

Title **OBJECT DICTIONARY E-MEC DRIVE**

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_____ Is the original document on which is based this translation.

| | Translated | Approved |
|--------------------|------------|----------|
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1. Content

This documentation contains list and descriptions of object dictionary implemented inside E-MEC Drive (slave CanOpen).

2. Product features

The described product has full compatibility with CANopen DS301 and DSP402.

The CANopen protocols comprise:

- SDO protocol
- PDO protocol
- NMT protocol
- Special function protocols
- Error control protocols

For protocol, specification refer to CiA Group.

3. 1000h – 1FFFh Communication profile area

These objects are part of DS301, for details refer at CIA official documents.

The mandatory objects are listed before:

a. Object 1000h: Device type

The object is fix at value 0x92020100. Is used different from std, the object is not fully compliant with CIA DS 402.

b. Object 1001h: Error register

The error register is a field of 8 bits, each for a certain error type. If an error occurs the bit has to be set.

Bit Meaning

0 generic error

1 current

2 voltage

3 temperature

4 communication error (overflow, error state)

5 device profile specific

6 reserved

7 manufacturer specific

c. Object 1005h: COB-ID SYNC

COB-ID of the Synchronization object.

The device generates a SYNC message if bit 30 is set.

The meaning of other bits is equal to the other communication objects.

d. Object 1008h: Device name

Drv5 Canopen. Is always the same component for CanOpen interface

e. Object 1009h: Manufacturer hardware version

VX.XX is different from Slewing and Lift component. Due to different HW implementation and change.

f. Object 100Ah: Manufacturer software version

VX.XX is different from Slewing and Lift component. Due to different HW implementation and change.

g. Object 100Ch: Guard time

h. Object 100Dh: Life time factor

i. Object 1010h: Store Parameter Field

j. Object 1016h: Consumer heartbeat time

k. Object 1017h: Producer Heartbeat Time

l. Object 1018h: Identity Object

m. Object 1200h: Server SDO Parameter %f

n. Object 1400h to 15FFh: RPDO communication parameter

o. Object 1600h to 17FFh: RPDO mapping parameter

p. Object 1800h to 19FFh: TPDO communication parameter

q. Object 1A00h to 1BFFh: TPDO mapping parameter

r. Object 1F51h Program control

4. 2000h – 5FFFh Manufacturer-specific profile area

These objects contain a specifics parameters of the drive

a. Object 2000h: Statistics Object

This object shall provide statistics data of the device.

VALUE DEFINITION

- Sub-index 00h shall contain the accumulative operating time. This value is given in seconds. When reached the maximal value (0xFFFFFFFF), the value must not be reseted.
- Sub-index 01h shall contain the number of start procedures CCW executed. When reached the maximal value (0xFFFFFFFF), the counter must stop to count.
- Sub-index 02h shall contain the number of start procedures CW executed. When reached the maximal value (0xFFFFFFFF), the counter must stop to count.
- Sub-index 03h shall contain the number of errors or stop due to errors. When reached the maximal value (0xFFFFFFFF), the counter must stop to count.

Object description

| Index | Name | Object Code | Data Type | Category |
|-------|------------------|-------------|-----------|-----------|
| 2000h | Drive statistics | ARRAY | uint32 | Mandatory |

Entry description

| Sub-Index | Description | Access | PDO Mapping | Value range | Default Value |
|-----------|----------------------------------------|--------|-------------|-------------|---------------|
| 00h | Accumulative operating time | ro | No | uint32 | 0 |
| 01h | Number of start procedures CCW | ro | No | uint32 | 0 |
| 02h | Number of start procedures CW | ro | No | uint32 | 0 |
| 03h | Number of errors or stop due to errors | ro | No | uint32 | 0 |

b. Object 2001h: Device Temperature Object

This object shall provide the actual temperature of device

VALUE DEFINITION

- Sub-index 00h shall contain the device temperature. This value is given in °C.
- Sub-index 01h shall contain the maximal device temperature allowed. This value is given in °C. If the device temperature is greater than this value then the motor will be stopped and emergency messages will be sent.

Object description

| Index | Name | Object Code | Data Type | Category |
|-------|--------------------|-------------|-----------|-----------|
| 2001h | Device temperature | ARRAY | int16 | Mandatory |

Entry description

| Sub-Index | Description | Access | PDO Mapping | Value range | Default Value |
|-----------|----------------------------|--------|-------------|-------------|---------------|
| 00h | Device temperature | ro | Possible | int16 | 0 |
| 01h | Maximal device temperature | rw | Possible | int16 | 60 |

c. Object 2100h: Device error flags

The device error flags shows the details of errors present. When the flag is 1, the error is present otherwise is not.

Object description

| Index | Name | Object Code | Data Type | Category |
|-------|--------------------|-------------|-----------|-----------|
| 2100h | Device error flags | VAR | uint16 | Mandatory |

ENTRY DESCRIPTION

| Access | PDO Mapping | Value range | Default Value |
|--------|-------------|-------------|---------------|
| ro | Possible | Uint16 | No |

Flags description

| | | | | | | | | | | | | | | | |
|-----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|-----|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| MSB | | | | | | | | | | | | | | | LSB |

| Bit | Description | M/O |
|-----|---------------------------|-----|
| 0 | Overcurrent error | M |
| 1 | Overtemperature error | M |
| 2 | Position controller error | M |
| 3 | Following error | M |
| 4 | Reserved | O |
| 5 | Reserved | O |
| 6 | Reserved | O |
| 7 | Reserved | O |
| 8 | Reserved | O |
| 9 | Reserved | O |
| 10 | Reserved | O |
| 11 | Reserved | O |
| 12 | Reserved | O |
| 13 | Reserved | O |
| 14 | Reserved | O |
| 15 | Reserved | O |

5. 6000h – 67FFh Standardized profile area

These objects are part of DSP402.

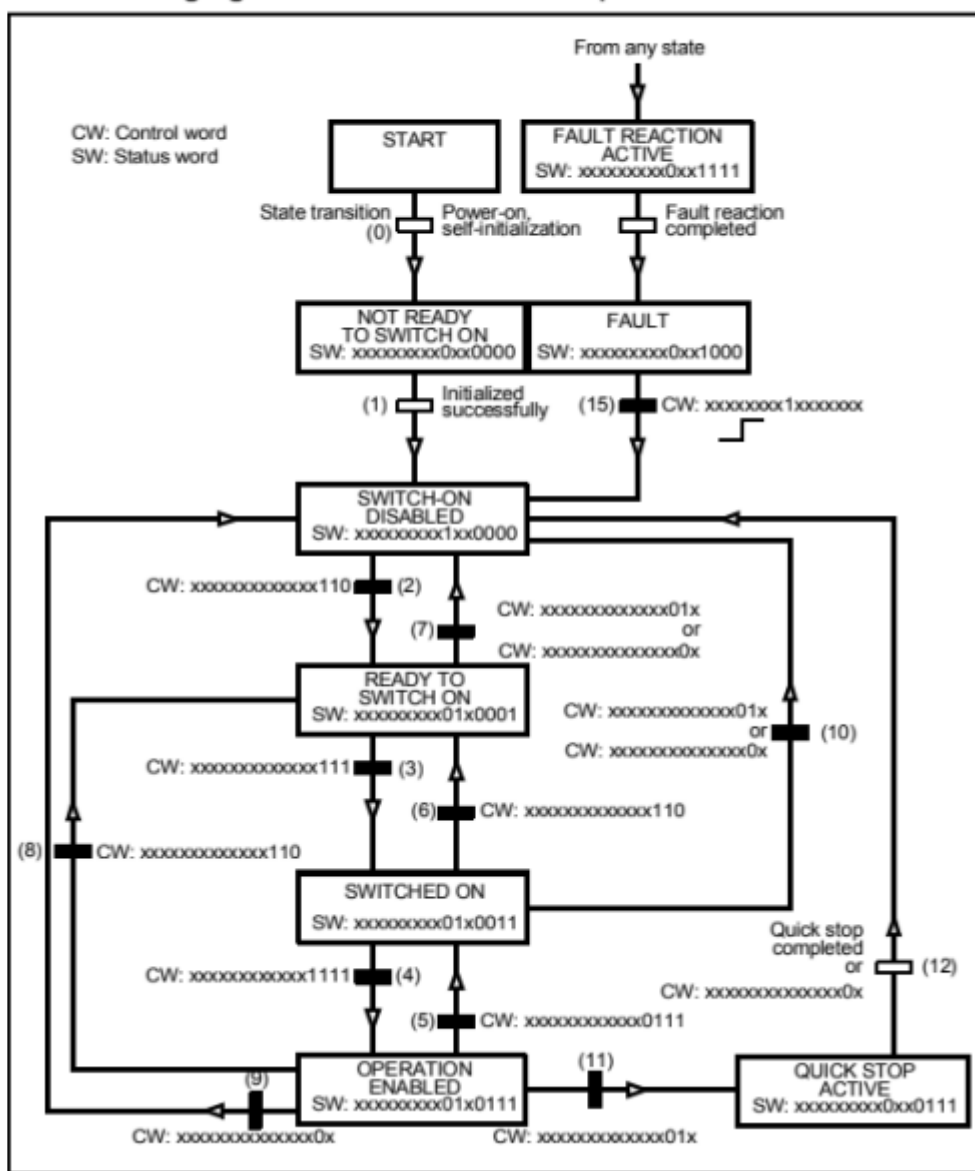
The mandatory objects are listed before:

a. Object 6040 - Control Word

This object controls the CiA 402 Power State Machine.

State machine

The following figure describes the CANopen state machine.



OBJECT DESCRIPTION

| Index | Name | Object Code | Data Type | Category |
|-------|-------------|-------------|-----------|-----------|
| 6040h | Controlword | VAR | uint16 | Mandatory |

ENTRY DESCRIPTION

| Access | PDO Mapping | Value range | Default Value |
|--------|-------------|-------------|---------------|
| ro | Possible | uint16 | No |

DATA DESCRIPTION

The bits of the ControlWord are defined as follows:

| | | | | | | | | | | | | | | | |
|-----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|-----|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| MSB | | | | | | | | | | | | | | | LSB |

| Bit | Description | M/O |
|-----|-------------------------|-----|
| 0 | Switch on | M |
| 1 | Enable voltage | M |
| 2 | Quick stop | M |
| 3 | Enable operation | M |
| 4 | Operation mode specific | O |
| 5 | Operation mode specific | O |
| 6 | Operation mode specific | O |
| 7 | Fault reset | M |
| 8 | halt | O |
| 9 | reserved | O |
| 10 | reserved | O |
| 11 | Manufacturer specific | O |
| 12 | Manufacturer specific | O |
| 13 | Manufacturer specific | O |
| 14 | Manufacturer specific | O |
| 15 | Manufacturer specific | O |

BITS 0 – 3 AND 7

Device control commands are triggered by the following bit patterns in the controlword:

| Bit | Operation mode | | | | | |
|-----|----------------|------------------------|-----------------------|---------------------|------------------------|-----------------------------|
| | Velocity mode | Profile position mode | Profile velocity mode | Profile torque mode | Homing mode | Interpolation position mode |
| 4 | rfg enable | New set-point | reserved | reserved | Homing operation start | Enable ip mode |
| 5 | rfg enable | Change set immediately | reserved | reserved | reserved | reserved |
| 6 | rfg use ref | abs / rel | reserved | reserved | reserved | reserved |
| 8 | Halt | Halt | Halt | Halt | Halt | Halt |

NB: Only Profile position mode is enabled, and the bit 4-5-6 in our application aren't used. When the drive is in operation enabled state "move at target position"

BITS 9, 10:

These bits are reserved for further use. They are inactive by setting to zero. If they have no special function, they must be set to zero

BITS 11, 12, 13, 14 AND 15

These bits are manufacturer specific

b. Object 6041 - Status Word

The StatusWord indicates the current state of the drive. No bits are latched. The StatusWord consist of bits for:

- the current state of the drive,
- the operating state of the mode and manufacturer specific options.

Object description

| Index | Name | Object Code | Data Type | Category |
|-------|------------|-------------|-----------|-----------|
| 6041h | Statusword | VAR | uint16 | Mandatory |

Entry description

| Access | PDO Mapping | Value range | Default Value |
|--------|-------------|-------------|---------------|
| ro | Possible | uint16 | No |

StatusWord description

| | | | | | | | | | | | | | | | |
|-----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|-----|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| MSB | | | | | | | | | | | | | | | LSB |

| Bit | Description | M/O |
|-----|-------------------------|-----|
| 0 | Ready to switch on | M |
| 1 | Switched on | M |
| 2 | Operation enabled | M |
| 3 | Fault | M |
| 4 | Voltage enabled | M |
| 5 | Quick stop | M |
| 6 | Switch on disabled | M |
| 7 | Warning | O |
| 8 | Manufacturer specific | O |
| 9 | Remote | M |
| 10 | Target reached | M |
| 11 | Internal limit active | M |
| 12 | Operation mode specific | O |
| 13 | Operation mode specific | O |
| 14 | Motor activity | M |
| 15 | Direction of rotation | M |

BITS 0 – 3, 5 AND 6:

The following bits indicate the status of the device:

| Value (binary) | State |
|---------------------|------------------------|
| xxxx xxxx x0xx 0000 | Not ready to switch on |
| xxxx xxxx x1xx 0000 | Switch on disabled |
| xxxx xxxx x01x 0001 | Ready to switch on |
| xxxx xxxx x01x 0011 | Switched on |
| xxxx xxxx x01x 0111 | Operation enabled |
| xxxx xxxx x00x 0111 | Quick stop active |
| xxxx xxxx x0xx 1111 | Fault reaction active |
| xxxx xxxx x0xx 1000 | Fault |

BIT 4: VOLTAGE ENABLED

High voltage is applied to the drive when this bit is set to 1.

BIT 5: QUICK STOP

When reset, this bit indicates that the drive is reacting on a quick stop request. Bits 0, 1 and 2 of the statusword must be set to 1 to indicate that the drive is capable to regenerate. The setting of the other

bits indicate the status of the drive (e.g. the drive is performing a quick stop as result of a reaction to a non-fatal fault. The fault bit is set as well as bits 0, 1 and 2).

BIT 7: WARNING

A drive warning is present if bit 7 is set. The cause means no error but a state that has to be mentioned, e.g. temperature limit, job refused. The status of the drive does not change. The cause of

this warning may be found by reading the fault code parameter. The bit is set and reset by the device.

BIT 8:

This bit may be used by a drive manufacturer to implement any manufacturer specific functionality.

BIT 9: REMOTE

If bit 9 is set, then parameters may be modified via the CAN-network, and the drive executes the content of a command message. If the bit remote is reset, then the drive is in local mode and will not execute the command message. The drive may transmit messages containing valid actual values like

a position actual value, depending on the actual drive configuration. The drive will accept accesses via

SDO in local mode.

BIT 10: TARGET REACHED

If bit 10 is set by the drive, then a set-point has been reached. The set-point is dependent on the operating mode. The description is situated in the chapter of the special mode. The change of a target

value by software alters this bit.

If quick stop option code is 5, 6, 7 or 8, this bit must be set, when the quick stop operation is finished and the drive is halted.

If halt occurred and the drive has halted, then this bit is set too.

In Position profile mode, the target reached keep in charge tolerance windows, the value of tolerance is fix inside FW and value is 16cnts.

Target reached TRUE. If the following condition is satisfied:

$((\text{TargetPosition [cnts]} - \text{Tolerance [cnts]}) < \text{Actual position [cnts]} < (\text{TargetPosition [cnts]} + \text{Tolerance [cnts]}))$.

Tolerance [cnts] ABK = 8[cnts]

Tolerance [cnts] ATF = 30[cnts]

BIT 11: INTERNAL LIMIT ACTIVE

This bit set by the drive indicates, that an internal limitation is active (e.g. position range limit).

BIT 12 AND 13:

These bits are operation mode specific. The description is situated in the chapter of the special mode
The following table gives an overview:

| Bit | Operation mode | | | | | |
|-----|----------------|-----------------------|-----------------------|---------------------|-----------------|-----------------------------|
| | Velocity mode | Profile position mode | Profile velocity mode | Profile torque mode | Homing mode | Interpolation position mode |
| 12 | reserved | Set-point acknowledge | Speed | reserved | Homing attained | ip mode active |
| 13 | reserved | Following error | Max slippage error | reserved | Homing error | reserved |

BIT 14 AND 15:

These bits may be used by a drive manufacturer to implement any manufacturer specific functionality

Manufacturer specific bits:

| Bit | Name | Definition |
|-----|-----------------------|-----------------------------------|
| 14 | Motor activity | 0 = motor stop; 1 = motor rotates |
| 15 | Direction of rotation | 0 = CW; 1 = CCW |

c. Object 6060 - Modes Of Operation

The parameter modes of operation switches the actually chosen operation mode

Object description

| Index | Name | Object Code | Data Type | Category |
|-------|--------------------|-------------|-----------|-----------|
| 6060h | Modes of operation | VAR | int8 | Mandatory |

Entry description

| Access | PDO Mapping | Value range | Default Value |
|--------|-------------|-------------|---------------|
| rw | Possible | int8 | No |

Data description

| Value | State |
|-----------|------------------------------------------|
| -1...-128 | manufacturer specific modes of operation |
| 0 | reserved |
| 1 | Profile Position Mode |
| 2 | Velocity Mode |
| 3 | Profile Velocity Mode |
| 4 | Torque Profile Mode |
| 5 | reserved |
| 6 | Homing Mode |
| 7 | Interpolated Position Mode |
| 8...127 | reserved |

NB: Profile Position Mode is required for application.

d. Object 6061 - Modes Of Operation Display

The modes of operation display shows the current mode of operation. The meaning of the returned value corresponds to that of the modes of operation option code (index 6060h).

e. Object 6064 - Position Actual Value (Pp)

This object represents the actual value of the position measurement device in user defined units.

Object description

| Index | Name | Object Code | Data Type | Category |
|-------|-----------------------|-------------|-----------|-----------------------------------------------------------------------|
| 6064h | Position actual value | VAR | int32 | Mandatory, if pc supported Optional, if pp, ip, hm or tq supported |

Entry description

| Access | PDO Mapping | Value range | Default Value |
|--------|-------------|-------------|---------------|
| ro | Possible | int32 | No |

f. Object 6073 - Max Current

Contains the maximum current in tenths of a percent of the Motor Rated Current entered in 6075h. The value is given per thousand of rated current (6075h).

Object description

| Index | Name | Object Code | Data Type | Category |
|-------|-------------|-------------|-----------|-----------|
| 6073h | Max Current | VAR | uint16 | Mandatory |

Entry description

| Access | PDO Mapping | Value range | Default Value |
|--------|-------------|-------------|---------------|
| rw | Possible | uint16 | No |

The value is given per thousand of rated current (6075h), and is calculated as follows:

$$6075h * (6073h / 1000.0)$$

g. Object 6075 - Motor Rated Current

Contains the rated current entered in mA.

Object description

| Index | Name | Object Code | Data Type | Category |
|-------|---------------------|-------------|-----------|-----------|
| 6075h | Motor Rated Current | VAR | Uint32 | Mandatory |

Entry description

| Access | PDO Mapping | Value range | Default Value |
|--------|-------------|-------------|---------------|
| rw | Possible | Uint32 | 0 |

h. Object 6078 – Current Actual Value

The current actual value refers to the instantaneous current in the drive motor. The value is given per thousand of rated current.

Object description

| Index | Name | Object Code | Data Type | Category |
|-------|----------------------|-------------|-----------|-----------|
| 6078h | Current actual value | VAR | int16 | Mandatory |

Entry description

| Access | PDO Mapping | Value range | Default Value |
|--------|-------------|-------------|---------------|
| ro | Possible | int16 | 0 |

i. Object 607A -Target Position (PP)

The target position is the position that the drive should move to in position profile mode using the current settings of motion control parameters such as velocity, acceleration, deceleration, motion profile type etc. The target position is given in user defined position units. It is converted to position increments using the position factor. The target position will be interpreted as absolute or relative depending on the 'abs / rel' flag in the Controlword

Object description

| Index | Name | Object Code | Data Type | Category |
|-------|-----------------|-------------|-----------|----------------------------------|
| 607Ah | Target position | VAR | int32 | Mandatory, if pp or pc supported |

Entry description

| Access | PDO Mapping | Value range | Default Value |
|--------|-------------|-------------|---------------|
| rw | Possible | int32 | No |

6. Emergency Messages

| Error code | Description |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0000h | <p>Fault reset</p> <p>The fault reset command has been executed.</p> |
| 2310h | <p>Overcurrent on motor driver</p> <p>The motor driver indicates an overcurrent: this can be caused by a short circuit in the motor.</p> |
| 4310h | <p>Overtemperature error</p> <p>The motor driver has been switched off because the temperature limit has been exceeded.</p> |
| 8110h | <p>CAN controller overflow</p> <p>The receive message buffer of the CAN controller hardware is full and some CAN message are lost</p> |
| 8120h | <p>CAN error passive</p> <p>The CAN controller has detected communication errors and has entered the CAN Error passive state.</p> |
| 8130h | <p>Life guard error or heartbeat error</p> |
| 8140h | <p>CAN controller recovered from bus-off state</p> <p>The CAN controller has detected too many errors and has changed into bus-off state. The drive has been stopped and disabled. This message is sent after the CAN controller has recovered from bus-off state and is bus-on again.</p> |
| 8210h | <p>PDO not processed due to length error</p> |
| 8220h | <p>PDO length exceeded</p> |
| 8500h | <p>Position controller</p> |
| 8611h | <p>Following error</p> <p>The deviation between the motor position counter and encoder position counter has exceeded the following error window.</p> |