CANopen PDO Example

The mode of operation is mapped at index 0x6060 subindex 0 with size of 1 byte. For example: Profile position is 1, Profile velocity is 3, Torque profile is 4, Interpolated position is 7.

The Control Word is mapped at index 0x6040 subindex 0 with size of 2byte. The Status Word is mapped at index 0x6041 subindex 0 with size of 2byte

The communication is with DS402 Profile on CiA 301 (CAN in Automation). Reference: https://en.wikipedia.org/wiki/CANopen

PDOs must be transmitted and received at every Sync, COB ID = **0x80**. Master can access the parameter inside the slave using SDO read and write.
See here: https://www.nilab.at/dokuwiki/doku.php?id=mbd_servo_drive:registers|

How to program using SDO write - Position control - Interpolated position

Configuration of PDO from Slave to Master

COB ID	D0	D1	D2	D3	D4	D5	D6	D7	Comment
0x600+(nodeid)	0x23	0x00	0x1A	0x01	0x20	0x00	0x64	0x60	Position actual value
0x600+(nodeid)	0x23	0x00	0x1A	0x02	0x10	0x00	0x41	0x60	Status word
0x600+(nodeid)	0x23	0x00	0x1A	0x03	0x08	0x00	0x61	0x60	Mode of operation display

Configuration of PDO from Master to Slave

COB ID	D0	D1	D2	D3	D4	D5	D6	D7	Comment
0x600+(nodeid)	0x23	0x00	0x16	0x01	0x20	0x00	0xC1	0x60	Interpolated data record
0x600+(nodeid)	0x23	0x00	0x16	0x02	0x10	0x00	0x40	0x60	Control word
0x600+(nodeid)	0x23	0x00	0x16	0x03	0x08	0x00	0x60	0x60	Mode of operation

How to program using SDO write - Torque control

Configuration of PDO from Slave to Master

COB ID	D0	D1	D2	D3	D4	D5	D6	D7	Comment
0x600+(nodeid)	0x23	0x00	0x1A	0x01	0x10	0x00	0x77	0x60	Torque actual value
0x600+(nodeid)	0x23	0x00	0x1A	0x02	0x10	0x00	0x41	0x60	Status word
0x600+(nodeid)	0x23	0x00	0x1A	0x03	0x08	0x00	0x61	0x60	Mode of operation display

Configuration of PDO from Master to Slave

COB ID	D0	D1	D2	D3	D4	D5	D6	D7	Comment
0x600+(nodeid)	0x23	0x00	0x16	0x01	0x10	0x00	0x71	0x60	Target Torque

0x600+(nodeid)	0x23	0x00	0x16	0x02	0x10	0x00	0x40	0x60	Control word
0x600+(nodeid)	0x23	0x00	0x16	0x03	0x08	0x00	0x60	0x60	Mode of operation

Additional parameter are 0x6087 ⇒ Torque Slope and 0x6088 ⇒ Torque profile type (0 = Linear ramp)

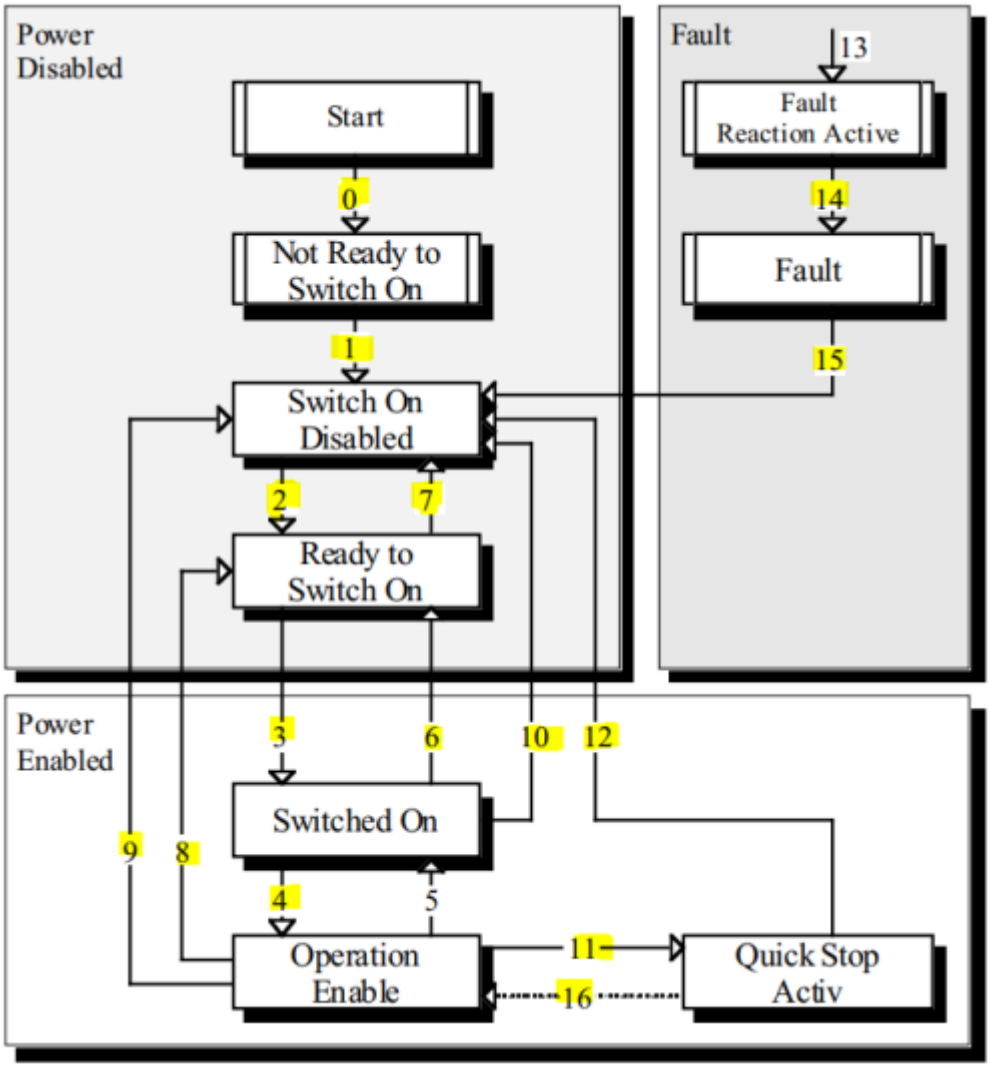
STATUS WORD Register

BIT Number	Description	Mode of operation
11	STATUSWORD_INTERNAL_LIMIT_ACTIVE	
12	STATUSWORD_IP_MODE_ACTIVE	Interpolated positioning
12	STATUSWORD_SPEED	Profile velocity
13	STATUSWORD_MAX_SLIPPAGE_ERR	Profile velocity
12	STATUSWORD_HOMING_ATTAINED	Homing
13	STATUSWORD_HOMING_ERROR	Homing
12	STATUSWORD_SETPOINT_ACK	Profile positioning
13	STATUSWORD_FOLLOWING_ERROR	Profile positioning

CONTROL WORD Register

BIT Number	Description	Mode of operation
0	CTRLWORD_BIT_SWITCH_ON	
1	CTRLWORD_BIT_EN_VOLTAGE	
2	CTRLWORD_BIT_QUICK_STOP	
3	CTRLWORD_BIT_EN_OPERATION	
4	CTRLWORD_HOME_START	Homing
4	CTRLWORD_ENABLE_IP_MODE	Interpolated positiong
4	CTRLWORD_NEW_SETPOINT	Profile positioning
5	CTRLWORD_CHANGE_SET_NOW	Profile positioning
6	CTRLWORD_ABS_REL_POSITION	Profile positioning
7	CTRLWORD_BIT_FAULT_RESET	
8	CTRLWORD_BIT_HALT	

DS402 State Machine



Enabling the drive

SERVO-ON: is procedure that Master should read Statusword from driver and send corresponded Controlword (command) to driver to make it change to final state, Operation Enable. The common SERVO-ON path in CiA 402 state machine is: (1) → (2) → (3) → (4) or (13) → (14) → (15) → (2) → (3) → (4)
From the specification when disabled you need to pass from SWITCH ON.
DISABLED to READY TO SWITCH ON then to SWITCHED ON then finally OPERATION ENABLED

For example: You do that through the controlword where you set bit1 and bit 2 with bit 0 and bit 3 reset (0x06 READY TO SWITCH ON) then you set bit 0, bit 1 and bit 2 (0x07 READY TO SWITCH ON) them finally bit 0, bit 1, bit 2, bit 3 all set (0x0F OPERATION ENABLED).

Disabling the drive

SERVO-OFF: is procedure to switch off servo drive, that is moving its state to 'Switch On Disabled' state. The shorted path is transition (9) in which Master send Controlword of 0 to an operating driver.

EDS (CANopen) and XML (ETHERCAT) files

EDS File:
https://www.nilab.at/download/mbd-tbs1-eds-file/?wpdmdl=2134&refresh=637351b05ed9d1668501936

XML File:
https://www.nilab.at/download/mbd-tbs1-ethercat-eds-file/?wpdmdl=3335&refresh=637351b0868111668501936

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