



Motion Control SW

Documentation of the Motion Control SW

- E1100/B1100 Servo Controller Series



Motion Control SW

User Manual V3.9

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1 System Overview

This user Manual describes the Motion Control SW functionality of the LinMot E1100/B1100 servo controllers.

1.1 References

| Ref | Title | Source |
|-----|--------------------------------|--|
| 1 | Installation_Guide_E1100.pdf | www.linmot.com |
| 2 | Installation_Guide_B1100.pdf | www.linmot.com |
| 3 | Usermanual_LinMot-Talk1100.pdf | www.linmot.com |
| 4 | QuickStartGuide_B1100-VF.pdf | www.linmot.com |

The documentation is distributed with the LinMot-Talk1100 configuration SW or could be downloaded from the internet from the download section of our homepage.

1.2 Definitions, Items, Shortcuts

| Shortcut | Meaning |
|----------|---|
| LM | LinMot linear motor |
| OS | Operating system SW |
| MC (SW) | Motion Control SW |
| VAI | VA-Interpolator (Max velocity limited acceleration position interpolator) |
| Pos | Position |
| Vel | Velocity |
| Acc | Acceleration |
| Dec | Deceleration |
| UPID | Unique Parameter ID (16 bit) |

1.3 Data types

| Type | Range/Format | Num of bytes |
|--------|------------------------------|--------------|
| Bool | Boolean, False/True | 1/8 |
| Byte | 0..255 | 1 |
| Char | ASCII | 1 |
| String | Array of char last char=0x00 | X |
| SInt16 | -32768..32767 | 2 |
| UInt16 | 0..65535 | 2 |
| SInt32 | -2147483648..2147483647 | 4 |
| UInt32 | 0..4294967295 | 4 |

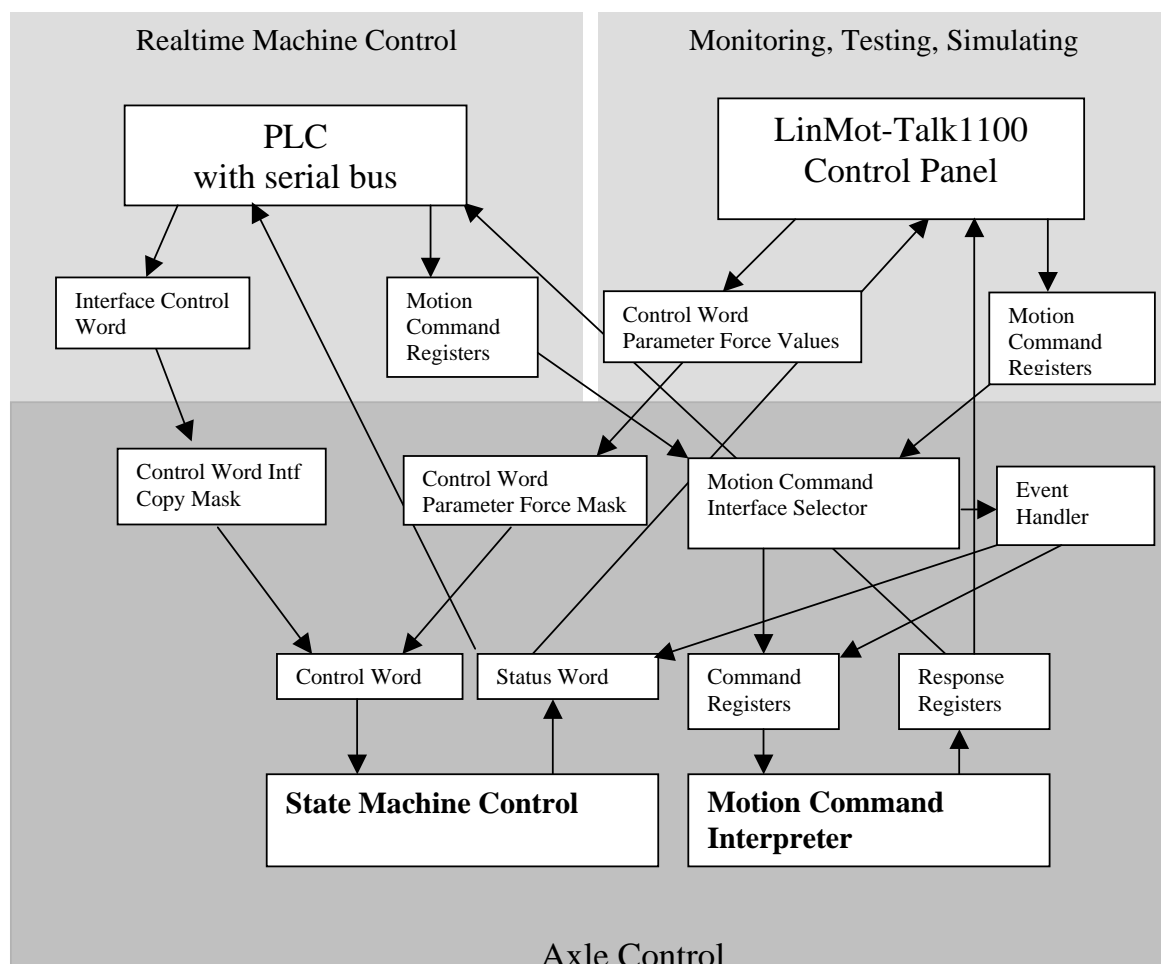
2 Motion Control Interfaces

For controlling the behavior of the motion control SW, two different Interfaces are available. For controlling the main state machine, a bit coded **control word** can be used. For controlling the motion functionality a memory mapped **motion command interface** can be used. These two instances are mapped via an interface SW to an upper control system (PLC, IPC, PC, ..). The interfacing is done with digital I/Os or a serial link like Profibus DP, CAN bus (DeviceNet, CANopen), RS485, RS422 or RS232 (LinRS protocol).

With LinMot-Talk1100 the control over the control word could be taken bit by bit, for testing and debugging. Unused control word bits could be forced by parameter value.

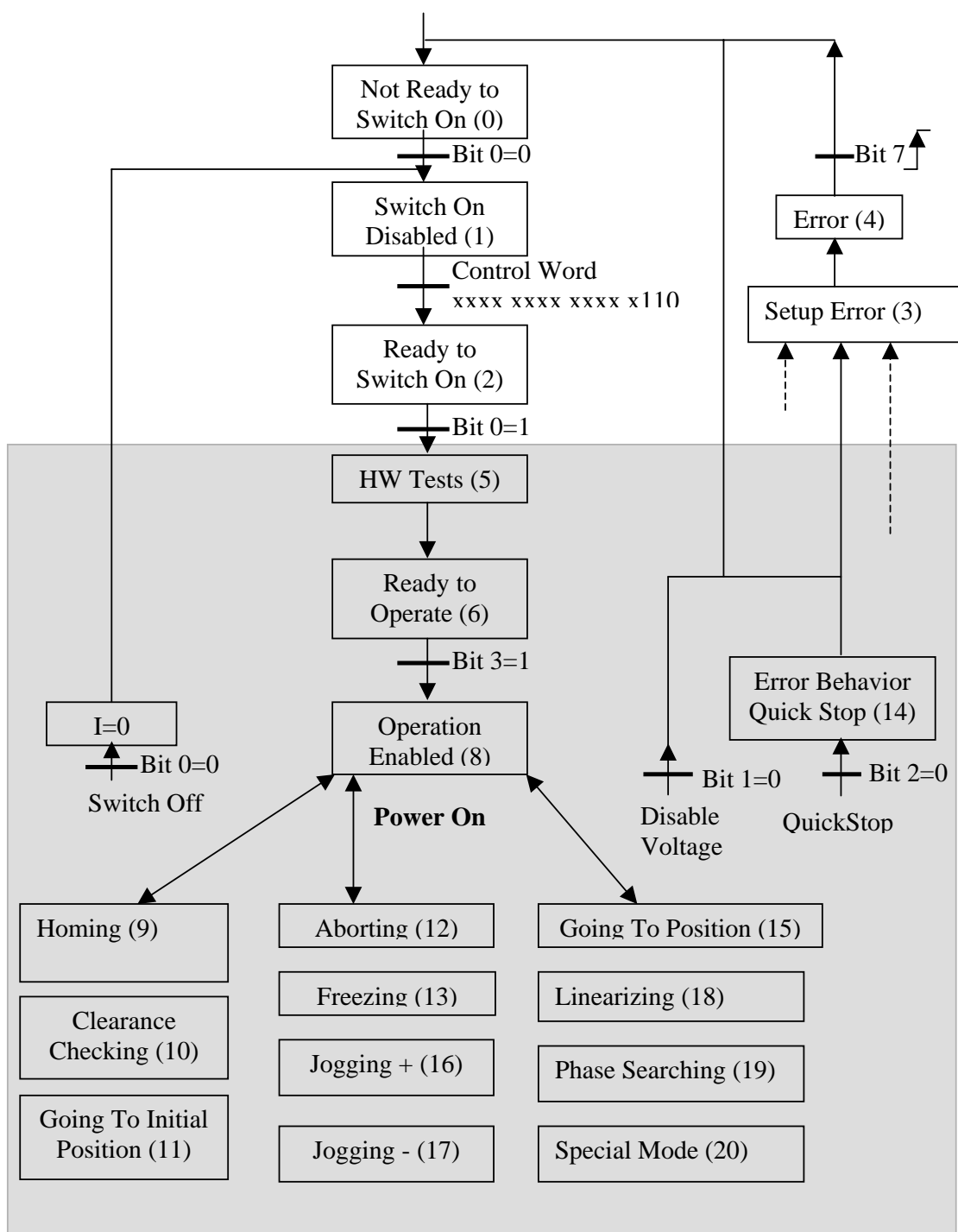
Also the control of the motion command interpreter can be switched to the control panel of the LinMot-Talk1100 software for testing.

All this can be done when the system is running, so be careful using this features on a running machine!



3 State Machine

The main behavior of the axes is controlled with the control word, it is shown in the following state diagram.



The state machine could be followed in the PLC's with fieldbus over the StateVar this response word could be configured in the response of any supported fieldbus.

| State Var | | | | | | | | | | | | | | | |
|------------|----|----|----|----|----|---|---|-----------|---|---|---|---|---|---|---|
| Main State | | | | | | | | Sub State | | | | | | | |
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

The State Var is divided into two sections: the Main State section (high byte) contains directly the number of the state machine, the content of the Sub State (low byte) is state depending.

| State Var | |
|---|--|
| Main State | Sub State |
| 00: Not Ready To Switch On | 0 |
| 01: Switch On Disabled | 0 |
| 02: Ready To Switch On | 0 |
| 03: Setup Error | Error Code which will be logged |
| 04: Error | Logged Error Code |
| 05: HW Tests | 0 (Not yet defined) |
| 06: Ready To Operate | 0 (Not yet defined) |
| 07: - | |
| 08: Operation Enabled | Bits 0..3: Motion Command Count Bit 4: Event Handler Active Bit 5: Motion Active Bit 6: In Target Position Bit 7: Homed |
| 09: Homing | 0Fh: Homing Finished |
| 10: Clearance Check | 0Fh: Clearance Check Finished |
| 11: Going To Initial Position | 0Fh: Going To Initial Position Finished |
| 12: Aborting | Not yet defined |
| 13: Freezing | Not yet defined |
| 14: Quick Stop (Error Behaviour) | Not yet defined |
| 15: Going To Position | 0Fh: Going To Position Finished |
| 16: Jogging + | 01h: Moving positive 0Fh: Jogging +Finished |
| 17: Jogging - | 01h: Moving negative 0Fh: Jogging -Finished |
| 18: Linearizing | Not yet defined |
| 19: Phase Search | Not yet defined |
| 20: Special Mode | Not yet defined |

3.1 State 0: Not Ready To Switch On

In this state the release of control word bit 0 *switch on* is awaited. As soon as this bit is cleared a change to state 1 is performed. This behavior avoids self starting if all necessary bits for a start are set correctly in the control word.

3.2 State 1: Switch On Disabled

The state machine rests in this state as long as the bits 1 or 2 of the control word are cleared.

3.3 State 2: Ready To Switch On

The state machine rests in this state as long as the bit 0 is cleared.

3.4 State 3: Setup Error State

The state machine rests in this state as long the bits 0 is cleared.

3.5 State 4: Error State

The error state can be acknowledged with a rising edge of the control word bit 7 'Error Acknowledge'. If the error is fatal, bit 12 'Fatal Error' in the status word is set, no error acknowledgment is possible.

In the case of a fatal error, the error has to be checked, and the problem has to be solved before a reset or power cycle is done for resetting the error.

3.6 State 5: HW Test

The HW Test state is an intermediate state before turning on the power stage of the servo controller. If everything seems to be ok the servo changes to state 6 without any user action. The test takes about 300ms.

3.7 State 6: Ready to Operate

In this state the motor is either position controlled or with demand current = 0 and under voltage, but no motion commands are accepted. The mode is configurable with UPID 6300h.

Sending motion commands in this state will generate the error 'Motion command sent in wrong state' and a state change to the error state will be performed.

Clearing the control word bit 3 'Enable Operation' in state 8 or higher will stop immediately the set point generation and a state transition to 6 is performed. Clearing the bit while a motion is in execution a following error might be generated.

3.8 State 8: Operation Enabled

This is the state of the normal operation in which the motion commands are executed. It is strongly recommended to use the State Var for the motion command synchronisation with any fieldbus system.

| State Var | | | | | | | | | | | | | | | |
|----------------|----|----|----|----|----|---|---|-------|--------------------|---------------|---------------|----------------------|---|---|---|
| Main State = 8 | | | | | | | | Homed | In Target Position | Motion Active | Event Handler | Motion Command Count | | | |
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

In the high byte stands the number of the main state = 8. In the low byte stands in the lowest 4 bits the actual interpreted 'Motion Command Count', bit 4 indicates if the event handler is active, in bit 5 stands the status word bit 'Motion Active', in bit 6 the status word bit 'In Target Position' and in bit 7 the status word bit 'Homed'. Because the 'Motion Command Count' echo and this status word bits are located in the same byte no data consistency problem is possible with any fieldbus.

A new motion command could be setup when the Motion Command Count has changed to the last sent **and** the 'Motion Active' bit is 0 or the 'In Target Position' bit is 1 if an exact positioning is required.

3.9 State 9: Homing

The homing state is used to define the position of the system according a mechanical reference, a home switch or an index.

For LinMot motors the slider home position at this home position is taken to compensate edge effects.

In the home sequence a position check of two positions and the motion to an initial position can be added.

Hint: If a mechanical stop homing mode is chosen, the initial position should be a little apart from this mechanical stop to avoid overheating of the motor.

3.10 State 10: Clearance Check

Setting the Clearance Check bit in the Control Word, two positions are moved to, to check if the whole motion range is free. Normally this action is added to the homing sequence to ensure that the homing was done correctly.

3.11 State 11: Going To Initial Position

Setting the Go To Initial Position bit in the control word, the servo moves to the initial position, normally used to move away from the mechanical stop after homing, to protect the motor from overheating at the mechanical stop. After an error it is also recommended to move to a defined position again.

3.12 State 12: Aborting

Clearing the /Abort bit in the control word initiates a quick stop. After the motion has stopped the servo rests position controlled. Setting the bit again the servo controller rests in position until a new motion command is executed.

3.13 State 13: Freezing

Clearing the /Freeze bit in the control word initiates a quick stop. After the motion is stopped the servo rests position controlled. Setting the bit again the servo controller will finish the frozen motion (e.g. if it was a VAI command). Curve motion can be frozen but not restarted by releasing this bit, setting the bit again the motor moves at the target position of the last VAI command, if never used a VAI command it will go to the initial position.

3.14 State 14: Error Behaviour Quick Stop

Most of the errors, which can occur during an active motion, cause a quick stop behavior to stop the motion. After the quick stop is finished the motor is no longer position controlled.

3.15 State 15: Going To Position

Setting the Go To Position bit in the control word, the servo moves to the defined position, recommendable for example, after an error, to move to a defined position again.

3.16 State 16: Jogging +

Setting the Jog Move + bit in the control word, the servo moves either a defined position increment or to the maximal position with a limited speed. Releasing the bit will stop the motion.

3.17 State 17: Jogging -

Setting the Jog Move - bit in the control word, the servo moves either a defined position decrement or to the minimal position with a limited speed. Releasing the bit will stop the motion

3.18 State 18: Linearizing

The linearizing state is used to correct position feedback parameters, to improve the linearity of the position feedback.

3.19 State 19: Phase Searching

The phase search is only defined for three phase EC motors with hall switches and ABZ-sensors to find the commutation offset for to the sensor. It cannot be guaranteed that this feature will work for all kinds of EC motors. The found offset can be found in the variable section Calculated Commutation Offset (UPID: 1C1Bh), and has to be set manually to the parameter Phase Angle (UPID 11F2h).

3.20 State 20: Special Mode

The Special Mode is available only on the B1100 servo controllers. In this state the current command mode over the analog input is available. For the use of this mode see the [4].

3.21 Building the Control Word

The Control Word can be accessed bit by bit from different sources with different priorities. The highest priorities have the bits that are forced by parameters. The second highest priority has the control panel of the LinMot-Talk1100 SW, if logged in with the SW. The next lower priorities have the bits that are defined on the X4 IO's as control word input bits. The lowest priority have bits which are set over the interface (normally a serial fieldbus connection), so in the Ctrl Word Interface Copy mask all bits can be selected, without causing any problems, but bits which should not be accessed through the interface can be masked out.

3.22 Control Word

With the Control Word (16Bit) the main state machine of the servo controller could be accessed. Following table shows the meaning of each bit:

| Bit Name | Val | Meaning | Remark |
|------------------------------|-----|------------------------|---|
| 0 Switch On | 0 | OFF1 | A-Stop, -> Current = 0, power switches disabled |
| | 1 | ON | State change from switch on disabled to ready to switch on |
| 1 Voltage Enable | 0 | OFF2 | Power switches disabled without microcontroller action |
| | 1 | Operation | |
| 2 /Quick Stop | 0 | OFF3 | Quick Stop -> Current = 0 -> H-Bridges disabled |
| | 1 | Operation | |
| 3 Enable Operation | 0 | Operation disabled | Position controller active Motion Commands disabled |
| | 1 | Operation enable | Position controller active Motion Commands enabled |
| 4 /Abort | 0 | Abort | Quick Stop position control rests active, motion command is cleared. |
| | 1 | Operation | |
| 5 /Freeze | 0 | Freeze motion | Quick Stop position control rests active, Target position not cleared, curves motions are aborted |
| | 1 | Operation | Rising edge will reactivate motion command |
| 6 Go To Position | 0 | | |
| | 1 | Go To Position | Go to fixed parameterized Position. Wait for release of signal. |
| 7 Error Acknowledge | 0 | | |
| | 1 | Error Acknowledge | Rising edge of signal acknowledges error |
| 8 Jog Move + | 0 | | |
| | 1 | | Jog Move + |
| 9 Jog Move - | 0 | | |
| | 1 | | Jog Move - |
| 10 Special Mode | 0 | | |
| | 1 | Special Mode | Special Mode |
| 11 Home | 0 | Stop Homing | |
| | 1 | Homing | At startup bit 11 Status word is cleared, until procedure is finished. |
| 12 Clearance Check | 0 | Stop Clearance Check | |
| | 1 | Clearance Check | Enable Clearance Check Movements |
| 13 Go To Initial Position | 0 | | |
| | 1 | Go To initial Position | Rising edge will start go to initial position |
| 14 Reserved | 0 | | |
| | 1 | | Reserved |
| 15 Phase Search | 0 | Stop Phase Search | |
| | 1 | Phase Search | Enable Phase Search Movements |

3.23 Status Word

Following table shows the meaning of the single bits:—

| Bit Name | Val | Meaning | Remark |
|----------------------------|-----|------------------------|---|
| 0 Operation Enabled | 0 | | State Nr < 8 |
| | 1 | Operation Enabled | State Nr 8 or higher (copied to Controller EN LED) |
| 1 Switch On Active | 0 | Switch On Disabled | Control Word Bit 0 |
| | 1 | Switch On Enabled | |
| 2 Enable Operation | 0 | Operation Disabled | Control Word Bit 3 |
| | 1 | Operation | |
| 3 Error | 0 | No Error | |
| | 1 | Error | Acknowledge with Control word Bit 7 (Reset Error) |
| 4 Voltage Enable | 0 | Power Bridge Off | Control Word Bit 1 |
| | 1 | Operation | |
| 5 /Quick Stop | 0 | Active | Control Word Bit 2 |
| | 1 | Operation | |
| 6 Switch On Locked | 0 | Not Locked | |
| | 1 | Switch On Locked | Release with 0 of Control word bit 0 (Switch On) |
| 7 Warning | 0 | Warning not active | No bit is set in the Warn Word |
| | 1 | Warning active | One or more bits in the Warn Word are set |
| 8 Event Handler Active | 0 | Event Handler Inactive | Event Handler cleared or disabled |
| | 1 | Event Handler Active | Event Handler setup |
| 9 Special Motion Active | 0 | Normal Operation | |
| | 1 | Special Command runs | Special motion commands (Homing, ..) runs |
| 10 In Target Position | 0 | Not In Pos | Motion active or actual position out of window |
| | 1 | In Pos | Actual position after motion in window |
| 11 Homed | 0 | Motor not homed | Incremental sensor not homed (referenced) |
| | 1 | Motor homed | Position sensor system valid |
| 12 Fatal Error | 0 | | |
| | 1 | Fatal Error | A fatal error could not be acknowledged! |
| 13 Motion Active | 0 | No Motion | Setpoint generation inactive |
| | 1 | Motion active | Setpoint generation (VAI, curve) active |
| 14 Range Indicator 1 | 0 | Not In Range 1 | Defined UPID is not in Range 1 |
| | 1 | In Range1 | Defined UPID is in Range 1 |
| 15 Range Indicator 2 | 0 | Not In Range 2 | Defined UPID is not in Range 2 |
| | 1 | In Range2 | Defined UPID is in Range 2 |

3.24 Warn Word

Following table shows the meaning of the single bits of the Warn Word:

| Bit Name | Val | Meaning |
|---------------------------------------|-----|---|
| 0 Motor Hot Sensor | 0 | Normal Operation |
| | 1 | Motor Temperature Sensor On |
| 1 Motor Short Time Overload I^2t | 0 | Normal Operation |
| | 1 | Calculated Motor Temperature Reached Warn Limit |
| 2 Motor Supply Voltage Low | 0 | Normal Operation |
| | 1 | Motor Supply Voltage Reached Low Warn Limit |
| 3 Motor Supply Voltage High | 0 | Normal Operation |
| | 1 | Motor Supply Voltage Reached High Warn Limit |
| 4 Position Lag Always | 0 | Normal Operation |
| | 1 | Position Error during Moving Reached Warn Limit |
| 5 Position Lag Standing | 0 | Normal Operation |
| | 1 | Position Error During Standing Reached Warn Limit |
| 6 Controller Hot | 0 | Normal Operation |
| | 1 | Temperature on Servo Controller High |
| 7 Motor Not Homed | 0 | Normal Operation |
| | 1 | Warning Motor Not Homed Yet |
| 8 PTC Sensor 1 Hot | 0 | Normal Operation |
| | 1 | PTC Temperature Sensor 1 On |
| 9 Reserved PTC 2 | 0 | Normal Operation |
| | 1 | PTC Temperature Sensor 2 On |
| 10 RR Hot Calculated | 0 | Normal Operation |
| | 1 | Regenerative Resistor Temperature Hot Calculated |
| 11 Reserved | 0 | |
| | 1 | |
| 12 Reserved | 0 | |
| | 1 | |
| 13 Reserved | 0 | |
| | 1 | |
| 14 Interface Warn Flag | 0 | Normal Operation |
| | 1 | Warn Flag Of Interface SW layer |
| 15 Application Warn Flag | 0 | Normal Operation |
| | 1 | Warn Flag Of Application SW layer |

Normally the warn word bits are used to react in conditions before the controller goes into the error state. E.g. a typical reaction on the warning '*Motor Temperature Sensor*' would be a stop of the machine, before the controller goes into the error state and the motor goes out of control to avoid crashes.

4 Motion Command Interface

4.1 Motion Command Interface

The motion command interface consists of one word that contains the command ID, and up to 16 command parameter words. Example: 'VA-Interpolator 16 bit Go To Absolute Position'

| Word | Description | Example of command |
|--------|------------------------|-----------------------------------|
| 1. | Command Header with ID | Go To Absolute Position Immediate |
| 2. | 1. Command Parameter | Position |
| 3. | 2. Command Parameter | Maximal Speed |
| 4. | 3. Command Parameter | Acceleration |
| 5. | 4. Command Parameter | Deceleration |
| 6.-16. | 5. - Command Parameter | Not used |

4.1.1 Command Header

| Master ID | | | | | | | | Sub ID | | | | Command Count | | | |
|-----------|----|----|----|----|----|---|---|--------|---|---|---|---------------|---|---|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

The header of the Motion command is split into three parts:

- Master ID
- Sub ID
- Command Count

4.1.1.1 Master ID

The master ID specifies the command group.

4.1.1.2 Sub ID

The sub ID is used to identify different commands from the same command group.

4.1.1.3 Command Count

A new command will only be executed, if the value of the command count has changed. In the easiest way bit 0 can be toggled.

4.2 Overview Motion Commands

| Master ID | Sub ID | B 1 1 0 0 | Description |
|-----------|--------|-----------------------|---|
| 00h | 0h | X | No Operation |
| | 1h | X | Write Interface Control Word |
| | 2h | X | Write Live Parameter |
| | 3h | | Write X4 Intf Outputs with Mask |
| | 4h | | Write X6 Intf Outputs with Mask |
| | 8h | | Clear Event Evaluation |
| | 9h | X | Master Homing |
| 01h | 0h | X | VAI Go To Pos |
| | 1h | X | VAI Increment Dem Pos |
| | 2h | X | VAI Increment Target Pos |
| | 3h | X | VAI Go To Pos From Act Pos And Act Vel |
| | 4h | X | VAI Go To Pos From Act Pos Starting With Dem Vel = 0 |
| | 5h | X | VAI Increment Act Pos |
| | 6h | X | VAI Increment Act Pos Starting with Dem Vel = 0 |
| | 7h | X | VAI Stop |
| | 8h | | VAI Go To Pos After Actual Command |
| | 9h | X | VAI Go To Analog Pos |
| | Ah | | VAI Go To Pos On Rising Trigger Event |
| | Bh | | VAI Increment Target Pos On Rising Trigger Event |
| | Ch | | VAI Go To Pos On Falling Trigger Event |
| | Dh | | VAI Increment Target Pos On Falling Trigger Event |
| | Eh | | VAI Change Motion Parameters On Positive Position Transition |
| | Fh | | VAI Change Motion Parameters On Negative Position Transition |
| 02h | 0h | X | Predef VAI Go To Pos |
| | 1h | X | Predef VAI Increment Dem Pos |
| | 2h | X | Predef VAI Increment Target Pos |
| | 3h | X | Predef VAI Go To Pos From Act Pos And Act Vel |
| | 4h | X | Predef VAI Go To Pos From Act Pos Starting With Dem Vel = 0 |
| | 7h | X | Predef VAI Stop With Quick Stop Deceleration |
| | 8h | | Predef VAI Go To Pos After Actual Command |
| | Ah | | Predef VAI Go To Pos On Rising Trigger Event |
| | Bh | | Predef VAI Increment Target Pos On Rising Trigger Event |
| | Ch | | Predef VAI Go To Pos On Falling Trigger Event |
| | Dh | | Predef VAI Increment Target Pos On Falling Trigger Event |
| | Eh | X | Predef VAI Infinite Motion Positive Direction |
| | Fh | X | Predef VAI Infinite Motion Negative Direction |
| 03h | 0h | X | P Stream With Slave Generated Time Stamp |
| | 1h | X | PV Stream With Slave Generated Time Stamp |
| | 2h | X | P Stream With Slave Generated Time Stamp and Configured Period Time |
| | Fh | X | Stop Streaming |
| 04h | 0h | | Time Curve With Default Parameters |
| | 1h | | Time Curve With Default Parameters From Act Pos |
| | 2h | | Time Curve To Pos With Default Speed |
| | 3h | | Time Curve To Pos With Adjustable Time |

| | | | |
|-----|----|---|--|
| | 4h | | Time Curve With Adjustable Offset, Time Scale & Amplitude Scale |
| | 5h | | Time Curve With Adjustable Offset, Time & Amplitude Scale |
| | 6h | | Time Curve With Adjustable Offset, Time & Amplitude Scale On Rising Trigger Event |
| | 7h | | Time Curve With Adjustable Offset, Time & Amplitude Scale On Falling Trigger Event |
| | Ah | | Time Curve To Pos With Default Speed On Rising Trigger Event |
| | Ch | | Time Curve To Pos With Default Speed On Falling Trigger Event |
| | Eh | | Time Curve To Pos With Adjustable Time On Rising Trigger Event |
| | Fh | | Time Curve To Pos With Adjustable Time On Falling Trigger Event |
| 05h | 0h | | Modify Curve Start Address in RAM |
| | 1h | | Modify Curve Info Block 16 Bit Value in RAM |
| | 2h | | Modify Curve Info block 32 Bit Value in RAM |
| | 4h | | Modify Curve Data Block 32 Bit in RAM |
| | 5h | | Modify Curve Data Block 32 Bit in RAM |
| | 6h | | Modify Curve Data Block 32 Bit in RAM |
| 06h | 9h | | Setup Encoder CAM On Rise Trigger Event With Delay Counts |
| | Ah | | Setup Encoder CANM On Rise Trigger Event With Delay Counts, Target Pos and Length |
| | Bh | | Setup Encoder CAM On Fall Trigger Event With Delay Counts |
| | Ch | | Setup Encoder CAM On Fall Trigger Event With Delay Counts, Target Pos and Length |
| | Dh | | Setup Encoder CAM On Rise Trigger Event With Delay Counts Amplitude scale and length |
| | Eh | | Setup Encoder CAM On Fall Trigger Event With Delay Counts Amplitude scale and length |
| 07h | 0h | | Start VAI Encoder Position Indexing |
| | 1h | | Start Predef VAI Encoder Position Indexing |
| | Eh | | Stop Position Indexing And VAI Go To Pos |
| | Fh | | Stop Position Indexing And Predefined VAI Go To Pos |
| 09h | 0h | X | VAI 16 Bit Go To Pos |
| | 1h | X | VAI 16 Bit Increment Dem Pos |
| | 2h | X | VAI 16 Bit Increment Target Pos |
| | 3h | X | VAI 16 Bit Go To Pos From Act Pos And Act Vel |
| | 4h | X | VAI 16 Bit Go To Pos From Act Pos Starting With Dem Vel = 0 |
| | 5h | X | VAI 16Bit Increment Act Pos |
| | 6h | X | VAI Increment Act Pos Starting with Dem Vel = 0 |
| | 7h | X | VAI 16 Bit Stop |
| | 8h | | VAI 16 Bit Go To Pos After Actual Command |
| | Ah | | VAI 16 Bit Go To Pos On Rising Trigger Event |
| | Bh | | VAI 16 Bit Increment Target Pos On Rising Trigger Event |
| | Ch | | VAI 16 Bit Go To Pos On Falling Trigger Event |
| | Dh | | VAI 16 Bit Increment Target Pos On Falling Trigger Event |
| | Eh | | VAI 16 Bit Change Motion Parameters On Positive Position Transition |
| | Fh | | VAI 16 Bit Change Motion Parameters On Negative Position Transition |
| 0Ah | 0h | X | Predef VAI 16 Bit Go To Pos |
| | 1h | X | Predef VAI 16 Bit Increment Dem Pos |
| | 2h | X | Predef VAI 16 Bit Increment Target Pos |
| | 3h | X | Predef VAI 16 Bit Go To Pos From Act Pos And Act Vel |
| | 4h | X | Predef VAI 16 Bit Go To Pos From Act Pos Starting With Dem Vel = 0 |
| | 7h | X | Predef VAI 16 Bit Stop With Quick Stop Deceleration |
| | 8h | | Predef VAI 16 Bit Go To Pos After Actual Command |

| | | | |
|-----|----|---|---|
| | Ah | | Predef VAI 16 Bit Go To Pos On Rising Trigger Event |
| | Bh | | Predef VAI 16 Bit Increment Target Pos On Rising Trigger Event |
| | Ch | | Predef VAI 16 Bit Go To Pos On Falling Trigger Event |
| | Dh | | Predef VAI 16 Bit Increment Target Pos On Falling Trigger Event |
| 0Bh | 0h | | VAI Predef Acc Go To Pos |
| | 1h | | VAI Predef Acc Increment Dem Pos |
| | 2h | | VAI Predef Acc Increment Target Pos |
| | 3h | | VAI Predef Acc Go To Pos From Act Pos And Act Vel |
| | 4h | | VAI Predef Acc Go To Pos From Act Pos Starting With Dem Vel = 0 |
| | 8h | | VAI Predef Acc Go To Pos After Actual Command |
| | Ah | | VAI Predef Acc Go To Pos On Rising Trigger Event |
| | Bh | | VAI Predef Acc Increment Target Pos On Rising Trigger Event |
| | Ch | | VAI Predef Acc Go To Pos On Falling Trigger Event |
| | Dh | | VAI Predef Acc Increment Target Pos On Falling Trigger Event |
| 0Ch | 0h | X | VAI Dec=Acc Go To Pos |
| | 1h | X | VAI Dec=Acc Increment Dem Pos |
| | 2h | X | VAI Dec=Acc Increment Target Pos |
| | 3h | X | VAI Dec=Acc Go To Pos From Act Pos And Act Vel |
| | 4h | X | VAI Dec=Acc Go To Pos From Act Pos Starting With Dem Vel = 0 |
| | 5h | X | VAI Dec=Acc Go To Pos With Max Curr |
| | 6h | | VAI Dec=Acc Go To Pos From Act Pos And Act Vel With Max Curr |
| | 7h | | VAI Dec=Acc Go To Pos From Act Pos, Dem Vel = 0 and With Max Curr |
| | 8h | | VAI Dec=Acc Go To Pos After Actual Command |
| | Ah | | VAI Dec=Acc Go To Pos On Rising Trigger Event |
| | Bh | | VAI Dec=Acc Increment Target Pos On Rising Trigger Event |
| | Ch | X | VAI Dec=Acc Go To Pos On Falling Trigger Event |
| | Dh | X | VAI Dec=Acc Increment Target Pos On Falling Trigger Event |
| 0Dh | 0h | X | VAI Go Relative To Captured Pos |
| | 4h | X | VAI Go To Cmd Table Var 1 Pos |
| | 5h | X | VAI Go To Cmd Table Var 2 Pos |
| | 6h | X | VAI Go To Cmd Table Var 1 Pos From Act Pos And Act Vel |
| | 7h | X | VAI Go To Cmd Table Var 2 Pos From Act Pos And Act Vel |
| 10h | 0h | | Encoder CAM Enable |
| | 1h | | Encoder CAM Disable |
| | 2h | | Encoder CAM Go To Sync Pos |
| | 4h | | Encoder CAM Set Value |
| 11h | 0h | | Encoder CAM 1 Define Curve With Default Parameters |
| | 1h | | Encoder CAM 1 Define Curve From Act Pos |
| | 2h | | Encoder CAM 1 Define Curve To Pos |
| | 4h | | Encoder CAM 1 Define Curve To Pos In Counts |
| | 5h | | Encoder CAM 1 Define Curve with Amplitude Scale In Counts |
| | 6h | | Encoder CAM 1 Enable |
| | 7h | | Encoder CAM 1 Disable |
| | 8h | | Encoder CAM 1 Change Amplitude Scale and Length |
| 12h | 0h | | Encoder CAM 2 Define Curve With Default Parameters |
| | 1h | | Encoder CAM 2 Define Curve From Act Pos |
| | 2h | | Encoder CAM 2 Define Curve To Pos |
| | 4h | | Encoder CAM 2 Define Curve To Pos In Counts |
| | 5h | | Encoder CAM 2 Define Curve with Amplitude Scale In Counts |
| | 6h | | Encoder CAM 2 Enable |
| | 7h | | Encoder CAM 2 Disable |

| | | | |
|-----|----|---|--|
| | 8h | | Encoder CAM 2 Change Amplitude Scale and Length |
| 20h | 0h | X | Start Command Table Command |
| | 1h | X | Start Command Table Command On Rising Trigger Event |
| | 2h | X | Start Command Table Command On Falling Trigger Event |
| | 8h | | Modify Command Table 16 bit Parameter in RAM |
| | 9h | | Modify Command Table 32 bit Parameter in RAM |
| | | | |
| 21h | 0h | X | Wait Time |
| | 1h | X | Wait Until Motion Finished |
| | 2h | X | Wait Until In Target Position |
| | 3h | X | Wait Until Rising Trigger Edge |
| | 4h | X | Wait Until Falling Trigger Edge |
| | 8h | X | Wait Time Defined With Cmd Table Var 1 |
| | 9h | X | Wait Time Defined With Cmd Table Var 2 |
| 22h | 0h | X | Wait Until Demand Position Greater Than |
| | 1h | X | Wait Until Demand Position Less Than |
| | 2h | X | Wait Until Actual Position Greater Than |
| | 3h | X | Wait Until Actual Position Less Than |
| | 4h | X | Wait Until Difference Position Greater Than |
| | 5h | X | Wait Until Difference Position Less Than |
| | 6h | X | Wait Until Difference Position Unsigned Greater Than |
| | 7h | X | Wait Until Difference Position Unsigned Less Than |
| | 8h | X | Wait Until Demand Velocity Greater Than |
| | 9h | X | Wait Until Demand Velocity Less Than |
| | Ah | X | Wait Until Actual Velocity Greater Than |
| | Bh | X | Wait Until Actual Velocity Less Than |
| | Eh | X | Wait Until Current Greater Than |
| | Fh | X | Wait Until Current Less Than |
| | | | |
| 24h | 0h | X | Set Cmd Table Var 1 To |
| | 1h | X | Add To Cmd Table Var 1 |
| | 2h | X | Set Cmd Table Var 2 To |
| | 3h | X | Add To Cmd Table Var 2 |
| | 8h | X | Write Cmd Table Var 1 To UPID RAM value |
| | 9h | X | Write Cmd Table Var 2 To UPID RAM value |
| | Ch | X | Write UPID RAM value To Cmd Table Var 1 |
| | Dh | X | Write UPID RAM value To Cmd Table Var 2 |
| 25h | 0h | X | IF Cmd Table Var 1 Less Than |
| | 1h | X | IF Cmd Table Var 1 Greater Than |
| | 2h | X | IF Cmd Table Var 2 Less Than |
| | 3h | X | IF Cmd Table Var 2 Greater Than |
| | 6h | X | IF Cmd Table Var 1 Less Than UPID Value |
| | 7h | X | IF Cmd Table Var 2 Less Than UPID Value |
| | 8h | X | IF Demand Position Less Than |
| | 9h | X | IF Demand Greater Than |
| | Ah | X | IF Actual Position Less Than |
| | Bh | X | IF Actual Greater Than |
| | Ch | X | IF Difference Position Less Than |
| | Dh | X | IF Difference Greater Than |
| | Eh | X | IF Current Less Than |
| | Fh | X | IF Current Greater Than |
| | | | |
| 26h | 0h | X | IF Analog Val On X4.4 Less Than |
| | 2h | X | IF Masked X4 Input Value Equal Than |
| | 3h | | IF Masked X6 input Value Equal Than |

| | | | |
|-----|----|---|--|
| | 4h | X | IF Masked Status Word Equal Than |
| | 5h | X | IF Masked Warn Word Equal Than |
| 30h | 0h | | Encoder Winding Start With Default Parameters |
| | 1h | | Encoder Winding Start With Default Parameters At Revolutions |
| | 4h | | Encoder Winding Stop Adaptation Of Left, Right Position And Disturbance |
| | 5h | | Encoder Winding Restart Adaptation Of Left, Right Position And Disturbance |
| 31h | 0h | | Encoder Curve Winding Start With Default Parameters |
| | 1h | | Encoder Curve Winding Start With Default Parameters At Revolutions |
| 38h | 0h | | VAI Go To Pos With Force Ctrl Limit |
| | 1h | | VAI Go To Pos From Act Pos And Reset Force Control |
| | 2h | | Force Ctrl Change Target Force |
| | 3h | | VAI Go To Pos With Force Ctrl Limit and Target Force |

4.3 Detailed Motion Command Description

4.3.1 No Operation (000xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|----------------------|--------|------|
| Header | 0 | No Operation (000xh) | UInt16 | - |

This command does nothing. It can be sent in any operational state.

4.3.2 Write Interface Control Word (001xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--------------------------------------|--------|------|
| Header | 0 | 001xh : Write Interface Control Word | UInt16 | - |
| 1. Par | 2 | Interface Control Word | UInt16 | - |

This command allows writing the control word through the motion command interface. The fieldbus interfaces (CANOpen, DeviceNet, Profibus, LinRS) offer other ways to access the control word directly. Mostly a direct access is more comfortable than the way over the motion command interface.

4.3.3 Write Live Parameter (002xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|------|
| Header | 0 | 002xh: Write Live Parameter | UInt16 | - |
| 1. Par | 2 | UPID (Unique Parameter ID) | UInt16 | - |
| 2. Par | 4 | Parameter Value, the Unit depends on Parameter | Div | Div |

This command allows writing any live parameter's ram value through the motion command interface. The parameter has to be specified by its UPID (Unique Parameter ID). In order to keep the interface as simple as possible any parameter can be accessed as 32bit integer value. The controller's operating system will filter out the relevant number of bits for parameters with smaller data size (e.g. only the lowest bit is considered for Boolean parameters).

The fieldbus interfaces (CANOpen, DeviceNet, Profibus, LinRS) offer other ways to read and write parameter values directly. Mostly a direct access is more comfortable than the way over the motion command interface.

4.3.4 Write X4 Intf Outputs with Mask (003xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|------|
| Header | 0 | 003xh: Write X4 Intf Outputs with Mask | UInt16 | - |
| 1. Par | 2 | Bit Mask; Bit 0 = X4.3 Bit 1 = X4.4... | UInt16 | - |
| 2. Par | 4 | Bit Value; Bit 0 = X4.3, Bit 1 X4.4.. | UInt16 | - |

This command allows writing the configured X4 interface outputs with a write mask through the motion command interface. To write an output, the corresponding bit in the mask must be set. Bit 0 is mapped to output X4.3, bit 1 to output X4.4 etc.

4.3.5 Write X6 Intf Outputs with Mask (004xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|------|
| Header | 0 | 004xh: Write X6 Intf Outputs with Mask | UInt16 | - |
| 1. Par | 2 | Bit Mask; Bit 0 = X6.9 Bit 1 = X6.22... | UInt16 | - |
| 2. Par | 4 | Bit Values; Bit 0 = X6.9, Bit 1 X6.22.. | UInt16 | - |

This command allows writing the X6 interface outputs with a write mask through the motion command interface. To write an output, the corresponding bit in the mask must be set. Bit 0 is mapped to output X6.9, bit 1 to output X6.22 etc.

4.3.6 Clear Event Evaluation (008xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-------------------------------|--------|------|
| Header | 0 | 008xh: Clear Event Evaluation | UInt16 | - |

This command resets the event handler. The event handler becomes active, if a motion command has been sent, that does not immediately start, but waits with its execution until other conditions are fulfilled (e.g. command 'VAI Go To Pos On Rising Trigger Event'). The bit 8 of the status word shows, if the event handler is active.

Once the event handler becomes active, it remains active, until it is deactivated with this clear command. As long the event handler is active, the command to be executed on the event situation will be restarted each time the event condition is fulfilled.

4.3.7 Master Homing (009xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|----------------------|--------|--------|
| Header | 0 | 009xh: Master Homing | UInt16 | - |
| 1. Par | 2 | Home Position | SInt32 | 0.1 um |

This command can be used, if the master system knows the home position without going to the home state in the state machine. The passed value of the home position is stored in the RAM value of the parameter Home Position (UPID 13C7h), then the corresponding value of the parameter Slider Home Position (UPID 13CAh) is calculated and stored in the RAM value. Then a homing at actual position is done without going into the homing state.

4.3.8 VAI Go To Pos (010xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|----------------------|--------|-----------------------|
| Header | 0 | 010xh: VAI Go To Pos | UInt16 | - |
| 1. Par | 2 | Target Position | UInt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Deceleration | UInt32 | 1E-5 m/s ² |

4.3.9 VAI Increment Dem Pos (011xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-----------------------------|--------|-----------------------|
| Header | 0 | 011xh:VAI Increment Dem Pos | UInt16 | - |
| 1. Par | 2 | Position Increment | UInt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Deceleration | UInt32 | 1E-5 m/s ² |

This command sets a new target position and defines the maximal velocity, acceleration and deceleration for going there. The new target position value will be determined by the firmware. It is calculated by adding the position increment argument to the demand position value. The demand position is the actual position setpoint on which the motor is controlled. The demand position value moves towards the target position value while a motion command is in execution.

4.3.10 VAI Increment Target Pos (012xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---------------------------------|--------|-----------------------|
| Header | 0 | 012xh: VAI Increment Target Pos | UInt16 | - |
| 1. Par | 2 | Position Increment | UInt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Deceleration | UInt32 | 1E-5 m/s ² |

This command sets a new target position and defines the maximal velocity, acceleration and deceleration for going there. The new target position value will be determined by the firmware. It is calculated by adding the position increment argument to the (former) target position. The target position is the motion's end position and doesn't change during the execution of a motion command.

4.3.11 VAI Go To Pos From Act Pos And Act Vel (013xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|-----------------------|
| Header | 0 | 013xh: VAI Go To Pos From Act Pos And Act Vel | UInt16 | - |
| 1. Par | 2 | Target Position | UInt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Deceleration | UInt32 | 1E-5 m/s ² |

This command starts the new VAI setpoint generation from the actual position and actual velocity. Can be used after a press command.

4.3.12 VAI Go To Pos From Act Pos Starting With Dem Vel = 0 (014xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|-----------------------|
| Header | 0 | 014xh: VAI Go To Pos From Act Pos Starting With Dem Vel =0 | UInt16 | - |
| 1. Par | 2 | Target Position | SInt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Deceleration | UInt32 | 1E-5 m/s ² |

This command starts the new VAI setpoint generation from the actual position and the start velocity is forced to zero. Can be used after a press command.

4.3.13 VAI Increment Act Pos (015xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|------------------------------|--------|-----------------------|
| Header | 0 | 015xh: VAI Increment Act Pos | UInt16 | - |
| 1. Par | 2 | Position Increment | SInt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Deceleration | UInt32 | 1E-5 m/s ² |

This command sets a new target position and defines the maximal velocity, acceleration and deceleration for going there. The new target position value will be determined by the firmware. It is calculated by adding the position increment argument to the actual position. The actual position is the effective motor position. This command can be used to perform a retraction move after a press command. If the position increment argument is zero, this command defines the actual motor position as new setpoint.

4.3.14 VAI Increment Act Pos Starting With Dem Vel = 0 (016xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|-----------------------|
| Header | 0 | 016xh: VAI Increment Act Pos Starting With Dem Vel = 0 | UInt16 | - |
| 1. Par | 2 | Position Increment | SInt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Deceleration | UInt32 | 1E-5 m/s ² |

This command starts the new VAI setpoint generation from the actual position and the start velocity is forced to zero. This command defines the maximal velocity, acceleration and deceleration for going to the target position. The new target position value will be determined by the firmware. It is calculated by adding the position increment argument to the actual position. The actual position is the effective motor position. This command could be used to perform a retraction move after a press command. If the position increment argument is zero, then this command defines the actual motor position as new setpoint.

4.3.15 VAI Stop (017xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-----------------|--------|-----------------------|
| Header | 0 | 017xh: VAI Stop | UInt16 | - |
| 1. Par | 2 | Deceleration | UInt32 | 1E-5 m/s ² |

4.3.16 VAI Go To Pos After Actual Command (018xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|-----------------------|
| Header | 0 | 018xh: VAI Go To Pos After Actual Command | UInt16 | - |
| 1. Par | 2 | Target Position | UInt32 | 0.1 μ m |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Deceleration | UInt32 | 1E-5 m/s ² |

This command waits until the actual motion setpoint generation has finished, then starts the new defined VAI motion.

4.3.17 VAI Go To Analog Pos (019xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-----------------------------|--------|-----------------------|
| Header | 0 | 019xh: VAI Go To Analog Pos | UInt16 | - |
| 1. Par | 2 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 2. Par | 6 | Acceleration | UInt32 | 1E-5 m/s ² |
| 3. Par | 10 | Deceleration | UInt32 | 1E-5 m/s ² |

4.3.18 VAI Go To Pos On Rising Trigger Event (01Axh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|-----------------------|
| Header | 0 | 01Axh: VAI Go To Pos On Rising Trigger Event | UInt16 | - |
| 1. Par | 2 | Target Position | UInt32 | 0.1 μ m |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Deceleration | UInt32 | 1E-5 m/s ² |

4.3.19 VAI Increment Target Pos On Rising Trigger Event (01Bxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|-----------------------|
| Header | 0 | 01Bxh: VAI Increment Target Pos On Rising Trigger Event | UInt16 | - |
| 1. Par | 2 | Position Increment | UInt32 | 0.1 μ m |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Deceleration | UInt32 | 1E-5 m/s ² |

4.3.20 VAI Go To Pos On Falling Trigger Event (01Cxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|-----------------------|
| Header | 0 | 01Cxh: VAI Go To Pos On Falling Trigger Event | UInt16 | - |
| 1. Par | 2 | Target Position | Slnt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Deceleration | UInt32 | 1E-5 m/s ² |

4.3.21 VAI Increment Target Pos On Falling Trigger Event (01Dxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|-----------------------|
| Header | 0 | 01Dxh: VAI Increment Target Pos On Falling Trigger Event | UInt16 | - |
| 1. Par | 2 | Position Increment | Slnt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Deceleration | UInt32 | 1E-5 m/s ² |

4.3.22 VAI Change Motion Parameters On Positive Position Transition (01Exh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|-----------------------|
| Header | 0 | 01Exh: VAI Change Motion Parameters On Positive Position Transition | UInt16 | - |
| 1. Par | 2 | Transition Event Position | Slnt32 | 0.1 μm |
| 2. Par | 6 | Max Velocity After Event | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration After Event | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Deceleration After Event | UInt32 | 1E-5 m/s ² |

This motion command moves an event change position, an event maximal speed, an event acceleration and an event deceleration to the event instance, and starts the event evaluation. As soon as the demand position crosses the event change position in the positive direction the VAI is changed with event values, the target position rests unchanged.

4.3.23 VAI Change Motion Parameters On Negative Position Transition (01Fhx)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|-----------------------|
| Header | 0 | 01Fhx: VAI Change Motion Parameters On Negative Position Transition | UInt16 | - |
| 1. Par | 2 | Transition Event Position | Slnt32 | 0.1 μm |
| 2. Par | 6 | Max Velocity After Event | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration After Event | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Deceleration After Event | UInt32 | 1E-5 m/s ² |

This motion command moves an event change position, an event maximal speed, an event acceleration and an event deceleration to the event instance, and starts the event evaluation. As soon as the demand position crosses the event change position in the negative direction the VAI is changed with event values, the target position rests unchanged.

4.3.24 Predef VAI Go To Pos (020xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-----------------------------|--------|--------|
| Header | 0 | 020xh: Predef VAI Go To Pos | UInt16 | - |
| 1. Par | 2 | Target Position | SLnt32 | 0.1 um |

4.3.25 Predef VAI Increment Dem Pos (021xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-------------------------------------|--------|--------|
| Header | 0 | 021xh: Predef VAI Increment Dem Pos | UInt16 | - |
| 1. Par | 2 | Position Increment | SLnt32 | 0.1 um |

4.3.26 Predef VAI Increment Target Pos (022xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 022xh: Predef VAI Increment Target Pos | UInt16 | - |
| 1. Par | 2 | Position Increment | SLnt32 | 0.1 um |

4.3.27 Predef VAI Go To Pos From Act Pos and Act Vel (023xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 023xh: Predef VAI Go To Pos From Act Pos And Act Vel | UInt16 | - |
| 1. Par | 2 | Target Position | SLnt32 | 0.1 um |

This command starts the new VAI setpoint generation from the actual position, can be used after a press command.

4.3.28 Predef VAI Go To Pos From Act Pos Starting With Dem Vel = 0 (024xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 024xh: Predef VAI Go To Pos From Act Pos With Dem Vel = 0 | UInt16 | - |
| 1. Par | 2 | Target Position | SLnt32 | 0.1 um |

This command starts the new VAI-Setpoint generation from the actual position and the start velocity is forced to zero can be used after a press command.

4.3.29 Predef VAI Stop (027xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|------|
| Header | 0 | 017xh: Predef VAI Stop With Quick Stop Deceleration | UInt16 | - |

4.3.30 Predef VAI Go To Pos After Actual Command (028xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 028xh: Predef VAI Go To Pos After Actual Command | UInt16 | - |
| 1. Par | 2 | Target Position | Slnt32 | 0.1 um |

This command waits until the actual motion setpoint generation has finished, then starts the new defined VAI motion.

4.3.31 Predef VAI Go To Pos On Rising Trigger Event (02Axh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 02Axh: Predef VAI Go To Pos On Rising Trigger Event | UInt16 | - |
| 1. Par | 2 | Target Position | Slnt32 | 0.1 um |

4.3.32 Predef VAI Increment Target Pos On Rising Trigger Event (02Bxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 02Bxh: Predef VAI Increment Target Pos On Rising Trigger Event | UInt16 | - |
| 1. Par | 2 | Position Increment | Slnt32 | 0.1 um |

4.3.33 Predef VAI Go To Pos On Falling Trigger Event (02Cxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 02Cxh: Predef VAI Go To Pos On Falling Trigger Event | UInt16 | - |
| 1. Par | 2 | Target Position | Slnt32 | 0.1 um |

4.3.34 Predef VAI Go To Pos On Falling Trigger Event (02Dxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 02Cxh: Predef VAI Go To Pos On Falling Trigger Event | UInt16 | - |
| 1. Par | 2 | Target Position | Slnt32 | 0.1 um |

4.3.35 Predef VAI Infinite Motion Positive Direction (02Exh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|------|
| Header | 0 | 02Exh: Predef VAI Infinite Motion Positive Direction | UInt16 | - |

4.3.36 Predef VAI Infinite Motion Negative Direction (02Fhx)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|------|
| Header | 0 | 02Fhx: Predef VAI Infinite Motion Negative Direction | UInt16 | - |

4.3.37 P Stream With Slave Generated Time Stamp (030xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 030xh: P Stream With Slave Generated Time Stamp | UInt16 | - |
| 1. Par | 2 | Position | Slnt32 | 0.1 um |

Position streaming mode. The time stamp is generated by the interface (receive time stamp of T0), the streaming period has to be in the time range 2..5ms. For good results the streaming period has to be as constant as possible.

4.3.38 PV Stream With Slave Generated Time Stamp (031xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 031xh: PVA Stream With Slave Generated Time Stamp | UInt16 | - |
| 1. Par | 2 | Position | Slnt32 | 0.1 um |
| 2. Par | 6 | Velocity | Slnt32 | 1 um/s |

Position and velocity streaming mode: Preferred streaming mode. The time stamp is generated by the interface (receive time stamp of T0), the streaming period has to be in the time range 2..5ms. Less sensitive to deviations of the streaming period.

4.3.39 P Stream With Slave Generated Time Stamp and Configured Period Time (032xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 032xh: P Stream With Slave Generated Time Stamp and Configured Period Time | UInt16 | - |
| 1. Par | 2 | Position | Slnt32 | 0.1 um |

Position streaming mode. The time stamp is generated by the interface (receive time stamp of T0), the streaming period has to be in the time range 2..5ms. For good results the streaming period has to be as constant as possible. For the derivation of the velocity and the acceleration the configured streaming period time 14E6h\$ is taken to minimize communication time jittering.

4.3.40 Stop Streaming (03Fhx)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-----------------------|--------|------|
| Header | 0 | 03Fhx: Stop Streaming | UInt16 | - |

This command is used to leave the streaming mode.

4.3.41 Time Curve With Default Parameters (040xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 040xh: Time Curve With Default Parameters | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |

4.3.42 Time Curve With Default Parameters From Act Pos (041xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 41xh: Time Curve With Default Parameters From Act Pos | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |

This command sets the curve offset to the actual position set point then starts the specified time curve with the default parameters (curve time scaling and curve amplitude scaling).

4.3.43 Time Curve To Pos With Default Speed (042xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 042xh: Time Curve To Pos With Default Speed | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Target Position | SInt32 | 0.1 um |

This command sets the curve offset to the actual demand position and scales the curve the way that the target position is reached at the end (the scaling range is -2000%..2000%, if this range is exceeded an error will be generated) then starts the specified time curve with the default curve speed parameter.

4.3.44 Time Curve To Pos With Adjustable Time (043xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 043xh: Time Curve To Pos With Adjustable Time | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Target Position | SInt32 | 0.1 um |
| 3. Par | 8 | Curve Time | SInt32 | 10us |

This command sets the curve offset to the demand position and scales the curve the way that the target position is reached at the end (the scaling range is -2000%..2000%, if this range is exceeded an error will be generated). The curve time is taken from the motion command.

4.3.45 Time Curve With Adjustable Offset, Time Scale & Amplitude Scale (044xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 044xh: Time Curve With Adjustable Offset, Time Scale & Amplitude Scale | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Curve Offset | SInt32 | 0.1 um |
| 3. Par | 8 | Time Scale | UInt16 | 0.01% |
| 4. Par | 10 | Amplitude Scale | SInt16 | 0.1% |

With this command all the curve parameters are defined.

4.3.46 Time Curve With Adjustable Offset, Time & Amplitude Scale (045xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 045xh: Time Curve With Adjustable Offset, Time & Amplitude Scale | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Curve Offset | SInt32 | 0.1 um |
| 3. Par | 8 | Curve Time | SInt32 | 10us |
| 4. Par | 12 | Amplitude Scale | SInt16 | 0.1% |

With this command all the curve parameters are defined, unlike command 44xh this command defines the absolute curve time.

4.3.47 Time Curve With Adjustable Offset, Time & Amplitude Scale On Rising Trigger Event (046xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 046xh: Time Curve With Adjustable Offset, Time & Amplitude Scale On Rise Trigger Event | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Curve Offset | SInt32 | 0.1 um |
| 3. Par | 8 | Curve Time | SInt32 | 10us |
| 4. Par | 12 | Amplitude Scale | SInt16 | 0.1% |

On a rising trigger event start command 0x45xh.

4.3.48 Time Curve With Adjustable Offset, Time & Amplitude Scale On Falling Trigger Event (047xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 047xh: Time Curve With Adjustable Offset, Time & Amplitude Scale On Falling Trigger Event | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Curve Offset | SInt32 | 0.1 um |
| 3. Par | 8 | Curve Time | SInt32 | 10us |
| 4. Par | 12 | Amplitude Scale | SInt16 | 0.1% |

On a falling trigger event start command 0x45xh.

4.3.49 Time Curve To Pos With Default Speed On Rising Trigger Event (04Axh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 04Axh: Time Curve To Pos With Default Speed On Rising Trigger Event | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Target Position | SInt32 | 0.1 um |

On a rising trigger event start command 0x42xh.

4.3.50 Time Curve To Pos With Default Speed On Falling Trigger Event (04Cxxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 04Cxxh: Time Curve To Pos With Default Speed On Falling Trigger Event | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Target Position | SInt32 | 0.1 µm |

On a falling trigger event start command 0x42xxh.

4.3.51 Time Curve To Pos With Adjustable Time On Rising Trigger Event (04Exh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 04Exh: Time Curve Go To Absolute Position With Adjustable Time On Rising Trigger Event | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Target Position | SInt32 | 0.1 µm |
| 3 Par | 8 | Curve Time | SInt32 | 10µs |

On a rising trigger event start command 0x43xxh.

4.3.52 Time Curve To Pos With Adjustable Time On Falling Trigger Event (04Fxxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 04Fxxh: Time Curve To Pos With Adjustable Time On Falling Trigger Event | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Target Position | SInt32 | 0.1 µm |
| 3 Par | 8 | Curve Time | SInt32 | 10µs |

On a falling trigger event start command 0x43xxh.

4.3.53 Modify Curve Start Address in RAM (050xxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 050xxh: Modify Curve Start Address in RAM | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Curve Start Address Offset | UInt16 | - |

This command allows to locate the curve start address (points to the start of the curve info header). A value of 0xFFFFh means no curve is defined, can be used to clear a curve. When using this command the whole memory management of the curve data has to be done by the superior system! A curve can only be defined with a valid start address. If a start address is defined, the curve (curve info header and curve data points) has to be defined completely, otherwise this will lead to an unpredictable behavior!

4.3.54 Modify Curve Info Block 16 Bit Value in RAM (051xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 051xh: Modify Curve Info Block 16 Bit Value in RAM | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Offset in Byte | UInt16 | 0.. |
| 3. Par | 6 | Value | Sint16 | - |

This command allows to modify a 16 bit value (or half of a 32 bit value) in RAM within the curve info block of an existing curve profile with the given ID. The offset argument defines on which position within the curve info block the modification takes place (byte offset). In order to modify for instance the value of x-Length you first have to set the low word of the new curve length with Offset 32 and then the high word with offset 34.

The fieldbus interfaces (CANOpen, DeviceNet, Profibus, LinRS) offer a safer way to download and modify curve profiles (Curve Service). Writing with wrong offsets, may overwrite and destroy data of other curves and may lead to unpredictable behavior!

4.3.55 Modify Curve Info Block 32 Bit Value in RAM (052xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 052xh: Modify Curve Info Block 32 Bit Value in RAM | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Offset in Byte | UInt16 | 0.. |
| 3. Par | 6 | Value | Sint32 | - |

This command allows to modify a 32 bit value in RAM within the curve data block of an already existing curve profile with the given ID. The offset argument defines on which position within the curve data block the modification takes place (byte offset). In order to modify for instance the first position setpoint value (SInt32) you have to set the new position with offset 0. The second setpoint has offset 4, and so on.

The fieldbus interfaces (CANOpen, DeviceNet, Profibus, LinRS) offer a safer way to download and modify curve profiles (Curve Service). Writing with wrong offsets, may overwrite and destroy data of other curves and may lead to unpredictable behavior!

4.3.56 Modify Curve Data Block 32 Bit Value in RAM (054xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 054xh: Modify Curve Data Block 32 Bit Value in RAM | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Offset in Byte | UInt16 | 0.. |
| 3. Par | 6 | Curve point value | Sint32 | - |

This command allows to modify in RAM a 32 bit value within the Curve Data Block of a curve with existing curve start address and curve info header block with the given ID. The offset argument defines on which position within the curve data block the modification takes place (byte offset). In order to modify for instance the first position setpoint value (Sint32) you have to set the new position with offset 0. The second setpoint has offset 4, and so on.
The fieldbus interfaces (CANOpen, DeviceNet, Profibus, LinRS) offer a safer way to download and modify curve profiles (Curve Service). Writing with wrong offsets, may overwrite and destroy data of other curves and may lead to unpredictable behavior!

4.3.57 Modify Curve Data Block 64 Bit Value in RAM (055xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 055xh: Modify Curve Data Block 64 Bit Value in RAM | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Offset in Byte | UInt16 | 0.. |
| 3. Par | 6 | Curve point value | Sint32 | - |
| 4. Par | 10 | Curve point value | Sint32 | - |

This command allows to modify in RAM two 32 bit value within the curve data block of a curve with existing curve start address and curve info header block with the given ID. The offset argument defines on which position within the curve data block the modification takes place (byte offset). In order to modify for instance the first position setpoint value (Sint32) you have to set the new position with offset 0. The second setpoint has offset 4, and so on.
The fieldbus interfaces (CANOpen, DeviceNet, Profibus, LinRS) offer a safer way to download and modify curve profiles (Curve Service). Writing with wrong offsets, may overwrite and destroy data of other curves and may lead to unpredictable behavior!

4.3.58 Modify Curve Data Block 96 Bit Value in RAM (056xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 056xh: Modify Curve Data Block 96 Bit Value in RAM | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Offset in Byte | UInt16 | 0.. |
| 3. Par | 6 | Curve point value | SInt32 | - |
| 4. Par | 10 | Curve point value | SInt32 | - |
| 4. Par | 14 | Curve point value | SInt32 | - |

This command allows to modify in RAM three 32 bit value within the curve data block of a curve with existing curve start address and curve info header block with the given ID. The offset argument defines on which position within the curve data block the modification takes place (byte offset). In order to modify for instance the first position setpoint value (SInt32) you have to set the new position with offset 0. The second setpoint has offset 4, and so on.
The fieldbus interfaces (CANOpen, DeviceNet, Profibus, LinRS) offer a safer way to download and modify curve profiles (Curve Service). Writing with wrong offsets, may overwrite and destroy data of other curves and may lead to unpredictable behavior!

4.3.59 Setup Encoder Cam On Rising Trigger Event With Delay Counts (069xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 069xh: Setup Encoder Cam On Rising Trigger Event With Delay Counts | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Curve Start Delay Count | UInt32 | 1 Incr |

Setup in the event handler to start a cam curve on the rising trigger event with the specified curve ID and the specified delay counts. The specified curve ID is written to the RAM value of UPID 154Ah, and the specified cam start delay is written to the RAM value of UPID 154Ch. Use the infinite cam Length (UPID1527h) for triggered cam motions.

4.3.60 Setup Encoder Cam On Rising Trigger Event With Delay Counts, Target Pos and Length (06Axh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 06Axh: Setup Encoder Cam On Rise Trigger Event With Delay Counts, Target Pos and Length | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Curve Start Delay Count | SInt32 | 1 Incr |
| 3. Par | 8 | Target Position | SInt32 | 0.1 um |
| 4. Par | 12 | Curve length | SInt32 | 1 Incr |

Setup in the event handler to start a cam curve on the rising trigger event with the specified curve ID and the specified delay counts to specified target position in specified counts. The specified curve ID is written to the RAM value of UPID 154Ah, and the specified cam start delay is written to the RAM value of UPID 154Ch. Use the infinite cam length (UPID1527h) for triggered cam motions.

4.3.61 Setup Encoder Cam On Falling Trigger Event With Delay Counts (06Bxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 06Bxh: Setup Encoder Cam On Falling Trigger Event With Delay Counts | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Curve Start Delay Count | UInt32 | 1 Incr |

Setup in the event handler to start a cam curve on the falling trigger event with the specified curve ID and the specified delay counts. The specified curve ID is written to the RAM value of UPID 154Bh, and the specified cam start delay is written to the RAM value of UPID 154Dh. Use the infinite cam length (UPID1527h) for triggered cam motions.

4.3.62 Setup Encoder Cam On Falling Trigger Event With Delay Counts, Target Pos and Length (06Cxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 06Cxh: Setup Encoder Cam On Falling Trigger Event With Delay Counts, Target Pos and Length | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Curve Start Delay Count | SInt32 | 1 Incr |
| 3. Par | 8 | Target Position | SInt32 | 0.1 um |
| 4. Par | 12 | Curve length | SInt32 | 1 Incr |

Setup in the event handler to start a cam curve on the falling trigger event with the specified curve ID and the specified delay counts to specified target position in specified counts. The specified curve ID is written to the RAM value of UPID 154Bh, and the specified cam start delay is written to the RAM value of UPID 154Dh. Use the infinite cam length (UPID1527h) for triggered cam motions.

4.3.63 Setup Encoder Cam On Rising Trigger Event With Delay Counts, Amplitude scale and Length (06Dxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 06Dxh: Setup Encoder Cam On Rise Trigger Event With Delay Counts, Amplitude scale and Length | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Curve Start Delay Count | SInt32 | 1 Incr |
| 3. Par | 8 | Amplitude Scale | SInt16 | 0.1 % |
| 4. Par | 10 | Curve length in Counts | SInt32 | 1 Incr |

Setup in the event handler to start a cam curve on the rising trigger event with the specified curve ID and the specified delay counts to specified target position in specified counts. The specified curve ID is written to the RAM value of UPID 154Ah, and the specified cam start delay is written to the RAM value of UPID 154Ch. Use the infinite cam length (UPID1527h) for triggered cam motions.

4.3.64 Setup Encoder Cam On Falling Trigger Event With Delay Counts, Amplitude scale and Length (06Exh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 06Exh: Setup Encoder Cam On Fall Trigger Event With Delay Counts, Amplitude scale and Length | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Curve Start Delay Count | SInt32 | 1 Incr |
| 3. Par | 8 | Amplitude Scale | Sint16 | 0.1 % |
| 4. Par | 10 | Curve length in Counts | SInt32 | 1 Incr |

Setup in the event handler to start a cam curve on the rising trigger event with the specified curve ID and the specified delay counts to specified target position in specified counts. The specified curve ID is written to the RAM value of UPID 154Ah, and the specified cam start delay is written to the RAM value of UPID 154Ch. Use the infinite cam length (UPID1527h) for triggered cam motions.

4.3.65 Start VAI Encoder Position Indexing (070xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|-----------------------|
| Header | 0 | 070xh: Start VAI Encoder Position Indexing | UInt16 | - |
| 1. Par | 2 | Target Position | SInt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Deceleration | UInt32 | 1E-5 m/s ² |

Changes to the VAI encoder position indexing mode, the actual encoder count is to the target position. To stop the indexing mode use one of the commands (008xh) , (07Exh) or (07Fxxh).

4.3.66 Start Predef VAI Encoder Position Indexing (071xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|-------------------|
| Header | 0 | 071xh: Start Predef VAI Encoder Position Indexing | UInt16 | - |
| 1. Par | 2 | Target Position | SInt32 | 0.1 μm |

Changes to the VAI encoder position indexing mode, the actual encoder count is to the target position. The VAI parameters maximal velocity, acceleration and deceleration are ones taken at calling time from the predefined VAI parameter set (UPIDs: 14BEh, 14BF and 14C0h). To stop the indexing mode use one of the commands (008xh) , (07Exh) or (07Fxxh).

4.3.67 Stop Position Indexing and VAI Go To Pos (07Exh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|-----------------------|
| Header | 0 | 07Exh: Stop Position Indexing And VAI Go To Pos | UInt16 | - |
| 1. Par | 2 | Target Position | SInt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Deceleration | UInt32 | 1E-5 m/s ² |

This command stops the position indexing mode and moves to the defined target position with a VAI command.

4.3.68 Stop Position Indexing and VAI Go To Pos (07Fxxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|-------------------|
| Header | 0 | 07Vxxh: Stop Position Indexing And VAI Go To Pos | UInt16 | - |
| 1. Par | 2 | Target Position | SInt32 | 0.1 μm |

This command clears the position indexing mode and moves to the defined target position with a Predefined VAI command.

4.3.69 VAI 16 Bit Go To Pos (090xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-----------------------------|--------|--------|
| Header | 0 | 090xh: VAI 16 Bit Go To Pos | UInt16 | - |
| 1. Par | 2 | Target Position | Slnt16 | Scaled |
| 2. Par | 4 | Maximal Velocity | UInt16 | Scaled |
| 3. Par | 6 | Acceleration | UInt16 | Scaled |
| 4. Par | 8 | Deceleration | UInt16 | Scaled |

This command is similar to the 010xh command, but the parameters are only 16 bit and scaled. The scaling is according to the parameter settings under \Motion Control SW\ Motion Interface\ 16 Bit Interface Scaling\.

4.3.70 VAI 16 Bit Increment Dem Pos (091xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 091xh: VAI 16 Bit Go To Relative Position | UInt16 | - |
| 1. Par | 2 | Position Increment | Slnt16 | Scaled |
| 2. Par | 4 | Maximal Velocity | UInt16 | Scaled |
| 3. Par | 6 | Acceleration | UInt16 | Scaled |
| 4. Par | 8 | Deceleration | UInt16 | Scaled |

4.3.71 VAI 16 Bit Increment Target Pos (092xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 092xh: VAI 16 Bit Increment Target Pos | UInt16 | - |
| 1. Par | 2 | Position Increment | Slnt16 | Scaled |
| 2. Par | 4 | Maximal Velocity | UInt16 | Scaled |
| 3. Par | 6 | Acceleration | UInt16 | Scaled |
| 4. Par | 8 | Deceleration | UInt16 | Scaled |

4.3.72 VAI 16 Bit Go To Pos From Act Pos And Act Vel (093xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 093xh: VAI 16 Bit Go To Pos From Act Pos And Act Vel | UInt16 | - |
| 1. Par | 2 | Target Position | Slnt16 | Scaled |
| 2. Par | 4 | Maximal Velocity | UInt16 | Scaled |
| 3. Par | 6 | Acceleration | UInt16 | Scaled |
| 4. Par | 8 | Deceleration | UInt16 | Scaled |

This command starts the new VAI setpoint generation from the actual position, can be used after a press command.

4.3.73 VAI 16 Bit Go To Pos From Act Pos Starting With Dem Vel = 0 (094xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 094xh: VAI 16 Bit Go To Pos From Act Pos Starting With Dem Vel = 0 | UInt16 | - |
| 1. Par | 2 | Target Position | SInt16 | Scaled |
| 2. Par | 4 | Maximal Velocity | UInt16 | Scaled |
| 3. Par | 6 | Acceleration | UInt16 | Scaled |
| 4. Par | 8 | Deceleration | UInt16 | Scaled |

This command starts a the new VAI-Setpoint generation from the actual position and the start velocity is forced to zero. Can be used after a press command.

4.3.74 VAI 16 Bit Increment Act Pos (095xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-------------------------------------|--------|--------|
| Header | 0 | 095xh: VAI 16 Bit Increment Act Pos | UInt16 | - |
| 1. Par | 2 | Position Increment | SInt16 | Scaled |
| 2. Par | 4 | Maximal Velocity | UInt16 | Scaled |
| 3. Par | 6 | Acceleration | UInt16 | Scaled |
| 4. Par | 8 | Deceleration | UInt16 | Scaled |

4.3.75 VAI 16 Bit Increment Act Pos Starting With Dem Vel = 0 (096xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-------------------------------------|--------|--------|
| Header | 0 | 096xh: VAI 16 Bit Increment Act Pos | UInt16 | - |
| 1. Par | 2 | Position Increment | SInt16 | Scaled |
| 2. Par | 4 | Maximal Velocity | UInt16 | Scaled |
| 3. Par | 6 | Acceleration | UInt16 | Scaled |
| 4. Par | 8 | Deceleration | UInt16 | Scaled |

4.3.76 VAI 16 Bit Stop (097xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|------------------------|--------|--------|
| Header | 0 | 097xh: VAI 16 Bit Stop | UInt16 | - |
| 1. Par | 2 | Deceleration | UInt16 | Scaled |

4.3.77 VAI 16 Bit Go To Pos After Actual Command (098xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 098xh: VAI 16 Bit Go To Pos After Actual Command | UInt16 | - |
| 1. Par | 2 | Target Position | Slnt16 | Scaled |
| 2. Par | 4 | Maximal Velocity | UInt16 | Scaled |
| 3. Par | 6 | Acceleration | UInt16 | Scaled |
| 4. Par | 8 | Deceleration | UInt16 | Scaled |

This command waits until the actual motion setpoint generation has finished, then starts the new defined VAI motion.

4.3.78 VAI 16 Bit Go To Pos On Rising Trigger Event (09Axh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 9Axh: VAI 16 Bit Go To Pos On Rising Trigger Event | UInt16 | - |
| 1. Par | 2 | Target Position | Slnt16 | Scaled |
| 2. Par | 4 | Maximal Velocity | UInt16 | Scaled |
| 3. Par | 6 | Acceleration | UInt16 | Scaled |
| 4. Par | 8 | Deceleration | UInt16 | Scaled |

4.3.79 VAI 16 Bit Increment Target Pos On Rising Trigger Event (09Bxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 9Bxh: VAI 16 Bit Increment Target Pos On Rising Trigger Event | UInt16 | - |
| 1. Par | 2 | Position Increment | Slnt16 | Scaled |
| 2. Par | 4 | Maximal Velocity | UInt16 | Scaled |
| 3. Par | 6 | Acceleration | UInt16 | Scaled |
| 4. Par | 8 | Deceleration | UInt16 | Scaled |

4.3.80 VAI 16 Bit Go To Pos On Falling Trigger Event (09Cxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 09Cxh: VAI 16 Bit Go To Pos On Falling Trigger Event | UInt16 | - |
| 1. Par | 2 | Target Position | Slnt16 | Scaled |
| 2. Par | 4 | Maximal Velocity | UInt16 | Scaled |
| 3. Par | 6 | Acceleration | UInt16 | Scaled |
| 4. Par | 8 | Deceleration | UInt16 | Scaled |

4.3.81 VAI 16 Bit Increment Target Pos On Falling Trigger Event (09Dxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|---------|--------|
| Header | 0 | 09Dxh: VAI 16 Bit Increment Target Pos On Falling Trigger Event | UInt16 | - |
| 1. Par | 2 | Position Increment | SIInt16 | Scaled |
| 2. Par | 4 | Maximal Velocity | UInt16 | Scaled |
| 3. Par | 6 | Acceleration | UInt16 | Scaled |
| 4. Par | 8 | Deceleration | UInt16 | Scaled |

4.3.82 VAI 16 Bit Change Motion Parameters On Positive Position Transition (09Exh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|---------|--------|
| Header | 0 | 09Exh: VAI 16 Bit Change Motion Parameters On Positive Position Transition | UInt16 | - |
| 1. Par | 2 | Transition Event Position | SIInt16 | Scaled |
| 2. Par | 4 | Max Velocity After Event | UInt16 | Scaled |
| 3. Par | 6 | Acceleration After Event | UInt16 | Scaled |
| 4. Par | 8 | Deceleration After Event | UInt16 | Scaled |

As soon as the demand position crosses the event change position in positive direction the parameters for velocity, acceleration and deceleration will be changed to the values defined in the command.

4.3.83 VAI 16 Bit Change Motion Parameters On Negative Position Transition (09Fhx)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|---------|--------|
| Header | 0 | 09Fhx: VAI Change Motion Parameters on Negative Position Transition | UInt16 | - |
| 1. Par | 2 | Transition Event Position | SIInt16 | Scaled |
| 2. Par | 4 | Max Velocity After Event | UInt16 | Scaled |
| 3. Par | 6 | Acceleration After Event | UInt16 | Scaled |
| 4. Par | 8 | Deceleration After Event | UInt16 | Scaled |

As soon as the demand position crosses the event change position in negative direction the parameters for velocity, acceleration and deceleration will be changed to the values defined in the command.

4.3.84 Predef VAI 16 Bit Go To Pos (0A0xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|------------------------------------|--------|--------|
| Header | 0 | 0A0xh: Predef VAI 16 Bit Go To Pos | UInt16 | - |
| 1. Par | 2 | Target Position | SInt16 | Scaled |

4.3.85 Predef VAI 16 Bit Increment Dem Pos (0A1xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 0A1xh: Predef VAI 16 Bit Increment Dem Pos | UInt16 | - |
| 1. Par | 2 | Position Increment | SInt16 | Scaled |

4.3.86 Predef VAI 16 Bit Increment Target Pos (0A2xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 0A2xh: Predef VAI 16 Bit Increment Target Pos | UInt16 | - |
| 1. Par | 2 | Position Increment | SInt16 | Scaled |

4.3.87 Predef VAI 16 Bit Go To Pos From Act Pos And Act Vel (0A3xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 0A3xh: VAI 16 Bit Go To Pos From Act Pos And Act Vel | UInt16 | - |
| 1. Par | 2 | Target Position | SInt16 | Scaled |

This command starts a new VAI setpoint generation from the actual position, can be used after a press command.

4.3.88 Predef VAI 16 Bit Go To Pos From Act Pos Starting With Dem Vel = 0 (0A4xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 0A4xh: Predef VAI 16 Bit Go To Pos From Act Pos Starting With Dem Vel = 0 | UInt16 | - |
| 1. Par | 2 | Target Position | SInt16 | Scaled |

This command starts a new VAI setpoint generation from the actual position and the start velocity is forced to zero. Can be used after a press command.

4.3.89 Predef VAI 16 Bit Stop (0A7xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|------|
| Header | 0 | 0A7xh: Predef VAI Stop With Quick Stop Deceleration | UInt16 | - |

4.3.90 Predef VAI 16 Bit Go To Pos After Actual Command (0A8xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 0A8xh: Predef VAI 16 Bit Go To Pos After Actual Command | UInt16 | - |
| 1. Par | 2 | Target Position | SInt16 | Scaled |

This command waits until the actual motion setpoint generation has finished, then starts the new defined VAI motion.

4.3.91 Predef VAI 16 Bit Go To Pos On Rising Trigger Event (0AAxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 0AAxh: Predef VAI 16 Bit Go To Pos On Rising Trigger Event | UInt16 | - |
| 1. Par | 2 | Target Position | SInt16 | Scaled |

4.3.92 Predef VAI 16 Bit Increment Target Pos On Rising Trigger Event (0ABxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 0ABxh: Predef VAI 16 Bit Increment Target Pos On Rising Trigger Event | UInt16 | - |
| 1. Par | 2 | Position Increment | SInt16 | Scaled |

4.3.93 Predef VAI 16 Bit Go To Pos On Falling Trigger Event (0ACxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 0ACxh: VAI 16 Bit Go To Pos On Falling Trigger Event | UInt16 | - |
| 1. Par | 2 | Target Position | SInt32 | 0.1 um |

4.3.94 Predef VAI 16 Bit Increment Target Pos On Falling Trigger Event (0ADxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 0ADxh: Predef VAI 16 Bit Increment Target Pos On Falling Trigger Event | UInt16 | - |
| 1. Par | 2 | Target Position | SInt16 | Scaled |

4.3.95 VAI Predef Acc Go To Pos (0B0xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---------------------------------|--------|-------------|
| Header | 0 | 0B0xh: VAI Predef Acc Go To Pos | UInt16 | - |
| 1. Par | 2 | Target Position | UInt32 | 0.1 μ m |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |

4.3.96 VAI Predef Acc Increment Dem Pos (0B1xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|-------------|
| Header | 0 | 0B1xh:VAI Predef Acc Increment Dem Pos | UInt16 | - |
| 1. Par | 2 | Position Increment | UInt32 | 0.1 μ m |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |

4.3.97 VAI Predef Acc Increment Target Pos (0B2xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|-------------|
| Header | 0 | 0B2xh: VAI Predef Acc Increment Target Pos | UInt16 | - |
| 1. Par | 2 | Position Increment | UInt32 | 0.1 μ m |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |

4.3.98 VAI Predef Acc Go To Pos From Act Pos And Act Vel (0B3xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|-------------|
| Header | 0 | 0B3xh: VAI Predef Acc Go To Pos From Act Pos And Act Vel | UInt16 | - |
| 1. Par | 2 | Target Position | UInt32 | 0.1 μ m |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |

This command starts a new VAI setpoint generation from the actual position and with actual velocity. Can be used after a press command.

4.3.99 VAI Predef Acc Go To Pos From Act Pos Starting With Dem Vel = 0 (0B4xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|-------------|
| Header | 0 | 0B4xh: VAI Predef Acc Go To Pos From Act Pos Starting With Dem Vel =0 | UInt16 | - |
| 1. Par | 2 | Target Position | UInt32 | 0.1 μ m |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |

This command starts a new VAI setpoint generation from the actual position and the start velocity is forced to zero. Can be used after a press command.

4.3.100 VAI Predef Acc Go To Pos After Actual Command (0B8xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|-------------|
| Header | 0 | 0B8xh: VAI Predef Acc Go To Pos After Actual Command | UInt16 | - |
| 1. Par | 2 | Target Position | Slnt32 | 0.1 μ m |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |

This command waits until the actual motion setpoint generation has finished, then starts the new defined VAI motion.

4.3.101 VAI Predef Acc Go To Pos On Rising Trigger Event (0BAxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|-------------|
| Header | 0 | 0BAxh: VAI Predef Acc Go To Pos On Rising Trigger Event | UInt16 | - |
| 1. Par | 2 | Target Position | Slnt32 | 0.1 μ m |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |

4.3.102 VAI Predef Acc Increment Target Pos On Rising Trigger Event (0BBxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|-------------|
| Header | 0 | 0BBxh: VAI Predef Acc Increment Target Pos On Rising Trigger Event | UInt16 | - |
| 1. Par | 2 | Position Increment | Slnt32 | 0.1 μ m |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |

4.3.103 VAI Predef Acc Go To Pos On Falling Trigger Event (0BCxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|-------------|
| Header | 0 | 0BCxh: VAI Predef Acc Go To Pos On Falling Trigger Event | UInt16 | - |
| 1. Par | 2 | Target Position | Slnt32 | 0.1 μ m |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |

4.3.104 VAI Predef Acc Increment Target Pos On Falling Trigger Event (0BDxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|-------------|
| Header | 0 | 0BDxh: VAI Predef Acc Increment Target Pos On Falling Trigger Event | UInt16 | - |
| 1. Par | 2 | Position Increment | Slnt32 | 0.1 μ m |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |

4.3.105 VAI Dec=Acc Go To Pos (0C0xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|------------------------------|--------|-----------------------|
| Header | 0 | 0C0xh: VAI Dec=Acc Go To Pos | UInt16 | - |
| 1. Par | 2 | Target Position | SInt32 | 0.1 μ m |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration = Deceleration | UInt32 | 1E-5 m/s ² |

4.3.106 VAI Dec=Acc Increment Dem Pos (0C1xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-------------------------------------|--------|-----------------------|
| Header | 0 | 0C1xh:VAI Dec=Acc Increment Dem Pos | UInt16 | - |
| 1. Par | 2 | Position Increment | SInt32 | 0.1 μ m |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration = Deceleration | UInt32 | 1E-5 m/s ² |

4.3.107 VAI Dec=Acc Increment Target Pos (0C2xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|-----------------------|
| Header | 0 | 0C2xh: VAI Dec=Acc Increment Target Pos | UInt16 | - |
| 1. Par | 2 | Position Increment | SInt32 | 0.1 μ m |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration = Deceleration | UInt32 | 1E-5 m/s ² |

4.3.108 VAI Dec=Acc Go To Pos From Act Pos And Act Vel (0C3xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|-----------------------|
| Header | 0 | 0C3xh: VAI Dec=Acc Go To Pos From Act Pos And Act Vel | UInt16 | - |
| 1. Par | 2 | Target Position | SInt32 | 0.1 μ m |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration = Deceleration | UInt32 | 1E-5 m/s ² |

This command starts a new VAI setpoint generation from the actual position and actual velocity. Can be used after a press command.

4.3.109 VAI Dec=Acc Go To Pos From Act Pos Starting With Dem Vel = 0 (0C4xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|-----------------------|
| Header | 0 | 0C4xh: VAI Dec=Acc Go To Pos From Act Pos Starting With Dem Vel =0 | UInt16 | - |
| 1. Par | 2 | Target Position | SInt32 | 0.1 μ m |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration = Deceleration | UInt32 | 1E-5 m/s ² |

This command starts a new VAI setpoint generation from the actual position and the start velocity is forced to zero. Can be used after a press command.

4.3.110 VAI Dec=Acc Go To Pos With Max Curr (0C5xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|---------|-----------------------|
| Header | 0 | 0C5xh: VAI Dec=Acc Go To Pos With Max Curr | UInt16 | - |
| 1. Par | 2 | Target Position | SIInt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration = Deceleration | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Demand Curr Limit | UInt16 | 1mA |

This command can be used as press command with limited current (force). This command sets the maximal current of the actual position controller set (UPID 13A6h or 13BAh) to the value defined with the 4th parameter. To reset the current to the normal value, use the command 0C6xh or 0C7xh.

4.3.111 VAI Dec=Acc Go To Pos From Act Pos And Vel With Max Curr (0C6xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|---------|-----------------------|
| Header | 0 | 0C6xh: VAI Dec=Acc Go To Pos From Act Pos And Vel With Max Curr | UInt16 | - |
| 1. Par | 2 | Target Position | SIInt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration = Deceleration | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Demand Curr Limit | UInt16 | 1mA |

This command can be used after the command 0C5xh to set the current to the normal value. At the beginning of the motion the position controller integrator is cleared. This command sets the maximal current of the actual position controller set (UPID 13A6h or 13BAh) to the value defined with the 4th parameter.

4.3.112 VAI Dec=Acc Go To Pos From Act Pos And Vel = 0 With Max Curr (0C7xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|---------|-----------------------|
| Header | 0 | 0C7xh: VAI Dec=Acc Go To Pos From Act Pos And Vel = 0 With Max Curr | UInt16 | - |
| 1. Par | 2 | Target Position | SIInt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration = Deceleration | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Demand Curr Limit | UInt16 | 1mA |

This command can be used after the command 0C5xh to set the current to the normal value. At the beginning of the motion the position controller integrator is cleared. This command sets the maximal current of the actual position controller set (UPID 13A6h or 13BAh) to the value defined with the 4th parameter.

4.3.113 VAI Dec=Acc Go To Pos After Actual Command (0C8xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|-----------------------|
| Header | 0 | 0C8xh: VAI Dec=Acc Go To Pos After Actual Command | UInt16 | - |
| 1. Par | 2 | Target Position | Slnt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration = Deceleration | UInt32 | 1E-5 m/s ² |

This command waits until the actual motion setpoint generation has finished, then starts the new defined VAI motion.

4.3.114 VAI Dec=Acc Go To Pos On Rising Trigger Event (0CAxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|-----------------------|
| Header | 0 | 0CAxh: VAI Dec=Acc Go To Pos On Rising Trigger Event | UInt16 | - |
| 1. Par | 2 | Target Position | Slnt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration = Deceleration | UInt32 | 1E-5 m/s ² |

4.3.115 VAI Dec=Acc Increment Target Pos On Rising Trigger Event (0CBxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|-----------------------|
| Header | 0 | 0CBxh: VAI Dec=Acc Increment Target Pos On Rising Trigger Event | UInt16 | - |
| 1. Par | 2 | Position Increment | Slnt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration = Deceleration | UInt32 | 1E-5 m/s ² |

4.3.116 VAI Dec=Acc Go To Pos On Falling Trigger Event (0CCxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|-----------------------|
| Header | 0 | 0CCxh: VAI Dec=Acc Go To Pos On Falling Trigger Event | UInt16 | - |
| 1. Par | 2 | Target Position | Slnt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration = Deceleration | UInt32 | 1E-5 m/s ² |

4.3.117 VAI Dec=Acc Increment Target Pos On Falling Trigger Event (0CDxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|-----------------------|
| Header | 0 | 0CDxh: VAI Dec=Acc Increment Target Pos On Falling Trigger Event | UInt16 | - |
| 1. Par | 2 | Position Increment | Slnt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration = Deceleration | UInt32 | 1E-5 m/s ² |

4.3.118 VAI Increment Captured Pos (0D0xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-----------------------------------|--------|-----------------------|
| Header | 0 | 0D0xh: VAI Increment Captured Pos | UInt16 | - |
| 1. Par | 2 | Captured Position Increment | SInt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Deceleration | UInt32 | 1E-5 m/s ² |

Go to the target position (Captured Pos + Captured Increment Position).

4.3.119 VAI Go To Cmd Tab Var1 Pos (0D4xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-----------------------------------|--------|-----------------------|
| Header | 0 | 0D4xh: VAI Go To Cmd Tab Var1 Pos | UInt16 | - |
| 1. Par | 2 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 2. Par | 6 | Acceleration | UInt32 | 1E-5 m/s ² |
| 3. Par | 10 | Deceleration | UInt32 | 1E-5 m/s ² |

Go to the target position defined with the command table variable 1 (UPID 0x1E72h).

4.3.120 VAI Go To Cmd Tab Var2 Pos (0D5xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-----------------------------------|--------|-----------------------|
| Header | 0 | 0D5xh: VAI Go To Cmd Tab Var2 Pos | UInt16 | - |
| 1. Par | 2 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 2. Par | 6 | Acceleration | UInt32 | 1E-5 m/s ² |
| 3. Par | 10 | Deceleration | UInt32 | 1E-5 m/s ² |

Go to the target position defined with the command table variable 2 (UPID 0x1E73h).

4.3.121 VAI Go To Cmd Tab Var1 Pos From Act Pos And Act Vel (0D6xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|-----------------------|
| Header | 0 | 0D6xh: VAI Go To Cmd Tab Var1 Pos From Act Pos And Act Vel | UInt16 | - |
| 1. Par | 2 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 2. Par | 6 | Acceleration | UInt32 | 1E-5 m/s ² |
| 3. Par | 10 | Deceleration | UInt32 | 1E-5 m/s ² |

Go to the target position defined with the command table variable 1 (UPID 0x1E72h) starting from actual position and with actual velocity.

4.3.122 VAI Go To Cmd Tab Var2 Pos From Act Pos And Act Vel (0D7xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|-----------------------|
| Header | 0 | 0D7xh: VAI Go To Cmd Tab Var2 Pos From Act Pos And Act Vel | UInt16 | - |
| 1. Par | 2 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 2. Par | 6 | Acceleration | UInt32 | 1E-5 m/s ² |
| 3. Par | 10 | Deceleration | UInt32 | 1E-5 m/s ² |

Go to the target position defined with the command table Variable 2 (UPID 0x1E73h) starting from actual position and with actual velocity.

4.3.123 Encoder Cam Enable (100xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---------------------------|--------|------|
| Header | 0 | 100xh: Encoder CAM Enable | UInt16 | - |

4.3.124 Encoder Cam Disable (101xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|----------------------------|--------|------|
| Header | 0 | 101xh: Encoder CAM Disable | UInt16 | - |

4.3.125 Encoder Cam Go To Sync Pos (102xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-----------------------------------|--------|------|
| Header | 0 | 102xh: Encoder CAM Go To Sync Pos | UInt16 | - |

4.3.126 Encoder Cam Set Value (104xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|------------------------------|--------|---------|
| Header | 0 | 104xh: Encoder CAM Set Value | UInt16 | - |
| 1. Par | 2 | Counter Value | SInt32 | 1 Incr. |

4.3.127 Encoder Cam y Define Curve With Default Parameters (1y0xh)

At the moment two cams can be defined. In the following y=1 stands for cam 1 and y=2 stands for cam 2.

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|---------|
| Header | 0 | 1y0xh: Encoder Cam y Define Curve With Default Parameters (y=1..2) | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Curve Start Count | SInt32 | 1 Incr. |

4.3.128 Encoder Cam y Define Curve From Act Pos (1y1xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|---------|
| Header | 0 | 1y1xh: Encoder Cam y Define Curve From Act Pos (y=1..2) | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Curve Start Count | SInt32 | 1 Incr. |

If the encoder value is in the range of cam y, the motor has to be at the start position of the cam y during the command setup, to set the position start point of cam y correctly.

4.3.129 Encoder Cam y Define Curve To Pos (1y2xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 1y2xh: Encoder Cam y Define Curve To Pos (y=1..2) | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Curve Start Count | SInt32 | 1 Incr |
| 3. Par | 8 | Target Position | SInt32 | 0.1 um |

If the encoder value is in the range of cam y, the motor has to be at the start position of the cam y during command setup, to set the position start point correctly of cam y.

4.3.130 Encoder Cam y Define Curve To Pos In Counts (1y4xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 1y4xh: Encoder Cam y Define Curve To Pos (y=1..2) | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Curve Start Count | SInt32 | 1 Incr |
| 3. Par | 8 | Target Position | SInt32 | 0.1 um |
| 4. Par | 12 | CAM Length In Counts | SInt32 | 1 Incr |

If the encoder value is in the range of cam y, the motor has to be at the start position of the cam y during command setup, to set the position start point correctly of cam y.

4.3.131 Encoder Cam y Define Curve With Amplitude Scale In Counts (1y5xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|---------|
| Header | 0 | 1y5xh: Encoder CAM y Define Curve To Pos (y=1..2) | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Curve Start Count | SInt32 | 1 Incr |
| 3. Par | 8 | Amplitude Scale | SInt16 | 0.1% |
| 4. Par | 10 | CAM Length In Counts | SInt32 | 1 Incr. |

The values for the amplitude scale and cam length are updated immediately, for this reason this command should only used outside the cam y (old and new) definition. For changing the amplitude scale and/or length during cam y is active, use the command 1y8xh instead.

4.3.132 Encoder Cam y Enable (1y6xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--------------------------------------|--------|------|
| Header | 0 | 1y6xh Encoder Cam y Enable; (y=1..2) | UInt16 | - |

4.3.133 Encoder Cam y Disable (1y7xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---------------------------------------|--------|------|
| Header | 0 | 1y7xh Encoder Cam y Disable; (y=1..2) | UInt16 | - |

4.3.134 Encoder Cam y Change Amplitude Scale and Length (1y8xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|---------|
| Header | 0 | 1y8xh: Encoder Cam y Define Curve To Pos (y=1..2) | UInt16 | - |
| 1. Par | 2 | Amplitude Scale | Sint16 | 0.1% |
| 2. Par | 4 | CAM Length In Counts | Sint32 | 1 Incr. |

The new values for the amplitude scale and cam length are updated at next cam y start event.

4.3.135 Encoder Winding Start With Default Parameters (300xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|------|
| Header | 0 | 300xh: Encoder Winding Start With Default Parameters | UInt16 | - |

4.3.136 Encoder Winding Start With Default Parameters At Revolutions (301xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|-------|
| Header | 0 | 301xh: Encoder Winding Start With Default Parameters At Revolutions | UInt16 | - |
| 1. Par | 2 | Revolution Counts To Start | SInt32 | 1 Rev |

4.3.137 Start Command Table Command (200xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|------------------------------------|--------|--------|
| Header | 0 | 200xh: Start Command Table Command | UInt16 | - |
| 1. Par | 2 | Command Table ID | UInt16 | 1..255 |

4.3.138 Start Command Table Command On Rising Trigger Event (201xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 201xh: Start Command Table Command On Rising Trigger Event | UInt16 | - |
| 1. Par | 2 | Command Table ID | UInt16 | 1..255 |

4.3.139 Start Command Table Command On Falling Trigger Event (202xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 202xh: Start Command Table Command On Falling Trigger Event | UInt16 | - |
| 1. Par | 2 | Command Table ID | UInt16 | 1..255 |

4.3.140 Modify Command Table 16 bit Parameter in RAM (208xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 208xh: Modify Command Table 16 bit Parameter in RAM | UInt16 | - |
| 1. Par | 2 | Command Table ID | UInt16 | 1..255 |
| 2. Par | 4 | Parameter Offset | UInt16 | 0..3Eh |
| 3. Par | 6 | Parameter Value | Sint16 | - |

This command modifies a single 16 bit parameter of the specified command table entry with the specified offset to specified value. Within the command table entry the link ID has offset = 2 the motion command header has offset = 4 and the first motion command parameter has offset = 6.

4.3.141 Modify Command Table 32 bit Parameter in RAM (209xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 209xh: Modify Command Table 32 bit Parameter in RAM | UInt16 | - |
| 1. Par | 2 | Command Table ID | UInt16 | 1..255 |
| 2. Par | 4 | Parameter Offset | UInt16 | 0..3Eh |
| 3. Par | 6 | Parameter Value | Sint16 | - |

This command modifies a single 32 bit parameter of the specified command table entry with the specified offset to specified value. Within the command table entry the link ID has offset = 2 the motion command header has offset = 4 and the first motion command parameter has offset = 6.

4.3.142 Wait Time (210xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|------------------|--------|-------|
| Header | 0 | 210xh: Wait Time | UInt16 | - |
| 1. Par | 2 | Time | UInt32 | 100us |

Can be used in a linked command table sequence.

4.3.143 Wait Until Motion Finished (211xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-----------------------------------|--------|------|
| Header | 0 | 211xh: Wait Until Motion Finished | UInt16 | - |

Can be used in a linked command table sequence.

4.3.144 Wait Until In Target Position (212xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-----------------------------------|--------|------|
| Header | 0 | 212xh: Wait Until Motion Finished | UInt16 | - |

Can be used in a linked command table sequence.

4.3.145 Wait Until Rising Trigger Event (213xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|----------------------------------|--------|------|
| Header | 0 | 213xh: Wait Until Rising Trigger | UInt16 | - |

Can be used in a linked command table sequence.

4.3.146 Wait Until Falling Trigger Event (214xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-----------------------------------|--------|------|
| Header | 0 | 214xh: Wait Until Falling Trigger | UInt16 | - |

Can be used in a linked command table sequence.

4.3.147 Wait Until Demand Position Greater Than (220xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|---------|--------|
| Header | 0 | 220xh: Wait Until Demand Position Greater Than | UInt16 | - |
| 1. Par | 2 | Dem Pos Trig Level | SIInt32 | 0.1 um |

Can be used in a linked command table sequence.

4.3.148 Wait Until Demand Position Less Than (221xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|---------|--------|
| Header | 0 | 221xh: Wait Until Demand Position Less Than | UInt16 | - |
| 1. Par | 2 | Dem Pos Trig Level | SIInt32 | 0.1 um |

Can be used in a linked command table sequence.

4.3.149 Wait Until Actual Position Greater Than (222xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|---------|--------|
| Header | 0 | 222xh: Wait Until Actual Position Greater Than | UInt16 | - |
| 1. Par | 2 | Act Pos Trig Level | SIInt32 | 0.1 um |

Can be used in a linked command table sequence.

4.3.150 Wait Until Actual Position Less Than (223xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 223xh: Wait Until Actual Position Less Than | UInt16 | - |
| 1. Par | 2 | Act Pos Trig Level | Slnt32 | 0.1 um |

Can be used in a linked command table sequence.

4.3.151 Wait Until Difference Position Greater Than (224xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 224xh: Wait Until Difference Position Greater Than | UInt16 | - |
| 1. Par | 2 | Diff Pos Trig Level | Slnt32 | 0.1 um |

Can be used in a linked command table sequence.

4.3.152 Wait Until Difference Position Less Than (225xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 225xh: Wait Until Difference Position Less Than | UInt16 | - |
| 1. Par | 2 | Diff Pos Trig Level | Slnt32 | 0.1 um |

Can be used in a linked command table sequence.

4.3.153 Wait Until Difference Position Unsigned Greater Than (226xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 226xh: Wait Until Difference Position Unsigned Greater Than | UInt16 | - |
| 1. Par | 2 | Diff Pos Trig Level | Slnt32 | 0.1 um |

Can be used in a linked command table sequence.

4.3.154 Wait Until Difference Position Unsigned Less Than (227xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 227xh: Wait Until Difference Position Unsigned Less Than | UInt16 | - |
| 1. Par | 2 | Diff Pos Trig Level | Slnt32 | 0.1 um |

Can be used in a linked command table sequence.

4.3.155 Wait Until Demand Velocity Greater Than (228xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|----------|
| Header | 0 | 228xh: Wait Until Demand Velocity Greater Than | UInt16 | - |
| 1. Par | 2 | Dem Vel Trig Level | Slnt32 | 1E-6 m/s |

Can be used in a linked command table sequence.

4.3.156 Wait Until Demand Velocity Less Than (229xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|----------|
| Header | 0 | 229xh: Wait Until Demand Velocity Less Than | UInt16 | - |
| 1. Par | 2 | Dem Vel Trig Level | SInt32 | 1E-6 m/s |

Can be used in a linked command table sequence.

4.3.157 Wait Until Actual Velocity Greater Than (22Axh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|----------|
| Header | 0 | 22Axh: Wait Until Actual Velocity Greater Than | UInt16 | - |
| 1. Par | 2 | Act Vel Trig Level | SInt32 | 1E-6 m/s |

Can be used in linked command table sequence.

4.3.158 Wait Until Actual Velocity Less Than (22Bxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|----------|
| Header | 0 | 22Bxh: Wait Until Actual Velocity Less Than | UInt16 | - |
| 1. Par | 2 | Act Vel Trig Level | SInt32 | 1E-6 m/s |

Can be used in a linked command table sequence.

4.3.159 Wait Until Current Greater Than (22Exh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|------|
| Header | 0 | 22Exh: Wait Until Current Greater Than | UInt16 | - |
| 1. Par | 2 | Dem Curr Vel Trig Level | Sint16 | 1mA |

Can be used in linked command table sequence.

4.3.160 Wait Until Current Less Than (22Fxx)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-------------------------------------|--------|------|
| Header | 0 | 22Fxx: Wait Until Current Less Than | UInt16 | - |
| 1. Par | 2 | Dem Curr Trig Level | Sint16 | 1mA |

Can be used in a linked command table sequence.

4.3.161 Set Cmd Table Var 1 To (240xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-------------------------------|--------|------|
| Header | 0 | 240xh: Set Cmd Table Var 1 To | UInt16 | - |
| 1. Par | 2 | Set value | Sint32 | - |

4.3.162 Add To Cmd Table Var 1 (241xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-------------------------------|--------|------|
| Header | 0 | 241xh: Add To Cmd Table Var 1 | UInt16 | - |
| 1. Par | 2 | Add value | Sint32 | - |

4.3.163 Set Cmd Table Var 2 To (242xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-------------------------------|--------|------|
| Header | 0 | 242xh: Set Cmd Table Var 2 To | UInt16 | - |
| 1. Par | 2 | Set value | Sint32 | - |

4.3.164 Add To Cmd Table Var 2 (243xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-------------------------------|--------|------|
| Header | 0 | 243xh: Add To Cmd Table Var 2 | UInt16 | - |
| 1. Par | 2 | Add value | Sint32 | - |

4.3.165 Write Cmd Table Var 1 To UPID RAM value (248xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|------|
| Header | 0 | 248xh: Write Cmd Table Var 1 To UPID RAM value | UInt16 | - |
| 1. Par | 2 | UPID (Unique Parameter ID) | UInt16 | - |

4.3.166 Write Cmd Table Var 2 To UPID RAM value (249xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|------|
| Header | 0 | 249xh: Write Cmd Table Var 2 To UPID RAM value | UInt16 | - |
| 1. Par | 2 | UPID (Unique Parameter ID) | UInt16 | - |

4.3.167 Write UPID RAM Value To Cmd Table Var 1 (24Cxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|------|
| Header | 0 | 24Cxh: Write UPID RAM value To Cmd Table Var 1 | UInt16 | - |
| 1. Par | 2 | UPID (Unique Parameter ID) | UInt16 | - |

4.3.168 Write UPID RAM Value To Cmd Table Var 2 (24Dxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|------|
| Header | 0 | 24Dxh: Write UPID RAM value To Cmd Table Var 2 | UInt16 | - |
| 1. Par | 2 | UPID (Unique Parameter ID) | UInt16 | - |

4.3.169 IF Cmd Table Var 1 Less Than (250xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-------------------------------------|--------|--------|
| Header | 0 | 250xh: IF Cmd Table Var 1 Less Than | UInt16 | - |
| 1. Par | 2 | Condition Value | Sint32 | - |
| 2. Par | 6 | Command Table ID IF TRUE | UInt16 | 1..255 |
| 3. Par | 8 | Command Table ID IF FALSE | UInt16 | 1..255 |

4.3.170 IF Cmd Table Var 1 Greater Than (251xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 251xh: IF Cmd Table Var 1 Greater Than | UInt16 | - |
| 1. Par | 2 | Condition Value | Sint32 | - |
| 2. Par | 6 | Command Table ID IF TRUE | UInt16 | 1..255 |
| 3. Par | 8 | Command Table ID IF FALSE | UInt16 | 1..255 |

4.3.171 IF Cmd Table Var 1 Less Than (252xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-------------------------------------|--------|--------|
| Header | 0 | 252xh: IF Cmd Table Var 1 Less Than | UInt16 | - |
| 1. Par | 2 | Condition Value | Sint32 | - |
| 2. Par | 6 | Command Table ID IF TRUE | UInt16 | 1..255 |
| 3. Par | 8 | Command Table ID IF FALSE | UInt16 | 1..255 |

4.3.172 IF Cmd Table Var 1 Greater Than (253xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 253xh: IF Cmd Table Var 1 Greater Than | UInt16 | - |
| 1. Par | 2 | Condition Value | Sint32 | - |
| 2. Par | 6 | Command Table ID IF TRUE | UInt16 | 1..255 |
| 3. Par | 8 | Command Table ID IF FALSE | UInt16 | 1..255 |

4.3.173 IF Demand Position Less Than (258xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-------------------------------------|--------|--------|
| Header | 0 | 258xh: IF Demand Position Less Than | UInt16 | - |
| 1. Par | 2 | Condition Value | Sint32 | - |
| 2. Par | 6 | Command Table ID IF TRUE | UInt16 | 1..255 |
| 3. Par | 8 | Command Table ID IF FALSE | UInt16 | 1..255 |

4.3.174 IF Demand Position Greater Than (259xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 259xh: IF Demand Position Greater Than | UInt16 | - |
| 1. Par | 2 | Condition Value | Sint32 | - |
| 2. Par | 6 | Command Table ID IF TRUE | UInt16 | 1..255 |
| 3. Par | 8 | Command Table ID IF FALSE | UInt16 | 1..255 |

4.3.175 IF Actual Position Less Than (25Axh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-------------------------------------|--------|--------|
| Header | 0 | 25Axh: IF Actual Position Less Than | UInt16 | - |
| 1. Par | 2 | Condition Value | Sint32 | - |
| 2. Par | 6 | Command Table ID IF TRUE | UInt16 | 1..255 |
| 3. Par | 8 | Command Table ID IF FALSE | UInt16 | 1..255 |

4.3.176 IF Actual Position Greater Than (25Bxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 25Bxh: IF Actual Position Greater Than | UInt16 | - |
| 1. Par | 2 | Condition Value | Sint32 | - |
| 2. Par | 6 | Command Table ID IF TRUE | UInt16 | 1..255 |
| 3. Par | 8 | Command Table ID IF FALSE | UInt16 | 1..255 |

4.3.177 IF Difference Position Less Than (25Cxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 25Cxh: IF Difference Position Less Than | UInt16 | - |
| 1. Par | 2 | Condition Value | Sint32 | - |
| 2. Par | 6 | Command Table ID IF TRUE | UInt16 | 1..255 |
| 3. Par | 8 | Command Table ID IF FALSE | UInt16 | 1..255 |

4.3.178 IF Difference Position Greater Than (25Dxh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 25Dxh: IF Difference Position Greater Than | UInt16 | - |
| 1. Par | 2 | Condition Value | Sint32 | - |
| 2. Par | 6 | Command Table ID IF TRUE | UInt16 | 1..255 |
| 3. Par | 8 | Command Table ID IF FALSE | UInt16 | 1..255 |

4.3.179 IF Current Less Than (25Exh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|-----------------------------|--------|--------|
| Header | 0 | 25Exh: IF Current Less Than | UInt16 | - |
| 1. Par | 2 | Condition Value | Sint32 | - |
| 2. Par | 6 | Command Table ID IF TRUE | UInt16 | 1..255 |
| 3. Par | 8 | Command Table ID IF FALSE | UInt16 | 1..255 |

4.3.180 IF Current Greater Than (25Fhx)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--------------------------------|--------|--------|
| Header | 0 | 25Fhx: IF Current Greater Than | UInt16 | - |
| 1. Par | 2 | Condition Value | Sint32 | - |
| 2. Par | 6 | Command Table ID IF TRUE | UInt16 | 1..255 |
| 3. Par | 8 | Command Table ID IF FALSE | UInt16 | 1..255 |

4.3.181 IF Analog Val On X4.4 Less Than (260xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 260xh: IF Analog Val On X4.4 Less Than | UInt16 | - |
| 1. Par | 2 | Condition Value | Sint32 | - |
| 2. Par | 6 | Command Table ID IF TRUE | UInt16 | 1..255 |
| 3. Par | 8 | Command Table ID IF FALSE | UInt16 | 1..255 |

4.3.182 IF Masked X4 Input Value Equal Than (262xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 262xh: IF Masked X4 Input Value Equal Than | UInt16 | - |
| 1. Par | 2 | X4 Bit Mask | UInt16 | |
| 2. Par | 4 | Condition Value | UInt16 | - |
| 3. Par | 6 | Command Table ID IF TRUE | UInt16 | 1..255 |
| 4. Par | 8 | Command Table ID IF FALSE | UInt16 | 1..255 |

4.3.183 IF Masked X6 Input Value Equal Than (263xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 263xh: IF Masked X6 Input Value Equal Than | UInt16 | - |
| 1. Par | 2 | X6 Bit Mask | UInt16 | |
| 2. Par | 4 | Condition Value | UInt16 | - |
| 3. Par | 6 | Command Table ID IF TRUE | UInt16 | 1..255 |
| 4. Par | 8 | Command Table ID IF FALSE | UInt16 | 1..255 |

4.3.184 IF Masked Status Word Equal Than (264xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 264xh IF Masked Status Word Equal Than | UInt16 | - |
| 1. Par | 2 | Status Word Bit Mask | UInt16 | |
| 2. Par | 4 | Condition Value | UInt16 | - |
| 3. Par | 6 | Command Table ID IF TRUE | UInt16 | 1..255 |
| 4. Par | 8 | Command Table ID IF FALSE | UInt16 | 1..255 |

4.3.185 IF Masked Warn Word Equal Than (265xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--------------------------------------|--------|--------|
| Header | 0 | 265xh IF Masked Warn Word Equal Than | UInt16 | - |
| 1. Par | 2 | Warn Word Bit Mask | UInt16 | |
| 2. Par | 4 | Condition Value | UInt16 | - |
| 3. Par | 6 | Command Table ID IF TRUE | UInt16 | 1..255 |
| 4. Par | 8 | Command Table ID IF FALSE | UInt16 | 1..255 |

4.3.186 Encoder Winding Stop Adaptation Of Left/Right Position and Disturbance (304xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|------|
| Header | 0 | 304xh: Encoder Winding Stop Adaptation Of Left/Right Position And Disturbance. | UInt16 | - |

4.3.187 Encoder Winding Restart Adaptation Of Left/Right Position and Disturbance (305xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|------|
| Header | 0 | 305xh: Encoder Winding Restart Adaptation Of Left/Right Position And Disturbance | UInt16 | - |

4.3.188 Encoder Curve Winding Start With Default Parameters (310xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|--------|
| Header | 0 | 310xh: Encoder Curve Winding Start With Default Parameters | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |

4.3.189 Encoder Curve Winding Start With Default Parameters At Revolutions (311xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|--------|
| Header | 0 | 311xh: Encoder Curve Winding Start With Default Parameters At Revolutions | UInt16 | - |
| 1. Par | 2 | Curve ID | UInt16 | 1..100 |
| 2. Par | 4 | Revolution Counts To Start | SInt32 | 1 Rev |

4.3.190 VAI Go To Pos With Force Ctrl Limit (380xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|--|--------|-----------------------|
| Header | 0 | 380xh: VAI Go To Pos With Force Ctrl Limit | UInt16 | - |
| 1. Par | 2 | Target Position | UInt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Force Limit | UInt16 | 0.1 N |

Moves to the defined target position, if the measured force reaches the defined value the controller switches to the force control mode with target force = force limit.

To change back to position control mode use motion command VAI Go To Pos From Act Pos And Reset Force Control (381xh).

4.3.191 VAI Go To Pos From Act Pos And Reset Force Control (381xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|-----------------------|
| Header | 0 | 381xh: VAI Go To Pos From Act Pos And Reset Force Control | UInt16 | - |
| 1. Par | 2 | Target Position | UInt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Deceleration | UInt32 | 1E-5 m/s ² |

Reinstalls the position control mode and moves to the defined target position.

4.3.192 Force Ctrl Change Target Force (382xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---------------------------------------|--------|-------|
| Header | 0 | 382xh: Force Ctrl Change Target Force | UInt16 | - |
| 1. Par | 2 | Target Force | UInt16 | 0.1 N |

This command can be used to change the target force during the force control mode.

4.3.193 VAI Go To Pos With Force Ctrl Limit and target Force (383xh)

| Name | Byte Offset | Description | Type | Unit |
|--------|-------------|---|--------|-----------------------|
| Header | 0 | 383xh: VAI Go To Pos With Force Ctrl Limit and Target Force | UInt16 | - |
| 1. Par | 2 | Target Position | UInt32 | 0.1 μm |
| 2. Par | 6 | Maximal Velocity | UInt32 | 1E-6 m/s |
| 3. Par | 10 | Acceleration | UInt32 | 1E-5 m/s ² |
| 4. Par | 14 | Force Limit | UInt16 | 0.1 N |
| 5. Par | 16 | Target Force | UInt16 | 0.1 N |

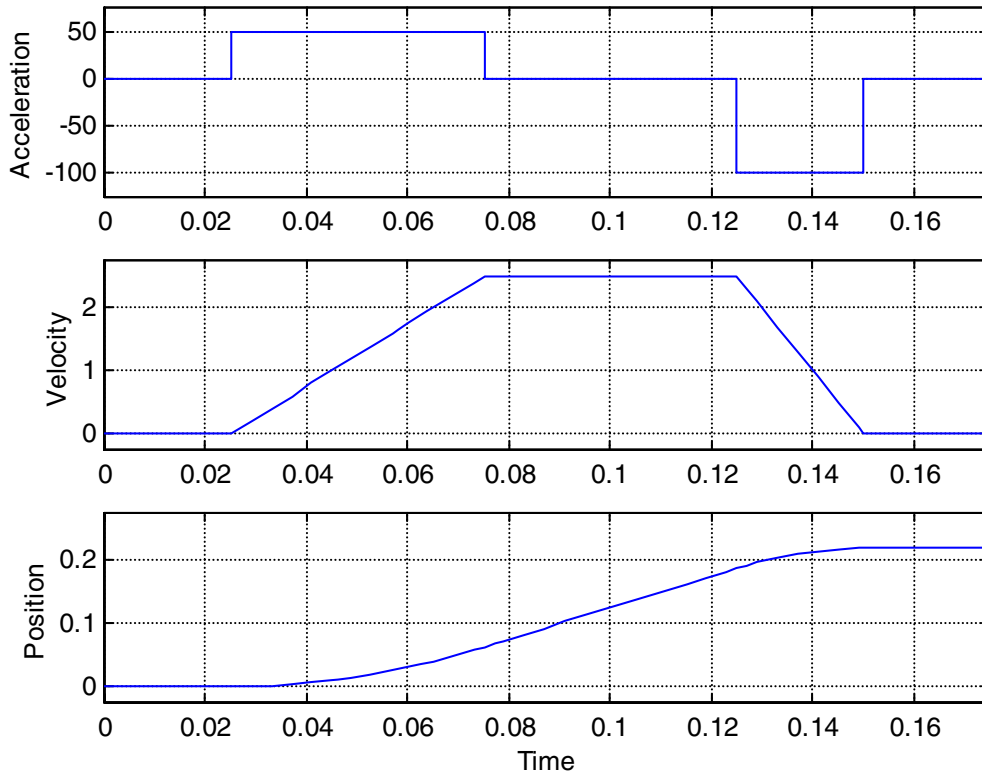
Moves to the defined target position, if the measured force reaches force limit the controller switches to the force control mode with target force = target force.

To change back to position control mode use motion command VAI Go To Pos From Act Pos And Reset Force Control (381xh).

5 Setpoint Generation

5.1 VA-Interpolator

The VA-Interpolator generates a position curve from one position to another due to the parameter values of acceleration deceleration and a maximal speed. A new target position can be set even if the old target position was not reached.



5.1.1.1 Parameters and Output

The VA-Interpolator is defined by the following parameters:

- Target Position [SInt32; 0.1um/s]
- Maximal Speed [UInt32; 1E-6 m/s]
- Acceleration [UInt32; 1E-5 m/s²]
- Deceleration [UInt32; 1E-5 m/s²]

The VA-Interpolator generates as outputs:

- Position [SInt32; 0.1um]
- Velocity [SInt32; 1E-6 m/s]
- Acceleration [SInt32; 1E-5 m/s²]

5.2 P(V)-Stream

For masters with NC (Numerical Control) capabilities, the software supports cyclic streaming modes of the position and velocity, or position only. The streaming has to be strictly cyclic in the period range 2ms..5ms. The feature is supported with all fieldbus variants like Profibus DP, CAN Open, ..

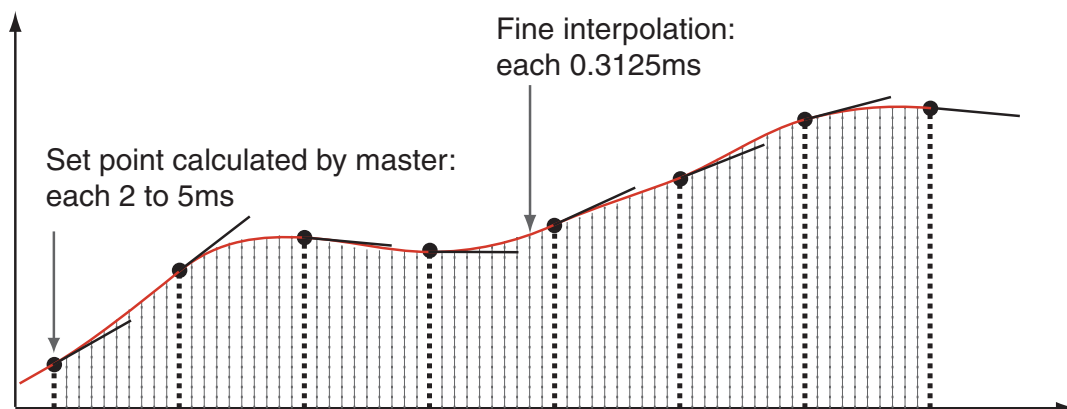
Different modes are supported:

In the first mode (Motion command: 030xh) the master only streams the position.

In the second mode (Motion command: 031xh) the master streams position and velocity, whenever possible use the PV-streaming mode, because the acceleration derivation is less sensitive to bus jitters than in the position only streaming mode.

The third mode (Motion command: 032xh) is like the first mode, but for the derivation of the velocity and the acceleration a configured period time (UPID 14E6h) is taken, instead of the slave receive time stamp. This minimizes the bad influence of the transmission jitter.

The position setpoint generation in these modes is delayed 1.5 times the streaming cycle time, e.g. with 2ms streaming period time the delay is 3ms.



5.3 Cam Motions

NOTE: Cam motions are not available in the B1100 servo controllers.

For high speed synchronization different modes of cam motions are supported. The motions are defined with cam curves, which can be defined with the curve tool of the LinMot-Talk1100 SW.

5.3.1 Triggered Cam Motions

For triggered cam motions setup the master encoder and then set cam mode (UPID1527h) to infinite length. Then use the motion commands 069xh or 06Bxh to setup the cam curves which should be started at the trigger event, or use the triggered cam curve run mode.

5.3.2 Repeated Cam Motions with the Modulo CamMode

For repeated cam motions setup the master encoder and then set cam mode (UPID1527h) to modulo cam length. The cam length can be defined independently from the master encoder length! So with a 8000 counts ABZ master encoder also 16'000 counts or 4'000 counts cam length is possible.

With the following sequence a startup or resynchronization to a standing master encoder is possible:

- Move to start position of cam 1 motion e.g. VAI GoTo Pos (010xh)
- Define cam 1 motion e.g. Encoder CAM 1 Define Curve To Pos (112xh)
- Move to start position of cam 2 motion e.g. VAI GoTo Pos (010xh)
- Define cam 2 motion e.g. Encoder CAM 2 Define Curve To Pos (112xh)
- Go to synchronized cam position with (102xh)
- After synchronized cam position is reached enable cam motion with (100xh)
- Start turning the encoder

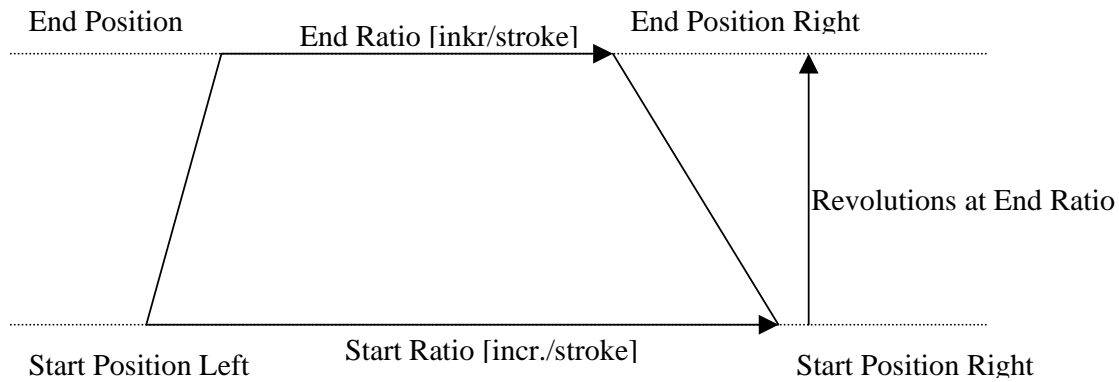
With the following sequence a (re)synchronization to a moving master encoder is possible:

- Disable cam start enable (UPID 1528h) and wait until cam enabled vanishes, or clear also cam enabled (1BA9h)
- Move to start position of cam 1 motion e.g. VAI GoTo Pos (010xh)
- Define cam 1 motion e.g. Encoder CAM 1 Define Curve To Pos (112xh)
- Define cam 2 motion e.g. Encoder CAM 2 Define Curve To Pos (112xh)
- After the synchronized cam position is reached, enable the cam motion with (100xh)
- Enable cam start enable (UPID 1528h)

5.4 Winding

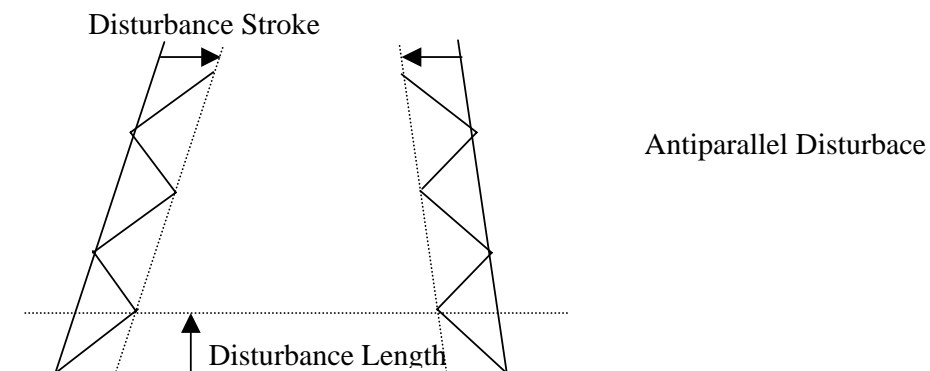
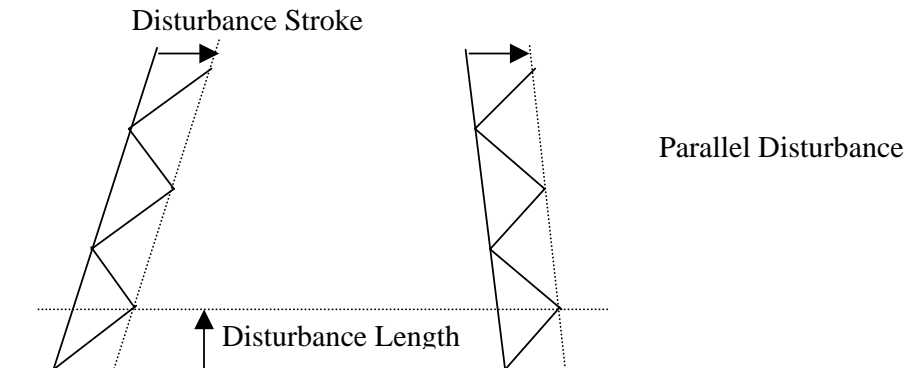
NOTE: Winding is not available in the B1100 servo controllers.

Winding applications are supported with specific position setpoint functionality. Several parameters define the behavior of the setpoint generation and the shape of the resulting bobbin. The encoder has to be set to AB modulo mode (ABZ mode planned, but not implemented yet).



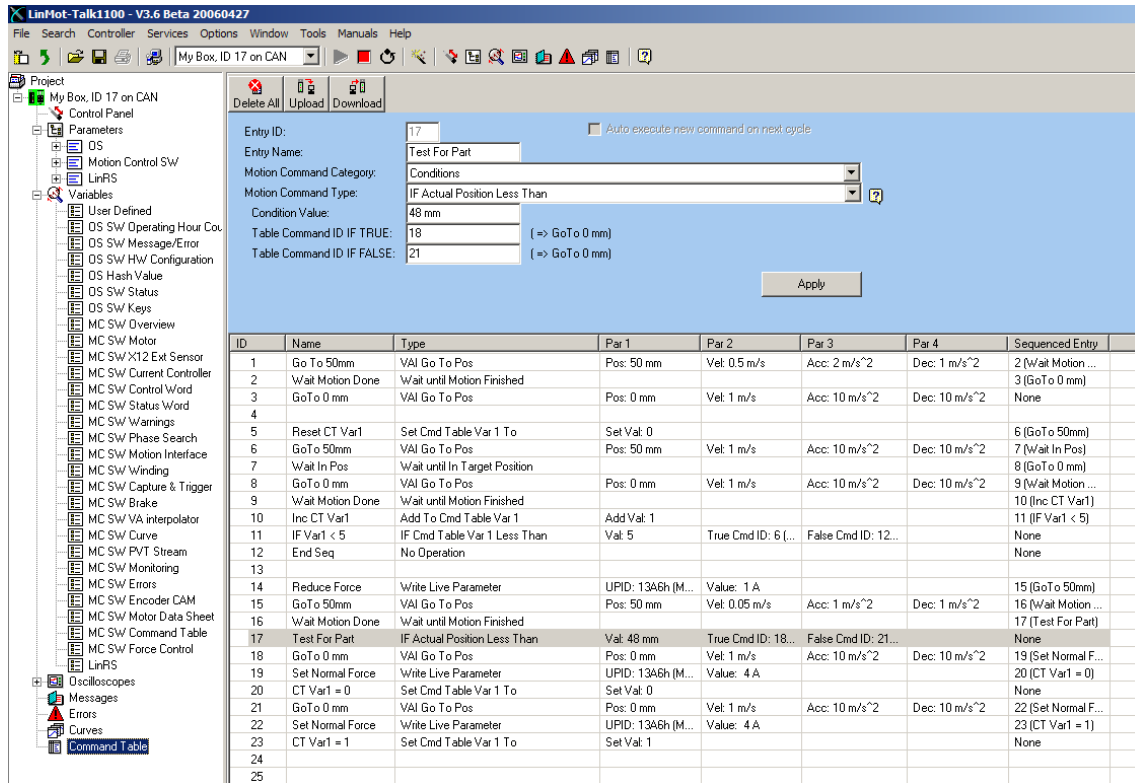
5.4.1 Winding disturbance

To avoid 'dog bones' on bobbins an additional disturbance can be added. The left and right end position of the stroke will be distributed within a definable range and pattern.



6 Command Table

NOTE: The command table in the B1100 servo controllers is limited to 31 entries, and is flash only, for this reason it is not possible to write or modify the table over a serial interface! The command table functionality can be used for programming sequences directly in the controller. The following examples illustrate the possibilities of the command table. The shown command table can be loaded from the defaults 'CT_Example.lmc'.



| ID | Name | Type | Par 1 | Par 2 | Par 3 | Par 4 | Sequenced Entry |
|----|------------------|-------------------------------|-------------------|----------------------|--------------------------|--------------------------|----------------------|
| 1 | Go To 50mm | VAl Go To Pos | Pos: 50 mm | Vel: 0.5 m/s | Acc: 2 m/s ² | Dec: 1 m/s ² | 2 (Wait Motion ...) |
| 2 | Wait Motion Done | Wait until Motion Finished | | | | | 3 (GoTo 0 mm) |
| 3 | GoTo 0 mm | VAl Go To Pos | Pos: 0 mm | Vel: 1 m/s | Acc: 10 m/s ² | Dec: 10 m/s ² | None |
| 4 | | | | | | | |
| 5 | Reset CT Var1 | Set Cmd Table Var 1 To | Set Val: 0 | | | | 6 (GoTo 50mm) |
| 6 | GoTo 50mm | VAl Go To Pos | Pos: 50 mm | Vel: 1 m/s | Acc: 10 m/s ² | Dec: 10 m/s ² | 7 (Wait In Pos) |
| 7 | Wait In Pos | Wait until In Target Position | | | | | 8 (GoTo 0 mm) |
| 8 | GoTo 0 mm | VAl Go To Pos | Pos: 0 mm | Vel: 1 m/s | Acc: 10 m/s ² | Dec: 10 m/s ² | 9 (Wait Motion ...) |
| 9 | Wait Motion Done | Wait until Motion Finished | | | | | 10 (Inc CT Var1) |
| 10 | Inc CT Var1 | Add To Cmd Table Var 1 | Add Val: 1 | | | | 11 (IF Var1 < 5) |
| 11 | IF Var1 < 5 | IF Cmd Table Var 1 Less Than | Val: 5 | True Cmd ID: 6 (...) | False Cmd ID: 12... | | None |
| 12 | End Seq | No Operation | | | | | None |
| 13 | | | | | | | |
| 14 | Reduce Force | Write Live Parameter | UPID: 13A6h (M... | Value: 1 A | | | 15 (GoTo 50mm) |
| 15 | GoTo 50mm | VAl Go To Pos | Pos: 50 mm | Vel: 0.05 m/s | Acc: 1 m/s ² | Dec: 1 m/s ² | 16 (Wait Motion ...) |
| 16 | Wait Motion Done | Wait until Motion Finished | | | | | 17 (Test For Part) |
| 17 | Test For Part | IF Actual Position Less Than | Val: 48 mm | True Cmd ID: 18... | False Cmd ID: 21... | | None |
| 18 | GoTo 0 mm | VAl Go To Pos | Pos: 0 mm | Vel: 1 m/s | Acc: 10 m/s ² | Dec: 10 m/s ² | 19 (Set Normal F... |
| 19 | Set Normal Force | Write Live Parameter | UPID: 13A6h (M... | Value: 4 A | | | 20 (CT Var1 = 0) |
| 20 | CT Var1 = 0 | Set Cmd Table Var 1 To | Set Val: 0 | | | | None |
| 21 | GoTo 0 mm | VAl Go To Pos | Pos: 0 mm | Vel: 1 m/s | Acc: 10 m/s ² | Dec: 10 m/s ² | 22 (Set Normal F... |
| 22 | Set Normal Force | Write Live Parameter | UPID: 13A6h (M... | Value: 4 A | | | 23 (CT Var1 = 1) |
| 23 | CT Var1 = 1 | Set Cmd Table Var 1 To | Set Val: 1 | | | | None |
| 24 | | | | | | | |
| 25 | | | | | | | |

The first sequence ID1, ID2 and ID3 shows a simple sequence GoTo 50mm wait until motion is completed and then go back to 0mm.

The second sequence ID5..12 repeats 5 times the Sequence GoTo 50mm GoTo 0mm

1. ID 5: Set Command Table To Var 1= 0
2. ID 6: GoTo 50mm
3. ID 7: Wait Until In Target Position
4. ID 8: GoTo 0mm
5. ID 9: Wait until Motion Done
6. ID 10: Increment Command Table Var 1
7. ID 11: If Command Table To Var 1< 5 Then GoTo ID 5 Else GoTo ID 12
8. ID 12: No Operation End of Sequence

The third sequence ID14..23 changes the maximal current of the position controller set A (UPID 13A6), goes to 50mm wait until motion completed, tests if part is present (Act Pos < 48), goes back to 0mm, sets Normal Force (Current) and sets CT Var 1 = 0 if part was present else set CT Var1 = 1.

7 Controller Configuration

The parameter configuration is normally done with Lintalk1100- SW [3]. The UPIDs, over which the parameter can be accessed, differ between the E1100 and B1100 servo controllers. In this documentation the E1100 UPIDs are used. If a UPID for a B1100 servo controller is needed, a conversion list can be generated with the Lintalk1100- SW.

7.1 Power Bridge

The E1100/B1100 servo controllers are divided into three different power classes. The normal controllers have a maximal current of 8A, the high current (name extension HC) variant has a maximal current of 15A and the extreme current (name extension XC) has a maximal current of 25A.

7.2 X4 I/O Definitions

The functionality of most IOs can be programmed as a control word input bit or status word output bit, or they can be used as interface IO and read out or written over a serial bus interface. Apart from this general functionality a few IOs have a special functionality.

| Descriptor | General Purpose IO | Special Functions |
|------------|--------------------|---------------------------------------|
| X4.3 | Yes | Brake (Output) |
| X4.4 | Yes | Analog In |
| X4.5 | Yes | Capture Input |
| X4.6 | Yes | Trigger (Input) |
| X4.7 | Yes | Home Switch (Input) |
| X4.8 | Yes | Limit IN (Input) |
| X4.9 | Yes | Limit OUT (Input) / 24V Step (Input) |
| X4.10 | Yes | PTC 1 (Input) / 24V Direction (Input) |
| X4.11 | Yes | PTC 2 (Input) |
| X4.12 | No | SVE Safety Voltage Enable (Input) |

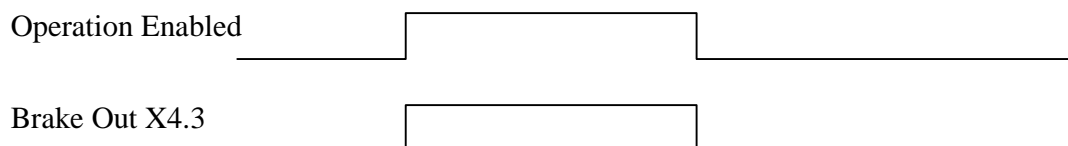
7.2.1 X4.3 Brake

The output X4.3 can drive up to 1A, so it can be used to control directly a valve of a pneumatic brake module. For this reason this output can be configured as brake output. The cases in which the brake has to be applied or released are configured over the brake mode parameters. The brake output is controlled from the state machine.

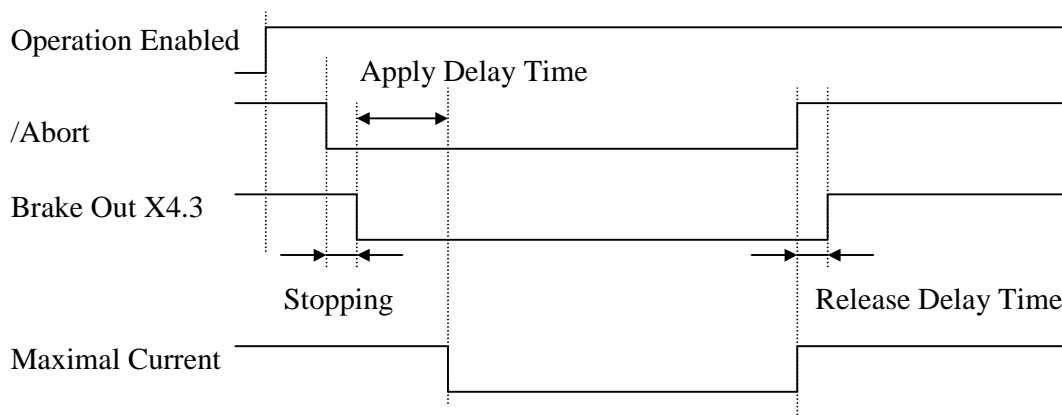
| Parameter Name | UPID | Description |
|--------------------------------|-------|---|
| Status Word: Operation Enabled | 1717h | The brake is released (X4.3 = 24V), when bit 0 of the status word (Operation Enabled) is set. Otherwise the brake is applied. |
| Ctrl Word: /Abort | 1718h | The brake is applied (X4.3 = 0V) when entering the Aborting State (12) and released (X4.3 = 24V) when going to Operation Enabled State (8) again. |
| Quick Stop | 1716h | Special brake behavior with Quick Stop (Brake Mode Status Word: Operation Enabled has also to be set) |

7.2.1.1 X4.3 Brake Operation Enabled Behavior

The following figure shows the behavior when only the brake mode “Status Word: Operation Enabled” is selected. If only this switch (with UPID 1717h) is activated, no apply or release delay time is regarded.

**7.2.1.2 X4.3 Brake Operation /Abort Behavior**

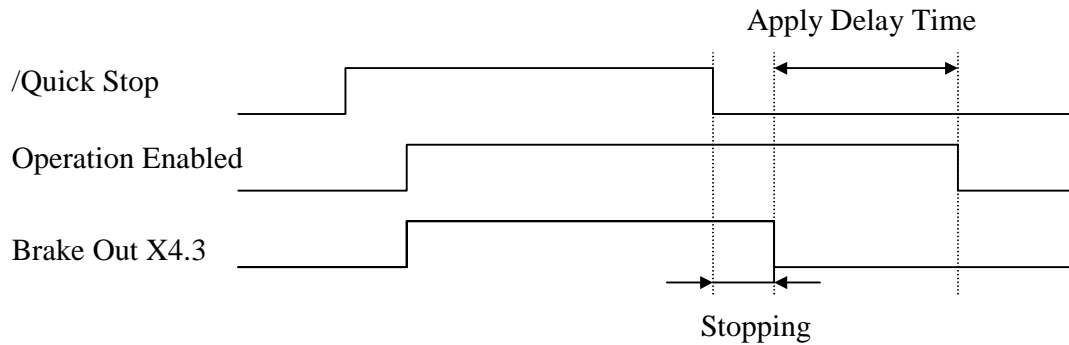
When set the brake mode to “Ctrl Word: /Abort”, the brake is applied in state Aborting (12) and the maximal current of the motor is set to 0A. If using this behavior, ensure that the maximal current (UPID 13A6h and 13BAh) is not set over a serial bus during the state Aborting (12)!



| Parameter Name | UPID | Description |
|--------------------|-------|--|
| Apply Delay Time | 171Bh | Delay time after brake output goes to 0V until the maximal current of the motor is set to 0A (UPID 13A6h and 13BAh). |
| Release Delay Time | 171Ch | Delay time of the Status Word bit: Operation Enabled after the motion has stopped. |

7.2.1.3 X4.3 Brake Operation Quick Stop Behavior

If also the Quick Stop brake behavior is selected the brake is applied (X4.3 = 0V) as soon as the motion has stopped, then the reset of the Operation Enabled bit is delayed by the apply delay time, which then also powers off the motor.



| Parameter Name | UPID | Description |
|------------------|-------|--|
| Apply Delay Time | 171Bh | Delay time of the Status Word bit: Operation Enabled after the motion has stopped. |

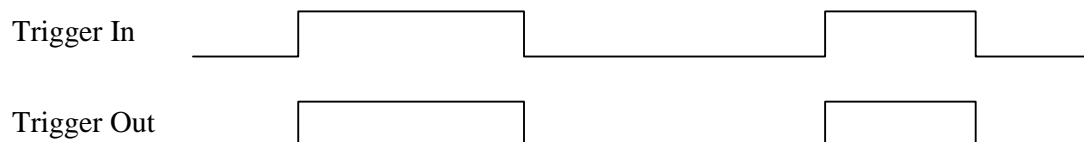
7.2.2 X4.6 Trigger

For the trigger input, which is evaluated in the motion control task, different evaluation modes are supported.

| Parameter Name | UPID | Description |
|----------------|-------|--|
| Trigger Modes | 170Ch | Trigger mode selection: <ul style="list-style-type: none"> • 0: None • 1: Direct • 2: Inhibited • 3: Delayed • 4: Inhibited & Delayed |

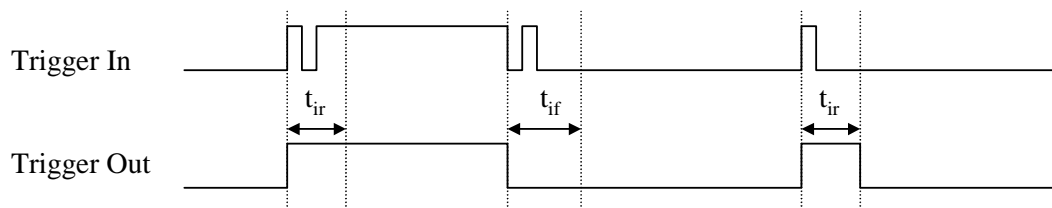
7.2.2.1 Direct Trigger Mode

In the Direct Trigger Mode copies the trigger input directly copied to the trigger output, which is used by the MC-SW. No parameter configuration is needed for this mode.



7.2.2.2 Inhibited Trigger Mode

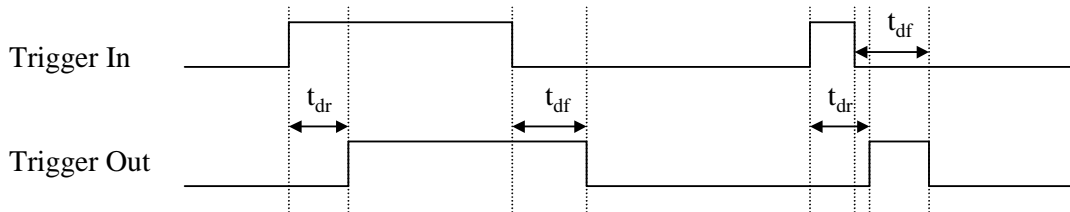
The Inhibit Trigger Mode can be used to debounce a jittering trigger input without delay. This method doesn't increase the noise immunity!



| Parameter Name | UPID | Description |
|-------------------|-------|---|
| Rise Inhibit Time | 170Dh | Inhibit time after rising edge of trigger in signal (t_{ir}) |
| Fall Inhibit Time | 170Eh | Inhibit time after falling edge of trigger in signal (t_{if}) |

7.2.2.3 Delayed Trigger Mode

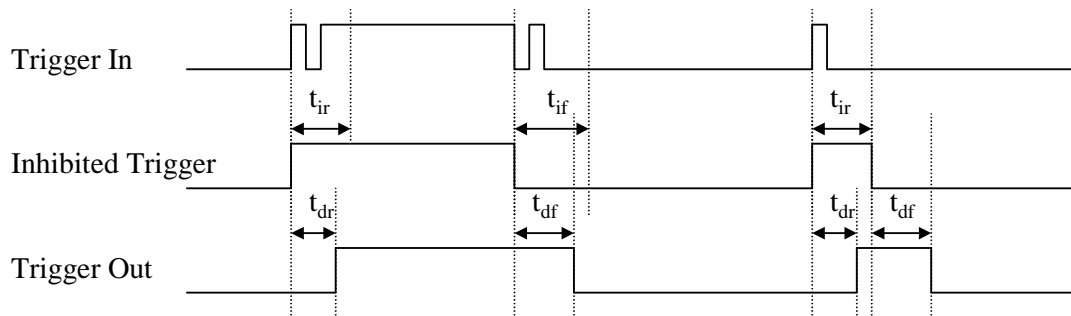
The Delayed Trigger Mode can be used to delay an action following the rising or falling trigger event.



| Parameter Name | UPID | Description |
|-----------------|-------|---|
| Rise Delay Time | 170Fh | Trigger Out delay time after rising edge of Trigger In signal (t_{dr}) |
| Fall Delay Time | 1710h | Trigger Out delay time after falling edge of Trigger In signal (t_{df}) |

7.2.2.4 Inhibited & Delayed Trigger Mode

The Inhibited & Delayed Trigger Mode first debounces the trigger input signal with the inhibit time. The inhibited trigger signal is then delayed with the rise/fall delay time and then copied to the trigger out signal.



| Parameter Name | UPID | Description |
|-------------------|-------|---|
| Rise Inhibit Time | 170Dh | Inhibit time after rising edge of Trigger In signal (t_{ir}) |
| Fall Inhibit Time | 170Eh | Inhibit time after falling edge of Trigger In signal (t_{if}) |
| Rise Delay Time | 170Fh | Trigger Out Delay time after rising edge of Trigger In signal (t_{dr}) |
| Fall Delay Time | 1710h | Trigger Out Delay time after falling edge of Trigger In signal (t_{df}) |

7.2.3 X4.8 and X4.9 Limit Switches

If on IO pin X4.8 and/or on X4.9 a limit switch is defined, the error behavior in case of an active limit switch can be configured. The error is only generated on a powered motor which is homed, so it is possible to exit the error state with a new homing request. For that reason also the homed bit in the status word is cleared if moving into a limit switch.

| Parameter Name | UPID | Description |
|----------------|-------|--|
| Error Behavior | 121Bh | Error behavior of the configured limit switches: <ul style="list-style-type: none"> • 0: No Error (maybe only used for homing) • 1: Power Off • 2: Quick Stop |

7.2.4 X4.10 and X4.11 PTC 1 and PTC 2

On IO pins X4.10 and X4.11 PTC sensors can be connected to supervise an over temperature of a motor and/or the transformer supply. The other side of the PTC has to be connected to 24V. If the resistance is below 2kOhm the input is high. If it rises above 15kOhm the output is regarded as low. Typically, the transition low to high is between 5kOhm and 7kOhm. If the input rises, the corresponding bit in the warn word will be set after the PTC Warn Time. After the PTC error time the corresponding error is set. The error only can be acknowledged if the corresponding PTC warn bit has vanished.

7.2.5 X4.12 SVE (Safety Voltage Enable)

X4.12 is a special input (input only). If it goes low the PWM generation of the power stage is disabled by hardware. Additionally, this bit is mapped directly to the Control Word bit 1. To disable this feature, the input must be wired to 24V logic supply.

7.3 Master Encoder

The master encoder can be used for applications where high speed synchronization is needed, such as winding application, indexing positioning mode, etc.

The parameter Encoder Source defines whether the master encoder is connected to the X10 (RJ45) or the X12 (DSUB 9) connector. X10 is looped through to the master encoder connector X11 (RJ45). This simplifies the loop through cabling of the encoder signals.

| Parameter Name | UPID | Description |
|----------------|-------|--|
| Encoder Source | 172Ah | Defines the source of the Master Encoder: <ul style="list-style-type: none"> • 0: None • 1: Encoder Input X10 • 2: Ext Sensor Input X12 |

The encoder type parameter defines the signal type of the master encoder. At any rate the signals have to be differential RS422. When using a SD(Z) master encoder, the step signal has to be connected to A, /A, Dir signal to B, /B and the Zero to Z, /Z.

| Parameter Name | UPID | Description |
|----------------|-------|---|
| Encoder Type | 128Eh | Defines the Master Encoder Type: <ul style="list-style-type: none">• 0: None• 1: ABZ• 2: AB• 4: Step Dir (SD)• 5: Step Dir Zero (SDZ) |

The decoding parameter defines how many edges of the signals are evaluated. For AB(Z) encoder types 1x, 2x, 4x decoding is valid; for SD(Z) encoder types only 1x and 2x decoding is valid. If 4x decoding is selected a 2x decoding is forced without error generation.

| Parameter Name | UPID | Description |
|----------------|-------|--|
| Decoding | 128Fh | Defines the Master Encoder decoding: <ul style="list-style-type: none">• 0: 1x• 1: 2x• 2: 4x |

With the direction parameter the count direction of the encoder evaluation can be defined.

| Parameter Name | UPID | Description |
|----------------|-------|---|
| Direction | 1290h | Defines the Master Encoder direction: <ul style="list-style-type: none">• 0: Positive• 1: Negative |

The Counts/Revolution parameter defines the number of counts per revolution for ABZ or SDZ master encoders.

| Parameter Name | UPID | Description |
|-----------------------|-------|---|
| Counts/ Revolution | 1291h | Only used for ABZ or SDZ encoders, to define the counts per revolution. |

The Speed Filter Time parameter defines the time over which the master encoder speed is calculated. Bigger values generate a smoother master encoder speed but generate a bigger delay time of the speed, which may be a problem if the master encoder speed varies quickly.

| Parameter Name | UPID | Description |
|-------------------------|-------|--|
| Speed Filter Time | 1293h | Time over which the Master Encoder speed is generated. |

7.4 Monitoring

The E1100/B1100 servo controller series support enhanced monitoring features of the supply voltages and the board temperatures.

7.4.1 Logic Supply Voltage

The logic supply voltage must be in the range 20V.. 28V when using the default parameter settings. If the supply voltage goes out of this range, an error will be generated. If the supply voltage goes below approx. 18V the servo controller shuts down.

| Parameter Name | UPID | Description |
|------------------------------|-------|---|
| Logic Supply Voltage Too Low | 100Eh | If the logic supply voltage sinks below this limit the error 01h will be generated. |

| Parameter Name | UPID | Description |
|-------------------------------|-------|---|
| Logic Supply Voltage Too High | 1010h | If the logic supply voltage rises above this limit the error 02h will be generated. |

7.4.2 Motor Supply Voltage

The motor supply voltage can be monitored with different warn and error levels.

| Parameter Name | UPID | Description |
|---------------------------|-------|---|
| Motor Supply Voltage Low | 1018h | If the motor supply voltage sinks below this limit the warn bit Motor Supply Voltage Low (bit 2) is set. |
| Motor Supply Voltage High | 1019h | If the logic supply voltage rises above this limit the warn bit Motor Supply Voltage High (bit 3) is set. |

| Parameter Name | UPID | Description |
|-------------------------------|-------|---|
| Motor Supply Voltage Too Low | 101Ah | If the logic supply voltage sinks below this limit the error 03h will be generated. |
| Motor Supply Voltage Too High | 101Bh | If the logic supply voltage rises above this limit the error 04h will be generated. |

7.4.2.1 Phase Switch On Test

The parameters in the Phase Switch On Test section are used in the HW Tests State (State 5) before enabling the power stage. If the motor power supply is on and there is no ground path in the motor (inclusive cabling) the phase voltage is approx. 6.5V when in power off state. When moving the motor the induced voltage may lead to HW test error.

| Parameter Name | UPID | Description |
|--------------------------|-------|---|
| Phase Voltage Low Level | 102Ch | If one of the phase voltages is below this limit before powering up an error will be generated. |
| Phase Voltage High Level | 102Dh | If one of the phase voltages is above this limit before powering up an error will be generated. |

As a next motor cabling test step, one single end of a phase is set to half of the motor supply voltage. At this time, the current into the servo controller has to be below the Phase Test Max Incurrent value. An error will be generated otherwise.

| Parameter Name | UPID | Description |
|--------------------------|-------|--|
| Phase Test Max Incurrent | 102Eh | If the current rises above this limit if one edge of a phase is set to a voltage an error will be generated. |

7.4.3 Regeneration Resistor

The regeneration resistor terminals on X1 can be used for energy dissipation, when the motor is decelerating.

| Parameter Name | UPID | Description |
|----------------|-------|---|
| Enable | 101Dh | The regeneration resistor output could be activated with this parameter: <ul style="list-style-type: none">• 0: Disable• 1: Enable |

In the configuration section the switch on and off voltage levels for the regeneration resistor can be defined. The turn on voltage has to be at minimum 0.5V higher than the turn off voltage. Ensure that the idle motor supply voltage is lower than the turn off voltage!

| Parameter Name | UPID | Description |
|------------------|-------|--|
| Turn On Voltage | 101Eh | If the Motor Supply Voltage rises above this limit the low side switch of the regeneration output is activated. |
| Turn Off Voltage | 101Fh | If the Motor Supply Voltage sinks below this limit the low side switch of the regeneration output is turned off. |

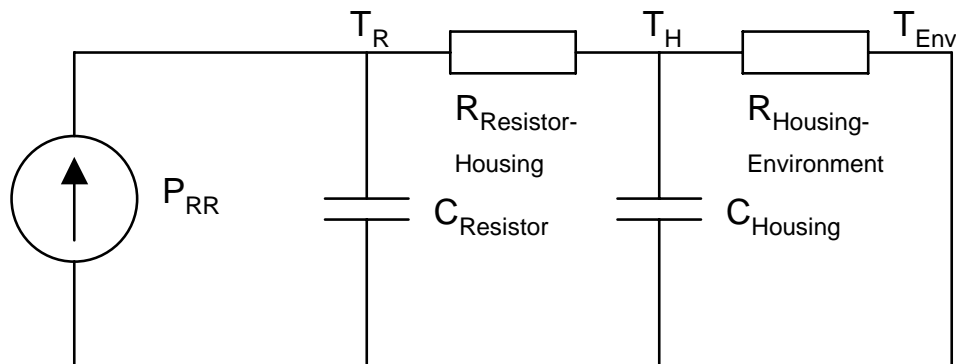
With the RR Temp Calculated section, the temperature model of the regeneration resistor is parameterized. This is used for avoiding damages to the regeneration resistor if the energy dissipation rises over the resistor's capabilities.

| Parameter Name | UPID | Description |
|----------------|-------|---|
| RR Resistance | 1022h | Resistance value of the regeneration resistor. This value is used for calculating how much heat energy is generated in the resistor at the current DC link voltage. |
| Warning Temp | 1024h | If Calc Temp RR Winding (UPID1C0Dh) of the calculated temperature model rises above this value, bit 10 of the Warn Word is set. |
| Error Temp | 1025h | If Calc Temp RR Winding (UPID1C0Dh) of the calculated temperature model rises above this value, the controller goes to error state with the error 15h. |

In the Temp Model Parameters section the regeneration resistor's temperature model is defined.

| Parameter Name | UPID | Description |
|-------------------------|-------|--|
| C Resistor | 1026h | Heat capacity of the resistor winding itself. |
| R Winding Housing | 1027h | Thermal resistance value between resistor winding and its housing. |
| C Housing | 1028h | Heat capacity of the resistor housing. |
| R Housing Environment | 1029h | Thermal resistance value between resistor housing and environment. |
| Environment Temperature | 102Ah | Environmental temperature of the regeneration resistor. |

The figure below shows the implemented temperature model for the regeneration resistor.



7.4.4 Temperature Monitoring

The E1100 servo controller hardware contains eight absolute temperature sensors for thermal protection. On the B1100 controller is one sensor placed.

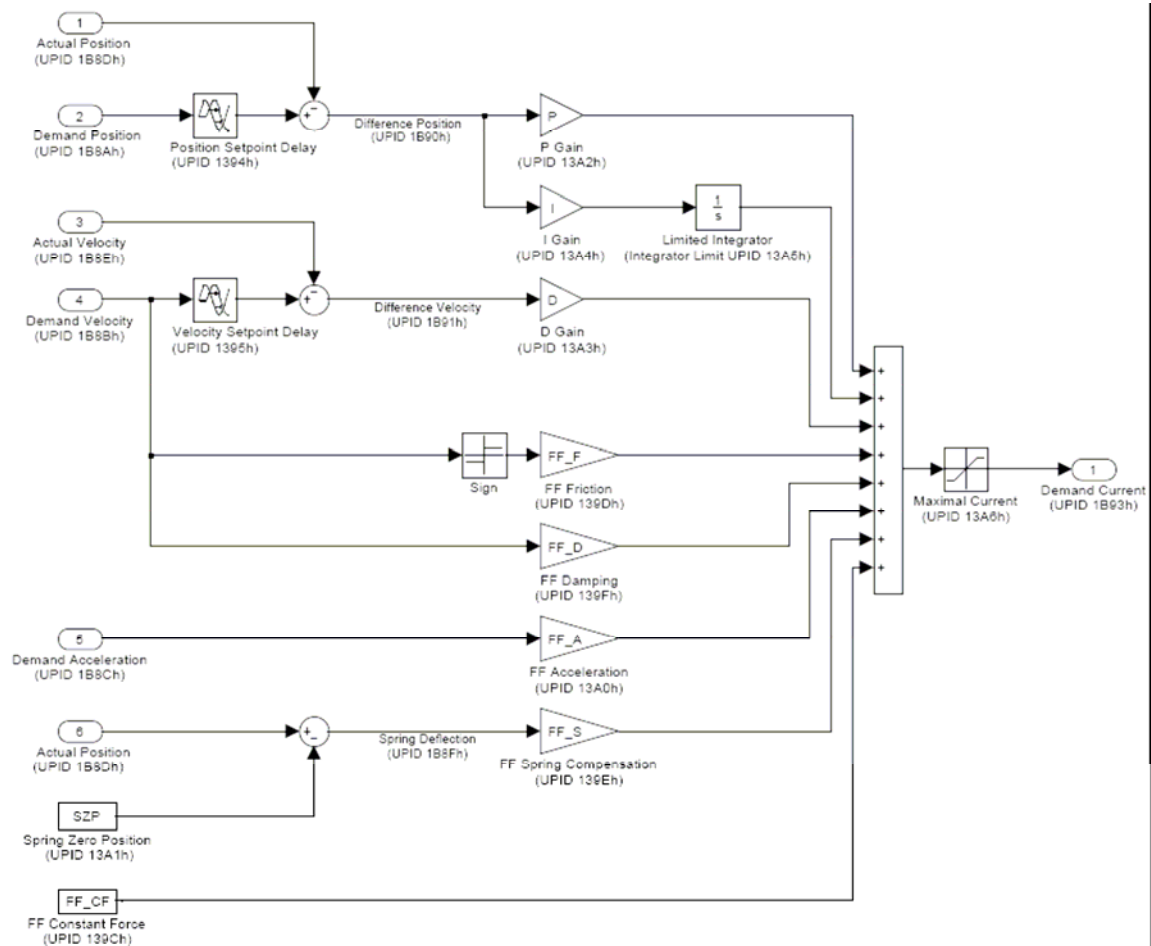
| Parameter Name | UPID | Description |
|-----------------------|-------|--|
| Temp Sens Warn Level | 1040h | If the maximal board temperature rises above this level, a warning is generated (bit 6 in Warn Word is set). |
| Temp Sens Error Level | 1041h | If the maximal board temperature rises above this level, the error is generated (error codes 10h..17h). |

The table below shows the mapped variables of the temperature monitoring.

| Variable Name | UPID | Description |
|------------------------|-------|---|
| Power Bridge Temp Ph1+ | 1BC6h | Temperature of power driver Phase 1+ (E1100 only) |
| Power Bridge Temp Ph1- | 1BC7h | Temperature of power driver Phase 1- (E1100 only) |
| Power Bridge Temp Ph2+ | 1BC8h | Temperature of power driver Phase 2+ (E1100 only) |
| Power Bridge Temp Ph2- | 1BC9h | Temperature of power driver Phase 2- (E1100 only) |
| Power Bridge | 1BC9h | Temperature of power driver Phase 2+ (E1100 only) |

| | | |
|-------------------------|-------|---|
| Temp Ph2+ | | |
| Power Bridge Temp DCLV+ | 1BCAh | Temperature of power drivers DC link voltage (E1100 only) |
| Temp RR Driver | 1BCBh | Temperature of Regeneration Resistor low side driver (E1100 only) |
| Connector Temp X3 | 1BCCh | Temperature of motor connector X3 (E1100 only) |
| Temp Core | 1BCDh | Temperature near microcontroller core (E1100 only) |
| Max Controller Temp | 1BCEh | Maximal temperature of above variables |

7.5 PosCtrlStructure

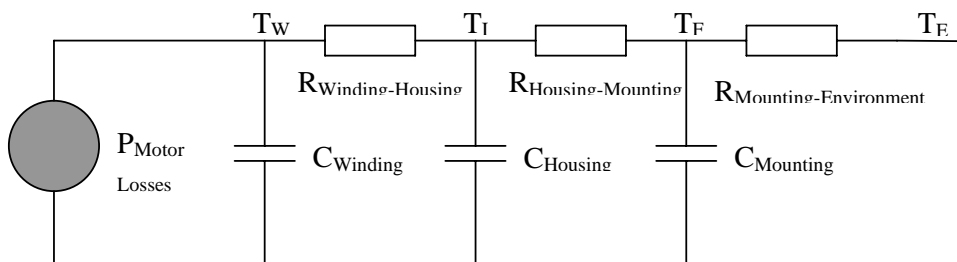


8 Motor Configuration

The motor usually is set up with the motor wizard, which sets all needed parameters. Therefore a detailed description of the parameters will follow in the future.

8.1 Generic Motor Temperature Calculated

For third parties motors a generic calculated motor temperature model is used to adapt the winding resistance and to detect excess temperature.



| | |
|-------------------------|------------|
| C Winding: | UPID 120Ch |
| R Winding-Housing: | UPID 1210h |
| C Housing: | UPID 1211h |
| R Housing-Mounting: | UPID 1212h |
| C Mounting: | UPID 1213h |
| R Mounting-Environment: | UPID 1214h |

The sum of all R defines the static power losses (consider also T_W and T_E). With the capacitance the thermal time constant can be influenced. The bigger the thermal capacitance the slower the temperature will rise.

9 State Machine Setup

In the state machine setup sections the parameters to influence the behavior of the single states can be defined.

10 Error Code List

| Code | Description | Actions to take |
|-------|-----------------------------------|--|
| 0000h | No Error | No error is pending. |
| 0001h | Err: X4 Logic Supply Too Low | The logic supply voltage has been too low. The minimal logic supply voltage level is defined through parameter 100Eh. Recommended actions: check your 24V logic power supply. |
| 0002h | Err: X4 Logic Supply Too High | The logic supply voltage has been too high. The maximal logic supply voltage level is defined through parameter 1010h. Recommended actions: check your 24V logic power supply. |
| 0003h | Err: X1 Pwr Voltage Too Low | The motor power supply voltage has been too low. The minimal motor supply voltage level is defined through parameter 101Ah. Recommended actions: check your motor power supply, check the wiring, check the sizing of the power supply, add a capacitor too enforce your DC link. |
| 0004h | Err: X1 Pwr Voltage Too High | The motor power supply voltage has been too high. The maximal motor supply voltage level is defined through parameter 101Bh. Back EMF effects may boost the DC link voltage. Recommended actions: check your motor power supply, check the wiring, check the sizing of the power supply, use a regeneration resistor for power dissipation, add a capacitor too enforce your DC link. |
| 0005h | Err: X1 RR Not Connected | A regeneration resistor is configured (see parameter 101Dh) but not connected. Recommended actions: connect the regeneration resistor to X1. |
| 0006h | Err: PTC 1 Sensor Too Hot | The PTC 1 sensor on X4.10 is hot or not connected. Recommended actions: check the temperature, check the wiring |
| 0007h | Err: Min Pos Undershot | The motor position has been below the minimal position (see parameter 146Eh). Recommended actions: check the configuration, check the PLC program |
| 0008h | Err: Max Pos Overshot | The motor position has been above the maximal position (see parameter 146Fh). Recommended actions: check the configuration, check the PLC program |
| 0009h | Err: Ext-Int Sensor Diff Err | The position difference between sensor feedback on X3 and sensor feedback on X12 has been too big. Recommended actions: check sensor wiring, check sensor configuration (count direction, etc.), check parameter 1266h |
| 000Ah | Fatal Err: X12 Signals Missing | The external sensor is not connected to X12 or the wiring is not ok. Recommended actions: check the wiring |

| | | |
|-------|-------------------------------------|--|
| 000Bh | Err: Pos Lag Always Too Big | The motor was not able to follow the demand position. The maximal allowed position difference is defined through parameter 1473h. Recommended actions: check the motor load, check the motor stroke range for possible collisions, check the position controller setup, check the setpoint generation (unreachable speed/acceleration values?), check the motor sizing. |
| 000Ch | Err: Pos Lag Standing Too Big | The motor was not able to reach the target position or was not able to stay at the target position. The maximal allowed position difference is defined through parameter 1475h. Recommended actions: check the motor load, check the motor stroke range for possible collisions, check the position controller setup, check the motor sizing |
| 000Dh | Fatal Err: X1 Pwr Over Current | Over current on X1 detected. Recommended actions: check motor wiring, check motor configuration, for P01-48 type motors: set parameter 11F4h to value 0001h |
| 000Eh | Err: Supply Dig Out Missing | Controller board defective. Recommended actions: contact support for repair |
| 000Fh | Err: PTC 2 Sensor Too Hot | The PTC 2 sensor on X4.11 is hot or not connected. Recommended actions: check the temperature, check the wiring |
| 0010h | Err: Controller Ph1+ Too Hot | Servo controller power bridge phase 1+ too hot. Recommended actions: check motor wiring |
| 0011h | Err: Controller Ph1- Too Hot | Servo controller power bridge phase 1- too hot. Recommended actions: check motor wiring |
| 0012h | Err: Controller Ph2+ Too Hot | Servo controller power bridge phase 2+ too hot. Recommended actions: check motor wiring |
| 0013h | Err: Controller Ph2- Too Hot | Servo controller power bridge phase 2- too hot. Recommended actions: check motor wiring |
| 0014h | Err: Controller Pwr Too Hot | DC link temp sensor has detected over temperature. Recommended actions: check wiring |
| 0015h | Err: Controller RR Hot Calc | Regeneration resistor switch hot: Recommended actions: check RR configuration (Turn On level, Resistance, etc.), check RR sizing |
| 0016h | Err: Controller X3 Too Hot | Temp sensor on X3 has detected over temperature. Recommended actions: check motor wiring |
| 0017h | Err: Controller Core Too Hot | Temp sensor on controller's PCB board reports core being hot. |
| 0018h | Err: Power Bridge Ph1+ Defective | Servo controller power bridge phase 1+ may be defective. Recommended actions: contact support |
| 0019h | Err: Power Bridge Ph1- Defective | Servo controller power bridge phase 1- may be defective. Recommended actions: contact support |
| 001Ah | Err: Power Bridge Ph2+ Defective | Servo controller power bridge phase 2+ may be defective. Recommended actions: contact support |

| | | |
|-------|--|--|
| 001Bh | Err: Power Bridge Ph2- Defective | Servo controller power bridge phase 2- may be defective. Recommended actions: contact support |
| 001Ch | Err: Supply DigOut X6 Fuse Blown | Supply fuse for digital outputs on X6 blown. Recommended actions: check X6 wiring, contact support for repair |
| 001Dh | Err: Supply X3.3 5V Fuse Blown | Supply X3.3 5V fuse blown. Motor or and/or wiring defective. Recommended actions: contact support for controller repair, check motor and wiring, replace motor and motor cables |
| 001Eh | Err: Supply X3.8 AGND Fuse Blown | Supply X3.8 analog ground fuse blown. Recommended actions: contact support for controller repair, check motor and wiring, replace motor and motor cables |
| 0020h | Err: Motor Hot Sensor | Temp sensor reports hot motor. Recommended actions: wait until motor has cooled down (until corresponding warning disappears, check load, check the motor configuration, check the setpoint generation (unreachable speed/acceleration values?), check the motor sizing |
| 0021h | Fatal Err: X3 Hall Sig Missing | Motor hall signals not connected to X3 or motor defective: Recommended actions: Power down the controller and all power supplies, then reconnect motor, check motor and wiring, check parameter 1221h. |
| 0022h | Fatal Err: Motor Slider Missing | Motor hall sensors could not see magnetic field of the slider. The motor position was outside the allowed range defined through the motors ZP and Max Stroke data (see data sheet). Recommended actions: check stroke range, check slider orientation. |
| 0023h | Err: Motor Short Time Overload | Short time motor overload detected. Recommended actions: check if motor is blocked, check motor sizing |
| 0024h | Err: RR Hot Calculated | Regeneration resistor hot calculated. Recommended actions: check RR configuration (Turn On level, Resistance, etc.), check RR sizing |
| 0025h | Err: Sensor Alarm | Sensor Alarm On X12 Occurred. Recommended actions: Check sensor mounting, band contamination or motion speed |
| 0028h | Err: Ph1+ Short Circuit To GND | Short circuit between phase 1+ and ground detected. Recommended actions: check motor wiring, check motor |
| 0029h | Err: Ph1- Short Circuit To GND | Short circuit between phase 1- and ground detected. Recommended actions: check motor wiring, check motor |
| 002Ah | Err: Ph2+ Short Circuit To GND | Short circuit between phase 2+ and ground detected. Recommended actions: check motor wiring, check motor |

| | | |
|-------|-----------------------------------|--|
| 002Bh | Err: Ph2- Short Circuit To GND | Short circuit between phase 2- and ground detected. Recommended actions: check motor wiring, check motor |
| 002Ch | Err: Ph1 Short Circuit To Ph2 | Short circuit between motor phase 1 and phase 2 detected. Recommended actions: check motor wiring, check motor |
| 0030h | Err: Ph1+ Wired To Ph2+ | Motor phase 1+ has contact to phase 2+. Recommended actions: check motor wiring, check motor |
| 0031h | Err: Ph1+ Wired To Ph2- | Motor phase 1+ has contact to phase 2-. Recommended actions: check motor wiring, check motor |
| 0032h | Err: Ph1+ Not Wired To Ph1- | Motor phase 1+ has no connection to phase 1-. Recommended actions: check motor wiring, check motor |
| 0033h | Err: Ph2+ Wired To Ph1+ | Motor phase 2+ has contact to phase 1+. Recommended actions: check motor wiring, check motor |
| 0034h | Err: Ph2+ Wired To Ph1- | Motor phase 2+ has contact to phase 1-. Recommended actions: check motor wiring, check motor |
| 0035h | Err: Ph2+ Not Wired To Ph2- | Motor phase 2+ has no connection to phase 2-. Recommended actions: check motor wiring, check motor |
| 0036h | Err: Ph1 Short Circuit To Ph2+ | Short circuit between motor phase 1 and phase 2+ detected. Recommended actions: check motor wiring, check motor |
| 0037h | Err: Ph1 Short Circuit To Ph2- | Short circuit between motor phase 1 and phase 2- detected. Recommended actions: check motor wiring, check motor |
| 0038h | Err: Ph2 Short Circuit To Ph1+ | Short circuit between motor phase 2 and phase 1+ detected. Recommended actions: check motor wiring, check motor |
| 0039h | Err: Ph2 Short Circuit To Ph1- | Short circuit between motor phase 2 and phase 1- detected. Recommended actions: check motor wiring, check motor |
| 003Ah | Err: Phase U Broken | Motor phase U broken. Recommended actions: check motor wiring, check motor |
| 003Bh | Err: Phase V Broken | Motor phase V broken. Recommended actions: check motor wiring, check motor |
| 003Ch | Err: Phase W Broken | Motor phase W broken. Recommended actions: check motor wiring, check motor |

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| 0040h | Err: X4.3 Brake Driver Error | X4.3 brake driver reports error. Recommended actions: check for short circuit on X4.3 |
| 0041h | Err: Dig Out X4.4..X4.11 Status | X4.3..X4.11 output driver reports error. Recommended actions: check for short circuit on outputs X4.4..X4.11 or output configurations. |
| 0042h | Err: Dig Out X6 Status | X6 output driver reports error. Recommended actions: check for short circuit on outputs X6. |
| 0044h | Err: X4 Dig Out GND Fuse Blown | Ground fuse for digital outputs on X4 blown. Recommended actions: check X4 wiring, contact support for repair |
| 0045h | Fatal Err: Motor Comm Lost | Motor communication lost. Recommended actions: Power down and check motor wiring and motor, replace cable and/or motor. |
| 0046h | Err: PTC 1 Broken | PTC 1 on X4.10 broken or not connected. Recommended actions: Power down and check PTC 1 wiring and resistance. |
| 0047h | Err: PTC 1 Short To 24V | PTC 1 on X4.10 short to 24V. Recommended actions: Power down and check PTC 1 wiring and resistance. |
| 0050h | Setup Err: HW Not Supported | Setup error, hardware is not supported by the software. Recommended actions: download correct firmware, contact support |
| 0051h | Setup Err: SW Key Missing | Software key and access code for special functionality is missing. Recommended actions: Order the SW key with your support together with the serial number of your HW. |
| 0058h | Runtime Err: ROM write error | Runtime error, MC SW was not able to change parameter value in ROM. Recommended actions: verify PLC is not configuring during this action, contact support |
| 0060h | Cfg Err: RR Voltage Set Too Low | Configuration error: regeneration resistor turn on/off voltage parameter value is too low. Recommended actions: check parameters 101Eh and 101Fh |
| 0061h | Cfg Err: RR Hysteresis < 0.5V | Configuration error: regeneration resistor turn on/off voltage parameter values too close to each other. Recommended actions: check parameters 101Eh and 101Fh |
| 0062h | Cfg Err: Curve Not Defined | Configuration error. Software tried to start a curve that is not defined yet. Action to take: define the curve using the curves service, check if curves were downloaded to controller, check the curve IDs, check the configuration, check the PLC program |
| 0063h | Cfg Err: Pos Ctrl Max Curr High | Configuration error: Invalid max current setting in control parameters. Recommended actions: check parameters 13A6h and 13BAh, check PLC program |
| 0064h | Cfg Err (Fatal): No Motor Defined | Configuration error: No motor has been configured yet. Recommended actions: use the motor wizard to configure the motor |

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| 0065h | Cfg Err (Fatal): No Trigger Mode Defined | Configuration error: Digital input X4.6 is configured for trigger input function, but the trigger mode is not defined yet. Recommended actions: configure parameter 170Ch |
| 0067h | Cfg Err (Fatal): Wrong Stator Type | Configuration error: The configured motor type does not match with the connected motor. Recommended actions: configure correct motor type by using the motor wizard, connect an appropriate motor |
| 0068h | Cfg Err (Fatal): No Motor Communication | Configuration error: The controller was not able to establish the communication to the microcontroller on the motor. Older P01 motors don't support motor communication. Recommended actions: check motor wiring, check motor, check the motor configuration, disable communication by using parameter 11FBh if you have an old P01 motor. |
| 0069h | Cfg Err: Wrong Slider | Configuration error: A wrong slider has been configured or slider home position has an invalid value. Recommended actions: reconfigure the motor by using the motor wizard |
| 0080h | User Err: Lin: Not Homed | User error: The PLC program tried to start an action that requires the motor to be already homed, but the motor was not homed. Recommended actions: check the PLC program, do a homing of the motor first |
| 0081h | User Err: Unknown Motion Cmd | User error: The PLC program sent an unknown motion command ID. Recommended actions: check PLC program, check firmware version |
| 0082h | User Err: PVT Buffer Overflow | User error: The PLC program has sent the stream position commands too fast, the buffer had an overflow. Streaming has to be strictly cyclic! Recommended actions: check PLC program, check the fieldbus by using bus monitor tools |
| 0083h | User Err: PVT Buffer Underflow | User error: The PLC program has sent the stream position commands too slowly, the buffer had an underflow. Streaming has to be strictly cyclic! Recommended actions: check PLC program, check the fieldbus by using bus monitor tools |
| 0084h | User Err: PVT Master Too Fast | User error: The PLC program has begun to send PVT streaming command. The commands were too close to each other. The servo controller expects new streaming commands every 2ms .. 5ms. Recommended actions: check PLC program, check the fieldbus by using bus monitor tools |
| 0085h | User Err: PVT Master Too Slow | User error: The PLC program has begun to send PVT streaming command. The cycle time between the streaming commands has been too long. The servo controller expects new streaming commands every 2ms .. 5ms. Recommended actions: check PLC program, check the fieldbus by using bus monitor tools |

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| 0086h | User Err: Motion Cmd In Wrong St | User error: The PLC program has sent a motion command while the controller was not in an appropriate operational state. Most of the motion commands are accepted only in operational state 8 (Operation Enabled). Recommended actions: check the PLC program |
| 0087h | User Err: Limit Switch In High | User error: The motor moved into the Limit Switch In while it was still in the stroke range. Recommended actions: check the PLC program or check homing |
| 0088h | User Err: Limit Switch Out High | User error: The motor moved into the Limit Switch Out while it was still in the stroke range. Recommended actions: check the PLC program or check homing |
| 0089h | User Err: Curve Amp Scale Error | User error: The automatic calculated amplitude scale is out of range -2000percent to 2000percent. Recommended actions: check the PLC program or use other curve |
| 008Ah | User Err: Cmd Tab Entry Not Def | Called command Table entry is not defined. Recommended actions: check the PLC program or define Command Table Entry. |

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