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Accessing the Objects in TwinCAT3

Communication Objects

0x1000: Device Type

Provides information on the device type.

Sub-index	Description	Range	Default	Type	Access	PDO Mapping
0x00	Device Type	0x00-0xFFFFFFFFh	0x00040192	UDINT	ro	No

Explanation of set value

Bits	Name	Description
0-15	Device Profile Number	402 (0x192): Drive Profile
16-23	Type	04: Step motor
24-31	Mode	0: Manufacturer specific

0x1001: Error Register

Indicates the error type that occurs in the slave device. The generic error bit is set on all errors. Specific error codes can be found in object Object Dictionary#0x603F

Sub-index	Description	Range	Default	Type	Access	PDO Mapping
0x00	Error Register	0x00-0xFF	0x00	USINT	ro	No

Definition of bits:

Bit	Error Description
0	Generic
1	Current
2	Voltage
3	Temperature
4	Communication Error
5	Device profile specific
6	N/A
7	Manufacturer specific

0x1008: Manufacturer Device Name

Indicates the manufacturers device name

Sub-index	Description	Range	Default	Type	Access	PDO Mapping
0x00	Manufacturers Device Name	-	"CM1-E"	STRING	ro	No

0x1009: Manufacturer Hardware Version

Indicates the EtherCAT hardware version.

Sub-index	Description	Range	Default	Type	Access	PDO Mapping
0x00	Manufacturer Hardware Version	-	"MYO28-02A"	STRING	ro	No

0x100A: Manufacturer Software Version

Indicates the version of the EtherCAT firmware

Sub-index	Description	Range	Default	Type	Access	PDO Mapping
0x00	Manufacturer Software Version	-	"1.0.0"	STRING	ro	No

0x1018: Identity Object

Indicates general device information

Sub-index	Description	Range	Default	Type	Access	PDO Mapping

0x00	Number of Entries	0x01-0x04	0x04	USINT	ro	No
0x01	Vendor ID	0x00-0xFFFFFFFF	0x00004441	UDINT	ro	No
0x02	Product Code	0x00-0xFFFFFFFF	0x44412002	UDINT	ro	No
0x03	Revision Number	0x00-0xFFFFFFFF	0x20020001	UDINT	ro	No
0x04	Serial Number	0x00-0xFFFFFFFF	0x00000000	UDINT	ro	No

PDO Mapping Objects

0x1600: Receive PDO mapping parameter - Dynamic switching of modes

Sub-index	Description	Value	Access	PDO Mapping
0x00	Number of entries	0x07	ro	No
0x01	Controlword mapping	0x60400010	ro	No
0x02	Target position mapping	0x607A0020	ro	No
0x03	Target velocity mapping	0x60FF0020	ro	No
0x04	Digital outputs mapping	0x60FE0010	ro	No
0x05	Mode of operation mapping	0x60600008	ro	No

0x1601: Receive PDO mapping parameter - CSP mode

Sub-index	Description	Value	Access	PDO Mapping
0x00	Number of entries	0x04	ro	No
0x01	Controlword mapping	0x60400010	ro	No
0x02	Target position mapping	0x607A0020	ro	No
0x03	Digital outputs mapping	0x60FE0010	ro	No

0x1602: Receive PDO mapping parameter - CSV mode

Sub-index	Description	Value	Access	PDO Mapping
0x00	Number of entries	0x04	ro	No
0x01	Controlword mapping	0x60400010	ro	No
0x02	Target velocity mapping	0x60FF0020	ro	No
0x03	Digital outputs mapping	0x60FE0010	ro	No

0x1603: Receive PDO mapping parameter - Profile mode

Sub-index	Description	Value	Access	PDO Mapping
0x00	Number of entries	0x06	ro	No
0x01	Controlword mapping	0x60400010	ro	No
0x03	Target Position mapping	0x607A0020	ro	No
0x04	Target Velocity mapping	0x60FF0020	ro	No
0x05	Profile Velocity mapping	0x60810020	ro	No
0x06	Profile Acceleration mapping	0x60830020	ro	No
0x07	Mode of operation mapping	0x60600008	ro	No

0x1A00: Transmit PDO mapping parameter - Dynamic switching of modes

Sub-index	Description	Value	Access	PDO Mapping

0x00	Number of entries	0x0B	ro	No
0x01	Statusword mapping	0x60410010	ro	No
0x02	Position actual value mapping	0x60640020	ro	No
0x03	Velocity actual value mapping	0x606C0020	ro	No
0x04	Torque actual value mapping	0x60770020	ro	No
0x05	Digital input mapping	0x60FD0010	ro	No
0x06	Error code mapping	0x603F0010	ro	No
0x07	Temperature-C mapping	0x23010010	ro	No
0x08	DC voltage mapping	0x60790010	ro	No
0x09	Modes of operation display mapping	0x60610008	ro	No

0x1A01: Transmit PDO mapping parameter - CSP mode

Sub-index	Description	Value	Access	PDO Mapping
0x00	Number of entries	0x07	ro	No
0x01	Statusword mapping	0x60410010	ro	No
0x02	Position actual value mapping	0x60640020	ro	No
0x03	Velocity actual value mapping	0x606C0020	ro	No
0x04	Torque actual value mapping	0x60770020	ro	No
0x05	Digital input mapping	0x60FD0010	ro	No
0x06	Error code mapping	0x603F0010	ro	No

0x1A02: Transmit PDO mapping parameter - CSV mode

Sub-index	Description	Value	Access	PDO Mapping
0x00	Number of entries	0x07	ro	No
0x01	Statusword mapping	0x60410010	ro	No
0x02	Position actual value mapping	0x60640020	ro	No
0x03	Velocity actual value mapping	0x606C0020	ro	No
0x04	Torque actual value mapping	0x60770020	ro	No
0x05	Digital input mapping	0x60FD0010	ro	No
0x06	Error code mapping	0x603F0010	ro	No

0x1A03: Transmit PDO mapping parameter - Profile mode

Sub-index	Description	Value	Access	PDO Mapping
0x00	Number of entries	0x0B	ro	No
0x01	Statusword mapping	0x60410010	ro	No
0x02	Position actual value mapping	0x60640020	ro	No
0x03	Velocity actual value mapping	0x606C0020	ro	No
0x04	Torque actual value mapping	0x60770020	ro	No
0x05	Digital input mapping	0x60FD0010	ro	No
0x06	Error code mapping	0x603F0010	ro	No
0x07	Temperature-C mapping	0x23010010	ro	No
0x08	DC voltage mapping	0x60790010	ro	No
0x09	Mode of operation display mapping	0x60610008	ro	No

CiA402 Drive Profile Objects

0x603F: Error Code

Indicates specific error code when an error occurs.

Sub-index	Description	Range	Default	Type	Access	PDO Mapping
0x00	Error Code	0x0000-0xFFFF	0x0000	UINT	ro	No

The following table outlines the error and the relevant objects that are set.

0x603F Error Code	0x1001 Error Register	0x6041 Fault (Bit 3)	Description
0x0000	0x00	0	No error
0x2310	0x03	1	Continuous over current error (torque overload)
0x4310	0x09	1	Drive over temperature
0x4502	0x00	0	No mode selected (0x6060=0) [1]
0x7310	0x81	1	Over speed error
0x7320	0x81	1	Position Error overflow
0x7500	0x11	1	Motor communication error
0x7510	0x11	1	Motor drive to EtherCAT slave communication error
0x8611	0x00	0	Motor not currently following commanded position [1,2]
0xFF01	0x00	0	Motor disabled by command[1]
0xFF04	0x81	1	Emergency stop active
0xFF05	0x11	0/1[3]	24V drive power not present

1. Not an error state
2. The motor is not following because for example the FSM state is not in Operation Enabled.
3. If the FSM is in Operation Enabled the loss of 24V power will generate a fault on the statusword otherwise the fault bit will not show an error.

0x6040: Controlword

Sub-index	Description	Type	Access	PDO Mapping
0x00	Used to control the drive's state machine	UINT	rw	Yes

For more information on the Controlword usage see the chapter CiA 402 - Drives and Motion Control Device Profile

0x6041: Statusword

Sub-index	Description	Type	Access	PDO Mapping
0x00	Displays the status of the drive's state machine	UINT	ro	Yes

For more information on the Statusword usage see the chapter CiA 402 - Drives and Motion Control Device Profile

0x6060: Modes of operation

Sub-index	Description	Type	Access	PDO Mapping
0x00	Set the desired mode of operation	SINT	rw	Yes

Value	Mode of Operation
0	No mode selected
3	Profile Velocity (PV) Mode
6	Homing Mode (HM)
8	Cyclic Synchronois Position (CSP) Mode
9	Cyclic Synchronous Velocity (CSV) Mode

0x6061: Modes of operation display

Sub-index	Description	Type	Access	PDO Mapping
0x00	Read the mode of operation currently set on the drive	SINT	ro	Yes

Value	Mode of Operation
0	No mode selected
3	Profile Velocity (PV) Mode
8	Cyclic Synchronois Position (CSP) Mode
9	Cyclic Synchronous Velocity (CSV) Mode

0x6064: Position actual value

Sub-index	Description	Type	Access	PDO Mapping
0x00	Read the actual position of the motor. • Unit - pulses (50,000 pulses/revolution)	DINT	ro	Yes

0x606C: Speed actual value

Sub-index	Description	Type	Access	PDO Mapping
0x00	Read the actual speed of the motor. • Unit - pulses/millisecond (50,000 pulses/revolution)	DINT	ro	Yes

0x6072: Peak torque

Sub-index	Description	Type	Access	PDO Mapping
0x00	Read the peak torque of the motor. • Unit - 0.1% of rated torque	UINT	ro	Yes

0x6073: Motor max current

Sub-index	Description	Type	Access	PDO Mapping
0x00	Read the max current of the motor. • Unit - 0.1% of rated current	UINT	ro	No

0x6075: Motor rated current

Sub-index	Description	Type	Access	PDO Mapping

0x00	Read the rated current of the motor. • Unit - mA	UDINT	ro	No

0x6076: Motor rated torque

Sub-index	Description	Type	Access	PDO Mapping
0x00	Read the rated torque of the motor. • Unit - nNm	UDINT	ro	Yes

0x6077: Torque actual value

Sub-index	Description	Type	Access	PDO Mapping
0x00	Read the actual torque of the motor. • Unit - 0.1% of rated torque	INT	ro	Yes

0x6079: DC link circuit voltage

Sub-index	Description	Type	Access	PDO Mapping
0x00	Read the actual value of the 24V DC bus. • Unit - 0.1V	DINT	ro	Yes

0x607A: Target position

Sub-index	Description	Type	Access	PDO Mapping
0x00	Set the target position of the motor. • Unit - pulses (50,000 pulses/revolution) • Used in CSP and CML modes	DINT	rw	Yes

0x607C: Home offset

Sub-index	Description	Type	Access	PDO Mapping
0x00	Set the offset after a home switch/hardstop has been found. • Unit - pulses (50,000 pulses/revolution) ◦ Internally will be rounded to the closest 100. • Used in homing mode	DINT	rw	No

0x6081: Profile velocity

Sub-index	Description	Type	Access	PDO Mapping
0x00	Set the target velocity in profile position mode • Unit - pulses/s (50,000 pulses/revolution) • Used in profile position mode	UDINT	rw	Yes

0x6083: Profile acceleration

Sub-index	Description	Type	Access	PDO Mapping

0x00	Set the profile acceleration. • Unit - pulses/s^2 (50,000 pulses/revolution) • Used in profile position and profile velocity modes	UDINT	rw	Yes

0x6084: Profile deceleration

Sub-index	Description	Type	Access	PDO Mapping
0x00	Set the profile deceleration in profile velocity mode. • Unit - pulses/s^2 (50,000 pulses/revolution) • Used in profile velocity mode	UDINT	rw	No

0x6098: Homing method

Sub-index	Description	Type	Access	PDO Mapping
0x00	Set the method of the home routine. • 0: No home routine selected • -1: Hardstop CW • -2: Hardstop CCW • -3: Input 2 sensor CW • -4: Input 2 sensor CCW • -5: Input 3 sensor CW • -6: Input 3 sensor CCW	SINT	rw	No

0x6099: Homing speeds

Sub-index	Description	Type	Access	PDO Mapping
0x00	Highest sub-index supported	SINT	rw	No
0x01	Speed during search for switch or hardstop • The homing speed is written to an internal register which has a unit of 100 pulses/s. The value written into 0x6099:01 will be rounded to the closest 100. • Used in homing mode	UDINT	rw	No
0x02	N/A Speed during search for 0 uses the same speed as search for switch/hardstop	UDINT	rw	No

0x609A: Homing acceleration

Sub-index	Description	Type	Access	PDO Mapping
0x00	Set the homing acceleration in homing mode. • Unit - pulses/s^2 (50,000 pulses/revolution) • The homing acceleration is written to an internal register which has a unit of 1000 pulses/s. The value written into 0x609A will be rounded to the closest 1000. • Used in homing mode	UDINT	rw	No

0x60F6: K Parameter Settings

Sub-index	Description	Type	Access	PDO Mapping
0x00	Highest sub-index supported = 0x51 (81_d)	USINT	rw	No
0x51 ... 0x51	K parameter settings. • See standard Cool Muscle documentation for details • Typically these parameters do not need to be modified as the current profile mode changes them directly as required.	UINT	rw	No

0x60FB: H Parameter Settings (Tuning Parameters)

Sub-index	Description	Type	Access	PDO Mapping
0x00	Number of entries	UINT	ro	No
0x01	H0	INT	rw	No
0x02	H1	INT	rw	No
0x03	H2	INT	rw	No
0x04	H3	INT	rw	No
0x05	H4	INT	rw	No
0x06	H5	INT	rw	No
0x07	H6	INT	rw	No
0x08	H7	INT	rw	No
0x09	H8	INT	rw	No

- The H parameters are stored in non-volatile memory in the drive. The value will be retained on power down and do not need to be reloaded after a power cycle.
- Information on the H infinity parameters can be found in the RT3 user manual - Motor Tuning.

0x60FD: Digital inputs

Sub-index	Description	Type	Access	PDO Mapping
0x00	Read the status of the inputs	UINT	ro	Yes

Bit	7	6	5	4	3	2	1	0
INPUT	-	-	-	-	4	3	2	1

0x60FE: Digital outputs

Sub-index	Description	Type	Access	PDO Mapping
0x00	Set the digital output	UINT	rw	Yes

Bit	7	6	5	4	3	2	1	0
OUTPUT	-	-	-	-	-	-	OUT2	OUT1

- Output 1 is driven by 0x60FD
- Output 2 is driven by 0x60FD or by the motor driver depending on the K34 value. See K Parameters for additional information.
    - Set K34=40 for 0x60FD
    - Set K34=20 for alarm output
    - Set K34=10 for inposition signal output.

0x60FF: Target velocity

Sub-index	Description	Type	Access	PDO Mapping
0x00	Set the target velocity of the motor. • Unit - pulses/ms (50,000 pulses/revolution) • Used in CSV, PV and CML modes	DINT	rw	Yes

0x6502: Supported drive modes

Sub-index	Description	Type	Access	PDO Mapping

0x00	Shows support drive modes Value = 0x1A5 *Bit0 = 1: PP mode* Bit1 = 0: VL mode *Bit2 = 1: PV mode* Bit3 = 0: TQ mode Bit4 = 0: reserved *Bit5 = 1: HM mode* Bit6 = 0: IP mode *Bit7 = 1: CSP mode* *Bit8 = 1: CSV mode* Bit9 = 0: CST mode	UDINT	ro	No

Manufacturer Specific Objects

0x2201: 32bit User Variables

This object contains 4 volatile variables. Variable1 in addition has BIT15 and BIT14 mapped to the manufacturer specific bits, B15 and B14, on the Statusword (0x6041).

An example of usage would be if the application requires a custom home routine. These bit could be set as a flag to indicate the home routine has been completed. Due to the volatile nature of the variables if a reset occurs on the drive the flag bit would be reset.

Sub-index	Description	Type	Access	PDO Mapping
0x00	Number of entries	UINT	ro	No
0x01	Variable1	DINT	rw	BIT15 and B14 are mapped to the Statusword 0x6041 BIT15 and B14.
0x02	Variable2	DINT	rw	No
0x03	Variable3	DINT	rw	No
0x04	Variable4	DINT	rw	No

0x2301: Drive temperature

Sub-index	Description	Type	Access	PDO Mapping
0x00	Read the drive temperature • Unit - degrees C	INT	ro	Yes

0xFE00: PDO Timing

The PDO time is autodetected by the slave. The detected time can be read in 0xFE00.

Only PDO rates of 200s, 250s, 500s and 1000s (1ms) are accepted by the CM1-E.

Sub-index	Description	Type	Access	PDO Mapping
0x00	Number of entries	UINT	ro	No
0x01	PDO Time in s	UINT	ro	No
0x02	N/A	UINT	ro	No
0x03	N/A	UINT	ro	No
0x04	N/A	UINT	ro	No

0xFF00: Status LED brightness

Sub-index	Description	Type	Access	PDO Mapping
0x00	Set the brightness of the system and motor status LED.This is a non-volatile object that is stored in memory. • Range [0,16] • 0 - OFF • 1 - minimum brightness (default) • 16 - maximum brightness	SINT	rw	No

0xFF01: Status LED Override

Sub-index	Description	Type	Access	PDO Mapping
0x00	Override the status LED colour and flash. This allows the user to use the status LED to indicate custom operations such as identify a motor in a large axes application.	UDINT	rw	No

Byte Description

	Byte3	Byte2	Byte1	Byte0
Description	Red LED on/off	Green LED on/off	Blue LED on/off	Override on/off Bit 0 - override on/off Bit 1 - flash on/off
Values	0x00 - Red OFF 0x01 - Red ON	0x00 - Green OFF 0x01 - Green ON	0x00 - Blue OFF 0x01 - Blue ON	0x00 - No override 0x01 - Override with solid colour defined in bytes 3-1 0x03 - Override with flash colour defined in bytes 3-1

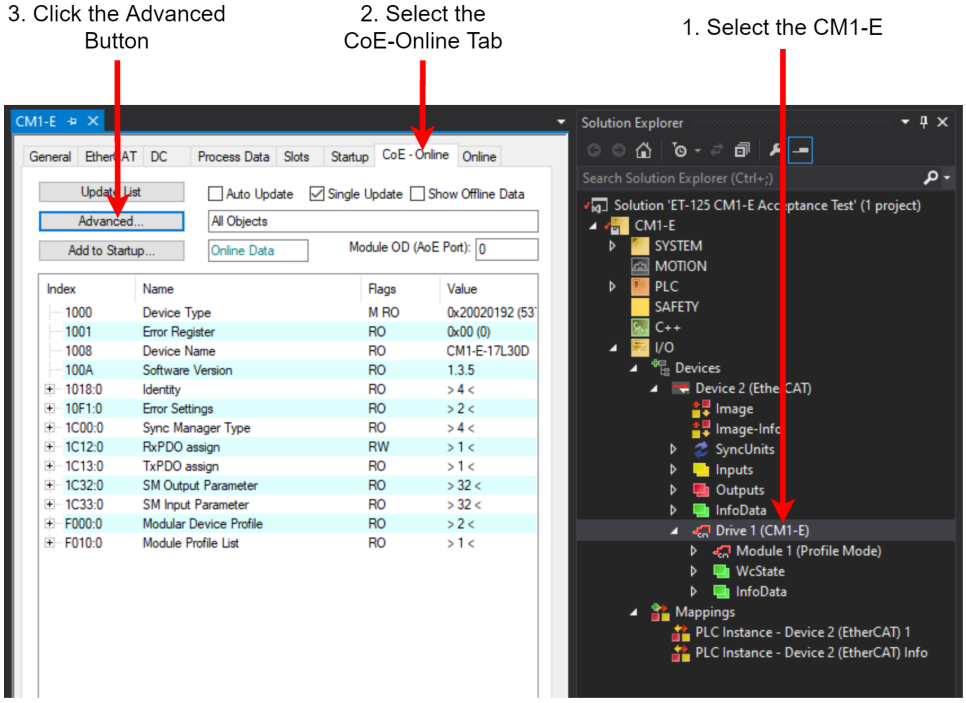
Example Values

- 0xFF01 = 0x01010101 - LED will turn solid white
- 0xFF01 = 0x01000003 - LED will flash red

Accessing the Objects in TwinCAT3

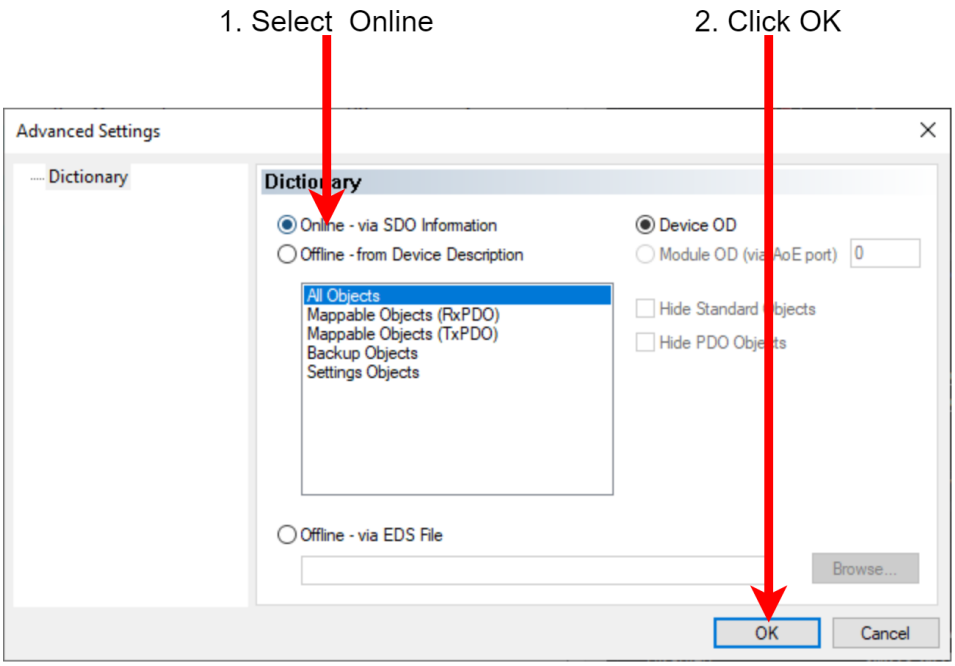
The following instructions show how to read/write the objects in TwinCAT3 through the online object dictionary. It assumes a CM1-E drive has already been added.

1. In the Solution Explorer select the CM1-E drive
2. Select the CoE-Online tab. Only the objects listed in the EDS are currently listed.
3. Click the Advanced button to enable reading all objects.

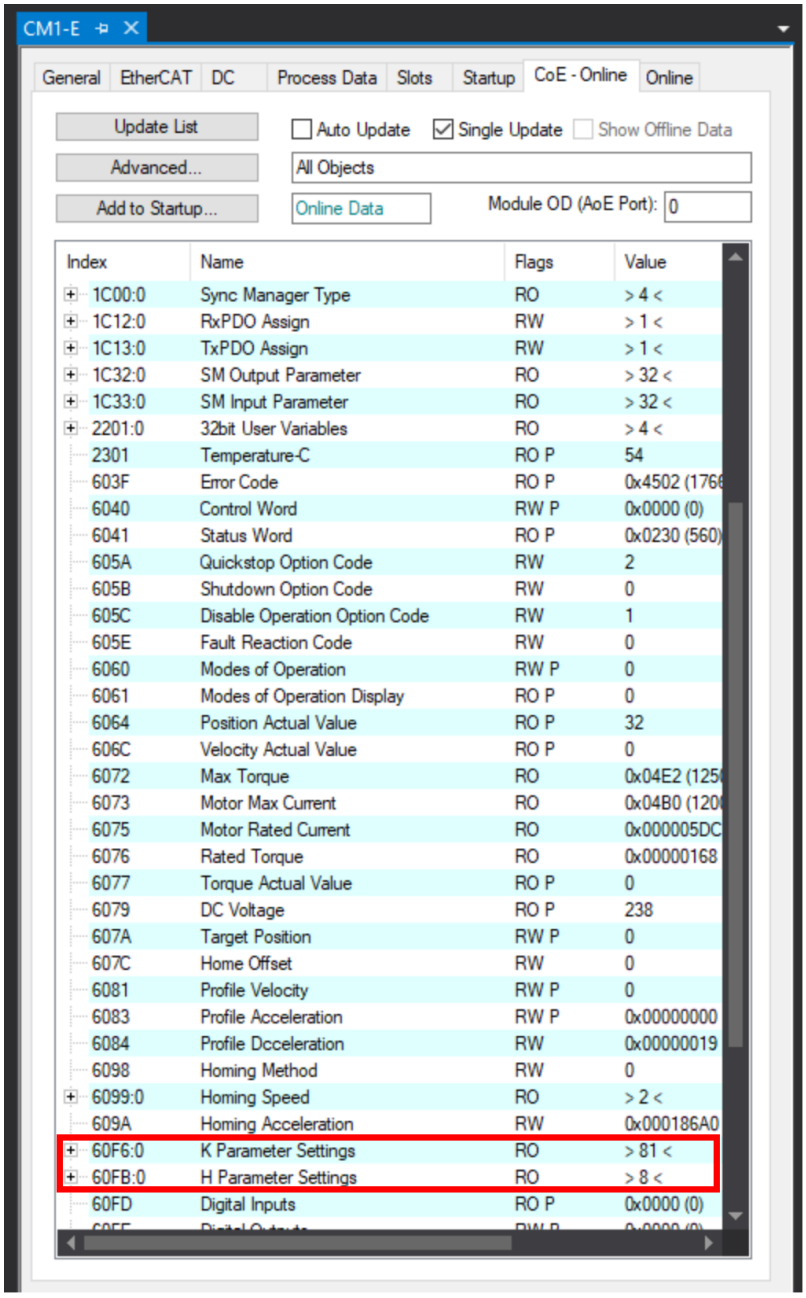


4. Select the Online radio button

5. Click OK



The full object dictionary is now available. The K and H parameters are shown below in red. Expand the list to see all the parameters.


CM1-E
General
EtherCAT
DC
Process Data
Slots
Startup
CoE - Online
Online
Update List
Auto Update
Single Update
Show Offline Data
Advanced...
All Objects
Add to Startup...
Online Data
Module OD (AoE Port):
0
Index
Name
Flags
Value
1C00:0 Sync Manager Type RO > 4 <
1C12:0 RxPDO Assign RW > 1 <
1C13:0 TxPDO Assign RW > 1 <
1C32:0 SM Output Parameter RO > 32 <
1C33:0 SM Input Parameter RO > 32 <
2201:0 32bit User Variables RO > 4 <
2301 Temperature-C RO P 54
603F Error Code RO P 0x4502 (1766
6040 Control Word RW P 0x0000 (0)
6041 Status Word RO P 0x0230 (560)
605A Quickstop Option Code RW 2
605B Shutdown Option Code RW 0
605C Disable Operation Option Code RW 1
605E Fault Reaction Code RW 0
6060 Modes of Operation RW P 0
6061 Modes of Operation Display RO P 0
6064 Position Actual Value RO P 32
606C Velocity Actual Value RO P 0
6072 Max Torque RO 0x04E2 (125
6073 Motor Max Current RO 0x04B0 (120
6075 Motor Rated Current RO 0x000005DC
6076 Rated Torque RO 0x00000168
6077 Torque Actual Value RO P 0
6079 DC Voltage RO P 238
607A Target Position RW P 0
607C Home Offset RW 0
6081 Profile Velocity RW P 0
6083 Profile Acceleration RW P 0x00000000
6084 Profile Dcceleration RW 0x00000019
6098 Homing Method RW 0
6099:0 Homing Speed RO > 2 <
609A Homing Acceleration RW 0x000186A0
60F6:0 K Parameter Settings RO > 81 <
60FB:0 H Parameter Settings RO > 8 <
60FD Digital Inputs RO P 0x0000 (0)