Operating instructions Compax3 Fluid T40: Cam

Hydraulics controller

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Contents

1. Introduction

In this chapter you can read about:

1.1 Device assignment Compax3 Fluid

This manual applies to the following devices:

- C3 F001 D2 F12 I11 T40
- C3 F001 D2 F12 I20 T40
- C3 F001 D2 F12 I21 T40
- C3 F001 D2 F12 I22 T40
- C3 F001 D2 F12 I30 T40
- C3 F001 D2 F12 I31 T40

1.1.1. Type specification plate Compax3 Fluid

You will find the exact description of the device on the type specification plate, which is located on the right side of the device:

Type specification plate Compax3 Fluid:

Explanation:

1	Type designation	The complete order designation of the device (2, 6, -9...) (Category No.)
2	C3F001D2	**C3:**Abbreviation for Compax3 **F =Fluid:**Hydraulics controller **001:**+/-10V and 0..20mA outputs (16 Bit) **D2:**24VDC device
3	Unique number of the particular device	
4	Supply voltage	24 VDC
5	Date of factory test	
6	Designation of the feedback system	**F12:** Feedback Module
7	Device interface	**I11 / I12:** Digital Inputs / Outputs and RS232 / RS485 **I20:** Profibus DP **I21:** CANopen **I22:** DeviceNet
8	Technology function	**T11:** Positioning / pressure/force control **T30:** Motion control programmable according to IEC61131-3 **T40:** Electronic cam generation
9	Options	**Mxx:**
10	CE compliance	
11	UL certification	**PD2** (see page 456) (degree of pollution)

1.2 Safety Instructions

In this chapter you can read about:

1.2.1. General hazards

General Hazards on Non-Compliance with the Safety Instructions
The device described in this manual is designed in accordance with the latest technology and is safe in operation. Nevertheless, the device can entail certain hazards if used improperly or for purposes other than those explicitly intended.
Electronic, moving and rotating components can

- constitute a hazard for body and life of the user, and
- cause material damage

Usage in accordance with intended purpose

The device is designed for operation in electric power drive systems (VDE0160). Motion sequences can be automated with this device. Several motion sequences can be combined by interconnecting several of these devices. Mutual interlocking functions must be incorporated for this purpose.

1.2.2. Safety-conscious working

This device may be operated only by qualified personnel.
Qualified personnel in the sense of these operating instructions consists of:

- Persons who, by virtue to their training, experience and instruction, and their knowledge of pertinent norms, specifications, accident prevention regulations and operational relationships, have been authorized by the officer responsible for the safety of the system to perform the required task and in the process are capable of recognizing potential hazards and avoiding them (definition of technical personnel according to VDE105 or IEC364),
- Persons who have a knowledge of first-aid techniques and the local emergency rescue services.
- Persons who have read and will observe the safety instructions.
- Those who have read and observe the manual or help (or the sections pertinent to the work to be carried out).

This applies to all work relating to setting up, commissioning, configuring, programming, modifying the conditions of utilization and operating modes, and to maintenance work.
This manual and the help information must be available close to the device during the performance of all tasks.

1.2.3. Special safety instructions

- Check the correct association of the device and its documentation.
- Never detach electrical connections while voltage is applied to them.
- Safety devices must be provided to prevent human contact with moving or rotating parts.
- Make sure that the device is operated only when it is in perfect condition.
- Implement and activate the stipulated safety functions and devices.
- Operate the device only with the housing closed.
- Make sure that all axes are sufficiently fixed.
- Attention during configuration downloads with master - slave couplings (electronic gear, cam)
  Deactivate the drive before starting the configuration download: Master and Slave axis

1.3 Warranty conditions

- The device must not be opened.
- Do not make any modifications to the device, except for those described in the manual.
- Make connections to the inputs, outputs and interfaces only in the manner described in the manual.
- Fix the devices according to our **mounting instructions.** (see page 40)
  We cannot provide any guarantee for any other mounting methods.

Note on exchange of options

Compax3 options must be exchanged in the factory to ensure hardware and software compatibility.

1.4 Conditions of utilization for CE-conform operation

- Industry and trade -

The EC guidelines for electromagnetic compatibility 2006/95/EC and for electrical operating devices for utilization within certain voltage limits 2004/108/EC are fulfilled when the following boundary conditions are observed:

Operation of the devices only in the condition in which they were delivered, i.e. with all housing panels.

Shielding connection of the valve cables

The cable should be fully screened and connected to the Compax3 housing. We offer a special **Shield connecting terminal** (see page 432) as accessory item (ZBH./...).
The shield of the valve cable must also be connected with the valve housing. The fixing (via plug or screw in the terminal box) depends on the valve type.

Requirements for encoder cable Compax3: <100m

Control: Use only with aligned controller (to avoid control loop oscillation).

Cable installation: Signal lines and power lines should be installed as far apart as possible.
Signal leads should never pass close to excessive sources of interference (motors, transformers, contactors etc.).

Accessories: Make sure to use only the accessories recommended by Parker

Connect all cable shields at both ends, ensuring large contact areas!

Warning:

This is a product in the restricted sales distribution class according to EN 61000-6-4. In a domestic area this product can cause radio frequency disturbance, in which case the user may be required to implement appropriate remedial measures.

2. Positioning with IEC61131-3

Compax3F: Electrohydraulic servo drive

Compax3F is another member of the Parker Hannifin servo drive family. Compax3F was especially designed to meet the requirements of electrohydraulic systems for the control of position and force of hydraulic axes.

Compax3 Fluid – (Hydraulics controller)

Technical data

Motion control with motion profiles, suitable for position and force/pressure control for up to 2 axes.

Command value generator

- Jerk-limited ramps.
- Travel data in increments, mm, inch.
- Specification of speed, acceleration, delay and jerk factor.
- Force/pressure data in N, bar, psi.

Monitoring functions

- Voltage range.
- Following error monitoring.
- Hard and Software limit switch

Technology functions of servo controllers

- IEC61131-3 programs in the servo controller (T30)
- Cam function in the servo controller (T40)

IEC 61131-3 Programming

Due to its high functionality, Compax3 in the version “IEC 61131-3 - Positioning with function modules based on PLCopen” forms an ideal basis for many applications in high-performance motion automation.
A standard with general applicability was created with Standard IEC 61131-3. The programming system is equipped with a series of functions in addition to the compliant editor. The Motion Control functions specified in PLCopen are also provided by Parker as a library with the device and control software.

The graphical program editor supports the following functions:

- Ladder diagram
- Function block diagram (structurally-guided)
- Function block diagram (free graphical editor)

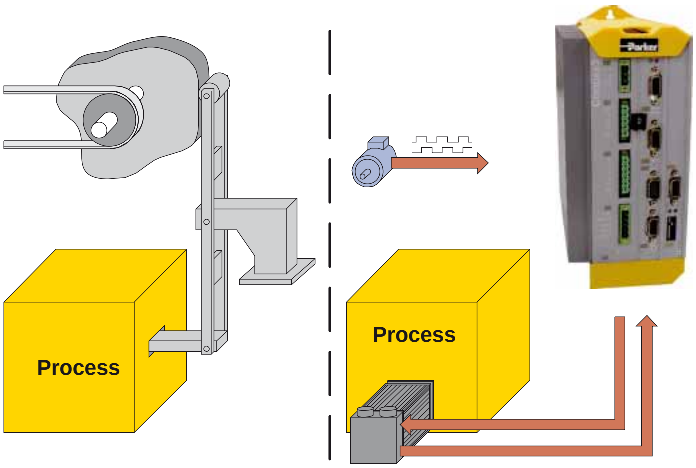
The text-oriented editor supports programming in

- Instruction list
- Structured text

Programming of Compax3 based on IEC 61131-3 is also made considerably easier by a series of additional functions. This includes in particular Syntax Coloring, multi-level undo/redo and context-sensitive input help.

Cam control T40

Rising rationalization pressure and an increasing degree of automation in process engineering demand modern and flexible drive concepts. The introduction of digital and communicating control devices was an important step towards the decentralization of control and regulation tasks. An increasing number of mechanical construction components can be replaced by programmable servo drives.



In particular mechanical cam switching mechanisms and discontinuous shafts maintained until today their fields of application in many areas of machine construction. Mechanical cam switching mechanisms offer, besides complex motion profiles, a high positioning accuracy and rigid coupling between master and slave drive. Their drawbacks are, however, the long changeover times and the limitation to a defined profile.
In this respect the Compax3 T40 electronic cam offers considerable time advantages, above all when changing between small batch sizes or with a wide range of products. The decentralization of the drive performance can reduce size, costs and maintenance effort considerably.
The switching command between different motion profiles takes only seconds – no fitter or wrench is required.
Large, mechanically coupled drive systems can be divided into small, independent drives. The dynamic and stationary behavior of every drive can be individually set and optimized.
Compax3 is able to simulate mechanical cams and cam switching mechanisms electronically.
This helps to realize discontinuous material supply, flying knife and similar drive applications with distributed drive performance.
The compact servo controller processes the signals of a master axis and controls a servo drive via the desired motion profile, which is defined in the form of an interpolation point memory.
The cam function modules (T40) and the CamDesigner make it easy to launch cam applications in the IEC program:

Interfaces with superordinate controllers

Independent of your motion automation you can access Compax3 externally via different interfaces (e.g. with the superordinate control):

- via RS232 / RS485
- via digital Inputs/Outputs (Interface I11)
- via Profibus (Interface I20)
- via CANopen (Interface I21)

Profibus (I20 - functions)

The higher-level control system communicates with Compax3 via Profibus.
A number of different cyclic transfer telegrams (which can be conveniently adjusted with the Compax3 ServoManager) can be used to adjust bus communication to the requirements of specific applications.
In addition to the cyclic data channel, parameter access is also possible via a DPV1 master or using the parameter channel with a DPV0 master.

CANopen (I21 - functions)

The higher level control system communicates with Compax3 via CANopen.
Via various cyclic process data objects (which can be comfortably set with the Compax3 ServoManager) the bus communication can be adapted to the application requirements.
Apart from the cyclic process data objects, acyclic parameter access is possible via service data objects.

DeviceNet (I22 functions)

The higher level control system communicates with Compax3 via DeviceNet.
Cyclic I/O messages (which can be conveniently adjusted with the Compax3 ServoManager) can be used to adjust bus communication to the requirements of specific applications.
Besides the cyclic data, acyclic access to objects is possible via Explicit Messges.

Compax3 control technology

High-performance control technology and openness for various sender systems are fundamental requirements for a fast and high-quality automation of movement.

Model / standards / auxiliary material

The structure and size of the device are of considerable importance. Powerful electronics is an important feature which made it possible to manufacture the Compax3F so small and compact. All connectors are located on the front of the Compax3.
The Compax3 is CE-conform.
The intuitive user interface familiar from many applications, together with the oscilloscope function, wizards and online help, simplifies making and modifying settings via the PC.
The optional **Operator control module (BDM01/01 (see page 435))** for Compax3 makes it possible to exchange devices quickly without requiring a PC.

Configuration

Configuration is made on a PC using the Compax3 ServoManager.
General proceeding

3. Compax3F device description

In this chapter you can read about:

3.1 State of delivery

Compax3 is delivered without configuration!
After switching on the 25VDC supply, the red LED is flashing while the green LED is dark.
Please configure the device with the help of the Windows-Software ”Compax3 – ServoManager”!

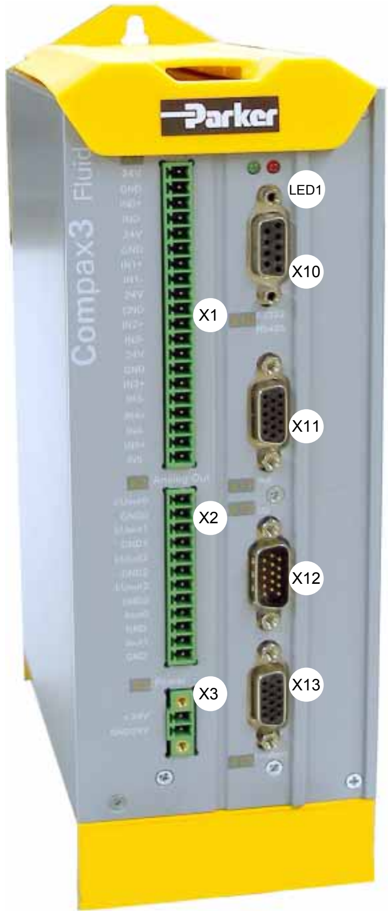
3.2 Plug and connector assignment Compax3 Fluid

In this chapter you can read about:

3.2.1. Meaning of the front panel LEDs (via X10)

status	LED red	LED green
Voltages missing.	off	off
While booting.	alternately flashing	
No configuration present. Compax3 IEC61131-3 program not compatible with Compax3 Firmware. no Compax3 IEC61131-3 program.	flashing	off
Axis(es) blocked.	off	Flashes slowly
Axis(es) enabled.	off	on
Axis in fault status / fault present.	on	off

3.2.2. Plug and connector assignment

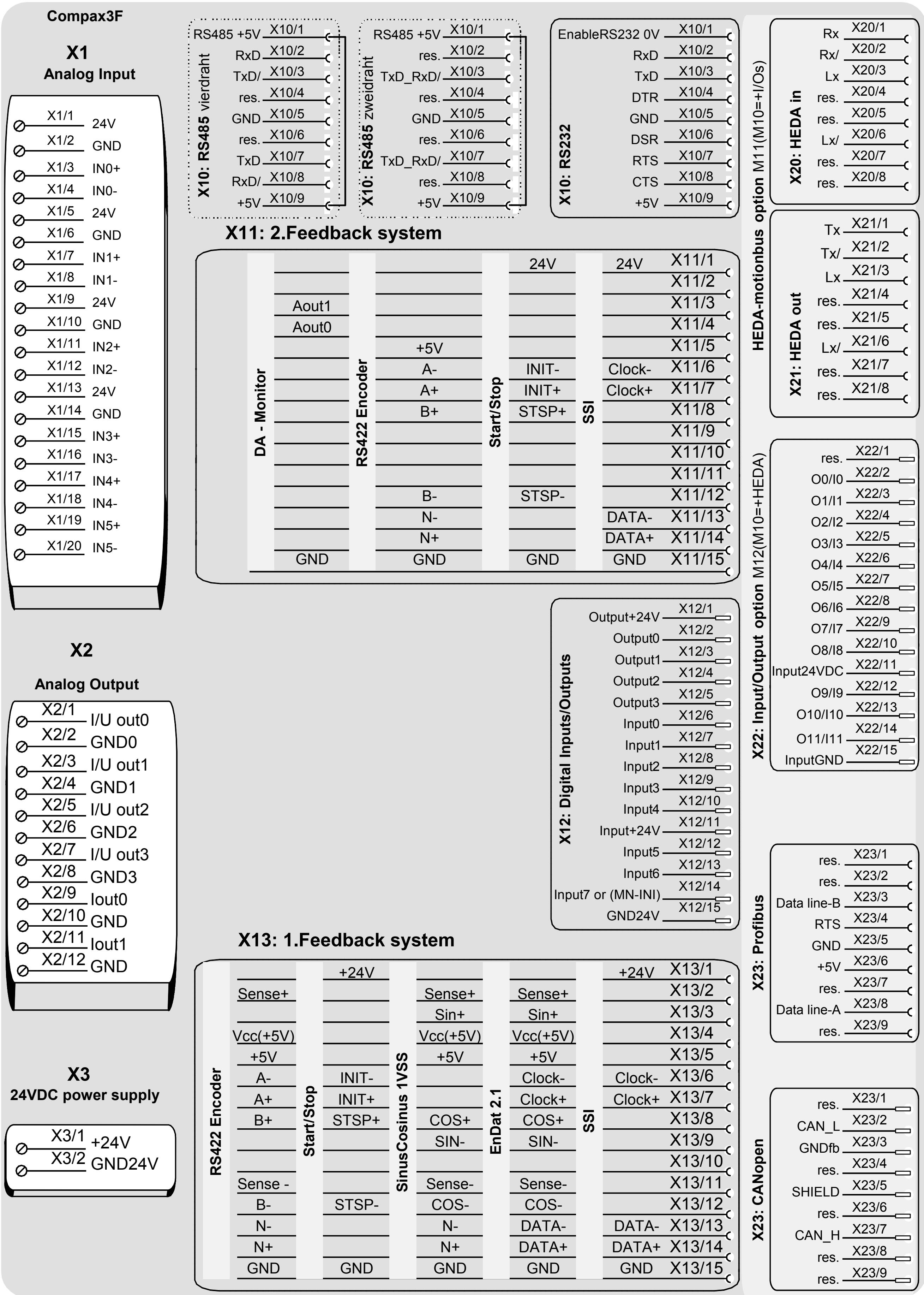


X1	Analog Inputs
X2	Analog Outputs
X3	24 VDC power supply
X10	RS232/RS485
X11	2. Feedback Type
X12	Inputs/Outputs
X13	1. Feedback Type

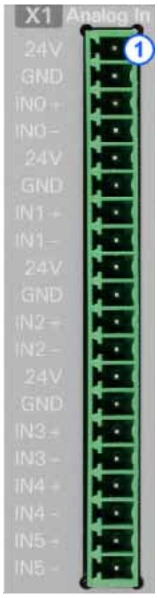
Always switch devices off before wiring them!

3.2.3. Plug and connector assignment complete

In detail: The fitting of the different plugs depends on the extension level of Compax3.
In part, the assignment depends on the Compax3 option implemented.


Compax3F
X1
Analog Input
X1/1 24V
X1/2 GND
X1/3 IN0+
X1/4 IN0-
X1/5 24V
X1/6 GND
X1/7 IN1+
X1/8 IN1-
X1/9 24V
X1/10 GND
X1/11 IN2+
X1/12 IN2-
X1/13 24V
X1/14 GND
X1/15 IN3+
X1/16 IN3-
X1/17 IN4+
X1/18 IN4-
X1/19 IN5+
X1/20 IN5-
X2
Analog Output
X2/1 I/U out0
X2/2 GND0
X2/3 I/U out1
X2/4 GND1
X2/5 I/U out2
X2/6 GND2
X2/7 I/U out3
X2/8 GND3
X2/9 Iout0
X2/10 GND
X2/11 Iout1
X2/12 GND
X3
24VDC power supply
X3/1 +24V
X3/2 GND24V
X10: RS485 vierdraht
RS485 +5V X10/1
RxD X10/2
TxD/ X10/3
res. X10/4
GND X10/5
res. X10/6
TxD X10/7
RxD/ X10/8
+5V X10/9
X10: RS485 zweidraht
RS485 +5V X10/1
res. X10/2
TxD_RxD/ X10/3
res. X10/4
GND X10/5
res. X10/6
TxD_RxD/ X10/7
res. X10/8
+5V X10/9
X10: RS232
EnableRS232 0V X10/1
RxD X10/2
TxD X10/3
DTR X10/4
GND X10/5
DSR X10/6
RTS X10/7
CTS X10/8
+5V X10/9
X11: 2.Feedback system
DA - Monitor
RS422 Encoder
Start/Stop
SSI
24V 24V X11/1
X11/2
Aout1 X11/3
Aout0 X11/4
+5V X11/5
A- INIT- Clock- X11/6
A+ INIT+ Clock+ X11/7
B+ STSP+ X11/8
X11/9
X11/10
X11/11
B- STSP- X11/12
N- DATA- X11/13
N+ DATA+ X11/14
GND GND GND GND X11/15
X12: Digital Inputs/Outputs
Output+24V X12/1
Output0 X12/2
Output1 X12/3
Output2 X12/4
Output3 X12/5
Input0 X12/6
Input1 X12/7
Input2 X12/8
Input3 X12/9
Input4 X12/10
Input+24V X12/11
Input5 X12/12
Input6 X12/13
Input7 or (MN-INI) X12/14
GND24V X12/15
X13: 1.Feedback system
RS422 Encoder
Start/Stop
SinusCosinus 1VSS
EnDat 2.1
SSI
+24V +24V X13/1
Sense+ Sense+ Sense+ X13/2
Sin+ Sin+ X13/3
Vcc(+5V) Vcc(+5V) Vcc(+5V) X13/4
+5V +5V +5V X13/5
A- INIT- Clock- Clock- X13/6
A+ INIT+ Clock+ Clock+ X13/7
B+ STSP+ COS+ COS+ X13/8
SIN- SIN- X13/9
X13/10
Sense - Sense- Sense- X13/11
B- STSP- COS- COS- X13/12
N- N- DATA- DATA- X13/13
N+ N+ DATA+ DATA+ X13/14
GND GND GND GND GND X13/15
HEDA-motionbus option M11(M10=+I/Os)
X20: HEDA in
Rx X20/1
Rx/ X20/2
Lx X20/3
res. X20/4
res. X20/5
Lx/ X20/6
res. X20/7
res. X20/8
X21: HEDA out
Tx X21/1
Tx/ X21/2
Lx X21/3
res. X21/4
res. X21/5
Lx/ X21/6
res. X21/7
res. X21/8
X22: Input/Output option M12(M10=+HEDA)
res. X22/1
O0/I0 X22/2
O1/I1 X22/3
O2/I2 X22/4
O3/I3 X22/5
O4/I4 X22/6
O5/I5 X22/7
O6/I6 X22/8
O7/I7 X22/9
O8/I8 X22/10
Input24VDC X22/11
O9/I9 X22/12
O10/I10 X22/13
O11/I11 X22/14
InputGND X22/15
X23: Profibus
res. X23/1
res. X23/2
Data line-B X23/3
RTS X23/4
GND X23/5
+5V X23/6
res. X23/7
Data line-A X23/8
res. X23/9
X23: CANopen
res. X23/1
CAN_L X23/2
GNDfb X23/3
res. X23/4
SHIELD X23/5
res. X23/6
CAN_H X23/7
res. X23/8
res. X23/9

3.2.4. Analog Input (plug X1)



Connector X1 Pin	Description	Combicon 3,81mm; female connector
1	24V	Supply Sensor 0
2	GND	Supply Sensor 0
3	IN0+	Signal Sensor 0 +
4	IN0-	Signal Sensor 0 -
5	24V	Supply Sensor 1
6	GND	Supply Sensor 1
7	IN1 +	Signal Sensor 1 +
8	IN1 -	Signal Sensor 1 -
9	24V	Supply Sensor 2
10	GND	Supply Sensor 2
11	IN2 +	Signal Sensor 2 +
12	IN2 -	Signal Sensor 2 -
13	24V	Supply Sensor 3
14	GND	Supply Sensor 3
15	IN3 +	Signal Sensor 3 +
16	IN3-	Signal Sensor 3 -
17	IN4+	+/-10V Input 4
18	IN4-	+/-10V Input 4
19	IN5+	+/-10V Input 5
20	IN5-	+/-10V Input 5

Requirement: Connection cable

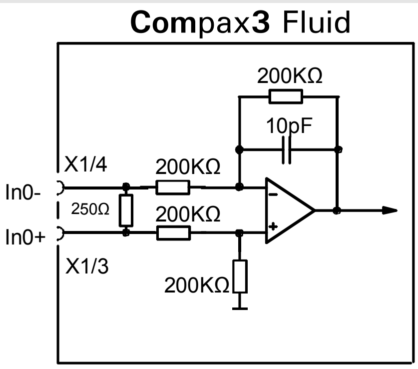
Use shielded cables.

Shield connection of the cables

The cable should be fully screened and connected to the Compax3 housing. We offer a special **Shield connecting terminal** (see page 432) as accessory item (ZBH./...).

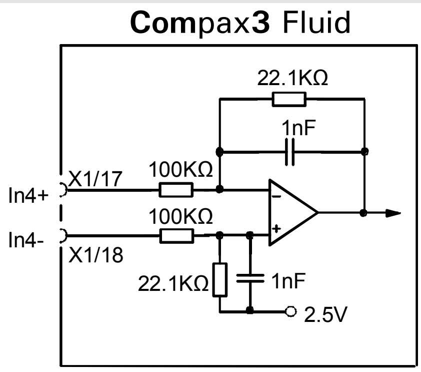
3.2.4.1 Wiring of the analog inputs

Input IN0



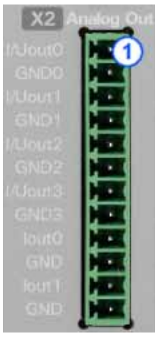
IN0 to IN3 do have the same wiring!
Pin assignment (see page 25) X1

Input IN4



IIN4 and IN5 (X11/19 and X11/20) have the same wiring!

3.2.5. Analog Output (plug X2)



Plug X2 Pin	Description	Combicon 3,81mm; female connector
1	I/U Aout0	±10V/10mA or 4..20mA
2	GND 0	
3	I/U Aout1	±10V/10mA or 4..20mA
4	GND 1	
5	I/U Aout2	±10V/10mA or 4..20mA
6	GND 2	
7	I/U Aout3	±10V/10mA or 4..20mA
8	GND 3	
9	Iout 0	+/-100mA current output 0
10	GND	
11	Iout 1	+/-100mA current output 1
12	GND	

Terminating resistor:
Voltage +/-10V: ≥ 1000Ω
Current 4..20mA: ≤ 600Ω
Current 100mA: ≤ 100Ω
All outputs are short-circuit proof.

Requirement: Connection cable

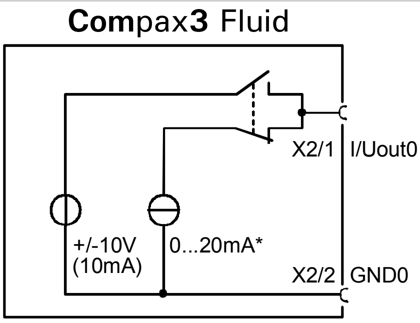
Use shielded cables.

Shield connection of the cables

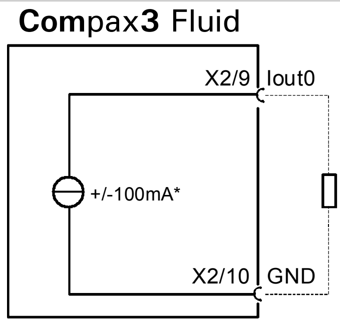
The cable should be fully screened and connected to the Compax3 housing. We offer a special **Shield connecting terminal** (see page 432) as accessory item (ZBH./...).

3.2.5.1 Wiring of analog outputs

Output I/U Aout0	**Output Iout0**



* 20mA to max. 450Ω



* at RL<=180Ω

Aout0 to Aout3 do have the same wiring!
Pin assignment (see page 26) X2

Iout0 and Iout1 (X2/11 and X2/12) have the same wiring!

3.2.6. Voltage supply (plug X3)

Connector X3 Pin	Description	Combicon 5mm
1	+24 V	24 VDC (power supply)
2	Gnd 24 V	GND

Voltage supply 24VDC

Controller type	Compax3 F001 D2
Voltage range	21 - 27VDC
Mains module	with switch-on current limitation, due to capacitive load
Fuse	MTP miniature circuit breaker or "delayed action fuse", due to capacitive load
Current drain of the device	0.8A (max. 1.5A)
Total current drain	0.8A + total load of the digital outputs
Ripple	<1Vss
Requirement according to safe extra low voltage (SELV)	yes

3.2.7. RS232 / RS485 interface (plug X10)

Interface selectable by contact functions assignment of X10/1:
X10/1=0V RS232
X10/1=5V RS485

PIN X10	RS232 (Sub D)
1	(Enable RS232) 0V
2	RxD
3	TxD
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	+5V

RS485 2-wire

PIN X10	RS485 two wire (Sub D) Pin 1 and 9 jumpered externally
1	Enable RS485 (+5V)
2	res.
3	TxD_RxD/
4	res.
5	GND
6	res.
7	TxD_RxD
8	res.
9	+5V

RS485 4-wire

PIN X10	RS485 four wire (Sub D) Pin 1 and 9 externally jumpered
1	Enable RS485 (+5V)
2	RxD
3	TxD/
4	res.
5	GND
6	res.
7	TxD
8	RxD/
9	+5V

USB - RS232/RS485 converter

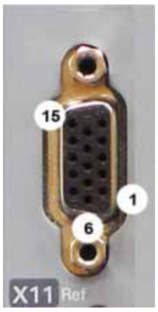
The following USB - RS232 converters were tested:

- ATEN UC 232A
- USB GMUS-03 (available under several company names)
- USB / RS485: **Moxa Uport 1130** http://www.moxa.com/product/UPort_1130.htm
- Ethernet/RS232/RS485: **NetCom 113** http://www.vscom.de/666.htm

3.2.8. Analog / Encoder (plug X11)

The following position sensors can be connected via X11:

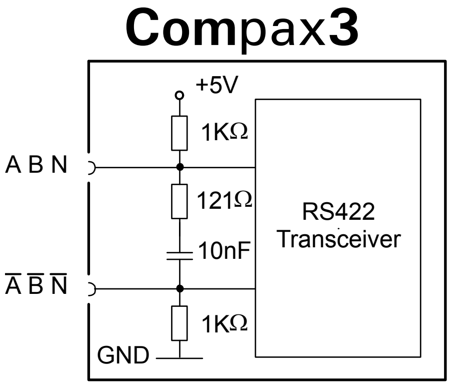
- RS422 Encoder (max. 5MHz, or Step/Direction)
- SSI (RS422)
- Start / Stop (Time of Flight, RS422)



2. Feedback system / X11 High Density /Sub D				
PIN	**D-A Monitor**	**RS422 Encoder**	**Start / Stop (Time of Flight)**	**SSI**
1			+24V max. 100mA	+24V max. 100mA
2				
3	Aout1			
4	Aout0			
5		+5V (for encoder) max. 150mA		
6		A-	INIT-	Clock-
7		A+	INIT+	Clock+
8		B+	STSP+	
9				
10				
11				
12		B-	STSP-	
13		N-		DATA-
14		N+		DATA+
15	GND	GND	GND	GND

Max. start/stop time is 1.6ms (over 4.15m).

3.2.8.1 Connections of the encoder interface



The input connection is available in triple (for A & /A, B & /B, N & /N)

3.2.9. Digital inputs/outputs (plug X12)

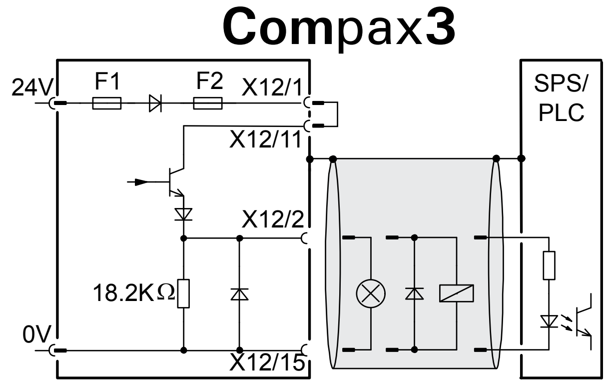
X12 Pin	Input/output	I/O /X12 High density/Sub D
1	Output	+24VDC output (max. 340mA)
2	O0	Output 0 (max. 100mA)
3	O1	Output 1 (max. 100mA)
4	O2	Output 2 (max. 100mA)
5	O3	Output 3 (max. 100mA)
6	I0	Input 0
7	I1	Input 1
8	I2	Input 2
9	I3	Input 3
10	I4	Input 4
11	E	24V input for the digital outputs Pins 2 to 5
12	I5	Input 5
13	I6	Input 6
14	I7	Input 7
15	Output	Gnd 24 V

All inputs and outputs have 24V level.
The exact assignment depends on the the device type!
You will find the description of the device-specific assignment in the online help which can be opened from the Compax3 – ServoManager.

Maximum capacitive loading of the outputs: 50nF (max. 4 Compax3 inputs).

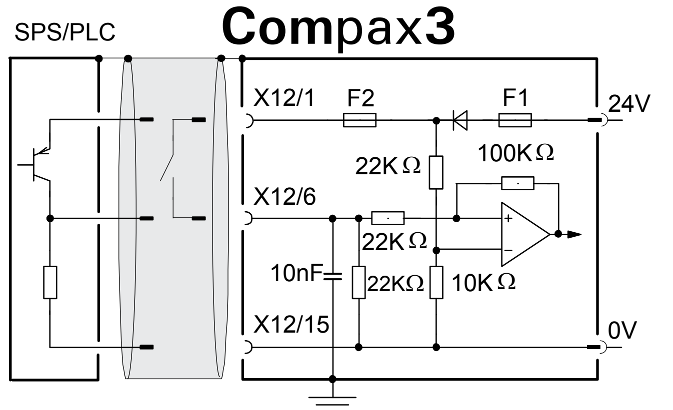
3.2.9.1 Connection of the digital Outputs/Inputs

Wiring of digital outputs



The circuit example is valid for all digital outputs!
The outputs are short circuit proof; a short circuit generates an error.

Status of digital inputs



The circuit example is valid for all digital inputs!
Signal level:

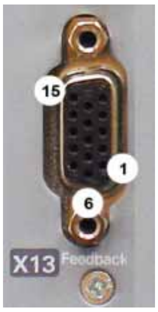
- > 9.15V = "1" (38,2% of the control voltage applied)
- > 8.05V = "0" (33.5% of the control voltage applied)

F1: delayed action fuse
F2: quick action electronic fuse; can be reset by switching the 24VDC supply off and on again.

3.2.10. Feedback (connector X13)

The following position sensors can be connected via X13:

- 1VSS SineCosine (max. 400Hz)
- RS422 Encoder (max. 5MHz, or Step/Direction)
- SSI (RS422)
- Start / Stop (Time of Flight, RS422)
- EnDat2.1



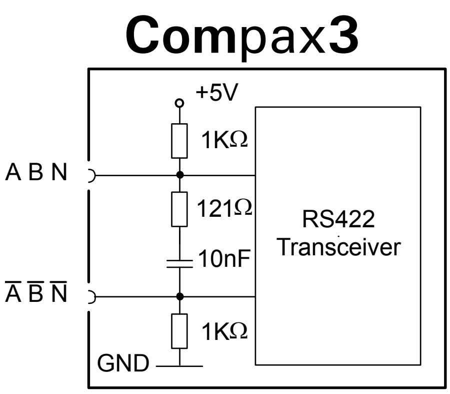
1. Feedback system / X13 High Density /Sub D					
PIN	**RS422 Encoder**	**SinusCosinus 1VSS**	**EnDat 2.1**	**Start / Stop (Time of Flight)**	**SSI**
1				+24V max. 100mA	+24V max. 100mA
2	Sense +	Sense +	Sense +		
3		Sin +	Sin +		
4	Vcc +5V (controlled on the encoder side)	Vcc +5V (controlled on the encoder side)	Vcc +5V (controlled on the encoder side)		
5	+5V (for encoder) max. 150mA	+5V	+5V		
6	A-		Clock-	INIT-	Clock-
7	A+		Clock+	INIT+	Clock+
8	B+	COS+	COS+	STSP+	
9		SIN-	SIN-		
10					
11	Sense -	Sense -	Sense -		
12	B-	COS-	COS-	STSP-	
13	N-	N-	DATA-		DATA-
14	N+	N+	DATA+		DATA+
15	GND	GND	GND	GND	GND

Max. start/stop time is 1.6ms (over 4.15m).

Note on F12:

+5V (Pin 4) is measured and controlled directly at the end of the line via Sense – and Sense +.
Maximum cable length: 100m
Caution! Pin 4 and Pin 5 must under no circumstances be connected!

3.2.10.1 Connections of the encoder interface



The input connection is available in triple (for A & /A, B & /B, N & /N)

3.2.11. Profibus connector X23 with Interface I20

Pin X23	Profibus (Sub D)
1	Reserved
2	Reserved
3	Data line B
4	RTS
5	GND
6	+5V
7	Reserved
8	Data line A
9	Reserved

The assignment corresponds to Profibus standard EN 50170.
Wiring (see page 451).

3.2.11.1 Adjusting the bus address

Address setting

Values:

1: 2^0; **2:** 2^1; **3:** 2^2; ... **7:** 2^6; **8:** reserved

Settings:

left: OFF
right: ON
(The address is set to 0 in the illustration to the left)

Range of values: 1 ...127

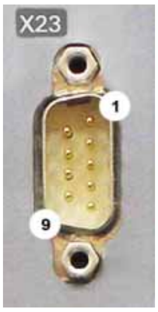
Address 0 is set internally to address 126.

3.2.11.2 Function of the Bus LEDs

Meaning of the LEDs (under X23)

Green LED (left)	Red LED (right)	Description
alternately flashing		Field bus program missing
off	flashing	Device is not initialized
on	flashing	Bus operation mode (no DATA exchange)
on	off	Bus operation mode (DATA exchange)
on	on	Bus error

3.2.12. CANopen connector X23 Interface I21



Pin X23	CANopen (Sub D)	
1	Reserved	
2	CAN_L	CAN Low
3	GNDfb	Opto-isolated GND-supply
4	Reserved	
5	SHIELD	Shield optional
6	Reserved	
7	CAN_H	CAN High
8	Reserved	
9	Reserved	

The assignment corresponds to CANopen DS301.
At the beginning and end of the device chain a terminating resistor of 120Ω is required between CAN_L and CAN_H
Wiring (see page 452).

3.2.12.1 Adjusting the bus address

Address setting

Values:

1: 2^0; **2:** 2^1; **3:** 2^2; ... **7:** 2^6; **8:** reserved

Settings:

left: OFF
right: ON
(The address is set to 0 in the illustration to the left)

Range of values: 1 ...127

Address 0 is set internally to address 126.

3.2.12.2 Function of the Bus LEDs

LED red

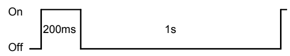
No.	Signal	Status	Description
1	**off**	No Error	The bus is operating
2	**Single flash**	Warning	at least one of the error counters of the CAN controller has reached the warning level.
3	**Double flash**	Error	Node Guarding Error
4	**Triple flash**	Error	Sync Error Buffer overflow (0x8110)
5	**on**	Bus not active	

If several errors occur at once, the error with the most significant number is reported.

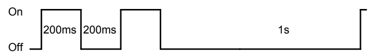
LED green

Signal	Status	Description
Single flash	Stop	The bus is in STOPPED state
blinks (permanently)	pre-operational	The bus is ready to operate (Pre-Operational)
on	operational	The bus is operating (operational)

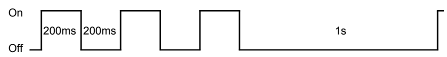
Single flash



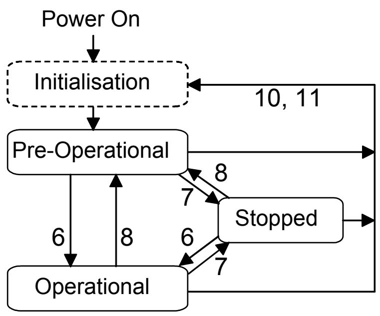
Double flash



Triple flash



CANopen states



6: Start Remote Node
7: Stop Remote Node
8: Enter Pre-Operational State
10: Reset Node
11: Reset Communication
The "Initialization" state is no fixed state but only a transition state.

3.2.13. DeviceNet connector X23

Pin X23	DeviceNet (Open Plug Phoenix MSTB 2.5/5-GF5.08 ABGY AU)	
1	V-	Mass
2	CAN-	CAN Low
3	Shield	Shield
4	CAN+	CAN High
5	V+	not required, internal supply

A mating plug is included in the delivery.
If Compax3 is used as first or last device in the fieldbus network, a terminal resistance of 121 Ω is required. This is integrated between Pin 2 and Pin 4.
Additional information on the DeviceNet wiring can be found under **www.odva.org** http://www.odva.org.
Please do also heed the instructions in the DeviceNet master manual.

3.2.13.1 Adjusting the bus address

Address setting (NA: Node Address)

Values:

1: 2^0; **2:** 2^1; **3:** 2^2; ... **6:** 2^5reserved

Settings:

left: OFF
right: ON
(The address is set to 2 in the illustration)

Range of values: 1 ... 63

Address 0 is set internally to address 63.

Data Rate setting (DR):

Data Rate [kBit/s]	S24_7	S24_8
125	left: OFF	left: OFF
250	left: ON	right: OFF
500	right: OFF	left: ON
Reserved	right: ON	right: ON

Bear in mind that the maximum cable length depends on the Data rate:

Data Rate	Maximum length
500kbit/s	100m
250kbit/s	250m
125kbit/s	500m

3.2.13.2 Function of the Bus LEDs

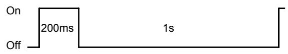
LED (red)

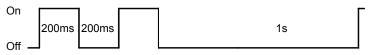
No.	Signal	Status	Description
1	**off**	No Error	The bus is operating
2	**Single flash**	Warning	at least one of the error counters of the CAN controller has reached the warning level.
3	**Double flash**	Error	Communication Fault
4	**Triple flash**	Error	Double Mac ID
5	**on**	Error	Bus Off

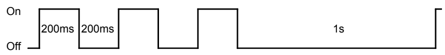
If several errors occur at once, the error with the most significant number is reported.

LED green

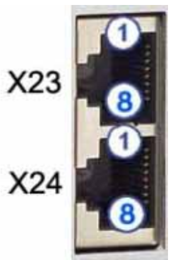
Signal	Status	Description
Single flash	On-line Not Connected	Online, not at the master (not allocated)
blinks (permanently)	On-line Connected	Online, at the master (allocated)
on	On-line I/O Connected	I/O Messages allocated

Single flash


Double flash


Triple flash


3.2.14. Ethernet Powerlink (Option I30) / EtherCAT (option I31) X23, X24



	RJ45 (X23)	RJ45 (X24)
PIN	in	out
1	Tx +	Tx +
2	Tx -	Tx -
3	Rx +	Rx +
4	-	Reserved
5	-	Reserved
6	Rx -	Rx -
7	-	Reserved
8	-	Reserved

Wiring with Ethernet Crossover cable Cat5e (from X24 to X23 of the next device without termination); for this, we recommend ourl **SSK28** (see page 430, see page 445) interface cable.

Meaning of the RJ45 LEDs (only for Ethernet Powerlink, I30)

Green LED (top): connection established (RPT_LINK/RX)
Yellow LED (bottom): Traffic (exchange of data) (Transmit / Receive Data) (RPT_ERR)

3.2.14.1 Set Ethernet Powerlink (option I30) bus address

Automatic address assignment with EtherCAT

Address setting

Values:

1: 2^0; **2:** 2^1; **3:** 2^2; ... **7:** 2^6; **8:** 2^7

Settings:

left: OFF
right: ON
(The address is set to 0 in the illustration)

Range of values: 1 ... 239

3.2.14.2 Meaning of the Bus LEDs (Ethernet Powerlink)

Red LED (right): Ethernet Powerlink error

LED is influenced by the transitions of the NMT - status diagram (for further details, please refer to the **Ethernet Powerlink Specification** http://www.parker.com/euro_emd/EME/downloads/compax3/EPL/epl2.0-ds-v-1-0-0.pdf)

Error LED	Transition
off => on	NMT_CT11,NMT_GT6,NMT_MT6
on => off	NMT_CT6, NMT_GT2, NMT_CT3, NMT_MT5

Green LED (left): Ethernet Powerlink Status

LED indicates the states of the NMT - status diagram (for further details, please refer to the **Ethernet Powerlink Specification** http://www.parker.com/euro_emd/EME/downloads/compax3/EPL/epl2.0-ds-v-1-0-0.pdf)

Status LED		status
off	off	NMT_GS_OFF, NMT_GS_INITIALISATION, NMT_CS_NOT_ACTIVE / NMT_MS_NOT_ACTIVE
flickering	flickering	NMT_CS_BASIC_ETHERNET
single flash	Single flash	NMT_CS_PRE_OPERATIONAL_1 / NMT_MS_PRE_OPERATIONAL_1
double flash	Double flash	NMT_CS_PRE_OPERATIONAL_2 / NMT_MS_PRE_OPERATIONAL_2
triple flash	Triple flash	NMT_CS_READY_TO_OPERATE / NMT_MS_READY_TO_OPERATE
on	on	NMT_CS_OPERATIONAL / NMT_MS_OPERATIONAL
blinking	flashing	NMT_CS_STOPPED

3.2.14.3 Meaning of the Bus LEDs (EtherCAT)

Red LED (right): EtherCAT error

LED is influenced by the transitions of the status diagram

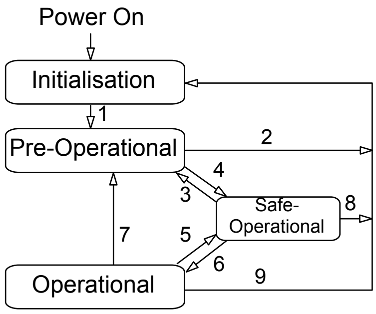
Error LED	Error:	Description
Off	No Error	
Flickering	Boot error	Error during initialization
Blinking	Invalid configuration	
Single Flash	Unsolicited change of status	Slave changed the status independently
Double Flash	Application Watchdog Timeout	Watchdog
On	PDI Watchdog Timeout	

Green LED (left): EtherCAT Status

LED shows the states of the status diagram

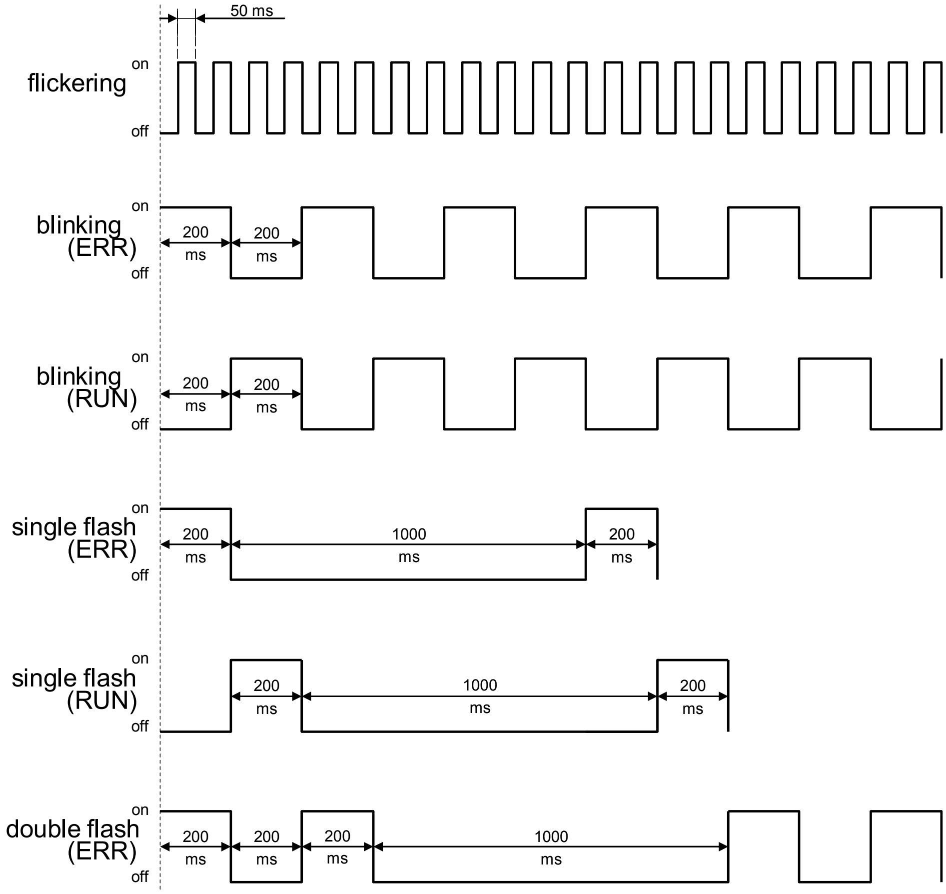
Status LED	status	Description
Off	INITIALIZATION	Initialisation
Blinking	PRE-OPERATIONAL	Ready
Single Flash	SAFE-OPERATIONAL	Master reads values
On	OPERATIONAL	Operation

Status diagram



Transition	Action
1	Start mailbox communication
2	Stop mailbox communication
3	Start input update
4	Stop input update
5	Start output update
6	Stop output update
7	Stop output update, stop input update
8	Stop input update, stop mailbox communication
9	Stop output update, stop input update, stop mailbox communication

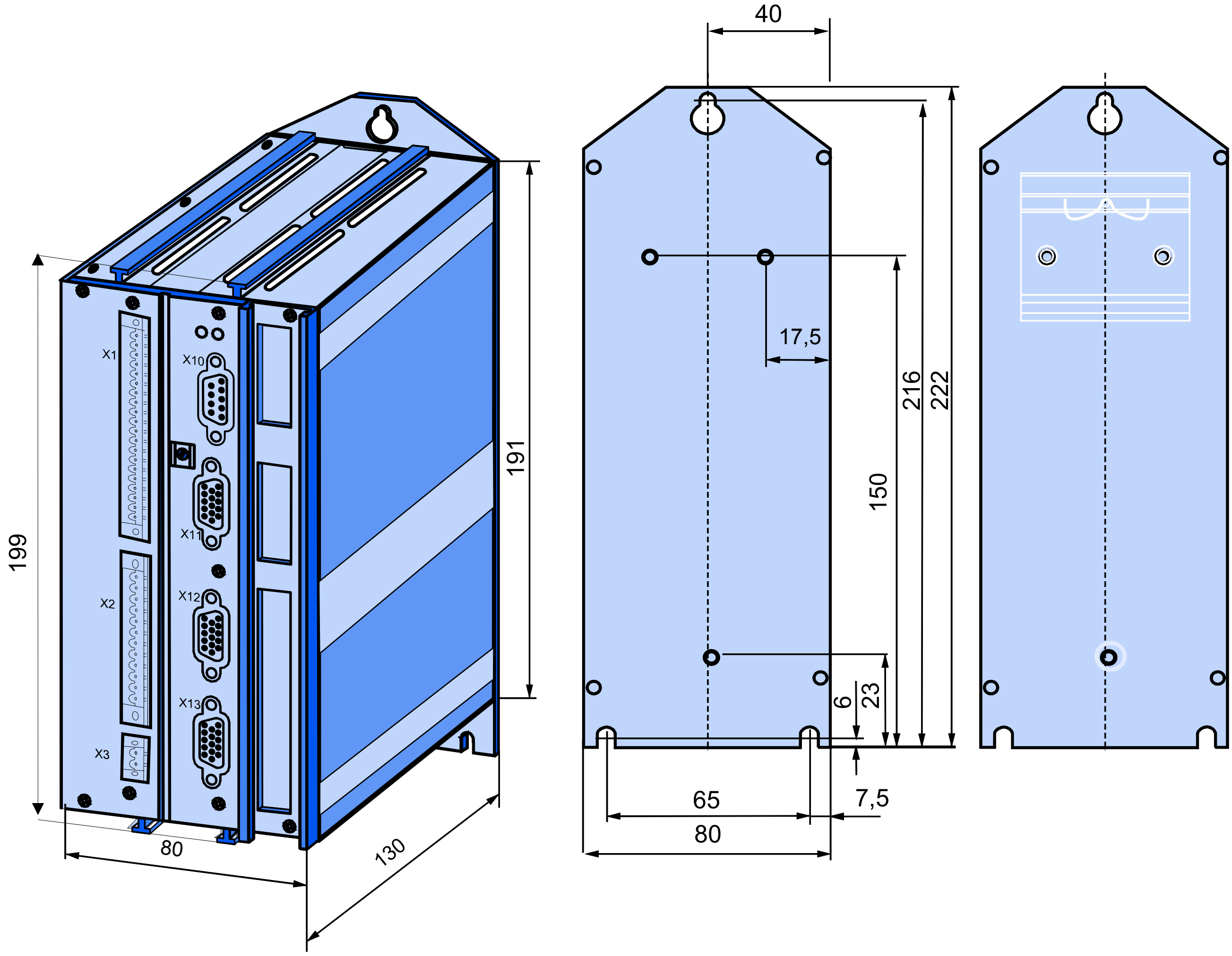
Meaning of the LED states



3.2.15. Mounting and dimensions

Mounting:

- 3 socket head screws M5 or
- by direct snapping on a 35mm supporting rail (according to DIN EN 50 022), Mounting material: DIN rail clip and distance piece available as accessories - **Set ZBH02/04** (see page 432)



Stated in mm

4. Setting up Compax3

In this chapter you can read about:

4.1 Configuration

In this chapter you can read about:

Configuration sequence:

Installation of the C3 ServoManager

The Compax3 ServoManager can be installed directly from the Compax3 DVD. Click on the appropriate hyperlink or start the installation program "C3Mgr_Setup_V.... .exe" and follow the instructions.

PC requirements

Recommendation:

Operating system:	MS Windows XP SP2 / MS Windows 2000 as from SP4 / (MS Vista)
Browser:	MS Internet Explorer 6.x
Processor:	Intel Pentium 4 / Intel Core 2 Duo / AMD Athlon class as from >=2GHz
RAM memory:	>= 1024MB
Hard disk:	>= 20GB available memory
Drive:	DVD drive
Monitor:	Resolution 1024x768 or higher
Graphics card:	on onboard graphics (for performance reasons)
Interface:	USB

Minimum requirements:

Operating system:	MS Windows XP SP2 / MS Windows 2000 as from SP4
Browser:	MS Internet Explorer 6.x
Processor:	>= 1.5GHz
RAM memory:	512MB
Hard disk:	10GB available memory
Drive:	DVD drive
Monitor:	Resolution 1024x768 or higher
Graphics card:	on onboard graphics (for performance reasons)
Interface:	USB

Note:

- For the installation of the software you need administrator authorization on the target computer.
- Several applications running parallelly, reduce the performance and operability.
- especially customer applications, exchanging standard system components (drivers) in order to improve their own performance, may have a strong influence on the communication performance or even render normal use impossible.
- Operation under virtual machines such as Vware Workstation 6/ MS Virtual PC is not possible.
- Onboard graphics card solutions reduce the system performance by up to 20% and cannot be recommended.
- Operation with notebooks in current-saving mode may lead, in individual cases, to communication problems.

Connection between PC - Compax3

Your PC is connected with Compax3 via a RS232 cable (**SSK1** (see page 441)). Cable **SSK1** (see page 441) (COM 1/2-interface on the PC to X10 on the Compax3 or via adapter SSK32/20 on programming interface of Compax3H).
Start the Compax3 servo manager and make the setting for the selected interface in the menu"**Options Communication settings RS232/RS485...**".

Device Selection

In the menu tree under device selection you can read the device type of the connected device (Online Device Identification) or select a device type (Device Selection Wizard).

Configuration

Then you can double click on "Configuration" to start the configuration wizard. The wizard will lead you through all input windows of the configuration.

Input quantities will be described in the following chapters, in the same order in which you are queried about them by the configuration wizard.

4.1.1. C3HydraulicsManager

In this chapter you can read about:

4.1.1.1 Function description

With the aid of the C3Hydraulicsmanager, component databases for

- hydraulic valves (2/2, 3/3, 4/3 valves)
- actors (constant- and differential cylinders, hydromotors)
- Position feedback systems (with SSI-, Start/Stop, +/-10V-, 0..20mA-, RS422, Sine/Cosine- or EnDat2.1 interface)

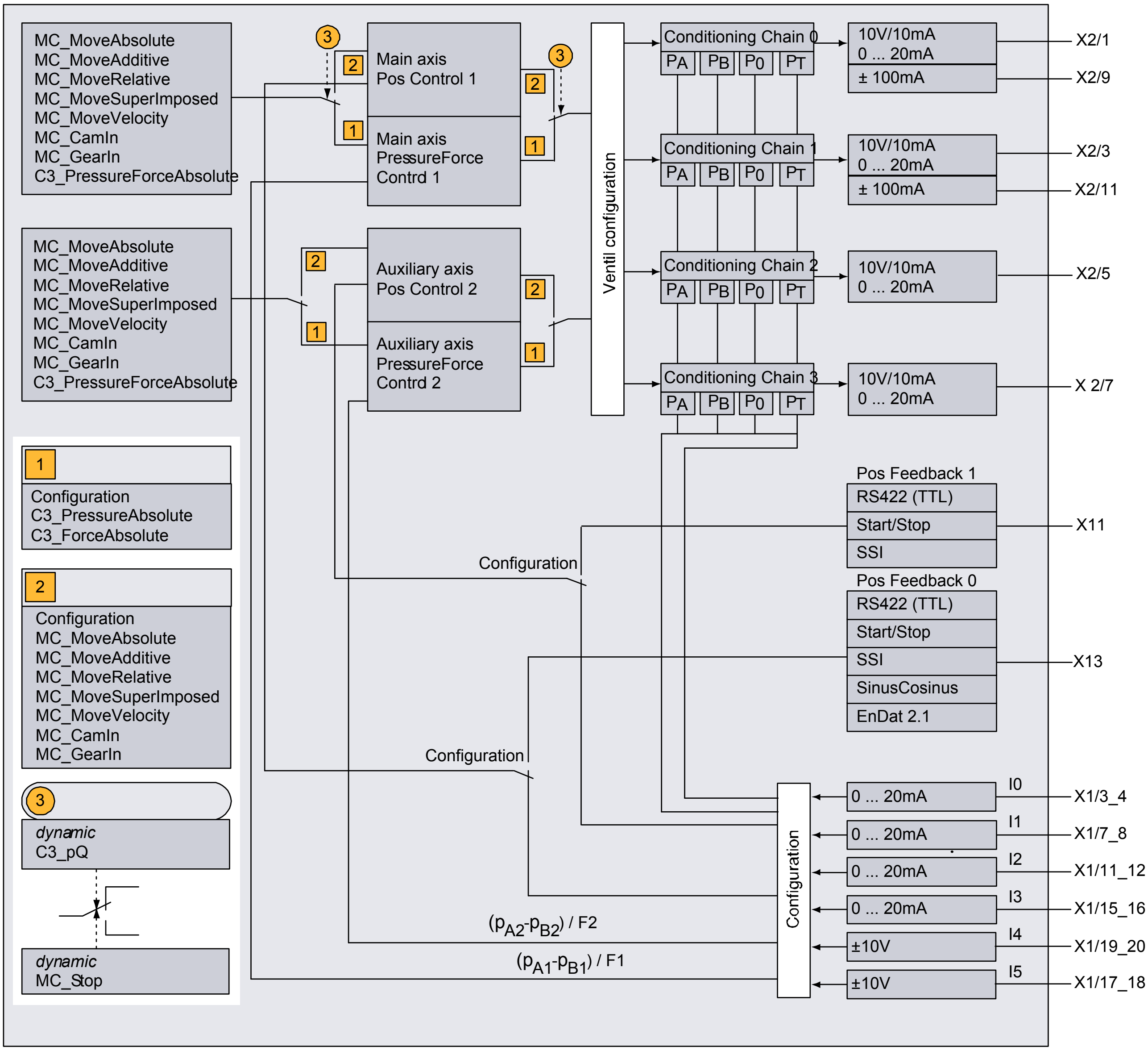
can be created and updated. A distinction is made between customer components and Parker components. Databases with Parker components are already available upon delivery, the customer has furthermore the possibility to create new components from different suppliers in the customer database in order to make possible their operation together with Compax3.
All component data can be called up and printed out. Existing components can be used as templates for new components. A caracteristic with the specific flow rate can be read in and memorized for each valve .
The detailed characterization of the components facilitates the commisisioning of the hydraulic system, as a pre-parameterization of the control loop is effected during the Compax3 configuration with the aid of these characteristic values.
An up-to-date Parker component database can be downloaded from the internet. The customer component databases are not overwritten.

4.1.1.2 Structure of the databases

4 databases contain the data of the hydraulics components.

- Parker valves with characteristics (Valve.mdb)
- Parker actuators and path-measurement systems (CylinderDrive.mdb)
- Customer valves with characteristics (ValveC.mdb)
- Customer actuators and path-measurement systems (CylinderDriveC.mdb)

4.1.2. Compax3F structure image

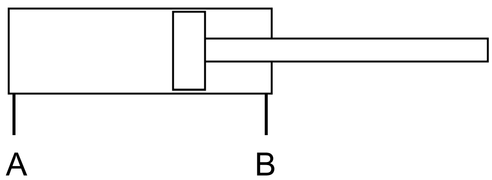


Components of Compax3F:

- 4 controllers for 2 axes
  - Main axis position controller (Main axis: Pos Control 1)
  - Main axis pressure difference / force controller (Main axis: PressureForce Control 1)
  - Auxiliary axis position controller (Auxiliary axis: Pos Control 2)
  - Auxiliary axis pressure difference / force controller (Auxiliary axis: PressureForce Control 2)
- 4 Conditioning Chains for the liearisation of the valves and cylinders
  - The axis assignment is made via the valve configuration (Valve configuration)
  - For the linearisation, pressures can be made available to the Conditioning Chains (fixed or measured pressures: pA, pB, p0, pT).
  - The Conditioning Chains are fixedly connected to the analog outputs.
- Interfaces for actual position values
  - Pos Feedback 2 or configurable analog interface for the auxiliary axis (Configuration switch)
  - Pos Feedback 2 or configurable analog interface for the main axis (Configuration switch)
- 6 analog interfaces for pressures or force (or position)
  - Assignment to the axis via configuration
  - Assignment to the Conditioning Chain via the configuration (axis assignment, valve assignment)
- Setpoint predefinition via IEC61131-3 modules
- Static (1), (2), or dynamic (dynamic) (3) switching via IEC61131-3 modules

4.1.3. Drive configuration

- Please select the number of drives (1 or 2) to be controlled (by open or closed loop) with Compax3F.
- Physical system: Selection of the unit for the force or pressure control
  - The unit for force is Newton and a force is controlled
  - For differential pressure the unit is Bar or PSI (depending on the unit system) and a differential pressure is controlled.
- Unit system: Global selection of units for the entry and display of data
  - Metric (SI): N, Bar, m
  - Imperial (US/UK): N, PSI, inch
- Inversion of the direction: Inverts the direction of movement of the drives.



Definition of the sense of direction (without direction inversion): In positive direction, the cap end (A) of a cylinder is charged with pressure.

4.1.4. Configuring drive1

In this chapter you can read about:

4.1.4.1 Position feedback system drive1

If the position feedback system is part of the cylinder / motor, it has already been parameterized in the C3HydraulicsManager and this step is not needed.
Parameterizing a position feedback system:

General entries for each position feedback system:

- Inversion of the direction: Inverts the sense of direction.
- Rotatory position feedback system?

'EnDat (no further entries)

Sine cosine & RS422 encoder

- Resolution in µm / bit

SSI:

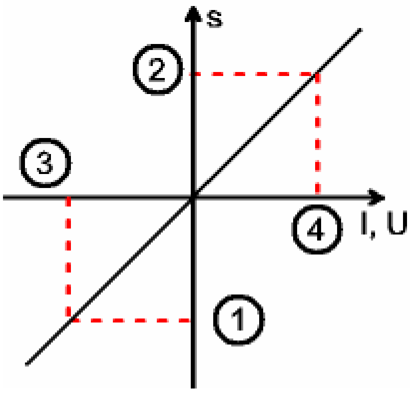
- Resolution in µm / bit
- Update rate: Necessary updating time of the actual value in µs.
- Word length: Gives the telegram length of the sensor.
- Gray code: Sensor gray code coded yes/no.
- Synchronous system: Sensor sends data synchronously to Compax3F step yes/no
- Baud rate/step: Max. transmission rate of the path measurement system.

Start-Stop:

- Velocity of sound: Speed, at which the mechanical wave moves within the range of the wave guide (e.g. 2830 m/s).
- Update rate: Necessary updating time of the actual value in µs.

Analog:

- Selection of the C3f analog interface



- (2) - (1): Length path measurement system.
- (3): Minimum signal of the path measurement system.
- (4): Maximum signal of the path measurement system.

4.1.4.2 Cylinder / motor selection

The selection is made from the hdydraulics database.
Parker cylinders or Parker motors are stored there.
Furthermore you can create customer-specific cylinders/motors with the aid of the C3HydraulicsManager and then select them here.
The selection of the drive is separated as follows:

- Parker Cylinder
- Customer cylinders.

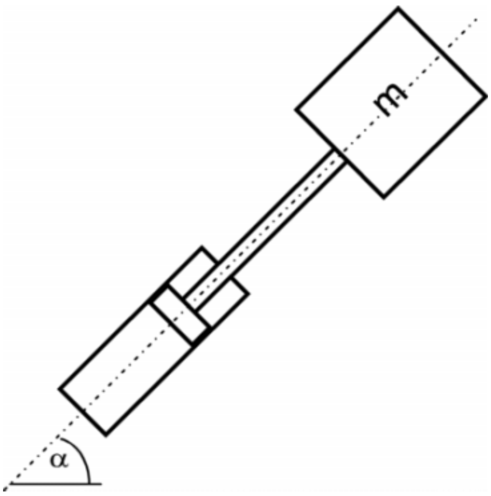
Cylinder / motor data from the hydraulics database

A cylinder / motor can be created in the hydraulics database with or without position feedback system.

4.1.4.3 Load configuration drive1

In order to make the settings of the servo controller, information on the external load is needed. The more accurately the load of the system is known, the better is the stability and the shorter is the settle-down time of the control loop. It is important to specify the minimum and maximum external load for best possible behavior under varying loads.

- With rotatory drives: as minimum and maximum external moment of inertia.
- With linear drives: as minimum and maximum external mass.
- With a fixed load, minimum = maximum load or moment is entered.
- Installation position for linear drives:
  The installation position is entered as an angle. For an upright load upwards, the installation position is 90°.



- Stroke length for linear drives:
  This value is not stored in the hydraulics database.

4.1.5. Configuring drive2

The following dialogs can only be selected, if under "number of drives" 2 drives were selected.
Drive2 is configured as described under drive1, the selection of the path measurement system EnDat and Sine/Cosine is however not available for drive2.

Select operating mode (only applies for Compax3 T30 and T40; not for Compax3 Ixx11)

The possible operating mode of the auxiliary axis depends on the operating mode set for the main axis

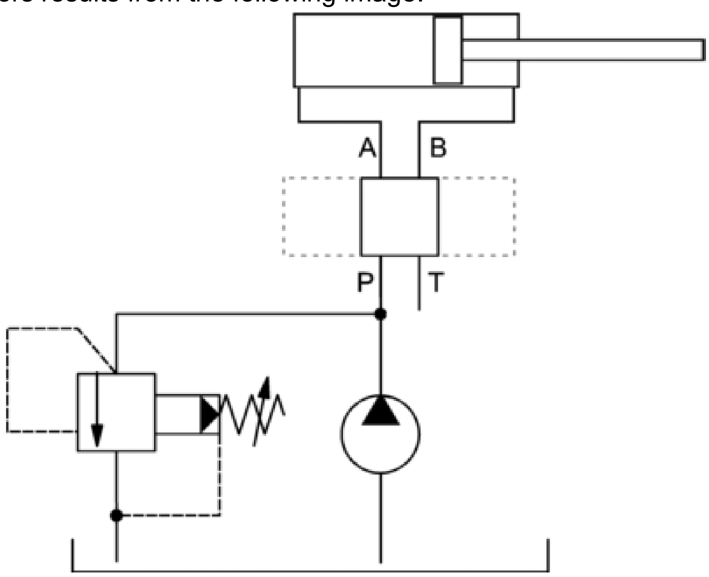
Main axis operating mode	Possible operating mode of the auxiliary axis
Pressure/Force Controller	Pressure/Force Controller
Positioning & Pressure/Force Controller	Positioning & Pressure/Force Controller or Pressure/Force Controller

4.1.6. Sensors

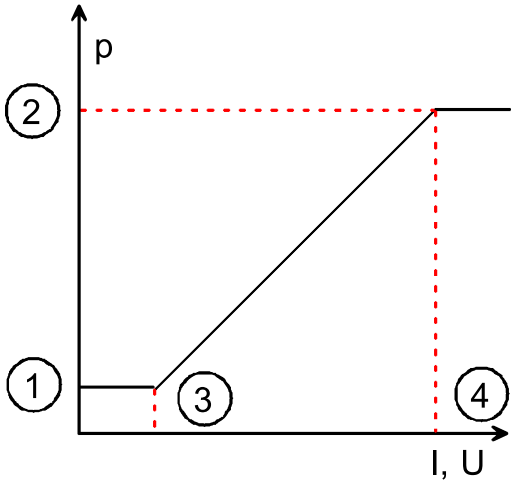
Force or pressure sensors are req uired for the control of force or pressure.
Altogether 6 analog inputs are available for the integration of the pressure and force sensors for the drives 1 and 2 (if no analog input is used as position feedback system).
Inputs that are not utilized can be used in an IEC61131-3 program (for example as setpoint input).

4.1.6.1 Pressure sensors

Pressure sensors can be used for the cnontrol of pressure or force (with pressure P_A & P_B).
If pressure sensors are utilized for the control of force, the resulting force is calculated via the the differential pressure P_A - P_B and the ratio of major area to minor area of the cap
A maximum of 4 pressure sensors per axis can be parameterized. The logic assignment of the sensors results from the following image.

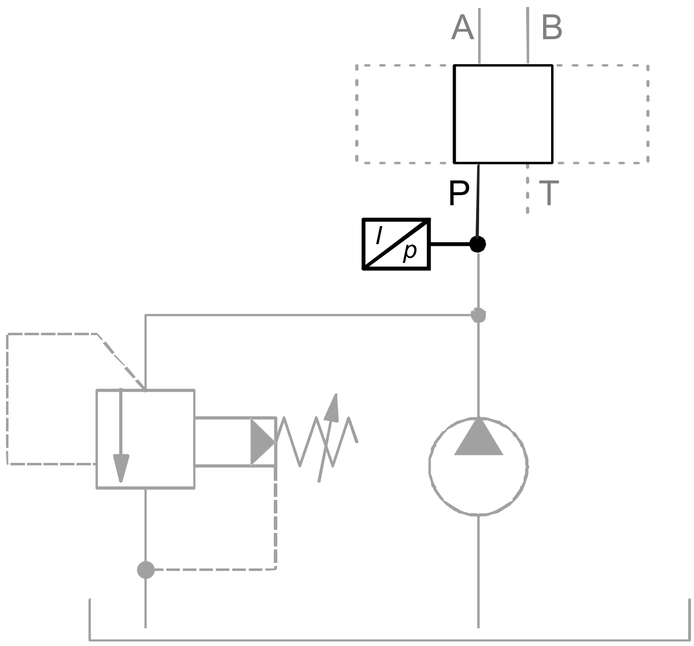


- Interface:
  Select the interface where the sensor is connected. Only the freely available inputs are displayed.

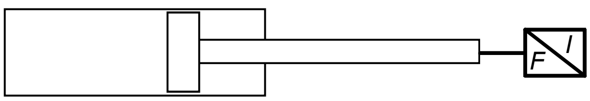


- (1) pressure min.: Enter the minimum pressure.
- (2) pressure max.: Enter the maximum pressure.
- (3) Sensor signal min.: Enter the minimum singal of the pressure sensor.
- (4) Sensor signal max.: Enter the maximum singal of the pressure sensor.
- Constant pressure: If the pressure is constant, a pressure sensor is not necessary. You can then specify a constant pressure value instead.

Example: Parameterization interface supply pressure p0

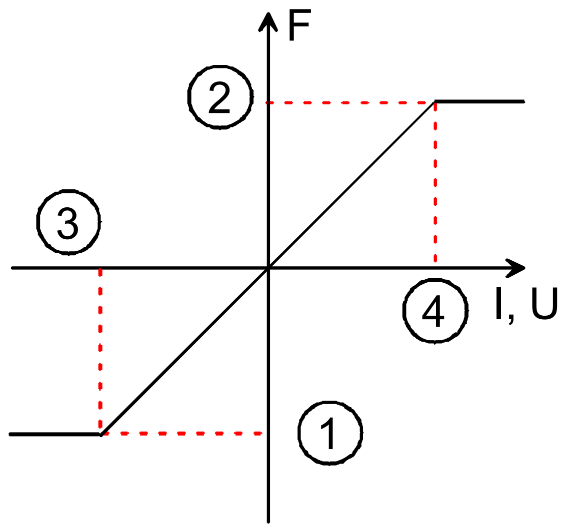


4.1.6.2 Force sensor drive 1



If a force sensor is used for force control, the following parameters must be entered:

- Interface:
  Select the interface where the sensor is connected. Only the freely available inputs are displayed.



- Force min.: Enter the minimum force (1).
- Force max.: Enter the maximum force (2).
- Sensor signal min.: Enter the minimum singal of the pressure sensor (3).
- Sensor signal max.: Enter the maximum singal of the pressure sensor (4).
- Force constant: If the force is constant, a force sensor is not necessary. You can then specify a constant force value instead.

4.1.6.3 Pressure and force sensor drive 2

The following dialogs can only be selected, if under "number of drives" 2 drives were selected before.
The sensors for drive 2 are configured as described under drive 1.

4.1.7. Valve configuration

Up to 4 valves can be selected. Those valves (0..3) are fixedly assigned to the analog outputs I/Uout0...3 and are assigned within the configuration to the drives 1 and 2 as well as to the position and force/pressure control loops.
Not all valves must necessarily be used.

4.1.7.1 Selection and configuration of the valves

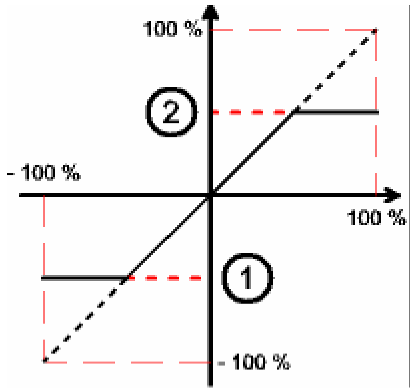
The selection of the respective valves is made from the hdydraulics database. You can choose between Parker valves or customized valves that were created with the aid of the C3HydraulicsManager from the database.
The valves in the valve database are structured as follows:

- Parker Valves
  - Porportional direction control valves
    - ...
    - High dynamics, high repeatability
    - VCD® Dynamics, highest precision
    - D*FP
    - …
    - ...
- Pressure valves
  - Pressure control valves
    - PE
    - …
  - Pressure reducing valves
    - RE
    - ...
  - Flow-control valves
    - ...
    - TDL
    - ...
- Other valves

Input values:

Control variable limitation [min.][max.]:

Via these parameters, the control signal of the valve is limited. This limitation is above all sensible during commissioning in order to avoid an uncontrolled movement of the axis if the parameterization is not yet optimal.



(1) min. control variable limitation
(2) max. control variable limitation

Drive:

Hereby you can define the assignment of the selected valve to a specific drive. This dialog comes only up, if 2 drives were selected.

Control range of the position controller.

The "control range" parameter

- --
- -100%...100%
- 0...100% (P -> A)
- -100%...0 (A -> T)
- 0...100% (B -> T)
- -100%...0 (P -> B)

defines the output range of the position controller for the selected valve.
If you enter "--", the valve is not influenced by the position controller.

Control range of the force/pressure control loop:

The "control range" parameter

- --
- -100%...100%
- 0...100% (P -> A)
- -100%...0 (A -> T)
- 0...100% (B -> T)

-100%...0 (P -> B)
defines the output range of the force/pressure controller for the selected valve.
If you enter "--", the valve is not influenced by the force/pressure controller.

4.1.8. Defining the reference system

The reference system for positioning is defined by:

- a unit,
- the travel distance per motor revolution,
- a machine zero point with true zero,
- positive and negative end limits.

4.1.8.1 Position transducer

Absolute feedback system

For positioning operation of two axes with a Compax3F, we recommend an absolute feedback system

Thus the homing run after switching on, which is only possible in coupled state for 2 axes and may lead to difficulties with definedly referencing the auxiliary axis is not necessary.

4.1.8.2 Machine Zero

In this chapter you can read about:

The Compax3 machine zero modes are adapted to the CANopen profile for Motion Control CiADS402.

Position reference point

Essentially, you can select between operation with or without machine reference. The reference point for positioning is determined by using the machine reference and the machine reference offset.

Machine reference run

In a homing run the drive normally moves to the position value 0 immediately after finding the home switch. The position value 0 is defined via the homing offset.

A machine reference run is required each time after turning on the system for operation with machine reference.

Please note:

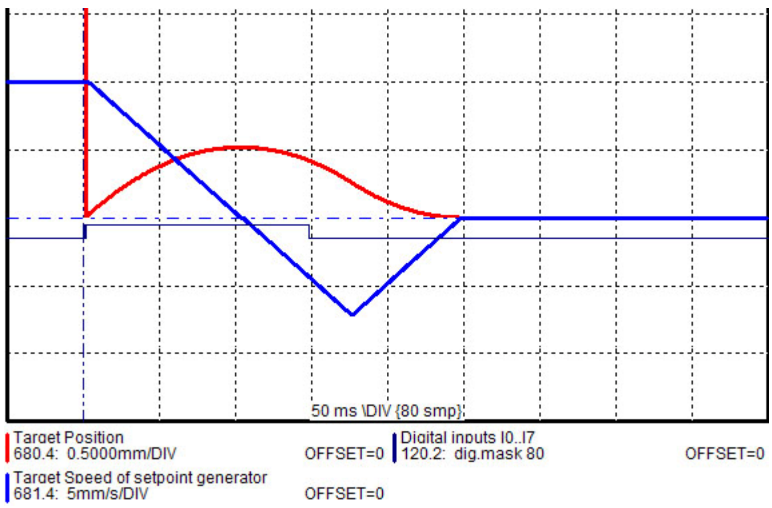
During homing run the software end limits are not monitored.

Positioning after homing run

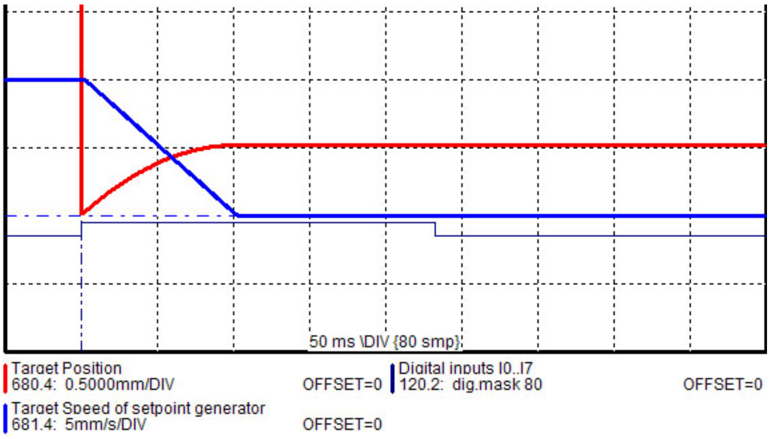
The positioning made after the home switch has been found can be switched off. For this enter in the ”machine zero” window in the configuration wizard ”no” under ”approach MN point after MN run”.

Example Homing mode 20 (Home on homing switch) with T40 by homing offset 0

With positioning after homing run The motor stands then on 0:



Without positioning after homing run The position reached is not exactly on 0, as the drive brakes when detecting the home and stops:



Please note:

In controlled operation (open loop) no machine zero run is possible!

The home of the auxiliary axis is automatically set, by coupling the auxiliary axis to the main axis for the homing run!

Homing run for 2 axes

- Axis 2 is coupled to axis 1 and moves along
- Axis 1 and axis 2 set the home at the same time after axis 1 has detected the homing switch

Therefore you should bring the auxiliary axis to a defined start position before the homing run.

Or use absolute feedback systems:

Absolute feedback system

For positioning operation of two axes with a Compax3F, we recommend an absolute feedback system

Thus the homing run after switching on, which is only possible in coupled state for 2 axes and may lead to difficulties with definedly referencing the auxiliary axis is not necessary.

Machine zero speed and acceleration

With these values you can define the motion profile of the machine zero run.

Machine zero modes overview

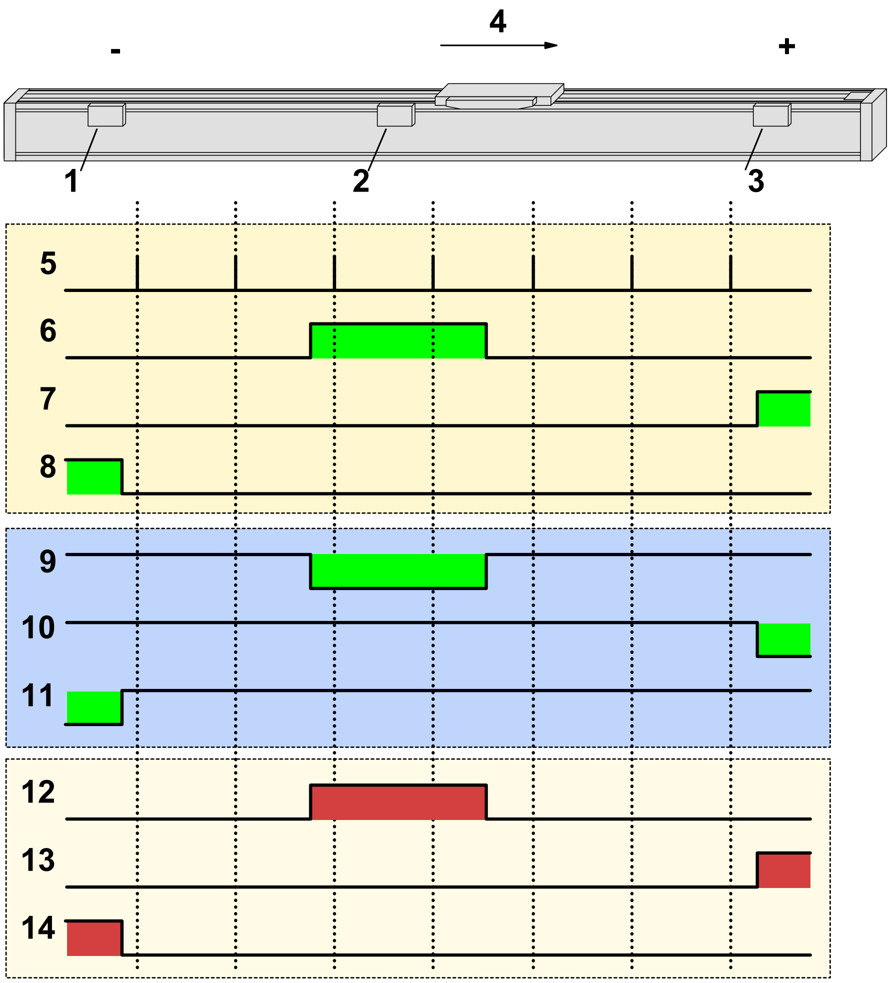
Selection of the machine zero modes (MN-M)

Machine home switch on X12/14: MN-M 3 ... 14, 19 ... 30	Without motor reference point MN-M 19 ...30	without direction reversal switches: **MN-M 19, 20** (see page 58), **MN-M 21, 22** (see page 59)
		with reversal switches: **MN-M 23, 24, 25, 26** (see page 60), **MN-M 27, 28, 29, 30** (see page 61)
	With motor reference point MN-M 3 ... 14	without direction reversal switches: **MN-M 3, 4** (see page 62), **MN-M 5, 6** (see page 63)
		with reversal switches: **MN-M 7, 8, 9, 10** (see page 64), **MN-M 11,12,13, 14** (see page 64)
Without machine zero initiator on X12/14: MN-M 1, 2, 17, 18, 33 .. 35, 128, 129, 130 ... 133	Without motor reference point MN-M 17, 18, 35, 128, 129	**MN-M 35: at the current Position** (see page 65) **MN-M 128, 129: while moving to block** (see page 65)
		With limit switch as machine zero: **MN-M 17, 18** (see page 66)
	With motor reference point	Only motor reference: **MN-M 33, 34** (see page 67), **MN-M 130, 131** (see page 67)
	MN-M 1, 2, 33, 34, 130 ... 133	With limit switch as machine zero: **MN-M 1, 2** (see page 68), **MN-M 132, 133** (see page 69)

Definition of terms / explanations:

Motor zero point	Zero pulse of the feedback Motor feedback systems such as resolvers or SinCos© / EnDat give one pulse per revolution. Some motor feedback systems of direct drives do also have a zero pulse, which is generated once or in defined intervals. By interpreting the motor zero point (generally in connection with the machine zero initiator) the machine zero can be defined more exactly.
Machine zero initiator:	For creating the mechanical reference Has a defined position within or on the edge of the travel range.
Direction reversal switches:	Initiators on the edge of the travel range, which are used only with a machine zero run in order to detect the end of the travel range. In some cases, the function " direction reversal via Following error threshold" is also possible, then you will need no initiator, Compax3 detects the end of the travel range via the threshold. Please observe the respective notes. During operation, the direction reversal switches are often used as limit switches.

Example axis with the initiator signals



1: Direction reversal / end switch on the negative end of the travel range (the **assignment of the reversal / end switch inputs** (see page 74) to travel range side can be changed).

2: Machine zero initiator (can, in this example, be released to 2 sides)

3: Direction reversal / end switch on the positive end of the travel range (the **assignment of the reversal / end switch inputs** (see page 74) to travel range side can be changed).

4: Positive direction of movement

5: Signals of the motor zero point (zero pulse of the motor feedback)

6: Signal of the machine zero initiator (**without inversion of the initiator logic** (see page 74)).

7: Signal of the direction reversal resp. end switch on the positive end of the travel range (without inversion of the initiator logic).

8: Signal of the direction reversal / resp. end switch on the negative end of the travel range (without inversion of the initiator logic).

9: Signal of the machine zero initiator (**with inversion of the initiator logic** (see page 74)).

10: Signal of the direction reversal / resp. end switch on the positive end of the travel range (with inversion of the initiator logic).

11: Signal of the direction reversal / resp. end switch on the negative end of the travel range (with inversion of the initiator logic).

12: Logic state of the home switch (independent of the inversion)

13: Logic state of the direction reversal resp. end switch on the positive end of the travel range (independent of the inversion)

14: Logic state of the direction reversal resp. end switch on the negative end of the travel range (independent of the inversion)

The following principle images of the individual machine zero modes always refer to the logic state (12, 13, 14) of the switches.

Homing modes with home switch (on X12/14)

In this chapter you can read about:

Without motor reference point

In this chapter you can read about:

Without direction reversal switches

In this chapter you can read about:

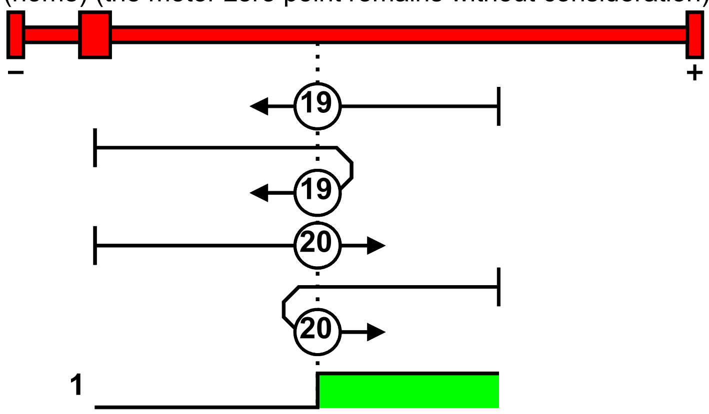
In this chapter you can read about:

MN-M 19.20: MN-Initiator = 1 on the positive side

The MN initiator can be positioned at any location within the travel range. The travel range is then divided into 2 contiguous ranges: one range with deactivated MN initiator (left of the MN initiator) and one range with activated MN initiator (right of the MN initiator).
When the MN initiator is inactive (signal = 0) the search for the machine reference is in the positive travel direction.

Without motor zero point, without direction reversal switches

MN-M 19: The negative edge of the MN proximity switch is used directly as MN (home) (the motor zero point remains without consideration).
MN-M 20: The positive edge of the MN proximity switch is used directly as MN (home) (the motor zero point remains without consideration).



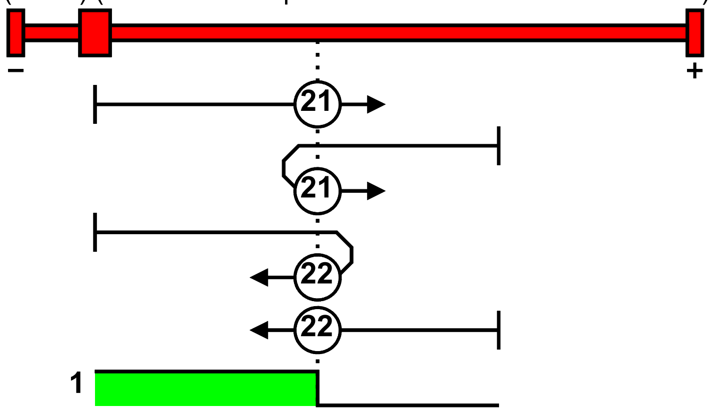
1: logic state

MN-M 21.22: MN initiator = 1 on the negative side

The MN initiator can be positioned at any location within the travel range. The travel range is then divided into 2 contiguous ranges: one range with deactivated MN initiator (positive part of the travel range) and one range with activated MN initiator (negative part of the travel range).
When the MN initiator is inactive (signal = 0) the search for the machine reference is in the negative travel direction.

Without motor zero point, without direction reversal switches

MN-M 21: The negative edge of the MN proximity switch is used directly as MN (home) (the motor zero point remains without consideration).
MN-M 22: The positive edge of the MN proximity switch is used directly as MN (home) (the motor zero point remains without consideration).



1: logic state

With direction reversal switches

Machine zero modes with a home switch which is activated in the middle of the travel range and can be deactivated to both sides.
The **assignment of the direction reversal switches** (see page 74) can be changed.

Function Reversal via Following error threshold

If no direction reversal switches are available, the reversal of direction can also be performed during the machine zero run via the function "direction reversal via Following error threshold"
Here the drive runs towards the mechanical limit mounted at the end of the travel range.
When the settable Following error threshold is reached, the drive is braked and changes the travel direction.

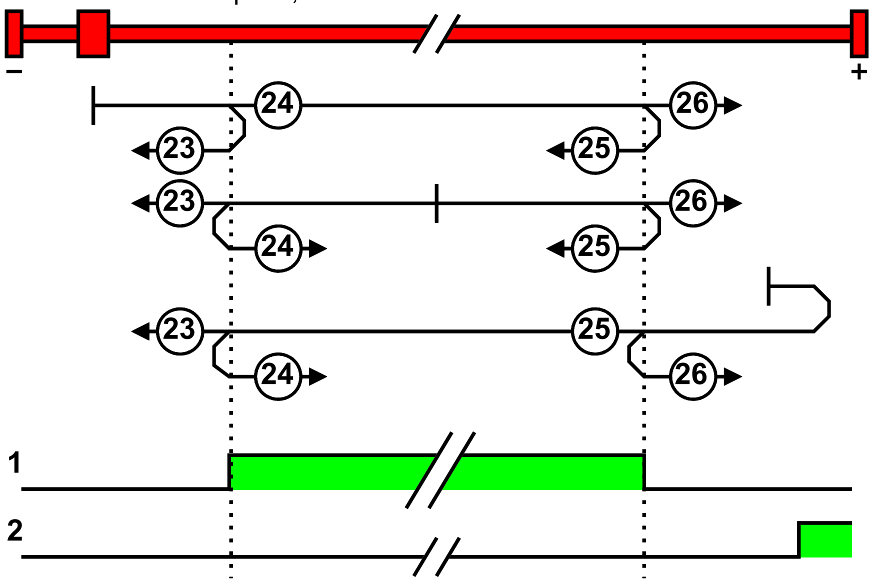
	**Caution!** Wrong settings can cause hazard for man and machine.

It is therefore essential to respect the following:

- Choose a low machine zero speed.
- Set the machine zero acceleration to a high value, so that the drive changes direction quickly, the value must, however, not be so high that the limit threshold is already reached by accelerating or decelerating (without mechanical limitation).
- The mechanical limitation as well as the load drain must be set so that they can absorb the resulting kinetic energy.

MN-M 23...26: Direction reversal switches on the positive side

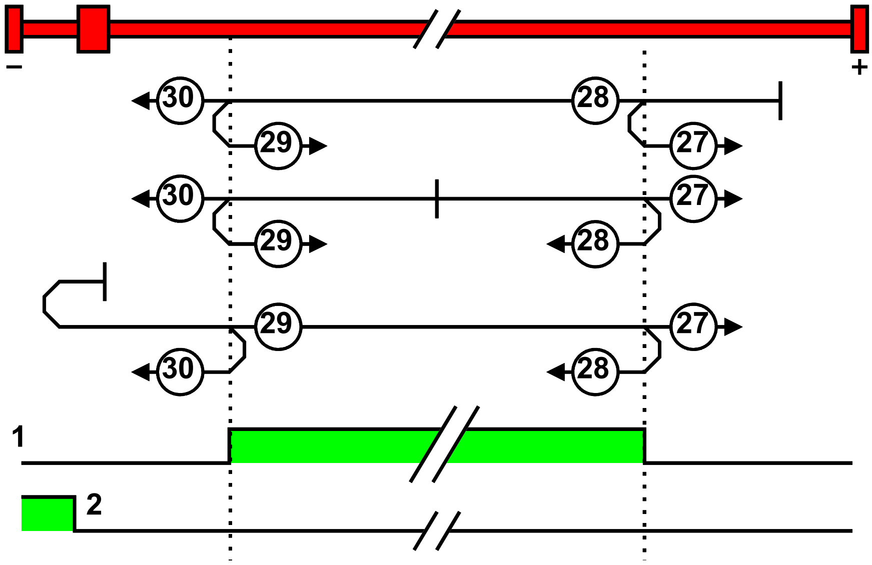
Without motor zero point, with direction reversal switches



1: Logic state of the home switch
2: Logic state of the direction reversal switch

MN-M 27...30: With direction reversal switches on the negative side

Without motor zero point, with direction reversal switches



1: Logic state of the home switch

2: Logic state of the direction reversal switch

With motor reference point

In this chapter you can read about:

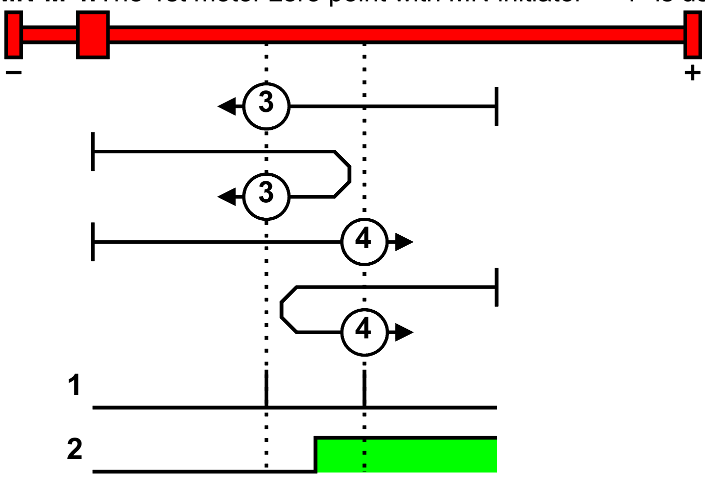
Without direction reversal switches

MN-M 3.4: MN-Initiator = 1 on the positive side

The MN initiator can be positioned at any location within the travel range. The travel range is then divided into 2 contiguous ranges: one range with deactivated MN initiator (left of the MN initiator) and one range with activated MN initiator (right of the MN initiator).
When the MN initiator is inactive (signal = 0) the search for the machine reference is in the positive travel direction.

With motor zero point, without direction reversal switches

MN-M 3: The 1st motor zero point with MN initiator = "1" is used as MN.
MN-M 4: The 1st motor zero point with MN initiator = "1" is used as MN.



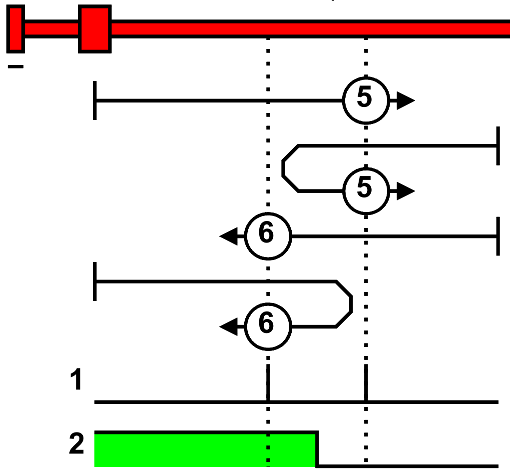
1: Motor zero point
2: Logic state of the home switch

MN-M 5.6: MN initiator = 1 on the negative side

The MN initiator can be positioned at any location within the travel range. The travel range is then divided into 2 contiguous ranges: one range with deactivated MN initiator (positive part of the travel range) and one range with activated MN initiator (negative part of the travel range).
When the MN initiator is inactive (signal = 0) the search for the machine reference is in the negative travel direction.

With motor zero point, without direction reversal switches

MN-M 5: The 1st motor zero point with MN proximity switch = "0" is used as MN.
MN-M 6: The 1st motor zero point with MN initiator = "1" is used as MN.



1: Motor zero point
2: Logic state of the home switch

With direction reversal switches

Machine zero modes with a home switch which is activated in the middle of the travel range and can be deactivated to both sides.
The **assignment of the direction reversal switches** (see page 74) can be changed.

Function Reversal via Following error threshold

If no direction reversal switches are available, the reversal of direction can also be performed during the machine zero run via the function "direction reversal via Following error threshold"
Here the drive runs towards the mechanical limit mounted at the end of the travel range.
When the settable Following error threshold is reached, the drive is braked and changes the travel direction.

⚠	**Caution!** Wrong settings can cause hazard for man and machine.

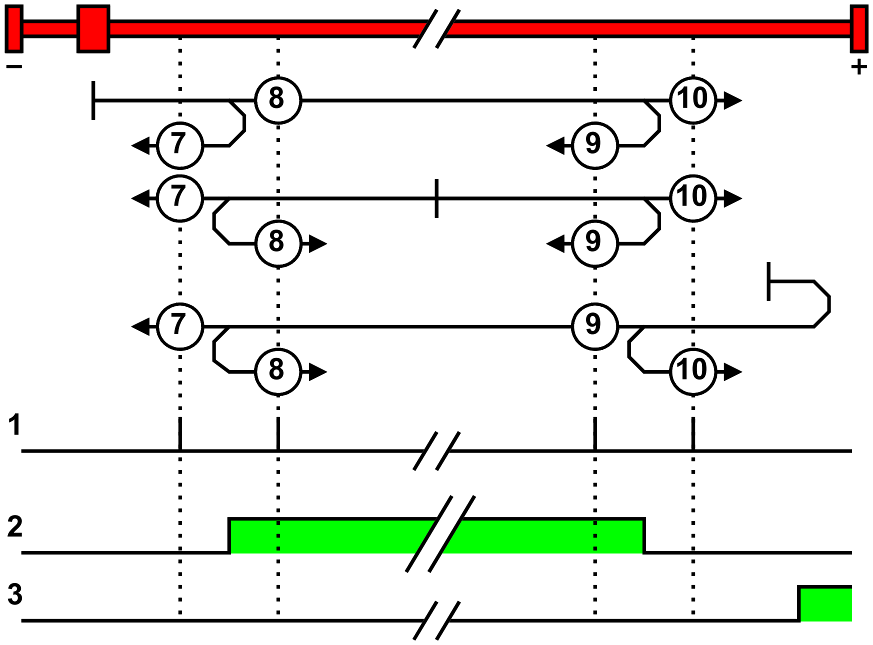
It is therefore essential to respect the following:

- Choose a low machine zero speed.
- Set the machine zero acceleration to a high value, so that the drive changes direction quickly, the value must, however, not be so high that the limit threshold is already reached by accelerating or decelerating (without mechanical limitation).
- The mechanical limitation as well as the load drain must be set so that they can absorb the resulting kinetic energy.

MN-M 7...10: Direction reversal switches on the positive side

With motor zero point, with direction reversal switches

Machine zero modes with a home switch which is activated in the middle of the travel range and can be deactivated to both sides.

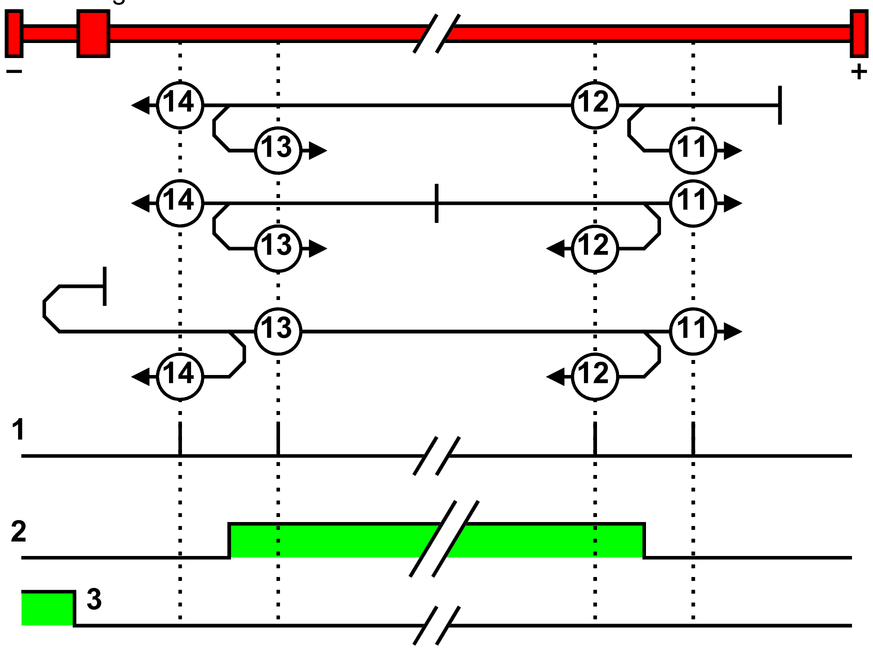


1: Motor zero point
2: Logic state of the home switch
3: Logic state of the direction reversal switch

MN-M 11...14: With direction reversal switches on the negative side

With motor zero point, with direction reversal switches

Machine zero modes with a home switch which is activated in the middle of the travel range and can be deactivated to both sides.



1: Motor zero point
2: Logic state of the home switch
3: Logic state of the direction reversal switch

Machine zero modes without home switch

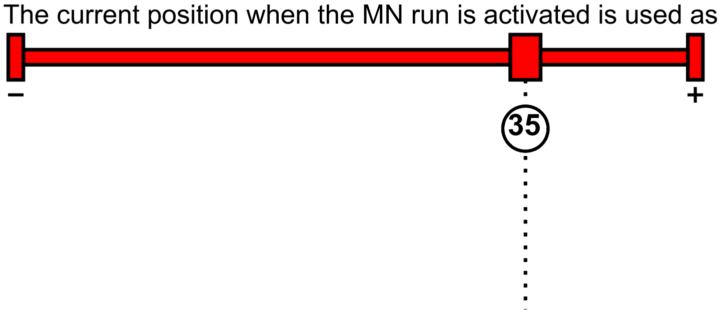
In this chapter you can read about:

Without motor reference point

In this chapter you can read about:

MN-M 35: MN at the current position

The current position when the MN run is activated is used as an MN.



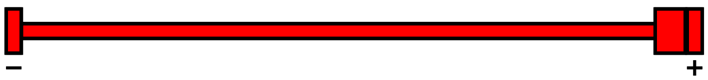
MN-M 128/129: Following error threshold when moving to block

Without a MN (machine zero) initiator, an end of travel region (block) is used as MN (machine zero).
For this the Following error threshold is evaluated if the drive pushes against the end of the travel region. If the limit is exceeded, the MN is set. During the homing run (MN), the error reaction "following error" is deactivated.

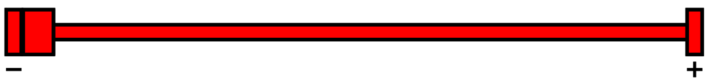
Please observe:

The homing offset must be set so that the home (reference point) for positioning lies witihn the travel range.

MN-M 128: Travel in the positive direction to the end of the travel region



MN-M 129: Travel in the negative direction to the end of the travel region

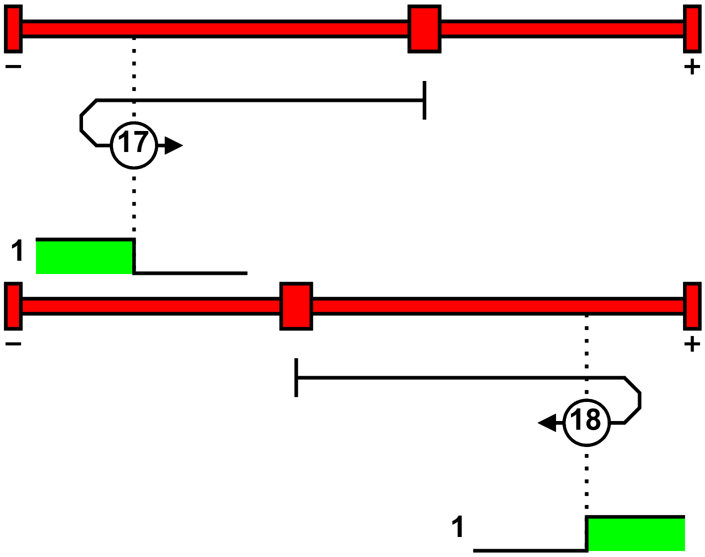


Caution!
Wrong settings can cause hazard for man and machine.

It is therefore essential to respect the following:

- Choose a low machine zero speed.
- Set the machine zero acceleration to a high value, so that the drive changes direction quickly, the value must, however, not be so high that the limit threshold is already reached by accelerating or decelerating (without mechanical limitation).
- The mechanical limitation as well as the load drain must be set so that they can absorb the resulting kinetic energy.

MN-M 17.18: Limit switch as machine zero



1: Logic state of the direction reversal switch

Function Reversal via Following error threshold

If no direction reversal switches are available, the reversal of direction can also be performed during the machine zero run via the function ”direction reversal via Following error threshold"
Here the drive runs towards the mechanical limit mounted at the end of the travel range.
When the settable Following error threshold is reached, the drive is braked and changes the travel direction.

⚠	**Caution!** Wrong settings can cause hazard for man and machine.

It is therefore essential to respect the following:

- Choose a low machine zero speed.
- Set the machine zero acceleration to a high value, so that the drive changes direction quickly, the value must, however, not be so high that the limit threshold is already reached by accelerating or decelerating (without mechanical limitation).
- The mechanical limitation as well as the load drain must be set so that they can absorb the resulting kinetic energy.

With motor reference point

In this chapter you can read about:

Machine zero only from motor reference

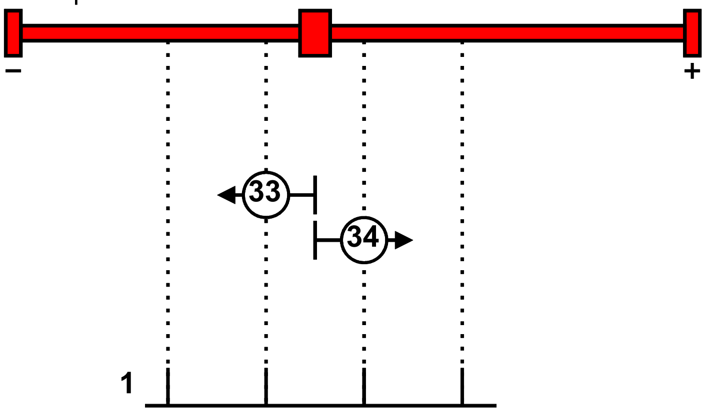
In this chapter you can read about:

MN-M 33,34: MN at motor zero point

The motor reference point is now evaluated (no MN initiator):

Without home switch

MN-M 33: For a MN run, starting from the current position, the next motor zero point in the negative travel direction is taken as the MN.
MN-M 34: For a MN run, starting from the current position, the next motor zero point in the positive travel direction is taken as the MN.



1: Motor zero point

MN-M 130, 131: Determine absolute position via distance coding

Only for motor feedback with distance coding (the absolute position can be determined via the distance value).
Compax3 determines the absolute position from the distance of two signals and then stops the movement (does not automatically move to position 0).

1: Signals of the distance coding

With direction reversal switches

Machine zero modes with a home switch which is activated in the middle of the travel range and can be deactivated to both sides.
The **assignment of the direction reversal switches** (see page 74) can be changed.

Function Reversal via Following error threshold

If no direction reversal switches are available, the reversal of direction can also be performed during the machine zero run via the function "direction reversal via Following error threshold"
Here the drive runs towards the mechanical limit mounted at the end of the travel range.
When the settable Following error threshold is reached, the drive is braked and changes the travel direction.

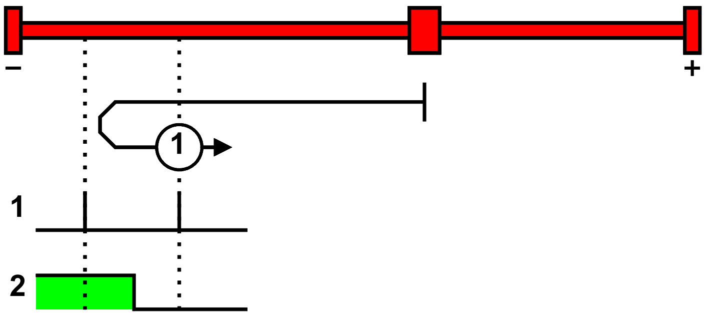
⚠	**Caution!** Wrong settings can cause hazard for man and machine.

It is therefore essential to respect the following:

- Choose a low machine zero speed.
- Set the machine zero acceleration to a high value, so that the drive changes direction quickly, the value must, however, not be so high that the limit threshold is already reached by accelerating or decelerating (without mechanical limitation).
- The mechanical limitation as well as the load drain must be set so that they can absorb the resulting kinetic energy.

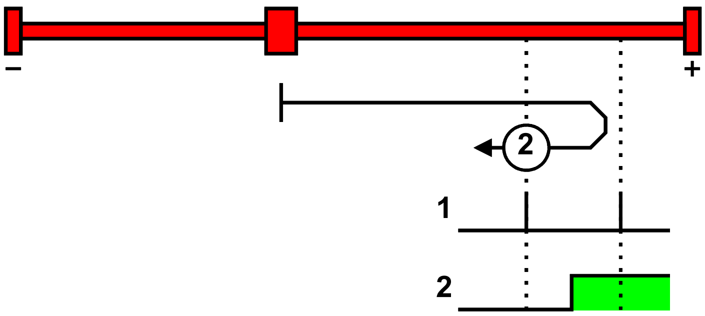
MN-M 1, 2: Limit switch as machine zero

End switch on the negative side



1: Motor zero point
2: Logic state of the direction reversal switch

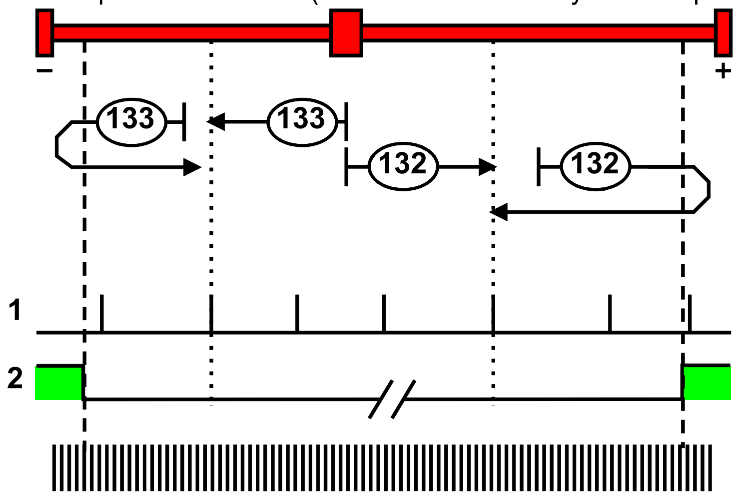
End switch on the positive side:



1: Motor zero point
2: Logic state of the direction reversal switch

MN-M 132, 133: Determine absolute position via distance coding with direction reversal switches

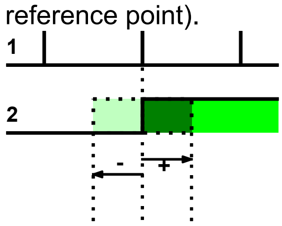
Only for motor feedback with distance coding (the absolute position can be determined via the distance value).
Compax3 determines the absolute position from the distance of two signals and then stops the movement (does not automatically move to position 0).



1: Signals of the distance coding
2: Logic state of the direction reversal switches

Adjusting the machine zero proximity switch

This is helpful in some cases with homing modes that work with the home switch and motor reference point.
If the motor reference point happens to coincide with the position of the MN initiator, there is a possibility that small movements in the motor position will cause the machine reference point to shift by one motor revolution (to the next motor reference point).



1: Motor zero point
2: Logic state of the home switch
A solution to this problem is to move the MN initiator by means of software. This is done using the value initiator adjustment.

Initiator adjustment

Unit: Motor angle in degrees	Range: -360 ... 360	Standard value: 0
Move the machine reference initiator using software		

4.1.8.3 Travel Limit Settings

Please note:

Both the software and the hardware end limits are the same for the main axis and the auxiliary axis!

Software end limits

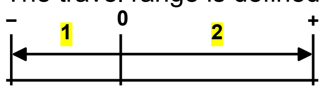
The error reaction when reaching the software end limits can be set:
Possible settings for the error reaction are:

- No response
- downramp / stop
- Downramp / switch to currentless (standard setting)

If "no reaction" was set, no software limits must be entered.

Software end limits:

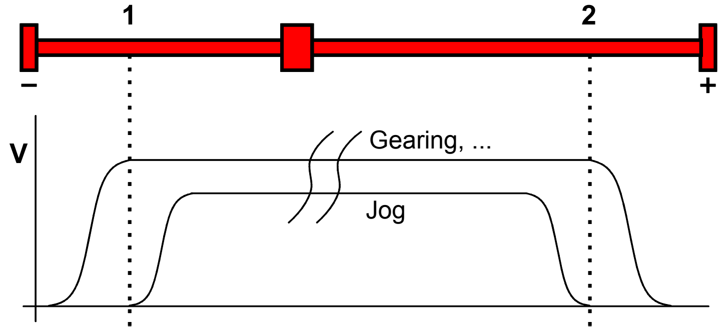
The travel range is defined via the negative and positive end limits.



1: negative end limit
2: positive end limit

Software end limit in absolute operating mode

The positioning is restricted to the range between the travel limits.
A positioning order aiming at a target outside the travel range is not executed.



1: negative end limit
2: positive end limit
The reference is the position reference point that was defined with the machine reference and the machine reference offset.

Software end limits in reset mode

The reset mode does not support software end limits

Software end limit in continuous mode

Each individual positioning is confined within the travel limits.
A positioning order aiming at a target outside the software end limits is not executed.
The reference is the respective current position.

Error when disregarding the software end limits

A software end limit error is triggered, if the position value exceeds an end limit. For this, the position setpoint value is evaluated in energized state; in currentless state, the actual position value is evaluated.

Hysteresis in disabled state:

If the axis stands currentless at an end limit, another error may be reported due to position jitter after acknowledging the end limit error. To avoid this, a hysteresis surrounding the end limits was integrated (size corresponds to the size of the positioning window).
Only if the distance between axis and the end limits was larger than the positioning window, another end limit error will be detected

Error codes of the end limit errors:
0x7323 Error when disregarding the positive software end limit.
0x7324 Error when disregarding the negative software end limit.

Activating / deactivating the end limit error:

In the C3 ServoManager under configuration: End limits, the error can be (de)activated.
For IEC-programmable devices with the "C3_ErrorMask" module.

Behavior after the system is turned on

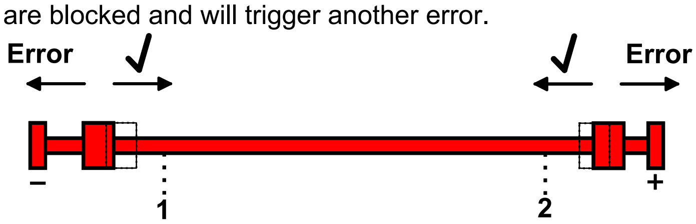
The end limits are not active after switching on. The end limits do not refer to the position reference point until after a machine reference run.
During homing run the end limits are not monitored.
With a Multiturn encoder or with active Multiturn emulation, the limit is valid immediately after switching on.

Behavior outside the travel range

1. If the software end limit errors are deactivated, all movements are possible.

2. if the software end limit errors are activated:

After disregarding the software end limits, an error is triggered. First of all, this error must be acknowledged.
Then a direction block is activated: only motion commands in the direction of the travel range are executed. These will not trigger another error.
Motion commands inciting a movement in the opposite direction of the travel range are blocked and will trigger another error.



1: negative end limit
2: positive end limit

Notes on special feedback systems (Feedback F12)

During automatic commutation, the end limit monitoring is deactivated!

Behavior with software end limits of a referenced axis

	Position within target outside	**Position outside target outside and aiming in the opposite direction of the travel range**	**Position outside target within and aiming in the direction of the travel range**
JOG +/-	◆ Positioning up to the end limits ◆ No Error	◆ No positioning ◆ No Error	◆ Positioning
MC_MoveAbsolute, MC_MoveRelative, MC_MoveAdditive, MC_MoveSuperImposed	◆ No positioning ◆ Error	◆ No positioning ◆ Error	◆ Positioning
MC_GearIn, MC_Cam... C3_Cam...	◆ Positioning up to the end limits, from these on braking with the error ramp. The end limit is exceeded ◆ Error	◆ No positioning ◆ Error	◆ No positioning ◆ Error
MC_MoveVelocity	◆ Positioning up to the end limits ◆ Error	◆ No positioning ◆ Error	◆ Positioning
MC_Home	◆ No monitoring of the software end limits		

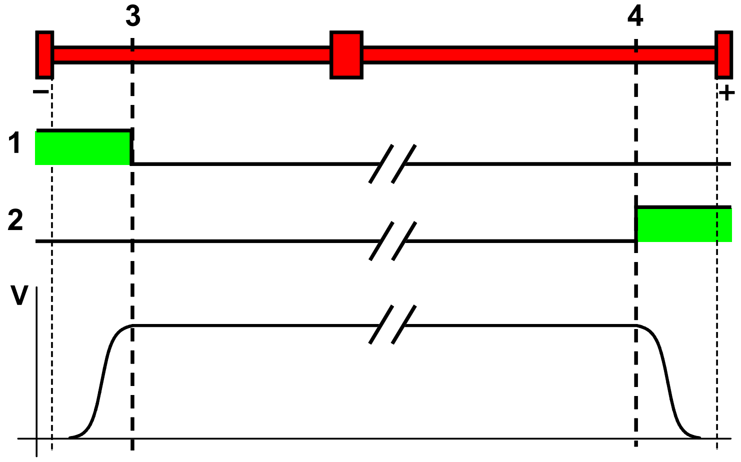
The software end limit error can be deactivated in general via the configuration or separately for each end limit via the C3_Error_Mask f module.

Hardware end limits

The error reaction when reaching the hardware end limits can be set:
Possible settings for the error reaction are:

- No response
- downramp / stop
- Downramp / switch to currentless (standard setting)

Hardware end limits are realized with the aid of end switches.
These are connected to X12/12 (input 5) and X12/13 (input 6) and can be (de)activated separately in the C3 ServoManager under Configuration: End limits.
After a limit switch has been detected, the drive decelerates with the ramp values set for errors (error code 0x54A0 at X12/12 active, 0x54A1 at X12/13 active) and the motor is switched to currentless.
Please make sure that after the detection of the end switch there is enough travel path left up to the limit stop.



1: Limit switch E5 (X12/12)
2: Limit switch E6 (X12/13)
3: Limit switch position E5 (X12/12)
4: Limit switch position E6 (X12/13)
The **assignment of the end switches** (see page 74) can be changed!

Please note: The limit switches must be positioned so that they cannot be released towards the side to be limited.

Limit switch / direction reversal switch
Limit switches functioning as direction reversal switches during homing run, will not trigger a limit switch error.

Behavior in the case of an active limit switch
The error can be acknowledged with activated limit switch.
The drive can then be moved out of the end switch range with a normal positioning.
Both directions of movement are possible.
A direction block can be programmed in the IEC program with the aid of the limit switch bits or the error message.

(De)activate limite switch errors
The end limit error can be deactivated in general via the configuration or separately for each end limit via the C3_Error_Mask module.

4.1.8.4 Change assignment direction reversal / limit switches

If this function is not activated, the direction reversal / end switches are assigned as follows:
Direction reversal / limit switch on E5 (X12/12): negative side of the travel range
Direction reversal / limit switch on E6 (X12/13): Direction reversal / limit switch on E6 (X12/13):

Change assignment of direction reversal / limit switch is activated

If this function is activated, the direction reversal / limit switches are assigned as follows:
Direction reversal / limit switch on **E5** (X12/12): **positive side** of the travel range
Direction reversal / limit switch on **E6** (X12/13): **negative side** of the travel range

4.1.8.5 Change initiator logic

The initiator logic of the limit switches (this does also apply for the direction reversal switches) and the machine zero initiator can be changed separately.

- Limit switch E5 low active
- Limit switch E6 low active
- Home switch E7 low active

In the basic settings the inversion is deactivated, so that the signals are ”high active”.

With this setting the inputs I5 to I7 can even be switched within their logic, if they are not used as direction reversal/limit switches or machine zero.

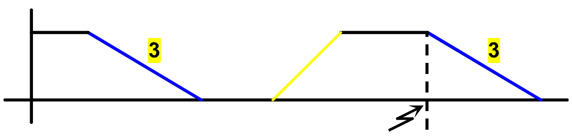
4.1.8.6 Debouncing: Limit switch, machine zero and input 0

A majority gate is used for debouncing.
The signal is sampled every 0.5ms
The debounce time determines the number of scans the majority gate will perform.
If the level of more than half of the signals was changed, the internal status will change.
The debounce time can be set in the configuration wizard within the range of 0 ... 20ms.
The value 0 deactivates the debouncing.

If the debouncing time is stated, the input I0 can be debounced as well (checkbox below).

4.1.9. Ramp upon error and switch to currentless

Ramp (deceleration) upon error and "switch to currentless"



3: Deceleration upon error and upon deactivation of **MC_Power** (see page 165)

Please observe:

The configured error ramp is limited. The error ramp will not be smaller than the deceleration set in the last motion set.

4.1.10. Limit and monitoring settings of force

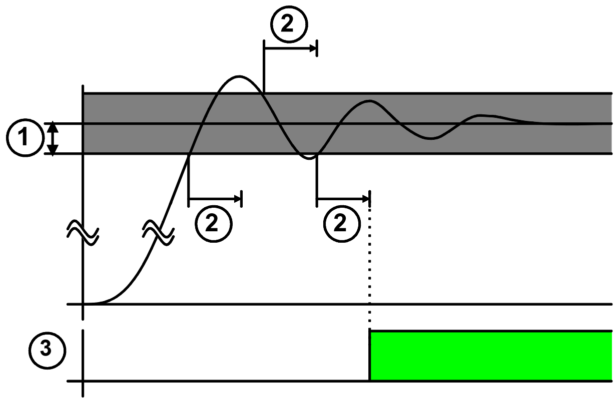
In this chapter you can read about:

Please note:

Limit and monitoring settings are the same for the main axis as well as for the auxiliary axis!

4.1.10.1 Force window - force achieved

"Force achieved" indicates that the actual force is within the tolerance window of the setpoint force. In addition to the force window, a force window time is supported. If the actual force goes inside the force window, the force window time is started.
If the actual force is still within the force window after the force window time, "force achieved = 1" will be set.
If the actual force leaves the force window within the force window time, the force window time is started again. When leaving the force window, "force achieved" is set immediately to "0".
The force monitoring is even active, if the force leaves the force window due to external measures.



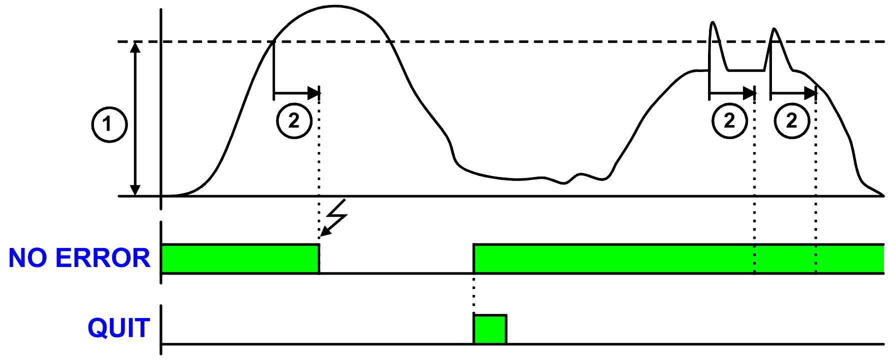
1: Force window
2: Force window time
3: Setpoint force reached (== object ForceAccuracy_ForceReached)

Linkage to the setpoint value

The signal "force attained" can be linked to the setpoint value.
In addition, the internal setpoint value generation is evaluated.
It applies: **The force window is only evaluated with a constant internal setpoint value.**

4.1.10.2 Maximum control deviation of force controller

The force control deviation is a dynamic error.
The dynamic difference between the setpoint force and the actual force during a force control is called the force control deviation. Do not confuse this with the static difference which is always 0; the target force is always achieved exactly.
If the force control deviation exceeds the given limit (max. control deviation of force controller), the "time window" elapses.
If the force control deviation after the time window still exceeds the threshold, an error is reported.
If the force control deviation is below the threshold, the time window is started anew.



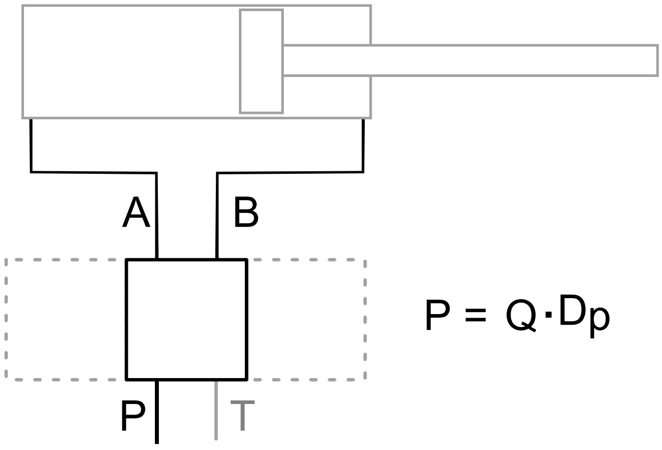
1: max. control deviation of force controller
2: time window force control deviation
NO ERROR: Error output of positioning modules
QUIT: Ackn with MC_Reset module

4.1.10.3 Maximum force

if the "maximum force" is exceeded, an error is reported.
This monitoring is only active, if pressure sensors are present for pA and / or pB.

4.1.10.4 Hydraulic corner power limitation

The hydraulic corner power is calculated from the differential pressure between p0 and pA or pB. If pressure sensors are present for pA as well as for pB, both differential pressures are evaluated.



$$P = Q \cdot Dp$$

The corner power limitation can only be activated, if at least one pressure sensor for pA or pB and p0 was parameterized before.

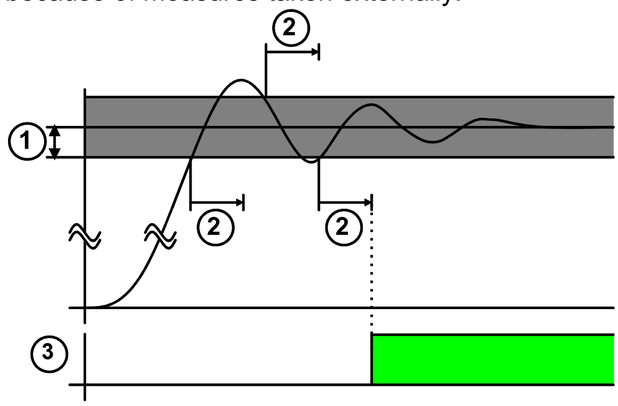
Note:

- Currently, the corner power is calculated; which must however, if necessary, be limited in the IEC program!
  the corner power can be read from the objects C3.HydraulicPower_Axis1, C3.HydraulicPower_Axis2 and C3.HydraulicPower_Sum.
  the unit is [W]; this means that the standardization is only correct for the metric system.
- The hydraulic power is calculated from the units bar and l/min according to the following equation:

$$P[kW] = \frac{\Delta p[bar] \cdot Q[l/\min]}{600}$$

4.1.11. Positioning window - Position reached

Position reached indicates that the target position is located within the position window.
In addition to the position window, a position window time is supported. If the actual position goes inside the position window, the position window time is started. If the actual position is still inside the position window after the position window time, "Position reached" is set.
If the actual position leaves the position window within the position window time, the position window time is started again.
When the actual position leaves the position window with Position reached = "1", Position reached is immediately reset to "0".
Position monitoring is active even if the position leaves the position window because of measures taken externally.



1: Positioning window
2: positioning window time
3: Setpoint position reached (== object 420.6 C3.PositioningAccuracy_PositionReached)

4.1.12. Following error limit

The error reaction upon a following error can be set:
Possible settings for the error reaction are:

- No response
- downramp / stop
- Downramp / switch to currentless (standard setting)

The following error is a dynamic error.
The dynamic difference between the setpoint position and the actual position during a positioning is called the following error. Do not confuse this with the static difference which is always 0; the target position is always reached exactly.

The change of position over time can be specified exactly using the parameters jerk, acceleration and speed. The integrated Setpoint value generator calculates the course of the target position. Because of the delay in the feedback loop, the actual position does not follow the setpoint position exactly. This difference is referred to as the following error.

Disadvantages caused by a following error

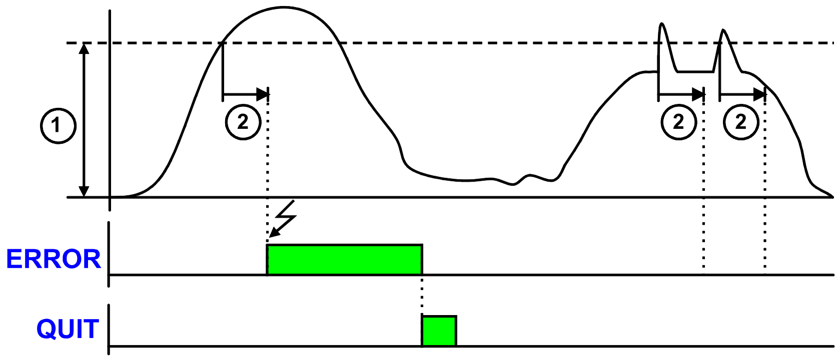
In joint operation of several servo controllers (e.g. master controller and slave controller), following errors lead to problems due to the dynamic position differences, and a large following error can lead to positioning overshoot.

Error message

If the following error exceeds the specified following error limit, the "following error time" then expires. If the following error is even greater than the following error limit at the end of the following error time, an error is reported.
If the following error falls short of the following error limit, a new following error time is then started.

Minimizing the following error

The following error can be minimized with the help of the extended (advanced) control parameters, in particular with the feed forward parameters.



1: Following error limit [parameterized unit]
2: Tracking error time
ERROR: Error output of positioning modules
QUIT: Ackn with MC_Reset module

4.1.13. Maximum permissible speed

The limitation of the speed controller is deduced from the maximum permissible speed. In order to ensure control margins, the speed is limited to a higher value. The speed setpoint value is actively limited to 1.1 times the given value.
If the speed actual value exceeds the preset maximum permissible speed by 21% (="switching off limit speed"), error 0x7310 is triggered.

4.1.14. Encoder Simulation

You can make use of a permanently integrated encoder simulation feature to make the actual position value available to additional servo drives or other automation components.

Caution!

- The encoder simulation is not possible at the same time as the encoder input resp. the step/direction input or the SSI interface.
  The same interface is used here.
- A direction reversal configured in the C3 ServoManager does not affect the encoder simulation.
  The direction of rotation of the encoder simulation can, however, be changed via the feedback direction in the MotorManager.

Simulated Encoder Output Resolution

Unit: Increments per 500mm*	Range: 4 - 16384	Standard value: 1024
Any resolution can be set **Limit frequency: 620kHz** i. e. for:		
Increments per 500mm	max. velocity	
1024	30m/s	
4096	7.5m/s	
16384	1.8m/s	

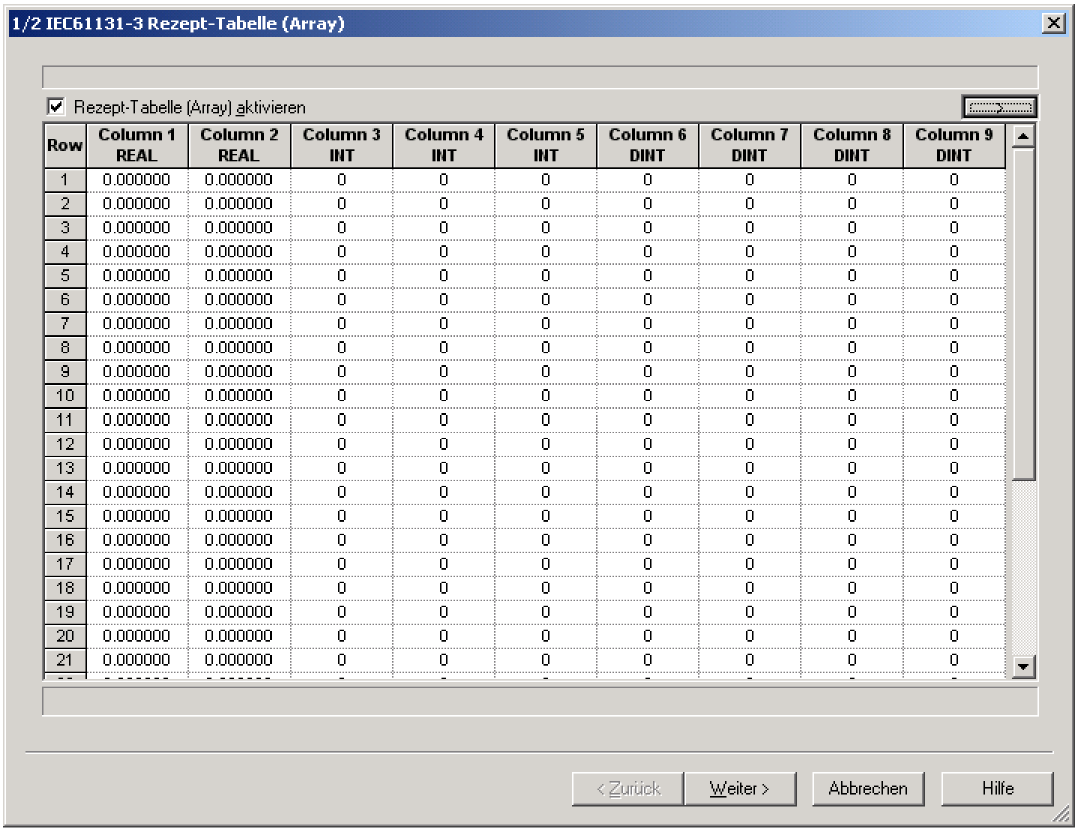
* or with a rotary feedback travel per feedback rotation

4.1.15. Recipe table

If you would like to work with the **recipe array** (see page 157), (e.g. for the storage of variable machine data) you can make preassignments in it with Compax3 ServoManager.

Note:

The recipe array can also be loaded separately into the device (>button on the right side).



Row	Column 1 REAL	Column 2 REAL	Column 3 INT	Column 4 INT	Column 5 INT	Column 6 DINT	Column 7 DINT	Column 8 DINT	Column 9 DINT
1	0.000000	0.000000	0	0	0	0	0	0	0
2	0.000000	0.000000	0	0	0	0	0	0	0
3	0.000000	0.000000	0	0	0	0	0	0	0
4	0.000000	0.000000	0	0	0	0	0	0	0
5	0.000000	0.000000	0	0	0	0	0	0	0
6	0.000000	0.000000	0	0	0	0	0	0	0
7	0.000000	0.000000	0	0	0	0	0	0	0
8	0.000000	0.000000	0	0	0	0	0	0	0
9	0.000000	0.000000	0	0	0	0	0	0	0
10	0.000000	0.000000	0	0	0	0	0	0	0
11	0.000000	0.000000	0	0	0	0	0	0	0
12	0.000000	0.000000	0	0	0	0	0	0	0
13	0.000000	0.000000	0	0	0	0	0	0	0
14	0.000000	0.000000	0	0	0	0	0	0	0
15	0.000000	0.000000	0	0	0	0	0	0	0
16	0.000000	0.000000	0	0	0	0	0	0	0
17	0.000000	0.000000	0	0	0	0	0	0	0
18	0.000000	0.000000	0	0	0	0	0	0	0
19	0.000000	0.000000	0	0	0	0	0	0	0
20	0.000000	0.000000	0	0	0	0	0	0	0
21	0.000000	0.000000	0	0	0	0	0	0	0

4.1.16. Error response

Under "configuring: Under "configuration: error reaction" you can change the error reaction for individual errors (the error no. which can be influenced is displayed). Possible settings for the error reaction are:

- No response
- downramp / stop
- Downramp / switch to currentless (standard setting)

4.1.17. Configuration name / comments

Here you can name the current configuration as well as write a comment.
Then you can download the configuration settings or, in T30 or T40 devices, perform a complete Download (with IEC program and curve).

⚠	**Caution!** Deactivate the drive before downloading the configuration software! **N.B.!** Incorrect configuration settings entail danger when activating the drive. Therefore take special safety precautions to protect the travel range of the system.

⚠	**Mechanical limit values!** Observe the limit values of the mechanical components! Ignoring the limit values can lead to destruction of the mechanical components.

4.2 Configuring the signal source

In this chapter you can read about:

Possible master signal sources

Under the tree entry "Configuring the signal source" of the C3 ServoManager you can configure 3 signal sources for Master – Slave applications.
The master signal source can then be selected in the IEC program with the aid of the **C3_MasterControl** (see page 237) module via the input "Master".
3 signal sources are available:

- Physical Source
  - analog value above +/-10V
  - Encoder signal A/B (5V)
  - Step/Direction signal (5V)
  - SSI Feedback
- Internal virtual master (IEC program) (only T40)
- HEDA

the "use as current signal source" CheckBox can be found in the signal source configuration wizards.
This CheckBox is only relevant for the Compax3 firmware versions < V2.05; it is used to define the signal source for the CoDeSys program.
Otherwise, the signal source is directly selected at the IEC module.

Signal source of the load feedback system

Configuration of the load control (Dual Loop Option)

4.2.1. Physical Source

In this chapter you can read about:

4.2.1.1 Encoder A/B 5V, step/direction or SSI feedback as signal source

Caution!

- The encoder simulation is not possible at the same time as the encoder input resp. the step/direction input or the SSI interface.
  The same interface is used here.
- A direction reversal configured in the C3 ServoManager does not affect the encoder simulation.
  The direction of rotation of the encoder simulation can, however, be changed via the feedback direction in the MotorManager.

The dimensional reference to the master is established via the following settings:

- Travel path per motor revolution master axis numerator = 50mm or with a rotary feedback system: Travel per feedback revolution.
  With denominator = 1 the value can be entered directly.
  Long-term drift can be avoided by entering non-integral values integrally as a fraction with numerator and denominator.
- Increments per revolution of the master axis

If required the direction of rotation of the master axis read in can be changed.

Example: Electronic gearbox with position detection via encoder

Reference to master axis

The reference to the master axis is established via the increments per revolution and the travel path per revolution of the master axis (corresponds to the circumference of the measuring wheel).
That is:

$$\text{MasterPos} = \frac{\text{Master\_I}}{\text{I\_M}} * \frac{\text{Travel Distance per Master Axis revolution (M\_Units/rev)}}{\text{Travel Distance per Master Axis revolution - Denominator}} \quad (1)$$

MasterPos: Master Position
Master_I: master increments read in
I_M: Increments per revolution of the master axis

External signal source

Encoder with 1024 increments per master revolution and a circumference of the measuring wheel of 40mm.

Settings:

Travel path per revolution of the master axis numerator = 40
Travel path per revolution of the master axis denominator = 1
Increments per revolution of the master axis = 1024

Configuration wizard:

Reference system of Slave axis: Unit of measure [mm]
Travel path per revolution numerator = 1
Travel path per revolution denominator = 1

Gearing:

Gearing numerator = 2
Gearing denominator = 1

This results in the following interrelations:

If the measuring wheel moves by 40mm (1 master revolution), the slave axis will move by 80mm.

$$\text{Slave unit} = \text{MasterPos} * \frac{\text{Gearing numerator}}{\text{Gearing denominator}} \quad (2)$$

(1) set into (2) and with numerical values results with 1024 increments read in (=1 Master revolution):

$$\text{Slave unit} = 1024 * \frac{1}{1024} * \frac{40\text{mm}}{1} * \frac{2}{1} = 80\text{mm}$$

Master - Position = +40mm => Slave - Position = +80mm

Structure:

Master	Z1	MasterPos	Gearing numerator	Slave -	N2	Slave_U	Gearbox	Load
	N1		Gearing denominator	Units	Z2	to motor		

Detailed structure image with:

MD =	Z1 / N1	*	Travel Distance per Master Axis revolution (M_Units/rev) / Travel Distance per Master Axis revolution - Denominator	Entry in the ”configuration of the signal source” wizard
SD =	Z2 / N2	*	Travel path per revolution slave axis numerator / Travel path per revolution slave axis denominator	Entry in the ”configuration of the signal source” wizard

MD: Feed of the master axis
SD: Feed of the slave axis

SSI configuration

Notes on the SSI sensor **(see page 84)**

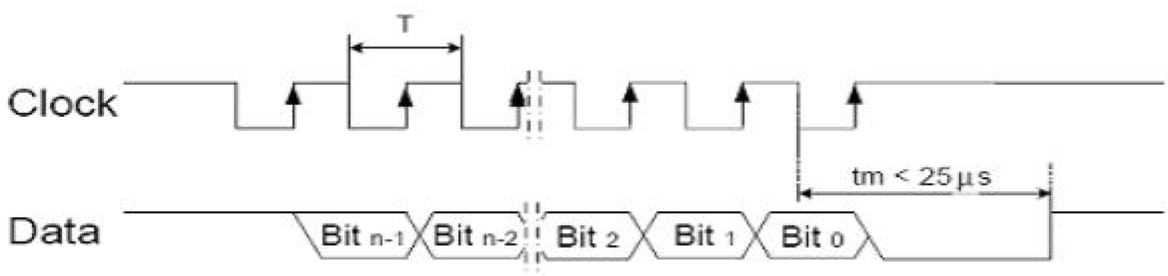
- With Multiturn: Number of sensor rotations with absolute reference
- Word length: Gives the telegram length of the sensor.
- Baud rate/step: Max. transmission rate of the path measurement system.
- Gray code: Sensor gray code coded yes/no (if no binary coded).

Note:

The absolute position is not evaluated!
It is available in the objects 680.24 (load position) and 680.25 (master position) (C3T30, C3T40).

General requirements for supported SSI feedbacks

- Baud rate: 350k ... 5MBaud
- Word length: 8 ... 32 Bit
- Binary or gray code (start value = 0)
- Initialization time after PowerOn: < 1.1s
- Signal layout:



The most significant bit must be transmitted the first!
Caution! Feedback systems, transmitting data containing error or status bits are not supported!

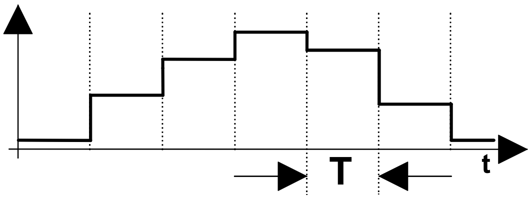
- Examples of supported SSI feedback systems:
  - IVO / GA241 SSI;
  - Thalheim / ATD 6S A 4 Y1;
  - Hübner Berlin / AMG75;
  - Stegmann / ATM60 & ATM90;
  - Inducoder / SingleTurn: EAS57 & Multiturn: EAMS57

4.2.1.2 +/-10V Master speed

Via Analog channel 4 (X11/17 and X1/18) the speed of the master is read in.
From this value a position is internally derived.
The reference to the master is established with the velocity at 10V.
If required the direction of rotation of the master axis read in can be changed.

Time grid of master signal source

Averaging and a following filter (interpolation) can help to avoid steps caused by discrete signals.
If the external signal is analog, there is no need to enter a value here (Value = 0).
For discrete signals e.g. from a PLC, the scanning time (or cylce time) of the signal source is entered.



This function is only available if the analog interface +/-10V is used!

4.2.2. Internal virtual master

In this chapter you can read about:

The reset distance of the virtual master is only used for resetting the displayed value (Object680.2).
The travel per motor revolution of the master axis (numerator/denominator) is set to 1 for a virtual master.

If required the direction of rotation of the master axis read in can be changed.

4.2.3. HEDA Master signal source

Please choose if the virtual master of the HEDA master is transmitted via the HEDA.
If yes, the input ”travel per revolution” is not necessary, as a positioning signal is already present.

The dimensional reference to the master is established via the following settings:

- Travel path per motor revolution (or pitch for linear motors) master axis numerator
  With denominator = 1 the value can be entered directly.
  Long-term drift can be avoided by entering non-integral values integrally as a fraction with numerator and denominator.
- Travel per motor revolution (or pitch ofr linear motors) master axis denominator

If required the direction of rotation of the master axis read in can be changed.

4.3 Optimization

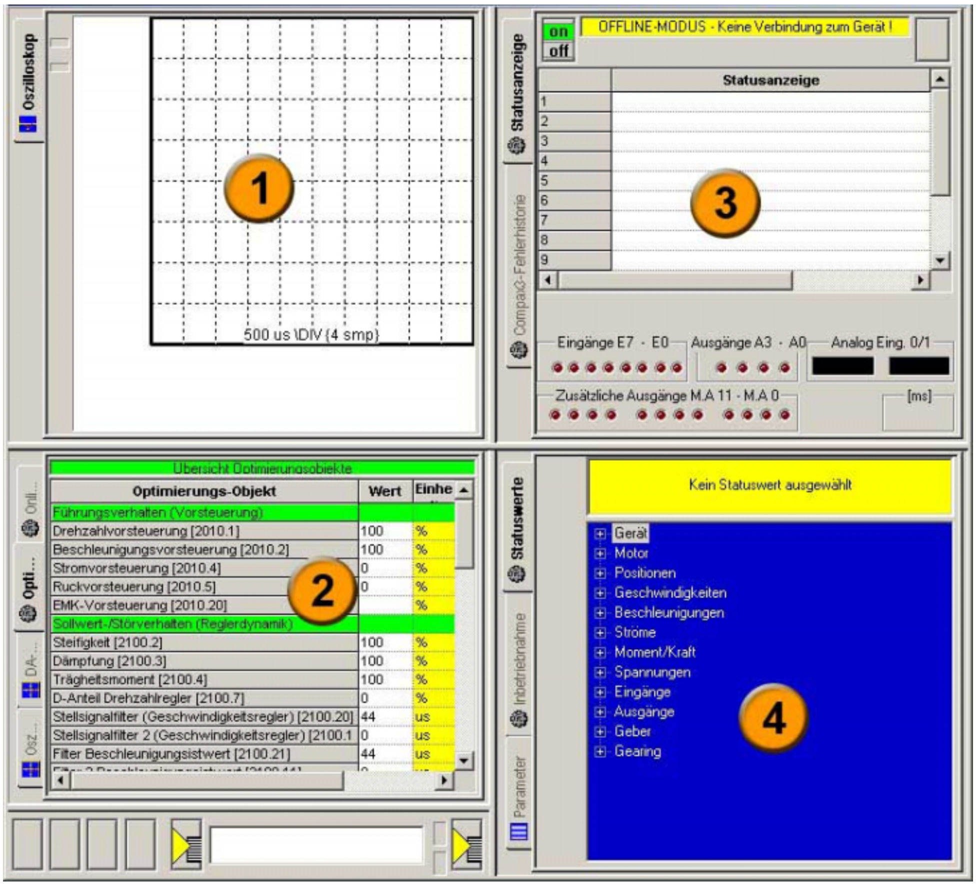
In this chapter you can read about:

- Select the entry **"Optimization"** in the tree.
- Open the optimization window by clicking on the **"Optimization Tool"** button.

4.3.1. Optimization window

Layout and functions of the optimization window

Segmentation	Functions (TABs)
Window1:	◆ **Scope** (see page 89)
Window 2:	◆ **Optimization: Controller optimization** (see page 97)
	◆ **D/A Monitor** (see page 427): Output of status values via 2 analog outputs
	◆ Scope Settings
Window 3:	◆ Status Display
	◆ Compax3 Error History
Window 4:	◆ Status values
	◆ Commissioning: Setup mode with load identification
	◆ Parameters for commissioning, test movements (relative & absolute) and for load identification.



4.3.2. Scope

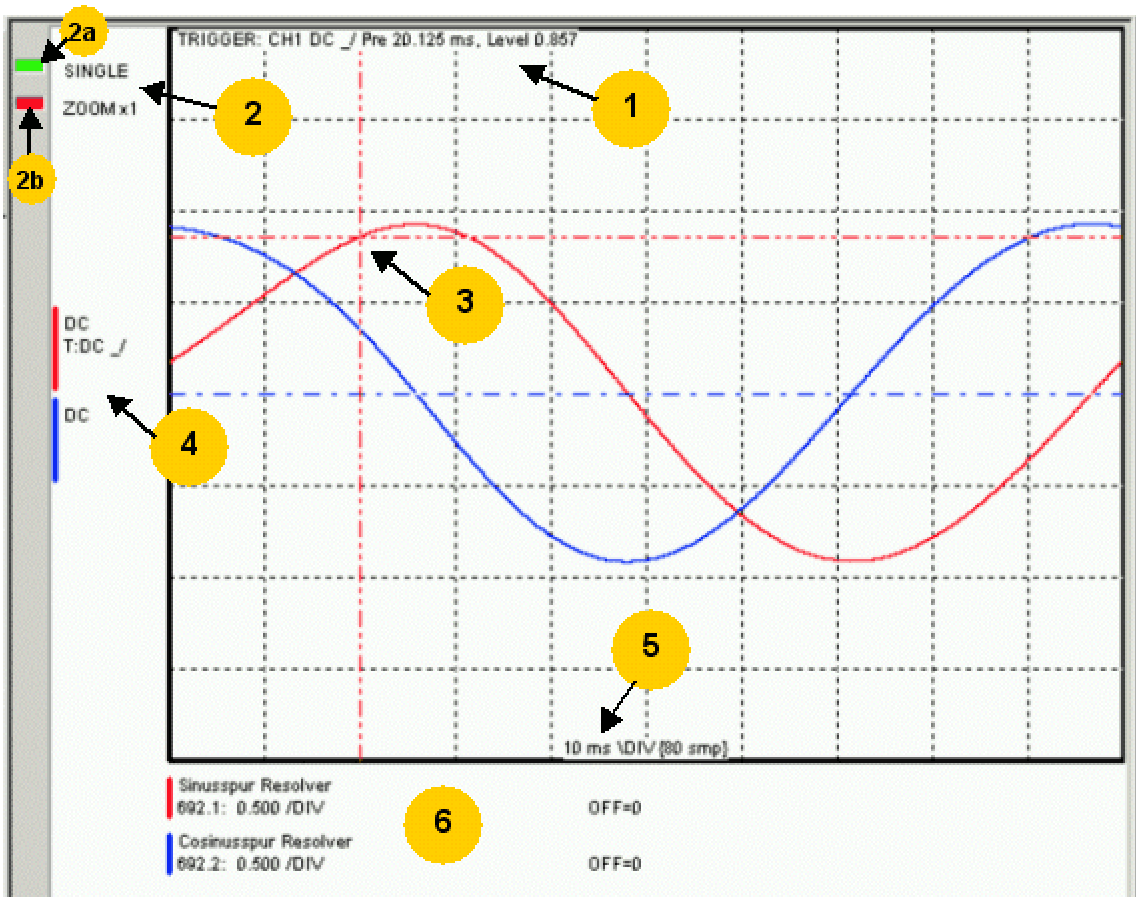
In this chapter you can read about:

The integrated oscilloscope function features a 4-channel oscilloscope for the display and measurement of signal images (digital and analog) consisting of a graphic display and a user interface.

Special feature:

in the single mode you can close the ServoManager after the activation of the measurement and disconnect the PC from Compax3 and upload the measurement into the ServoManager later.

4.3.2.1 Monitor information



1: Display of the trigger information
2: Display of the operating mode and the zoom setting

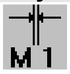
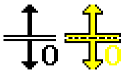
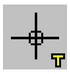
- **2a:** Green indicates, that a measurement is active (a measurement can be started or stopped by clicking here).
- **2b:** Active channel: the active channel can be changed sequentially by clicking here (only with valid signal source).

3: Trigger point for Single and Normal operating mode
4: Channel information: Type of display and trigger settiing
5: X-DIV: X deviation set
6: Single channel sources

Cursormodes/ -functions

Depending on the operating mode, different cursor functions are available within the osci monitor.

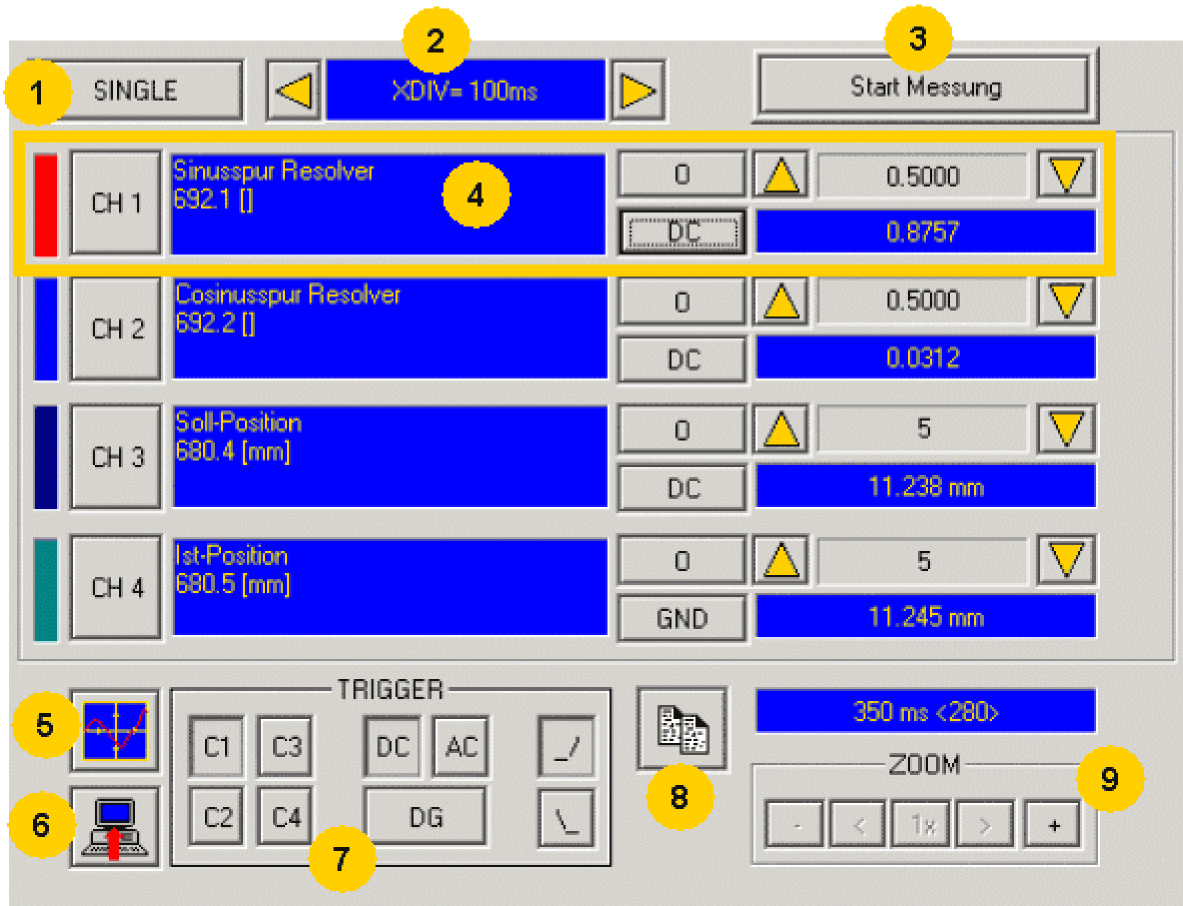
The functions can be changed sequentially by pressing on the right mouse button.

Cursor Symbol	Function
	Set Marker 1 the measurement values of the active channel as well as the y difference to marker 2 are displayed
	Set Marker 2
	Delete and hide marker
	Move offset of the active channel. The yellow symbol indicates that the scrolling is active.
	Set trigger level and pretrigger

In the ROLL operating mode, marker functions and set trigger level positions are not available.

4.3.2.2 User interface

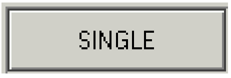
In this chapter you can read about:



1: **Operating mode switch** (see page 91) (Single / Normal / Auto / Roll)
2: **Setting the time basis** (see page 91)
3: Starting / Stopping the measurement (prerequisites are valid channel sources and if necessary valid trigger settings.)
4: **Setting channel** (see page 92) (Channels 1 ...4)
5: **Special functions** (see page 93) (Color settings; memorizing settings and measurement values)
6: Loading a measurement from Compax3: in the single mode you can close the ServoManager after the activation of the measurement and disconnect the PC from Compax3 and upload the measurement later.
7: **Setting triggering** (see page 93)
8: Copy osci display to clipboard
9: Zoom of the osci display (1, 2, 3, 8, 16 fold) with the possibility to move the zoom window (<,>)

Oscilloscope operating mode switch:

Oscilloscope operating mode switch:



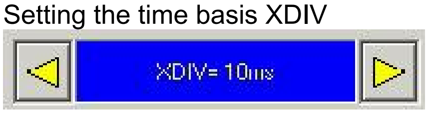
Selection of the desired operating mode: SINGLE, NORMAL; AUTO and ROLL by clicking on this button.
Changing the operating mode is also permitted during a measurement. The current measurement is interrupted and started again with the changed settings.
The following operating modes are possible:

Operating mode	Short description
SINGLE	Single measurements of 1-4 channels with trigger on a freely selectable channel
NORMAL	Like Single, but after each trigger event, the measurement is started again.
AUTO	No Trigger. Continuous measuring value recording with the selected scanning time or XDIV setting
ROLL	Continuous measuring value recording of 1 .. 4 channels with selectable scanning time and a memory depth of 2000 measuring values per channel.

With SINGLE / NORMAL / AUTO, the meansurement is made in Compax3 and is then loaded into the PC and displayed.
With ROLL, the measuring values are loaded into the PC and displayed continuously.

Setting the time basis XDIV

Setting the time basis XDIV



Depending on the selected operating mode, the time basis can be changed via the arrow keys.

For the operatiing modes SINGLE, NORMAL and AUTO, the following XDIV time settings are possible:

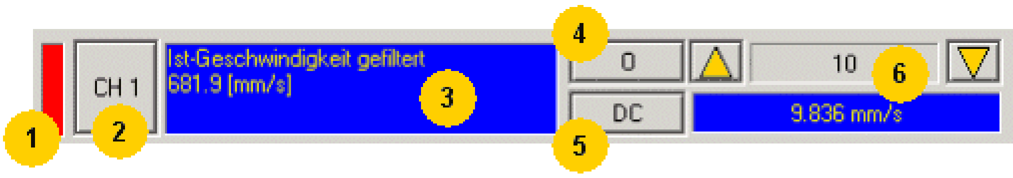
XDIV	Mode	Scanning time	Samples DIV/TOTAL	Measuring time
0.5ms	1	125us	4/40	5ms
1.0ms	2	125µs	8/80	10ms
2.0ms	3	125µs	16/160	20ms
5.0ms	4	125µs	40/400	50ms
10.0ms	5	125µs	80/800	100ms
20.0ms	6	250µs	80/800	200ms
50.0ms	7	625µs	80/800	500ms
100.0ms	8	1.25ms	80/800	1s
200.0ms	9	2.50ms	80/800	2s
500.0ms	10	6.25ms	80/800	5s
1s	11	12.50s	80/800	10s
2s	12	25.00ms	80/800	20s
5s	13	62.50ms	80/800	50s
10s	14	125.00ms	80/800	100s

For the operating ROLL, the following XDIV time settings are possible:

XDIV	Mode	Scanning time	Samples DIV/TOTAL
2 ms	54	125us	200/2000
2ms	54	125µs	200/2000
4ms	55	125µs	200/2000
10ms	56	125µs	200/2000
20ms	57	125µs	200/2000
40ms	58	125µs	200/2000
100ms	59	250µs	200/2000
200ms	60	625µs	200/2000

Changing the time basis is also permitted during an OSCI measuring sequence. This means, however, that the current measurement is interrupted and started again with the changed settings.

Settings for channels 1..4



1: Select channel color

2: Open menu for channel-specific settings

- **Reset Channel CH 1..4** all channel settings are deleted.
  Please note: Channels can only be fileld with sources one after the other. It is, for example, not possible to start a measurement which has only a signal source for channel 2!
- **Select channel color:** Here you can change the color of the channel..
- **show/hide channel:** Hide/show display of the channel.
- **Change logic display mask:** Mask bits in logic display.
- **auto scaling** Calculation of YDIV and Offset: The program calculates the best settings for YDIV and channel offset in order to display the complete signal values optimally.

3: Set signal source with object name, number and if necessary unit

- Define source: Draw the desired status object with the mouse (drag & drop) from the "Status value" window (right at the bottom) into this area.

4: Set Channel offset to 0

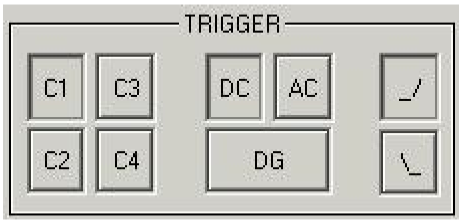
5: Select channel display (GND, DC, AC, DIG)

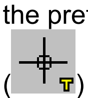
- **DC:** Display of the measurement values with constant component
- **AC:** Display of the measurement values without constant component
- **DIG:** Display of the individual bits of an INT signal source.
  The displayed bits can be defined via the logic display mask.
- **GND:** A straight line is drawn on the zero line.

6: Set Y-amplification (YDIV)

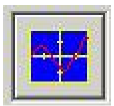
Change of the Y amplification YDIV in the stages 1,2,5 over all decades.
Arrow upwards increases YDIV, arrow downwards diminishes YDIV.
the standard value is 1 per DIV.
The measurement value of the channel at the cursor cross is displayed.

Trigger settings



Select trigger channel: Buttons C1, C2, C3, C4
Select trigger mode: DC, AC, DG
Select trigger edge: rising_/ or falling _
the pretrigger as well as the trigger level are set by clicking on the trigger cursor
() directly in the OSCI display.

Special functions



Menu with special oscilloscope functions such as memorizing or loading settings.

Functions:

- **Select background color:** Adapt background color to personal requirements.
- **Select grid color:** Adapt grid color to personal requirements.
- **Memorize OSCI settings in file:** The settings can be memorized in a file on any drive. The file ending is *.OSC.
- The format correspnds to an INI file and is presented in the appendix.
- **open OSCI settings from file.** Loading a memorized set of settings. The file ending is *.OSC.
- **Memorizing OSCI settings in the project:** Up to four sets of OSCI settings can be memorized in the current C3 ServoManager project. .
- **open OSCI settings from project.** If settings were memorized in the project, they can be read in again.
- **Memorize OSCI measurement in file:** Corresponds to memorizing the setting; the measurement values of the measurement are stored in addition. Thus it is possible to memorize and read measurements completely with settings. The file ending is *.OSM.
- **Exporting measurement values into a CSV file:** e.g. for reading into Excel.

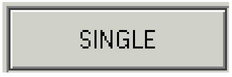
4.3.2.3 Example: Setting the Oscilloscope

SINGLE measurement with 2 channels and logic trigger on digital inputs

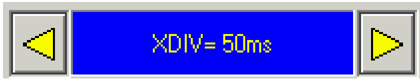
The order of the steps is not mandatory, but provides a help for better understanding.
As a rule, all settings can be changed during a measurement. This will lead to an automatic interruption of the current measurement and to a re-start of the measurement with the new settings:

Assumption: A test movement in the commissioning mode is active.

1.) Select OSCI operating mode



2.) Select Time basis XDIV



3.) Select channel 1 signal source digital inputs 120.2 from status tree with the aid of Drag & Drop

4.) Select channel 2 (filtered actual speed) via "Drag and drop" from the status tree

5.) Set trigger to channel 1 and DG.

Input of the mask in HEX
Triggering a rising edge to input I1.
BIT 0 (value 1) = I0
BIT 1 (value 2) = I1
BIT 2 (value 4) = I2 etc.

Trigger to input	I0	I1	I2	I3	I4	I5	I6	I7
Trigger mask in hex	1	2	4	8	10	20	40	80

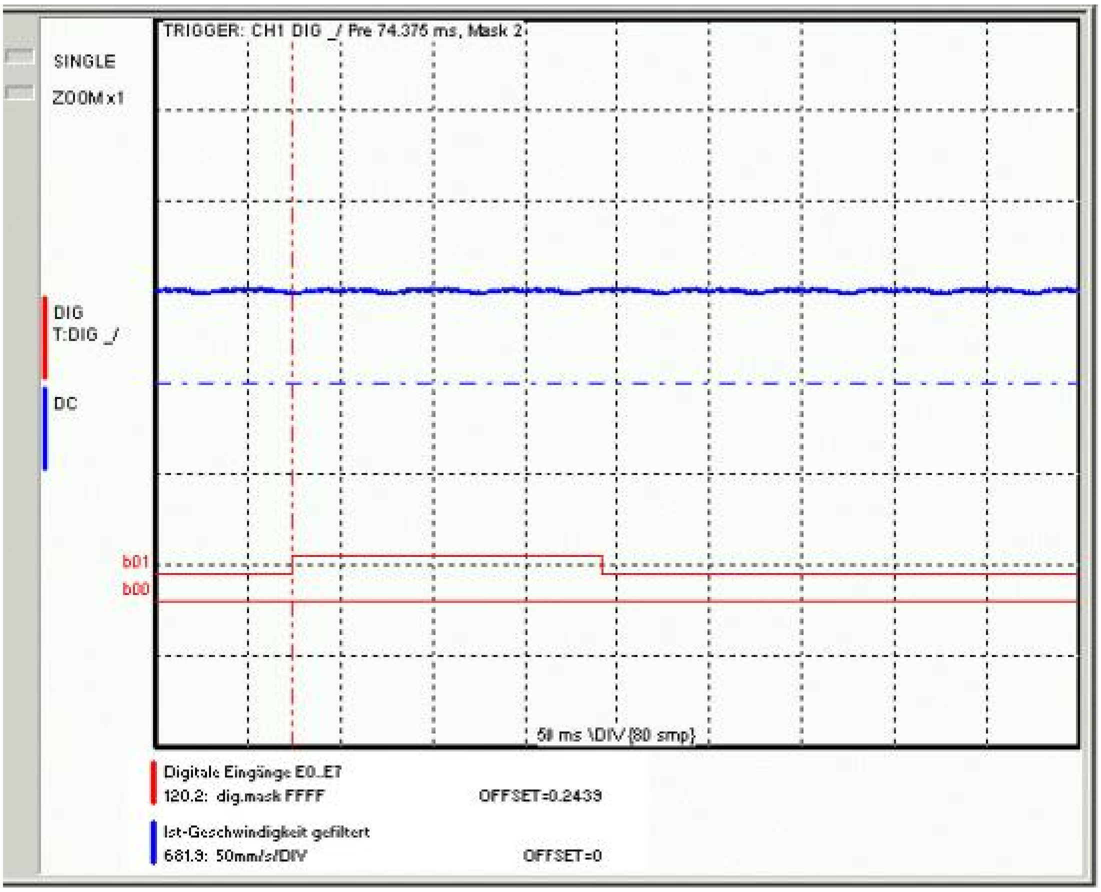
The masks can also be combined so that the trigger is only active, if several inputs are active. Example: Triggering to I2 and I5 and I6 -> 4h + 20h + 40h = 64h
The mask for input I1 is in this case 2.
select rising edge.
Note: If the trigger mask DG (digital) is selected for a channel, the display mode of the trigger channel is automatically set to DIG display.

6.) Start measurement

7.) Set pretrigger in the OSCI window

Note: There is no level for the DIG trigger The the event lomit determines the mask
If a trigger event occurs, the measurement values are captured until the measurement is completed.
Afterwards, the measurement values are read from the Compax3 and displayed.
The display mask of trigger channel 1 was not yet limited, therefore it shows all 16 bit tracks (b0...b15). In order to limit it to 8 bit tracks, you must call up the menu for channel 1 via [CH1] and select "change logic of display mask [H].
Limit the display mask to 8 bit tracks with Mask FFh.
In the display the bit tracks b0 to b7 are now shown:

Example: Only b0 and b1 are to be displayed: Set display mask to 03


TRIGGER: CH1 DIG _/ Pre 74.375 ms, Mask 2
SINGLE
ZOOM x1
DIG
T:DIG _/
DC
b01
b00
50 ms \DIV {80 smp}
Digitale Eingänge E0..E7
120.2: dig.mask FFFF
OFFSET=0.2439
Ist-Geschwindigkeit gefiltert
681.9: 50mm/s/DIV
OFFSET=0

4.3.3. Control Loop Dynamics

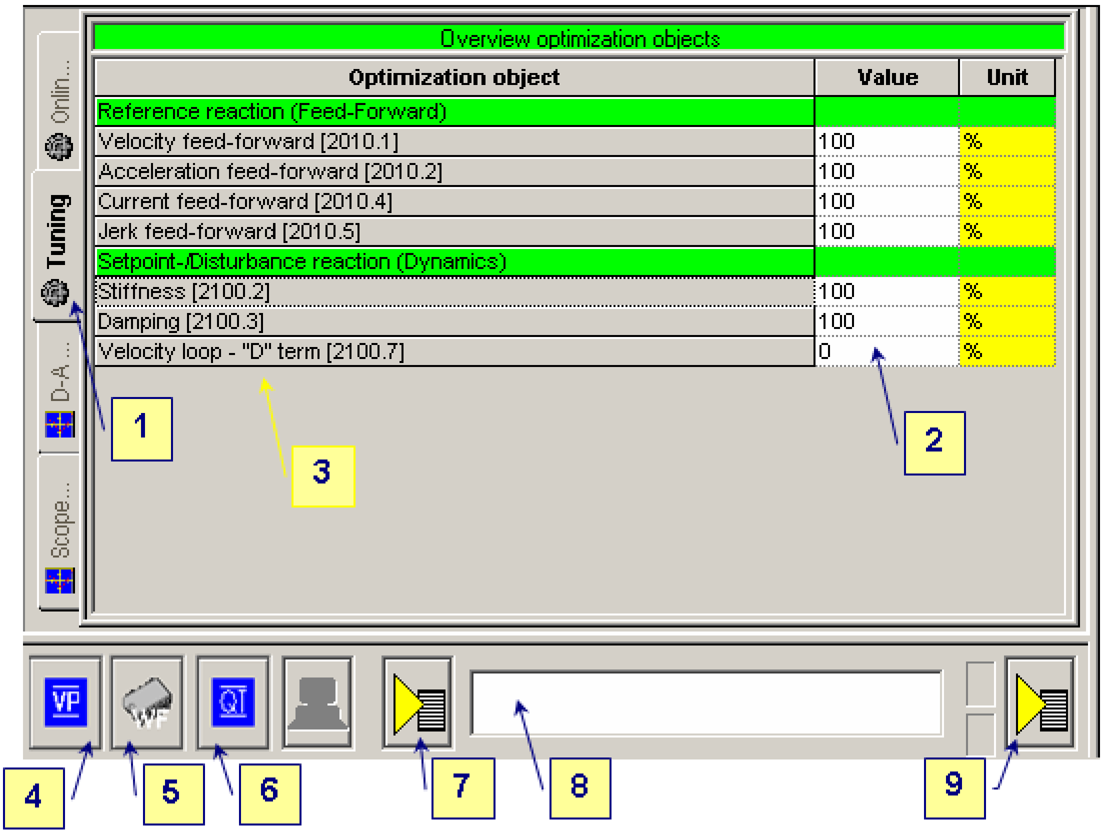
In this chapter you can read about:

The controller optimization of the Compax3 is carried out by setting the optimization objects in 2 steps:

- Via the standard settings, with the help of which many applications can be optimized in a simple manner.
- With advanced settings for users familiar with control loops.

Editing the optimization objects

The settings are made in the controller optimization window:



1: Selection of the optimization tab
2: Selection of the optimization value
3: List of the optimization objects, with object name and object number
4: Command VP for accepting a changed optimization object.
Yellow background indicates that an object has been changed, was however not yet set to valid with VP.
5: Command WF for permanently saving the changed obejcts (also after mains off/on)
6: Acknowledging a Compax3 error.
7: Setting options:

- Standard / Advanced mode
- Load protocol to clipboard, load into notepad or delete

8: Editing window: The value of an object selected with the aid of the mouse (in 3) can here be edited and confirmed with return.
9: Additional functions, depending on the Compax3 technology function.

4.3.3.1 Preparatory settings for the controller alignment

In this chapter you can read about:

Configuring the device

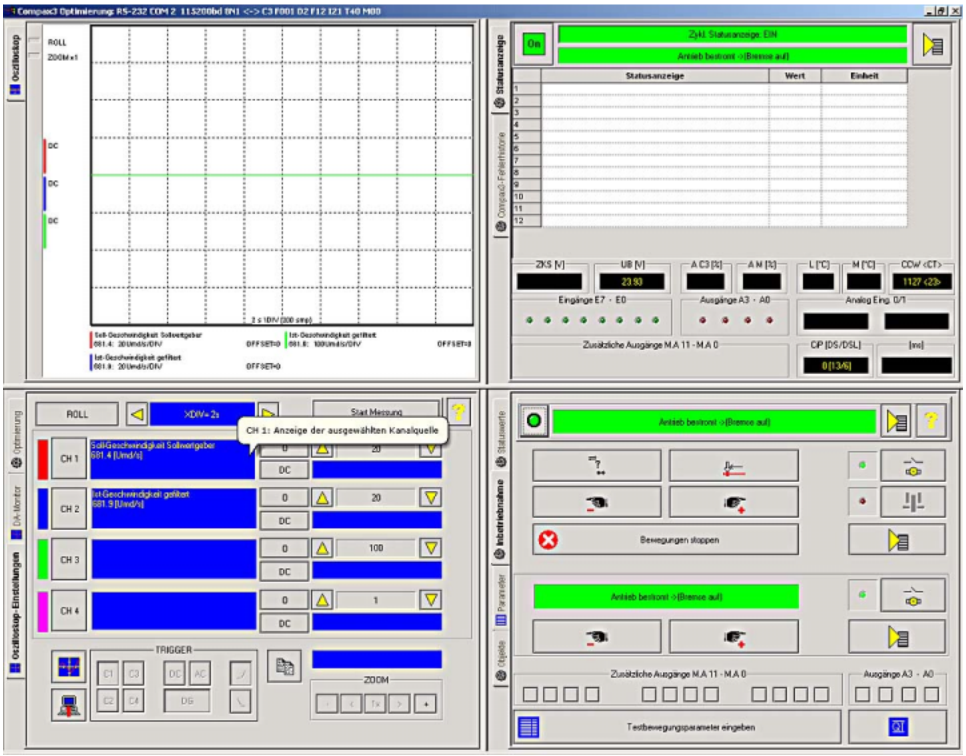
The configuration settings must be made before with the aid of the Configuration Wizard.
Optimization takes place in the **optimization window** (see page 88).

Checking the feedback direction and the valve output polarity

Feedback direction and valve polarity are verified in the open loop.

ATTENTION:
In the open loop operation, the drive axis might drift, as the position controller is deactivated!

With the aid of the jog+/- function, the axis can be moved.
The setpoint generator- (681.4 or 681.2) and the actual speed (681.9 or 681.14) must have the same sign (shown in the roll mode of the oscilloscope).



If this is not the case, there are two possible causes:

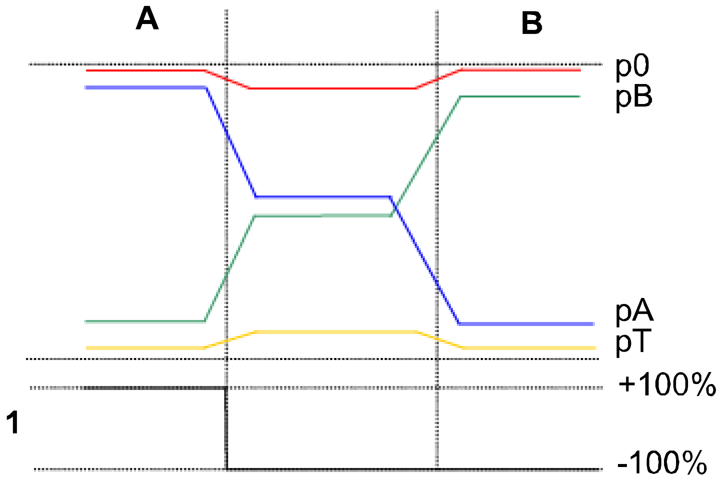
- Wrong orientation of the position feedback system: The actual position can be displayed in order to check this. Resolve by changing the feedback direction in the configuration wizard or in the C3HydraulicsManager.
- Incorrect wiring of the valves. The polarity can either be changed by changing the wiring at the clamp or by inverting the output (Optimization → Output Chain X → Inversion).

Compensation of non-linearities of the distance

Before the controller alignment, the non-linear components of the path should be compensated with the aid of the Output Conditioning Chains. This helps to achieve an improvement of the system behavior. There are several possibilities:
a) Pressure compensation
If pressure sensors are available, those can be used to compensate the differtial pressure. This makes the control more robust with respect to variations in the system pressure or the load.

Before the activation, please notice the following:

- Correct connection of the pressure sensors to the controller.
  - By approaching the end limits and simultaneously monitoring the pressure values (Status values → pressure of main or auxiliary axis → pa, pb, pT and p0) it is possible to conclude if the pressure sensors are correctly assigned.



A = yclinder at limit A
B = cylinder at limit B
1 = valve position

- The pressure signals should be well filtered (smooth). (Optimization → Analog input → InX Filter)

If those conditions are fulfilled, the pressure compensation can be activated under (Optimization→ Output Chain → PressureCompensation).

b) characteristics compensation
The control behavior of valves with bent characteristic lines or overlap can be considerably improved if the valve characteristics are stored in the controller and are used for the compensation. The characteristic is integrated into the resepective valve data via the C3HydraulicsManager and is loaded into the controller via the C3ServoManager. The activation of the characteristic line is made via optimization → Output Chain → Characterisitic Flow.
If the valve characteristic line is activated, the behavior between control signal and speed should be mainly linear.
(Doubling of the setpoint speed → Doubling of the resulting speed in the open control loop).

c) Deadband compensation
If for valves with overlap or gap no adequate characteristics are available, they can be optimized with the aid of the deadband compensation. The corresponding values are set in (Optimization → Output Chain → Deadband ...).

Checking the open loop gain

In order to verify the open loop gain calculated from the component data. In the ideal case, the axis achieves the setpoint speed in both directions during open loop operation.

- Oscilloscope settings:
  - Setpoint speed of the setpoint generator
  - Actual speed (filtered)

Initially compensate a possible valve offset. In order to do this the value optimization → Output chain X → Offset is changed until the axis comes to a standstill.

Afterwards, the axis is moved for example with the aid of the jog funciton in the setup window. When comparing the setpoint speed and the actual speed you have distinguish between four different cases:

- **Setpoint speed> actual speed, positive travel direction:**
  - The open loop gain is too small → Optimization → Output chain X → increase Gain factor positive.
- **Setpoint speed< actual speed, positive travel direction:**
  - The open loop gain is too high → Optimization → Output chain X → decrease Gain factor positive.
- **Setpoint speed> actual speed, negative travel direction:**
  - The open loop gain is too small → Optimization → Output chain X → increase Gain factor negative.
- **Setpoint speed< actual speed, negative travel direction:**
  - The open loop gain is too high → Optimization → Output chain X → decrease Gain factor negative.

Now the axis must move in open loop with the preset speed.

Filter alignment

Especially when using feedback systems with low resolution, a filter alignment is necessary. With high resolution systems, this step might not be necessary.

- Oscilloscope settings:
  - Actual speed (filtered)

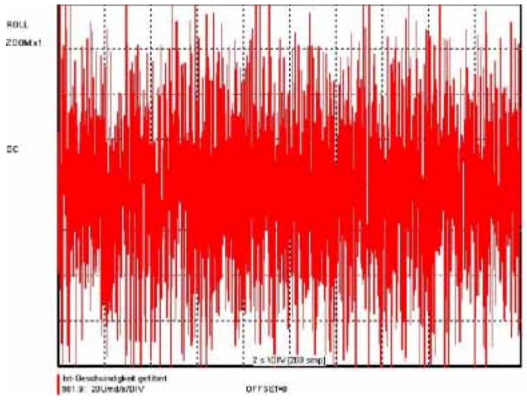
The Parameter Optimization → Controller dynamic → Filter 2 speed actual value is increased until there are no longer any spikes in the speed signal during the open loop movement of the axis.

ATTENTION: too strong filterung causes additional deceleration and phase shifting in the control loop and may later make the control instable! Filter as moderately as possible.

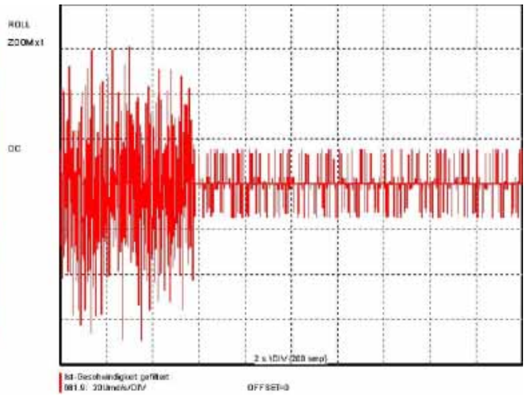
ATTENTION: when using analog position feedback systems, you should at first perform an input filtering. Optimization → Analog input → Inx → Filter.

Example: analog path measurement system +/-10V on input IN4:

Without input filter



With input filter 550%



Controller optimization

Now the control loop of the axis can be closed. Before you should **Save the settings** (see page 97).
Then the axis can be switched into the preoperational mode (power-off) in order to change then to closed loop operation. Switching between open and closed loop operation is only possible in this state.

ATTENTION: When the control is activated, uncontrolled movements of the axis may occur, if the control is inadequately parameterized!

ATTENTION: In order to limit the speed of the axis, the control signal range for the valve control can be limited with the aid of the output limitation. Settings: Optimization → Output Chain X → Upper Limit bzw. Lower Limit. The limitation should not be set too small, as this would put into effect an additional non-linearity (limitation) in the distance, which complicates the controller alignment.

Oscilloscope settings:

- Following error
- Actual speed
- Setpoint speed

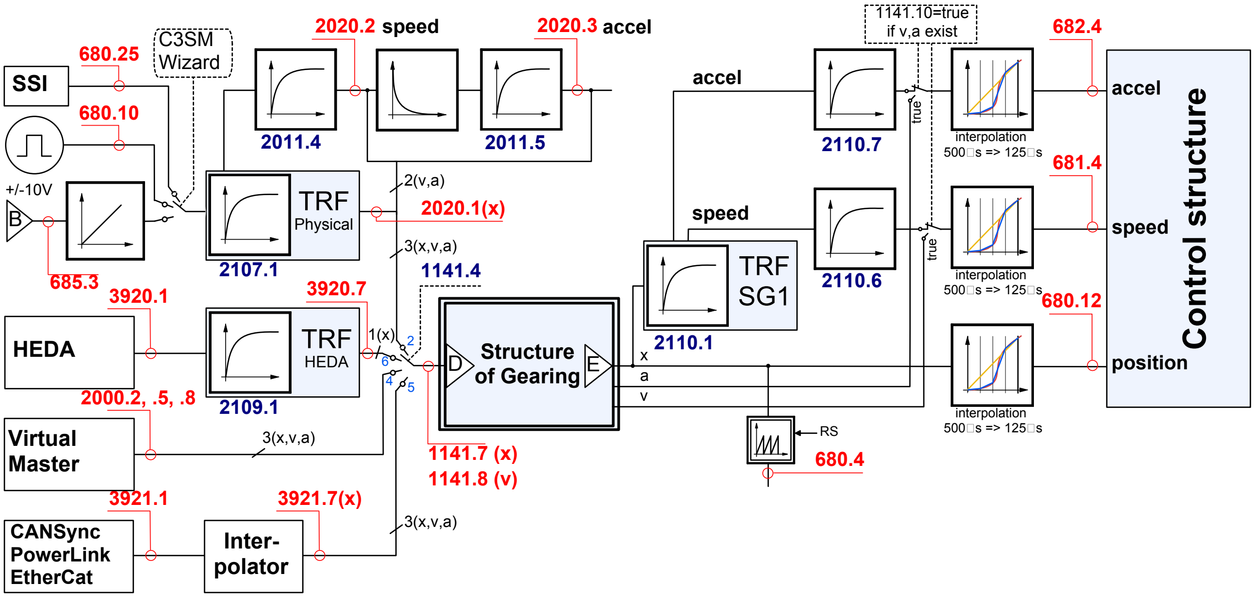
4.3.3.2 Signal filtering with external command value

In this chapter you can read about:

The command signal read in from an external source (via HEDA or physical input) can be optimized via different filters.
For this the following filter structure is available:

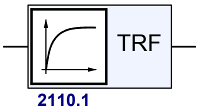
Signal filtering for external setpoint specification and electronic gearbox

Does not apply for Compax3I11T11!

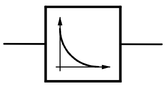


B: Structure image of the signal processing
D/E: **Structure of Gearing** (see page 196)
Control structure

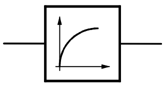
Symbols



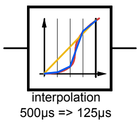
Trackingfilter
The displayed filter influences all outputs of the tracking filter.
Number: Object number of the filter characteristic



Differentiator
Output signal = d(input signal)/dt
The output signal is the derivation (gradient) of the input signal



Filter
Number: Object number of the filter characteristic



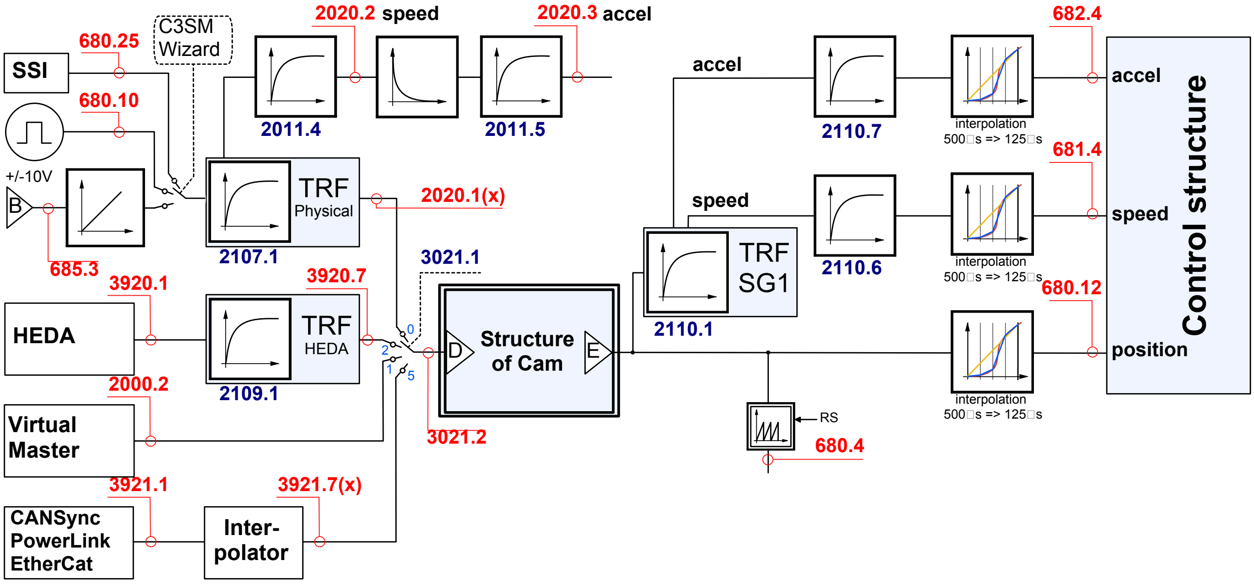
Interpolation
Linear Interpolation.
Values in the 500µs grid are converted into the more exact time grid of 125µs.

Note:

- A setpoint jerk setpoint feedback is not required for external setpoint specification.
- The description of the objects can be found in the **object list** (see page 414).

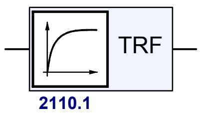
Signal filtering for external setpoint specification and electronic cam

Only Compax3 T40!

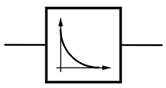


B: Structure image of the signal processing
D/E: **Structure of Cam** (see page 225)
Control structure

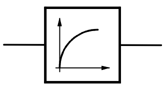
Symbols



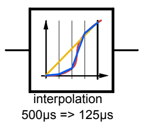
Trackingfilter
The displayed filter influences all outputs of the tracking filter.
Number: Object number of the filter characteristic



Differentiator
Output signal = d(input signal)/dt
The output signal is the derivation (gradient) of the input signal



Filter
Number: Object number of the filter characteristic

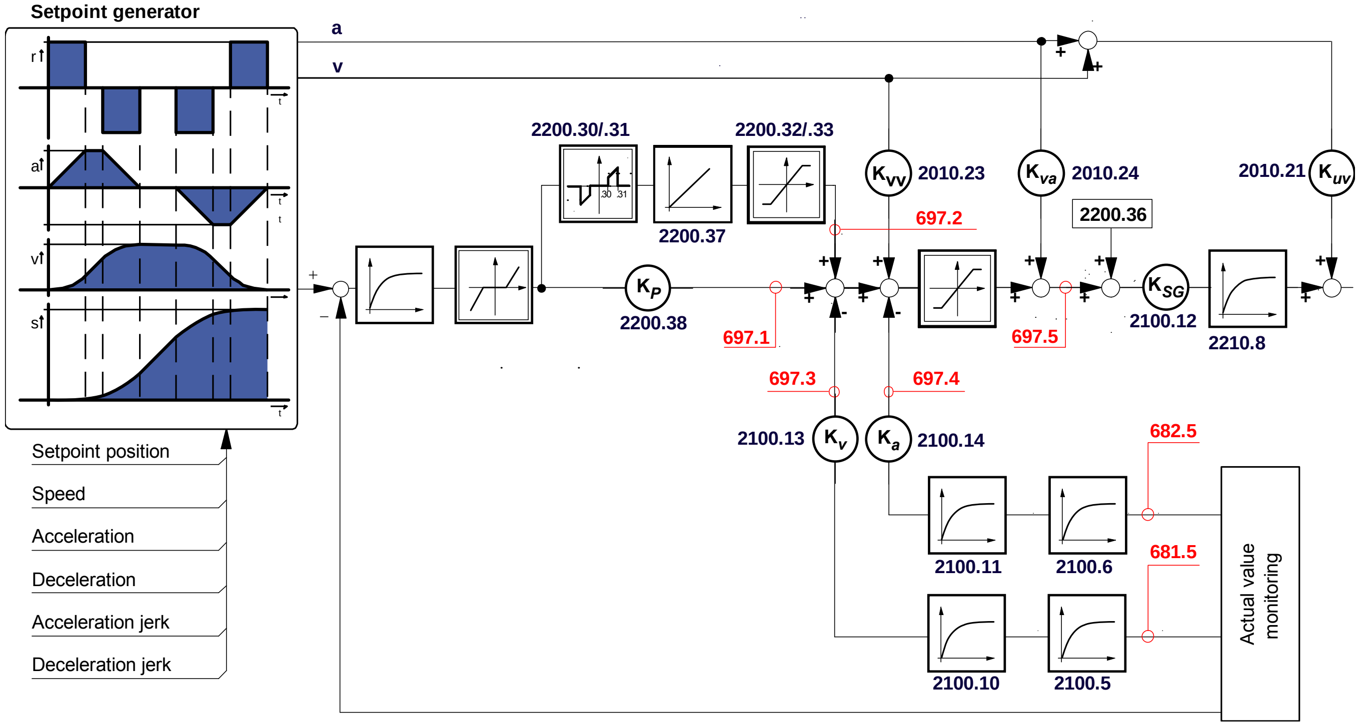


Interpolation
Linear Interpolation.
Values in the 500µs grid are converted into the more exact time grid of 125µs.

Note:

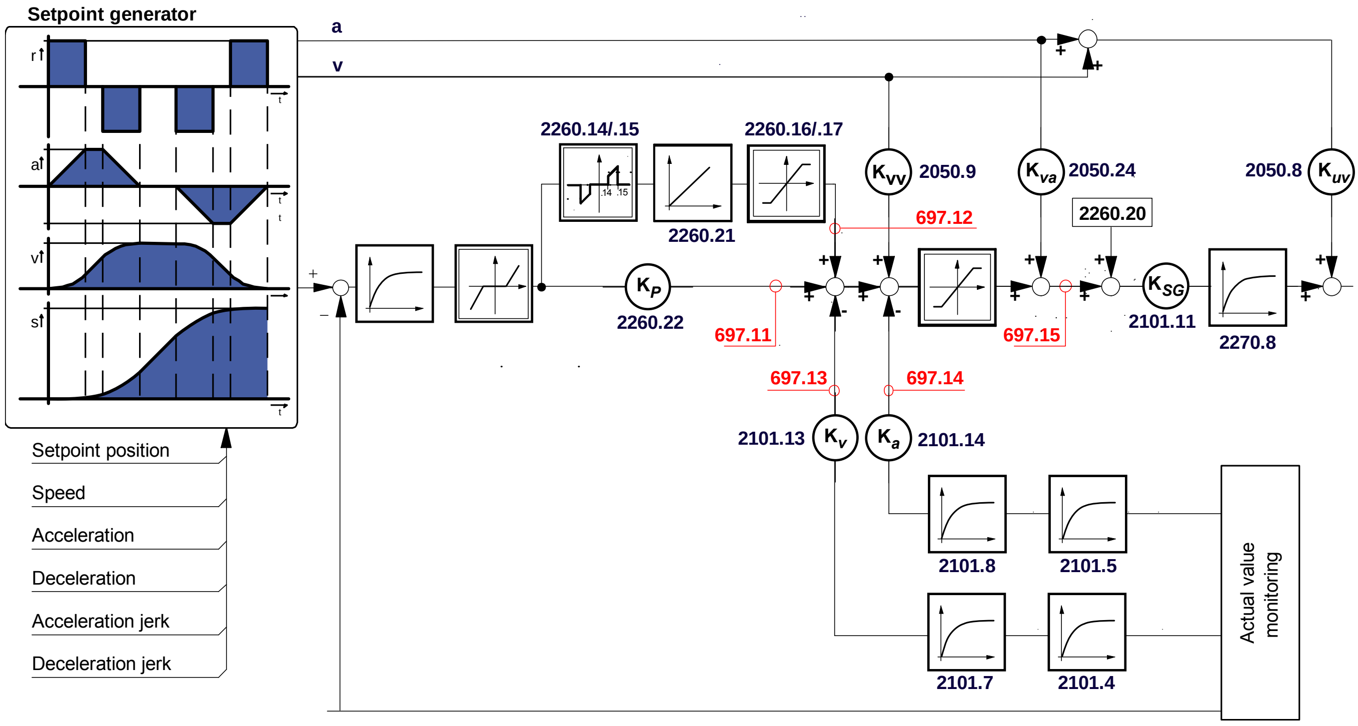
- A setpoint jerk setpoint feedback is not required for external setpoint specification.
- The description of the objects can be found in the **object list** (see page 414).

4.3.3.3 Controller structure of main axis



Measurement values: Status objects are displayed in red.
Fctors and time constants: Corresponding objects are displayed in blue.
Below you can find the descriptions of the individual objects.

4.3.3.4 Controller strucutre auxiliary axis



Measurement values: Status objects are displayed in red.
Fctors and time constants Corresponding objects are displayed in blue.
Below you can find the descriptions of the individual objects.

4.3.3.5 Feedforward main axis (status controller)

In this chapter you can read about:

Object 2010.23: Speed

Object name	*C3.FeedForward_Speed_FFW*		
Object No.	**2010.23**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	%s/unit		
Minimum value	%s/unit	**Maximum value**	%s/unit
Remark:	Factor for speed feedforward (main axis) (does only apply for single-loop status control)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	C4_3

Object 2010.24: Acceleration

Object name	*C3.FeedForward_Speed_FFW*		
Object No.	**2010.24**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	%s²/unit		
Minimum value	%s²/unit	**Maximum value**	%s²/unit
Remark:	Factor for acceleration feedforward (main axis) (does only apply for single-loop status control)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	C4_3

4.3.3.6 Feedforward auxiliary axis (status controller)

In this chapter you can read about:

Object 2050.9: Speed

Object name	*C3.FeedForward_2_Speed_FFW*		
Object No.	**2050.9**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	%s/unit		
Minimum value	%s/unit	**Maximum value**	%s/unit
Remark:	Factor for speed feedforward (main axis) (does only apply for single-loop status control)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	C4_3

Object 2050.10: Acceleration

Object name	*C3.FeedForward_2_Accel_FFW*		
Object No.	**2050.10**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	%s²/unit		
Minimum value	%s²/unit	**Maximum value**	%s²/unit
Remark:	Factor for acceleration feedforward (main axis) (does only apply for single-loop status control)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	C4_3

4.3.3.7 Position controller main axis (status controller)

In this chapter you can read about:

Object 2200.24: Filter - Following Error

Object name	*C3Plus.PositionController_TrackingErrorFilter_us*		
Object No.	**2200.24**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	no	**CodeSys format:**	INT
Unit	us		
Minimum value	0 us	**Maximum value**	8300000 us
Remark:	Time constant of the following error filter of the position controller in µs (analog to 2200.11 in %) Is set to the default value corresponding to the motor in the configuration when changing the motor. Default value 0us. The filter is deactivated for values from 0 to 62us. C3F: The filter is deactivated for values from 0 to 125us. Only internal: Due to structure, the following error is, as from R07, filtered with the sum time constant actual velocity value filter 1 + actual velocity value 2 + time constant of following filter + user filter 2200.24.		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	U16

Object 2200.11: Filter - Following Error

Object name	*C3Plus.PositionController_TrackingErrorFilter*		
Object No.	**2200.11**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	INT
Unit	%		
Minimum value	0 %	**Maximum value**	554 %
Remark:	Is set to the corresponding default value when changing the motor.		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	U16

Object 2200.38: P-term

Object name	*C3Plus.PositionController_Kp_PPart*		
Object No.	2200.38	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	yes	CodeSys format:	REAL
Unit	%/unit		
Minimum value	%/unit	Maximum value	%/unit
Remark:			
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	I16

Object 2200.37: I-term

Object name	*C3Plus.PositionController_Ki_IPart*		
Object No.	2200.37	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	yes	CodeSys format:	REAL
Unit	%/(s unit)		
Minimum value	%/(s unit)	Maximum value	%/(s unit)
Remark:			
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	I16

Object 2200.30: Internal window I-term

Object name	*C3Plus.PositionController_InsideWindow_IPart*		
Object No.	2200.30	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	yes	CodeSys format:	REAL
Unit	Unit		
Minimum value	Unit	Maximum value	Unit
Remark:	I term internal window (beginning of the integration) main axis (does only apply for single-loop status control)		
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	C4_3

Object 2200.31: External window I-term

Object name	*C3Plus.PositionController_OutsideWindow_IPart*		
Object No.	2200.31	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	yes	CodeSys format:	REAL
Unit	Unit		
Minimum value	Unit	Maximum value	Unit
Remark:	I term external window (end of the integration) main axis (does only apply for single-loop status control)		
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	C4_3

Object 2200.32: Positive limit I-term

Object name	*C3Plus.PositionController_PosLimit_IPart*		
Object No.	**2200.32**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	%		
Minimum value	%/unit	**Maximum value**	%/unit
Remark:	Upper limit of the I term (main axis) (does only apply for single-loop status control)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	C4_3

Object 2200.33: Negative limit I-term

Object name	*C3Plus.PositionController_NegLimit_IPart*		
Object No.	**2200.33**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	%		
Minimum value	%	**Maximum value**	%
Remark:	Lower limit of the I term (man axis) (does only apply for single-loop status control)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	C4_3

Object 2100.13: Speed feedback

Object name	*C3.ControllerTuning_SpeedFeedback_Kv*		
Object No.	**2100.13**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	%s/unit		
Minimum value	%s/unit	**Maximum value**	%s/unit
Remark:	Feedback of the speed signal (main axis) (does only apply for single-loop status control)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	U16

Object 2100.14: Acceleration feedback

Object name	*C3.ControllerTuning_AccelFeedback_Ka*		
Object No.	**2100.14**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	%s²/unit		
Minimum value	%s²/unit	**Maximum value**	%s²/unit
Remark:	Feedback of the acceleration signal (main axis) (does only apply for single-loop status control)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	U16

Object 2210.8: Filter control signal

Object name	*C3.SpeedController_ActuatingSignal_filt*		
Object No.	**2210.8**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	DINT
Unit	us		
Minimum value	0 us	**Maximum value**	8300000 us
Remark:			
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	U16

4.3.3.8 Position controller auxiliary axis (status controller)

In this chapter you can read about:

Object 2260.8: Filter - Following Error

Object name	*C3.PositionController_2_TrackingErrorFilter_us*		
Object No.	2260.8	HEDA-channel	no
Access:	Read/write	Valid after:	Immediately
CodeSys object:	yes	CodeSys format:	DINT
Unit	us		
Minimum value	0 us	Maximum value	8300000 us
Remark:			
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	U16

Object 2260.22: P-term

Object name	*C3Plus.PositionController_2_Kp_PPart*		
Object No.	2260.22	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	yes	CodeSys format:	REAL
Unit	%/unit		
Minimum value	n/a	Maximum value	n/a
Remark:			
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	I16

Object 2260.21: I-term

Object name	*C3Plus.PositionController_2_Ki_IPart*		
Object No.	2260.21	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	yes	CodeSys format:	REAL
Unit	%/(s unit)		
Minimum value	%/(s unit)	Maximum value	%/(s unit)
Remark:			
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	I16

Object 2260.14: Internal window I-term

Object name	*C3Plus.PositionController_2_InsideWindow_IPart*		
Object No.	**2260.14**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	Unit		
Minimum value	Unit	**Maximum value**	Unit
Remark:	I term internal window (beginning of the integration) auxiliary axis (does only apply for single-loop status control)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	C4_3

Object 2260.15: External window I-term

Object name	*C3Plus.PositionController_2_OutsideWindow_IPart*		
Object No.	**2260.15**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	Unit		
Minimum value	Unit	**Maximum value**	Unit
Remark:	I term external window (end of the integration) auxiliary axis (does only apply for single-loop status control)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	C4_3

Object 2260.16: Positive limit I-term

Object name	*C3Plus.PositionController_2_PosLimit_IPart*		
Object No.	**2260.16**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	%		
Minimum value	%	**Maximum value**	%
Remark:	Upper limit of the I term (auxiliary axis) (does only apply for single-loop status control)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	C4_3

Object 2260.17: Negative limit I-term

Object name	*C3Plus.PositionController_2_NegLimit_IPart*		
Object No.	**2260.17**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	%		
Minimum value	%	**Maximum value**	%
Remark:	Lower limit of the I term (auxiliary axis) (does only apply for single-loop status control)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	C4_3

Object 2101.13: Speed feedback

Object name	*C3.ControllerTuning_2_SpeedFeedback_Kv*		
Object No.	**2101.13**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	%s/unit		
Minimum value	%s/unit	**Maximum value**	%s/unit
Remark:	Feedback of the speed signal (auxiliary axis) (does only apply for single-loop status control)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	U16

Object 2101.14: Acceleration feedback

Object name	*C3.ControllerTuning_2_AccelFeedback_Ka*		
Object No.	**2101.14**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	%s²/unit		
Minimum value	%s²/unit	**Maximum value**	%s²/unit
Remark:	Feedback of the acceleration signal (auxiliary axis) (does only apply for single-loop status control)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	U16

Object 2270.8: Filter control signal

Object name	*C3.SpeedController2_ActuatingSignal_filt*		
Object No.	**2270.8**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	DINT
Unit	us		
Minimum value	0 us	**Maximum value**	8300000 us
Remark:			
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	U16

4.3.3.9 Filter main axis

In this chapter you can read about:

Object 2100.10: Filter 2 actual speed

Object name	*C3.ControllerTuning_FilterSpeed2*		
Object No.	**2100.10**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	DINT
Unit	us		
Minimum value	0 us	**Maximum value**	8300000 us
Remark:	Works in line with actual velocity filter Default value 0us The filter is deactivated for values from 0 to 62us.		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	U16

Object 2100.11: Filter 2 actual accel

Object name	*C3.ControllerTuning_FilterAccel2*		
Object No.	**2100.11**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	DINT
Unit	us		
Minimum value	0 us	**Maximum value**	8300000 us
Remark:	Works in line with actual acceleration filter Default value 0us The filter is deactivated for values from 0 to 62us.		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	U16

4.3.3.10 Filter auxiliary axis

In this chapter you can read about:

Object 2101.7: Filter 2 actual speed

Object name	*C3.ControllerTuning_2_FilterSpeed2*		
Object No.	**2101.7**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	INT
Unit	us		
Minimum value	0 us	**Maximum value**	8300000 us
Remark:	Works in line with actual velocity filter Default value 0us The filter is deactivated for values from 0 to 62us.		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	U16

Object 2101.8: Filter 2 actual accel

Object name	*C3.ControllerTuning_2_FilterAccel2*		
Object No.	**2101.8**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	INT
Unit	us		
Minimum value	0 us	**Maximum value**	8300000 us
Remark:	Works in line with actual acceleration filter Default value 0us The filter is deactivated for values from 0 to 62us.		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	U16

4.3.3.11 Analog Input

In this chapter you can read about:

Object 172.11: IN0 Offset

Object name	*C3Plus.AnalogInput0_Offset_normed*		
Object No.	**172.11**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	Immediately
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	mA		
Minimum value	mA	**Maximum value**	mA
Remark:			
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	C4_3

Object 172.4: IN0 Offset

Object name	*C3.AnalogInput0_Offset*		
Object No.	**172.4**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	Immediately
CodeSys object:	no	**CodeSys format:**	INT
Unit	Increments		
Minimum value	0 n/a	**Maximum value**	65535 n/a
Remark:	Offset in AD converter increments.		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I16

Object 172.3: IN0 Filter

Object name	*C3Plus.AnalogInput0_FilterCoefficient*		
Object No.	172.3	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	yes	CodeSys format:	DINT
Unit	us		
Minimum value	0 us	Maximum value	us
Remark:			
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	I32

Object 173.11: IN1 Offset

Object name	*C3Plus.AnalogInput1_Offset_normed*		
Object No.	173.11	HEDA-channel	no
Access:	Read/write	Valid after:	Immediately
CodeSys object:	yes	CodeSys format:	REAL
Unit	mA		
Minimum value	mA	Maximum value	mA
Remark:			
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	C4_3

Object 173.4: IN1 Offset

Object name	*C3.AnalogInput1_Offset*		
Object No.	173.4	HEDA-channel	no
Access:	Read/write	Valid after:	Immediately
CodeSys object:	no	CodeSys format:	INT
Unit	Increments		
Minimum value	n/a	Maximum value	n/a
Remark:	Offset in AD converter increments. Range 0..65535		
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	I16

Object 173.3: IN1 Filter

Object name	*C3Plus.AnalogInput1_FilterCoefficient*		
Object No.	173.3	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	yes	CodeSys format:	DINT
Unit	us		
Minimum value	0 us	Maximum value	us
Remark:			
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	I32

Object 174.11: IN2 Offset

Object name	*C3Plus.AnalogInput2_Offset_normed*		
Object No.	**174.11**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	Immediately
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	mA		
Minimum value	mA	**Maximum value**	mA
Remark:			
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	C4_3

Object 174.4: IN2 Offset

Object name	*C3.AnalogInput2_Offset*		
Object No.	**174.4**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	Immediately
CodeSys object:	no	**CodeSys format:**	INT
Unit	Increments		
Minimum value	n/a	**Maximum value**	n/a
Remark:	Offset in AD increments. Range 0..65535.		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I16

Object 174.3: IN2 Filter

Object name	*C3Plus.AnalogInput2_FilterCoefficient*		
Object No.	**174.3**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	DINT
Unit	us		
Minimum value	us	**Maximum value**	us
Remark:			
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I32

Object 175.11: IN3 Offset

Object name	*C3Plus.AnalogInput3_Offset_normed*		
Object No.	**175.11**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	Immediately
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	mA		
Minimum value	mA	**Maximum value**	mA
Remark:			
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	C4_3

Object 175.4: IN3 Offset

Object name	*C3.AnalogInput3_Offset*		
Object No.	**175.4**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	Immediately
CodeSys object:	no	**CodeSys format:**	INT
Unit	Increments		
Minimum value	n/a	**Maximum value**	n/a
Remark:	Offset in AD increments		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I16

Object 175.3: IN3 Filter

Object name	*C3Plus.AnalogInput3_FilterCoefficient*		
Object No.	**175.3**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	DINT
Unit	us		
Minimum value	us	**Maximum value**	us
Remark:			
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I32

Object 176.11: IN4 Offset

Object name	*C3Plus.AnalogInput4_Offset_normed*		
Object No.	**176.11**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	Immediately
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	V		
Minimum value	V	**Maximum value**	V
Remark:			
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	C4_3

Object 176.4: IN4 Offset

Object name	*C3.AnalogInput4_Offset*		
Object No.	**176.4**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	Immediately
CodeSys object:	no	**CodeSys format:**	INT
Unit	n/a		
Minimum value	n/a	**Maximum value**	n/a
Remark:	Offset in AD increments		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I16

Object 176.3: IN4 Filter

Object name	*C3Plus.AnalogInput4_FilterCoefficient*		
Object No.	**176.3**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	DINT
Unit	us		
Minimum value	0 us	**Maximum value**	us
Remark:	Filter of time constant in us for the filtering of the input signal 0 => Filter off => output = input		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I16

Object 177.11: IN5 Offset

Object name	*C3Plus.AnalogInput5_Offset_normed*		
Object No.	**177.11**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	Immediately
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	V		
Minimum value	V	**Maximum value**	V
Remark:			
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	C4_3

Object 177.4: IN5 Offset

Object name	*C3.AnalogInput5_Offset*		
Object No.	**177.4**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	Immediately
CodeSys object:	no	**CodeSys format:**	INT
Unit	n/a		
Minimum value	n/a	**Maximum value**	n/a
Remark:	Offset in AD increments		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I16

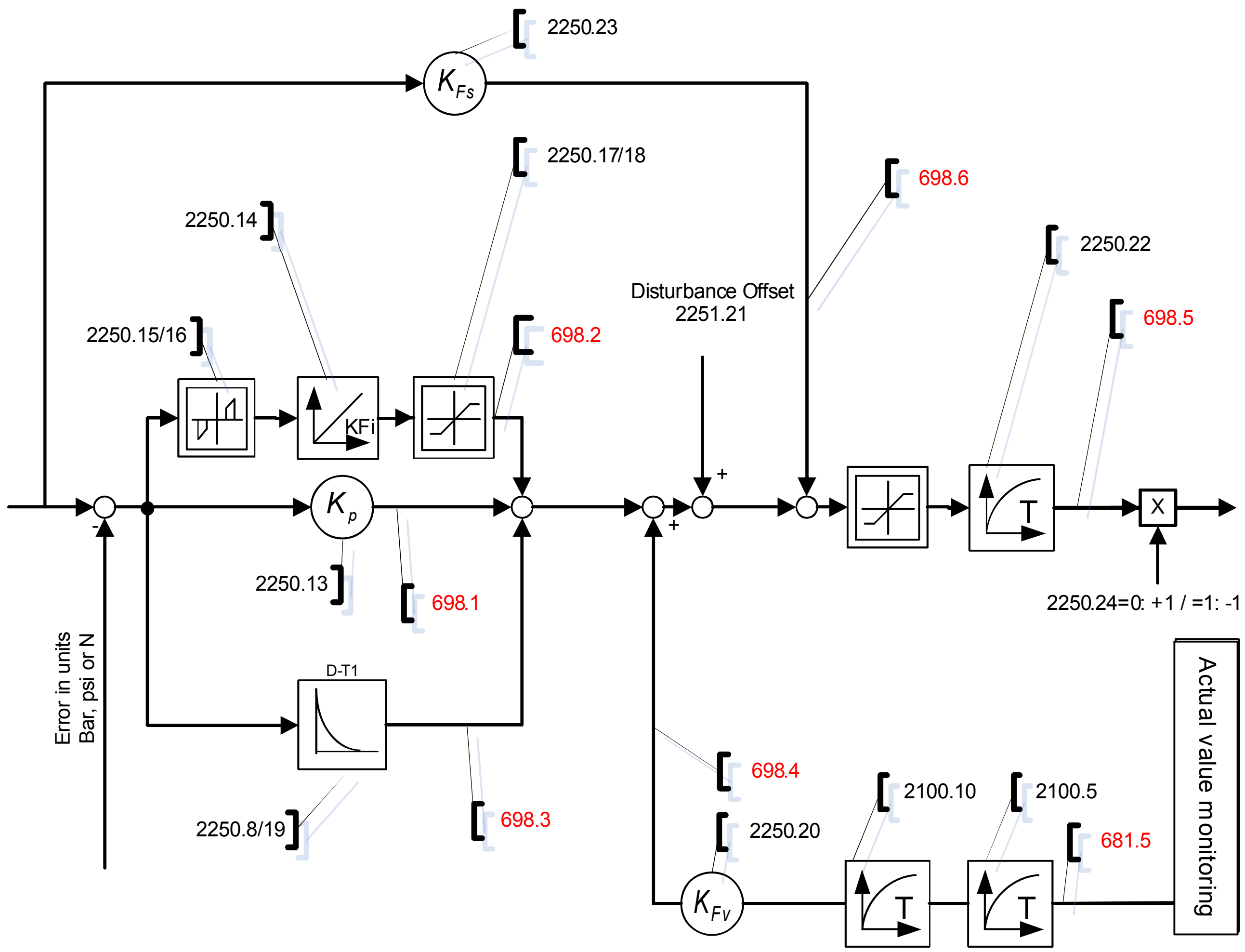
Object 177.3: IN5 Filter

Object name	*C3Plus.AnalogInput5_FilterCoefficient*		
Object No.	**177.3**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	DINT
Unit	us		
Minimum value	0 us	**Maximum value**	us
Remark:			
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I16

4.3.3.12 Force-/Pressure Control main axis

In this chapter you can read about:

Signal image of pressure / force control of the main axis:



Object 2250.13: P-term

Object name	*C3Plus.PressureController_1_Proportional_Part_Kp*		
Object No.	2250.13	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	yes	CodeSys format:	REAL
Unit	%/pres		
Minimum value	%/pres	Maximum value	%/pres
Remark:			
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	I32

Object 2250.14: I-term

Object name	*C3Plus.PressureController_1_Integration_Part_KFi*		
Object No.	2250.14	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	yes	CodeSys format:	REAL
Unit	%/(s pres)		
Minimum value	0 %/(s pres)	Maximum value	4,000 %/(s pres)
Remark:			
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	I32

Object 2250.15: Internal window I-term

Object name	*C3Plus.PressureController_1_InsideWindow_IPart*		
Object No.	2250.15	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	yes	CodeSys format:	REAL
Unit	pres		
Minimum value	pres	Maximum value	pres
Remark:			
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	I32

Object 2250.16: External window I-term

Object name	*C3Plus.PressureController_1_OutsideWindow_IPart*		
Object No.	2250.16	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	yes	CodeSys format:	REAL
Unit	pres		
Minimum value	pres	Maximum value	pres
Remark:			
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	I32

Object 2250.17: Positive limit I-term

Object name	*C3Plus.PressureController_1_PosLimit_IPart*		
Object No.	**2250.17**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	%		
Minimum value	%	**Maximum value**	%
Remark:			
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I32

Object 2250.18: Negative limit I-term

Object name	*C3Plus.PressureController_1_NegLimit_IPart*		
Object No.	**2250.18**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	%		
Minimum value	%	**Maximum value**	%
Remark:			
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I32

Object 2250.19: D-term

Object name	*C3Plus.PressureController_1_Derivative_Part_KFd*		
Object No.	**2250.19**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	no	**CodeSys format:**	REAL
Unit	%s/pres		
Minimum value	%s/pres	**Maximum value**	%s/pres
Remark:			
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I32

Object 2250.8: Delay T1

Object name	*C3.PressureController_1_TimeDelay_DT1_T1*		
Object No.	**2250.8**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	no	**CodeSys format:**	INT
Unit	us		
Minimum value	250 us	**Maximum value**	us
Remark:	PID force controller 1 delay time constant of the D-term T1 Influences the D-term of the controller		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	U32

Object 2250.20: Speed feedback

Object name	*C3Plus.PressureController_1_Speed_Feedback_KFv*		
Object No.	**2250.20**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	no	**CodeSys format:**	REAL
Unit	%s/unit		
Minimum value	%s/unit	**Maximum value**	%s/unit
Remark:			
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	U16

Object 2250.23: Force feedforward

Object name	*C3Plus.PressureController_1_Force_FeedForward_KFs*		
Object No.	**2250.23**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	no	**CodeSys format:**	REAL
Unit	%/pres		
Minimum value	%/pres	**Maximum value**	%/pres
Remark:			
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	U16

Object 2250.24: Inversion of the control variable [on/off]

Object name	*C3Plus.PressureController_1_ActuatingSignal_Inversion*		
Object No.	**2250.24**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	Immediately
CodeSys object:	yes	**CodeSys format:**	BOOL
Unit	n/a		
Minimum value	0 n/a	**Maximum value**	1 n/a
Remark:	Inversion of the force controller control variable of the main axis. The inversion is only effective for the valve output and not for the status values of the force controller.		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I16

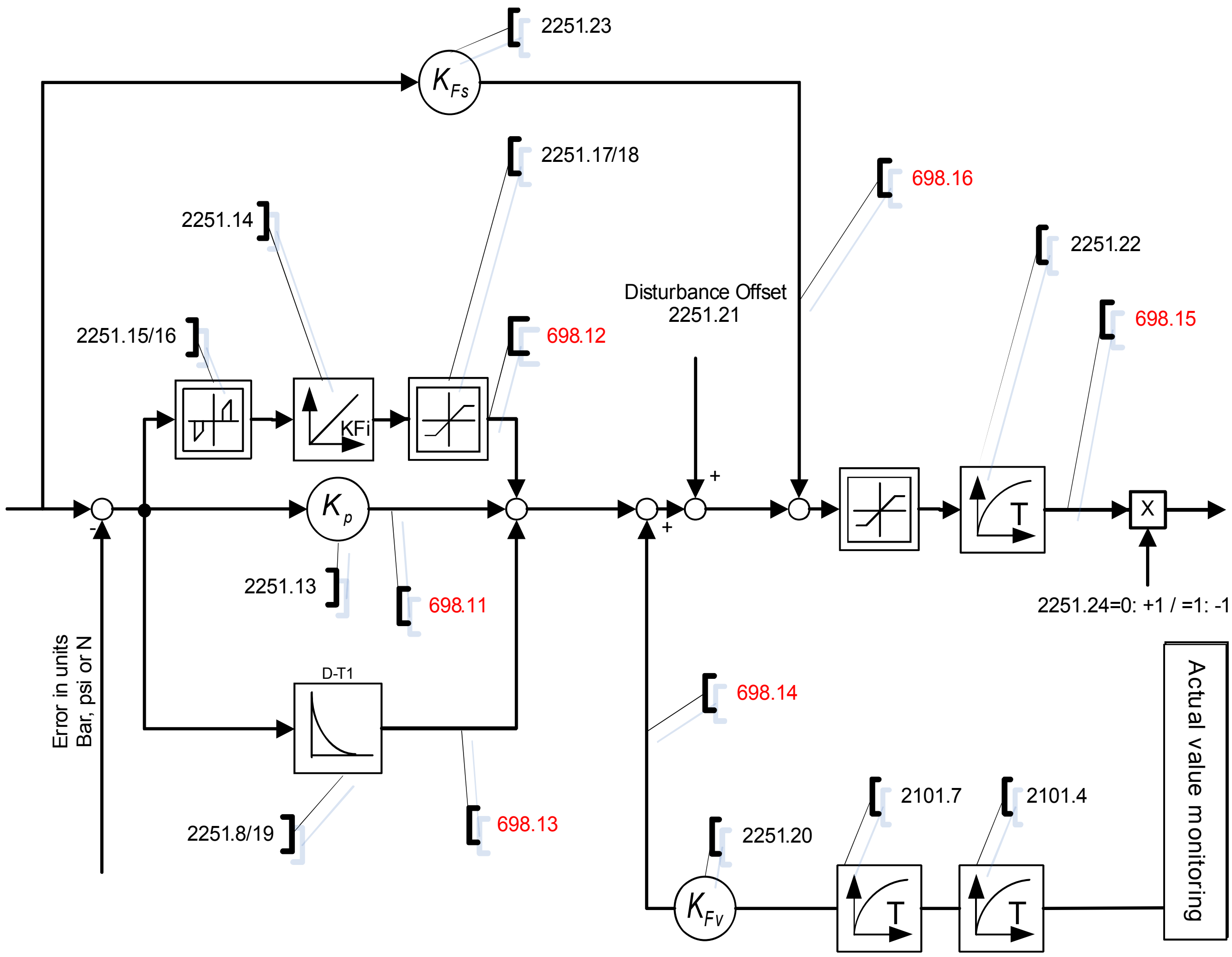
Object 2250.22: Filter control signal

Object name	*C3.PressureController_1_ActuatingSignalFilter*		
Object No.	**2250.22**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	no	**CodeSys format:**	
Unit	us		
Minimum value	us	**Maximum value**	8300000 us
Remark:			
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I32

4.3.3.13 Force-/Pressure Control auxiliary axis

In this chapter you can read about:

Signal image of pressure / force control of the auxiliary axis:



Object 2251.13: P-term

Object name	*C3Plus.PressureController_2_Proportional_Part_Kp*		
Object No.	2251.13	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	yes	CodeSys format:	REAL
Unit	%/pres		
Minimum value	%/pres	Maximum value	%/pres
Remark:			
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	I32

Object 2251.14: I-term

Object name	*C3Plus.PressureController_2_Integration_Part_KFi*		
Object No.	2251.14	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	yes	CodeSys format:	REAL
Unit	%/(s pres)		
Minimum value	%/(s pres)	Maximum value	4,000 %/(s pres)
Remark:			
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	I32

Object 2251.15: Internal window I-term

Object name	*C3Plus.PressureController_2_InsideWindow_IPart*		
Object No.	2251.15	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	yes	CodeSys format:	REAL
Unit	pres		
Minimum value	pres	Maximum value	pres
Remark:			
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	I32

Object 2251.16: External window I-term

Object name	*C3Plus.PressureController_2_OutsideWindow_IPart*		
Object No.	2251.16	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	yes	CodeSys format:	REAL
Unit	pres		
Minimum value	pres	Maximum value	pres
Remark:			
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	I32

Object 2251.17: Positive limit I-term

Object name	*C3Plus.PressureController_2_PosLimit_IPart*		
Object No.	2251.17	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	yes	CodeSys format:	REAL
Unit	%		
Minimum value	%	Maximum value	%
Remark:			
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	I32

Object 2251.18: Negative limit I-term

Object name	*C3Plus.PressureController_2_NegLimit_IPart*		
Object No.	2251.18	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	yes	CodeSys format:	REAL
Unit	%		
Minimum value	%	Maximum value	%
Remark:			
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	I32

Object 2251.19: D-term

Object name	*C3Plus.PressureController_2_Derivative_Part_KFd*		
Object No.	2251.19	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	no	CodeSys format:	REAL
Unit	%s/pres		
Minimum value	%s/pres	Maximum value	%s/pres
Remark:			
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	I32

Object 2251.8: Delay T1

Object name	*C3.PressureController_2_TimeDelay_DT1_T1*		
Object No.	2251.8	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	no	CodeSys format:	INT
Unit	us		
Minimum value	250 us	Maximum value	us
Remark:	Influences the D-term of the controller		
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	U32

Object 2251.20: Speed feedback

Object name	*C3Plus.PressureController_2_Speed_Feedback_KFv*		
Object No.	2251.20	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	no	**CodeSys format:**	REAL
Unit	%s/unit		
Minimum value	%s/unit	**Maximum value**	%s/unit
Remark:			
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	U16

Object 2251.23: Force feedforward

Object name	*C3Plus.PressureController_2_Force_FeedForward_KFs*		
Object No.	2251.23	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	no	**CodeSys format:**	REAL
Unit	%/pres		
Minimum value	%/pres	**Maximum value**	%/pres
Remark:			
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	U16

Object 2251.24: Inversion of the control variable [on/off]

Object name	*C3Plus.PressureController_2_ActuatingSignal_Inversion*		
Object No.	2251.24	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	Immediately
CodeSys object:	yes	**CodeSys format:**	BOOL
Unit	n/a		
Minimum value	0 n/a	**Maximum value**	1 n/a
Remark:	Inversion of the force controller control variable of the auxiliary axis. The inversion is only effective for the valve output and not for the status values of the force controller.		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I16

Object 2251.22: Filter control signal

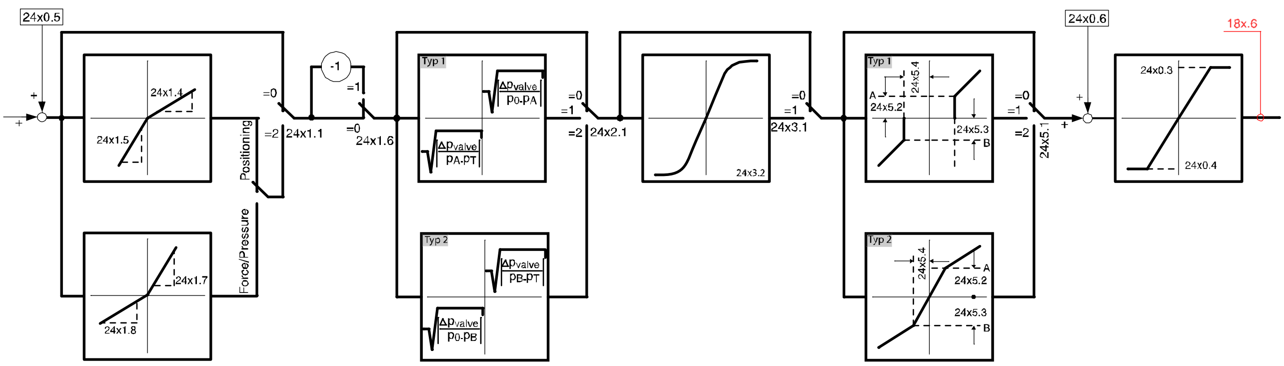
Object name	*C3.PressureController_2_ActuatingSignalFilter*		
Object No.	2251.22	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	no	**CodeSys format:**	
Unit	us		
Minimum value	us	**Maximum value**	8300000 us
Remark:			
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I32

4.3.3.14 Output signal conditioning 0

In this chapter you can read about:

In order to linearize the valve as well as the entire control path 4 linearization chains (conditioning chains => output signal conditioning) are available.

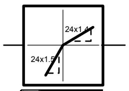
Layout of the path linearization (Conditioning Chains):



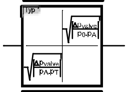
Objects of the conditioning chains:

The Conditioning Chains are set via objects in the **optimization window** (see page 88).
The "x" in the objects given in the signal image depends on the conditioning chains to be parameterized:
x = 0,1,2,3 = Conditioning Chain No.
In the **Compax3F structure image** (see page 45) you can see how the Conditioning Chains are integrated in the total structure.
Below you can find the descriptions of the individual objects.

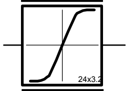
Conditioning Chain Symbols



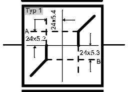
Direction dependent gain



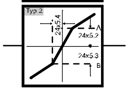
Direction dependent pressure compensation



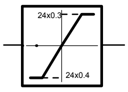
Non-linear characteristic (valve characteristic)



Deadband
No signal is transmitted in a range definable by objects.



Change of gain for small signals.
In a range definable by objects, the signal is transmitted with changed gain.



Limitation
The signal is limited to a range definable by objects.

Object 2400.3: Upper limit of ocntrol signal

Object name	*C3Plus.OutputConditioningChain_Ch0_Upper_Limit*		
Object No.	**2400.3**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	INT
Unit	%		
Minimum value	0 %	**Maximum value**	100 %
Remark:	Upper limit of valve output 0 Objects of the other conditioning chains: 24x0.3 (x = 0,1,2,3 = Conditioning Chain No.)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I16

Object 2400.4: Lower limit of the control signal

Object name	*C3Plus.OutputConditioningChain_Ch0_Lower_Limit*		
Object No.	**2400.4**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	INT
Unit	%		
Minimum value	0 %	**Maximum value**	100 %
Remark:	Lower limit of valve output 0 Objects of the other conditioning chains: 24x0.4 (x = 0,1,2,3 = Conditioning Chain No.)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I16

Object 2400.6: Output Offset

Object name	*C3Plus.OutputConditioningChain_Ch0_Output_Offset*		
Object No.	**2400.6**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	%		
Minimum value	-100 %	**Maximum value**	100 %
Remark:			
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I32

Object 2400.7: Replacement value (inactive Chain 0)

Object name	*C3Plus.OutputConditioningChain_Ch0_Input_DefaultValue*		
Object No.	**2400.7**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	%		
Minimum value	-100 %	**Maximum value**	100 %
Remark:	Replacement value on the input of the chain, if the correspondiing controller (position or force controller) is not operating.		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I32

Object 2401.4: Gain factor positive

Object name	*C3Plus.DirectionDependentGain_Ch0_Factor_positive*		
Object No.	**2401.4**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	Immediately
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	1		
Minimum value	n/a	**Maximum value**	n/a
Remark:	Gain factor for positive input values Objects of the other conditioning chains: 24x1.4 (x = 0,1,2,3 = Conditioning Chain No.)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I32

Object 2401.5: Gain factor negative

Object name	*C3Plus.DirectionDependentGain_Ch0_Factor_negative*		
Object No.	**2401.5**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	Immediately
CodeSys object:	yes	**CodeSys format:**	REAL
Unit	1		
Minimum value	n/a	**Maximum value**	n/a
Remark:	Gain factor for negative input values Objects of the other conditioning chains: 24x1.5 (x = 0,1,2,3 = Conditioning Chain No.)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I32

Object 2401.7: Gain positive direction (Force-/Pressure- control)

Object name	*C3.DirectionDependentGain_Ch0_Factor_positiv_Pressure*		
Object No.	**2401.7**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	Immediately
CodeSys object:	no	**CodeSys format:**	
Unit	1		
Minimum value	n/a	**Maximum value**	n/a
Remark:	Gain factor for positive input values (with pressure/force control) Objects of the other conditioning chains: 24x1.7 (x = 0,1,2,3 = Conditioning Chain No.)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I32

Object 2401.8: Gain negative direction (Force-/Pressure- control)

Object name	*C3.DirectionDependentGain_Ch0_Factor_negative_Pressure*		
Object No.	**2401.8**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	Immediately
CodeSys object:	no	**CodeSys format:**	
Unit	1		
Minimum value	n/a	**Maximum value**	n/a
Remark:	Gain factor for negative input values (with pressure/force control) Objects of the other conditioning chains: 24x1.8 (x = 0,1,2,3 = Conditioning Chain No.)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I32

Object 2401.6: Inversion [on/off]

Object name	*C3Plus.DirectionDependentGain_Ch0_InvertType*		
Object No.	**2401.6**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	Immediately
CodeSys object:	yes	**CodeSys format:**	BOOL
Unit	n/a		
Minimum value	n/a	**Maximum value**	n/a
Remark:	Type=0 no inversion Type<>0 Signal is inverted (+<=>-) Objects of the other conditioning chains: 24x1.6 (x = 0,1,2,3 = Conditioning Chain No.)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I16

Object 2402.1: Pressure Compensation [on/off]

Object name	*C3Plus.PressureCompensation_Ch0_Type*		
Object No.	**2402.1**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	INT
Unit	n/a		
Minimum value	n/a	**Maximum value**	n/a
Remark:	Type=1 Differential pressure at side A is compensated Type=1 Differential pressure at side A is compensated Objects of the other conditioning chains: 24x2.1 (x = 0,1,2,3 = Conditioning Chain No.)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I16

Object 2403.1: Characteristic flow [on/off]

Object name	*C3Plus.SignalFlowCharacteristic_Ch0_Type*		
Object No.	**2403.1**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	INT
Unit	n/a		
Minimum value	n/a	**Maximum value**	n/a
Remark:	Type=0 characeristic compensation is switched off Type=1 characteristic commpensation is switched on: when the limits of the characteristic line are exceeded, interpolation is continued with constant slope Type=2 characteristic compensation is switched on: when the limits of the characteristic line are exceeded, the output value is limited to the limit value of the characteristic line. Objects of the other conditioning chains: 24x3.1 (x = 0,1,2,3 = Conditioning Chain No.)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I16

Object 2405.1: Deadband [on/off]

Object name	*C3Plus.DeadBandCompensation_Ch0_Type*		
Object No.	2405.1	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	yes	CodeSys format:	INT
Unit	1		
Minimum value	n/a	Maximum value	n/a
Remark:	Type of deadband compensation Type=0 block off (input=output) Type=1 deadband compensation with constantly zero in the deadband Type=2 deadband compensation with straight line in the deadband Objects of the other conditioning chains: 24x5.1 (x = 0,1,2,3 = Conditioning Chain No.)		
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	I16

Object 2405.2: Deadband A-side

Object name	*C3Plus.DeadBandCompensation_Ch0_A_Side*		
Object No.	2405.2	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	yes	CodeSys format:	INT
Unit	°/oo		
Minimum value	0 °/oo	Maximum value	1,000 °/oo
Remark:	Threshold value on A side Objects of the other conditioning chains: 24x5.2 (x = 0,1,2,3 = Conditioning Chain No.)		
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	I32

Object 2405.3: Deadband B-side

Object name	*C3Plus.DeadBandCompensation_Ch0_B_Side*		
Object No.	2405.3	HEDA-channel	no
Access:	Read/write	Valid after:	VP
CodeSys object:	yes	CodeSys format:	INT
Unit	°/oo		
Minimum value	0 °/oo	Maximum value	1,000 °/oo
Remark:	Threshold value on B side Objects of the other conditioning chains: 24x5.3 (x = 0,1,2,3 = Conditioning Chain No.)		
CAN No.	-	PD object:	no
Profibus-No. (PNU)	-	Bus format:	I32

Object 2405.4: Deadband threshold value

Object name	*C3Plus.DeadBandCompensation_Ch0_Threshold*		
Object No.	**2405.4**	**HEDA-channel**	no
Access:	Read/write	**Valid after:**	VP
CodeSys object:	yes	**CodeSys format:**	INT
Unit	°/oo		
Minimum value	0 °/oo	**Maximum value**	1,000 °/oo
Remark:	Width of the deadband on one side Objects of the other conditioning chains: 24x5.4 (x = 0,1,2,3 = Conditioning Chain No.)		
CAN No.	-	**PD object:**	no
Profibus-No. (PNU)	-	**Bus format:**	I32

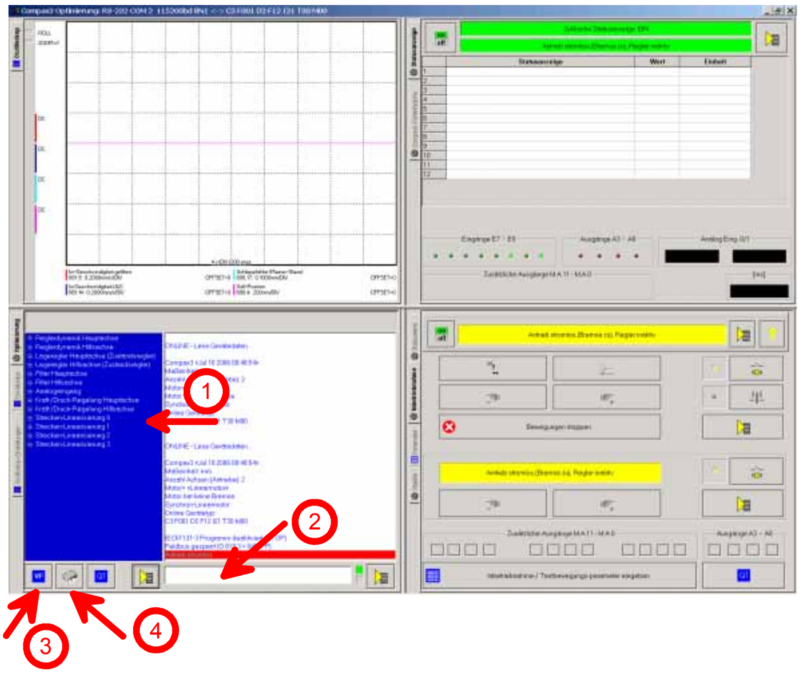
4.3.3.15 Step-by-step optimization

In this chapter you can read about:

General

All parameters are changed in the optimization window in the optimization field via the object tree in the lower left window.

- Click on the object in the object tree (1).
- Enter new value in the command line (2) and press Return.
- Set value to valid with CP (3).
  Attention: Entry of the values must be terminated with a Return and must be set to valid via VP (3)!
- The changed objects are permanenty stored with WF (4).
- **ATTENTION:** When writing the data into the flash, control oscillations may occur due to increased processor load!
  => Switch drive to currentless / PowerOff state before



Procedure

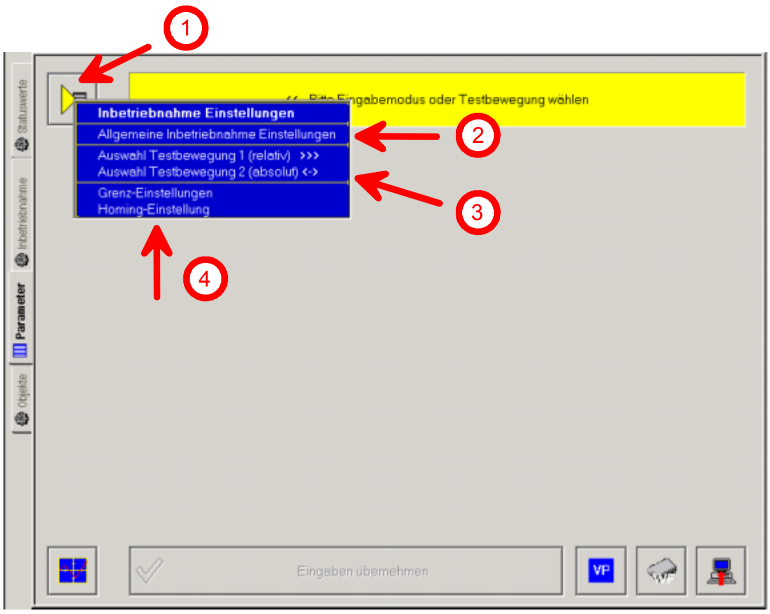
In this chapter you can read about:

A valid configuration is a prerequisite for this operation and for force/pressure control, operation with one or 2 pressure sensors per cylinder is assumed.

Parameters for manual movement/jogging mode and test movement.

In the optimization window ⇒ setup field ⇒ parameter.

- Activate dropdown list via button on the upper left (1)
- The parameters for manual movement/jogging mode can be found under general setup settings (2).
- Select test movement absolute (3) for linear drives (cylinders)
- If needs be, change the limit and homing settings from the configuration for the setup (4).
- Terminate with "accept entry".



Limit valve set value

In the optimization tree under output chain:

- Upper limit of control signal (Object 2400.3) and lower limit of control signal (Object 2400.4) must be set sensibly.
- Take step 1 for all additional valves.

Tip:

In order to avoid a fast, uncontrolled movement of the drive during the setup, the valve outputs should at first be limited!

Attention:

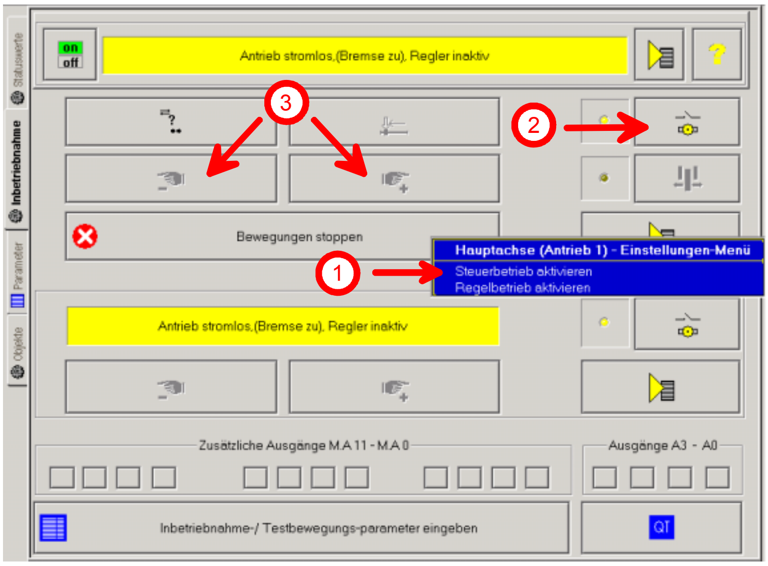
- The drive does not reach its maximum power due to the limitation of the valve outputs.

As soon as the drive is stably positioned in the control loop, the limitation can be lifted.

Move drive controlledly

In the optimization window ⇒ setup field ⇒ setup.

- Select "controlled movement" operating mode.
- Energize drive (2).
- Move the drive to both sides (3).
  Does the axis move?
  No:
  - Valve positive overlap? -> activate valve characteristic line or set deadband compensation.
  - Check control value limitation -> increase control value limitation.
  - Control signal gain too small -> increase parameter control signal gain.



Tip:

Check, if the control signals to the valves (status values -> valve outputs -> output signal0..3) change.

Check sense of direction

- Select "controlled movement" operating mode
- Move drive into both directions.
- Are the directions of the setpoint and of the actual position the same?
  No: Switch on valve inversion(s): Inversion [on/off] = 1 (in the optimization tree under output chain:)
- Is the direction of the actual position identical with the desired direction in the machine?
  No: Change sense of direction of the feedback in the configuration

Set valve offset

- Select "controlled movement" operating mode
- Move drive to medium position
  In which direction does the axis drift?
  - Positive: Reduce output offset until the drive is at standstill.
  - Negative: Increase output offset until the drive is at standstill.

Attention:

- If the values are too high, the drive might move uncontrolledly at high speed!

With activated valve inversion, the offset does also work in the opposite direction!
(In the optimization tree under output chain)
Appproach additional positions and check setting.

Check connection assignment of the pressure sensors

- Check if the correct pressure is displayed when moving the cylinder.
  In the optimization window ⇒ setup field ⇒ status values select the corresponding values and drag them into the status display field.

  No:
  - Check connections and configuration of the pressure sensors.

Check input offset or zero of the pressure sensors

- Switch off hydraulics and make sure that there is no pressure (0 bar) on the pressure sensors.
  In the optimization window ⇒ setup field ⇒ status values select the corresponding values and drag them into the status display field.

  No:

In the optimization window ⇒ optimization field ⇒ optimization.
  - Adapt zero for analog input offset.

Direction dependent gain

For differential cylinders, the direction dependence can be compensated via object gain positive and negative direction.
In the optimization window ⇒ optimization field ⇒ object tree under path linearization.

- Positive direction
  - Object 2401.4: Direction dependent gain
  - Object 2401.7: Direction dependent gain (pressure control)
- Negative direction
  - Object 2401.5: Direction dependent gain
  - Object 2401.8: Direction dependent gain (pressure control)

Attention:

If several valves are used for a drive, the direction dependent gain must be set individually for each valve.

Optimization of position controller

In this chapter you can read about:

Filter

In this chapter you can read about:

Depending on the feedback type, the actual signals for position, speed and acceleration are disturbed with different intensity. A strong noise on the signals influences the achievable quality of control negatively.

Attention:

Too high filter constants distort the signals and have a negative effect on the control quality!

Set position (only analog feedback)

In the optimization tree under analog input.
Typical setting value: 7000µs.

Set filter for speed- and acceleration actual value.

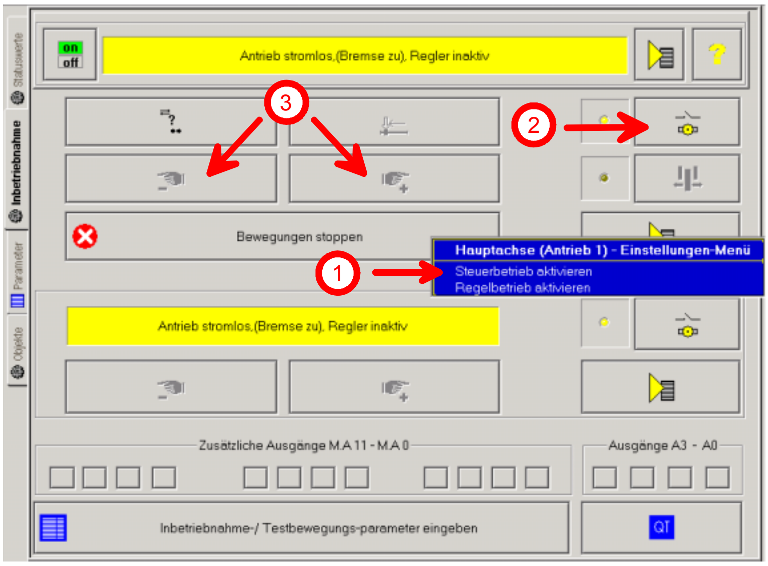
In the optimization tree under filter main axis.
Typical setting values for the individual path measurement system:

Type	Speed[µs]	Acceleration
Analog	7000	
EnDat	500	
RS422		
SSI	1000 ... 7000	
Start-Stop	7000	

Close control loop

- Switch drive to currentless (2)
- Select control operation (1)
- Re-energize drive (2)
- Move drive at low speed in manual mode (jogging) (3).
- In the event of oscillations, stop the movement
  Does the drive oscillate at standstill?
- Yes: Switch drive to currentless (2)

Reduce control parameters (Proportional factor KP **(see page 143) to** acceleration feedback **(see page 144)).**



Set control parameters

In this chapter you can read about:

In the optimization tree under position controller main axis

Proportional factor KP

- Increase Kp (2200.38/2260.22) at lowest speed up to the stability limit.
- Value will be preassigned by the configuration.
- Acceleration and jerk must be adapted to the potential of the axis.
- Deceleration and jerk_deceleration must be adapted to the potential of the axis.
- Compensate unbalances with direction-dependant gain.
- Check settings at 50% Vmax and reduce if needs be.
- Check settings at Vmax and reduce if needs be.

Integrator KI

- Increase KI (2200.37/2260.21), so that the following error becomes minimal and the axis does not overshoot.
- Value will be preassigned by the configuration.
- Set inner window (2200.30) so that the axis does not readjust constantly (only sensible larger than feedback resolution!)
- Set outer window (2200.31) so that possible overshoot is reduced.
- Limit maximum **I** term (2200.32 and 2200.33).
- Check settings at 50% Vmax and reduce if needs be.
- Check settings at Vmax and reduce if needs be.

Speed feedback

The feedback of the speed can increase the natural frequency, i.e. the dynamic of the hydraulic drive.

Prerequisite:

Speed filter set correctly (**Filter for Speed and Acceleration actual value** (see page 142))

- Increase speed feedback (2100.13) at lowest speed up to the stability limit.
- Check settings at 50% Vmax and reduce if needs be.
- Check settings at Vmax and reduce if needs be.

Acceleration feedback

The feedback of the acceleration can dampen the hydraulic drive, i.e. reduce the oscillation tendency.

Prerequisite:

Acceleration filter set correctly (**Filter for Speed and Acceleration actual value** (see page 142))

- Increase acceleration feedback (2100.14) at lowest speed up to the stability limit.
- Check settings at 50% Vmax and reduce if needs be.
- Check settings at Vmax and reduce if needs be.

Feedforwards (advanced)

In this chapter you can read about:

The control behavior of the control can be adapted to the application via the feedforward (in the optimization tree under feedforward main axis)
The following error can be minimized at movement with constant speed via the feedforward without negative effect on the stability of the control.

Attention:

Feedforward controls may cause an overshoot over the target position!

Speed feedforward (advanced)

- Reduce speed feedforward (2010.13) at lowest speed until the following error is minimized.
- Check settings at 50% Vmax and reduce if needs be.
- Check settings at Vmax and reduce if needs be.

Acceleration feedforward (advanced)

- Reduce acceleration feedforward (2010.24) at lowest speed until the following error is minimized.
- Check settings at 50% Vmax and reduce if needs be.

Check settings at Vmax and reduce if needs be

Optimization of pressure/Force Controller

In this chapter you can read about:

Activation of pressure / force control

- Set all control parameters to 0
  - P-term (%N)
    main axis: Object 2250.13
    auxiliary axis: Object 2251.13
  - I-term (%N)
    main axis: Object 2250.14
    auxiliary axis: Object 2251.14
  - Internal and external window of I-term (N)
    internal window: Object 2250.15
    external window: Object 2220.16
  - KFv (speed feedback) (%s/mm)
    main axis: Object 2250.20
    auxiliary axis: Object 2050.9
- Set force demand value and force gradient to expedient small values.
  - The actual force should be smaller than the demand force.

Adapt control parameters

- Increase P-term in small increments until the actual force is near the demand force.
  - Pressure or force should remain stable and not be subject to instability.
  - P-term starts working at 0,0000001%/N
- Set window for I-term.
  - The value for the outer window should be greater than the actual difference between demand force and actual force (697.1, 697.11).
  - Value for the inner window should be set very small in order to equate demand force and actual force.
  - Positive limit of I-term to 100%
    Main axis: Object 2250.17, auxiliary axis: Object 2251.17
    Negative limit I-term to -100%
    Main axis: Object 2250.18, auxiliary axis: Set object 2251.18.
- Increase P-term in small increments until the actual force = demand force.
  - Value should be held small in order to avoid strong overshoot.
  - I-term starts working at 0.00013%/N.
  - I-term is switching (only swiches on, if the actual force is within the window defined before).
- Increase speed feedback FKv slightly if necessary, this will reduce the error between the demand force and the actual force while the force is built up. The force is built up faster, peaks can however be the result of increased values.

Force feedforward

For the force control with pumps and pressure valves, the control signal is, differently from the control with path valves, proportional to the actual pressure value for dynamic control the integrator is not sufficient in order to generate the static component of the control variable.
This requires the force feedforward (KFs).
Main axis: Object 2250.23
auxiliary axis: Object 2251.23

- KFs (%/N) or(%/bar/PSI), a defined component of the force build-up is built up in a controlled manner.

4.3.4. Input simulation

In this chapter you can read about:

Function

The input simulation is used for the performance of tests without the complete input/output hardware being necessary.
The digital inputs (standard and inputs of M10/M12 option) as well as the analog inputs are supported.
The following operating modes are available for digital inputs:

- The physical inputs are deactivated, the digital inputs are only influenced via the input simulation.
- The digital inputs and the physical inputs are logically or-linked.
  This necessitates very careful action, as the required function is, above all with low-active signals, no longer available.

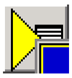
The pre-setting of an analog input value is always made in addition to the physical analog input.

the function of the inputs depends on the Compax3 device type; please refer to the respective online help or the manual.

The input simulation is only possible if the connection with Compax3 is active and if the commissioning mode is deactivated!

4.3.4.1 Calling up the input simulation

Open the optimization window (double klick in the C3 ServoManager tree entry: Optimization).
Activate the Tab ”Setup” in the right lower window.
Clicking on the following button will open a menu; please select the input simulation.



4.3.4.2 Functionality

Window Compax3 InputSimulator:
1st series: Standard inputs I7 ... I0 = ”0” button not pressed; = ”1” switch pressed
2nd series: Optional digital inputs (M10 / M12)
Green field: port 4 is defined as input
Red field: port 4 is defined as output
the least significant input is always on the right side
3rd series:if the button ”deactivating physical inputs” is pressed, all physical, digital inputs are deactivated; only the input simulation is active.
If both sources (physical and simulated inputs) are active, they are or-linked!

Caution!
Please consider the effects of the or-linking; above all on low-active functions.

4th series: Simulation of the analog inputs 0 and 1 in 100mV – steps.
The set value is added to the value on the physical input.

After the input simulation has been called up, all simulated inputs are on ”0”.

When the input simulation is left, the physical inputs become valid.

4.3.5. Setup mode

The setup mode is used for moving an axis independent of the system control
The following functions are possible:

- Machine reference run
- Jog+ / Jog-
- Activation / deactivation of the motor holding brake.
- Acknowledging errors
- Defining and activating a test movement
- Activating the digital outputs.

Activating the setup mode

By activating the setup mode, the the control program (IEC Program) is deactivated; the system function of the device is no longer available. Access via an interface (RS232/RS485, Profibus, CANopen,...) and via digital inputs is deactivated.
Attention! The safety functions are not always guaranteed during the setup mode!

- In the Commissioning window (left at the bottom) the commissioning mode is activated.
- Then parameterize the desired test movement in the Parameter window.
  You can accept changed configuration settings into the current project.
- Now energize drive in the commissioning window and start the test movement.

Caution! Safeguard the travel range before energizing!

Deactivating the setup mode

If the setup mode is left, the drive is deactivated and the the control program (IEC Program) is re-activated.

Note:

- The parameters of the setup window are saved with the project and are loaded into Compax3 if the setup mode is activated (see below).

4.3.5.1 Motion objects in Compax3

The motion objects in Compax3 describe the active motion set.
The motion objects can be influenced via different interfaces.
The following table describes the correlations:

Source	active motion objects		Compax3 device
	==>	**describe**	
	<==	**read**	
Set-up (working with the commissioning window)	==>	◆ With the "accept entry" button. ◆ The current project gets a motion set. Download by activating the motion	**Active motion objects** ◆ Position [O1111.1] ◆ Speed [O1111.2] ◆ Acceleration [O1111.3] ◆ Deceleration [O1111.4] ◆ jerk* [O1111.5] (Acceleration) ◆ Jerk* [O1111.6] (Deceleration) * for IxxT11 - devices, both jerk values are identical
	<==	◆ When opening the commisisoning window of a new project for the first time. ◆ Activated via the "Upload settings fromdevice" button (bottom at the left side).	
Compax3 ServoManager project	==>	◆ C3IxxT11: via an activated motion set ◆ C3I2xT11: via a configuration download	
	<==	For Compax3 I2xT11: ◆ via a configuration upload ◆ in the commissioning window via "accept configuration"	
Fieldbus (Compax3 I2xTxx)	==>	◆ Changing the motion objects directly	
	<==	◆ Reading the motion objects	
IEC61131-3 program (Compax3 IxxT30, IxxT40)	==>	◆ via positioning modules	

4.3.6. ProfileViewer for the optimization of the motion profile

In this chapter you can read about:

You will find the ProfileViewer in the Compax3 ServoManager under the "Tools" Menu:

4.3.6.1 Mode 1: Time and maximum values are deduced from Compax3 input values

- The motion profile is calculated from Position, Speed, Acceleration, Deceleration, Acceleration Jerk and Deceleration Jerk
- As a result you will get, besides a graphical display, the following characteristic values of the profile:
  - Times for the acceleration, deceleration and constant phase
  - Maximum values for acceleration, deceleration and speed

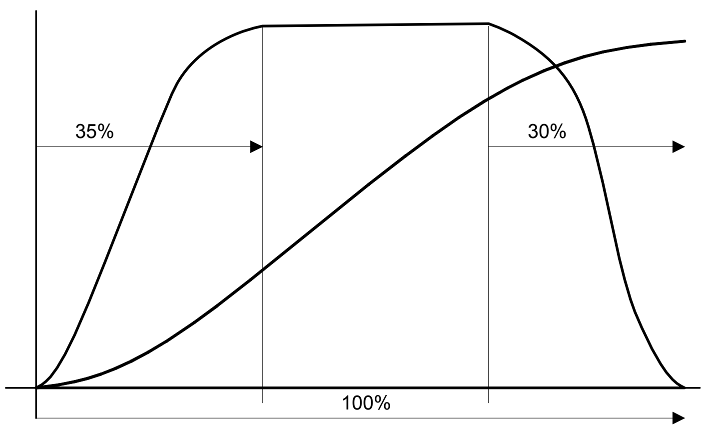
4.3.6.2 Mode 2: Compax3 input values are deduced from times and maximum values

- A jerk-limited motion profile is calculated from the positioning time and the maximum speed / acceleration
- As a result you will get, besides a graphical display, the following characteristic values of the profile:
  - the parameters Position, Speed, Acceleration, Deceleration, Acceleration Jerk and Deceleration Jerk
  - Times for the acceleration, deceleration and constant phase
  - Maximum values for acceleration, deceleration and speed

Set deceleration and acceleration phase

The profile can be defined more exactly by entering the segmentation into deceleration and acceleration phase.
When setting 50% and 50%, a symmetrical design will result, the values for triangular operation are calculated, which is limited by the maximum speed.
The total of the percentage values may not exceed 100.
The percentage entries refer to the total positioning time.

Example:



5. Motion control

In this chapter you can read about:

5.1 Programming based on IEC61131-3

In this chapter you can read about:

5.1.1. Prerequisites

- Installation of the CoDeSys programming tool.
- Installation of necessary Target Packages (target systems):
  - Bring up the "InstallTarget" program (program group "3S Software": "CoDeSys V2.3")
  - From “Open”, select the target file; file name: "Compax3.tnf".
  - The selected target can be installed with "Install".

5.1.2. CoDeSys / Compax3 target system (Target Package)

Targets for Compax3 servo axes

Beginning with Compax3 software version V2.0, two Compax3 targets are included with delivery (containing module and object descriptions).

- **CoDeSys for C3 T30**: for Compax3 T30 (beginning with Compax3 software version V2.0)
- **CoDeSys for C3 T40**: for Compax3 T40 (beginning with Compax3 software version V2.0)

The old target is still available for programs that were created earlier (created with Compax3 software version < V2.0).

- **CoDeSys for Compax3**: for Compax3 T30

This programs are thus still capable of running.

When migrating to a new target, you must be certain that the module and object names have been changed.
Edit the appropriate parts of the IEC program accordingly.

Targets for Compax3F hydraulic axes

CoDeSys for C3F T30: for Compax3 T30

CoDeSys for C3F T40: For Compax3 T40

5.1.2.1 Program development and test

Program development

CoDeSys is the development environment for control systems which will help you develop Compax3 IEC61131 programs. CoDeSys is called up from the Compax3 ServoManager (under ”programming: IEC61131-3 development environment")
The IEC program can be integrated into the C3 ServoManager project or exported again from the project as required.
When CoDeSys is brought up, the IEC program stored in the project is opened. If the project does not contain an IEC program, a selection dialog appears.

Download to Compax3

After the IEC61131 program has been developed and compiled with CoDeSys, it is downloaded to Compax3 by means of the ServoManager (in ”Download: IEC61131-3").

Program test

For testing your program directly with Compax3, you may use the Compax3 IEC61131-3 debugger (the debug functions of CoDeSys are not supported in conjunction with Compax3). The debugger is called up from the ServoManager (under Programming: IEC61131-3 debugger). It automatically accesses the last IEC61131-3 program in the ServoManager to be loaded into Compax3 with "Download: IEC61131-3" and makes its modules and variables available in the project tree.
The data from Compax3 are read via the instruction ”log in”. Please note in this regard that the interface to Compax3 can only be assigned once: Online functions in the ServoManager such as Upload, Download, Status display in the Optimization window or oscilloscope functions are not possible simultaneously. These functions interrupt the connection between debugger and Compax3 automatically.

5.1.2.2 Recipe management

The recipe management function in CoDeSys is not supported in conjunction with Compax3. Please use the recipe table available in Compax3 (also see in the configuration wizard).

5.1.3. Languages supported

- IL (Instruction List)
- ST (Structured Text)
- FBD (Function block diagram)
- CFC (continuous function chart editor)
- LD (Ladder diagram)

5.1.4. Function range supported

In this chapter you can read about:

5.1.4.1 Operators supported

IL	FBP / CFC / SFC	ST
LD(N)		
ST(N)		
R		
S		
AND(N)	AND	AND(N)
OR(N)	OR	OR(N)
XOR(N)	XOR	XOR(N)
NOT	NOT	NOT
ADD	ADD	+
SUB	SUB	-
MUL	MUL	*
DIV	DIV	/
GT	GT	>
GE	GE	>=
EQ	EQ	=
NE	NE	<>
LE	LE	<=
LT	LT	<
RET	RET	RETURN
	MOVE	
		:=

CAL(C/N)		
JMP(C/N)		
		CASE
		DO
		ELSE
		ELSIF
		END_CASE
		END_FOR
		END_IF
		END_REPEAT
		END_WHILE
		EXIT
		FOR
		IF
		REPEAT
		THEN
		TO
		UNTIL
		WHILE

5.1.4.2 Standard functions supported

Bit manipulation functions

SHL, SHR, ROL, ROR

Numeric functions

ABS, SQRT, SIN, COS

Functions for type conversion

Type conversions x_TO_y	X=Source data type, Y=Target data type
TRUNC	

Functions for selection

MIN	Not for BOOL /WORD / DWORD
MAX	Not for BOOL /WORD / DWORD
LIMIT	Not for BOOL /WORD / DWORD
SEL	Not for BOOL /WORD / DWORD

5.1.4.3 Standard function modules supported

FlipFlops

RS, SR,

Trigger

R_TRIG, F_TRIG,

Numerator

CTU, CTD, CTUD,

Timer

TON, TOF, TP,
max. 8 pcs., time resolution 0.5ms
(the number of timers required is displayed in the CoDeSys output window during compilation)

PID Controller function block

5.1.5. Data types supported

The following data types are available for IEC61131-3 programming:

Name	Division	Format
BOOL	Status values: TRUE or FALSE	Logical variable.
INT	-32768...32767	16-bit integer: Fixed point number without places after the decimal
DINT	-2147483648...2147483647	32-bit integer: Fixed point number without places after the decimal
REAL		32-bit floating point: 16 bits before the decimal and 16 bits after the decimal
WORD	0...65535	16-bit bit sequence (no range of values)
DWORD	0...4294967295	32-bit bit sequence (no range of values)
TIME	0...4194,3035s	32 Bit - Format (resolution: 0.5 ms)
ENUM	User-defined type of enumeration (local enumerations are not supported)	

Altogether 500 16-bit variables are available. These include BOOL, INT, and WORD.
Altogether 150 32-bit variables are available. These include DINT,DWORD,TIME,REAL.
The number of the required variables is displayed in the CoDeSys output window during compilation.

5.1.6. Retain Variables

6 retain variables (variables that are safe from power failure) are available

- 3x16-bit retain-variables
- 3x32-bit retain-variables

5.1.7. Recipe table with 9 columns and 32 lines

An array, i.e. a table with 9 columns and 32 rows, is available to store values.
This table is freely assignable and can be used for example to store position sets or for recipe management.
In addition, this table can be used to exchange data with an external control system or a POP, for example.

The layout of the table is as follows:

Column 1 Type: REAL Objects O1901	Column 2 Type: REAL Objects O1902	Column 3 Type: INT Objects O1903	Column 4 Type: INT Objects O1904	Column 5 Type: INT Objects O1905	Column 6 Type: DINT Objects O1906	Column 7 Type: DINT Objects O1907	Column 8 Type: DINT Objects O1908	Column 9 Type: DINT Objects O1909
Row 1 "C3Array_Col1_Row1" (1901.1)	Row 1 "C3Array_Col2_Row1" (1902.1)	Row 1 "C3Array_Col3_Row1" (1903.1)	Row 1 "C3Array_Col4_Row1" (1904.1)	Row1 "C3Array_Col5_Row1" (1905.1)	Row 1 "C3Array_Col6_Row1" (1906.1)	Row 1 "C3Array_Col7_Row1" (1907.1)	Row 1 "C3Array_Col8_Row1" (1908.1)	Row 1 "C3Array_Col9_Row1" (1909.1)
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
Row 32 "C3Array_Col1_Row32" (1901.32)	Row 32 "C3Array_Col2_Row32" (1902.32)	Row 32 "C3Array_Col3_Row32" (1903.32)	Row 32 "C3Array_Col4_Row32" (1904.32)	Row 32 "C3Array_Col5_Row32" (1905.32)	Row 32 "C3Array_Col6_Row32" (1906.32)	Row 32 "C3Array_Col7_Row32" (1907.32)	Row 32 "C3Array_Col8_Row32" (1908.32)	Row 32 "C3Array_Col9_Row32" (1909.32)

In addition to direct access to every individual field in the table, direct access is also possible through pointer addressing.
To do this, the table pointer "C3ArrayPointer_Row" (Object 1900.1) must be set to the desired rows.

This makes access to Columns 1 through 9 of the referenced rows possible through "C3Array_Indirect_Col1" to "C3Array_Indirect_Col9" (objects 1910.1 to 1910.9).

5.1.8. Maximum program size

Up to 6000 (IL) instructions are possible

Note! Please note, that integrated function modules do also require program memory. The required program memory can therefore increase due to a Targets update, even without any program changes.

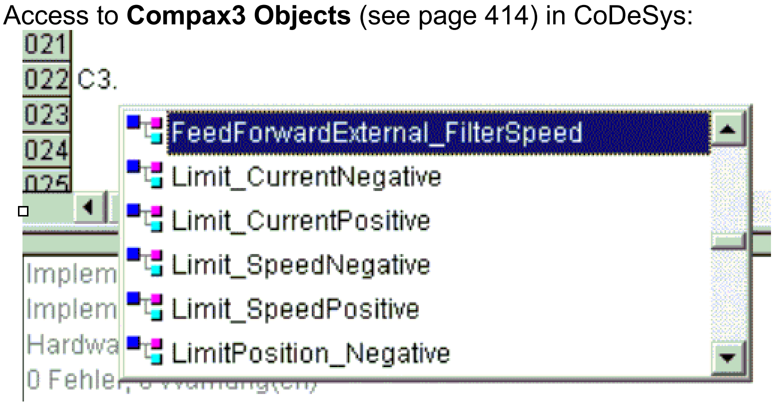
The number of instructions generated is displayed in the CoDeSys output window by the Compax3 compiler during interpretation.

5.1.9. Cycle time

Minimal cycle time: 1ms.
The cycle time can be adjusted with the Compax3 ServoManager when downloading IEC61131-3 programs.
It is possible to optimize later in the optimization display of the Compax3 Servomanager. The cycle time is displayed there in increments of 500 µs (2 = 1 ms; 3 = 1.5 ms; etc.).
The IEC61131-3 program is stopped cycle time of 0.

5.1.10. Access to the Compax3 object directory

All Compax3 objects are encapsulated in the "C3" program module.
Access to **Compax3 Objects** (see page 414) in CoDeSys:



Compax3 objects are divided into groups:

C3.	Compax3 - Objects
C3Array.	Variable (Recipe) List
C3Pop.	Objects for the Parker Operator Panel Pop.
C3Cam.	Objects for the T40 cam control. **Do only use the objects described in this help; the additional objects are for internal use only!**
C3Plus.	Additional objects that are generally not required.
C3Scope.	Objects for programming the oscilloscope function. **For internal use only!**

The object name reveals the group assignment.

In general, it applies:

Objects that are not described here are reserved objects!

5.1.11. Compilation, debugging and down/upload of IEC61131 programs

- Compiling IEC61131-3 programs in CoDeSys
- Downloading or uploading of IEC61131-3 programs with the Compax3 ServoManager.
- The debugger is called up from the C3 ServoManager under ”Programming: IEC61131-3 debugger” called up.

Note:

Before compiling you have to enter for which Compax3 versions the compilation is to be executed.
Please note that when selecting ”all versions” not all functions are available, only the minimal range of functions is supported.
Only if the latest firmware version was selected (and the corresponding firmware is loaded in the target Compax3) all functions described here are supported.

5.1.12. General rules / timing

General rules

Positioning

Within an IEC cycle, only one positioning module may be activated!
If 2 positioning modules are activated within one IEC cycle, it is not defined which one is executed.

Status of the outputs

- The outputs "Done", "InVelocity", "Error", "ErrorID" and "CommandAborted" reset with the falling edge of the "Execute" input.
- If the "Execute" input goes back to FALSE again before the module action (for example positioning) has been completed ("pulse to Execute"), the corresponding outputs (for example "Done") will still be set for exactly ONE cycle upon termination.
- The outputs "Done" and "Error" are never simultaneously TRUE.
- If the instance of a function module receives a new "Execute" signal before the function ends, the module will not show any response (no "Done" and no "Command Aborted") in reference to the previous action.

Input parameters

- Parameters are accepted with the rising edge of the "Execute" signal.
- To be able to accept modified parameters, the module must be triggered again with an "Execute" signal.

Missing input parameters

- If an input parameter is missing, the previous value of this instance will be used in accordance with IEC61131-3.
- The default value is used the first time a call is made.

Position and distance

- "Position" is a value that is defined for a reference system, i.e. a specific position value is a fixed location in the reference system.
- "Distance" is the difference between 2 positions.

Sign

- "Velocity", "Acceleration", "Deceleration" and "Jerk" are always positive variables.
- "Position" and "Distance" may be positive or negative.

Error handling

- All function modules have an "Error" output that can be activated by a module during a module sequence.
- The ErrorID (error number) can be read by an axis error with the "MC_ReadAxisError" module.

Behavior of the "Done" - output

The "Done" output is set if the function module has been successfully executed.
If one positioning process is interrupted by a second before it is complete, the first function module will not set "Done".

Behavior of the "CommandAborted" output

"CommandAborted" is set if a positioning process is interrupted by a second positioning process, by "MC_Stop" or MC_Power.
The reset behavior of "CommandAborted" is the same as "Done".
If "CommandAborted" occurs, the other outputs will be reset.

Value range of the movement parameters

Please note that the limits are specified in revolutions.
To convert to the configured unit, multiply the min/max values by the "travel distance per motor revolution".

Linear motors

With a configured linear motor, all revolution data must be replaced by pitch.
To convert to the configured unit, the min/max values must be multiplied by the pitch length (see the technical data for the motor).

5.1.13. Library constants

The following global constants are declared in the PLCopen function module library:

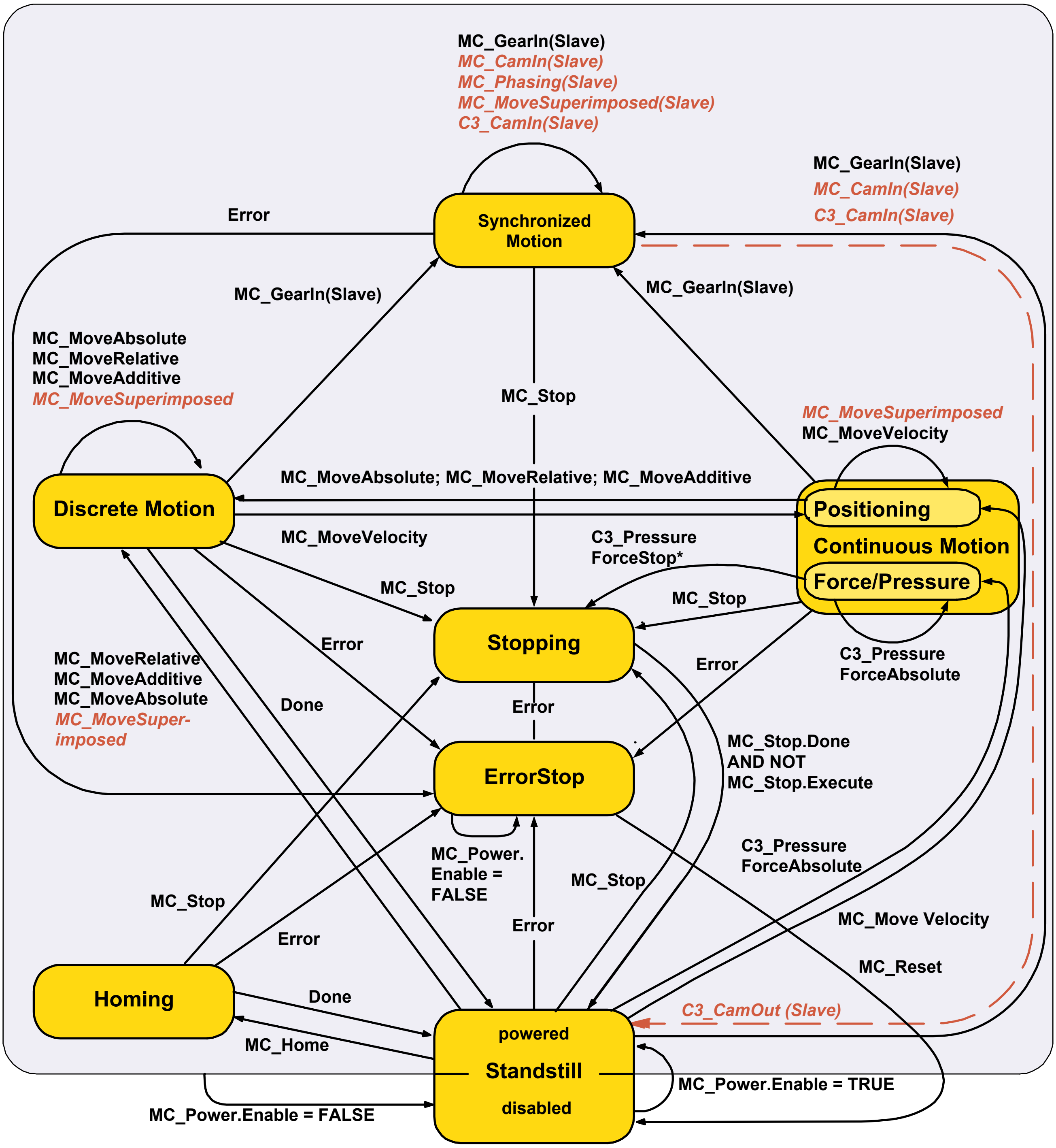
Name	Table Style	Description
For power supply of the axis inputs/outputs of modules:		
Axis_Ref_LocalAxis	INT	Local axis for Compax3F: Main axis
Axis_Ref_LocalAxisAux	INT	Only for Compax3F: Local auxiliary axis
Axis_Ref_Virtual	INT	virtual Master (only with T40)
AXIS_REF_LocalCam	INT	Local Cam axis (physically present axis)

For the selection of the master signal source:		
AXIS_REF_Physical	INT	for +/-10V analog input, step / direction input 5V or Encoder A/B input 5V (depending on the configuration of the physical source under signal source)
Axis_Ref_Virtual	INT	virtual Master
Axis_Ref_HEDA	INT	HEDA
Axis_Ref_Additional	INT	reserved (additional sources)
Axis_Ref_CAN	INT	reserved (CAN)
General constants		
MC_Direction_Positive	INT	For supply of the Direction input of the MC_MoveVelocity module (for positive rotational direction)
MC_Direction_Negative	INT	For supply of the Direction input of the MC_MoveVelocity module (for negative rotational direction)
MC_Direction_Current	INT	For supply of the Direction input of the MC_MoveVelocity module (retaining the last rotational direction to be selected)
Direction_Memory	INT (Variable)	The MC_MoveVelocity modules instances store the last direction parameter in this variable. This variable can only be used by Motion Control modules and must not be overwritten!
OutputSelect_C3Output	INT	for the C3_OutputSelect module: Assignment of the source for the respective output to module "C3_Output".
OutputSelect_FastCam	INT	for the C3_OutputSelect module: Assignment of the source for the respective output to the respective fast cam.
Reset positioning mode		
All directions	INT	C3_all_direction
Positive direction	INT	MC_positive_direction
Shortest path	INT	MC_shortest_way
Negative direction	INT	MC_negative_direction
Actual direction	INT	MC_current_direction

5.2 Status diagrams

In this chapter you can read about:

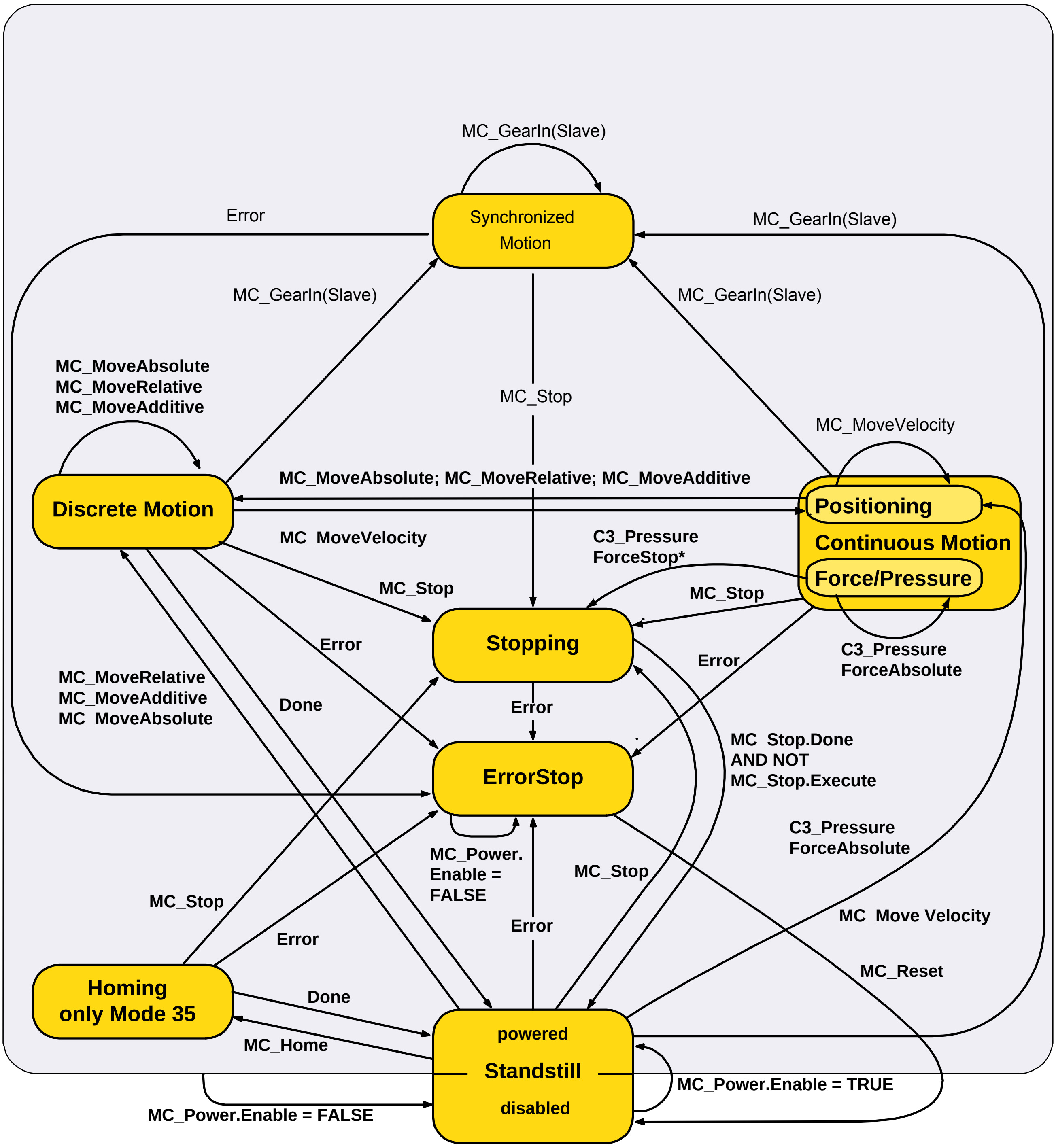
5.2.1. Status diagram of Compax3F main axis



* C3_PressureForceStop is valid for axes that are entirely pressure/force controlled, where no position control is configured.

- T30 Functions: Transitions and states as continuous line, text not in italics
- T40 Functions: complete status diagram, all functions
- Special T40 functions are displayed in italics and in dashed line
- MC_Power.Enable = FALSE changes to "not powered" from any state (apart from ErrorStop).

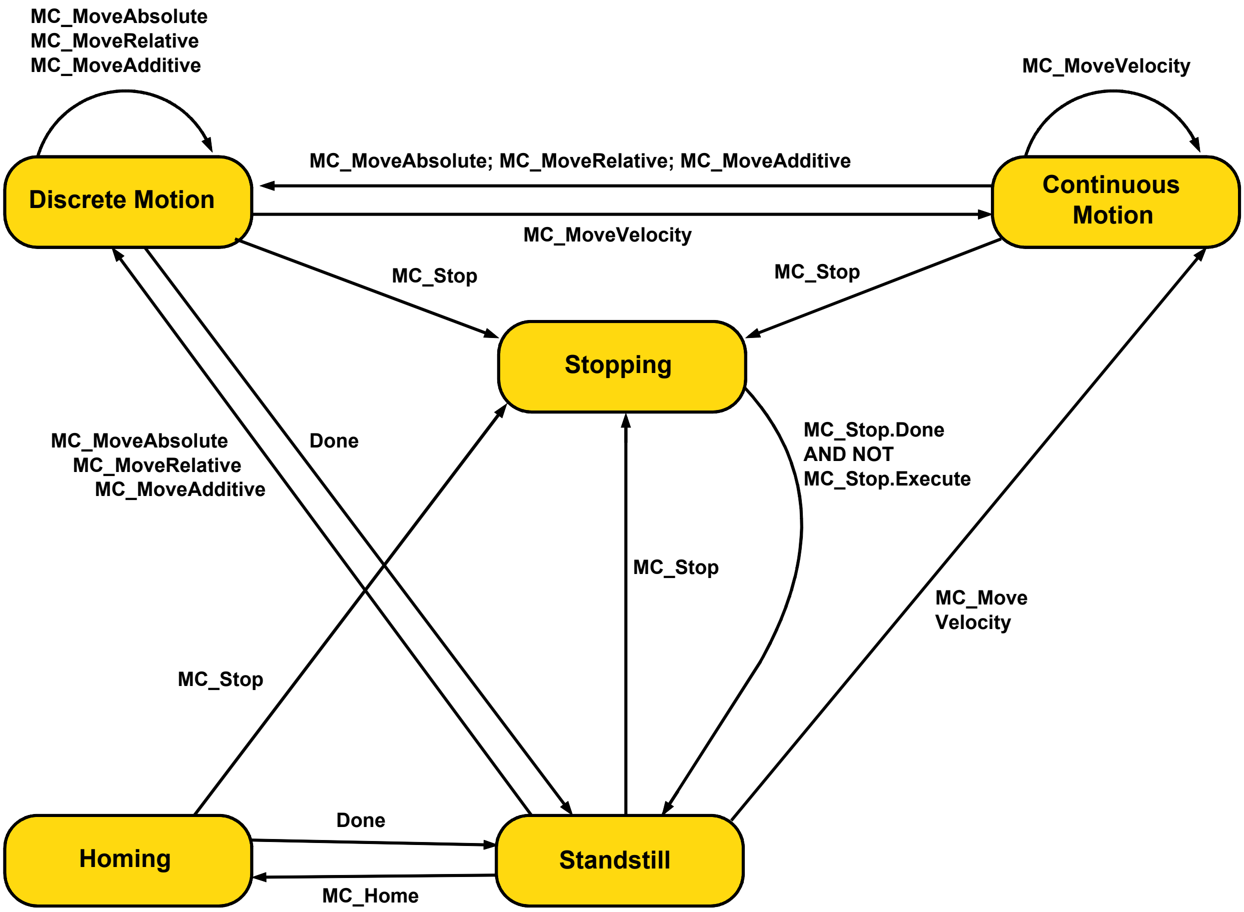
5.2.2. Status diagram of Compax3F auxiliary axis



* C3_PressureForceStop is valid for axes that are entirely pressure/force controlled, where no position control is configured.

- T30 Functions: Transitions and states as continuous line, text not in italics
- T40 Functions: complete status diagram, all functions
- Special T40 functions are displayed in italics and in dashed line
- MC_Power.Enable = FALSE changes to "not powered" from any state (apart from ErrorStop).

5.2.3. Status diagram of the virtual master



Create a program for the virtual axis.
The virtual axis supports the function modules listed in the status diagram.
To do so, the input/output variable "Axis" is assigned to the constant "AXIS_REF_Virtual".
The position value of the virtual axis can be used as master signal source.

Note: Please note that the virtual axis is only available for function modules listed in the status diagram.

Please note:

The "virtual master" function is only possible, if no auxiliary axis was configured.

5.3 Control functions

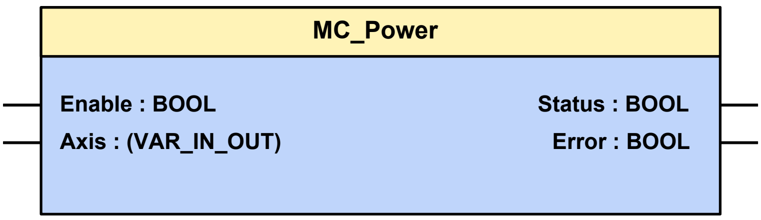
In this chapter you can read about:

5.3.1. Activation of the drive (MC_Power)

FB name	**MC_Power**	
Transition into the status "Standstill: disable" or "Standstill: powered"		
VAR_IN_OUT		
Axis	INT	Axis-ID (library constants)
VAR_INPUT		
Enable	BOOL	Activates the module; as long as Enable=TRUE, the drive is activated. With Enable=FALSE, the drive stops with the **ramp defined for the error** (see page 74). **Please observe:** The configured error ramp is limited. The error ramp will not be smaller than the deceleration set in the last motion set.
VAR_OUTPUT		
Status	BOOL	State of the power output stage (TRUE=drive activated, FALSE=drive deactivated)
Error	BOOL	Error when deactivating the drive

Notes:

- If the input parameter "Enable" = TRUE, all enables of the drive will be set.
- All enables will be reset if the input parameter "Enable" = FALSE, the axis decelerates with the configured error ramp to speed = 0.
- Note on Compax3 Servo: During automatic commutation, the output "Status" is not set to TRUE for activation, but rather not until after automatic commutation has been successfully completed.
- An enable is denied until the intermediate circuit is loaded, this may take up to 2s when switching on Compax3H for the first time.
- If the drive is in **error state** (see page 302) (error reaction 1: controller active) and the enable of the MC_Power is deactivated, the drive is deactivated (error reaction 2).
- C3 powerPLmC Note: This module is also available as group function block. You can then trigger this function for the entire Compax3 group.



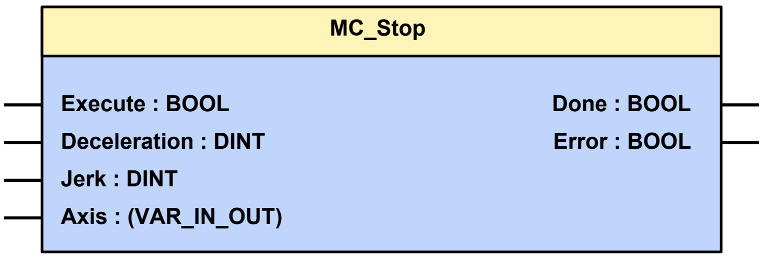
5.3.2. Stop (MC_Stop)

In this chapter you can read about:

FB name	**MC_Stop**	
Stops the current movement **Please note:** Only one instance of MC_Stop is permitted per axis!		
VAR_IN_OUT		
Axis	INT	Axis-ID (library constants)
VAR_INPUT		
Execute	BOOL	Stops the movement
Deceleration	DINT	The value of deceleration (always positive) [units/s^2] Value range: 0.24 rev/s^2 ... 1000000 rev/s^2 **Please observe:** The configured STOP ramp is limited. The STOP ramp will not be smaller than the deceleration set in the last motion set.
Jerk	DINT	Value of the deceleration jerk [units/s^3] (always positive) Value range: 30 rev/s^3 ... 125,000,000 rev/s^3
VAR_OUTPUT		
Done	BOOL	Stop move
Error	BOOL	Error while stopping positioning

Note:

As long as the "Execute" input is set, the axis remains in the "Stopping" status (as long the axis is activated) and is unable to execute any additional movement commands!
If the axis is deactivated by setting the Enable signal of the "MC_Power" module to FALSE, the Stopping state will then be exited.
If the enable signal of the "MC_Power" module is set to TRUE again, the axis goes back to the "Stopping" state again if the Execute input of the "MC_Stop" module is still TRUE.
C3 powerPLmC Note: This module is also available as group function block. You can then trigger this function for the entire Compax3 group.



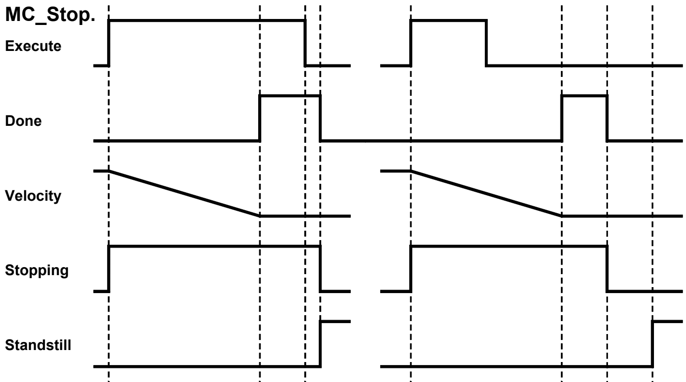
5.3.2.1 MC_Stop at pressure/force control

If a position control is configured, the MC_Stop.Execute = TRUE switches to position control (pQ). The axis is stopped (with a ramp defined via Deceleration and Jerk).
If no position control is defined, MC_Stop does not have any function. Set the axis into a Stop state by specifying a defined force (or pressure difference) in a Stop state.

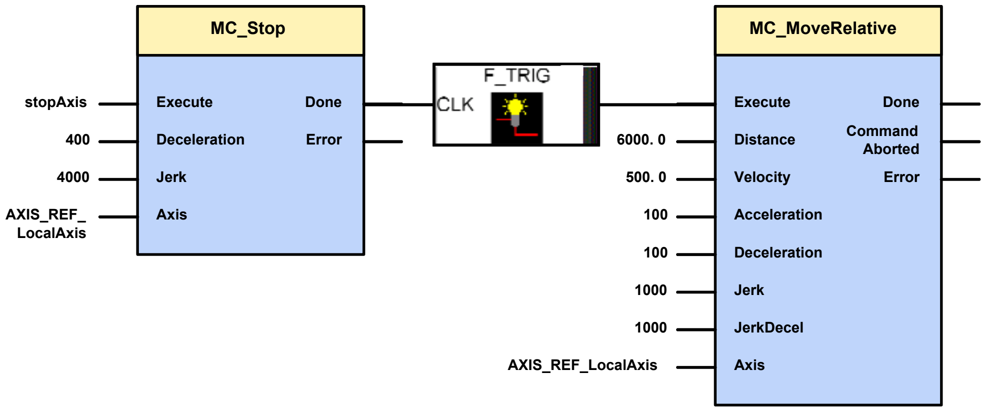
5.3.2.2 MC_Stop: Example 1

The following illustration shows an example of how the MC_Stop module interrupts and stops a movement that is in progress.
If a positioning module is interrupted by the MC_Stop module, it reports "Command Aborted" and can no longer be executed as long as the MC_Stop module is active.
If the MC_Stop module is inactive (no "Execute" signal), the function module can be executed again.

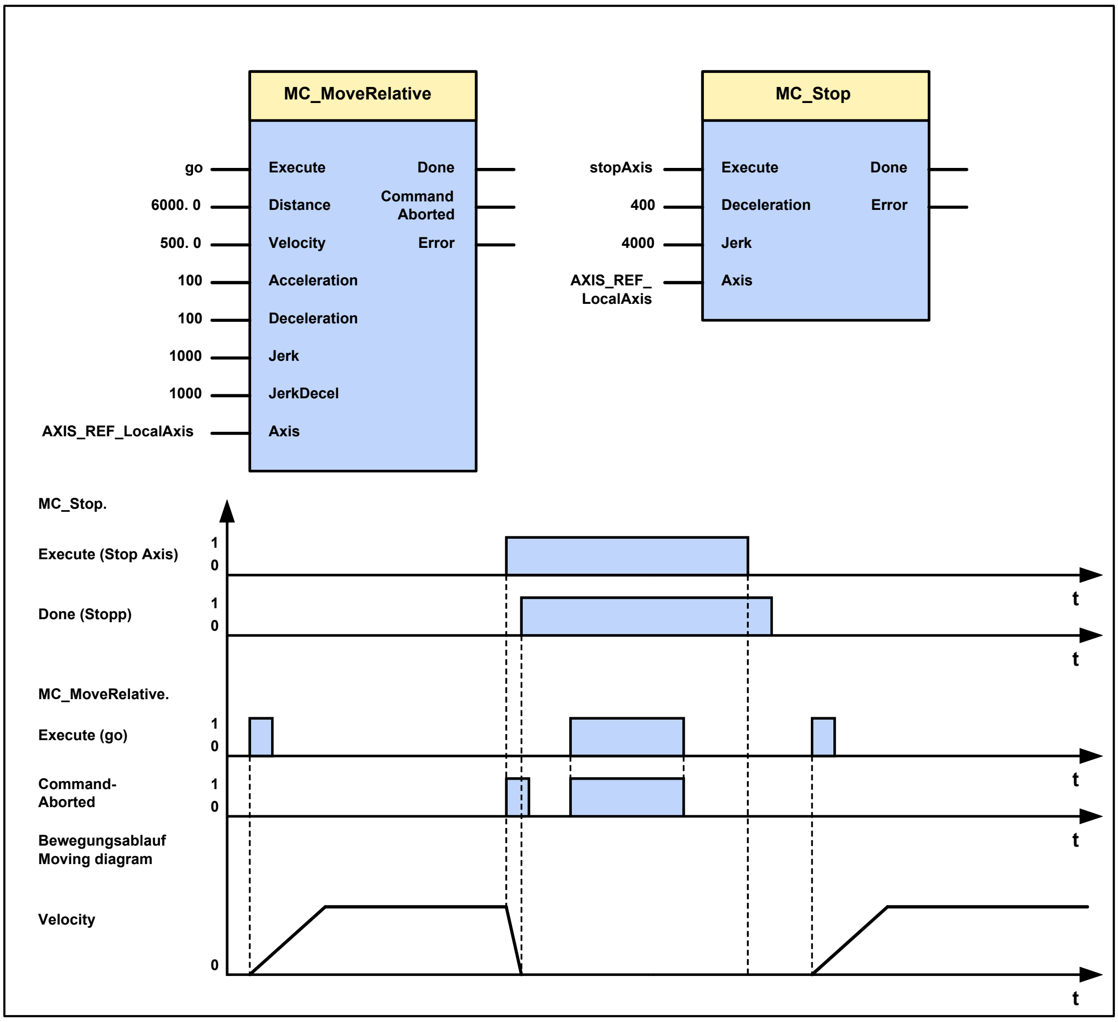
Timing Diagram:



Note: If a positioning is to follow immediately after the stop, this can take place with the falling edge of the done output at the earliest:



5.3.2.3 MC_Stop: Example 2

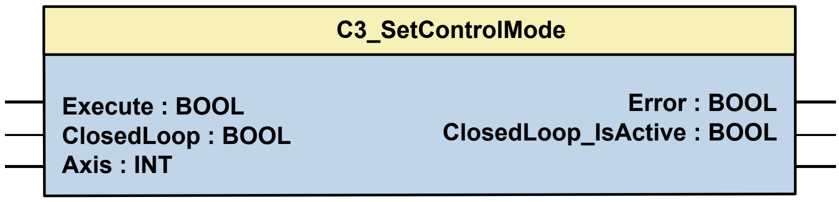


5.3.3. C3_SetControlMode

FB name	C3_SetControlMode	
Switching between open loop and closed loop.		
VAR_IN_OUT		
Axis	INT	Axis ID (Library constants) AXIS_REF_LocalAxis: Main axis AXIS_REF_LocalAxisAux: Auxiliary axis
VAR_INPUT		
Execute	BOOL	Starts the sequences of the module with positive edge
ClosedLoop	BOOL	TRUE: Sets closed loop operation for the selected axis FALSE: Sets open loop operation for the selected axis
VAR_OUTPUT		
ClosedLoop_IsActive	BOOL	TRUE, when closed loop operation has been set
Error	BOOL	Error while executing module. The axis may not be in the "operational" or a higher state for the change!

Note:

- A change can only be executed if the axis is in pre-operational sate (Standstill: not powered).
- In open loop mode, the axis may drift!
- For safe operation in the closed loop mode, the controller must be aligned!

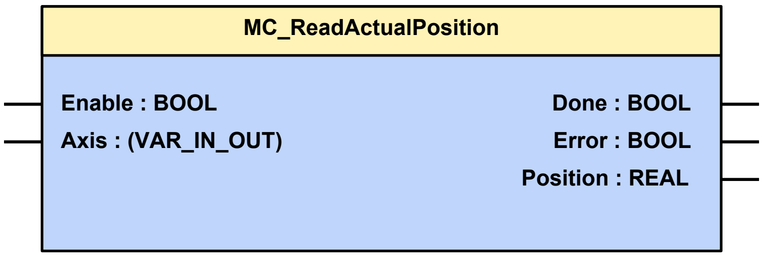


5.4 Reading values

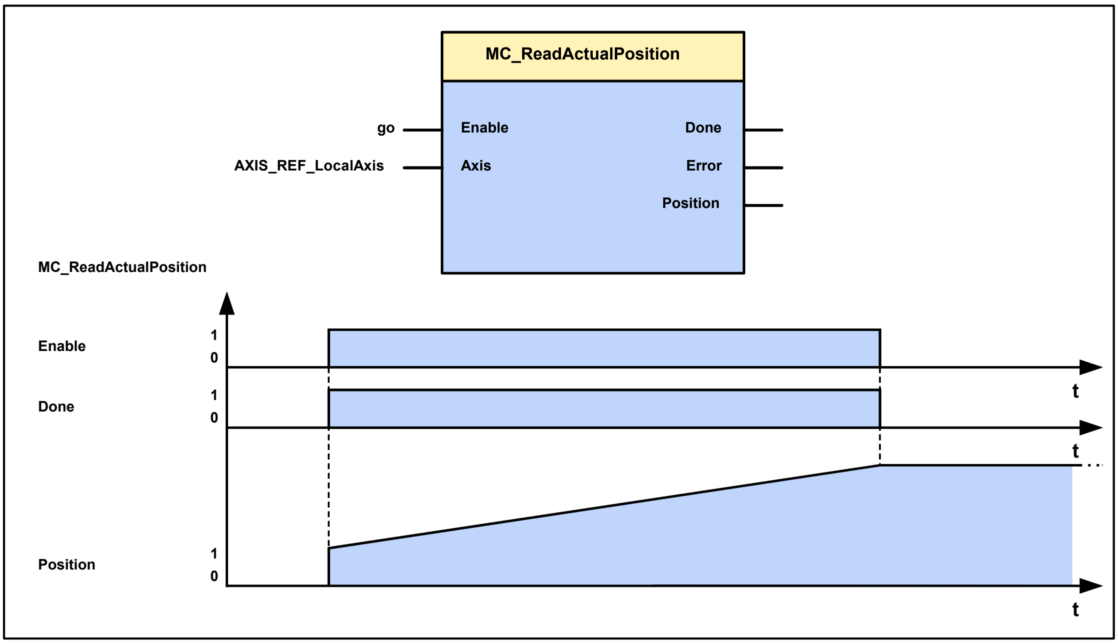
In this chapter you can read about:

5.4.1. Reading the current position (MC_ReadActualPosition)

FB name	**MC_ReadActualPosition**	
Reading the current axis position		
VAR_IN_OUT		
Axis	INT	Axis-ID (library constants)
VAR_INPUT		
Enable	BOOL	Activates the module, continuous reading of the axis position as long as Enable=TRUE
VAR_OUTPUT		
Done	BOOL	Position value available
Error	BOOL	Error while reading the position
Position	REAL	Axis position
Note: -		

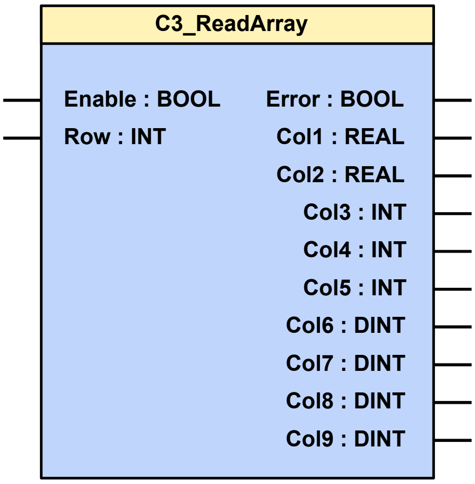


You can read the current position of the axis with this module.
As long as the input parameter "Enable" = TRUE, the current parameter value will be supplied **cyclically** (see page 317) to the output parameter "Position".
The status of the input parameter must be present for at least one module call.
The following illustration shows the behavior of parameters in the MC_ReadActualPosition function module.



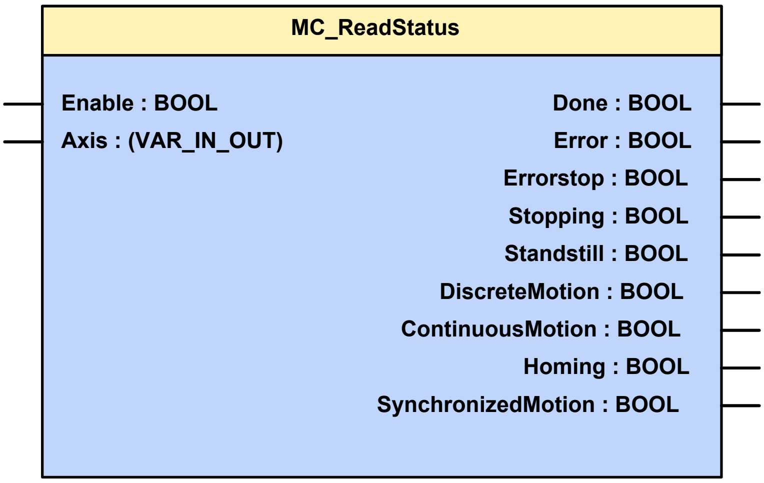
5.4.2. Read access to the (C3_ReadArray) array

FB name	**C3_ReadArray**	
This module is used for simplified read access to the array (recipe table).		
VAR_INPUT		
Enable	BOOL	The desired rows can be read with the Enable input (after selecting "Row").
Row	INT	The desired row in the table must be created at the end of the Row module input. this input works with object 1900.1; please take this into consideration, if you directly access the object 1900.1 in addition.
VAR_OUTPUT		
Error	BOOL	Error as an output indicates that an error was encountered while reading the array (a row that does not exist selected on the Row input).
Col1 – Col9	REAL INT DINT	The individual columns of the array can be accessed through outputs Col1 through Col9.
Notes: Rows will be read cyclically as long as Enable = TRUE.		



5.4.3. Reading the device status (MC_ReadStatus)

FB name	**MC_ReadStatus**	
Specifies the current status according to the PLCopen status machine		
VAR_IN_OUT		
Axis	INT	Axis-ID (library constants)
VAR_INPUT		
Enable	BOOL	Activates the module; continuous outputs of output parameters as long as Enable=TRUE
VAR_OUTPUT		
Done	BOOL	Status values available
Error	BOOL	Error while executing module
Errorstop	BOOL	Error stop function. The motor brakes as specified by the stop ramp and is de-energized;
Stopping	BOOL	The motor is stopped;
Standstill	BOOL	The motor is stopped;
DiscreteMotion	BOOL	Individual movement;
ContinuousMotion	BOOL	Continuous positioning;
Homing	BOOL	Machine home is approached;
SynchronizedMotion	BOOL	Synchronous motion
Note: See also in the status diagram.		



5.5 Determine valve/range parameters (C3_GetSystemFingerPrint)

In this chapter you can read about:

The characteristic line known as "SystemFingerPrint" contains besides the behavior of the valve (valve characteristic line) all static non-linearities of the hydraulic system.
The "SystemFingerPrint" is valid in the working point, where it has been determined. If the parameters such as system pressure, load, friction or oil temperature change significantly, this may affect the usability of the "SystemFingerPrint".

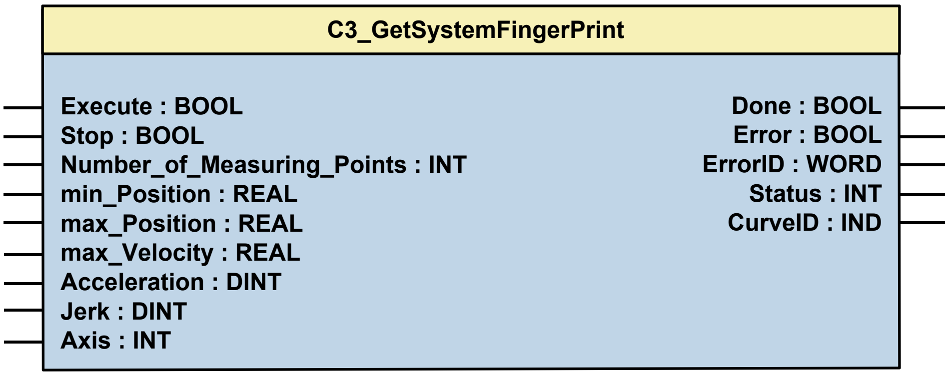
FB name	**C3_GetSystemFingerPrint**	
This module is used for measuring and memorizing the "SystemFingerPrint" (Signal/Flow characteristic)		
VAR_IN_OUT		
Axis	INT	Axis ID (Library constants) AXIS_REF_LocalAxis: Main axis AXIS_REF_LocalAxisAux: Auxiliary axis
VAR_INPUT		
Execute	BOOL	Starts the sequences of the module with positive edge
Stop		Stops the measurement sequence with a positive edge
Number_of_Measuring_Points	INT	Number of measuring points (max. 300). Defines the setpoint accuracy.
min_Position	REAL	Position window, where the measurement takes place
max_Position	REAL	
max_Velocity	REAL	Highest speed to be measured
Acceleration	DINT	Maximum acceleration during the measurement
Jerk	DINT	Maximum jerk during the measurement
VAR_OUTPUT		
Done	BOOL	Measurement terminated successfully
Error	BOOL	A fault has occurred. Measurement was terminated (by error or by stop).
ErrorID	Word	Indicates, which error caused the abort: 0 = no Error 1 = measurement was terminated with stop (measurement is immediately terminated) 2 = Compax3F is in error state (measurement is immediately terminated) 3 = The given adjusting range could not be entierely identified. (Measurement is continued in the opposite direction and the result is memorized in the Flash). Possible causes: ◆ In the set travel range, the end speed (maxVelocity) could not be reached: =>reduce max_Velocity ◆ The demanded accuracy could not be achieved: Reduce (ax_Error=max_Velocity / Number_of_Measuring_Points) => Number_of_Measuring_Points 4 = error when memorizing the characteristic line in the flash memory, no CurveID free 5 = The axis was energized at the start of the identification 6 = Input parameters of the measurement are outside the permissible range (Number_of_Measuring_Points or max_Velocity

Status	INT	Indicates how advanced the measurement is yet. 0 = waits for the start of the measurement with "Execute" 1 = Initialization of the measurement 2 = determination of the offset (at which valve position does the axis no longer move 3 = Execution of the measurement 4 = Recovering of different settings 5 = Interpolation of the measurement values 6 = Memorizing the characteristic line in the flash 7 = Setting the Conditioning Chain Parameter to a new characeristic line 8 = Measurement terminated successfully, waiting for "Execute"
CurveID	INT	States, under which ID the characteristic line was memorized. The ID of the characteristic line is in object 24x3.2* If you wish to switch back to characteristic lines set before, you should read the ID of the characteristic line before activating the module. Switching back of a characteristic line: ◆ Select characteristiac line (for all connected Conditioning Chains) 24x3.2* = number of the characteristic line ◆ Select characteristic line (for all connected Conditioning Chains) 24x3.1=1*

Note:

- After successful measurement of the characteristic line, it is memorized in the same way and at the same place as up to now the valve characteristic lines. As the memory utilized provides space for up to 8 characteristic lines, existing characteristic lines must not be deleted.
- In order to activate the characteristic line for the control, the characteristic lines are activated by this module with 24x3.1=1* at the conditioning chains which are connected to the measured axis.

* (x stands for the respective Conditioning Chain: x=0 for Chain 0, x=1 for Chain 1,...)



5.5.1. Important notes

Requirements:

- Stable control (even though slow)
- Following error window set relatively wide => unless abortion due to following error is possible.
- The controller may not be active when the identification is started (State **"Standstill disable"**).
- The measurement is in part executed in open loop operation. This means that the function is, for example with z-axes, only possible to a limited extent. (the load could for example be lowered due to leakages)
- The entire hydraulic system should be well dampened.
  Unless the measurement could be strongly influenced by resonance frequencies present.
- There must be enough travel space in order to perform the identification.
- Enough memory space in the characteristics memory
  Altogether 8 characteristic lines can be stored in the memory of the controller, if these all are taken up by the identification, the identification will be terminated with a corresponding error.
  Check before the start of the identification, if there is enough memory space available.
  If there is no space available, the entire characteristics memory can be deleted by writing a value <> 0 into object 2439.3 C3 "Plus.CurveMemory_Erase. Attention! all characteristics present are deleted.
- The loop gain of the speed control should be set at least approximately. If the loop gain is much too small, the preset speed range might not be entirely measured. If the loop gain is too high, the resolution of the measurement will be too low.

Please respect the following for the measurement:

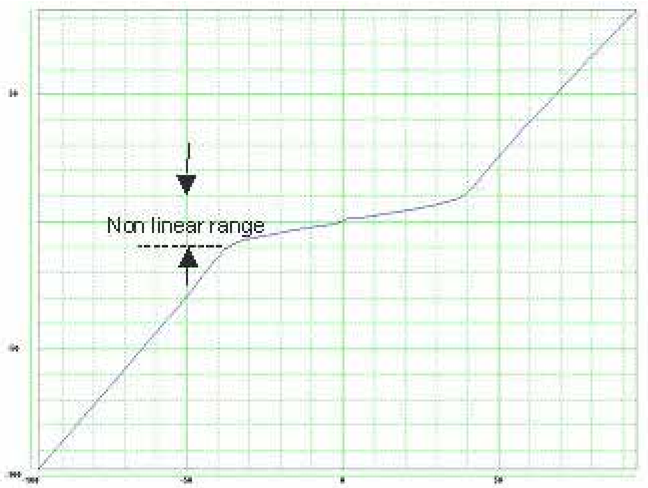
- The axis to be measured may not be used for an action in the IEC.
  (for example MC_Power, MC_Stop, MC_MoveRelative,...)
- The software oscilloscope cannot be used during the measurement.

State after the end of the measurement:

- Axis is not active (State "Standstill disable").
- After MC_Power, the axis is in closed loop operation.

5.5.2. Procedure when working with the C3_getSystemFingerPrint

Example of a valve characteristic line (volume current via control signal):



Procedure:

- Specification of the travel range available for the measurement with min_Position and max_Position.
- Setting max_Velocity (is valid symmetrically for positive and negative values). With max_Velocity, you make 2 settings at once: the max. velocity during the measurement and the measurement range.
  Connection between velocity (max_Velocity) and the relative volume current:
  $$\max\_Velocity = \frac{relative\_volume\_current[\%] \cdot Valve\_nominal\_volume\_current}{Cylinder\_surfaceA \cdot 100\%}$$
  (Value_nominal_volume_current Valve-nominal-volume-current;
  Cylinder_surfaceA: Cylinder_surface-A
  max_Velocity should be set at least so high that the measurement exceeds the non-linear range shown above, as the characteristic line is continued at the same slope outside the measured velocity range.
- the Number_of_Measuring_Points should be set high enough so that the non-linearity to be emulated can be exactly detected (typically N=100).
- Start of the measurement by positive edge at the Execute input.
- The state of the measurement can be monitored via the Status, Done, Error and ErrorID outputs.
- A positive edge at the Done output shows the successful termination of the identification:
  - Measurement terminated successfully
  - The characteristic line was inverted and written into the FLASH memory.
  - In the conditioning chain responsible for the measured system, the curve ID was already set to the new characteristic line and the characteristic line compensation was activated.

5.6 Positioning functions (standard)

In this chapter you can read about:

5.6.1. Value range for positioning parameters

Target position: Min: -4000000 rev Max: 4000000 rev
Speed for positioning: Min: 0.00001157 rev/s Max: 2000 rev/s
Acceleration for positioning Min: 0.24 rev/s² Max: 100000 rev/s²
Acceleration jerk for positioning: Min: 30 rev/s³ Max: 125,000,000 rev/s³
Deceleration for positioning: Min: 0.24 rev/s² Max: 1000000 rev/s²
Deceleration jerk for positioning: Min: 30 rev/s³ Max: 125,000,000 rev/s³

The unit "increments" is valid only for position values!

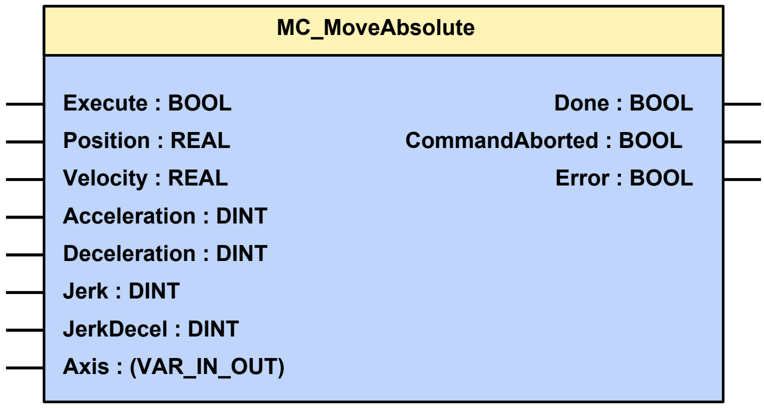
speed, acceleration and jerk are specified in this case in revolutions/s, revolutions/s² and revolutions/s³ (resp. pitch/s, pitch/s², pitch/s³).

5.6.2. Absolute positioning (MC_MoveAbsolute)

FB name	**MC_MoveAbsolute**	
Absolute positioning to a specified position.		
VAR_IN_OUT		
Axis	INT	Axis-ID (library constants)
VAR_INPUT		
Execute	BOOL	Starts the sequences of the module with positive edge
Position	REAL	Absolute target position of the movement to be executed (configured unit [Units]) (positive and negative direction) **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
Velocity	REAL	Value of the maximum speed (always positive) (not necessarily reached) **<value range>** (see page **Fehler! Textmarke nicht definiert.**) [Units/s]
Acceleration	DINT	Value of acceleration (always positive) [Units/s²] **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
Deceleration	DINT	Value of deceleration (always positive) [Units/s²] **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
Jerk	DINT	Value of the acceleration **jerk** (see page 183) [Units/s³] (always positive) **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
JerkDecel	DINT	Value of deceleration jerk [Units/s³] (always positive) **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
VAR_OUTPUT		
Done	BOOL	Specified setpoint position on the setpoint generator output is reached
CommandAborted	BOOL	Positioning aborted
Error	BOOL	Error while executing module

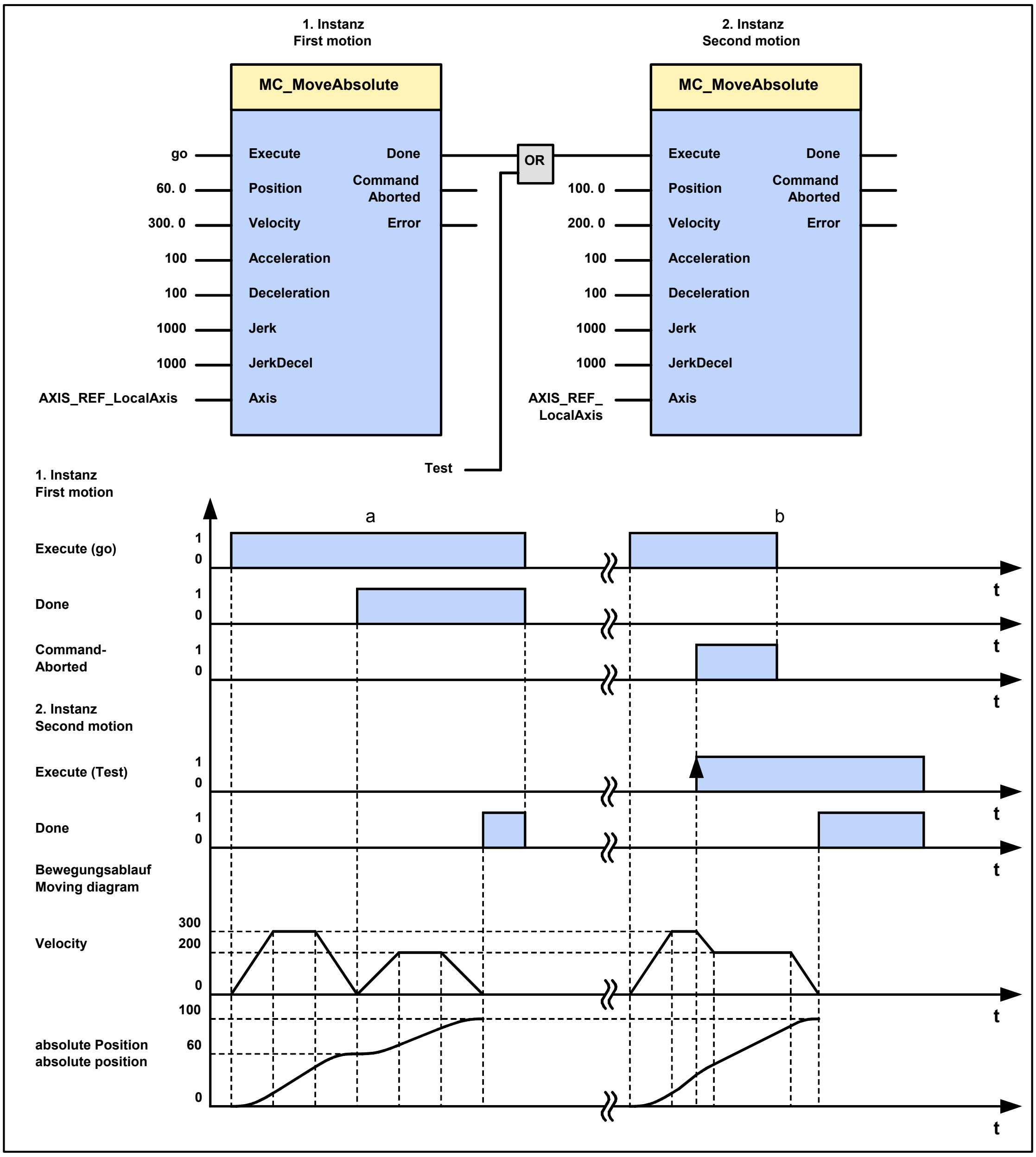
Note: -

- If a SuperImposed movement is started during an absolute movement, the absolute position is not accessed, but the absolute position plus the position entered in the SuperImposed.
- The same applies if a SuperImposed movement is already being executed and an absolute movement is started, then the absolute position is not accessed but the sum of both values.
- After the SuperImposed movement has been finished, the absolute position is accessed with the next absolute movement.
- Continuous operation can be selected via object 1111.8 "C3Plus.Position_restposition_mode" <> 0; setpoint value and actual value are then set to 0 before each positioning.
- You can optimize the motion profile data with the **"ProfilViewer"** (see page 150) software tool!


MC_MoveAbsolute
Execute : BOOL
Position : REAL
Velocity : REAL
Acceleration : DINT
Deceleration : DINT
Jerk : DINT
JerkDecel : DINT
Axis : (VAR_IN_OUT)
Done : BOOL
CommandAborted : BOOL
Error : BOOL

The following illustration shows two examples of the combination of two MC_MoveAbsolute modules.

- The left part (a) of the time diagram shows a case in which the second function module (FB) is executed after the first function module..
  When the first function module has reached Position 60, the "Done" output gives the execution command to the second function module, which then moves to Position 100.
- The right part (b) of the diagram shows a case in which the second function module is activated while the first function module is being executed. The first function module is automatically interrupted..
  The second function module moves directly to position 100 whether or not position 60 of the first function module has already been reached.



5.6.2.1 Position mode in reset operation

In this chapter you can read about:

In reset operation (activated by the configured reset distance), additional positioning functions are possible for absolute positionings:

All directions	Standard positioning mode
Positive direction	Positioning only in positive direction
Shortest path	Positioning on the shortest path
Negative direction	Positioning only in negative direction
Actual direction	Positioning by keeping the actual direction of travel

Dynamic positioning

In dynamic positioning, a decision concerning the positioning travel is not taken on the basis of the actual position, but on the basis of the braking position resulting from the motion parameters.

Please observe:

- In the event of positioning specifications below zero and higher than or equal to the reset distance, this function is deactivated.
- The positioning functions are neither effective in test movements nor in a positioning after homing travel.
- In the event of ”shortest path” the motion is not defined for a positioning by half the reset distance.

Setting the positioning mode in reset mode

The positioning modes in reset operation are configured via object 1111.13 [=C3Plus.POSITION_direction:=MC_Direction_Positive]:

Mode	Value	IEC constant
All directions	0	C3_all_direction
Positive direction	1	MC_positive_direction
Shortest path	2	MC_shortest_way
Negative direction	3	MC_negative_direction
Actual direction	4	MC_current_direction

Setting the desired value must take place in the IEC initialization routine, as a configuration download by the C3 ServoManager would reset the value to 0 (due to downwards compatibility).

Examples in the help file

In the help file you can find here examples for the functioning of the individual positioning modes.

5.6.2.2 Description of jerk

Jerk

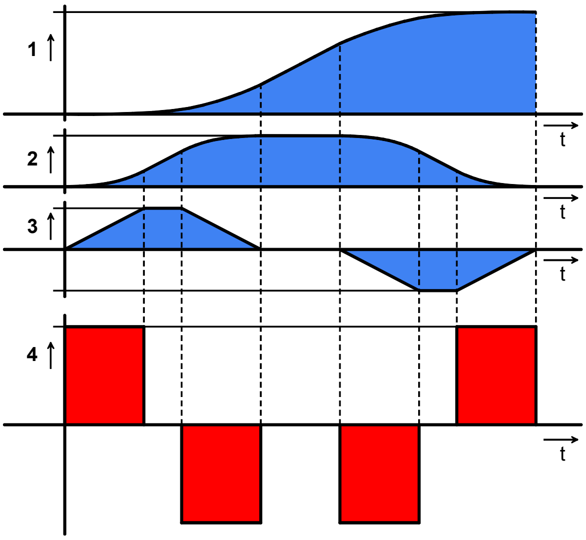
The jerk (marked with "4" in the drawing below) describes the change in acceleration (derivation of the acceleration)

The maximum change in acceleration is limited via the jerk limitation.
A motion process generally starts from a standstill, accelerates constantly at the specified acceleration to then move at the selected speed to the target position. The drive is brought to a stop before the target position with the delay that has been set in such a manner as to come to a complete stop at the target position. To reach the set acceleration and deceleration, the drive must change the acceleration (from 0 to the set value or from the set value to 0).
This change in speed is limited by the maximum jerk.

Without jerk according to VDI2143

According to VDI2143 the jerk is defined (other than here) as the jump in acceleration (infinite value of the jerk function).
This means that positionings with Compax3 are without jerk according to VDI2143, as the value of the jerk funciton is limited.

Motion sequence



1: Position
2: Velocity
3: Acceleration
4: Jerk

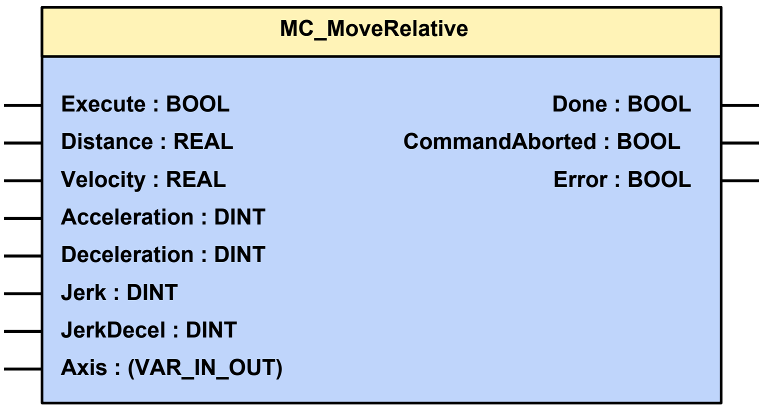
High changes in acceleration (high jerks) often have negative effects on the mechanical systems involved. There is a danger that mechanical resonance points will be excited or that impacts will be caused by existing mechanical slack points. You can reduce these problems to a minimum by specifying the maximum jerk.

5.6.3. Relative positioning (MC_MoveRelative)

FB name	**MC_MoveRelative**	
Relative positioning by a specified distance.		
VAR_IN_OUT		
Axis	INT	Axis-ID (library constants)
VAR_INPUT		
Execute	BOOL	Starts the sequences of the module with positive edge
Distance	REAL	Relative distance of the movement to be executed (configured unit [Units]) **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
MoveVelocity	REAL	Value of maximum speed (always positive) (not necessarily reached) [Units/s] **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
Acceleration	DINT	Value of acceleration (always positive) [Units/s^2] **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
Deceleration	DINT	Value of deceleration (always positive) [Units/s^2] **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
Jerk	DINT	Value of the acceleration **jerk** (see page 183) [Units/s^3] (always positive) **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
JerkDecel	DINT	Value of deceleration jerk [Units/s^3] (always positive) **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
VAR_OUTPUT		
Done	BOOL	Specified setpoint distance on the setpoint generator output is reached
CommandAborted	BOOL	Positioning aborted
Error	BOOL	Error while executing module

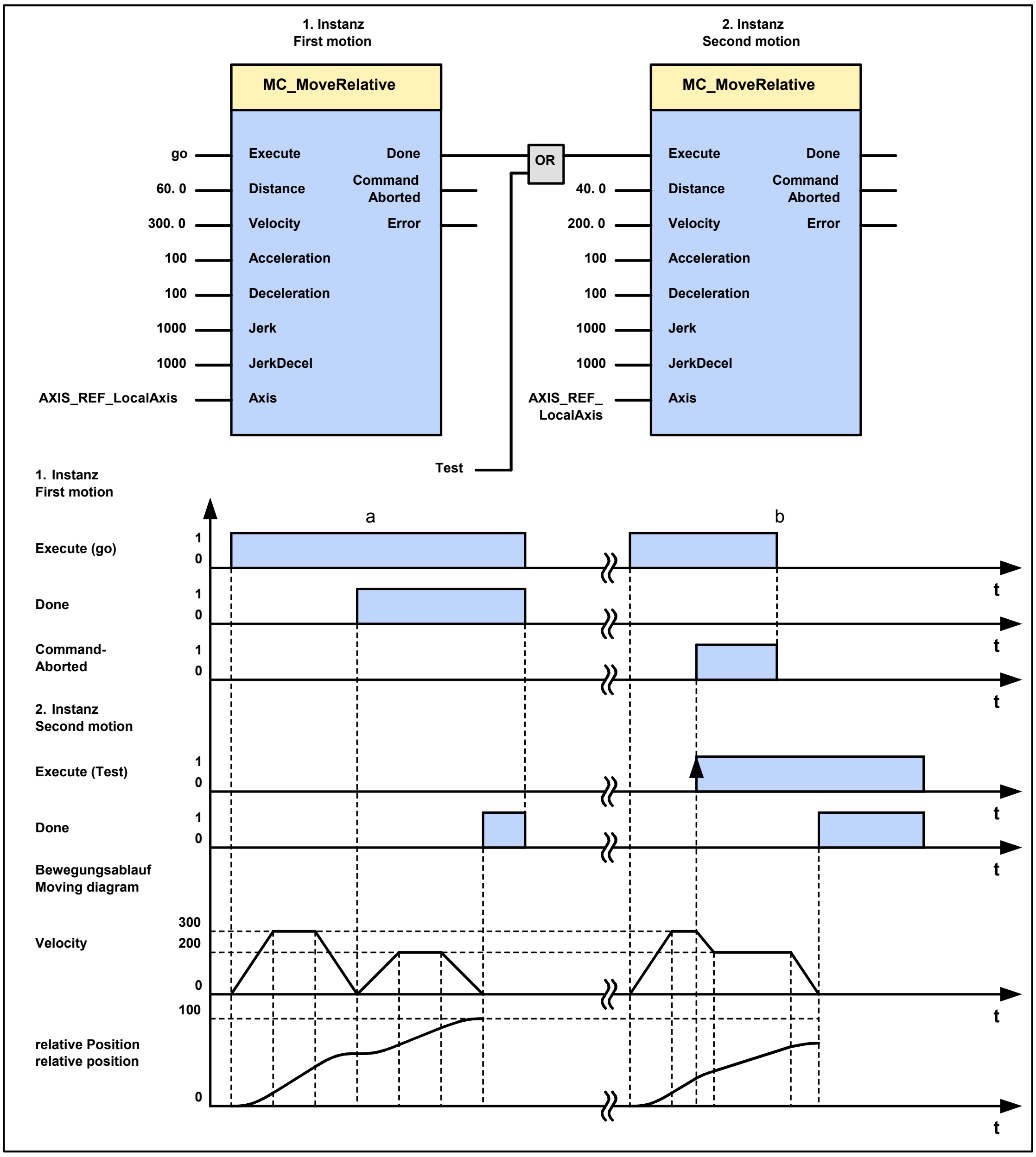
Note:

- In the case of dynamic positioning (module is called during a positioning process) the specified position is added to the current actual position.
- Continuous operation can be selected via object 1111.8 "C3Plus.Position_restposition_mode" <> 0; setpoint value and actual value are then set to 0 before each positioning.
- You can optimize the motion profile data with the **"ProfilViewer"** (see page 150) software tool!



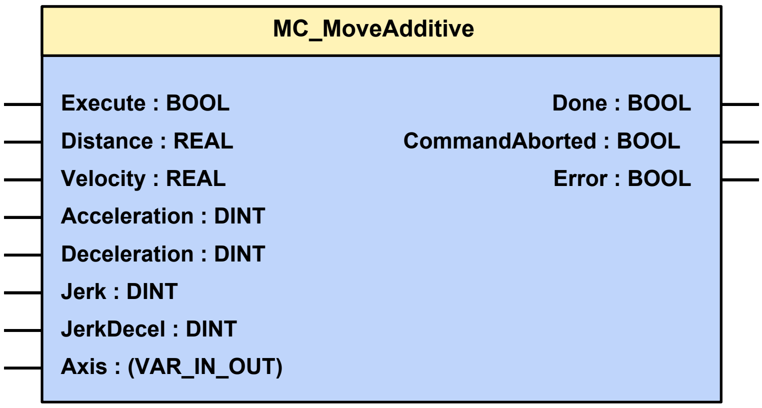
The following illustration shows two examples of the combination of two MC_MoveRelative modules.

- The left part (a) of the time diagram shows a case in which the second function module is executed after the first function module..
  If the first function module has reached 60 units, the "Done" output gives the execution command to the second function module, which then moves an addition 40 units.
- The right part (b) of the diagram shows a case in which the second function module is activated while the first function module is being executed. Because the second module is started during the execution of the first function module, the first function module is automatically interrupted.
  The second function module immediately moves an additional 40 units whether or not the 60 units of the first function were already reached.



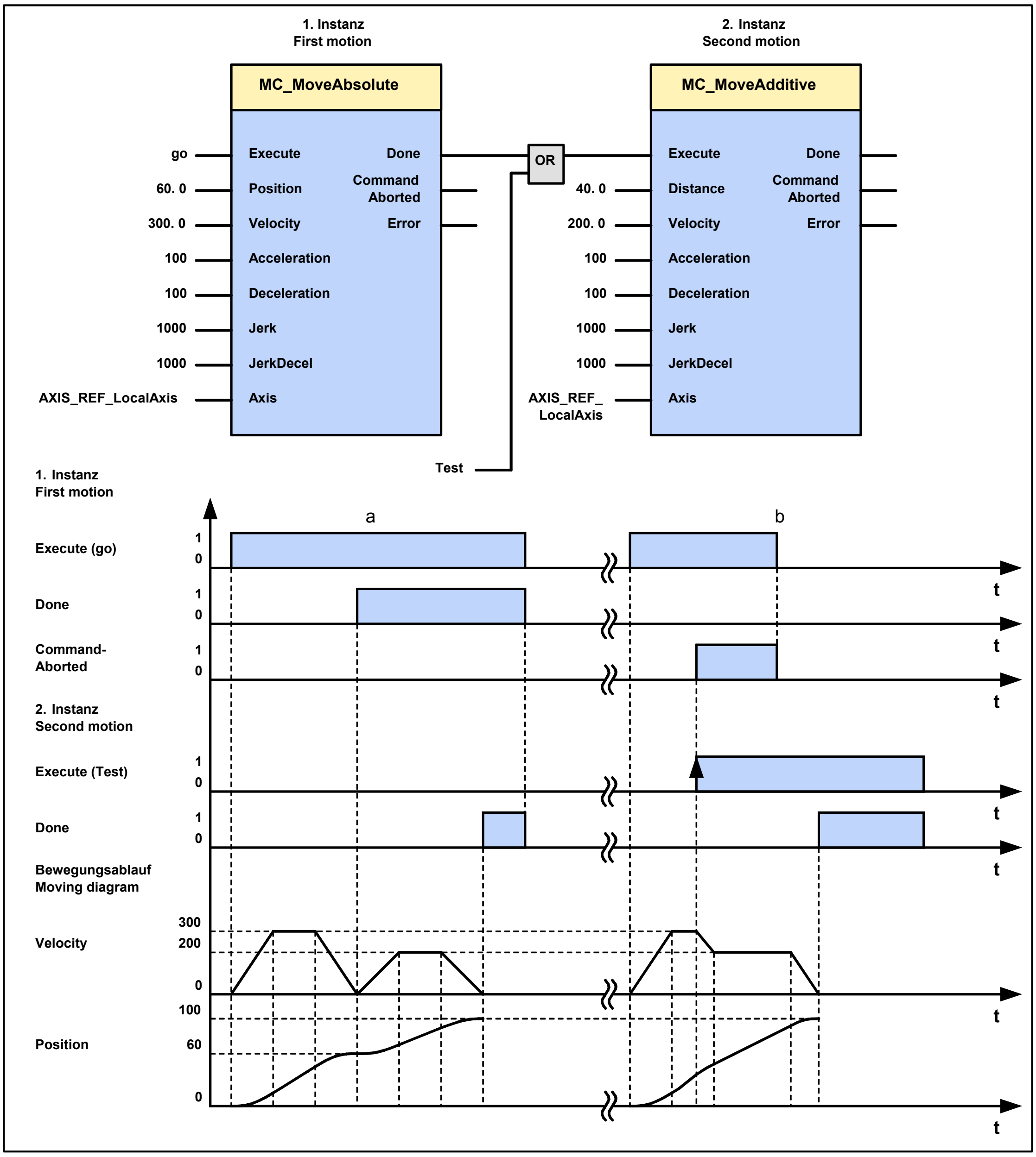
5.6.4. Additive positioning (MC_MoveAdditive)

FB name	**MC_MoveAdditive**	
Adds a relative distance to the target position of a positioning process in progress.		
VAR_IN_OUT		
Axis	INT	Axis-ID (library constants)
VAR_INPUT		
Execute	BOOL	Starts the sequences of the module with positive edge
Distance	REAL	Relative distance **<Value range>** (see page **Fehler! Textmarke nicht definiert.**)
MoveVelocity	REAL	Value of maximum speed (always positive) (not necessarily reached) [Units/s] **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
Acceleration	DINT	Value of acceleration (always positive) [Units/s²] **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
Deceleration	DINT	Value of deceleration (always positive) [Units/s²] **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
Jerk	DINT	Value of the acceleration **jerk** (see page 183) [Units/s³] (always positive) **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
JerkDecel	DINT	Value of deceleration jerk [Units/s³] (always positive) **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
VAR_OUTPUT		
Done	BOOL	Specified distance has been reached
CommandAborted	BOOL	Positioning aborted
Error	BOOL	Error during positioning
Note: In the case of dynamic positioning (module is called during a positioning process) the specified position is added to the current target position.		



The following illustration shows two examples of the combination of a MC_MoveAbsolute and an MC_MoveAdditive module.

- The left part (a) of the time diagram shows a case in which the second function module is executed after the first function module.
  After the first function module has traveled to Position 60, the "Done" output gives the execution command to the second FB, which then moves on another 40 units
- The right part (b) of the diagram shows a case in which the second function module is activated while the first FB is being executed. Because the second module is started during the execution of the first FB, the first FB is automatically interrupted.
  The second function module adds the missing units that are still lacking for the first module and the moves an additional 40 units with the new predefined settings.

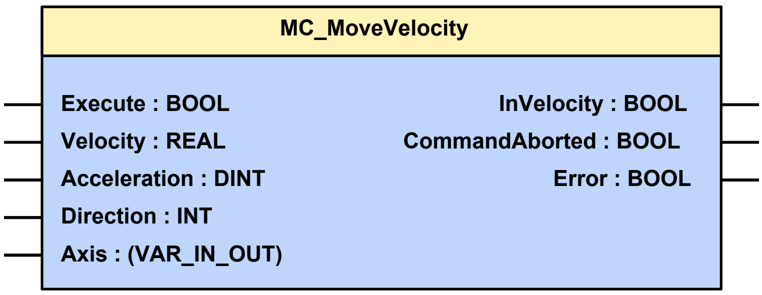


5.6.5. Continuous positioning (MC_MoveVelocity)

FB name	**MC_MoveVelocity**	
Continuous controlled positioning with adjustable speed		
VAR_IN_OUT		
Axis	INT	Axis-ID (library constants)
VAR_INPUT		
Execute	BOOL	Starts the sequences of the module with positive edge
MoveVelocity	REAL	Value of maximum speed (always positive) (not necessarily reached) [Units/s] Value range: 0 rev/s ... 2000 rev/s
Acceleration	DINT	Value of the acceleration and deceleration (always positive) [Units/s²] Value range: 0.24 rev/s² ... 1000000 rev/s²
Direction	INT	Selection: positive direction, negative direction, current direction; **library constants** (see page 161)
VAR_OUTPUT		
InVelocity	BOOL	Specified target speed on the setpoint output is reached
CommandAborted	BOOL	Execution interrupted
Error	BOOL	Error during positioning

Note:

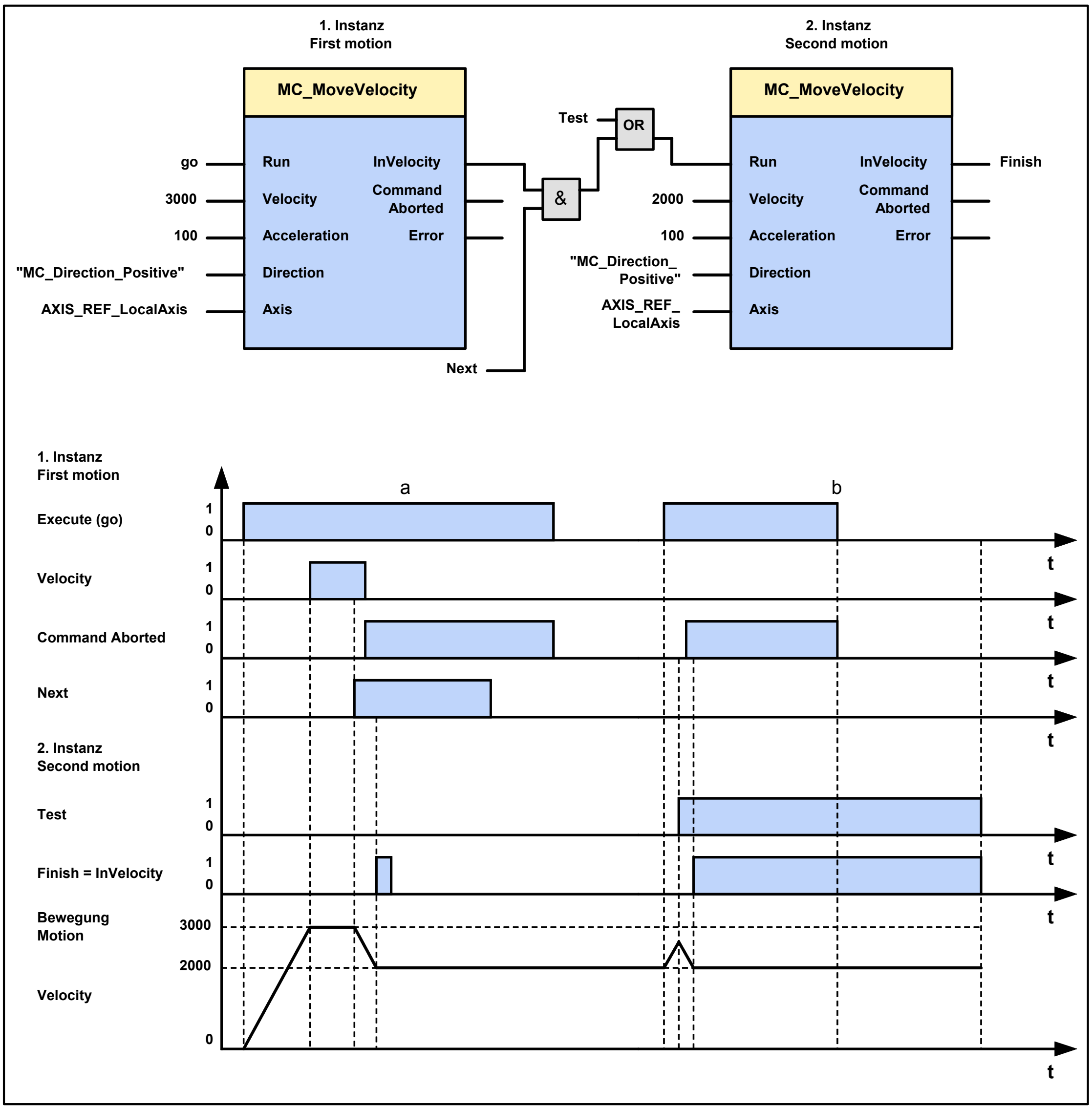
- To be able to stop the drive, the function module must be interrupted by another positioning function module or positioning must be stopped by calling the MC_Stop function module.
- A positioning to the end limit follows.



Example

The following illustration shows two examples of the combination of two MC_MoveVelocity modules.

- The left part (a) of the time diagram shows a case in which the second function module is executed after the first function module.
  After the first function module has accelerated to a speed of 3000, the "InVelocity" output, AND-linked with the "Next" signal gives the execution command to the second FB, which then slows to a speed of 2000.
- The right part (b) of the diagram shows a case in which the second FB is activated while the first function module is being executed. Because the second module is started during the execution of the first FB, the first FB is automatically interrupted.
  During the acceleration of the first module, the second module slows again similarly to a speed of 2000 without the speed of the first module having been reached.

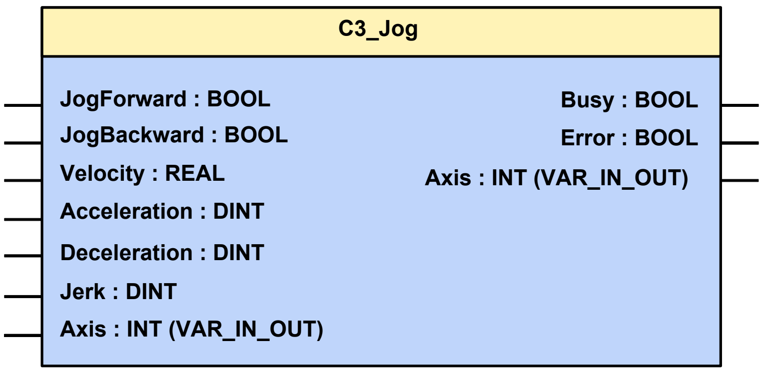


5.6.6. Manual operation (C3_Jog)

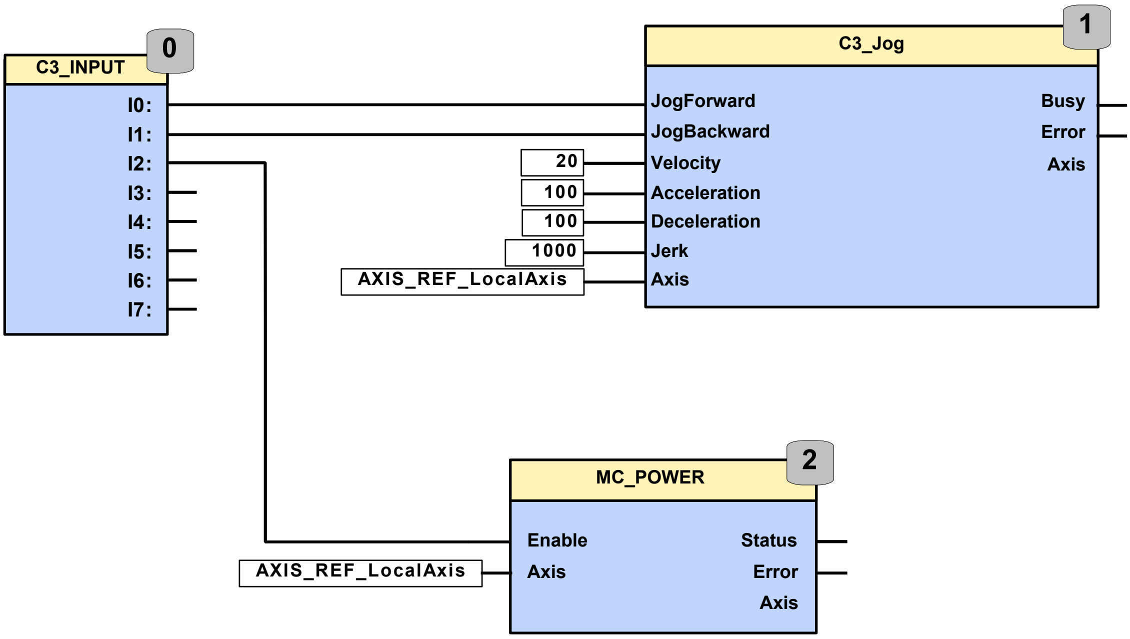
FB name	**C3_Jog**	
Traveling along the axis in manual mode (in the "standstill" state)		
VAR_IN_OUT		
Axis	INT	Axis-ID (library constants)
VAR_INPUT		
JogForward	BOOL	JogForward = TRUE makes the axis move in positive direction.
JogBackward	BOOL	JogBackward = TRUE makes the axis move in negative direction. **<Value range>** (see page **Fehler! Textmarke nicht definiert.**)
Velocity	REAL	Speed value [Units/s] **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
Acceleration	DINT	Value of the acceleration [Units/s²] **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
Deceleration	DINT	Value of deceleration during stop[Units/s²] **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
Jerk	DINT	Value of the acceleration and deceleration **jerk** (see page 183) [Units/s³] **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
VAR_OUTPUT		
Busy	BOOL	Module is active (manual operation in progress)
Error	BOOL	Error during manual operation or faulty parameter when starting manual operation

Note:

- The axis must be in the "standstill" state in order to start manual operation (Jogging Mode).
- Start: When starting manual operation, the output "Busy" is set to TRUE.
- Stop: The axis is brought to a standstill if the respective input (JogForward or JogBackward) is set to FALSE again
- As soon as manual operation is stopped, the output "Busy" is set to FALSE. Further commands can only be executed after this feedback.



Example: Manual movement via digital inputs.



5.6.7. Homing (MC_Home)

FB name	**MC_Home**	
Predefined search for the machine reference point		
VAR_IN_OUT		
Axis	INT	Axis-ID (library constants)
VAR_INPUT		
Execute	BOOL	Starts the sequences of the module with positive edge
Position	REAL	Position on the machine zero point (configured unit [units]) = Machine zero Offset
VAR_OUTPUT		
Done	BOOL	Referencing process completed
CommandAborted	BOOL	Referencing process aborted
Error	BOOL	Error while searching for machine reference point

Note:

This module gives the command to search for the machine reference point; not for "zero" position. The type of search function (machine reference mode) can be adjusted with the configuration or with the object "HOMING_mode" (Object 1130.4).

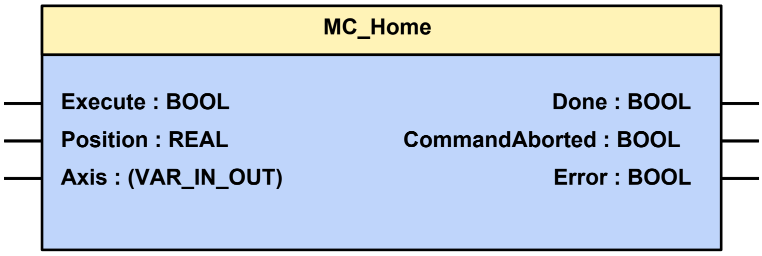
.

Objects that are connected with the machine reference point:

- C3Plus.HOMING_speed (Object 1130.3)
- C3Plus.HOMING_accel (Object 1130.1)

C3Plus.HOMING_mode (Object 1130.4)

- C3Plus.HOMING_edge_sensor_distance (Object 1130.7)



The Compax3 machine zero modes are adapted to the CANopen profile for Motion Control CiADS402.

Position reference point

Essentially, you can select between operation with or without machine reference. The reference point for positioning is determined by using the machine reference and the machine reference offset.

Machine reference run

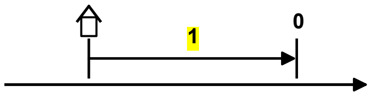
In a homing run the drive normally moves to the position value 0 immediately after finding the home switch. The position value 0 is defined via the homing offset.

A machine reference run is required each time after turning on the system for operation with machine reference.

Please note:

During homing run the software end limits are not monitored.

Machine reference offset



1: machine zero point
The machine reference offset is used to determine the actual reference point for positioning.
The rule for this is: Machine zero point = - Machine zero Offset

A change in the machine reference offset does not take effect until the next machine reference run.

Please note:

In controlled operation (open loop) no machine zero run is possible!

The home of the auxiliary axis is automatically set, by coupling the auxiliary axis to the main axis for the homing run!

Homing run for 2 axes

- Axis 2 is coupled to axis 1 and moves along
- Axis 1 and axis 2 set the home at the same time after axis 1 has detected the homing switch

Therefore you should bring the auxiliary axis to a defined start position before the homing run.

Or use absolute feedback systems:

Absolute feedback system

For positioning operation of two axes with a Compax3F, we recommend an absolute feedback system

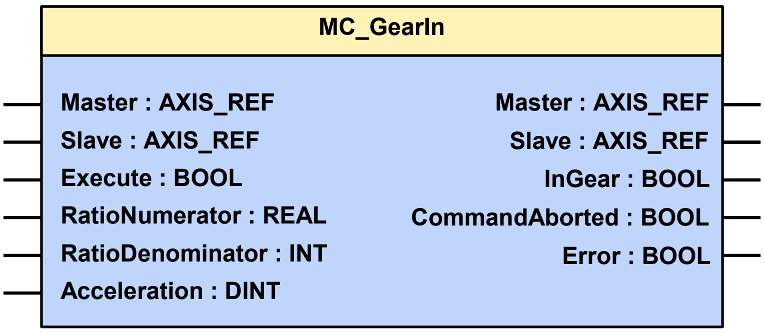
Thus the homing run after switching on, which is only possible in coupled state for 2 axes and may lead to difficulties with definedly referencing the auxiliary axis is not necessary.

5.6.8. Electronic gearbox (MC_GearIn)

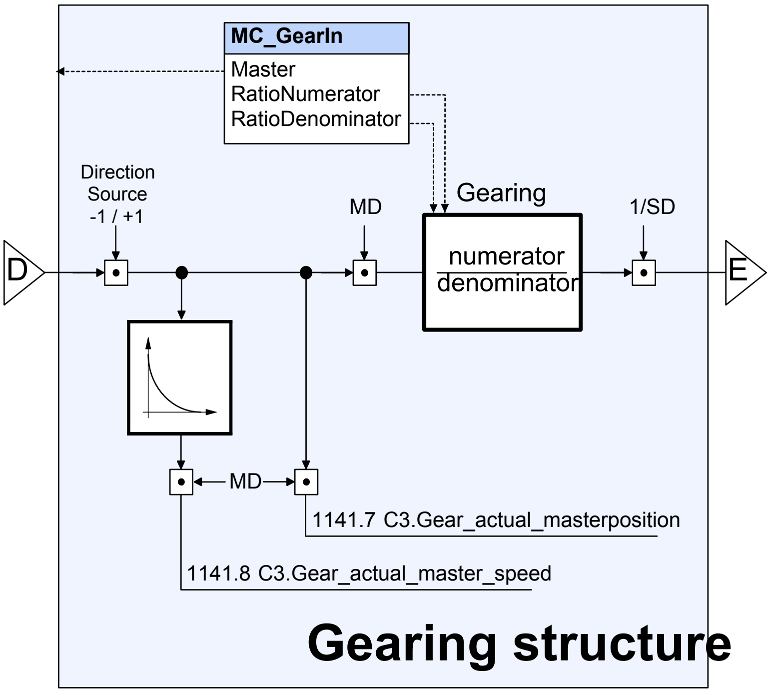
FB name	MC_GearIn	
Controlled speed and position synchronicity with adjustable transmission ratio		
VAR_IN_OUT		
Master	INT	Constant for the **master signal source** (see page 161) **Configuration** (see page 82) of the signal sources Please note: The auxiliary axis can only be coupled to the position setpoint value of the main axis => if Slave = auxiliary axis, the main axis must be the Master. The reduction ratio is then fixed to 1:1.
Slave	INT	
VAR_INPUT		
Execute	BOOL	Starts the sequences of the module with positive edge
RatioNumerator	REAL	Reduction ratio numerator Field is only valid, if Slave=AXIS_REF_LocalAxis (main axis).
RatioDenominator	INT	Reduction ratio denominator Field is only valid, if Slave=AXIS_REF_LocalAxis (main axis).
Acceleration	DINT	Value of acceleration / deceleration (always positive) until the synchronism is reached [Units/s²] **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
VAR_OUTPUT		
InGear	BOOL	Synchronicity achieved
CommandAborted	BOOL	Command aborted
Error	BOOL	Error while executing module

Note:

- Behaviour: the drive accelerates (with Acceleration) until the master speed is reached - the module will report synchronicity with "InGear". Position losses during acceleration to master speed are not made up.
- The transmission ratio can be changed at any time with a positive edge on Execute. InGear is reset until synchronicity is achieved again.
- For example, if speed synchronicity is not achieved because of limiting effects, the position difference that arises will be made up (by the active position controller).
- Acceleration / deceleration to the set transmission ratio takes place without a jerk limit.
- If the master and slave units do not correspond, this fact must be considered for the transmission ratio.
- **Example** (see page 83)



Structure of the "electronic cam" function

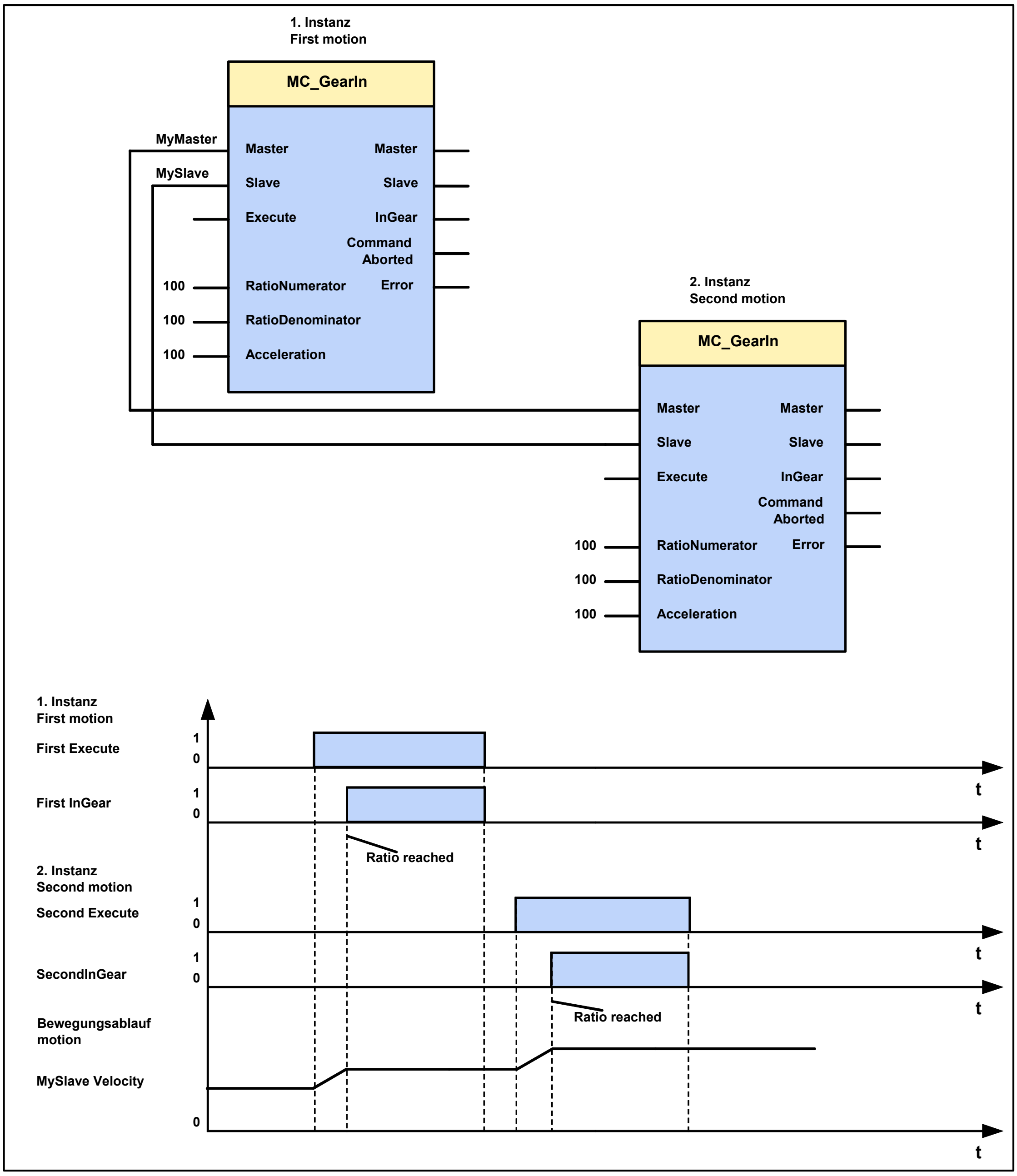


D: / E: **additional structure** (see page 102)

Note:

- Direction -1 / +1: with direction reversal (under configuration of signal sources) factor -1 is applied.
- The "virtual master" source is not available with Compax3 T30.

Example:


1. Instanz
First motion
MC_GearIn
MyMaster
MySlave
Master
Master
Slave
Slave
Execute
InGear
Command
Aborted
100
RatioNumerator
Error
100
RatioDenominator
100
Acceleration
2. Instanz
Second motion
MC_GearIn
Master
Master
Slave
Slave
Execute
InGear
Command
Aborted
100
RatioNumerator
Error
100
RatioDenominator
100
Acceleration
1. Instanz
First motion
First Execute
1
0
t
First InGear
1
0
t
Ratio reached
2. Instanz
Second motion
Second Execute
1
0
t
SecondInGear
1
0
t
Ratio reached
Bewegungsablauf
motion
MySlave Velocity
0
t

5.7 Superimposed motion

In this chapter you can read about:

5.7.1. Dynamic positioning

Dynamic positioning processes can be performed with the modules MC_MoveAbsolute, MC_MoveRelative and MC_MoveAdditive. The speed can be altered dynamically with MC_MoveVelocity.

In the state: ”Discrete Motion”

If another, second positioning process is activated in the "Discrete Motion" state, the 1st positioning process will be interrupted. The transition to the new destination occurs dynamically, i.e. without any intervening stop.

In "Continuous Motion" state

If a positioning process (MC_MoveAbsolute, MC_MoveRelative or MC_MoveAdditive) or a MC_MoveVelocity is activated in the "Continuous Motion" state, the active function module will then be interrupted. All input variables of the new positioning process will then be taken over.

Superimposed positioning

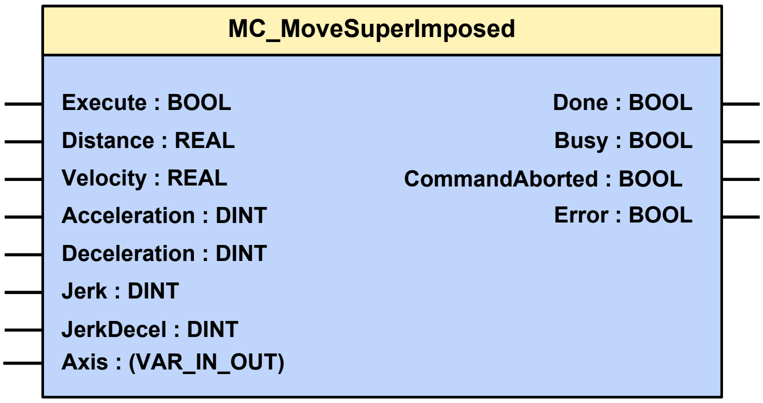
Please note also the difference to **superimposed positioning** (see page 199) with MC_MoveSuperImposed.
Here, the movement of the active function module is executed until the end.

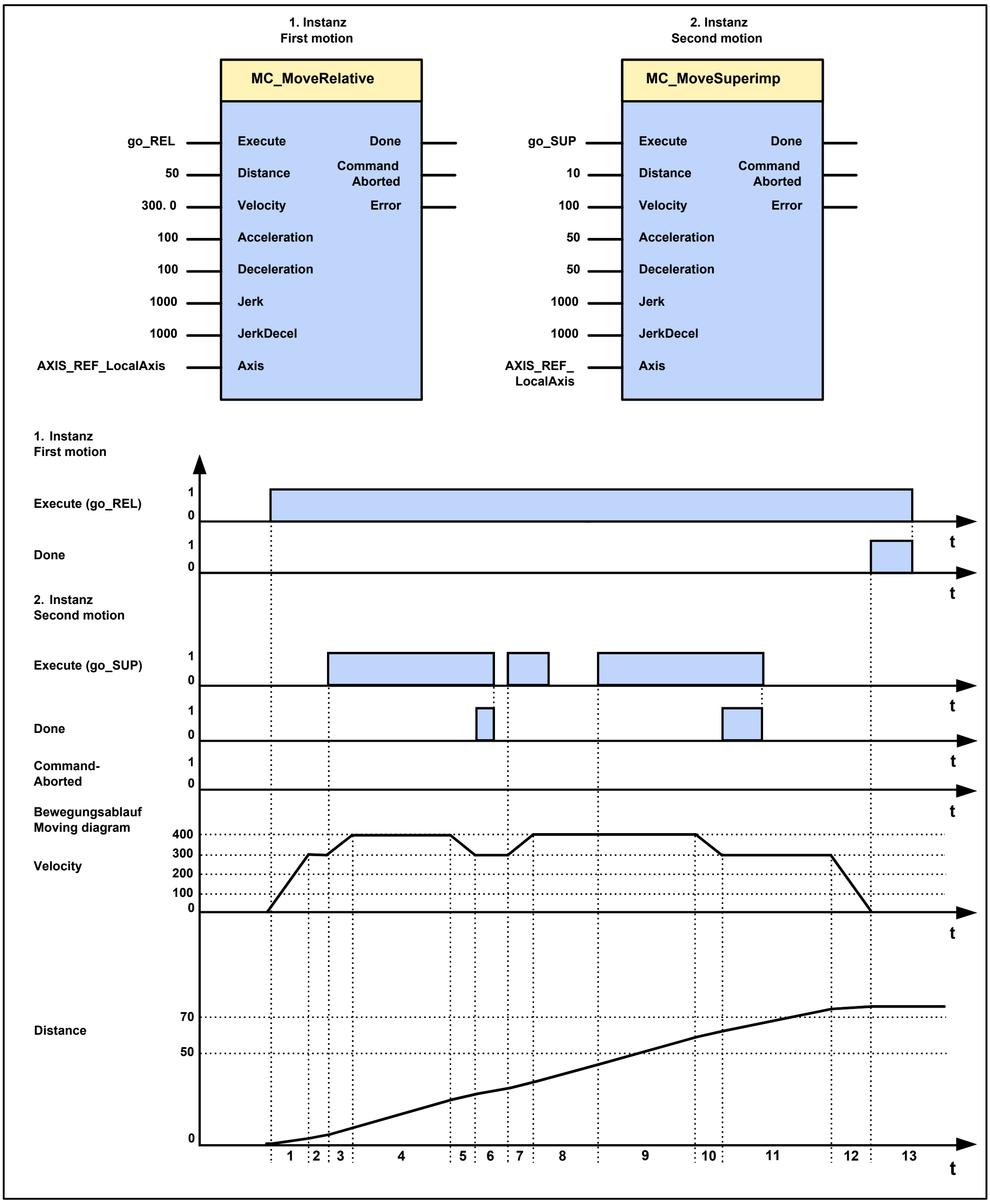
5.7.2. Superimposed positioning (MC_MoveSuperImposed)

FB name	**MC_MoveSuperImposed**	
Superimposing of an active positioning with an additional relative distance. The positioning process that is currently underway is not interrupted by MC_MoveSuperImposed; it is superimposed instead		
VAR_IN_OUT		
Axis	INT	Axis ID; constant: AXIS_REF_LocalAxis
VAR_INPUT		
Execute	BOOL	Starts the sequences of the module with positive edge
Distance	REAL	Additional distance for superimposed positioning (configured unit [Units]) (positive and negative direction) **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
MoveVelocity	REAL	Value of the maximum speed difference compared to the speed of the current positioning (always positive) (not necessarily reached) [units/s] **<Value range>** (see page **Fehler! Textmarke nicht definiert.**)
Acceleration	DINT	Value of acceleration (always positive) [units/s^2] **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
Deceleration	DINT	The value of deceleration (always positive) [units/s^2] **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
Jerk	DINT	Value of the acceleration **jerk** (see page 183) [Units/s^3] (always positive) **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
JerkDecel	DINT	Value of the deceleration jerk [units/s^3] (always positive) **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
VAR_OUTPUT		
Done	BOOL	Additional distance was added to the current positioning
Busy	BOOL	Superimposed motion is performed
CommandAborted	BOOL	Positioning aborted
Error	BOOL	Error while executing module

Note:

- The values Distance, Velocity, Acceleration, Deceleration, Jerk JerkDecel are no absolute values, they are added to the current movement.
- A stop of the axis will interrupt the current as well as the superimposed movement.
- In the PLCopen state "Standstill" the MC_MoveSuperImposed module acts like the MC_MoveRelative module.
- MC_MoveSuperImposed does not interrupt an active command.
- ”Position reached” (Object 420.6) is not influenced by the additional movement triggered by MC_MoveSuperImposed.
- This module cannot be operated with C3_ShiftPosition and MC_Phasing at a time.
- The position of the module in the **structure image** (see page 412).


MC_MoveSuperImposed
Execute : BOOL
Distance : REAL
Velocity : REAL
Acceleration : DINT
Deceleration : DINT
Jerk : DINT
JerkDecel : DINT
Axis : (VAR_IN_OUT)
Done : BOOL
Busy : BOOL
CommandAborted : BOOL
Error : BOOL


1. Instanz
First motion
MC_MoveRelative
go_REL
50
300. 0
100
100
1000
1000
AXIS_REF_LocalAxis
Execute
Distance
Velocity
Acceleration
Deceleration
Jerk
JerkDecel
Axis
Done
Command Aborted
Error
2. Instanz
Second motion
MC_MoveSuperimp
go_SUP
10
100
50
50
1000
1000
AXIS_REF_ LocalAxis
1. Instanz
First motion
Execute (go_REL)
Done
2. Instanz
Second motion
Execute (go_SUP)
Done
Command-Aborted
Bewegungsablauf
Moving diagram
Velocity
400
300
200
100
0
Distance
70
50
t
1 2 3 4 5 6 7 8 9 10 11 12 13

5.7.3. Zero point shift caused by superimposed positioning (C3_ShiftPosition)

FB name	C3_ShiftPosition

Shifting the reference point, i.e. the zero point of the system is shifted by the stated relative distance. The drive performs a physical movement which is, however, not displayed.

The positioning being executed at that time is not interrupted by C3_ShiftPosition. Application: Slave reg synchronization.

VAR_IN_OUT

Axis	INT	Axis ID; constant: AXIS_REF_LocalAxis

VAR_INPUT

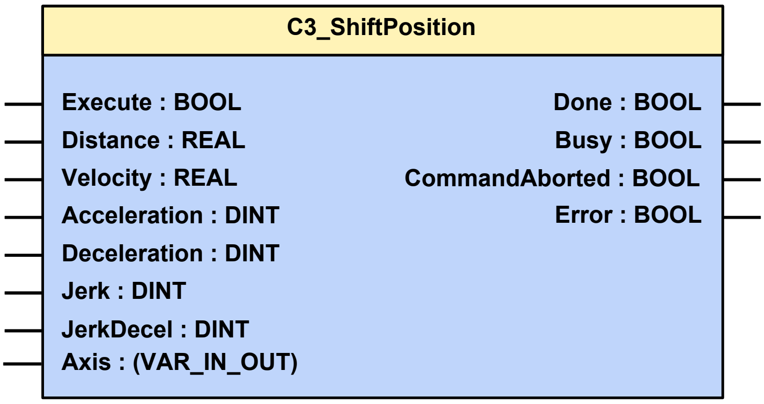
Execute	BOOL	Starts the sequences of the module with positive edge
Distance	REAL	Distance of the offset (configured unit [units]) (positive and negative direction) **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
Velocity	REAL	Value of the maximum speed difference (always positive) (not necessarily reached) [Units/s] **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
Acceleration	DINT	Value of acceleration (always positive) [units/s²] **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
Deceleration	DINT	The value of deceleration (always positive) [units/s²] **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
Jerk	DINT	Value of the acceleration **jerk** (see page 183) [Units/s³] (always positive) **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
JerkDecel	DINT	Value of the deceleration jerk [units/s³] (always positive) **<value range>** (see page **Fehler! Textmarke nicht definiert.**)

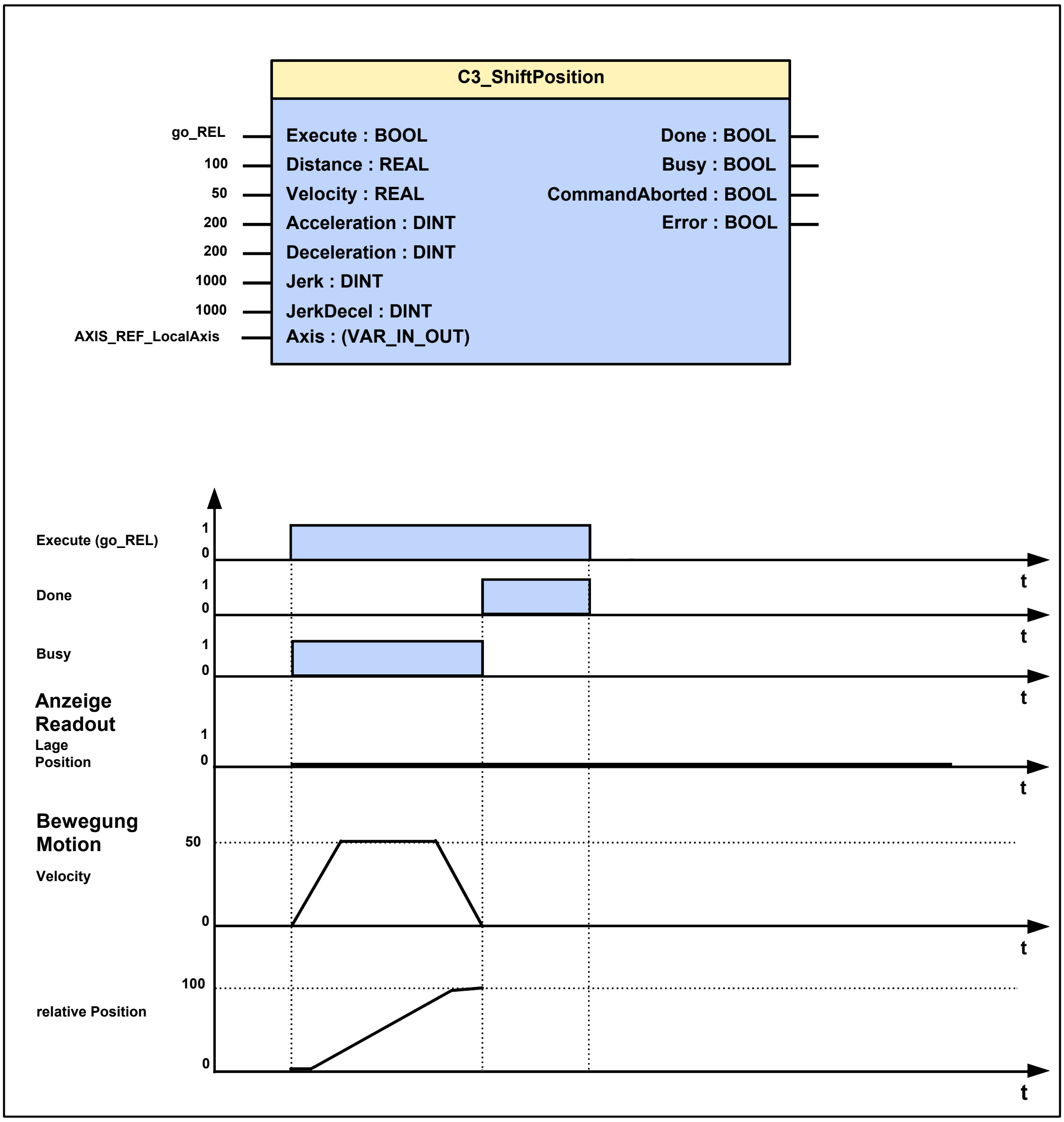
VAR_OUTPUT

Done	BOOL	Relative distance was reached
Busy	BOOL	Shift is being executed
CommandAborted	BOOL	Positioning aborted
Error	BOOL	Error while executing module

Note:

- The values Distance, Velocity, Acceleration, Deceleration, Jerk JerkDecel are no absolute values, they are added to the current movement.
- In the PLCopen "Standstill" state, the axis performs a relative movement, during which the axis moves, but the displayed position is not changed.
- In the PLCopen "Discrete Motion" state, the speed and the position of the active movement are superimposed, but the displayed speed and position are not changed.
- In the case of a stop command on the axis, the current movement is interrupted as well as the shift.
- C3_ShiftPosition does not interrupt any active command.
- This module cannot be operated with MC_MoveSuperImposed and MC_Phasing at a time.
- The position of the module in the **structure image** (see page 412).


C3_ShiftPosition
Execute : BOOL
Distance : REAL
Velocity : REAL
Acceleration : DINT
Deceleration : DINT
Jerk : DINT
JerkDecel : DINT
Axis : (VAR_IN_OUT)
Done : BOOL
Busy : BOOL
CommandAborted : BOOL
Error : BOOL

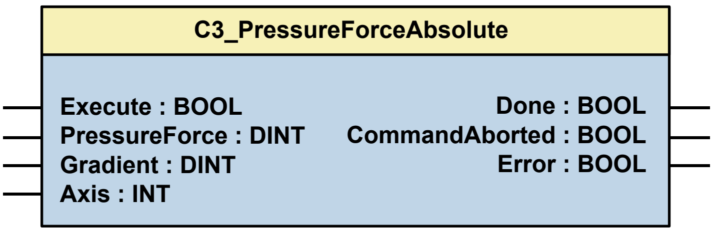

C3_ShiftPosition
go_REL
100
50
200
200
1000
1000
AXIS_REF_LocalAxis
Execute : BOOL
Distance : REAL
Velocity : REAL
Acceleration : DINT
Deceleration : DINT
Jerk : DINT
JerkDecel : DINT
Axis : (VAR_IN_OUT)
Done : BOOL
Busy : BOOL
CommandAborted : BOOL
Error : BOOL
Execute (go_REL)
Done
Busy
Anzeige
Readout
Lage
Position
Bewegung
Motion
Velocity
relative Position
1
0
50
100
t

5.8 Adjust force / pressure (C3_PressureForceAbsolute)

FB name	C3_PressureForceAbsolute	
Control absolute force or differential pressure (depending on the physical system selected in the **configuration** (see page 46). Differential pressure: $\frac{F_A - F_B}{A_A} = p_A - \frac{A_B}{A_A} \cdot p_B = p_A - \alpha \cdot p_B$ Force: $F = F_A - F_B$		
VAR_IN_OUT		
Axis	INT	Axis ID (Library constants) AXIS_REF_LocalAxis: Main axis AXIS_REF_LocalAxisAux: Auxiliary axis
VAR_INPUT		
Execute	BOOL	Starts the sequences of the module with positive edge
PressureForce	DINT	Setpoint differential pressure [mbar, psi] or setpoint force [N].
Gradient	DINT	Change speed for pressure or force in [bar/s, psi/s], [N/s].
VAR_OUTPUT		
Done	BOOL	Specified setpoint value on the setpoint output is reached
CommandAborted	BOOL	Command aborted
Error	BOOL	Error while executing module

Note:

- the axis must be in controlled operation, so that the module becomes active.
- After termination of the module, the axis continues to control the differential pressure or the force.
- Executing a MC_Stop module causes the transition to position control. The current speed of the axis is controlled down to zero and the position reached then is kept with the aid of the position controller.
- The execution of the C3_PressureForceStop is required, if no position control is configured. It causes the gradient to be reduced to zero and the axis to remain force or pressure controlled.



5.9 Dynamic switching: Position- on force/pressure - adjustment

In this chapter you can read about:

Compax3F supports the so-called pQ operating mode. This function permits condition-dependent switching between position control (pQ mode) and force (for example differential pressure) control and back.
This function can only be executed in connection with the main axis.
The following boundary conditions are to be taken into consideration:

- The output control operation for the PQ function is alwayss a position control (state "Discrete Motion" or "Standstill: powered").
  The defined switching condition is therefore valid for the switching from the position control to force/pressure control.
- The condition for the switching from force control back to position control is (current speed>=calculated setpoint speed).
  If the countercheck is lost (actual speed> setpoint speed), the drive will return into position control into the motion profile programmed before.
- The configuration and activation of the pQ operating mode is made via an IEC module.
- After the activation of the C3_pQ module, the C3_PressureForceAbsolute module can no longer be activated.
- The setpoint value for the force/pressure controller is read from an object, which is indicated via a pointer.
- The deactivation of the module and consequently of the pQ operating mode can be initiated with the negative edge at the enable input.
  The deactivation itself is only possible in the "Standstill Powered" state.
  If the pQ operating mode is deactivated during a positioning sequence, the started positioning is finished in pQ mode.
  If the drive is in force control at the time of deactivation, a MC_Stop is necessary in order to switch back to position control.

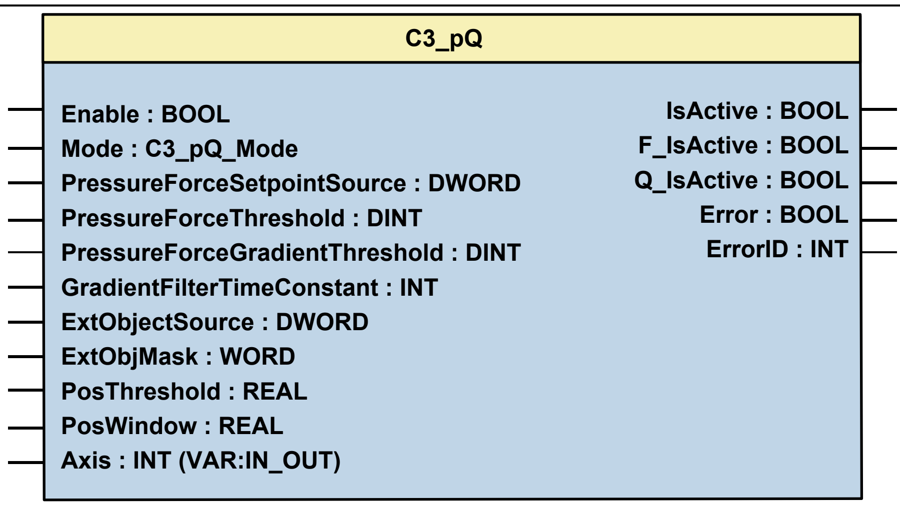
5.9.1. Switching: from force to position mode (C3_pQ)

FB name	C3_pQ	
Activate pQ (Volume flow control / position control) – Mode depending on the conditions ◆ Switching to pressure / force control: see in this module description ◆ Switching back to position control: ◆ Actual speed > setpoint speed from the motion profile or ◆ Target position from the original positioning reached.		
VAR_IN_OUT		
Axis	INT	Axis ID (Library constants) Note: C3_pQ_Force is only possible for the main axis
VAR_INPUT		
Enable	BOOL	Starts the sequence of the module at positive edge and terminates the qQ mode at negative edge
Mode	C3_pQ_MODE	Switching conditions from position to pressure/force control: **EVENT_EXTERN** External event: Any object (given by "ExtObjectSource") can be configured as source (Index.Sub). via an additional mask (ExtObjMask), an AND-link is established. **ABS_FORCE_PRESSURE_THRESHOLD** Controller-Actual-Pressure/Force > Value "PressureForceThreshold" **ABS_FORCE_PRESSURE_GRADIENT** Pressure/Force-Gradient > Value "PressureForceGradientThreshold". The gradient exceeds the parameterized value. **ABS_ACTUALPOS_THRESHOLD** Value of the actual position > parameterized position value "PosThreshold" AND Value of the actual position <parameterized position value "PosThreshold" + PosWindow **ABS_DEMANDPOS_THRESHOLD** Value of the setpoint position > parameterized position value "PosThreshold" AND Value of the setpoint position < parameterized position value "PosThreshold" + PosWindow
PressureForceSetpointSource	DWORD	Pointer to the source of the setpoint value of the pressure/force controller Note: The source must have the type INT or DINT
PressureForceThreshold	DINT	The pressure/force threshold in [mbar], [psi] or [N] at which the switching to pressure/force control takes place. Note: This parameter is only relevant in the Mode=ABS_FORCE_PRESSURE_THRESHOLD.
PressureForceGradientThreshold	DINT	The pressure/force change threshold in [mbar], [psi] or [N] at which the switching to pressure/force control takes place. Note: This parameter is only relevant in the Mode=ABS_FORCE_PRESSURE_GRADIENT.
GradientFilterTimeConstant	INT	The filter time constant in [µs] of the filter at which the pressure/force gradient is filtered.
ExtObjectSource	DWORD	Pointer to any object that is intended to be the source of the external exent. Note: This parameter is only relevant in the Mode=EVENT_EXTERN.

ExtObjMask	WORD	Bit mask for the relevant bits in "ExtObjectSource". The contents of the ExtObjectSource is AND-linked with the aid of this bit mask. Note: This parameter is only relevant in the Mode=EVENT_EXTERN.
PosThreshold	REAL	Position threshold for switching to pressure/force controller
PosWindows	REAL	Position window in Units, measured from the position threshold (PosThreshold). In this window, the monitoring of the switching condition to force/pressure control is active. If the position exceeds the value: PosThreshold + PosWindows, then the monitoring of the switching condition to force/pressure control is not active. The window should be defined as small as possible. Within this window, the actual speed caused by the pressure/force control must be below the setpoint speed, unless the axis will switch back to position control.
VAR_OUTPUT		
IsActive	BOOL	TRUE: pQ Mode aktive FALSE: pQ Mode not active
F_IsActive	BOOL	Shows that the pressure/force control is activated. Note: Is only updated if the Enable input provides TRUE
Q_IsActive	BOOL	Shows, that the volume flow control (pQ: Position control) is activated. Note: Is only updated if the Enable input provides TRUE
Error	BOOL	Error while executing module
ErrorID	INT	Error description 0: No Error 1: Mode EVENT_EXTERN => source "ExtObjectSource" is missing 2: Invalid MODE set 3: No source entered for the pressure/force controller setpoint 4: Activation of the PQ module is not permitted in this mode 5: pQ mode with mere pressure/force control axis is not possible. 6: The axis ID does not correspond the the ID of the main axis

Note:

- The switching conditions are monitored until the target position of the current positioning sequence is reached; this is not valid in the "ABS_ACTUALPOS_THRESHOLD" and "ABS_DEMANDPOS_THRESHOLD" modes.



5.10 Cam Control

In this chapter you can read about:

5.10.1. Introduction: Electronic cam control

In this chapter you can read about:

Rising rationalization pressure and an increasing degree of automation in process engineering demand modern and flexible drive concepts.

The introduction of digital and communicating control devices was an important step towards the decentralization of control and regulation tasks. An increasing number of mechanical construction components can be replaced by programmable servo drives.

In particular mechanical cam switching mechanisms and discontinuous shafts maintained until today their fields of application in many areas of machine construction.

Mechanical cam switching mechanisms offer, besides complex motion profiles, a high positioning accuracy and rigid coupling between master and slave drive. Their drawbacks are, however, the long changeover times and the limitation to a defined profile.

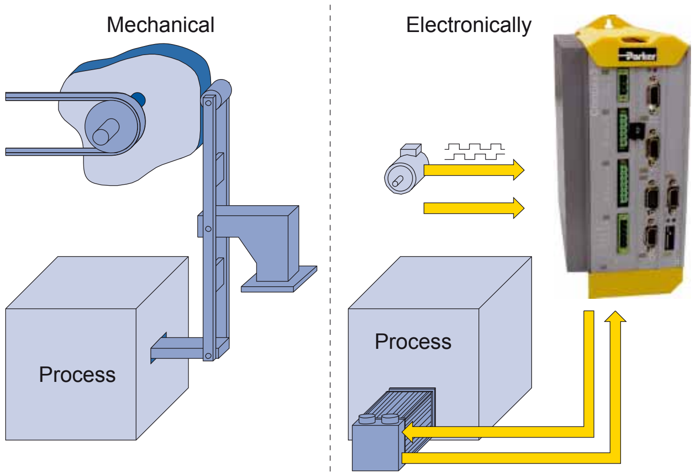
In this respect the Compax3 T40 electronic cam offers considerable time advantages, above all when changing between small batch sizes or with a wide range of products.

The decentralization of the drive performance can reduce size, costs and maintenance effort considerably.

Compax3 allows to implement in an axis module all control and drive functions for a flexible and cost-effective solution of complex motion sequences and synchronization tasks with the aid of powerful IEC61131-3 modules.

The switching command between different motion profiles takes only seconds – no fitter or wrench is required.

Large, mechanically coupled drive systems can be divided into small, independent drives. The dynamic and stationary behavior of every drive can be individually set and optimized.

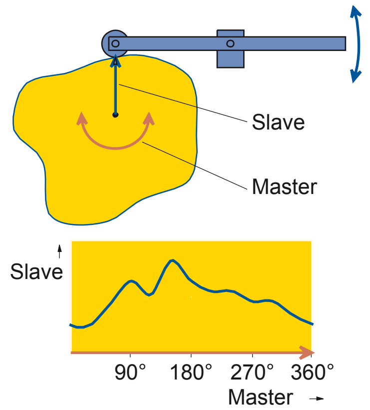


Compax3 is able to simulate mechanical cams as well as cam switching mechanisms electronically.
This helps to realize discontinuous material supply, flying knife and similar drive applications with distributed drive performance.
The compact servo controller processes the position signals of a master axis and controls a servo motor, torque motor or a direct-drive linear actuator via the desired motion profile, which is defined in the form of an interpolation point memory. The combination of drive, control and power unit in one device offers many advantages:

- Fast and easy commissioning.
- fast and stable control.
- feedforward control measures result in reduced need for peak torque and improved response behavior - therefore following errors are avoided.
- central digital control from the setpoint generator to the power output stage.
- lower wiring overhead and thus substantially reduced fault liability.

5.10.1.1 Function principle

In this chapter you can read about:



Depending on the angle setting of a leading axis (master), the following axis (slave) is moved according to a user-defined motion profile. The master position moves within a defined value range; the master clock distance, and moves through it cyclically. Each cycle corresponds to a revolution of the cam or a repetition cycle of any complex movement. Via the master position, a sequence of interpolation points with up to 10000 non-equidistant interpolation points is addressed. Compax3 interpolates linarly between the interpolation points. Those position setpoint values are used to form the feedforward signals for the subordinate controller cascades of the following axis. This feedforward of speed and acceleration is used to reduce the following error of the following axis as fas as possible.

Coupling and decoupling

An important function for complex plants is the coupling and decoupling of individual drives, triggered by an external control signal. During the coupling, the following axis (slave) is synchronized via a defined motion profile to the position of the leading axis (master). This can take place from any start position with a continuous, jump free speed course. Upon decoupling, the slave leaves the synchronous operation and is brought definedly to a standstill. The coupling or decoupling can take place with a running or stationary master axis.

Mark synchronization

In the packaging and print industry, a synchronization of following slave axes to print marks is required, for example in order to balance material slip or for an alignment according to existing prints. The error is compensated up to the next mark by correcting the master position acquired in the slave or by correcting the slave position by the determined slip between the product and the print mark button.

5.10.2. Overview

T40 Functions: Cam

General	◆ Cam control function
	◆ Programmable based on IEC61131-3
	◆ Position of selected master signal source via:
	  ◆ Encoder, Step / direction or +/-10V analog
	  ◆ HEDA
	  ◆ Virtual Master

Cam memory	◆ 10.000 interpolation points (master / slave in 24 bit format) saved failure save. ◆ Distance of interpolation points can be adapted to curve (non equidistant interpolation points) ◆ Linear interpolation between points
Linking curve segments	◆ Up to 20 cam segments can be produced. ◆ Virtually random cam links (forwards and backwards) ◆ Freely programmable, event-triggered curve branching. ◆ Scalable cam segments and complete cam profiles
Coupling and decoupling functions	◆ With the aid of a quadratic function. ◆ By means of a change-over function ◆ Without overspeeding by coupling over several master cycles. ◆ Virtually free set-up of the coupling and decoupling movement ◆ master-guided coupling movement. ◆ Random standstill position
Mark synchronization	◆ Master or slave oriented (simultaneous, cam-independent). ◆ highly precise mark recognition (accuracy < 1 µs)
Cam generation with renowned Nolte tool.	◆ Standard or extended range of functions ◆ evaluation of the motion profiles.

5.10.3. Basics

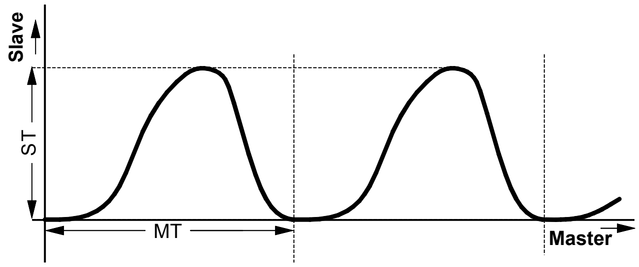
In this chapter you can read about:

5.10.3.1 Cam types

There are two principal curve types:

Closed curve

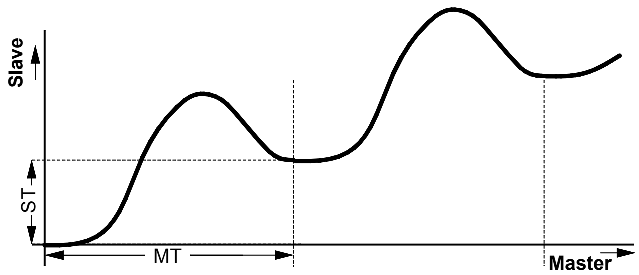
The start and end positions of the Slave are identical. I.e. the Slave moves always within the same position range.



ST: Slave clock distance
MT: Master clock distance

Open curve

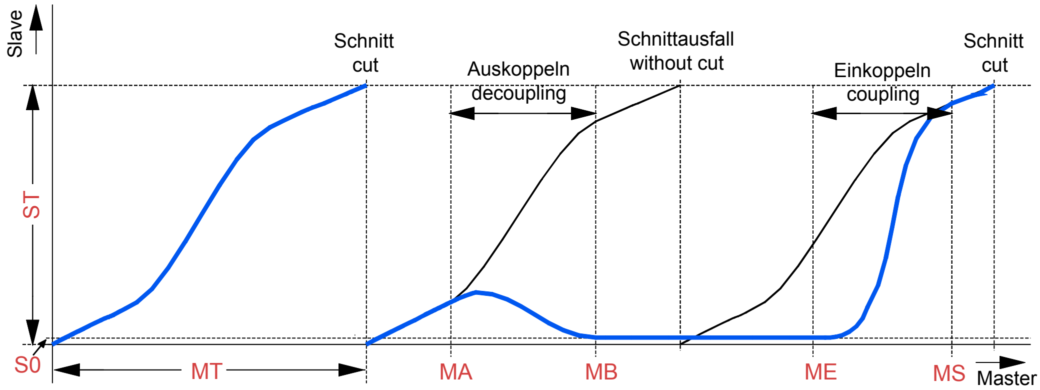
The start and the end position of the Slave are not identical. I.e. the Slave moves in one direction, as at the end of the curve the actual position of the Slave is compared to the start position of the curve.



ST: Slave clock distance
MT: Master clock distance

5.10.3.2 Cam parameters / terms

Example:



ST: Slave clock distance
MT: Master clock distance
ME: Coupling position
MS: Synchronous position
MA: Decoupling position
MB: Braking position
S0: Standstill position of the Slave

Master clock distance (MT)

The Master clock distance is the distance which the master runs, i.e. after which the cycle is repeated. This distance is stated in the physical unit of the Master. After this distance, the curve is repeated.

Slave clock distance (ST)

The Slave clock distance is the distance which the Slave runs, stated in the physical unit of the Slave.

Coupling position (ME)

Master position, where the coupling sequence starts.

Synchronous position (MS)

The coupling sequence is finished, if the master has reached the synchronous position MS, i.e. at the master position MS the slave is synchronous to the curve (MS > MT possible).

Decoupling position (MA)

Via the decoupling position MA the decoupling sequence can be started in a defined fashion from a certain master position (MA) on (dependent on the decoupling operating mode selected).

Braking position (MB)

At this master position, the slave comes to a standstill after decoupling (MB > MT possible).

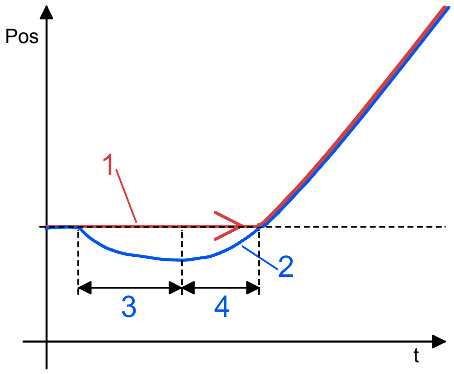
Standstill position Slave (S0)

Target position of the slave axis after decoupling.

Back stop

The back stop can be enabled if required (IEC module **C3_MasterControl** (see page 237)).
It ensures that a backwards movement of the master will not incite an axis movement of the slave.

Example:



1: Master signal after back stop
2: Master signal before back stop
3: Backwards movement of the master
4: Forwards movement of the master corresponding to the backwards movement.

Note: The negative distance difference caused by the backwards movement of the master (3) must be traveled in positive direction (4), before it can be effective as a movement.

5.10.3.3 Basic procedure

When implementing a standard cam application, the following steps are necessary:

- Create curve and load into Compax3.
- Setting the master position detection
- Establish relationship between master position read in and curve.
- Select curve.
- Start curve operation in a defined fashion.
- Establish relationship with slave position (coupling).
- Finish curve operation in a defined fashion (decoupling).

5.10.4. Generating cams

In this chapter you can read about:

The curve creation software "C3 CamDesigner" is a separate program and must therefore be installed separately.
You will find the program on the Compax3 CD.
Please note:
The CamDesigner must be installed in a folder, whose name does not contain any blanks.
This problem occurs above all when working with english Windows versions (...\Program Files\...).

5.10.4.1 Introduction to the CamDesigner (example)

Prerequisite:
Compax3 is configured
Compax3 ServoManager is installed (can be found on the Compax3 CD).
C3 CamDesigner is installed (can be found on the Compax3 CD).

Settings:

- Travel distance per motor revolution = 360°
- Reset distance = 360°

In the ”Configuration” wizard in the ”reference system” window

- Travel path per revolution of the physical source: Numerator = 360, Denominator = 1

in the ”signal sources” wizard windows: ”Physical source”

- Signal source: Encoder A/B; 5V

Procedure:

Starting the CamDesigner: Nagivation tree of the Compax3 ServoManager under ”cam”: ”Modify cam with CamDesigner”
The transfer window from Compax3 ServoManager to CamDesigner will open:


CamDesigner
Parameter axis 1
Axis name
Axis
Master axis
Reset distance
Numerator
360
Denominator
1
Alternative master reset distance [M_Units]
360
Signal source
Encoder A/B 5V
Max. speed [M_Units/s]
1200.000
Parker
Cam Parameter
ADVANCED Level
Point reduction
Interpolation tolerance
0.0001
Number of points per curve
180
Dwell-to-dwell motion law
Modified Sine Line according to Neklutin
Always calculate motion diagrams
Modular grid for graphic cam input
Step angle
10
Travel coordinate
1
Click to Start CamDesigner
Cancel

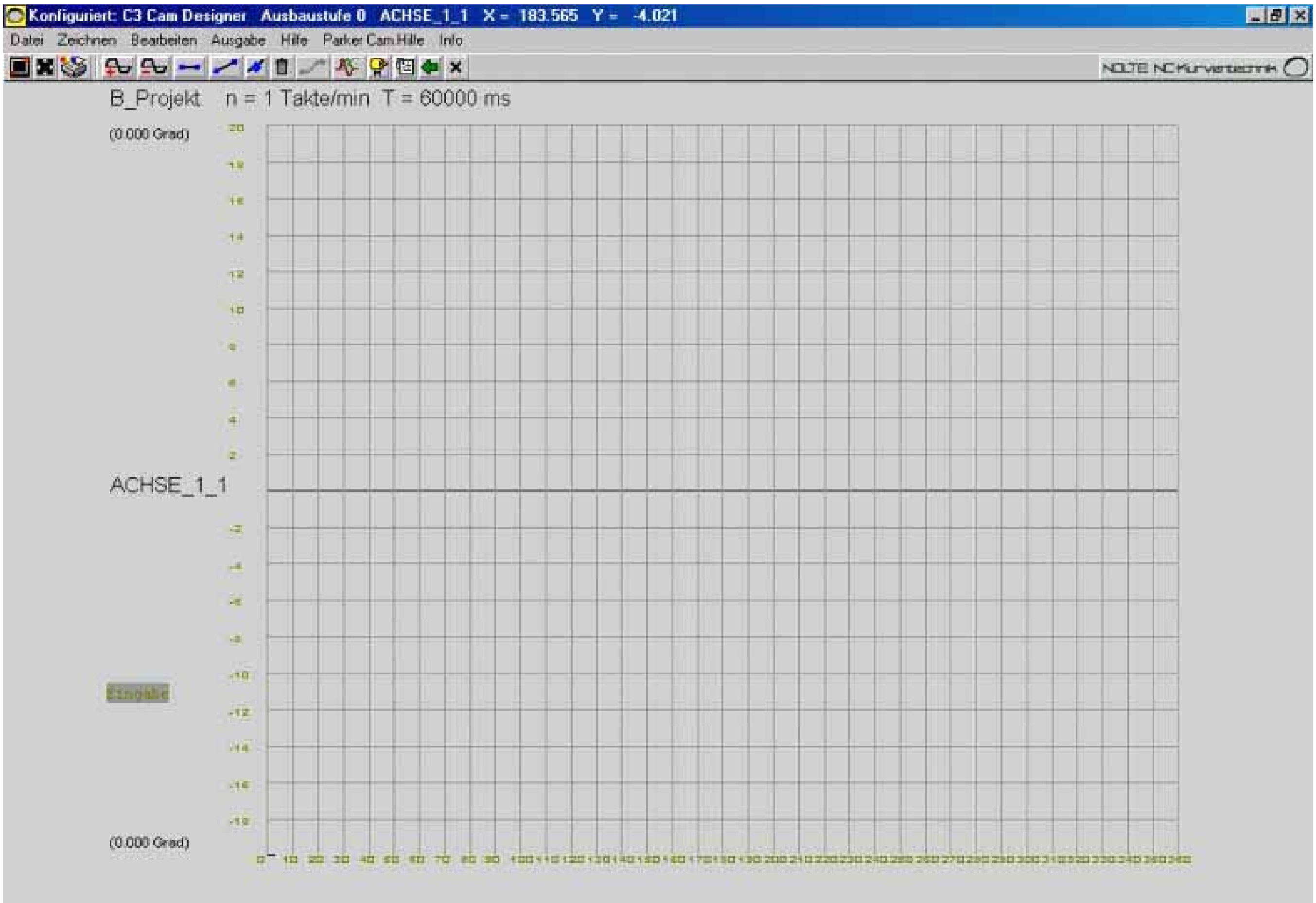
Here you can enter:

- Axis name
- Number of interpolation points to be calculated per curve,
- Signal source ”Encoder A/B 5V” and
- "Dwell-to-dwell motion law".

Do not change the default settings:

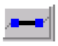
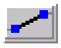
- 180 points and
- the ”modified sine line according to Neklutin” (russian mathematician)

At first the display is empty; the motion sequence can be entered.
This is made via the menu: File: New sequence.
In the dialog box you can select the the axis name of your choice, here ”axis”
The display looks as follows:



Now the curve can be created:

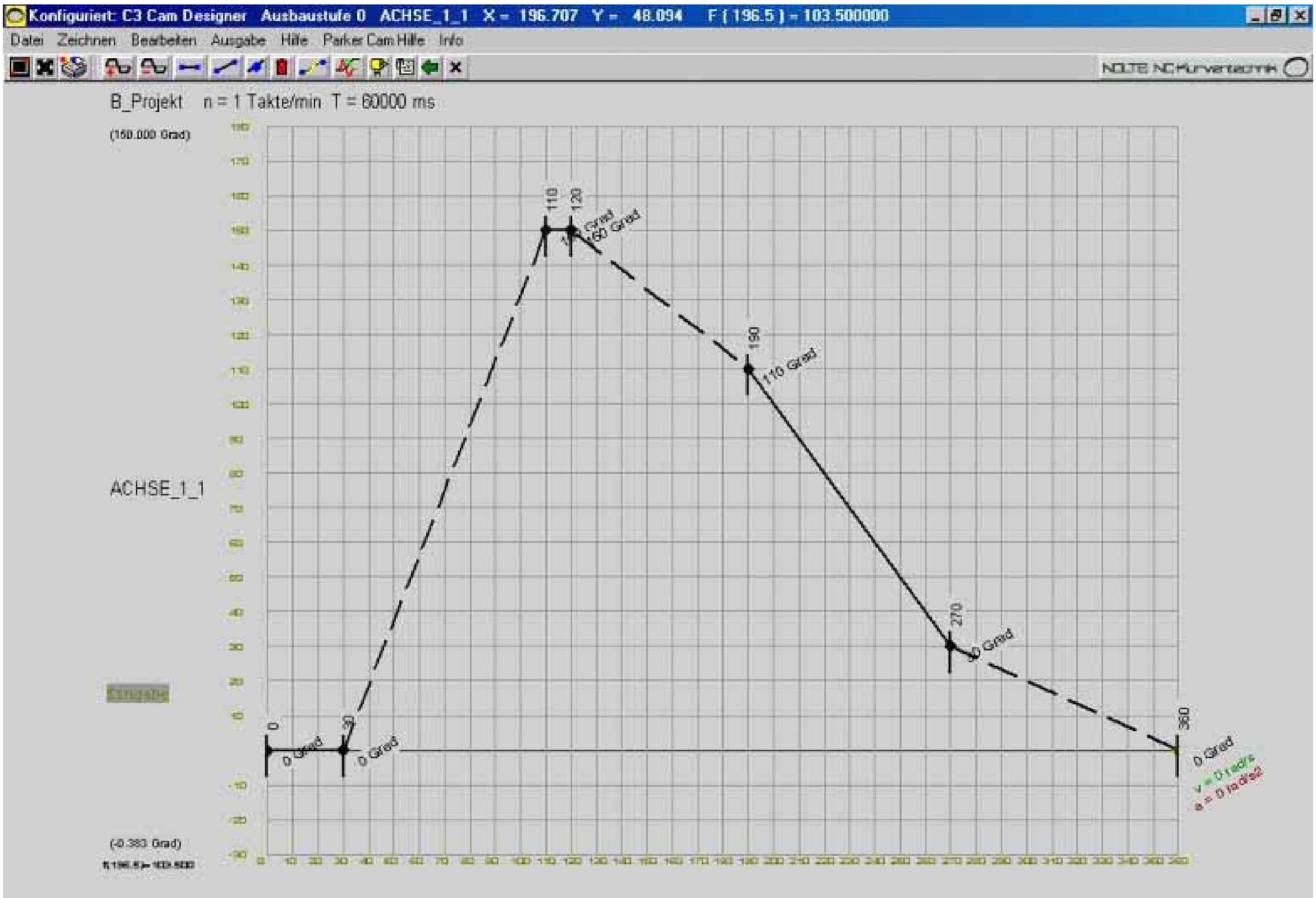
The BASIC version of the CamDesigner offers three tools:

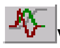
- Drawing -> Dwell 
- Drawing -> straight 
- Drawing -> point 

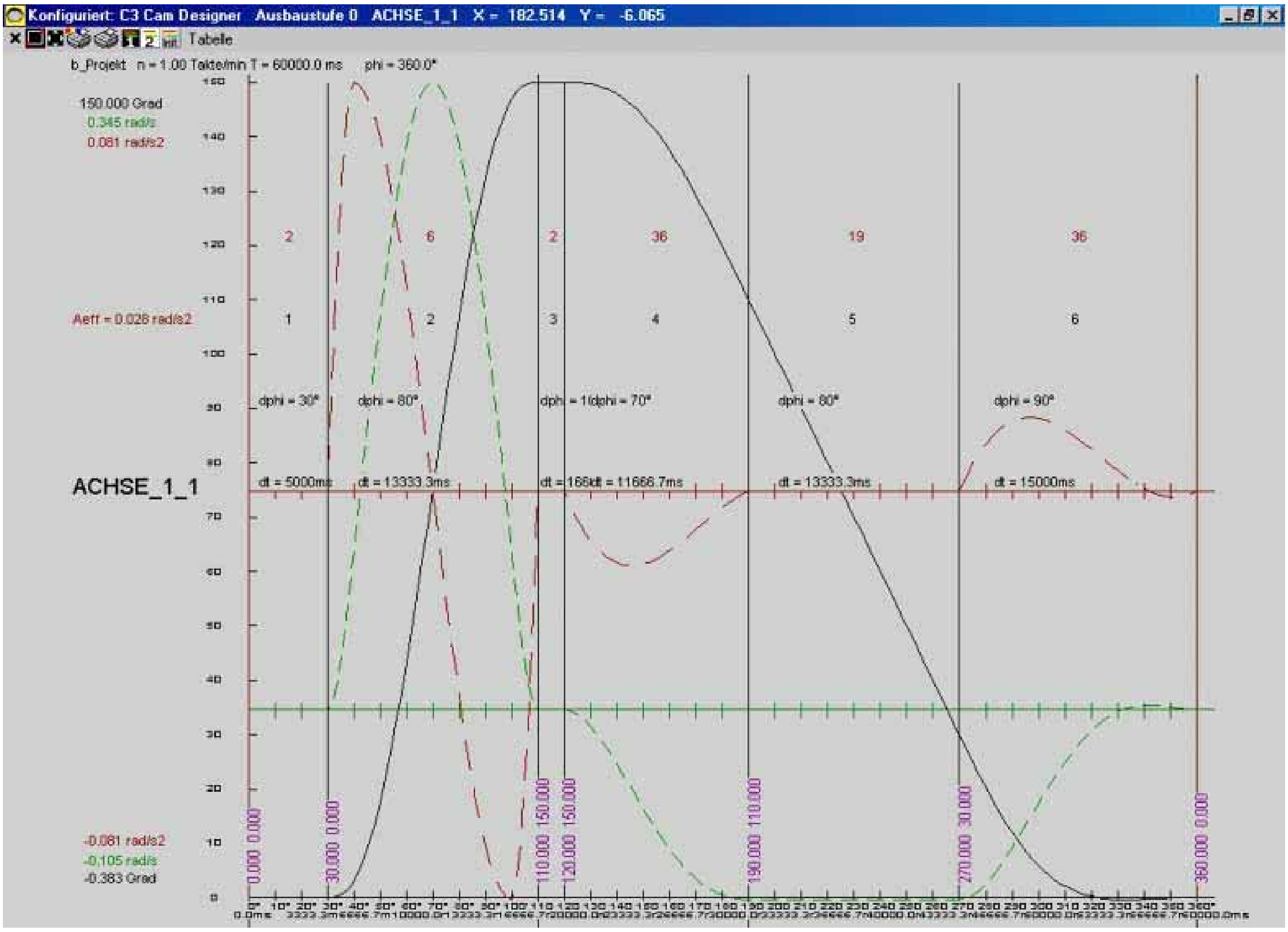
With the aid of these tools the known sections of a motion sequence, in general dwells or sections with constant speed, are entered. Please select a tool.
Now you can position the respective section per mouse click or enter it with the keyboard. Click into the ”enter” field. In the dialog box you can make the following entries depending on the tool selected:

- Tool dwell:
  - a. Path coordinate 0 Degrees
  - b. Clock angle beginning 0 Degrees
  - c. Clock angle end 30 Degrees
- Tool dwell:
  - a. Path coordinate 150 Degrees
  - b. Clock angle beginning 110 Degrees
  - c. Clock angle end 120 Degrees
- Tool straight line:
  - a. Path coordinate beginning 110 Degrees
  - b. Clock angle beginning 190 Degrees
  - c. Path coordinate end 30 Degrees
  - d. Clock angle end 270 Degrees
- Tool interpolation point:
  - a. Path coordinate 0 Degrees
  - b. Clock angle 3600 Degrees
- and as an option
  - c. speed 0 rad/s
  - d. Acceleration 0 rad/s2

The display looks as follows


Konfiguriert: C3 Cam Designer Ausbaustufe 0 ACHSE_1_1 X = 196.707 Y = 48.094 F (196.5) = 103.500000
Datei Zeichnen Bearbeiten Ausgabe Hilfe Parker Cam Hilfe Info
B_Projekt n = 1 Takte/min T = 60000 ms
(150.000 Grad)
ACHSE_1_1
(-0.383 Grad)
110
120
160 Grad
190
110 Grad
270
30 Grad
0
0 Grad
30
0 Grad
360
0 Grad
v = 0 rad/s
a = 0 rad/s2

The dashed sections are now calculated by the CamDesigner.
The transitions from dwell to motion are always calculated via a polynomial 5th order (in the BASIC version).
For the transitions dwell-to-dwell, the preselected motion law is used. This can also be changed retrospectively in the header data (menu: edit: Header data). The header data mask also states the cycle time (cycles per minute).
The result is displayed  via the ”show motion diagram” icon:

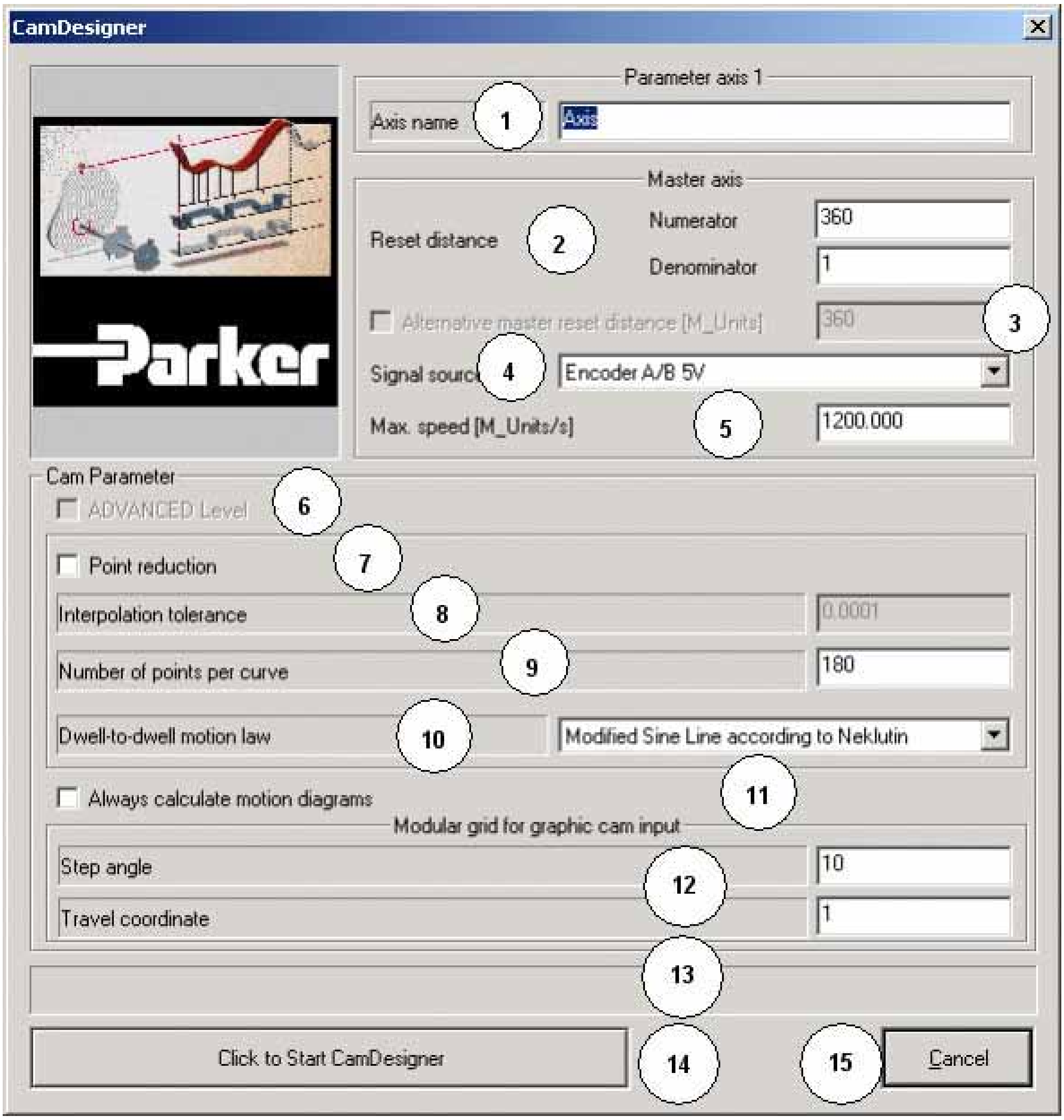


Displayed are the sequences for position, speed and acceleration, in physical units and with respect to the cycle time entered.
This window can be left via the X Icon.
If necessary, you can make modifications (motion laws, cycle time, etc.)
After the optimization the curve progression you can leave the CamDesigner via ”file”: "Exit"
The following dialog queries if the Cam Download is to take place immediately. The download can also be executed later via "Download": "Cam - curve data".

5.10.4.2 Cam functions of the Compax3 ServoManager / motion laws

In this chapter you can read about:

Description of the cam wizard



1 Name of the cam project being used in the CamDesigner.

2 Reset distance (=clock distance) of the master = length of the X axis in the CamDesigner.
The entry fields are inactive, if motion sequences were already created in the CamDesigner.
The values can, however, be modified in the header data of the CamDesinger.
ATTENTION:
Cam interpolation points may need to be adapted or deleted, if they are redundant due to a smaller clock distance!.
Decimal numbers must be converted into integers as numerator and denominator values. Please note, that max. 3 decimal places are considered for numerator/denominator. (see on page 3)

3 If the master clock distance has more than 3 decimal places, a drift is created.
If the Compax3 ServoManager states this, you can avoid this drift by using an alternative master clock distance.
Use another unit for the alternative master clock distance, instead of [mm] or [degrees] rather use [product cycles] or [%], so that you have an integer.
This unit is then valid for all master-related values (ME, MS, status values, ...) as well as for the curve.

Create the curve for this alternative master clock distance and you will get ad drift free curve operation.
the input field will become inactive, if motion sequences were already created in the CamDesigner. The alternative clock distance can also be manipulated in the header data mask of the CamDesigner.
Example:
Master: Direct-driven indexing table with 7 work stations;
Path/revolution = 360°
Reset distance = 360°
Slave: One of the work stations
Path/revolution = 360/7° master degree; cannot be displayed as clock resp. master reset distance (drift)!
Better: alternative clock distance e.g. 360 slave degrees.

4 Selection of the signal source which is used as default value for the master source (Input AXIS_REF_Local_Cam on the IEC block C3_MasterControl). An entry is required.
You can choose between configured signal sources.
The source can be changed afterwards with the input master of the IEC block C3_MasterControl.

5 The maximum speed is used as axis dimensioning for the display of the motion profile as well as a limit value for the motion sequence..
At +/-10V as signal source, the value 10V is used (the entry field is deactivated).
This value can also be manipulated in the header data mask of the CamDesigner.
Please note: The value is converted into steps/min by the CamDesigner; therefore a slight difference in this value caused by rounding is possible after the return from the CamDesigner.

6 If the licence file is installed: Switching between Advanced and Basic version of the CamDesigner.

7 Interpolation point reduction
deactivated: The curve is stored in equidistant interpolation points (corresponding to the stated number of interpolation points)
Activation: The equidistant interpolation points are reduced (resulting in the creation of not equidistant interpolation points).
The interpolation points are removed so that the resulting error is smaller than the interpolation tolerance stated (linear interpolation is respected).

8 Interpolation tolerance (see 7).

9 Maximum number of interpolation points per curve. Value range 18..3600.
Without activated interpolation point reduction, a curve has this number of interpolation points.
If the reduction is activated, the actual number of interpolation points may (depending on the tolerance selected) be smaller. Please respect that this value also constitutes the "basic grid" for the interpolation point reduction.
The number of interpolation points can also be manipulated in the header data mask of the CamDesigner.

10 Here the dwell-to-dwell interpolation method is selected. The following motion laws are possible in the BasicVersion of the CamDesigner:

- 3 Sloping Sine Line according to Helling-Bestehorn
- 4 5th order polynomial
- 5 Modified acceleration trapezoid
- 6 Modified Sine Line according to Neklutin
- 7 Simple sine (disadavantageous jerk)
- 11 11th order polynomial
- 12 Squared parabola (disadvantageous jerk)
- 28 8th order polynomial (disadvantgeous jerk)
- 30 low-noise cosine combination
- 31 3th order polynomial (disadvantgeous jerk)
- 32 4th order polynomial
- 33 6th order polynomial (disadvantgeous jerk)
- 34 7th order polynomial
- 38 mirrored sine

- 47 harmonic combination

For all other interpolations, the 5th order polynomial is used in the basic version. In the "Advanced Version", all methods of interpolation (also in combination) are possible in general. A detailed description of the methods not mentioned here, can be found in the CamDesinger help.
The dwell-to-dwell motion law can also be specified in the header data mask of the CamDesigner.

11 if the option "always calculate motion diagrams" is activated, the CamDesigner will calculate the interpolated motion sequence and the acceleration sequence after each change.
This option can also be de-/activated in the header data mask of the CamDesigner.

12 Modular grid for graphic cam input.
These values determine to which master/slave grid the curve elements placed with the aid of the mouse are brought ("catched"). The grid of the master (x)-axis must be smaller than the configured clock distance.
These values can also be de-/activated in the input mask of the CamDesigner for curve points.

13 Here are displayed status resp. error messages and notes.

14 Starting the CamDesigner.
This must be installed from the Compax3 CD before.
After the return from the CamDesigner it is necessary to perform a curve data download in order to load the changes into Compax3 (even if the curves themselves were not modified).

15 Cancel. Closing gehe window, the changes are discarded.

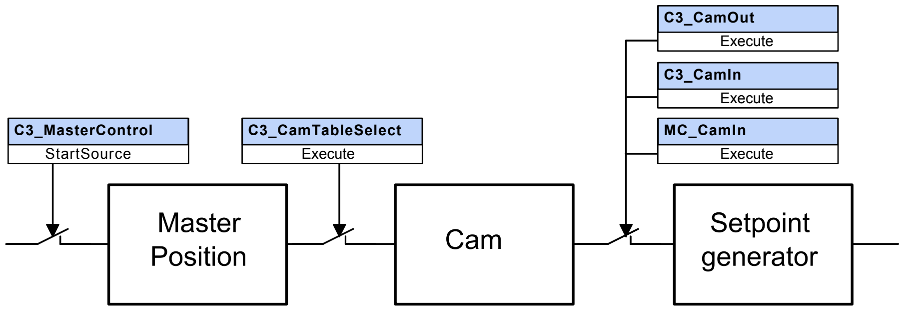
Motion laws:

Detailed information on the topic of "motion laws" can be found in the online help of the device.

5.10.5. Cam function structure

In this chapter you can read about:

5.10.5.1 Function modules of the cam



Functions of the individual modules:

Master Position:

- Detection of the master position
- Alignment / adjustment of the master position signal

For this the following IEC modules are available

- C3_MasterControl:
  - Select source
  - activate detection
  - activate master back stop (only rising master signals are accepted)
- C3_SetMaster: Define start position for the master signal.
- C3_MasterConfig: Define master reset distance (independent of the curve reseet distance).
- MC_Phasing: Additional master distance which is added to the master signal and which causes a slave movement.

Cam: Curve generation and control

- Selection of the curve
- Settings: run through curve once or cyclically
- Enable the master signal to the curve
- Definition of the master reference: relative or absolute.
- Specification of the master and slave segment distance.
- Specification of another MasterOffset with absolute reference or a starting delay with relative reference.

This is made via the "C3_CamTableSelect2 IEC module.

Setpoint generator: Coupling and decoupling curves

- Enable the curve slave position.
- Alignment / adjustment of the curve slave position to the actual slave position.

For this the following IEC modules are available

- MC_CamIn: Coupling with relative slave reference.
- C3_CamIn: Coupling with absolute slave reference with coupling function, master coupling position and master synchronous position
- C3_CamOut: Decoupling with absolute slave reference with coupling function, master decoupling position, master braking position and slave standstill position.

5.10.5.2 Signal image

Displayed are 2 different signal plans, which differ in their master reference:

- absolute master reference
- relative master reference

Displayed are:

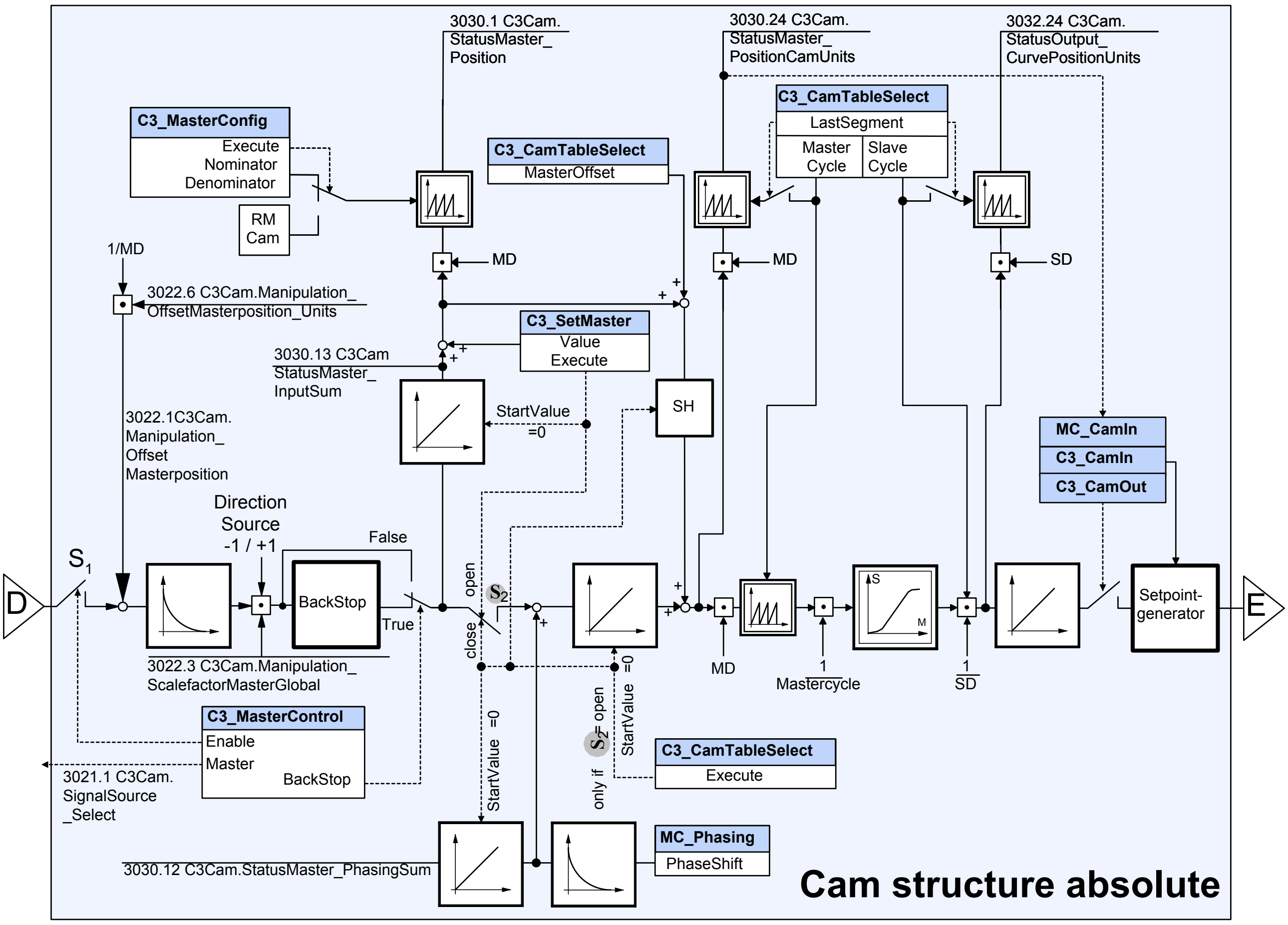
- the master signal processing,
- the function of the individual IEC function modules as well as
- the status objects made available for the commissioning or processing.

Symbols Please make yourself familiar with the **Symbols of the signal image** (see page 228).

Abbreviations:

RV:	Reset distance of the virtual master (from C3 ServoManager wizard ”signal source”)
RM Cam:	Reset distance of the master from curve
RS:	Reset distance of the slave (from C3 ServoManger Wizard ”configuration: Reference system)
MD:	Feed of the master axis
SD:	Feed of the slave axis

Signal image with absolute master reference



D: / E: **additional structure** (see page 102)

Note: Direction -1 / +1: with direction reversal (under configuration of signal sources) factor -1 is applied.

Switches S1 & S2:

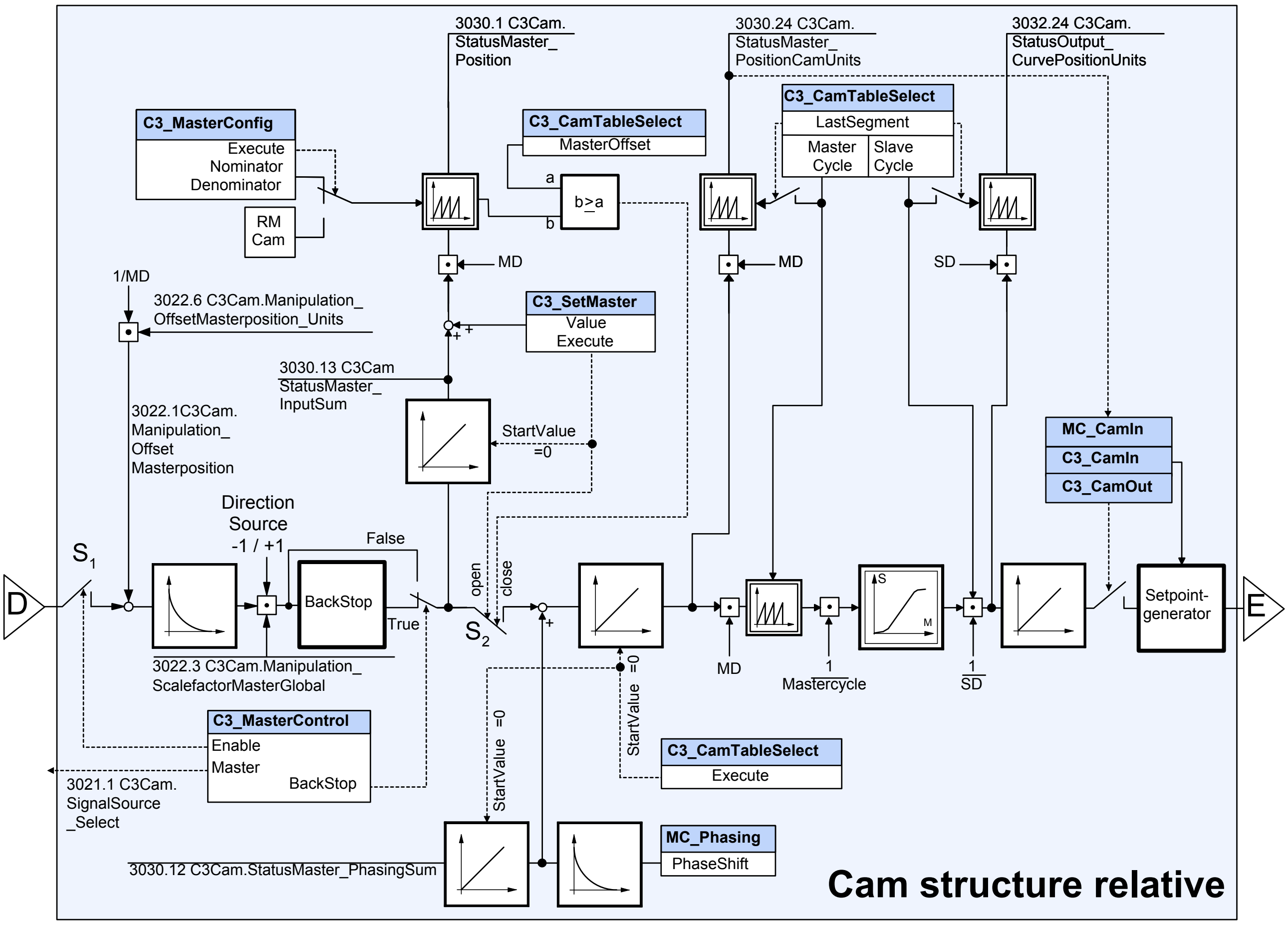
S1: Enable master acquisition; status switch in object 3030.7

O3030.7 = 0: switch open
O3030.7 = -2: switch closed, stop at the end of the cycle
O3030.7 = 2: switch closed, stop at the end of the cycle - single operation (run through curve once)
O3030.7 = 4: switch closed, periodic operation (run through curve cyclically)

S2: Enable cam input; status switch in object 3030.17

O3030.17 = 0: switch open
O3030.17 = 3: switch closed, single operation (run through curve once)
O3030.17 = 4: switch closed, periodic operation (run through curve cyclically)

Signal image with relative master reference



D: / E: **additional structure** (see page 102)

Note: Direction -1 / +1: with direction reversal (under configuration of signal sources) factor -1 is applied.

Switches S1 & S2:

S1: Enable master acquisition; status switch in object 3030.7

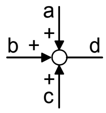
O3030.7 = 0: switch open
O3030.7 = -2: switch closed, stop at the end of the cycle
O3030.7 = 2: switch closed, stop at the end of the cycle - single operation (run through curve once)
O3030.7 = 4: switch closed, periodic operation (run through curve cyclically)

S2: Enable cam input; status switch in object 3030.17

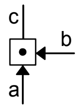
O3030.17 = 0: switch open
O3030.17 = 3: switch closed, single operation (run through curve once)
O3030.17 = 4: switch closed, periodic operation (run through curve cyclically)

Symbols of the signal image

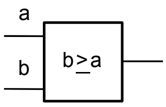
Symbol | **Description**



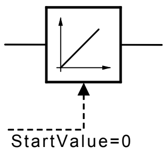
Point of addition:
d = a + b + c



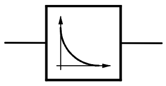
Point of multiplication:
c = a * b



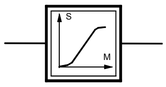
Comparison:
If b >= a, then output active



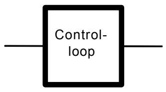
Integrator
Output signal = ∫(Input signal)*dt
The output signal is the integral (sum over time) of the input signal
”Start value=0” will set the output to 0; this is triggered by activating ”Execute” of an IEC module.



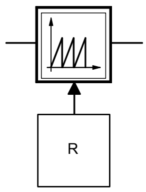
Differentiator
Output signal = d(input signal)/dt
The output signal is the derivation (gradient) of the input signal



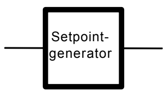
non-linear curve function Slave / Master
Slave-Position = f (Master-Position)



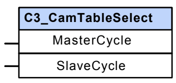
Closed control loop
Input: Setpoint Position
Output: Actual position



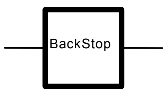
Reset function
Output signal is reset to 0 after value ”R”.
Value R can be taken in the signal image.



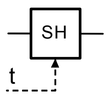
Command value generator
Generates the desired setpoint process (e.g. when coupling into a curve)



IEC function module
with module name and input values



Back stop
Prevents a declining master signal
(Functions of **C3_MasterControl** (see page 237))



Sampling-holding-function (SH: Sample & Hold)
The input value of the SH member is written to the output with trigger signal t.

5.10.5.3 Cam reference systems

In this chapter you can read about:

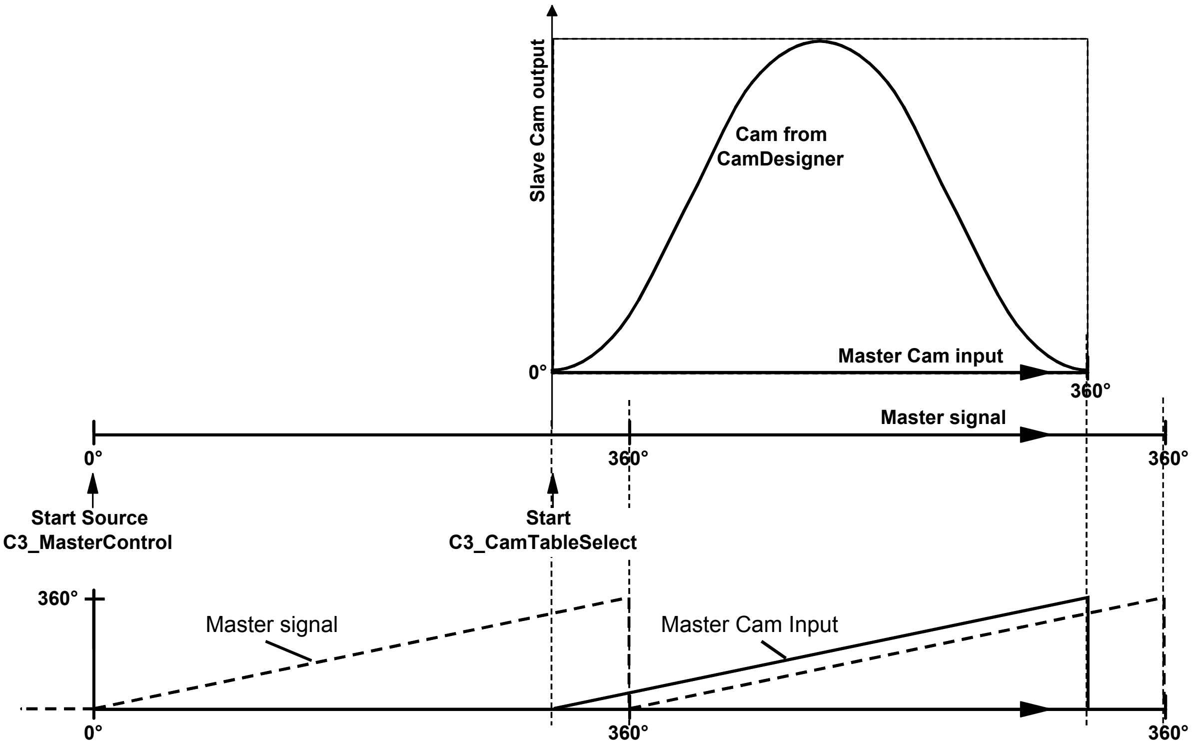
For a cam application it is necessary to adapt the curve values (positions) to the master and slave positions.
There are different possibilites to do this:

- relative master reference
  - without offset
  - with offset
- absolute master reference
  - without offset
  - with offset

The "Slave Cam output" setpoint signal from the curve is only related to the current physical slave position by the selected coupling function. A distinction is made between:

- relative slave reference and
- absolute slave reference

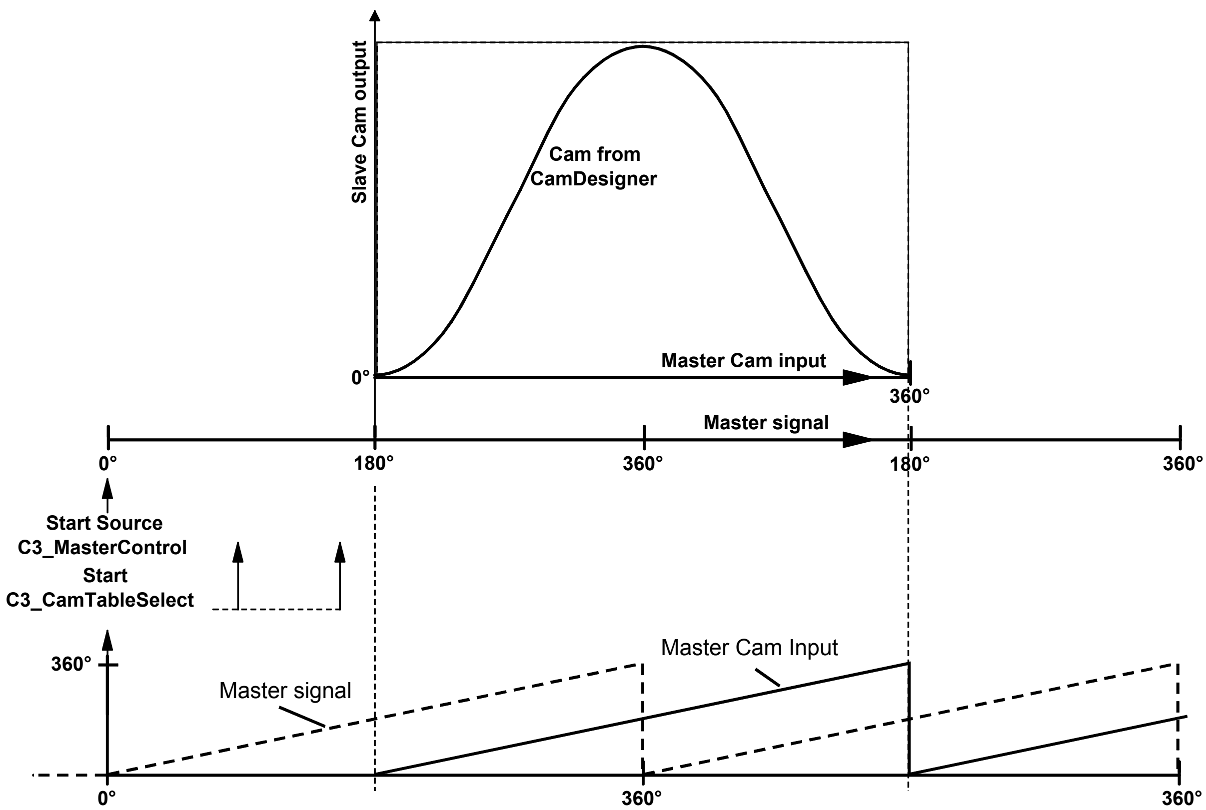
Relative master reference without offset



Master Cam input: Master signal at the curve input (C3Cam.StatusMaster_PositionCamUnits o3030.24)
Master signal: Master signal of the acquisition (C3Cam.StatusMaster_Position o3030.1)
Slave: Signal at the curve output (C3Cam.StatusOutput_CurvePositionUnits o3032.24)

Note:
- With a relative master reference, a given curve is processed generally from the beginning, independent of the start delay (=offset).

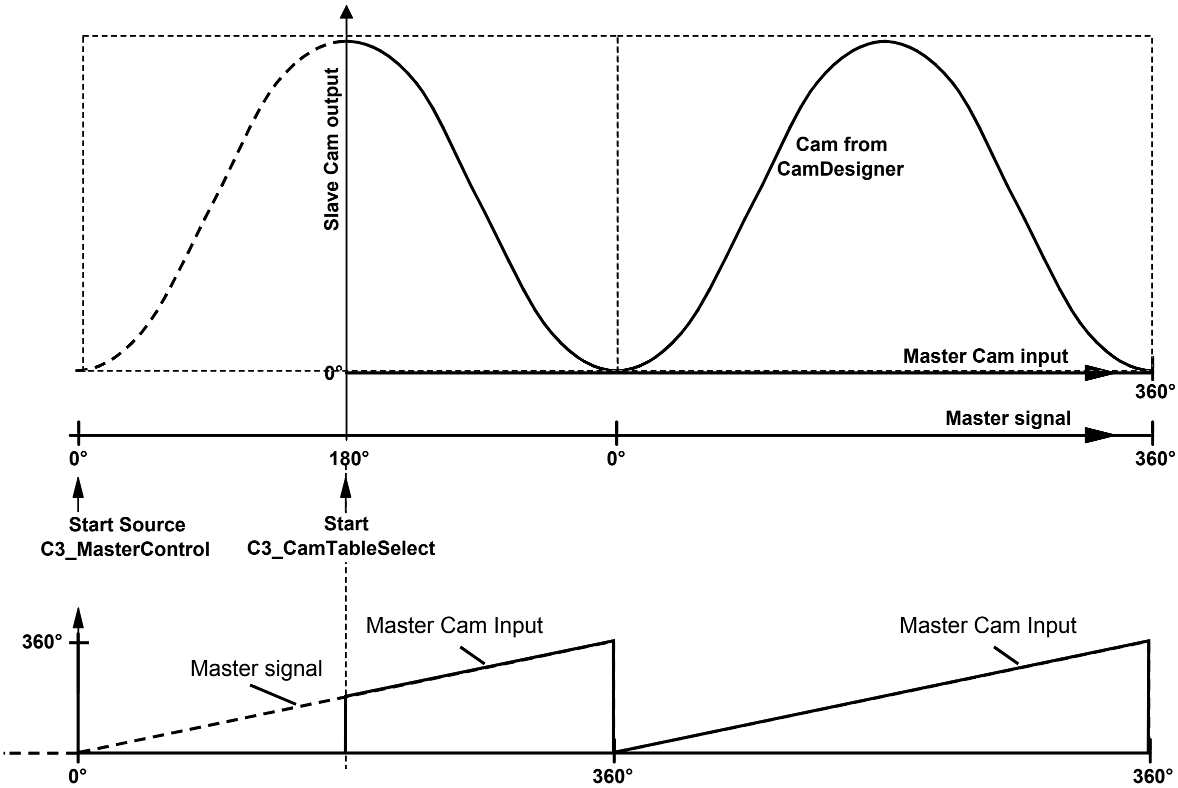
Relative master reference with 180° offset



Master Cam input: Master signal at the curve input (C3Cam.StatusMaster_PositionCamUnits o3030.24)
Master signal: Master signal of the acquisition (C3Cam.StatusMaster_Position o3030.1)
Slave: Signal at the curve output (C3Cam.StatusOutput_CurvePositionUnits o3032.24)

Note:
- With a relative master reference, a given curve is processed generally from the beginning, independent of the start delay (=offset).
- The offset is here used as start delay.
- The start of the C3_CamTableSelect can be at any position; it must however be before the start offset is reached.

Absolute master reference without offset

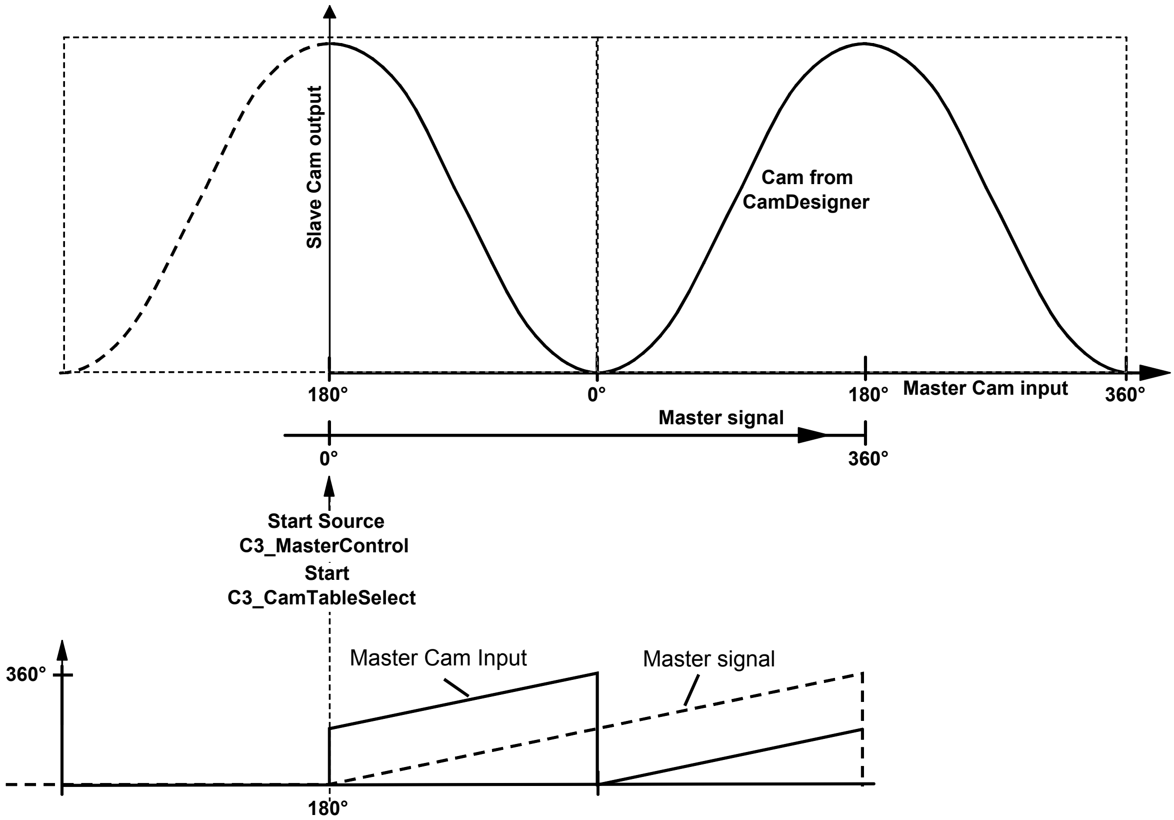


Master Cam input: Master signal at the curve input (C3Cam.StatusMaster_PositionCamUnits o3030.24)
Master signal: Master signal of the acquisition (C3Cam.StatusMaster_Position o3030.1)
Slave: Signal at the curve output (C3Cam.StatusOutput_CurvePositionUnits o3032.24)

Hint

- Only with absolute master reference, a given curve can be started at any position. This position corresponds to the offset value if the events "Start Source C3_MasterControl" and "Start C3_CamTableSelect" take place at the same point in time. Alternatively, you can preset the start value of the master position acquisition with the C3_SetMaster.
  Typical application: Shifting an open, s-shaped curve in the master reference system.

Absolute master reference with 180° offset



Master Cam input: Master signal at the curve input (C3Cam.StatusMaster_PositionCamUnits o3030.24)
Master signal: Master signal of the acquisition (C3Cam.StatusMaster_Position o3030.1)
Slave: Signal at the curve output (C3Cam.StatusOutput_CurvePositionUnits o3032.24)

Hint

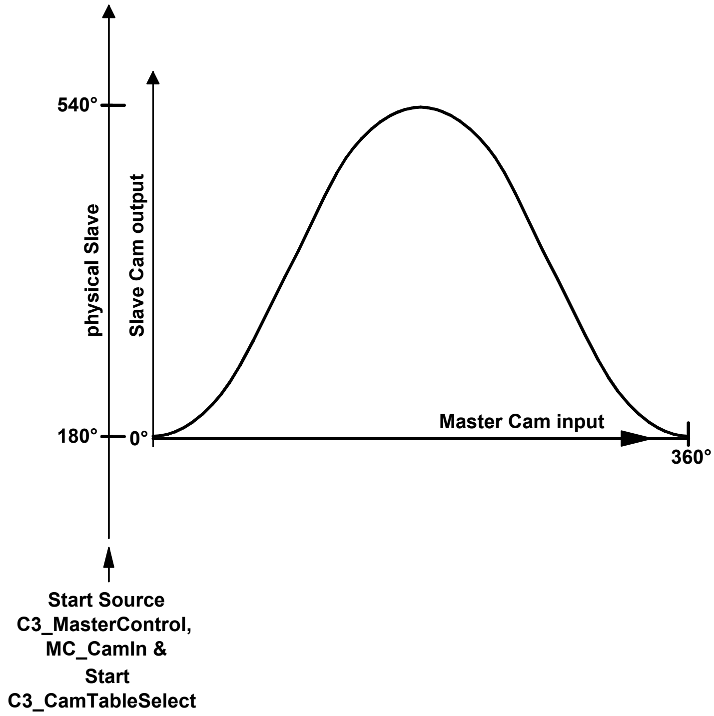
- Only with absolute master reference, a given curve can be started at any position. This position corresponds to the offset value if the events "Start Source C3_MasterControl" and "Start C3_CamTableSelect" take place at the same point in time. Alternatively, you can preset the start value of the master position acquisition with the C3_SetMaster.
  Typical application: Shifting an open, s-shaped curve in the master reference system.
- The offset is added to the current value of the master signal at the start time of CamTableSelect.

Relative slave reference

Relative slave reference can be established with MC_CamIn.
See also **application example 1** (see page 264)

Relative slave reference example 1

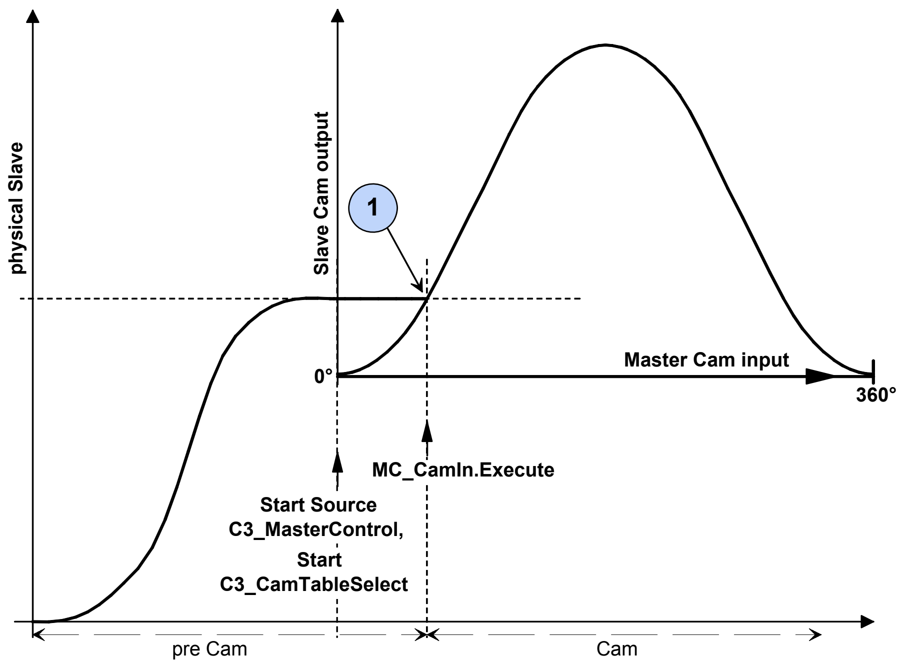
Example 1: MC_CamIn is started before or upon the curve start and the master position acquisition:



Master Cam input: Master signal at the curve input (C3Cam.StatusMaster_PositionCamUnits o3030.24)
Master signal: Master signal of the acquisition (C3Cam.StatusMaster_Position o3030.1)
Slave: Signal at the curve output (C3Cam.StatusOutput_CurvePositionUnits o3032.24)

Relative slave reference example 2

Example 1: MC_CamIn is started after the curve start and the master position acquisition:



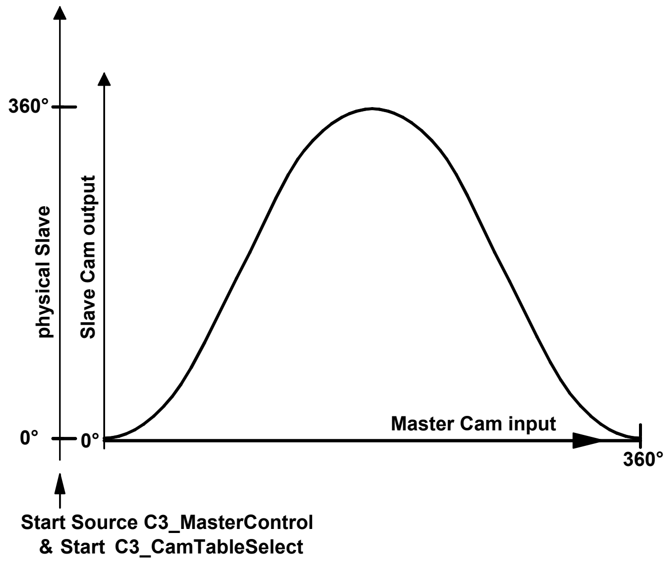
1: Alignment of the current slave setpoint position from the curve with the current setpoint position from the history of the Execute of the MC_CamIn

Master Cam input: Master signal at the curve input (C3Cam.StatusMaster_PositionCamUnits o3030.24)
Master signal: Master signal of the acquisition (C3Cam.StatusMaster_Position o3030.1)
Slave: Signal at the curve output (C3Cam.StatusOutput_CurvePositionUnits o3032.24)

Note: If a closed curve is combined with absolute master reference, an entry with MC_CamIn at a master position > 0 will lead to a backwards movement of the axis with reference to the start point.

Absolute slave reference

Absolute reference can be established by coupling in with a coupling movement (Mode 1 or 2)



Master Cam input: Master signal at the curve input (C3Cam.StatusMaster_PositionCamUnits o3030.24)
Master signal: Master signal of the acquisition (C3Cam.StatusMaster_Position o3030.1)
Slave: Signal at the curve output (C3Cam.StatusOutput_CurvePositionUnits o3032.24)

Note: The reference point and the curve zero point are always identical for absolute slave reference with C3_CamIn.

5.10.6. Master signal source

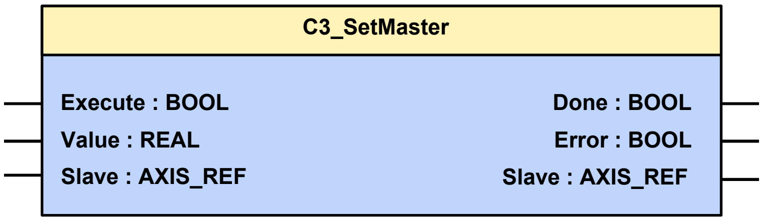
In this chapter you can read about:

5.10.6.1 Setting the position of the selected master source (C3_SetMaster)

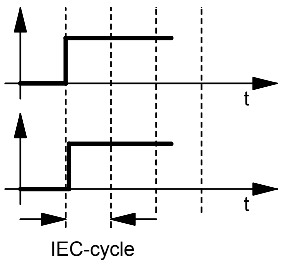
FB name	**C3_SetMaster**	
Setting the master position		
VAR_IN_OUT		
Slave	INT	
VAR_INPUT		
Execute	BOOL	Start setting sequence
Value	REAL	Start value
VAR_OUTPUT		
Done	BOOL	Setting sequence finished successfully
Error	BOOL	Setting the master failed

Note:

- Setting the value is possible:
  - without having selected a curve
  - during master position acquisition.
- The SetMaster function can only be executed, if the axis is not synchronized (not in ”Synchronized Motion”)
- SetMaster intrrupts the connection with the curve generator (see in the **signal image** (see page 225)).
- If the ”Value” is greater than the current reset distance, the value is allowed for in the reset distance.



Timing for Execute / Done:



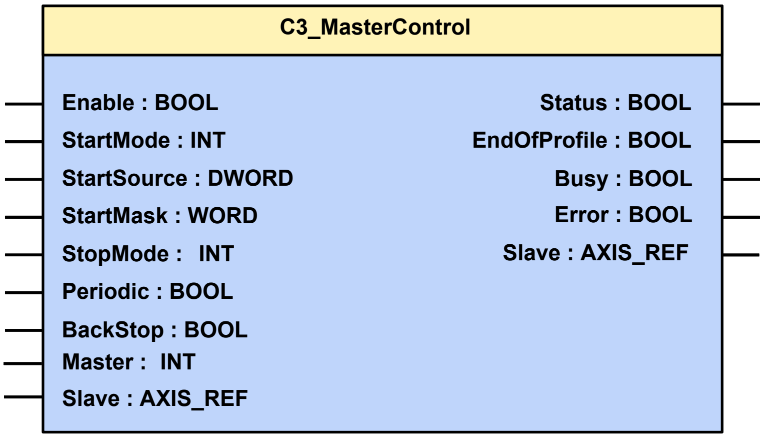
"Done" comes immediately after the execution of the module.

5.10.6.2 Recording the position of the selected master source (C3_MasterControl)

FB name	**C3_MasterControl**	
Start and Stop of the master detection		
VAR_IN_OUT		
Slave	INT	Axis-ID (library constants)
VAR_INPUT		
Enable	BOOL	Starting the module. Acquisition is started or stopped in accordance with the Mode
StartMode	INT	Selection of the Start mode 1: Start of the detection with rising edge of the enable 2: Fast start after external event (Impulse). Defined by ”StartSource” and ”StartMask”, , does start within 0.5ms. 3: Start of the acquisition with the next encoder zero pulse, after the start of the modules (Enable = TRUE)
StartSource	DWORD	Specification of an object (see example) for starting the detection. Only relevant with StartMode 2. The address operator ADR () must be used for the selection of an object.
StartMask	WORD	Binary mask for and-linking the source in order to select a bit from the source object. Only relevant with StartMode 2.
StopMode	INT	Selection of the Stop mode 1: Stops the acquisition with falling edge of the Enable 2: Stops the detection at the end of the master clock distance. Defined via the curve or via **C3_MasterConfig** (see page 243).
Periodic	BOOL	False: run trough once True: cyclic run
BackStop	BOOL	False: Backstop not active True: Back stop active
Master	INT	**Axis- ID of theMaster signal source** (see page 161) AXIS_REF_HEDA: HEDA AXIS_REF_Physical: +/-10V, step/direction/ Encoder AXIS_REF_Virtual: virtual Master
VAR_OUTPUT		
Status	BOOL	Shows that the master position acquisition is running
EndOfProfile	BOOL	Impulse at the end of the configured master cycle
Busy	BOOL	Waiting for an external event
Error	BOOL	Command was aborted; error when starting the detection

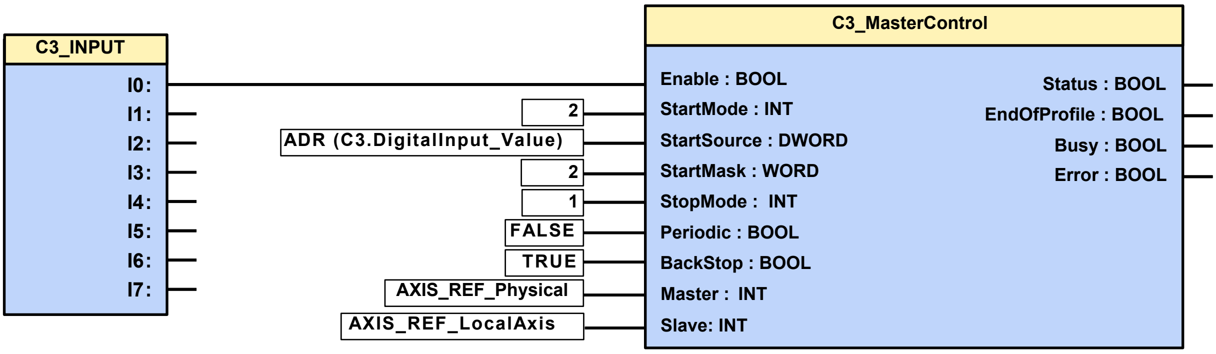
Note:

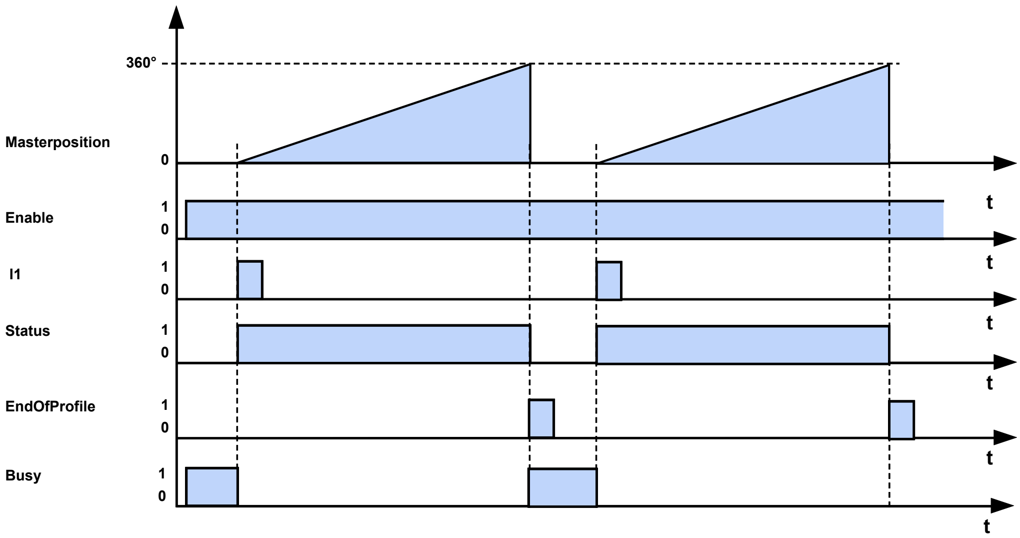
- Witht the active enable, the "Periodic" and "Master" inputs are always accepted.
- With the transition Enable low to high the StartMode is evaluated.
- With the transition Enable high to low the StopMode is evaluated.
- Only one module controlling the detection is allowed in the project.
- Enable and StartSource must have different sources.



Example 1:

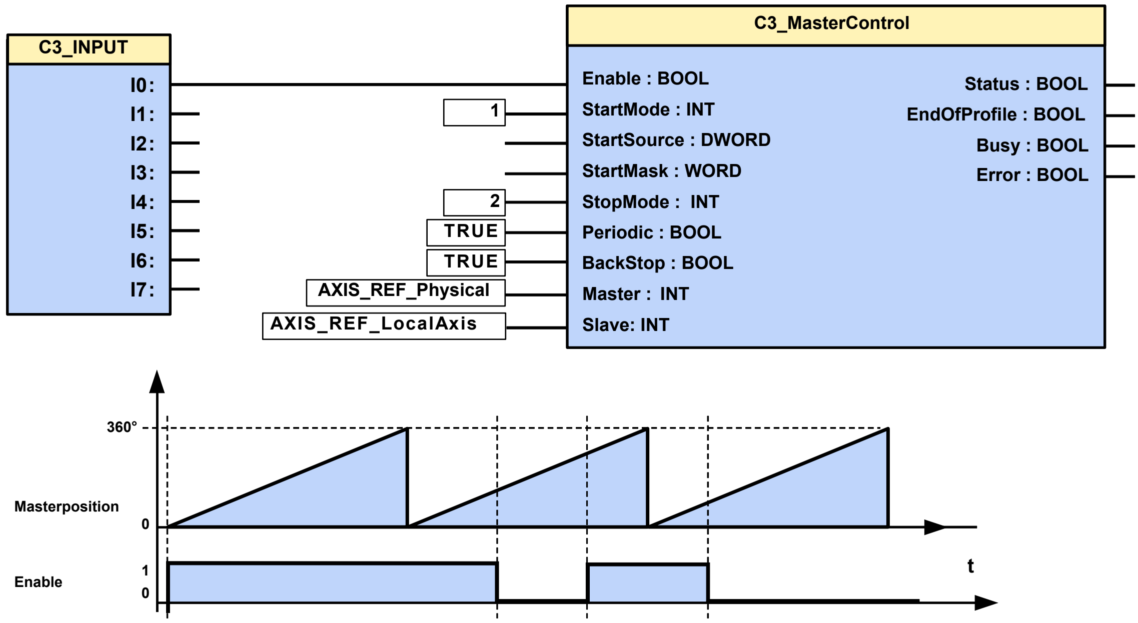
- Enable of the master position acquisition with input I0.
- Start of the detection with an external event = rising edge at the I1 input. Input I1 is selected via the object "C3.DigitalInput_Value".
  The input I1 is placed on Bit 1 (counting from 0), as a result the input "StartMask" receives the value 2.
- Detection runs in single mode.





Example 2:

- StopMode=2: Acquisition stops at the end of the master clock distance
- If "Enable" is deactivated within the master clock distance and is re-activated before the end of the master clock distance, the acquisition will continue undisturbed.



Cam operation with STOP or Error

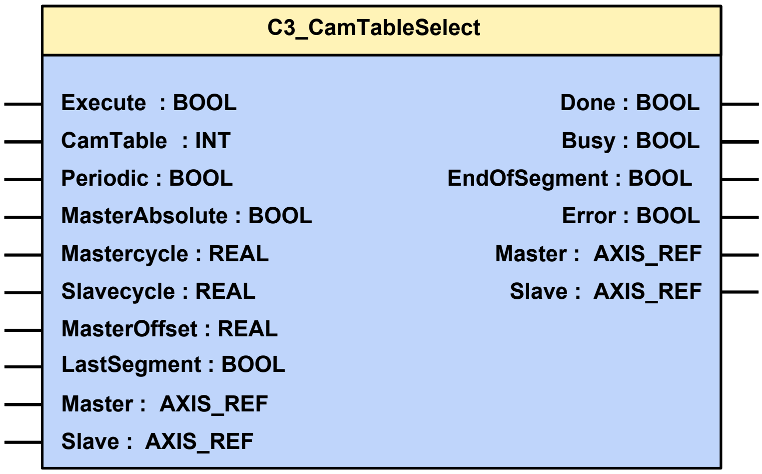
The master position and the curve are not influenced by a STOP or an error of the axis.
The detection and the curve generation continue; this means that the curve output is also available in the case of an error.

5.10.6.3 Control of the cam generator (C3_CamTableSelect)

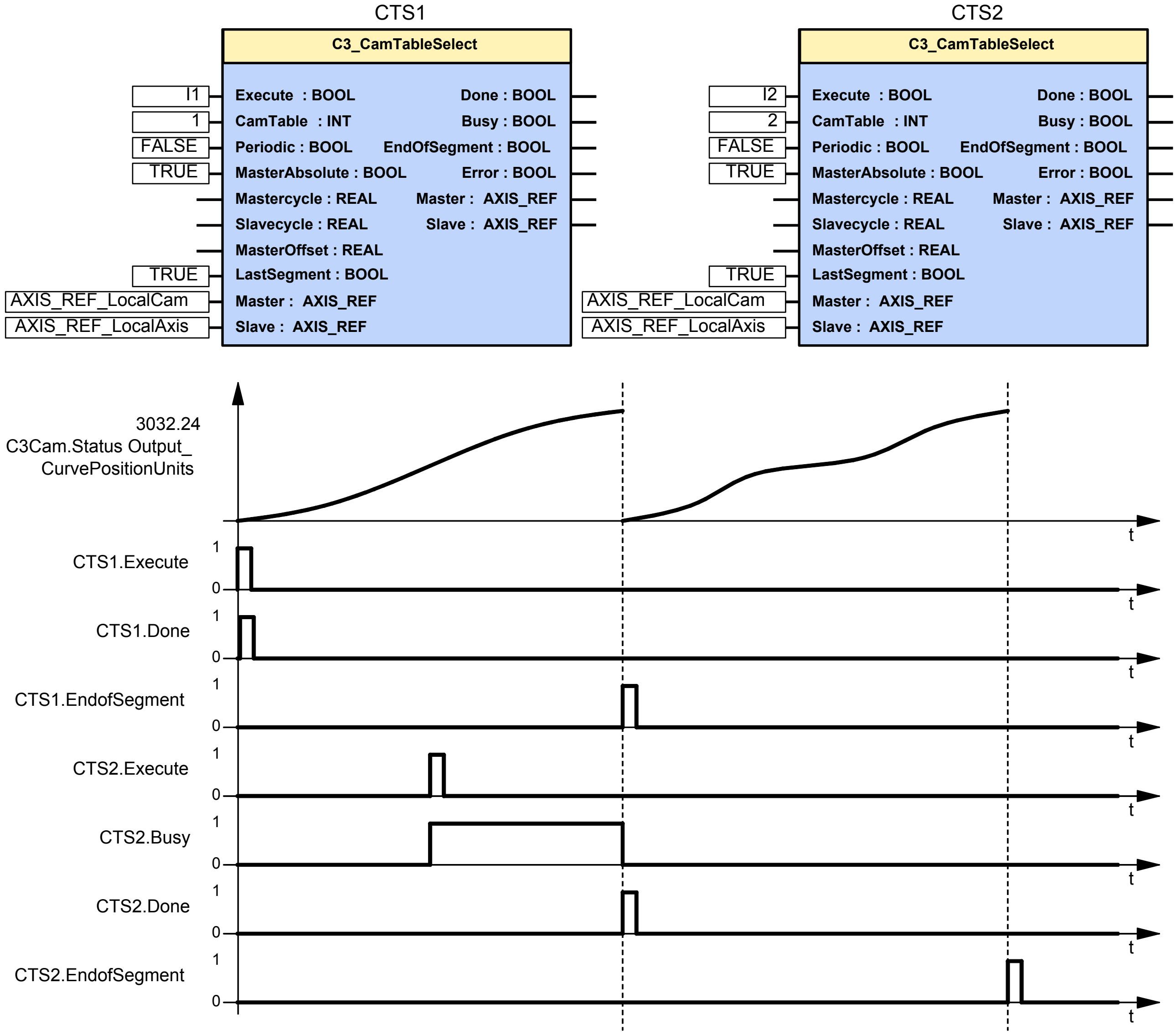
FB name	**C3_CamTableSelect**	
Control of the curve generator		
VAR_IN_OUT		
Master	INT	Axis ID; constant: AXIS_REF_LocalCam
Slave	INT	
VAR_INPUT		
Execute	BOOL	Curve selection with positive edge
CamTable	INT	Curve number (beginning with 1)
Periodic	BOOL	=FALSE: run through curve once (Single operation) =TRUE: cyclic run trough curve (periodic operation)
MasterAbsolute	BOOL	Select master reference of the curve FASLE = relative TRUE = absolute
Mastercycle	REAL	Value of the master segment distance [physical units] 3 decimal places are considered.
Slavecycle	REAL	Value of the slave segment distance [physical units] 3 decimal places are considered.
MasterOffset	REAL	**Absolute mode:** Offset at the start of the master position aquisition **relative mode:** Start delay, the master position acquisition starts if the master signal reaches this value, see in the **signal image** (see page 225). If the input is open the curve starts with Execute (without delay)
LastSegment	BOOL	Resets the display, see in the **signal image** (see page 225) and is used as reference signal for coupling.
VAR_OUTPUT		
Done	BOOL	Change of curves finished
Busy	BOOL	Waiting for change of cams
EndOfSegment	BOOL	Impulse at the end of a curve even if no Execute is present
Error	BOOL	Command aborted Error in cam selection or master connection

Note:

- If the inputs ”Mastercycle” and ”Slavecycle” are not assigned, the master cycle is accepted by the configuration and the highest feed of the selected curve is taken as slave cycle (see **curve types** (see page 211)).
- If the MasterAbsolute input stands on TRUE (absolute), the switch to the curve genertor is closed with the CamTableSelect and the curve adapts to the master position detection.
  The MasterOffset functions as Offset for the master position acquisition;
  Input not assigned means MasterOffset = 0.
- If the MasterAbsolute input stands on FALSE (relative), the switch to the curve generator is closed with the CamTableSelect and the curve does not adapt but begins on the master side at 0.
  The MasterOffset works as start delay; the curve starts only when the master has traveled further than this value in the positive direction.
- If the curve runs in single mode, only direct coupling with MC_CamIn is sensible.
- If the curve runs in single mode and the master runs periodically, it is only sensible to have the curve run relative to the master.
- After running through the curve in single mode, the drive changes from the ”Synchronized Motion” state back to the ”Standstill” state, i.e. after a SingleStart a positioning is possible.
- An Execute during a curve cycle leads to a curve change at the end of the curve cycle. The ”MasterAbsolute” and "MasterOffset" inputs are not evaluated.
  Please note: If an Execute signal follows an Execute (by bouncing), another change of curve is already triggered.
- With relative master reference (MasterAbsoute=FALSE) with start delay, the change of curve is already executed (Done=TRUE), if the master signal has not yet reached the Masteroffset (start delay).
- In the event of error message 0xFFE2: Er ror in the IEC61131-3 program sequence. Function module was called with incorrect parameters.
  CamTable<1 or CamTable>C3Cam.StatusData_SegmentsInFlash



Example / Timing diagram



Cam operation with STOP or Error

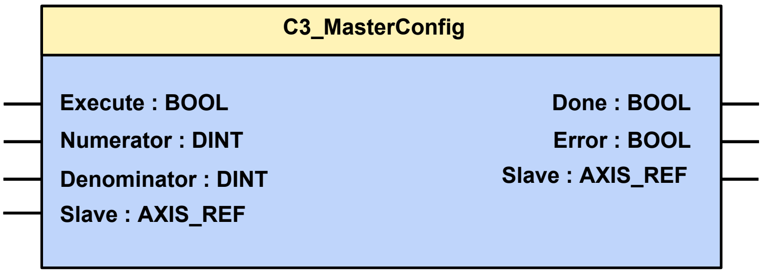
The master position and the curve are not influenced by a STOP or an error of the axis.
The detection and the curve generation continue; this means that the curve output is also available in the case of an error.

5.10.6.4 C3_MasterConfig

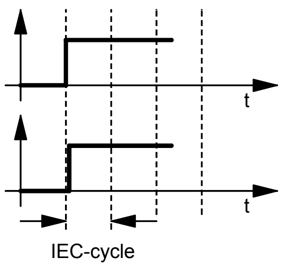
FB name	**C3_MasterConfig**	
Configure reset distance of the position of selected master (does not influence the curve, only in the display object)		
VAR_IN_OUT		
Slave	INT	Axis-ID (library constants)
VAR_INPUT		
Execute	BOOL	Start configuration
Numerator	DINT	Numerator of the reset distance to master position acquisition
Denominator	DINT	Numerator of the reset distance for the position of selected master source (automatically 1 with alternative master clock distance)
The reset distance is disabled with: Numerator = 0 and Denominator = 1 thus the display is no longer reset		
VAR_OUTPUT		
Done	BOOL	Configuration finished successfully.
Error	BOOL	Configuration of the master failed

Note:

- Module can be executed with running master.
- Write Flash is not executed, the changed values of the reset distance are lost when switching off.
- The reset distance defined via the module deactivates the previously valid reset distance of the curve, see in the **signal image** (see page 225).
- For linked **curves** (see page 271) the sum of all master segments (Numerator / Denominator) is entered as reset distance.



Timing for Execute / Done:



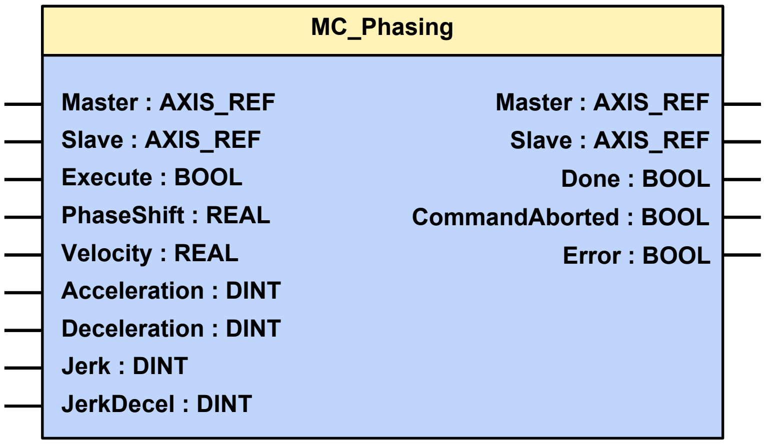
"Done" comes immediately after the execution of the module.

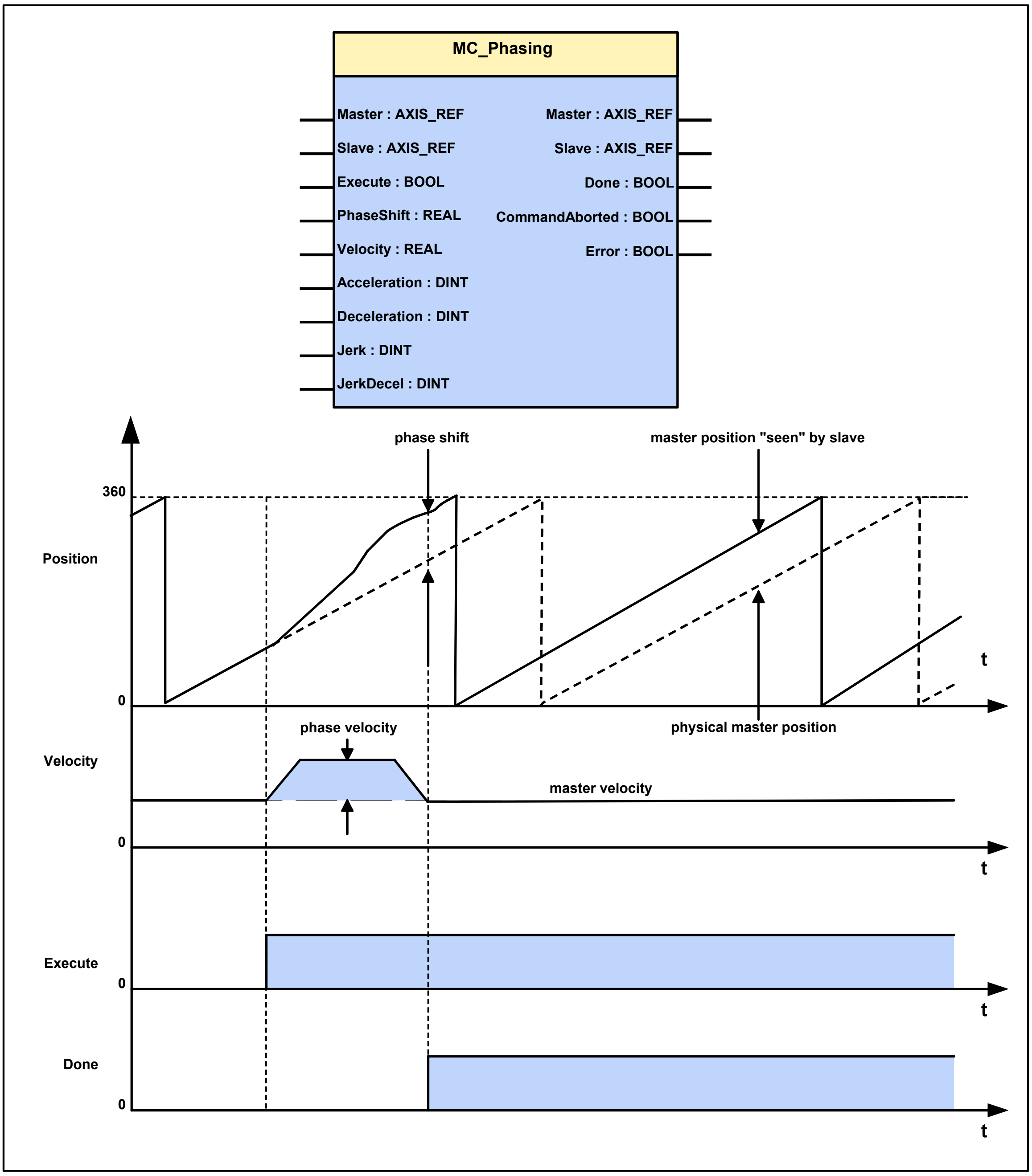
5.10.6.5 Master signal phase shift (MC_Phasing)

FB name	**MC_Phasing**	
A phase equalization between Master and Slave can be performed with a position offset. Only the Master signal in the Slave is affected in this case. The Master itself remains unaffected. PhaseShift influences the master signal before the curve; the slave moves by the resulting distance after the curve. Calling MC_Phasing a second time causes an additional offset of the Master signal by the value specified in PhaseShift		
VAR_IN_OUT		
Master	INT	Axis ID; constant: AXIS_REF_LocalCam
Slave	INT	Axis-ID (library constants)
VAR_INPUT		
Execute	BOOL	Starts the sequences of the module with positive edge
PhaseShift	REAL	The relative distance that will be added to the Master signal (configured unit [units]) (positive and negative direction) **<Value range>** (see page **Fehler! Textmarke nicht definiert.**)
MoveVelocity	REAL	Speed when adjusting the Master signal (always positive) (not necessarily reached) [units/s] **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
Acceleration	DINT	Acceleration when adjusting the Master signal (always positive) [units/s^2]**<Value range>** (see page **Fehler! Textmarke nicht definiert.**)
Deceleration	DINT	Deceleration when adjusting the Master signal (always positive) [Units/s^2] **<Value range>** (see page **Fehler! Textmarke nicht definiert.**)
Jerk	DINT	Acceleration **jerk** (see page 183) [Units/s^3] when changing the master signal (always positive) **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
JerkDecel	DINT	Deceleration jerk [Units/s^3] when adjusting the Master signal (always positive) **<value range>** (see page **Fehler! Textmarke nicht definiert.**)
VAR_OUTPUT		
Done	BOOL	Phase offset achieved
CommandAborted	BOOL	Command aborted
Error	BOOL	Error while executing module

Note:

- The values PhaseShift, Velocity, Acceleration, Deceleration, Jerk JerkDecel are no absolute values, they are added to the current movement of the master signal.
- MC_Phasing is not stopped by a stop of the axis.
- This module cannot be operated with C3_ShiftPosition and MC_MoveSuperImposed at a time.
- This function is only possible in cam operation.


MC_Phasing
Master : AXIS_REF
Slave : AXIS_REF
Execute : BOOL
PhaseShift : REAL
Velocity : REAL
Acceleration : DINT
Deceleration : DINT
Jerk : DINT
JerkDecel : DINT
Master : AXIS_REF
Slave : AXIS_REF
Done : BOOL
CommandAborted : BOOL
Error : BOOL


MC_Phasing
Master : AXIS_REF
Slave : AXIS_REF
Execute : BOOL
PhaseShift : REAL
Velocity : REAL
Acceleration : DINT
Deceleration : DINT
Jerk : DINT
JerkDecel : DINT
Master : AXIS_REF
Slave : AXIS_REF
Done : BOOL
CommandAborted : BOOL
Error : BOOL
phase shift
master position "seen" by slave
360
Position
0
t
phase velocity
physical master position
Velocity
master velocity
0
t
Execute
0
t
Done
0
t

5.10.7. Alignment of the slave axis

In this chapter you can read about:

5.10.7.1 Start cam / coupling

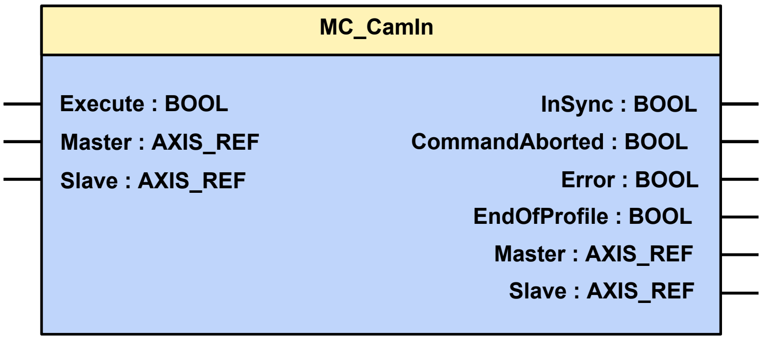
In this chapter you can read about:

Starting a selected curve (MC_CamIn)

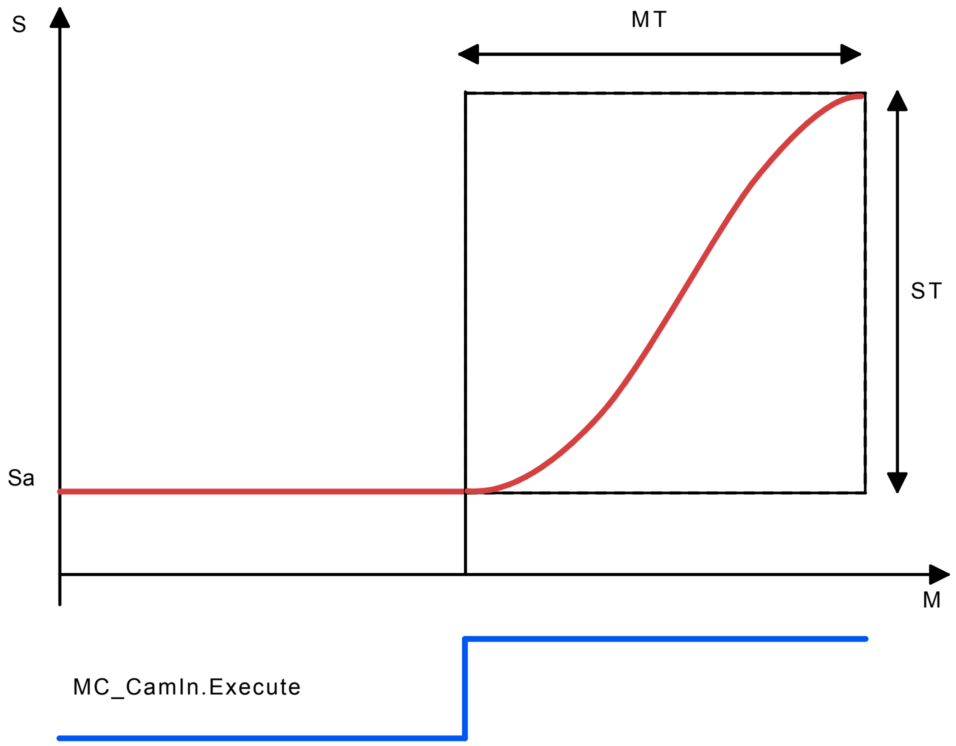
FB name	MC_CamIn	
Synchronization of the axis with the output of the curve generator without coupling movement		
VAR_IN_OUT		
Master	INT	Axis ID; constant: AXIS_REF_LocalCam
Slave	INT	Axis-ID (library constants)
VAR_INPUT		
Execute	BOOL	Curve start with positive edge
VAR_OUTPUT		
InSync	BOOL	Synchronous operation active
CommandAborted	BOOL	Command aborted
Error	BOOL	Command aborted Error in the cam operation
EndOfProfile	BOOL	End of a cam cycle. A pulse with the length of an IEC cycle indicates the end of each cam cycle. Suitable for setting up a loop counter.

Note:

- Curve alignment:
  - Execute is followed by immediate coupling; the current curve setpoint value is adapted to the current slave setpoint value. This adapts the curve to the current position.
  - In order to avoid velocity jumps, the master should be at a standstill or the curve should have an initial gradient (slope) of 0.
- MC_CamIn can also be started by a C3_CamTableSelect, if the curve setpoint value does not jump after the start of the C3_CamTableSelect **example 6: Operation with curve segments and standstill area** (see page 276).



Direct coupling with MC_CamIn



Sa: current slave position
MT: Master clock distance
ST: Slave clock distance

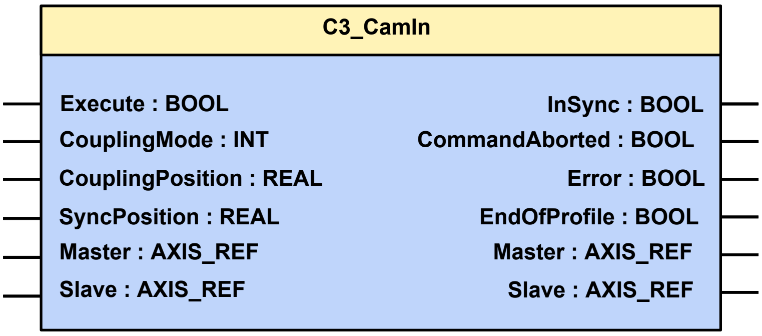
Starting a selected curve with coupling movement (C3_CamIn)

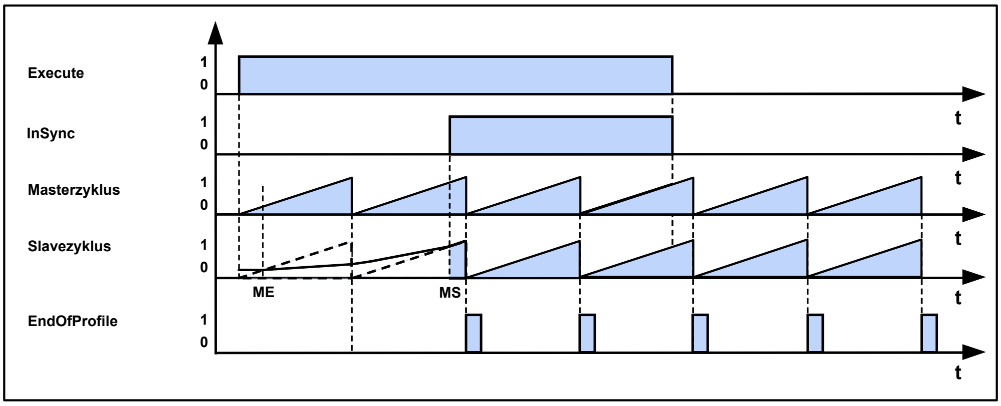
In this chapter you can read about:

FB name	C3_CamIn	
Synchronization of the axis to the output of the curve generator with adjustable coupling movement		
VAR_IN_OUT		
Master	INT	Axis ID; constant: AXIS_REF_LocalCam
Slave	INT	
VAR_INPUT		
Execute	BOOL	Curve start with positive edge
CouplingMode	INT	0 = coupling without coupling movement, after the master having traveled over the coupling position (ME) in positive direction. 1 = coupling via quadratic function; the master coupling position (ME) is calculated. 2 = couling via changeover function.
CouplingPosition	REAL	Master coupling position (ME) in master units (is taken into consideration with CouplingMode = 0 and 2 with CouplingMode = 1, the coupling position is calculated) Value range: 0 ... n*MT
SyncPosition	REAL	Master synchronous position (MS) in master units (not relevant with CouplingMode = 0) Value range: CouplingMode 1: 0 ... MT CouplingMode 2: 0 ... n*MT
VAR_OUTPUT		
InSync	BOOL	Synchronous operation active
CommandAborted	BOOL	Command aborted
Error	BOOL	Command aborted Error in the cam operation
EndOfProfile	BOOL	End of a slave cam cycle. A pulse with the length of a IEC cycle indicates the end of each master cam cycle . Suitable for setting up a loop counter.

Note:

- Master coupling position (ME) and master synchronized position (MS):
  - With CouplingMode = 0: ME is taken into consideration, MS not relevant.
  - With CouplingMode = 1: ME is calculated internally, MS is taken into consideration.
  - With CouplingMode = 2: ME is taken into consideration, MS is taken into consideration.
- With CouplingMode =1 the curve must be constantly rising at the Master synchronous position (MS).
- If the master runs backwards after the beginning of the coupling movement, the slave will be at its original position after reaching the coupling position.
- With changeover, the coupling function depends on the current curve.
- The relevant master position for coupling position and synchronized position is object 3030.24.
- Before C3_CamIn is executed, a curve must be selected with C3_CamTableSelect.



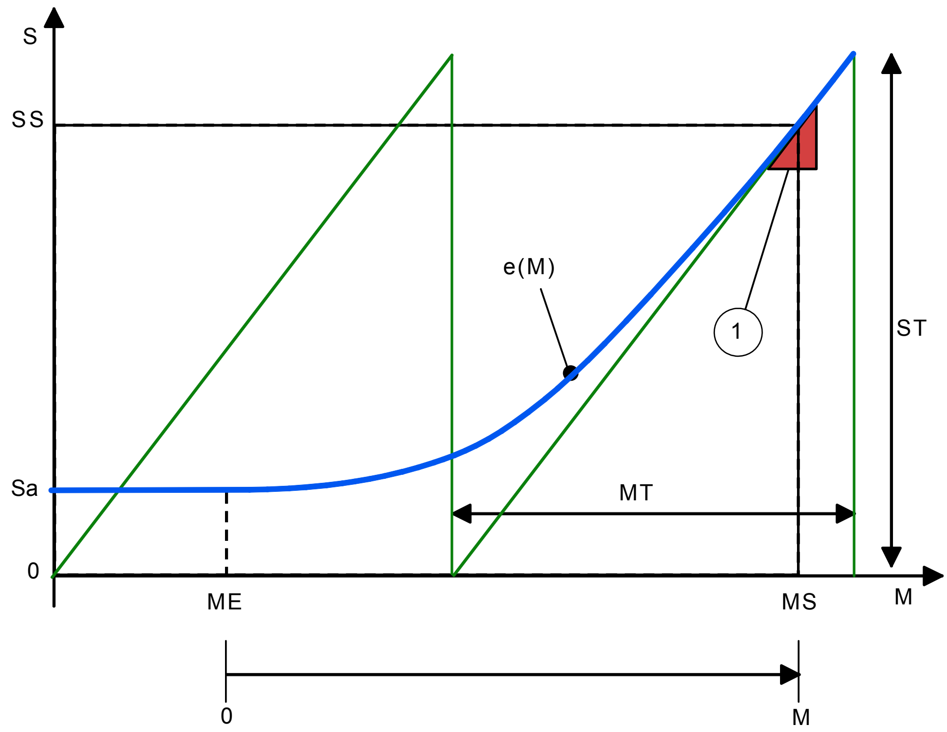


Example with CouplingMode = 1 and C3_CamTableSelect: Periodic = TRUE.

Quadratic coupling (CouplingMode = 1)

The quadratic coupling results in a quadratic position course of the slave axis without velocity superelevation:
The synchronous position with master reference (MS) is ideally stated within the hind range of the master clock distance, so that the coupling movement takes place within one single cycle.
For this, the start position (activating the coupling sequence with C3_CamIn: Execute) must also be near the curve zero point.
The master-related coupling position (ME) is calculated from the slope of the curve in the synchronization point and the actual slave position (Sa) so that it results in a quadratic position course.
For this, there must be a positive slope (gradient) at the synchronization position. The master speed must be positive, i.e. the master position must be rising.

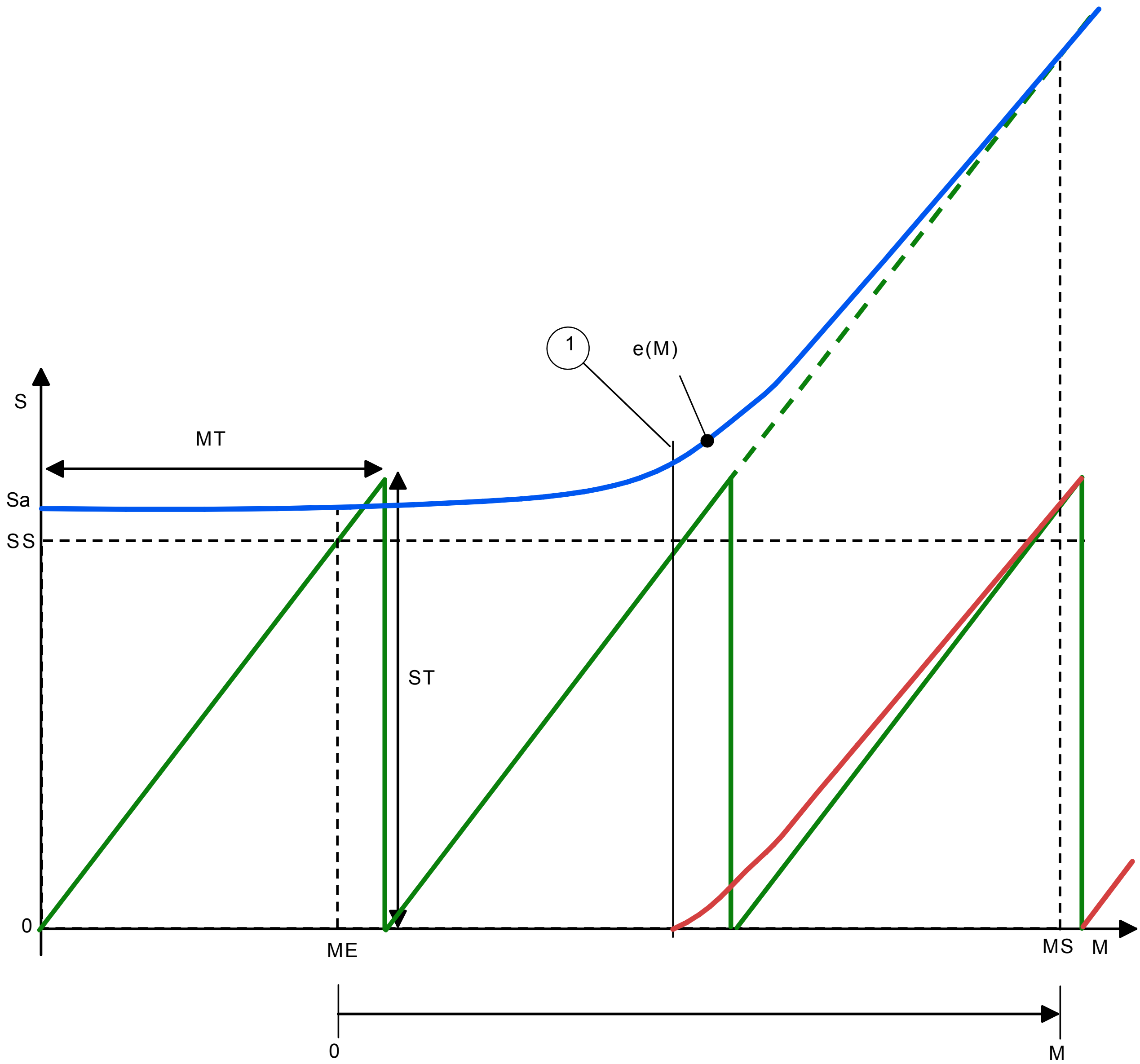
Coupling via a slave clock distance



SS: Slave synchronization position
Sa: current slave position before start of curve
ME: Master coupling position calculated from MS, slope in MS/SS and Sa
MS: Master synchronous position
MT: Master clock distance
ST: Slave clock distance
e(M): quadratic coupling function
1: gradient triangle: determines the duration of the coupling sequence (the steeper, the faster is the coupling sequence)

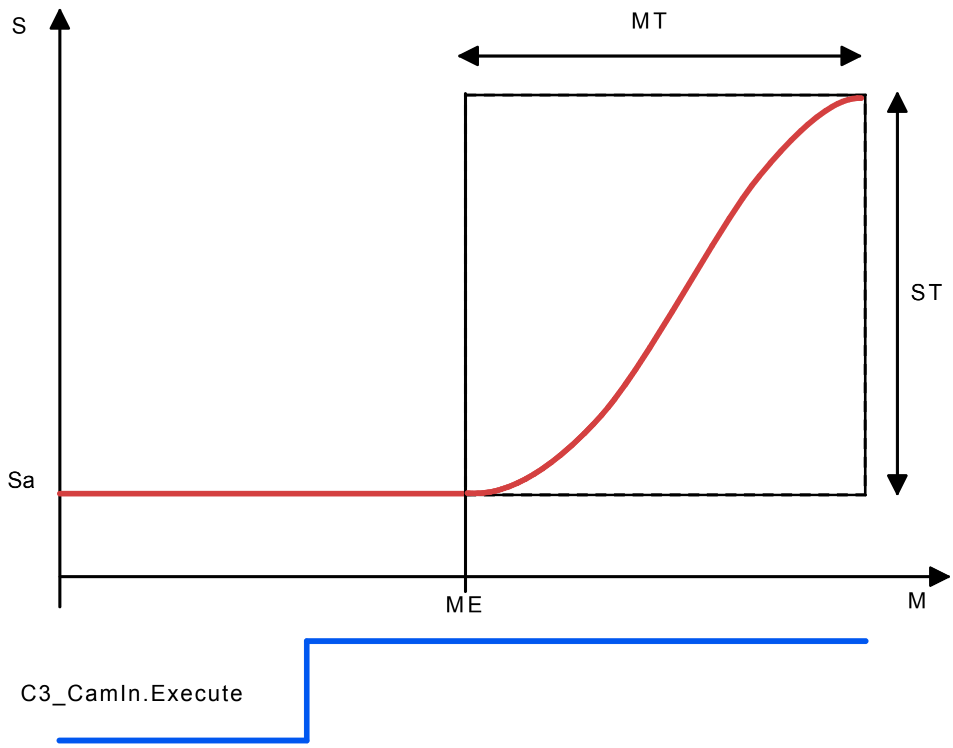
Coupling over several slave clock distances

If the curve has a very flat slope in the synchronization point (MS/SS), or if the current Slave Sa is behind the Slave synchronzation position, the coupling sequence takes place over several master cycles.



SS: Slave synchronization position
Sa: current slave position before start of curve
ME: Master coupling position calculated from MS, slope in MS/SS and Sa
MS: Master synchronous position
MT: Master clock distance
ST: Slave clock distance
e(M): quadratic coupling function
1: The slave setpoint value is reset at this position in the display.

Direct coupling (CouplingMode = 0)



Sa: current slave position
MT: Master clock distance
ST: Slave clock distance
After Execute of C3_CamIn the slave will only couple in from the master coupling position ME.
In order to avoid velocity jumps, the curve should have an initial gradient (slope) of 0.

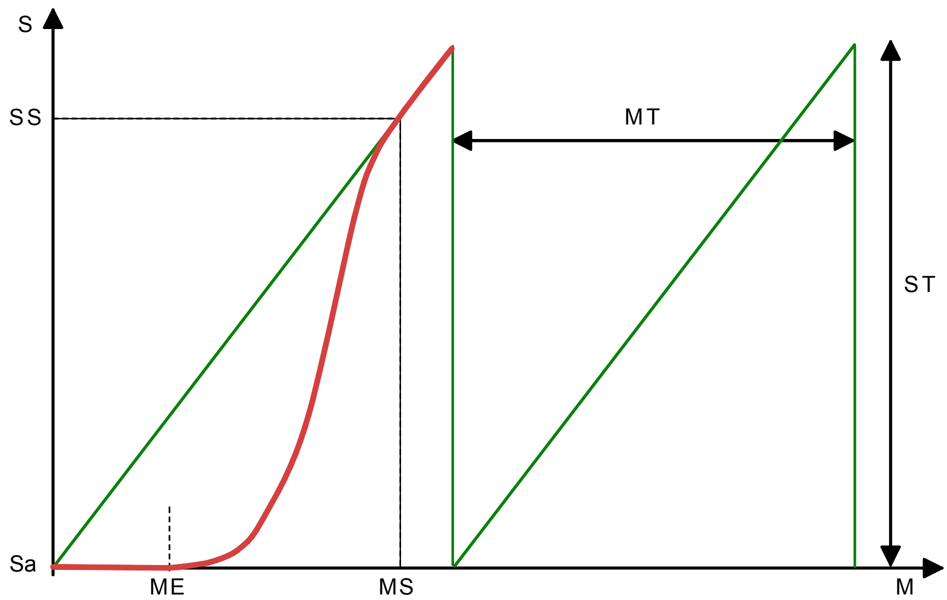
Change-over (CouplingMode = 2)

When using the change-over-function, the curve setpoint value is permanently displayed during coupling, while the current slave position is permanently hidden. Overspeeding and pull-out movement are possible.
By specifying the master-related coupling and synchronization position in master units, the coupling curve is mapped to a range of any length of the curve. This means that it is no longer fixedly coupled to the curve cycle.

Algorithm of the change-over function

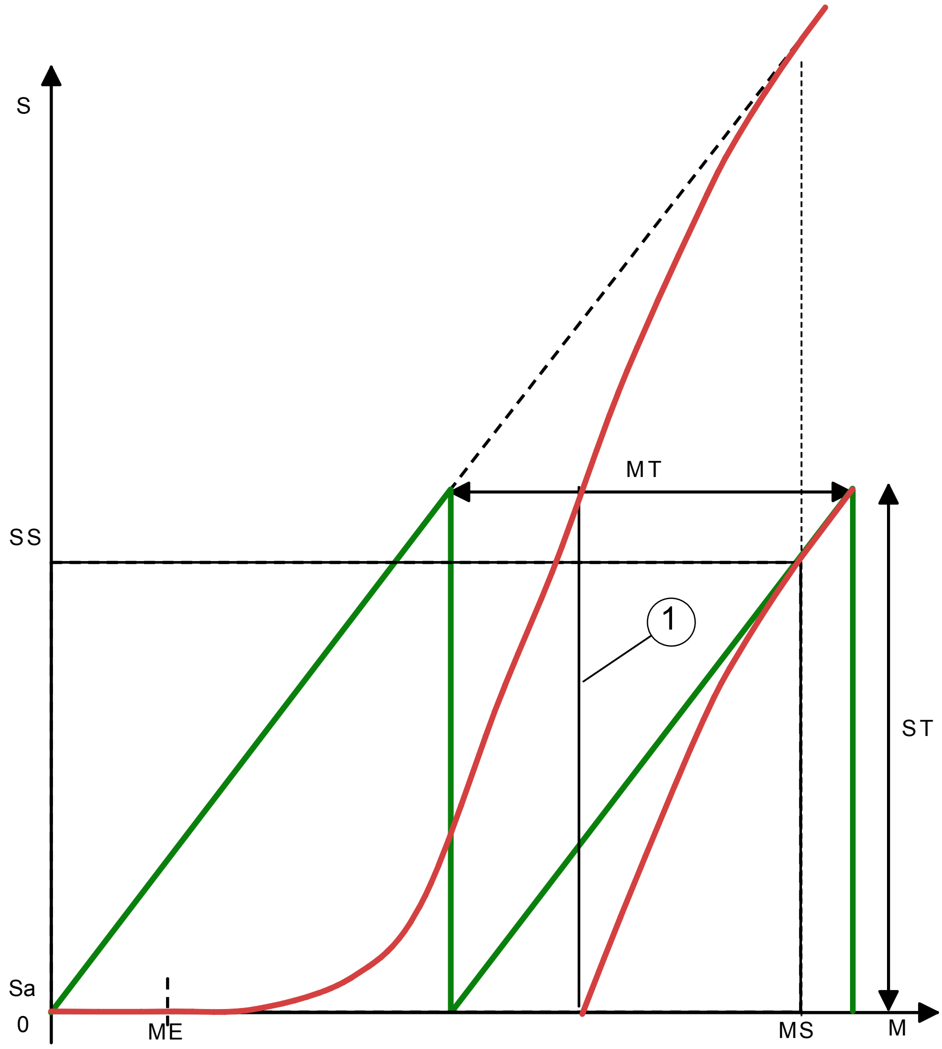
The normalized coupling function begins at the value 0 and end at the value 1 and rises continually in between. It is a 5th order function.
The coupling curve does not produce a direct slave setpoint value but produces a factor KE for the weighting of the current curve setpoint value resp. the current slave position Sa (position at the start of the coupling sequence).
The course of the coupling curve depends on the slave position Sa and the course of the curve in synchronized operation.
The master speed must be positive, i.e. the master position must be rising.
The weighting is made according to the following function:
coupling curve = SK * KE + S0 * (1 – KE)
with:
S0 = standstill position
SK = current curve setpoint value
KA = control variable between 0 ... 1.0 (between ME and MS)

Example: Change-over function over a curve cycle



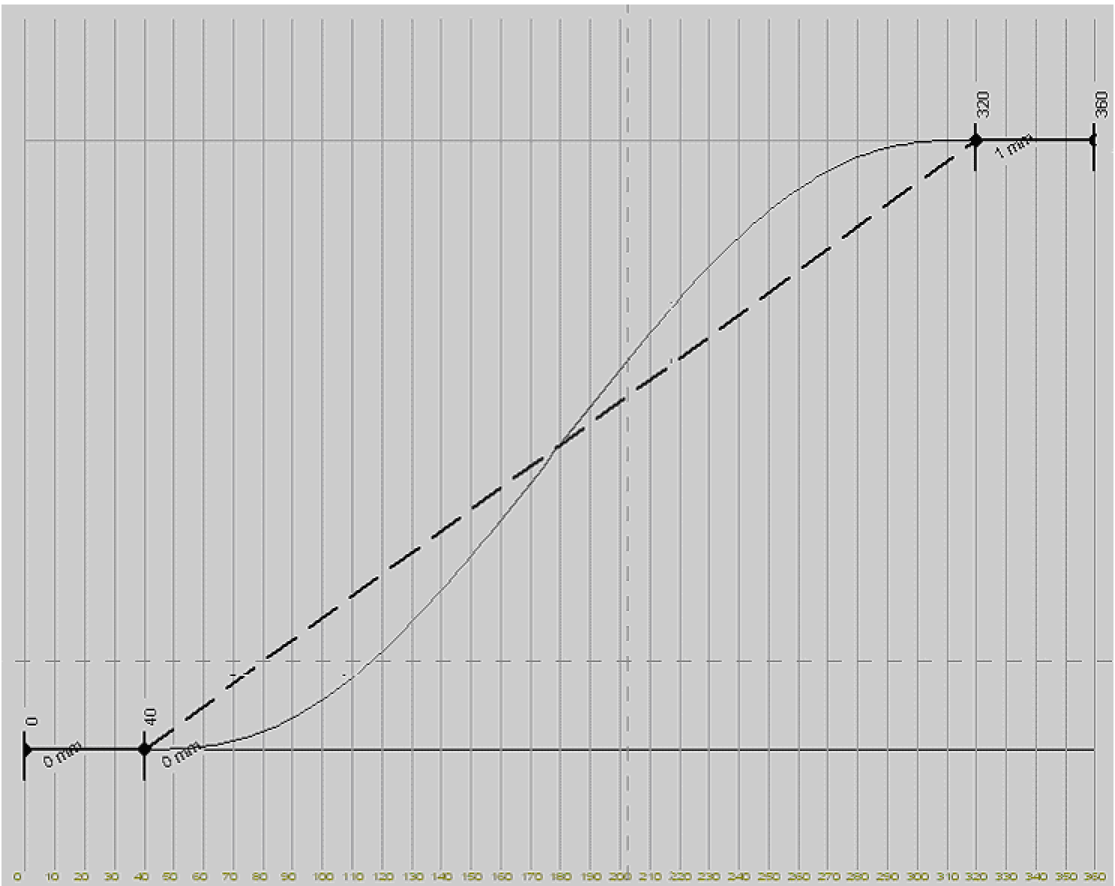
SS: Slave synchronization position
Sa: current slave position before start of curve
ME: Master coupling position = 30°
MS: Master synchronized position = 340°
MT: Master clock distance = 360°
ST: Slave clock distance
The slope (speed) of the coupling sequence shows a clear overspeeding in comparison with the synchronized run.

Example: Change-over function over several curve cycles



SS: Slave synchronization position
Sa: current slave position before start of curve
ME: Master coupling position = 60°
MS: Master synchronized position = 700°
MT: Master clock distance = 360°
ST: Slave clock distance
1: The slave setpoint value is reset at this position in the display.

Change-over function KE:



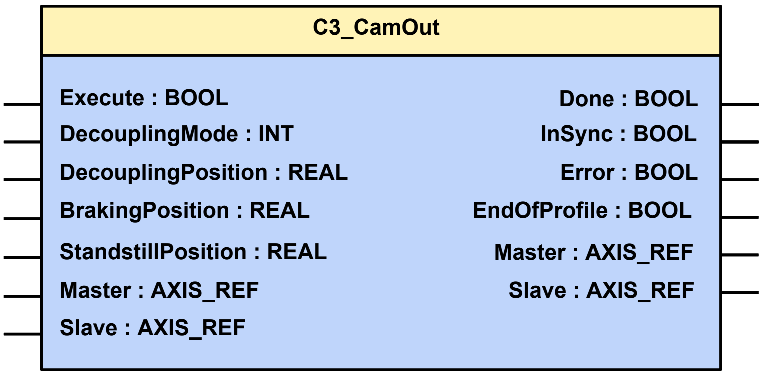
5.10.7.2 Exiting the active curve with coupling movement (C3_CamOut)

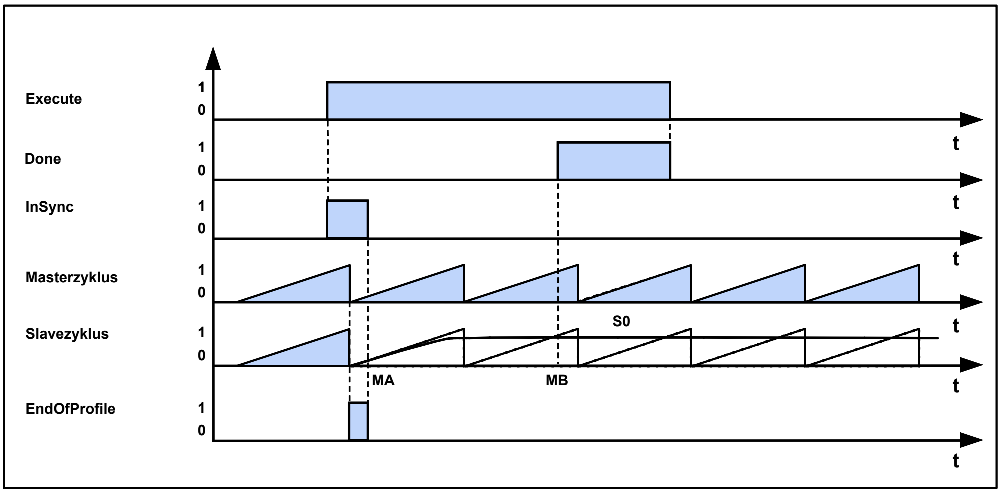
In this chapter you can read about:

FB name	C3_CamOut	
Decouple the active curve with adjustable coupling movement		
VAR_IN_OUT		
Master	INT	Axis ID; constant: AXIS_REF_LocalCam
Slave	INT	
VAR_INPUT		
Execute	BOOL	Activate the decoupling process with a positive edge
DecouplingMode	INT	0 = decoupling without coupling movement, after the master having traveled over the decoupling position MA in positive direction. (MB and S0 not relevant) 1 = decoupling via quadratic function; the master braking position (MB) is calculated 2 = decoupling via changeover function
DecouplingPosition	REAL	Master decoupling position in Master units (MA) Value range: 0 ... MT
BrakingPosition	REAL	Master braking position in master units (MB) (is taken into consideration with CouplingMode = 2 with CouplingMode = 1, the braking position is calculated). MB must be > than MA. Value range: 0 ... n*MT
StandstillPosition	REAL	Slave standstill position in Slave units (S0)
VAR_OUTPUT		
Done	BOOL	Decoupling complete
InSync	BOOL	Wait for decoupling position
Error	BOOL	Command aborted Error in the cam operation
EndOfProfile	BOOL	End of the curve cycle.

Note:

- Decoupling is not possible during coupling.
- Master decoupling position (MA) and Master braking position (MB)
  - With DecouplingMode 0: MA is taken into consideration, MB not relevant.
  - With DecouplingMode 1: MA is taken into consideration; MB is calculated.
  - With DecouplingMode 2: MA is taken into consideration; MB is taken into consideration.
- The Slave standstill position is not taken into consideration with DecouplingMode = 0.
- With DecouplingMode =1 the curve must be constantly rising at the Master decoupling position (MA).
- if the master runs backwards after the beginning of the decoupling movement, the curve is accessed again after reaching the decoupling position.
- With changeover, the decoupling function depends on the current curve.
- The relevant master position for ecoupling position and braking position is object 3030.24.
- In the event of error message 0xFFE2: Error in the IEC61131-3 program sequence. Function module was called with incorrect parameters. DecouplingMode=2 and BrakingPosition <= DecouplingPosition





Example with DecouplingMode = 1 and C3_CamTableSelect: Periodic = TRUE.

Direct decoupling (CouplingMode = 0)

With direct decoupling, the curve operation is immediately terminated with the Execute.
In order to avoid speed jumps, the master should be at a standstill during direct decoupling or should be decoupled at a point, where the slope iss 0 (constant slave position).

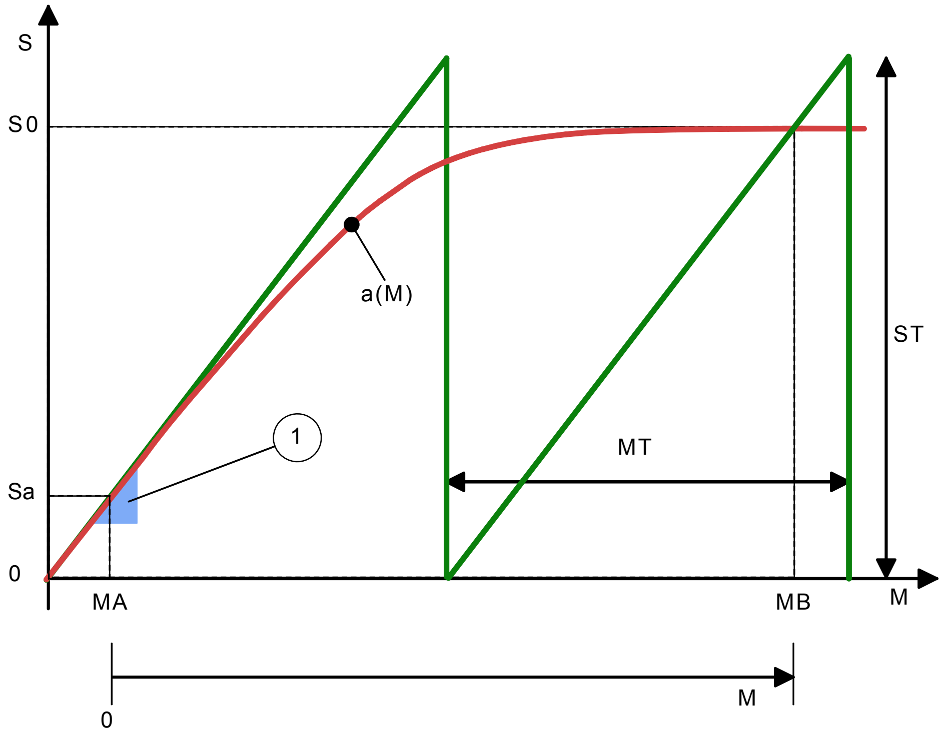
Quadratic decoupling (CouplingMode = 1)

The quadratic decoupling results in a quadratic position course of the slave axis without velocity superelevation:

The braking position (MB) is calculated from the slope of the curve at the decoupliing point and the standstill position (S0) so that a quadratic position course is the result.
If the standstill position is smaller than the slave position at the beginning of the decoupling, the decoupling movement will only be terminated in the following cycle. For this, there **must** be a positive slope (gradient) at the decoupling position. The master speed must be positive, i.e. the master position must be rising.

Decoupling over several master clock distances

If the slope (gradient) of the curve in the decoupling point is very flat, the decoupling sequence will take several master clock distances.



S0: Slave standstill position
Sa: Slave position at the master decoupling position
MA: Master decoupling position
MB: Master braking position
MT: Master clock distance
ST: Slave clock distance
a(M): quadratic decoupling function
1: gradient triangle: determines the duration of the decoupling sequence (the steeper, the faster is the coupling sequence)

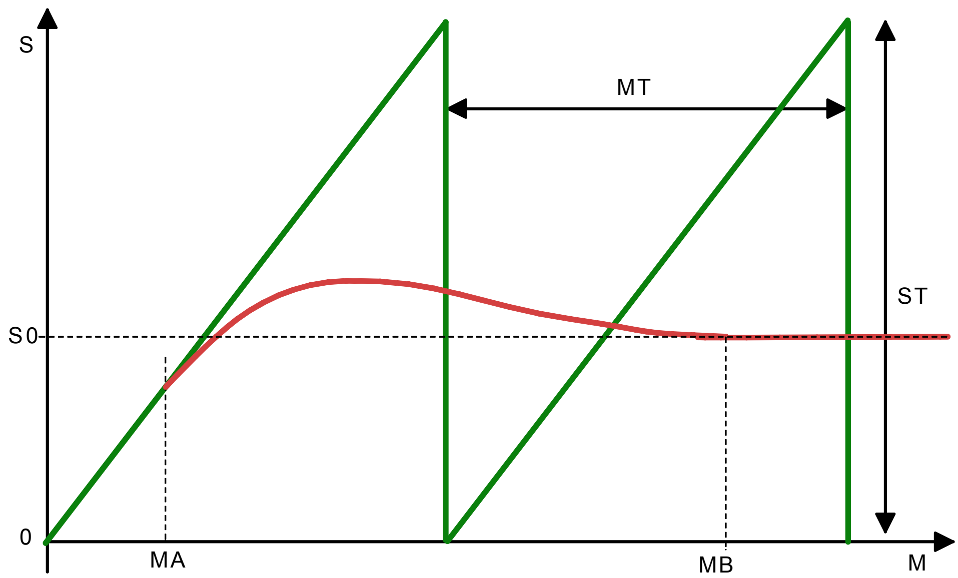
Decoupling with change-over function (CouplingMode = 2)

The standstill position is continually displayed during decoupling, while the curve is continually hidden.
Overspeeding and pull-out movement are possible.
By the specification of the master-related decoupling and braking position in master units, the decoupling curve is mapped on any length of the curve.

Algorithm of the change-over function

The normalized coupling function corresponds to the coupling function, but it is run trough in inverse direction during decoupling. It provides factor KA, which is used for the weighting.
The course of the decoupling curve depends on the standstill position and the course of the curve in synchronized operation.
The weighting is made according to the following function:
decoupling curve = SK * KA + S0 * (1 – KA)
with:
S0 = standstill position
SK = current curve setpoint value
KA = control variable between 1.0 ... 0 (between MA and MB)

Example: Decoupling with the changeover-function



S0: Slave standstill position
MA: Master decoupling position = 60°
MB: Master braking position 680°
MT: Master clock distance = 360°
ST: Slave clock distance

5.10.8. 10 Steps for cam generation

In this chapter you can read about:

Example:

- Electronic Cam with 2 standstill areas,
- Master signal is the internal virtual master.

5.10.8.1 Step 1: C3 ServoManager

- Install Compax3 ServoManager (Compax3-CD 840-100005) on your PC (it is recommended to un-install all previous versions beforehand).
- Install CamDesigner (Compax3-CD 840-100005).
- You need a RS232 cable (SSK1/xx) for the connection PC - Compax3 X10.

5.10.8.2 Step 2: Connect motor.

- Motor cable to Compax3 X3
- Feedback cable to Compax3 X13.

5.10.8.3 Step 3: Supply & I/O wiring

- AC supply (1 or 3 phase) to X1
- DC supply to X4
- Device enable by 24VDC on X4/Pin3
- The following digital inputs must be assigned:

Input 0 - Pin X12/6	24V = Enable of the power output stage
Input 1 - Pin X12/7	24V = Start machine zero
Input 2 - Pin X12/8	24V = Start virtual master 0V = Stop virtual master
Input 4 - Pin X12/10	24V = select and start curve
Input 5 - Pin X12/12	24V = curve coupling
Input 6 - Pin X12/13	24V = curve decoupling
Input 7 - Pin X12/14	24V = Reset (ackn.)

5.10.8.4 Step 4: RS232 connection & C3 ServoManager

- Establish RS232 connection (cable SSk1/xx) between PC and C3 X10.
- Start C3 ServoManager

5.10.8.5 Step 5: Set Compax3 device type

- Compax3 device selection wizard, select type

or

- Type online identification

5.10.8.6 Step 6: Configuration

Start configuration in the C3 ServoManager and configure Compax3.

- Set motor
- Braking Resistor
- External moment of inertia
- Reference System
  - Unit: Degrees
  - Travel distance per motor revolution numerator = 360°
  - Travel distance per revolution – Denominator = 1
  - Reset distance numerator = 360°
  - Reset distance denominator = 1
- Machine zero = mode 34
- Limit switch
- Jerk / Ramps
- Monitoring / Limits: Following error to 5°
- Encoder Simulation
- Variable (Recipe) List

5.10.8.7 Step 7: Selecting Master signal source

- Open entry of signal source (left side of the tree)
- Select master signal source: virtual Master
- Enter units and reset distance (360°)
- Rs485 settings

load configuration into Compax3.

5.10.8.8 Step 8: Generating the cam

Call up/process curve with the aid of the CamEditor

- Enter axis name
- Select signal source of virtual master
- Enter number of interpolation points: 360
- Enter motion law: dwell-to-dwell: ”Modified Sine Line according to Neklutin”
- Start CamDesigner
- Under Menu File: New sequence. Select axis name
- Add 2 standstill areas: 0/360; 0/310; 50/360 (Path coordinate/clock angle)
- View path-time-diagram and optimize curve if needs be
- End CamDesigner via Menu:File:End
- Download of the curve into Compax3

5.10.8.9 Step 9: Create IEC program

- Start IEC development environment (in the tree on the left side under Programming: IEC61131-3 development environment
- File, enter new project name
- Set target system: CoDeSys for C3 T40
- Open program example "cd\exambles\10StepsToCam" in CFC.
- Save project
- Project translate everything
- Download of the IEC program into Compax3 (in the C3 ServoManager in the tree on the left side under Download: IEC61131-3)

5.10.8.10 Step 10: Starting and monitoring cam

Input 0 - Pin X12/6	24V = energize Compax3
Input 1 - Pin X12/7	24V = Starting the homing run
Input 2 - Pin X12/8	24V = Start virtual master
	0V = Stop virtual master
Input 4 - Pin X12/10	24V = select and start curve
Input 5 - Pin X12/12	24V = curve coupling
Input 6 - Pin X12/13	24V = curve decoupling
Input 7 - Pin X12/14	24V = Reset (ackn.)

Control status values in the IEC61131-3 - Debugger or in the oscilloscope (optimization window) (e. g. C3Cam.STATUSMASTER_Position, ...)

5.10.9. Cam applications

In this chapter you can read about:

You will find the applications described below as CoDeSys project on the Compax3 CD in the "\Examples" file.

Th following application descriptions can also be found on the CD in the "\Examples" file:

C3T40_A1003	Cutting on the fly with Start/Stop operating mode, registration mark reference, separation function, phase correction
C3T40_A1004	Flying knife with fixed blade circumference and variable product length
C3T40_A1005	Sync gate, registration mark reference, synchronous motion, automatic or manual travel back to start position.
C3T40_A1007	PID controller for IEC61131-3; operating P, PD, PI, PID are possible
C3T40_A1015	Gearing with Stop/Start and Phase correction

The ZIP files contain the german and english description as well as the related projects.

5.10.9.1 Example 1: Single start of a closed cam

Task:

- Closed cam (forwards and backwards) with standstill area at the beginning and at the end.
- Digital input starts run through curve once.
- Connection to virtual master.

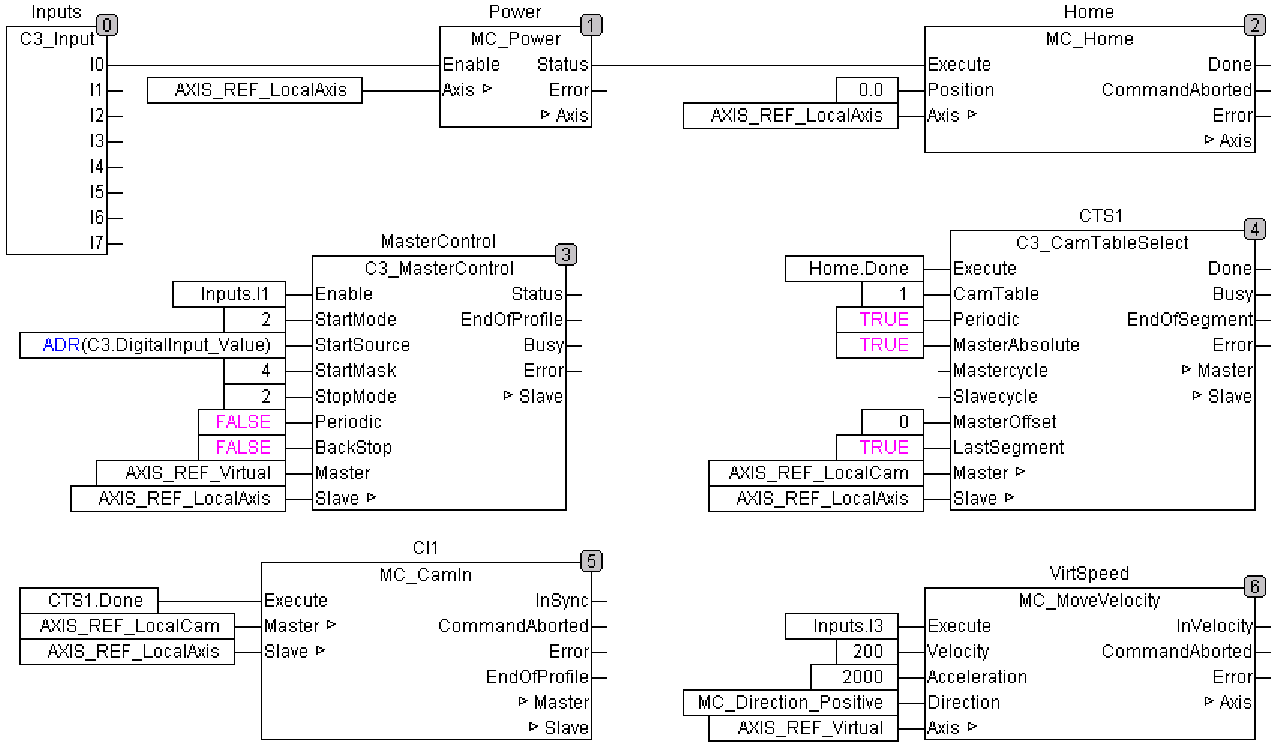
Corresponding files:

CamExample01.C3P (Compax3 project on the Compax3 CD:\Examples\Example1)
CamExample01.pro (CoDeSys project on the Compax3 CD:\Examples\Example1)

Control interface:

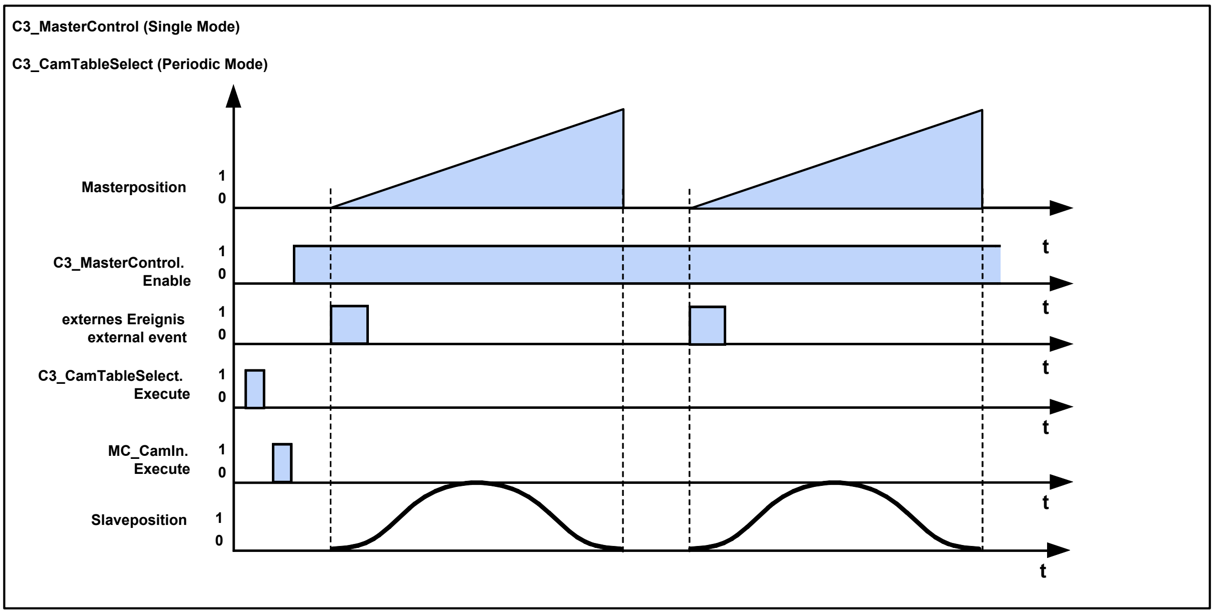
Input	Function
I0	Energize axis, homing, curve generator, starting and coupling axis
I1	Enable master detection
I2	Starting detection in single mode
I3	Start of the virtual master
I4	Free
I5	Free
I6	Free
I7	Free

Solution:


Inputs
C3_Input
I0
I1
I2
I3
I4
I5
I6
I7
Power
MC_Power
Enable
Axis
Status
Error
Axis
AXIS_REF_LocalAxis
Home
MC_Home
Execute
Position
Axis
Done
CommandAborted
Error
Axis
0.0
AXIS_REF_LocalAxis
MasterControl
C3_MasterControl
Inputs.I1
2
ADR(C3.DigitalInput_Value)
4
2
FALSE
FALSE
AXIS_REF_Virtual
AXIS_REF_LocalAxis
Enable
StartMode
StartSource
StartMask
StopMode
Periodic
BackStop
Master
Slave
Status
EndOfProfile
Busy
Error
Slave
CTS1
C3_CamTableSelect
Home.Done
1
TRUE
TRUE
0
TRUE
AXIS_REF_LocalCam
AXIS_REF_LocalAxis
Execute
CamTable
Periodic
MasterAbsolute
Mastercycle
Slavecycle
MasterOffset
LastSegment
Master
Slave
Done
Busy
EndOfSegment
Error
Master
Slave
CI1
MC_CamIn
CTS1.Done
AXIS_REF_LocalCam
AXIS_REF_LocalAxis
Execute
Master
Slave
InSync
CommandAborted
Error
EndOfProfile
Master
Slave
VirtSpeed
MC_MoveVelocity
Inputs.I3
200
2000
MC_Direction_Positive
AXIS_REF_Virtual
Execute
Velocity
Acceleration
Direction
Axis
InVelocity
CommandAborted
Error
Axis

- The curve is activated after the homing run (Home.Done to CTS1).
- After that the axis is synchronized via CS1.Done at CI1. Now the master detection can be started.
- Input I1 enables the master acquisition, which will wait for the external event (Input I2)
  In order to do this, the C3_MasterControl module: is assigned to following value: ADR(C3.DigitalInput_Value).
  In order to select the 3rd bit from this value the input StartMask receives the value 4.
- The master acquisition runs in Single Mode and the curve generator (C3_CamTableSelect) in the Periodic, this means that the switch between the curve generator and detection is always closed, see in the **signal image** (see page 225). With the external event (input I2) a curve cycle is run through.

Signal image:



5.10.9.2 Example 2: Change between single start of an open cam and POSA

Task:

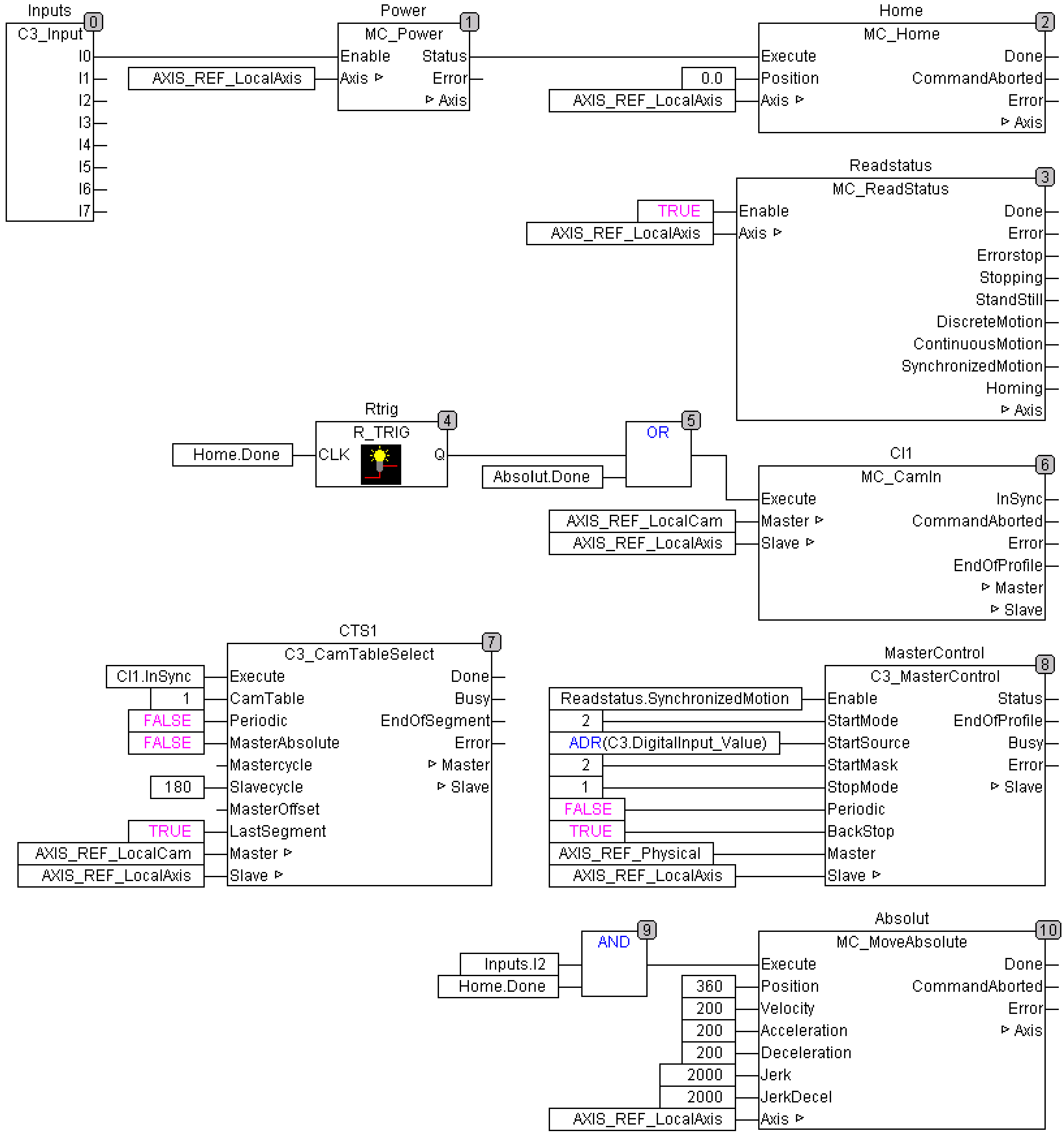
- Open curve with standstill range at the beginnning and at the end
- Digital input starts run through curve once
- Digital input starts positioning movement on slave cycle
- Connection to encoder

Corresponding files: CamExample02.C3P (Compax3 project on the Compax3 CD:\Examples\Example2)
CamExample02.pro (CoDeSys project on the Compax3 CD:\Examples\Example2)

Control interface:

Input	Function
I0	Energize axis, homing, curve generator, starting and coupling axis
I1	Starting detection in single mode
I2	Start of the absolute movement
I3	Free
I4	Free
I5	Free
I6	Free
I7	Free

Solution:


Inputs
C3_Input
I0
I1
I2
I3
I4
I5
I6
I7
Power
MC_Power
Enable
Status
Axis
Error
Axis
AXIS_REF_LocalAxis
Home
MC_Home
Execute
Done
Position
CommandAborted
Axis
Error
Axis
0.0
AXIS_REF_LocalAxis
Readstatus
MC_ReadStatus
TRUE
AXIS_REF_LocalAxis
Enable
Axis
Done
Error
Errorstop
Stopping
StandStill
DiscreteMotion
ContinuousMotion
SynchronizedMotion
Homing
Axis
Rtrig
R_TRIG
Home.Done
CLK
Q
OR
Absolut.Done
CI1
MC_CamIn
Execute
InSync
Master
CommandAborted
Slave
Error
EndOfProfile
Master
Slave
AXIS_REF_LocalCam
AXIS_REF_LocalAxis
CTS1
C3_CamTableSelect
CI1.InSync
1
FALSE
FALSE
180
TRUE
AXIS_REF_LocalCam
AXIS_REF_LocalAxis
Execute
CamTable
Periodic
MasterAbsolute
Mastercycle
Slavecycle
MasterOffset
LastSegment
Master
Slave
Done
Busy
EndOfSegment
Error
Master
Slave
MasterControl
C3_MasterControl
Readstatus.SynchronizedMotion
2
ADR(C3.DigitalInput_Value)
2
1
FALSE
TRUE
AXIS_REF_Physical
AXIS_REF_LocalAxis
Enable
StartMode
StartSource
StartMask
StopMode
Periodic
BackStop
Master
Slave
Status
EndOfProfile
Busy
Error
Slave
AND
Inputs.I2
Home.Done
Absolut
MC_MoveAbsolute
360
200
200
200
2000
2000
AXIS_REF_LocalAxis
Execute
Position
Velocity
Acceleration
Deceleration
Jerk
JerkDecel
Axis
Done
CommandAborted
Error
Axis

Explanation:

- The repeated turning up of the single start during the run through curve must not disturb the operation.
- Single start during positioning must not disturb, curve must not start: This is prevented by the fact that the enable of the master position detection is only started, if the drive is in the "Synchronized Motion" state.
- If a positioning is executed, the axis is in the "discrete Motion" state. When MC-CamIn is executed, the axis will switch into the "Synchronized Motion" state; the axis is now synchronous with the curve generator.
- Master detection is started with an external event (input I1).
  In order to do this the C3_MasterControl module: is assigned to following value: ADR(C3.DigitalInput_Value = object for the digital inputs).
  In order to select the 2nd bit from this value the input StartMask receives the value 2.
- The axis is coupled after Homing (MC_CamIn), then the curve generator (C3_CamTableSelect) starts, after that the master position acquisition is started via the external input (C3_MasterControl).
  As the output Home.Done is permanently present, this output must be put to CI1 with an edge module. This ensures that CI1 (MC_CamIn) can be activated again.
- The absolute movement is not executed in the "Synchronized Motion " status (MC_MoveAbsolut reports an error), so this is automatically blocked.

5.10.9.3 Example 3: Single Start for run through curve 5 times

Task:

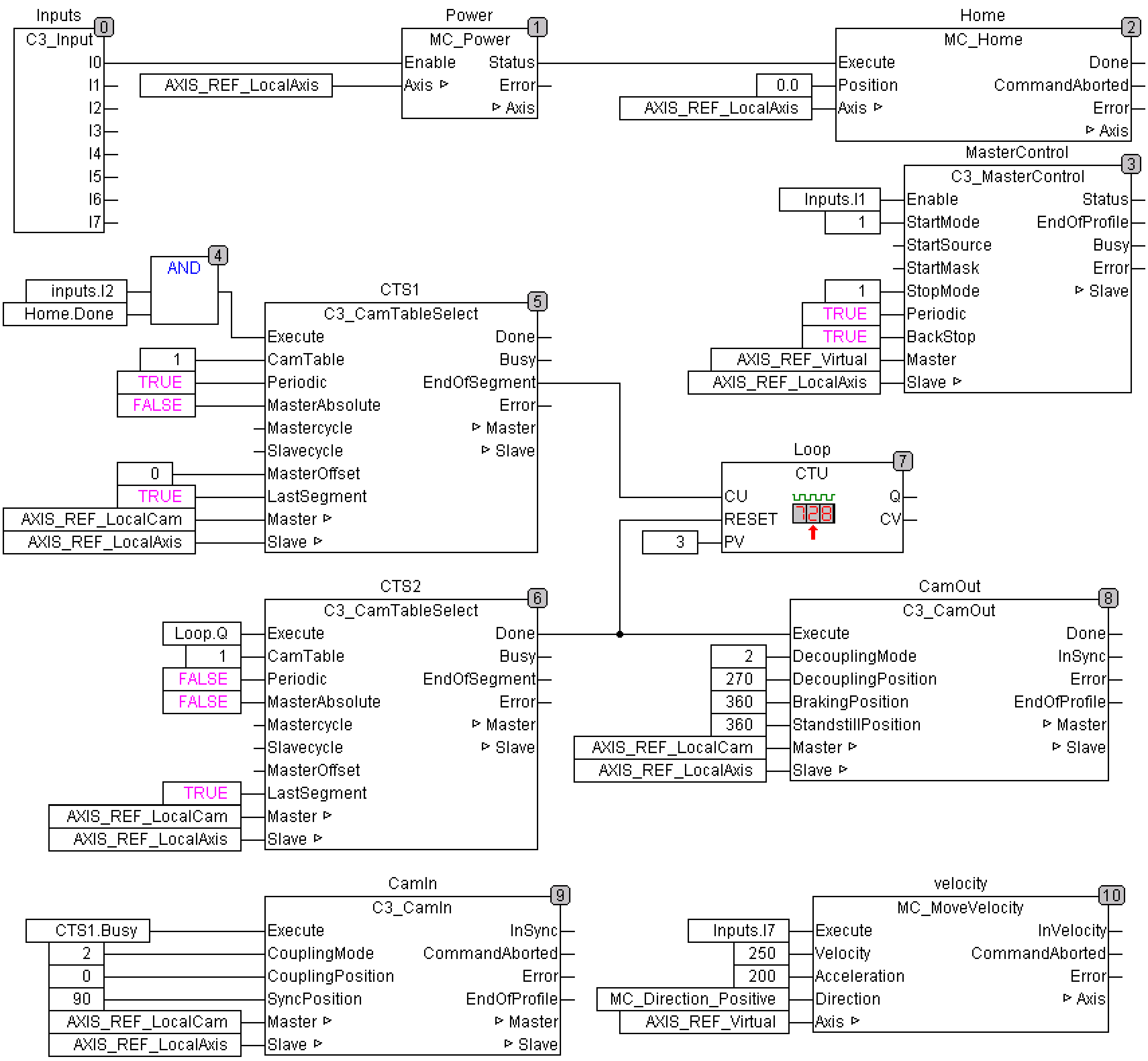
- Open curve without standstill area
- Coupling / decoupling with change-over function
- Digital input for the start of 5 curve cycles (incl coupling and decoupling cycle)

Corresponding files: CamExample03.C3P (Compax3 project on the Compax3 CD:\Examples\Example3)
CamExample03.pro (CoDeSys project on the Compax3 CD:\Examples\Example3)

Control interface:

Input	Function
I0	Energize axis, Homing
I1	Enable and start of the master position detection
I2	Start of the curve cycle
I3	Free
I4	Free
I5	Free
I6	Free
I7	Start of the virtual master

Solution:



Explanation:

- Coupling from 0 on (CamIn.CouplingPosition = 0), decoupling on 360° (CamOut.StandstillPosition = 360°).
- The curve generator (C3_CamTableSelect) is started in relative Mode with the Input I2.
- with MasterOffset = 0, the next zero crossing is waited for if the master is already running.
- The busy output of CTS1 starts the coupling sequence before the selected curve is active. Only if the master position has exceeded the value 0 (CTS1.MasterOffset = 0, CTS1.MasterAbsolute = TRUE), the curve starts to run and CTS1.Done will become TRUE.
- After the 3rd impulse "EndOfSegment" of the C3_CamTableSelect module, the 4th curve is already running. The change of cam to the single mode is then triggered with the counter module. This will become active at the end of the 4th curve, so that the curve is run through 5 times.
- If the change to the 5th curve cycle has been executed, the Done output will come to this module (CTS2), which will trigger the decoupling sequence.

5.10.9.4 Example 4: Composing curves

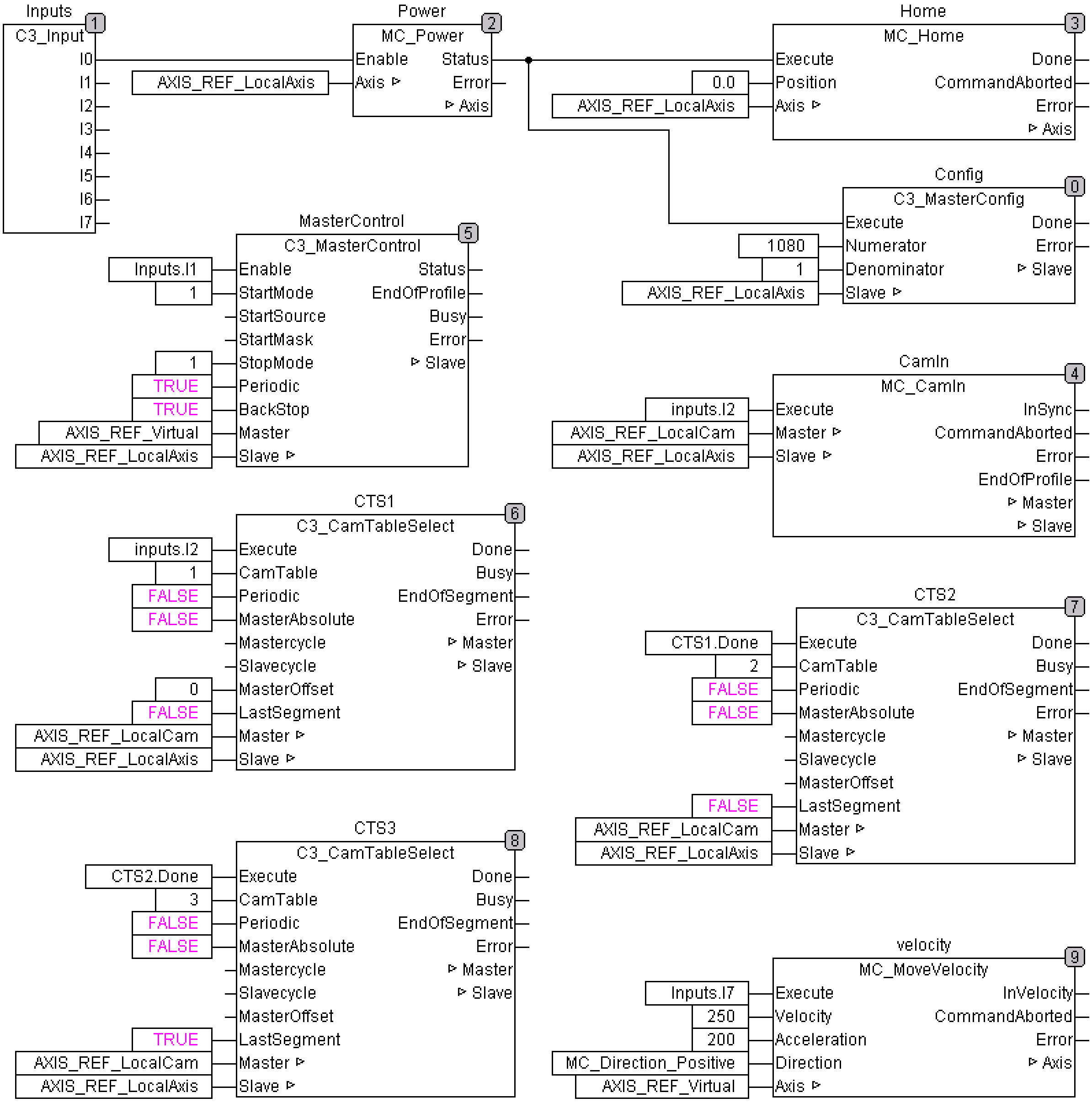
- 3 curves (ramp-up curve, straight line, ramp-down curve) with the same master clock distance
- digital input for single start of a curve sequence, after that standstill until the repeated start of the 3-curve sequence.

Corresponding files:
CamExample04.C3P (Compax3 project on the Compax3 CD:\Examples\Example4)
CamExample04.pro (CoDeSys project on the Compax3 CD:\Examples\Example4)

Control interface:

Input	Function
I0	Energize axis, Homing
I1	Enable and start of the master position detection
I2	Coupling and curve start
I3	Free
I4	Free
I5	Free
I6	Free
I7	Start of the virtual master

Solution:

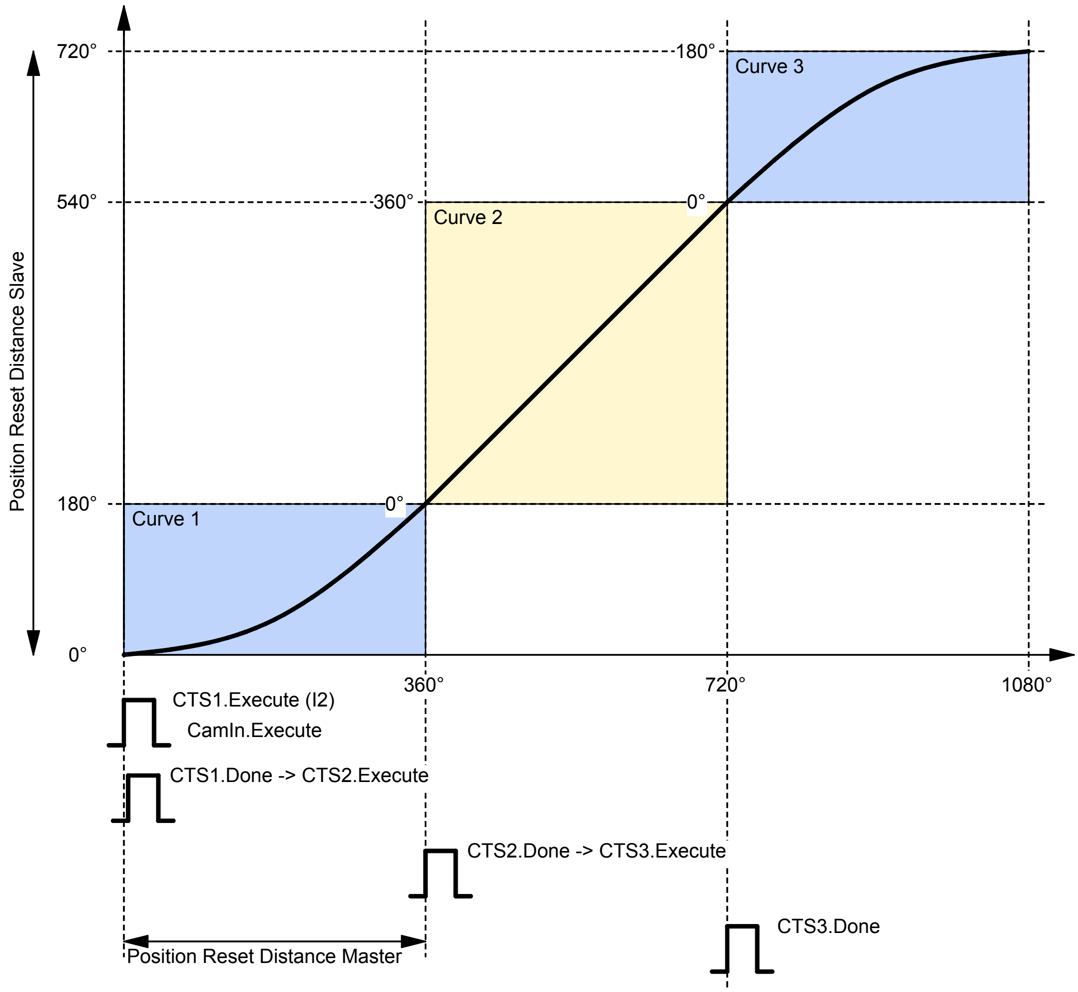


Inputs
C3_Input
I0
I1
I2
I3
I4
I5
I6
I7
Power
MC_Power
Enable
Status
Axis
Error
Axis
AXIS_REF_LocalAxis
Home
MC_Home
Execute
Done
Position
CommandAborted
Axis
Error
Axis
0.0
AXIS_REF_LocalAxis
Config
C3_MasterConfig
Execute
Done
Numerator
Error
Denominator
Slave
Slave
1080
1
AXIS_REF_LocalAxis
MasterControl
C3_MasterControl
Inputs.I1
1
1
TRUE
TRUE
AXIS_REF_Virtual
AXIS_REF_LocalAxis
Enable
Status
StartMode
EndOfProfile
StartSource
Busy
StartMask
Error
StopMode
Slave
Periodic
BackStop
Master
Slave
CamIn
MC_CamIn
inputs.I2
AXIS_REF_LocalCam
AXIS_REF_LocalAxis
Execute
InSync
Master
CommandAborted
Slave
Error
EndOfProfile
Master
Slave
CTS1
C3_CamTableSelect
inputs.I2
1
FALSE
FALSE
0
FALSE
AXIS_REF_LocalCam
AXIS_REF_LocalAxis
Execute
Done
CamTable
Busy
Periodic
EndOfSegment
MasterAbsolute
Error
Mastercycle
Master
Slavecycle
Slave
MasterOffset
LastSegment
Master
Slave
CTS2
C3_CamTableSelect
CTS1.Done
2
FALSE
FALSE
FALSE
AXIS_REF_LocalCam
AXIS_REF_LocalAxis
Execute
Done
CamTable
Busy
Periodic
EndOfSegment
MasterAbsolute
Error
Mastercycle
Master
Slavecycle
Slave
MasterOffset
LastSegment
Master
Slave
CTS3
C3_CamTableSelect
CTS2.Done
3
FALSE
FALSE
TRUE
AXIS_REF_LocalCam
AXIS_REF_LocalAxis
Execute
Done
CamTable
Busy
Periodic
EndOfSegment
MasterAbsolute
Error
Mastercycle
Master
Slavecycle
Slave
MasterOffset
LastSegment
Master
Slave
velocity
MC_MoveVelocity
Inputs.I7
250
200
MC_Direction_Positive
AXIS_REF_Virtual
Execute
InVelocity
Velocity
CommandAborted
Acceleration
Error
Direction
Axis
Axis
1
2
3
0
5
4
6
7
8
9

Explanation:

- The entire curve line is 720° long, the reset distance in the slave axis configuration stands on 720° (Configuration: Reference system).
- The change of cams is triggered with the Done of the curve activated before (CTS1 ... CTS3). The Done output follows, if the change into the respective curve has been executed.
- The axis is synchronized with input I2 (CamIn) and at the same time the curve generator (CTS1) is started.1
  This ensures that no increments are lost with running master.

Design of a curve:



Position Reset Distance Slave: Reset distance slave
Position Reset Distance Master: Reset distance Master = time axis in the Cam Designer

5.10.9.5 Example 5: Cyclic operation with event-triggered change of curve

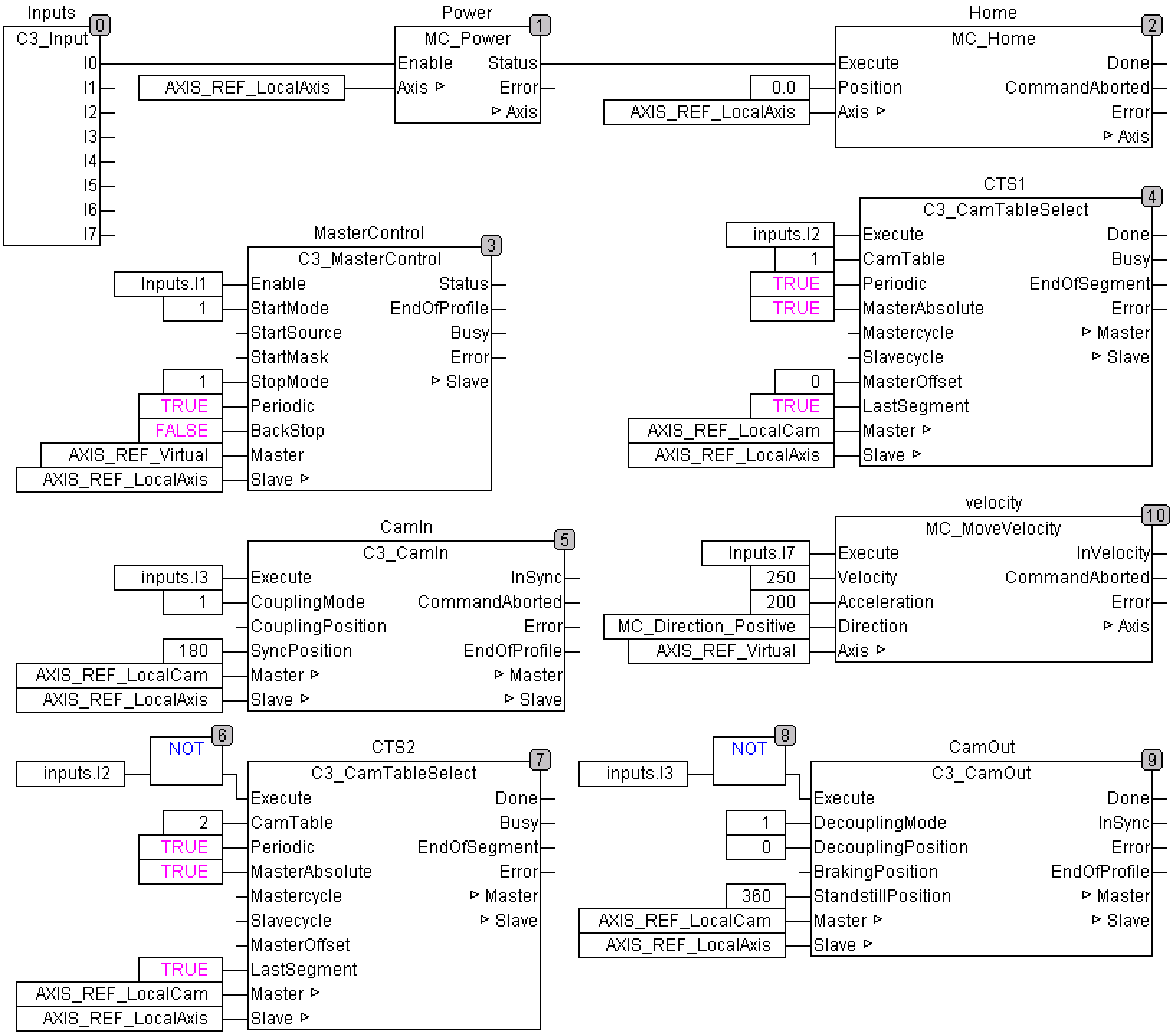
- 2 curves with the same clock distances: S-curve without standstill area and straight line
- digital input for quadratic coupling and decoupling
- digital input for switching of curve
- Master reference must be kept with exactly the same increments during the change
- The master position acquisition must continue in decoupled state

Corresponding files: CamExample05.C3P (Compax3 project on the Compax3 CD:\Examples\Example5)
CamExample05.pro (CoDeSys project on the Compax3 CD:\Examples\Example5)

Control interface:

Input	Function
I0	Energize axis, Homing
I1	Enable and start of the master position detection
I2	Selection of cam
I3	Coupling / Decoupling
I4	Free
I5	Free
I6	Free
I7	Start of the virtual master

Solution:



Explanations:

- Via Input I2 either curve 1 (CTS1) or curve 2 (CTS2) is activated, both in the absolute mode (MasterAbsolute=TRUE).
- The detection starts with I1 (MasterControl).
- Coupling in takes place with rising edge of I3, decoupling takes place with falling edge of I3.

5.10.9.6 Example 6: Operation with curve segments and standstill area

- Via a master cycle, a slave feed with following standstill is to take place from a master position of 30° on; from a master position of 230° on, the slave is to return. This sequence is to be repeated cyclically.

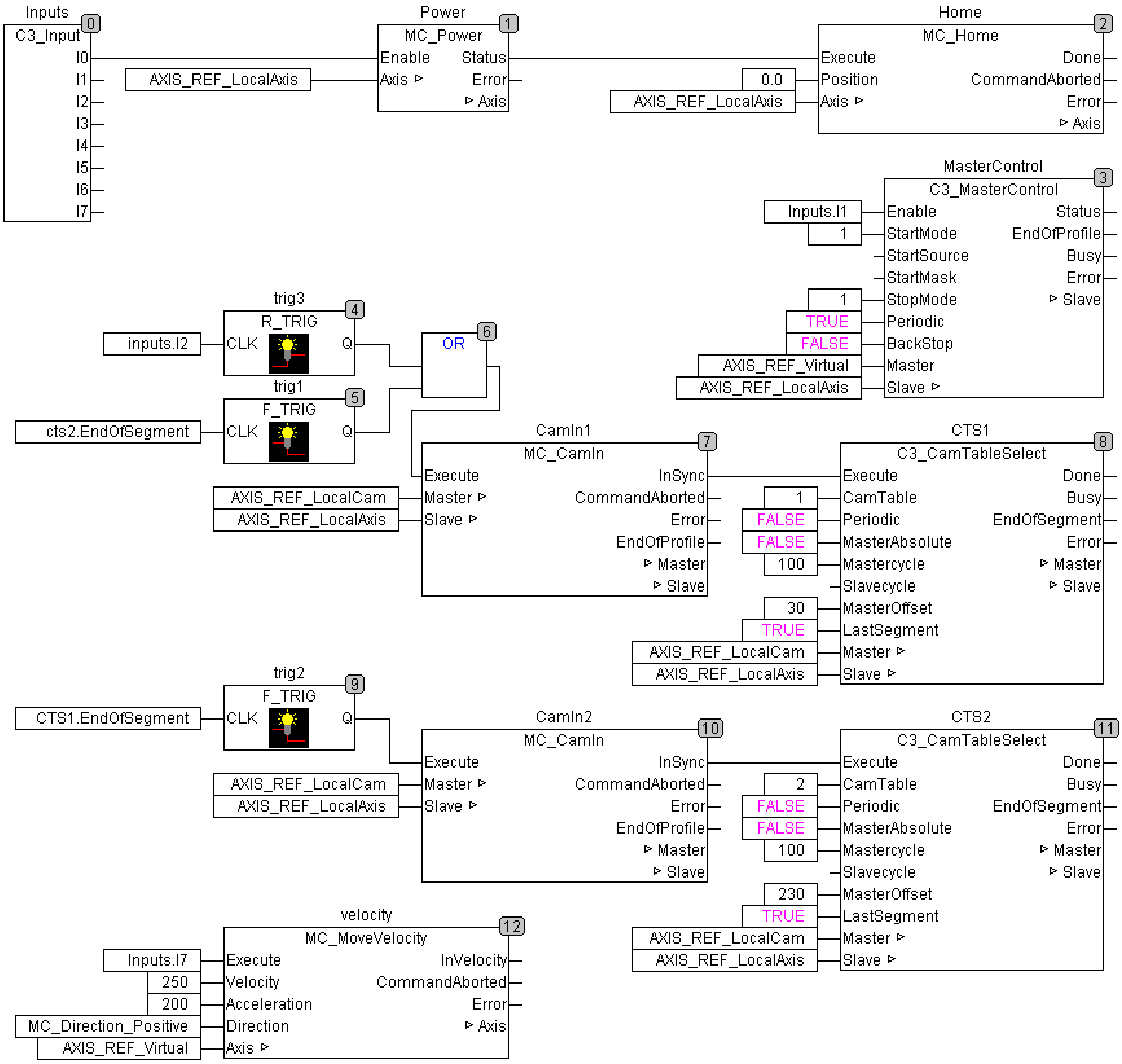
Corresponding files:

CamExample06.C3P (Compax3 project on the Compax3 CD:\Examples\Example6)
CamExample06.pro (CoDeSys project on the Compax3 CD:\Examples\Example6)

Control interface:

Input	Function
I0	Energize axis, Homing
I1	Enable and start of the master position detection
I2	Start of the curve cycle
I3	Free
I4	Free
I5	Free
I6	Free
I7	Start of the virtual master

Solution:


Inputs
C3_Input
I0
I1
I2
I3
I4
I5
I6
I7
Power
MC_Power
Enable
Status
Axis
Error
Axis
AXIS_REF_LocalAxis
Home
MC_Home
Execute
Done
Position
CommandAborted
Axis
Error
Axis
0.0
AXIS_REF_LocalAxis
MasterControl
C3_MasterControl
Inputs.I1
Enable
Status
1
StartMode
EndOfProfile
StartSource
Busy
StartMask
Error
1
StopMode
Slave
TRUE
Periodic
FALSE
BackStop
AXIS_REF_Virtual
Master
AXIS_REF_LocalAxis
Slave
trig3
R_TRIG
inputs.I2
CLK
Q
OR
trig1
F_TRIG
cts2.EndOfSegment
CLK
Q
CamIn1
MC_CamIn
Execute
InSync
AXIS_REF_LocalCam
Master
CommandAborted
AXIS_REF_LocalAxis
Slave
Error
EndOfProfile
Master
Slave
CTS1
C3_CamTableSelect
Execute
Done
1
CamTable
Busy
FALSE
Periodic
EndOfSegment
FALSE
MasterAbsolute
Error
100
Mastercycle
Master
Slavecycle
Slave
30
MasterOffset
TRUE
LastSegment
AXIS_REF_LocalCam
Master
AXIS_REF_LocalAxis
Slave
trig2
F_TRIG
CTS1.EndOfSegment
CLK
Q
CamIn2
MC_CamIn
Execute
InSync
AXIS_REF_LocalCam
Master
CommandAborted
AXIS_REF_LocalAxis
Slave
Error
EndOfProfile
Master
Slave
CTS2
C3_CamTableSelect
Execute
Done
2
CamTable
Busy
FALSE
Periodic
EndOfSegment
FALSE
MasterAbsolute
Error
100
Mastercycle
Master
Slavecycle
Slave
230
MasterOffset
TRUE
LastSegment
AXIS_REF_LocalCam
Master
AXIS_REF_LocalAxis
Slave
velocity
MC_MoveVelocity
Inputs.I7
Execute
InVelocity
250
Velocity
CommandAborted
200
Acceleration
Error
MC_Direction_Positive
Direction
Axis
AXIS_REF_Virtual
Axis

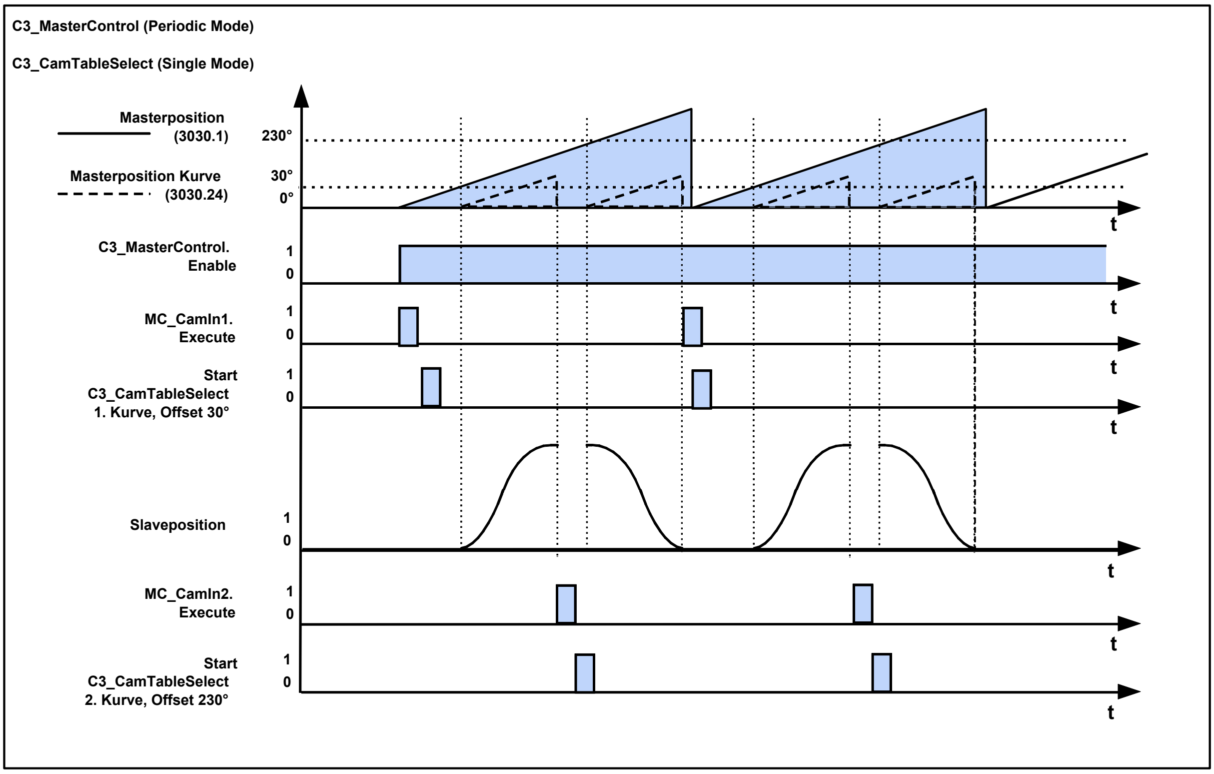
Boundary conditions:

- After the coupling of the axis, the curve generator (CST1) is started in relative mode with an offset of 30°.
  The start of the curve takes only place, if a master position of 30° is reached.
- The feed takes place via 100 master degrees (C3_CamTableSelect module): Mastercycle = 100).
- With the falling edge of EndofSegment of the CamTableSelect module (CTS1), the next movement will be triggered via CamIn2.
- CamIn2 will start via "InSynch" the 2nd C3_CamTableSelect (CTS2), whose curve will reset the slave to its previous position via the master position range between 100° and 230°.
- The sequence can be repeated with "EndofSegment" of this module.

Special feature:

- In this example, the curve shall be run through entirely, therefore MC_CamIn is started before C3_CamTableSelect. This is only possible with MC_CamIn.

Signal image:



5.10.9.7 Example 7: Curve operation with slave reg synchronization

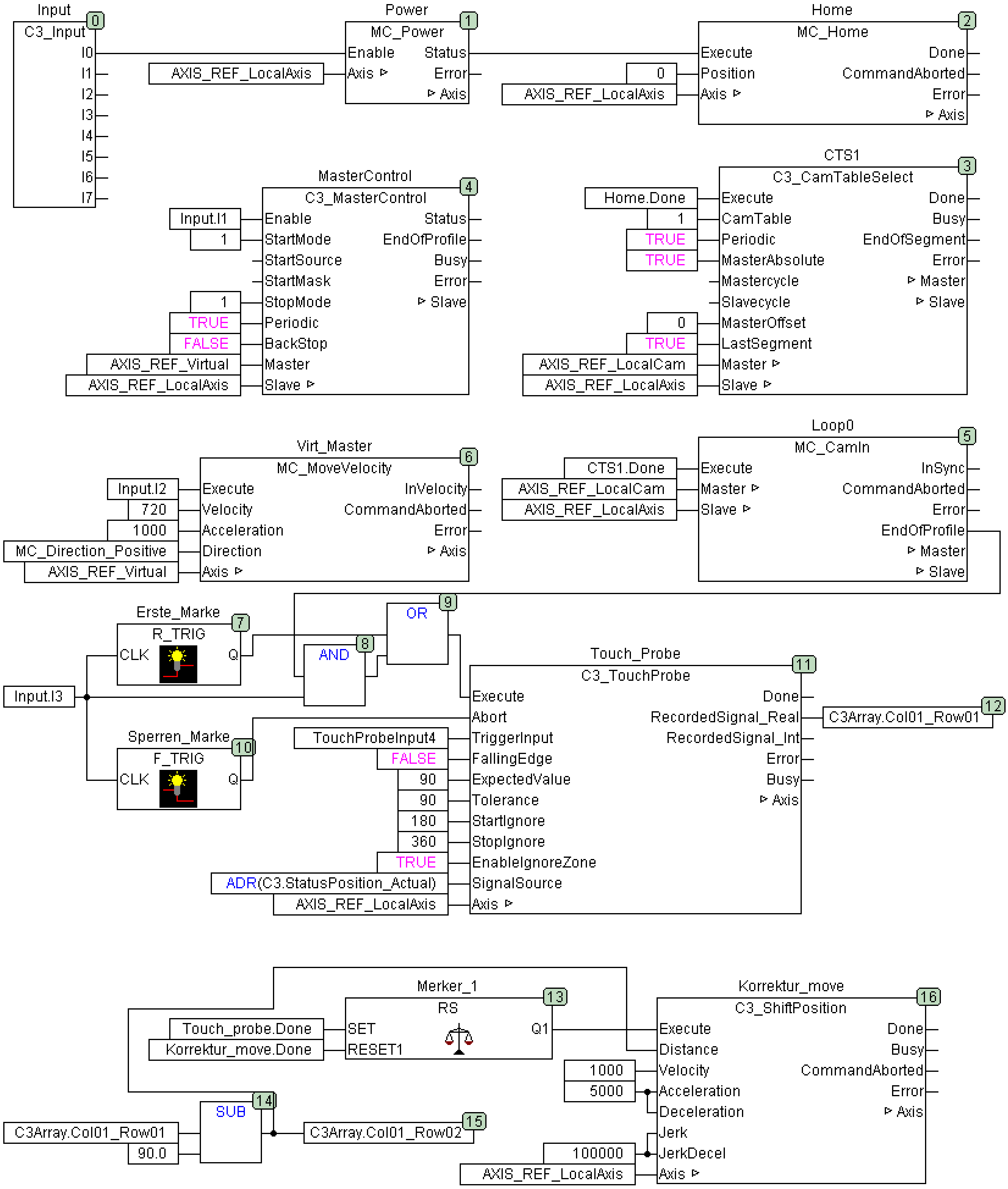
The slave position in the curve mode is to be corrected in dependance of a registration mark: Slave-oriented reg synchronization.

Corresponding files: Slave_Markenkorrektur_Example.C3P (Compax3 Project auf Compax3 CD:\Examples\Example7)
Slave_Markenkorrektur_Example.pro (CoDeSys Project on the Compax3 CD:\Examples\Example7)

Control interface:

Input	Function
I0	Energize axis, homing, select curve, starting and coupling axis (static)
I1	Enable and start of the master position acquisition (static)
I2	Start virtual master
I3	Reg enable (static)
I4	Reg input (edge)
I5	Free
I6	Free
I7	Free

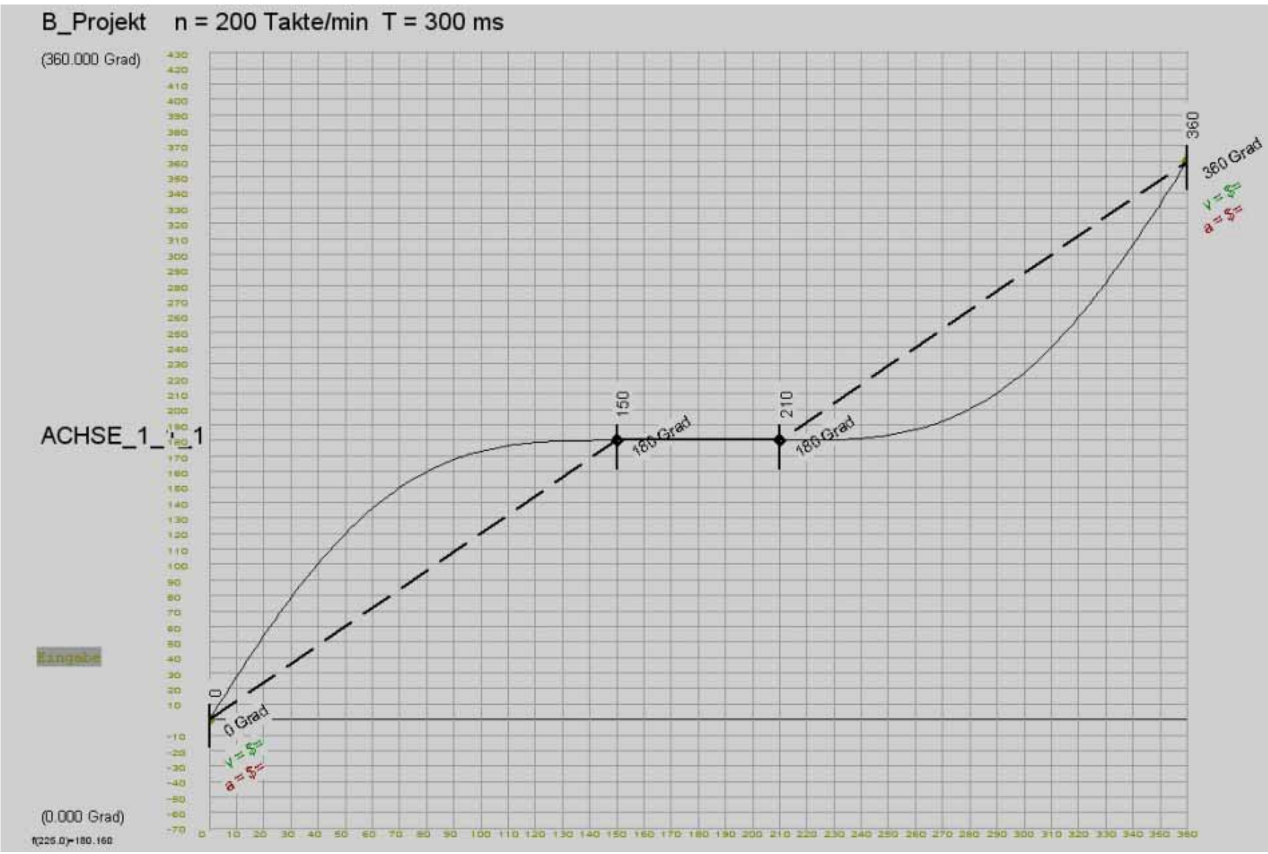
Solution:


Input
C3_Input
Power
MC_Power
Home
MC_Home
AXIS_REF_LocalAxis
MasterControl
C3_MasterControl
CTS1
C3_CamTableSelect
Home.Done
TRUE
FALSE
AXIS_REF_Virtual
AXIS_REF_LocalCam
Virt_Master
MC_MoveVelocity
Loop0
MC_CamIn
CTS1.Done
MC_Direction_Positive
Erste_Marke
R_TRIG
OR
AND
Touch_Probe
C3_TouchProbe
Input.I3
Sperren_Marke
F_TRIG
TouchProbeInput4
C3Array.Col01_Row01
ADR(C3.StatusPosition_Actual)
Merker_1
RS
Korrektur_move
C3_ShiftPosition
Touch_probe.Done
Korrektur_move.Done
SUB
C3Array.Col01_Row02

Boundary conditions:

- Setpoint position of the registration mark: 90°
- Ignore zone of the reg detection: 180° - 360°

curve



5.10.9.8 Example 8: Curve operation with master reg synchronization

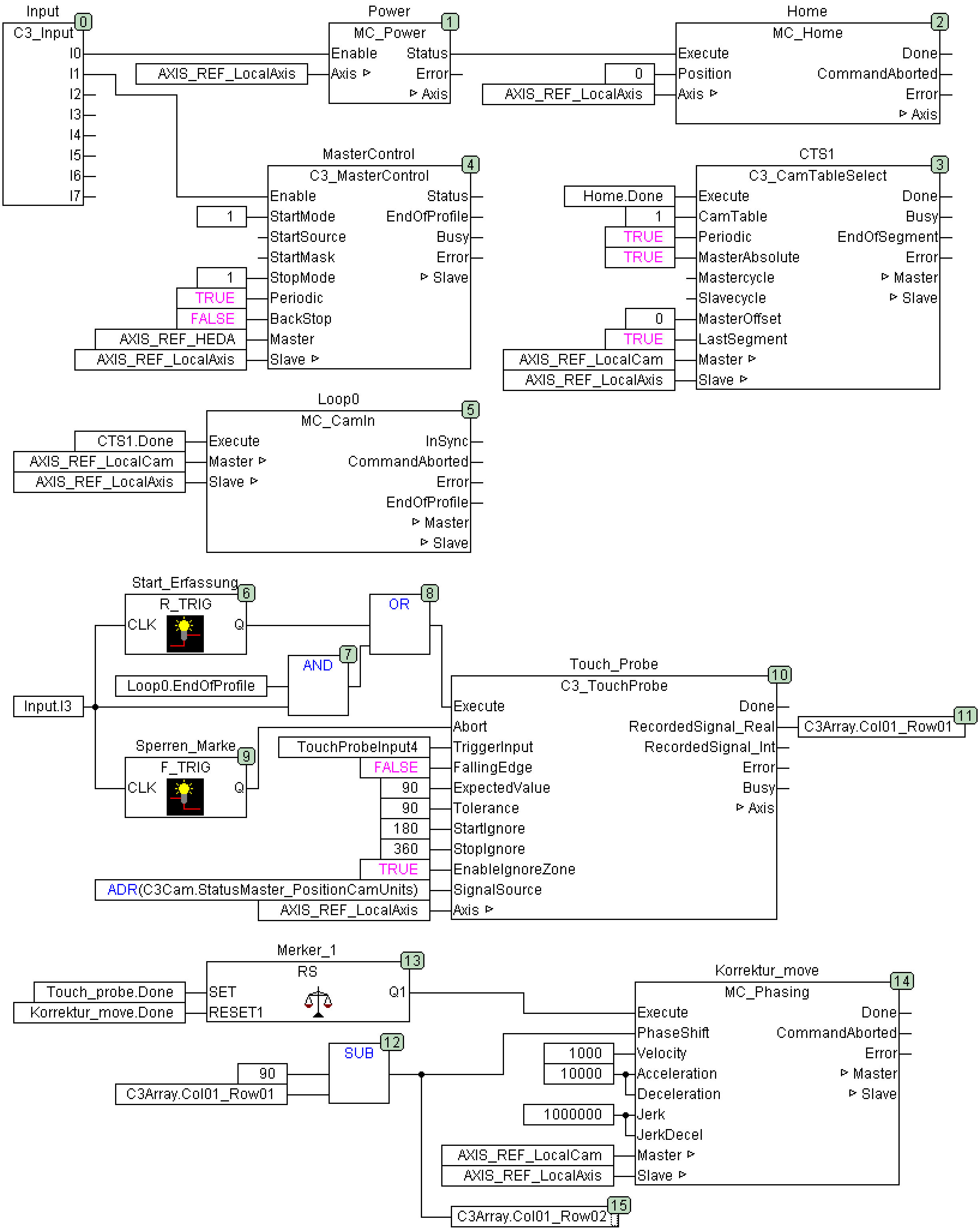
The master position in the curve mode is to be corrected in dependance of a registration mark: Master oriented reg synchronization.

Corresponding files: Master_Markenkorrektur.C3P (Compax3 Project auf Compax3 CD:\Examples\Example8)
Master_Markenkorrektur.pro (CoDeSys Project on the Compax3 CD:\Examples\Example8)

Control interface:

Input	Function
I0	Energize axis, homing, select curve, starting and coupling axis (static)
I1	Enable master acquisition (static)
I2	Start virtual master
I3	Reg enable (static)
I4	Reg input (edge)
I5	Free
I6	Free
I7	Free

Solution:

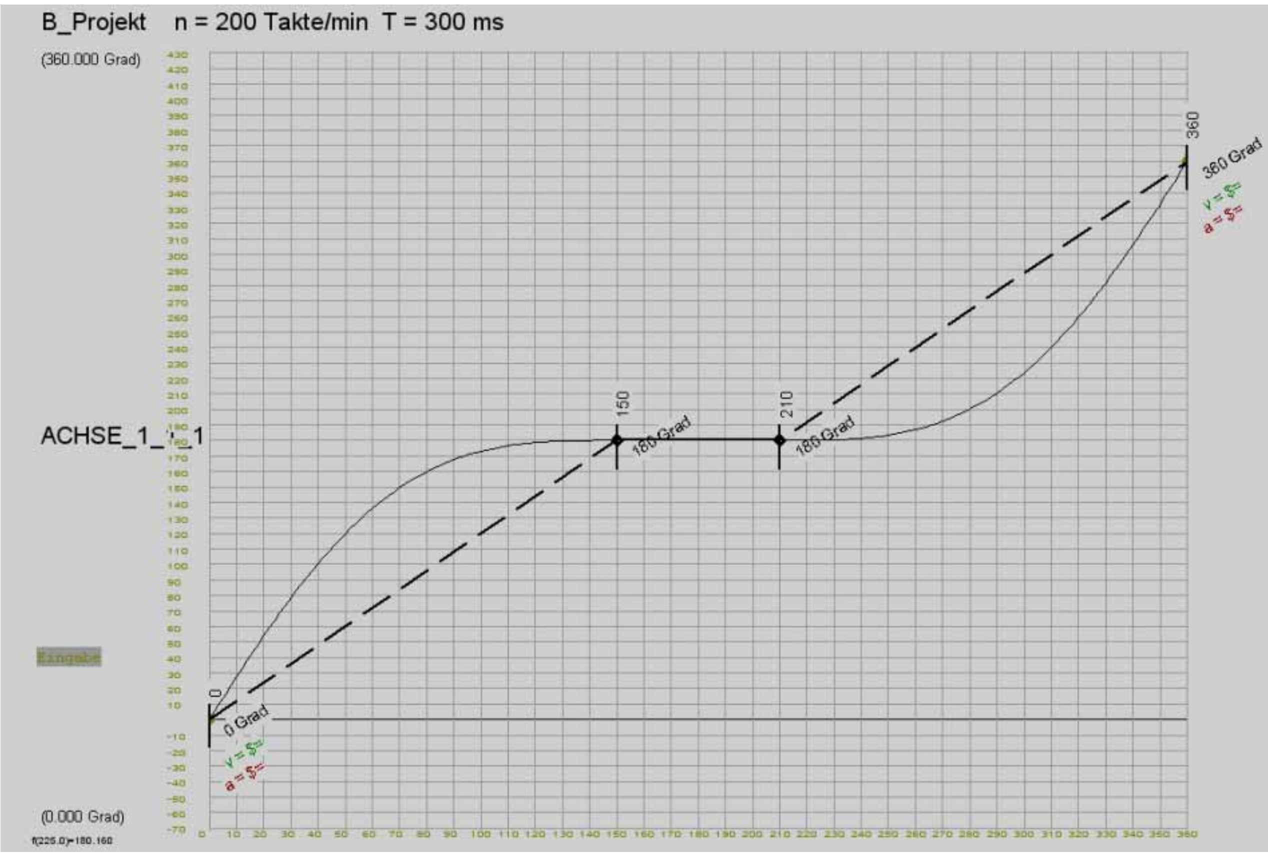


Input
C3_Input
I0
I1
I2
I3
I4
I5
I6
I7
Power
MC_Power
Enable
Axis
Status
Error
Axis
AXIS_REF_LocalAxis
Home
MC_Home
Execute
Position
Axis
Done
CommandAborted
Error
Axis
0
AXIS_REF_LocalAxis
MasterControl
C3_MasterControl
Enable
StartMode
StartSource
StartMask
StopMode
Periodic
BackStop
Master
Slave
Status
EndOfProfile
Busy
Error
Slave
1
1
TRUE
FALSE
AXIS_REF_HEDA
AXIS_REF_LocalAxis
CTS1
C3_CamTableSelect
Execute
CamTable
Periodic
MasterAbsolute
Mastercycle
Slavecycle
MasterOffset
LastSegment
Master
Slave
Done
Busy
EndOfSegment
Error
Master
Slave
Home.Done
1
TRUE
TRUE
0
TRUE
AXIS_REF_LocalCam
AXIS_REF_LocalAxis
Loop0
MC_CamIn
Execute
Master
Slave
InSync
CommandAborted
Error
EndOfProfile
Master
Slave
CTS1.Done
AXIS_REF_LocalCam
AXIS_REF_LocalAxis
Start_Erfassung
R_TRIG
CLK
Q
OR
AND
Loop0.EndOfProfile
Input.I3
Sperren_Marke
F_TRIG
CLK
Q
Touch_Probe
C3_TouchProbe
Execute
Abort
TriggerInput
FallingEdge
ExpectedValue
Tolerance
StartIgnore
StopIgnore
EnableIgnoreZone
SignalSource
Axis
Done
RecordedSignal_Real
RecordedSignal_Int
Error
Busy
Axis
C3Array.Col01_Row01
TouchProbeInput4
FALSE
90
90
180
360
TRUE
ADR(C3Cam.StatusMaster_PositionCamUnits)
AXIS_REF_LocalAxis
Merker_1
RS
SET
RESET1
Q1
Touch_probe.Done
Korrektur_move.Done
Korrektur_move
MC_Phasing
Execute
PhaseShift
Velocity
Acceleration
Deceleration
Jerk
JerkDecel
Master
Slave
Done
CommandAborted
Error
Master
Slave
SUB
90
C3Array.Col01_Row01
1000
10000
1000000
AXIS_REF_LocalCam
AXIS_REF_LocalAxis
C3Array.Col01_Row02

Boundary conditions:

- Setpoint position of the registration mark: 90°.
- Slave standstill at 180°.
- The object C3Cam.StatusMaster_PositionCamUnits (o3030.24) is used as source for the C3_Touchprobe module and is set against the reg setpoint position.
- The adjustment movement is made via MC_Phasing (see the **signal image** (see page 225) of the cam).

curve



5.10.9.9 Example case of damage

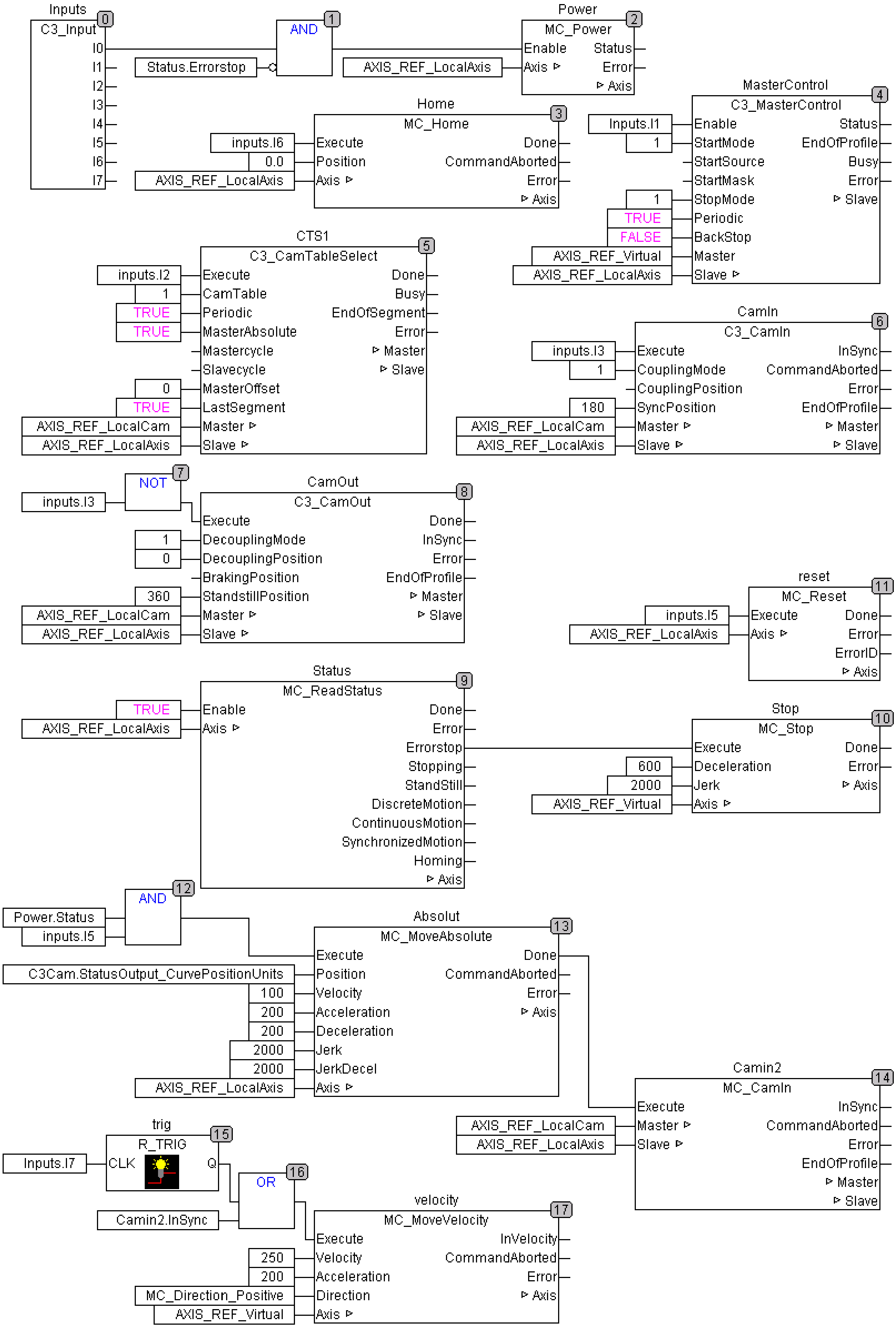
The axis should work in curve mode.
The master should be stopped in the case of an axis error. After the elimination and acknowledgement of the error, the axis shall synchronize and normal operation shall be resumed.

Corresponding files: CamExampleHav.C3P (Compax3 Project on the Compax3 CD:\Examples\Examples_Haverie)
CamExampleHav.pro (CoDeSys Project on the Compax3 CD:\Examples\Examples_Haverie)

Control interface:

Input	Function
I0	Energize axis
I1	Enable and start of the master position detection
I2	Start of the curve cycle
I3	Coupling / Decoupling
I4	Free
I5	Clear Error
I6	Homing
I7	Start of the virtual master

Solution:

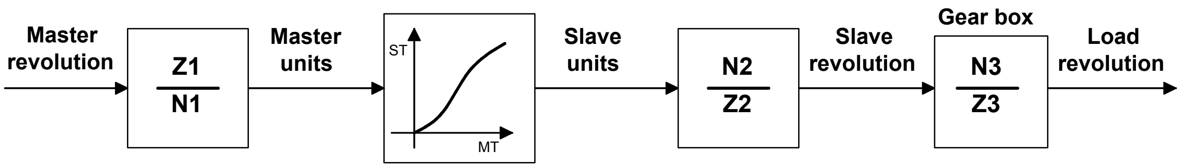

Inputs
C3_Input
I0
I1
I2
I3
I4
I5
I6
I7
AND
Status.Errorstop
Power
MC_Power
Enable
Status
Axis
Error
Axis
AXIS_REF_LocalAxis
Home
MC_Home
inputs.I6
0.0
AXIS_REF_LocalAxis
Execute
Done
Position
CommandAborted
Error
MasterControl
C3_MasterControl
Inputs.I1
Enable
Status
StartMode
EndOfProfile
StartSource
Busy
StartMask
StopMode
Slave
TRUE
FALSE
Periodic
BackStop
Master
AXIS_REF_Virtual
CTS1
C3_CamTableSelect
inputs.I2
CamTable
Busy
Periodic
EndOfSegment
MasterAbsolute
Mastercycle
Slavecycle
MasterOffset
LastSegment
AXIS_REF_LocalCam
CamIn
C3_CamIn
inputs.I3
InSync
CouplingMode
CouplingPosition
SyncPosition
180
NOT
CamOut
C3_CamOut
DecouplingMode
DecouplingPosition
BrakingPosition
StandstillPosition
360
reset
MC_Reset
inputs.I5
ErrorID
Status
MC_ReadStatus
Errorstop
Stopping
StandStill
DiscreteMotion
ContinuousMotion
SynchronizedMotion
Homing
Stop
MC_Stop
Deceleration
Jerk
600
2000
Power.Status
Absolut
MC_MoveAbsolute
C3Cam.StatusOutput_CurvePositionUnits
Velocity
Acceleration
JerkDecel
100
200
Camin2
MC_CamIn
trig
R_TRIG
CLK
Q
Inputs.I7
OR
Camin2.InSync
velocity
MC_MoveVelocity
InVelocity
Direction
250
MC_Direction_Positive

Boundary conditions:

- The ReadStatus module helps detect, if the axis is in the error state.
  An error will trigger the stop of the virtual axis, the curve cycle will stop, the curve generator (C3_CamTableSelect) will continue.
- After the stop of the master, the axis will also be at a standstill.
- The error is acknowledged via input I5; the axis will be energized again (see also the "AND" module at the input of MC_Power).
- If the axis is energized again and input I5 is present, the axis is moved to the current position of the curve output (MC_moveAbsolute) and at the end of the movement it is coupled again with MC_CamIn.
- The output "InSync" of the MC_CamIn (camin2) will re-start the virtual master and the cycle is continued.

5.10.9.10 Application note: Drift

Correct scaling of the reference values helps prevent drift.
For this, it is necessary to consider the conversions of the position signal:



Master / Slave / Load revolution: Master / Slave / Load revolutions:
Master / Slave units: Master / Slave - revolutions
Gear box: Gearbox
The rule for this is:

$$\frac{Z1}{N1} = \frac{\text{Travel distance per revolution master axis numerator}}{\text{Travel distance per motor revolution master axis denominator}}$$

(configured in the Compax3 ServoManager under "signal source")

$$\frac{Z2}{N2} = \frac{\text{Travel distance per revolution slave axis numerator}}{\text{Travel distance per revolution – Slave axis Denominator}}$$

(configured in the Compax3 ServoManager under "configuration")

$$\frac{Z3}{N3} = \text{transmission ratio} \quad \frac{\text{Motor}}{\text{Load}}$$

MT: Master clock distance $\frac{\text{"Position Reset" Distance - Master Axis (M\_Units)}}{\text{"Position Reset" Distance - Master Axis (Denominator)}}$

MT is rounded to 3 decimal places.
ST: Slave clock distance

Numerical Example:

Product: 314,871 long
14 products are to be transported per load revolution via a curve.
Gearbox: Motor/Load = 6949673 / 43890 => i = 158.3429...

1. Variant (with drift)

Load revolutions = (number of the products) * (length of a product) * (reciprocal of the travel path per motor revolution slave axis) * (gearbox load / motor)

$$\text{Load revolutions} = 14 * 314.871\text{mm} * \frac{N2}{Z2} * \frac{43890}{6949673}$$

$$14 * 314{,}871\text{mm} * \frac{43890}{6949673} = \frac{Z2}{N2} = \frac{193475634{,}66}{6949673}$$

This factor can not be expressed exactly in Compax3; the max. entry allowed in the Compax3 ServoManager:

$$\frac{1934756}{69496}$$

which causes drift.

2. Variant (without drift)

Slave clock distance = 1 product cycle
For this, the curve is created scaled to 1.

$$\text{Load revolutions} = 14 * 1\text{mm} * \frac{N2}{Z2} * \frac{43890}{6949673}$$

$$14 * 1\text{mm} * \frac{43890}{6949673} = \frac{Z2}{N2} = \frac{614460}{6949673}$$

This factor for the path per motor revolution can be expressed, no drift is generated!

5.11 Cam switching mechanism

In this chapter you can read about:

Please observe:

In the C3 powerPLmC, the "cam switching mechanism" function can only be programmed for a Compax3 slave axis with the T40 technology function.

5.11.1. Cam switching mechanism function overview

In this chapter you can read about:

Up to 36 cams can be programmed. They are divided into 2 cam types:

Serial cams

- 32 serial cams (Cam 0 ... 31) of which a cam is brought up once every 0.5 ms.
  The**cycle time**of the cams is: (**(Highest active serial cam +1) * 0.5ms.**.
  Example: if cam 17 is the highest cam enabled, this results in a cycle time of: 18 * 0.5ms = 9ms
- If no fast cams are used, the numberof the serial cams per cycle (0.5ms) can be increased up to 4:
  The setting is made via object 3701.6. It applies:
  Cycle time = number of the serial cams *0.5ms / O3701.6 with the value range O3701.6 = 1, 2, 3, 4.

Fast cams

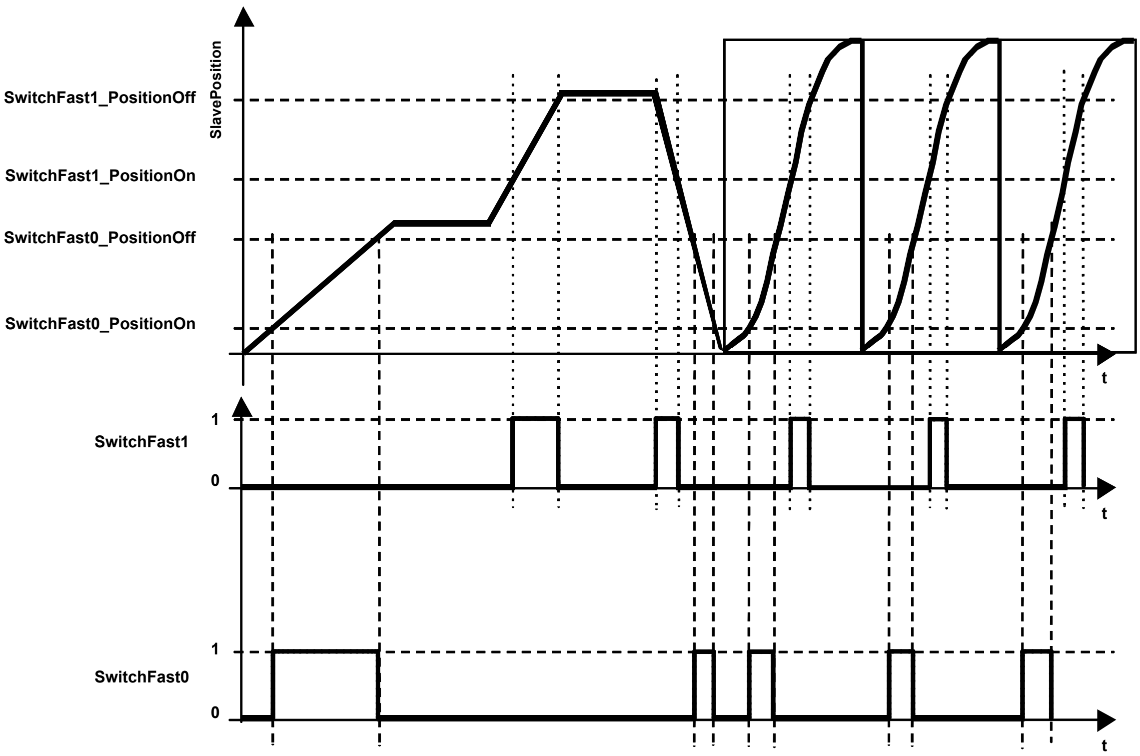
- 4 fast cams with a cycle time of 500µs (125µs per cam).
- When using fast cams, there is a cycle time of 0.5ms per cam for serial cams.
- With the **C3_OutputSelect** (see page 291) module the fast cams can be put directly and without delay, independently of the cycle time of the IEC program, on the digital outputs O0 ...O3.

Cam functions

- Switching-on and switching-off position of each cam individually.
- Cams with compensation for dead time, with switching-on and switching-off anticipation for each cam.
- Individually adjustable cam source.
- Enable for each individual cam.
- Adjustable switching hysteresis for actual position value as a cam source.
- The outputs of the cams are objects.

5.11.1.1 Example of cam function

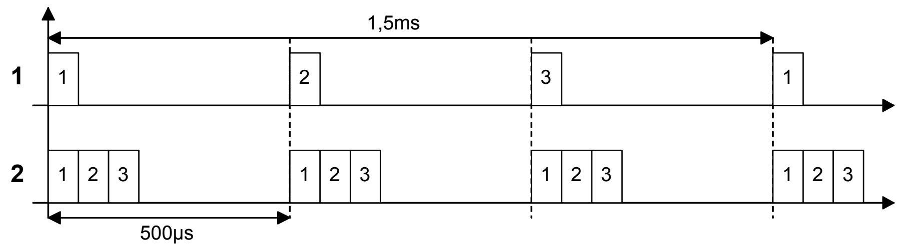
Example of cam function (without switching-on and switching-off anticipation)



5.11.1.2 Examples of a cam cycle

Example 1: Working cycles for:

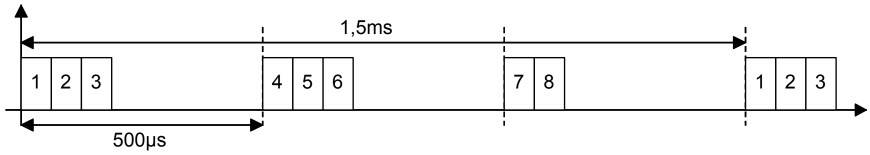
- 3 fast cams and
- 3 serial cams



1: Serial cams
2: Fast cams

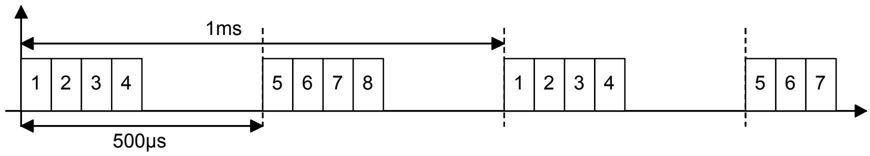
Example 2: Working cycles for:

- no fast cams,
- 8 serial cams and
- reduced cycle time (object O3701.6 = 3)



Example 3: Working cycles for:

- no fast cams,
- 8 serial cams and
- reduced cycle time (object O3701.6 = 4)



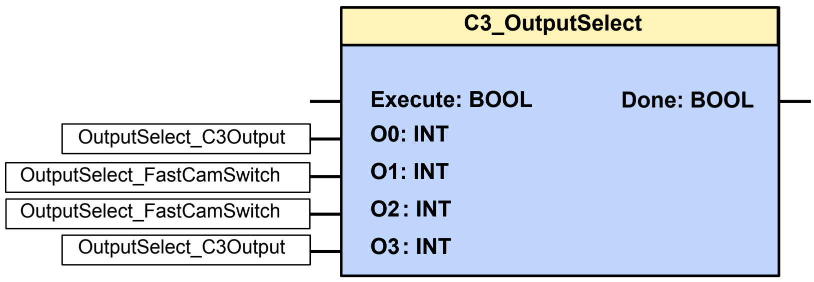
5.11.2. Redirect the fast cams directly to the physical output (C3_OutputSelect)

FB name	**C3_OutputSelect**	
Select source for digital outputs		
VAR_INPUT		
Execute	BOOL	Activates the module with a rising edge
O0	INT	Constant for source for the digital output 0
O1	INT	Constant for source for the digital output 1
O2	INT	Constant for source for the digital output 2
O3	INT	Constant for source for the digital output 3
VAR_OUTPUT		
Done	BOOL	Source selection executed

Note:

- The source selection for the outputs is executed with a rising edge of Execute.
- **Application for fast cams:**
  the fast cams are put directly and without delay to the digital outputs, independent of the cycle time of the IEC program.
- OutputSelect_C3Output allows to access the respective output directly via the IEC program (e.g. with the aid of C3_Output).
- OutputSelect_FastCamSwitch puts the respective fast cam to the output. The assignment is fixed, i.e. cam 0 would be put on O0, cam 1 would be put on output O1, etc.

Example:



- Source: output 0: C3_Output
- Source output 1: Fast cam 1
- Source output 2: Fast cam 2
- Source output 3: C3_Output

5.11.3. Objects of the cam switching mechanism

Object designations	Units	Objects for serial cams		Objects for fast cams		Valid after:
Source **="1": Actual position** **="2": Setpoint position** **="3": virtual Master** **="5": Master position (3030.1)**		Cam 0: ... Cam 31:	O3730.1 ... O3761.1	Cam 0: ... Cam 3:	O3710.1 ... O3713.1	VP*
Switching-on position	defined unit for positions	Cam 0: ... Cam 31:	O3730.2 ... O3761.2	Cam 0: ... Cam 3:	O3710.2 ... O3713.2	VP*
Switching-off position	defined unit for positions	Cam 0: ... Cam 31:	O3730.3 ... O3761.3	Cam 0: ... Cam 3:	O3710.3 ... O3713.3	VP*
Switch-on anticipation	1 ≡ 500µs	Cam 0: ... Cam 31:	O3730.4 ... O3761.4	Cam 0: ... Cam 3:	O3710.4 ... O3713.4	Imme diately
Switch-off anticipation	1 ≡ 500µs	Cam 0: ... Cam 31:	O3730.5 ... O3761.5	Cam 0: ... Cam 3:	O3710.5 ... O3713.5	Imme diately
Output **(the given object bit contains the cam switch status for further use)**		Cam 0: ... Cam 15 Cam 16 ... Cam 31:	O3701.3 Bit 0 ... O3701.3 Bit15 O3701.5 Bit 0 ... O3701.5 Bit15	Cam 0: ... Cam 3:	O3700.3 Bit 0 ... O3700.3 Bit 3	Imme diately
Enable		Cam 0: ... Cam 15 Cam 16 ... Cam 31:	O3701.2 Bit 0 ... O3701.2 Bit15 O3701.4 Bit 0 ... O3701.4 Bit15	Cam 0: ... Cam 3:	O3700.2 Bit 0 ... O3700.2 Bit 3	Imme diately
Hysteresis	defined unit for positions	With source = actual position: O3705.1 With source = Master position: O3705.5				VP*

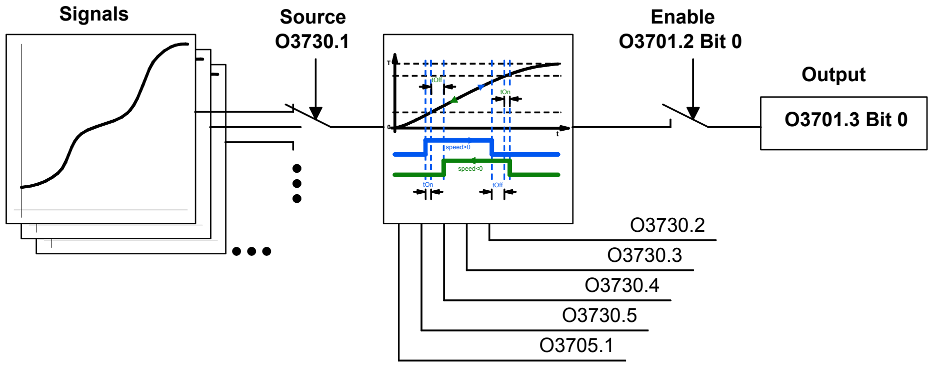
The exact description of the objects can be found in the **object directory** (see page 414).

The command VP (set objects to valid) can be executed as
- global VP – for all objects or
- selective VP – only objects of the cam switching mechanism -

- Global VP: Write into object 210.11 with value <> 0
- Selective VP: Write into object 210.9 with value <> 0 (C3Plus.ValidParameter_CamControlledSwitches:=True)

The selective VP is executed faster and constitutes a smaller temporal strain!

Scheme of the object assignment example of the serial cam 0



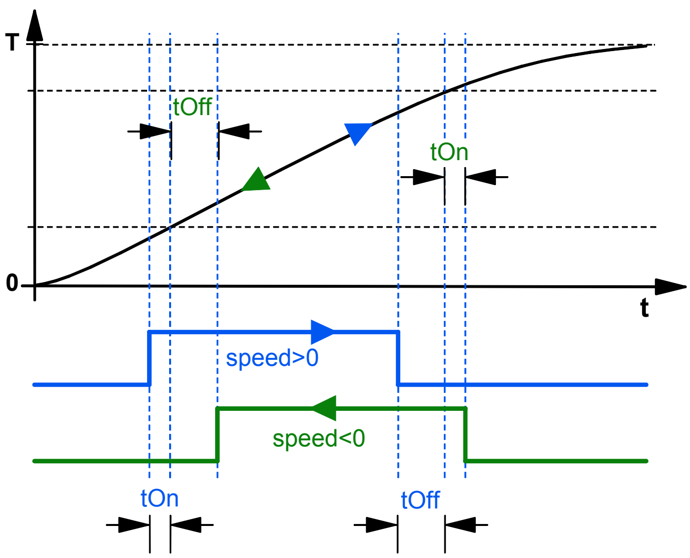
Notes:

- You can write directly into a serial cam switch output that is not enabled (e.g. cam 0 => object3701.3 bit 0).
- After deactivating the cam, the last output status is kept. You can then define the status by directly writing into the object.

5.11.4. Behavior of the switch-on/switch-off anticipation

The switching-on and switching-off behavior of the actuating elements (delayed switching, reaction time) can be compensated via a reaction time (switching-on/off anticipation) that can be parametered for each individual cam.
Compax3 will calculate a corrected switching-on/ or –off position by multiplying the reaction time with the current speed, so that the actuating element will switch at the actual switching position due to its delay; the actuating element delay is compensated.

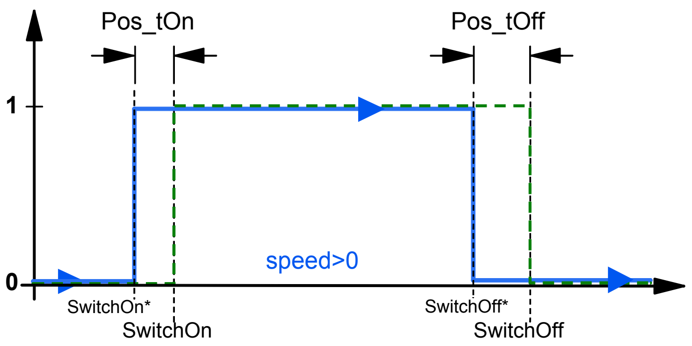
5.11.4.1 Behavior depending on the travel direction



tOn: Switch-on anticipation
tOff: Switch-off anticipation

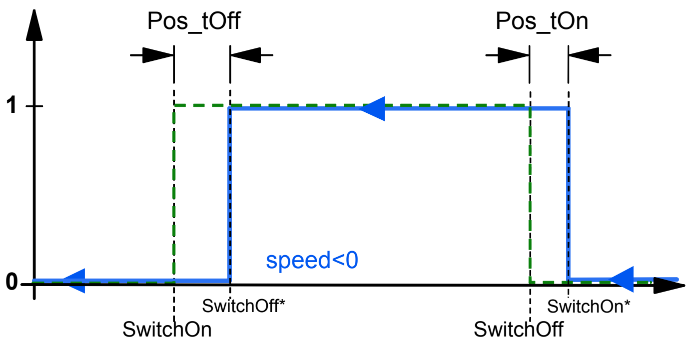
For the switching behavior depending on the position applies therefore:

Example: switching behavior at positive speed (speed>0)



SwitchOn: Switching-on position
SwitchOn*: corrected switching-on position
SwitchOff: Switching-off position
SwitchOff*: corrected switching-off position
Pos_tOn: position difference calculated from the switch-on anticipation
Pos_tOff: position difference calculated from the switch-off anticipation

Example: switching behavior at negative speed (speed<0)



SwitchOn: Switching-on position
SwitchOn*: corrected switching-on position
SwitchOff: Switching-off position
SwitchOff*: corrected switching-off position
Pos_tOn: position difference calculated from the switch-on anticipation
Pos_tOff: position difference calculated from the switch-off anticipation

N.B.! The switching-on resp. switching-off anticipation are exchanged with negative speed, as the cam

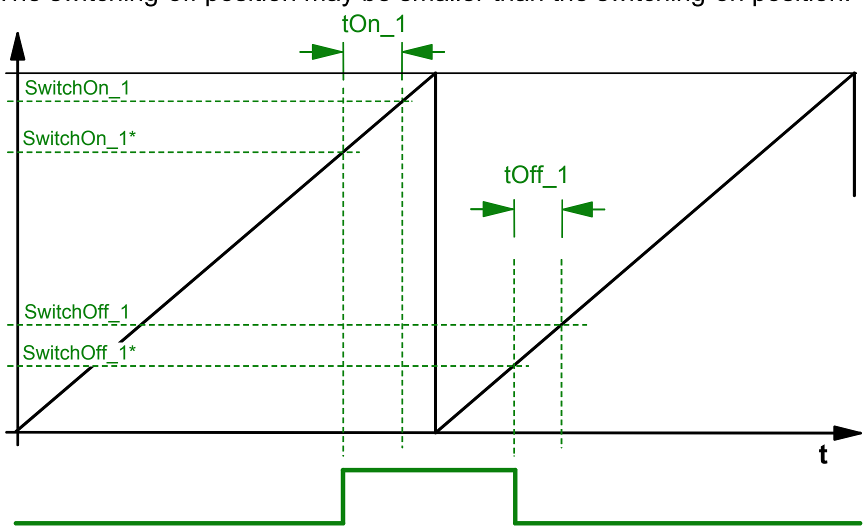
- switches on at the switching-off position

and

- switches off at the switching-on position!

5.11.4.2 Switching behavior with reset operation

When leaving the positioning area, the positions are corrected accordingly. The switching-off position may be smaller than the switching-on position:

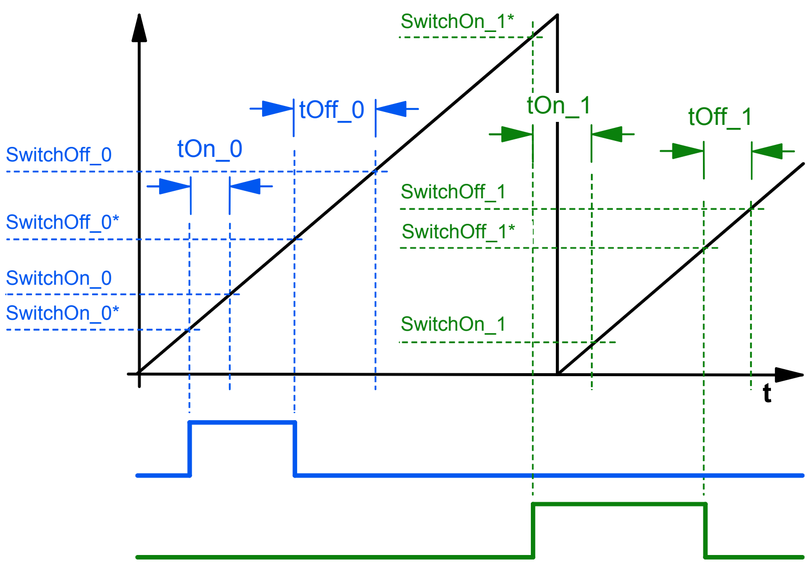


SwitchOn: Switching-on position
SwitchOn*: corrected switching-on position
SwitchOff: Switching-off position
SwitchOff*: corrected switching-off position
tOn: Switch-on anticipation
tOff: Switch-off anticipation

Note: With reset mode of the selected source, the switching position is limited to the area:
0 <= switching position < reset path

That means that values below zero will become 0, values higher than the reset distance will be come the reset distance-1LSB.

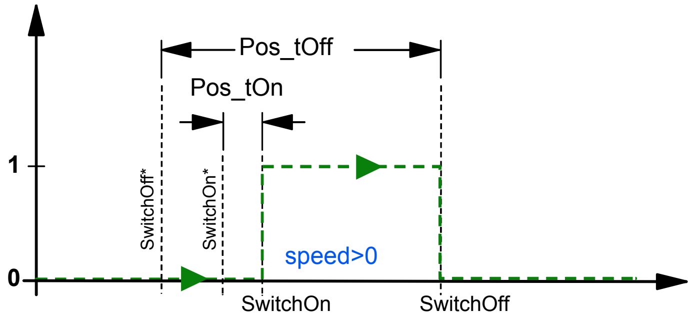
5.11.4.3 Switch-on anticipation is corrected via reset distance



SwitchOn: Switching-on position
SwitchOn*: corrected switching-on position
SwitchOff: Switching-off position
SwitchOff*: corrected switching-off position
tOn: Switch-on anticipation
tOff: Switch-off anticipation
For cam_1 and _2

5.11.4.4 Note: No switching operation with overlapping cams

If it occurs that for example the switching-off position is smaller than the switching-on position due to a movement caused by the reaction time compensation, no switching will take place. This case must be eliminated by choosing appropriate cam positions.



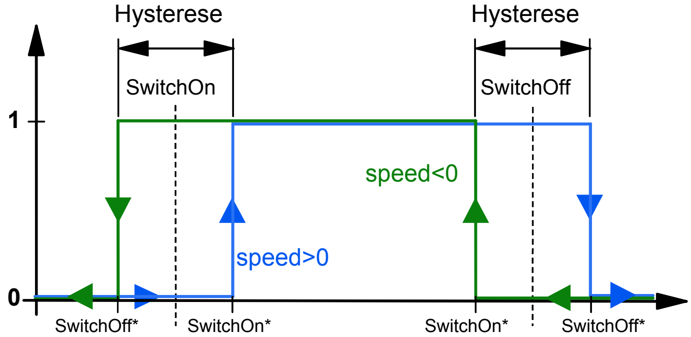
SwitchOn: Switching-on position
SwitchOn*: corrected switching-on position
SwitchOff: Switching-off position
SwitchOff*: corrected switching-off position
Pos_tOn: position difference calculated from the switch-on anticipation
Pos_tOff: position difference calculated from the switch-off anticipation

Please observe:

The position difference for the compensation of the switching delay rises with the speed.

5.11.5. Hysteresis

In order to avoid jitter of cams at the limits of the switching area (only relevant as source of cam with actual values) a switching hysteresis (the same for all cams) can be defined.



SwitchOn: Switching-on position
SwitchOn*: switching-on position corrected by the hysteresis
SwitchOff: Switching-off position
SwitchOff*: switching-off position corrected by the hysteresis
The hysteresis is preset as a position value.

Please observe: The hysteresis influences the switching-on and switching-off anticipation
You should therefore set this value at the lowest possible level.

5.11.6. CoDeSys-Project for the configuration of the cams

You will find a CoDeSys project for the configuration of the cams with the following functions on the Compax3 CD under
..\Examples\CamSwitch\CamSwitch_Template.pro:
Configuration of the cam switching mechanism via IEC61131-3 in ST (structured text):

1.) Initializing some "example cams" (Module "Init_Cam_Switch")

- Configuration of sequential cams,
- Configuration of fast cams,
- Configuration of the hystereses,
- Activation of (fast) cams,
- Resetting outputs,
- Triggering selective VP

Global variables determine, which functions are used or are relevant:

CAMsourceActual - True: Actual position is used as master source
CAMfast - True: fast cams are being used
CAMnumber_per_cycle - 1..4: Number of cams implemented/500µs)

2.) Use of the cams in the IEC (Module "PLC_PRG")

- Execute module "Init_Cam_Switch" once,
- logic query with cams,
- logic combination with cams,
- Output of cams via digital outputs,
- Deactivating individual cams,
- Manupulating deactivated cams

5.11.7. Example: Working with fast cams

Setting 2 fast cams to the Compax3 outputs O2 and O3.

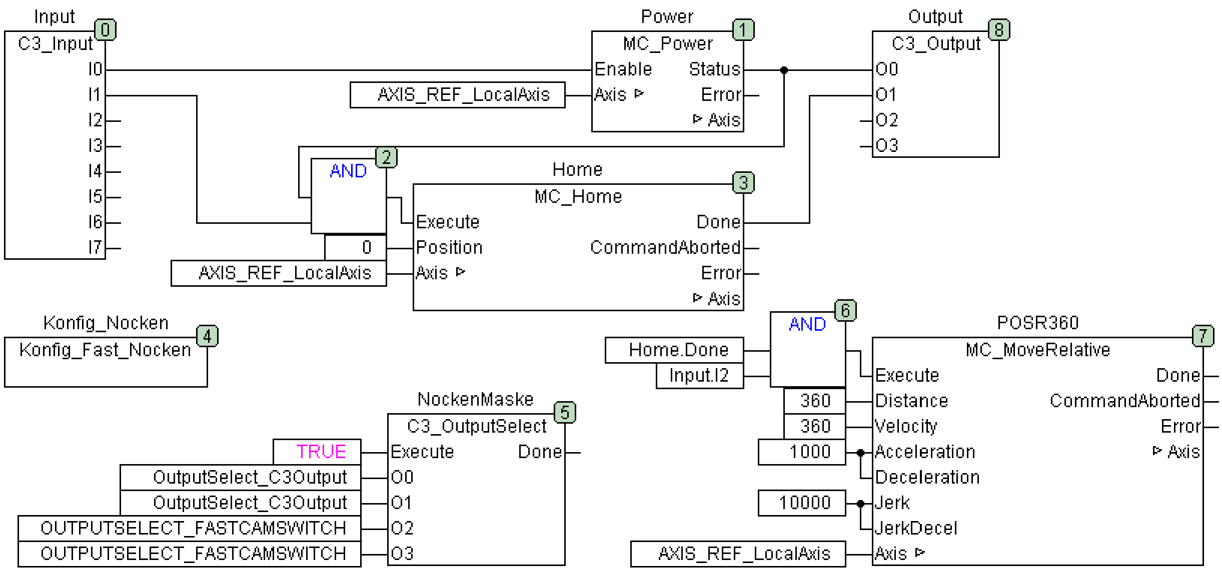
Related programs:

- ..\Examples\CamSwitch\2_schnelle_Nocken.C3P
- \Examples\CamSwitch\2_schnelle_Nocken.pro

Assignment:

O0 = 1: Drive energized
O1 = 1: Machine zero approached
O2 = 1 fast cam 2 (170° ... 190°)
O3 = 1 fast cam 3 (290° ... 310°)
I0: Energize Drive
I1: Start searching machine zero
I2: Start of a 360° positioning (reset distance = 360°)

Solution:



ST Part

```
FUNCTION_BLOCK Konfig_Fast_Nocken
VAR_INPUT
END_VAR
VAR_OUTPUT
END_VAR
VAR
    vari1: BOOL;
END_VAR

```

```
(*   Settings for 2 Fast CAM_switches CAM_Fast 2 and 3 set to Output O2 and O3  *)

IF vari1=FALSE THEN
    C3Cam.ControlledSwitchesFast_Enable:=12; (*enable Cam_switch2 and 3 *)

    C3Cam.ControlledSwitchFast2_Source:=1;   (*   actual position  *)
    C3Cam.ControlledSwitchFast2_PositionOn:=170;
    C3Cam.ControlledSwitchFast2_PositionOff:=190;
    C3Cam.ControlledSwitchFast2_TimeOn:=T#0s;  (* without TimeOn time *)
    C3Cam.ControlledSwitchFast2_TimeOff:=T#0s;  (* without TimeOff time *)

    C3Cam.ControlledSwitchFast3_Source:=1;   (*   actual position  *)
    C3Cam.ControlledSwitchFast3_PositionOn:=290;
    C3Cam.ControlledSwitchFast3_PositionOff:=310;
    C3Cam.ControlledSwitchFast3_TimeOn:=T#0s;  (* without TimeOn time *)
    C3Cam.ControlledSwitchFast3_TimeOff:=T#0S;  (* without TimeOff time *)

    C3Cam.ControlledSwitchesHysteresis_ActualPosition:=1;

    C3Plus.ValidParameter_CamControlledSwitches:=1; (* one time, after Power ON   *)
    vari1:=TRUE;
END_IF
```

Note:

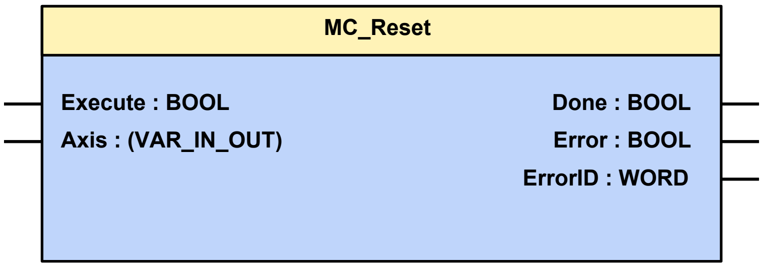
- With C3_OutputSelect the outputs O2 and O3 are assigned to the fast cams. Compax3 puts automatically the fast cams 2 and 3 to the outputs O2 and O3.
- The cam objects are set once after switching-on.

5.12 Error handling

In this chapter you can read about:

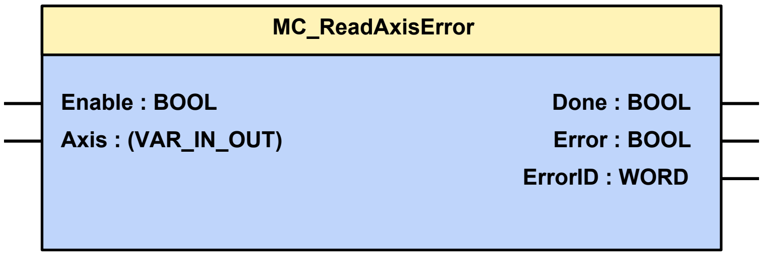
5.12.1. Acknowledging errors (MC_Reset)

FB name	**MC_Reset**	
Acknowledges errors (transition from "Errorstop" status to "Standstill" status).		
VAR_IN_OUT		
Axis	INT	Axis-ID (library constants)
VAR_INPUT		
Execute	BOOL	Activates the module if there is a positive edge
VAR_OUTPUT		
Done	BOOL	Error successfully acknowledged, axis is in the "Standstill" state again
Error	BOOL	Acknowledge failed /not possible
ErrorID	WORD	Error description, according to error history
Note: After the error is successfully acknowledged, the power must be supplied to the power output stage again by a rising edge on the enable input of the MC_Power power module. C3 powerPLmC Note: This module is also available as group function block. You can then trigger this function for the entire Compax3 group.		



5.12.2. Reading axis errors (MC_ReadAxisError)

FB name	**MC_ReadAxisError**	
This function module displays axis errors.		
VAR_IN_OUT		
Axis	INT	Axis-ID (library constants)
VAR_INPUT		
Enable	BOOL	Activates the module
VAR_OUTPUT		
Done	BOOL	Output values available
Error	BOOL	Compax3 in error state
ErrorID	WORD	Current error description
Note: -		



5.12.3. Set error reaction (C3_SetErrorReaction)

FB name	**C3_SetErrorReaction**	
This module is used to define the error reaction. Note: The error reaction cannot be changed for errors with standard reaction 5 (switch immediately to currentless (without ramp), close brake).		
VAR_INPUT		
Execute	BOOL	The defined error reaction is set for the selected error
ErrorID	WORD	Error number [hexadecimal] for which the error reaction should be set, e.g. 0x6281
Reaction	INT	Error response: 0: no reaction, error is deactivated. 1: Downramp actual speed; remain in position control state 2: Downramp the actual speed; then switch off controller
VAR_OUTPUT		
Done	BOOL	The defined error reaction was set
Error	BOOL	Error while executing module

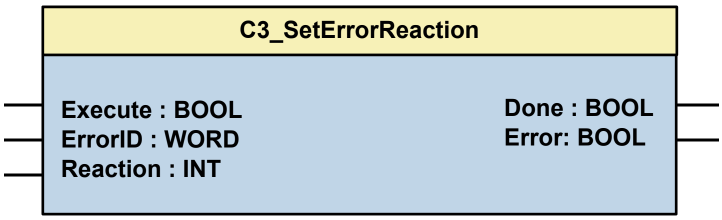
Note:

Error list

- The error reaction settings from the configuration wizard are overwritten.
- The setting of the error mask is made internally via a C3 object. If the objects are saved permanently, the setting is memorised after Power off.

Please note:

- The C3_ErrorMask overwrites (depending on the calling-up order) the settings.
- The corresponding error reaction is valid for both axes (of Compax3F) as the case may be.
- The module will overwrite the settings made via the C3 ServoManager.
- If the ErrorID has an invalid erorr number, no change is effected.

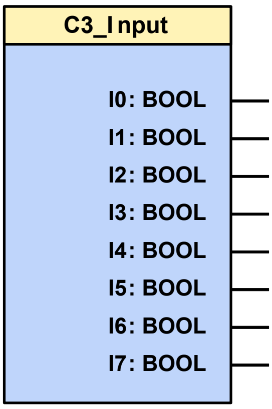


5.13 Process image

In this chapter you can read about:

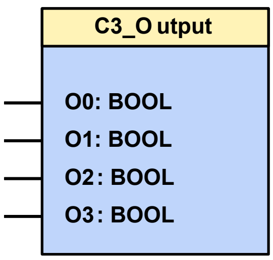
5.13.1. Reading digital inputs (C3_Input)

FB name	C3_Input	
Used to generate a process image of the digital inputs.		
VAR_INPUT		
I0 ... I7	BOOL	Displays the logic status of the respective input (with low active inputs, the physical statuses are negated).
Notes: the module should always be brought up at the beginning of the processing cycle.		



5.13.2. Write digital outputs (C3_Output)

FB name	C3_Output	
Used to generate a process image of the digital outputs.		
VAR_OUTPUT		
O0 ... O3	BOOL	Displays the status of the respective output.
Notes: the module should always be brought up at the end of the processing cycle.		

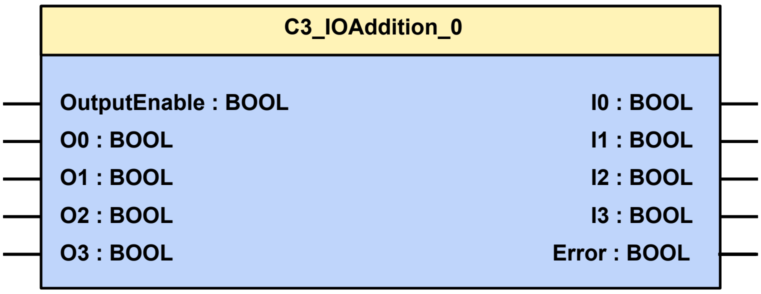


5.13.3. Reading/writing optional inputs/outputs

In this chapter you can read about:

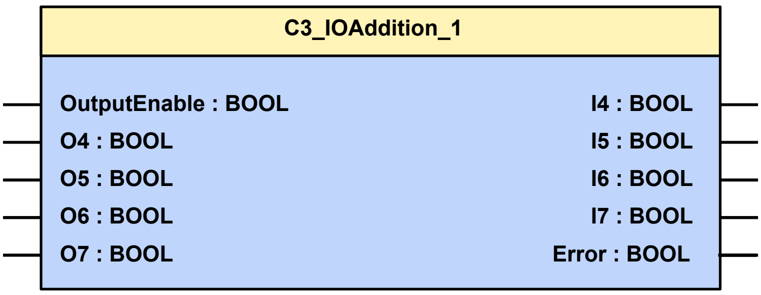
5.13.3.1 C3_IOAddition_0

FB name	**C3_IOAddition_0**	
Is used to create a process image of the optional digital inputs/outputs.		
VAR_INPUT		
I0 ... I3	BOOL	Displays the status of the respective input.
O0 ... O3	BOOL	Displays the status of the respective output.
Please note that the group of 4 may be assigned **as inputs or as outputs** (see page 447). You may only use either inputs or outputs exclusively. Notes: The module should always be brought up at the beginning (inputs) or end (outputs) of the processing cycle.		



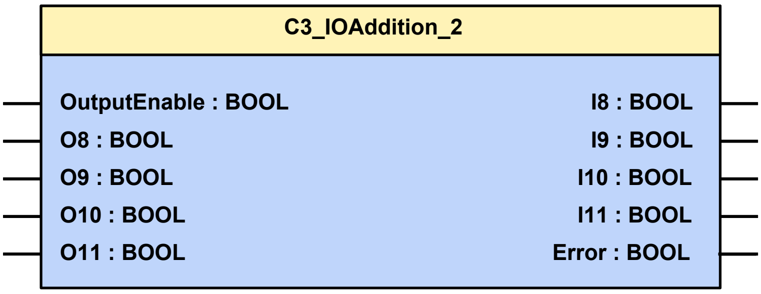
5.13.3.2 C3_IOAddition_1

FB name	**C3_IOAddition_1**	
Is used to create a process image of the optional digital inputs/outputs.		
VAR_INPUT		
I4 ... I7	BOOL	Displays the status of the respective input.
O4 ... O7	BOOL	Displays the status of the respective output.
Please note that the group of 4 may be assigned **as inputs or as outputs** (see page 447). You may only use either inputs or outputs exclusively. Notes: the module should always be brought up at the beginning of the processing cycle.		



5.13.3.3 C3_IOAddition_2

FB name	**C3_IOAddition_2**	
Is used to create a process image of the optional digital inputs/outputs.		
VAR_INPUT		
I8 ... I11	BOOL	Displays the status of the respective input.
O8 ... O11	BOOL	Displays the status of the respective output.
Please note that the group of 4 may be assigned **as inputs or as outputs** (see page 447). You may only use either inputs or outputs exclusively. Notes: the module should always be brought up at the beginning of the processing cycle.		

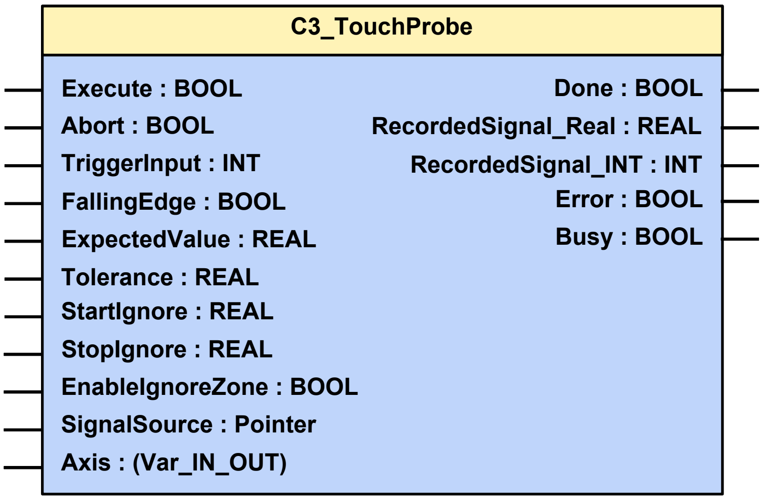


5.13.4. Memorizing the signals with the trigger event (C3_TouchProbe)

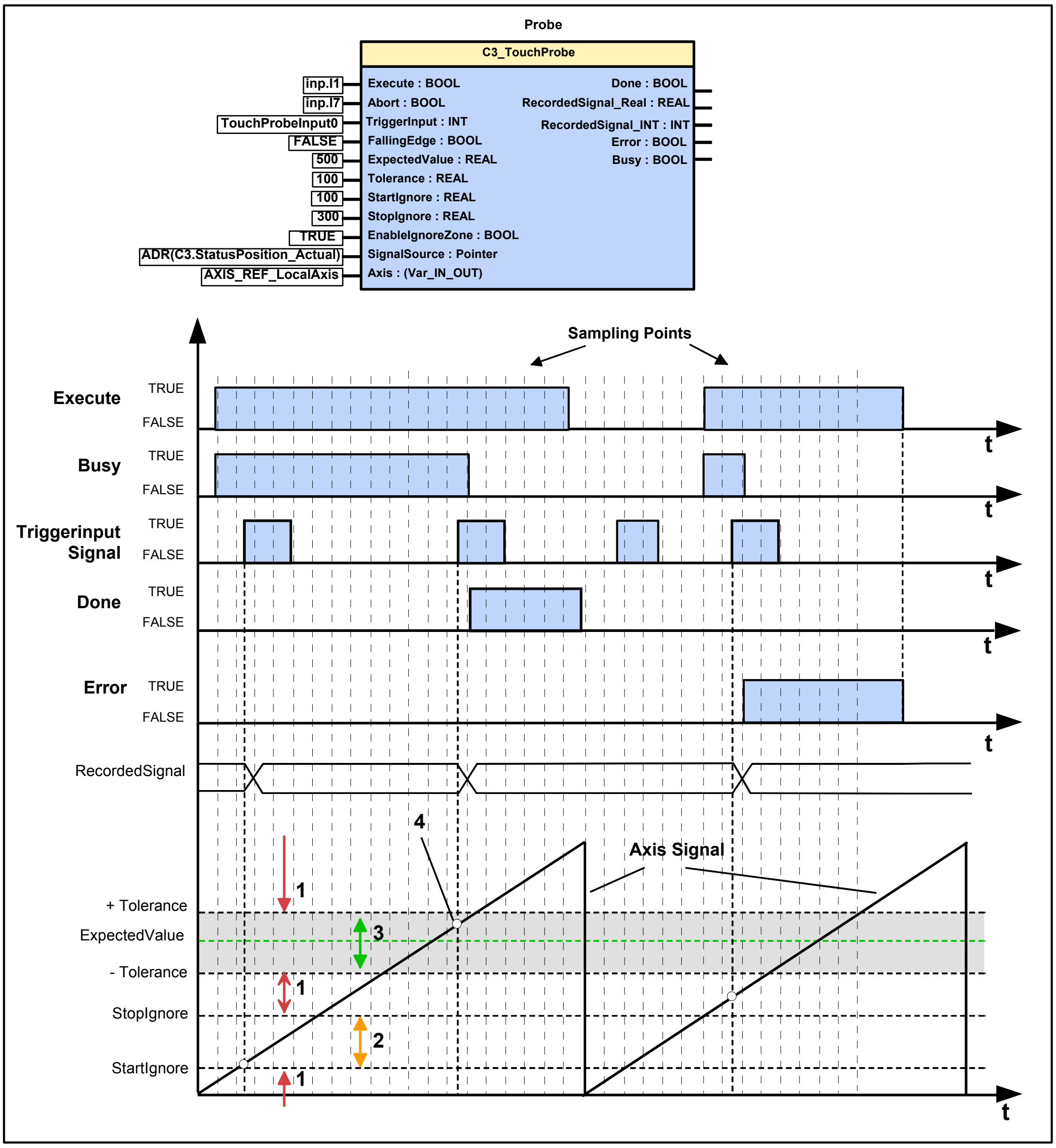
FB name	**C3_TouchProbe**	
Memorizing signals / objects with the trigger event - replaces the MC_TouchProbe module -		
VAR_IN_OUT		
Axis	INT	Axis ID (Library constants)
VAR_INPUT		
Execute	BOOL	Activates the module if there is a rising edge
SignalSource	Pointer	Selects the signal to be scanned. The<address opertor>must be used imperatively. The signal scanned must be in the REAL or the INT format.
FallingEdge	BOOL	If TRUE, it is triggered in the falling edge. The logical status after a possible input inversion is respected.
TriggerInput	INT	Selects the trigger input. Constant TouchProbeInputx (see note)
ExpectedValue	REAL	Value at which the trigger event is expected.
Tolerance	REAL	Tolerance interval around ExpectedValue, where the trigger event is accepted (always positive) (with reference to the signal source).
StartIgnore	REAL	The beginning of the range in which the trigger event will not be acknowledged with Done or Error (with reference to the signal source).
StopIgnore	REAL	The end of the range in which the trigger event will not be acknowledged with Done or Error (with reference to the signal source).
EnableIgnoreZone	BOOL	Activate IgnoreZone.
Abort	BOOL	Deactivate module.
VAR_OUTPUT		
Done	BOOL	Trigger event occurred within the tolerance interval and the signal was detected.
RecordedSignal_ Real	REAL	Value scanned at the time of the trigger event, if the source is available in the coDeSys "REAL format. Please respect the format information of the signal source (SignalSource)
RecordedSignal_ INT	INT	Value scanned at the time of the trigger event, if the source is available in the coDeSys "INT" format. Please respect the format information of the signal source (SignalSource)
Busy	BOOL	Module active and no scanning signal occurred outside the IgnoreZone.
Error	BOOL	Error while executing module.

Note:

- Temporal precision of signal recording: <1µs
- TriggerInput Trigger-input:
  via the constants "TouchProbeInput0" ... "TouchProbeInput7" (X12/6 - X12/14) the trigger signal input is selected.
- **Attention!**
  Max. one entity of the module can be active as the hardware resources are only available once!
  Several entities being activated one after the other are permitted.



Example: Scanning the actual position, triggered via Input I0



1: Area whrere a **module error** is generated.
2: Ignore Zone: Area whrere **no module error** and **no Done** is generated. The ranges 2 and 3 may not overlap. If they do, the ignore zone in range 3 is not effective.
3: ExpectedValueZone: Trigger signal in the permissible value range; this is confirmed with Done=TRUE.
4: RecordedSignal; is updated with every active edge of the TriggerInput signal upon Execute = TRUE.

- If the value of the signal (SignalSource) during the Trigger event is in the permissible value range between (ExpectedValue - Tolerance) and (ExpectedValue + Tolerance), this is confirmed with Done = TRUE; the RecordedSignal ist updated.
- If the value of the signal (SignalSource) during the Trigger Event is between StartIgnore and StopIgnore (Ignore zone), the module will report neither error nor Done, the RecordedSignal is however updated.
- If the value of the signal (SignalSource) during the Trigger Event is outside the permissible value range and outside the zone between StartIgnore and StopIgnore (Ignore zone), the module will report an error, the RecordesSignal is updated.
- Within this range, the signals are read in with a temporal exactitude of <1µs (determined by linear interpolation).
- If a Trigger Signal occurs at Execute = False, the RecordedSignal is not updated.
- If **no** Trigger Signal comes up, Busy remains active until the module is reset to the original state with Abort.
- More examples with C3_Touchprobe (**example 7** (see page 279) and **example 8** (see page 281)).

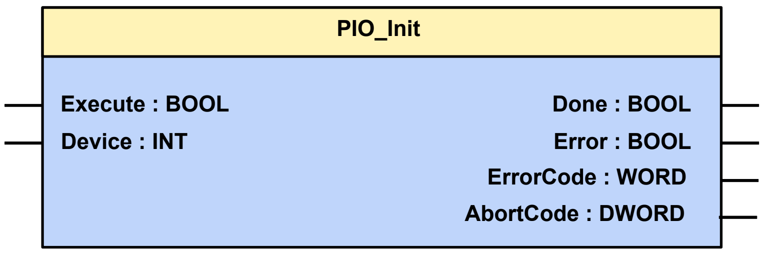
5.13.5. Integration of Parker I/Os (PIOs)

In this chapter you can read about:

In order to integrate PIOs via CANopen, the CANopen operating mode "**Master for PIOs** (see page 368, see page 367)" must be configured.

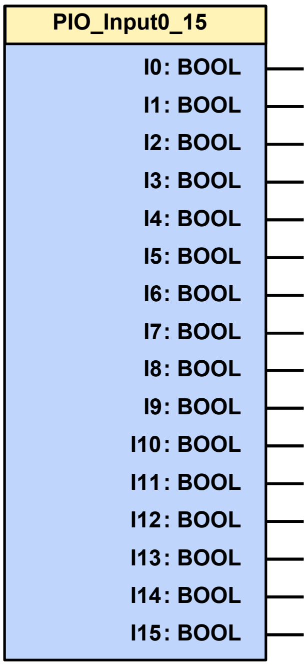
5.13.5.1 Initializing the PIOs (PIO_Init)

FB name	**PIO_Init**	
Initialization of the PIOs		
VAR_IN_OUT		
Device	INT	PIO - ID (Address)
VAR_INPUT		
Execute	BOOL	Activates the module if there is a positive edge
VAR_OUTPUT		
Done	BOOL	Initialization executed
Error	BOOL	An error occurred during initialization
ErrorCode	WORD	1 = no Parker device Additional errors can be found in the error list.
AbortCode	DWORD	**SDO abort code** (see page 383)
Note: Please execute this module at the beginning of the IEC program.		



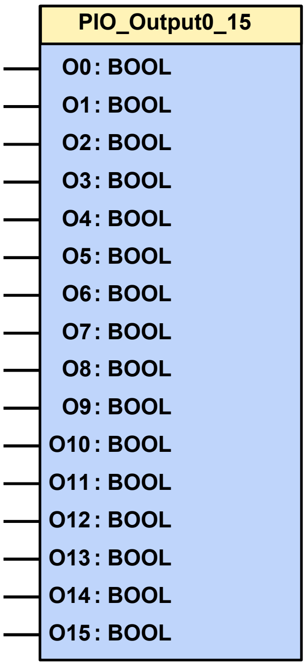
5.13.5.2 Reading the PIO inputs 0-15 (PIO_Inputx...y)

FB name	**PIO_Input0_15**	
Is used for reading the respective inputs		
VAR_INPUT		
I0 ... I15	BOOL	Displays the status of the respective input.
Note: For the additional inputs, the following modules are available PIO_Input16_31 PIO_Input32_47and PIO_Input48_63. Please execute this module at the beginning of the IEC program (After PIO_INIT).		



5.13.5.3 Writing the PIO outputs 0-15 (PIO_Outputx...y)

FB name	PIO_Output0_15	
Is used for writing on the respective outputs		
VAR_INPUT		
O0 ... O15	BOOL	Displays the status of the respective output.
Note: For the additional outputs, the following modules are available PIO_Output16_31 PIO_Output32_47and PIO_Output48_63. Please execute this module at the end of the IEC program.		



5.13.5.4 Example: Compax3 as CANopen Master with PIOs

- Compax3 control via PIOs.
- Cofiguration of the PIO connection with the C3 ServoManager.
- Initializing the PIO connection with the PIO_Init module
- Control of Compax3 via the digital PIOs and
- setpoint assignment via the analog PIOs

Related programs:

- ..\Examples\C3_mit_PIOs\T30_MasterPIO_ID2.C3P
- ..\Examples\C3_mit_PIOs\C3_PIO_CONNECTION_TEST.pro

Test setup:

A PIO-347 for CANopen with:

- 1 PIO-602 (24V DC feed)
- 2 PIO-402 (8 digital inputs) for operation wired to a switch box
- 6 PIO-504 (24 digital outputs)
- 1 PIO-468 (4 analog inputs)
- 1 PIO-550 (2 analog outputs) analog output 0 is wired with analog input 0 for setpoint definition
- 1 PIO-600 (Bus terminal)
- a 24V power supply unit
- a C3 S025 F10 I21 T30 M11 with power- and 24V-cable
- a motor SMH 60 60 1,4...4 with motor- and resolver cable
- a CAN-bus cable for the connection of the Compax3 with the PIO coupler.
- a serial cable for the connection of the Compax3 with the PC
- a switch box for the operation of the 8 digital inputs of the PIOs.

Settings:

- Baud rate = 1Mbit
- Node address of the PIO = 5 (setting via the address switch on the device)
- Node address of the C3 = 2 (setting via the address switch on the device)

Control interface:

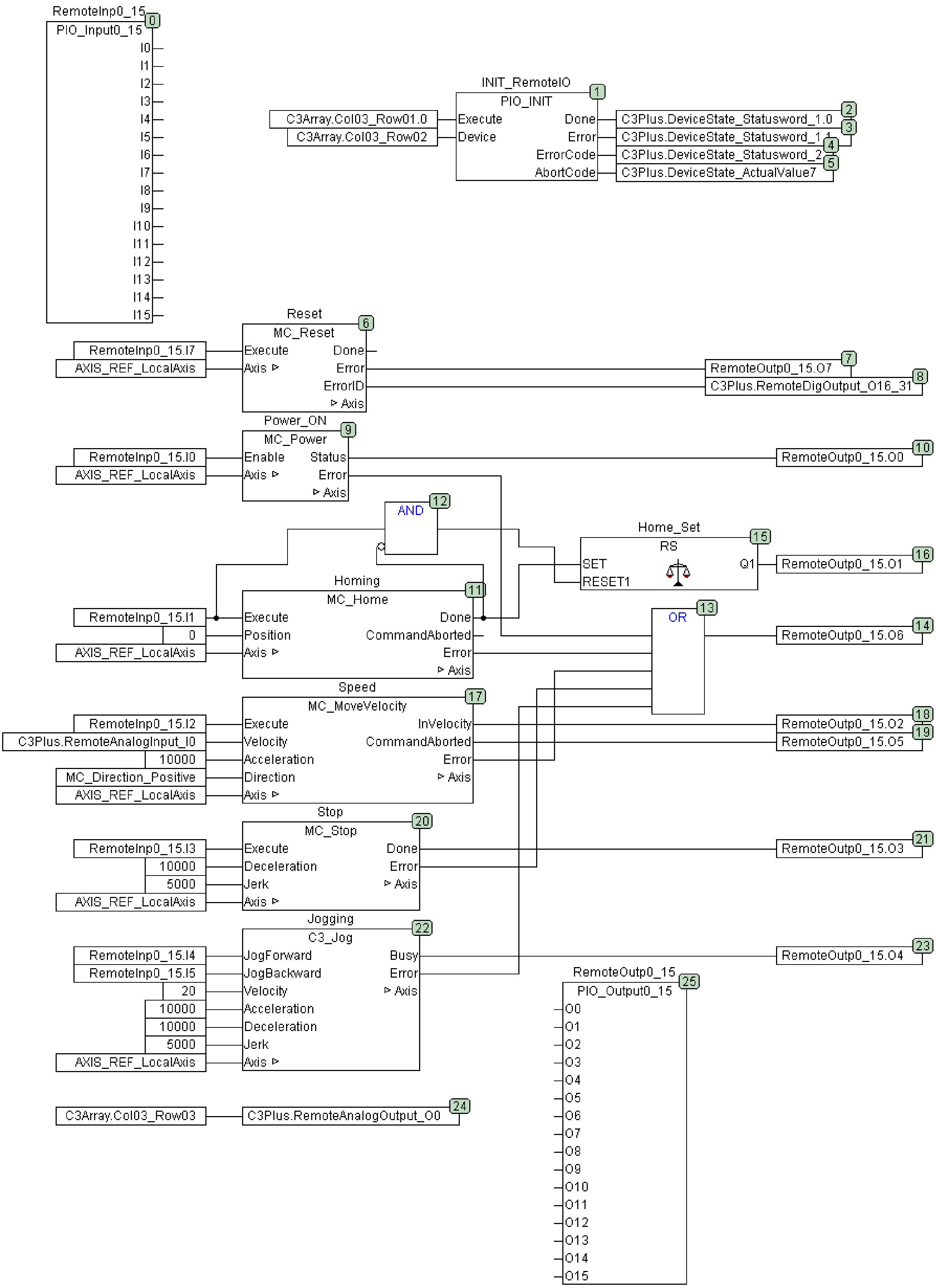
Digital input	Function	Digital output	Function
0	Energize axis	0	Axis is energized
1	Travel to MN (home)	1	MN (home) is accessed
2	Start MoveVelocity	2	Setpoitn speed reached
3	Stop	3	Stop is present
4	JOG +	4	Manual function active
5	JOG -	5	MoveVelocity aborted
6	Free	6	Global module error display
7	Error reset	7	Error is present
Analog input		**Analog output**	
0	Setpoint speed		Setpoint speed specification

Additional Compax3 settings:

- Array_Col03_Row01=1; activates the PIO_Init module
- Array_Col03_Row02=5; address of the PIO
- Array_Col03_Row03=10; Specification for analog output0 => setpoint speed specification

If these values are stored in the Compax3, the PIO will be automatically initialized after Power On and started for PDO data exchange with Compax3.

Solution:


RemoteInp0_15
PIO_Input0_15
I0 I1 I2 I3 I4 I5 I6 I7 I8 I9 I10 I11 I12 I13 I14 I15
INIT_RemoteIO
PIO_INIT
C3Array.Col03_Row01.0
C3Array.Col03_Row02
Execute
Device
Done
Error
ErrorCode
AbortCode
C3Plus.DeviceState_Statusword_1.0
C3Plus.DeviceState_Statusword_1.1
C3Plus.DeviceState_Statusword_2
C3Plus.DeviceState_ActualValue7
Reset
MC_Reset
RemoteInp0_15.I7
AXIS_REF_LocalAxis
ErrorID
RemoteOutp0_15.O7
C3Plus.RemoteDigOutput_O16_31
Power_ON
MC_Power
RemoteInp0_15.I0
Enable
Status
RemoteOutp0_15.O0
AND
Home_Set
RS
SET
RESET1
Q1
RemoteOutp0_15.O1
Homing
MC_Home
RemoteInp0_15.I1
Position
CommandAborted
OR
RemoteOutp0_15.O6
Speed
MC_MoveVelocity
RemoteInp0_15.I2
C3Plus.RemoteAnalogInput_I0
10000
MC_Direction_Positive
Velocity
Acceleration
Direction
InVelocity
RemoteOutp0_15.O2
RemoteOutp0_15.O5
Stop
MC_Stop
RemoteInp0_15.I3
5000
Deceleration
Jerk
RemoteOutp0_15.O3
Jogging
C3_Jog
RemoteInp0_15.I4
RemoteInp0_15.I5
20
JogForward
JogBackward
Busy
RemoteOutp0_15.O4
RemoteOutp0_15
PIO_Output0_15
O0 O1 O2 O3 O4 O5 O6 O7 O8 O9 O10 O11 O12 O13 O14 O15
C3Array.Col03_Row03
C3Plus.RemoteAnalogOutput_O0

5.14 Interface to C3 powerPLmC

In this chapter you can read about:

5.14.1. Interface module "PLmC_Interface"

The interface between a central IEC61131-3 user program on C3 powerPLmC and a local IEC61131-3 user program on a Compax3 servo axis T30 or T40 is created with the program module "PLmC_interface".

The " PLmC_Interface" module must be called up in each Compax3 T30 which is operated as a slave on a C3 powerPLmC.
With Compax3 T40 this is only necessary, if the slave axis is programmed directly (not with **operating mode: "**Slave on C3 powerPLmC (Cam programming on C3 powerPLmC)**")**

The call-up must take place cyclically!

The module can be found in the "C3_PLmC_interface.lib" library, which must be integrated manually via the library manager, if required.

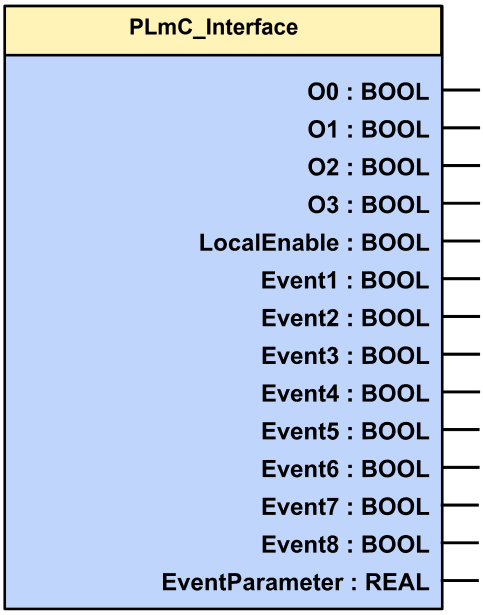
FB name	**PLmC_Interface**	
Interface module for the control of C3 powerPLmC		
VAR_OUTPUT		
O0	BOOL	Status of the digital output O0 on the C3 powerPLmC side
O1	BOOL	Status of the digital output O1 on the C3 powerPLmC side
O2	BOOL	Status of the digital output O2 on the C3 powerPLmC side
O3	BOOL	Status of the digital output O3 on the C3 powerPLmC side
LocalEnable	BOOL	Enable for the local IEC61131-3 program LocalEnable switches to FALSE for one cycle, if a command for this axis is activated on the C3 powerPLmC. This helps to avoid that the axis will receive different commands at a time.
Event1 ... Event8		Reserved
EventParameter		Reserved

Note:

- The execution of all local motion functions should be coupled with the LocalEnable output.
- Via the outputs O0...O3, the outputs set by C3 powerPLmC can be set out via the physical outputs with the aid of C3_Output.

Recipe array line 17... 32 assigned

Please note that the last 16 lines of the recipe array (C3Array.ColXX_Row17 to C3Array.ColXX_Row32) are reserved for the communucation with C3 powerPLmC.


PLmC_Interface
O0 : BOOL
O1 : BOOL
O2 : BOOL
O3 : BOOL
LocalEnable : BOOL
Event1 : BOOL
Event2 : BOOL
Event3 : BOOL
Event4 : BOOL
Event5 : BOOL
Event6 : BOOL
Event7 : BOOL
Event8 : BOOL
EventParameter : REAL

5.14.2. Cyclic data channel for C3T30 and C3T40

An additional communication channel (besides the one established by the Drive Interface which is not freely assignable) can be established between the programs of the C3 powerPLmC and a Compax3 axis via a freely usable cyclic data channel. To do this, the assignment of the channel is defined on the side of the C3 powerPLmC in the controller configuration for the respective axis. The assignment is always bidirectional.
The following options are available for the communication between the two programs.

2x INT:

Assignment of the cyclic channel with 2 INT variables

Mapping to Compax3 objects

C3.PLmCToC3_INT1 / C3.PLmCToC3_INT2	from PLmC to Compax3
C3.C3ToPLmC_INT1 / C3.C3ToPLmC_INT2	from Compax3 to PLmC

Mapping to power PLmC variables

"Axis name".PLmCToC3_INT1	from PLmC to Compax3
"Axis name".PLmCToC3_INT2	from PLmC to Compax3
"Axis name".C3ToPLmC_INT1	from Compax3 to PLmC
"Axis name".C3ToPLmC_INT2	from Compax3 to PLmC

1x DINT:

Assignment of the cyclic channel with one DINT variable

Mapping to Compax3 objects

C3.PLmCToC3_DINT	from PLmC to Compax3
C3.C3ToPLmC_DINT	from Compax3 to PLmC

Mapping to power PLmC variables

Axis name".PLmCToC3_DINT	from PLmC to Compax3
"Axis name".C3ToPLmC_DINT	from Compax3 to PLmC

1x REAL:

Assignment of the cyclic channel with one REAL variable

Mapping to Compax3 objects

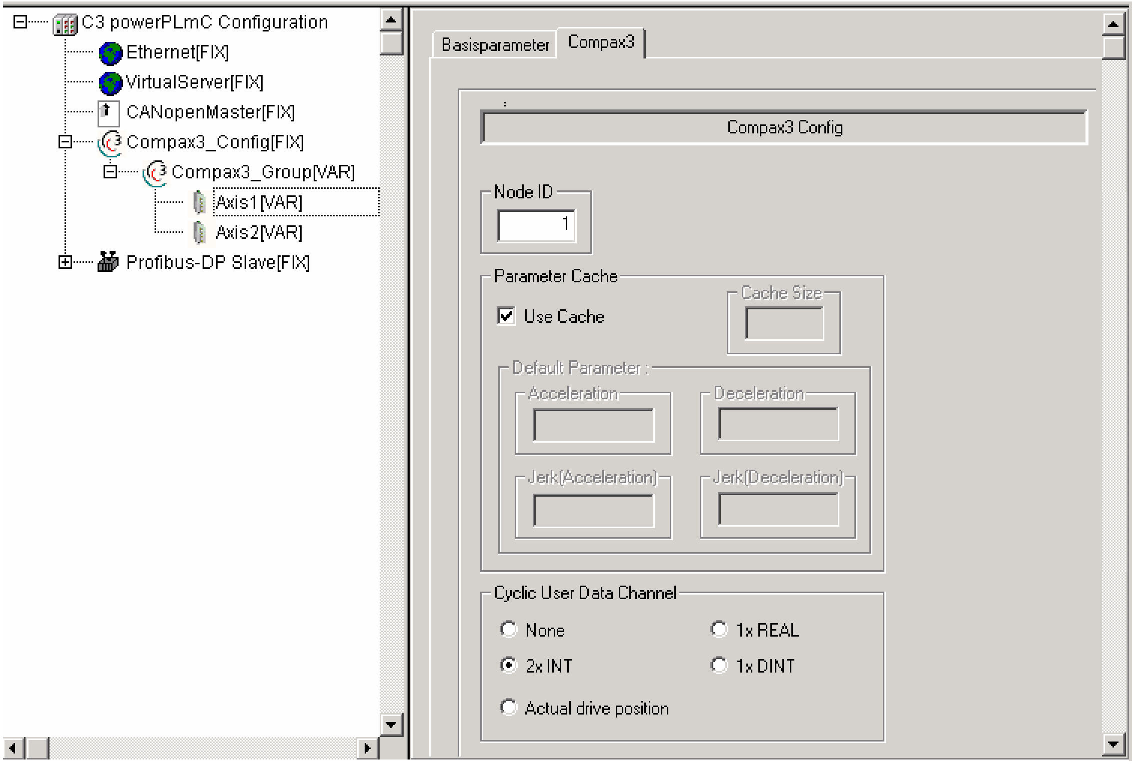
C3.PLmCToC3_REAL	from PLmC to Compax3
C3.C3ToPLmC_REAL	from Compax3 to PLmC

Mapping to power PLmC variables

"Axis name".PLmCToC3_REAL	from PLmC to Compax3
"Axis name".C3ToPLmC_REAL	from Compax3 to PLmC

Note: The use of INT or DINT variables is especially suitable for implementing a user-defined control word / status word between C3 powerPLmC IEC61131-3 program and Compax3 IEC61131-3 program.

Configuration of the data channel



Note: If the cyclic data channel is not required, it can also be assigned to the actual position of the axis. This is then provided by the "**MC_ReadActualPosition** (see page 170)" module. Therefore the value must not be continually read via the acyclic channel if the module is used; this reduces the bus load and the IEC cycle time.

5.14.3. Example: C3 powerPLmC Program & Compax3 Program

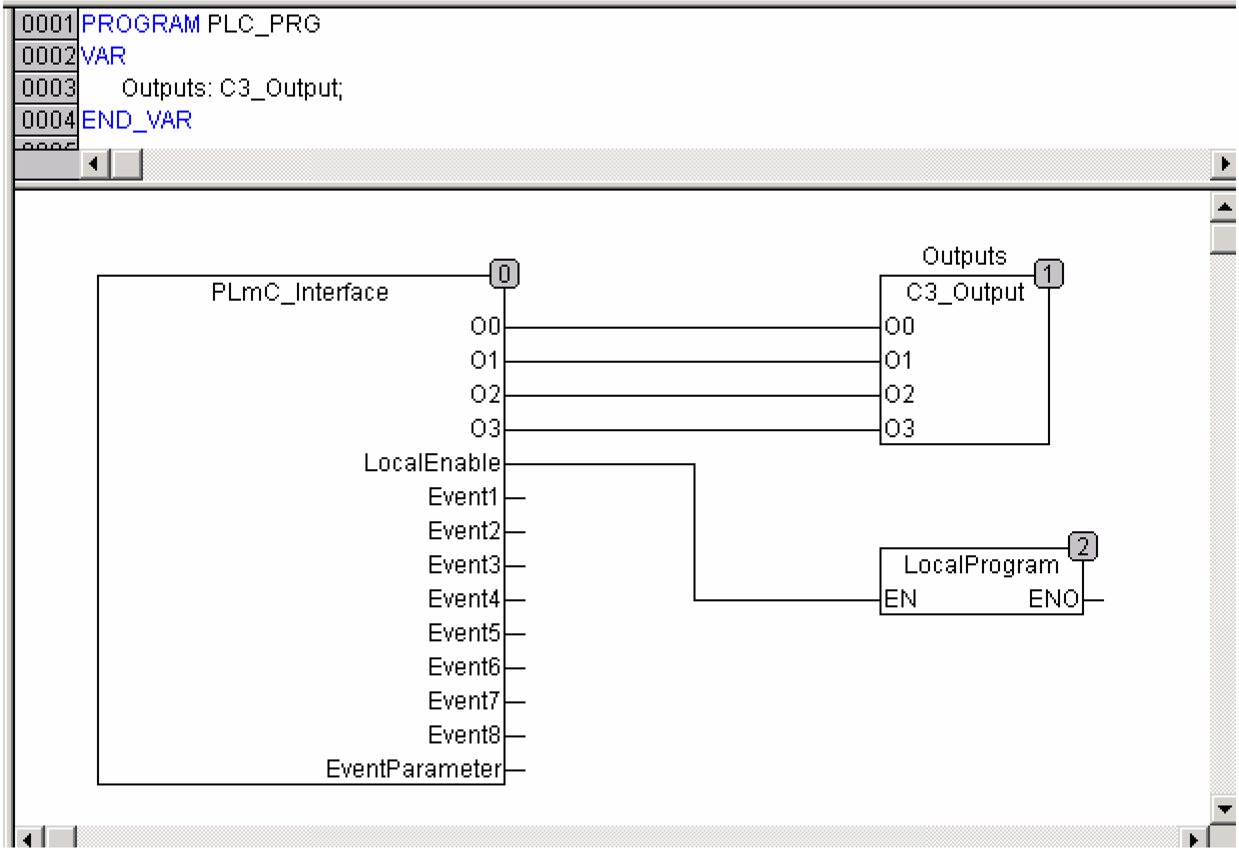
Task:

- Implementation of a mark synchronization in a Compaxa3 servo axis.
- Control of the program via the C3 powerPLmC via a user-defined control word / status word.

Main program on Compax3 (module PLC_PRG)

Cyclic call-up of the interface to powerPLmC in the PLC_PRG module

In CFC:

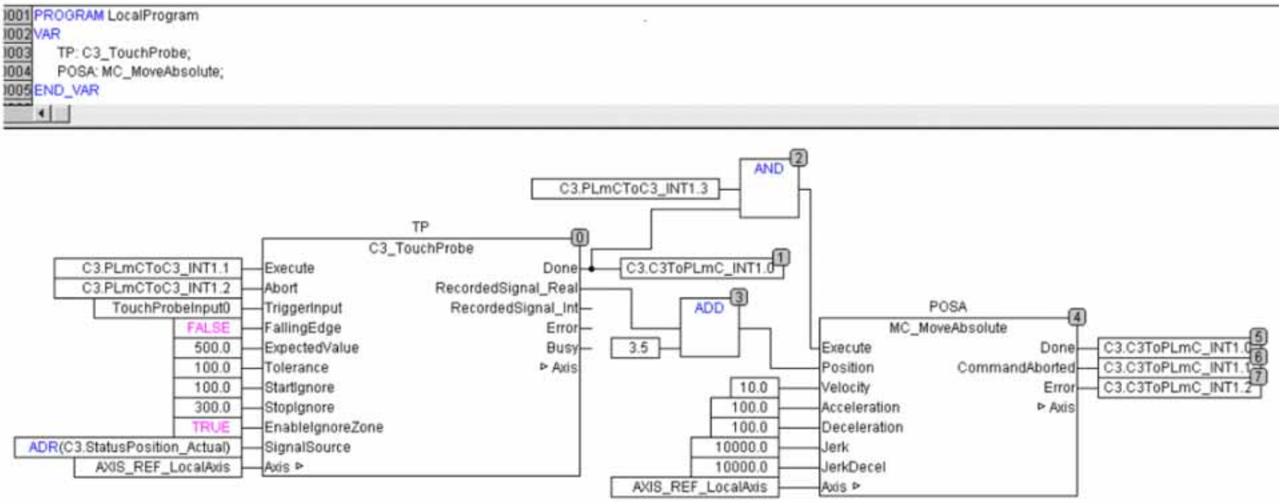


In ST:

```
PROGRAM PLC_PRG
VAR
    Outputs : C3_Output;
END_VAR
```

```
PLmC_Interface(O0=>Outputs.O0,O1=>Outputs.O1,O2=>Outputs.O2,O3=>Outputs.O3);
Outputs();
IF PLmC_Interface.LocalEnable THEN
    LocalProgram();
END_IF
```

Local Compax3 Program in the LocalProgram module



Program on C3 powerPLmC

```
PROGRAM PLC_PRG
VAR
    Inputs : C3_Input;
    Power : MC_Power;
    MoveAbs : MC_MoveAbsolute;
    Status : MC_ReadStatus;
    TouchProbeDone: BOOL;
END_VAR
```

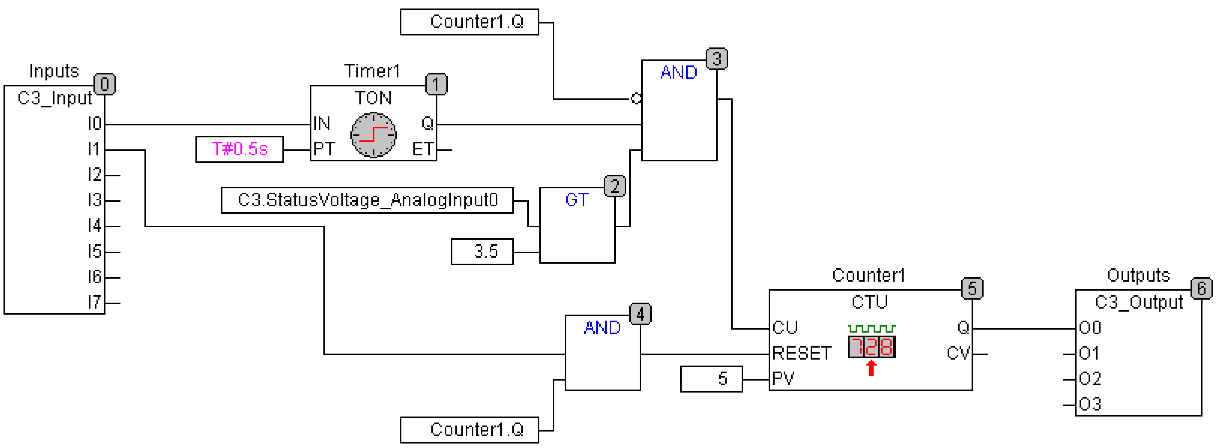
```
DriveExecuteStart(ADR(Compax3_Group));

Inputs(Axis := Axis1);
Status(Axis := Axis1);

IF(Inputs.I0 AND NOT Inputs.I3) THEN
    Power.Enable := TRUE;
ELSE
    Power.Enable := FALSE;
END_IF

IF(Inputs.I4) THEN
    MoveAbs.Position := Position1;
    MoveAbs.Velocity  :=  Velocity1;
    MoveAbs.Acceleration  :=  100;
    MoveAbs.Deceleration := 100;
    MoveAbs.Jerk := 10000;
    MoveAbs.JerkDecel := 10000;
    MoveAbs.Execute := TRUE;
END_IF

IF(Inputs.I4 AND Status.DiscreteMotion) THEN
    (* set control bit to start C3_TouchProbe in local program *)
    Axis1.PLmCToC3_INT1.1 := TRUE;
END_IF

IF(Axis1.C3ToPLmC_INT1.0) THEN
    (* C3_TouchProbe in local program is done *)
    TouchProbeDone := TRUE;
END_IF

Power(Axis := Axis1);
MoveAbs(Axis := Axis1);

DriveExecuteEnd(ADR(Compax3_Group));
```

5.15 IEC examples

In this chapter you can read about:

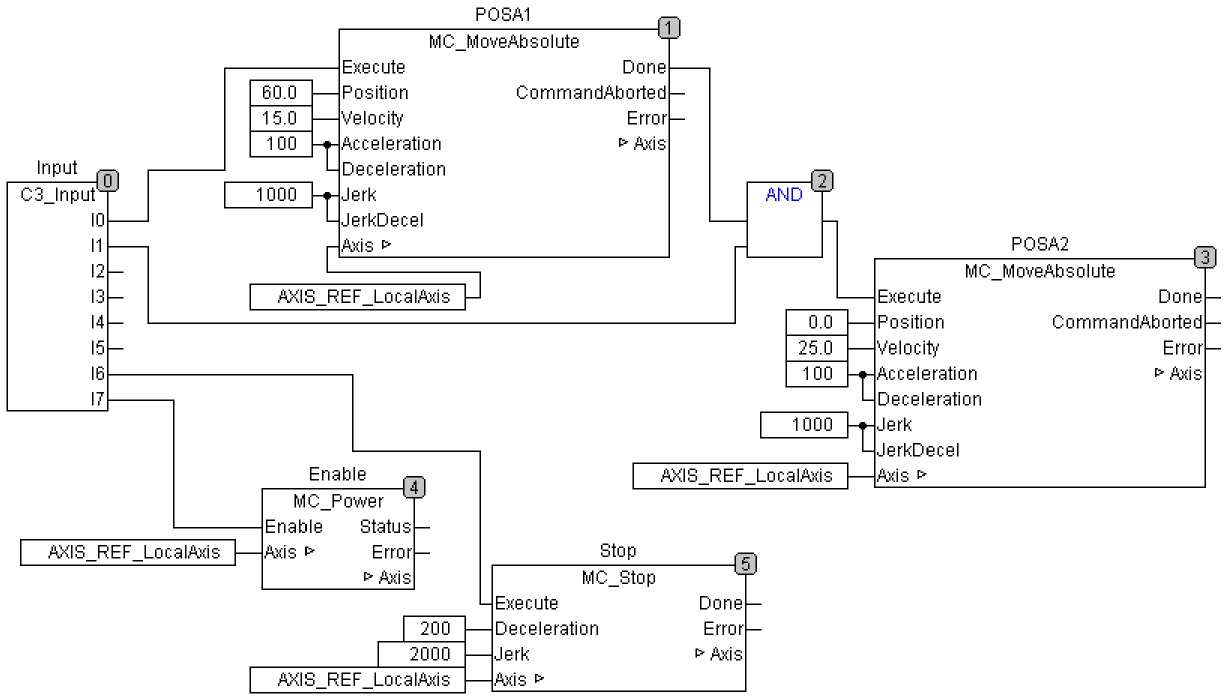
5.15.1. Example in CFC: Using Compax3-specific function modules and Compax3 objects

- Read in the process image of the digital inputs with the InputStatus module.
- Generate a process image of the digital outputs with the OutputStatus module.
- Digital input I0, used for counting an external event. The event is only detected as an event if
  - The I0 input is at TRUE for at least 0.5 seconds and
  - The voltage on analog input 0 exceeds the threshold value of 3.5 volts.
- When 5 of these events have been counted, the digital output is set to O0. At the same time, the program prevents additional events on the I0 from being counted. The counter state can be reset again with Input I1 as soon as it reaches a value of 5.



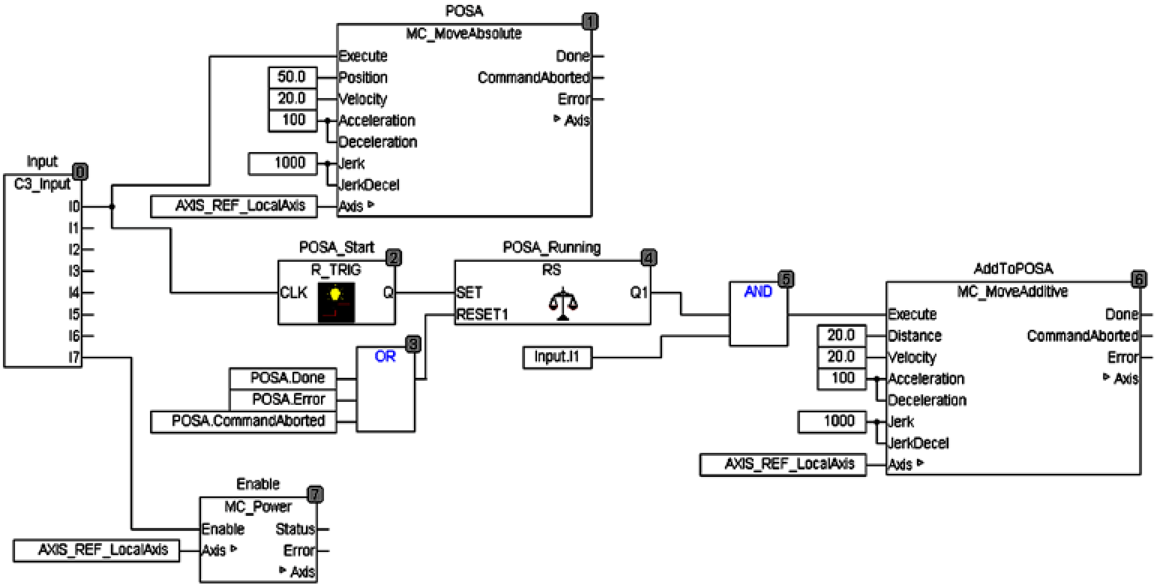
5.15.2. Example in CFC: Positioning 1

- Input I7 enables the power output stage
- Input I0 starts an absolute positioning process with fixed parameters
- Input I6 is used to stop the movement
- After positioning is complete, there will be a return to Position 0 as soon as Input I1 has been activated



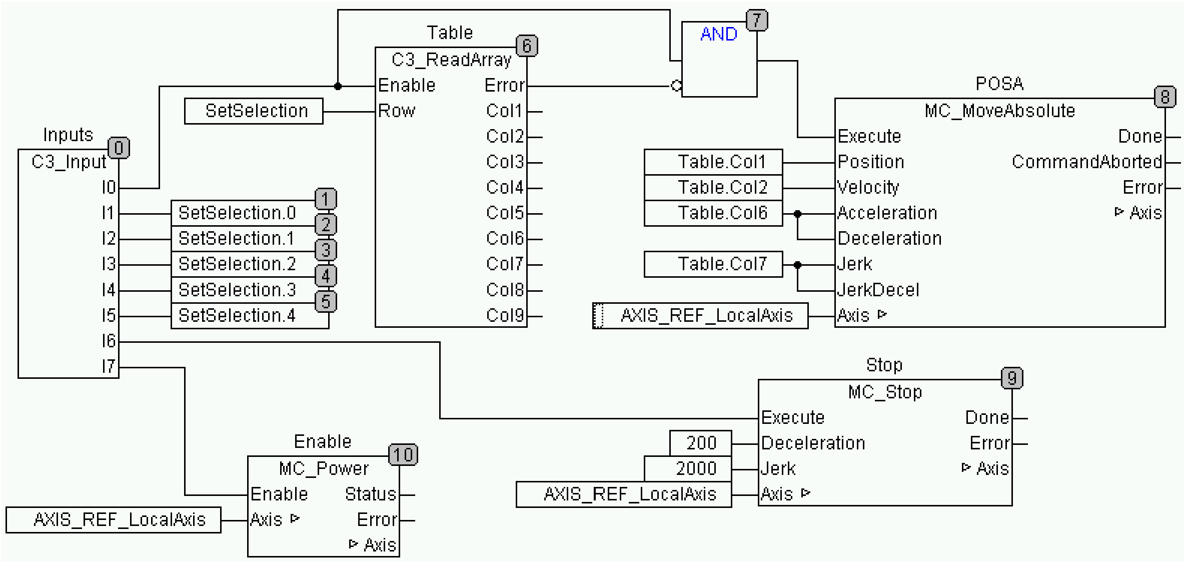
5.15.3. Example in CFC: Positioning 2

- Input I7 enables the power output stage
- Input I0 starts an absolute positioning process
- If an event (I1) occurs during the positioning, the target position will be moved back by 20 ("MoveAdditive")
- If an event occurs while positioning is not in progress, it has no effect



5.15.4. Example in CFC: Positioning with set selection

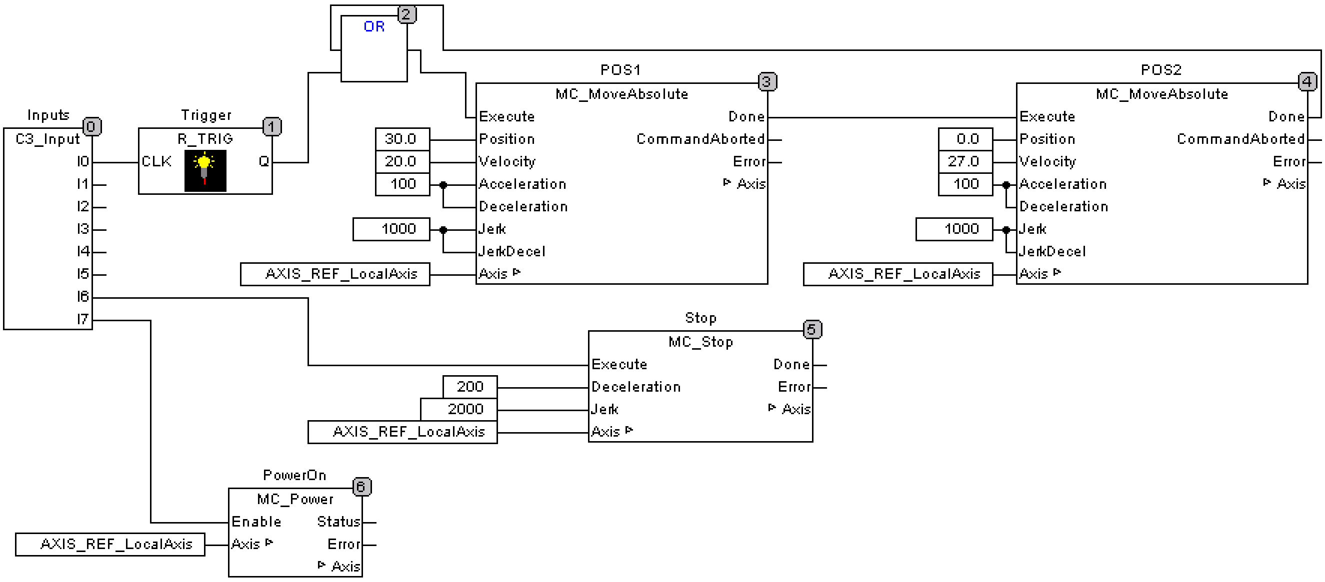
- Input I7 enables the power output stage
- The position, speed and ramps can be stored in the array (table) (for example input with the Compax3 ServoManager)
- The desired set can be selected with inputs I1 through I5 (binary coded)
- Input I0 starts the positioning (absolute positioning)
- Positioning that is in progress can be stopped with Input I6



5.15.5. Example in CFC: Cycle mode

Example a: Cycle mode

- Input I7 enables the power output stage
- Input I0 starts cyclical positioning. During this process, two positions are approached in alternation.
- Input I6 stops cycle mode



5.15.6. Example in ST: Cycle mode with a Move module

Input I2 enables the power output stage.

- Input I0 starts cycle mode. Two positions are approached alternately.
- There is a pause of 1 second after the first position is reached.
- There is a pause of 1.5 seconds after the second position is reached.
- Input I1 stops cycle mode.

CoDeSys - Schrittkette_ST_Englisch.pro* - [PLC_PRG (PRG-ST)]

Datei Bearbeiten Projekt Einfügen Extras Online Fenster Hilfe

```
PROGRAM PLC_PRG
VAR
    Inputs: C3_Input;
    Outputs: C3_Output;
    StartTrigger: R_TRIG;
    POSA: MC_MoveAbsolute;
    Timer1: TON;
    Stop: MC_Stop;
    Power: MC_Power;
    State: INT;
END_VAR

```

```
    Inputs(); (* Read Input process image*)

    (* Enable Power stage *)
    Power(Enable:=Inputs.I2 , Axis:= AXIS_REF_LocalAxis, Status=>Outputs.O0);

    (* State machine Start *)
    StartTrigger(CLK:=Inputs.I0); (* detect a rising edge on Input I0 *)
    IF(StartTrigger.Q) THEN   (* Rising Edge ? *)
        State:=1;             (* -> Start State machine *)
    END_IF

    (* State machine *)
    CASE State OF
    1:  (* Prepare first Move command *)
        POSA.Execute:=FALSE;
        POSA.Position:=30.0;
        POSA.Velocity:=15.0;
        State:=2;
    2:  (* Start first Move command *)
        POSA.Execute:=TRUE;
        State:=3;
    3:  (* Wait until position 1 reached *)
        IF(POSA.Done) THEN
            State:=4;
        END_IF
```

Z.: 55, Sp.: 46 ON

```
4:  (* 1 Sekunde Pause *)
    Timer1(IN:=TRUE , PT:=T#1.0s);
    IF(Timer1.Q) THEN
        Timer1(IN:=FALSE);
        Zustand:=5;
    END_IF
5:  (* Positionierung 2 vorbereiten *)
    POSA.Execute:=FALSE;
    POSA.Position:=0.0;
    POSA.Velocity:=25.0;
    Zustand:=6;
6:  (* Positionierung 2 Start *)
    POSA.Execute:=TRUE;
    Zustand:=7;
7:  (* Warten bis Position 2 erreicht *)
    IF(POSA.Done) THEN
        Zustand:=8;
    END_IF
8:  (* 1.5 Sekunden Pause *)
    Timer1(IN:=TRUE , PT:=T#1.5s);
    IF(Timer1.Q) THEN
        Timer1(IN:=FALSE);
        Zustand:=1;     (* Schrittkette erneut starten *)
    END_IF
END_CASE
(* Positionierbaustein aufrufen *)
POSA(Acceleration:=100, Deceleration:=100, Jerk:=10000, JerkDecel:=10000, Axis:=AXIS_REF_LocalAxis);
(* Stop Eingang *)
Stop(Execute:=Inputs.I1 , Deceleration:=200 , Jerk:=20000 , Axis:=AXIS_REF_LocalAxis);
IF(Inputs.I1) THEN          (* Stop Eingang = TRUE *)
    Zustand:=0;             (* Schrittkette zurücksetzen *)
    Timer1(IN:=FALSE);      (* Timer zurücksetzen *)
    POSA.Execute:=FALSE;
END_IF
Outputs(); (* PA Ausgänge schreiben *)
```

5.16 Profibus: Emulating the ProfiDrive profile (C3F_ProfiDrive_Statemachine)

The function module can be found in the "C3_Profiles_lib" library and must be integrated via the library manager before use.

Notes on the use:

- The input values coming from the master control via the Profibus can be changed before they are transmitted to the Statemachine (e.g. I/Os).
- In the simplest case, the control word and the motion parameters (which may come from the Profibus) are manipulated by te IEC program.
- If the Statemachine is active, all motions must be executed via the Statemachine. Motions such as for example MoveAbsolut, MoveRelativ; MoveAdditiv; MoveVelocity; Gearing, Reg-related positioning are possible. Or with Compax3F: Force/pressure regulating.
- With the "control via PLC" bit (CW1 bit 10 = 1), the Statemachine takes the control for the drive (is active). This means that no functions concerning the device status (such as Power, MoveX) by other function/program modules are permitted. If "no control" is selected (CW1 bit 10 = 0), the device status can be changed via function/program modules.
- The Profidrive Statemachine works independently of hte Profibus. I.e. it can also be used in connection with other busses.
- The Profidrive Statemachine contains states, which cannot be mapped to the PLCopen status machine.

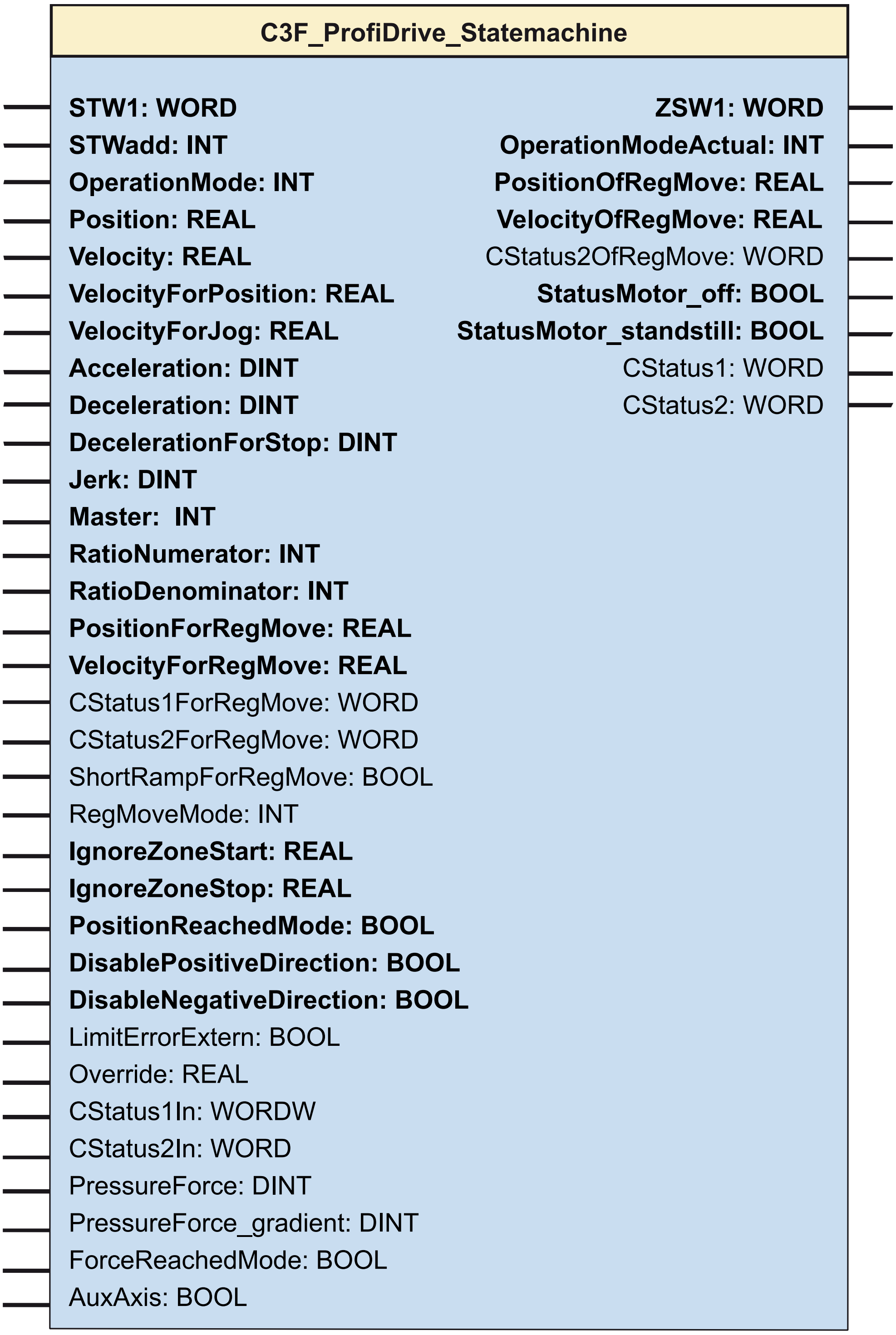
FB name	C3_ProfiDrive_Statemachine	
With the aid of the Profibus function module, the PROFIdrive profile can be simulated. The profile is described in the help of the Compax3 I20T11 technology function (set operation is however not possible). The inputs of the module can be assigned as required.		
VAR_IN_OUT		
--	--	--
VAR_INPUT		
CW1	WORD	Control word according to Profidrive (see below)
STWadd	INT	additional control word: the following functions can be triggered in the positioning mode 0: no action 1: NOP (No Operation) 2: Stop 3: Homing Execution takes place with the "activate motion order" of CW1. The value must be reset to zero after the execution!
OperationMode	INT	Operating mode after Profidrive 1: Speed control 2: Positioning
Position	REAL	Position setpoint value for all positioning commands (MoveAbs, MoveRel, MoveAdd, RegSearch, RegMove preparation)
Velocity	REAL	Setpoint speed in operating mode 1 (speed control) and for MoveVelocity (not for positioning)
VelocityForPosition	REAL	Setpoint travel speed for positioning
VelocityForJog	REAL	Speed for JOG
Acceleration	DINT	Commanded acceleration
Deceleration	DINT	Setpoint deceleration

DecelerationForStop	DINT	Deceleration for Stop
Jerk	DINT	Setpoint jerk
Master	INT	Source for Gearing - AXIS_REF_Physical (T30, T40) [e.g. encoder input X11] – AXIS_REF_HEDA (T30, T40) – AXIS_REF_Virtual (T40)
RatioNumerator	INT	Numerator for Gearing
RatioDenominator	INT	Denominator for Gearing
PositionForRegMove	REAL	Position for RegMove, necessary if RegSearch is executed and registration is detected. Note: The input is connected to the PositionOfRegMove output in the simplest case.
VelocityForRegMove	REAL	Speed for RegMove, necessary if RegSearch is executed and registration is detected. Note: The input is connected to the VelocityOfRegMove output in the simplest case.
CStatus1ForRegMove	WORD	- do not use - Command status 1 for RegMove end; necessary if RegSearch is executed and registration is detected
CStatus2ForRegMove	WORD	reserved!
ShortRampForRegMove	BOOL	Permits the Compax3 to calculate individual parameters for the RegMove positioning, if the set parameters would not reach the target.
RegMoveMode	INT	reserved!
IgnoreZoneStart	REAL	Registration mark-related positioning: Beginning of Registration lock-out zone (StartIgnore)
IgnoreZoneStop	REAL	Registration mark-related positioning: End of Registration lock-out zone (StopIgnore)
PositionReachedMode	BOOL	Mode for the generation of the PositionReached in the status word (CW1.10). TRUE: link to setpoint value
DisablePositiveDirection	BOOL	Block for positive direction
DisableNegativeDirection	BOOL	Block for negative direction
LimitErrorExtern	BOOL	reserved!
Override	REAL	reserved!
CStatus1In	WORDW	reserved!
CStatus2In	WORD	reserved!
PressureForce	DINT	Setpoint differential pressure [mbar, psi] or setpoint force [N]. **Description** (see page 203)
PressureForce_Gradient	DINT	Change speed for pressure or force in [bar/s, psi/s], [N/s].
ForceReachedMode	BOOL	Mode for the generation of the ForceReached in the status word (SW1.10). TRUE: Link to setpoint value.
AuxAxis	BOOL	Defines, if the auxiliary axis is to be used as a following axis. TRUE: Auxiliary axis runs synchronously to the main axis
VAR_OUTPUT		
ZSW1	WORD	Status word after Profidrive
OperationModeActual	INT	Active operating mode
PositionOfRegMove	REAL	Position transmitted to the RegMove command (cache memory) Note: The output is connected to the PositionForRegMove input in the simplest case.

VelocityOfRegMove	REAL	Velocity transmitted to the RegMove command (cache memory) Note: The input is connected to the VelocityForRegMove output in the simplest case.
CStatus2OfRegMove	WORD	reserved!
StatusMotor_off	BOOL	Motor is currentless (TRUE)
StatusMotor_standstill	BOOL	Status motor is energized at standstill (setpoint value) (TRUE)
CStatus1	WORD	reserved!
CStatus2	WORD	reserved!

Notes:

- You can call up directly the help for the Compax3 Profidrive device (I20T11) via the help intaller (C3 ServoManager "?" Start C3 ServoManager Help Installer...) (select and open in the left window).
- On the Compax3 DVD you will find an application example with additional explanations for the use of this module:
  C3 DVD directory .....\Examples\Profidrive with T30T40\


C3F_ProfiDrive_Statemachine
STW1: WORD
STWadd: INT
OperationMode: INT
Position: REAL
Velocity: REAL
VelocityForPosition: REAL
VelocityForJog: REAL
Acceleration: DINT
Deceleration: DINT
DecelerationForStop: DINT
Jerk: DINT
Master: INT
RatioNumerator: INT
RatioDenominator: INT
PositionForRegMove: REAL
VelocityForRegMove: REAL
CStatus1ForRegMove: WORD
CStatus2ForRegMove: WORD
ShortRampForRegMove: BOOL
RegMoveMode: INT
IgnoreZoneStart: REAL
IgnoreZoneStop: REAL
PositionReachedMode: BOOL
DisablePositiveDirection: BOOL
DisableNegativeDirection: BOOL
LimitErrorExtern: BOOL
Override: REAL
CStatus1In: WORDW
CStatus2In: WORD
PressureForce: DINT
PressureForce_gradient: DINT
ForceReachedMode: BOOL
AuxAxis: BOOL
ZSW1: WORD
OperationModeActual: INT
PositionOfRegMove: REAL
VelocityOfRegMove: REAL
CStatus2OfRegMove: WORD
StatusMotor_off: BOOL
StatusMotor_standstill: BOOL
CStatus1: WORD
CStatus2: WORD

6. Communication

In this chapter you can read about:

Here you will find the description of the fieldbus interfaces, which can be configured in the Compax3 ServoManager under the tree entry "configuring the communication".

Please note: The configuration of the process data (Mapping) is made wizard-guided with the Compax3 ServoManager.
If you perform the mapping directly via the master, you must go through this fieldbus wizard once; the Compax3 ServoManager will perform the necessary initializations.

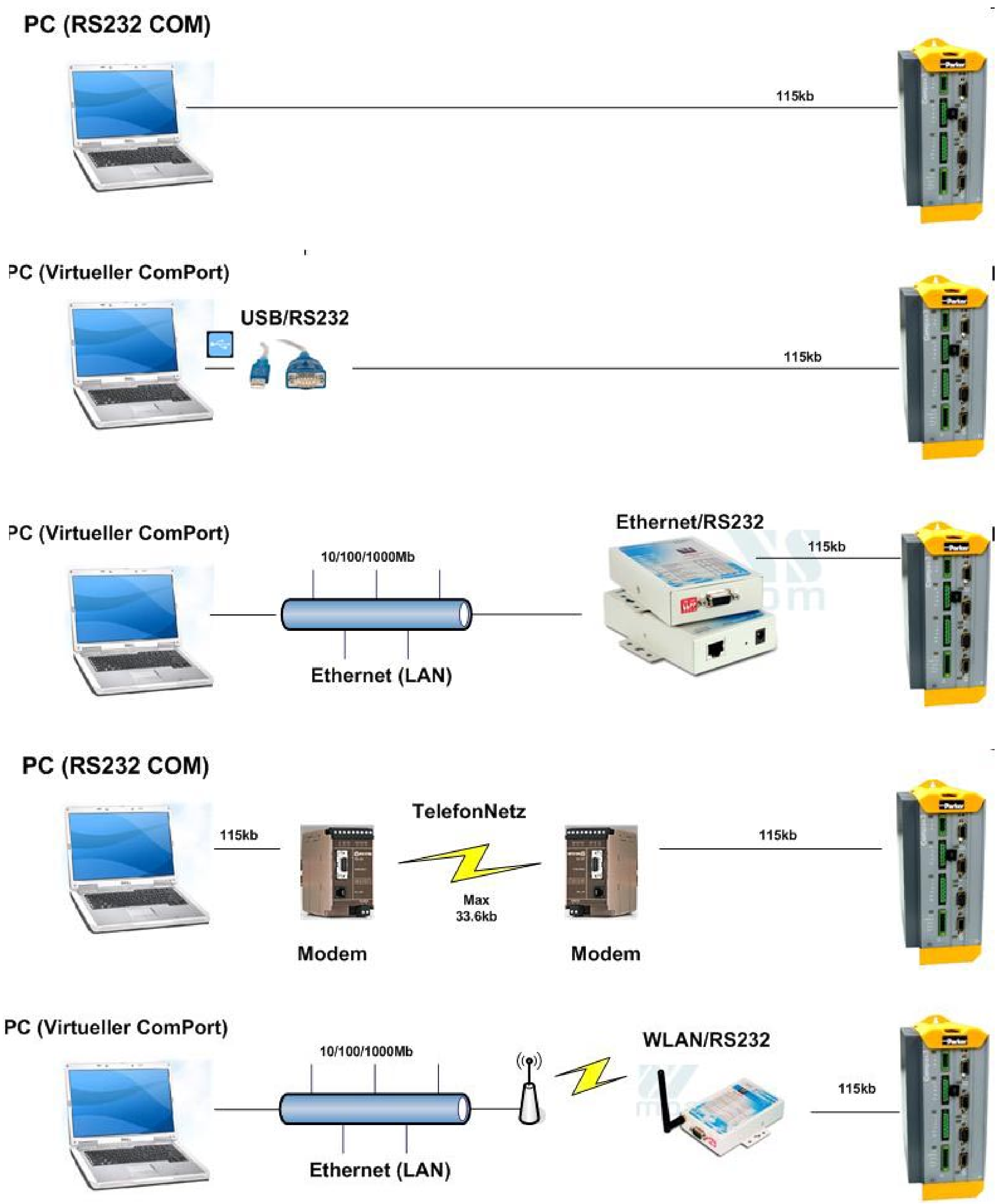
6.1 Compa3 communication variants

In this chapter you can read about:

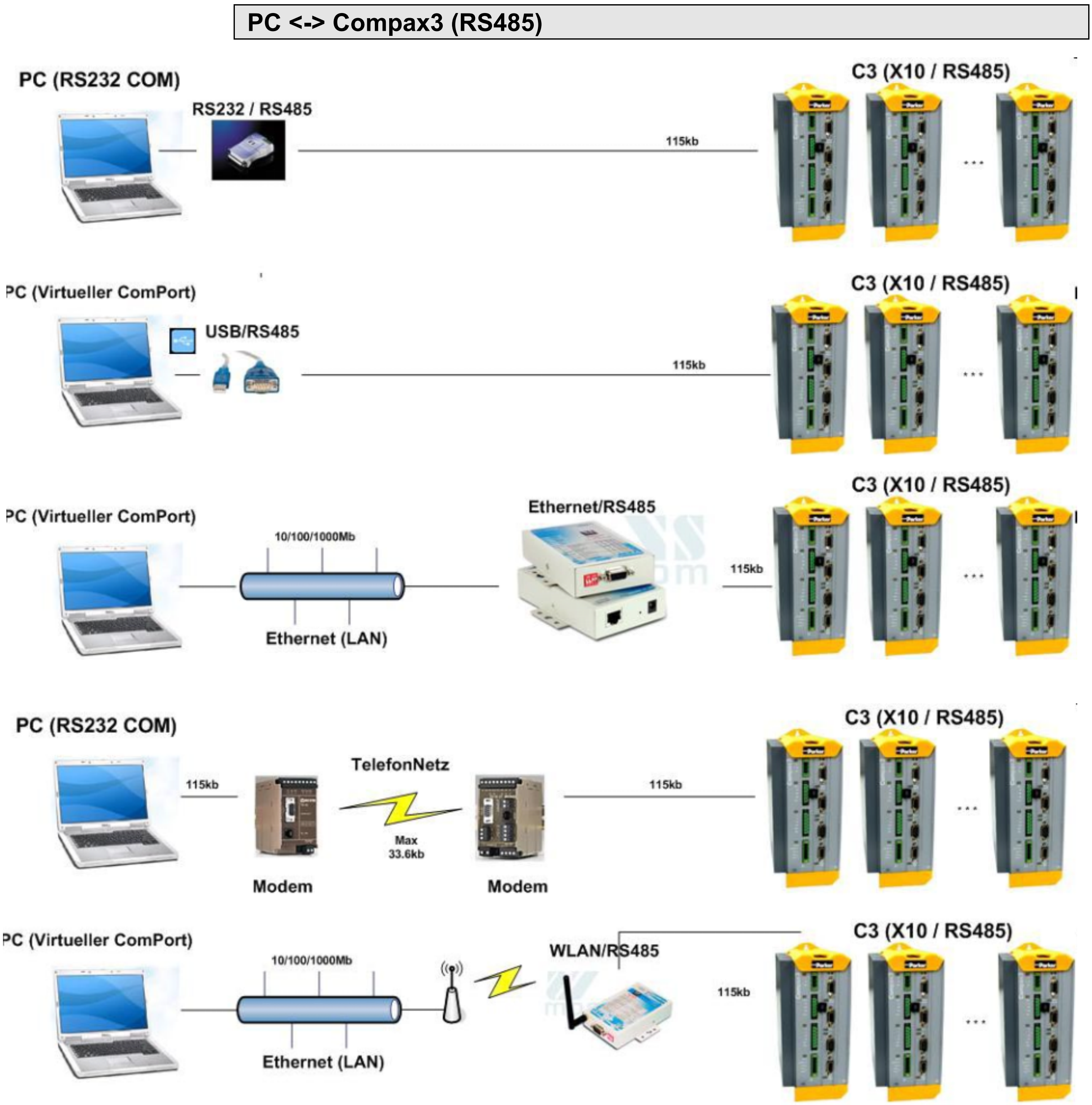
Overview of all possible communication modes between Compax3 deviecs and a PC.

6.1.1. PC <-> Compax3 (RS232)

PC <-> Compax3 (RS232): Connections to a device

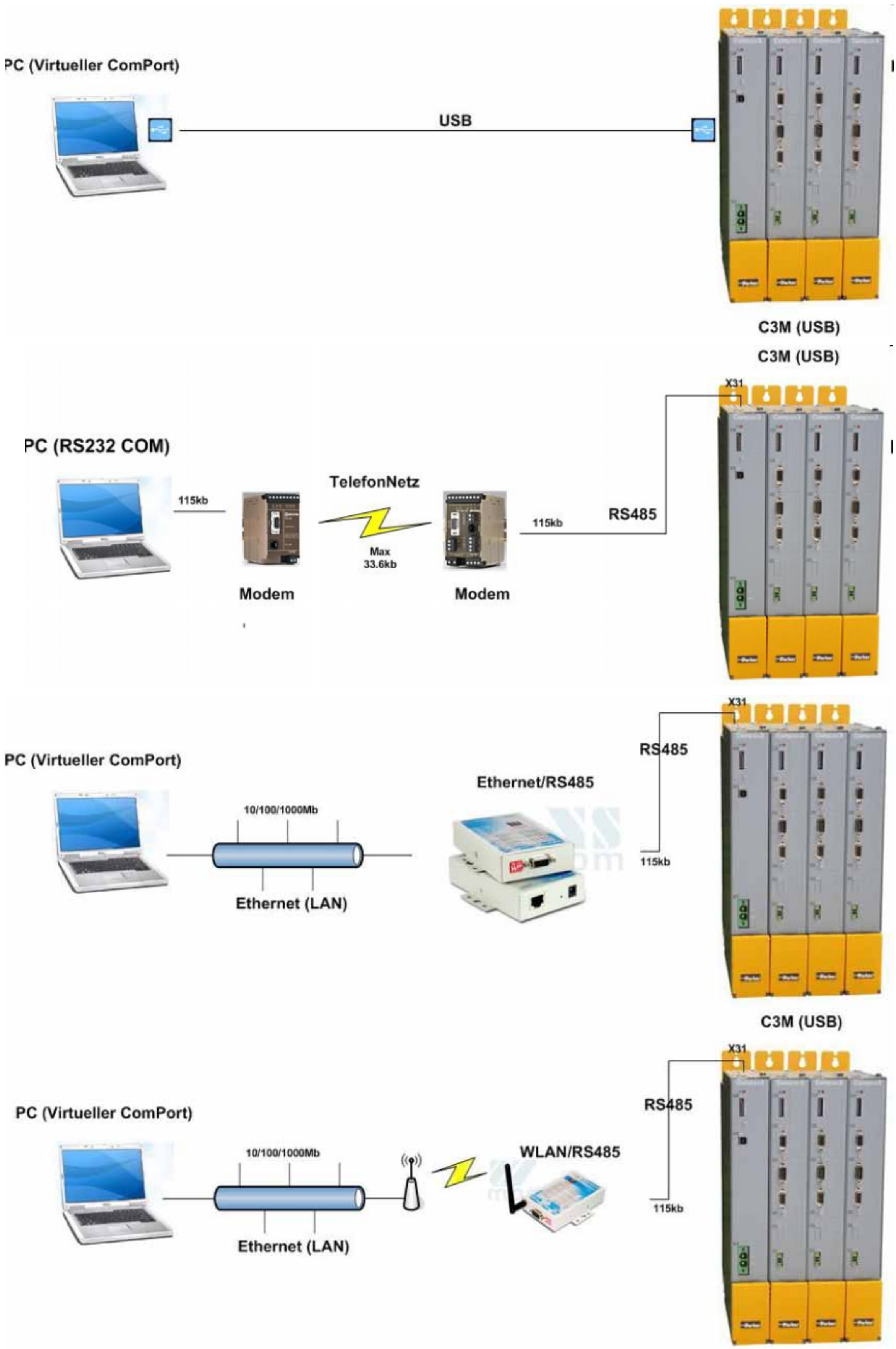


6.1.2. PC <-> Compax3 (RS485)



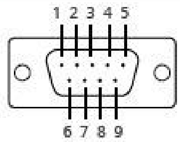
6.1.3. PC <-> C3M device combination (USB)

PC <-> C3M device combination



6.1.4. USB-RS485 Moxa Uport 1130 adapter

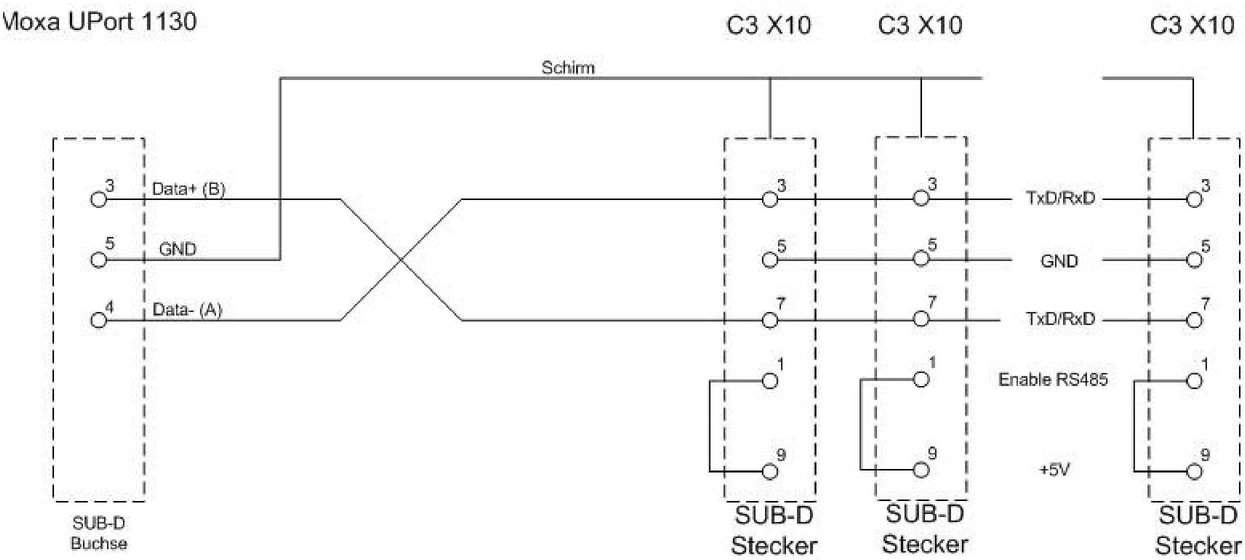
Male DB9



PIN	RS-422/4-wire RS-485	2-wire RS-485
1	TxD-(A)	–
2	TxD+(B)	–
3	RxD+(B)	Data+(B)
4	RxD-(A)	Data-(A)
PIN	**RS-422/4-wire RS-485**	**2-wire RS-485**
5	GND	GND
6	–	–
7	–	–
8	–	–

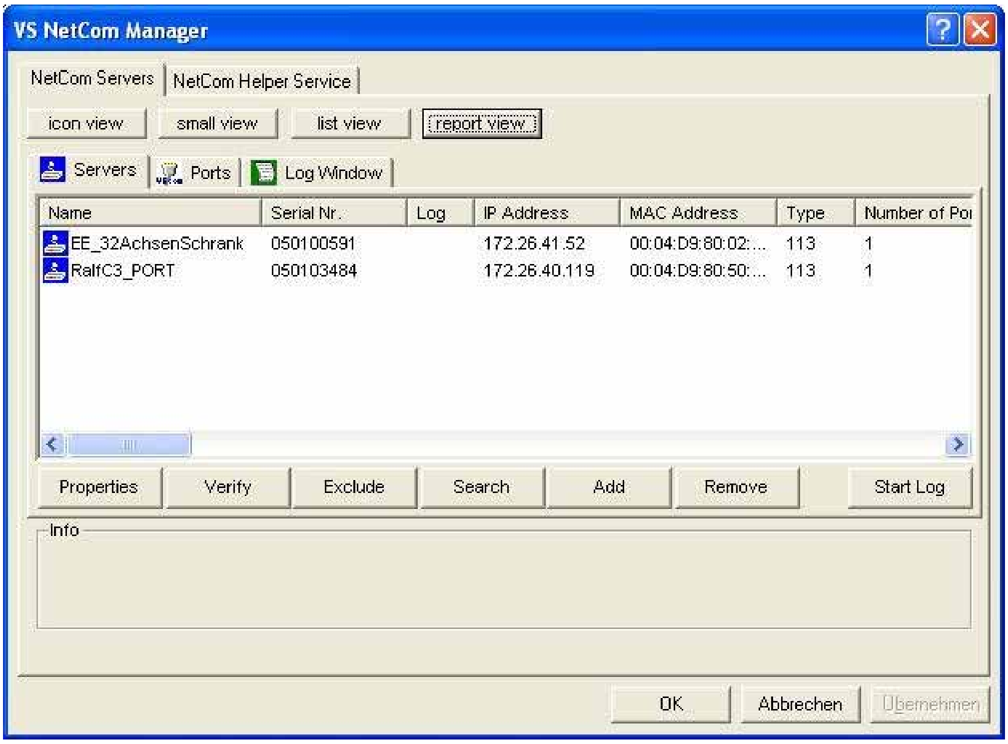
The serial UPort 1130 USB adapter offers a simple and comfortable method of connecting an RS-422 or RS-485 device to your laptop or PC. The UPort 1130 is connected to the USB port of your computer and complements your workstation with a DB9 RS-422/485 serial interface. For simple installation and configuraiton, Windows drivers are already integrated. The UPort 1130 can be used with new or legacy serial devices and supports both 2- and 4-wire RS-485. It is especially suited for mobile, instrumentation and point-of-sale (POS) applications.
Herstellerlink: **http://www.moxa.com/product/UPort_1130.htm**
http://www.moxa.com/product/UPort_1130.htm

Connection plan for Compax3S:



6.1.5. ETHERNET-RS485 NetCOM 113 adapter

Herstellerlink: **http://www.vscom.de/666.htm** (http://www.vscom.de/666.htm)



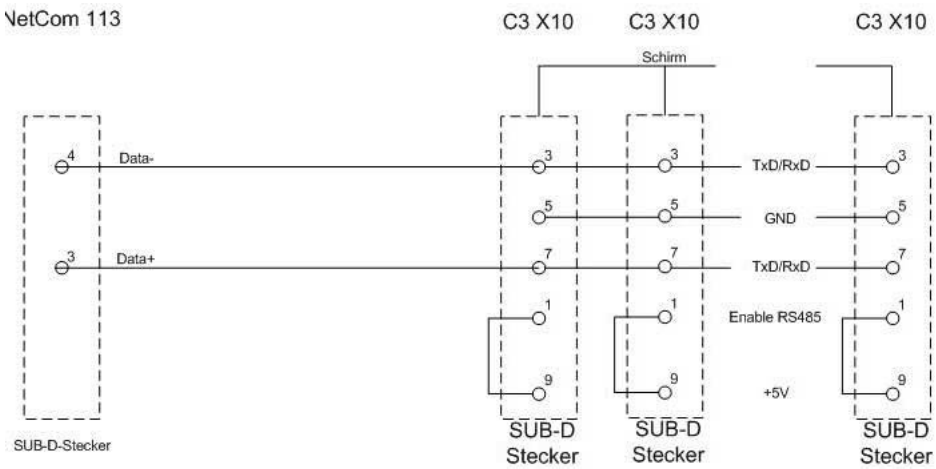
DIP Switch settings NetCom 113 for two-wire operation:

1ON 2ON 3off 4off (Mode: RS485 by ART (2 wire without Echo)

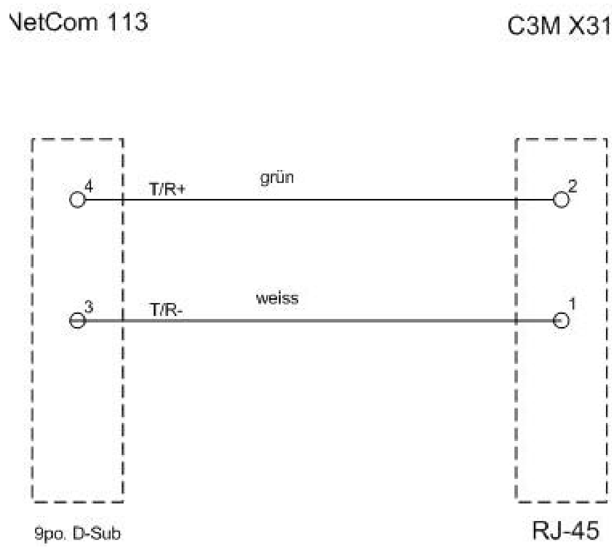
Communication settings C3S/C3M:

Object	Function	Value
810.1	Protocol	16 (two wire)
810.2	Baud rate	115200
810.3	NodeAddress	1..254
810.4	Multicast Address	

Connection plan NetCom113<-> C3S:

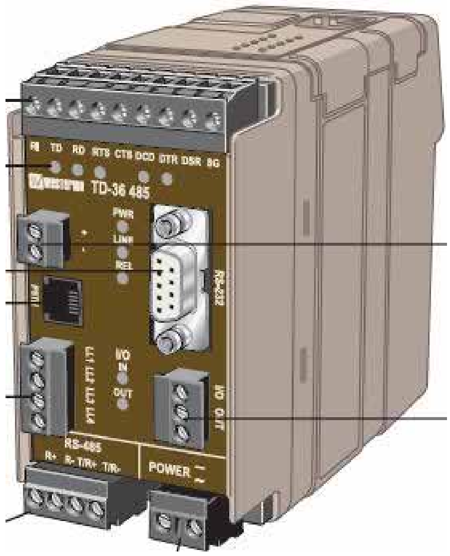


Connection plan NetCom113<-> C3M X31:



6.1.6. Modem Westermo TD-36 485

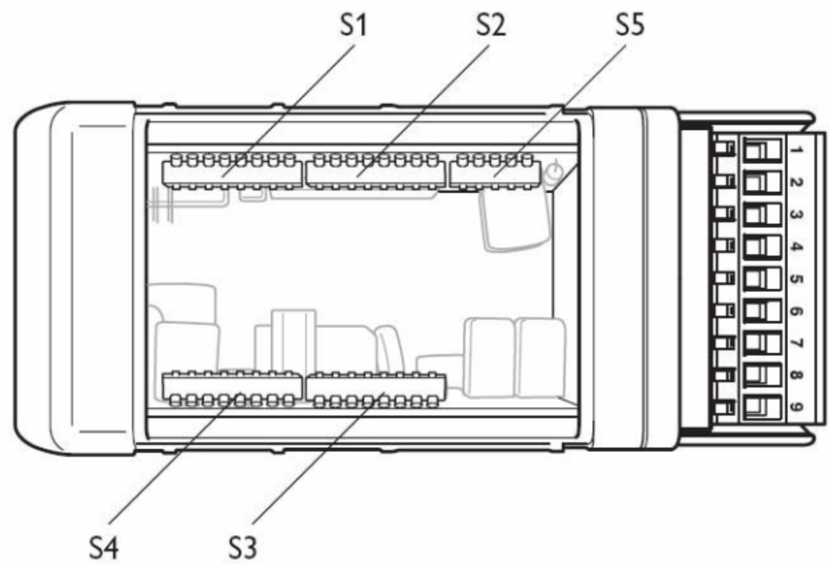
Modem Westermo TD-36 485 (Remote maintenance C3S /C3M)

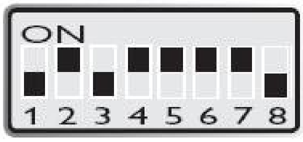


DIP Switch - settings TD-36 (RS485 two wire)

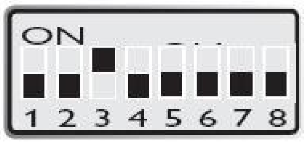
For operation , all settings must be reset to factory settings!
All other settings must be made via the DIP switches.

IMPORTANT: The changes of the DIP switches are only accepted after POWER ON!

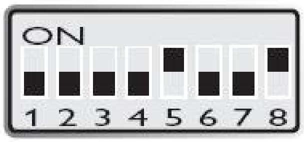


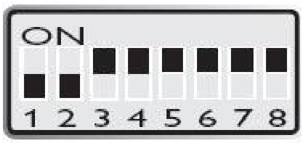
S1: 

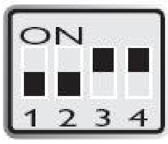
115kB / Direct Mode 8N

S2: 

PSTN enable/ RS-422/RS85 enable / 2 Wire /

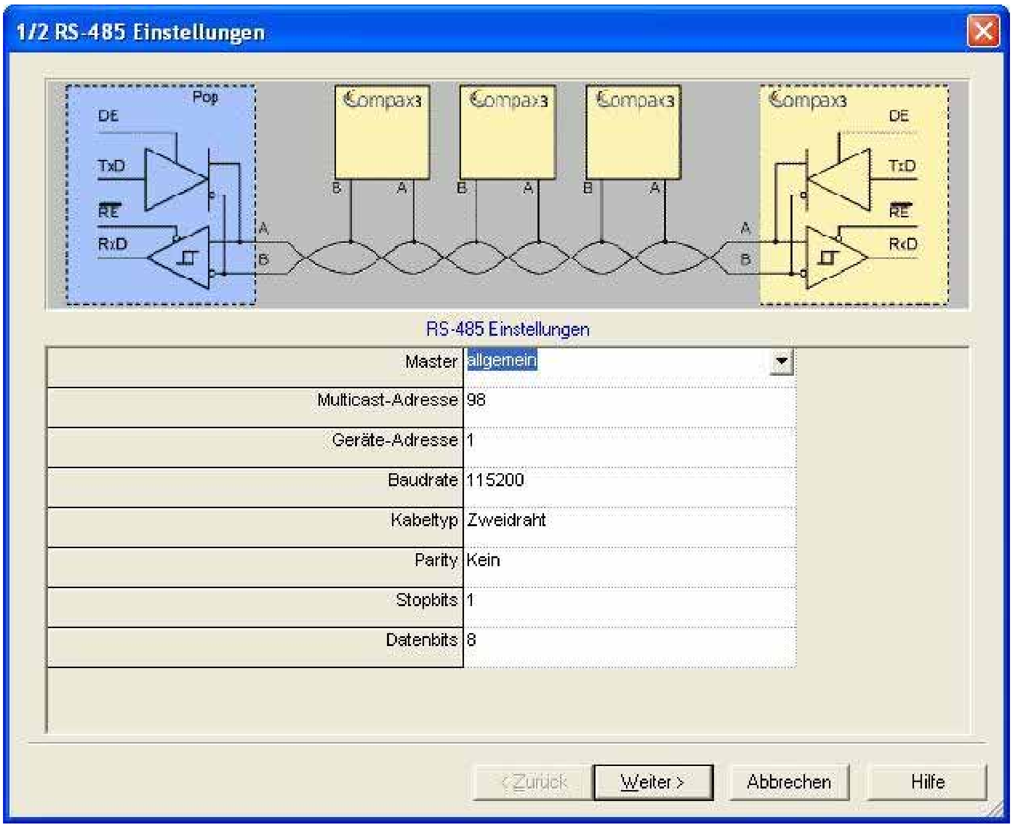
S3: 

S4: 

S5: 

C3 ServoManager RS485 wizard settings:

download with configuration in RS232 mode°!



Communication settings C3S/C3M:

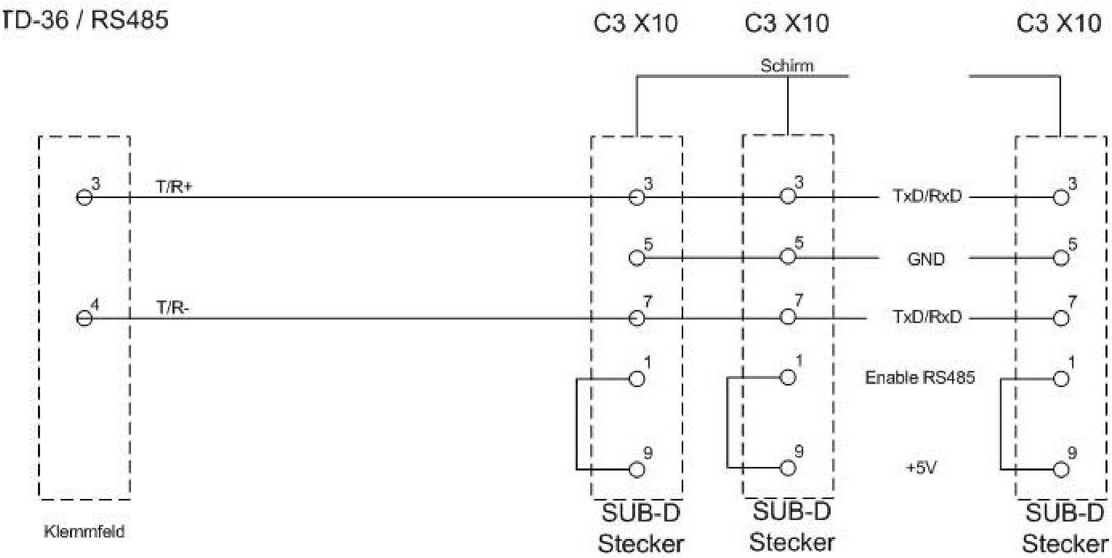
Object	Function	Value
810.1	Protocol	16 (two wire)
810.2	Baud rate	115200
810.3	NodeAddress	1..254
810.4	Multicast Address	

Connection plan TD-36 / Compaxx3 S

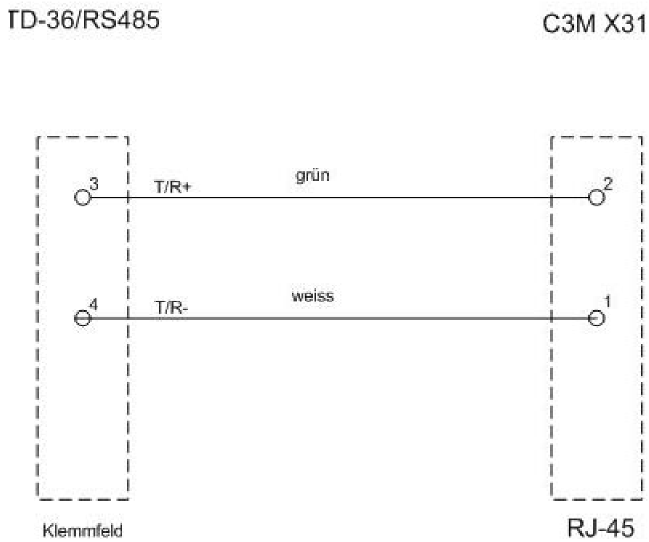
RS-422/485

Position	Direction*	Description		Product marking
No. 1	In	R+ (A') Receive	RS-422/485 4-wire	R+
No. 2	In	R– (B') Receive	RS-422/485 4-wire	R–
No. 3	Out	T+ (A) Transmit	RS-422/485 4-wire	T/R+
	In/Out	T+ (A/A') Transmit/Receive	RS-485 2-wire	
No. 4	Out	T– (B) Transmit	RS-422/485 4-wire	T/R–
	In/Out	T+ (A/A') Transmit/Receive	RS-485 2-wire	

* Direction relative to this unit



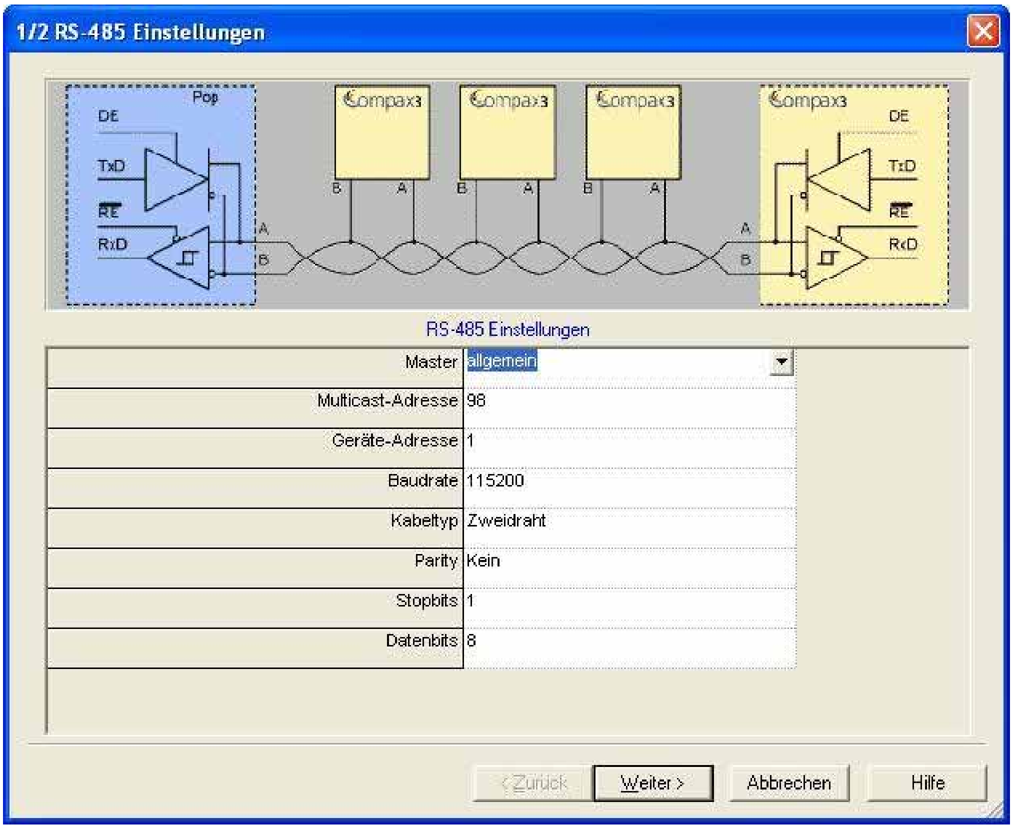
Connection plan TD-36 / Compax3 M



6.1.7. C3 settings for RS485 two wire operation

C3 ServoManager RS485 wizard settings:

download with configuration in RS232 mode°!



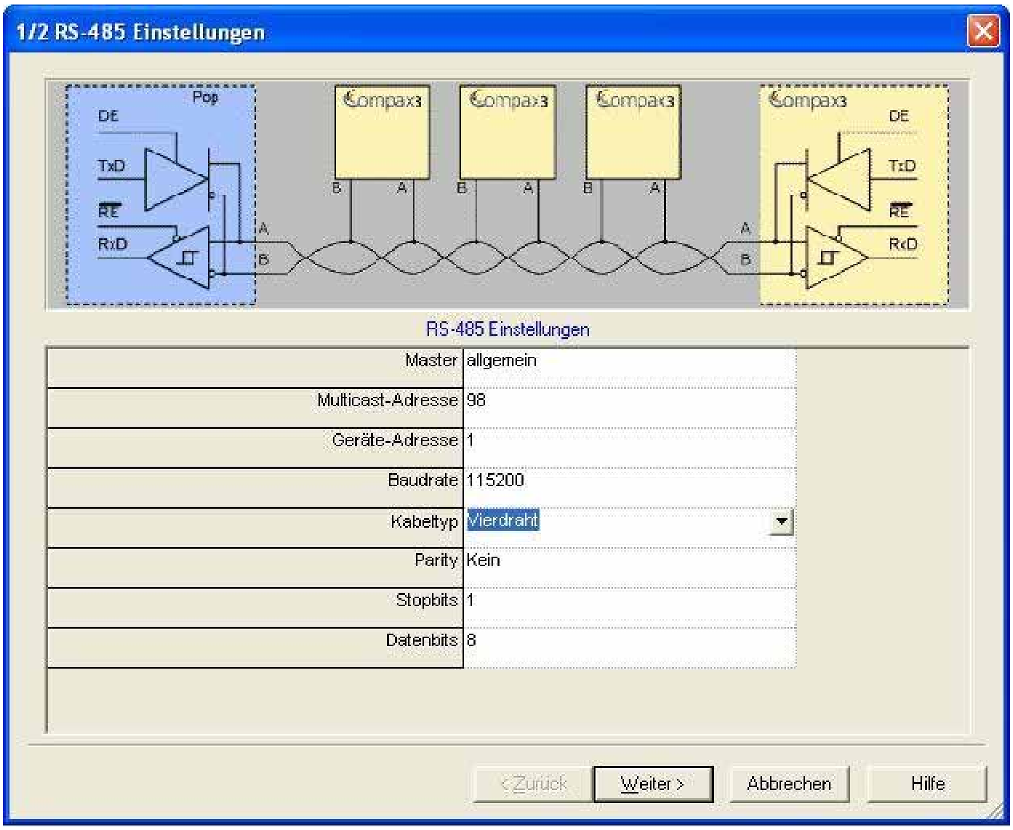
Communication settings C3S/C3M:

Object	Function	Value
810.1	Protocol	16 (two wire)
810.2	Baud rate	115200
810.3	NodeAddress	1..254
810.4	Multicast Address	

6.1.8. C3 settings for RS485 four wire operation

C3 ServoManager RS485 wizard settings:

download with configuration in RS232 mode



Communication settings C3S/C3M:

Object	Function	Value
810.1	Protocol	0 (four wire)
810.2	Baud rate	115200
810.3	NodeAddress	1..254
810.4	Multicast Address	

6.2 COM port protocol

In this chapter you can read about:

You can communicate with Compax3 in order to read or write objects via plug X10 (or X3 on the mains module of Compax3M) on the front via a COM port (max. 32 nodes).

As a rule 2 records are possible:

- ASCII record simple communication with Compax3
- Binary record: fast and secure communication with Compax3 by the aid of block securing.

Switching between the ASCII and the binary record via automatic record detection.

interface settings **(see page 458)**

Wiring

RS232: **SSK1** (see page 441)
RS485: like **SSK27** (see page 442) / RS485 is activated by +5V on X10/1.
USB: SSK33/03 (only for Compax3M)

6.2.1. RS485 setting values

If "Master=Pop" was selected, only the settings compatible with the Pops (Parker Operator Panels) made by Parker are possible.

Please note that the connected Pop has the same RS485 setting values.

You can test this with the "PopDesigner" software.

"Master=General" makes all Compax3 settings possible.

Multicast Address You can use this address to allow the master to access multiple devices simultaneously.

Device Address The device address of the connected Compax3 can be set here.

Baud rate Adjust the transfer speed (baud rate) to the master.

Connection Type Please choose between **two-wire and four-wire RS485** (see page 27).

Protocol Adjust the protocol settings to the settings of your master.

6.2.2. ASCII - record

The general layout of a command string for Compax3 is as follows:

[Adr] command CR

Adr	RS232: no address RS485: Compax3 address in the range 0 ... 99 Address settings can be made in the C3 ServoManager under "RS485 settings"
Command	valid Compax3 command
CR	End sign (carriage return)

Command

A command consists of the representable ASCII characters (0x21 .. 0x7E). Lower cases are converted automatically into capitals and blanks (0x20) are deleted, if they are not placed between two quotation marks.
Separator between places before and after the decimal is the decimal point (0x2E).
A numeric value can be given in the Hex-format if it is preceded by the "$" sign.
Values can be requested in the Hex-format if the CR is preceded additionally by the "$" sign.

Answer strings

All commands requesting a numeric value from Compax3 are acknowledged with the respective numeric value in the ASCII format followed by a CR without preceding command repetition and following statement of unit. The length of these answer strings differs depending on the value.
Commands requesting an Info-string (e.g. software version), are only acknowledged with the respective ASCII character sequence followed by a CR, without preceding command repetition. The length of these answer strings is here constant.
Commands transferring a value to Compax3 or triggering a function in Compax3 are acknowledged by:

>CR

if the value can be accepted resp. if the function can be executed at that point in time.
If this is ot the case or if the command syntax was invalid, the command is acknowledged with

!xxxxCR

The 4 digit error number **xxxx** is given in the HEX format; you will find the meaning in the appendix.

RS485 answer string

When using RS485, each answer string is preceded by a *" (ASCII - character: 0x2A).

Compax3 commands

Read object

RS232: O [$] Index , [$] Subindex [$]

RS485: Address O [$] Index , [$] Subindex [$]

The optional "$" after the subindex stands for "hex-output" which means that an object value can also be requested in hex;
e.g. "**O $0192,2$**": (Object 402.2)

Write object

RS232: O [$] Index , [$] Subindex = [$] Value [; Value2 ; Value3 ; ...]

RS485: Address O [$] Index , [$] Subindex = [$] Value [; Value2 ; Value3 ; ...]

The optional "$" preceding Index, Subindex and value stands for "Hex-input" which means that Index, Subindex and the value to be transferred can also be entered in hex (e.g. **O $0192,2=$C8**).

6.2.3. Binary record

The binary record with block securing is based on 5 different telegrams:

- 2 request telegrams which the control sends to Compax3 and
- 3 response telegrams which Compax3 returns to the control.

Telegram layout

Basic structure:

Start code	address	Number of data bytes - 1	Data				block securing	
SZ	A	L	D0	D1	...	Dn	Crc(Hi)	Crc(Lo)

The start code defines the frame type and is composed as follows:

Bit		7	6	5	4	3	2	1	0
Frame type		Frame identification				PLC		Gateway	address
RdObj	Read object	1	0	1	0	x	1	x	x
WrObj	Write object	1	1	0	0	x	1	x	x
Rsp	Answer	0	0	0	0	0	1	0	1
Ack	Positive command acknowledgement	0	0	0	0	0	1	1	0
Nak	Negative command acknowledgement	0	0	0	0	0	1	1	1

Bits 7, 6, 5 and 4 of the start code form the telegram identification; Bit 2 is always ”1”.
Bits 3, 1 and 0 have different meanings for the request and response telegrams.
The address is only necessary for RS484.

Request telegrams

-> Compax3

- the address bit (Bit 0 = 1) shows if the start code is followed by an address (only for RS485; for RS232 Bit 0 = 0)
- the gateway bit (Bit 1 = 1) shows if the message is to be passed on. (Please set Bit 1 = 0, as this function is not yet available)
- the PLC bit (Bit 3 = 1) allows access to objects in the PLC/Pop format
  U16, U32: for integer formats (see bus formats: Ix, Ux, V2)
  IEEE 32Bit Floating Point: for broken formats (bus formats: E2_6, C4_3, Y2, Y4; without scaling)
  With Bit 3 = 0 the objects are transmitted in the DSP format.
  DSP formats:
  24 Bit = 3 Bytes: Integer INT24 or Fractional FRACT24
  48 Bit = 6 Bytes: Real REAL48 (3 Byte Int, 3 Byte Fract) / Double Integer DINT48 / Double Fractional DFRACT48

Response telegram **Compax3>**

- Bits 0 and 1 are used to identify the response
- Bit 3 is always 0

The maximum number of data bytes in the request telegram is 256, in the response telegram 253.
The block securing (CRC16) is made via the CCITT table algorithm for all characters.
After receiving the start code, the timeout monitoring is activated in order to avoid that Compax3 waits in vain for further codes (e.g. connection interrupted) The timeout period between 2 codes received is fixed to 5ms (5 times the code time at 9600Baud)

Write object – WrObj telegram

SZ	Adr	L	D0	D1	D2	D3 ... Dn	Crc(Hi)	Crc(Lo)
0xCX		n	Index(Hi)	Index(Lo)	Subindex	Value	0x..	0x..

Describing an object by a value.

Positive acknowledgement – Ack-telegram

SZ	L	D0	D1	Crc(Hi)	Crc(Lo)
0x06	1	0	0	0x..	0x..

Answer from Compax3 if a writing process was successful, i.e. the function could be executed and is completed in itself.

Negative acknowledgement – Nak - telegram

SZ	L	D0	D1	Crc(Hi)	Crc(Lo)
0x07	1	F-No.(Hi)	F-No.(Lo)	0x..	0x..

Answer from Compax3 if access to the object was denied (e.g. function cannot be executed at that point in time or object has no reading access). The error no. is coded according to the DriveCom profile resp. the CiA Device Profile DSP 402.

Read object – RdObj - telegram

SZ	Adr	L	D0	D1	D2	D3	D4	D5	...	Dn	Crc(Hi)	Crc(Lo)
0xAX		n	Index1(Hi)	Index1(Lo)	Subindex1	Index2(Hi)	Index2(Lo)	Subindex2	...	...	0x..	0x..

Reading one or several objects

Answer – Rsp - telegram

SZ	L	D0 ... Dx-1	Dx ... Dy-1	Dy-D..	D ... D..	D ... Dn	Crc(Hi)	Crc(Lo)
0x05	n	Value1	Value 2	Value 3	Value ..	Value n	0x..	0x..

Answer from Compax3 if the object can be read.
If the object has no reading access, Compax3 answers with the Nak – telegram.

Example:

Reading object "StatusPositionActual" (o680.5):

Request: A5 03 02 02 A8 05 E1 46
Response: 05 05 FF FF FF FF FE 2D 07 B4

Writing into an Array (o1901.1 = 2350)

Request: C5 02 08 07 6D 01 00 09 2E 00 00 00 95 D5
Response: 06 01 00 00 BA 87

Block securing:

Checksum calculation for the CCITT table algorithm

The block securing for all codes is performed via the following function and the corresponding table:
The ”CRC16” variable is set to ”0” before sending a telegram.

Function call:

```
CRC16 = UpdateCRC16(CRC16, Character);
```

This function is called up for each Byte (Character) of the telegram.
The result forms the last two bytes of the telegram
Compax3 checks the CRC value on receipt and reports CRC error in the case of a deviation.

Function

```
const unsigned int _P CRC16_table[256] = {
   0x0000, 0x1021, 0x2042, 0x3063, 0x4084, 0x50a5, 0x60c6, 0x70e7,
   0x8108, 0x9129, 0xa14a, 0xb16b, 0xc18c, 0xd1ad, 0xe1ce, 0xf1ef,
   0x1231, 0x0210, 0x3273, 0x2252, 0x52b5, 0x4294, 0x72f7, 0x62d6,
   0x9339, 0x8318, 0xb37b, 0xa35a, 0xd3bd, 0xc39c, 0xf3ff, 0xe3de,
   0x2462, 0x3443, 0x0420, 0x1401, 0x64e6, 0x74c7, 0x44a4, 0x5485,
   0xa56a, 0xb54b, 0x8528, 0x9509, 0xe5ee, 0xf5cf, 0xc5ac, 0xd58d,
   0x3653, 0x2672, 0x1611, 0x0630, 0x76d7, 0x66f6, 0x5695, 0x46b4,
   0xb75b, 0xa77a, 0x9719, 0x8738, 0xf7df, 0xe7fe, 0xd79d, 0xc7bc,
   0x48c4, 0x58e5, 0x6886, 0x78a7, 0x0840, 0x1861, 0x2802, 0x3823,
   0xc9cc, 0xd9ed, 0xe98e, 0xf9af, 0x8948, 0x9969, 0xa90a, 0xb92b,
   0x5af5, 0x4ad4, 0x7ab7, 0x6a96, 0x1a71, 0x0a50, 0x3a33, 0x2a12,
   0xdbfd, 0xcbdc, 0xfbbf, 0xeb9e, 0x9b79, 0x8b58, 0xbb3b, 0xab1a,
   0x6ca6, 0x7c87, 0x4ce4, 0x5cc5, 0x2c22, 0x3c03, 0x0c60, 0x1c41,
   0xedae, 0xfd8f, 0xcdec, 0xddcd, 0xad2a, 0xbd0b, 0x8d68, 0x9d49,
   0x7e97, 0x6eb6, 0x5ed5, 0x4ef4, 0x3e13, 0x2e32, 0x1e51, 0x0e70,
   0xff9f, 0xefbe, 0xdfdd, 0xcffc, 0xbf1b, 0xaf3a, 0x9f59, 0x8f78,
   0x9188, 0x81a9, 0xb1ca, 0xa1eb, 0xd10c, 0xc12d, 0xf14e, 0xe16f,
   0x1080, 0x00a1, 0x30c2, 0x20e3, 0x5004, 0x4025, 0x7046, 0x6067,
   0x83b9, 0x9398, 0xa3fb, 0xb3da, 0xc33d, 0xd31c, 0xe37f, 0xf35e,
   0x02b1, 0x1290, 0x22f3, 0x32d2, 0x4235, 0x5214, 0x6277, 0x7256,
   0xb5ea, 0xa5cb, 0x95a8, 0x8589, 0xf56e, 0xe54f, 0xd52c, 0xc50d,
   0x34e2, 0x24c3, 0x14a0, 0x0481, 0x7466, 0x6447, 0x5424, 0x4405,
   0xa7db, 0xb7fa, 0x8799, 0x97b8, 0xe75f, 0xf77e, 0xc71d, 0xd73c,
   0x26d3, 0x36f2, 0x0691, 0x16b0, 0x6657, 0x7676, 0x4615, 0x5634,
   0xd94c, 0xc96d, 0xf90e, 0xe92f, 0x99c8, 0x89e9, 0xb98a, 0xa9ab,
   0x5844, 0x4865, 0x7806, 0x6827, 0x18c0, 0x08e1, 0x3882, 0x28a3,
   0xcb7d, 0xdb5c, 0xeb3f, 0xfb1e, 0x8bf9, 0x9bd8, 0xabbb, 0xbb9a,
   0x4a75, 0x5a54, 0x6a37, 0x7a16, 0x0af1, 0x1ad0, 0x2ab3, 0x3a92,
   0xfd2e, 0xed0f, 0xdd6c, 0xcd4d, 0xbdaa, 0xad8b, 0x9de8, 0x8dc9,
   0x7c26, 0x6c07, 0x5c64, 0x4c45, 0x3ca2, 0x2c83, 0x1ce0, 0x0cc1,
   0xef1f, 0xff3e, 0xcf5d, 0xdf7c, 0xaf9b, 0xbfba, 0x8fd9, 0x9ff8,
   0x6e17, 0x7e36, 0x4e55, 0x5e74, 0x2e93, 0x3eb2, 0x0ed1, 0x1ef0
};

unsigned int UpdateCRC16(unsigned int crc,unsigned char value) {

unsigned int crc16;

crc16 = (CRC16_table[(crc >> 8) & 0x00FF] ^ (crc << 8)
  ^ (unsigned int)(value));

return crc16;

}
```

You will find this function on the Compax3 CD under RS232_485\Function UpdateCRC16.txt!

6.3 Remote diagnosis via Modem

In this chapter you can read about:

Caution!

As the transmission via modem may be very slow and interference-prone, the operation of the Compax3 ServoManager via modem connection is on your own risk!

The function setup mode as well as the ROLL mode of the oscilloscope are not available for remote diagnosis!

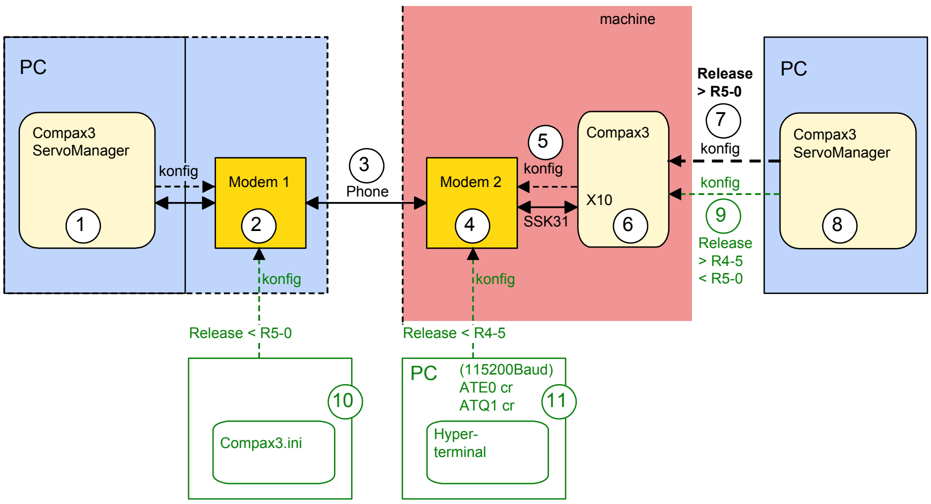
It is not recommended to use the logic analyzer in the Compax3 IEC61131-3 debugger due to the limited bandwidth.

Requirements:

For modem operation, a direct and stable telephone connection is required. Operation via a company-internal telephone system is not recommended.

6.3.1. Structure

Layout and configuration of a modem connection ServoManager - Compax3:



The green part of the drawing shows the proceeding for Compax3 release versions < R5-0!
The proceeding for Compax3 release versions < R5-0 is described in an application example (.../modem/C3_Appl_A1016_*language*.pdf on the Compax3 CD).

Connection Compax3 ServoManager <=> Compax3

The Compax3 ServoManager (1) establishes a RS232 connection with modem 1 (PC internal or external).
Modem 1 dials modem 2 via a telephone connection (3).
Modem 2 communicates with Compax3 (6) via RS232.

Configuration

Modem 1 is configured via the Compax3 ServoManager (1)
Modem 2 can be configured via Compax3 (on place), triggered by putting **SSK31** (see page 446) on X10. For this, the device must be configured before. This can be made locally before the system / machine is delivered with the aid of the Compax3 ServoManager (8).

The transmission was tested with a TD33 modem made by "**Westermo** http://www.westermo.com". The configuration with this standard modem is especially simple.
Other modem types are also possible.

6.3.2. Configuration of local modem 1

- Menu "Options: Communication settings RS232/RS485..." must be opened
- Select "Connection via Modem"
- Under "name" you can enter a name for the connection
- Enter the target telephone number.
  Note: If an ISDN telephone system is operated within a company network, an additional "0" may be required in order to get out of the local system into the comany network before reaching the outside line with an additional "0".
- The timeout periods are set to reasonable standard values according to our experience.
- Select the modem type: "Westermo TD-33" or "user-defined modem"
  - For "Westermo TD-33", no further settings are required.
  - For "user-defined modem", additional settings are only required, if the modem does not support standard AT commands.
    Then you can enter special AT commands.
  - **Note:** When operating the local modem on a telephone system, it may be necessary to make a blind dialling. Here, the modem does not wait for the dialling tone. For the Westermo TD33, the additional command sequence is ATX3.
- Select the COM interface where the modem is connected.
- Close the window and establish the connection with button (open/close COM port).
- The connection is interrupted when the COM port is closed.

- Select the modem type: "Westermo TD-33" or "user-defined modem"
  - For "Westermo TD-33", no further settings are required.
  - For "user-defined modem", additional settings are only required, if the modem does not support standard AT commands.
    Then you can enter special AT commands.
  - **Note:** When operating the local modem on a telephone system, it may be necessary to make a blind dialling. Here, the modem does not wait for the dialling tone. For the Westermo TD33, the additional command sequence is ATX3.

6.3.3. Configuration of remote modem 2

Settings in Compax3 under "configure communication: Modem settings":

- Modem initialization = "ON": After the SSK31 modem cable has been connected, Compax3 initializes the modem
- Modem initialization after Power On = "ON": After Power on of Compax3, the device initializes the modem
- Modem check = "ON": a modem check is performed
- The timeout periods are set to reasonable standard values according to our experience.
- Select the modem type: "Westermo TD-33" or "user-defined modem"
  - For "Westermo TD-33", no further settings are required.
  - For "user-defined modem", additional settings are only required, if the modem does not support standard AT commands.
    Then you can enter special AT commands.
  - **Note:** When operating the local modem on a telephone system, it may be necessary to make a blind dialling. Here, the modem does not wait for the dialling tone. For the Westermo TD33, the additional command sequence is ATX3.
- in the following wizard window, a specific download of the modem configuration can be made.

Note:

If a configuration download is interrupted, the original settings in the non volatile memory of the Compax3 are still available.
You have to finish the communication on the PC side and to reset the Compax3 via the 24V supply before you can start a new trial.

Reinitialization of the remote modem 2

Remove cable on Compax3 X10 and connect again!

6.3.4. Recommendations for preparing the modem operation

Preparations:

- Settings in Compax3 under "configure communication: Modem settings":
  - Modem initialization: "ON"
  - Modem initialization after Power On: "ON"
  - Modem check: "ON"
- Deposit SSK31 cable in the control cabinet.
- Install modem in the control cabinet and connect to telephone line.

Remote diagnosis required:

- On site:
  - Connect modem to Compax3 X10 via SSK31
  - Modem is automatically initialized
- Local:
  - connect modem to telephone line
  - Establish cable connection to modem (COM interface)
  - Select "connection via modem" under "options: communication settings RS232/RS485...".
  - Select modem under "selection"
  - Enter telephone number
  - Select COM interface (PC - modem)
  - Establish connection with button  (open/close COM port).

6.4 Profibus

In this chapter you can read about:

I20 Function

The Profibus option is available with the Compax3 devices C3I20Txx**!**

Notes on the configuration of the Profibus master

Before configuring the Profibus master (e.g. S7), you will have to configure the Compax3 axis.

In the **Profibus window** (see page 354)of the configuration wizard you will receive the status message "Profibus Telegram" with the information on the telegram which can be set in the master (PPO type).

6.4.1. Typical application with fieldbus and IEC61131

We recommend the following procedure to control the IEC61131-3 program via Profibus:

- Use the control word (DeviceControl_Controlword_1) to control the PLCopen function modules (Execute, Enable) to activate the modules via Profibus.
- The logical module outputs can be placed on the status word (DeviceState_Statusword_1).
- Place the control word and the status word on the cyclic process data channel.
- Connect variable module outputs of your IEC61131-3 program with the recipe array.
  - For rapid access, the values from the first 5 rows of the recipe array can be placed in the cyclic channel.
  - Additional values of the recipe array can be written acyclically.

Now you can use the bus to assign values, to activate function modules with the control word and to read the current status with the control word.

6.4.2. Profibus configuration

In this chapter you can read about:

Following are described the input windows of the Profibus configuration wizard. Can be called up in the tree (Compax3 ServoManager, left window) under "configure configuration".

6.4.2.1 Configuration of the process-data channel

You can use the Process Data Channel (PZD) to exchange actual and Setpoint values cyclically between the Compax3 and the Profibus master.
Adjusting the cyclic PZD:
The PZD is adjusted separately for the following transfer directions:

- Profibus-Master ⇒ Compax3 (PAD)
- Compax3 ⇒ Profibus-Master (PED)

Maximum size of the process-data channel:
8 words (16 bytes) PAD and
8 words (16 bytes) PED

The objects that can be put on the process data channel can be found in the " Compax3 Objects **(see page 414)"!**

Assignment of the process data channel

Assignment of the process data channel is automated in Compax3 ServoManager. You select the objects which you want to put one after the other to the process input data (PED: Compax3 => PLC) and to the process output data (PAD: PLC => Compax3).
ServoManager continuously checks areas of the PZD that are free and enables additional input options correspondingly.

PPO type

Depending on the configuration that is set, the resulting PPO type is displayed in the "Profibus telegram" wizard window (in the status line of the wizard window). You can use this value for the configuration of the Profibus master.

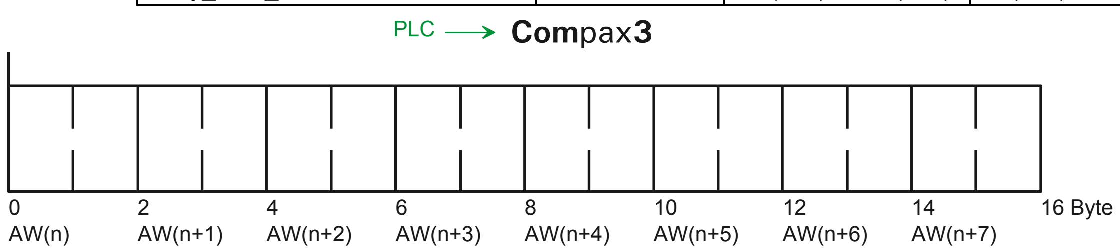
Assignment of the PZD

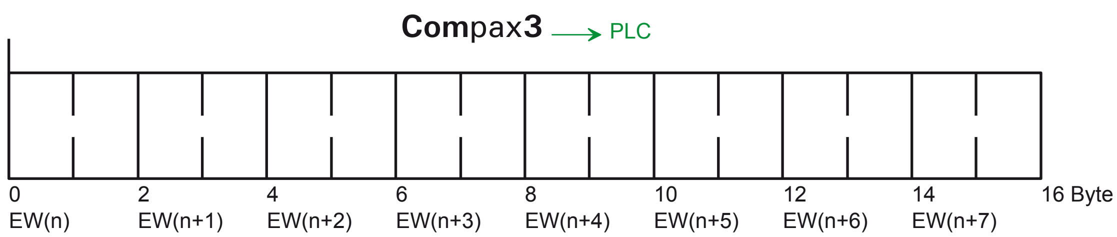
When data is read out of the Process Data Channel (PZD), the word width of the individual objects must be carefully noted.

Example:

Assignment:

Object	Word width	Assignment	address
POSITION_position	2	AW(n) & AW(n+1)	AD(n)
POSITION_speed	2	AW(n+2) & AW(n+3)	AD(n+2)
AnalogOutput0_DemandValue	1	AW(n+4)	AW(n+4)
AnalogOutput1_DemandValue	1	AW(n+5)	AW(n+5)
Array_Col1_Row1	2	AW(n+6) & AW(n+7)	AD(n+6)





6.4.2.2 PKW parameter channel

Parameter access with DPV0

In addition to cyclic data exchange, you can use the PKW mechanism for acyclic access to parameters.
The PKW mechanism is implemented for Profibus masters without DPV1 functionality.
PKW: Parameter identification value

You can select between:

- **no PKW** - without acyclic parameter access.
- **PKW** - paramter access via a PKW length of 8 bytes.

PKW structure

PKW							
Octet1	Octet2	Octet 3	Octet 4	Octet5	Octet6	Octet 7	Octet 8
PKE		IND		PWE			
0		2		4			8

Additional information on the **structure of the PKW** (see page 357)

6.4.2.3 Error reaction to a bus failure

Here you can adjust how Compax3 will respond to a fieldbus error:
Possible settings for the error reaction are:

- No response
- downramp / stop
- Downramp / switch to currentless (standard setting)

6.4.3. Cyclic process data channel

The structure of the PZD is defined in the configuration menu: "Profibus Telegram" of the Servomanager.

6.4.3.1 Control and status word

The cyclic process data channel contains a control word and a status word both, freely available and 16 bits in size:
Control word: Profibus-Master ⇒ Compax3
Status word: Compax3 ⇒ Profibus-Master

6.4.4. Acyclic parameter channel

In this chapter you can read about:

Compax3 supports parameter access with DPV1.

6.4.4.1 Parameter access with DPV0: Required data channel

You can use the PKW mechanism for acyclic access to parameters in cyclic data exchange as well. This is made available to make it possible for the master to have access to the important device parameters without DPV1 functionality.
The master formulates an order in the PKW mechanism. Compax3 processes the order and formulates the response.

PKW structure:

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
PKE		IND		PWE			

PKW: Parameter identification value
PKE: Parameter identification (1. and 2. octet) (see below)
IND: Subindex* (3. Octet), 4. byte is reserved
PWE: Parameter value (5th to 8th byte resp. 5th to 12th byte with extended PKW)

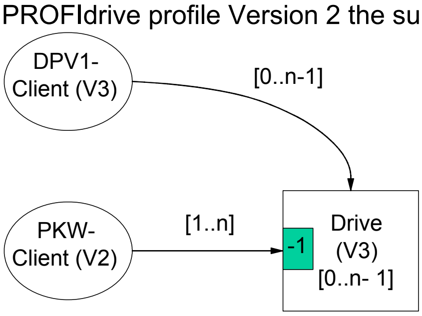
PKE structure:

Byte 1								Byte 2							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
AK				SPM	PNU										

AK: Order /response identification (value range 0 ... 15)
SPM: Reserved
PNU: Parameter number

***Reference to the subindex**

The information for PNU subindex (parameter number) also applies to PROFIdrive profile Version 3, i.e., that the subindex is counted starting at 0, while for PROFIdrive profile Version 2 the subindex is counted starting at 1:



The result of this is as follows:

Profibus master based on PROFIdrive profile Version 3

The subindex of the Profibus No. (PNU) specified in the object list is directly valid.
Example: Example: PNU object forward speed control = 400.1 (as specified).

Profibus master based on PROFIdrive profile Version 2

The subindex of the Profibus No. (PNU) specified in the object list must be incremented by 1.
Example: PNU object forward speed control = 400.2

Order and response processing

Order/response identifications are defined so that it is apparent from the identification which fields of the PKW interface (IND, PWE) also need to be evaluated. To this may be added the distinction between parameter value and parameter description.

Order identification	Order Master → Compax3	response identification Compax3 → Master
0	No order	0
1	Request parameter value	1,2
2	Change parameter value (word)	1
3	Change parameter value (double word)	2
6	Request parameter value (array)	4,5
7	Change parameter value (array of word)	4
8	Change parameter value (array of double word)	5
9	Request number of array elements	6
14	Change object	14
15	Request object	15

Response identifications 7 and 8 are used for negative acknowledgements for problems.

Sequence

- The master transfers an order to a Compax3.
- The master repeats this order at least until a response is received from Compax3. This procedure ensures the transfer of orders /responses on the user level.
- Only one order is ever being processed at a time.
- Compax3 continues to make the response available until the master formulates a new order.
- For responses containing parameter values, Compax3 always responds upon repetition with the current value (cyclic processing). This applies to all responses to the orders ”Request parameter value”, ”Request parameter value (Array)’” and ”Request object”.
- The PWE transfer of word sizes takes place with byte 7 and 8, while the transfer of double word sizes takes place with byte 5 through 8.

Explanation of response identification

Response identificatio n	Response Compax3 → Master
0	No response
1	Transfer value (word)
2	Transfer parameter value (double word)
4	Transfer parameter value (array of word)
5	Transfer parameter value (array of double word)
7	Order cannot be executed (with error no..)
8	No user level for PKW interface
9	Reserved
10	Reserved
14	Object value transferred
15	Object value transferred

Example: Changing the stiffness

Task:

Parameter / object change via PKW (DPV0)
The object "stiffness" will be set to 200%
Object stiffness: PNU 402.2; valid after VP
Format UNSIGNED 16 == 1 word == order identification = 2 == "Change parameter value (word)"
The master sends to Compax3:

PLC - Compax3

Octet 1								Octet 2								Octet 3	Octet 4	Octet 5	Octet 6	Octet 7	Octet 8
PKE																IND		PWE			
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Subindex	-	MSB			LSB
AK					PNU																
2				0	402											3	0				200
0	0	1	0	0	0	0	1	1	0	0	1	0	0	1	0						
0x21								0x92								0x3	0x0	0x0	0x0	0x0	0xC8

Compax3 responds with the same content, except with response identification = 1:

Compax3 - PLC

Octet 1								Octet 2								Octet 3	Octet 4	Octet 5	Octet 6	Octet 7	Octet 8
PKE																IND		PWE			
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Subindex	-	MSB			LSB
AK					PNU																
1				0	402											3					200
0	0	0	1	0	0	0	1	1	0	0	1	0	0	1	0						
0x11								0x92								0x3	0x0	0x0	0x0	0x0	0xC8

If no additional object needs to be changed, the new value can be set to valid with VP:
Object: Set objects to valid PNU 338.10 (because of DPV0, the **Subindex must be incremented by 1** (see page 357))

PLC - Compax3

Octet 1								Octet 2								Octet 3	Octet 4	Octet 5	Octet 6	Octet 7	Octet 8
PKE																IND		PWE			
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Subindex	-	MSB			LSB
AK					PNU																
2				0	338											11					1
0	0	1	0	0	0	0	1	0	1	0	1	0	0	1	0						
0x21								0x52								0xB	0x0	0x0	0x0	0x0	0x1

Compax3 responds with the same content, except with response identification = 1:

Compax3 - PLC

Octet 1								Octet 2								Octet 3	Octet 4	Octet 5	Octet 6	Octet 7	Octet 8
PKE																IND		PWE			
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Subindex	-	MSB			LSB
AK					PNU																
1				0	338											11					1
0	0	0	1	0	0	0	1	0	1	0	1	0	0	1	0						
0x11								0x52								0xB	0x0	0x0	0x0	0x0	0x1

Reading back the object set objects to valid makes it possible to check whether the command was performed. Byte 8 will the contain the value 0.

The change can be stored and will not be lost even with a power failure by using the object "Save objects permanently".
Object: Save objects permanently PNU 339

PLC - Compax3

<table>
<tr><th colspan="8">Octet 1</th><th colspan="8">Octet 2</th><th>Octet 3</th><th>Octet 4</th><th>Octet 5</th><th>Octet 6</th><th>Octet 7</th><th>Octet 8</th></tr>
<tr><th colspan="16">PKE</th><th colspan="2">IND</th><th colspan="4">PWE</th></tr>
<tr><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td><td>Subindex</td><td>-</td><td>MSB</td><td></td><td></td><td>LSB</td></tr>
<tr><td colspan="4">AK</td><td></td><td colspan="11">PNU</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="4">2</td><td>0</td><td colspan="11">339</td><td>0</td><td></td><td colspan="4">1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="8">0x21</td><td colspan="8">0x53</td><td>0x0</td><td>0x0</td><td>0x0</td><td>0x0</td><td>0x0</td><td>0x1</td></tr>
</table>

Compax3 responds with the same content, except with response identification = 1:

Compax3 - PLC

<table>
<tr><th colspan="8">Octet 1</th><th colspan="8">Octet 2</th><th>Octet 3</th><th>Octet 4</th><th>Octet 5</th><th>Octet 6</th><th>Octet 7</th><th>Octet 8</th></tr>
<tr><th colspan="16">PKE</th><th colspan="2">IND</th><th colspan="4">PWE</th></tr>
<tr><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td><td>Subindex</td><td>-</td><td>MSB</td><td></td><td></td><td>LSB</td></tr>
<tr><td colspan="4">AK</td><td></td><td colspan="11">PNU</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="4">1</td><td>0</td><td colspan="11">339</td><td>0</td><td></td><td colspan="4">1</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="8">0x11</td><td colspan="8">0x53</td><td>0x0</td><td>0x0</td><td>0x0</td><td>0x0</td><td>0x0</td><td>0x1</td></tr>
</table>

Upload/download objects via the Profibus

All settings of Compax3 can be read using the Profibus and written back to Compax3. This makes it easy to replace a device, for example.

Condition: Compax3 must be configured (once running through the configuration wizard followed by a download is enough; the configuration settings are, however, not relevant)
To implement this, the PKW mechanism has been changed.

Structure of modified PKW:

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
PKE		IND		PWE			

PKW: Parameter identification value
PKE: Parameter identification (1. and 2. octet) (see below)
IND: Object index (3. octet high 4. octet low)
PWE: Parameter value (5. to 8. octet)

Structure of modified PKE:

Byte 1								**Byte 2**							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
AK=14 or 15				SPM	DF	DPZ		SI							

AK: Order/response identification
SPM: Reserved
DF: Data format (DF=1 constant)
DPZ: Data buffer access
SI: Object subindex

Data buffer access:
For each object, 16 bytes must be read or written. Since the size of the PWE channel is 4 bytes, each object must be read or written 4 times.

Sequence for reading / writing and object:

DPZ=0: Object byte 1 ... 4 can be read / is being written
Order executed
DPZ=1 Object byte 5 ... 8 can be read / is being written
DPZ=2 Object byte 9 ... 12 can be read / is being written
DPZ=3 Object byte 13 ... 16 can be read / is being written
The data will either be read fro the PWE or written into the PWE.

Access algorithm for reading objects

- Object 20.2 written with value 0 (object 20.2 is a counter that specifies the next object to be read; the starting value is 0).
- Read object index and subindex in object 20.5.
  Format I32 of Object 20.5:

Not assigned	Index (high byte)	Index (low byte)	Subindex

- Read the object with the index and subindex read in object 20.5 and in save it in a table with the following structure: Index (2Byte), Subindex(1Byte), Contents (16Byte).
- Read the next object-Index and subindex in object 20.5.
- ....

This must be performed until index = 0xFFFF and until subindex = 0xFF.

Writing objects

Write the entire table to Compax3. Each index and subindex is written with the value stored in the table.

It should be noted in this regard that each time an object is written, the internal buffer must first be written with DPZ=1, 2, 3 and then the entire order is written with DPZ0.

6.4.4.2 Data formats of the bus objects

In this chapter you can read about:

Integer formats

Twos complement representation;
The highest order bit (MSB) is the bit after the sign bit (VZ) in the first octet.
VZ == 0: positive numbers and zero; VZ == 1: negative numbers

Type	Bit	8	7	6	5	4	3	2	1
Integer 8 length: 1 Byte		VZ	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Integer 16	MSB	VZ	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8
Length: 1 Word	LSB	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Integer 32	MSB	VZ	2^{30}	2^{29}	2^{28}	2^{27}	2^{26}	2^{25}	2^{24}
Length: 2 Words		2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}
		2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8
	LSB	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

Unsigned - Formats

Type	Bit	8	7	6	5	4	3	2	1
Unsigned 8 Length: 1 Byte		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Unsigned 16	MSB	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8
Length: 1 Word	LSB	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Unsigned 32	MSB	2^{31}	2^{30}	2^{29}	2^{28}	2^{27}	2^{26}	2^{25}	2^{24}
Length: 2 Words		2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}
		2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8
	LSB	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

Fixed point format E2_6

Linear fixed point value with six binary places after the decimal point. 0 corresponds to 0, 256 corresponds to 2^{14} (0x4000).
Twos complement representation;
MSB is the bit after the sign bit
VZ == 0: positive numbers and zero;
VZ == 1: negative numbers

Type	Bit	8	7	6	5	4	3	2	1
E2_6	MSB	VZ	2^8	2^7	2^6	2^5	2^4	2^3	2^2
Length: 1 Word	LSB	2^1	2^0	2^{-1}	2^{-2}	2^{-3}	2^{-4}	2^{-5}	2^{-6}

Fixed point format C4_3

Linear fixed point value with three decimal places after the decimal point. 0 corresponds to 0 and 0,001 corresponds to 2^0 (0x0000 0001).
Structure like data type Integer32, value of the bits reduced by a factor of 1000.
Length: 2 Words

Bus format Y2 and Y4

Layout:

- Y2 like data type Integer16
- Y4 like data type Integer32

The values can be adjusted by a scaling factor.
The following rules apply:
- Scaling factor for Y2: Object 200.1, ... 200.5
- Scaling factor for Y4: Object 201.1, ... 201.5

There are different scaling factors for individual values

1. Y2 scaling factors

- Object 200.1: NormFactorY2_Speed: Scaling factor for Y2 speeds
- Object 200.2: NormFactorY2_Position: Scaling factor for Y2 positions
- Object 200.3: NormFactorY2_Voltage: Scaling factor for Y2 voltages
- Object 200.5: NormFactorY2_Array_Col2: Scaling factor for Column 2 of the recipe array

2. Y4 scaling factors

- Object 201.1: NormFactorY4_Speed: Scaling factor for Y4 speeds
- Object 201.2: NormFactorY4_Position: Scaling factor for Y4 positions
- Object 201.3: NormFactorY4_Voltage: Scaling factor for Y4 voltages
- Object 201.4: NormFactorY4_Array_Col1: Scaling factor for Column 1 of the recipe array

Meaning of scaling factors

- Bit 5: Meaning of scaling factor:
  - Bit 5 = "0": decimal factors 1, 1/10, 1/100, ..
    Bit 0 .. Bit 4: Scaling factor

#	Bit 0...4	Factor dec (Bit 5 = 0) yy0x xxxx	
0	00000	10^{0}	1
1	00001	10^{-1}	0,1
2	00010	10^{-2}	0,01
3	00011	10^{-3}	0,001
4	00100	10^{-4}	0,0001
5	00101	10^{-5}	0,00001
6	00110	10^{-6}	0,000001
7	00111	10^{-7}	0,0000001
8	01000	10^{-8}	0,00000001
9	01001	10^{-9}	0,000000001

  - Bit 5 = "1": binary factors 1, 1/2, 1/4, 1/8, ...
    Bit 0 ... Bit 4: Scaling factor

#	Bit 0...4	Factor bin (Bit 5 = 1) yy1x xxxx	
32	00000	2^{0}	1
33	00001	2^{-1}	0,5
34	00010	2^{-2}	0,25
35	00011	2^{-3}	0,125
36	00100	2^{-4}	0,0625
37	00101	2^{-5}	0,03125
38	00110	2^{-6}	0,015625
39	00111	2^{-7}	0,0078125
40	01000	2^{-8}	0,00390625
41	01001	2^{-9}	0,001953125
42	01010	2^{-10}	0,0009765625
43	01011	2^{-11}	0,00048828125
44	01100	2^{-12}	0,000244140625
45	01101	2^{-13}	0,0001220703125
46	01110	2^{-14}	0,00006103515625
47	01111	2^{-15}	0,000030517578125
48	10000	2^{-16}	0,0000152587890625
49	10001	2^{-17}	0,00000762939453125
50	10010	2^{-18}	0,000003814697265625
51	10011	2^{-19}	0,0000019073486328125
20	10100	2^{-20}	0,00000095367431640625
21	10101	$2–^{21}$	0,000000476837158203125
22	10110	2^{-22}	0,0000002384185791015625
23	10111	2^{-23}	0,00000011920928955078125
24	11000	2^{-24}	0,000000059604644775390625

- Bit 6 ... Bit 15: Reserved

Bit sequence V2

The V2 bus format is a bit sequence with a length of 16 bits.

Byte string OS

Octet string OS: String with variable length.

6.4.5. Simatic S7 -300/400 - modules

You can find the modules on the Compax3 DVD or in the internet under **http:/www.compax3.info/startup** http://www.compax3.info/startup.
You will find a description of these function modules in the help file !

6.5 CANopen - Node Settings

In this chapter you can read about:

I21 Function

The CANopen option is available with the Compax3 devices C3I21Txx**!**

6.5.1. CANopen - configuration

In this chapter you can read about:

Following are described the input windows of the CANopen configuration wizard. Can be called up in the tree (Compax3 ServoManager, left window) under "configure configuration".

6.5.1.1 CANopen Operating Mode

CANopen Operating Modes:

- **Slave on C3 powerPLmC**:
  Compax3 as Slave on C3 powerPLmC integrated via the DriveInterface
  Note for C3I21T40: The cam programming is made in the slave axis
- **Slave**
  Compax3 is Slave of a CANopen Master; the CANopen configuration is made via the ServoManager
- **Slave with configuration via Master**
  Compax3 is Slave of a CANopen Master; the CANopen configuration is made via the Master
- **Master for PIOs**
  Compax3 as CANopen Master only for the operation of external digital and analog PIOs (Parker Input and Output modules).
  Please note: The device cannot be operated with an additional CANopen Master!
- **Slave on C3 powerPLmC (Cam programming on C3 powerPLmC)**
  Operating mode only available with I21T40!
  The programming of the device (C3I21T40) is only made on the C3 powerPLmC.

C3 Master PIO

In the "C3 Master PIO" operating mode, the input window for the CANopen PIO mapping is follwowing:
Please state, how many words the process image of the PIOs will need, 1.. 4 words are possible.
The process image is transmitted via teh process data objects as follows:
Digital Inputs: RPDO1
Analog Inputs: RPDO2
Digital Outputs: TPDO1
Analog Outputs: TPDO2
The inputs and outputs are stored in objects (O150.x ... O153.x).
Object 150.x: Digital Inputs
Object 151.x: Digital Outputs
Object 152.x: Analog Inputs
Object 153.x: Analog Outputs
The digital inputs and outputs can be read or written into in the IEC program via **modules** (see page 309) in order to get an exact process image. Modules: PIO_Input0_15, PIO_Input16_31, PIO_Input32_47, PIO_Input48_63, PIO_Output0_15, PIO_Output16_31, PIO_Output32_47, PIO_Output48_63.
Before that, you must execute some initializations; this can be made with the aid of the **PIO_INIT** (see page 309) module.

6.5.1.2 Error reaction to a bus failure

Here you can adjust how Compax3 will respond to a fieldbus error:
Possible settings for the error reaction are:

- No response
- downramp / stop
- Downramp / switch to currentless (standard setting)

6.5.1.3 Baud rate

Selecting the Baud rate.
Bear in mind that the maximum cable length depends on the Baud rate:

Baud rate	Maximum length
1Mbit/s	25m
800kbit/s	50m
500kbit/s	100m
250kbit/s	250m
125kbit/s	500m
100kbit/s	700m
50kbit/s	1,000m
20kbit/s	2,500m

6.5.1.4 Possible PDO assignment

Via the process data objects (PDOs) actual values and Setpoint values are continually exchanged between Compax3 and the CANopen client.
4 cyclic PDOs are possible, they are configured with the help of the Compax3 ServoManager:
The PDOs are set separately for the transmission directions

- CANopen - Client ⇒ Compax3 (**RPDO**) (max. 16 words)
- Compax3 ⇒ CANopen - Client (**TPDO)** (max. 16 words)

The objects that can be put on the process data channel can be found in the " **Compax3 Objects** (see page 414)"!

6.5.1.5 Transmission cycle time

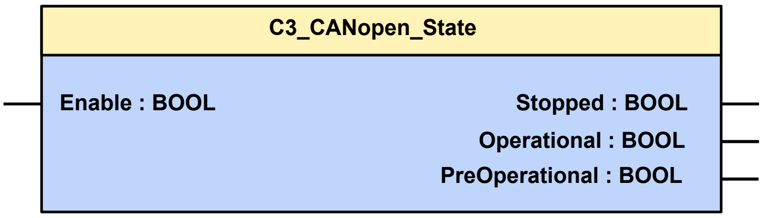
For the TPDOs a transmission cycle time can be set in each case.
This time specifies the time intervals at which Compax3 applies the cyclic data new to the respective PDO.
The minimum value is thereby 1ms.

6.5.2. Supporting IEC modules

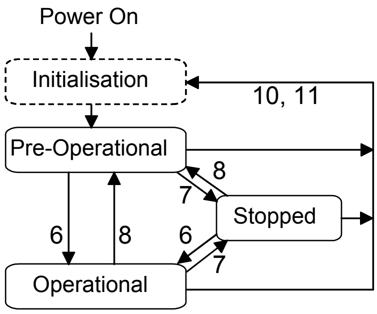
In this chapter you can read about:

6.5.2.1 C3_CANopen_State

FB name	**C3_CANopen_State**	
This module is used to determine the status of the CANopen NMT status machine		
VAR_INPUT		
Enable	BOOL	Activating the module
VAR_OUTPUT		
Stopped	BOOL	CANopen node is in "Stopped" state
Operational	BOOL	CANopen node is in the "Operational" state (communication via process data and service data objects is possible)
PreOperational	BOOL	CANopen node is in the "PreOperational" state (communication via process data and service data objects is possible)



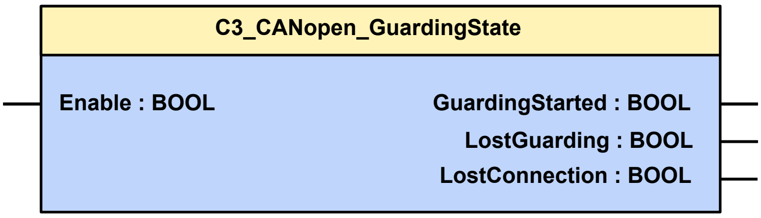
CANopen states



6: Start Remote Node
7: Stop Remote Node
8: Enter Pre-Operational State
10: Reset Node
11: Reset Communication
The "Initialization" state is no fixed state but only a transition state.

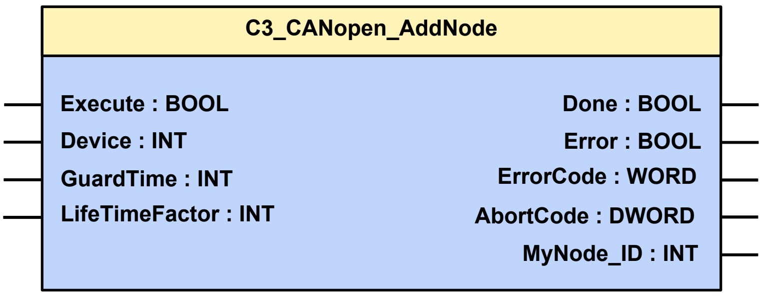
6.5.2.2 C3_CANopen_GuardingState

FB name	**C3_CANopen_GuardingState**	
This module is used to determine the status during Nodeguarding		
VAR_INPUT		
Enable	BOOL	Activating the module
VAR_OUTPUT		
GuardingStarted	BOOL	The NMT master started the Nodeguarding procedure
LostGuarding	BOOL	The node did not receive a Nodeguarding RTR telegram from the NMT master during the Guarding time.
LostConnection	BOOL	The node did not receive a RTR telegram from the NMT Master during the "Node Life Time" (GuardingTime * LifeTimeFactor) and therefore considers the connection as interrupted.



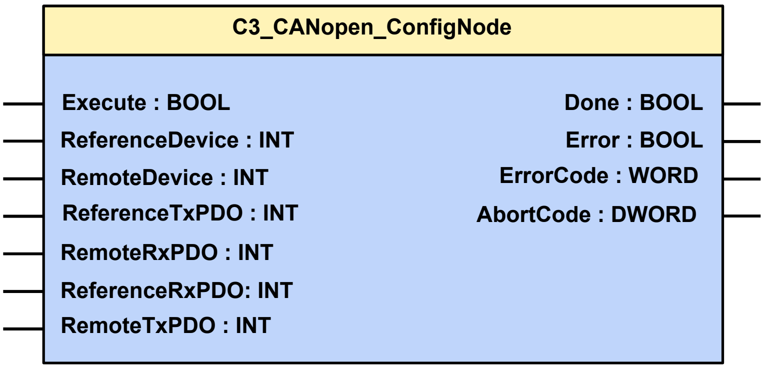
6.5.2.3 C3_CANopen_AddNode

FB name	C3_CANopen_AddNode	
This module inserts a new CANopen node into the management list of the NMT master with the stated Node Guarding parameters and the current CANopen status PRE_OPERATIONAL.		
VAR_INPUT		
Execute	BOOL	Activating the module
Device	INT	Node-ID (1 ... 127)
GuardTime	INT	Guard time = 0
LifeTimeFactor	INT	Life Time Factor = 0
VAR_OUTPUT		
Done	BOOL	Function executed without error
Error	BOOL	Error occurred
ErrorCode	WORD	You will find the error code in the Compax3 error list.
AbortCode	DWORD	CANopen SDO **abort code** (see page 383) upon error 65377 C3 CANopen **stack error** (see page 374) no. upon error 65376
MyNode_ID	INT	Own Node_ID (NMT master)
Note: Compax3 must be CANopen master.		



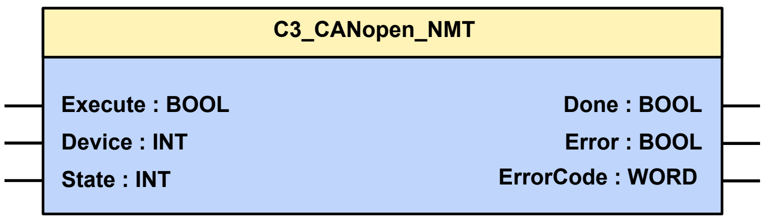
6.5.2.4 C3_CANopen_ConfigNode

FB name	C3_CANopen_ConfigNode	
This module establishes a PDO connection between two CANopen nodes. To do this, the module changes the COB-Ids of the 2nd node (RemoteDevice) to the COB-Ids of the 1st node (ReferenceDevice).		
VAR_INPUT		
Execute	BOOL	Activating the module
ReferenceDevice	INT	Node ID of the 1st node (1 ... 127)
RemoteDevice	INT	Node ID of the 2nd node (1 ... 127)
ReferenceTxPDO	INT	TxPDO number of the 1st node (1 ... 4)
RemoteRxPDO	INT	TxPDO number of the 2nd node (1 ... 4)
ReferenceRxPDO	INT	RxPDO number of the 1st node (1 ... 4)
RemoteTxPDO	INT	TxPDO number of the 2nd node (1 ... 4) "0" do not establish connection
VAR_OUTPUT		
Done	BOOL	Function executed without error
Error	BOOL	Error occurred
ErrorCode	WORD	You will find the error code in the Compax3 error list.
AbortCode	DWORD	CANopen SDO **abort code** (see page 383) upon error 65377 C3 CANopen **stack error** (see page 374) no. upon error 65376
Note: Compax3 must be CANopen master.		



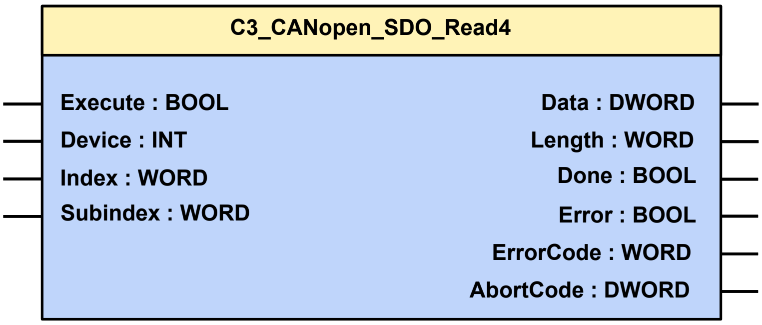
6.5.2.5 C3_CANopen_NMT

FB name	**C3_CANopen_NMT**	
This module allows to send NMT messages.		
VAR_INPUT		
Execute	BOOL	Activating the module
Device	INT	Node ID (0 ... 127) 0 = NMT-message is valid for all nodes
State	INT	State which the node must take on: START_REMOTE_NODE STOP_REMOTE_NODE ENTER_PRE_OPERATIONAL RESET_NODE RESET_COMMUNICATION (these are no constants; please enter therefore directly)
VAR_OUTPUT		
Done	BOOL	Function executed without error
Error	BOOL	Error occurred
ErrorCode	WORD	CANopen-Stack error no. 1 = not sufficient memory 2 = node is not in the management list 3 = node is already in the management list 4 = nodes are in the wrong state 11 = network object not available 12 = node 0 was selected 65378 = C3 has no master functionality
Note: Compax3 must be CANopen master.		



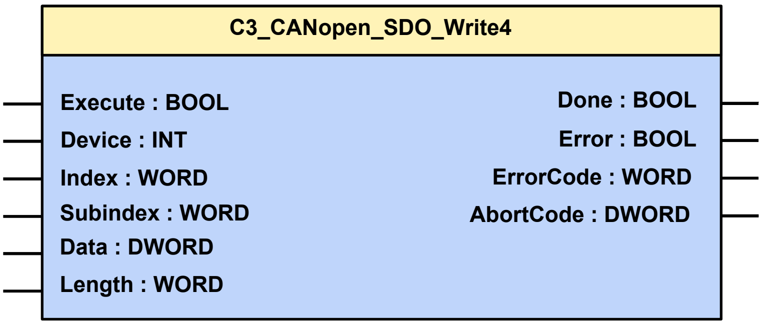
6.5.2.6 Reading an object in another node (C3_CANopen_SDO_Read4)

FB name	**C3_CANopen_SDO_Read4**	
This module allows to read an object with a max. length of 4 bytes in another node via SDO.		
VAR_INPUT		
Execute	BOOL	Activating the module
Device	INT	Node ID of the other node (1 ... 127)
Index	WORD	Object Index (CAN-No.)
Subindex	WORD	Object Subindex (CAN-No.)
VAR_OUTPUT		
Data	DWORD	Object data read in
Length	WORD	Data length in Byte
Done	BOOL	Function executed without error
Error	BOOL	Error occurred
ErrorCode	WORD	You will find the error code in the Compax3 error list.
AbortCode	DWORD	CANopen SDO **abort code** (see page 383) upon error 65377 C3 CANopen **stack error** (see page 374) no. upon error 65376
Note: Compax3 must be CANopen master.		



6.5.2.7 Writing an object in another node (C3_CANopen_SDO_Write4)

FB name	C3_CANopen_SDO_Write4	
This module allows to write an object with a max. length of 4 bytes in another node via SDO.		
VAR_INPUT		
Execute	BOOL	Activating the module
Device	INT	Node ID of the other node (1 ... 127)
Index	WORD	Object Index
Subindex	WORD	Object subindex
Data	DWORD	Object data which must be written
Length	WORD	Data length in Byte
VAR_OUTPUT		
Done	BOOL	Function executed without error
Error	BOOL	Error occurred
ErrorCode	WORD	You will find the error code in the Compax3 error list.
AbortCode	DWORD	CANopen SDO **abort code** (see page 383) upon error 65377 C3 CANopen **stack error** (see page 374) no. upon error 65376
Note: Compax3 must be CANopen master.		



6.5.3. CANopen communication profile

The CANopen communication objects described in this chapter are either set to sensible standard values or they are set under menu control with the help of the ServoManager.

The communication objects described below must be modified only for special deviating settings.

- CAN is an open system which has been standardised in the ISO 11898 and OSI reference model ISO 7498.
- CAN is Multi-Master compatible.
- Data transmission takes place with up to 8 Bytes useful data.
- The CAN objects are designated with an 11 Bit identifier (ID or COB-ID: CAN Object identifier). The identifier specifies the priority of the objects (the smaller the value of the object ID is, the higher is the priority level of the object).
- The COB-ID consists of the function code and the node ID:

Structure of the COB-ID

Bit 10	9	8	7	6	5	4	3	2	1	0
Function code				NodeID (1 ... 127)						

NodeID: The Compax3 device address is used here as standard value

I21 Function

CANopen ratings

Baud rate [kBit/s]	◆ 20, 50, 100, 125, 250, 500, 800, 1000
EDS file	◆ C3.EDS
Service data object	◆ SDO1
Process data objects	◆ PDO1, ... PDO4

6.5.3.1 Object types

The following table shows the preset COB-IDs:

Communication object type	Function code	COB - Identifier (dec)	COB - Identifier (hex)	Defined in Index...	Description	
Broadcast objects						
NMT	0000b	0	0h	-	Network management and identifier assignment	
SYNC	0001b	128	80h	1005h	CANSYNC	
TIME	0010b	256	100h	1012h	TIME is not implemented in Compax3.	
Point to point objects						
EMCY	0001b	129-255	81h-FFh	1014h	Error messages	
T-PDO1	0011b	385-511	181h-1FFh	1800h	Assignment via Index 1A00h	Transmit process data object (Compax3) max. 8 Bytes
T-PDO2	0101b	641-767	281h-2FFh	1801h	Assignment via Index 1A01h	
T-PDO3	0111b	897-1023	381h-3FFh	1802h	Assignment via Index 1A02h	
T-PDO4	1001b	1153-1279	481h-1279h	1803h	Assignment via Index 1A03h	
R-PDO1	0100b	513-639	201h-27Fh	1400h	Assignment via Index 1600h	Receive process data objects (Compax3) max. 8 Bytes
R-PDO2	0110b	769-895	301h-37Fh	1401h	Assignment via Index 1601h	
R-PDO3	1000b	1025-1151	401h-47Fh	1402h	Assignment via Index 1602h	
R-PDO4	1010b	1281-1407	501h-57Fh	1403h	Assignment via Index 1603h	
T-SDO1	1011b	1409-1535	581h-5FFh	1200h	Transmit service data object 1	
T-SDO2	-*	-*	-	1201h	Transmit service data object 2	
R-SDO1	1100b	1537-1663	601h-67Fh	1200h	Receive service data object 1	
R-SDO2	-*	-*	-	1201h	Receive service data object 2	
Node guard	1110b	1793-1919	701h-77Fh	100Eh	Check bus subscribers.	

* The SDO2 are not activated.
The standard value of the COB-ID for an object is calculated as follows: COB-ID = (Function code * 128) + Device address
The standard values of the COB-Ids can be changed via communication objects via SDOs.

Application of the communication object types

Transmission of real time data (faster transmission because higher priority)

T-PDO Transmit process data object: Compax3 reply.
R-PDO Receive process data object: send to Compax3.

Once only transmission, e. g. of parameters or programme lines

T-SDO Transmit service data object: Compax3 reply.
R-SDO Receive service data object: send to Compax3.

6.5.3.2 Communication objects

General note:
Every CAN object which is created as array (with subindex) contains the number of entries in subindex 0.

CAN communication objects overview sorted according to CAN No.

CAN-No	Name	Bus format	Standard value	Minimum value	Maximum value	Access
0x1000	Device Type	Unsigned32	0x00020192	0x00000000	0xFFFFFFFF	const
0x1001	Error Register	Unsigned8	0x00	0x00	0xFF	ro
0x1005	COB-ID SYNC	Unsigned32	0x80000080	0x00000001	0xFFFFFFFF	rw
0x1006	Communication Cycle Period	Unsigned32	0x00000000	0x00000000	0xFFFFFFFF	rw
0x1007	Synchronous Window Length	Unsigned32	0x00000000	0x00000000	0xFFFFFFFF	rw
0x1008	Manufacturer Device Name	Visible_String	C3xxxxxxxxxxxxxxxxx			const
0x1009	Manufacturer Hardware Version	Visible_String	CTPxxxxxxxLEIxxxxxxxx			const
0x100A	Manufacturer Software Version	Visible_String	V xxxxxxxxxxxxxxxxxx			const
0x100C	Guard Time	Unsigned16	0x0000	0x0	0xFFFF	rw
0x100D	Life Time Factor	Unsigned8	0x00	0x0	0xFF	rw
0x1014	COB-ID EMCY	Unsigned32	0x000000FF	0x00000001	0xFFFFFFFF	rw
0x1015	Inhibit Time Emergency	Unsigned16	0x0	0x0	0xFFFF	rw
0x1018	**Identity Object** (see page 381)	-				
0x1018.1	Vendor Id	Unsigned32	0x0	0x0	0xFFFFFFFF	ro
0x1018.2	Product Code	Unsigned32	0x0	0x0	0xFFFFFFFF	ro
0x1018.3	Revision number	Unsigned32	0x0	0x0	0xFFFFFFFF	ro
0x1018.4	Serial number	Unsigned32	0x0	0x0	0xFFFFFFFF	ro
0x1200	Server SDO1 Parameter	-				
0x1200.1	SDO1: COB-ID Client -> Server	Unsigned32	0x0000067F	0x00000001	0xFFFFFFFF	ro
0x1200.2	SDO1: COB-ID Server -> Client	Unsigned32	0x000005FF	0x00000001	0xFFFFFFFF	ro
0x1200.3	Node ID of the SDO1 client	Unsigned8	0x00	0x00	0xFF	rw
0x1201	Server SDO2 Parameter	-				
0x1201.1	SDO2: COB-ID Client -> Server	Unsigned32	0x800006E0	0x00000001	0xFFFFFFFF	rw
0x1201.2	SDO2: COB-ID Server -> Client	Unsigned32	0x800006E0	0x00000001	0xFFFFFFFF	rw
0x1201.3	Node ID of the SDO2 Client	Unsigned8	0x00	0x00	0xFF	rw
0x1400	Receive PDO1 communication parameters	-				
0x1400.1	RPDO1: COB-ID	Unsigned32	0x0000027F	0x00000001	0xFFFFFFFF	rw
0x1400.2	RPDO1: Transmission type	Unsigned8	0xFE	0x00	0xFF	rw
0x1400.3	RPDO1: Inhibit Time	Unsigned16	0x0000	0x0000	0xFFFF	rw
0x1400.5	RPDO1: Event timer	Unsigned16	0x0	0x0	0xFFFF	rw
0x1401	Receive PDO2 communication parameters	-				
0x1401.1	RPDO2: COB-ID	Unsigned32	0x0000037F	0x00000001	0xFFFFFFFF	rw
0x1401.2	RPDO2: Transmission type	Unsigned8	0xFE	0x00	0xFF	rw
0x1401.3	RPDO2: Inhibit Time	Unsigned16	0x0000	0x0000	0xFFFF	rw
0x1401.5	RPDO2: Event timer	Unsigned16	0x0	0x0	0xFFFF	rw
0x1402	Receive PDO3 communication parameter	-				
0x1402.1	RPDO3: COB-ID	Unsigned32	0x0000047f	0x0	0xFFFFFFFF	rw
0x1402.2	RPDO3: Transmission type	Unsigned8	0xFE	0x0	0xFF	rw
0x1402.3	RPDO3: Inhibit Time	Unsigned16	0x0000	0x0	0xFFFF	rw
0x1402.5	RPDO3: Event timer	Unsigned16	0x0	0x0	0xFFFF	rw
0x1403	Receive PDO4 communication parameter	-				
0x1403.1	RPDO4: COB-ID	Unsigned32	0x0000057f	0x0	0xFFFFFFFF	rw
0x1403.2	RPDO4: Transmission type	Unsigned8	0xFE	0x0	0xFF	rw
0x1403.3	RPDO4: Inhibit Time	Unsigned16	0x0000	0x0	0xFFFF	rw
0x1403.5	RPDO4: Event timer	Unsigned16	0x0	0x0	0xFFFF	rw
0x1600	Receive PDO1 mapping parameter	-				
0x1600.1	RPDO1 mapping entry 1	Unsigned32	0x00000000	0x00000000	0xFFFFFFFF	rw
0x1600.2	RPDO1 mapping entry 2	Unsigned32	0x00000000	0x00000000	0xFFFFFFFF	rw
0x1600.3	RPDO1 mapping entry 3	Unsigned32	0x00000000	0x00000000	0xFFFFFFFF	rw
0x1600.4	RPDO1 mapping entry 4	Unsigned32	0x00000000	0x00000000	0xFFFFFFFF	rw
0x1600.5	RPDO1 mapping entry 5	Unsigned32	0x00000000	0x00000000	0xFFFFFFFF	rw

CAN-No	Name	Bus format	Standard value	Minimum value	Maximum value	Access
0x1601	Receive PDO2 mapping parameter	-				
0x1601.1	RPDO2 mapping entry 1	Unsigned32	0x00000000	0x00000000	0xFFFFFFFF	rw
0x1601.2	RPDO2 mapping entry 2	Unsigned32	0x00000000	0x00000000	0xFFFFFFFF	rw
0x1601.3	RPDO2 mapping entry 3	Unsigned32	0x00000000	0x00000000	0xFFFFFFFF	rw
0x1601.4	RPDO2 mapping entry 4	Unsigned32	0x00000000	0x00000000	0xFFFFFFFF	rw
0x1601.5	RPDO2 mapping entry 5	Unsigned32	0x00000000	0x00000000	0xFFFFFFFF	rw
0x1602	Receive PDO3 mapping parameter	-				
0x1602.1	RPDO3 mapping entry 1	Unsigned32	0x00000000	0x0	0xFFFFFFFF	rw
0x1602.2	RPDO3 mapping entry 2	Unsigned32	0x00000000	0x0	0xFFFFFFFF	rw
0x1602.3	RPDO3 mapping entry 3	Unsigned32	0x00000000	0x0	0xFFFFFFFF	rw
0x1602.4	RPDO3 mapping entry 4	Unsigned32	0x00000000	0x0	0xFFFFFFFF	rw
0x1602.5	RPDO3 mapping entry 5	Unsigned32	0x00000000	0x0	0xFFFFFFFF	rw
0x1603	Receive PDO3 mapping parameter	-				
0x1603.1	RPDO4 mapping entry 1	Unsigned32	0x00000000	0x0	0xFFFFFFFF	rw
0x1603.2	RPDO4 mapping entry 2	Unsigned32	0x00000000	0x0	0xFFFFFFFF	rw
0x1603.3	RPDO4 mapping entry 3	Unsigned32	0x00000000	0x0	0xFFFFFFFF	rw
0x1603.4	RPDO4 mapping entry 4	Unsigned32	0x00000000	0x0	0xFFFFFFFF	rw
0x1603.5	RPDO4 mapping entry 5	Unsigned32	0x00000000	0x0	0xFFFFFFFF	rw
0x1800	Transmit PDO1 communication parameter	-				
0x1800.1	TPDO1: COB-ID	Unsigned32	0x000001FF	0x00000001	0xFFFFFFFF	rw
0x1800.2	TPDO1: Transmission type	Unsigned8	0xFE	0x00	0xFF	rw
0x1800.3	TPDO1: Inhibit Time	Unsigned16	0x0000	0x0000	0xFFFF	rw
0x1800.5	TPDO1: Event timer	Unsigned16	0x0	0x0	0xFFFF	rw
0x1801	Transmit PDO2 communication parameter	-				
0x1801.1	TPDO2: COB-ID	Unsigned32	0x000002FF	0x00000001	0xFFFFFFFF	rw
0x1801.2	TPDO2: Transmission type	Unsigned8	0xFE	0x00	0xFF	rw
0x1801.3	TPDO2: Inhibit Time	Unsigned16	0x0000	0x0000	0xFFFF	rw
0x1801.5	TPDO2: Event timer	Unsigned16	0x0	0x0	0xFFFF	rw
0x1802	Transmit PDO3 communication parameter	-				
0x1802.1	TPDO3: COB-ID	Unsigned32	0x000003ff	0x0	0xFFFFFFFF	rw
0x1802.2	TPDO3: Transmission type	Unsigned8	0xFE	0x0	0xFF	rw
0x1802.3	TPDO3: Inhibit Time	Unsigned16	0x0000	0x0	0xFFFF	rw
0x1802.5	TPDO3: Event timer	Unsigned16	0x0	0x0	0xFFFF	rw
0x1803	Transmit PDO4 communication parameter	-				
0x1803.1	TPDO4: COB-ID	Unsigned32	0x000004ff	0x0	0xFFFFFFFF	rw
0x1803.2	TPDO4: Transmission type	Unsigned8	0xFE	0x0	0xFF	rw
0x1803.3	TPDO4: Inhibit Time	Unsigned16	0x0000	0x0	0xFFFF	rw
0x1803.5	TPDO4: Event timer	Unsigned16	0x0	0x0	0xFFFF	rw
0x1A00	Transmit PDO1 mapping parameter	-				
0x1A00.1	TPDO1 mapping entry 1	Unsigned32	0x00000000	0x00000000	0xFFFFFFFF	rw
0x1A00.2	TPDO1 mapping entry 2	Unsigned32	0x00000000	0x00000000	0xFFFFFFFF	rw
0x1A00.3	TPDO1 mapping entry 3	Unsigned32	0x00000000	0x00000000	0xFFFFFFFF	rw
0x1A00.4	TPDO1 mapping entry 4	Unsigned32	0x00000000	0x00000000	0xFFFFFFFF	rw
0x1A00.5	TPDO1 mapping entry 5	Unsigned32	0x00000000	0x00000000	0xFFFFFFFF	rw
0x1A01	Transmit PDO2 mapping parameter	-				
0x1A01.1	TPDO2 mapping entry 1	Unsigned32	0x00000000	0x00000000	0xFFFFFFFF	rw
0x1A01.2	TPDO2 mapping entry 2	Unsigned32	0x00000000	0x00000000	0xFFFFFFFF	rw
0x1A01.3	TPDO2 mapping entry 3	Unsigned32	0x00000000	0x00000000	0xFFFFFFFF	rw
0x1A01.4	TPDO2 mapping entry 4	Unsigned32	0x00000000	0x00000000	0xFFFFFFFF	rw
0x1A01.5	TPDO2 mapping entry 5	Unsigned32	0x00000000	0x00000000	0xFFFFFFFF	rw
0x1A02	Transmit PDO3 mapping parameter	-				
0x1A02.1	TPDO3 mapping entry 1	Unsigned32	0x00000000	0x0	0xFFFFFFFF	rw
0x1A02.2	TPDO3 mapping entry 2	Unsigned32	0x00000000	0x0	0xFFFFFFFF	rw
0x1A02.3	TPDO3 mapping entry 3	Unsigned32	0x00000000	0x0	0xFFFFFFFF	rw
0x1A02.4	TPDO3 mapping entry 4	Unsigned32	0x00000000	0x0	0xFFFFFFFF	rw

CAN-No	Name	Bus format	Standard value	Minimum value	Maximum value	Access
0x1A02.5	TPDO3 mapping entry 5	Unsigned32	0x00000000	0x0	0xFFFFFFFF	rw
0x1A03	Transmit PDO4 mapping parameter	-				
0x1A03.1	TPDO4 mapping entry 1	Unsigned32	0x00000000	0x0	0xFFFFFFFF	rw
0x1A03.2	TPDO4 mapping entry 2	Unsigned32	0x00000000	0x0	0xFFFFFFFF	rw
0x1A03.3	TPDO4 mapping entry 3	Unsigned32	0x00000000	0x0	0xFFFFFFFF	rw
0x1A03.4	TPDO4 mapping entry 4	Unsigned32	0x00000000	0x0	0xFFFFFFFF	rw
0x1A03.5	TPDO4 mapping entry 5	Unsigned32	0x00000000	0x0	0xFFFFFFFF	rw

Identity Object (0x1018)

This object is composed as follows:

Vendor-ID (0x1018.1)

Is stored in the FBI-EEPROM binarily from addr. 56...59 (low...high). Current value = 0x02000089.

Product-Code (0x1018.2)

Is composed of the part of the order code "Faa Ibb Tcc Mdd" to 0xaabbccdd, i.e. the device with the order code C3S025V2F10I21T40M11 has the product code 0x10214011.
The product code is hex coded, but can be read decimally.

Revision number (0x1018.3)

Is composed of 5 digits of the software version no. of the DSP software and 3 digits of the SV no. of the FBI softwre, i.e. the device with the DSP SV no. 01.08.02 and the FBI SV no. 1.21 has the revision no. 0x10802121.

Serial number (0x1018.4)

Is stored in the CTP-EEPROM as a 10 digit ASCII string from addr. 56...65 (series number of the device). A C3 with the series number 1423440001 has the serial number 0x54D7F881.

Communication objects

The description of the CANopen communication objects can be found in the corresponding help file.

6.5.4. Acyclic parameter channel

In this chapter you can read about:

6.5.4.1 Service Data Objects (SDO)

Asynchronous access to the object directory of Compax3 is implemented with the help of the SDOs. The SDOs serve for parameter configuration and status interrogation. Access to an individual object takes place via the RS232 / RS485 index and subindex of the object directory.

Attention!
A SDO is a confirmed service, therefore the SDO reply telegram must always be awaited before a new telegram may be transmitted.

CiA405_SDO_Error (Abort Code): UDINT

In the case of an incorrect SDO transmission, the error cause is returned via the "abort code".

Abort Code	Description
0x0503 0000	” Toggle Bit” was not alternated
0x0504 0000	SDO protocol ”time out”
0x0504 0001	Client/server command designator invalid or unknown
0x0504 0002	Unknown block size (block mode only)
0x0504 0003	Unknown block number (block mode only)
0x0504 0004	CRC error (block mode only)
0x0504 0005	Outside of memory
0x0601 0000	Access to this object is not supported
0x0601 0001	Attempted read access to a write only object
0x0601 0002	Attempted write access to a read only object
0x0602 0000	The object does not exist in the object directory
0x0604 0041	The object cannot be ”mapped” in a PDO
0x0604 0042	The size and number of the ”mapped” objects exceeds the maximum PDO length
0x0604 0043	General parameter incompatibility
0x0604 0047	General incompatibility in the device
0x0606 0000	Access infringement due to a hardware error
0x0607 0010	Data type does not fit, length of the service parameter does not fit
0x0607 0012	Data type does not fit, length of the service parameter too large
0x0607 0013	Data type does not fit, length of the service parameter too small
0x0609 0011	Subindex does not exist
0x0609 0030	Outside parameter value range (only for write access operations)
0x0609 0031	Parameter value too large
0x0609 0032	Parameter value too small
0x0609 0036	Maximum value smaller than minimum value
0x0800 0000	General error
0x0800 0020	Date cannot be transmitted or saved
0x0800 0021	Date cannot be transmitted or saved due to local device management
0x0800 0022	Date cannot be transmitted or stored due to device status
0x0800 0023	Dynamic generation of the object directory is impossible or no object directory exists (the object directory is created from a file and an error occurs due to a defective file)

6.5.4.2 Object up-/download via RS232 / RS485

The up-/download takes place via the RS232 / RS485 objects C3_Request (Index 0x2200) and C3_Response (Index 0x2201). These have the data type data type octet string with a length of 20 bytes (octets). Write/read of a C3 object is carried out by writing of C3_Request with the corresponding data. When a C3 object is read, the data appear in the C3_Response object .

Meaning of the data from C3_Request

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	...	...	Byte 19	Byte 20
Request header				C3 object data (write)					
AK	Subindex	Index		D1	D2	...	...	D15	D16

AK: Job identifier; 3=read, 4= write
OD1..OD16: Object data; OD1 = High, OD16 = Low

Meaning of the data from C3_Response

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	...	...	Byte 19	Byte 20
Reply header				C3 object data (read)					
-	-	-	-	OD1	OD2	...	...	OD15	OD16

OD1..OD16: Object data; OD1 = High, OD16 = Low

Upload

RS232 / RS485		O 1	O 2	O 3	O 4	O 5	O 6	O 7	O 8	...	O 20
Access	Object	C3 object request/reply				C3 object data					
1. Write C3 object 20.2 with the value 0											
Write	0x2200.0	4	2	0	20	0	0	0	x	...	x
2. read next C3 object index/subindex in C3 object 20.5											
Write	0x2200.0	3	5	0	20	x	x	x	x	...	x
Read	0x2201.0	x	x	x	x	**I_hi**	**I_lo**	**Subi**	x	...	x
3. read the C3 object with the in index/subindex read in the C3 object 20.5											
Write	0x2200.0	3	**Subi**	**I_hi**	**I_lo**	x	x	x	x	...	x
Read	0x2201.0	x	x	x	x	D1	D2	D3	D4	...	D16
4. Store C3 object index, subindex and data D1...D16 in table											
5. Repeat steps 2 to 4 until I_hi = I_lo = Subi = 0xFF											

Download: Write the entire table of C3 objects.

RS232 / RS485		O 1	O 2	O 3	O 4	O 5	O 6	O 7	O 8	...	O 20
Access	Object	C3 object request/reply				C3 object data					
1. Write C3 object from the table											
Write	0x2200.0	4	**Subi**	**I_hi**	**I_lo**	D1	D2	D3	D4	...	D16
2. Repeat step 1 until the end of the table											

6.5.4.3 Data formats of the bus objects

Data formats of the bus objects (see page 363)

6.6 DeviceNet

In this chapter you can read about:

I22 Function

Please note:

A changed assignment (mapping) of the Input/Output Message is accepted with Power off / Power on!

The length of the Input / Output Message is adapted to the real assignment (mapping) (2...32).

Statement of Conformance
http://www.compax3.de/C3_DeviceNet_Statement_of_Conformance.pdf (in the Internet)

Address or Baud rate settings (see page 35)

Connector assignment (see page 35)

6.6.1. DeviceNet Configuration

In this chapter you can read about:

Following are described the input windows of the configuration wizard.
Can be called up in the tree (Compax3 ServoManager, left window) under "configure configuration".

6.6.1.1 Error reaction to a bus failure

Here you can adjust how Compax3 will respond to a fieldbus error:
Possible settings for the error reaction are:

- No response
- downramp / stop
- Downramp / switch to currentless (standard setting)

6.6.2. DeviceNet object classes

In this chapter you can read about:

The DeviceNet object classes described in this chapter are either set to sensible standard values or they are set under menu control with the help of the ServoManager.

The communication objects described below must be modified only for special deviating settings.

I22 Function

DeviceNet characteristic data

DeviceNet	◆ Predefined Master/Slave Connection Set ◆ Standard 2.0 Group-2-Slave ◆ Fieldbus I/O Data or Process Data (Polled, COS/Cyclic I/O and Bit Strobe)
Implemented object classes	◆ Identify, Message Router, DeviceNet, Assembly, Connection, Acknowledge Handler
Baud rate [kBit/s]	◆ 125, 250, 500
permissible cable length	◆ up to 500m on 125Bit/s, ◆ up to 200m on 250Bit/s, ◆ up to 100m on 500Bit/s,
Max. number of nodes	◆ 63 Slave
Insulation	◆ Isolated Device Physical Layer
EDS file	◆ C3_DeviceNet.EDS
Conformance (file in the Internet)	◆ **Statement of Conformance** http://www.compax3.de/C3_DeviceNet_Statement_of_Conformance.pdf
Further information:	◆ Application example (C3I22_DeviceNet.ZIP) on the Compax3 CD in the "\Examples" directory

6.6.2.1 Overview of the DeviceNet object classes

Object name	Class ID	Instance ID	Description
Identify	0x01	1	Mandatory
Message Router	0x02	1	Mandatory
DeviceNet	0x03	1	Mandatory
Assembly	0x04	101-103	I/O Messages
Connection	0x05	1	Explicit Messages
		2	Polled I/O Data
		3	Bit Strobe
		4	Change of State (COS), Cyclic I/O Data
Acknowledge Handler	0x2B	1	Necessary for connection class ID 05hex, instance ID 04
Image of I/O Data	0x64	1	Manufacturer-specific object class image of I/O data
C3 object	0x65	20-3300	Manufacturer-specific object class C3 object

6.6.2.2 Object classes

Detailed information on the topic of "object classes" can be found in the online help of the device.

6.6.3. Data formats of the bus objects

Data formats of the bus objects (see page 363)

6.7 Ethernet Powerlink

In this chapter you can read about:

The Ethernet Powerlink option is available with the Compax3 devices C3I30Txx**!**

The EtherCAT option is available with the Compax3 devices C3I31Txx**!**

6.7.1. Configuring Ethernet Powerlink / EtherCAT

In this chapter you can read about:

Following are described the input windows of the Ethernet Powerlink / EtherCAT configuration wizard.
Can be called up in the tree (Compax3 ServoManager, left window) under "configure configuration".

6.7.1.1 CN Controlled Node (Slave)

Compax3 is the slave of an Ethernet / EtherCAT master; the bus configuration is made via the ServoManager

6.7.1.2 Slave with configuration via master

Select "Slave with configuration via master". for operating mode and mapping via master.
Then run through the wizard completely.

6.7.1.3 Error reaction to a bus failure

Here you can adjust how Compax3 will respond to a fieldbus error:
Possible settings for the error reaction are:

- No response
- downramp / stop
- Downramp / switch to currentless (standard setting)

6.7.1.4 Possible PDO assignment

Via the process data objects (RPDO and TPDO), actual values and Setpoint values are cyclically exchanged between Compax3 and the Ethernet Powerlink Controlled Nodes (Slaves).
The cyclic PDOs are configured with the aid of the Compax3 ServoManager:
The PDOs are set separately for the transmission directions

- Slave ⇒ Compax3 (**RPDO**)
- Compax3 ⇒ Slave (**TPDO)**

The objects that can be put on the process data channel can be found in the " **Compax3 Objects** (see page 414)"!

6.8 HEDA Bus

In this chapter you can read about:

HEDA: **H**igh **E**fficiency **D**ata **A**ccess: Option M10 or M11

- Real-time data transfer
- High-stage axis synchronization
- fixed transfer rate of 10MBit/s
- Jitter < 300ns (Bus) which results in a high synchronicity
- Peer-to-Peer communication
- maximum cable length 50m (greater lengths on request)
- 1 Master / 31 Slave: Individual HEDA axis address inthe range between 1...32
- fixed cycle time of 0.5ms
- Synchronization of the scanning grid of the digital control loops and of the setpoint generation
- cyclic data exchange
- acyclic data exchange of time-uncritical values

HEDA wiring (see page 448)

Function of the HEDA LEDs

Green LED (left)

HEDA module energized

Red LED (right)

Error in the receive area
Possible causes:

- at the Master
  - no slave sending back
  - Wrong cabling
  - Terminal plug is missing
  - several masters are sending in the same slot
- at the slave
  - several masters in the system
  - no master active
  - Terminal plug is missing
  - no transmission from one or several receive slots (neither by the master nor by another slave)

The configuration may take place in two different ways:

- HEDA standard: Simple Master -> Slave communication
- HEDA advanced: Communication Master <-> Slave and Slave <-> Slave.

6.8.1. HEDA standard mode

In this chapter you can read about:

The HEDA option (option M10 or M11) can be used to send 4 process values in the "HEDA standard" operating mode from master to slave. A return transmission from Slave to Master is possible with "HEDA advanced".

First choose, if Compax3 is HEDA Master or HEDA Slave:

- HEDA master: in order to send process values
- HEDA slave: in order to receive process values

Please respect that only 1 HEDA station can be Master.

- Error reaction (from Compax3) at bus failure:
  - activated: Compax3 switches to error state in the case of a bus error. (Error reaction 2: Downramp / apply brake / de-energize.)
  - deactivated: Compax3 will ignore a bus error.

6.8.1.1 Error reaction to a bus failure

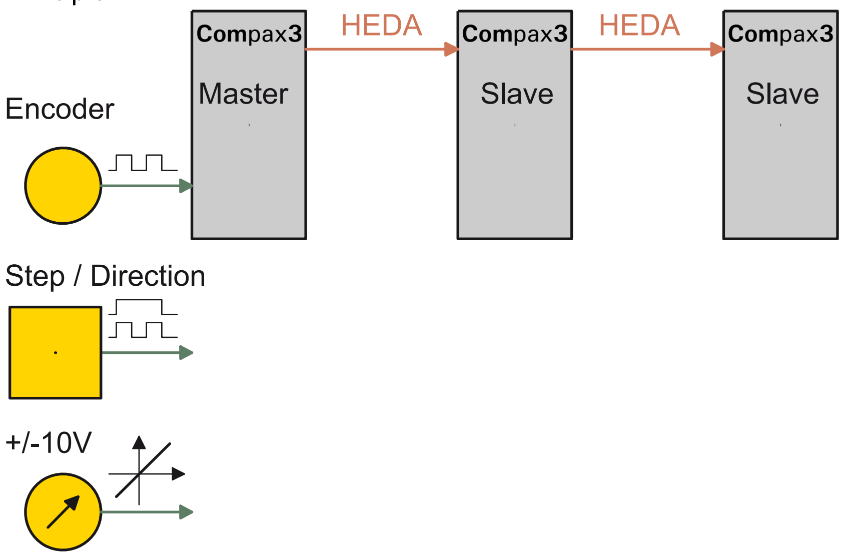
Here you can adjust how Compax3 will respond to a fieldbus error:
Possible settings for the error reaction are:

- No response
- downramp / stop
- Downramp / switch to currentless (standard setting)

6.8.1.2 HEDA-Master

You can transmit 4 process values with max. 7 words (one process value per channel).
The 1st process value (takes 3 words) is reserved for the axis synchronization. You may choose between:

- Process - setpoint position (Object 2000.1)
- Process - actual position (Object 2200.2)
- Position from external setpoint (object 2020.1)
  Signal read in via Analog channel 4 (X11/17 and X1/18), encoder input or step / direction input in the master.
  Principle:



<u>Attention in the case of a configuration download with master-slave coupling (electronic gearbox, cam)</u>

Switch Compax3 to currentless before starting the configuration download: Master and Slave axis

- Position from virtual Master (object 2000.2)

You can transmit 3 additional process values with 4 words data max. You can make your choice between the Compax3 PD objects.

Note: Please use the **coupling objects** (see page 412) for axis coupling.

6.8.1.3 HEDA-Slave

The transferred process values can be read and assigned to objects in the configuration wizard (e.g. array objects) in the HEDA slave.
Objects with appropriate data width (corresponding to the process values read in) must be assigned.
The 1st process value is used as input process value (object 3920.1: HEDA SignalProcessing Input) for axis synchronization. The target for the process values 2, 3, 4 can be selected from a list in the configuration wizard.

6.8.2. HEDA expansion (HEDA advanced)

In this chapter you can read about:

6.8.2.1 The possibilities of the HEDA expansion

The HEDA option (option M10 or M11) can be used to exchange process values in the "HEDA advanced" operating mode.

- from Slave to Master
- from Slave to Master and
- from Slave to Slave.

6.8.2.2 Technical data of the HEDA interface / overview

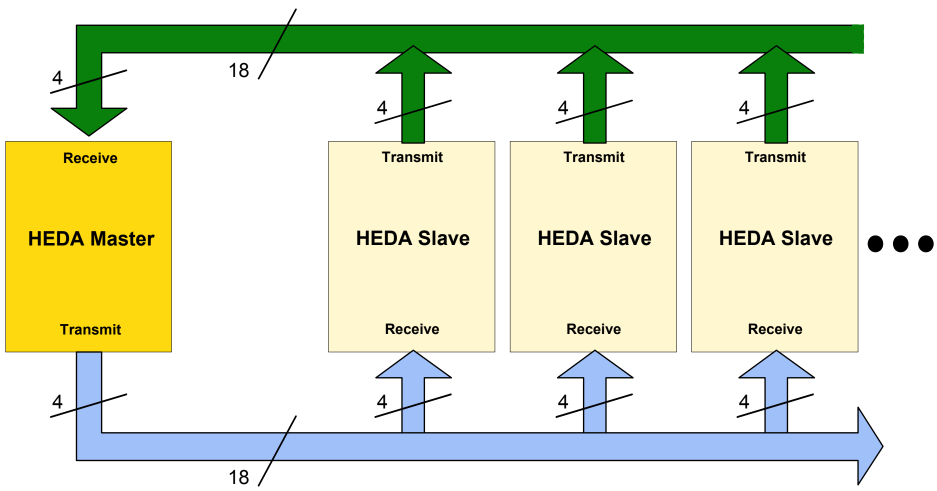
General HEDA data

- Synchronous, bidirectional, deterministic real-time bus.
- Bus access via time sharing (slots), Master/Slave, Producer/Consumer. (synchronization exactitude <1µs).
- Bus cycle time 500µs, distributed into 20 time slots à 25µs.
- 18 slots cyclic transmitting and receiving data channels (Slot 0 .. 17).
- 2 slots reserved for acyclic communication.
- Telegrams (frames) with max. 7 words à 16 bit can be sent and received in a slot.
- Freely configurable assignment of the cyclic transmit(Tx)/receive(rx)-slots to the stations.
- The transmitting and receiving data are freely definable via mapping tables.
- Master-Slave as well as Slave-Slave communication (cross-communication) are possible.
- A master=>slave frame in slot x can be received by every slave.
- A slave=>slave frame (cross-communication) in slot x can be received by every bus node.

Compax3-specific HEDA data:

- The Compaxa3 system cycle time is synchronized with the bus cycle time.
- System cycle time 500µs, distributed into 4 position control cycles à 125µs.
- For system-immanent reasons, only one slot is able to send and receive during the same position control cycle (every 125µs).
- Transmit- and receive slot can differ within one position controller cycle.
- The Master can receive frames from 4 slaves max.

Principle:



Displayed are the number of the possible telegrams (Frames).

6.8.2.3 Definitions

DSP Format	Objects with this format: ◆ are not reset ◆ are unlimited: you have a value range between $^{-223}$ and 2^{23}-1 ◆ are suitable as coupling objects If the DSP Format is not selected, the objects are transmitted into the **described formats** (see page 414). Please note that the **Bus formats Y2 and Y4** (see page 364) are set against the scaling factors.
Frame	Telegram of process values with a data width of 7 words.
Mapping	Image of process data on a communication channel (slot)
Mapping Table	Overview of process values that can be put on a communication channel (slot).
Coupling objects	Are suitable as master signals for electronic coupling and must be in the DSP format.
Receive	Received:
Slot	communication channel
Transmit	Send:
Process data	Objects, which are suitable for use in the cyclic data channel.

6.8.2.4 Calling up the HEDA wizard in the C3 ServoManager

The "HEDA Advanced" wizard can be found in the C3 ServoManager tree under communication.
Please observe:

The "HEDA advanced" wizard settings overwrite the settings of the HEDA standard wizard!

6.8.2.5 Configuration of the HEDA communication

In this chapter you can read about:

Error reaction to a bus failure

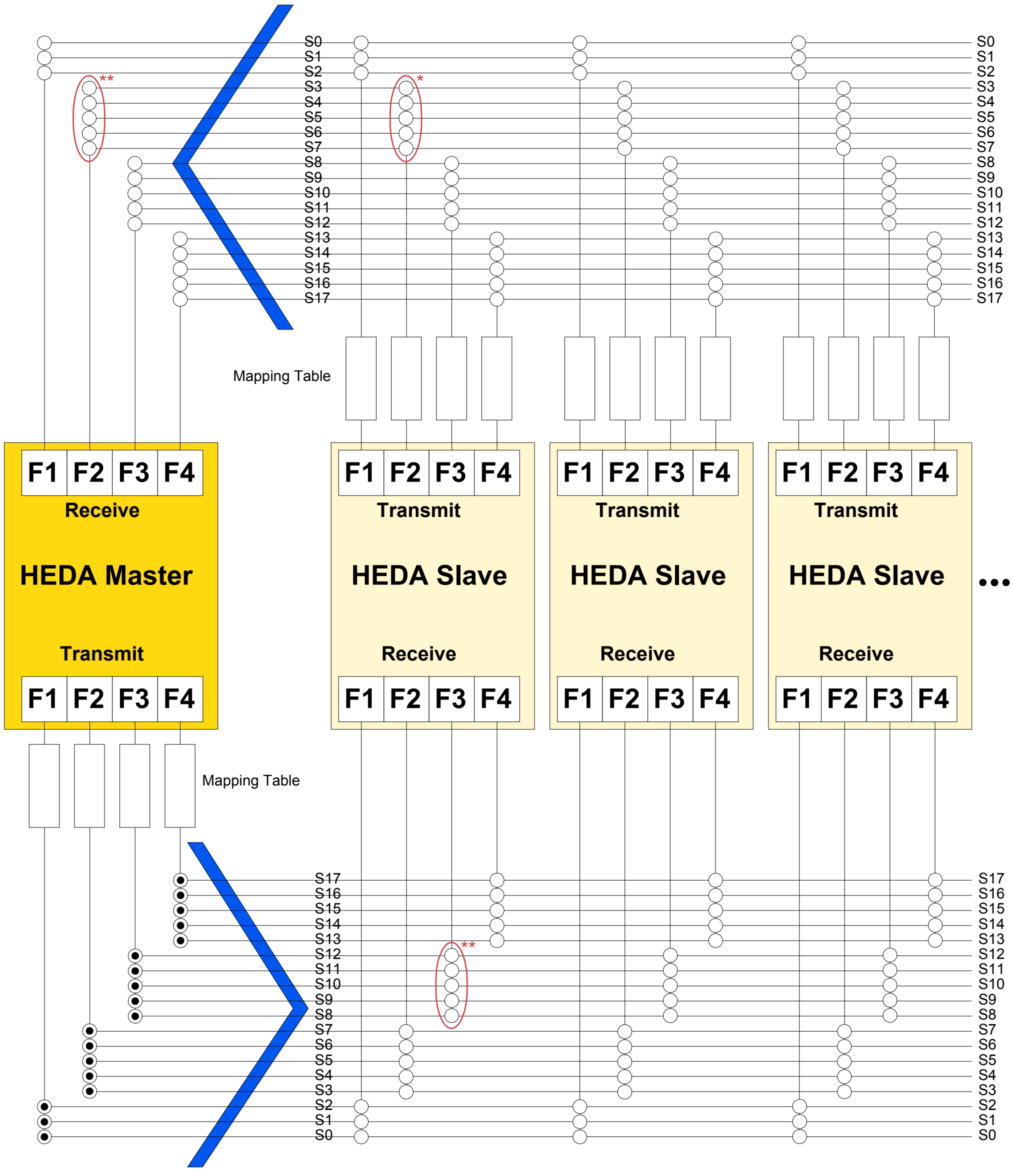
Here you can adjust how Compax3 will respond to a fieldbus error:
Possible settings for the error reaction are:

- No response
- downramp / stop
- Downramp / switch to currentless (standard setting)

Data transfer Master – Slave and back

In this chapter you can read about:

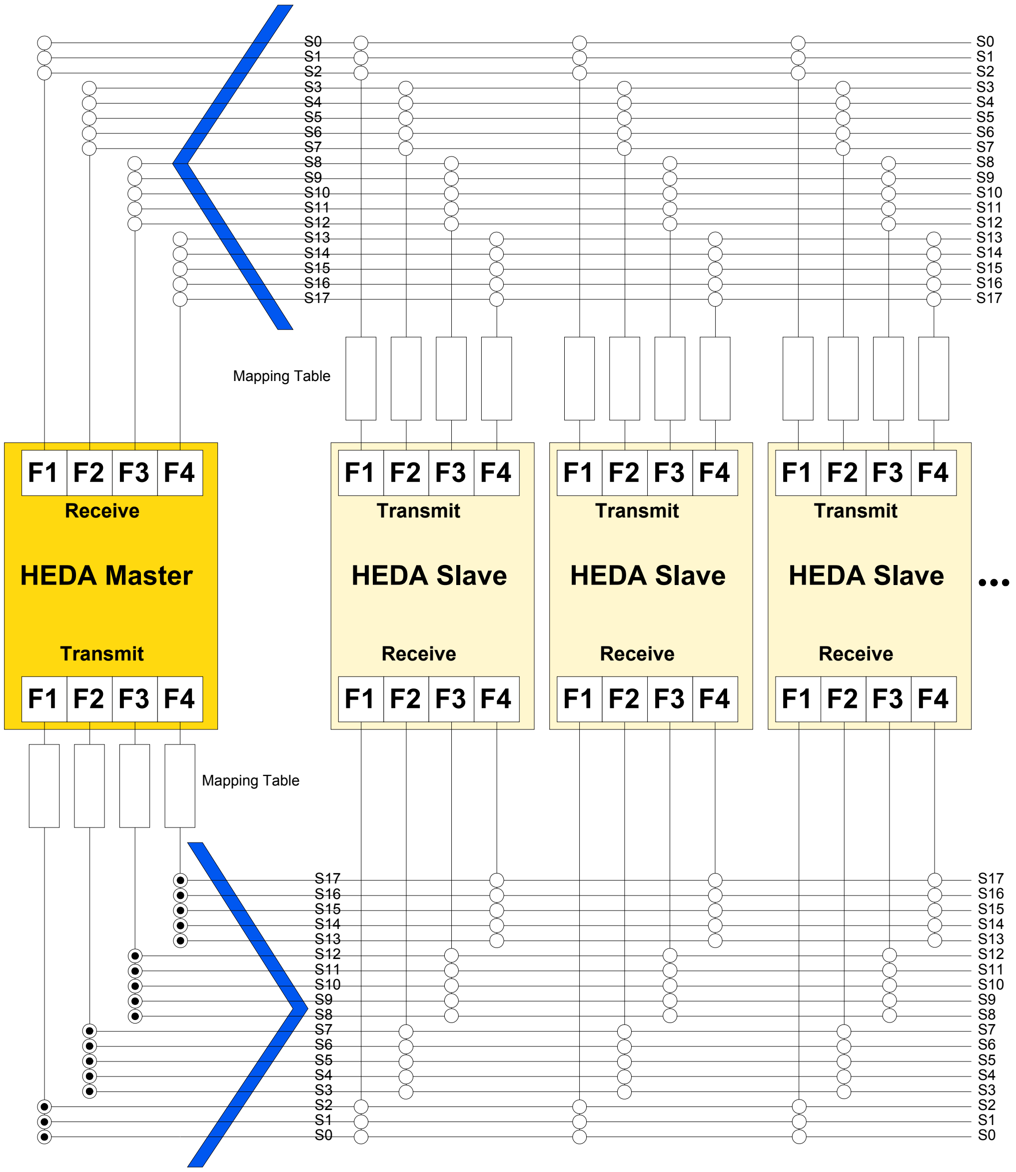
In standard applications the master sends process values to the slaves and reads the answers from the slaves.



* only one of the assigned slots per frame group may be activated on the slave transmit side (this is blocked by the C3 ServoManager)
* only one of the assigned slots per frame group may be activated on the master or slave receive side (this is blocked by the C3 ServoManager)

Print version available in the Internet

http://apps.parker.com/euro_emd/EME/downloads/compax3/HEDA-Formulare/HEDA-Standard.pdf



Functionality:

The master can send 4 different frames (F1,... F4). A frame can be sent from several slots:

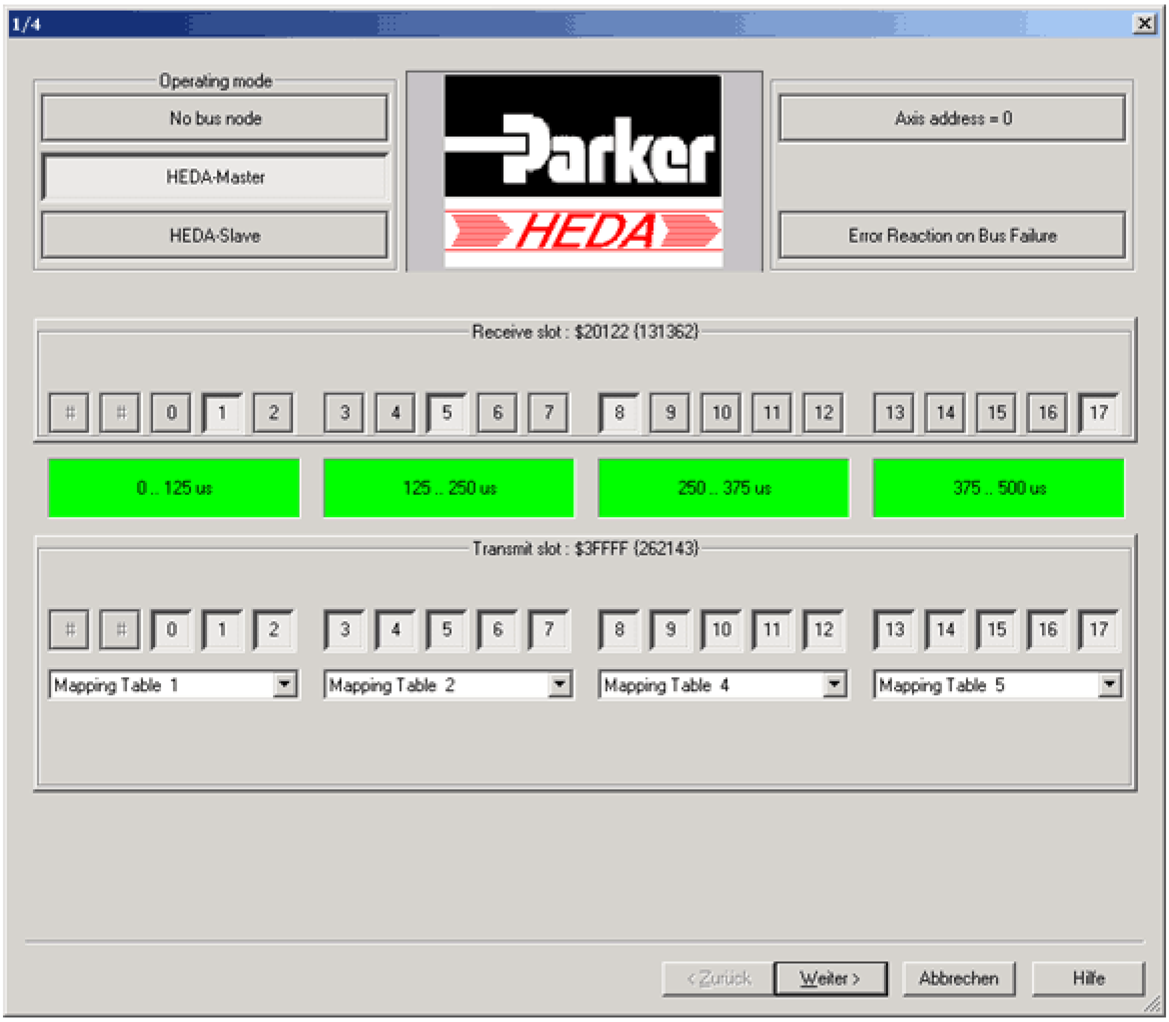
Frame:	F1	F2	F3	F4
possible slots:	0 ... 2	3 ... 7	8 ... 12	13 ... 17

Each frame is assigned a mapping table number.
The individual slaves read in the slot from where their relevant data are sent.
It is necessary to define a mapping table in the slave, stating where the individual process data are to be written (e.g. into an array-object).
The assignment of the mapping table is made via the mapping table number which is transferred via HEDA.
For this reason, the receive mapping table number and the transfer mapping table number must always be the same.

Important: **Receive**-Mapping-Tablen-Number = **Transmit**-Mapping-Table-Number

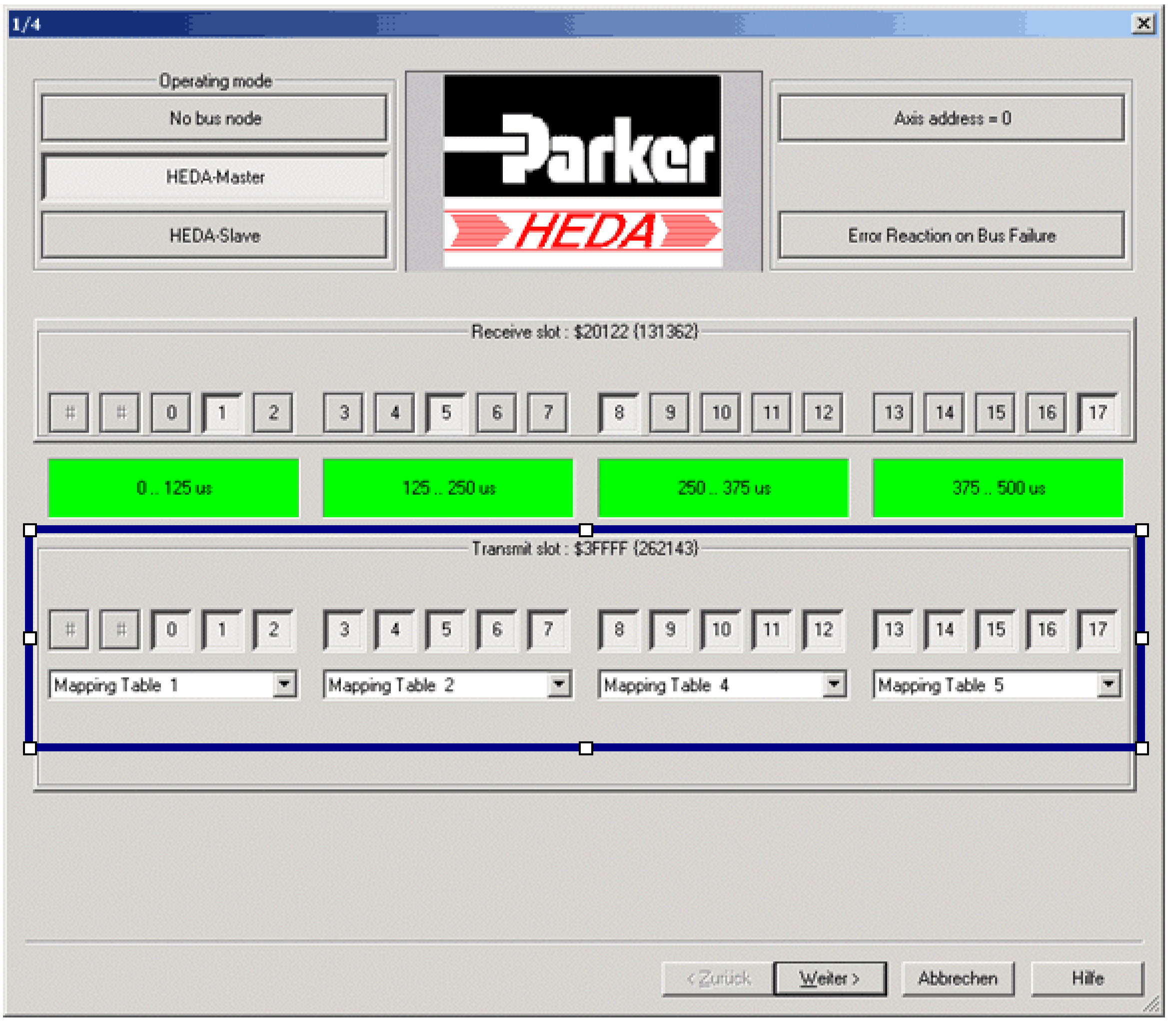
Setting the HEDA master

HEDA master settings:



- activate HEDA Master
- Axis address = 0
- Setting the error reaction (from Compax3) at bus failure:
  - activated: Compax3 switches to error state in the case of a bus error.
  - deactivated: Compax3 will ignore a bus error.

Master transmission slots (Transmit Slots)



Important:

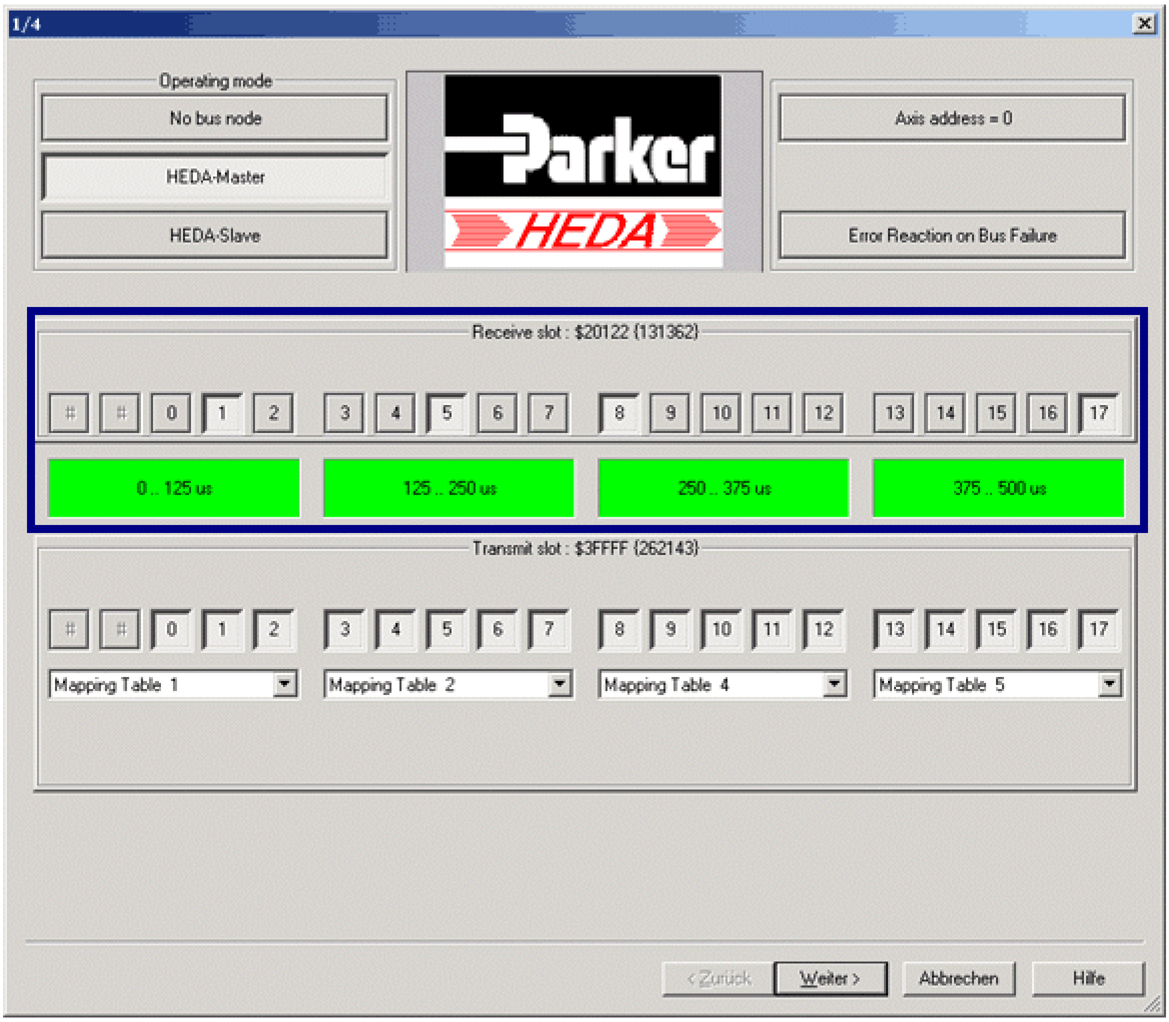
For standard applications (data transfer master – slave and back) all slots in the master must be transmitting.

- for this reason you should activate all transmit slots (0...17, in the lower area of the wizard window).
- Please assign, according to your requirements, a mapping table to each of the 4 transmit frames.

The contents of the transmit mapping table is defined in the next wizard window.

Master receive slots

Ąctivate the receive slots from which the slave sends data (corresponding to the settings in the slave).



In each of the 125µs cycles (slot 0...2, slot 3...7, slot 8...12, slot 13...17) data can be received only via one slot, see also the **HEDA communication structure** (see page 396).
The assignment of the data is made via the mapping table number (which was defined in the slave), this number is also received.
In the Wizard window "Receive Mapping table", it is defined under this mapping table number where the data received are to be written to.

Master Transmit Mapping Table (max. 4)

Here the transmit mapping tables, which were assigned to the max. 4 transmit 125µs slots, are defined.
Procedure:

- Selection of the corresponding transmit mapping table.
- Selection of the Compax3 objects to be transmitted.
  - The assignment of the mapping table is permanently identified and displayed.
  - Up to 7 words are possible.
  - How many words are used by an **object** (see page 414) depends on the **bus format** (see page 363) / DSP format

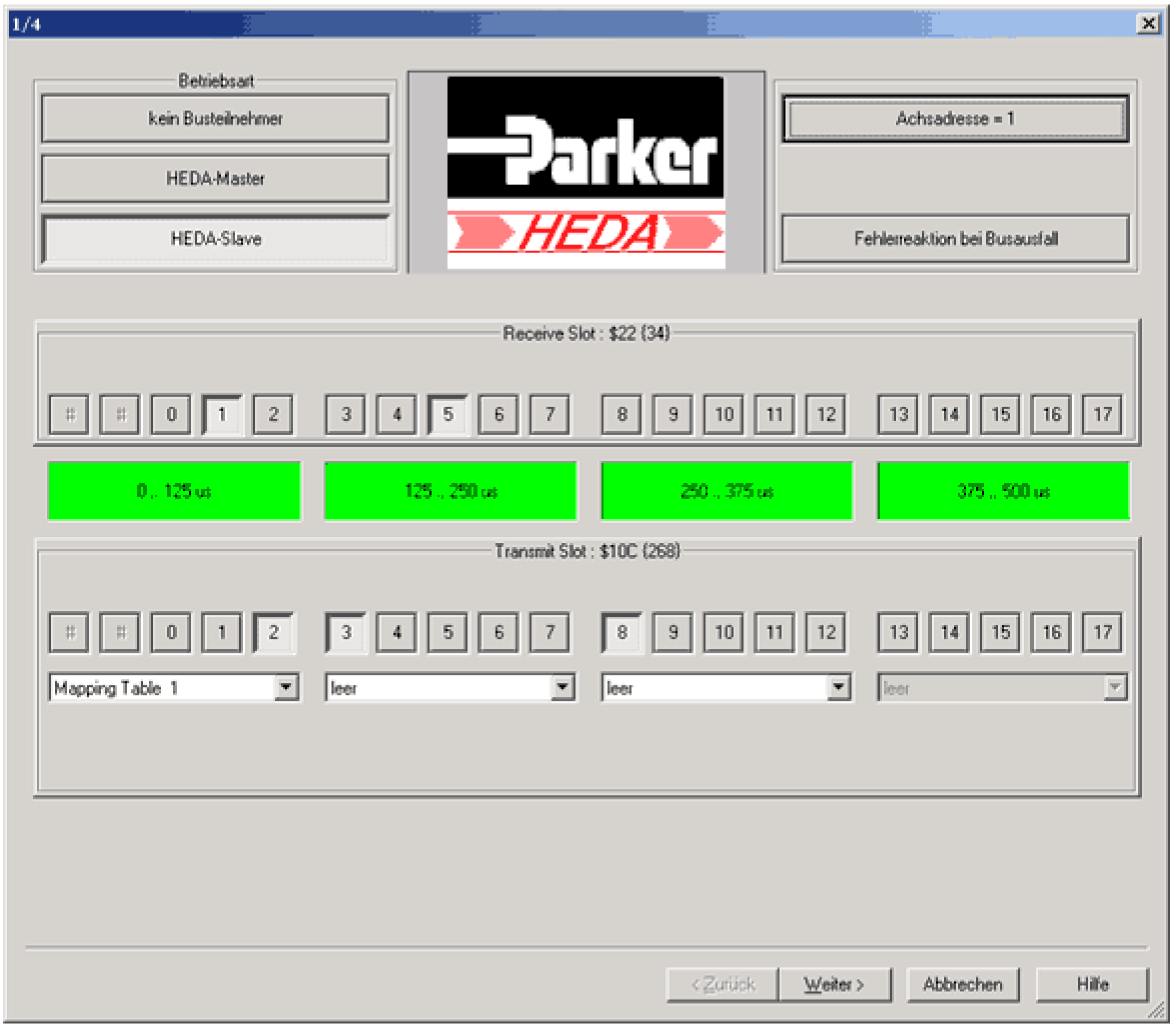
Note: For axis coupling, please use the **coupling objects** (see page 412) in the **DSP format** (see page 395) (selected by clicking on the DSP switch).
Please make sure that the DSP switch is activated on the master and the slave side in DSP format.

Master Receive Mapping Table (max. 4)

Please select the mapping table number, which was defined in the slave (under transmit mapping table).
Please enter where the data received shall be written (e.g. into an array object).
Please use the data formats as defined in the mapping table of the slave.

Note: For axis coupling, please use the **coupling object** (see page 412) O3920.1 in the **DSP format** (see page 395) as an input (selection by clicking on the DSP switch). Please make sure that the DSP switch is activated on the master and the slave side in DSP format.

Setting the HEDA slave



HEDA slave settings:

- Activating the HEDA Slave
- Assigning the axis address = 0 (can be changed by clicking)
- Setting the error reaction (from Compax3) at bus failure:
  - activated: Compax3 switches to error state in the case of a bus error.
  - deactivated: Compax3 will ignore a bus error.

Slave receive slots

Activate the receive slots, from where the slave is to receive the data.

In each of the four 125µs cycles (slot 0...2, slot 3...7, slot 8...12, slot 13...17) data can be received only via one slot, see also the **HEDA communication structure** (see page 396).
The assignment of the data is made via the mapping table number (which was defined in the master), this number is also received.
In the Wizard window "Receive Mapping table", it is defined under this mapping table number where the data received are to be written to.

Slave transmission slots (Transmit Slots)

Activate the transmit slots, from where the slave is to send the data.
In each of the four 125µs cycles (slot 0...2, slot 3...7, slot 8...12, slot 13...17) data can be transmitted only via one slot, see also the **HEDA communication structure** (see page 396).
Please make sure, that no other slave can send on this slot.
Now you can assign a mapping table to each individual activated slot.

Please consider, that transmit mapping table numbers are only used once in one transmit/receive range.

The contents of the transmit mapping table is defined in the next wizard window.

Slave Transmit Mapping table

Here the transmit mapping tables, which were assigned to the transmit slots activated before, are defined.
Procedure:

- Selection of the corresponding transmit mapping table.
- Selection of the Compax3 objects to be transmitted.
  - The assignment of the mapping table is permanently identified and displayed.
  - Up to 7 words are possible.
  - How many words are used by an **object** (see page 414) depends on the **bus format** (see page 363).

Note: For axis coupling, please use the **coupling objects** (see page 412) in the **DSP format** (see page 395) (selected by clicking on the DSP switch).
Please make sure that the DSP switch is activated on the master and the slave side in DSP format.

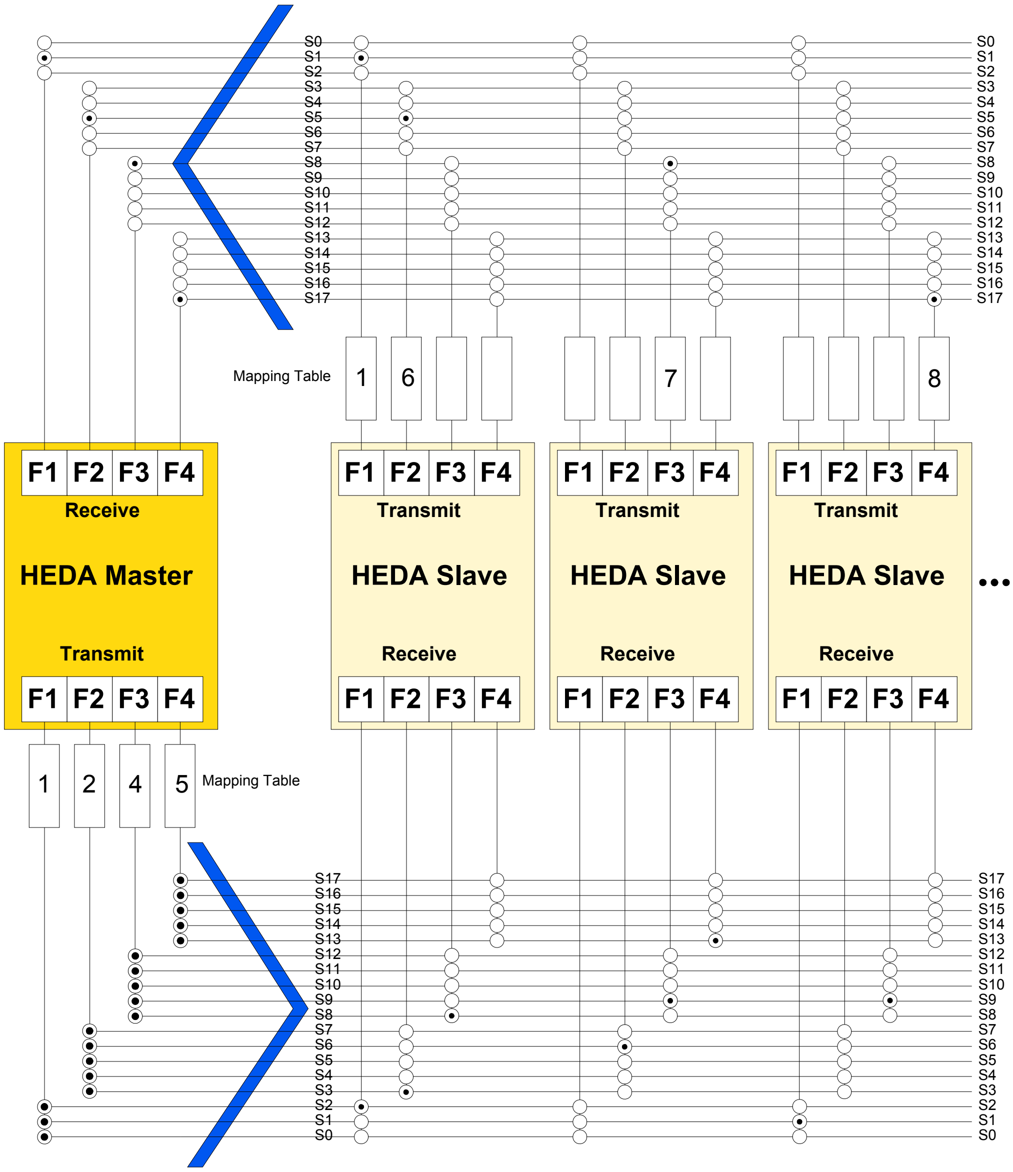
Slave Receive Mapping table

Please select the mapping table number, which was defined in the master (under transmit mapping table).
Please enter now, where the received data are to be written.
Please use the data formats as defined in the mapping table of the master.

Note: For axis coupling, please use the **coupling object** (see page 412) O3920.1 in the **DSP format** (see page 395) as an input (selection by clicking on the DSP switch).
Please make sure that the DSP switch is activated on the master and the slave side in DSP format.

Example: Communication Master – Slave and back

HEDa communication structure:



Master and Slave 1 to 3 (from left to right).

Task:

Master Transmit

- Master sends on:
  - Slot 0...2: Mapping table 1
  - Slot 3..0.7: Mapping table 2
  - Slot 8..0.12: Mapping table 4
  - Slot 13..0.17: Mapping table 5

Slave Receive

- Slave 1 reads on:
  - Slot 2: Mapping table 1
  - Slot 3: Mapping table 2 and
  - Slot 8: Mapping table 4
- Slave 2 reads on:
  - Slot 6: Mapping table 2
  - Slot 9: Mapping table 4 and
  - Slot 13: Mapping table 5.
- Slave 3 reads on
  - Slot 1: Mapping table 1 and
  - Slot 9: Mapping table 4.

Slave Transmit

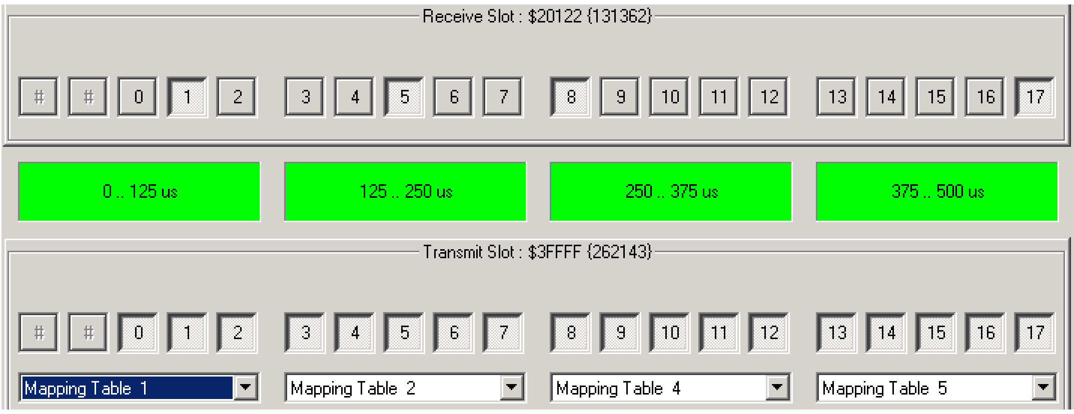
- Slave 1 sends on:
  - Slot 1: Mapping table 1
  - Slot 5: Mapping table 6
- Slave 2 sends on:
  - Slot 8: Mapping table 7
- Slave 3 sends on:
  - Slot 17: Mapping table 8

Master Receive

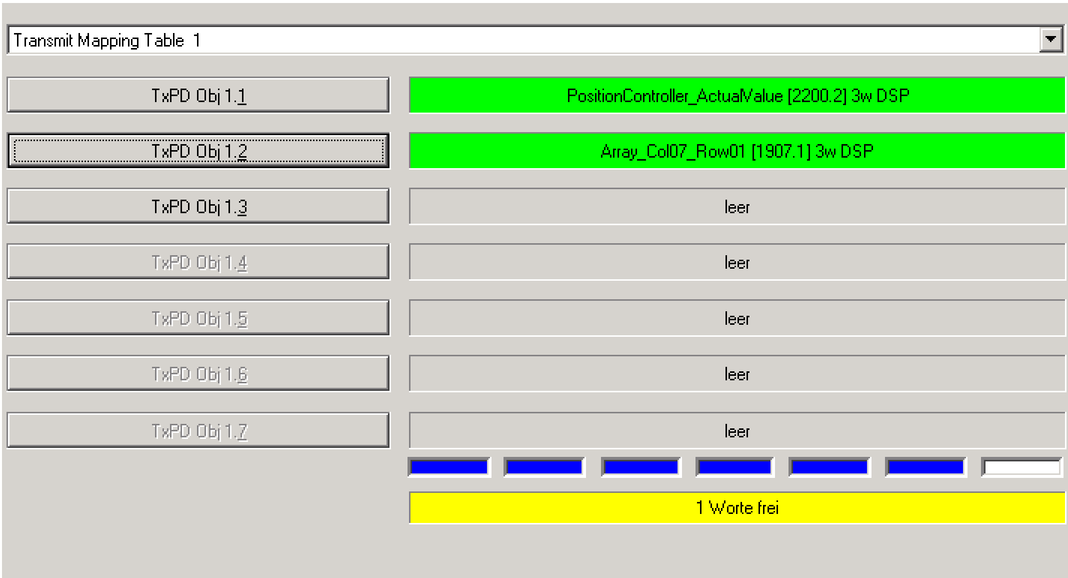
- Master receives on:
  - Slot 1: Mapping table 1
  - Slot 5: Mapping table 6
  - Slot 8: Mapping table 7
  - Slot 17: Mapping table 8

C3 ServoManger settings:

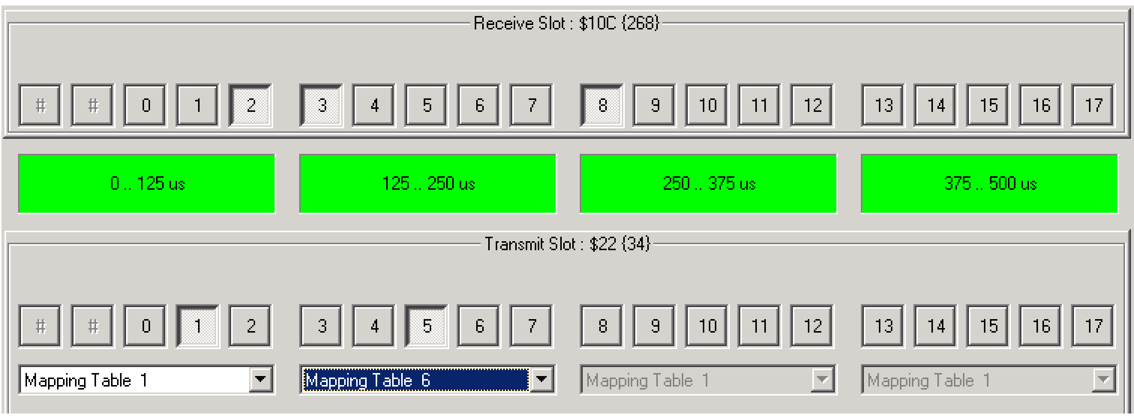
Slot - settings Master:



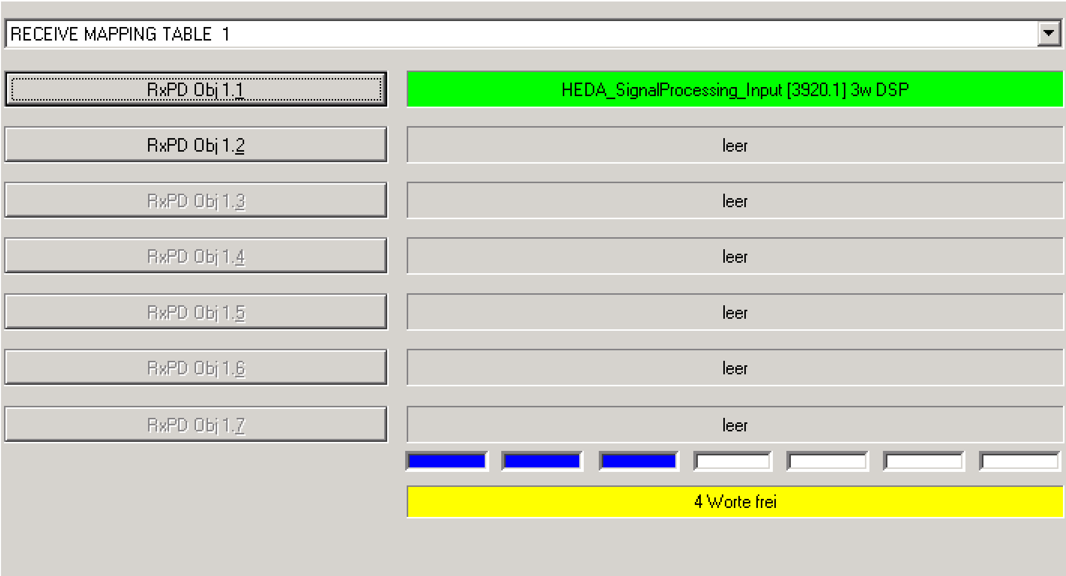
Example for transmit mapping table 1 on the master or slave



Slot settings slave 1:

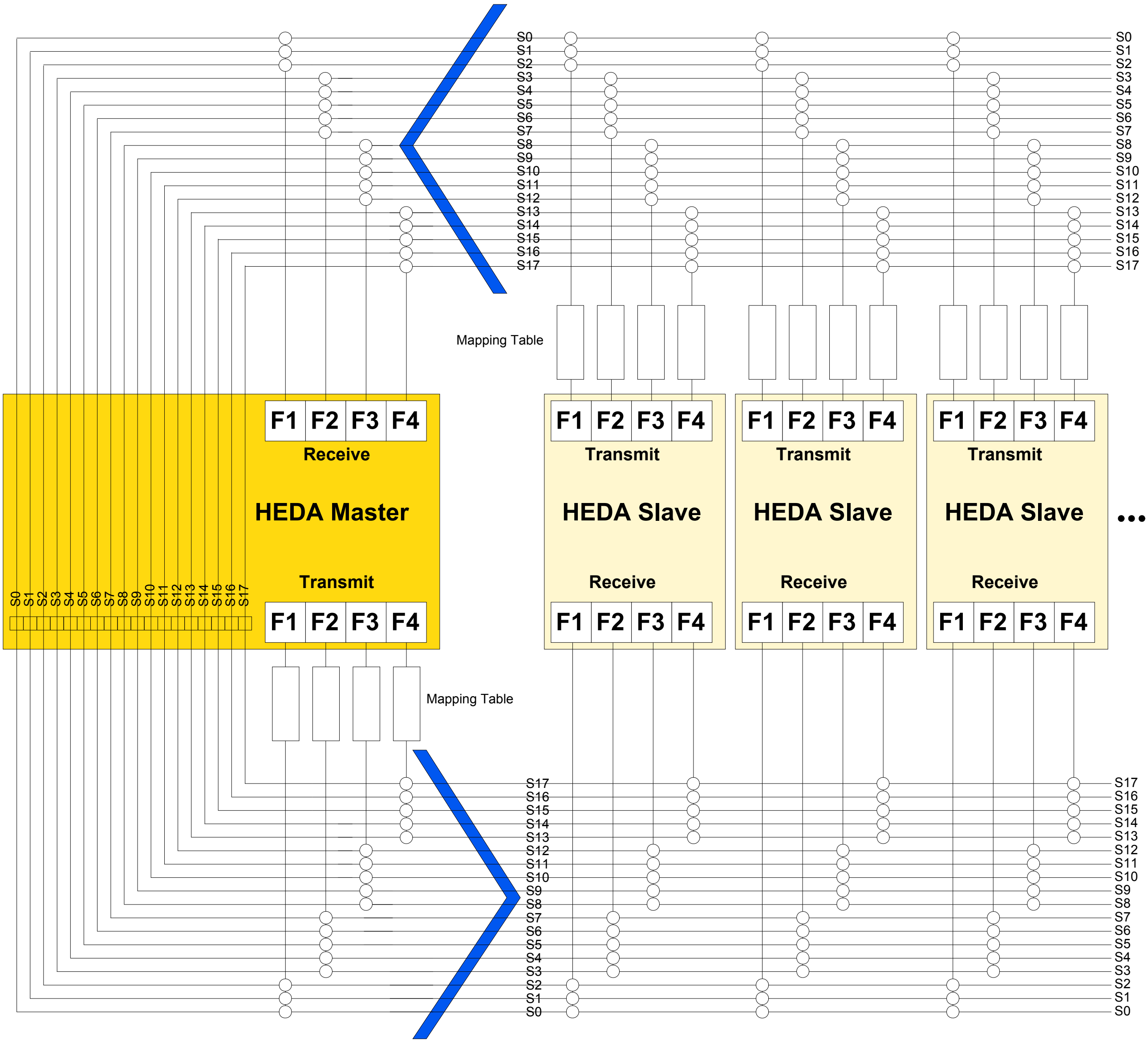


Example for receive mapping table 1 at slave 1 (is also valid for slave 3, master)



Data transfer from Slave to Slave.

HEDA communication structure with data transfer from Slave to Slave:



Print version available in the Internet

http://apps.parker.com/divapps/eme/EME/downloads/compax3/HEDA-Formulare/HEDA_adv.pdf

If a transmit slot of the HEDA master is not assigned, the master will pass the received data directly on to the slaves (independent of his reading from this slot or not).

I.e. if a transmit slot of the master where a slave is sending is disabled, the data will be passed on and can be received from any slave on this slot.

It is, however, valid:

All transmit slots must send!

This is also true, if a slave sends on this slot.

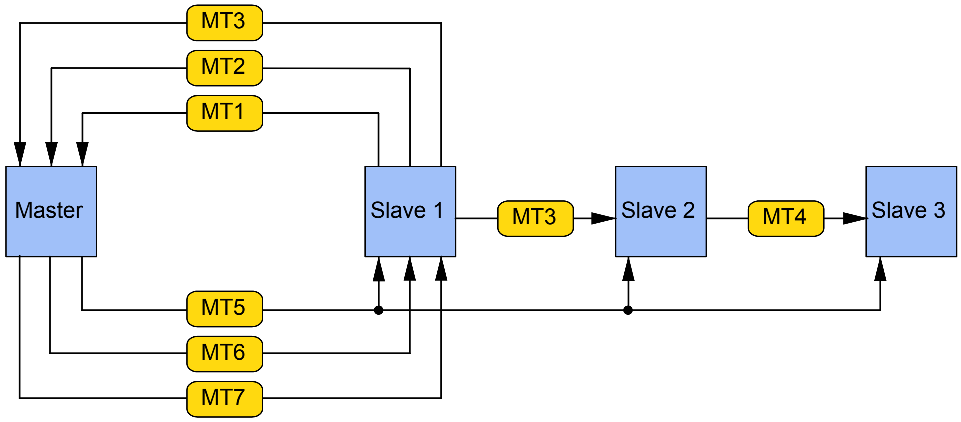
Please note:

Please ensure that all slots are used for transmission, the C3 ServoManager cannot verify this fact!

In order to verify this, please use the HEDA communication structure.

Example 1: Communication Master - Slave and Slave - Slave.

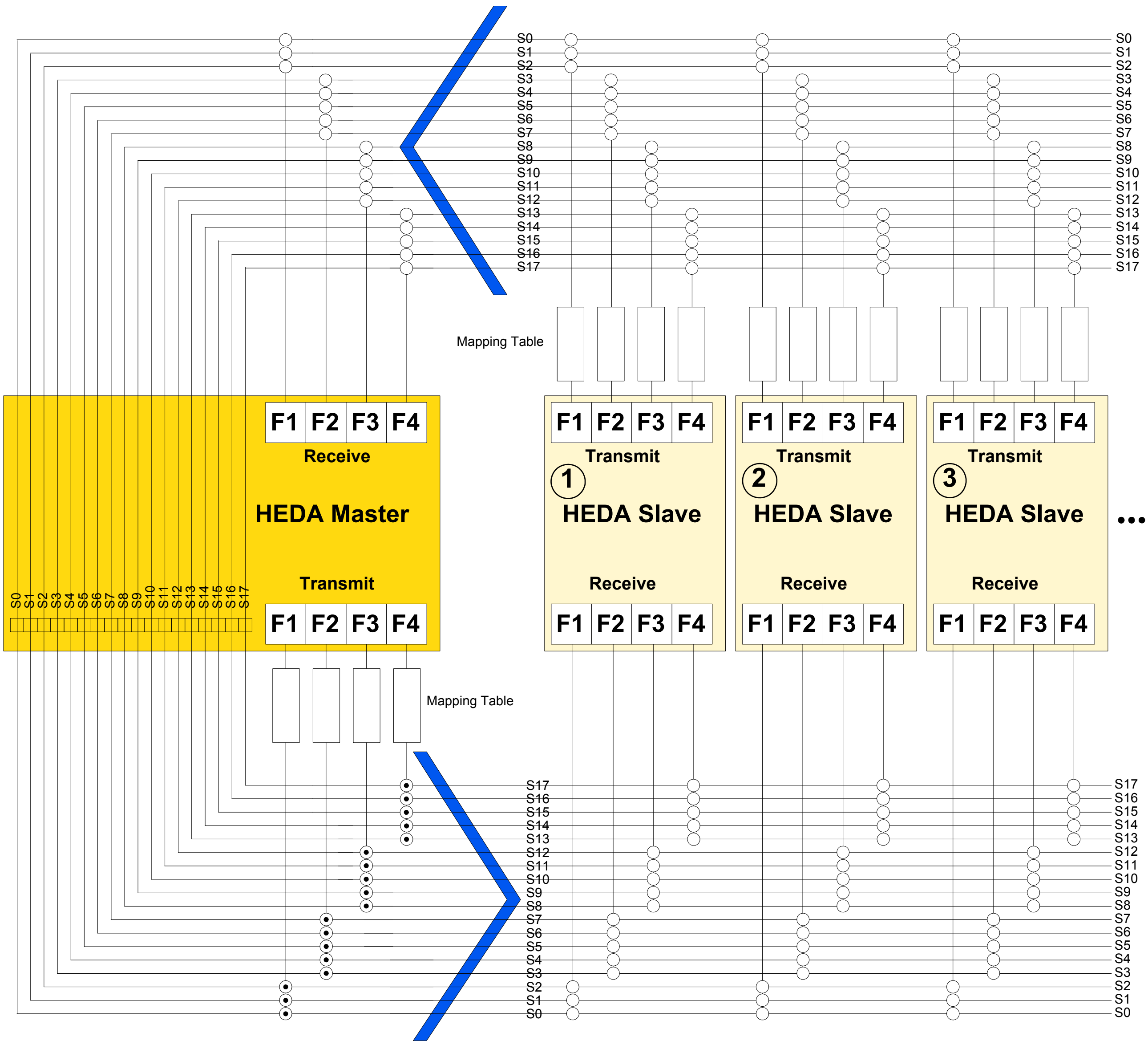
Task:



MT1 ... MT7: Mapping table 1... 7

Step-by-step setting of the HEDA communications:

Firstly, activate all transmit slots of the master in order to ensure that all transmit slots of the master are sending:

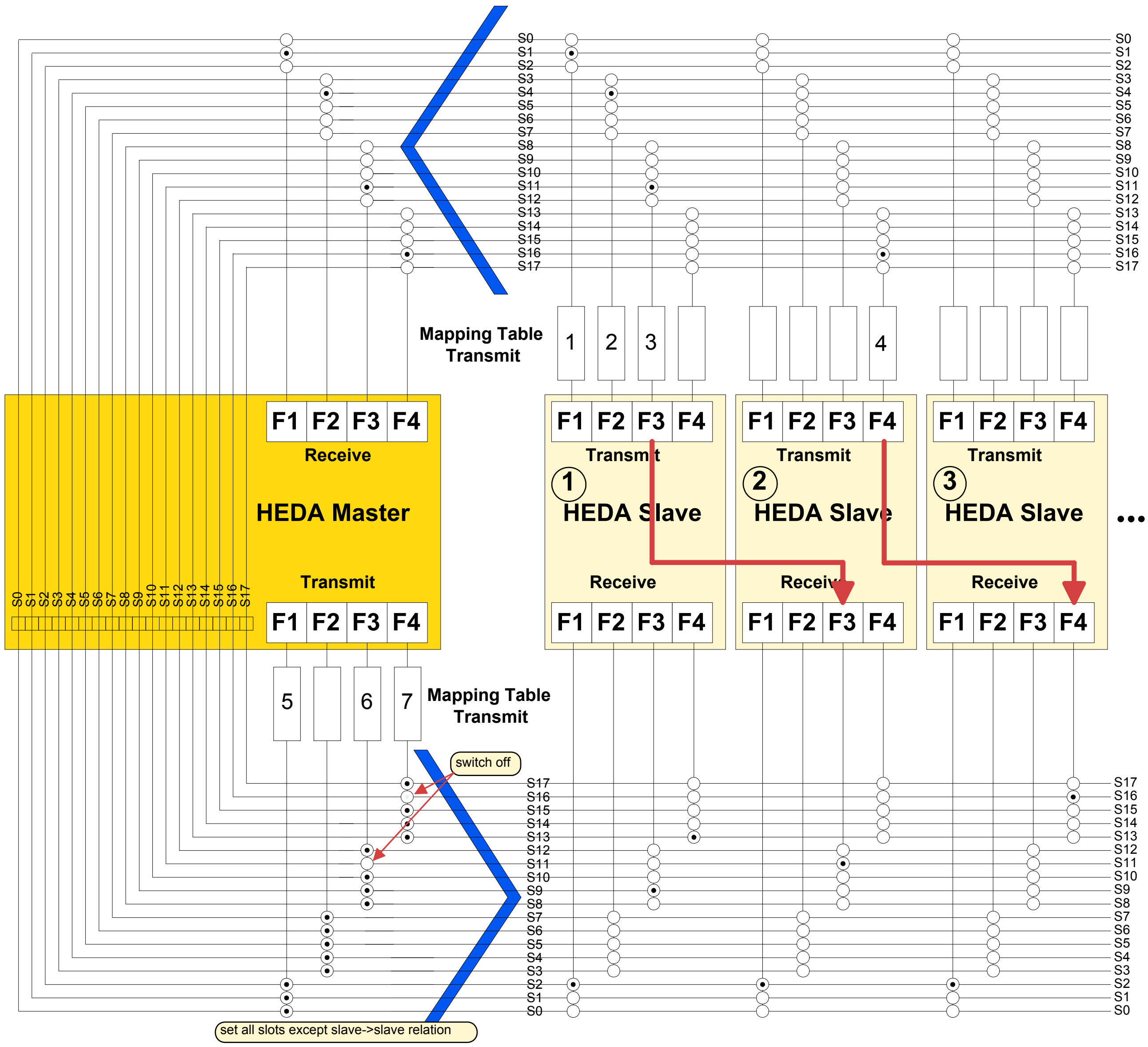


The mapping tahbles are now distributed to different slots:

Mapping Table	Slot	
MT1	1	Slave transmit range
MT2	4	
MT3	11	
MT4	16	
MT5	2 (& 0, 1)	Master transmit range
MT6	9 (& 8, 10, 12)	
MT7	13 (& 14, 15, 17)	

Note: The transmit slots where a slave-slave communication is taking place (Slot 11 & 16), must be deactivated in the master! Otherwise, the master would overwrite the data of the slave.

This results in the following image:



The following objects are transmitted:

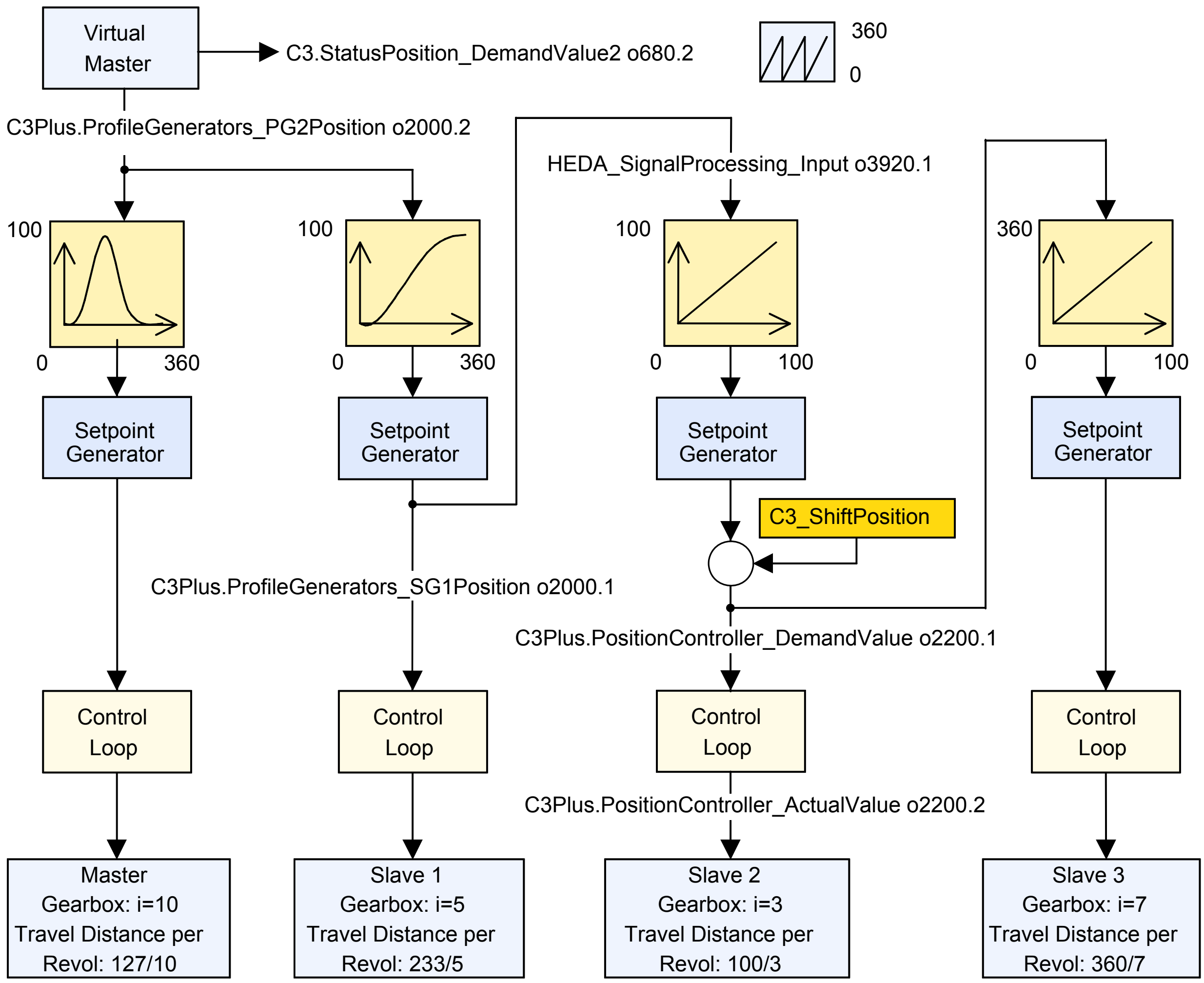
TRANSMIT (send)		RECEIVE		RECEIVE
Mapping Table	Source	Objects	Target	
1	S1	C3Array.Col01Row01 (1901.1)	M	C3Array.Col01Row01 (1901.1)
2	S1	C3Plus.DeviceState_Statusword1 (1000.3)	M	C3Array.Col03Row01 (1903.1)
3	S1	C3Plus.ProfileGenerators_SG1Position (2000.1)	M S2	C3Array.Col01Row02 (1902.1) C3Plus.HEDA_SignalProcessing_Input (3920.1)
4	S2	C3Plus.PositionController_DemandValue (2200.1)	S3	C3Plus.HEDA_SignalProcessing_Input (3920.1)
5	M	C3Plus.ProfilGenerators_PG2Position (2000.2)	S1 S2 S3	C3Plus.HEDA_SignalProcessing_Input (3920.1) C3Array.Col01Row05 (1901.5) C3Array.Col01Row05 (1901.5)
6	M	C3Plus.DeviceControl_Controlword1 (1100.3)	S1	C3Plus.DeviceControl_Controlword1 (1100.3)
7	M	C3Array.Col06Row01 (1906.1)	S1	C3Array.Col06Row01 (1906.1)

M: Master
S1, S2, S3: Slave 1 ... 3
Word form for the objects to be transmitted in the internet
http://apps.parker.com/euro_emd/EME/downloads/compax3/HEDA-Formulare/communications-table.doc.

Example 2: 4-axis application with HEDA

Task:

- four-axis processing machine
- Setting the steps via virtual master
- Forwards and backwards movement with the master (closed curve)
- Linearized feed movement with Slave 1 = rotating blade (open curve)
- Position synchronous operation of slave 2 with respect to slave 1 with slip correction (use of C3_Shift_Position)
- Fixed position assignment of a turning axis slave 3 to slave 2 with consideration of the correction movement of slave 2



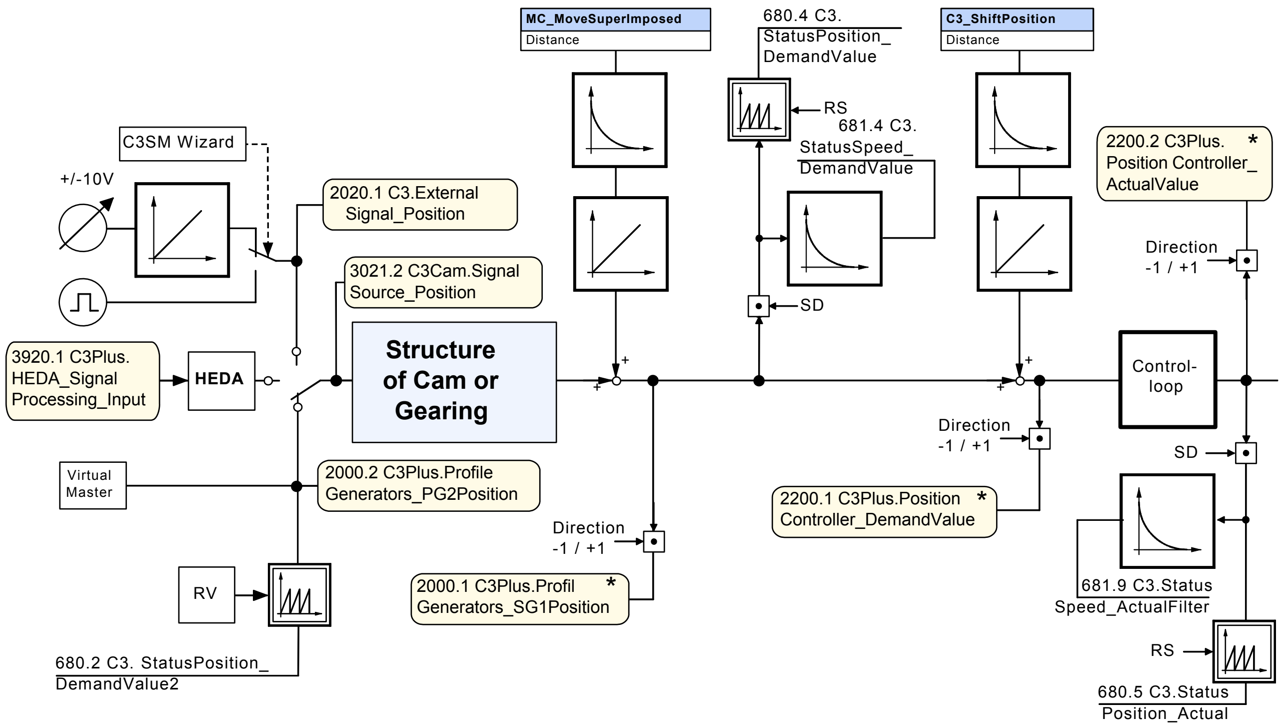
Master / Slave Configuration of the reference system

Configuration	Master	Slave 1	Slave 2	Slave 3
Travel distance per motor revolution ◆ Numerator ◆ Denominator Reset distance ◆ Numerator ◆ Denominator	 127 10 100 1	 **233** **5** 100 1	 **100** **3** 100 1	 360 7 360 1
Signal source (Master axis) ◆ Virtual Master ◆ Reset distance ◆ Use as current signal source	 360 yes			
Source HEDA (Slave axis) ◆ "Virtual master" as HEDA Master ◆ Path per motor revolution of the HEDA Master ◆ Numerator ◆ Denominator		 yes not required	 no **233** **5**	 no **100** **3**
◆ Create cams with the CamDesinger ◆ Distance Counter Reset Position - Numerator ◆ Distance Counter Reset Position - Denominator	 360 1	 360 1	 100 1	 100 1

The C3 ServoManager projects (configuration) can be found on the Compax3 CD: ...\Examples\HEDA\Master.c3p, slave1.c3p, slave2.c3p, slave3.c3p

6.8.3. Coupling objects

Coupling objects (framed objects) are suitable as master signal for electronic coupling and should be in the **DSP Format** (see page 395).



Input value for HEDA couplings is object 3920.1.

Note: * This values are not even reset by a home run.
Direction -1 / +1: with direction inversion (in the configuration wizard) these coupling values are inverted, relative to the drive direction (factor -1).

7. Compax3 - Objects

In this chapter you can read about:

Compax3 objects are encapsulated in the "C3, C3Array, ..." modules in the IEC61131-3 programming environment (CoDeSys).

Enter the object names before the "." and the corresponding list of objects will appear.

Objects that are not described here are reserved objects!

Note on searching objects:

- If the object number is known, you can enter it directly in the index.
- In addition you can find the CoDeSys name of the objects in the index.

Note on bus numbers (PNU, CAN-No.):

The bus numbers of the array can be found in the description on column 1, line 1 (Object 1901.1)

Set objects to valid

Please note that certain objects are not valid (read by Compax3) immediately after a change. This is described in the heading "Valid after".
These objects are converted to internal variables the Compax3 "VP" command (write in object 210.10 with value <> 0).

Save objects permanently

It should also be noted that modified objects are not permanently stored in the Compax3, i.e. the changes are lost after the power (24 VDC) is turned off.
The object "Save objects permanently" (write in object 20.11 with value <> 0)" can be used to save objects in a flash memory so they are retained even if the power fails.

7.1 Objects for the process data channel

No.	Object name	Object	PNU	PZD	CAN No.	PD	Bus format	Word width
634.4	Setpoint for analog output 0	C3.AnalogOutput0_DemandValue	24	PED/PAD	0x2019	R/TPDO	I16	1
635.4	setpoint for analog output 1	C3.AnalogOutput1_DemandValue	103	PED/PAD	0x201A	R/TPDO	I16	1
120.3	Status of digital inputs	C3.DigitalInput_DebouncedValue	21	PED	0x6100.1	TPDO	V2	1
121.2	Input word of I/O option	C3.DigitalInputAddition_Value	175	PED	0x6100.2	TPDO	V2	1
133.3	Output word for I/O option	C3.DigitalOutputAddition_Value	176	PED/PAD	0x6300.2	R/TPDO	V2	1
140.3	Command value of the digital outputs	C3.DigitalOutputWord_DemandState	22	PED/PAD	0x6300.1	R/TPDO	V2	1
2020.1	Position from external signal source	C3.ExternalSignal_Position		PED	0x2095.1	TPDO	C4_3	2
3921.1	Interpolation input CanSync, PowerLink	C3.FBI_SignalProcessing0_Input		PED/PAD	0x2050	R/TPDO	I32	2
695.11	Actual value force controller main axis [N]	C3.StatusForce_Actual	221	PED		TPDO	I32	2
695.14	Actual value force controller auxiliary axis [N]	C3.StatusForce_Actual2	222	PED		TPDO	I32	2
680.5	Status actual position	C3.StatusPosition_Actual	28	PED	0x6064	TPDO	C4_3	2
680.15	Actual position of auxiliary axis	C3.StatusPosition_Actual2	211	PED		TPDO	C4_3	2
680.4	Status demand position	C3.StatusPosition_DemandValue	323	PED	0x60FC	TPDO	C4_3	2
680.1	Position command value of Profile transmitter1	C3.StatusPosition_DemandValue1	0	PED	0x2052	TPDO	Y4	2
680.2	Status demand position virtual master	C3.StatusPosition_DemandValue2	202	PED	0x2042	TPDO	Y4	2
680.10	Status of encoder input 0 (5V)	C3.StatusPosition_EncoderInput5V		PED	0x2095.2	TPDO	C4_3	2
680.6	Status of tracking error	C3.StatusPosition_FollowingError	100	PED	0x60F4	TPDO	C4_3	2
680.16	Following error auxiliary axis	C3.StatusPosition_FollowingError2	212	PED		TPDO	C4_3	2
694.4	System pressure for main axis	C3.StatusPressure_p01	216	PED		TPDO	C4_3	2
694.9	System pressure for auxiliary axis	C3.StatusPressure_p02	220	PED		TPDO	C4_3	2
694.1	Pressure on A side of main axis	C3.StatusPressure_pA1	213	PED		TPDO	C4_3	2
694.6	Pressure on A side of auxiliary axis	C3.StatusPressure_pA2	217	PED		TPDO	C4_3	2
694.2	Pressure on B side of main axis	C3.StatusPressure_pB1	214	PED		TPDO	C4_3	2
694.7	Pressure on B side of auxiliary axis	C3.StatusPressure_pB2	218	PED		TPDO	C4_3	2
694.3	Tank pressure for main axis	C3.StatusPressure_pT1	215	PED		TPDO	C4_3	2
694.8	Tank pressure for auxiliary axis	C3.StatusPressure_pT2	219	PED		TPDO	C4_3	2
681.5	Status actual speed unfiltered	C3.StatusSpeed_Actual	8	PED	0x6069	TPDO	C4_3	2
681.14	Actual speed unfiltered auxiliary axis	C3.StatusSpeed_Actual2Filtered	210	PED		TPDO	C4_3	2
681.9	Status actual speed filtered	C3.StatusSpeed_ActualFiltered		PED	0x606C	TPDO	C4_3	2
681.7	Status of the actual filtered speed speed in the Y2 format	C3.StatusSpeed_ActualFiltered_Y2	6	PED	0x2023	TPDO	Y2	1
681.8	Status of the actual filtered peed in the Y4 format	C3.StatusSpeed_ActualFiltered_Y4	117	PED	0x2024	TPDO	Y4	2
681.4	Status demand speed of setpoint generator	C3.StatusSpeed_DemandValue	324	PED	0x606B	TPDO	C4_3	2
681.1	Speed command value of profile transmitter1	C3.StatusSpeed_DemandValue1	337	PED	0x2053	TPDO	Y4	2
681.2	Status demand speed virtual master	C3.StatusSpeed_DemandValue2	203	PED	0x2043	TPDO	Y4	2
681.6	Status control deviation of speed	C3.StatusSpeed_Error	101	PED	0x2027	TPDO	C4_3	2
685.3	Status of analog input 0	C3.StatusVoltage_AnalogInput0	23	PED	0x2025	TPDO	Y2	1
685.4	Status of analog input 1	C3.StatusVoltage_AnalogInput1	102	PED	0x2026	TPDO	Y2	1
1901.1	variable Column 1 Row 1	C3Array.Col01_Row01	130/341.1	PED/PAD	0x2301.1	R/TPDO	Y4	2
1901.2	Variable Column 1 Row 2	C3Array.Col01_Row02	131/341.2	PED/PAD	0x2301.2	R/TPDO	Y4	2
1901.3	Variable Column 1 Row 3	C3Array.Col01_Row03	132/341.3	PED/PAD	0x2301.3	R/TPDO	Y4	2
1901.4	Variable Column 1 Row 4	C3Array.Col01_Row04	133/341.4	PED/PAD	0x2301.4	R/TPDO	Y4	2
1901.5	Variable Column 1 Row 5	C3Array.Col01_Row05	134/341.5	PED/PAD	0x2301.5	R/TPDO	Y4	2
1902.1	variable Column 2 Row 1	C3Array.Col02_Row01	135/342.1	PED/PAD	0x2302.1	R/TPDO	Y2	1
1902.2	variable Column 2 Row 2	C3Array.Col02_Row02	136/342.2	PED/PAD	0x2302.2	R/TPDO	Y2	1
1902.3	variable Column 2 Row 3	C3Array.Col02_Row03	137/342.3	PED/PAD	0x2302.3	R/TPDO	Y2	1
1902.4	Variable Column 2 Row 4	C3Array.Col02_Row04	138/342.4	PED/PAD	0x2302.4	R/TPDO	Y2	1
1902.5	Variable Column 2 Row 5	C3Array.Col02_Row05	139/342.5	PED/PAD	0x2302.5	R/TPDO	Y2	1
1903.1	variable Column 3 Row 1	C3Array.Col03_Row01	140/343.1	PED/PAD	0x2303.1	R/TPDO	I16	1
1903.2	Variable Column 3 Row 2	C3Array.Col03_Row02	141/343.2	PED/PAD	0x2303.2	R/TPDO	I16	1
1903.3	Variable Column 3 Row 3	C3Array.Col03_Row03	142/343.3	PED/PAD	0x2303.3	R/TPDO	I16	1
1903.4	Variable Column 3 Row 4	C3Array.Col03_Row04	143/343.4	PED/PAD	0x2303.4	R/TPDO	I16	1
1903.5	Variable Column 3 Row 5	C3Array.Col03_Row05	144/343.5	PED/PAD	0x2303.5	R/TPDO	I16	1
1904.1	variable Column 4 Row 1	C3Array.Col04_Row01	145/344.1	PED/PAD	0x2304.1	R/TPDO	I16	1
1904.2	Variable Column 4 Row 2	C3Array.Col04_Row02	146/344.2	PED/PAD	0x2304.2	R/TPDO	I16	1
1904.3	Variable Column 4Row 3	C3Array.Col04_Row03	147/344.3	PED/PAD	0x2304.3	R/TPDO	I16	1
1904.4	Variable Column 4 Row 4	C3Array.Col04_Row04	148/344.4	PED/PAD	0x2304.4	R/TPDO	I16	1
1904.5	Variable Column 4 Row 5	C3Array.Col04_Row05	149/344.5	PED/PAD	0x2304.5	R/TPDO	I16	1
1905.1	variable Column 5 Row 1	C3Array.Col05_Row01	150/345.1	PED/PAD	0x2305.1	R/TPDO	I16	1
1905.2	Variable Column 5 Row 2	C3Array.Col05_Row02	151/345.2	PED/PAD	0x2305.2	R/TPDO	I16	1
1905.3	Variable Column 5 Row 3	C3Array.Col05_Row03	152/345.3	PED/PAD	0x2305.3	R/TPDO	I16	1
1905.4	Variable Column 5 Row 4	C3Array.Col05_Row04	153/345.4	PED/PAD	0x2305.4	R/TPDO	I16	1
1905.5	Variable Column 5Row 5	C3Array.Col05_Row05	154/345.5	PED/PAD	0x2305.5	R/TPDO	I16	1
1906.1	variable Column 6 Row 1	C3Array.Col06_Row01	155/346.1	PED/PAD	0x2306.1	R/TPDO	I32	2
1906.2	Variable Column 6 Row 2	C3Array.Col06_Row02	156/346.2	PED/PAD	0x2306.2	R/TPDO	I32	2
1906.3	Variable Column 6 Row 3	C3Array.Col06_Row03	157/346.3	PED/PAD	0x2306.3	R/TPDO	I32	2
1906.4	Variable Column 6 Row 4	C3Array.Col06_Row04	158/346.4	PED/PAD	0x2306.4	R/TPDO	I32	2
1906.5	Variable Column 6 Row 5	C3Array.Col06_Row05	159/346.5	PED/PAD	0x2306.5	R/TPDO	I32	2
1907.1	variable Column 7 Row 1	C3Array.Col07_Row01	160/347.1	PED/PAD	0x2307.1	R/TPDO	I32	2
1907.2	Variable Column 7 Row 2	C3Array.Col07_Row02	161/347.2	PED/PAD	0x2307.2	R/TPDO	I32	2
1907.3	Variable Column 7 Row 3	C3Array.Col07_Row03	162/347.3	PED/PAD	0x2307.3	R/TPDO	I32	2
1907.4	Variable Column 7 Row 4	C3Array.Col07_Row04	163/347.4	PED/PAD	0x2307.4	R/TPDO	I32	2
1907.5	Variable Column 7 Row 5	C3Array.Col07_Row05	164/347.5	PED/PAD	0x2307.5	R/TPDO	I32	2
1908.1	variable Column 8 Row 1	C3Array.Col08_Row01	165/348.1	PED/PAD	0x2308.1	R/TPDO	I32	2
1908.2	Variable Column 8 Row 2	C3Array.Col08_Row02	166/348.2	PED/PAD	0x2308.2	R/TPDO	I32	2
1908.3	Variable Column 8 Row 3	C3Array.Col08_Row03	167/348.3	PED/PAD	0x2308.3	R/TPDO	I32	2
1908.4	Variable Column 8 Row 4	C3Array.Col08_Row04	168/348.4	PED/PAD	0x2308.4	R/TPDO	I32	2
1908.5	Variable Column 8 Row 5	C3Array.Col08_Row05	169/348.5	PED/PAD	0x2308.5	R/TPDO	I32	2
1909.1	variable Column 9 Row 1	C3Array.Col09_Row01	170/349.1	PED/PAD	0x2309.1	R/TPDO	I32	2
1909.2	Variable Column 9 Row 2	C3Array.Col09_Row02	171/349.2	PED/PAD	0x2309.2	R/TPDO	I32	2
1909.3	Variable Column 9 Row 3	C3Array.Col09_Row03	172/349.3	PED/PAD	0x2309.3	R/TPDO	I32	2
1909.4	Variable Column 9 Row 4	C3Array.Col09_Row04	173/349.4	PED/PAD	0x2309.4	R/TPDO	I32	2

No.	Object name	Object	PNU	PZD	CAN No.	PD	Bus format	Word width
1909.5	Variable Column 9 Row 5	C3Array.Col09_Row05	174/349.5	PED/PAD	0x2309.5	R/TPDO	I32	2
1910.1	Indirect table access Column 1	C3Array.Indirect_Col01	181	PED/PAD	0x2311	R/TPDO	Y4	2
1910.2	Indirect table access Column 2	C3Array.Indirect_Col02	182	PED/PAD	0x2312	R/TPDO	Y2	1
1910.3	Indirect table access Column 3	C3Array.Indirect_Col03	183	PED/PAD	0x2313	R/TPDO	I16	1
1910.4	Indirect table access Column 4	C3Array.Indirect_Col04	184	PED/PAD	0x2314	R/TPDO	I16	1
1910.5	Indirect table access Column 5	C3Array.Indirect_Col05	185	PED/PAD	0x2315	R/TPDO	I16	1
1910.6	Indirect table access Column 6	C3Array.Indirect_Col06	186	PED/PAD	0x2316	R/TPDO	I32	2
1910.7	Indirect table access Column 7	C3Array.Indirect_Col07	187	PED/PAD	0x2317	R/TPDO	I32	2
1910.8	Indirect table access Column 8	C3Array.Indirect_Col08	188	PED/PAD	0x2318	R/TPDO	I32	2
1910.9	Indirect table access Column 9	C3Array.Indirect_Col09	189	PED/PAD	0x2319	R/TPDO	I32	2
1900.1	Pointer to table row	C3Array.Pointer_Row	180	PED/PAD	0x2300	R/TPDO	U16	1
3701.3	output of cam group 0	C3Cam.ControlledSwitches_Output0	205/501.3	PED/PAD	0x2401.3	R/TPDO	U16	1
3701.5	output of cam group 1	C3Cam.ControlledSwitches_Output1	206/501.5	PED/PAD	0x2401.5	R/TPDO	U16	1
3700.3	output for fast cams	C3Cam.ControlledSwitchesFast_Output	204/500.3	PED/PAD	0x2400.3	R/TPDO	U16	1
3030.1	Reset master position	C3Cam.StatusMaster_Position	207	PED	0x2410	TPDO	C4_3	2
3032.24	End of curve	C3Cam.StatusOutput_CurvePositionUnits	208	PED	0x2411	TPDO	C4_3	2
1100.1	Control command	C3Plus.DeviceControl_CommandOnRequest	108	PED/PAD	0x2028	R/TPDO	I16	1
1100.3	Control word CW	C3Plus.DeviceControl_Controlword_1	1	PED/PAD	0x6040	R/TPDO	V2	1
1100.4	Control word 2	C3Plus.DeviceControl_Controlword_2	3	PED/PAD	0x201B	R/TPDO	V2	1
1100.8	Device demand value C	C3Plus.DeviceControl_DemandValue3		PED/PAD	0x2048	R/TPDO	Y2	1
1100.5	Operating mode	C3Plus.DeviceControl_OperationMode	127/930	PED/PAD	0x6060	R/TPDO	I16	1
1000.5	Operating mode display	C3Plus.DeviceState_ActualOperationMode	128	PED/PAD	0x6061	R/TPDO	I16	1
1000.3	Status word SW	C3Plus.DeviceState_Statusword_1	2	PED/PAD	0x6041	R/TPDO	V2	1
1000.4	Status word 2	C3Plus.DeviceState_Statusword_2	4	PED/PAD	0x201C	R/TPDO	V2	1
550.1	Current error (n)	C3Plus.ErrorHistory_LastError	115/947.0	PED	0x603F/ 0x201D.1	TPDO	U16	1
1200.1	Control of virtual Master	C3Plus.PG2Control_CommandOnRequest	200	PED/PAD	0x2040	R/TPDO	I16	1
1111.3	Acceleration for positioning	C3Plus.POSITION_accel	114	PED/PAD	0x6083	R/TPDO	U32	2
1111.4	Deceleration for positioning	C3Plus.POSITION_decel	312	PED/PAD	0x6084	R/TPDO	U32	2
1111.1	Target position	C3Plus.POSITION_position	27	PED/PAD		R/TPDO	C4_3	2
1111.2	Speed for positioning	C3Plus.POSITION_speed	111	PED/PAD		R/TPDO	C4_3	2
1111.9	Speed for Positioning in Y2 Format	C3Plus.POSITION_speed_Y2	110	PED/PAD		R/TPDO	Y2	1
2000.2	Position value of the setpoint encoder of the virtual axis	C3Plus.ProfilGenerators_PG2Position		PED	0x2061	TPDO	C4_3	2
2000.5	Speed of the virtual axis	C3Plus.ProfilGenerators_PG2Speed		PED	0x2064	TPDO	I32	2
2000.1	Position value of the setpoint encoder	C3Plus.ProfilGenerators_SG1Position		PED	0x2060	TPDO	C4_3	2
2000.4	Speed of the setpoint encoder	C3Plus.ProfilGenerators_SG1Speed		PED	0x2063	TPDO	I32	2
152.1	PIO analog input 0	C3Plus.RemoteAnalogInput_I0		PED/PAD	0x2082.1	R/TPDO	I16	1
152.2	PIO analog input 1	C3Plus.RemoteAnalogInput_I1		PED/PAD	0x2082.2	R/TPDO	I16	1
152.3	PIO analog input 2	C3Plus.RemoteAnalogInput_I2		PED/PAD	0x2082.3	R/TPDO	I16	1
152.4	PIO analog input 3	C3Plus.RemoteAnalogInput_I3		PED/PAD	0x2082.4	R/TPDO	I16	1
153.1	PIO analog output 0	C3Plus.RemoteAnalogOutput_O0		PED/PAD	0x2083.1	R/TPDO	I16	1
153.2	PIO analog output 1	C3Plus.RemoteAnalogOutput_O1		PED/PAD	0x2083.2	R/TPDO	I16	1
153.3	PIO analog output 2	C3Plus.RemoteAnalogOutput_O2		PED/PAD	0x2083.3	R/TPDO	I16	1
153.4	PIO analog output 3	C3Plus.RemoteAnalogOutput_O3		PED/PAD	0x2083.4	R/TPDO	I16	1
150.1	Digital PIO inputs 0...15	C3Plus.RemoteDigInput_I0_15		PED/PAD	0x2080.1	R/TPDO	V2	1
150.2	Digital PIO inputs 16...31	C3Plus.RemoteDigInput_I16_31		PED/PAD	0x2080.2	R/TPDO	V2	1
150.3	Digital PIO inputs 32...47	C3Plus.RemoteDigInput_I32_47		PED/PAD	0x2080.3	R/TPDO	V2	1
150.4	Digital PIO inputs 48...63	C3Plus.RemoteDigInput_I48_63		PED/PAD	0x2080.4	R/TPDO	V2	1
151.1	Digital PIO outputs 0...15	C3Plus.RemoteDigOutput_O0_15		PED/PAD	0x2081.1	R/TPDO	V2	1
151.2	Digital PIO outputs 16...31	C3Plus.RemoteDigOutput_O16_31		PED/PAD	0x2081.2	R/TPDO	V2	1
151.3	Digital PIO outputs 32...47	C3Plus.RemoteDigOutput_O32_47		PED/PAD	0x2081.3	R/TPDO	V2	1
151.4	Digital PIO outputs 48...63	C3Plus.RemoteDigOutput_O48_63		PED/PAD	0x2081.4	R/TPDO	V2	1
1127.3	Target speed in speed control operating mode	C3Plus.SPEED_speed	7	PED/PAD		R/TPDO	C4_3	2
680.8	Status position actual value in the bus format Y4	C3Plus.StatusPosition_Actual_Y4	119	PED	0x2022	TPDO	Y4	2

7.2 Object overview sorted by object name (T40)

No.	Object name	Object	PNU	CAN No.	Format	PD	Valid beginning	Bus object I20	Bus object I21 / I22
172.5	C3.AnalogInput0_ActualValue	Actual value X1:IN0			I32	no	-	-	-
172.7	C3.AnalogInput0_ActualValueFiltered	Filtered actual value X1:IN0			I32	no	-	-	-
173.5	C3.AnalogInput1_ActualValue	Actual value X1:IN1			I32	no	-	-	-
173.7	C3.AnalogInput1_ActualValueFiltered	Filtered actual value X1:IN1			I32	no	-	-	-
174.5	C3.AnalogInput2_ActualValue	Actual value X1:IN2			I32	no	-	-	-
174.7	C3.AnalogInput2_ActualValueFiltered	Filtered actual value X1:IN2			I32	no	-	-	-
175.5	C3.AnalogInput3_ActualValue	Actual value X1:IN3			I32	no	-	-	-
175.7	C3.AnalogInput3_ActualValueFiltered	Filtered actual value X1:IN3			I32	no	-	-	-
176.5	C3.AnalogInput4_ActualValue	Actual value X1:IN4			I16	no	-	-	-
176.7	C3.AnalogInput4_ActualValueFiltered	Filtered actual value X1:IN4			I16	no	-	-	-
177.5	C3.AnalogInput5_ActualValue	Actual value X1:IN5			I16	no	-	-	-
177.7	C3.AnalogInput5_ActualValueFiltered	Filtered actual value X1:IN5			I16	no	-	-	-
634.4	C3.AnalogOutput0_DemandValue	Setpoint for analog output 0	24	0x2019	I16	yes	Immediately	-	-
635.4	C3.AnalogOutput1_DemandValue	setpoint for analog output 1	103	0x201A	I16	yes	Immediately	-	-
2101.14	C3.ControllerTuning_2_AccelFeedback_Ka	Acceleration feedback (A2)			U16	no	VP	-	-
2101.11	C3.ControllerTuning_2_ActuatingSignalGain_speed	Control signal gain of auxiliary axis			U16	no	VP	-	-
2101.8	C3.ControllerTuning_2_FilterAccel2	Filter actual acceleration 2			U16	no	VP	-	-
2101.7	C3.ControllerTuning_2_FilterSpeed2	Filter actual velocity 2			U16	no	VP	-	-
2101.13	C3.ControllerTuning_2_SpeedFeedback_Kv	Speed feedback (A2)			U16	no	VP	-	-
2100.14	C3.ControllerTuning_AccelFeedback_Ka	Acceleration feedback (A1)			U16	no	VP	-	-
2100.12	C3.ControllerTuning_ActuatingSignalGain_speed	open loop gain			U16	no	VP	-	-
2100.21	C3.ControllerTuning_FilterAccel_us	Filter - Actual acceleration			U16	no	VP	-	-
2100.11	C3.ControllerTuning_FilterAccel2	Filter actual acceleration 2			U16	no	VP	-	-
2100.10	C3.ControllerTuning_FilterSpeed2	Filter actual velocity 2			U16	no	VP	-	-
2100.13	C3.ControllerTuning_SpeedFeedback_Kv	Speed feedback (A1)			U16	no	VP	-	-
990.1	C3.Delay_MasterDelay	Setpoint delay for bus master			I16	no	Immediately	-	-
1.15	C3.Device_ProfileID	Profibus profile number	965		OS	no	-	X	-
120.3	C3.DigitalInput_DebouncedValue	Status of digital inputs	21	0x6100.1	V2	yes	-	-	-
120.2	C3.DigitalInput_Value	Status of digital inputs			V2	yes	-	-	-
121.2	C3.DigitalInputAddition_Value	Input word of I/O option	175	0x6100.2	V2	yes	-	-	-
133.4	C3.DigitalOutputAddition_Enable	Activate input/output option M10/M12	350	0x6300.3	V2	no	Immediately	-	-
133.2	C3.DigitalOutputAddition_Error	Error in I/O option	351	0x6300.4	V2	no	-	-	-
133.3	C3.DigitalOutputAddition_Value	Output word for I/O option	176	0x6300.2	V2	yes	Immediately	-	-
140.3	C3.DigitalOutputWord_DemandState	Command value of the digital outputs	22	0x6300.1	V2	yes	Immediately	X	X
2401.8	C3.DirectionDependentGain_Ch0_Factor_negative_Pressure	Direction dependent gain (pressure control)			I32	no	Immediately	-	-
2401.7	C3.DirectionDependentGain_Ch0_Factor_positiv_Pressure	Direction dependent gain (pressure control)			I32	no	Immediately	-	-
2401.3	C3.DirectionDependentGain_Ch0_FactorDenominator	Direction dependent gain denominator			I16	no	VP	-	-
2401.2	C3.DirectionDependentGain_Ch0_FactorNumerator	Direction dependent gain numerator			I16	no	VP	-	-
2401.1	C3.DirectionDependentGain_Ch0_Type	Direction dependent gain of output 0			I16	no	VP	-	-
2411.8	C3.DirectionDependentGain_Ch1_Factor_negative_Pressure	Direction dependent gain (pressure control)			I32	no	Immediately	-	-
2411.7	C3.DirectionDependentGain_Ch1_Factor_positiv_Pressure	Direction dependent gain (pressure control)			I32	no	Immediately	-	-
2411.3	C3.DirectionDependentGain_Ch1_FactorDenominator	Direction dependent gain denominator			I16	no	VP	-	-
2411.2	C3.DirectionDependentGain_Ch1_FactorNumerator	Direction dependent gain numerator			I16	no	VP	-	-
2411.1	C3.DirectionDependentGain_Ch1_Type	Direction dependent gain of output 1			I16	no	VP	-	-
2421.8	C3.DirectionDependentGain_Ch2_Factor_negative_Pressure	Direction dependent gain (pressure control)			I32	no	Immediately	-	-
2421.7	C3.DirectionDependentGain_Ch2_Factor_positiv_Pressure	Direction dependent gain (pressure control)			I32	no	Immediately	-	-
2421.3	C3.DirectionDependentGain_Ch2_FactorDenominator	Direction dependent gain denominator			I16	no	VP	-	-
2421.2	C3.DirectionDependentGain_Ch2_FactorNumerator	Direction dependent gain numerator			I16	no	VP	-	-
2421.1	C3.DirectionDependentGain_Ch2_Type	Direction dependent gain of output 2			I16	no	VP	-	-
2431.8	C3.DirectionDependentGain_Ch3_Factor_negative_Pressure	Direction dependent gain (pressure control)			I32	no	Immediately	-	-
2431.7	C3.DirectionDependentGain_Ch3_Factor_positiv_Pressure	Direction dependent gain (pressure control)			I32	no	Immediately	-	-
2431.3	C3.DirectionDependentGain_Ch3_FactorDenominator	Direction dependent gain denominator			I16	no	VP	-	-
2431.2	C3.DirectionDependentGain_Ch3_FactorNumerator	Direction dependent gain numerator			I16	no	VP	-	-
2431.1	C3.DirectionDependentGain_Ch3_Type	Direction dependent gain of output 3			I16	no	VP	-	-
550.2	C3.ErrorHistory_1	Error (n-1) in the error history	947.1	0x201D.2	U16	no	-	X	X
2020.1	C3.ExternalSignal_Position	Position from external signal source		0x2095.1	C4_3	yes	-	-	-
2020.2	C3.ExternalSignal_Speed	Speed from external signal source			C4_3	yes	-	-	-
3925.23	C3.FBI_Interpolation_AccelStatus	Input value of the acceleration of O3925.21			C4_3	no	-	-	X
3925.1	C3.FBI_Interpolation_SubModeSelect	Interpolation method		0x60C0	I16	no	Immediately	-	X
3925.22	C3.FBI_Interpolation_VelocityStatus	Input speed of the differentiated input position O2121.1			C4_3	no	-	-	X

No.	Object name	Object	PNU	CAN No.	Format	PD	Valid beginning	Bus object	
								I20	I21 / I22
950.1	C3.FBI_RxPD_Mapping_Object_1	1. Object of the setpoint PZD (Profibus)	915.0		U16	no	Immediately	X	-
950.2	C3.FBI_RxPD_Mapping_Object_2	2. object of the Setpoint value PZD	915.1		U16	no	Immediately	X	-
950.3	C3.FBI_RxPD_Mapping_Object_3	3. object of the Setpoint value PZD	915.2		U16	no	Immediately	X	-
950.4	C3.FBI_RxPD_Mapping_Object_4	4. object of the Setpoint value PZD	915.3		U16	no	Immediately	X	-
950.5	C3.FBI_RxPD_Mapping_Object_5	5. object of the Setpoint value PZD	915.4		U16	no	Immediately	X	-
950.6	C3.FBI_RxPD_Mapping_Object_6	6. object of the Setpoint value PZD	915.5		U16	no	Immediately	X	-
950.7	C3.FBI_RxPD_Mapping_Object_7	7. object of the Setpoint value PZD	915.6		U16	no	Immediately	X	-
950.8	C3.FBI_RxPD_Mapping_Object_8	8. object of the Setpoint value PZD	915.7		U16	no	Immediately	X	-
3921.1	C3.FBI_SignalProcessing0_Input	Interpolation input CanSync, PowerLink		0x2050	I32	yes	Immediately	-	X
951.1	C3.FBI_TxPD_Mapping_Object_1	1. object of actual value PZD	916.0		U16	no	Immediately	X	-
951.2	C3.FBI_TxPD_Mapping_Object_2	2. object of actual value PZD	916.1		U16	no	Immediately	X	-
951.3	C3.FBI_TxPD_Mapping_Object_3	3. object of actual value PZD	916.2		U16	no	Immediately	X	-
951.4	C3.FBI_TxPD_Mapping_Object_4	4. object of actual value PZD	916.3		U16	no	Immediately	X	-
951.5	C3.FBI_TxPD_Mapping_Object_5	5. object of actual value PZD	916.4		U16	no	Immediately	X	-
951.6	C3.FBI_TxPD_Mapping_Object_6	6. object of actual value PZD	916.5		U16	no	Immediately	X	-
951.7	C3.FBI_TxPD_Mapping_Object_7	7. object of actual value PZD	916.6		U16	no	Immediately	X	-
951.8	C3.FBI_TxPD_Mapping_Object_8	8. object of actual value PZD	916.7		U16	no	Immediately	X	-
2050.10	C3.FeedForward_2_Accel_FFW	Acceleration feedforward (A2)			C4_3	no	VP	-	-
2050.9	C3.FeedForward_2_Speed_FFW	Speed feedforward (A2)			C4_3	no	VP	-	-
2050.8	C3.FeedForward_2_Valve	Valve feedforward auxiliary axis			U16	no	VP	-	-
2010.24	C3.FeedForward_Speed_FFW	Acceleration feedforward (A1)			C4_3	no	VP	-	-
2010.23	C3.FeedForward_Speed_FFW	Speed feedforward (A1)			C4_3	no	VP	-	-
2010.21	C3.FeedForward_Valve	Valve feedforward			U16	no	VP	-	-
2011.5	C3.FeedForwardExternal_FilterAccel_us	Filter time constant ext. Acceleration			U16	no	VP	-	-
2011.4	C3.FeedForwardExternal_FilterSpeed_us	Filter time constant ext. Velocity			U16	no	VP	-	-
1141.8	C3.GEAR_actual_master_speed	Master speed for Gearing			C4_3	no	-	-	-
1141.7	C3.GEAR_actual_masterposition	Position input value for Gearing		0x2058	C4_3	no	-	-	-
696.1	C3.HydraulicPower_Axis1	Control signal main axis			I32	no	-	-	-
696.2	C3.HydraulicPower_Axis2	Control signal auxiliary axis			I32	no	-	-	-
696.3	C3.HydraulicPower_Sum	Sum of the hydraulic corner power			I32	no	-	-	-
402.2	C3.Limit_SpeedNegative	Maximum permissible negative speed	318	0x200A	I16	no	VP	-	-
402.1	C3.Limit_SpeedPositive	Maximum permissible positive speed	317	0x2009	I16	no	VP	-	-
425.2	C3.LimitForcePressure_FollowingErrorTime	Trigger time for event "Control deviation of force controller"			I16	no	Immediately	-	-
425.1	C3.LimitForcePressure_FollowingErrorWindow	Max. control deviation of force controller			C4_3	no	VP	-	-
425.6	C3.LimitForcePressure_ForceReachedAux	Force of auxiliary axis in the control window			BOOL	no	-	-	-
425.5	C3.LimitForcePressure_ForceReachedMain	Force of main axis in the control window			BOOL	no	-	-	-
425.3	C3.LimitForcePressure_MaxForce	Maximum force			I32	no	Immediately	-	-
425.4	C3.LimitForcePressure_Window	Window for "Force achieved"			I32	no	VP	-	-
425.7	C3.LimitForcePressure_WindowTime	Trigger time for message "Force achieved"			U16	no	Immediately	-	-
410.3	C3.LimitPosition_Negative	negative end limit	322	0x607D.1	C4_3	no	Immediately	-	-
410.2	C3.LimitPosition_Positive	positive end limit	321	0x607D.2	C4_3	no	Immediately	-	-
3310.1	C3.Multiturnemulation_Status	Status of the Multiturn emulation			I16	no	-	-	-
200.10	C3.NormFactorY2_ActualValue2_Y2	Normalization factor for 1000.14			V2	no	Immediately	X	X
200.7	C3.NormFactorY2_ActualValue3	Normalization factor for 1000.8	355.7	0x2020.7	V2	no	Immediately	X	X
200.8	C3.NormFactorY2_ActualValue4	Normalization factor for 1000.9	355.8	0x2020.8	V2	no	Immediately	X	X
200.5	C3.NormFactorY2_Array_Col2	Scaling factor recipe arrays column 2	355.5	0x2020.5	V2	no	Immediately	X	X
200.9	C3.NormFactorY2_DemandValue2_Y2	Normalization factor for 1100.14 1100.14			V2	no	Immediately	X	X
200.4	C3.NormFactorY2_DemandValue3	Normalization factor for 1100.8	355.4	0x2020.4	V2	no	Immediately	X	X
200.6	C3.NormFactorY2_DemandValue4	Normalization factor for 1100.9	355.6	0x2020.6	V2	no	Immediately	X	X
200.1	C3.NormFactorY2_Speed	Scaling factor for Y2 speeds	355.1	0x2020.1	V2	no	Immediately	X	X
200.3	C3.NormFactorY2_Voltage	Scaling factor for Y2 voltages	355.3	0x2020.3	V2	no	Immediately	X	X
201.7	C3.NormFactorY4_ActualValue1	Normalization factor for 1000.6	356.7	0x2021.7	V2	no	Immediately	X	X
201.8	C3.NormFactorY4_ActualValue2	Normalization factor for 1000.7	356.8	0x2021.8	V2	no	Immediately	X	X
201.13	C3.NormFactorY4_ActualValue8	Normalization factor for 1000.13	356.13	0x2021.13	V2	no	Immediately	X	X
201.4	C3.NormFactorY4_Array_Col1	Scaling factor recipe arrays column 1	356.4	0x2021.4	V2	no	Immediately	X	X
201.5	C3.NormFactorY4_DemandValue1	Normalization factor for 1100.6	356.5	0x2021.5	V2	no	Immediately	X	X

No.	Object name	Object	PNU	CAN No.	Format	PD	Valid beginning	Bus object I20	Bus object I21 / I22
201.6	C3.NormFactorY4_DemandValue2	Normalization factor for 1100.7	356.6	0x2021.6	V2	no	Immediately	X	X
201.12	C3.NormFactorY4_DemandValue8	Normalization factor for 1100.13	356.12	0x2021.12	V2	no	Immediately	X	X
201.11	C3.NormFactorY4_FBI_SignalProcessing	Normalization factor for bus interpolation CANSync/EthernetPowerLink	356.11	0x2021.11	V2	no	Immediately	-	X
201.1	C3.NormFactorY4_Speed	Scaling factor for Y4 speeds	356.1	0x2021.1	V2	no	Immediately	X	X
201.3	C3.NormFactorY4_Voltage	Scaling factor for Y4 voltages	356.3	0x2021.3	V2	no	Immediately	X	X
20.1	C3.ObjectDir_Objekts-->FLASH	Store objects permanently (bus)	339	0x2017	I16	no	Immediately	X	X
20.10	C3.ObjectDir_ReadObjects	Read objects from Flash			I16	no	Immediately	-	-
20.11	C3.ObjectDir_WriteObjects	Save objects permanently			I16	no	Immediately	-	-
2260.8	C3.PositionController_2_TrackingErrorFilter_us	Following error filter of auxiliary axis			U16	no	Immediately	-	-
420.3	C3.PositioningAccuracy_FollowingErrorTimeout	Following Error Time	331	0x6066	U16	no	Immediately	-	-
420.2	C3.PositioningAccuracy_FollowingErrorWindow	Following error limit	330	0x6065	C4_3	no	VP	-	-
420.6	C3.PositioningAccuracy_PositionReached	Position reached			I32	no	-	-	-
420.8	C3.PositioningAccuracy_PositionReached_2	Position reached (auxiliary axis)			I32	no	-	-	-
420.1	C3.PositioningAccuracy_Window	Positioning window for position reached	328	0x6067	C4_3	no	VP	-	-
420.7	C3.PositioningAccuracy_WindowTime	In Position Window Time	329	0x6068	U16	no	Immediately	-	-
165.1	C3.PressureArray_Index0	Analog Input X1:IN0 measured pressure in mbar			I16	no	Immediately	-	-
165.2	C3.PressureArray_Index1	Analog Input X1:IN1 measured pressure in mbar			I16	no	Immediately	-	-
165.11	C3.PressureArray_Index10	Reference pressure 10			I16	no	Immediately	-	-
165.12	C3.PressureArray_Index11	Reference pressure 11			I16	no	Immediately	-	-
165.13	C3.PressureArray_Index12	Reference pressure 12			I16	no	Immediately	-	-
165.3	C3.PressureArray_Index2	Analog Input X1:IN2 measured pressure in mbar			I16	no	Immediately	-	-
165.4	C3.PressureArray_Index3	Analog Input X1:IN3 measured pressure in mbar			I16	no	Immediately	-	-
165.5	C3.PressureArray_Index4	Analog Input X1:IN4 measured pressure in mbar			I16	no	Immediately	-	-
165.6	C3.PressureArray_Index5	Analog Input X1:IN5 measured pressure in mbar			I16	no	Immediately	-	-
165.7	C3.PressureArray_Index6	Reference pressure 6			I16	no	Immediately	-	-
165.8	C3.PressureArray_Index7	Reference pressure 7			I16	no	Immediately	-	-
165.9	C3.PressureArray_Index8	Reference pressure 8			I16	no	Immediately	-	-
165.10	C3.PressureArray_Index9	Reference pressure 9			I16	no	Immediately	-	-
2250.22	C3.PressureController_1_ActuatingSignalFilter	Control signal filter of force			I32	no	VP	-	-
2250.8	C3.PressureController_1_TimeDelay_DT1_T1	Delay time constant T1			U32	no	VP	-	-
2251.22	C3.PressureController_2_ActuatingSignalFilter	Control signal filter of force (A2)			I32	no	VP	-	-
2251.8	C3.PressureController_2_TimeDelay_DT1_T1	PID force controller 2 delay time constant of the D-term T1			U32	no	VP	-	-
2210.8	C3.SpeedController_ActuatingSignal_filt	Control signal filter of position			U16	no	VP	-	-
2270.8	C3.SpeedController2_ActuatingSignal_filt	Control signal filter of position auxiliary axis			U16	no	VP	-	-
682.5	C3.StatusAccel_Actual	Status of actual acceleration unfiltered			I32	no	-	-	-
682.6	C3.StatusAccel_ActualFilter	Status of filtered actual acceleration			I32	no	-	-	-
682.4	C3.StatusAccel_DemandValue	Status demand acceleration	325	0x200E	I32	no	-	-	-
682.7	C3.StatusAccel_FeedForwardAccel	Status acceleration feed forward			C4_3	no	-	-	-
692.4	C3.StatusFeedback_EncoderCosine	Status of analog input cosine			I32	no	-	-	-
692.3	C3.StatusFeedback_EncoderSine	Status of analog input sine			I32	no	-	-	-
692.2	C3.StatusFeedback_FeedbackCosineDSP	Status of cosine in signal processing			I32	yes	-	-	-
692.1	C3.StatusFeedback_FeedbackSineDSP	Status of sine in signal processing			I32	yes	-	-	-
692.5	C3.StatusFeedback_FeedbackVoltage[Vpp]	Status of feedback level			C4_3	no	-	-	-
695.11	C3.StatusForce_Actual	Actual value force controller main axis [N]	221		I32	yes	-	-	-
695.14	C3.StatusForce_Actual2	Actual value force controller auxiliary axis [N]	222		I32	yes	-	-	-
695.10	C3.StatusForce_Demand	Setpoint value force controller main axis [N]			I32	no	-	-	-
695.13	C3.StatusForce_Demand2	Setpoint value force controller auxiliary axis [N]			I32	no	-	-	-
695.12	C3.StatusForce_Error	Control deviation force controller main axis [N]			I32	no	-	-	-
695.15	C3.StatusForce_Error2	Control deviation force controller auxiliary axis [N]			I32	no	-	-	-
695.1	C3.StatusForce_Force1	Force of force sensor main axis			I32	no	-	-	-
695.2	C3.StatusForce_Force2	Force of force sensor of auxiliary axis			I32	no	-	-	-
689.1	C3.StatusHeda_RxPD	Receive string			OS	no	-	-	-
689.2	C3.StatusHeda_TxPD	Transmit string			OS	no	-	-	-
697.4	C3.StatusPosController_ActuatingSignal_AddAccel_YA	Acceleration feedback (A1)			C4_3	no	-	-	-
697.14	C3.StatusPosController_ActuatingSignal_AddAccel_YA2	Acceleration feedback (A2)			C4_3	no	-	-	-
697.3	C3.StatusPosController_ActuatingSignal_AddSpeed_YV	Speed feedback (A1)			C4_3	no	-	-	-

No.	Object name	Object	PNU	CAN No.	Format	PD	Valid beginning	Bus object I20	I21 / I22
697.13	C3.StatusPosController_ActuatingSignal_AddSpeed_YV2	Speed feedback (A2)			C4_3	no	-	-	-
697.2	C3.StatusPosController_ActuatingSignal_IPart_YI	Control signal I-term (A1)			C4_3	no	-	-	-
697.12	C3.StatusPosController_ActuatingSignal_IPart_YI2	Control signal I-term (A2)			C4_3	no	-	-	-
697.5	C3.StatusPosController_ActuatingSignal_PosCtrl_Ycom	Control signal total (A1)			C4_3	no	-	-	-
697.15	C3.StatusPosController_ActuatingSignal_PosCtrl_Ycom2	Control signal total (A2)			C4_3	no	-	-	-
697.1	C3.StatusPosController_ActuatingSignal_PPart_YP	Control signal P-term (A1)			C4_3	no	-	-	-
697.11	C3.StatusPosController_ActuatingSignal_PPart_YP2	Control signal P-term (A2)			C4_3	no	-	-	-
680.5	C3.StatusPosition_Actual	Status actual position	28	0x6064	C4_3	yes	-	-	-
680.15	C3.StatusPosition_Actual2	Actual position of auxiliary axis	211		C4_3	yes	-	-	-
680.13	C3.StatusPosition_ActualController	Status actual position without absolute reference			C4_3	no	-	-	-
680.18	C3.StatusPosition_ActualNotReset	Status actual position (not reset)			C4_3	yes	-	-	-
680.12	C3.StatusPosition_DemandController	Status demand position without absolute reference			C4_3	no	-	-	-
680.4	C3.StatusPosition_DemandValue	Status demand position	323	0x60FC	C4_3	yes	-	-	-
680.1	C3.StatusPosition_DemandValue1	Position command value of Profile transmitter1	0	0x2052	Y4	yes	-	-	-
680.2	C3.StatusPosition_DemandValue2	Status demand position virtual master	202	0x2042	Y4	yes	-	-	-
680.11	C3.StatusPosition_EncoderInput24V	Status of encoder input 0 (24V)			C4_3	yes	-	-	-
680.10	C3.StatusPosition_EncoderInput5V	Status of encoder input 0 (5V)		0x2095.2	C4_3	yes	-	-	-
680.6	C3.StatusPosition_FollowingError	Status of tracking error	100	0x60F4	C4_3	yes	-	-	-
680.16	C3.StatusPosition_FollowingError2	Following error auxiliary axis	212		C4_3	yes	-	-	-
680.17	C3.StatusPosition_MasterSlaveError	Position deviation main/auxiliary axis			C4_3	no	-	-	-
680.30	C3.StatusPosition_Referenced	Status of axis referenced			I16	no	-	-	-
694.4	C3.StatusPressure_p01	System pressure for main axis	216		C4_3	yes	-	-	-
694.9	C3.StatusPressure_p02	System pressure for auxiliary axis	220		C4_3	yes	-	-	-
694.1	C3.StatusPressure_pA1	Pressure on A side of main axis	213		C4_3	yes	-	-	-
694.6	C3.StatusPressure_pA2	Pressure on A side of auxiliary axis	217		C4_3	yes	-	-	-
694.2	C3.StatusPressure_pB1	Pressure on B side of main axis	214		C4_3	yes	-	-	-
694.7	C3.StatusPressure_pB2	Pressure on B side of auxiliary axis	218		C4_3	yes	-	-	-
694.3	C3.StatusPressure_pT1	Tank pressure for main axis	215		C4_3	yes	-	-	-
694.8	C3.StatusPressure_pT2	Tank pressure for auxiliary axis	219		C4_3	yes	-	-	-
698.4	C3.StatusPressureForceController_ActuatingSignal_AddSpeed_YV	Control signal velocity component of force/pressure controller (A1)			C4_3	no	-	-	-
698.14	C3.StatusPressureForceController_ActuatingSignal_AddSpeed_YV2	Control signal velocity component of force/pressure controller (A2)			C4_3	no	-	-	-
698.3	C3.StatusPressureForceController_ActuatingSignal_DPart_YD	Control signal D-term of force/pressure controller (A1)			C4_3	no	-	-	-
698.13	C3.StatusPressureForceController_ActuatingSignal_DPart_YD2	Control signal D-term of force/pressure controller (A2)			C4_3	no	-	-	-
698.6	C3.StatusPressureForceController_ActuatingSignal_FFWPart_YF	Force feedforward of force/pressure controller (A1)			C4_3	no	-	-	-
698.16	C3.StatusPressureForceController_ActuatingSignal_FFWPart_YF2	Force feedforward of force/pressure controller (A2)			C4_3	no	-	-	-
698.5	C3.StatusPressureForceController_ActuatingSignal_ForceCtrl_Ycom	Total control signal of force/pressure controller (A1)			C4_3	no	-	-	-
698.15	C3.StatusPressureForceController_ActuatingSignal_ForceCtrl_Ycom2	Total control signal of force/pressure controller (A2)			C4_3	no	-	-	-
698.2	C3.StatusPressureForceController_ActuatingSignal_IPart_YI	Control signal I-term of force/pressure controller (A1)			C4_3	no	-	-	-
698.12	C3.StatusPressureForceController_ActuatingSignal_IPart_YI2	Control signal I-term of force/pressure controller (A2)			C4_3	no	-	-	-
698.1	C3.StatusPressureForceController_ActuatingSignal_PPart_YP	Control signal P-term of force/pressure controller (A1)			C4_3	no	-	-	-
698.11	C3.StatusPressureForceController_ActuatingSignal_PPart_YP2	Control signal P-term of force/pressure controller (A2)			C4_3	no	-	-	-
681.5	C3.StatusSpeed_Actual	Status actual speed unfiltered	8	0x6069	C4_3	yes	-	-	-
681.14	C3.StatusSpeed_Actual2Filtered	Actual speed unfiltered auxiliary axis	210		C4_3	yes	-	-	-
681.9	C3.StatusSpeed_ActualFiltered	Status actual speed filtered		0x606C	C4_3	yes	-	-	-
681.7	C3.StatusSpeed_ActualFiltered_Y2	Status of the actual filtered speed speed in the Y2 format	6	0x2023	Y2	yes	-	X	X
681.8	C3.StatusSpeed_ActualFiltered_Y4	Status of the actual filtered peed in the Y4 format	117	0x2024	Y4	yes	-	X	X
681.12	C3.StatusSpeed_ActualScaled	Filtered actual speed			C4_3	no	-	-	-
681.13	C3.StatusSpeed_DemandScaled	Setpoint speed of the setpoint generator			C4_3	no	-	-	-
681.10	C3.StatusSpeed_DemandSpeedController	Status demand speed controller input			C4_3	yes	-	-	-
681.4	C3.StatusSpeed_DemandValue	Status demand speed of setpoint generator	324	0x606B	C4_3	yes	-	-	-
681.1	C3.StatusSpeed_DemandValue1	Speed command value of profile transmitter1	337	0x2053	Y4	yes	-	-	-
681.2	C3.StatusSpeed_DemandValue2	Status demand speed virtual master	203	0x2043	Y4	yes	-	-	-
681.6	C3.StatusSpeed_Error	Status control deviation of speed	101	0x2027	C4_3	yes	-	-	-
681.15	C3.StatusSpeed_Error2	Speed control deviation			C4_3	no	-	-	-
681.11	C3.StatusSpeed_FeedForwardSpeed	Status speed feed forward			C4_3	no	-	-	-
685.3	C3.StatusVoltage_AnalogInput0	Status of analog input 0	23	0x2025	Y2	yes	-	-	-
685.4	C3.StatusVoltage_AnalogInput1	Status of analog input 1	102	0x2026	Y2	yes	-	-	-
685.1	C3.StatusVoltage_AuxiliaryVoltage	Status of auxiliary voltage	326	0x200F	E2_6	no	-	-	-
210.10	C3.ValidParameter_Global	Set objects to valid	338.10	0x2016.10	U16	no	Immediately	-	-
210.6	C3.ValidParameter_Limits				U16	no	Immediately	-	-
180.6	C3.ValveOutput0_Status	Status of valve output 0			U16	no	-	-	-
181.6	C3.ValveOutput1_Status	Status of valve output 1			U16	no	-	-	-
182.6	C3.ValveOutput2_Status	Status of valve output 2			U16	no	-	-	-
183.6	C3.ValveOutput3_Status	Status of valve output 3			U16	no	-	-	-
1901.1	C3Array.Col01_Row01	variable Column 1 Row 1	130/341.1	0x2301.1	Y4	yes	Immediately	-	-

No.	Object name	Object	PNU	CAN No.	Format	PD	Valid beginning	Bus object I20	I21 / I22
1901.2	C3Array.Col01_Row02	Variable Column 1 Row 2	131/341.2	0x2301.2	Y4	yes	Immediately	-	-
1901.3	C3Array.Col01_Row03	Variable Column 1 Row 3	132/341.3	0x2301.3	Y4	yes	Immediately	-	-
1901.4	C3Array.Col01_Row04	Variable Column 1 Row 4	133/341.4	0x2301.4	Y4	yes	Immediately	-	-
1901.5	C3Array.Col01_Row05	Variable Column 1 Row 5	134/341.5	0x2301.5	Y4	yes	Immediately	-	-
1902.1	C3Array.Col02_Row01	variable Column 2 Row 1	135/342.1	0x2302.1	Y2	yes	Immediately	-	-
1902.2	C3Array.Col02_Row02	variable Column 2 Row 2	136/342.2	0x2302.2	Y2	yes	Immediately	-	-
1902.3	C3Array.Col02_Row03	variable Column 2 Row 3	137/342.3	0x2302.3	Y2	yes	Immediately	-	-
1902.4	C3Array.Col02_Row04	Variable Column 2 Row 4	138/342.4	0x2302.4	Y2	yes	Immediately	-	-
1902.5	C3Array.Col02_Row05	Variable Column 2 Row 5	139/342.5	0x2302.5	Y2	yes	Immediately	-	-
1903.1	C3Array.Col03_Row01	variable Column 3 Row 1	140/343.1	0x2303.1	I16	yes	Immediately	-	-
1903.2	C3Array.Col03_Row02	Variable Column 3 Row 2	141/343.2	0x2303.2	I16	yes	Immediately	-	-
1903.3	C3Array.Col03_Row03	Variable Column 3 Row 3	142/343.3	0x2303.3	I16	yes	Immediately	-	-
1903.4	C3Array.Col03_Row04	Variable Column 3 Row 4	143/343.4	0x2303.4	I16	yes	Immediately	-	-
1903.5	C3Array.Col03_Row05	Variable Column 3 Row 5	144/343.5	0x2303.5	I16	yes	Immediately	-	-
1904.1	C3Array.Col04_Row01	variable Column 4 Row 1	145/344.1	0x2304.1	I16	yes	Immediately	-	-
1904.2	C3Array.Col04_Row02	Variable Column 4 Row 2	146/344.2	0x2304.2	I16	yes	Immediately	-	-
1904.3	C3Array.Col04_Row03	Variable Column 4Row 3	147/344.3	0x2304.3	I16	yes	Immediately	-	-
1904.4	C3Array.Col04_Row04	Variable Column 4 Row 4	148/344.4	0x2304.4	I16	yes	Immediately	-	-
1904.5	C3Array.Col04_Row05	Variable Column 4 Row 5	149/344.5	0x2304.5	I16	yes	Immediately	-	-
1905.1	C3Array.Col05_Row01	variable Column 5 Row 1	150/345.1	0x2305.1	I16	yes	Immediately	-	-
1905.2	C3Array.Col05_Row02	Variable Column 5 Row 2	151/345.2	0x2305.2	I16	yes	Immediately	-	-
1905.3	C3Array.Col05_Row03	Variable Column 5 Row 3	152/345.3	0x2305.3	I16	yes	Immediately	-	-
1905.4	C3Array.Col05_Row04	Variable Column 5 Row 4	153/345.4	0x2305.4	I16	yes	Immediately	-	-
1905.5	C3Array.Col05_Row05	Variable Column 5Row 5	154/345.5	0x2305.5	I16	yes	Immediately	-	-
1906.1	C3Array.Col06_Row01	variable Column 6 Row 1	155/346.1	0x2306.1	I32	yes	Immediately	-	-
1906.2	C3Array.Col06_Row02	Variable Column 6 Row 2	156/346.2	0x2306.2	I32	yes	Immediately	-	-
1906.3	C3Array.Col06_Row03	Variable Column 6 Row 3	157/346.3	0x2306.3	I32	yes	Immediately	-	-
1906.4	C3Array.Col06_Row04	Variable Column 6 Row 4	158/346.4	0x2306.4	I32	yes	Immediately	-	-
1906.5	C3Array.Col06_Row05	Variable Column 6 Row 5	159/346.5	0x2306.5	I32	yes	Immediately	-	-
1907.1	C3Array.Col07_Row01	variable Column 7 Row 1	160/347.1	0x2307.1	I32	yes	Immediately	-	-
1907.2	C3Array.Col07_Row02	Variable Column 7 Row 2	161/347.2	0x2307.2	I32	yes	Immediately	-	-
1907.3	C3Array.Col07_Row03	Variable Column 7 Row 3	162/347.3	0x2307.3	I32	yes	Immediately	-	-
1907.4	C3Array.Col07_Row04	Variable Column 7 Row 4	163/347.4	0x2307.4	I32	yes	Immediately	-	-
1907.5	C3Array.Col07_Row05	Variable Column 7 Row 5	164/347.5	0x2307.5	I32	yes	Immediately	-	-
1908.1	C3Array.Col08_Row01	variable Column 8 Row 1	165/348.1	0x2308.1	I32	yes	Immediately	-	-
1908.2	C3Array.Col08_Row02	Variable Column 8 Row 2	166/348.2	0x2308.2	I32	yes	Immediately	-	-
1908.3	C3Array.Col08_Row03	Variable Column 8 Row 3	167/348.3	0x2308.3	I32	yes	Immediately	-	-
1908.4	C3Array.Col08_Row04	Variable Column 8 Row 4	168/348.4	0x2308.4	I32	yes	Immediately	-	-
1908.5	C3Array.Col08_Row05	Variable Column 8 Row 5	169/348.5	0x2308.5	I32	yes	Immediately	-	-
1909.1	C3Array.Col09_Row01	variable Column 9 Row 1	170/349.1	0x2309.1	I32	yes	Immediately	-	-
1909.2	C3Array.Col09_Row02	Variable Column 9 Row 2	171/349.2	0x2309.2	I32	yes	Immediately	-	-
1909.3	C3Array.Col09_Row03	Variable Column 9 Row 3	172/349.3	0x2309.3	I32	yes	Immediately	-	-
1909.4	C3Array.Col09_Row04	Variable Column 9 Row 4	173/349.4	0x2309.4	I32	yes	Immediately	-	-
1909.5	C3Array.Col09_Row05	Variable Column 9 Row 5	174/349.5	0x2309.5	I32	yes	Immediately	-	-
1910.1	C3Array.Indirect_Col01	Indirect table access Column 1	181	0x2311	Y4	yes	Immediately	-	-
1910.2	C3Array.Indirect_Col02	Indirect table access Column 2	182	0x2312	Y2	yes	Immediately	-	-
1910.3	C3Array.Indirect_Col03	Indirect table access Column 3	183	0x2313	I16	yes	Immediately	-	-
1910.4	C3Array.Indirect_Col04	Indirect table access Column 4	184	0x2314	I16	yes	Immediately	-	-
1910.5	C3Array.Indirect_Col05	Indirect table access Column 5	185	0x2315	I16	yes	Immediately	-	-

No.	Object name	Object	PNU	CAN No.	Format	PD	Valid beginning	Bus object	
								I20	I21 / I22
1910.6	C3Array.Indirect_Col06	Indirect table access Column 6	186	0x2316	I32	yes	Immediately	-	-
1910.7	C3Array.Indirect_Col07	Indirect table access Column 7	187	0x2317	I32	yes	Immediately	-	-
1910.8	C3Array.Indirect_Col08	Indirect table access Column 8	188	0x2318	I32	yes	Immediately	-	-
1910.9	C3Array.Indirect_Col09	Indirect table access Column 9	189	0x2319	I32	yes	Immediately	-	-
1900.1	C3Array.Pointer_Row	Pointer to table row	180	0x2300	U16	yes	Immediately	-	-
3730.3	C3Cam.ControlledSwitch00_PositionOff	switch-off position of cam	509.1	0x2409.1	C4_3	no	VP	-	-
3730.2	C3Cam.ControlledSwitch00_PositionOn	switch-on position of cam	508.1	0x2408.1	C4_3	no	VP	-	-
3730.1	C3Cam.ControlledSwitch00_Source	source of cam	507.1	0x2407.1	I16	no	VP	-	-
3730.5	C3Cam.ControlledSwitch00_TimeOff	switch-off anticipation of cam	511.1	0x240B.1	I16	no	Immediately	-	-
3730.4	C3Cam.ControlledSwitch00_TimeOn	switch-on anticipation of cam	510.1	0x240A.1	I16	no	Immediately	-	-
3701.2	C3Cam.ControlledSwitches_Enable0	enable of cam group 0	501.2	0x2401.2	U16	no	Immediately	-	-
3701.4	C3Cam.ControlledSwitches_Enable1	enable of cam group 1	501.4	0x2401.4	U16	no	Immediately	-	-
3701.6	C3Cam.ControlledSwitches_NumberPerCycle	Number of cams in one cycle			U16	no	Immediately	-	-
3701.3	C3Cam.ControlledSwitches_Output0	output of cam group 0	205/501.3	0x2401.3	U16	yes	Immediately	-	-
3701.5	C3Cam.ControlledSwitches_Output1	output of cam group 1	206/501.5	0x2401.5	U16	yes	Immediately	-	-
3700.2	C3Cam.ControlledSwitchesFast_Enable	enable fast cams	500.2	0x2400.2	U16	no	Immediately	-	-
3700.3	C3Cam.ControlledSwitchesFast_Output	output for fast cams	204/500.3	0x2400.3	U16	yes	Immediately	-	-
3705.1	C3Cam.ControlledSwitchesHysteresis_ActualPosition	Hysteresis for cam switching mechanism, source "current position"			C4_3	no	VP	-	-
3705.5	C3Cam.ControlledSwitchesHysteresis_Masterposition	Hysteresis for cam switching mechanism, source "master position"			C4_3	no	VP	-	-
3710.3	C3Cam.ControlledSwitchFast0_PositionOff	switch-off position for fast cam	504.1	0x2404.1	C4_3	no	VP	-	-
3710.2	C3Cam.ControlledSwitchFast0_PositionOn	switch-on position for fast cam	503.1	0x2403.1	C4_3	no	VP	-	-
3710.1	C3Cam.ControlledSwitchFast0_Source	source of fast cam	502.1	0x2402.1	I16	no	VP	-	-
3710.5	C3Cam.ControlledSwitchFast0_TimeOff	switch-off anticipation of fast cam	506.1	0x2406.1	I16	no	Immediately	-	-
3710.4	C3Cam.ControlledSwitchFast0_TimeOn	switch-on anticipation of fast cam	505.1	0x2405.1	I16	no	Immediately	-	-
3022.1	C3Cam.Manipulation_OffsetMasterposition	Master position offset			C4_3	no	Immediately	-	-
3022.6	C3Cam.Manipulation_OffsetMasterposition_Units	Offset Master position			C4_3	no	Immediately	-	-
3022.3	C3Cam.Manipulation_ScalefactorMasterGlobal	Global scaling factor for the master speed			C4_3	no	Immediately	-	-
3021.10	C3Cam.SignalSource_InputAdditional	CAM Master position			C4_3	yes	Immediately	-	-
3021.2	C3Cam.SignalSource_Position	Status of position of selected master signal source			C4_3	yes	-	-	-
3021.1	C3Cam.SignalSource_Select	Source of master position			U16	no	Immediately	-	-
3031.4	C3Cam.StatusData_ActualCurve	Current curve number			I16	no	-	-	-
3030.7	C3Cam.StatusMaster_Enable	Status: Enable of master acquisition			U16	no	-	-	-
3030.17	C3Cam.StatusMaster_EnableCam	Status: Enable of cam input			U16	no	-	-	-
3030.13	C3Cam.StatusMaster_InputSum	Free running master position after MP enable			C4_3	yes	-	-	-
3030.12	C3Cam.StatusMaster_PhasingSum	Added up position sum of the master-side phasing			C4_3	no	-	-	-
3030.1	C3Cam.StatusMaster_Position	Reset master position	207	0x2410	C4_3	yes	-	-	-
3030.24	C3Cam.StatusMaster_PositionCamUnits	Master position at the beginning of the curve			C4_3	yes	-	-	-
3030.22	C3Cam.StatusMaster_SpeedUnits	Master speed [Units/s]			C4_3	no	-	-	-
3032.4	C3Cam.StatusOutput_AbsolutePositionGreat	Slave position (free running)			C4_3	yes	-	-	-
3032.24	C3Cam.StatusOutput_CurvePositionUnits	End of curve	208	0x2411	C4_3	yes	-	-	-
3032.1	C3Cam.StatusOutput_Position	Slave position			C4_3	yes	-	-	-
172.3	C3Plus.AnalogInput0_FilterCoefficient	Filter X1:IN0			I32	no	VP	-	-
172.2	C3Plus.AnalogInput0_Gain	Gain X1:IN0			C4_3	no	VP	-	-
172.9	C3Plus.AnalogInput0_LowerLimit	Lower limit value X1:IN0			I32	no	Immediately	-	-
172.11	C3Plus.AnalogInput0_Offset_normed	Offset X1:IN0			C4_3	no	Immediately	-	-
172.10	C3Plus.AnalogInput0_UpperLimit	upper limit value X1:IN0			I32	no	Immediately	-	-
173.3	C3Plus.AnalogInput1_FilterCoefficient	Filter X1:IN1			I32	no	VP	-	-
173.2	C3Plus.AnalogInput1_Gain	Gain X1:IN1			C4_3	no	VP	-	-
173.9	C3Plus.AnalogInput1_LowerLimit	Lower limit value X1:IN1			I32	no	Immediately	-	-
173.11	C3Plus.AnalogInput1_Offset_normed	Offset X1:IN1			C4_3	no	Immediately	-	-
173.10	C3Plus.AnalogInput1_UpperLimit	Upper limit value X1:IN1			I32	no	Immediately	-	-
174.3	C3Plus.AnalogInput2_FilterCoefficient	Filter X1:IN2			I32	no	VP	-	-
174.2	C3Plus.AnalogInput2_Gain	Gain X1:IN2			C4_3	no	VP	-	-
174.9	C3Plus.AnalogInput2_LowerLimit	Lower limit value X1:IN2			I32	no	Immediately	-	-
174.11	C3Plus.AnalogInput2_Offset_normed	Offset X1:IN2			C4_3	no	Immediately	-	-
174.10	C3Plus.AnalogInput2_UpperLimit	upper limit value X1:IN2			I32	no	Immediately	-	-
175.3	C3Plus.AnalogInput3_FilterCoefficient	Filter X1:IN3			I32	no	VP	-	-
175.2	C3Plus.AnalogInput3_Gain	Gain X1:IN3			C4_3	no	VP	-	-

No.	Object name	Object	PNU	CAN No.	Format	PD	Valid beginning	Bus object	
								I20	I21 / I22
175.9	C3Plus.AnalogInput3_LowerLimit	Lower limit value X1:IN3			I32	no	Immediately	-	-
175.11	C3Plus.AnalogInput3_Offset_normed	Offset X1:IN3			C4_3	no	Immediately	-	-
175.10	C3Plus.AnalogInput3_UpperLimit	Upper limit value X1:IN3			I32	no	Immediately	-	-
176.3	C3Plus.AnalogInput4_FilterCoefficient	Filter X1:IN4			I16	no	VP	-	-
176.2	C3Plus.AnalogInput4_Gain	Gain X1:IN4			C4_3	no	VP	-	-
176.9	C3Plus.AnalogInput4_LowerLimit	Lower limit value X1:IN4			I32	no	Immediately	-	-
176.11	C3Plus.AnalogInput4_Offset_normed	Offset X1:IN4			C4_3	no	Immediately	-	-
176.10	C3Plus.AnalogInput4_UpperLimit	Upper limit value X1:IN4			I32	no	Immediately	-	-
177.3	C3Plus.AnalogInput5_FilterCoefficient	Filter X1:IN5			I16	no	VP	-	-
177.2	C3Plus.AnalogInput5_Gain	Gain X1:IN5			C4_3	no	VP	-	-
177.11	C3Plus.AnalogInput5_Offset_normed	Offset X1:IN4			C4_3	no	Immediately	-	-
177.10	C3Plus.AnalogInput5_UpperLimit	Upper limit value X1:IN5			I32	no	Immediately	-	-
206.1	C3Plus.C3FluidNorm_Metric_Imperial	Unit system			BOOL	no	Immediately	-	-
2439.3	C3Plus.CurveMemory_Erase	Delete valve characteristics			I16	no	Immediately	-	-
2405.2	C3Plus.DeadBandCompensation_Ch0_A_Side	Threshold value on A side output 0			I32	no	VP	-	-
2405.3	C3Plus.DeadBandCompensation_Ch0_B_Side	Threshold value on B side output 0			I32	no	VP	-	-
2405.4	C3Plus.DeadBandCompensation_Ch0_Threshold	Width of deadband output 0			I32	no	VP	-	-
2405.1	C3Plus.DeadBandCompensation_Ch0_Type	Deadband compensation output 0			I16	no	VP	-	-
2415.2	C3Plus.DeadBandCompensation_Ch1_A_Side	Threshold value on A side output 1			I32	no	VP	-	-
2415.3	C3Plus.DeadBandCompensation_Ch1_B_Side	Threshold value on B side output 1			I32	no	VP	-	-
2415.4	C3Plus.DeadBandCompensation_Ch1_Threshold	Width of deadband output 1			I32	no	VP	-	-
2415.1	C3Plus.DeadBandCompensation_Ch1_Type	Deadband compensation output 1			I16	no	VP	-	-
2425.2	C3Plus.DeadBandCompensation_Ch2_A_Side	Threshold value on A side output 2			I32	no	VP	-	-
2425.3	C3Plus.DeadBandCompensation_Ch2_B_Side	Threshold value on B side output 2			I32	no	VP	-	-
2425.4	C3Plus.DeadBandCompensation_Ch2_Threshold	Width of deadband output 2			I32	no	VP	-	-
2425.1	C3Plus.DeadBandCompensation_Ch2_Type	Deadband compensation output 2			I16	no	VP	-	-
2435.2	C3Plus.DeadBandCompensation_Ch3_A_Side	Threshold value on A side output 3			I32	no	VP	-	-
2435.3	C3Plus.DeadBandCompensation_Ch3_B_Side	Threshold value on B side output 3			I32	no	VP	-	-
2435.4	C3Plus.DeadBandCompensation_Ch3_Threshold	Width of deadband output 3			I32	no	VP	-	-
2435.1	C3Plus.DeadBandCompensation_Ch3_Type	Deadband compensation output 3			I16	no	VP	-	-
1100.1	C3Plus.DeviceControl_CommandOnRequest	Control command	108	0x2028	I16	yes	Immediately	-	-
1100.3	C3Plus.DeviceControl_Controlword_1	Control word CW	1	0x6040	V2	yes	Immediately	-	-
1100.4	C3Plus.DeviceControl_Controlword_2	Control word 2	3	0x201B	V2	yes	Immediately	-	-
1100.8	C3Plus.DeviceControl_DemandValue3	Device demand value C		0x2048	Y2	yes	Immediately	-	-
1100.5	C3Plus.DeviceControl_OperationMode	Operating mode	127/930	0x6060	I16	yes	Immediately	X	X
1000.5	C3Plus.DeviceState_ActualOperationMode	Operating mode display	128	0x6061	I16	yes	Immediately	X	X
1000.3	C3Plus.DeviceState_Statusword_1	Status word SW	2	0x6041	V2	yes	Immediately	-	-
1000.4	C3Plus.DeviceState_Statusword_2	Status word 2	4	0x201C	V2	yes	Immediately	-	-
2401.5	C3Plus.DirectionDependentGain_Ch0_Factor_negative	Direction dependent gain			I32	no	Immediately	-	-
2401.4	C3Plus.DirectionDependentGain_Ch0_Factor_positive	Direction dependent gain			I32	no	Immediately	-	-
2401.6	C3Plus.DirectionDependentGain_Ch0_InvertType	Inversion output 0			I16	no	Immediately	-	-
2411.5	C3Plus.DirectionDependentGain_Ch1_Factor_negative	Gain factor for negative input values			I32	no	Immediately	-	-
2411.4	C3Plus.DirectionDependentGain_Ch1_Factor_positive	Gain factor for positive input values			I32	no	Immediately	-	-
2411.6	C3Plus.DirectionDependentGain_Ch1_InvertType	Inversion output 1			I16	no	Immediately	-	-
2421.5	C3Plus.DirectionDependentGain_Ch2_Factor_negative	Gain factor for negative input values			I32	no	Immediately	-	-
2421.4	C3Plus.DirectionDependentGain_Ch2_Factor_positive	Gain factor for positive input values			I32	no	Immediately	-	-
2421.6	C3Plus.DirectionDependentGain_Ch2_InvertType	Inversion output 3			I16	no	Immediately	-	-
2431.5	C3Plus.DirectionDependentGain_Ch3_Factor_negative	Direction dependent gain			I32	no	Immediately	-	-
2431.4	C3Plus.DirectionDependentGain_Ch3_Factor_positive	Direction dependent gain			I32	no	Immediately	-	-
2431.6	C3Plus.DirectionDependentGain_Ch3_InvertType	Inversion output 3			I16	no	Immediately	-	-
550.1	C3Plus.ErrorHistory_LastError	Current error (n)	115/947.0	0x603F/ 0x201D.1	U16	yes	-	-	-
2020.7	C3Plus.ExternalSignal_Accel_Munits	Acceleration of the external signal source			I32	yes	-	-	-
2020.6	C3Plus.ExternalSignal_Speed_Munits	Speed value of the external signal source			C4_3	yes	-	-	-
3921.7	C3Plus.FBI_SignalProcessing0_OutputGreat	Interpolation output of the Position CanSync, PowerLink			Y4	no	-	-	X
3921.8	C3Plus.FBI_SignalProcessing0_Source	Switching the position source of the interpolator			I16	no	Immediately	-	X
1141.10	C3Plus.GEAR_FFW_mode	Control bits for feedforward with source CANSync/EthernetPowerLink		0x2097	U16	no	Immediately	-	X
1141.4	C3Plus.GEAR_mode	Source selection Gearing		0x2055	U16	no	Immediately	-	-

No.	Object name	Object	PNU	CAN No.	Format	PD	Valid beginning	Bus object I20	I21 / I22
900.12	C3Plus.HEDA_CRC_ErrorCounter	Error counter CRC (HEDA)			U32	no	Immediately	-	-
3920.1	C3Plus.HEDA_SignalProcessing_Input	Process input signal Slave			C4_3	yes	Immediately	-	-
3920.7	C3Plus.HEDA_SignalProcessing_OutputGreat	Output of the Heda Tracking Filter			C4_3	no	-	-	-
900.1	C3Plus.HEDA_State	Status HEDA			I16	no	Immediately	-	-
900.13	C3Plus.HEDA_SyncErrorCounter	Error counter Sync (HEDA)			U32	no	Immediately	-	-
1130.1	C3Plus.HOMING_accel	Acceleration / deceleration homing run	300	0x609A	U32	no	Immediately	-	-
1130.7	C3Plus.HOMING_edge_sensor_distance	Initiator adjustment	304	0x2000	C4_3	no	Immediately	-	-
1130.2	C3Plus.HOMING_jerk	Jerk for machine reference run	357	0x201E	U32	no	Immediately	-	-
1130.4	C3Plus.HOMING_mode	Adjusting the machine reference mode	302	0x6098	U16	no	Immediately	-	-
1130.3	C3Plus.HOMING_speed	Speed for machine reference run	301	0x6099.1	C4_3	no	Immediately	-	-
201.2	C3Plus.NormFactorY4_Position	Scaling factor for Y4 positions	356.2	0x2021.2	V2	no	Immediately	X	X
2400.7	C3Plus.OutputConditioningChain_Ch0_Input_DefaultValue	Replacement value at the input of Chain0			I32	no	VP	-	-
2400.5	C3Plus.OutputConditioningChain_Ch0_Input_Offset	Offset at input Chain 0			I16	no	VP	-	-
2400.4	C3Plus.OutputConditioningChain_Ch0_Lower_Limit	Lower output limitation of output 0			I16	no	VP	-	-
2400.6	C3Plus.OutputConditioningChain_Ch0_Output_Offset	Offset at output Chain 0			I32	no	VP	-	-
2400.3	C3Plus.OutputConditioningChain_Ch0_Upper_Limit	Upper output limitation of output 0			I16	no	VP	-	-
2410.7	C3Plus.OutputConditioningChain_Ch1_Input_DefaultValue	Preset value at the input of Chain1			I32	no	VP	-	-
2410.5	C3Plus.OutputConditioningChain_Ch1_Input_Offset	Offset at input Chain1			I16	no	VP	-	-
2410.4	C3Plus.OutputConditioningChain_Ch1_Lower_Limit	Lower output limitation of output 1			I16	no	VP	-	-
2410.6	C3Plus.OutputConditioningChain_Ch1_Output_Offset	Offset at output Chain1			I32	no	VP	-	-
2410.3	C3Plus.OutputConditioningChain_Ch1_Upper_Limit	Upper output limitation of output 1			I16	no	VP	-	-
2420.7	C3Plus.OutputConditioningChain_Ch2_Input_DefaultValue	Preset value at the input of Chain2			I32	no	VP	-	-
2420.5	C3Plus.OutputConditioningChain_Ch2_Input_Offset	Offset at input Chain2			I16	no	VP	-	-
2420.4	C3Plus.OutputConditioningChain_Ch2_Lower_Limit	Lower output limitation of output 2			I16	no	VP	-	-
2420.6	C3Plus.OutputConditioningChain_Ch2_Output_Offset	Offset at output Chain2			I32	no	VP	-	-
2420.3	C3Plus.OutputConditioningChain_Ch2_Upper_Limit	Upper output limitation of output 2			I16	no	VP	-	-
2430.7	C3Plus.OutputConditioningChain_Ch3_Input_DefaultValue	Preset value at the input of Chain3			I32	no	VP	-	-
2430.5	C3Plus.OutputConditioningChain_Ch3_Input_Offset	Offset at input Chain 3			I16	no	VP	-	-
2430.4	C3Plus.OutputConditioningChain_Ch3_Lower_Limit	Lower limit of valve output 3			I16	no	VP	-	-
2430.6	C3Plus.OutputConditioningChain_Ch3_Output_Offset	Offset at output Chain 3			I32	no	VP	-	-
2430.3	C3Plus.OutputConditioningChain_Ch3_Upper_Limit	Upper limit of valve output 3			I16	no	VP	-	-
185.1	C3Plus.OutputGroup_OutputSelect_0	Output signal valves 0 & 1			BOOL	no	Immediately	-	-
185.2	C3Plus.OutputGroup_OutputSelect_1	Output signal valves 2&3			BOOL	no	Immediately	-	-
1200.1	C3Plus.PG2Control_CommandOnRequest	Control of virtual Master	200	0x2040	I16	yes	Immediately	-	-
1211.13	C3Plus.PG2POSITION_direction	Manipulation of the motion direction in reset mode			I32	no	Immediately	-	-
50.3	C3Plus.PLC_ActualCycleTime	Status of cycle time of the control program	353	0x201F.2	U16	no	-	-	-
50.4	C3Plus.PLC_ActualCycleTimeMax	Status of maximum cycle time	354	0x201F.3	U16	no	Immediately	-	-
50.1	C3Plus.PLC_DemandCycleTime	Cycle time specification	352	0x201F.1	U16	no	Immediately	-	-
1111.3	C3Plus.POSITION_accel	Acceleration for positioning	114	0x6083	U32	yes	Immediately	-	-
1111.4	C3Plus.POSITION_decel	Deceleration for positioning	312	0x6084	U32	yes	Immediately	-	-
1111.13	C3Plus.POSITION_direction	Manipulation of the motion direction in reset mode			I32	no	Immediately	-	-
1111.5	C3Plus.POSITION_jerk_accel	Acceleration jerk for positioning	313	0x2005	U32	no	Immediately	-	-
1111.6	C3Plus.POSITION_jerk_decel	Deceleration jerk for positioning	314	0x2006	U32	no	Immediately	-	-
1111.1	C3Plus.POSITION_position	Target position	27		C4_3	yes	Immediately	-	-
1111.8	C3Plus.POSITION_resetpositon_mode	Continuous mode	0	0	U16	no	Immediately	-	-
1111.2	C3Plus.POSITION_speed	Speed for positioning	111		C4_3	yes	Immediately	-	-
1111.9	C3Plus.POSITION_speed_Y2	Speed for Positioning in Y2 Format	110		Y2	yes	Immediately	-	-
1111.17	C3Plus.POSITION_turnaround	Direction inversion - lock			U16	no	Immediately	-	-
2260.13	C3Plus.PositionController_2_DeadBand	Deadband of position controller auxiliary axis			C4_3	no	VP	-	-

No.	Object name	Object	PNU	CAN No.	Format	PD	Valid beginning	Bus object I20	I21 / I22
2260.20	C3Plus.PositionController_2_Disturbance_Offset	Disturbance compensation (A2)			C4_3	no	Immediately	-	-
2260.14	C3Plus.PositionController_2_InsideWindow_IPart	Internal window I-term (A2)			C4_3	no	VP	-	-
2260.18	C3Plus.PositionController_2_IPart_Scaling	Quantifier I-term (A2)			C4_3	no	VP	-	-
2260.21	C3Plus.PositionController_2_Ki_IPart	I-term for the position controller (auxiliary axis)			I16	no	VP	-	-
2260.22	C3Plus.PositionController_2_Kp_PPart	P-term for the position controller (auxiliary axis)			I16	no	VP	-	-
2260.17	C3Plus.PositionController_2_NegLimit_IPart	Lower limit I-term (A2)			C4_3	no	VP	-	-
2260.15	C3Plus.PositionController_2_OutsideWindow_IPart	External window I-term (A2)			C4_3	no	VP	-	-
2260.16	C3Plus.PositionController_2_PosLimit_IPart	Upper limit I-term (A2)			C4_3	no	VP	-	-
2260.19	C3Plus.PositionController_2_PPart_Scaling	Quantifier P-term (A2)			C4_3	no	VP	-	-
2200.2	C3Plus.PositionController_ActualValue	Position actual value (sequentially)			C4_3	yes	-	-	-
2200.20	C3Plus.PositionController_DeadBand	Deadband of position controller			C4_3	no	VP	-	-
2200.1	C3Plus.PositionController_DemandValue	Position setpoint value (sequentially)			C4_3	yes	-	-	-
2200.36	C3Plus.PositionController_Disturbance_Offset	Disturbance compensation (A1)			C4_3	no	Immediately	-	-
2200.30	C3Plus.PositionController_InsideWindow_IPart	Internal window I-term (A1)			C4_3	no	VP	-	-
2200.34	C3Plus.PositionController_IPart_Scaling	Quantifier I-term (A1)			C4_3	no	VP	-	-
2200.37	C3Plus.PositionController_Ki_IPart	I-term for the position controller (main axis)			I16	no	VP	-	-
2200.38	C3Plus.PositionController_Kp_PPart	P-term for the position controller (main axis)			I16	no	VP	-	-
2200.33	C3Plus.PositionController_NegLimit_IPart	Lower limit I-term (A1)			C4_3	no	VP	-	-
2200.31	C3Plus.PositionController_OutsideWindow_IPart	External window I-term (A1)			C4_3	no	VP	-	-
2200.32	C3Plus.PositionController_PosLimit_IPart	Upper limit I-term (A1)			C4_3	no	VP	-	-
2200.35	C3Plus.PositionController_PPart_Scaling	Quantifier P-term (A1)			C4_3	no	VP	-	-
2200.24	C3Plus.PositionController_TrackingErrorFilter_us	Time constant following error filter of positon controller			U16	no	VP	-	-
2402.1	C3Plus.PressureCompensation_Ch0_Type	Pressure compensation output 0			I16	no	VP	-	-
2412.1	C3Plus.PressureCompensation_Ch1_Type	Pressure compensation output 1			I16	no	VP	-	-
2422.1	C3Plus.PressureCompensation_Ch2_Type	Pressure compensation output 2			I16	no	VP	-	-
2432.1	C3Plus.PressureCompensation_Ch3_Type	Pressure compensation output 3			I16	no	VP	-	-
2250.24	C3Plus.PressureController_1_ActuatingSignal_Inversion	Inversion of the force controller control variable			I16	no	Immediately	-	-
2250.19	C3Plus.PressureController_1_Derivative_Part_KFd	Derivative action coefficient Kd (A1)			I32	no	VP	-	-
2250.21	C3Plus.PressureController_1_Disturbance_Offset	Disturbance compensation (A1)			C4_3	no	Immediately	-	-
2250.23	C3Plus.PressureController_1_Force_FeedForward_KFs	Force feedforward			U16	no	VP	-	-
2250.15	C3Plus.PressureController_1_InsideWindow_IPart	Internal window I-term (A1)			I32	no	VP	-	-
2250.14	C3Plus.PressureController_1_Integration_Part_KFi	Integration coefficient Ki (A1)			I32	no	VP	-	-
2250.18	C3Plus.PressureController_1_NegLimit_IPart	Negative limit I-term (A1)			I32	no	VP	-	-
2250.16	C3Plus.PressureController_1_OutsideWindow_IPart	External window I-term (A1)			I32	no	VP	-	-
2250.17	C3Plus.PressureController_1_PosLimit_IPart	Positive limit I-term (A1)			I32	no	VP	-	-
2250.13	C3Plus.PressureController_1_Proportional_Part_Kp	Proportional coefficient Kp (A1)			I32	no	VP	-	-
2250.20	C3Plus.PressureController_1_Speed_Feedback_KFv	Speed feedback (A1)			U16	no	VP	-	-
2251.24	C3Plus.PressureController_2_ActuatingSignal_Inversion	Inversion of the force controller control variable (A2)			I16	no	Immediately	-	-
2251.19	C3Plus.PressureController_2_Derivative_Part_KFd	Derivative action coefficient Kd (A2)			I32	no	VP	-	-
2251.21	C3Plus.PressureController_2_Disturbance_Offset	Disturbance compensation (A2)			C4_3	no	Immediately	-	-
2251.23	C3Plus.PressureController_2_Force_FeedForward_KFs	Force feedforward (A2)			U16	no	VP	-	-
2251.15	C3Plus.PressureController_2_InsideWindow_IPart	Internal window I-term (A2)			I32	no	VP	-	-
2251.14	C3Plus.PressureController_2_Integration_Part_KFi	Integration coefficient Ki (A2)			I32	no	VP	-	-
2251.18	C3Plus.PressureController_2_NegLimit_IPart	Negative limit I-term (A2)			I32	no	VP	-	-
2251.16	C3Plus.PressureController_2_OutsideWindow_IPart	External window I-term (A2)			I32	no	VP	-	-
2251.17	C3Plus.PressureController_2_PosLimit_IPart	Positive limit I-term (A2)			I32	no	VP	-	-
2251.13	C3Plus.PressureController_2_Proportional_Part_Kp	Proportional coefficient Kp (A2)			I32	no	VP	-	-
2251.20	C3Plus.PressureController_2_Speed_Feedback_KFv	Speed feedback (A2)			U16	no	VP	-	-
830.2	C3Plus.Profibus_Baudrate	Baud rate			U32	no	-	X	-
830.3	C3Plus.Profibus_NodeAddress	Station address	918		U16	no	-	X	-
830.1	C3Plus.Profibus_Protocol	PPO-type selection switch			U16	no	Immediately	X	-
830.6	C3Plus.Profibus_StandardSignalTable	List of Profidrive standard signals	923.x		U16	no	-	X	-
830.4	C3Plus.Profibus_TelegramSelect	Telegram selection switch	922		U16	no	Immediately	X	-
2000.2	C3Plus.ProfilGenerators_PG2Position	Position value of the setpoint encoder of the virtual axis		0x2061	C4_3	yes	-	-	-
2000.5	C3Plus.ProfilGenerators_PG2Speed	Speed of the virtual axis		0x2064	I32	yes	-	-	-
2000.1	C3Plus.ProfilGenerators_SG1Position	Position value of the setpoint encoder		0x2060	C4_3	yes	-	-	-
2000.4	C3Plus.ProfilGenerators_SG1Speed	Speed of the setpoint encoder		0x2063	I32	yes	-	-	-
152.1	C3Plus.RemoteAnalogInput_I0	PIO analog input 0		0x2082.1	I16	yes	Immediately	-	X
152.2	C3Plus.RemoteAnalogInput_I1	PIO analog input 1		0x2082.2	I16	yes	Immediately	-	X
152.3	C3Plus.RemoteAnalogInput_I2	PIO analog input 2		0x2082.3	I16	yes	Immediately	-	X
152.4	C3Plus.RemoteAnalogInput_I3	PIO analog input 3		0x2082.4	I16	yes	Immediately	-	X
153.1	C3Plus.RemoteAnalogOutput_O0	PIO analog output 0		0x2083.1	I16	yes	Immediately	-	X

No.	Object name	Object	PNU	CAN No.	Format	PD	Valid beginning	Bus object	
								I20	I21 / I22
153.2	C3Plus.RemoteAnalogOutput_O1	PIO analog output 1		0x2083.2	I16	yes	Immediately	-	X
153.3	C3Plus.RemoteAnalogOutput_O2	PIO analog output 2		0x2083.3	I16	yes	Immediately	-	X
153.4	C3Plus.RemoteAnalogOutput_O3	PIO analog output 3		0x2083.4	I16	yes	Immediately	-	X
150.1	C3Plus.RemoteDigInput_I0_15	Digital PIO inputs 0...15		0x2080.1	V2	yes	Immediately	-	X
150.2	C3Plus.RemoteDigInput_I16_31	Digital PIO inputs 16...31		0x2080.2	V2	yes	Immediately	-	X
150.3	C3Plus.RemoteDigInput_I32_47	Digital PIO inputs 32...47		0x2080.3	V2	yes	Immediately	-	X
150.4	C3Plus.RemoteDigInput_I48_63	Digital PIO inputs 48...63		0x2080.4	V2	yes	Immediately	-	X
151.1	C3Plus.RemoteDigOutput_O0_15	Digital PIO outputs 0...15		0x2081.1	V2	yes	Immediately	-	X
151.2	C3Plus.RemoteDigOutput_O16_31	Digital PIO outputs 16...31		0x2081.2	V2	yes	Immediately	-	X
151.3	C3Plus.RemoteDigOutput_O32_47	Digital PIO outputs 32...47		0x2081.3	V2	yes	Immediately	-	X
151.4	C3Plus.RemoteDigOutput_O48_63	Digital PIO outputs 48...63		0x2081.4	V2	yes	Immediately	-	X
2403.2	C3Plus.SignalFlowCharacteristic_Ch0_Curve_ID_A	Which characteristic (ID) is used			I16	no	VP	-	-
2403.1	C3Plus.SignalFlowCharacteristic_Ch0_Type	Characteristic output 0			I16	no	VP	-	-
2413.2	C3Plus.SignalFlowCharacteristic_Ch1_Curve_ID_A	Which characteristic (ID) is used			I16	no	VP	-	-
2413.1	C3Plus.SignalFlowCharacteristic_Ch1_Type	Characteristic output 1			I16	no	VP	-	-
2423.2	C3Plus.SignalFlowCharacteristic_Ch2_Curve_ID_A	Which characteristic (ID) is used			I16	no	VP	-	-
2423.1	C3Plus.SignalFlowCharacteristic_Ch2_Type	Characteristic output 2			I16	no	VP	-	-
2433.2	C3Plus.SignalFlowCharacteristic_Ch3_Curve_ID_A	Which characteristic (ID) is used			I16	no	VP	-	-
2433.1	C3Plus.SignalFlowCharacteristic_Ch3_Type	Characteristic output 3			I16	no	VP	-	-
1127.3	C3Plus.SPEED_speed	Target speed in speed control operating mode	7		C4_3	yes	Immediately	-	-
680.8	C3Plus.StatusPosition_Actual_Y4	Status position actual value in the bus format Y4	119	0x2022	Y4	yes	-	X	X
2109.1	C3Plus.TrackingfilterHEDA_TRFSpeed	Time constant tracking filter HEDA-process position			I16	no	VP	-	-
2107.1	C3Plus.TrackingfilterPhysicalSource_TRFSpeed	Time constant tracking filter physical source			U16	no	VP	-	-
2110.7	C3Plus.TrackingfilterSG1_AccelFilter_us	Filter time constant acceleration setpoint generator			U16	no	VP	-	-
2110.6	C3Plus.TrackingfilterSG1_FilterSpeed_us	Filter time constant velocity setpoint generator			U16	no	VP	-	-
2110.1	C3Plus.TrackingfilterSG1_TRFSpeed	Time constant tracking filter setpoint encoder		0x2096	I16	no	VP	-	-
210.9	C3Plus.ValidParameter_CamControlledSwitches	Set cam switching mechanism parameters to valid	338.9	0x2016.9	U16	no	Immediately	-	-
210.5	C3Plus.ValidParameter_FeedForward				U16	no	Immediately	-	-
210.2	C3Plus.ValidParameter_FiltersRSDP				U16	no	Immediately	-	-
180.2	C3Plus.ValveOutput0_Gain	Gain valve output 0			C4_3	no	Immediately	-	-
180.4	C3Plus.ValveOutput0_Offset	Offset valve output 0			I32	no	Immediately	-	-
180.5	C3Plus.ValveOutput0_Value	Value of valve output 0			C4_3	no	Immediately	-	-
181.2	C3Plus.ValveOutput1_Gain	Gain factor real			C4_3	no	Immediately	-	-
181.4	C3Plus.ValveOutput1_Offset	Offset valve output 1			I32	no	Immediately	-	-
181.5	C3Plus.ValveOutput1_Value	Value of valve output 1			C4_3	no	Immediately	-	-
182.2	C3Plus.ValveOutput2_Gain	Gain valve output 2			C4_3	no	Immediately	-	-
182.4	C3Plus.ValveOutput2_Offset	Offset valve output 2			I32	no	Immediately	-	-
182.5	C3Plus.ValveOutput2_Value	Value of valve output 2			C4_3	no	Immediately	-	-
183.2	C3Plus.ValveOutput3_Gain	Gain valve output 3			C4_3	no	Immediately	-	-
183.4	C3Plus.ValveOutput3_Offset	Offset valve output 3			I32	no	Immediately	-	-
183.5	C3Plus.ValveOutput3_Value	Value of valve output 3			C4_3	no	Immediately	-	-

7.3 Detailed object list

A detailed object list can be found in the corresponding online help.

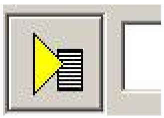
8. Status values

In this chapter you can read about:

A list of the status values supports you in optimization and commissioning.
Open the optimization function in the C3 ServoManager (double-click on optimization in the tree)
You will find the available status values in the lower right part of the window under selection (TAB) ”Status values”
You can pull them into the oscilloscope (upper part of the left side) or into the status display (upper part of the right side) by the aid of the mouse (drag and drop).
The status values are divided into 2 groups (user levels):
standard: here you can find all important status values
advanced: advanced status values, require a better knowledge

Switching of the user level

The user level can be changed in the optimization window (left hand side lower part under selection (TAB) "optimization") with the following button.



8.1 D/A-Monitor

A part of the status values can be output via the D/A monitor channel 0 (X11/4) and channel 1 (X11/3).In the following status list under D/A monitor output: possible / not possible).
The reference for the output voltage can be entered individually in the reference unit of the status value.

Example: Output Object 2210.2: (actual position unfiltered)

In order to get an output voltage of 10V at 3000min^{-1} , please enter 50Umd/s (=3000min^{-1}) as "value of the signal at 10V".

Hint

The unit of measurement of the D/A monitor values differs from the unit of measurement of the status values.

8.2 Status values

Additional information on the topic of "status values" can be found in the online help of the device.

9. Error:

All errors lead to error status.
Two error reactions are possible which are assigned to the individual error:

Reaction 2: Downramp with error ramp and then switching the valve outputs with high impedance (tristate) or, depending on the set **error reaction** (see page 80, see page 302) remaining in the controlled state.
The method of "downramping" depends on the operating mode configured:

Position AND force control configured

Downramp with position control

Pure force congrol configured

Downramp with force control

Reaction 5: Immediate tristating of the valve outputs (without ramp).

With the aid of the "**SetErrorReaction** (see page 302)" IEC module, additional error reactions can be assigned to individual errors.

Most pending errors can be acknowledged with Quit!

The following errors must be acknowledged with "Power on":

0x7381, 0x7382, 0x7391, 0x7392, 0x73A0

The errors as well as the error history can be viewed in the C3 ServoManager under optimization (at the top right of the optimization window).

10. Order code

In this chapter you can read about:

10.1 Order code device: Compax3 Fluid

	C3							
	F	0 0 1	D2	F12				
Hydraulics controller	F							
Table Style		0 0 1						
Supply voltage 24VDC			D2					
Feedback Module				F12				
Interface:								
Control via Inputs/Outputs					I11			
Control via Inputs/Outputs or COM interface					I12			
Profibus DP V0/V1/V2 (12Mbaud)					I20			
CANopen					I21			
DeviceNet					I22			
Ethernet Powerlink					I30			
Ethercat					I31			
Technology functions:								
Positioning (available as I12T11 & I20T11)						T11		
Motion control programmable according to IEC61131-3						T30		
Motion control programmable according to IEC61131-3 & electronic cam extension						T40		
Options:								
no additional supplement							M00	
Expansion 12 digital I/Os & HEDA (Motionbus)							M10	
HEDA (Motionbus)							M11	
Expansion, 12 digital I/Os							M12	

10.2 Accessories order code

Order Code connection set for Compax3 Fluid

for C3F00xD2	ZBH 02/04	ZBH	0 2	/	0 4

Order code for feedback cables

X11, X13	with connector for Balluff BTL series with SSI- and Start/Stop interface	GBK	4 0	/	... ...
X13	Feedback cable EnDat2.1	GBK	4 1	/	... ...
Encoder – Compax3		GBK	2 3	/	... ...(1

Order code for interface cables and plugs

PC – Compax3 (RS232)		SSK	0 1	/ ... ...(1
PC - Compax3MP (USB)		SSK	3 3	/ ... ...
on X11 (Ref/Analog) and X13 at C3F001D2	with flying leads	SSK	2 1	/ ... ...(1
on X12 / X22 (I/Os digital)	with flying leads	SSK	2 2	/ ... ...(1
on X11 (Ref /Analog)	for I/O terminal block	SSK	2 3	/ ... ...(1
on X12 / X22 (I/Os digital)	for I/O terminal block	SSK	2 4	/ ... ...(1
PC ⬄ POP (RS232)		SSK	2 5	/ ... ...(1
Compax3 ⬄ POP (RS485) for several C3H on request		SSK	2 7	/ ../ ...(6
Compax3 HEDA ⬄ Compax3 HEDA or PC ⬄ C3powerPLmC Compax3 I30 ⬄ Compax3 I30 or C3M-multi-axis communication		SSK	2 8	/ ../ ...(5
Compax3 X11 ⬄ Compax3 X11 (encoder coupling of 2 axes)		SSK	2 9	/ ... ...(1
Compax3 X10 ⬄ Modem		SSK	3 1	/ ...
Compax3H adapter cable ⬄ SSK01 (length 15cm, delivered with the device)		SSK	3 2	/ 2 0
Compax3H X10 RS232 connection control ⬄ Programming interface (delivered with the device)		VBK	1 7	/ 0 1
Bus terminal connector (for the 1st and last Compax3 in the HEDA Bus/or multi-axis system).		BUS	0 7	/ 0 1
Profibus cable (2	non prefabricated	SSL	0 1	/ ... ...(1
Profibus plug		BUS	0 8	/ 0 1
CAN-Bus cable (2	non prefabricated	SSL	0 2	/ ... ...(1
CANbus connector		BUS	1 0	/ 0 1

(x **Note on the cable** (see page 431)

Order Code operating module

Operating module (for Compax3S and Compax3F)	BDM	0 1	/ 0 1

Order Code terminal block

for I/Os without luminous indicator	for X11, X12, X22	EAM	0 6	/ 0 1
for I/Os with luminous indicator	for X12, X22	EAM	0 6	/ 0 2

Order Code decentralized input terminals

PIO 2DI 24VDC 3.0ms	2-channel digital input terminal	PIO	4 0 0
PIO 4DI 24VDC 3.0ms	4-channel digital input terminal	PIO	4 0 2
PIO 8DI 24VDC 3.0ms	8-channel digital input terminal	PIO	4 3 0
PIO 2AI DC ± 10V differential input	2 channel analog input terminal (± 10V differential input)	PIO	4 5 6
PIO 4AI 0-10VDC S.E.	4 channel analog input terminal (0-10V signal voltage)	PIO	4 6 8
PIO 2AI 0 -20mA differential input	2 channel analog input terminal (0 -20mA differential input)	PIO	4 8 0

Order Code decentralized output terminals

PIO 2DO 24VDC 0.5A	2 channel digital output terminal (output voltage 0.5A)	PIO	5 0 1
PIO 4DO 24VDC 0.5A	4 channel digital output terminal (output voltage 0.5A)	PIO	5 0 4
PIO 8DO 24VDC 0.5A	8 channel digital output terminal (output voltage 0.5A)	PIO	5 3 0
PIO 2AO 0-10VDC	2 channel analog output terminal (0-10V signal voltage)	PIO	5 5 0
PIO 2AO 0 -20mA	2 channel analog output terminal (0-20mA signal voltage)	PIO	5 5 2
PIO 2AO DC ± 10V	2 channel analog output terminal (± 10V signal voltage)	PIO	5 5 6

Order Code CANopen Fieldbus Coupler

CANopen Standard	max. vectorial sum current for bus terminals 1650mA at 5V	PIO	3 3 7
CANopen ECO	max. vectorial sum current for bus terminals 650mA at 5V	PIO	3 4 7

(1 **Length code 1**

Length [m]	1,0	2,5	5,0	7,5	10,0	12,5	15,0	20,0	25,0	30,0	35,0	40,0	45,0	50,0
Order code	01	02	03	04	05	06	07	08	09	10	11	12	13	14

Example:

SSK01/09: length 25m
(2 Colours according to DESINA
(3 with motor plug
(4 with cable eye for motor terminal box

(5**Length code 2 for SSK28**

Length [m]	0,17	0,25	0,5	1,0	3,0	5,0	10,0
Order code	23	20	21	01	22	03	05

(6 **Order code: SSK27/nn/..**

Length A (Pop - 1. Compax3) variable (the last two numbers according to the length code for cable, for example SSK27/nn/01)
Length B (1. Compax3 - 2. Compax3 - ... - n. Compax3) fixed 50 cm (only if there is more than 1 Compax3, i.e. nn greater than 01)
Number n (the last two digits)

Examples:

SSK27/05/.. for connecting from Pop to 5 Compax3.
SSK27/01/.. for connection from Pop to one Compax3

MOK55 and MOK54 can also be used for linear motors LXR406, LXR412 and BLMA.
(x **Note on the cable** (see page 431)

11. Compax3 Accessories

In this chapter you can read about:

11.1 ZBH plug set

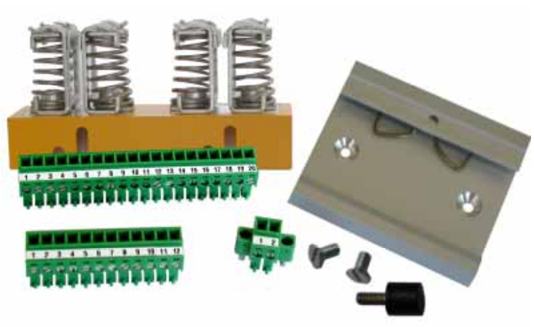
The plug set which is available as accessory comprises:

- a shield connecting terminal for the large area shield connection of the sensor and valve cable (X1, X2), as well as
- the mating plug connectors for the Compax3 plug connectors X1, X2, X3, and
- fixing material for the mounting of a supporting rail

Order Code connection set for Compax3 Fluid

for C3F00xD2	ZBH 02/04	ZBH	0 2 /	0 4

ZBH02/04: for Compax3 F00x D2

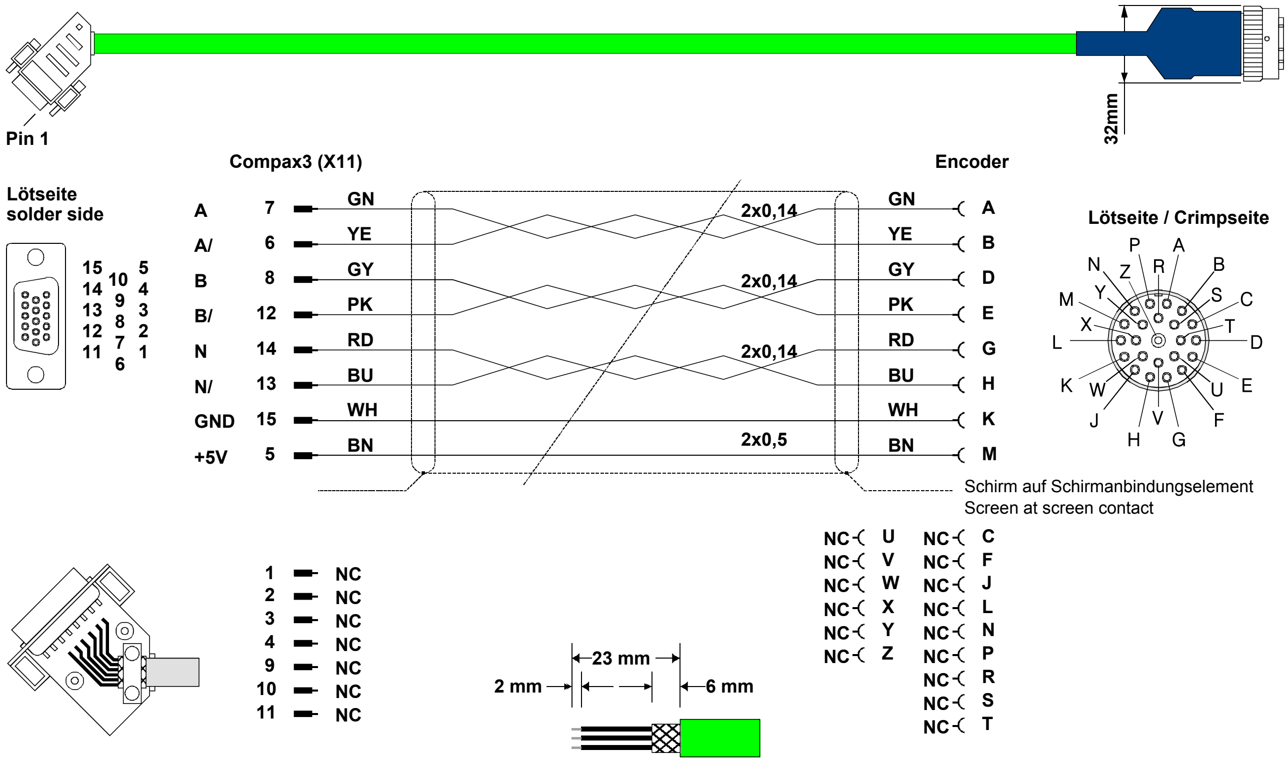


11.2 Cable for path measurement systems

In this chapter you can read about:

11.2.1. Encoder cable

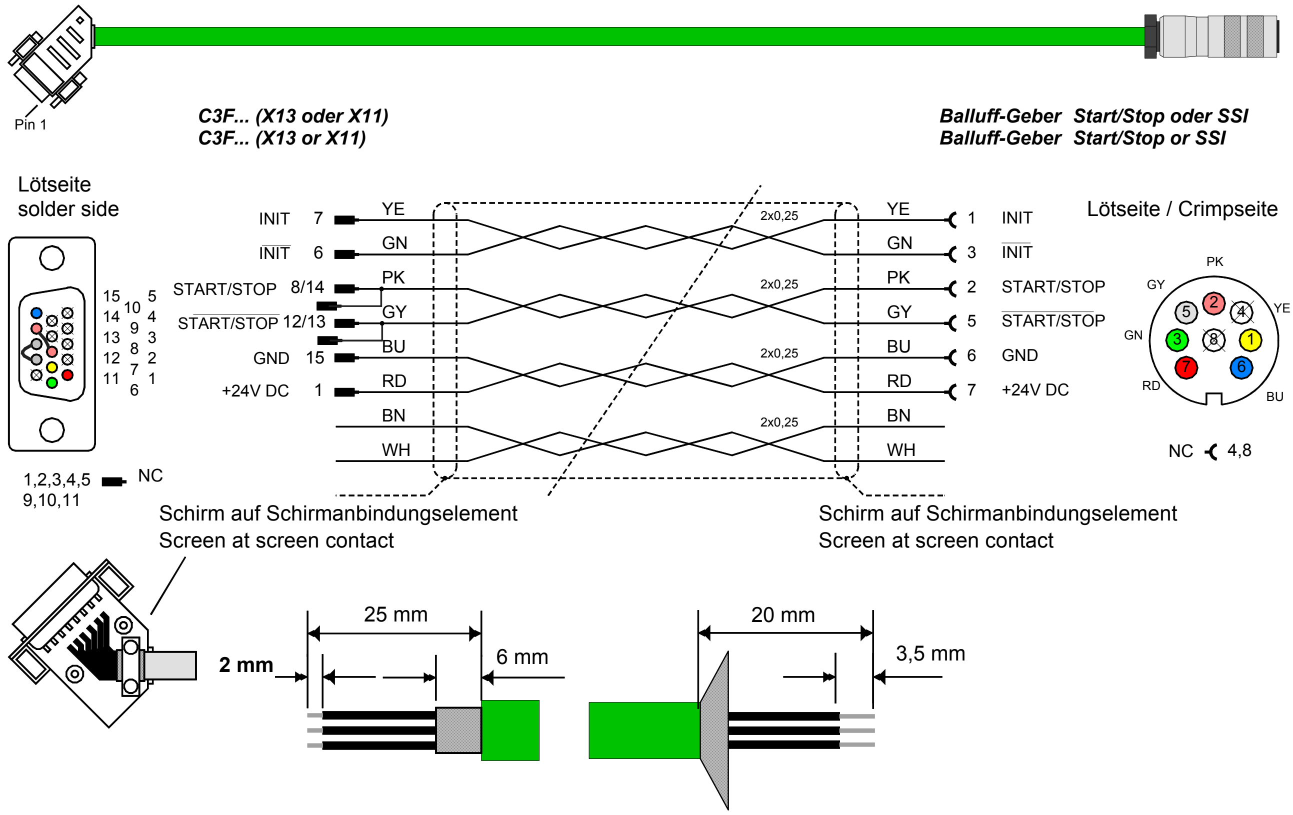
GBK23/..: Connection Encoder - Compax3



You will find the length code in the **accessories order code** (see page 429).

11.2.2. Feedback cable (Balluff)

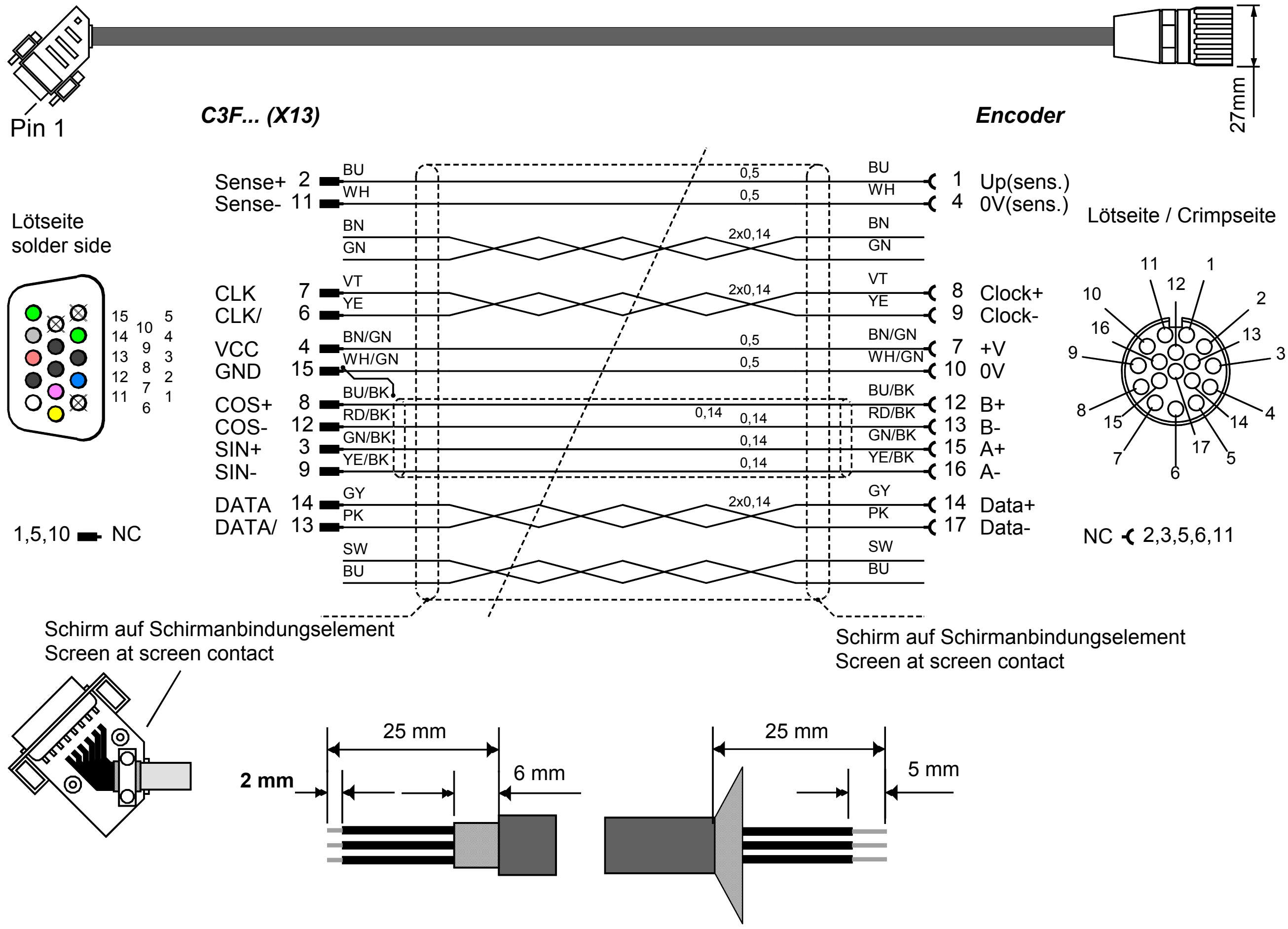
GBK40/..: Connection Compax3 - Start/Stop or SSI feedback



You will find the length code in the **accessories order code** (see page 429).

11.2.3. Feedback cable EnDat2.1

GBK41/..: Connection Compax3 - EnDat2.1 feedback



You will find the length code in the **accessories order code** (see page 429).

11.3 Operator control module BDM

Order Code operating module

Operating module (for Compax3S and Compax3F)	BDM	0	1	/	0	1

Flexible service and maintenance

Functions:

- Mobile or stationary handling: can remain on the unit for display and diagnostic purposes, or can be plugged into any unit.
- Can be plugged in while in operation
- Power supply via Compax3 servo control
- Display with 2 times 16 places.
- Menu-driven operation using 4 keys.
- Displays and changing of values.
- Display of Compax3 messages.
- Duplication of device properties (no valve characteristics) and IEC61131-3 program to another Compax3 with identical hardware.
- Additional information can be found int he BDM manual This can be found on the Compax3 CD or on our Homepage: **BDM-manual** (http://apps.parker.com/divapps/EME/EME/Literature_List/dokumentationen/BDM.pdf).

11.4 EAM06: Terminal block for inputs and outputs

Order Code terminal block

for I/Os without luminous indicator	for X11, X12, X22	EAM	0	6	/	0	1
for I/Os with luminous indicator	for X12, X22	EAM	0	6	/	0	2

The terminal block EAM06/.. can be used to route the Compax3 plug connector X11 or X12 for further wiring to a terminal strip and to a Sub-D plug connector.

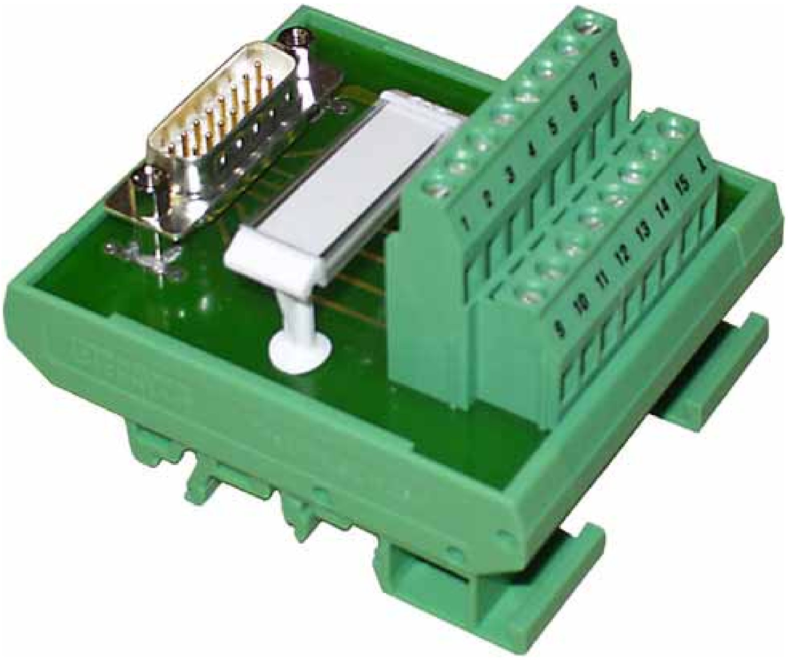
Via a supporting rail (Design: ⌞⌟ or ⌐⌙) the terminal block can be installed on a mounting rail in the control cabinet.
EAM06/ is available in 2 variants:

- EAM06/01: Terminal block for X11, X12, X22 without luminous indicator
- EAM06/02: Terminal block for X12, X22 with luminous indicator

Corresponding connecting cables EAM06 - Compax3 are available:

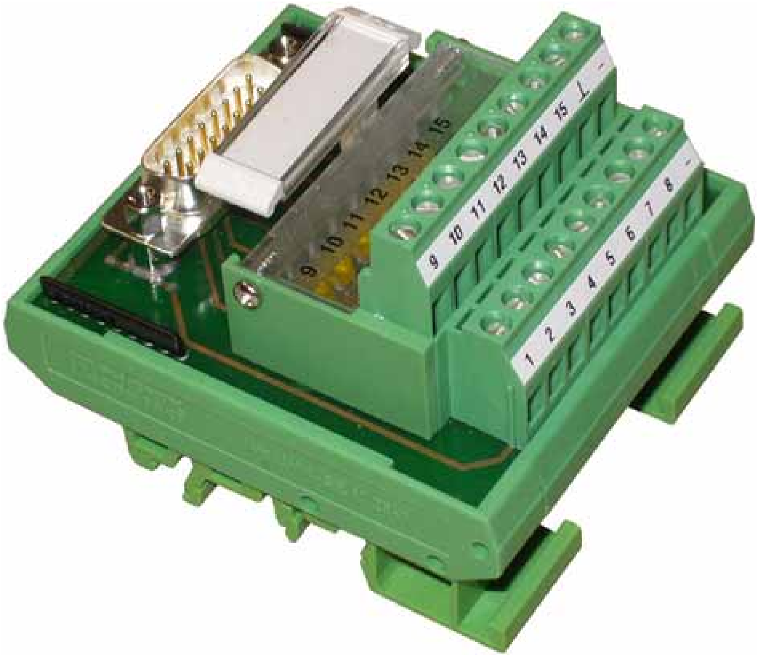
- from X11 - EAM06/01: SSK23/..
- from X12, X22 - EAM06/xx: SSK24/..

EAM6/01: Terminal block without luminous indicator for X11, X12 or X22



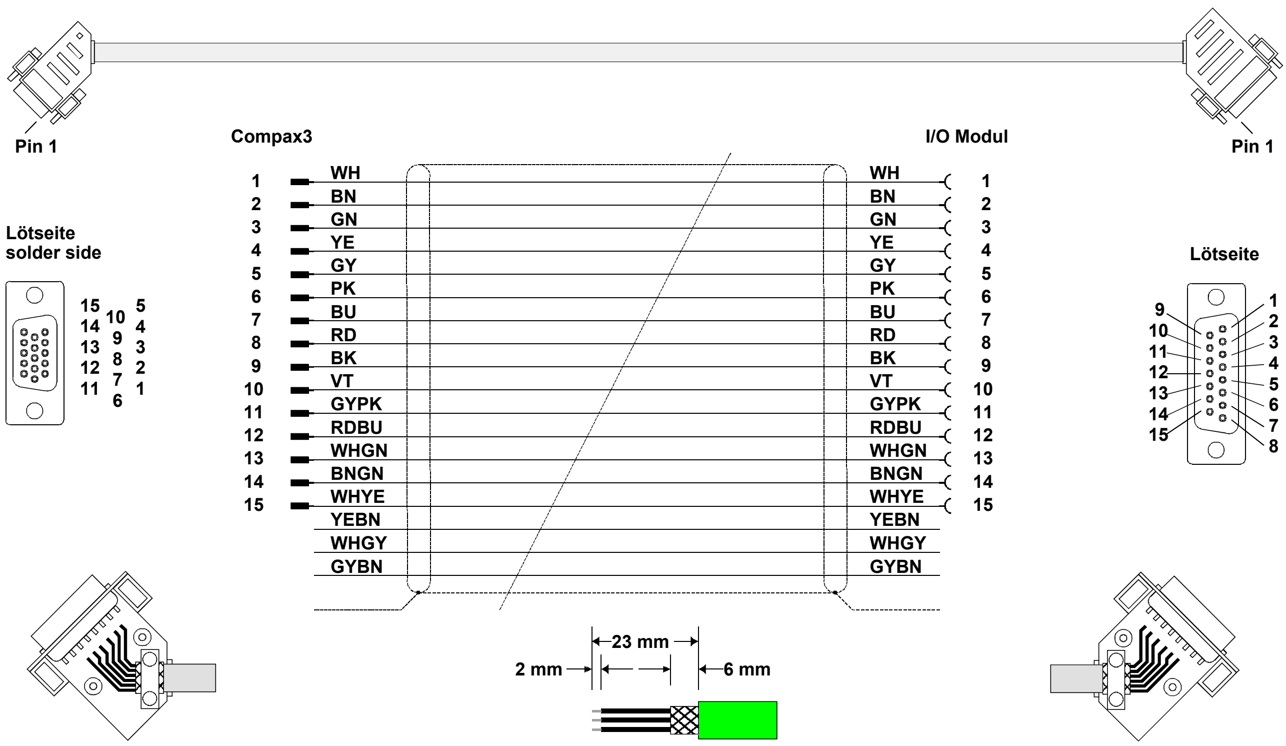
Width: 67.5mm

EAM6/02: Terminal block with luminous indicator for X12, X22

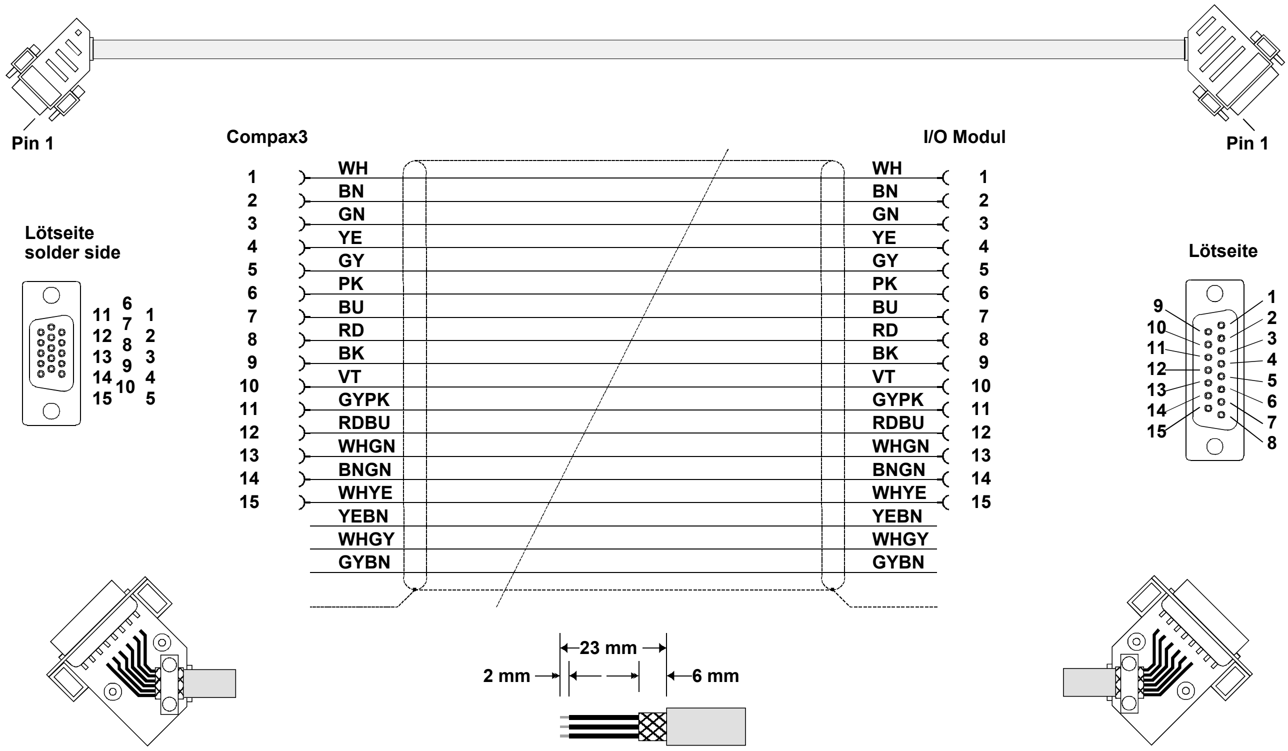


Width: 67.5mm

Cable plan SSK23/..: X11 to EAM 06/01



Cable plan SSK24/..: X12 to EAM 06/xx



11.5 Interface Cables

In this chapter you can read about:

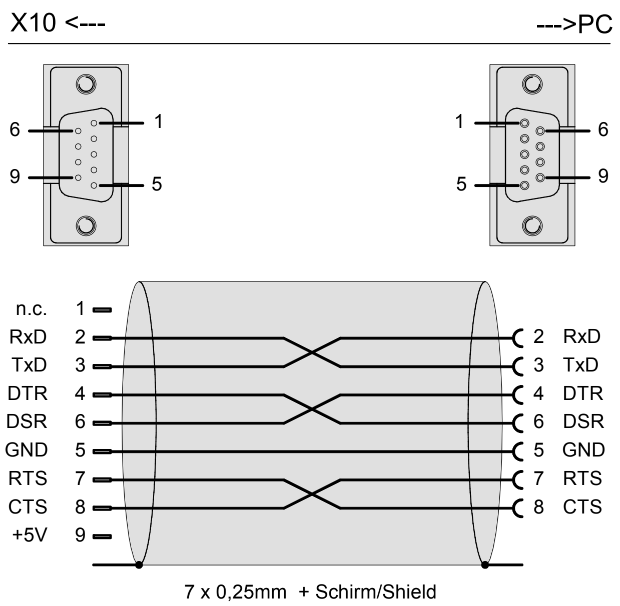
Order code for interface cables and plugs

PC – Compax3 (RS232)		SSK	0	1	/	...	...[1]
PC - Compax3MP (USB)		SSK	3	3	/	...	...
on X11 (Ref/Analog) and X13 at C3F001D2	with flying leads	SSK	2	1	/	...	...[1]
on X12 / X22 (I/Os digital)	with flying leads	SSK	2	2	/	...	...[1]
on X11 (Ref /Analog)	for I/O terminal block	SSK	2	3	/	...	...[1]
on X12 / X22 (I/Os digital)	for I/O terminal block	SSK	2	4	/	...	...[1]
PC ⇔ POP (RS232)		SSK	2	5	/	...	...[1]
Compax3 ⇔ POP (RS485) for several C3H on request		SSK	2	7	/	../	...[6]
Compax3 HEDA ⇔ Compax3 HEDA or PC ⇔ C3powerPLmC Compax3 I30 ⇔ Compax3 I30 or C3M-multi-axis communication		SSK	2	8	/	../	...[5]
Compax3 X11 ⇔ Compax3 X11 (encoder coupling of 2 axes)		SSK	2	9	/	...	...[1]
Compax3 X10 ⇔ Modem		SSK	3	1	/	...	
Compax3H adapter cable ⇔ SSK01 (length 15cm, delivered with the device)		SSK	3	2	/	2	0
Compax3H X10 RS232 connection control ⇔ Programming interface (delivered with the device)		VBK	1	7	/	0	1
Bus terminal connector (for the 1st and last Compax3 in the HEDA Bus/or multi-axis system).		BUS	0	7	/	0	1
Profibus cable [2]	non prefabricated	SSL	0	1	/	...	...[1]
Profibus plug		BUS	0	8	/	0	1
CAN-Bus cable [2]	non prefabricated	SSL	0	2	/	...	...[1]
CANbus connector		BUS	1	0	/	0	1

[x] **Note on the cable** (see page 431)

11.5.1. RS232 cable

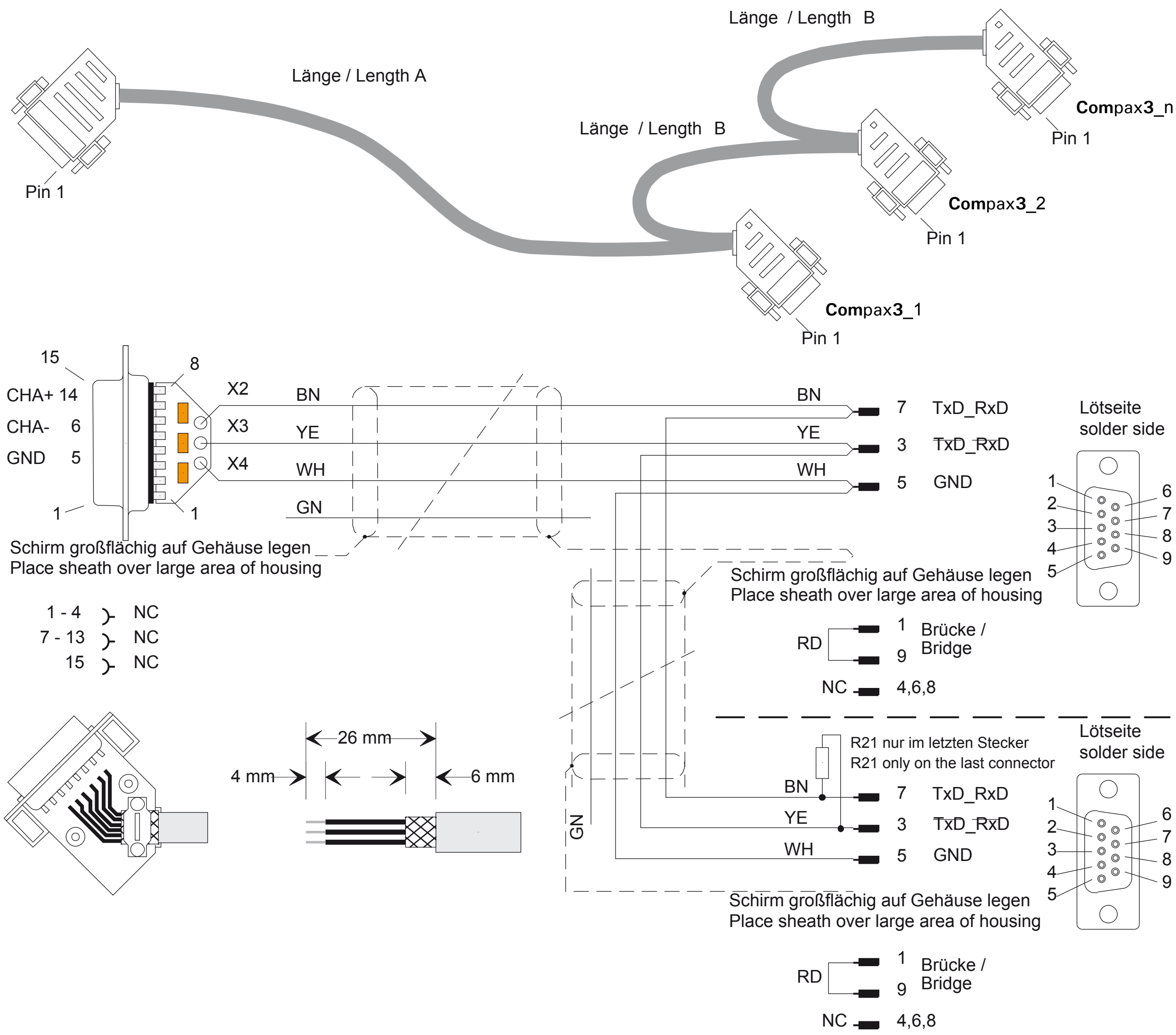
SSK1/..



You will find the length code in the **accessories order code** (see page 429).

11.5.2. RS485 cable to Pop

SSK27: Connection Pop - Compax3 - Compax3 - ...



R21 = 220 Ohm

(6 Order code: SSK27/nn/..

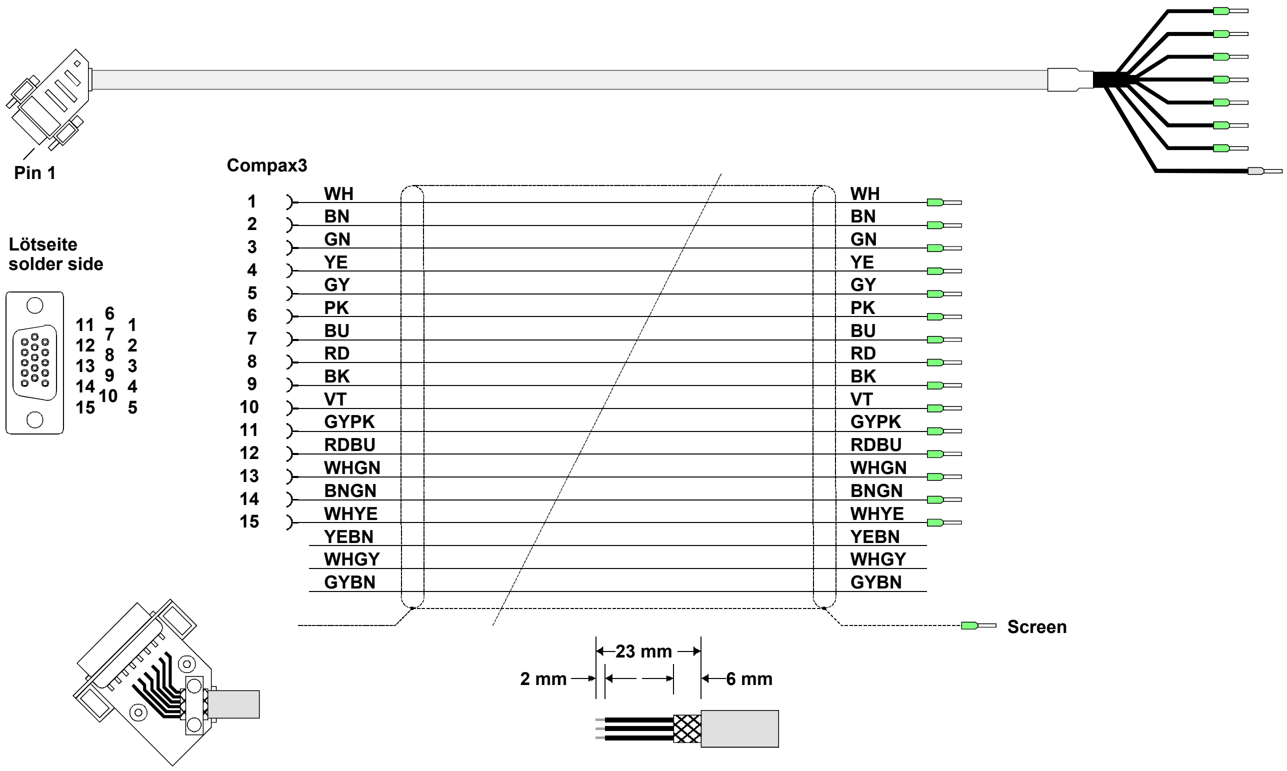
Length A (Pop - 1. Compax3) variable (the last two numbers according to the length code for cable, for example SSK27/nn/01)
Length B (1. Compax3 - 2. Compax3 - ... - n. Compax3) fixed 50 cm (only if there is more than 1 Compax3, i.e. nn greater than 01)
Number n (the last two digits)

Examples:

SSK27/05/.. for connecting from Pop to 5 Compax3.
SSK27/01/.. for connection from Pop to one Compax3

11.5.3. I/O interface X12 / X22

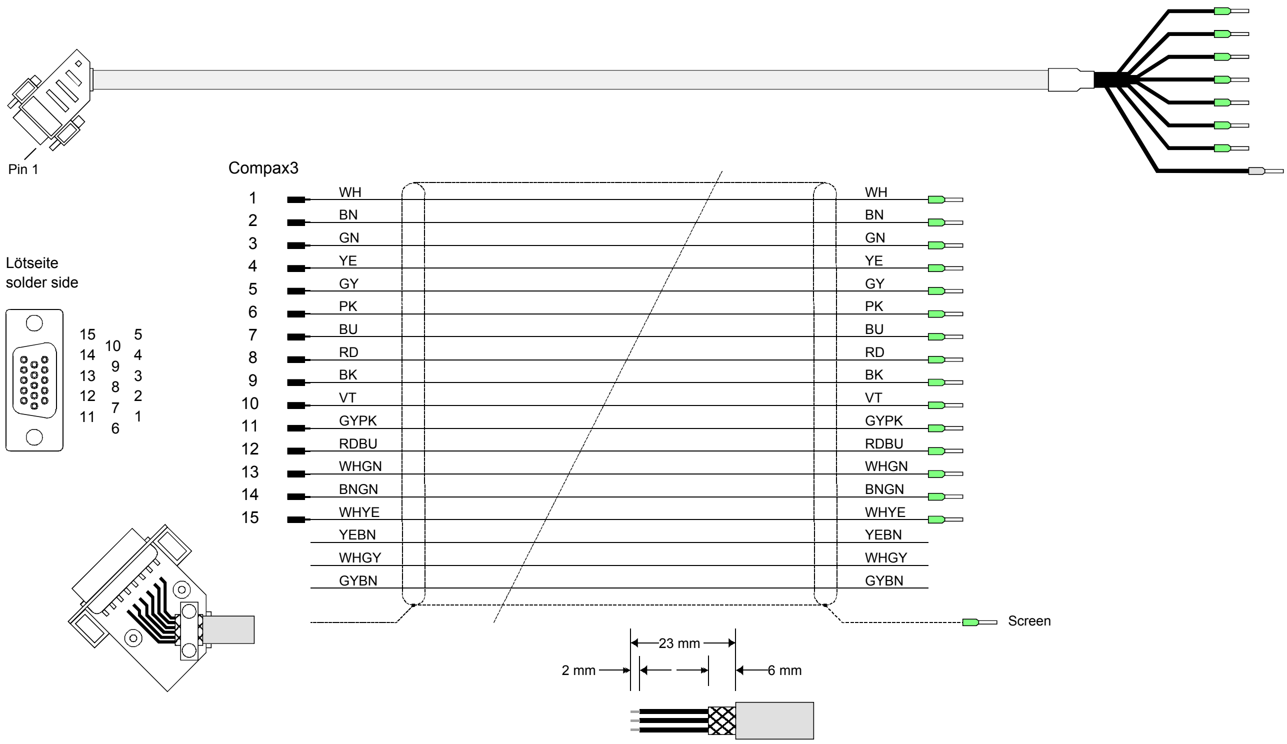
SSK22/..: Cable for X12 / X22 with flying leads



You will find the length code in the **accessories order code** (see page 429).

11.5.4. Ref X11

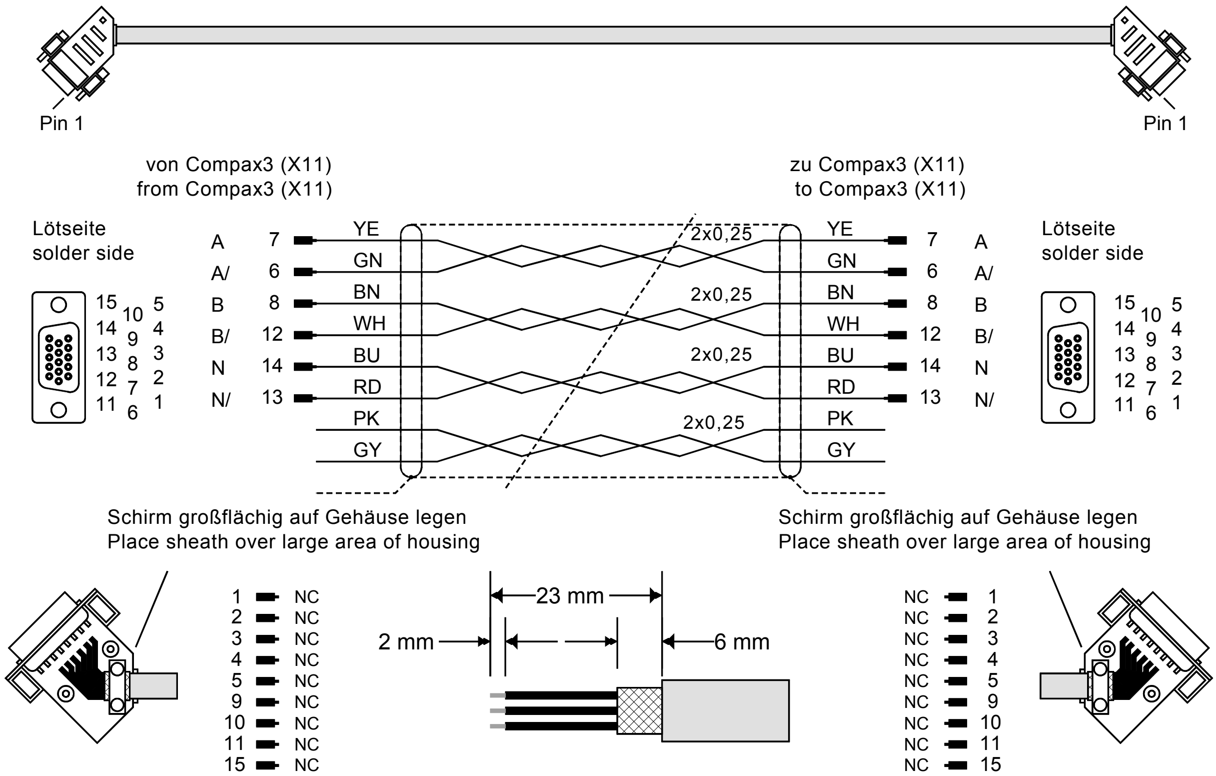
SSK21/..: Cable for X11 with flying leads



You will find the length code in the **accessories order code** (see page 429).

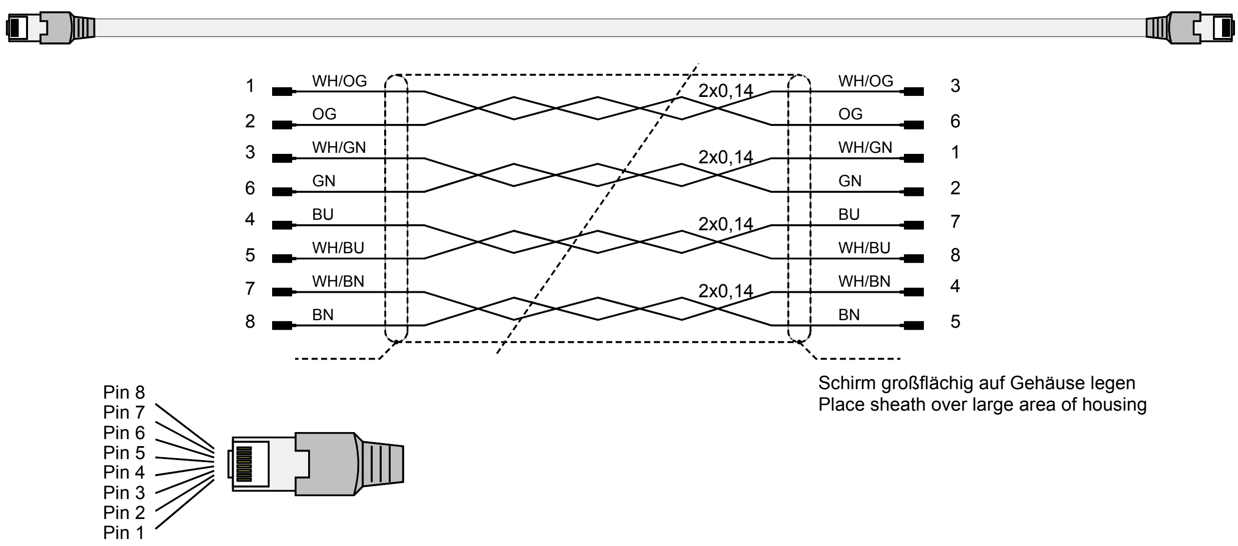
11.5.5. Encoder coupling of 2 Compax3 axes

SSK29/..: Cable from Compax3 X11 to Compax3 X11



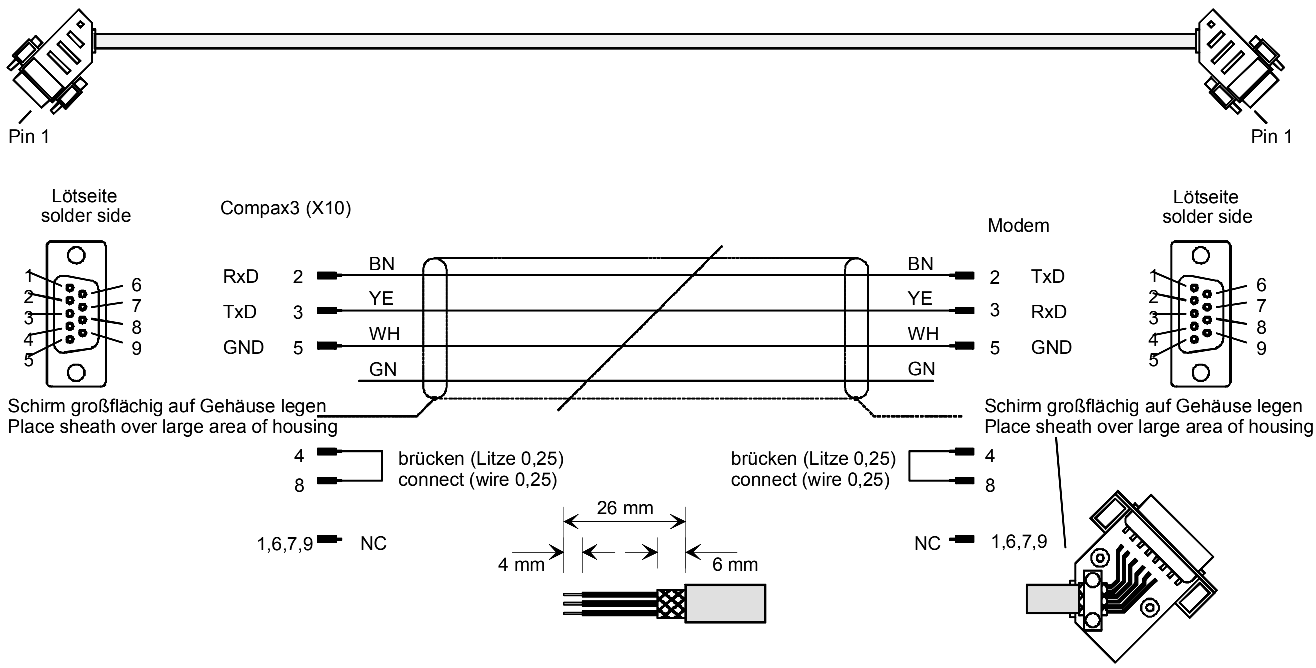
You will find the length code in the **accessories order code** (see page 429).

Layout of SSK28:



11.5.6. Modem cable SSK31

SSK31/..



You will find the length code in the **accessories order code** (see page 429).

11.6 Options M1x

In this chapter you can read about:

11.6.1. Input/output option M12

An optional input/output extension is available for Compax3. This option is named M12 and offers 12 digital 24V inputs/outpus (Ports) on X22.
The use of the option as inputs or outputs is programmable in groups of 4 (via the object 133.4).
The outputs are written via the object 133.3 "Output word for the I/O option"; this applies only for the ports defined as output.
The inputs are read via the object 121.2 " Input word for the I/O option"; all ports are being read, also the outputs.

11.6.1.1 Assignment of the X22 connector

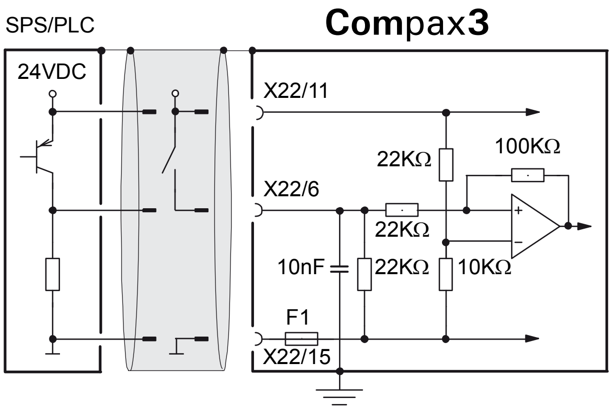
PIN X22/	Input/output	I/O /X22 High density/Sub D	Access via IEC module:
1	n.c.	Reserved	
2	O0/I0	Output 0 / Input 0 - adjustable	**C3_IOAddition_0** (see page 304)
3	O1/I1	Output 1 / Input 1 - adjustable	
4	O2/I2	Output 2 / Input 2 - adjustable	
5	O3/I3	Output 3 / Input 3 - adjustable	
6	O4/I4	Output 4 / Input 4 - adjustable	**C3_IOAddition_1** (see page 304)
7	O5/I5	Output 5 / Input 5 - adjustable	
8	O6/I6	Output 6 / Input 6 - adjustable	
9	O7/I7	Output 7 / Input 7 - adjustable	
10	O8/I8	Output 8 / Input 8 - adjustable	**C3_IOAddition_2** (see page 305) (not 24VDC)
11	E	24 VDC power supply	
12	O9/I9	Output 9 / Input 9 - adjustable	
13	O10/I10	Output 10 / Input 10 - adjustable	
14	O11/I11	Output 11 / Input 11 - adjustable	
15	E	Gnd 24 V	

The assignment can be adjusted.
All inputs and outputs have 24V level.
Maximum load on an output: 100mA

Maximum capacitive load: 50nF (max. 4 Compax3 inputs)

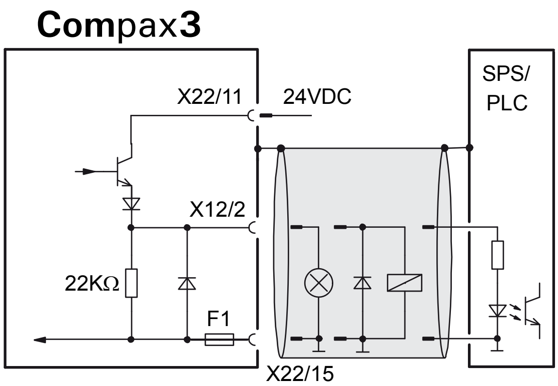
Caution! The 24VDC power supply (X22/11) must be supplied from an external source and must be protected by a 1.2A delayed fuse!

Input wiring of digital inputs



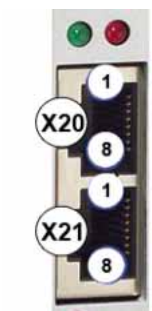
The circuit example is valid for all digital inputs!
F1: quick action electronic fuse; can be reset by switching the 24VDC supply off and on again.

Output wiring of digital outputs



The circuit example is valid for all digital outputs!
The outputs are short circuit proof; a short circuit generates an error.
F1: quick action electronic fuse; can be reset by switching the 24VDC supply off and on again.

11.6.2. HEDA (motion bus) - Option M11



	RJ45 (X20)	**RJ45 (X21)**
PIN	**HEDA in**	**HEDA out**
1	Rx	Tx
2	Rx/	Tx/
3	Lx	Lx
4	-	Reserved
5	-	Reserved
6	Lx/	Lx/
7	-	Reserved
8	-	Reserved

Function of the HEDA LEDs

Green LED (left)

HEDA module energized

Red LED (right)

Error in the receive area
Possible causes:

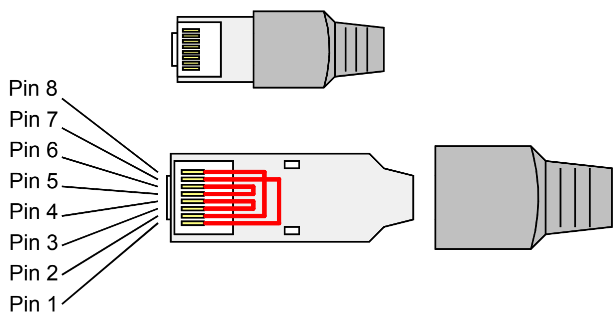
- at the Master
  - no slave sending back
  - Wrong cabling
  - Terminal plug is missing
  - several masters are sending in the same slot
- at the slave
  - several masters in the system
  - no master active
  - Terminal plug is missing
  - no transmission from one or several receive slots (neither by the master nor by another slave)

HEDA-wiring:

HEDA-Master

Layout of SSK28 (see page 430, see page 445)

Design of the HEDA bus terminator BUS 07/01:



Jumpers: 1-7, 2-8, 3-4, 5-6

Function of the HEDA LEDs

Green LED (left)

HEDA module energized

Red LED (right)

Error in the receive area
Possible causes:

- at the Master
  - no slave sending back
  - Wrong cabling
  - Terminal plug is missing
  - several masters are sending in the same slot
- at the slave
  - several masters in the system
  - no master active
  - Terminal plug is missing
  - no transmission from one or several receive slots (neither by the master nor by another slave)

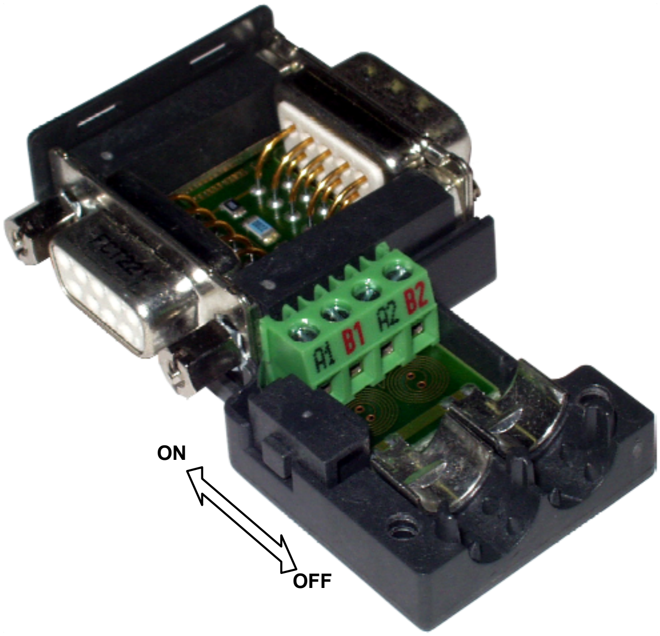
11.6.3. Option M10 = HEDA (M11) & I/Os (M12)

The M10 option includes the M12 input/output option and the HEDA M11 option.

11.7 Profibus plug BUS08/01

We offer a Profibus plug and special cable as meterware for Profibus wiring:

- Profibus cable: SSL01/.. not prefabricated (color according to DESINA).
- Profibus plug: BUS8/01 with 2 cable inputs (for one incoming A1, B1 and one continuing Profibus cable- A2, B2 -) and screw terminals as well as a switch for activating the terminal resistor.
  The terminal resistor must be activated on the first and on the last station (= switch setting ON).



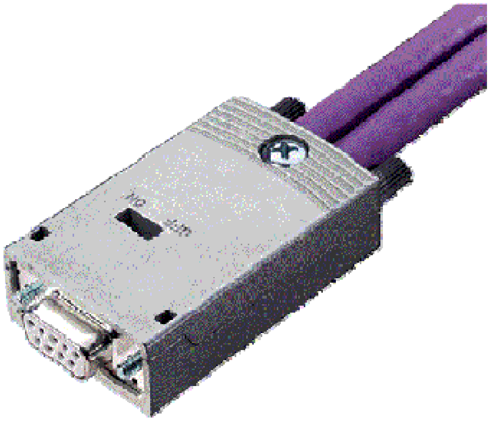
11.8 CAN - plug BUS10/01

We offer a CAN plug and special cable in any length to order for the CAN-bus wiring:

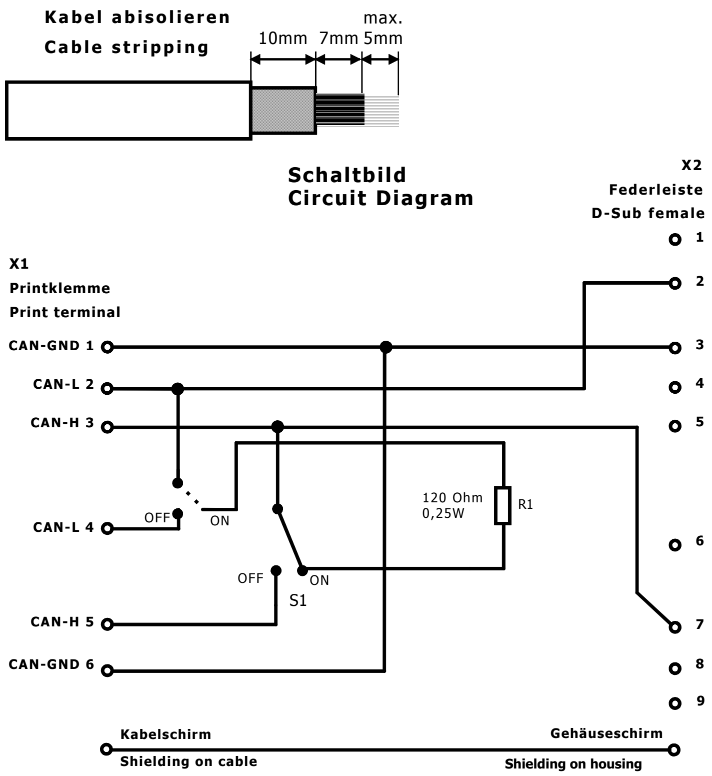
- CAN cable: SSL02/.. not prefabricated (colour according to DESINA).
- CAN plug: BUS10/01 with 2 cable inputs and screw terminals as well as a switch for activating the terminal resistor.
  The terminal resistor must be activated on the first and on the last station (=switch setting ON).

Note for integrated C3 powerPLmC (Compax3 interface designation "C1x")

- The CAN bus of the C3 powerPLmC does already contain a terminal resistor.
- Therefore it applies for the **C3 powerPLmC**:
  Put switch to OFF
  wire C3 powerPLmC always at the end of the CAN bus!



CAN wiring



11.9 PIO: Inputs/Outputs

Additional external digital and analog inputs and outputs can be integrated via CANopen.
For this purpose we offer the Parker I/O system (PIO).
PIO offers the convenience of exceptionally simple installation. The individual modules can be installed and removed without any tools.

Available modules:

Order Code decentralized input terminals

PIO 2DI 24VDC 3.0ms	2-channel digital input terminal	PIO	4	0	0
PIO 4DI 24VDC 3.0ms	4-channel digital input terminal	PIO	4	0	2
PIO 8DI 24VDC 3.0ms	8-channel digital input terminal	PIO	4	3	0
PIO 2AI DC ± 10V differential input	2 channel analog input terminal (± 10V differential input)	PIO	4	5	6
PIO 4AI 0-10VDC S.E.	4 channel analog input terminal (0-10V signal voltage)	PIO	4	6	8
PIO 2AI 0 -20mA differential input	2 channel analog input terminal (0 -20mA differential input)	PIO	4	8	0

Order Code decentralized output terminals

PIO 2DO 24VDC 0.5A	2 channel digital output terminal (output voltage 0.5A)	PIO	5	0	1
PIO 4DO 24VDC 0.5A	4 channel digital output terminal (output voltage 0.5A)	PIO	5	0	4
PIO 8DO 24VDC 0.5A	8 channel digital output terminal (output voltage 0.5A)	PIO	5	3	0
PIO 2AO 0-10VDC	2 channel analog output terminal (0-10V signal voltage)	PIO	5	5	0
PIO 2AO 0 -20mA	2 channel analog output terminal (0-20mA signal voltage)	PIO	5	5	2
PIO 2AO DC ± 10V	2 channel analog output terminal (± 10V signal voltage)	PIO	5	5	6

Order Code CANopen Fieldbus Coupler

CANopen Standard	max. vectorial sum current for bus terminals 1650mA at 5V	PIO	3	3	7
CANopen ECO	max. vectorial sum current for bus terminals 650mA at 5V	PIO	3	4	7

For additional information please refer to our **catalog**
http://www.parker.com/euro_emd/EME/Literature_List/dokumentationen/PIO_catalogue%20eng.pdf.

12. Specifications

Technical data

Motion control with motion profiles, suitable for position and force/pressure control for up to 2 axes.

Command value generator

- Jerk-limited ramps.
- Travel data in increments, mm, inch.
- Specification of speed, acceleration, delay and jerk factor.
- Force/pressure data in N, bar, psi.

Monitoring functions

- Voltage range.
- Following error monitoring.
- Hard and Software limit switch

Technology functions of servo controllers

- IEC61131-3 programs in the servo controller (T30)
- Cam function in the servo controller (T40)

Voltage supply 24VDC

Controller type	Compax3 F001 D2
Voltage range	21 - 27VDC
Mains module	with switch-on current limitation, due to capacitive load
Fuse	MTP miniature circuit breaker or "delayed action fuse", due to capacitive load
Current drain of the device	0.8A (max. 1.5A)
Total current drain	0.8A + total load of the digital outputs
Ripple	<1Vss
Requirement according to safe extra low voltage (SELV)	yes

Size / weight

Controller type	Compax3 F001 D2
Dimensions: HxWxD [mm]	199x80x130
Weight [kg]	2.0
Housing / protection class	Enclosed metal housing, insulation according to EN60529 / IP 20

Inputs and outputs

Controller type	Compax3 F001 D2
8 control inputs	24VDC / 10kOhm
4 control outputs	active HIGH/short-circuit protected, 24 V / 100 mA
4 analog current inputs	14Bit
2 analog voltage inputs	14Bit
4 analog outputs	16bits, current or voltage
2 analog monitor ouptuts	8bits

COM ports

RS232	◆ 115200 baud ◆ Word length: 8 bits, 1 start bit, 1 stop bit ◆ Hardware handshake XON, XOFF
RS485 (2 or 4-wire)	◆ 9600, 19200, 38400, 57600 or 115200 baud ◆ Word length 7/8 bit, 1 start bit, 1 stop bit ◆ Parity (can be switched off) even/odd ◆ 2 or 4-wire

Supported valves and feedback systems

Valves	◆ D1*FH series
Absolute encoder	◆ Analog 0..20mA, 4..20mA, ±10V ◆ Start/Stop - interface ◆ SSI interface ◆ EnDat 2.1-interface ◆ 1VSS (max. 400kHz) Interface, 13.5bits / graduationof the scale ◆ RS422 encoder (max. 5MHz), internal quadrature of the resolution

EMC limit values

EMC interference emission	Limit values according to EN 61000-6-4: 2001 for the industrial environment
EMC disturbance immunity	Limit values according to EN 61000-6-2: 2001 for the industrial environment

Environmental requirements Compax3F

General ambient conditions	According to **EN 60 721-3-1 to 3-3** Climate (temperature/humidity/barometric pressure): Class 3K3	
Permissible ambient temperature:		
Operation Storage Transport	0 to +45 C Class 3K3 -25 to +70 C Class 2K3 –25 to +70 C Class 2K3	
Tolerated humidity:	No condensation	
Operation Storage Transport	<= 85% class 3K3 <= 95% class 2K3 <= 95% class 2K3	(Relative humidity)
Elevation of operating site	<=1000m above sea level for 100% load ratings <=2000m above sea level for 1% / 100m power reduction Please inquire for greater elevations	
Mechanic resonances:	EN 60068-2-6 (sinusoidal excitation)	
Sealing	IP20 protection class according to EN 60 529	

Insulation requirements

Degree of contamination	Level of contamination 2 according to EN 50 178

UL certification

conform to UL:	◆ USL according to UL508 (Listed) ◆ CNL according to C22.2 No. 142-M1987. (Listed)
Certified	◆ E-File_No.: E198563

The UL certification is documented by a ”UL” logo on the device (type specification plate).

”UL” logo C UL US
LISTED
IND. CONT. EQ.
36MC

IEC6113-3 functions

General	◆ Programming based on IEC61131-3 ◆ Up to 6000 instructions ◆ 650 16 bit variables ◆ 200 32 bit variables ◆ Recipe table with 288 variables ◆ 3x16-bit retain-variable ◆ 3x32-bit retain-variable
PLCOpen function modules	◆ Positioning: absolute, relative, additive, endless ◆ Electronic Gearbox (Gearing) ◆ Machine Zero ◆ Stop, activating the drice, quit ◆ Position, device status, reading axis error
IEC61131-3 standard modules	◆ Up to 8 timers (TON, TOF, TP) ◆ Triggers (R_TRIG, F_TRIG) ◆ Flip-flops (RS, SR) ◆ Counters (CTU, CTD, CTUD)
Device-specific function modules	◆ generates an input process image ◆ generates an output process image ◆ access to recipe table
Inputs/Outputs	◆ 8 digital inputs (24V level) ◆ 4 digital outputs (24-V level) ◆ Optional addition of 12 inputs/outputs

T40 Functions: Cam

General	◆ Cam control function
	◆ Programmable based on IEC61131-3
	◆ Position of selected master signal source via:
	  ◆ Encoder, Step / direction or +/-10V analog
	  ◆ HEDA
	  ◆ Virtual Master

Cam memory	◆ 10.000 interpolation points (master / slave in 24 bit format) saved failure save. ◆ Distance of interpolation points can be adapted to curve (non equidistant interpolation points) ◆ Linear interpolation between points
Linking curve segments	◆ Up to 20 cam segments can be produced. ◆ Virtually random cam links (forwards and backwards) ◆ Freely programmable, event-triggered curve branching. ◆ Scalable cam segments and complete cam profiles
Coupling and decoupling functions	◆ With the aid of a quadratic function. ◆ By means of a change-over function ◆ Without overspeeding by coupling over several master cycles. ◆ Virtually free set-up of the coupling and decoupling movement ◆ master-guided coupling movement. ◆ Random standstill position
Mark synchronization	◆ Master or slave oriented (simultaneous, cam-independent). ◆ highly precise mark recognition (accuracy < 1 µs)
Cam generation with renowned Nolte tool.	◆ Standard or extended range of functions ◆ evaluation of the motion profiles.

COM ports

RS232	◆ 115200 baud ◆ Word length: 8 bits, 1 start bit, 1 stop bit ◆ Hardware handshake XON, XOFF
RS485 (2 or 4-wire)	◆ 9600, 19200, 38400, 57600 or 115200 baud ◆ Word length 7/8 bit, 1 start bit, 1 stop bit ◆ Parity (can be switched off) even/odd ◆ 2 or 4-wire

USB (Compax3M)	◆ USB 2.0 Full Speed compatible

I20 Function

Profibus ratings

Profile	◆ PROFIdrive Profile drive system V3
DP Versions	◆ DPV0/DPV1
Baud rate	◆ up to 12MHz
Profibus ID	◆ C320
Device master file	◆ PAR_C320.GSD (can be found on the Compax3 - CD)
Communication Simatic <-> Compax3	◆ Simatic S7-300/400 - modules for Compax3 I20 and a corresponding help file can be found on the Compax3 CD in the folder: ..\Profibus\S7-moduls\

I21 Function

CANopen ratings

Baud rate [kBit/s]	◆ 20, 50, 100, 125, 250, 500, 800, 1000
EDS file	◆ C3.EDS
Service data object	◆ SDO1
Process data objects	◆ PDO1, ... PDO4

I22 Function

DeviceNet characteristic data

DeviceNet	◆ Predefined Master/Slave Connection Set ◆ Standard 2.0 Group-2-Slave ◆ Fieldbus I/O Data or Process Data (Polled, COS/Cyclic I/O and Bit Strobe)
Implemented object classes	◆ Identify, Message Router, DeviceNet, Assembly, Connection, Acknowledge Handler
Baud rate [kBit/s]	◆ 125, 250, 500
permissible cable length	◆ up to 500m on 125Bit/s, ◆ up to 200m on 250Bit/s, ◆ up to 100m on 500Bit/s,
Max. number of nodes	◆ 63 Slave
Insulation	◆ Isolated Device Physical Layer
EDS file	◆ C3_DeviceNet.EDS
Conformance (file in the Internet)	◆ **Statement of Conformance** http://www.compax3.de/C3_DeviceNet_Statement_of_Conformance.pdf
Further information:	◆ Application example (C3I22_DeviceNet.ZIP) on the Compax3 CD in the "\Examples" directory

Ethernet Powerlink / EtherCAT characteristics

Baud rate	◆ 100MBits (FastEthernet)
Bus file Ethernet Powerlink: EtherCAT:	◆ ◆ C3_EPL_cn.EDS ◆ C3_EtherCAT_xx.XML
Service data object	◆ SDO
Cycle time	◆ 1ms
Synchronicity accuracy	◆ maximum jitter: +/-25µs

13. Index

B

C

N

O

P

Q

R

S

T

U

V

W

X

Z