

# 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](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)

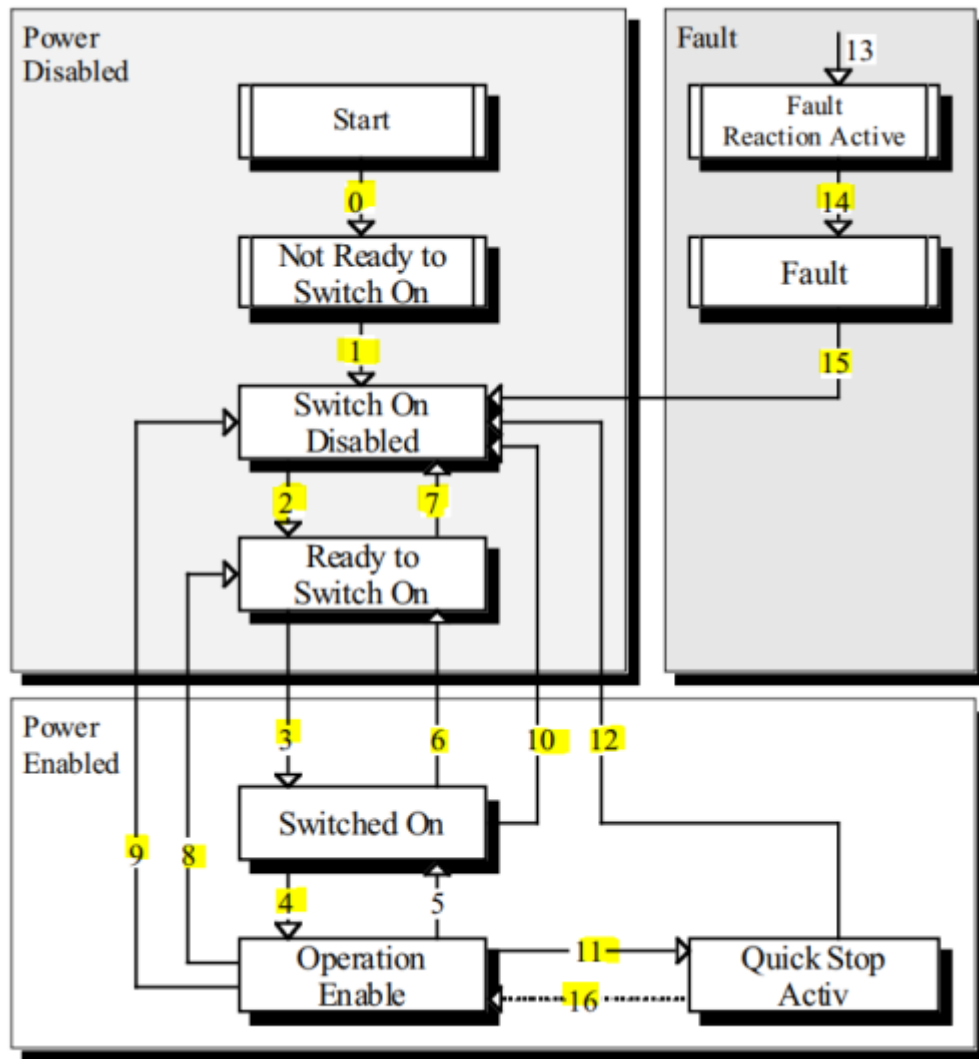
## STATUS WORD Register

| <b>BIT Number</b> | <b>Description</b>               | <b>Mode of operation</b> |
|-------------------|----------------------------------|--------------------------|
| 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

| <b>BIT Number</b> | <b>Description</b>        | <b>Mode of operation</b> |
|-------------------|---------------------------|--------------------------|
| 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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