TTLAC/1
TTLACT/1
TTLAC/2
TTLACT/2

EtherCAT MEASUREMENT SYSTEM MODULE

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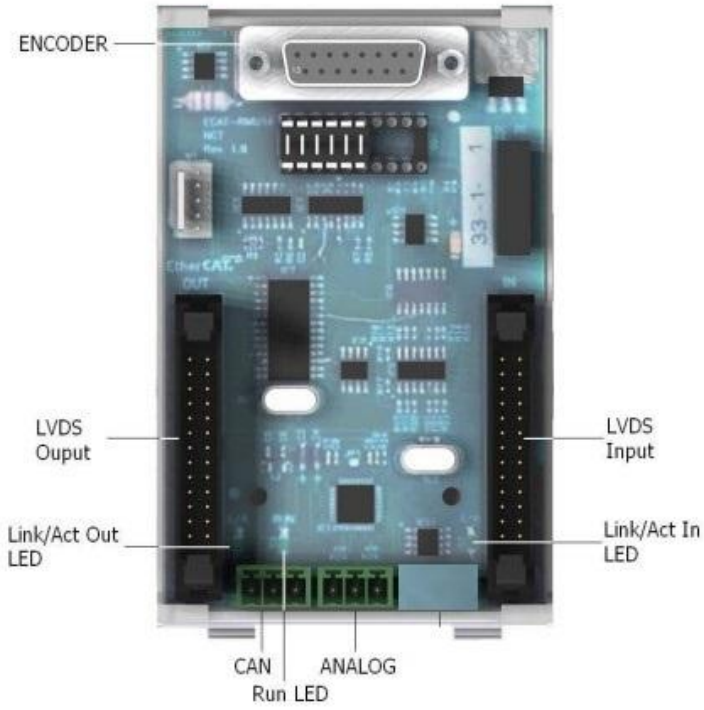
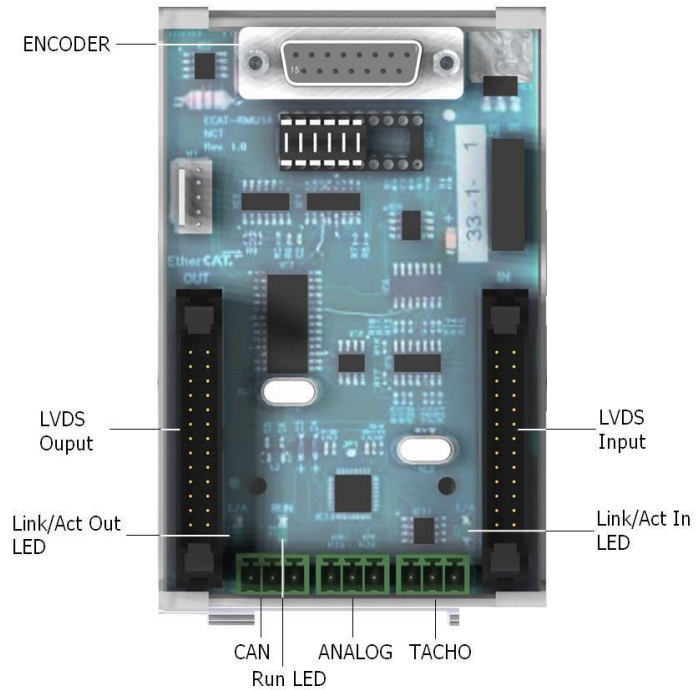
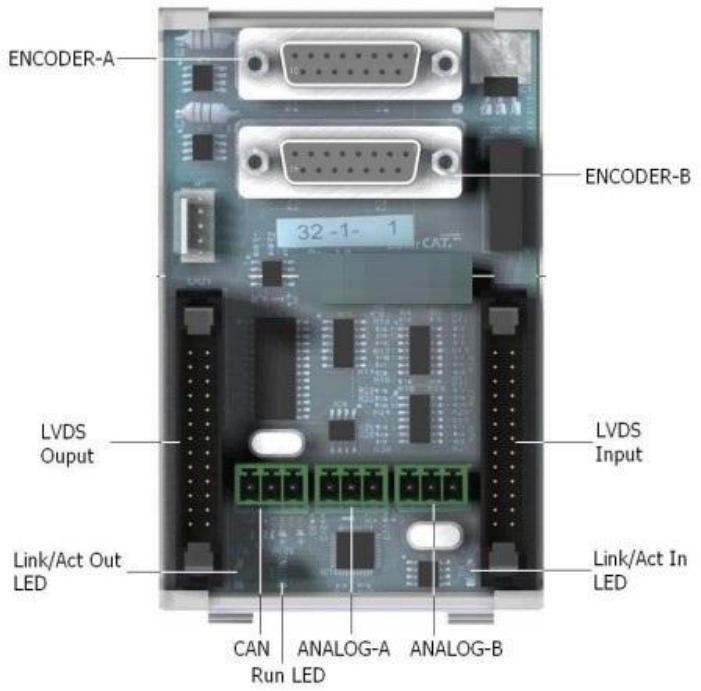


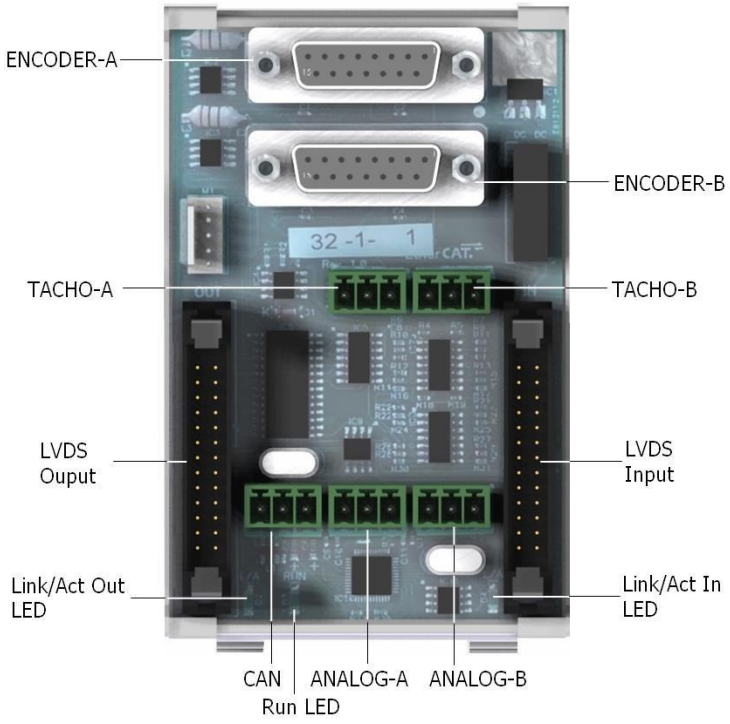
TTLACT/1



TTLAC/2



TTLACT/2



IDENTIFICATION

Type of the module:	TTLAC/1 TTLACT/1
Rated values:	5 V 230 mA
Mechanical dimensions:	62×108×56 mm
Weight:	100 g

Type of the module:	TTLAC/2 TTLACT/2
Rated values:	5 V 270 mA
Encoder max. frequency:	2 MHz
Mechanical dimensions:	62×108×56 mm
Weight:	110 g

1 PIN ASSIGNMENT

ENCODER

1: A
2: GND
3: BN
4: C
5: 5V
9: AN
10: B
11: GND
12: CN
14: 5V
shielding: connection box

CAN	**Connector marking:**
1: CANH	H
2: CANL	L
3: GND	GND

ANALOG	**Connector marking:**
1: ANALOG	A1/A2
2: GND	0
3: GND	GND

TACHO	**Connector marking:**
1: TACHO	T1/T2
2: GND	0
3: GND	GND

2 ENCODER INPUT

Reception of signals sent by the TTL incremental encoder

For TTLAC module, it is possible to receive current or voltage signals from sinusoidal encoders, using MUEXE guest module.

3 ANALOG OUTPUT

+/- 10 VDC speed reference signal (with resolution of 2^15) for analog drive

4 CAN INTERFACE

The module has a CAN interface through which it sends speed reference signal to the NCT servo drives and receives torque proportional data from the drive, which data it transmits to the control via EtherCAT.

The TTLAC module can serve one servo drive and the TTLAC2 module can serve two servo drives. For TTLAC the CAN address of the drive is 1, for TTLAC2 the CAN addresses of the drives are 1 or 2.

5 TACHOMETER SIGNAL OUTPUT

+/- 10 VDC speed check signal (with 2^15 resolution) for analog drives, if it is needed. The tachometer signal (speed check signal) produced from the signals of the incremental encoder can substitute the tachometer dynamo, generator.

6 ETHERCAT INTERFACE

The module communicates with the control via EtherCAT-LVDS bus. The module should be connected via the LVDS input to the EPU unit or to a module already connected to the EPU unit. The LVDS output connector can be used to connect a subsequent module.

The LEDs on the module and their functions are the following:

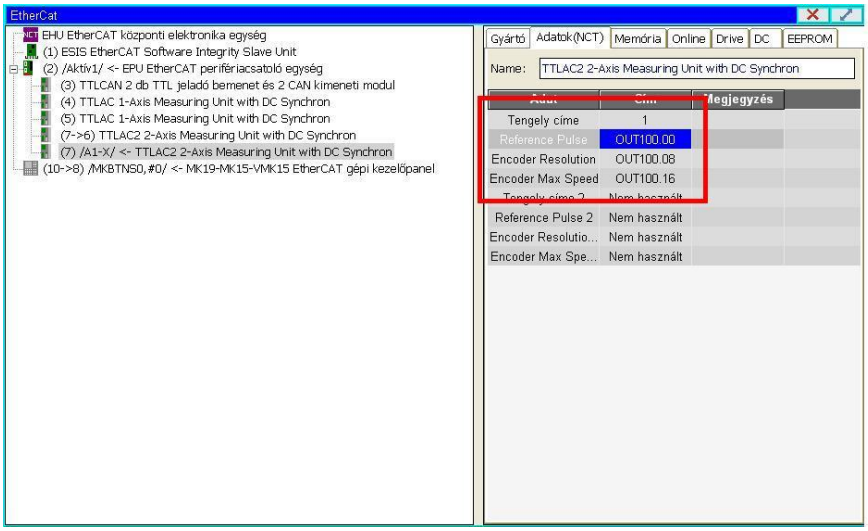
Link/Act In: the EtherCAT input port works

Link/Act Out: the EtherCAT output port works

Run: when the LED does not lit: the unit is in INIT status
when the LED light is blinking: the unit is in PRE-OPERATIONAL status
when the LED light flashes: the unit is in SAFE-OPERATIONAL status
when the LED lits: the unit is in OPERATIONAL status

7 ETHERCAT SETTINGS

In the EtherCAT window, the settings for the TTLAC (TTLAC2) module are the following:



7.1 THE ADDRESS OF THE AXIS

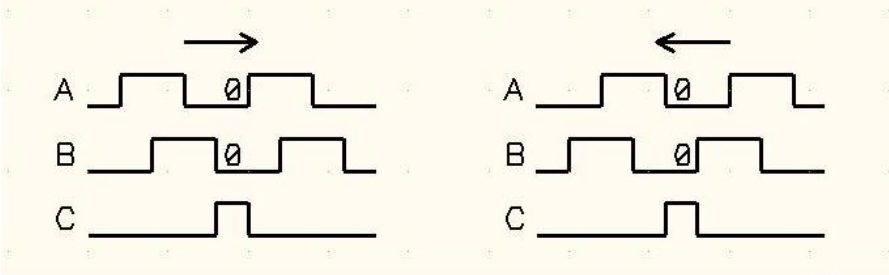
Assigning the encoder to a specific axis

7.2 REFERENCE PULSE

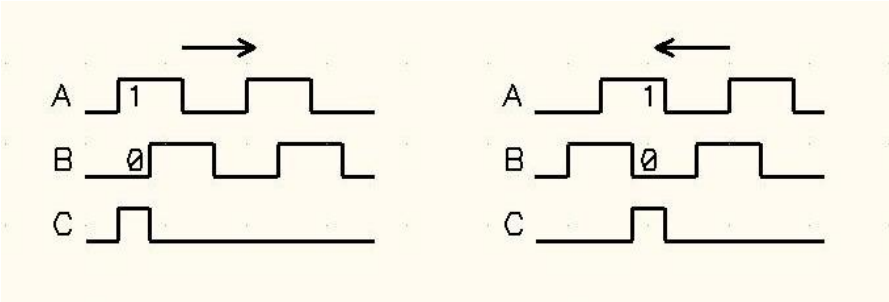
The signal level of the A and B phases pertaining to the reference pulse should be given on the set PLC variable (OUTxxxyy).

The value of the PLC variable is:

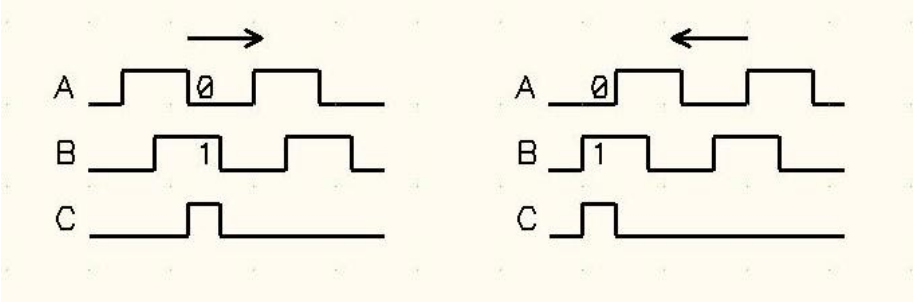
0: if A=0 and B=0



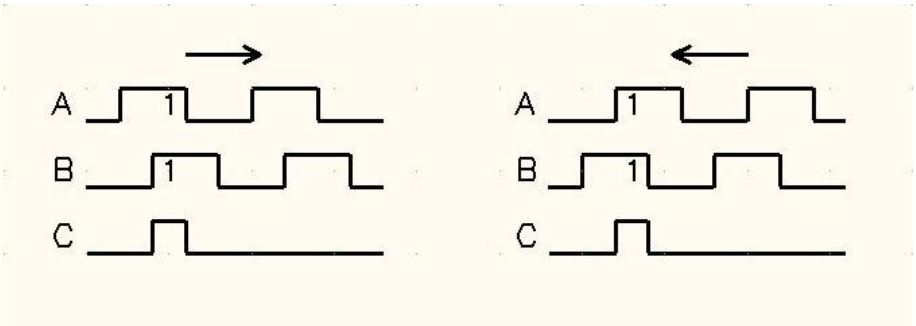
1: if A=1 and B=0



2: if A=0 and B=1



3: if A=1 and B=1



The correct setting should be checked in both directions of rotation!

7.3 ENCODER RESOLUTION

The period number pertaining to one revolution of the specific encoder should be given on the set PLC variable (OUTxxxyy). If there is an interpolation unit, the period number increased by the interpolation value should be given. It is necessary to generate tachometer signal.

7.4 ENCODER MAX SPEED

The maximum speed of the specific encoder in rpm should be given on the set PLC variable (OUTxxxyy). Setting negative value, the sign of the generated tachometer signal will also change. It is necessary to generate tachometer signal.

8 ETHERCAT PDO DATA

8.1 SPEEDSETVALUE (OUT)

Data type: INT32

31	30	29	28	27	26	25	24
SSV_31	SSV_30	SSV_29	SSV_28	SSV_27	SSV_26	SSV_25	SSV_24
23	22	21	20	19	18	17	16
SSV_23	SSV_22	SSV_21	SSV_20	SSV_19	SSV_18	SSV_17	SSV_16
15	14	13	12	11	10	9	8
SSV_15	SSV_14	SSV_13	SSV_12	SSV_11	SSV_10	SSV_9	SSV_8
7	6	5	4	3	2	1	0
SSV_7	SSV_6	SSV_5	SSV_4	SSV_3	SSV_2	SSV_1	SSV_0

Bit31..0 – SSV31..SSV0: signed speed reference signal
Maximum value: 0x200000
Minimum value: 0xffe00000

In the NC Ready state (EtherCAT OP mode), the value of SpeedSetValue on the output of the module will be valid promptly.

8.2 CONTROLDWORD (OUT)

Data type: UINT32

31	30	29	28	27	26	25	24
23	22	21	20	19	18	17	16
15	14	13	12	11	10	9	8
				ZPulseRequest		ErrorClear	
7	6	5	4	3	2	1	0

Bit 9 – Error Clear Deleting errors
When 1 is set for the value of the ErrorClear bit, the content of the ErrorDword will be deleted if the value of the ErrClearAck bit is 0 in the StatusDword.

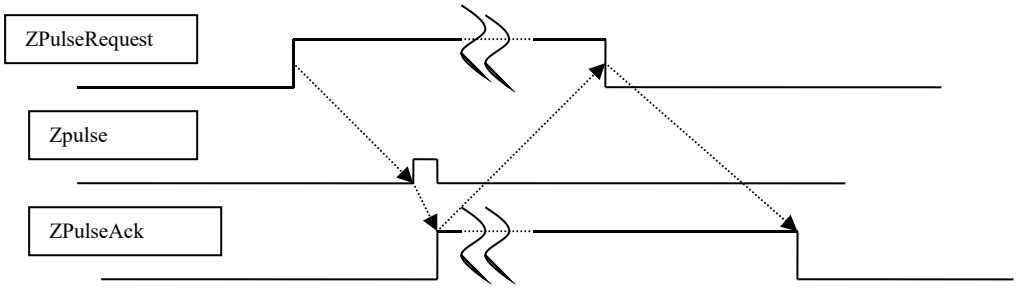
Bit 11 – ZpulseRequest Starting search for reference pulse
The ZpulseRequest bit starts search for reference pulse of the incremental encoder. The drive measurement system signals via the ZPulseAck flag bit when a reference pulse is found. This also indicates that the position (or angular position) is already available and can be read out from the ReferencePosition data field. On finding each

additional reference pulse, the current position of the reference pulse will be written in the ReferencePosition data field automatically, regardless of the status of the ZpulseRequest and ZpulseAck.

Short description of the process:

ZpulseRequest=1 triggers the reference pulse search. If the measurement system finds a reference pulse, it will be indicated by the ZPulseAck=1. Then the position of the reference pulse can be found in the ReferencePosition data field. The control acknowledges the existence of the reference pulse position by setting the ZpulseRequest bit to 0. ZpulseRequest=0 also causes ZpulseAck to take the value 0.

The flowchart below illustrates the process of reference point return. Refer also to ZPulseAck.



8.3 REFPULSEPOSITION (OUT)

Data type: UINT16

15	14	13	12	11	10	9	8
7	6	5	4	3	2	1	0
						B	A

Bit 0 – A: the signal level of the phase A of the incremental encoder at the position of the reference pulse

Bit 1 – B: the signal level of the phase B of the incremental encoder at the position of the reference pulse

See the subparagraph 7.2.

8.4 EncoderResolution (OUT)

Data type: UINT16

15	14	13	12	11	10	9	8
ER_15	ER_14	ER_13	ER_12	ER_11	ER_10	ER_9	ER_8
7	6	5	4	3	2	1	0
ER_7	ER_6	ER_5	ER_4	ER_3	ER_2	ER_1	ER_0

Bit15..0 – ER15..ER0: the period number of the incremental encoder per revolution

See the subparagraph 7.3.

8.5 EncoderMaxSpeed (OUT)

Data type: UINT16

15	14	13	12	11	10	9	8
EMS_15	EMS_14	EMS_13	EMS_12	EMS_11	EMS_10	EMS_9	EMS_8
7	6	5	4	3	2	1	0
EMS_7	EMS_6	EMS_5	EMS_4	EMS_3	EMS_2	EMS_1	EMS_0

Bit15..0 – EMS15..EMS0: the maximum speed of the incremental encoder on the given axis

See the subparagraph 7.4.

8.6 ActualPosition (IN)

Data type: UINT32

31	30	29	28	27	26	25	24
POS_31	POS_30	POS_29	POS_28	POS_27	POS_26	POS_25	POS_24
23	22	21	20	19	18	17	16
POS_23	POS_22	POS_21	POS_20	POS_19	POS_18	POS_17	POS_16
15	14	13	12	11	10	9	8
POS_15	POS_14	POS_13	POS_12	POS_11	POS_10	POS_9	POS_8
7	6	5	4	3	2	1	0
POS_7	POS_6	POS_5	POS_4	POS_3	POS_2	POS_1	POS_0

Bit 31..0 - POS_31..POS_0: current position

8.7 REFERENCEPOSITION (IN)

Data type: UINT32

31	30	29	28	27	26	25	24
RPOS_31	RPOS_30	RPOS_29	RPOS_28	RPOS_27	RPOS_26	RPOS_25	RPOS_24
23	22	21	20	19	18	17	16
RPOS_23	RPOS_22	RPOS_21	RPOS_20	RPOS_19	RPOS_18	RPOS_17	RPOS_16
15	14	13	12	11	10	9	8
RPOS_15	RPOS_14	RPOS_13	RPOS_12	RPOS_11	RPOS_10	RPOS_9	RPOS_8
7	6	5	4	3	2	1	0
RPOS_7	RPOS_6	RPOS_5	RPOS_4	RPOS_3	RPOS_2	RPOS_1	RPOS_0

Bit 31..0 - RPOS_31..RPOS_0: reference position

8.8 STATUSDWORD (IN)

Data type: UINT32

31	30	29	28	27	26	25	24
POS_31	POS_30	POS_29	POS_28	POS_27	POS_26	POS_25	POS_24
23	22	21	20	19	18	17	16
POS_23	POS_22	POS_21	POS_20	POS_19	POS_18	POS_17	POS_16
15	14	13	12	11	10	9	8
POS_15	POS_14	POS_13	POS_12	POS_11	POS_10	POS_9	POS_8
7	6	5	4	3	2	1	0
POS_7	POS_6	POS_5	ErrClearAck	ZpulseAck	Abs/Incr	POS_1	POS_0

Bit 2 - Abs/Incr Absolute or incremental encoder.
For TTLAC module its value is always 1, in other words it is incremental encoder.

Bit 3 - ZpulseAck Acknowledgement of valid reference pulse.
The value of this flag bit will be 1, when the first reference pulse is found after the start of the reference pulse search(ZpulseRequest). The drive measurment system indicates via the ZPulseAck flag bit that a reference pulse has been found, indicating that the ReferencePosition value is valid and can be read out.

Bit 4 - ErrClearAck. Locking the error clearance
The value of bit 1 of the ControlDword ErrClear causes this ErrClearAck bit to take the value 1 and remain 1 until the ControlDword ErrClear bit changes to 0.

8.9 ERRORDWORD (IN)

Data type: UINT32

31	30	29	28	27	26	25	24
23	22	21	20	19	18	17	16
15	14	13	12	11	10	9	8
7	6	5	4	3	2	1	0
						EncoderErr	UnitErrors

Bit 0 - UnitErrors Global error indication.
The UnitErrors bit takes the value 1 if any kind of error occurs on the unit.
The possible cause of the error can be explored by examination of additional error bits.
Bit 1 - EncoderErr Encoder error on the encoder connected.

8.10 MESSAGECODE (IN)

Data type: UINT32

The code identifying data (Message Data) sent by the NCT drive to the control through CAN bus.
In general, it is the code identifying motor current (0x00000002).

31	30	29	28	27	26	25	24
MSGC_31	MSGC_30	MSGC_29	MSGC_28	MSGC_27	MSGC_26	MSGC_25	MSGC_24
23	22	21	20	19	18	17	16
MSGC_23	MSGC_22	MSGC_21	MSGC_20	MSGC_19	MSGC_18	MSGC_17	MSGC_16
15	14	13	12	11	10	9	8
MSGC_15	MSGC_14	MSGC_13	MSGC_12	MSGC_11	MSGC_10	MSGC_9	MSGC_8
7	6	5	4	3	2	1	0
MSGC_7	MSGC_6	MSGC_5	MSGC_4	MSGC_3	MSGC_2	MSGC_1	MSGC_0

8.11 MESSAGEDATA (IN)

Data type: FLOAT32

The data sent by the NCT drive to the control through CAN bus.
In general, it is a data value proportional to the motor current.

31	30	29	28	27	26	25	24
MSGD_31	MSGD_30	MSGD_29	MSGD_28	MSGD_27	MSGD_26	MSGD_25	MSGD_24
23	22	21	20	19	18	17	16
MSGD_23	MSGD_22	MSGD_21	MSGD_20	MSGD_19	MSGD_18	MSGD_17	MSGD_16
15	14	13	12	11	10	9	8
MSGD_15	MSGD_14	MSGD_13	MSGD_12	MSGD_11	MSGD_10	MSGD_9	MSGD_8
7	6	5	4	3	2	1	0
MSGD_7	MSGD_6	MSGD_5	MSGD_4	MSGD_3	MSGD_2	MSGD_1	MSGD_0

8.12 TIMESTAMP_ (IN)

Data type: UINT16

Time elapsed between the current and previous position values in microseconds.
For information only. It is not required for synchronised DC unit.

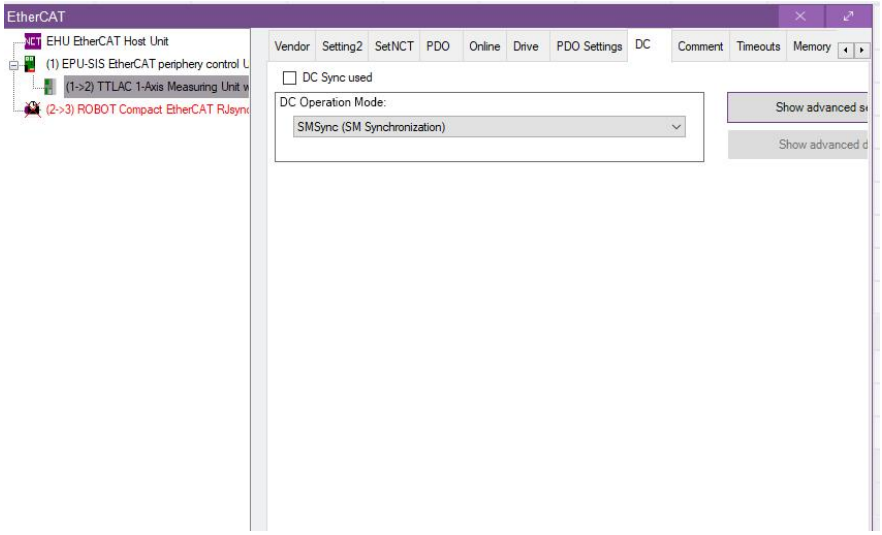
15	14	13	12	11	10	9	8
TS 15	TS 14	TS 13	TS 12	TS 11	TS 10	TS 9	TS 8
7	6	5	4	3	2	1	0
TS 7	TS 6	TS 5	TS 4	TS 3	TS 2	TS_1	TS_0

9 ADDITIONAL INFORMATION ON TTLACT/X

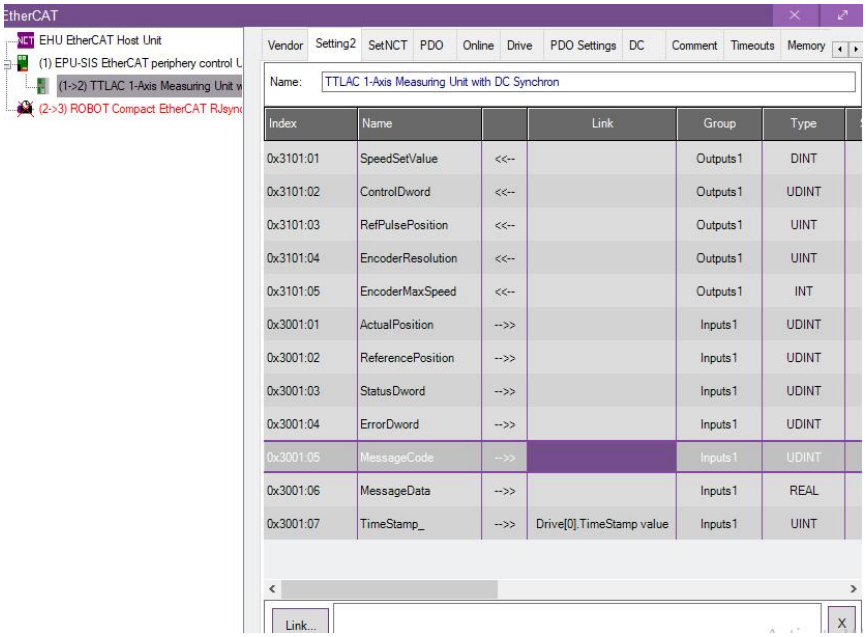
From the **firmware version 4.3**, the **TTLACT**/x unit should be set to the EtherCAT SM Synchron mode for accelerated tachosignal generation and the time stamp variable should be passed to the NC.

To do this, do the following in the EtherCAT window on the control:

- select the SMSync (SM Synchronization) mode in the DC tab;
- in the DC Sync used box, the selection should be removed.



- assign the **TimeStamp value USHORT16** data of the appropriate Drive(X) unit to the **TimeStamp_** variables in the Settings2 tab.



- after configuration, the set values should be validated and saved (Set Config and Save Config).