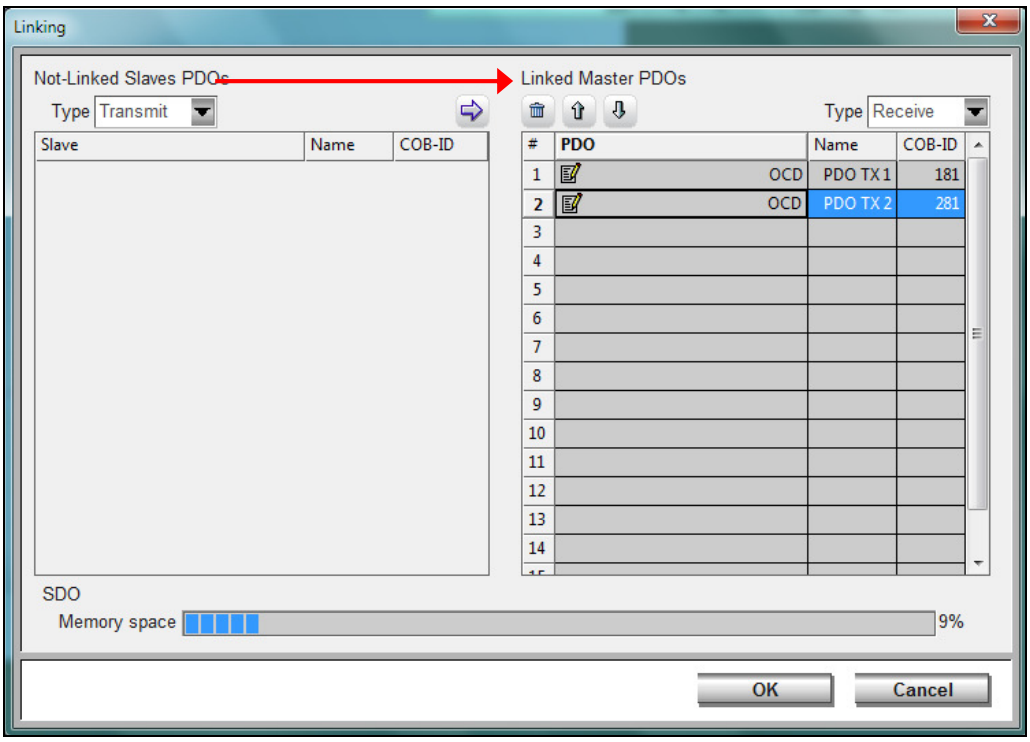
• CANOPEN BUS NETWORK CONFIGURATION

The CANopen bus network configuration is for the setting of a new CANopen network. If an already existing network is available, we need to configure only the encoder in order to make it compatible with the existing network.



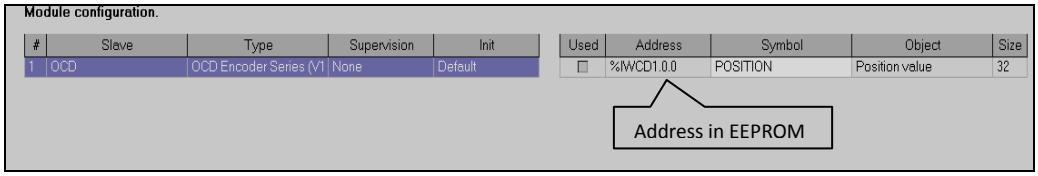
• LINKING OF CANOPEN MASTER AND OCD TRANSMIT-PDOS

The PDOs of the slave are mapped on to the CANopen master so that the information contained in the objects at the slave end are transmitted and saved on to the controller's memory. The position values thus obtained can be used for control purposes as directed by the PLC.



- **OCD & CONTROLLER MEMORY CONFIGURATION**

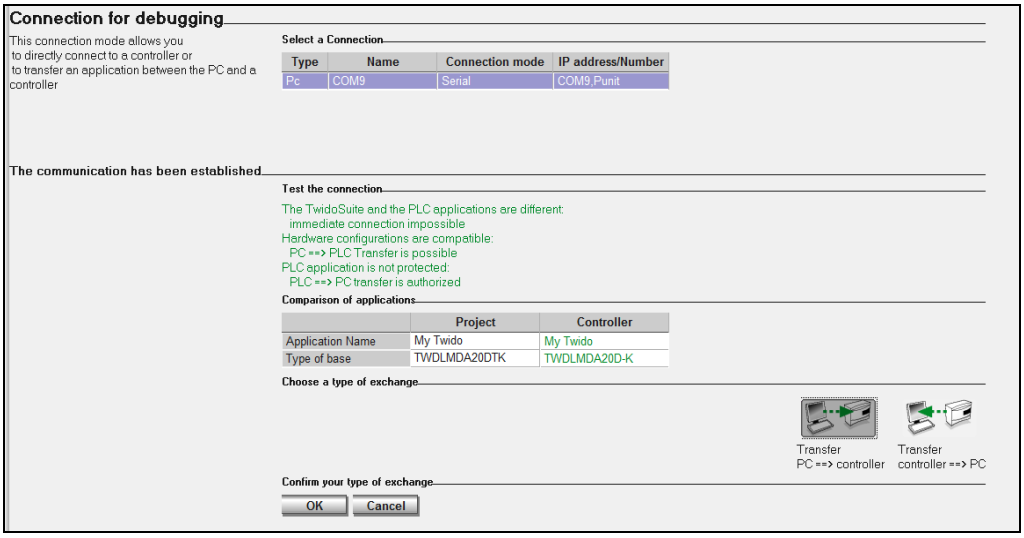
The current and updated position values from the OCD encoder are mapped on to an EEPROM memory location in the controller. In this case it is stored in %IWCD1.0.0 as indicated.



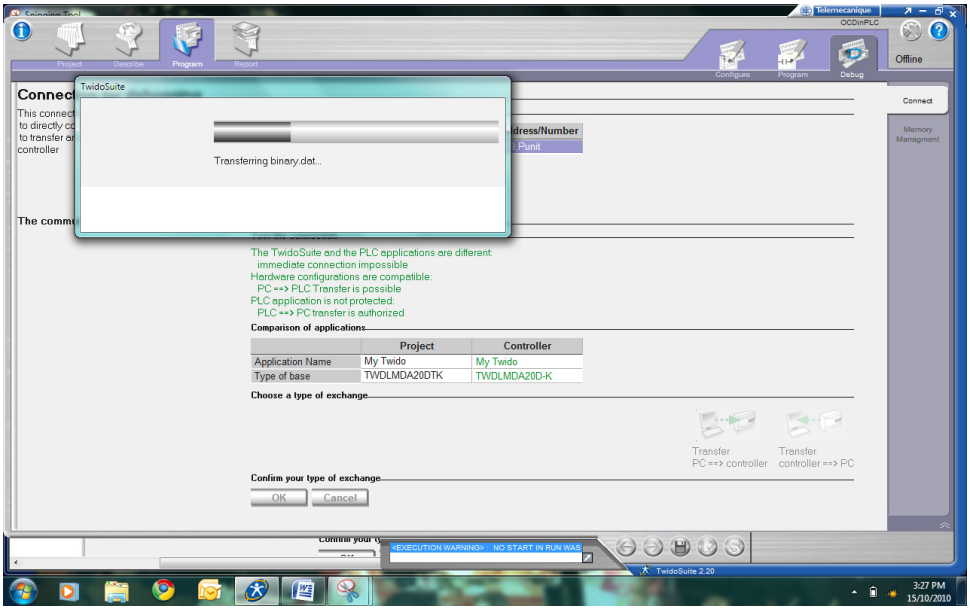
4. DEBUGGING

The debugging stage is done on completing the configuration of the PDO's.

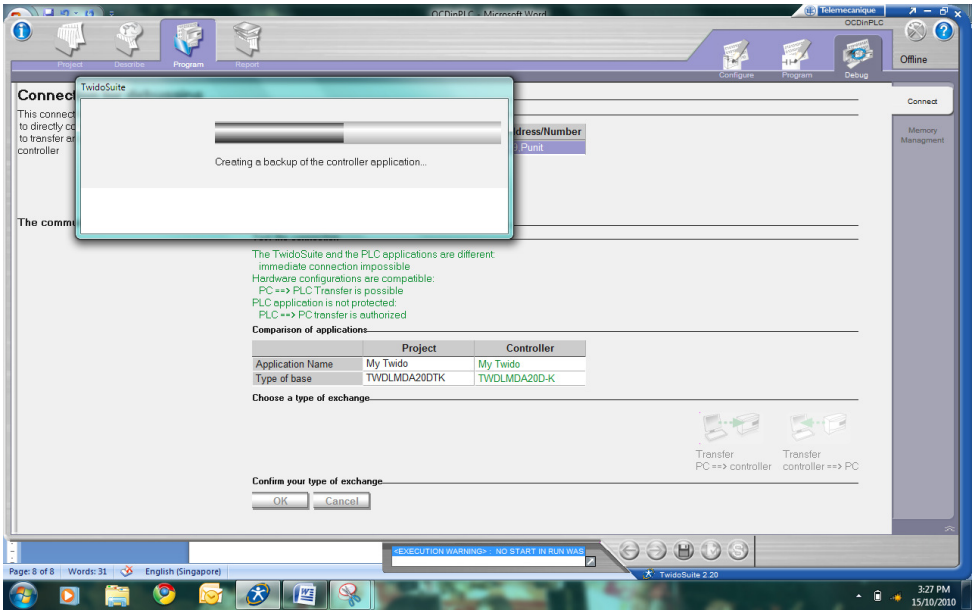
It involves the following steps:



The USB serial communication port is selected and PC-> controller transfer is initiated. Once the transfer is initiated the configured parameters and the programming done on the PC is debugged and transferred to the controller for real time application. The following illustrations are the intermediate tasks during debugging.



Converting all the programmed parameters to binary format…….

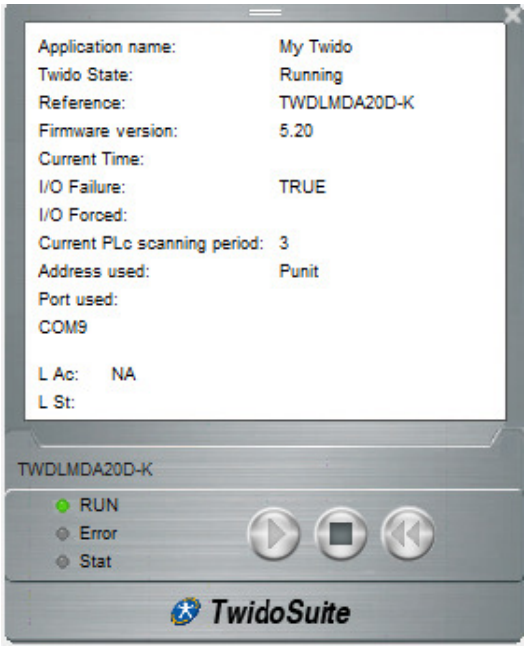


Creating a back up of the controller parameters before going into online mode…….

Once the controller goes into the online mode, the PDOs cannot be changed. But, we can program the SDOs as and when need arises.

5. RUN

Once debugged, the controller goes into online mode. We then, can program the SDOs if needed and then run the controller.



Upon start up, we can create an animation table to monitor the necessary controller parameters and the system variables which contain the position value. In this case %IWCD1.0.0 which contains the OCD position value (EEPROM memory mentioned in Section 3). Once the animation table is setup, we can run the controller.

		Us	Address	Symbol	Current	Retained	Format
1		☐	%SW81		0000000000101000	0000000000000000	Binary
2		☐	%SW20		0	0	Decimal
3		☐	%IWCD1.0.0	POSITION	0	0	Decimal
4							

%SW81 : System variable indicating the processing of CANOpen commands.

%SW20 : System variable indicating the current mode of the CAN network

=0: CAN bus off and error free nodes.

=2: Node operational and error free.

%IWCD1.0.0 : Memory location carrying the position value.

- **TRANSMITTED PDO BY OCD**

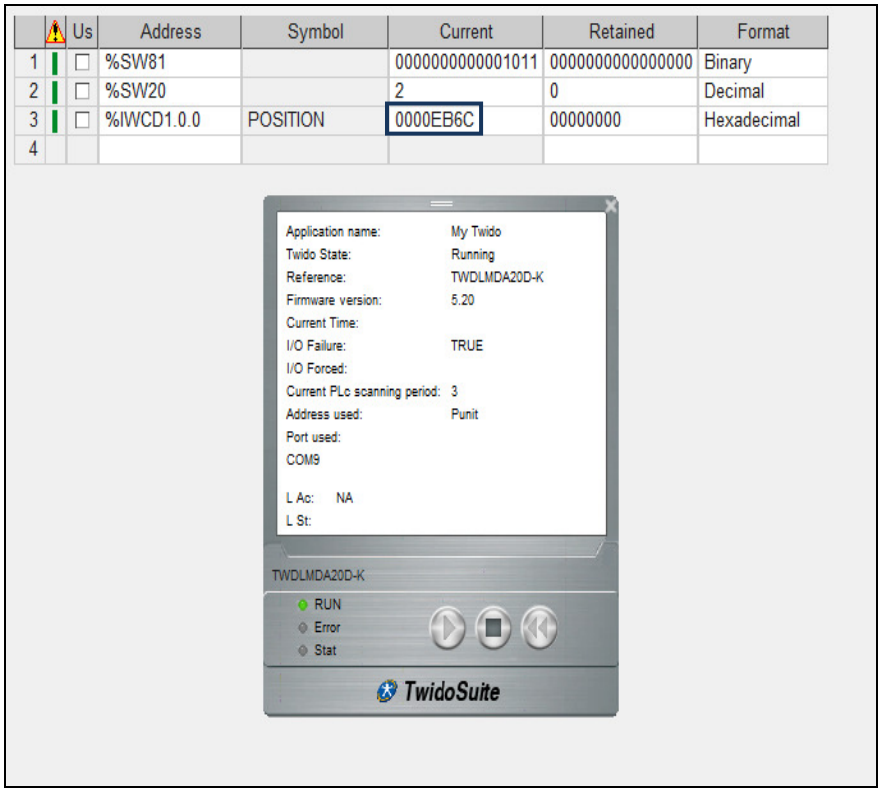
Once we run the controller all the system variables and position values gets updated regularly. We can see that the position value is updated to current position of the OCD. We know that the OCD is 12 bit single turn and 12 bit multi turn.

Therefore, SINGLETURN (ST) RESOLUTION is (360° / 4096) ~ 0.088°

If the output is: 0000EB6C Hex

(Hex) EB6C -> (Bin) 1110101101101100 -> (Dec) 14 2924 -> [Resolution: ST = 0.088]

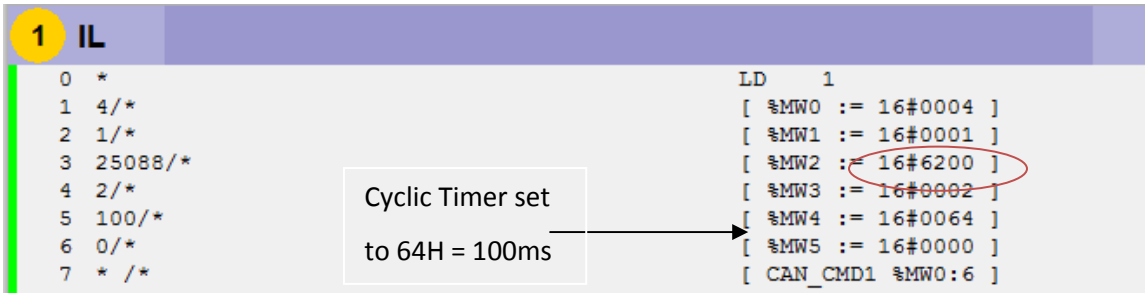
POSITION: MT 14 Turns & ST (2924 x 0.088) = 257.312°



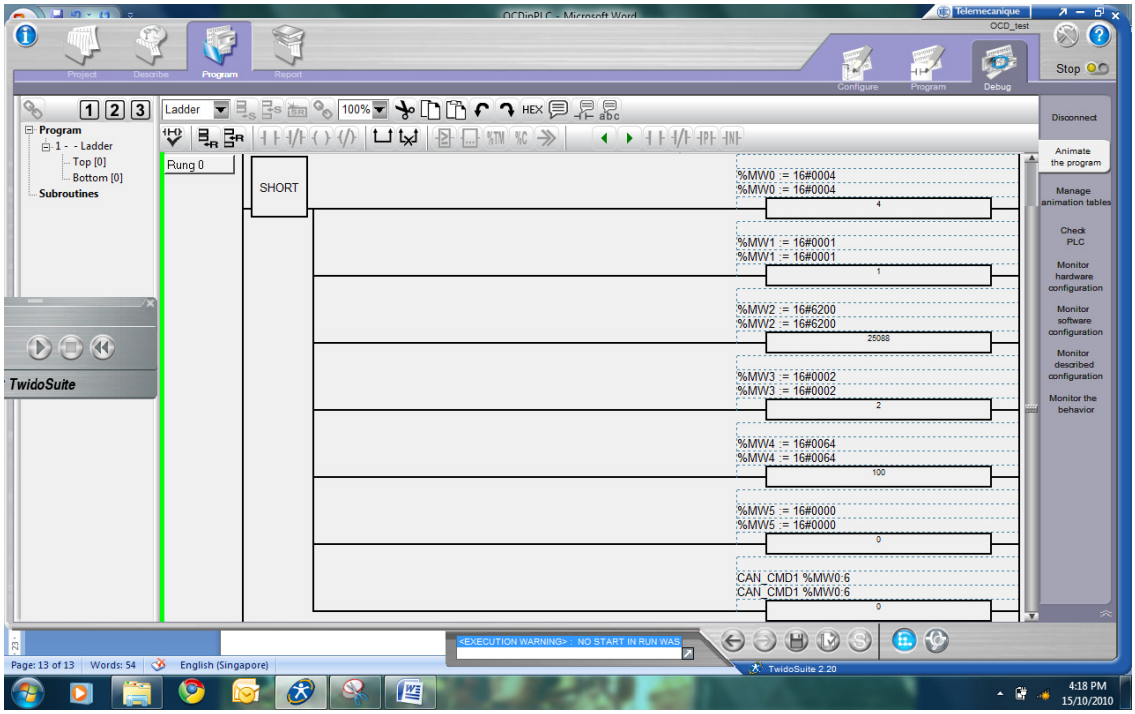
The mathematical computation of the position values vary according to the user. There are various methods of computing from the obtained value. The values are calculated such that, references can be set by the controller for particular programmed tasks according to the position or turn value or both as required by the application.

- **SDO REQUEST AND EXECUTION***

In order to continuously monitor the position values of the OCD, the **cyclic timer needs to be set** to a value. This can be done by using the object 6200h. Here we set the timer to 64h ms (100ms).



The equivalent program in ladder logic:



* All the programming are unique to Twido Suite and can vary from controller to controller. But the basic logic used in the programming is always the same.

6. Illustration of obtained Position Values

Initial (0°) Position:

		Us	Address	Symbol	Current	Retained	Format
1		☐	%SW81		0000000000001011	0000000000000000	Binary
2		☐	%SW20		2	0	Decimal
3		☐	%IWCD1.0.0	POSITION	0000A27A	00000000	Hexadecimal
4							

Position: **MT=** 10 Turns **ST=** 55.792°

At approximately 180 degree rotation:

		Us	Address	Symbol	Current	Retained	Format
1		☐	%SW81		0000000000001011	0000000000000000	Binary
2		☐	%SW20		2	0	Decimal
3		☐	%IWCD1.0.0	POSITION	0000AAA4	00000000	Hexadecimal
4							

Position: **MT=** 10 Turns **ST=** 239.712° [55.792° + 180° = 235.792° **]

At approximately 360 degree rotation i.e. 1 turn:

		Us	Address	Symbol	Current	Retained	Format
1		☐	%SW81		0000000000001011	0000000000000000	Binary
2		☐	%SW20		2	0	Decimal
3		☐	%IWCD1.0.0	POSITION	0000B2BA	00000000	Hexadecimal
4							

Position: **MT=** 11 Turns **ST=** 61.424° [55.792° + 360° = 59.792° **]

The above example shows the intermediate position values read out from the controller in one full rotation.

** The errors in the readings are due to the manual rotation by hand. It is just used to illustrate the variation of the readings obtained in rotating the shaft for one full turn.

For detailed information or any queries please contact:

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