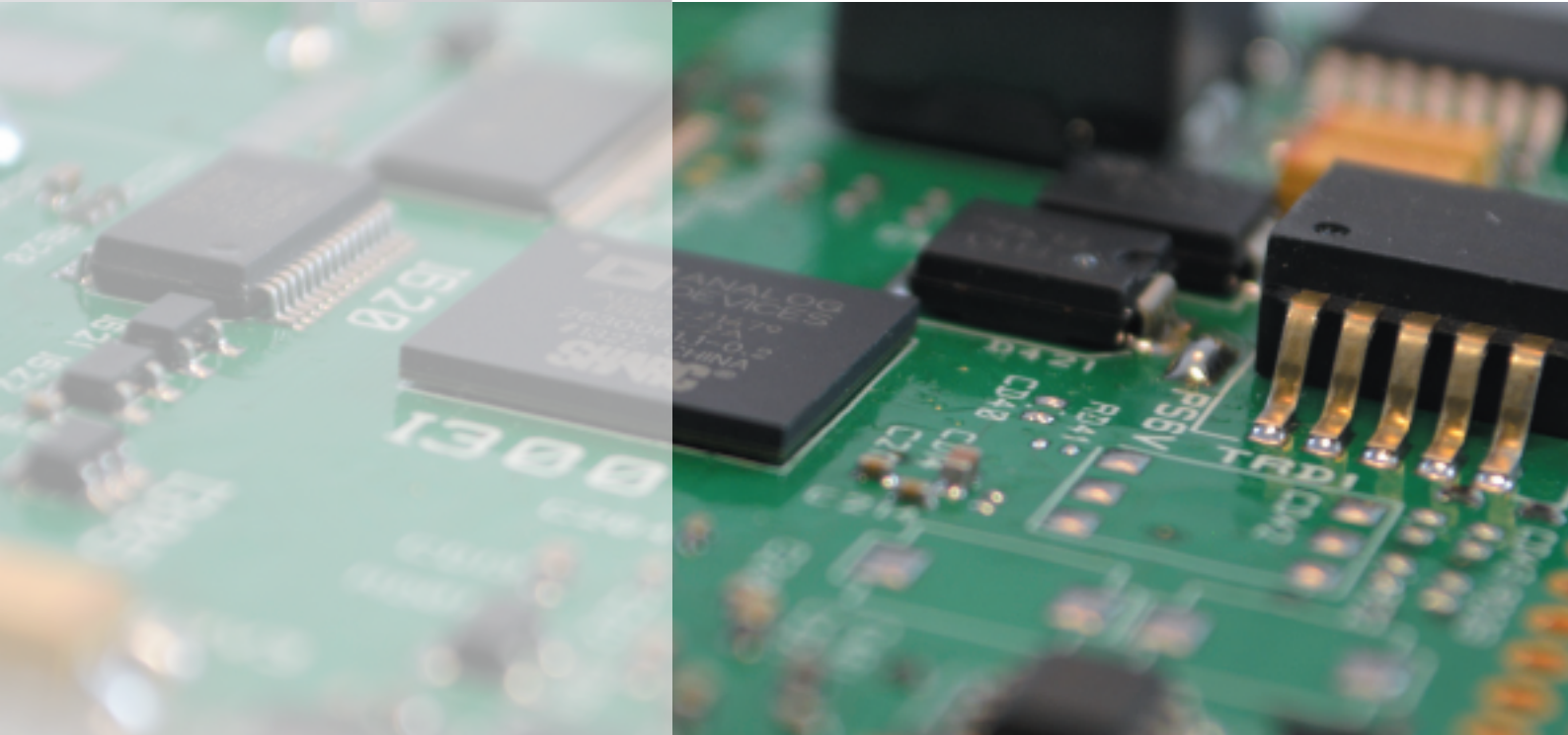


Fonction specifications



CU2115 - Documentation EtherCAT

Ether**CAT**® 



Document revisions

Date	Version	Firmware	Author	Modifications
12-Oct-16	1.0	2.0	M.Raoux	Add Error & Display
13-Mar-13	1.0	2.0	Heimbücher	New creation
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TABLE OF CONTENTS

1	GENERAL DESCRIPTION	3
2	SAFETY INSTRUCTIONS	3
3	PREREQUISITES: HARDWARE AND SOFTWARE	3
4	DESCRIPTION OF THE FUNCTIONALITY	4
4.1	State machine	4
4.2	CONTROLWORD	7
4.3	STATUSWORD	8
4.4	Error handling	9
4.5	Modes of operation	10
4.5.1	Profile Position Mode (pp)	11
4.5.2	Cyclic Synchronous Position Mode (csp)	15
4.5.3	Homing Mode (hm)	17
4.5.4	Manual Profile Position Mode (mpp)	19
4.6	Position control functions	20
4.6.1	Position reached	20
4.6.2	Following error	21
4.6.3	Standstill detection	22
4.7	Option Codes	22
5	OBJECT DICTIONARY	24
6	TABLE OF ILLUSTRATIONS	36
7	TABLES	37
8	EXPLICATION OF TERMS	38
9	BIBLIOGRAPHY	39
10	ERROR CODES	39
11	DRIVE DISPLAY CODES	46

1 GENERAL DESCRIPTION

This document describes the drive profile CiA402 of the servo amplifier Drive-FB, which is defined in the standard IEC 61800-7-201 (Profile type 1) ^[4].

Table 1 lists the categories for support of objects or functions of this drive profile.

Category:	Abbr.	Description
Mandatory	M	Object or function shall be supported
Conditional	C	It depends on other parameters or functions whether the object or function shall be supported
Recommended	R	Support of the object or of the function is recommended
Optional	O	Object or function may be supported, but does not have to be

Table 1: Categories for support of objects or functions

2 SAFETY INSTRUCTIONS

When using the servo amplifier and the available functionalities, the relevant applicable safety regulations must be observed.

3 PREREQUISITES: HARDWARE AND SOFTWARE

Servo amplifier Drive-FB with corresponding application and EtherCAT-Firmware

4 DESCRIPTION OF THE FUNCTIONALITY

4.1 State machine

The drive is controlled by the state machine defined in the standard IEC 61800-7-201 describing the current state of the device. The state can be controlled via a CONTROLWORD, while the STATUSWORD indicates the actual state. But states can also change due to results like e. g. occurrence of a fault in the servo amplifier (see Illustration 1).

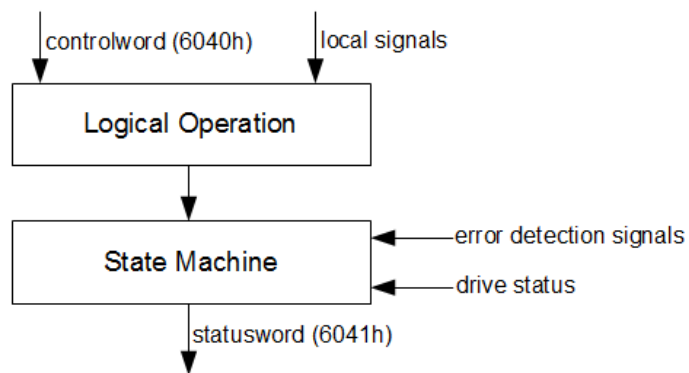


Illustration 1: Control of the state machine ^[4]

The following states are possible:

- NOT READY TO SWITCH ON
- SWITCH ON DISABLED
- READY TO SWITCH ON
- SWITCHED ON
- OPERATION ENABLED
- QUICK STOP ACTIVE
- FAULT REACTION ACTIVE
- FAULT

The individual states may change via the transitions 0 to 15 indicated in Illustration 2. Transition 16 is not supported. The initial state after connection of the voltage supply for the servo amplifier is NOT READY TO SWITCH ON.

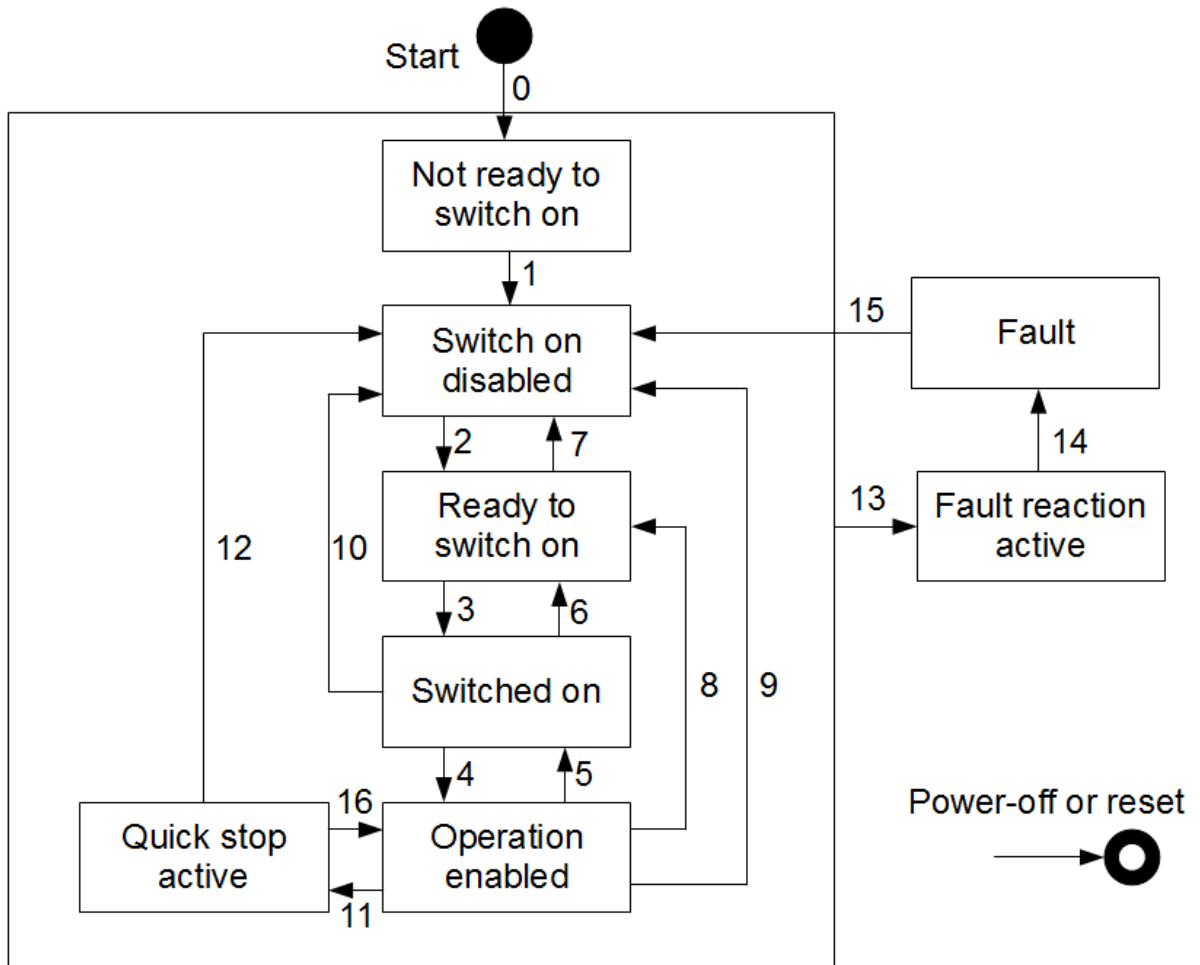


Illustration 2: State machine ^[4]

Depending on the state of the state machine, the functions listed in the Table 2 will be executed or not.

Function	States of the state machine							
	Not ready to switch on	Switch on disabled	Ready to switch on	Switched on	Operation enabled	Quick stop active	Fault reaction active	Fault
Brake applied, if present	Yes	Yes	Yes	Yes	Yes / No	Yes / No	Yes / No	Yes
Low-level power applied	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
High-level power applied	Yes / No	Yes / No	Yes / No	Yes	Yes	Yes	Yes	Yes / No
Drive function enabled	No	No	No	No	Yes	Yes	Yes	No
Configuration allowed	Yes	Yes	Yes	Yes	Yes / No	Yes / No	Yes / No	Yes

Table 2: Activated functions depending on the state of the state machine ^[4]

4.2 CONTROLWORD

The CONTROLWORD (Table 3) contains both the general bits and the operation mode specific bits that are only valid in the corresponding operation mode (operation mode specific).

CONTROLWORD		
Bit	Meaning	Category
0	Switch on	M
1	Enable voltage	M
2	Quick stop	O
3	Enable operation	M
4 - 6	Operation mode specific	O
7	Fault reset	M
8	Stop	O
9	Operation mode specific	O
10	reserved	O
11 - 15	Manufacturer specific	O

Table 3: CONTROLWORD (6040h) ^[2]

Using the CONTROLWORD it is possible to change between the states of the state machine (see Table 4). The transitions 0, 1 and 14 are automatic transitions, transition 13 is released by a fault event.

CONTROLWORD	Bits of the CONTROLWORD					Transition(s)
	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	
Shutdown	0	X	1	1	0	2, 6, 8
Switch on	0	0	1	1	1	3
Switch on + Enable operation	0	1	1	1	1	3 + 4 (NOTE)
Disable voltage	0	X	X	0	X	7, 9, 10, 12
Quick stop	0	X	0	1	X	7, 10, 11
Disable operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4, 16
Fault reset	0 → 1	X	X	X	X	15
NOTE: Automatic transition to Enable operation state after executing SWITCHED ON state functionality.						

Table 4: Commands from bit combinations of the CONTROLWORD ^[4]

4.3 STATUSWORD

The STATUSWORD (Table 5) indicates the state of the drive. It contains general bits for the state machine and operation mode specific bits that are only valid in the corresponding operation mode (operation mode specific).

STATUSWORD			
Bit	Meaning	Category	Notes
0	Ready to switch on	M	
1	Switched on	M	
2	Operation enabled	M	
3	Fault	M	
4	Voltage enabled	O	
5	Quick stop	O	
6	Switch on disabled	M	
7	Warning	O	
8	Home Position Set	O	Manufacturer specific
9	Remote	O	
10	Target reached or reserved	O	
11	Internal limit active	O	
12	Operation mode specific	C	Mandatory for mode csp, csv, cst
13	Operation mode specific	O	
14 - 15	Manufacturer specific	O	

Table 5: STATUSWORD (6041h) ^[2]

Each state the state machine may adopt is defined as bit pattern in the STATUSWORD. Thus the actual state of the state machine can be found out by means of the STATUSWORD (see Table 6).

Nr.	STATUSWORD	PDS FSA state
0	xxxx xxxx x0xx 0000	Not ready to switch on
1	xxxx xxxx x1xx 0000	Switch on disabled
2	xxxx xxxx x01x 0001	Ready to switch on
3	xxxx xxxx x01x 0011	Switched on
4	xxxx xxxx x01x 0111	Operation enabled
5	xxxx xxxx x00x 0111	Quick stop active
6	xxxx xxxx x0xx 1111	Fault reaction active
7	xxxx xxxx x0xx 1000	Fault

Table 6: State from bit combinations of the STATUSWORD ^[4]

4.4 Error handling

If a fault occurs in the servo amplifier, the state changes via transition 13 from any regular state to FAULT REACTION ACTIVE. In this state a fault reaction¹ is executed which is displayed via the object FAULT REACTION OPTION CODE (605Eh). The fault reaction may either be an immediate switch-off of the drive power with simultaneous closing of an available brake or the controlled stopping via a corresponding brake ramp. Doing so, the brake ramp can be executed with normal delay (object 6084h) or with quick stop delay (object 6085h). It depends on the occurred fault which reaction will finally be executed. After execution of the reaction there will automatically follow a transition into the state FAULT. In addition to bit 3 in the STATUSWORD also bit 0 in the object *Error register* indicates if there is any fault active at present (see Table 7). In addition also the type of fault can be found out using this object. The actual fault number is in the object *Error code* (see Table 8). The fault state can only be left via a fault reset (see Table 4). Of course this only applies if the corresponding fault is no longer active.

Bit	Meaning ²
0	Generic error
1	Current
2	Voltage
3	Temperature
4	Communication error (overrun, error state)
5	Device profile specific
6	reserved (always 0b)
7	manufacturer specific

Table 7: *Error register* (1001h) ^[2]

Fault number ³	ms ⁴	Fault group ⁵
15	8	7
1 - 255	1	0 - 127

Table 8: *Error code* (603Fh)

ms: manufacturer specific

¹ The fault reaction in the object FAULT REACTION OPTION CODE cannot be defined from externally for the time being.

² Presently in case of fault the bits 0 and 7 in the *Error register* are always set together. The other bits are not used for the time being.

³ For the meaning of the individual fault numbers refer to the document basic functions ServoFB.

⁴ Bit 7 in *Error code* is always set for the time being.

⁵ The bits of the fault group are all reset for the time being.

4.5 Modes of operation

The Table 9 lists the modes of operation which are described in the standard IEC 61800-7-201.

Modes of operation	Abbr.	Value
No allocation	-	0
Profile position mode	pp	1
Velocity mode (frequency converter)	vl	2
Profile velocity mode	pv	3
Torque profile mode	tq	4
Homing mode	hm	6
Interpolated position mode	ip	7
Cyclic synchronous position mode	csp	8
Cyclic synchronous velocity mode	csv	9
Cyclic synchronous torque mode	cst	10
reserved	-	11...127
Manual profile position mode (manufacturer specific)	mpp	-127
Manufacturer specific modes	-	-128... -1

Table 9: Modes of operation (6060h)

The servo amplifier Drive-FB presently supports the following operating modes:

- Profile Position Mode (pp)
- Cyclic Synchronous Position Mode (csp)
- Manual Profile Position Mode (mpp; manufacturer specific)
- Homing Mode (hm)

Via the object *Modes of operation* (6060h) the operating mode can be set. The really active operating mode is displayed via the object *Modes of operation display* (6061h). The object *Supported drive modes* (6502h) indicates which modes are supported in the software at all (see Table 10). If the corresponding bit is set, the appropriate mode will be supported.

The operating mode can only be changed if no fault is active, that is in the states NOT READY TO SWITCH ON, SWITCH ON DISABLED, READY TO SWITCH ON, SWITCHED ON and OPERATION ENABLED. Besides this, the axis must not be in motion during change-over.

In the state OPERATION ENABLED the corresponding functions for the selected operating mode are released and it is possible to execute positioning commands, for example.

Homing may be executed in any state except the fault states FAULT REACTION ACTIVE and FAULT, because here no movement of the axis is necessary.

Manufacturer specific			Device-profile specific											
31	17	16	15	10	9	8	7	6	5	4	3	2	1	0
		mpp	reserved	cst	csv	csp	ip	hm	r	tq	pv	vl	pp	

Table 10: Possible operating modes⁶

4.5.1 Profile Position Mode (pp)

(Modes of operation (6060h) = 1)

In *Profile Position Mode* the axis can be moved into a defined position by defining a target position. This is done using an internal trajectory generator which calculates a corresponding movement profile with intermediate position from the current position up to the target position. These intermediate positions are handed over cycle by cycle to the downstream position control (see Illustration 3).

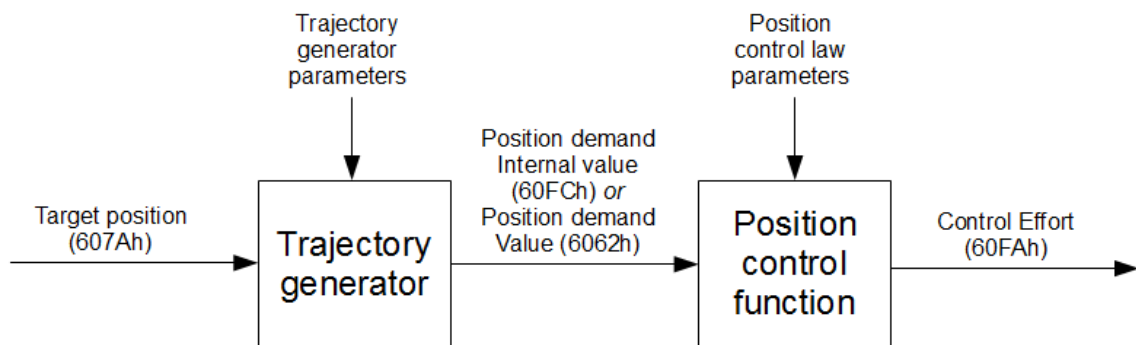
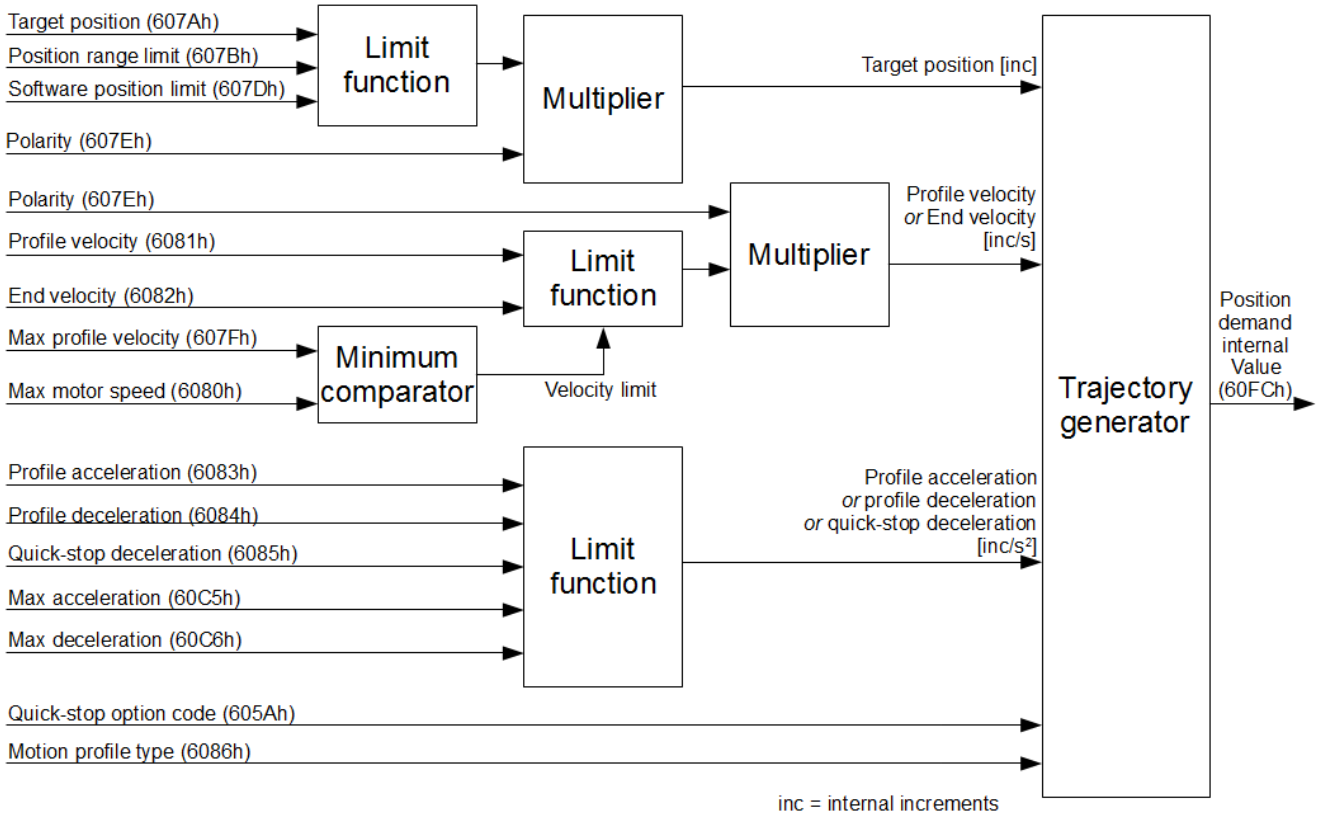


Illustration 3: Trajectory generator and position regulation ^[4]

For the movement profile, you still need the velocity (*Profile velocity*), the acceleration (*Profile acceleration*) and the deceleration (*Profile deceleration*). Besides this it is possible to indicate various limit values (see Illustration 4).

It must be observed that the use of the *Profile Position Mode* is only reasonable if bit 8 in the STATUSWORD is set, i. e. the homing has been successfully executed before.

⁶ Depending on the revision number (1018h:3) only certain modes from the table are supported for the time being.


 Illustration 4: Trajectory generator for the Profile Position Mode ^[4]

The *Profile Position Mode* uses some of the application-specific bits of the CONTROLWORD and of the STATUSWORD (see Table 11 and Table 12).

Controlword (Profile Position Mode)	
Bit	Meaning
0 - 3	see Table 3
4	New setpoint
5	Change set immediately
6	abs/rel ⁷
7	see Table 3
8	Stop
9	Change on setpoint ⁸
10 - 15	see Table 3

Table 11: Controlword (Profile Position Mode)

Statusword (Profile Position Mode)	
Bit	Meaning
0 - 9	see Table 5
10	Target reached
11	see Table 5
12	Set-point acknowledge
13	Following error
14 - 15	see Table 5

Table 12: Statusword (Profile Position Mode)

⁷ Presently only an absolute specification of the target position is supported. Therefore bit 6 in the CONTROLWORD is not evaluated for positioning.

⁸ As presently only the *Single Set-Point Mode* is supported, bit 5 in the CONTROLWORD must always be set for positioning, while the status of bit 9 is not evaluated.

If currently no positioning is active, a rising flank of bit 4 of the CONTROLWORD starts the positioning procedure. If a positioning has already been executed, the definitions in Table 13 must be observed. The Table 14 defines the use of bits 6 and 8 of the CONTROLWORD and the Table 15 the one of the bits of the STATUSWORD.

Bit 9	Bit 5	Bit 4	Definition
0	0	0 → 1	Positioning shall be completed (target reached) before the next one gets started
X	1	0 → 1	Next positioning shall be started immediately
1	0	0 → 1	Positioning with the current profile velocity up to the current setpoint shall be proceeded and then next positioning shall be applied

Table 13: Bit definition (4, 5, 9) of the Controlword in Profile Position Mode ^[4]

Bit	Value	Definition
6	0	Target position shall be an absolute value
	1	Target position shall be a relative value (depending on object 60F2h)
8	0	Positioning shall be executed or continued
	1	Axis shall be stopped accordingly to halt option code (605Dh)

Table 14: Bit definition (6, 8) of the Controlword in Profile Position Mode ^[4]

Bit	Value	Definition
10	0	Halt (Bit 8 in controlword) = 0: Target position not reached Halt (Bit 8 in controlword) = 1: Axis decelerates
	1	Halt (Bit 8 in controlword) = 0: Target position reached Halt (Bit 8 in controlword) = 1: Velocity of axis is 0
12	0	Previous setpoint already processed, waiting for new setpoint
	1	Previous setpoint still in process, setpoint overwriting shall be accepted
13	0	No following error
	1	Following error

Table 15: Bit definition (10, 12, 13) of the Statusword in Profile Position Mode ^[4]

The operating mode generally allows two types how to proceed with the specification of new target positions with regard to the *Control Device*. This depends on the CHANGE SET IMMEDIATELY Bit in the CONTROLWORD. If it is set, a new position nominal value is immediately approached, even if the previous position nominal value had not been reached yet (single set-point). The other possibility where a new nominal value is intermediately stored in a buffer so long until the previous nominal value has been reached is not supported for the time being (set of set-points).

The specification of a new target position is done via a handshake function. After a new target position has been transferred to the *Drive Device*, the *Control Device* tells the *Drive Device* that the new target position is valid using a rising flank in the NEW SET-POINT Bit of the CONTROLWORD. The *Drive Device* confirms receipt by setting the SET-POINT

ACKNOWLEDGE Bit in the STATUSWORD and approaching the new target position.

Then the *Control Device* resets the NEW SET-POINT Bit of the CONTROLWORD again. In reply to this, the *Drive Device* in turn resets the SET-POINT ACKNOWLEDGE Bit in the STATUSWORD and thus signals that it is ready to receive a new target position. If the last target position has been approached without any new settings being made, the TARGET REACHED Bit in the STATUSWORD is set (see Illustration 5).

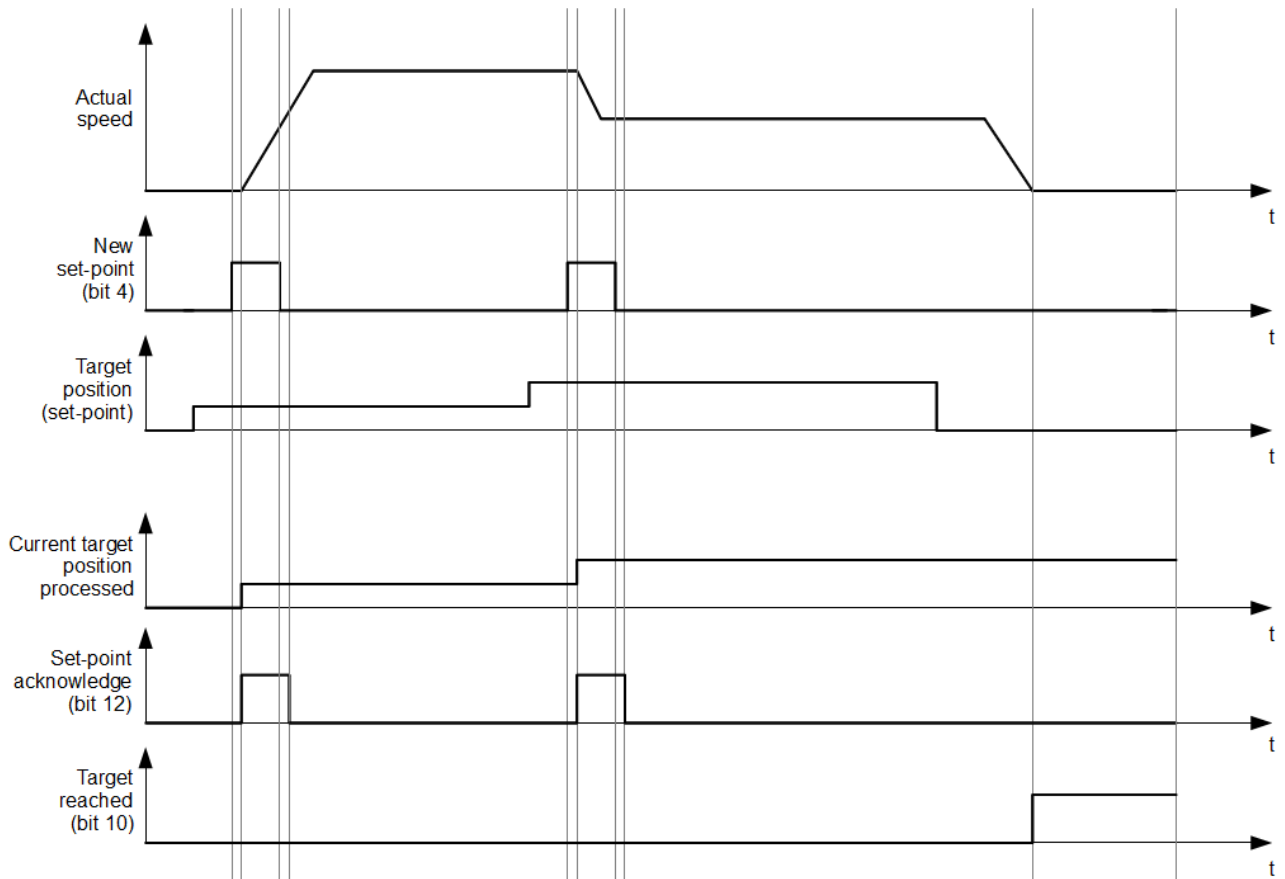


Illustration 5: Handshake procedure for the *Single Set-Point* function ^[4]

4.5.2 Cyclic Synchronous Position Mode (csp)

(Modes of operation (6060h) = 8)

In *Cyclic Synchronous Position Mode* the content of the object TARGET POSITION is transferred directly to the position controller and not via a trajectory generator like in the *Profile Position Mode*. Illustration 6 shows the functioning.

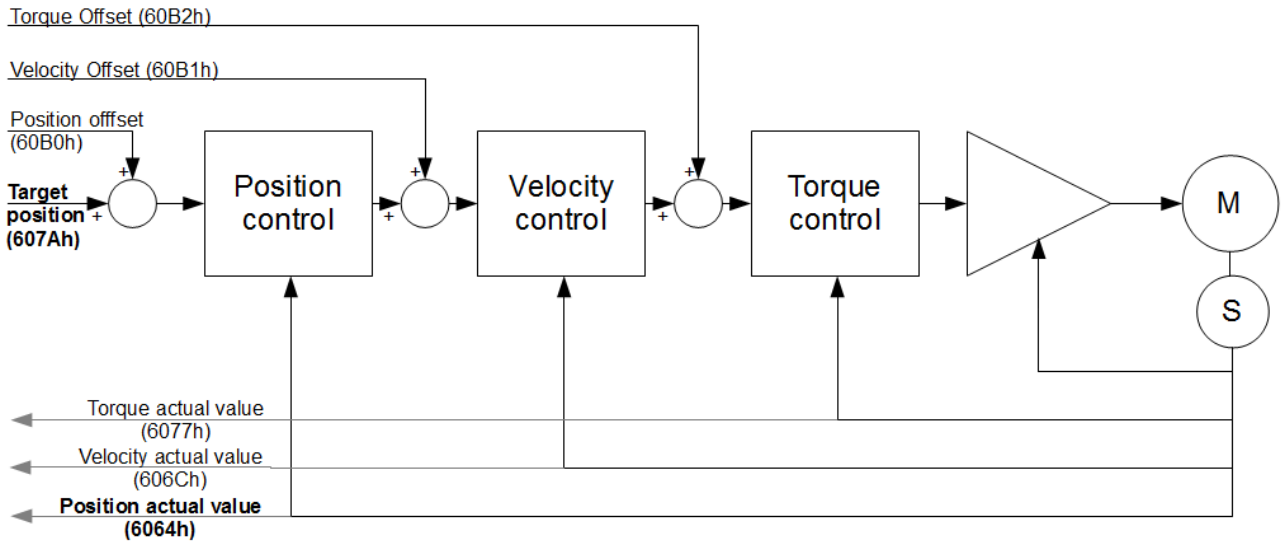


Illustration 6: Overview of the Cyclic Synchronous Position Mode ^[4]

Illustration 7 shows the functions of this mode in detail.

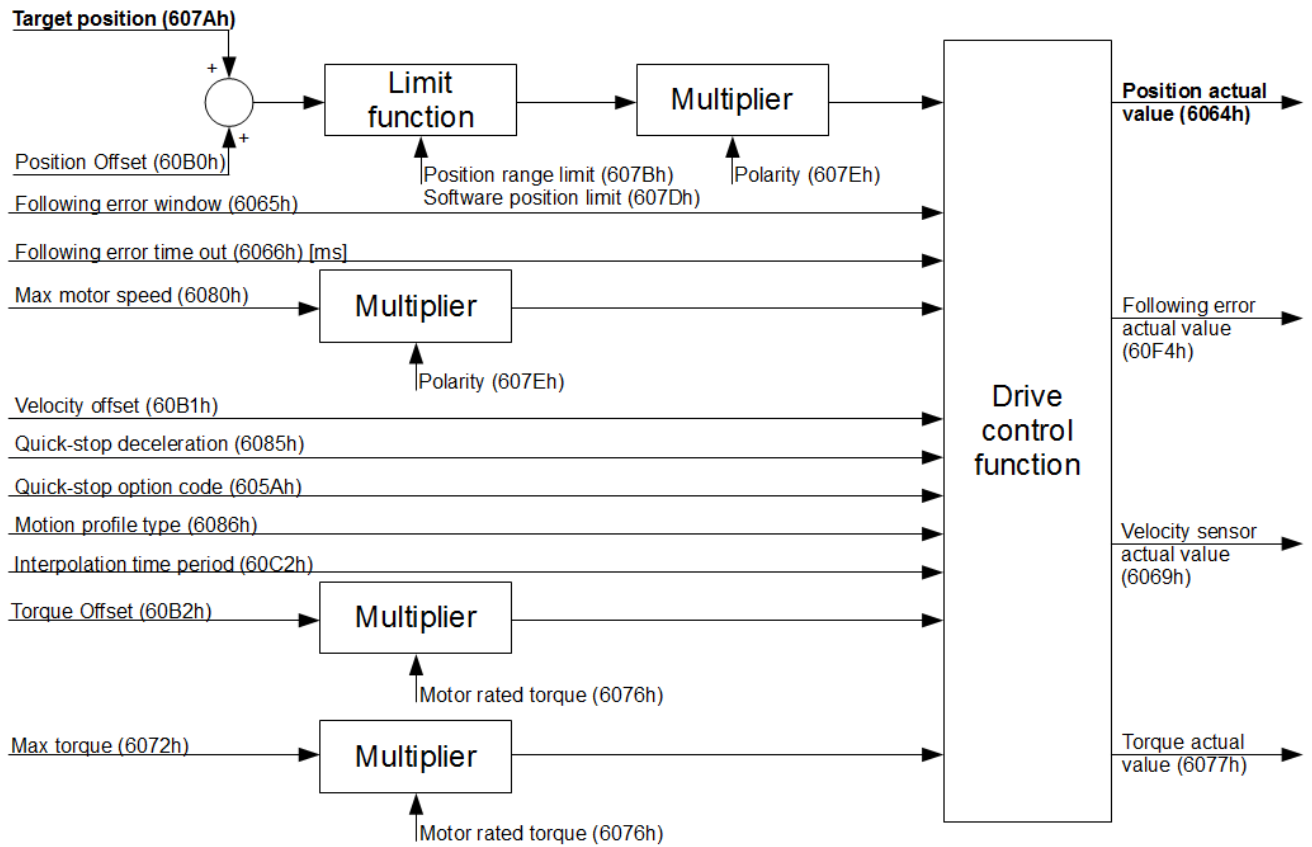


Illustration 7: Cyclic Synchronous Position Mode – Control Function ^[4]

For this operating mode there are no specific bits in the CONTROLWORD; in the STATUS-WORD the bits 10, 12 and 13 are used (see Table 16).

Statusword (Cyclic Synchronous Position Mode)	
Bit	Meaning
0 - 9	see Table 5
10	Status Toggle
11	see Table 5
12	Drive follows the command value
13	Following Error
14 - 15	see Table 5

Table 16: Statusword (Cyclic Synchronous Position Mode) ^[2]

The current nominal position is cyclically received by the *Drive Device* and fed into the position control as nominal value. A new value is signaled via the Bit STATUS TOGGLE in the STATUSWORD which changes its status with each update of the input data.

The Bit DRIVE FOLLOWS THE COMMAND in the STATUSWORD is set if the status machine is in state OPERATION ENABLED and the drive follows the position settings of the *Control Device*. In case the drive does no longer follow the nominal values for any reason, e. g. if an internal stop reaction is being executed, this bit will be reset.

4.5.3 Homing Mode (hm)

(Modes of operation (6060h) = 6)

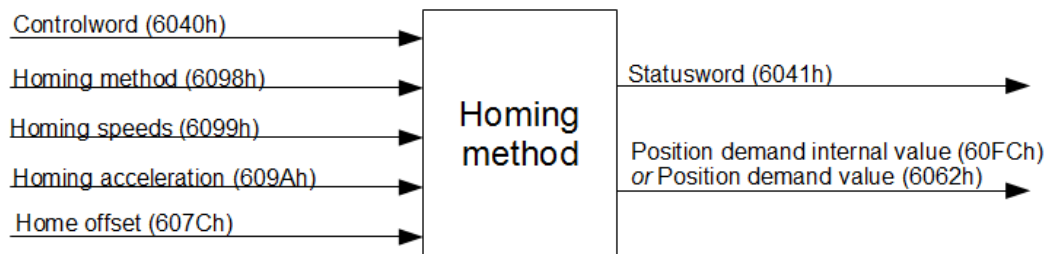


Illustration 8: Homing Mode ^[4]

Illustration 8 describes the function of the *Homing Mode* in general. In the present implementation, however, only the objects CONTROLWORD (6040h), HOMING METHOD (6098h), HOME OFFSET (607Ch) and STATUSWORD (6041h) are required, because the axis itself presently does not move during execution of the mode.

The methods listed in standard IEC 61800-7-201 are not supported for the time being. Instead, the following manufacturer-specific homing methods are available:

- Homing method 1 (6098h = 81h) – Referencing exactly (Setting):
The axis is moved exactly to the reference position beforehand. Then homing is started. The servo takes over the value in *Home offset* (607Ch) as current position actual value.
- Homing method 2 (6098h = 82h) – Referencing tolerant:
The axis must be moved near the reference position beforehand. The maximum deviation, however, must not exceed half an encoder period. Then homing is started. The servo only takes over full encoder periods of the value in *Home offset* (607Ch) as current position actual value and maintains the absolute value within one encoder period.

In contrast to the other operating modes, the homing mode can be executed in every no-error status, because the axis does not perform any movement in the modes implemented for the time being.

Also for the homing mode there are specific bits in the CONTROLWORD and in the STATUSWORD (see Table 17 and Table 18).

Controlword (Homing Mode)	
Bit	Meaning
0 - 3	see Table 3
4	Homing operation start
5 - 6	reserved
7	see Table 3
8	Stop
9 - 15	see Table 3

Table 17: Controlword (Homing Mode) ^[4]

Statusword (Homing Mode)	
Bit	Meaning
0 - 9	see Table 5
10	Target reached
11	see Table 5
12	Homing attained
13	Homing error
14 - 15	see Table 5

Table 18: Statusword (Homing Mode) ^[4]

The bits 4 and 8 of the CONTROLWORD are defined in Table 19. In the present implementation bit 8 only serves for start release of the homing procedure. As the axis does not move in the applied homing methods, there is no implementation of any stop reaction, either.

Bit	Value	Definition
4	0	Do not start homing procedure
	1	Start or continue homing procedure
8	0	Enable bit 4
	1	Stop axis according to halt option code (605Dh)

Table 19: Bit definition (4, 8) of the Controlword in Profile Position Mode ^[4]

The bits 10, 12 and 13 of the STATUSWORD are defined in Table 20.

Bit 13	Bit 12	Bit 10	Definition ⁹
0	0	0	Homing procedure is in progress
0	0	1	Homing procedure is interrupted or not started
0	1	0	Homing is attained, but target is not reached
0	1	1	Homing procedure is completed successfully
1	0	0	Homing error occurred, velocity is not 0
1	0	1	Homing error occurred, velocity is 0
1	1	X	reserved

Table 20: Bit definition (10, 12, 13) of the statusword in Homing Mode ^[4]

Homing is requested via bit 4 in the CONTROLWORD. If the servo amplifier is ready for a new homing, it immediately executes the corresponding functions. In case of successful homing, the bit HOMING ATTAINED in the STATUSWORD is set and with the next homing request will be reset again.

In the implemented homing modes the bit TARGET REACHED in the STATUSWORD is usually always set. For this purpose it is permanently checked whether the position actual value is situated within the defined window around the position nominal value.

To be able to recognize at any time whether homing has already been executed successfully before and thus, the actual position made available by the servo-amplifier is correct, bit 8 (HOME POSITION SET) of the STATUSWORD can be queried in any mode.

4.5.4 Manual Profile Position Mode (mpp)

(Modes of operation (6060h) = -127)

With the manual positioning mode an axis can be moved by means of the trajectory generator as long as a certain bit in the CONTROLWORD is set. Thus, controlled movement of an axis is even possible if it has not been referenced yet, that is bit 8 in the STATUSWORD is not set yet.

The manual positioning mode is activated by setting the object *Modes of operation* (6060h) to the value -127 (= 81h). This mode is a manufacturer-specific function.

The axis moves into positive direction as long as the bit POSITIVE DIRECTION in the CONTROLWORD is set (see Table 21). This also applies if the bit NEGATIVE DIRECTION is then set in addition. Only if the bit POSITIVE DIRECTION is reset again, the axis will move into negative direction. If the bit POSITIVE DIRECTION now is set again in addition to NEGATIVE DIRECTION, the axis will continue moving into negative direction until the bit NEGATIVE DIRECTION is reset again. If finally the bit POSITIVE DIRECTION is reset, too, the axis will stop again.

The acceleration and deceleration of the manual movement is performed like in *Profile Position Mode* with the values in *Profile acceleration* (6083h) or rather *Profile deceleration* (6084h). For the movement speed, also the value in *Profile velocity* (6081h) will be used.

⁹ The bit HOMING ERROR in the STATUS WORD is not used for the time being.

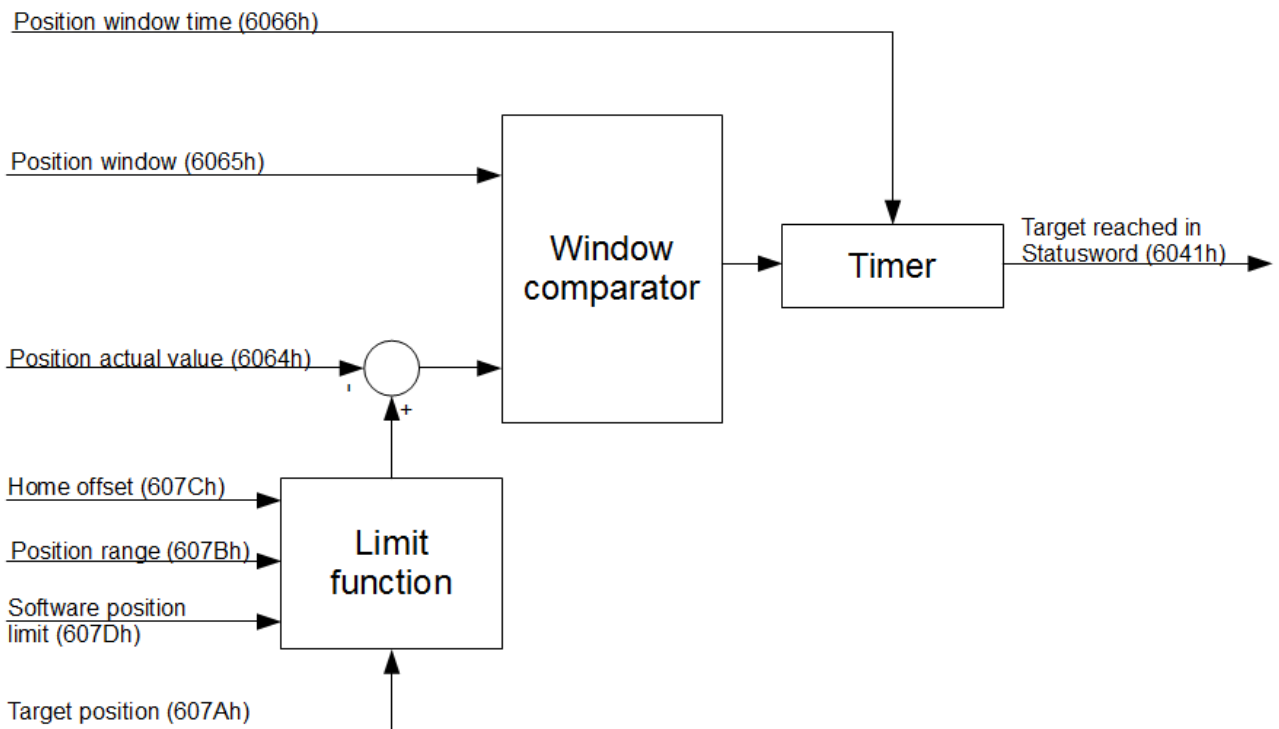
Controlword (Manual Profile Position Mode)	
Bit	Meaning
0 - 4	see Table 3
5	Positive direction
6	Negative direction
7 - 15	see Table 3

Table 21: Controlword (Manual Profile Position Mode)

4.6 Position control functions

4.6.1 Position reached

This function offers the possibility to define a tolerance range around the target position. If the position actual value is within this range for more than a defined period of time, it is supposed that the target position has been reached and thus the bit TARGET REACHED in the STATUSWORD is set (see Illustration 9 and Illustration 10).


 Illustration 9: Target Reached: Overview ^[4]

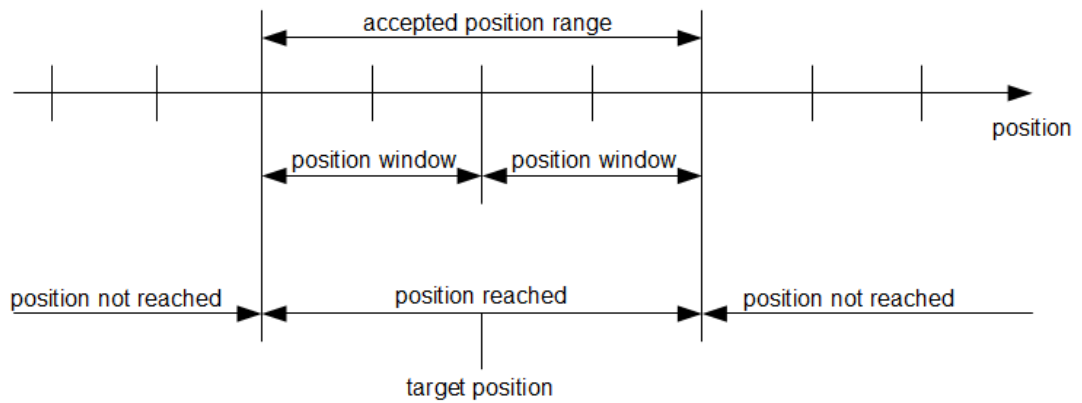


Illustration 10: Target Reached: Definition of a valid range ^[4]

4.6.2 Following error

To recognize a following error, the output parameter of the trajectory generator is compared to the position actual value. If the difference is beyond the defined range for longer than a certain period of time, there is a following error (see Illustration 11 and Illustration 12).

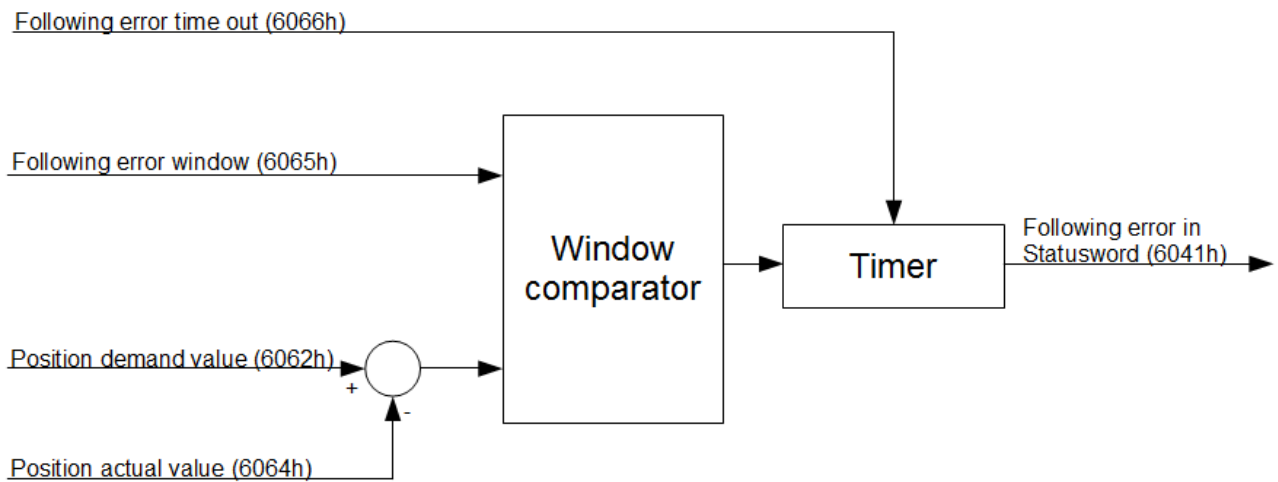


Illustration 11: Following Error: Overview ^[4]

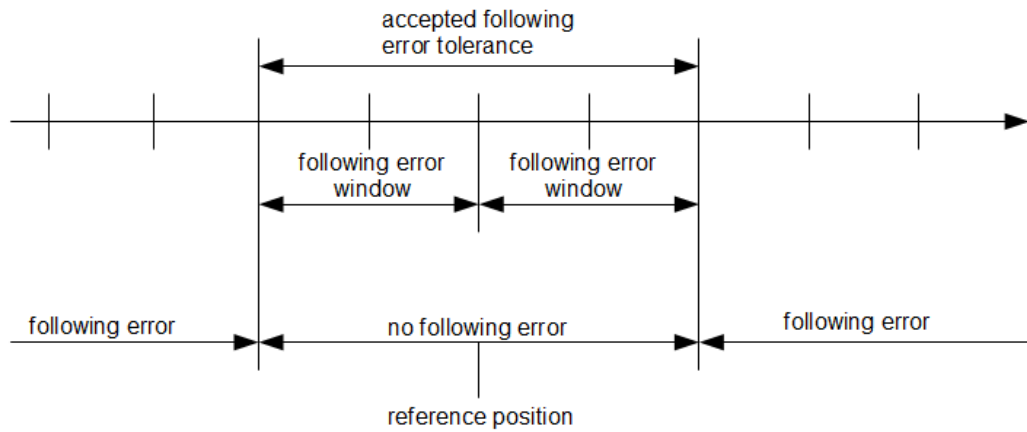


Illustration 12: Following Error: Definition of a valid range ^[4]

4.6.3 Standstill detection

The standstill detection with a brake ramp is used for recognition of the standstill of an axis from the current actual speed.

If the object VELOCITY ACTUAL VALUE (606Ch) is below the limit value VELOCITY THRESHOLD (606Eh) for a certain time VELOCITY THRESHOLD TIME (6070h), it is supposed that the axis does no longer move.

Depending on the situation, the status machine after recognition of standstill changes to the next status.

4.7 Option Codes

The behavior of the drive during a quick stop, shutdown¹⁰, disable operation, a stop or in case of a fault reaction¹¹ can be configured via the objects 605Ah – 605Eh (see Table 22).

¹⁰ Shutdown in this case means change-over to the status READY TO SWITCH ON

¹¹ The value for the *Fault reaction option code* presently is only described internally

Index	Name	Value range	Default	Notes
605Ah	Quick stop option code	0 - 2	2	
605Bh	Shutdown option code	0 - 1	0	If there is a transition from OPERATION ENABLED to READY TO SWITCH ON.
605Ch	Disable operation option code	0 - 1	1	If there is a transition from OPERATION ENABLED to SWITCHED ON.
605Dh	Halt option code	1 - 2	1	
605Eh	Fault reaction option code	0 - 2	2	If there is a fault in the PDS.

Table 22: Option Codes

For this purpose the value range for each option code is definitely specified. Value 0 means that the drive power is deactivated immediately. With value 1 the drive stops via a normal slow down ramp and with value 2 via a quick stop ramp (also see Table 23).

reaction	Values
Deactivate drive power immediately and close brake	0
Slow down ramp with normal deceleration	1
Quick stop ramp with quick stop deceleration	2

Table 23: Values for the option codes

For the time being only the stop reactions listed in Table 23 are supported.

5 OBJECT DICTIONARY

The object dictionary is a list of objects which can be accessed to via the EtherCAT bus. For addressing an object from the list clearly, it has an index (16 bit) and a subindex (8 bit) as address. Table 24 shows the general structure of the object dictionary.

Index	Object
0000h	not used
0001h – 001Fh	Static data types
0020h – 003Fh	Complex data types
0040h – 005Fh	Manufacturer specific complex data types
0060h – 025Fh	Device profile specific data types
0260h – 03FFh	reserved
0400h – 0FFFh	reserved
1000h – 1FFFh	Communication profile area
2000h – 5FFFh	Manufacturer specific profile area
6000h – 67FFh	Standardized profile area 1st logical device
6800h – 6FFFh	Standardized profile area 2nd logical device
7000h – 77FFh	Standardized profile area 3rd logical device
7800h – 7FFFh	Standardized profile area 4th logical device
8000h – 87FFh	Standardized profile area 5th logical device
8800h – 8FFFh	Standardized profile area 6th logical device
9000h – 97FFh	Standardized profile area 7th logical device
9800h – 9FFFh	Standardized profile area 8th logical device
A000h – AFFFh	Standardized network variable area
B000h – BFFFh	Standardized system variable area
C000h – FFFFh	reserved

Table 24: Structure of the object dictionary ^[2]

Table 25 shows the manufacturer-specific and Table 26 the profile-specific objects.

Name	Index:Sub	Obj.-Code	Data type	Access	Unit	Default	Description
SERVO_TYPE	2000h:0	VAR	UNSIGNED32	ro	-	00030000h	Servo type
SERVO_SIZE	2001h:0	VAR	UNSIGNED32	ro	-	-	Servo size
SERVO_CURRENT	2002h:0	ARRAY	UNSIGNED8	c	-	2	Servo currents:
SERVO_CURR_MAX	2002h:1	-	FLOAT32	ro	A	-	Servo maximum current
SERVO_CURR_NOM	2002h:2	-	FLOAT32	ro	A	-	Servo nominal current
SERVO_VOLTAGE	2004h:0	VAR	FLOAT32	ro	V	-	Servo mains voltage
SERVO_SERIAL_NO	2005h:0	VAR	UNSIGNED32	ro	-	-	Servo serial number
SERVO_TEMP	2006h:0	VAR	FLOAT32	ro	°C	-	Servo temperature
BUS_TYPE	2081h:0	VAR	UNSIGNED32	ro	-	9	Bus type 9: EtherCAT 21: Profinet
MOTOR_TYPE	2100h:0	VAR	UNSIGNED32	rw	-	1	Motor type 0: No motor 1: synchronous motor 2: asynchronous motor
MOTOR_DESCR	2101h:0	VAR	UNSIGNED32	rw	-	00000000h	Motor description Bit 0: 0: Rotatory motor 1: Linear motor Bit 1: Motor without temperature sensor
MOTOR_POLE_PAIRS	2106h:0	VAR	UNSIGNED32	rw	-	3	Number of motor pole pairs
MOTOR_PERIOD	2107h:0	VAR	FLOAT32	rw	° od. mm	360	Motor period
MOTOR_TEMP_MAX	2108h:0	VAR	FLOAT32	rw	°C	135	Maximum motor temperature
MOTOR_COMMUTE_OFFSET	2109h:0	VAR	FLOAT32	rw	° od. mm	120	Commutation offset motor
MOTOR_TEMP_SEN_TYPE	210Ah:0	VAR	UNSIGNED32	rw	-	2	Type of motor temperature sensor 0: Message if switch closed 1: Message if switch open 2: PTC (Message if temperature > 2108h:0)
MOTOR_COS_PHI	2120h:0	VAR	FLOAT32	rw	-	1.0	Asynchronous motor: power factor cos(φ)
MOTOR_SLIP_FACTOR	2121h:0	VAR	FLOAT32	Rw	-	0.04	Asynchronous motor: slip factor

MOTOR_FIELD_WEAK_SPEED	2122h:0	VAR	FLOAT32	rw	rpm	0	Asynchronous motor: field weakening speed
MOTOR_TEMP	2180h:0	VAR	FLOAT32	ro	°C	-	Current motor temperature
MOTOR_CURR_LOAD	2181h:0	VAR	FLOAT32	ro	%	-	Actual current load motor in % of the nominal current (I2T)
ENCODER_TYPE	2200h:0	VAR	UNSIGNED32	rw	-	1	Encoder type: 0: No encoder 1: Resolver 2: 1Vss
ENCODER_DESCR	2201h:0	VAR	UNSIGNED32	rw	-	00000010h	Encoder description (see document basic functions ServoFB)
ENCODER_POLE_PAIRS	2202h:0	VAR	UNSIGNED32	rw	-	1	Number of encoder pole pairs
ENCODER_PERIOD	2203h:0	VAR	FLOAT32	rw	° od. mm	360	Encoder period
ENCODER_OFFSET	2205h:0	VAR	INTEGER32	rw	Incr	0	Encoder offset value
DRIVE_NO	2280h:0	VAR	UNSIGNED32	ro	-	1	Drive number
SERVO_CONFIG	2400h:0	ARRAY	UNSIGNED8	c	-	5	Servo configuration:
SERVO_CONFIG_1	2400h:1	-	UNSIGNED32	rw	-	00000000h	Servo configuration 1 Bit 19: Suppression of errors E005, E051, E142 and E165 Bit 26: General intensification of monitoring Bit 27: General reduction of monitoring

SERVO_CONFIG_2	2400h:2	-	UNSIGNED32	rw	-	00000000h	<p>Servo configuration 2</p> <p>Bit 2: Internal velocity feedforward disabled</p> <p>Bit 6: Automatic power down during disconnection of the bus</p> <p>Bit 7: Torque offset without filter</p> <p>Bit 8: Velocity target without filter</p> <p>Bit 11: Interpolation for target velocity disabled</p> <p>Bit 16: Suppression of errors E168 and E169</p> <p>Bit 18: Suppression of error E018</p> <p>Bit 19: Suppression of error E017</p>
SERVO_CONFIG_3	2400h:3	-	UNSIGNED32	rw	-	00000000h	<p>Servo configuration 3 (currently internal use only)</p>

SERVO_CONFIG_4	2400h:4	-	UNSIGNED32	rw	-	00000000h	Servo configuration 4 Bit 11: Behavior of I-part of velocity control when current value in limit: 0: Anti-Windup-Hold 1: Anti-Windup-Reset Bit 17: Bus synchronization (if available) disabled Bit 18: Suppression of error E031 Bit 19: Suppression of errors E016 and E083 Bit 21: Suppression of error E233
SERVO_CONFIG_5	2400h:5	-	UNSIGNED32	rw	-	00000000h	Servo configuration 5 Bit 4: Reverse the direction of movement of the drive Bit 9: Drive has no holding brake Bit 26: Position filter (if present) off Bit 28: Suppression of error E006 Bit 31: Stop 0 without switching off delay
SERVO_STATE	2480h:0	ARRAY	UNSIGNED8	c	-	5	Servo status:
SERVO_STATE_1	2480h:1	-	UNSIGNED32	ro		00000000h	Servo status 1 Bit 11: Muting is active Bit 13: Bus communication is started
SERVO_STATE_2	2480h:2	-	UNSIGNED32	ro		00000000h	Servo status 2 Bit 0: Toggle bit (0.5 ms)

SERVO_STATE_3	2480h:3	-	UNSIGNED32	ro	00000000h	<p>Servo status 3</p> <p>Bit 4: Error present</p> <p>Bit 5: Brake is open</p> <p>Bit 6: Drive power is active</p> <p>Bit 7: Servo is ready</p> <p>Bit 9: Drive is referenced</p> <p>Bit 12: Safety relay is open</p> <p>Bit 21: Alive bit</p>
SERVO_STATE_4	2480h:4	-	UNSIGNED32	ro	00000000h	<p>Servo status 4</p> <p>Bit 3: Current limit reached</p> <p>Bit 10: Setting value is OK</p> <p>Bit 26: Resolver calibration was carried out</p> <p>Bit 27: Warning present</p>

SERVO_STATE_5	2480h:5	-	UNSIGNED32	ro		00000000h	Servo status 5 Bit 3: Parameters are valid Bit 12 : Resolver calibration is active Bit 14: Referencing is active Bit 17: Stop 0 without switching off delay is active Bit 19: Stop 0 is active Bit 29: Power down is active
FIRMWARE_VERSIONS	2500h:0	ARRAY	UNSIGNED8	c	-	4	Firmware versions:
FIRMWARE_VERS_MAIN	2500h:1	-	UNSIGNED32	ro	-	-	Firmware version (Reis)
FIRMWARE_VERS_BASE	2500h:2	-	UNSIGNED32	ro	-	-	Firmware version (IRT)
FIRMWARE_VERS_COMM	2500h:3	-	UNSIGNED32	ro	-	-	Firmware version (NetX)
LOADER_VERS	2500h:4	-	UNSIGNED32	ro	-	-	Monitor version
ERROR_NO	2600h:0	VAR	UNSIGNED32	ro	-	0	Current error number (see document basic functions Drive-FB)
WARNING_NO	2680h:0	VAR	UNSIGNED32	ro	-	0	Current warning number (see document basic functions Drive-FB)
POWER_OFF_DELAY	2703h:0	VAR	FLOAT32	rw	ms	200	Switch-off delay drive power
ALIVE_SIG_MONITORING	2704h:0	ARRAY	UNSIGNED8	c	-	1	Failure monitoring:
ALIVE_FAIL_TIME	2704h:1	-	FLOAT32	rw	ms	50	Tolerance time for failure monitoring
ENC_SIG_MONITORING	2705h:0	ARRAY	UNSIGNED8	c	-	1	Encoder signal monitoring:
ENC_SIG_TOL	2705h:1	-	FLOAT32	rw	%	20	Tolerance for encoder signal monitoring
POSITION_CONTROL	2800h:0	ARRAY	UNSIGNED8	c	-	1	Parameter position control:
CLC_POS_P	2800h:1	-	FLOAT32	rw	10^{-5} *rpm/Incr	5000	Position control P-factor
SPEED_CONTROL	2801h:0	ARRAY	UNSIGNED8	c	-	2	Parameter speed control:
CLC_SPEED_P	2801h:1	-	FLOAT32	rw	10^{-6} *A/rpm	7000	Speed control P-factor
CLC_SPEED_I	2801h:2	-	FLOAT32	rw	10^{-2} *A/rpm/s	30	Speed control I-factor
CURRENT_CONTROL	2802h:0	ARRAY	UNSIGNED8	c	-	2	Parameter current control:

CLC_CURR_P	2802h:1	-	FLOAT32	rw	0.005*/A	3600	Current control P-factor
CLC_CURR_I	2802h:2	-	FLOAT32	rw	40*/A/s	320	Current control I-factor
POSITIONING_FILTER	2810h:0	VAR	FLOAT32	rw	ms	160	Position nominal value filter (time constant)
TARGET_CURR_FILTER	2811h:0	VAR	FLOAT32	rw	Hz	143	Current nominal value filter (cutoff frequency)
DRIVE_FUNCTIONS	2900h:0	VAR	UNSIGNED32	rw	-	0	Servo functions: 1: Resolver calibration 2: Dereferencing 3: Brake test 4: Muting
DRIVE_PROFILE	2901h:0	VAR	UNSIGNED32	ro	-	12	Device profile type: 11: Reis Profinet Drive 12: Reis EtherCAT Drive
Controlword 2	3040h:0	VAR	UNSIGNED16	rw	-	0	Controlword 2: Bit 0: Alive toggle bit Bit 1: Change between power down and normal state (with positive edge) Bit 2: Activate the servo function that was set in 2900h:0
Statusword 2	3041h:0	VAR	UNSIGNED16	ro	-	0	Statusword 2: Bit 0: Alive toggle bit Bit 1: 0: normal state 1: power down Bit 2: Feedback servo function

Table 25: Manufacturer-specific objects

ro: read only
 rw: read/write
 wo: write only
 c: constant

Name	Index:Sub	Obj.-Code	Data type	Access	Unit	Default	Description
Device type	1000h:0	VAR	UNSIGNED32	ro	-	00420192h	Bit 0 – 15: Device profile number: 402 Bit 17: Servo Drive Bit 22: Type-specific PDO mapping
Error register	1001h:0	VAR	UNSIGNED8	ro	-	0	Error register (see Table 7)
Identify object	1018h:0	RECORD	TYPE_UNSIGNED8	c	-	4	Device identification:
Vendor ID	1018h:1	-	TYPE_UNSIGNED32	ro	-	-	Vendor identification
Product code	1018h:2	-	TYPE_UNSIGNED32	ro	-	-	Product identification
Revision number	1018h:3	-	TYPE_UNSIGNED32	ro	-	-	Bit 0 – 15: Minor revision Bit 16 – 31: Major revision
Serial number	1018h:4	-	TYPE_UNSIGNED32	ro	-	-	Serial number
Error code	603Fh:0	VAR	UNSIGNED16	ro	-	0	Error number (see Table 8)
Controlword	6040h:0	VAR	UNSIGNED16	rw	-	0000h	see Table 3
Statusword	6041h:0	VAR	UNSIGNED16	ro	-	0000h	see Table 5
Quick stop option code	605Ah:0	VAR	INTEGER16	rw	-	2	see 4.7
Shutdown option code	605Bh:0	VAR	INTEGER16	rw	-	0	see 4.7
Disable operation option code	605Ch:0	VAR	INTEGER16	rw	-	1	see 4.7
Halt option code	605Dh:0	VAR	INTEGER16	rw	-	1	see 4.7
Fault reaction option code	605Eh:0	VAR	INTEGER16	ro	-	2	see 4.7 (only set internally for the time being)
Modes of operation	6060h:0	VAR	INTEGER8	rw	-	1	see 4.5
Modes of operation display	6061h:0	VAR	INTEGER8	ro	-	1	see 4.5
Position demand value	6062h:0	VAR	INTEGER32	ro	Incr	0	Position demand value
Position actual value	6064h:0	VAR	INTEGER32	ro	Incr	0	Position actual value
Following error window	6065h:0	VAR	UNSIGNED32	rw	Incr	4096	Admissible following error FFFFFFFFh: Following error monitoring is not active
Following error time out	6066h:0	VAR	UNSIGNED16	rw	ms	100	Time tolerance for following error monitoring

Position window	6067h:0	VAR	UNSIGNED32	rw	Incr	4096	Positioning window for Target Reached FFFFFFFFh: Positioning detection is not active
Position window time	6068h:0	VAR	UNSIGNED16	rw	ms	100	Time tolerance for positioning detection
Velocity actual value	606Ch:0	VAR	INTEGER32	ro	Incr/s	0	Velocity actual value
Velocity window	606Dh:0	VAR	UNSIGNED16	rw	Incr/s	10000	Not used for the time being
Velocity window time	606Eh:0	VAR	UNSIGNED16	rw	ms	100	Not used for the time being
Velocity threshold	606Fh:0	VAR	UNSIGNED16	rw	Incr/s	10000	Threshold for standstill detection
Velocity threshold time	6070h:0	VAR	UNSIGNED16	rw	ms	100	Time tolerance for standstill detection
Target torque	6071h:0	VAR	INTEGER16	rw	0,001*6076h:0	0	Not used for the time being
Max torque	6072h:0	VAR	UNSIGNED16	rw	0,001*6076h:0	2000	Not used for the time being
Max current	6073h:0	VAR	UNSIGNED16	rw	0,001*6075h:0	2000	Maximum admissible motor current in per mil of the nominal current
Motor rated current	6075h:0	VAR	UNSIGNED32	rw	mA	1000	Motor nominal current
Motor rated torque	6076h:0	VAR	UNSIGNED32	rw	mNm	1000	Motor nominal torque
Torque actual value	6077h:0	VAR	INTEGER16	ro	0,001*6076h:0	0	Current motor torque in per mil of the nominal torque
Current actual value	6078h:0	VAR	INTEGER16	ro	0,001*6075h:0	0	Actual motor current in per mil of the nominal current
Target position	607Ah:0	VAR	INTEGER32	rw	Incr	0	Target position for positioning
Position range limit	607Bh:0	ARRAY	UNSIGNED8	c	-	2	Position limit values (if exceeded, there will be a jump to the corresponding other limit value):
Min position range limit	607Bh:1	-	INTEGER32	rw	Incr	80000000h	Minimum position value
Max position range limit	607Bh:2	-	INTEGER32	rw	Incr	7FFFFFFFh	Maximum position value
Home offset	607Ch:0	VAR	INTEGER32	rw	Incr	00000000h	Position value in the reference position
Software position limit	607Dh:0	ARRAY	UNSIGNED8	c	-	2	Software limit switch:
Min position limit	607Dh:1	-	INTEGER32	rw	Incr	80000000h	Limit switch minimum position
Max position limit	607Dh:2	-	INTEGER32	rw	Incr	7FFFFFFFh	Limit switch maximum position

Polarity	607Eh:0	VAR	UNSIGNED8	rw	-	00h	Direction factor for nominal values Bit 6: Velocity polarity Bit 7: Position polarity Bit = 0 → factor = 1 Bit = 1 → factor = -1
Max profile velocity	607Fh:0	VAR	UNSIGNED32	rw	Incr/s	5242880	Maximum speed for the movement profile
Max motor speed	6080h:0	VAR	UNSIGNED32	rw	rpm	4800	Maximum motor speed
Profile velocity	6081h:0	VAR	UNSIGNED32	rw	Incr/s	4369066	Speed of the movement profile
End velocity	6082h:0	VAR	UNSIGNED32	rw	Incr/s	0	Final speed of the movement profile
Profile acceleration	6083h:0	VAR	UNSIGNED32	rw	Incr/s ²	4369066	Acceleration of the movement profile
Profile deceleration	6084h:0	VAR	UNSIGNED32	rw	Incr/s ²	4369066	Deceleration of the movement profile
Quick stop deceleration	6085h:0	VAR	UNSIGNED32	rw	Incr/s ²	4369066	Quick stop deceleration
Position encoder resolution	608Fh:0	ARRAY	UNSIGNED8	c	-	2	Position resolution in increments per motor revolution (only readable for the time being):
Encoder increments	608Fh:1	-	UNSIGNED32	ro	Incr	00010000h	Number of increments
Motor revolutions	608Fh:2	-	UNSIGNED32	ro	-	1	Number of motor revolutions
Homing method	6098h:0	VAR	INTEGER8	rw	-	81h	Homing methods: 81h: Setting 82h: Referencing (see also 4.5.3)
Position offset	60B0h:0	VAR	INTEGER32	rw	Incr	0	see Illustration 6
Velocity offset	60B1h:0	VAR	INTEGER32	rw	Incr/s	0	see Illustration 6
Torque offset	60B2h:0	VAR	INTEGER16	rw	0,001*6076h:0	0	see Illustration 6 (in per mil of the nominal torque)
Interpolation time period	60C2h:0	RECORD	UNSIGNED8	c	s	2	Interpolation time: = 60C2h:1 * 10(60C2h:2) [s] (area: 0.5 – 100ms)
Interpolation time period value	60C2h:1	-	UNSIGNED8	rw	-	8	see 60C2h:0
Interpolation time index	60C2h:2	-	INTEGER8	rw	-	-3	see 60C2h:0
Max acceleration	60C5h:0	VAR	UNSIGNED32	rw	Incr/s ²	2 ³² - 1	Maximum acceleration for the movement profile

Max deceleration	60C6h:0	VAR	UNSIGNED32	rw	Incr/s ²	2 ³² - 1	Maximum deceleration for the movement profile
Supported homing methods	60E3h:0	ARRAY	UNSIGNED8	c	-	2	Supported homing methods:
Standard setting	60E3h:1	-	UNSIGNED16	ro	-	0081h	Setting (see 4.5.3)
Standard referencing	60E3h:2	-	UNSIGNED16	ro	-	0082h	Referencing (see 4.5.3)
Following error actual value	60F4h:0	VAR	INTEGER32	ro	Incr	0	Actual following error
Target velocity	60FFh:0	VAR	INTEGER32	rw	Incr/s	0	Not used for the time being
Supported drive modes	6502h:0	VAR	UNSIGNED32	ro	-	Firmw. csp: 000000A0h Firmw. pp: 00010021h	Supported operating modes (see 4.5)

Table 26: Profile-specific objects

ro: read only
 rw: read/write
 wo: write only
 c: constant

6 TABLE OF ILLUSTRATIONS

Illustration 1: Control of the state machine ^[4]	4
Illustration 2: State machine ^[4]	5
Illustration 3: Trajectory generator and position regulation ^[4]	11
Illustration 4: Trajectory generator for the Profile Position Mode ^[4]	12
Illustration 5: Handshake procedure for the <i>Single Set-Point</i> function ^[4]	14
Illustration 6: Overview of the Cyclic Synchronous Position Mode ^[4]	15
Illustration 7: Cyclic Synchronous Position Mode – Control Function ^[4]	16
Illustration 8: Homing Mode ^[4]	17
Illustration 9: Target Reached: Overview ^[4]	20
Illustration 10: Target Reached: Definition of a valid range ^[4]	21
Illustration 11: Following Error: Overview ^[4]	21
Illustration 12: Following Error: Definition of a valid range ^[4]	22

7 TABLES

Table 1: Categories for support of objects or functions.....	3
Table 2: Activated functions depending on the state of the state machine ^[4]	6
Table 3: CONTROLWORD (6040h) ^[2]	7
Table 4: Commands from bit combinations of the CONTROLWORD ^[4]	7
Table 5: STATUSWORD (6041h) ^[2]	8
Table 6: State from bit combinations of the STATUS WORD ^[4]	8
Table 7: <i>Error register</i> (1001h) ^[2]	9
Table 8: <i>Error code</i> (603Fh).....	9
Table 9: Modes of operation (6060h).....	10
Table 10: Possible operating modes.....	11
Table 11: Control word (Profile Position Mode).....	12
Table 12: Status word (Profile Position Mode).....	12
Table 13: Bit definition (4, 5, 9) of the Control word in Profile Position Mode ^[4]	13
Table 14: Bit definition (6, 8) of the Control word in Profile Position Mode ^[4]	13
Table 15: Bit definition (10, 12, 13) of the Status word in Profile Position Mode ^[4]	13
Table 16: Statusword (Cyclic Synchronous Position Mode) ^[2]	16
Table 17: Controlword (Homing Mode) ^[4]	18
Table 18: Statusword (Homing Mode) ^[4]	18
Table 19: Bit definition (4, 8) of the Controlword in Profile Position Mode ^[4]	18
Table 20: Bit definition (10, 12, 13) of the statusword in Homing Mode ^[4]	19
Table 21: Controlword (Manual Profile Position Mode).....	20
Table 22: Option Codes.....	23
Table 23: Values for the option codes.....	23
Table 24: Structure of the object dictionary ^[2]	24
Table 25: Manufacturer-specific objects.....	31
Table 26: Profile-specific objects.....	35

8 EXPLICATION OF TERMS

Term	Explanation
IEC	International Electrotechnical Commission: International standardization headquartered in Geneva for standards in the area of electrical engineering and electronics.
CiA	CAN in Automation
EtherCAT	Ethernet for Control Automation Technology: Real-time Ethernet initiated by the company Beckhoff
EtherCAT Technology Group (ETG)	User organization for EtherCAT technology
Control Device	Device controlling the servo-amplifier (e. g. PLC)
Drive Device	Device receiving commands from the control and moving the drive motor
PLC	Programmable Logic Controller
PDS	Power Drive System; servo-amplifier; servo
high-level power	Electric voltage supply for the power module of the servo-amplifier (mostly from mains voltage 400V _{AC})
low-level power	Electric voltage supply for the control electronics of the servo-amplifier (e. g. 24V _{DC})
FSA	Finite State Automaton
Referencing	An axis is referenced if the current position actual value of the axis gets an absolute reference to a defined axis position (= reference position or rather <i>Home Position</i>)

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10 ERROR CODES

A message of the controller is displayed in the 7-segment display in the form EXXX. The string XXX is the corresponding error number, which can be seen from the following table.

- 1=Error_Write() with wrong number.
- 2=Drive mode error
- 3=Drive mode error (TMS)
- 4=Online Change in control of relevant data
- 5=IRT-Communication error (WD)
- 6=IRT-Firmware falsch
- 7=MD by advanced Range
- 8=common programming errors P2(TMS)
- 9=DPort-Communication error
- 10=Wrong Baudrate CAN-B
- 11=C167-asynchron (one chanel)
- 12=C167-Exception-Error before reset
- 13=damage PWM-Synchronisation
- 14=Debuginfo SC_REFDRIVE asked
- 15=Derating-warning at Error 647

- 16=Speed Error
- 17=Switching state fault Brake
- 18=Switching state error PWM
- 19=EndOffset MIN_WAY changed
- 20=Nibbleerror at RSV_Istwertbi.
- 21=Error at RSV-Clock control
- 22=CAN-B Buffer-Overflow
- 23=MD_Check() reports error
- 24=Konfigerror linear drive
- 25=Feature at EndatCU illegal option
- 26=E1 not finished
- 27=E2/C167 not finished
- 28=General error GWK (not AT)
- 29=No Resolvercalibration
- 30=simple lag/Stop1
- 31=Lag too big
- 32=Imax reached
- 33=PWDN-Function can not be installed
- 34=unequal LIW meter readings
- 35=general error 35
- 36=Timeout in the actual value
- 37=C167-Resolvererror
- 38=Stationary fault
- 39=massive errors on CAN-B
- 40=Filter-Numerical protection
- 41=LIW lost (e.g. battery failure)
- 42=New setup data will be imported
- 43=Loader-Update: Timeouterror
- 44=Loader-Update: Checksum-error
- 45=Loader-Update: Receive error
- 46=Fail respect Rex - sync condition
- 47=general error 47
- 48=general error 48
- 49=general error 49

50=Communication error DPORT
51=allg. programming error P1
52= Overvoltage or undervoltage
53=CU-6: Power supply failure
54=AT-unused: CU-d: accidental ground
55=CU-4: Temperature controller
56=I2T Overcurrent
57=CU-3: Overheating Motor
58=CU-9: Software Watchdog
59=CU-F: Firmware Error
60=CU-E: Parameter error
61=CU-5: resolver error
62=CURRENT_MAX not adjustable
63=MaxiPower servo amplifier <= 0
64=CURRENT_RMS not adjustable
65=Nominal power servo amplifier . <= 0
66=CAN-WD Error
67=TMS-WD Error
68=SAB-WD Error
69=ADSP-WD Error (Coupling-RAM)
70=CU-b: Over Speed Error
71=Filter is not adjustable,
72=CU-C: Line break
73=Not reached target position
74=Error in the filtered setpoint
75=Error on Taktverh.IPO/LR
76=Reference point -Win. was changed
77=Offset-Angle has been changed
78=Travel direction has been changed
79=Checksum error.
80=Resolver out of tolerance (SHARC)
81=Resolver-Toleranz CAN-A
82=CU-h: ADSP-Overbraking
83=velocity error (step too big)

- 84=Brake pad injury at stop
- 85=Braking effect deficient
- 86=CAN-B-Sync Watchdog
- 87=Illegal Achsmodi exchange
- 88=Illegal Achsmodi exchange
- 89=MomOffset not just in time comes
- 90=No machine data received
- 91=Setpoint failure
- 92=Configuration error CAN-B
- 93=AC-Fail appeared
- 94=Configuration error CAN-A
- 95=Master toggle bit failure
- 96=SC-Stop-0
- 97=SC-FAST STOP
- 98=DPC failed (TMS)
- 99=DPC failed (C167\SHARC)
- 100=SFM with RFA failed (TMS)
- 101=SFM with RFA failed (C167\SHARC)
- 102=Internal Semaphore error C167
- 103=E2 not finished
- 104=E3 Timingerror
- 105=Invalid error from IRT
- 106=Error buffer is full
- 107=excessive tolerance b. Res.-Kal.
- 108=excessive tolerance final value b. Res.-Kal.
- 109=False Freq. of SOC-Signals
- 110=Access to illegal address
- 111=Timeout in level 1
- 112=currently unused
- 113=SCI-Receive buffer overflow
- 114=SCI-Transmit buffer overflow
- 115=SCI interrupt error
- 116=No data in the SCI receive buffer
- 117=No data in the send buffer of the SCI

- 118=Incorrect number of SCI data
- 119=Incorrect Checksum. of SCI data
- 120=Error in receiving the map data
- 121=CAN-Receive buffer overflow
- 122=CAN-Transmit buffer overflow
- 123=Warning-Level at CAN-B-Error
- 124=Error-Passiv at CAN-B-Error
- 125=CAN-B off at massive errors
- 126=IPO-controller clock is not synchronized.
- 127=currently unused
- 128=Res.-Sign. with excessive offset
- 129=Change of employer data TMS
- 130=Time exceeded at LIW-Erfas.
- 131=Time exceeded at Safe-Fkts.
- 132=Time exceeded at SCI-Kom.
- 133=Time exceeded at CAN-Kom.
- 134=Recognized Wrong IPO time
- 135=TMS-Resolvererror
- 136=Sharc is uninitialized
- 137=Invalid value for IPO-stroke
- 138=Axis number was adjusted
- 139=PWM On not released
- 140=CU-L: Current measuring module is faulty
- 141=Incorrect Checksum. of SCI-Daten
- 142=General error CAN-A
- 143=Incorrect HW for this SW
- 144=CU-A: Overcurrent warning
- 145=IRT reports E3-Overlapping
- 146=Error when writing to Flash
- 147=RESTART Without PowerDown
- 148=No IRT-Factory-Parameter
- 149=excessive tolerance at Res.-Kal.
- 150=Unterspg. of the external supply voltage)
- 151=Encoder error CU-. (Counter Error)

- 152=Encoder error TMS (Counter Error)
- 153=Configuration error Encoder TMS
- 154=Command-Kill from RSV received
- 155=Initialization error 1Vss
- 156=CU-5: SinCos-monitoring 1Vss
- 157=Pos.-Error between Counter a. Endat
- 158=CRC-Error at Endat
- 159=Internal timer error at Endat
- 160=Resolver- to number of motor pole pairs
- 161=ZAB-Emergencyswitch in ServoSW repressed
- 162=Illegal Function
- 163=Actual velocity too high with Stop 1
- 164=Change of important data Sharc
- 165=General configuration error
- 166=Fan error (ab AT-2)
- 167=PM:Overload braking resistor
- 168=Power system monitoring (Stop0)
- 169=Power system monitoring (Stop1)
- 170=RA-Monitoring reports error
- 171=Failure of the EOC-Signals
- 172=Failure of the Safe-Toggle-Bits
- 173=Safe-Monitors not ready
- 174=TMS: Code-Error in Flash
- 175=Sharc: Failure of channel B detected
- 176=TMS: Failure of channel A detected
- 177=Sharc: Hardware-Reset
- 178=TMS: Hardware-Reset
- 179=Sharc: Sin2Cos2-Error (Safe)
- 180=TMS: Sin2Cos2-Error (Safe)
- 181=Sharc: Fault current sensor test
- 182=TMS: Fault current sensor test
- 183=Sharc: wrong SafeLib Version
- 184=TMS: Error Safe-Lib-Version
- 185=Sharc: Plausi. Safe-Parameter

- 186=TMS: Plausi. Safe-Parameter
- 187=SharC: (De)Referenzieren Ursache f. Veri.-Req.
- 188=TMS: (De)Referenzieren Ursache f. Veri.-Req.
- 189=SHARC: Code-Error in RAM
- 190=TMS: Max. exceeded possible speed for encoder evaluation
- 191=TMS: Speed in ISERVO_SPEED_MAX+20% is too big
- 192=SharC: PWM-Turning on the unit during an active lock
- 193=TMS: Drive lock is active
- 194=SharC: Safe-Lib: The maximum allowable speed at active DLM has been exceeded.
- 195=TMS: Safe-Lib: The maximum allowable speed at active DLM has been exceeded.
- 196=SharC: It was noted a change in the safe servo parameters.
- 197=TMS: It was noted a change in the safe servo parameters.
- 198=SharC: An error occurred when importing the safe servo parameter.
- 224= Communication failure
- 225= Software limit positive
- 226= Software limit negative
- 227= SIN^2COS^2 value in init. <0.5 or >3.5
- 228= There were not Initializes all required parameters
- 229= The axis is not in position regulation during the current measurement
- 230= Brake test wasn't performed correctly
- 231= The axis moved during the brake test
- 232= The axis is not in operational condition

11 DRIVE DISPLAY CODES

Display	Description
0	State Machine: Not ready to switch on
1	State Machine: Switch on disabled
2	State Machine: Ready to switch on
3	State Machine: Switched on
4	State Machine: Operation enabled
5	State Machine: Quick stop active
6	State Machine: Fault reaction active
7	State Machine: Fault
E	Save data active
C	Data comparison when saving shows identical data
8	Modus Powerdown aktiv
-	Muting active mode
E052	Error active (here with the number 52)

Error reset

- A fault is indicated by a set bit 3 in the STATUS WORD.
- The error number can be read from the object Error code (603Fh) with the format XY80h (XY = Error number hexadecimal) or directly from the error_no object (2600h).
- The seven-segment displays the existing faults with an E followed by a three-digit number (eg. As E052) appears.
- Deleting a current error is done by setting bit 7 in the CONTROL WORD (positive edge).

Power down mode

- By setting the bit 1 in the CONTROL WORD 2 (positive edge), the servo will be set in the mode Powerdown.

- With the help of this function you can save important data such as the current position before turning off the power supply. The servo remains thus referenced after restarting the power supply. (The CU2115 has to be powered externally in this case)
- The Power Down mode is displayed in the seven segment display with an underscore (_).
- The bit 1 of the STATUS WORD 2 shows the current status:
0: Normal mode; 1: Power-down mode;
- Exiting the Power Down mode by re-setting the bit 1 in the CONTROL WORD 2 (positive edge).