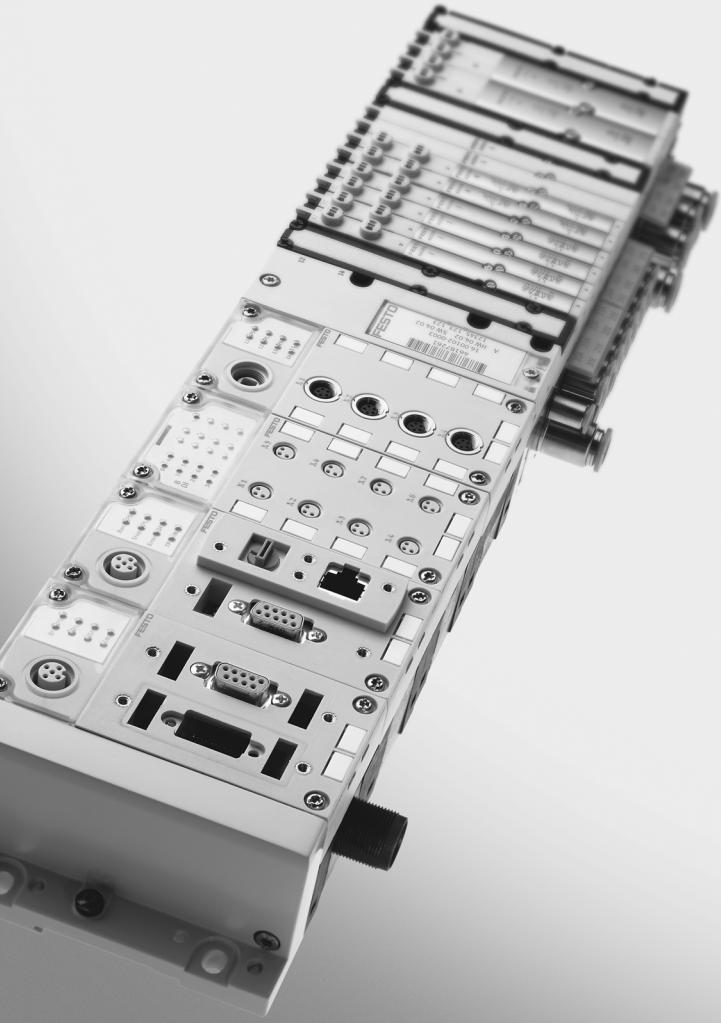
CPX terminal

US patent no. 6,085,632



FESTO

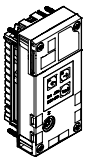
Description
Electronics

Soft Stop CMPX

Closed loop end-position controller
Type
CPX-CMPX-C-1-H1

System description
Soft Stop CMPX

Fitting,
installation,
commissioning
and diagnosis
Soft Stop system



Description
555 480
en 0802NH
[719 923]

Original ..... de

Edition ..... en 0802NH

Designation ..... P.BE-CPX-CMPX-SYS-EN

Order-no. 555 480

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Contents

Intended use

The CPX-CMPX-C-1-H1 end position controller documented in this manual is intended exclusively for use in Festo CPX terminals for installation in a machine or an automation control system.

In conjunction with a CPX terminal and a suitable CPX bus node or CPX-FEC and approved drives with a measuring system and fixed stops if necessary, and a VPWP proportional directional control valve, the CMPX Soft Stop system allows:

– fast movement into the mechanical end positions and one or two selectable intermediate positions,

– manual movement between the end positions.

The end position cushioning, movement to the intermediate positions and manual positioning are electronically controlled.

The CPX terminal may only be used with the CMPX as follows:

– as specified in industrial applications.

– in original status without unauthorized alterations. Only the conversions or modifications described in the documentation supplied with the product are permitted.

– in faultless technical condition.

– only in combination with approved components (valves, drive/displacement encoder combinations, see section 1.2).

The maximum values specified for pressures, temperatures, electrical data, torques etc. must be observed.

Please comply with national and local safety laws and regulations.

Safety note

Protection against dangerous movements

Warning
High acceleration forces at the connected actuators!
Accidental motion can cause collisions and severe injuries.

Dangerous movements can occur through faulty controlling of connected actuators, e.g. via:

– Unsafe or faulty circuitry or cabling,
– Faulty operation of the components,
– Faults in the measured value and signal generators,
– Faulty or non-EMC-compliant components,
– Faults in the higher-order control system.

- Before carrying out mounting, installation and maintenance work switch off the operating voltage and the compressed air supply, either simultaneously or in the following sequence:
  1. the compressed air supply
  2. the operating voltage supply for the electronics/sensors
  3. the load voltage supply for the outputs/valves
  Always make sure that the compressed air supply and power supply are switched off and locked before working in the machine area.
- Make sure that no persons are in the operating range of the drive or any other connected actuators.
- Simply switching off the compressed air supply or load voltage are not suitable locking procedures. In the event of a fault, this could lead to unintentional movement of the drive.
- Do not switch on the compressed air supply until the system is correctly installed and parameterised.

- Holding brakes controlled by the drive controller are alone not suitable to ensure personal protection! Provide additional support to protect vertical axes from sliding down when the compressed air and load voltage are switched off, as follows:
  – mechanical locking of the vertical axis,
  – external braking/safety catch/clamping device or
  – sufficient counterbalance of the axis.
- If used in safety relevant applications, additional measures are necessary, e.g. in Europe the standards listed under the EU machine guidelines must be observed. Without additional measures in accordance with statutory minimum requirements, the product is not suitable for use in safety-related sections of control systems.

Protection from pressurised tubing

Caution
Danger of injury through inappropriate handling of pressurised tubing!

Sudden unexpected movement of the connected actuators and uncontrolled movements of loose tubing can cause injury to human beings or damage to property.

- Do not connect, disconnect or open pressurised tubing.
- The tubes must always be exhausted before removal (release compressed air).
- Use suitable protective equipment (e.g. protective glasses, safety shoes, etc.).

Target group

This description is intended exclusively for technicians trained in control and automation technology, who have experience in installing, commissioning, programming and diagnosing positioning systems.

Service

Please consult your local Festo Service if you have any technical problems.

Required software versions

Particular software versions for the CPX bus node or CPX-FEC are required for operating the CMPX (versions as at February 2008):

Bus node/FEC	Required version [1]	Support/Operation
CPX-FEC	From Revision 14 (R14)	**Suitable**
CPX-FB6 (Interbus)	From Revision 22 (R22)	On request
CPX-FB11 (DeviceNet)	From Revision 20 (R20)	**Suitable**
CPX-FB13 (PROFIBUS-DP)	From Revision 22 (R22)	**Suitable**
CPX-FB14 (CANopen)	From Revision 20 (R20)	On request
CPX-FB23 (CC-Link)	From Revision 19 (R19)	On request
CPX-FB32 (Ethernet/IP)	From Revision 11 (R11)	On request
CPX-FB33 (PROFINET, M12)	From Revision 7 (R7)	On request
CPX-FB34 (PROFINET, RJ45)	From Revision 7 (R7)	On request
[1] Revisions version (R...) see type plate		

Tab. 0/1: Overview of CPX bus node / CPX-FEC

Please also observe the notes on the software status in the documentation for the CPX bus node or CPX-FEC.

Important user instructions

Danger categories

This description contains notes on potential dangers which may occur if the product is used incorrectly. These notes are marked with a signal word (Warning, Caution etc) printed on a shaded background and additionally with a pictogram. A distinction is made between the following danger warnings:

Warning
... means that failure to observe this note may result in serious personal injury or material damage.

Caution
... means that failure to observe this note may result in personal injury or material damage.

Note
... means that failure to observe this note may result in material damage.

The following pictogram marks passages in the text which describe activities with electrostatically sensitive components:

Electrostatic sensitive devices: inappropriate handling can result in damage to components.

Identification of specific information

The following pictograms mark passages in the text which contain specific information.

Pictograms

Information:
Recommendations, tips and references to other sources of information.

Accessories:
Information on necessary or useful accessories for the Festo product.

Environment:
Information on the environmentally-friendly use of Festo products.

Text designations

- Bullet points indicate activities which may be carried out in any sequence.

1. Figures denote activities which must be carried out in the numerical order specified.

– Arrowheads indicate general lists.

Notes on the use of this manual

This manual refers to the following versions:

– CPX-CMPX-C-1-H1 end position controller with software version V 1.0 and above

This manual contains special information on the functioning, mounting, installation and commissioning of the CMPX end position controller with associated modules and components on the axis string (see Tab. 0/2).

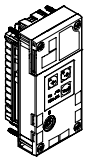
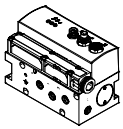
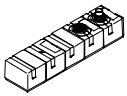
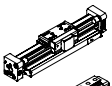
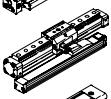
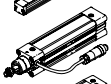
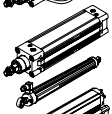
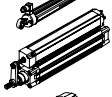
Information on controlling, parameterising and diagnosing the CMPX via the CPX bus node or CPX-FEC used is provided in chapter 4.

Special information on configuration using particular CPX masters is provided in appendix B.

General basic information on the mode of operation, on fitting, installing and commissioning CPX terminals can be found in the CPX system manual, type P.BE-CPX-SYS-... .

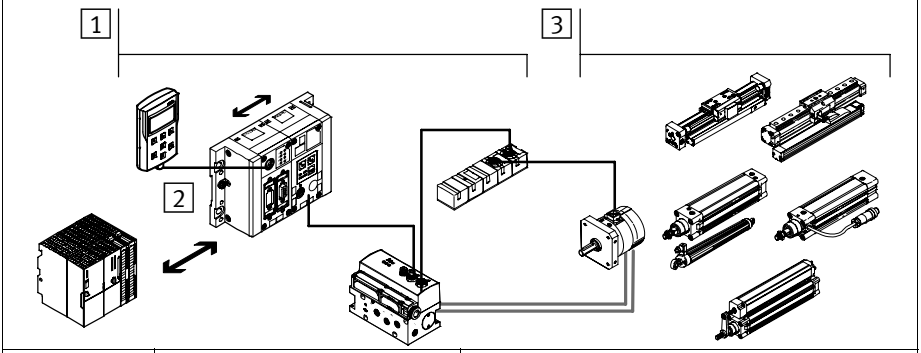
General information on operating the Handheld can be found in the manual for the CPX Handheld, type P.BE-CPX-MMI-1-... .

This manual contains information on the following modules and components of the Soft Stop system:

Module/Component – Type		Description
	CPX-CMPX-C-1-H1	CMPX end position controller with a 7-segment display, control panel and a control interface connection for a VPWP. The CMPX is a CPX module (technology module) in a CPX terminal.
	VPWP-...	VPWP proportional directional control valve with control interface connections for a CMPX and for a measuring system or sensor interface. The displacement encoder or sensor interface is connected to the VPWP.
	CASM-S-D2-R3 CASM-S-D3-R7	Sensor interfaces with a control interface connection for a VPWP, for connecting special displacement encoders to the axis string: – analogue, absolute measuring system (potentiometer) – digital, incremental measuring system
	DGCI-...	Permissible drives with displacement encoders: [1] – Linear drive with permanently installed displacement encoder (digital, absolute)
	DGP(L)-... with MLO-POT-...-TLF	– Linear drive with external displacement encoder (analogue, absolute – potentiometer)
	DNCI-..., DDPC-...	– Standard cylinder with integrated displacement encoder (digital, incremental)
	DNC-... with MLO-POT-...-LWG	– Standard cylinder with external displacement encoder (analogue, absolute – potentiometer)
	DNCM-...	– Standard cylinder with external displacement encoder (analogue, absolute – potentiometer)
	DSMI-...	– Semi-rotary drive with integrated displacement encoder (analogue, absolute – potentiometer)
[1] Support for other drives in preparation		

Tab. 0/2: Overview of modules and components of the Soft Stop system

User documentation for the Soft Stop system



Type	Title, type	Contents
Electronics description	1 “Soft Stop CMPX, Soft Stop system description”, P.BE-CPX-CMPX-SYS-...	Mounting, installation, commissioning and diagnosis of the CMPX end position controller and Soft Stop system.
Product attachments	2 “CMPX parameters”, CMPX-PARAMETER	Permissible drive-valve combinations with mounting positions, load mass and associated parameters for the CMPX.
Operating instructions	3 Operating manual for the drive used, see also Tab. 0/2.	

Tab. 0/3: Documentation for the Soft Stop system

Glossary

The following product-specific terms and abbreviations are used in this manual:

Term/abbreviation	Meaning
0 signal	Input or output provides 0 V (also LOW, FALSE or logical 0).
1 signal	Input or output provides 24 V (also HIGH, TRUE or logical 1).
AB	Output byte
Absolute displacement encoder	A displacement encoder with fixed (absolute) assignment of measurement values (position, angle, etc.) and measurement units.
Amplification stage	The amplification stage influences the acceleration behaviour of the drive, for example. The amplification stage should usually be set as specified in the “CMPX Parameters” appendix. To optimize the positioning behaviour, only the cushioning stage should be modified.
$A0_h$	Hexadecimal numbers are marked by a low-set “h”.
Axis string	The entire collection of all modules and cables connected to the CMPX via the control interface.
Bus node	Provides the connection to specific Fieldbuses. Transmit control signals to the connected modules and monitor their functioning (as CPX module: CPX bus node).
Control interface	Connection for all modules and cables in the axis string.
CPX module	Common term for the various modules which can be incorporated in a CPX terminal.
CPX terminal	Complete system consisting of CPX modules with or without pneumatics.
Cushioning stage	The positioning behaviour is determined by the amplification and cushioning stages. The cushioning stage serves to optimize the approach behaviour when moving to the end positions.
Drive	In this manual, the term “drive” represents linear drives (DGCI, DGP), standard cylinders, positioning drives (DNC, DNCI, DNCM) or swivel modules (DSMI).
FEC	Front-end controller (as CPX module: CPX-FEC)
Handheld	Handheld programmer for commissioning and service purposes

Term/abbreviation	Meaning
I	Digital input From the point of view of the master control system, the CMPX status outputs are module input data, see section 5.3.
I/Os	Digital inputs and outputs
Incremental displacement encoder	A path measuring system in which the measurement variable refers to a reference point and is determined by counting equally large measurement steps (increments).
O	Digital output. From the point of view of the master control system, the CMPX control inputs are module output data, see section 5.3.
Parameter	Parameters which must be set in order that the system can be operated. The amplification stage, the cushioning stage and the system parameter belong here.
PLC/IPC	Programmable logic controller/industrial PC
System parameters	Characteristic value which describes the system structure, the features and components of the drive used.
Teaching procedure	During the teaching procedure, the CMPX checks the set parameters, learns the position of the mechanical fixed stops as well as various characteristic system values and saves these in the integrated EEPROM.

Tab. 0/4: Terms and abbreviations

CMPX System Overview

Chapter 1

Contents

1.1 CMPX end position controller

1.1.1 Connection and display elements of the CMPX

The following connection and display elements can be found on the CMPX:

1 Status LEDs
2 Operating buttons
3 X: Control interface (connection for VPWP)
4 Identification labels (accessories)
5 3-character display
6 Rating plate see side

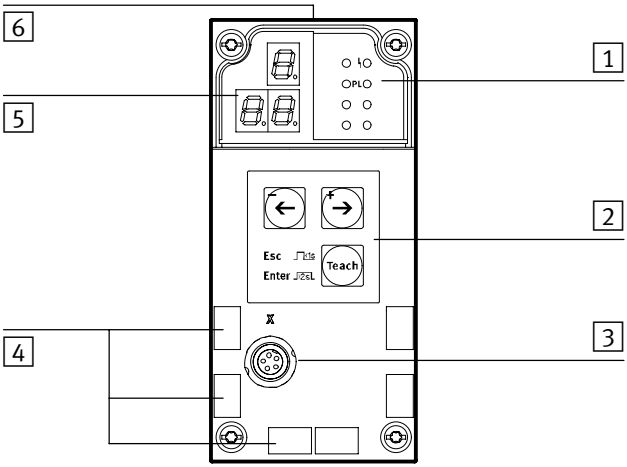


Fig. 1/1: Connection and display elements of the CMPX

1.1.2 Function of the CMPX

In conjunction with an approved proportional directional control valve and a drive with a displacement encoder, the CMPX end position controller forms a Soft Stop system (see section 1.2).

The Soft Stop system allows:

– fast movement into the mechanical end positions and one or two selectable intermediate positions,

– manual movement between the end positions.

End position cushioning, movement to the intermediate positions and manual positioning are electronically controlled.

During commissioning, the end positions (cylinder end positions or position of the fixed stops) as well as the desired intermediate positions are “learnt” by the CMPX.

During operation, the CMPX controls movement of the moveable mass into the saved end positions and intermediate positions at the highest possible speed. Shortly before the “learnt” end position or intermediate position is reached, the moveable mass is braked so that it comes to a standstill.

To keep the moveable mass in the “learnt” end position, it is pressed against the fixed stop (typically at a pressure that is slightly less than the operating pressure).

Advantages

Compared to impact-limited drives with pulse-valve control, this control procedure permits higher positioning speeds. Also, the following measures, which would be required for controlling a drive with a pulse valve, are no longer necessary:

– the use of restrictors,

– the use of limit switches,

– the use of mechanical end position cushioning (shock absorbers),

– the maintenance of fixed stops.

Compared with impact-limited drives with pulse-valve control, the CMPX allows:

– higher machine cycle times,

– less vibration of the system,

– lower maintenance costs.

Mode of operation

CMPX tasks

The CMPX takes over the following tasks:

- It ascertains characteristic system values of the connected components,
- It saves the desired end positions and intermediate positions,
- It specifies the end positions and intermediate positions,
- It compares the nominal and actual positions and controls positioning by appropriate actuation of the proportional directional control valve (status control).

Method of operation

The CMPX, the valve, the drive and the measuring system are connected to form a closed-loop control circuit. In this closed-loop control circuit, the position of the moveable mass represents the control variable. This control circuit is therefore also called positioning control.

1.1.3 CMPX in the CPX terminal

The CMPX is integrated into a CPX terminal as a CPX module and is controlled by the CPX master (bus node or FEC) via the internal bus using 6 module output bytes and 6 module input bytes, see section 5.3.

Information on controlling and parameterising the CMPX via the CPX bus node or CPX-FEC is provided in chapter 5.

1.2 Structure of a Soft Stop system

A Soft Stop system typically consists of the following components (see Fig. 1/2):

1. CPX terminal with CMPX
2. VPWP Proportional directional control valve
3. A sensor interface with measuring system cable (optional, depending on the measuring system used)
4. Drive with displacement encoder (in this example a DSMI)
5. Pneumatic tubing
6. Axis string

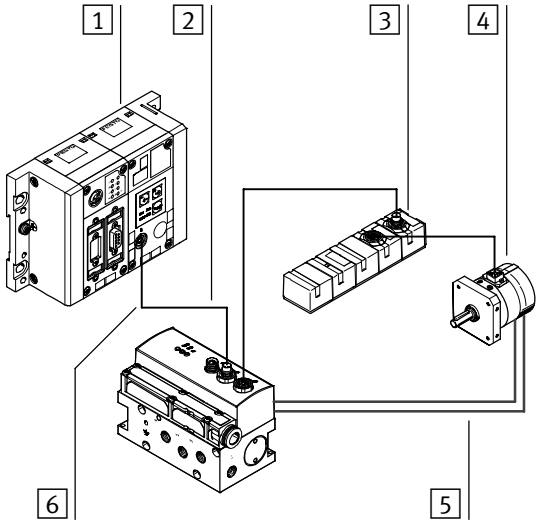


Fig. 1/2: Structure of the Soft Stop system

Specific information on the structure is provided in chapters 2 and 3.

1.3 Commissioning, parameterising and teaching possibilities

Tab. 1/5 provides an overview of the commissioning, parameterising and teaching possibilities.

Operated via	Advantages and disadvantages	For a description see
Control panel with display	+ Direct “on-site” operating with drive monitoring is possible + no accessories required – Parameterisation must be repeated for systems of the same type	Section 4.4
Handheld CPX-MMI	+ Direct “on-site” operating with drive monitoring is possible + Travel to positions 1 ... 4 is possible – Parameterisation must be repeated for systems of the same type	Section 4.5
CPX master (CPX bus node or CPX-FEC)	+ Fast and convenient parameterising of multiple Soft Stop systems is possible + Travel to positions 1 ... 4 is possible – Commissioning and teaching require additional measures for the necessary monitoring of the drive – Additional programming effort required	Chapter 5

Tab. 1/5: Commissioning, parameterising and teaching possibilities

Fitting and pneumatic installation

Chapter 2

Contents

2.1 General notes on fitting and installation

Warning
High acceleration forces at the connected actuators! Accidental motion can cause collisions and severe injuries.

Dangerous movements can occur through faulty controlling of connected actuators, e.g. via:

– Unsafe or faulty circuitry or cabling,
– Faulty operation of the components,
– Faults in the measured value and signal generators,
– Faulty or non-EMC-compliant components,
– Faults in the higher-order control system.

- Before carrying out mounting, installation and maintenance work switch off the operating voltage and the compressed air supply, either simultaneously or in the following sequence:
  1. the compressed air supply
  2. the operating voltage supply for the electronics/sensors
  3. the load voltage supply for the outputs/valves
  Always make sure that the compressed air supply and power supply are switched off and locked before working in the machine area.
- Simply switching off the compressed air supply or load voltage are not suitable locking procedures. In the event of a fault, this could lead to unintentional movement of the drive.
- Do not switch on the compressed air supply until the system is correctly installed and parameterised.
- Holding brakes controlled by the drive controller are alone not suitable to ensure personal protection!
  Provide additional support to protect vertical axes from sliding down when the compressed air and load voltage are switched off, as follows:
  – mechanical locking of the vertical axis,
  – external braking/safety catch/clamping device or
  – sufficient counterbalance of the axis.

Caution
Danger of injury through inappropriate handling of pressurised tubing!

Sudden unexpected movement of the connected actuators and uncontrolled movements of loose tubing can cause injury to human beings or damage to property.

- Do not connect, disconnect or open pressurised tubing.
- The tubes must always be exhausted before removal (release compressed air).
- Use suitable protective equipment (e.g. safety goggles, safety shoes, etc.).

Information on fitting the CPX terminal can be found in the CPX system manual (P.BE-CPX-SYS-..).

Note
The use of components that have not been approved for operation with the CMPX may lead to malfunctions.

Use only the special matching components from Festo for setting up and wiring the system.

When fitting the pneumatic components, observe also the notes on fitting in the operating instructions supplied and the notes on installation in this chapter.
Only then can you guarantee faultless operation.

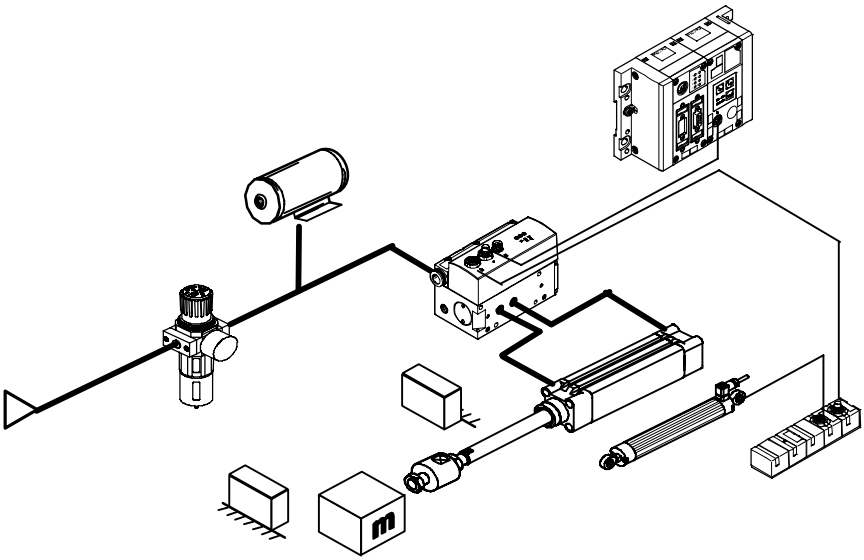


Fig. 2/1: Overview of fitting and pneumatic installation

2.2 Fitting and removing the CMPX

The CMPX is mounted in an interlinking block (see also section 3.4) of the CPX terminal, see Fig. 2/2.

Note
- Always switch off the power supply before fitting or removing CPX modules.

Note
The CMPX contains electrostatically sensitive components.
- Do not therefore touch any contacts.
- Observe the handling specifications for electrostatically sensitive devices.

Removal

Remove the CMPX as follows:

1. Loosen the four screws of the CMPX with a T10 Torx screwdriver.
2. Pull the CMPX carefully and without tilting away from the power rails of the interlinking block.

1 CMPX
2 Interlinking block
3 Contact rails
4 Torx T10 screws

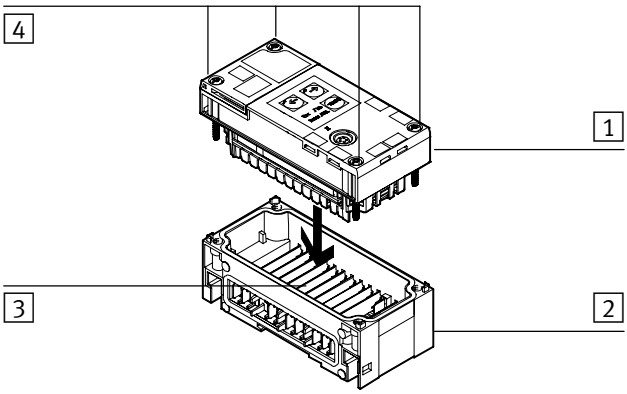


Fig. 2/2: Removal/Fitting of the CMPX

Fitting

Fit the CMPX as follows:

1. Place the CMPX in the interlinking block. Make sure that the grooves with the power contact terminals on the bottom of the CMPX lie above the power rails.
2. Push the CMPX carefully and without tilting as far as possible into the interlinking block.
3. Tighten the screws at first only by hand. Place the screws so that the self-cutting threads can be used.
4. Tighten the screws with a Torx screwdriver size T10 with torque 0.9 ... 1.1 Nm.

The parameterisation and taught positions are stored in the CMPX. After replacing a CMPX, check the parameters and, if necessary, repeat the commissioning process, see chapter 4. Observe the instructions in section A.3.

2.3 Installation of the drive and displacement encoder

Use only the permitted combinations of drives and measuring systems approved by Festo for the CMPX.

Note
In order to avoid damage caused by uncushioned movement into the end positions, the teach procedure must be carried out again after the fixed stops have been adjusted and components and tubing have been replaced.

The following drives can be used:

Drive		**Displacement encoder**		**Sensor interface**
Construction	**Type**	**Function**	**Type**	
Linear drive	DGCI	digital, absolute	Integrated	–
	DGP(L)	analogue, absolute	MLO-POT-TLF-...	CASM-S-D2-R3
Cylinders	DNCI, DDPC	digital, incremental	Integrated	CASM-S-D3-R7
	DNC	analogue, absolute	MLO-POT-LWG-...	CASM-S-D2-R3
	DNCM	analogue, absolute	Integrated	CASM-S-D2-R3
Semi-rotary drive	DSMI	analogue, absolute	Integrated	CASM-S-D2-R3

Tab. 2/1: Drive overview (at of January 2008)

All permissible drives, sizes, lengths, masses or mass moments and mounting positions are listed in the appendix “CMPX Parameters” (Type ...).
Further drives, sizes and mounting positions are in preparation.

2.3.1 General requirements of the mechanics

Note
Connect the drive, guide, measuring system and load **free of play** and flush with each other.

Mechanical play, e.g. between the cylinder piston rod and the mass to be moved, leads to poor movement behaviour (the play presents the controller with “constantly changing mass”).

Note
Lateral loadings produce false measuring results and may damage the measuring system.

- Use an external guide for the working load in order to prevent transverse loadings on the drive.

- Use fastening elements which will permanently resist the acceleration forces.
- If necessary, provide a sufficiently large supply of energy in order to minimise the effects of transverse forces on the positioning behaviour.

Note
Please observe the notes in the operating instructions for the axis used. Make sure that:

– the permitted lateral force,
– the permitted longitudinal force,
– the permitted mass moment of inertia,
– the maximum permitted speeds and swivel frequencies are observed.

The end position cushioning is regulated electronically. In conjunction with the CMPX, this means that special masses or mass moments of inertia may apply (see appendix “CMPX Parameters”).

2.3.2 Drive and fixed stops

Drive

Note
With all work, be sure to follow the mounting instructions in the operating manual.

Note
Observe the permissible mounting positions for use with the CMPX. Only then can you guarantee faultless operation.

The permissible drives and mounting positions for the drive used are provided in the relevant “CMPX Parameters” product appendix.

Additional special notes on the drives are provided in Tab. 2/2 (as of January 2008).

Drive	Description	Notes
DGCI	Linear drive with permanently installed displacement encoder.	–
DGP(L)	Linear drive with external displacement encoder, type MLO-POT-...-TLF.	• Completely unscrew the adjustment screws for the end-position cushioning (PPV) at both sides.
DNCI, DDPC	Standard cylinder with integrated displacement encoder.	–
DNC	Standard cylinder with external displacement encoder, type MLO-POT-...-LWG.	Note The following DNC variants are not permitted for use with the CMPX: – Constant run variant S10 (slow speed) – Light run variant S11 (low friction) – Temperature-resistant variant S6 (only on demand). Use only: – DNC variants with permitted maximum piston speed Vmax › 1 m/s. For standard cylinders with end-position cushioning PPV: • Completely unscrew the adjustment screws for the end-position cushioning (PPV) at both sides.
DNCM	Standard cylinder, external displacement encoder already mounted on delivery.	• Always leave the measuring system fitted to the standard cylinder.
DSMI	Semi-rotary drive with integrated displacement encoder.	• Fit the rotary drive horizontally. The output drive shaft points vertically upwards or downwards.

Tab. 2/2: Notes on mounting the drives

Fixed stops

Fixed stops may be necessary, depending on the specific application and the drive used. These fulfil the following functions:

– Definition or setting of the end positions,

– Protection of the driver or displacement encoder.

Note
Damage due to uncushioned travel into the end positions.
- Always carry out the teaching procedure again after adjusting the fixed stops or when components and tubing have been replaced.

Note
During the teach procedure and during operation, a work load is pressed against the stops at a pressure up to the level of the operating pressure.
- Make sure that the fixed stops can withstand this pressure, so that the end positions can be exactly determined during the teach procedure.
- All fixed stops must be deformation resistant and as inelastic as possible.
- The use of shock absorbers is not permitted!

For fixed stops, always use suitable external stops or Festo stops as per Tab. 2/3.

Information on mounting the Festo fixed stops is provided in the operating manual for the drive or the installation manual for the stops.

Drive	Fixed stops	Mounting instructions
DGCI	– Integrated original stops (drive end length) – Shock absorber retainer of type DADP-DGC (without shock absorber) with stops of type KYC-... – Suitable external fixed stops	• The original stops must not be removed. • Observe the notes in the operating manual!
DGP(L)	– Shock absorber retainer of type KYP-... (without shock absorber) – Suitable external fixed stops	–
DNCI, DDPC	External fixed stops required!	• If the entire drive length is used without fixed stops, the internal cushioning discs of the cylinder will deform. This can cause faults!
DNC	External fixed stops required!	• The use of the whole length of the drive can cause faults. • Fit the fixed stops with a minimum clearance of 0.5 mm from the drive end position!
DNCM	External fixed stops required!	
DSMI	– Integrated original stops (drive end length) – Suitable external fixed stops	• Observe the notes in the operating manual! • Make sure that a cushioning plate is not fitted on the stop lever.

Tab. 2/3: Notes on mounting the fixed stops

2.3.3 Displacement encoder

Tab. 2/4 provides notes on mounting the measuring system.

Drive	Displacement encoder	Mounting instructions
DGCI	Permanently installed displacement encoder.	–
DGP(L)	External displacement encoder of type MLO-POT-...-TLF.	• Use only a measuring system and cylinder with the same stroke length. The measuring system must be longer than the drive stroke used. since an electrical reserve must be available. • Mount the measuring system and drive symmetrically (middle of the measuring system stroke must match the middle of the entire drive stroke), see Fig. 2/3. • For safe and quick mounting of the measuring system: Use the BB-TLF-DGPL-... mounting kit. • Mount the measuring system electrically isolated on the mounting surface using the clamping brackets provided. When used under difficult environmental conditions (dusty environment): • Mount the measuring system with the actuator slide facing downwards. The drip edge on both sides prevents excessive dirt accumulating on the running surface.
DNCI, DDPC	Integrated displacement encoder.	–
DNC	External displacement encoder of type MLO-POT-...-LWG.	• Use only a measuring system and standard cylinder with the same stroke length. • Mount the measuring system and standard cylinder symmetrically (middle of the measuring system stroke must match the middle of the entire cylinder stroke).
DNCM	External displacement encoder already mounted on delivery	• Always leave the measuring system mounted on the standard cylinder. • Observe the notes in the operating manual.
DSMI	Integrated displacement encoder.	–

Tab. 2/4: Notes on mounting the displacement encoder

External displacement encoder MLO-POT-...:

The remaining path of the measuring system slide must be identical in the cylinder end positions on both sides.

1 Remaining slide path

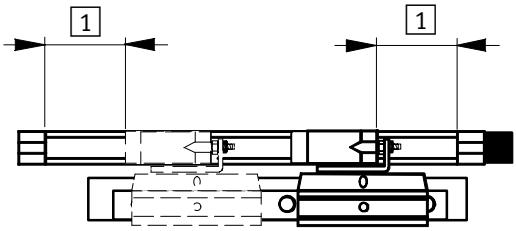


Fig. 2/3: Symmetrically mounted measuring system (MLO-POT-...-TLF)

2.3.4 Mass load

All permissible drives, sizes, lengths, masses or mass moments and mounting positions are listed in the appendix “CMPX Parameters” (Type ...).

- Mount the load mass free of play, if necessary use a guide for this.

Notes on coupling (piston rod drive)

If a coupling is required between the piston rod and the guide:

- Check the play of the coupling.
  The following applies here: coupling play ≤ 0.05 mm
- Set the play of the coupling accordingly.

If the coupling play is too large, it may not be possible to carry out the teach procedure successfully. If there is too much coupling play this may cause:

– noise due to knocking on the coupling

– increased wear on the coupling

– deterioration in travel behaviour.

Make sure that the coupling play does not exceed 0.05 mm.

Recommendation: Use a Festo coupling (e.g.) type KSZ-M...

Notes on the mass moment of inertia (Semi-rotary drives)

Note
Internal vibrations of the mass load can lead to malfunctioning.

- Fasten the mass load so that vibration is kept to a minimum.
- Avoid masses on long, flexible lever arms.

1 Favourable internal vibration behaviour

2 Unfavourable internal vibrations are not permitted

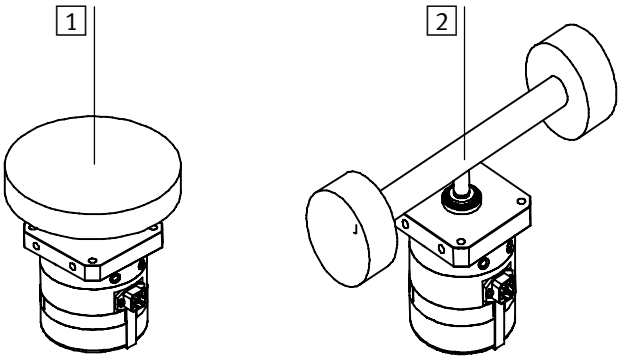


Fig. 2/4: Example: Favourable and unfavourable internal vibration behaviour of the mass

For permissible mass moments of inertia, see appendix “CMPX Parameters”. This contains a table with all permissible drive-valve combinations and mass moments of inertia for the CMPX.

Festo supports you in calculating the mass moment of inertia with the MTM calculation program (Internet: http://www.festo.com).
This program is used for calculating the 2nd. grade mass moments of inertia for various basic bodies and Festo standard parts (e.g. plug-on flange for DSMI-...).

2.4 Mounting the VPWP proportional directional control valve

Mount the VPWP proportional directional control valve on an even surface with two M3 bolts and one retaining washer each, see Fig. 2/5. Tightening torque: 1.5 Nm ± 10%

1 M3 screws with retaining washers

2 Earth connection (see section 3.1)

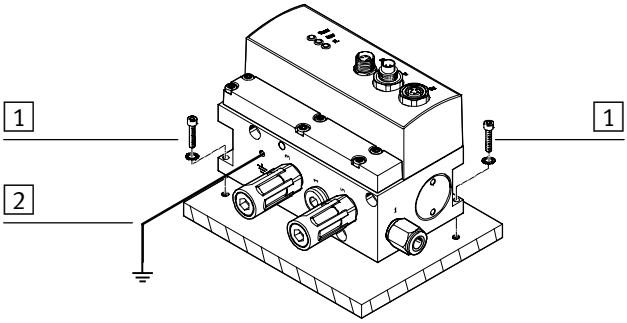


Fig. 2/5: Fitting the VPWP

When fitting to moving parts:

- Attach the VPWP perpendicular to the direction of movement. Acceleration forces thus have no influence on the valve slide setting.

1 Fitting at right angles to the direction of movement

2 Non-permitted: Fitting in the direction of movement

3 VPWP proportional directional control valve

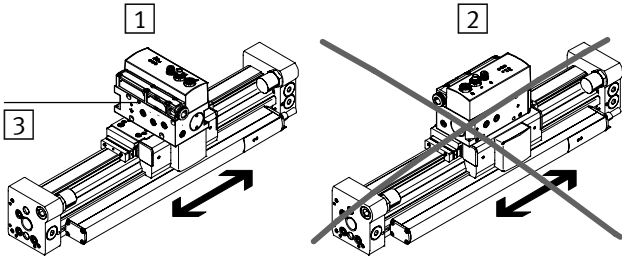


Fig. 2/6: Fitting the VPWP on moving parts

H-rail mounting

You require the following mounting materials to mount the VPWP on H-rails.

Valve	Module retainer	
	P. No.	Type
VPWP-2, ...-4, ...-6	527392	CPASC1-BG-NRH
VPWP-8, ...-10	123491	CPV10-VI-BG-NRH

Tab. 2/5: VPWP H-rail mounting set

Fitting onto a hat rail:

1. Ensure that the mounting surface can carry the weight of the VPWP.
2. Mount the H-rail (mounting rail EN 60715-TH35).
   Be sure to leave sufficient space for connecting the supply cables and tubes.
3. Screw the 2 mounting brackets from the mounting set to the VPWP using the screws provided (see Fig. 2/7).
   Tightening torque: 1.5 Nm.
   Make sure that the fixing bolts of the bracket grip into the groove of the VPWP.
4. Hang the VPWP on the H-rail. Secure against tipping or slipping by using the H-rail clamping unit.

1 Fixing bolts (underneath the VPWP-8/10)

2 M4x10 screw

3 H-rail

4 H-rail clamping unit

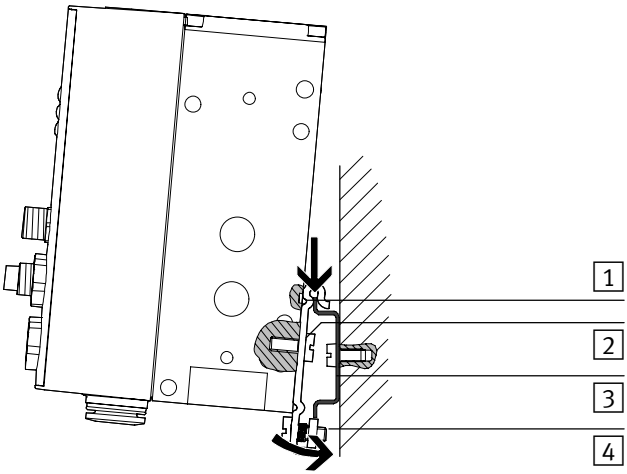


Fig. 2/7: Mounting the VPWP on an H-rail

2.5 Mounting the CASM-... sensor interface

Mount the CASM-... sensor interface on an even surface with two M4 bolts and one retaining washer each, see Fig. 2/8.
The ⊘ symbol marks the position of the fastening screws.
The outer fastening screw serves at the same time for earthing (1).
Tightening torque: 2 Nm.

1 Fastening screw (connect earthing)

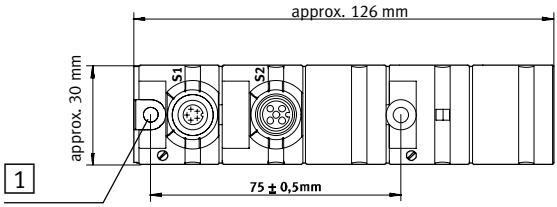


Fig. 2/8: Mounting the CASM-...

Fastening on H-rails as per EN 60715 is possible with mounting kit type CP-TS-HS35, see Fig. 2/9.

1 H-rail

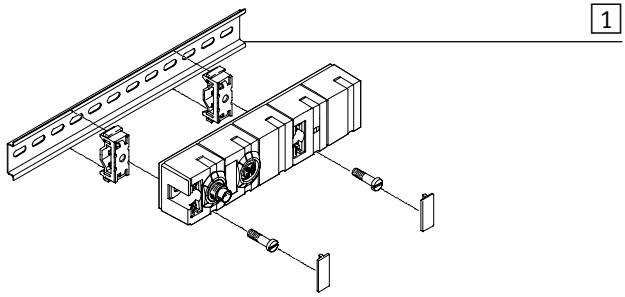
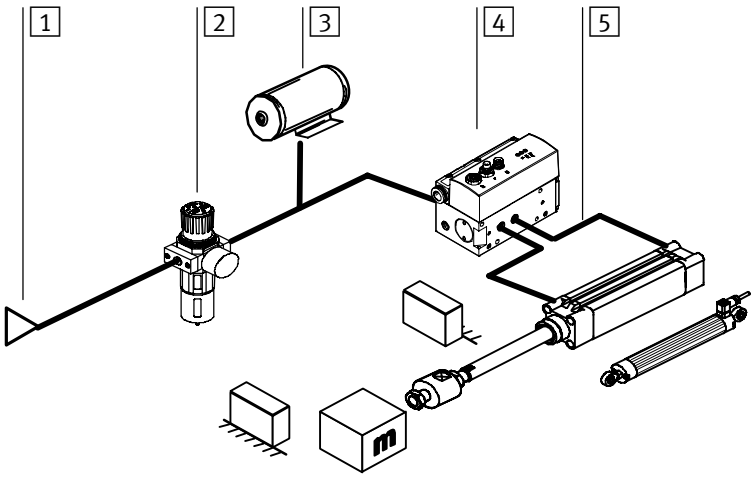


Fig. 2/9: Mounting the CASM-... on H-rails

2.6 Pneumatic installation

Note
Observe the following instructions on installing the pneumatic components. Only then can you guarantee faultless operation.



1 ... 5 : For instructions on pneumatic installation, see sections 2.6.1 to 2.6.5

Fig. 2/10: Overview of pneumatic installation

2.6.1 Compressed air supply

Requirements of the compressed air supply:

- Use only dry, unlubricated, 5 µm filtered compressed air.
- Permissible pressure range: 5 ... 7 bar.

2.6.2 Filter regulator

- Use a filter regulator consisting of a compressed air filter and a regulating valve (e.g. type LFR-...-D-... with 5 µm filter element) in conjunction with a soft-start valve (e.g. HEL-...):
  - without lubricator
  - with a 5 µm filter
  - with sufficiently large standard flow corresponding to the air requirement of the connected drive during positioning. Reference value: twice the standard flow of the valve (type VPWP), e.g.:

Valve (fitting)	Filter regulator
VPWP-2-... (M5)	LFR-1/8-D-5M-MINI or MS4-LFR-1/4-D7-CRM-AS
VPWP-4-... (1/8-LF)	LFR-1/8-D-5M-MINI or MS4-LFR-1/4-D7-CRM-AS
VPWP-6-... (1/8-HF)	LFR-1/4-D-5M-MINI or MS4-LFR-1/4-D7-CRM-AS
VPWP-8-... (1/4)	LFR-3/8-D-5M-MIDI or MS6-LFR-1/4-D7-CRM-AS
VPWP-10-... (3/8)	LFR-3/4-D-5M-MAXI or MS6-LFR-3/8-D7-CRM-AS

Tab. 2/6: Selection of filter regulator

- Use a fine filter or microfilter if you cannot avoid slight oil mist from the compressed air supply.

2.6.3 Air reservoir (optional)

If the positioning behaviour does not conform to your requirements, and if you ascertain fluctuations in pressure of over 1 bar at the measuring point, then proceed as follows:

- Fit a compressed air reservoir (e.g. type VZS-...-B) between the filter regulator and the proportional directional control valve.

In this way you can reduce fluctuations in pressure during operation. You can compensate for slight excesses in the permitted pressure by using supply tubing with a larger diameter.

Reservoir volume

The reservoir volume should be at least four times as large as the volume of the drive used.

$V_P = 4 * V_Z$

$V_P =$ Buffer volume
$V_Z =$ Cylinder volume
(Linear drives: $V_Z = r^2 * \pi * L_Z$)
$L_Z =$ Cylinder stroke length

2.6.4 Proportional directional control valve type VPWP-...

Arrange the tubing between the valve (VPWP) and the drive symmetrically.

Recommendation for linear drives and drives with piston rod: tubing length = cylinder length

Fig. 2/11 shows a schematic view of the tubing between a cylinder (example) and the VPWP.

1 Working connection 2 (blue release ring):
→ Drive moves in a positive direction

2 Working connection 4 (black release ring):
→ Drive moves in a negative direction

3 Proportional directional control valve type VPWP-...

4 Filter regulator with 5 µm filter, without lubricator

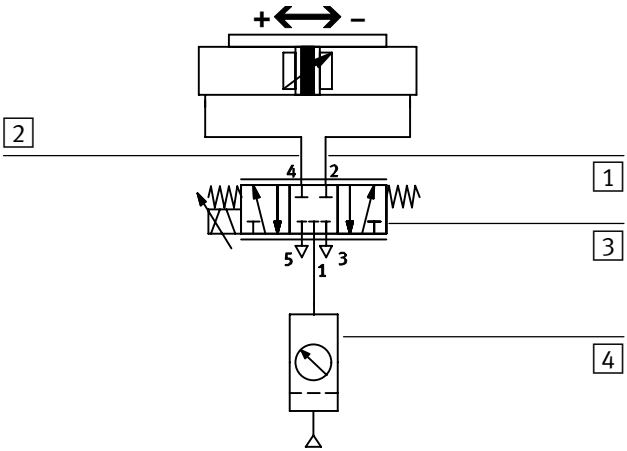
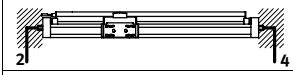
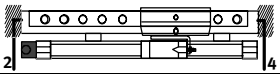
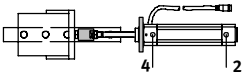
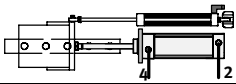
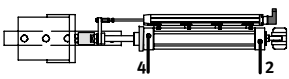


Fig. 2/11: Pneumatic circuit diagram

Drive with measuring system	Direction of movement		Circuit diagram
	Negative (–)	Positive (+)	
DGCI	Towards the measuring system connection	Away from the measuring system connection	
DGP(L) with MLO-POT-...-TLF			
DNCI	Retracted piston rod	Extended piston rod	
DNC with MLO-POT-...-LWG			
DNCM			
DSMI	Clockwise (view of stop lever)	Anticlockwise (view of stop lever)	

Tab. 2/7: Direction of movement and tubing

Tubing fitting aid for the DGCI

When ordering the DGCI with fittings – Standard (no modular system feature) or modular system feature “QD” or “QR”: The fittings on the valve and drive have colour-coded release rings.

- Connect the fittings with blue release rings and black release rings to the corresponding fittings with release rings of the same colour.

Silencer

The VPWP is available with an integrated flat plate silencer.

When using the VPWP without an integrated flat plate silencer:

- Use tubing to connect silencers with a large nominal flow capacity, e.g. UC-M5, U-1/8, U-1/4 or U-3/8 (depending on valve type), or
- Pass the ducted exhaust into a small compressed air reservoir and exhaust this with a large silencer. Make sure that the screw connectors and tubing provide sufficient flow (shortest possible tube length).

With correct layout this can reduce the exhaust noise.

Instructions on converting systems

When converting systems you should use further the existing drives. Usually, only drives with unilateral compressed air connection are available here and the cushioning path (PPV) is used as the drive stroke.

In some cases the specified positioning time cannot be fully achieved.

The specified positioning times and optimum system behaviour can only be achieved if the installation instructions described in the previous section are observed.

Drives with compressed air supply on one side

Please observe the following when using drives compressed air supply on one side:

– A unilateral air supply may only be used with cylinders or drives with a stroke length ≤ 600 mm.

– If compressed air is applied to port 4 of the proportional directional control valve then the drive must move in a negative direction. If compressed air is applied to port 2 then the drive must move in a positive direction. In some cases, arrows on the drive indicate the direction of motion.

– The resulting positioning times may vary according to the direction of the stroke.

2.6.5 Compressed air tubing and fittings

- Use only straight screw connectors. If ellbow connectors cannot be avoided, use plug connectors from the Quick Star series.
- Cut compressed air tubing and hoses to the required size, as specified in “CMPX Parameters” appendix.
- Arrange the tubing between the valve (VPWP) and the drive symmetrically.
- Use only clean compressed air tubing and connectors.
- Do not use flow control valves or one-way flow control valves in the compressed air supply tubes.
- Arrange the tubing so that it does not project into the positioning range.

For good positioning behaviour during operation, fluctuations in pressure of max. 1 bar are permitted in front of the proportional directional control valve. In order to check the stability of the supply pressure, you can fit a pressure measuring point directly in front of the proportional directional control valve.

If necessary, provide a sufficiently large supply of energy in order to minimise the effects of transverse forces on the positioning behaviour.

Electrical installation

Chapter 3

Contents

The CMPX power supply is provided via the CPX terminal, see section 3.4.

3.1 Earthing

The CMPX earthing is provided via the CPX terminal, see the CPX system description.

Observe the additional earthing measures described below, depending on the components used.

Note
Functional faults can occur through incorrect or missing earthing.

- Connect the specified earth connections at low impedance (short cable with large cross-section) to the earth potential.

Unless otherwise specified, the earthing conductors must have:

– A cable cross-section of at least 2.5 mm^2

– A cable length as short as possible (typically 20 ... 30 cm)

VPWP Earthing

- Connect the earth connection of the VPWP to the earth potential of the CPX terminal, see also sections 2.4, Fig. 2/5. Use the thread-cutting screws provided.

Sensor interface earthing

When using a sensor interface:

- Make a low-ohm connection between the earthing connection of the sensor interface and the earth potential of the CPX terminal.

Earthing the drive/measuring system...

Depending on the drive or measuring system used, these must be earthed, see Tab. 3/1.

Drive	Description	Earthing notes
DGCI	Linear drive with permanently installed displacement encoder.	• Make a low-ohm connection (earthing strip) between the flat plug of the displacement encoder and the earth potential! – Flat plug (DIN 46246-2, width: 4.8 mm)
DGP(L)	Linear drive with external displacement encoder, type MLO-POT-...-TLF.	• Install the displacement encoder electrically isolated [1)]
DNCI, DDPC	Standard cylinder with integrated displacement encoder.	• Make a low-ohm connection (short cable with large cross-section) between the earth connection at the cylinder and the earth potential. [1)] A self-tapping screw for fastening an earth strap is supplied with the displacement encoder.
DNC	Standard cylinder with external displacement encoder, type MLO-POT-...-LWG.	• Make a low-ohm connection (earthing strap supplied) between the flat plug of the displacement encoder and the earth potential!
DNCM	Standard cylinder, external displacement encoder already mounted on delivery.	No additional earthing required [1)]
DSMI	Semi-rotary drive with integrated displacement encoder.	• Make a low-ohm connection (earthing strap) between the earth connection of the DSMI and the earth potential!
[1)] Alternatively: Mount the drive on an earthed machine bed.		

Tab. 3/1: Notes on earthing the drive and displacement encoder

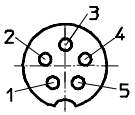
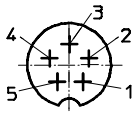
3.2 Axis connection

The VPWP proportional directional control valve is connected to axis connection 'X' of the CMPX. The displacement encoder or a sensor interface (depending on the measuring system) is connected to the VPWP.

This forms an axis string.

Notes on connecting the modules to the axis connection are provided in section 3.2.1.

The axis connection pin assignments for the CMPX, VPWP and sensor interface are Tab. 3/2.

Pin	Allocation	CMPX: X VPWP: Out	VPWP: In CASM: S1
1	Operating voltage 24 V		
2	+ 24 V load voltage		
3	0 V		
4	CAN_H		
5	CAN_L		
Housing	Cable shield [1)]		
[1)] Connect each VPWP cable shield to the earth connection			

Tab. 3/2: Pin allocation of the axis connections

3.2.1 Permissible module and string lengths

Maximum permissible cable length of the axis string: 30 m (total length CMPX – VPWP – Sensor interface or measuring system).

Connecting cable	Length	Type
Connecting cable WS-WD, angled plug – angled socket	0.25 m	KVI-CP-3-WS-WD-0.25
	0.5 m	KVI-CP-3-WS-WD-0.5
	2 m	KVI-CP-3-WS-WD-2
	5 m	KVI-CP-3-WS-WD-5
	8 m	KVI-CP-3-WS-WD-8
Connecting cable GS-GD, straight plug – straight socket	2 m	KVI-CP-3-GS-GD-2
	5 m	KVI-CP-3-GS-GD-5
	8 m	KVI-CP-3-GS-GD-8
Connection piece, for cabinet feed-through	–	KVI-CP-3-SSD

Tab. 3/3: Overview of cables between CMPX, VPWP, sensor interface, measuring system

3.2.2 VPWP Proportional directional control valve

The VPWP has incoming (In) and outgoing (Out) connections, see section 3.2.

Digital output DO (brake)

A digital output DO for controlling a valve for a brake or clamping unit is also available. This is controlled via the CMPX I/O data (see section 5.3).

Load voltage supply

The load supply voltage provided at pin 4 can (e.g.) also be used for switching a valve when the load supply V_{VAL} drops out, see section 3.4.3.

Pin	Allocation	DO
1	n.c. = (not assigned)	
2	Digital output (brake)	
3	0 V	
4	+ 24 V voltage output (load supply)	

Tab. 3/4: Pin assignments of connection DO of the VPWP

Technical data	Value
Digital output (pin 2)	
– Actuation	Via I/O data
– Supply	From 24 V_{VAL}
– Max. current	500mA
– Fuse protection	Short-circuit safe [1]
– Version	To IEC 61131-2, positive logic (PNP)
– Electrical isolation	No
Voltage output (Load voltage, pin 4)	
– Supply	From 24 V_{VAL}
– Max. current	500 mA
– Fuse protection	Short-circuit safe [1]
[1] Temperature switch-off: Maximum short-circuit current (short term) is defined only by the cable and connection resistances	

Tab. 3/5: Technical data of connection DO

3.2.3 Sensor interface CASM

The sensor interface type CASM-... have an incoming (S1) connection, see section 3.2.

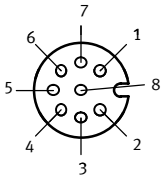
A corresponding input (S2) for connecting the specific displacement encoder is also available, see Tab. 3/6.

Drive	**Displacement encoder**	**Sensor interface**	**Connecting cable**
DGCI	Permanently mounted	– (no sensor interface required)	KVI-CP-3-...
DNCI, DDPC	Integrated	CASM-S-D3-R7	Permanently connected to DNCI/DDPC.
DNC	External, MLO-POT-...-LWG	CASM-S-D2-R3	NEBC-P1W4-K-0,3-N-M12G5
DSMI	Integrated		
DGP(L)	External, MLO-POT-...-TLF		NEBC-A1W3-K-0,3-N-M12G5
DNCM	External, fitted on delivery		

Tab. 3/6: Overview of sensor interfaces and measuring system cables

CASM-S-D3-R7

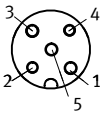
Sensor interface for digital, incremental measuring systems, with M12 measuring system connection (socket, 8 pin).

Pin	Allocation	S2
1	+ Vb Sensor (5 V)	
2	0 V	
3	Signal sine +	
4	Signal sine –	
5	Signal cosine –	
6	Signal cosine +	
7	Screening	
8	n.c. (not connected)	
Housing	Earthing connection (FE)	
The cable screening is connected to the earthing terminal of the sensor interface.		

Tab. 3/7: Pin assignment of connection S2 with the CASM-S-D3-R7

CASM-S-D2-R3

Sensor interface for analogue, absolute measuring system (potentiometer), with M12 measuring system connection (socket, 5 pin).

Pin	Allocation	S2
1	Measuring system housing	
2	n.c. (not connected)	
3	Analogue GND (AGND)	
4	Reference voltage 5 V (REF 5 V)	
5	Analogue input 0 ... 5 V (INPUT)	
Housing	Earthing connection (FE)	
The cable screening is connected to the earthing terminal of the sensor interface.		

Tab. 3/8: Pin assignment of connection S2 with the CASM-S-D2-R3

3.3 Ensuring protection class IP65/IP67

With a completely installed axis string (all plug connections inserted), the CMPX in the CPX terminal conforms to protection class IP65/IP67.

Note
To comply with protection class IP65/IP67:

- Seal unused connections with the protective caps supplied.

If the axis connection is not used, then seal this using a FLANGESOCKET, S712 protective cap. You will then comply with protection class IP65/IP67.

For the VPWP a protective cap type ISK-M8 for the outputs (DO, brake) is included in the scope of delivery.

3.4 Power supply

The power supply for the Soft Stop system with the CMPX interface is provided via the following connections on the CPX terminal (interlinking blocks with power supply):

Interlinking block CPX-EV-S... or CPX-M-EV-S... ($V_{EL/SEN}$)

The power supply for the following is provided via the operating voltage supply for the electronics/sensors ($V_{EL/SEN}$) of the CPX terminal:

- Internal electronics of the CMPX
- Internal electronics of the VPWP
- Connected sensor interface (optional)
- Connected displacement encoder.

Interlinking block CPX-EV-V..., CPX-M-EV-V..., CPX-EV-S... or CPX-M-EV-S... (V_{VAL})

The power supply for the following is provided via the load supply for the valves (V_{VAL}) of the CPX terminal:

- 24 V load supply of the VPWP
- Brake output (digital output) of the VPWP.

Note
Malfunctioning due to power supply outside the tolerance.

The module with the lowest tolerance always determines the permitted voltage tolerances.

- If the CMPX is used, special tolerances according to Tab. 3/9 must be observed for the load supply for the valves ($_{VAL}$) of the CMPX interface.

Load supply for valves (V_{VAL})	**Tolerance**
CMPX	20 ... 30 V [1]
[1] If midi/maxi pneumatics are also supplied via the load supply for the valves: 21.6 ... 26.4 V	

Tab. 3/9: Permitted voltage tolerance

3.4.1 Ascertaining the current consumption

The current consumption of a CMPX system depends on the number and type of the modules connected to the axis string.

Recommendation:

- Use a closed-loop controlled power unit.
- When selecting the power unit, check that it has sufficient output. Calculate the total current consumption, if necessary.

Calculations

Tab. 3/10 and Tab. 3/11 show the current consumption for a Soft Stop system.

Observe the notes on selecting the power unit in the CPX system manual.

CMPX current consumption via $V_{EL/SEN}$ of the CPX terminal	
Typical current consumption	200 mA
Maximum current consumption	**300 mA**

Tab. 3/10: Current consumption via $V_{EL/SEN}$ of the CPX terminal

Current consumption of V_{VAL} of the CPX terminal	
Typical current consumption for the VPWP valve	1 A
Maximum current consumption for the VPWP voltage output	0.5 A
Maximum current consumption for the VPWP voltage output	0.5 A
Maximum total current consumption	**2.5 A**

Tab. 3/11: Current consumption from V_{VAL} of the CPX terminal

3.4.2 Power supply arrangement – formation of power zones

The modular power supply arrangement of the CPX terminal facilitates the formation of power zones.

Observe the following:

– The internal electronics of the VPWP and the digital displacement encoder and, if present, the sensor interface are supplied with power by the electronics/sensors operating voltage supply ($V_{EL/SEN}$).
The VPWP load supply and the VPWP outputs are supplied with power by the valve load supply (V_{VAL}).

– The CMPX connects the internal contact rails 0 $V_{EL/SEN}$ to 0 V_{VAL} of the CPX terminal.

  – This means that the operating power supply for the electronics/sensors ($V_{EL/SEN}$) of the CPX terminal and the CMPX load supply for the valves (V_{VAL}) are thus no longer electrically isolated.

  – Complete electrical isolation (all poles) of the valve supply of the VPWP valve terminals is therefore **not** possible, even in conjunction with CPX valve supply type CPX-EV-V.

Note
Damage to components and functional damage

- The CMPX must be supplied via the same potential (common power unit) as the operating power supply for the electronics/sensors ($V_{EL/SEN}$) of the CPX terminal (see also Fig. 3/14).

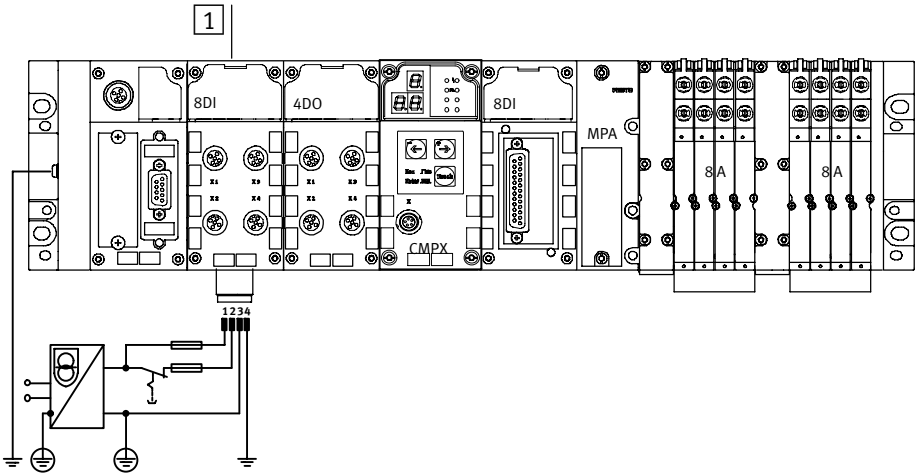
The CMPX always connects the O V supply for the electronics with the O V supply for the valves. This must be noted when a CPX-GE-EV-V interlinking block is located to the left of the CMPX because this can remove an intentional voltage isolation.

Basic information on the power supply arrangement of the CPX terminal can be found in the CPX system manual.

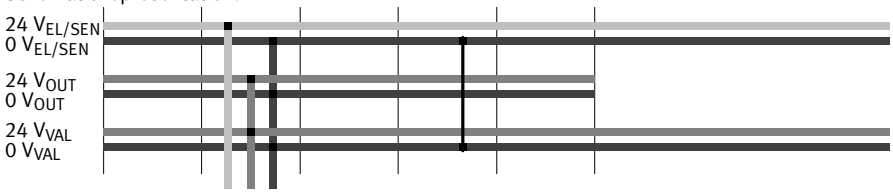
You will find some specific application cases in Fig. 3/12, Fig. 3/13 and Fig. 3/14.

CPX terminal with CMPX + system supply (Fig. 3/12)

In the example, the entire CPX terminal and the CMPX Soft Stop system are provided with power via the system supply.



Schematic representation:



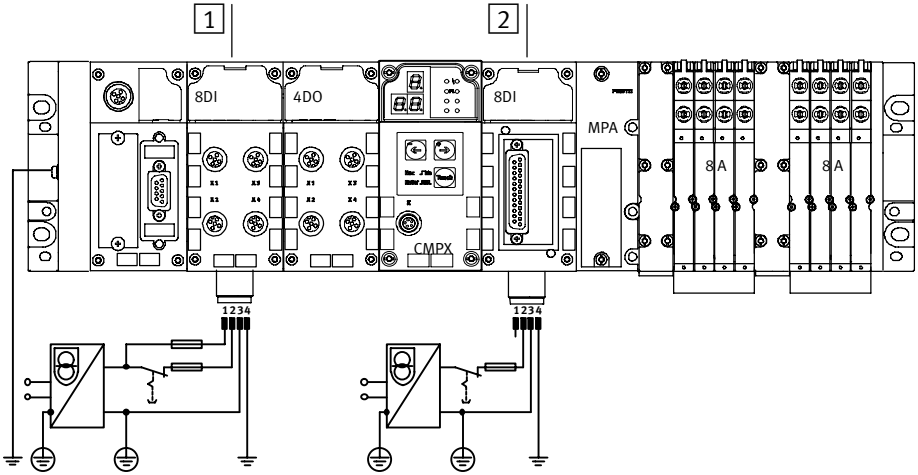
1 Interlinking block with system supply (supplies the CMPX and the MPA pneumatics)

Fig. 3/12: Common power supply (example)

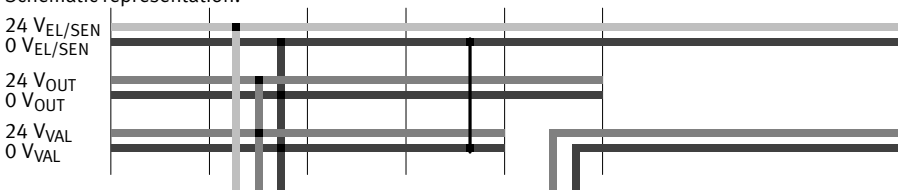
CPX terminal with CMPX + system supply and additional supply for valves (Fig. 3/13)

In the example, the CMPX and thus the Soft Stop system are provided with power via the system supply [1].

The MPA pneumatics are supplied via the valve supply [2] (only permitted with MPA electronic modules type VMPA..-FB-EMG-...). The MPA pneumatics can be switched off at all poles.



Schematic representation:



[1] Interlinking block with system supply (supplied the CMPX)

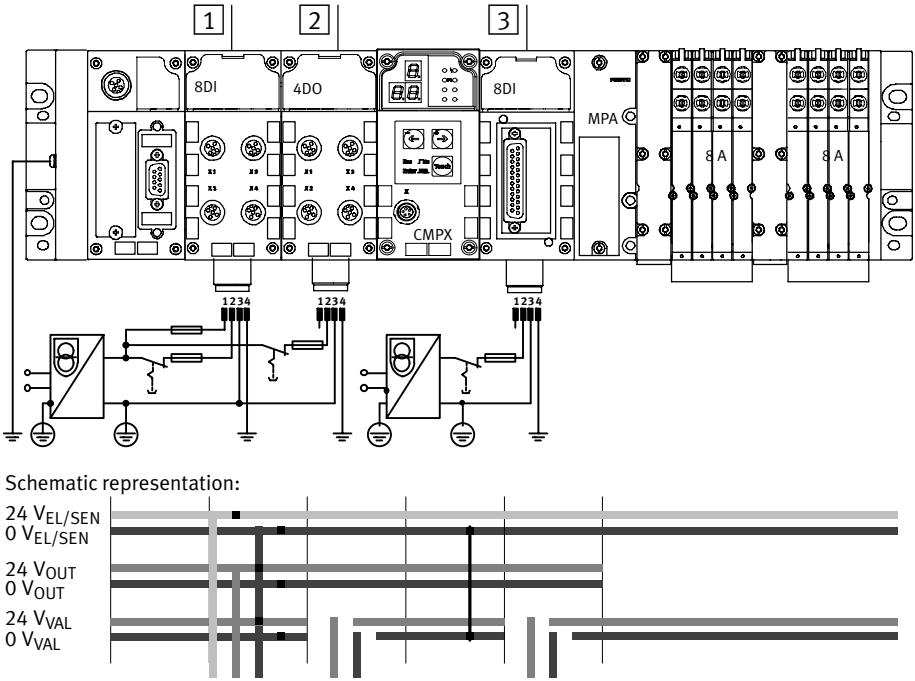
[2] Interlinking block with additional supply for valves (supplies MPA pneumatics)

Fig. 3/13: Separate power supply for MPA pneumatics (example)

CPX terminal with CMPX + system supply and 2 additional supplies for valves (Fig. 3/14)

In the example, the CMPX and thus the Soft Stop system are provided with power via the valve supply 2.
The VPWP load supply can only be switched off single-pole!

The MPA pneumatics are supplied via the valve supply 3 (only permitted with MPA electronic modules type VMPA..-FB-EMG-...).
The MPA pneumatics can be switched off at all poles.



1 Interlinking block with system supply

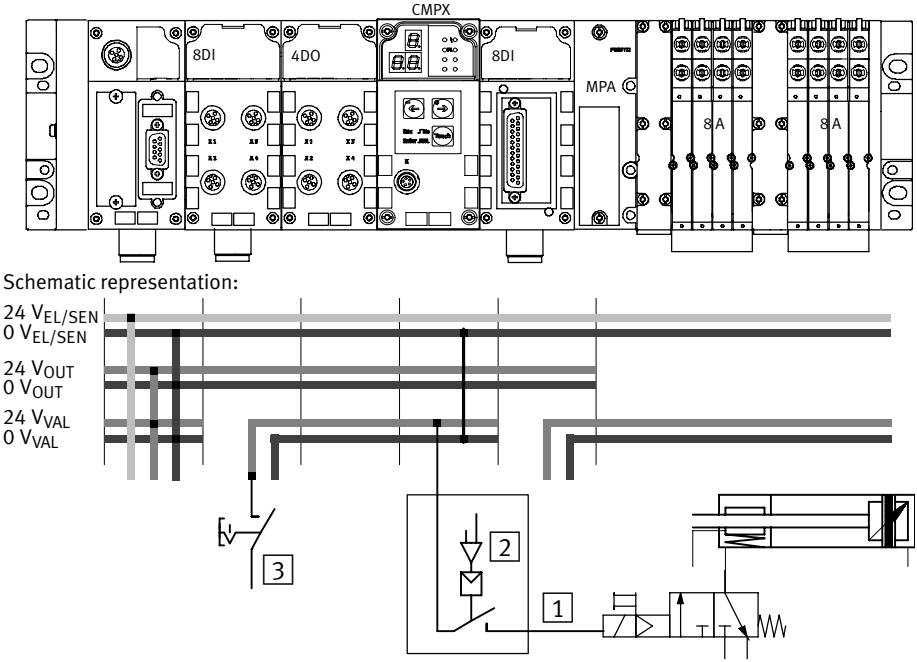
2 Interlinking block with additional supply for valves (supplies the CMPX)

3 Interlinking block with additional supply for valves (supplies MPA pneumatics)

Fig. 3/14: Separate power supply for the CMPX and MPA pneumatics (example)

3.4.3 Power supply concept – switching off the load supply

In the example, circuitry for a brake or clamping unit is connected to the brake output. When switching off, or when the CMPX valve load supply drops out, the brake or clamping unit is activated.



1 Brake output of the VPWP proportional directional control valve

2 Activation/deactivation of the brake/clamping unit by the CMPX

3 Activation of the brake/clamping unit by switching off the load supply

Fig. 3/15: Switching off the load supply of the brake output at the VPWP together with the valve load supply (example)

Commissioning

Chapter 4

Contents

4.1 Overview/Procedure for commissioning

This chapter describes parameterisation and commissioning of the Soft Stop system with the CMPX via:

– The control panel (CMPX keyboard and display), see section 4.4.

– The CPX-MMI Handheld, see section 4.5.

Instructions on commissioning using the CPX Master (CPX bus node or CPX-FEC) are provided in chapter 5.

Warning
High acceleration forces at the connected actuators! Unexpected motion can cause collisions and severe injuries.

Dangerous movements can occur through faulty controlling of connected actuators, e.g. via:

– Unsafe or faulty circuitry or cabling,
– Faulty operation of the components,
– Faults in the measured value and signal generators,
– Faulty or non-EMC-compliant components,
– Faults in the higher-order control system.

- Before carrying out mounting, installation and maintenance work switch off the operating voltage and the compressed air supply, either simultaneously or in the following sequence:
  1. the compressed air supply
  2. the operating voltage supply for the electronics/sensors
  3. the load voltage supply for the outputs/valves
  Always make sure that the compressed air supply and power supply are switched off and locked before working in the machine area.
- Make sure that no persons are in the operating range of the drive or any other connected actuators.

- Simply switching off the compressed air supply or load voltage are not suitable locking procedures. In the event of a fault, this could lead to unintentional movement of the drive.
- Do not switch on the compressed air supply until the system is correctly installed and parameterised.
- Brakes controlled by the drive controller are alone not suitable to ensure personal protection!
  Provide additional support to protect vertical axes from sliding down when the compressed air and load voltage are switched off, as follows:
  – mechanical locking of the vertical axis,
  – external braking/safety catch/clamping device or
  – sufficient counterbalance of the axis.

Note
Incorrectly set parameters can damage the fixed stops and the drive.

Be very careful when setting the parameters.

4.1.1 Instructions on commissioning

System structure

Note
Faults in the system structure and incorrect parameters can cause the drive to move to an end position uncushioned. The fixed stop or the drive may then be destroyed. You must observe the following instructions in order to prevent such collisions.

– The CMPX “learns” the location of the end positions (cylinder end positions or fixed stop positions) by means of the teaching procedure. The teaching procedure must be carried out during the first commissioning and always when the fixed stops have been adjusted or when components and tubing have been replaced.

– During the teaching procedure the CMPX can recognize faulty drive tubing or incorrectly set parameters. The teaching procedure must therefore be carried out again if the tubing is disconnected and then reconnected, or if the parameters A, C, S, L or r are modified.

– Ensure that the maximum permitted mass load is observed during operation.

Recommendation:
Place appropriate warning signs on your system.

CPX bus node or CPX-FEC

Recommendation:
When commissioning using the control panel or Handheld:

• To avoid the influence of I/O signals etc., commission the Soft Stop system without a bus by removing the bus cable or switching the CPX-FEC to “Stop”!

4.1.2 Overview of commissioning steps

When commissioning using the operating panel or the CPX-MMI, the following steps must be performed:

1. If necessary, check the construction of the Soft Stop system with the components used on the axis string (see section 4.2.1).
2. Check the power supply of the CPX terminal, switch on the power supply (see section 4.2.2).

   Warning: Leave the compressed air supply switched off for the moment.
3. Set the CMPX parameters (see section 4.3).
4. Switch on the compressed air supply.
5. Perform a teaching procedure.
6. If necessary, teach the mid-positions.

After commissioning the Soft Stop system:

7. Configure the CPX bus node or CPX-FEC (see section 5.1.1).
8. Check the control of the Soft Stop system using the CMPX (see section 5.6).

4.2 Preparations for commissioning

4.2.1 Checking the axis string

Before commissioning:

- Check the complete system structure, especially the drive tubing and the electrical installation (see chapters 2 and 3).

A list of the steps required to prepare for the teaching procedure is provided in section 4.3.4.

4.2.2 Switching on the power supply, switch on behaviour

Warning
High acceleration forces at the connected actuators!
Unexpected motion can cause collisions and severe injuries.

- **Switching on:**
  Always first switch on the operating voltage supply and then the compressed air supply.
- **Switching off:**
  Before carrying out mounting, installation and maintenance work switch off the operating voltage and the compressed air supply, either simultaneously or in the following sequence:
  1. the compressed air supply
  2. the operating voltage supply for the electronics/sensors
  3. the load voltage supply for the outputs/valves
  Always make sure that the compressed air supply and power supply are switched off and locked before working in the machine area.

Switch on behaviour in delivered state

After switching on the operating voltage the CMPX briefly displays the firmware version number and then waits for the amplification stage to be entered (see Fig. 4/1).

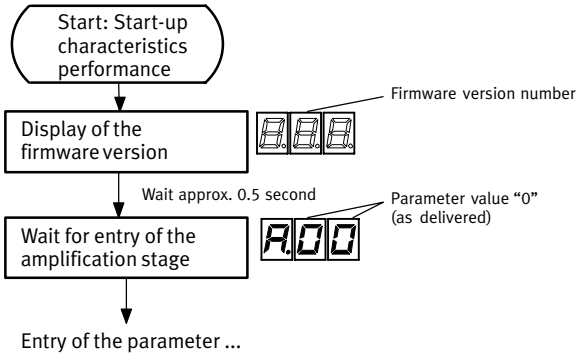
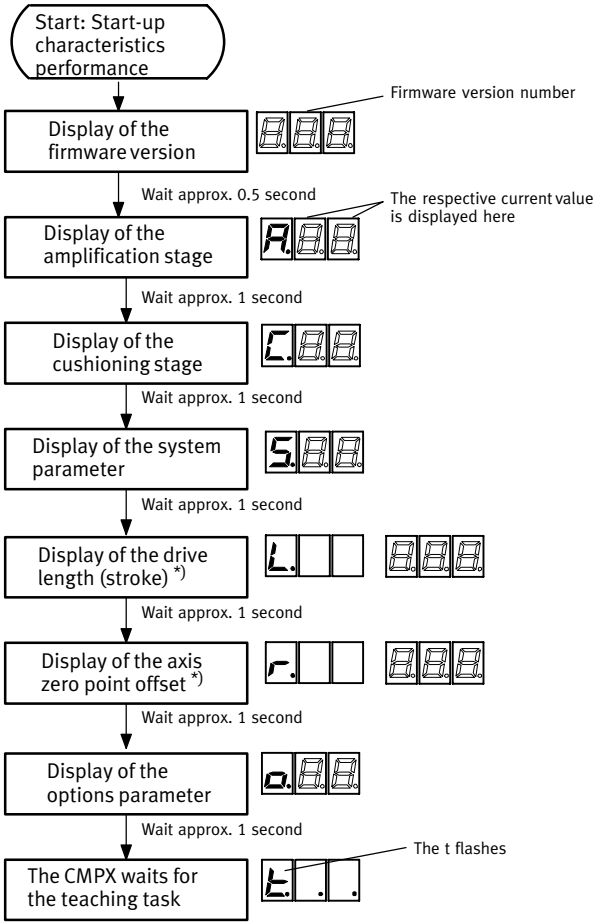


Fig. 4/1: Switch on behaviour in delivered state

Switch-on behaviour after successful pre-commissioning (in the office)

When the operating voltage is switched on again, the CMPX briefly shows the firmware version number and then the values of the set parameters, one after the other. The CMPX then indicates readiness to carry out the teaching procedure (t ...). The t flashes (see Fig. 4/2).



*) Only when using incremental displacement encoders (e.g. DNCI)

Fig. 4/2: Switch-on behaviour of the CMPX after pre-commissioning in the office (parameters set)

Switch-on behaviour after commissioning

If commissioning has already been carried out, the CMPX is ready to operate after a few seconds.

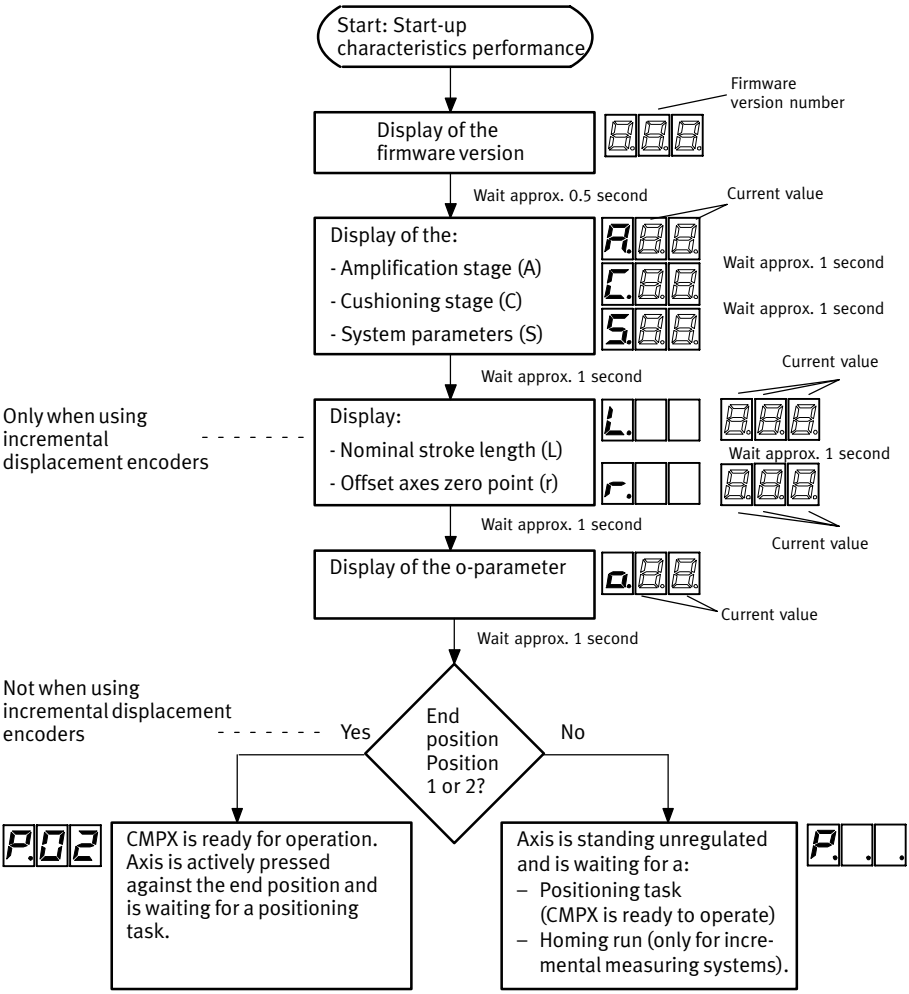
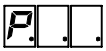
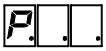


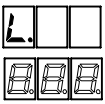
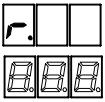
Fig. 4/3: Switch-on behaviour of the CMPX after commissioning

Switch on behaviour when using absolute displacement encoders		
Position of the moveable mass	**Display**	**Installation**
Outside of positions Pos...		The controller is activated, the current position becomes the nominal position ⟶ position-dependent standstill control. Monitoring is done for the faults E.13, E.50 and E.56. The drive is stopped, regulated in the current position, the CMPX waits for the first positioning task.
At end position 1 or 2		A positioning task to the appropriate end position is generated and the moveable mass is then pressed against that end position. The corresponding input (MC_POS1 or MC_POS2) provides a 1 signal, the drive is stopped, regulated in the corresponding position.

Switch on behaviour when using incremental displacement encoders		
Position of the moveable mass	**Display**	**Installation**
Unknown: homing required		The moveable mass remains uncontrolled in the taught position (P...). The CMPX waits for the start of the homing run to position 1 or position 2.

4.3 Basic parameterising and operating principles

The CMPX must be parameterised to suit the operating conditions. These conditions of use are described by the parameters in Tab. 4/1.

Display	Handheld	Parameter	Description
	A Gain	Amplification stage	Influences the acceleration behaviour of the drive.
	C Damp	Cushioning stage	Influences the braking behaviour when moving to the end positions and intermediate positions.
	S Sys	System parameters	Characteristic data of the drive. – First character: Characteristic value for the ratio of drive and measuring system length. – Second character: Characteristic value for the ratio of drive length and drive diameter.
	L Length	Nominal stroke- **l**ength of the drive	Nominal stroke length in 1 mm increments (e. g. nominal stroke 300 mm: L = 300) [1]
	r Refpos	Axis zero-point offset (from **R**eference point)	Offset between end position 1 and the axis zero point in 1 mm increments [1]
	o Option	Option parameters (**O**ptions)	Allows various options (e. g. stop behaviour etc., see section 4.3.3)
[1] Only when using an incremental displacement encoder, e. g. a DNCI			

Tab. 4/1: Overview of parameters

The parameters can be entered:

– before commissioning (pre-parameterising without drive in the office).

– when commissioning.

– when operating via the CPX-FEC or CPX bus node.

4.3.1 Parameters A, C and S

Parameters A,C and S must be set depending on the drive, valves and load mass.

The values for the parameters are listed in the appendix “CMPX Parameters”.

4.3.2 Parameters L, r

The parameters L and r are only necessary when using incremental displacement encoders (e. g. DNCI).

For incremental displacement encoders the CMPX needs the following information:

– Nominal stroke length (L) of the drive (see type designation on the type plate, e.g. type DNCI-32-**300**-P-A has a nominal stroke length of 300 mm).

– Offset axis zero point (r) – offset between the end position 1 and the axis zero point (see Fig. 4/1).
With an offset of 0 mm, the end position 1 lies at the axis zero point.

1 Axis zero point (piston rod run in)

2 Offset axis zero point (r)

3 Fixed stop (here for end position 1)

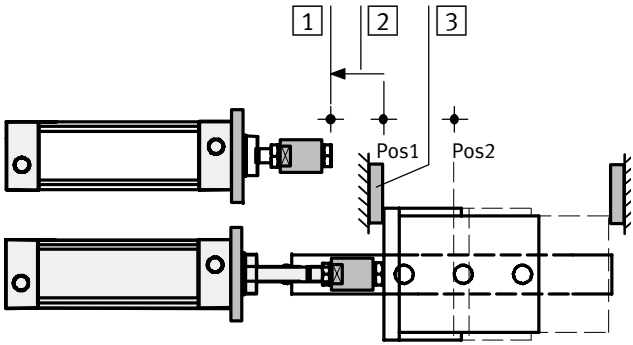


Fig. 4/1: Reference points for incremental displacement encoders

4.3.3 Parameter o

With the parameter o, you can change the signal behaviour of the CMPX and switch off certain standard functions.

The factory setting (o-parameter = 0) means:

– No option selected. Standard behaviour active.

Standard behaviour at factory setting (o-parameter = 0):

– Positioning time monitoring (10 s) active

– Constant adaptation active

– Soft end position behaviour active

– Stop without return travel (ramp).

Internally, the decimal value is interpreted as binary.
A specific option is assigned to each bit (see Tab. 4/2).
Only allowable option combinations can be set.
This results in a possible value range of 00 to 46 for the o parameter.

Parameter o (options)

Bit	Decimal value at 1	Option	Description
0	1	Reserved	– (no function)
1	2	Positioning time monitoring	Switches off the time monitoring during a positioning order. It is then not monitored whether the position is reached within approx. 10 s. 0 = Positioning time is monitored 1 = Positioning time monitoring is switched off
2	4	Constant adaptation	Switch off constant adaptation. Adaptation is then active after operating voltage is switched on only within the first 20 strokes. [1)] 0 = Adaptation operative 1 = No adaptation
3	8	Soft end position behaviour	Switches off soft end position behaviour. Travelling into the end position takes place with somewhat more remaining energy. You can reduce the cycle time with this function (up to max. 15%, depending on drive and mass load). 0 = Soft end position behaviour 1 = Switch off soft end position behaviour
4	16	Reserved	– (no function)
5	32	Stop behaviour	Stop signal behaviour (STOP output): [2)] 0 = Stop without return travel (with ramp): With a 0 signal at STOP, the drive stops using the braking ramp determined in the teaching procedure. [3)] 1 = Stop with return travel: With a 0 signal at STOP, the current position is taken over as the Stop position after an internally required signal processing time. The drive is braked with maximum power and travelled back to the Stop position.
6	64	Reserved	– (no function)
7	128	Reserved	– (no function)

1) With an oscillating mass load, constant adaptation can negatively influence travel behaviour.
2) A stop during the teaching procedure stops the drive without control. The procedure must then be restarted. A stop during the first positioning task causes error E.14, the drives stops and is unregulated. Direction of movement recognition remains active.
For instructions on stopping, see Tab. 4/3 and Fig. 4/2.
3) The brake ramps are dependent on direction and are automatically determined in the teaching procedure.

Tab. 4/2: o-parameter values

Determine value of the o-parameter

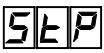
Different combinations of options are possible. You determine the value to be set through addition of the individual decimal values of the desired options.

Example:

Options	Bit	Calculation
Switch off soft end position behaviour	3	+ 8
Stop with return travel	5	+ 32
Total (value to be set)		**= 40**

Alternative calculation								
Bit no.	7	6	5	4	3	2	1	0
Bit value	0	0	1	0	1	0	0	0
Calculation	$1 * 2^3 + 1 * 2^5 = 40$							

Behaviour when stopping

Possible states after the stop signal			**Note**
Stop time	**Condition after stop**	**Display**	
Teaching procedure	– Drive is uncontrolled. – Input ACK_STOP supplies a 1 signal.		Restart the teaching process
Reference travel			Restart a reference travel to position 1 or 2
Teach position 3 or 4	– Drive is controlled. – Input ACK_STOP supplies a 1 signal.		Continue teaching position 3 or 4
Operation	– Drive is controlled. – Input ACK_STOP supplies a 1 signal when the drive has stopped.		Continue operation

Tab. 4/3: States after the stop signal

1 Setting STOP triggers a command to stop the drive according to the configured o-parameter

2 ACK_STOP is set as soon as the drive has stopped

3 When STOP is reset, the current actual position is used as the nominal position

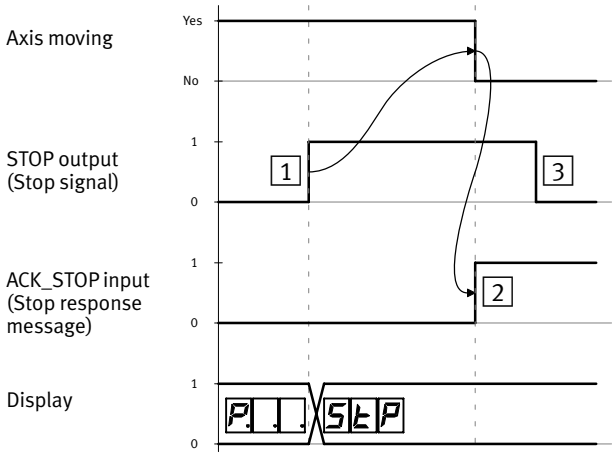


Fig. 4/2: Stopping sequence diagram

Note

The current reference position is held as long as the stop signal is set.

If the drive is moved during this period with the compressed air switched off and the compressed air switched back on again, the drive returns to the reference position.

When the stop signal is reset, the current position is used as the nominal position.

4.3.4 Teaching procedure

The teaching process occurs in 2 steps.

Static identification

During the teaching procedure, movement is made at first cyclically and slowly to end positions 1 and 2. In this way the CMPX learns the mechanical end positions and some characteristic system values such as friction and hysteresis. The CMPX saves these values in the integrated EEPROM.

Dynamic identification

In order to check the set parameters for plausibility, the moveable mass is first brought dynamically into the centre of the positioning stroke used and then moved to just in front of end position 1.

Note
When using an incremental displacement encoder (e.g. with a DNCI):

During the teaching procedure, movement always occurs to end positions 1 and 2. This creates the relationship between measurement variable and current position. Reference travel is not necessary.

The teaching procedure is concluded when the moveable mass is pressed against end position 1 and input MC_POS1 supplies a 1 signal.

Before commissioning can be undertaken, the pneumatic drive must be ready for operation. The teaching procedure should be carried out with maximum permitted mass load. During the teaching procedure there must be a 0 signal at outputs POS1 to POS4.

Preparing the teaching procedure

To prepare for the teaching procedure, proceed as follows:

The permissible stroke length and the associated parameters for the drive used are listed in the “CMPX Parameters” appendix. The currently set values will be shown briefly when the operating voltage is switched on (see also section 4.2.2, Fig. 4/2).

1. Check the complete system structure, especially the drive tubing and the electrical installation (see chapters 2 and 3).
2. If fixed stops are used:
   Set the fixed stops accurately in the desired end positions.
3. Switch on the power supply. Observe the instructions in sections 4.2.1 and 4.2.2
4. Check whether the parameters have already been correctly set in pre-commissioning.
   If necessary, set these correctly.
5. Switch on the compressed air supply.

You can now start the teaching procedure in accordance with the appropriate instructions (via operating panel, CPX-MMI, I/O data).

Preconditions for the teaching procedure

0 signals must be present at outputs POS1 to POS4. The parameters must be set correctly. The maximum mass load and, if applicable, the fixed stops must be fitted correctly.

You can start the teaching procedure using the following methods:

– If a teaching procedure has not yet been performed:
  Press the **Enter** (Teach) button for longer than 2 seconds.
– Start via the CPX-MMI.
– Via the I/O data module with the START_TEACH output.

Adaptation after the teaching procedure

Adaptation

The positioning behaviour is monitored continuously during operation. Internal characteristic values are adapted here to match the actual state of the drive, e.g. in order to compensate for wear during the service period.

After commissioning, the positioning behaviour improves by adaptation automatically after approximately 20 to 30 strokes. Therefore, after teaching the end positions and intermediate positions, always allow 20 to 30 positioning cycles to be carried out.

Carry out teaching procedure again

When the CMPX is ready for operation, the teaching procedure can be carried out again at any time.

The same preconditions apply as for the first teaching procedure.

If the end positions are taught again, the adaptation values will be deleted. Intermediate positions already “taught” are retained.

If, after you have taught the end positions again, the previously taught intermediate positions (positions 3 and 4) now lie outside the positioning range, positioning commands to move to the intermediate positions will be exited and an error will be generated (see section 6.2.3). As soon as the intermediate positions lie again in the permitted positioning range by adjustment of the end stops and teaching again of the end positions, or by renewed teaching of the intermediate positions, positioning commands to move to the intermediate positions will be carried out again.

4.3.5 Reference travel

With incremental displacement encoders, the measurement variable refers to a reference point and is determined by counting equally large measurement steps (increments). The relationship between measurement variable and current position is created through the reference travel.

Referencing in the teaching procedure	During the teaching procedure, movement always occurs to end positions 1 and 2. This creates the relationship between measurement variable and current position. An additional reference travel is not necessary.
Homing run after POWER ON	After the CMPX operating voltage is switched on again, the relationship between measurement variable and current position is lost. Reference travel to the end positions 1 or 2 is necessary (see also section 4.6.1).

4.3.6 Intermediate positions

The CMPX allows rapid travel to a maximum of two selectable intermediate positions (positions 3 and 4). The desired intermediate positions are “learnt” by manual movement or by shifting the moveable mass and then saving. The “learnt” intermediate positions can be travelled to during operation.

The intermediate positions can also be used as sensor positions, because the relevant input MC_POS3 or MC_POS4 supplies a 1 signal for 50 ms when the intermediate positions are travelled over (see section 5.7).

Requirement

The drive must be ready for operation. 0 signals must be present at outputs POS1 to POS4.

Variants	Procedure
Motion without supply pressure [1)]	The moveable mass can brought into the desired position very accurately by hand during the teaching procedure.
Motion with supply pressure	The mass can be moved manually. Under certain circumstances, very accurate positioning can be difficult and may take a considerable amount of time.

[1)] The pressure monitoring of the VPWP proportional directional control valve means that the supply pressure cannot be switched off without generating an error message. To move the mass, the tubes must be removed from the drive and the connections to the VPWP must be closed off.

You can use the following methods for teaching or defining the intermediate positions:

– Move the drive using the ← or → buttons and adopting the desired position using the **Enter** button.

– Moving and adopting using the CPX-MMI.

– Direct entry of the position values using the CPX-MMI.

– Moving the drive using the I/O data module with the JOG_NEG or JOG_POS outputs and adoption using the RETAIN_POS3 or RETAIN_POS4 outputs.

– Direct parameterisation of the position values using the I/O data module.

4.4 Commissioning with the control panel

4.4.1 Display and keyboard

Display

Depending on the operating state, the CMPX display shows one of the following:

– Parameter (see section 4.3, Tab. 4/1) or

– Status information (see section 6.4.2, Tab. 6/7).

Keyboard

Key	Function	Description
– ←	–	Decrementing values when entering parameters
	← (Jog_neg)	Inching operation in negative direction
+ →	+	Incrementing of values when entering parameters
	→ (Jog_pos)	Inching operation in positive direction
Teaching	Enter (› 2 s)	– Confirm the entry – Transfer to next input parameter
	Teach (› 2 s)	– Start of the identification travel – Adoption of intermediate positions
	Esc (‹ 1 s)	– Back to previous input parameter – Interruption of the teaching procedure for intermediate positions
All buttons simultaneously	Editing mode (› 2 s)	– Back to entry of parameters
	Reset (› 2 s)	– Reset all parameters (to factory settings) if the error number E43 (no CAN connection) is present
1) Press the button briefly in order to modify the value by 1. Hold the button pressed down in order to modify the value continuously.		

Tab. 4/4: Functions of the CMPX keyboard

4.4.2 Setting parameters

At the factory, all the parameters are zero (status at delivery). When the power supply is switched on, the CMPX in this case expects entry of the parameters. In preparation for commissioning, the parameters can be set “in the office” without setting up the drive. This simplifies the commissioning of large series in production.

Set the parameters as follows:

Note
Incorrectly set parameters can damage the fixed stops and the drive.

Be very careful when setting the parameters.

The correct amplification and cushioning stages and the system parameter for your drive can be found in the “CMPX Parameters” appendix.
The values specified here are examples. Instead, enter the values valid for setting up your drive.

1. Switch on the operating voltage for the CMPX.
   The CMPX will then show briefly the version number of the internal firmware.
   The CMPX then expects the amplification stage to be entered. The display shows the letter A (**A**mplification stage). The figures indicate the stage (here 0).

    (A.00)

2. Set amplification stage with +/- , e.g. 02.

    (A.02)

3. Hold the Enter key pressed down for more than 2 seconds (› 2 s).
   The value will then be transferred to the CMPX and the cushioning stage will be shown (here 0). This is shown by the letter C (**C**ushioning stage).

   
   (C.00)

4. Set cushioning stage with +/- , e.g. 04.

   
   (C.04)

5. Press the Enter key for › 2 seconds.
   The value will then be transferred and the system parameter shown (here 0).

   
   (S.00)

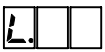
6. Set system parameters with +/-, e.g. 01.

   
   (S.01)

7. Press the Enter key for › 2 seconds. The value will then be taken over.

   If you do not use an incremental displacement encoder, the option parameter (o.00) is displayed. Then read further at point 14.

   If you use an incremental displacement encoder (e. g. DNCI) then you are asked to enter the drive length (stroke, L).

   
   (L.00)

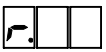
8. Press any desired button to display the drive length in mm (three-digit number).


(000)

9. Set drive length in mm with +/- (see rating plate), e.g. 300 for 300 mm.


(300)

10. Press the Enter key for › 2 seconds. The value will then be taken over and the identifying letter for the offset axes zero point (r) displayed.


(r.)

11. Press any desired button to display the offset axis zero point (r) in mm (three-digit number).


(000)

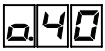
12. Set the axis zero point offset (see also section 4.3.2) in mm with +/-, e. g. 20 for 20 mm.


(020)

13. Press the Enter key for › 2 seconds. The value will then be transferred and the option parameter displayed.

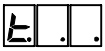

(o.00)

14. Set option parameter (see also section 4.3.3) with +/-, e. g. 40.



(o.40)

15. Press the Enter key for › 2 seconds. The value will then be transferred and the readiness to carry out the teaching procedure will be indicated by a flashing “t”. The parameters are thus saved and pre-parameterising (in the office) is completed.



The t flashes.

When all prerequisites for carrying out the teaching procedure have been made (see section 4.3.4), the teaching procedure can now be started (see section 4.4.4).

16. If you wish to conclude pre-commissioning, switch off the operating voltage.

4.4.3 Changing parameters

The option parameter o can be changed without a new teaching procedure being necessary. After the parameters A, C, S, L or r are changed, the teaching procedure must be performed again.

If necessary, the set parameters can be modified, e.g. in order to correct entry errors or to optimize positioning behaviour. This can be carried out in one of the following ways:

Options	Description
Activate modification mode	In this mode the set parameter values are retained and can be modified or transferred. Taught intermediate positions are retained.
Create status as at delivery	All parameter values are then set to 0. Taught intermediate positions are deleted.

Activate modification mode

Requirement

The measuring system must be connected. A 0 signal must be present at the DISABLE_KEYS output, Force_Mode must not be active at the CPX-MMI.
The drive must be at a standstill.

Note
When the modification mode is activated, the valve slide assumes the mid-position. During positioning the mass can therefore move uncushioned into an end position.

Make sure that the drive is standing still before you activate the modification mode.

Use the buttons as follows to activate the modification mode:

1. Make sure that the drive is standing still.
2. Press all 3 buttons on the CMPX at the same time.

   The display shows the letter A (**A**mplification stage) and the stage set (here 02).

(A.02)

If you have activated the modification mode by mistake, you can abort the procedure by switching off the power supply. If you have already carried out the teaching procedure, you can in this way avoid the need to carry out this procedure again.

With the +/- buttons, you can modify the parameter displayed and transfer it with Enter.

When you change the parameters A, C, S, L or r:
When the last parameter has been transferred, the CMPX then indicates readiness to carry out the teaching procedure (t flashes).

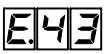
Create status as at delivery

Requirement

The measuring system must **not** be connected. A 0 signal must be present at the DISABLE_KEYS output, Force_Mode must not be active at the CPX-MMI.
The compressed air supply must be switched off.

Use the buttons as follows to create the status as at delivery:

1. Switch off the compressed air and the power supplies.
2. Interrupt the connection between the CMPX and VPWP.
3. Switch on the power supply.
   The CMPX then shows error E.43 (no CAN connection).



(E.43)

4. Restore the connection between the CMPX and VPWP.
5. Press all 3 buttons at the same time (› 2 s).

   The display shows the letter A (**A**mplification stage).
   The value is reset to 0.


(A.00)

With the +/- buttons, you can set the value again and transfer it with Enter. Then set the other parameters again in the same way (see section 4.4.2).

4.4.4 Start teaching process

Requirements

A 0 signal must be present at the POS1 ... POS4 outputs. The parameters must be set correctly. The maximum mass load and, if applicable, the fixed stops must be fitted correctly. In order to start the teaching procedure via the Teach button, a 0 signal must be present at the DISABLE_KEYS output, Force_Mode must not be active at the CPX-MMI.

To prepare for the teaching procedure, proceed as described in section 4.3.4.

Note
In order to avoid damage caused by uncushioned movement into the end positions
- with the first commissioning
- when the fixed stops have been adjusted
- after changing the parameters A, C, S, L, r
- or after replacing components or tubing, always proceed as follows:

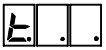
1. Make sure that:
   - The compressed air supply and power supply of the CMPX are switched off,
   - the above-mentioned prerequisites are fulfilled.
2. Switch on the operating voltage for the CMPX. The CMPX will then briefly show the version number of the firmware. The set parameters are then shown, so that they can be checked.
3. Now switch on the compressed air supply (5 to 7 bar). As the valve slide assumes the intermediate position, the moveable load can move slowly into one of the end positions due to the asymmetrical voltage-pressure curve of the proportional directional control valve.

Warning
High acceleration forces at the connected actuators! Unexpected motion can cause collisions and severe injuries.

During the teaching procedure, the moveable mass moves at first slowly, then at the highest possible acceleration and speed.

- Make sure that no persons are in the operating range of the drive or any other connected actuators.

4. If teaching has not yet taken place, the CMPX indicates readiness to carry out the teaching procedure.

 (t flashes)

Then proceed as described under 5.

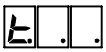
Carry out the teaching procedure again

If teaching has already been done, the movable mass stands regulated in a taught position (position 1 ... 4) or a random position. Proceed as follows:

- Hold the Enter/Teach button pressed down for at least 2 seconds. The CMPX then indicates readiness to carry out the teaching procedure (t flashes). The procedure cam be cancelled by switching off the power supply or via a Stop signal.

If the end positions are taught again, the adaptation values will be deleted. Intermediate positions already “taught” are retained.

5. Hold the Enter/Teach button down at least 2 seconds in order to start the teaching procedure.
The CMPX then carries out the teaching procedure. The moveable mass moves at first slowly, then dynamically. The display shows the following:

 The dots flash alternately.

The teaching procedure can last several minutes, depending on the drive used. It is concluded when the drive is at end position 1. The display shows the following:

Input MC_POS1 supplies a 1 signal. The drive is now ready for operation.

When the teaching procedure is concluded, the CMPX knows the locations of the mechanical end positions (position 1 or 2). You can now manually teach the intermediate positions (positions 3 and 4) or start a positioning task to the end positions (position 1 or 2).

After commissioning, the positioning behaviour improves by adaptation automatically after approximately 20 to 30 strokes. Therefore, after teaching the end positions and intermediate positions, always allow 20 to 30 positioning cycles to be carried out.

4.4.5 Teaching the intermediate positions

The following explains how to teach the intermediate positions when the supply pressure is switched on.

If you wish to teach the intermediate positions with the supply pressure switched off (see section 4.3.6), you must proceed in exactly the same manner. However, the mass will not start moving automatically when button ← or → is pressed, but must be brought into the desired intermediate position by hand. Button ← or → must still be pressed at the appropriate position.

Requirement

The drive must be ready for operation. 0 signals must be present at outputs POS1 to POS4. In order to start the teaching procedure via the buttons on the CMPX, a 0 signal must be present at the DISABLE_KEYS output, Force_Mode must not be active at the CPX-MMI. The supply pressure must be switched on or off, depending on the variant.

In order to teach an intermediate position with the supply pressure switched on, proceed as follows:

1. Briefly press button ← or →. The teachable position number (e.g. 03) will then flash.

   The position number flashes.

2. If you do not wish to teach the intermediate position shown, press briefly the ESC button. The process will then be interrupted. Then repeat step 1. The next teachable position number will then flash.

Warning
High acceleration forces at the connected actuators! Unexpected motion can cause collisions and severe injuries. Make sure that:

- No persons can enter the operating range of the drive or any other connected actuators.
- The travel range of the movable mass can only be accessed when the supply pressure is switched off.

3. If you wish to teach the intermediate position shown, hold button ← or → pressed down for as long as is required to move the mass. The mass will then move in the appropriate direction.

4. Release the button when the mass is to stop moving. The mass now stands controlled in the current position.

5. Repeat steps 3 and 4 until the moveable mass reaches the desired position.

The position number flashes.

6. When the moveable mass has reached the desired position, confirm with Enter (› 2 s), in order to save the position. The current position will then be saved as an intermediate position. The corresponding input MC_POS3 or MC_POS4 supplies a 1 signal.

No flashing.

7. If you wish to teach the next intermediate position, repeat the steps listed beginning at step 1.

Repetition accuracy

The repetition accuracy when moving to the intermediate positions depends on the type of drive and on the length of the measuring system: ± 0.25% of the measuring system length, and no less than ± 2 mm.

Observe the following instructions in order to achieve good positioning behaviour and the repetition accuracy specified.

– The distance between the intermediate position and the drive end position must be at least 10% of the complete cylinder stroke length or of the complete rotary angle, in order to provide a sufficient compressed air cushion.

– Positioning paths between taught positions should not be less than 3% of the complete cylinder stroke length or of the complete rotary angle.
With linear drives and cylinders the positioning paths should be at least 20 mm.

– If the intermediate positions 3 and 4 lie at the same point, and if movement is made to one of the intermediate positions (e.g. to position 3), only the output corresponding to the task (e.g. MC_POS3) will be set when the intermediate position is reached. The output bit of the other intermediate position will be set for 50 ms only if the position is travelled over (sensor function).

4.4.6 Overview of commissioning procedure

Setting the parameters and starting the teaching procedure (CMPX as delivered)

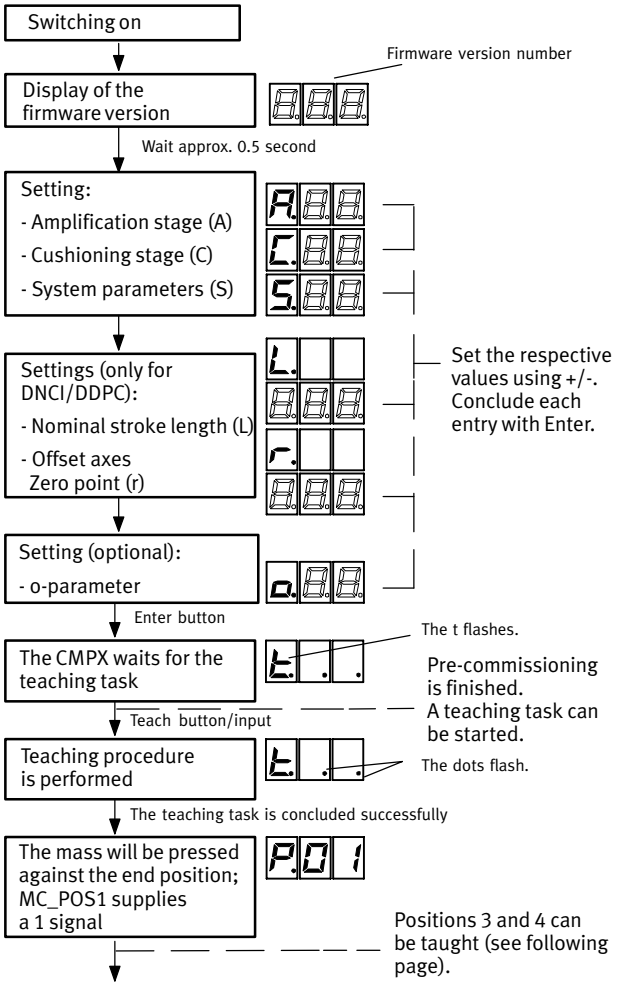


Fig. 4/3: Setting the parameters and starting the teaching procedure

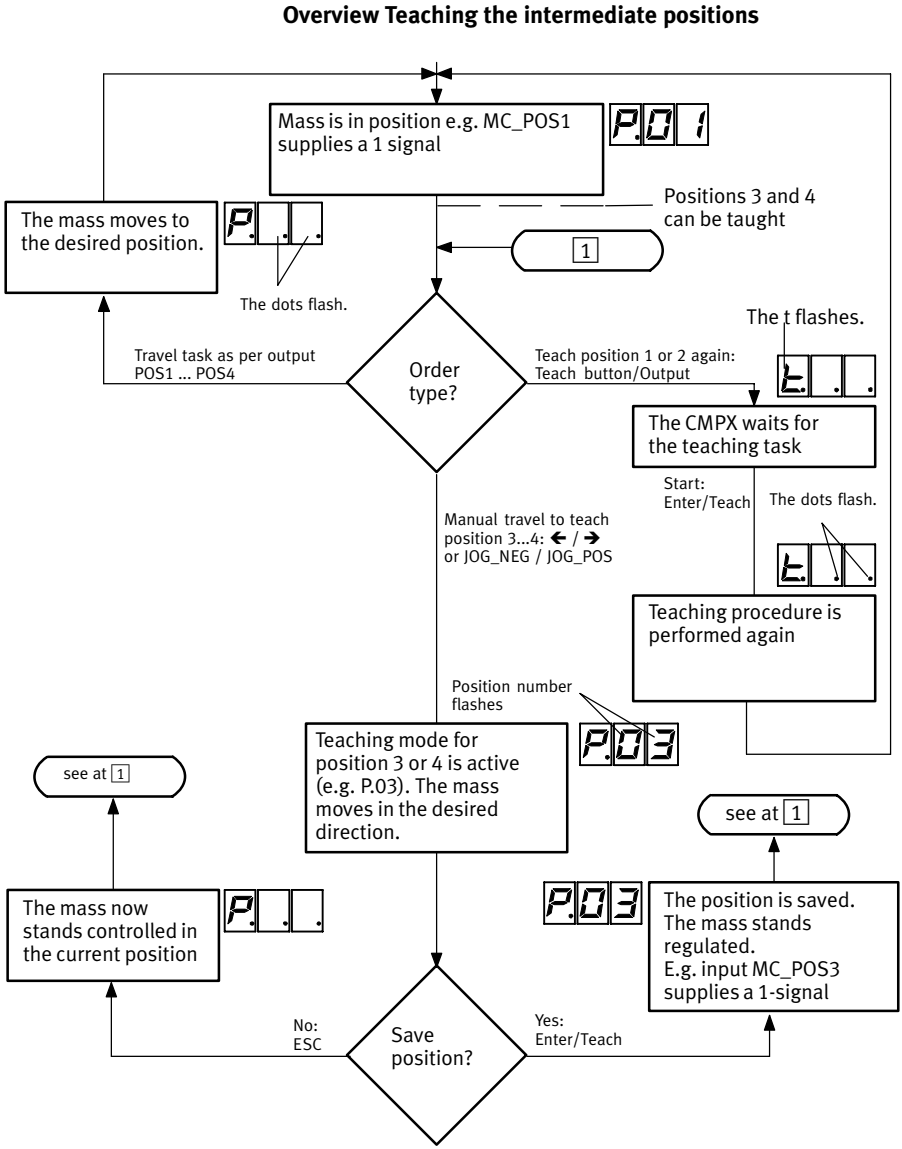


Fig. 4/4: Teaching the intermediate positions (positions 3 and 4)

4.5 Commissioning functions with the Handheld

The same commissioning functions as with the operating panel (display and keyboard) can also be conveniently performed using the CPX-MMI Handheld.

The CPX-MMI also allows the following functions:

– Direct entry of values for intermediate positions 3 and 4.

– Travel to the end positions and intermediate positions 1 to 4.

– Setting and resetting the brakes.

– Stop.

The following information can be displayed on the CPX-MMI for diagnosing the CMPX during commissioning:

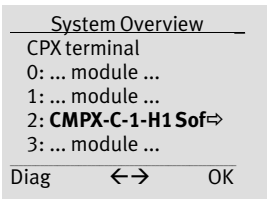
– Fault display in plain text and fault quitting.

– Display of the current position in mm.

– Status display of all control and status bits.

Information on diagnosis with the CPX-MMI is provided in section 6.5.

Representation

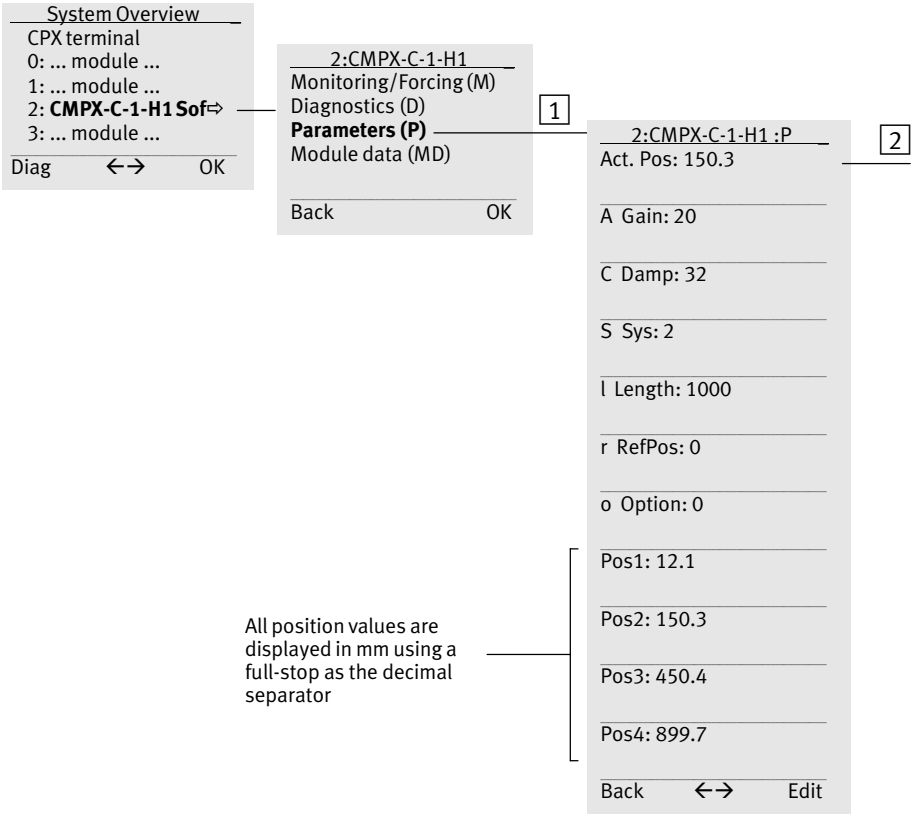


The CMPX is displayed as module “CMPX-C-1-H1 SoftStop CMPX-C-1-H1” on the Handheld.

4.5.1 Parameters ([Parameters] menu)

In the [Parameters] menu, the parameters and position values of positions 3 and 4 can be read and written. The current position and the position values of end positions 1 and 2 are displayed.

Displaying parameters



1 [Parameters] menu 2 Parameter list (page using ↑ or ↓)

Fig. 4/5: Parameter display with the Handheld

The position values are displayed with a resolution of 0.1 mm. The default length value for the potentiometer is 1000 (≙ 100.0 mm). For the measuring system potentiometer, this value can be adjusted to suit any potentiometer length via the MMI or a parameter download (but not via the keyboard). The display of the position (Pos1, Pos2, Pos3, Pos4) changes accordingly.

Entering an incorrect potentiometer length has no affect on the function.

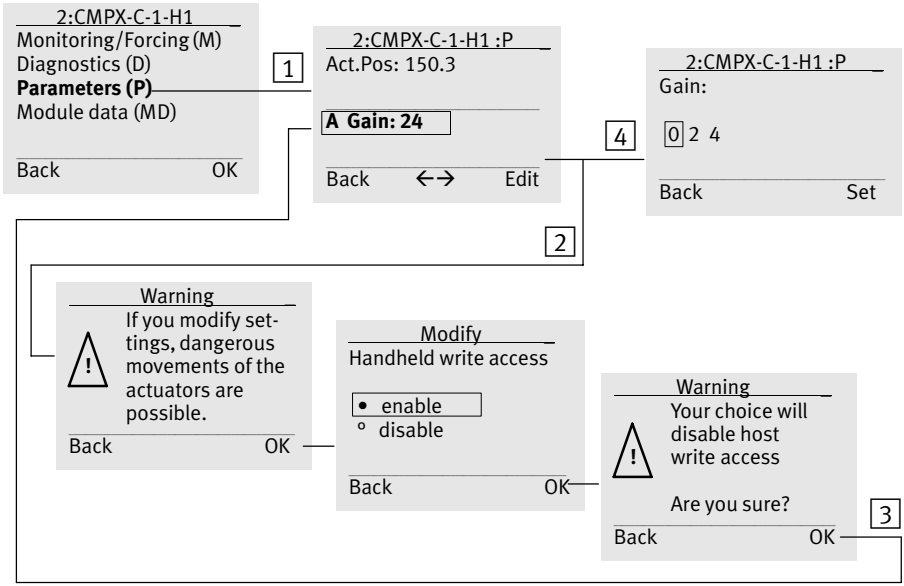
Changing parameters

Editable parameters can be selected (frame). You use “Edit” to edit the selected parameter.

You require write access for the Handheld for this and this is queried if necessary. For information on setting and resetting write access refer to the instructions for the CPX-MMI Handheld.

With activated “Handheld write access” the selected parameter can be changed using the ↑ or ↓ buttons.

Accept the set value with “Set”.



1 Select the parameter in the [Parameters] menu

2 Only when no write access exists: Confirm the warning with “OK”, select write access for the Handheld

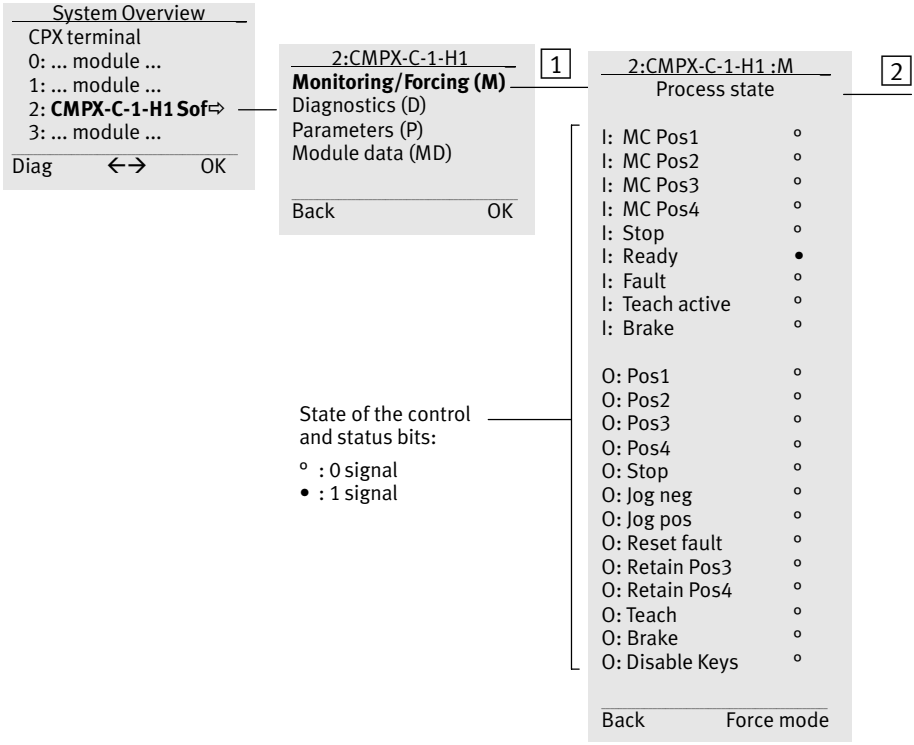
3 After activating write access, return to the [Parameters] menu

4 Change the position using ← or → Change the value using ↑ or ↓, accept the value with “Set”

Fig. 4/6: Changing parameters with the Handheld

4.5.2 Signal state of the CMPX ([Monitoring/Forcing] menu)

In the [Monitoring/Forcing] menu you can display the signal state of the input/output bits (process data status) of the CMPX.



1 [Monitoring/Forcing] menu

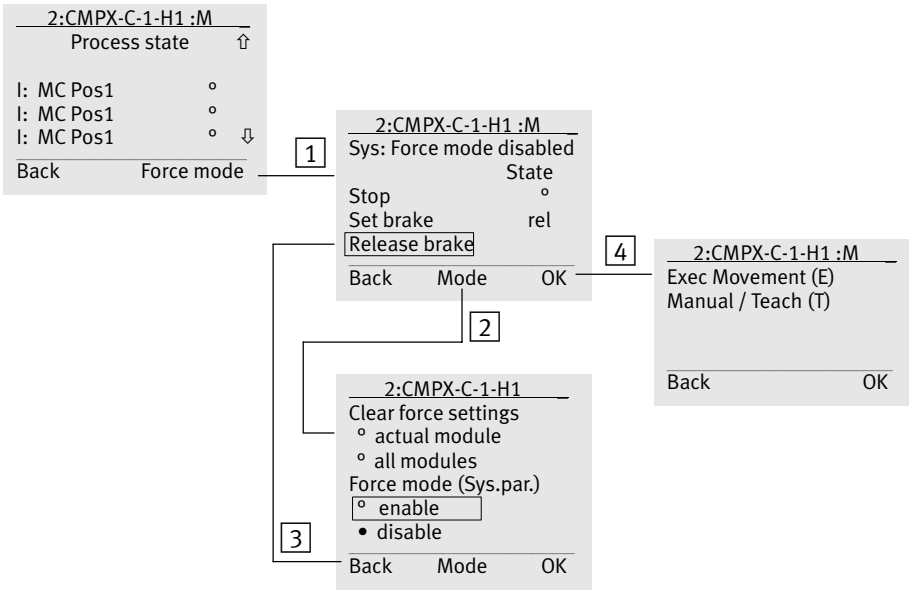
2 State of the CMPX input/output bits (page using ↑ or ↓)

Fig. 4/7: Display of the input/output bits using the Handheld

4.5.3 Force mode

Force mode must be activated in order to control the CMPX with the Handheld.

You require write access on the Handheld for this and this is queried if necessary. For general information on write access and Force mode, refer to the instructions for the CPX-MMI Handheld.



1 With “Force mode”, calling up the menu for controlling the CMPX. If not already done, “Handheld write access” must be activated here, see section 4.5.1, Fig. 4/6.

2 Use “Mode” to set Force mode

3 Select “Force mode enable”, confirm with “OK”, return with “Back”

4 For the menu functions see section 4.5.4

Fig. 4/8: Activating Force mode

When Force mode is active, control byte 1 is set to 0x00 and control byte 2 is set to 0x80 (the CMPX keyboard is locked out).

When leaving the menu [Exec. Movement] (Execute Movement) and [Manual/Teach] (Manual travel/Teach), control byte 1 is also set to 0x00 and control byte 2 is set to 0x80.

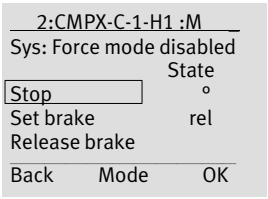
This means:

– No travel

– BRAKE = 0, brake is not active
(24 V, brake open)

4.5.4 Forcing Stop and Brake

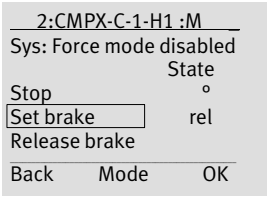
After activating Force mode in the [Monitoring/Forcing] menu as per section 4.5.3, Fig. 4/8 the menu items described below are available.



When “Stop” is selected, you can set the STOP output with OK (Force).

° 0 signal at the STOP output (drive can move).

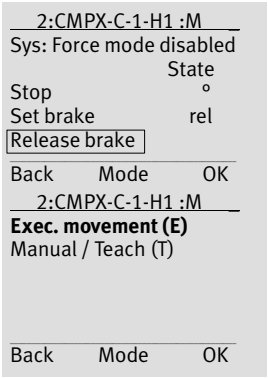
• 1 signal at the STOP output (drive is stopped).



When “Set brake” is selected, with OK you can activate the digital output for the brake. STOP is also set (1 signal, drive is stopped).

rel: 1 signal at brake input (brakes released – released).

act: 0 signal at brake input (brake activated – activated).



The brake must be released to control the drive, therefore access to the relevant menu occurs via releasing the brake.

When “Release brake” is selected, then OK releases the brake and the selection of the specific menus for controlling and commissioning the CMPX is displayed.

The following menus are available:

– [Exec. Movement (E)]: Forces the most important control outputs, see section 4.5.5.

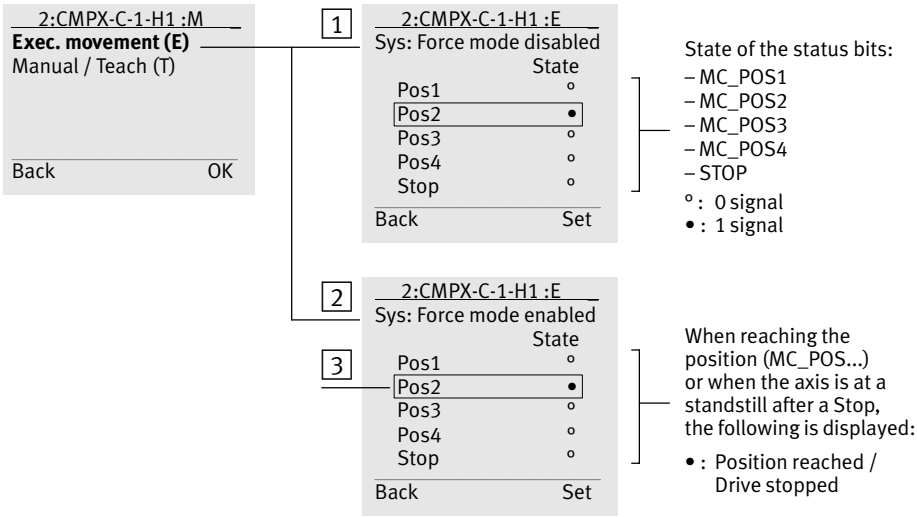
– [Manual/Teach (T)]: Commissioning functions, see section 4.5.6.

4.5.5 Control ([Exec. Movement] menu)

With activated Force mode, travel tasks can be controlled using the [Monitoring/Forcing] [Exec. movement] menu.

This requires write access and Force mode for the Handheld. For information on write access and Force mode, see the instructions for the CPX-MMI Handheld.

If necessary, “Mode” in the [Monitoring/Forcing] menu can be used to activate Force mode (see section 4.5.3)



1 When Force mode is disabled:
Only the status bits are displayed

2 When Force mode is enabled:
Set control outputs

3 Select the output and set it using “Set”:
The task is executed.

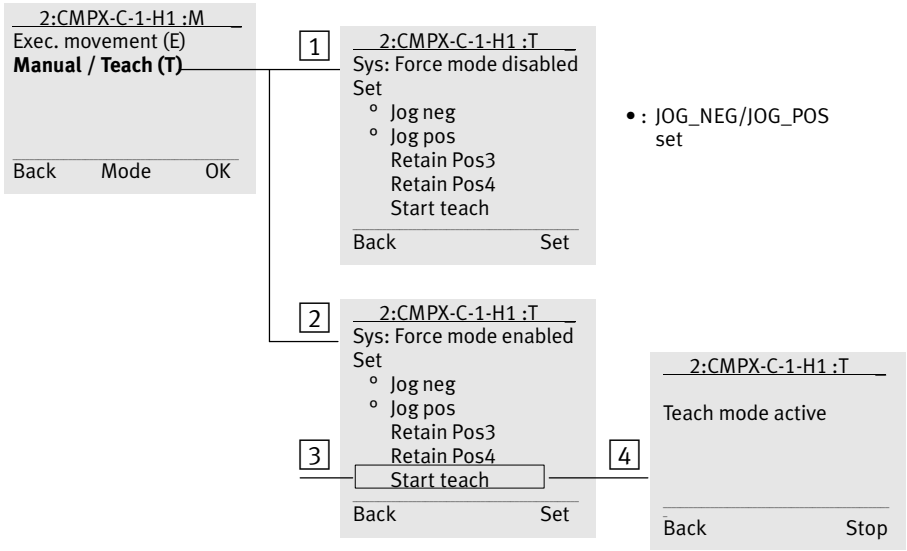
Fig. 4/9: Control ([Exec. Movement] menu)

4.5.6 Manually moving / Teaching ([Manual/Teach] menu)

With activated Force mode, the drive can be “manually” moved using the [Monitoring/Forcing] [Manual/Teach] menu. A Teaching procedure can also be started or the current position can be adopted as intermediate position 3 or 4.

This requires write access and Force mode for the Handheld. For more information on write access and Force mode, see the instructions for the CPX-MMI Handheld.

If necessary, “Mode” in the [Monitoring/Forcing] menu can be used to activate Force mode (see section 4.5.3)



1 When Force mode is disabled: Display only (no function)

2 When Force mode is enabled: Function can be executed

3 Select the output and set it using “Set”: The specified function is executed (see Tab. 4/5)

4 Display during teaching procedure

Fig. 4/10: Manually moving/Teaching ([Manual/Teach] menu)

Function	Description	Procedure / Notes
Jog neg Jog pos	Move the axis in a negative or positive direction at reduced speed.	1. Select “Jog ...” and then press the “Set” button. The axis moves in the corresponding direction. 2. Pressing the “Set” button again stops the movement. “Jog neg” and “Jog pos” are level active signals and are toggled each time they are selected and the “Set” button is pressed.
Retain Pos3 Retain Pos4	Adopts the current position as intermediate position 3 or 4.	1. Move to the desired position. 2. Select “Retain Pos...” and then press the “Set” button. The current position is immediately adopted as an intermediate position.
Start Teach	Start the teaching process.	1. Select “Start Teach” and then press the “Set” button. 2. During the teaching travel, “Identification active” is displayed. The running teaching procedure can be stopped with “Stop”. 3. After a successful teaching travel, “Teach done” is displayed. After a faulty teaching travel, “Teach fault” is displayed. 4. Return from each display with the “Back” button.

Tab. 4/5: Functions in the [Manual/Teach] menu

4.6 Notes on operation

4.6.1 General notes on operation

Warning
High acceleration forces at the connected actuators!
Unexpected motion can cause collisions and severe injuries.

- **Switching on:**
  Always first switch on the operating voltage supply and then the compressed air supply.
- **Switching off:**
  Before carrying out mounting, installation and maintenance work switch off the operating voltage and the compressed air supply, either simultaneously or in the following sequence:
  1. the compressed air supply
  2. the operating voltage supply for the electronics/sensors
  3. the load voltage supply for the outputs/valves

Note
Damage may occur if maximum permitted limits, such as mass loads, mass moments of inertia, swivel frequencies etc. are exceeded. Make sure that the maximum specified limits of the drive used are observed (see operating instructions for the relevant drive).

Note
In order to avoid damage due to uncushioned movement into the end positions:

- Always carry out the teaching procedure again after adjusting the fixed stops or when components and tubing have been replaced.
- Observe the permitted mass load.

Positioning orders

After switching on the operating voltage, you must wait until the READY input supplies a 1 signal. After this, the appropriate travel task can be executed with a positive edge on the outputs POS1 ... POS4, see section 5.3, Tab. 5/5.

Homing run after POWER ON

Only with incremental displacement encoders:
After the CMPX operating voltage is switched on again, the relationship between measurement variable and current position is lost. For that reason, you must always carry out homing after switching on again. The homing run can be performed to end position 1 or 2.

Starting homing

The homing run starts after the power supply is switched on, via a travel task to position 1 or 2.

Other travel tasks after switching on the power supply are not permitted and cause a fault E.10 (no homing run performed).

Process of homing

If the drive is already in the desired end position when homing is started:
A movement toward the end position is impossible. To check whether compressed air supply is lacking or the drive is already in the end position, pressure is added briefly in the opposite direction.

Here the drive carries out a short compensating movement in the opposite direction.

If the drive is not yet in the desired end position when homing is started:
The drive moves slowly toward the end position.

During homing, the message “rEF” is displayed. Homing is concluded when the moveable mass is pressed against the corresponding end position (position 1 or 2) and the assigned input (MC_POS1 or MC_POS2) supplies a 1 signal.

4.6.2 The first positioning task

During the first positioning task the CMPX checks whether the mass moves in the desired direction. If the mass moves in the wrong direction, the CMPX will diagnose incorrectly connected tubing in the system and display error E.13 (incorrect direction of movement...). The CMPX then reacts as follows:

– The valve slide of the proportional directional control valve will then be brought into the intermediate position (flow blocked),

– The FAULT output supplies a 1 signal,

– No new positioning tasks will be accepted.

This safety function helps prevent damage being caused by incorrect connections.

In the case of incorrectly connected tubing in the system:

• Switch off the operating voltage and correct the tubing.

If the moveable mass is already in one of the end positions when the operating voltage is switched on, a positioning task into this end position will be generated and the mass will be pressed against the end position. If the drive moves out of the end position instead of maintaining the end position, the CMPX will also diagnose incorrectly connected tubing in the system and will display an error. The fault may be due to one of the following causes:

– The compressed air supply is still switched off. The drive has been moved manually or moved from the end position by external forces, or it has moved itself (e.g. when fitted in a vertical position).

– The drive moves briefly out of the end position because the system has been pressurised too quickly (asymmetrical pressure build-up in the cylinder chambers).

In order to avoid such causes, proceed as follows:

- Pressurise the complete system slowly (e.g. by using the soft-start valve type HEL-... or HEM-...). No unexpected movements of the actuators will then occur.
- Make sure that the moveable mass cannot move itself or be moved manually (e.g. by means of a clamping unit) out of the end position when the operating voltage is switched on.

4.6.3 Manual movement

With the control panel

Requirement

The drive must be ready for operation. A 0 signal must be present at the POS1 ... POS4 outputs. A 0 signal must be present at the DISABLE_KEYS output, Force mode must not be active at the CPX-MMI.

The moveable mass can be moved manually with the ← or → buttons.

Key	Description
←/–	Reduce the position value (the mass moves slowly in the direction of the measuring system zero point)
+/→	Increase the position value (the mass moves slowly away from the measuring system zero point)

In order to move the mass manually:

- Hold down the appropriate button (← or →) for as long as is required to move the mass.
- Release the button in order to stop the mass.

The position number flashes to indicate that the current position can be saved as the intermediate position by pressing the Enter button (see section 4.4.5).

With the Handheld

With activated Force mode: [Monitoring/Forcing] [Manual/Teach] menu, “Jog neg” and “Jog pos” functions (see section 4.5.6).

Commissioning and control with the CPX-FEC or CPX bus node

Chapter 5

Contents

5.1 Planning aspects when parameterising the CMPX

5.1.1 Notes on the available CPX masters

Tab. 5/1 shows an overview of the available CPX masters (CPX-FEC or CPX bus nodes) that are suitable for operation with the CMPX (as of January 2008).

Bus node/FEC	Support/Operation	Special instructions
CPX-FEC	**Suitable**	Appendix B.1
CPX-FB6 (Interbus)	On request	Not present
CPX-FB11 (DeviceNet)	**Suitable**	Appendix B.3
CPX-FB13 (PROFIBUS-DP)	**Suitable**	Appendix B.2
CPX-FB14 (CANopen)	On request	Not present
CPX-FB23 (CC-Link)	On request	Not present
CPX-FB32 (Ethernet/IP)	On request	Not present
CPX-FB33 (PROFINET, M12)	On request	Not present
CPX-FB34 (PROFINET, RJ45)	On request	Not present

Tab. 5/1: Notes on CPX bus nodes / CPX-FEC

General parameterisation instructions are provided in the respective manuals for the CPX-FEC or CPX bus node used.

5.1.2 CMPX parameters in the CPX master

All CMPX parameters are stored in both the CMPX and the CPX master (module parameters of the CPX-FEC or CPX bus node).

Access to all parameters is therefore basically also possible via the I/O Diagnostic interface (see section 6.6.3) or via appropriate bus-specific channels. Among other possibilities, this also allows parameterising via standard CPX functions, e.g. via Start parameterising.

Parameter consistency

The CMPX module parameters can be changed from various sources.

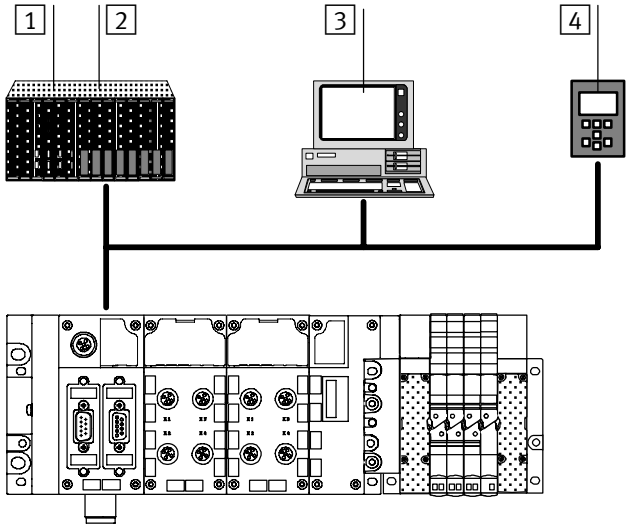
- Handheld CPX-MMI,
- CMPX control panel,
- Cyclic bus data (parameterisation via I/O, see section 5.3),
- Acyclic Fieldbus communication (e.g. PROFIBUS DPV1, parameterisation via I/O diagnostic interface),
- Start parameterisation via the Fieldbus.

Care must be taken to ensure that the data in the CMPX is consistent with the module data of the CPX bus node or CPX-FEC.

If parameters are changed at 2 sources simultaneously, then the last change stored in the CMPX is adopted.

5.1.3 CPX parameterisation

The parameterisation of the CPX terminal can be undertaken as follows, depending on the field bus protocol used:



1 Plug-in module or scanner/bus master; the desired parameterisation can be guaranteed e.g. in the start-up phase or after field bus interruptions

2 User program in the higher-order PLC/IPC; parameters can be modified during running time

3 Field bus-specific configurators; parameters can be modified during the commissioning phase or during the search for errors

4 Handheld; parameters can be modified during the commissioning phase, during the search for errors or during running time

Fig. 5/1: Possibilities of parameterisation

5.1.4 Fail-Safe and Idle-Mode parameterising

Depending on your application and the CPX master used, check if a corresponding Fail-Safe or Idle-Mode parameterisation is necessary.

Fail-Safe or Idle-Mode parameterisation allows pre-defined I/O states to be created when the bus drops out or the PLC switches to the 'Stop' state.
With the CMPX, this always occurs on a byte-oriented basis.

The behaviour of the CMPX in Idle or Fail-Safe mode is defined via the state of the control bytes (CMPX input bytes, module output data, "Channel 0 and 1").

Basic information on Fail-Safe or Idle-Mode parameterisation is provided in the "Influencing signal states" appendix to the P.BE-CPX-SYS-... CPX system description.

Refer to the description of the CPX-FEC or CPX bus system used, to see which functions are supported.
Respective examples are provided in the B.1 (CPX-FEC), B.2 (CPX-FB13) and B.3 (CPX-FB11) appendices.

Sensible Fail-Safe or Idle-Mode parameterisations

Response to errors/bus dropouts	Control signals	Control bytes [1]	Value (decimal)
The drive should stop and the brake should be activated. [2]	STOP = 1 BRAKE = 1 All others = 0	Control byte 1 = 00010000 Control byte 2 = 00001000 All others= 00000000	16 8 0
The drive should move in a positive direction to the end position (position 2)	POS2 = 1 All others = 0	Control byte 1 = 00010000 Control byte 2 = 00001000 All others= 00000000	2 0 0

[1] The assignments of the module output data are provided in section 5.3.
[2] Since the signals are simultaneously set, the axis is normally still in motion when the brake is activated. Make sure that the brake used is suitable for this.

Tab. 5/2: Example of Fail-Safe or Idle-Mode parameterisation

5.1.5 Parameterisation of the CPX terminal on restart

The desired parameterisation of the CPX terminal should be carried out in the start-up phase or after field businterruptions by the plug-in module or the scanner/bus master, providing this is supported by the field bus protocol used. In this way you can be sure that when a CPX terminal has been replaced, the new terminal is operated with the same parameter settings.

You can influence the start-up behaviour using the system parameter System start (see section B.2.2 of the CPX system description).

Note the instructions on replacing components in section A.3.

System start with default parameterising

If possible select the setting “System start with default parameterising and current CPX system equipment”. The desired parameterising can then be created in the start-up phase or after field bus interruptions e.g. by the plug-in module or the scanner/bus master (depending on the field bus used).

Caution
When using “System start with default parameterising” it is **essential** that changed CMPX parameters are also set in the Startup parameterisation of the Fieldbus Master or the master controller!

System start with saved parameterising

If the M-LED lights up permanently after the system start, then “System start with saved parameterising and saved CPX system equipment” is set.

Caution
With most CPX modules, when “System start with stored parameterising” is set the parameterisation stored in the CPX terminal is automatically used when a module is replaced.

This does not occur when a CMPX is replaced, see section 5.1.2). In this case, a correct parameterisation, as with first-time commissioning, must always be done.

5.2 Commissioning via the CPX master

The following steps must be performed when commissioning via the CPX master:

1. If not already done:
   Check the construction of the Soft Stop system with the components used on the axis string (see section 4.2.1).

2. Check the power supply of the CPX terminal, switch on the power supply (see section 4.2.2).

Note
Leave the compressed air supply switched off for the moment. You will thereby avoid undesired movements of the connected actuators.

3. Configure the CPX bus node or CPX-FEC
   (see section 5.1.3).

4. Set the CMPX parameters:

   – Via the configuration software or Startup parameterising: see appendix B.

   – Via the I/O data: See sections 5.3 and 5.4.

5. Switch on the compressed air supply.

6. Carry out a teaching procedure, see section 5.6.5.

7. If necessary, teach the mid-positions, see section 5.6.6.

After commissioning the Soft Stop system

8. Check the control of the Soft Stop system using the CMPX (see section 5.6).

5.3 I/O assignment of the CMPX/Address range

The CMPX is controlled by the CPX master via the internal bus using 6 bytes of output data and 6 bytes of input data.

CMPX inputs – Module output data

Byte	Name	Contents
0	Control byte 1	Control byte 1: Bit Name Description 0 POS1 Triggers motion to position 1 (Pos1) 1 POS2 Triggers motion to position 2 (Pos2) 2 POS3 Triggers motion to position 3 (Pos3) 3 POS4 Triggers motion to position 4 (Pos4) 4 STOP Stops the drive (depending on the o parameter) 5 JOG_NEG Slow motion in a negative direction 6 JOG_POS Slow motion in a positive direction 7 RESET_FAULT 0->1: Quits an error
1	Control byte 2	Control byte 2: Bit Name Description 0 RETAIN_POS3 0->1: Current position = Intermediate position Pos3 1 RETAIN_POS4 0->1: Current position = Intermediate position Pos4 2 START_TEACH 0->1: Starts an identification travel 3 BRAKE 1 signal: Activate brake (0 V) 0-signal: Brake not active (24 V) 4 – Reserved 5 – Reserved 6 – Reserved 7 DISABLE_KEYS 1 signal: Operating panel disabled
2	Reserved	–
3	Parameter_ID_Send	Parameter index, controls the parameter access transferred in bytes 4 and 5. Bit Name 0 Read parameters 1 Write parameter 2 Reserved 3 Reserved 4...7 Parameter index, see Tab. 5/3
4	Low byte of parameter	Low byte of the parameter defined in byte 3.
5	High byte of parameter	High byte of the parameter defined in byte 3.

Tab. 5/1: CMPX module output data

CMPX outputs – Module input data

Byte	Name	Contents
0	Status byte 1	Status byte 1: Bit Name Description 0 MC_POS1 Feedback for position 1 (Pos1) reached 1 MC_POS2 Feedback for position 2 (Pos2) reached 2 MC_POS3 Feedback for position 3 (Pos3) reached 3 MC_POS4 Feedback for position 4 (Pos4) reached 4 ACK_STOP Feedback for Stop 5 READY Ready for positioning task 6 FAULT An error exists 7 TEACH_ACTIVE Teaching procedure is running
1	Status byte 2	Status byte 2: Bit Name Description 0 – Reserved 1 – Reserved 2 – Reserved 3 STATUS_BRAKE Brake feedback: 1: Brake activated 0: Brake not activated 4 STATUS_AIR Compressed air feedback (see section 5.6.2): 1: Total valve chamber pressure ≥ limit value 0: Total valve chamber pressure < limit value 5 – Reserved 6 – Reserved 7 – Reserved
2	Status byte 3	CMPX error number, see sections 6.2.3, Tab. 6/2.
3	Parameter_ID_ Receive	Parameter feedback message, signals the status of the parameter access. Bit Name 0 Parameter transferred/valid 1 Parameter task not executable [1)] 2 Reserved 3 Reserved 4...7 Parameter index, see Tab. 5/3
4	Low byte of parameter	Low byte of transferred/read parameter.
5	High byte of parameter	High byte of transferred/read parameter.

[1)] In the case of a non-executable parameter task, bytes 4 and 5 contain a parameter error number instead of the parameter value, see Tab. 5/4. The CMPX does not enter an error state in the case of a failed parameter access.

Tab. 5/2: CMPX module input data

Parameter index (bits 4 ... 7 of Parameter_ID_Send)	
Value	**Description**
0	Current position (read-only)
1	A Gain
2	C Cushioning
3	S System parameter
4	L Length (only effective with digital measuring systems) [1 inc = 1 mm]
5	r Reference point (only effective with digital measuring systems) [1 inc = 1 mm]
6	o Option parameter
7	Position 1 (read-only) [1 inc = 0.1 mm]
8	Position 2 (read-only) [1 inc = 0.1 mm]
9	Position 3 [1 inc = 0.1 mm]
10	Position 4 [1 inc = 0.1 mm]
11	Displacement encoder type (read-only)
12	Valve type (read-only)
13 ... 15	Reserved

Tab. 5/3: Parameter_ID_Send

Error	**Parameter access not executable because**
1	Illegal index (parameter not defined)
2	Limit value exceeded
3	Value cannot be changed
4	Task cannot be carried out due to operating status
5	Parameter_ID_Send bits 0 and 1 (read and write) are simultaneously set.

Tab. 5/4: Parameter error numbers

Handling of the signals in control bytes 1 and 2

Signal name	Edge triggered	Level triggered	Uniqueness [1]	Always takes effect [2]
POS1	x		x	
POS2	x		x	
POS3	x		x	
POS4	x		x	
STOP		x		x
JOG_NEG	x	x [3]	x	
JOG_POS	x	x [3]	x	
RESET_FAULT	x			In error state
RETAIN_POS3 [1]	x		x	
RETAIN_POS4 [1]	x		x	
START_TEACH	x		x	
BRAKE		x	x	x
DISABLE_KEYS		x		x

[1] Uniqueness: Only triggered when no other input signal (travel signal) is present. RETAIN_POS3/ RETAIN_POS4 can also be activated when JOG_NEG or JOG_POS is active. The motion is then interrupted and the position adopted. Travel only continues with a new low-high edge at JOG_NEG/JOG_POS.

[2] Always takes effect: Always takes effect, regardless of operating state and the levels of other input signals.

[3] JOG_POS/NEG: Travel is started with a positive edge. The drive moves as long as a 1 signal is present. A 0 signal stops the drive.

Tab. 5/5: Overview of handling of output signals

If a procedure, e.g. motion for teaching an intermediate position, is started with the buttons then this procedure must be completed via the buttons. All output signals of the CPX-FEC or CPX bus node are disabled (except “STOP” – this always takes effect).
This ensures the uniqueness of the operating process.

Example

CMPX inputs – Module output data

	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Bit 7 ... 0	10000001	10001000	00000000	10010010	11101010	00000001
Hex.	0x81	0x80	0x00	0x92	0xEA	0x01
Description	**Bit 0:** Move to Pos1 **Bit 7:** Quit error	**Bit 3:** Open brake **Bit 7:** Disable keyboard	Reserved	**Bit 1:** Write parameter **Bits 4...7:** Parameter index 9 (Pos3)	**Bits 0...7:** Bit low byte of para-meter	**Bits 0...7:** High byte of parameter
					0x01EA := 490 mm	

CMPX outputs – Module input data

	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Bit 7 ... 0	00100001	00001000	00000000	10010001	11101010	00000001
Hex.	0x21	0x00	0x00	0x91	0xEA	0x01
Description	**Bit 0:** Pos1 reached **Bit 5:** Ready	**Bit 3:** Brake open	Reserved	**Bit 0:** Parameter transfer valid **Bits 4...7:** Parameter index 9 (Pos3)	**Bits 0...7:** Low byte of parameter feedback	**Bits 0...7:** High byte of parameter feedback
					0x01EA := 490 mm	

5.4 Parameterising via I/O data

Overview of CMPX parameters

Parameter	Access	Special feature
A Gain	Upload/Download	Valid value range: 0 ... 99 With the setting "255" (0xFF) this parameter is not downloaded.
C Cushioning	Upload/Download	
S System parameter	Upload/Download	
L Cylinder length	Upload/Download	Valid value range: 0 ... 65535
r Reference position	Upload/Download	
o Option	Upload/Download	Valid value range: 0 ... 46
Valve type	Upload (only available online)	Automatically recognised by the CMPX
Measuring system (displacement encoder) type	Upload (only available online)	
Position 1	Upload (only available online)	End positions are only determined via a teaching procedure and cannot be parameterised.
Position 2	Upload (only available online)	
Position 3	Upload/Download	Valid value range: 0 ... 65535
Position 4	Upload/Download	

Tab. 5/6: CMPX parameters

Parameters can also be transferred via the I/O Diagnostic interface, depending on the bus system used, see section 5.5, Tab. 5/7.

Parameterising rules

– “Write parameter” is edge-triggered. The new parameter is adopted when the edge occurs.
“Read parameter” is level-triggered. The value is cyclically updated as long as a “1” signal is present (e.g. when reading the current position).

– The parameters A, C, S, L, r, o can only be written when the controller is not in the “Identification” (Teaching procedure) state, performing a homing run or in Jog mode (“Manual motion”, JOG_NEG, JOG_POS).

  In the “Identification” state, bit B1 “Parameter task not executable” of the “Parameter_ID_Receive” byte is set.

– Parameters Pos3/Pos4 can always be written to (also when the drive is moving), except in Jog mode (“manual motion”, JOG_NEG, JOG_POS).

– When writing positions 3 and 4 via the Fieldbus, only the first value transferred after switching on is stored permanently in the CMPX module.
All values for positions 3 and 4 transferred from the CPX bus node or CPX-FEC after this take effect immediately but are not permanently stored.
After the power supply is switched off and on again, the last permanently stored values take effect.

Note
When parameterising, observe the rules in section 5.1.2.

Reading and writing parameters

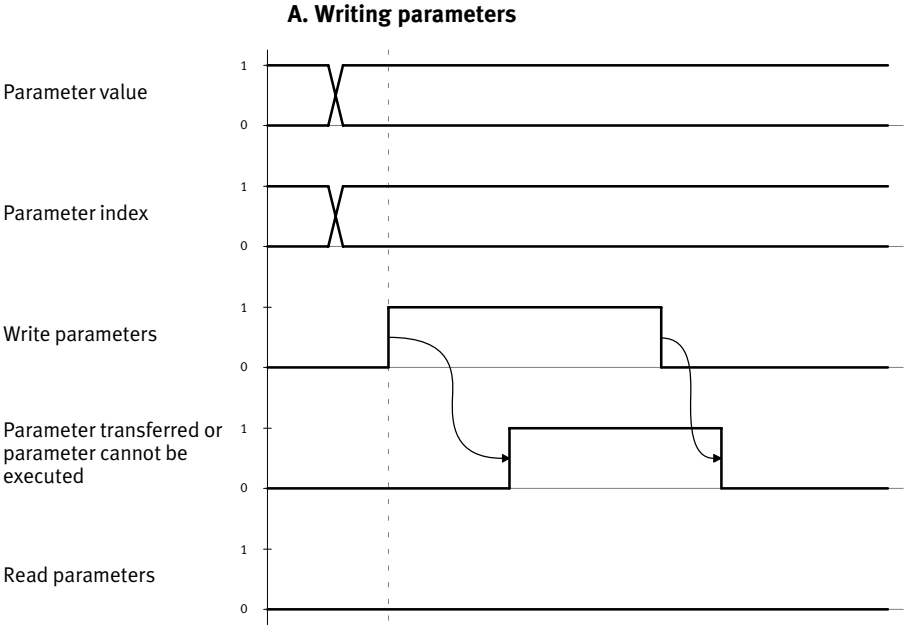


Fig. 5/2: I/O diagram for writing parameters

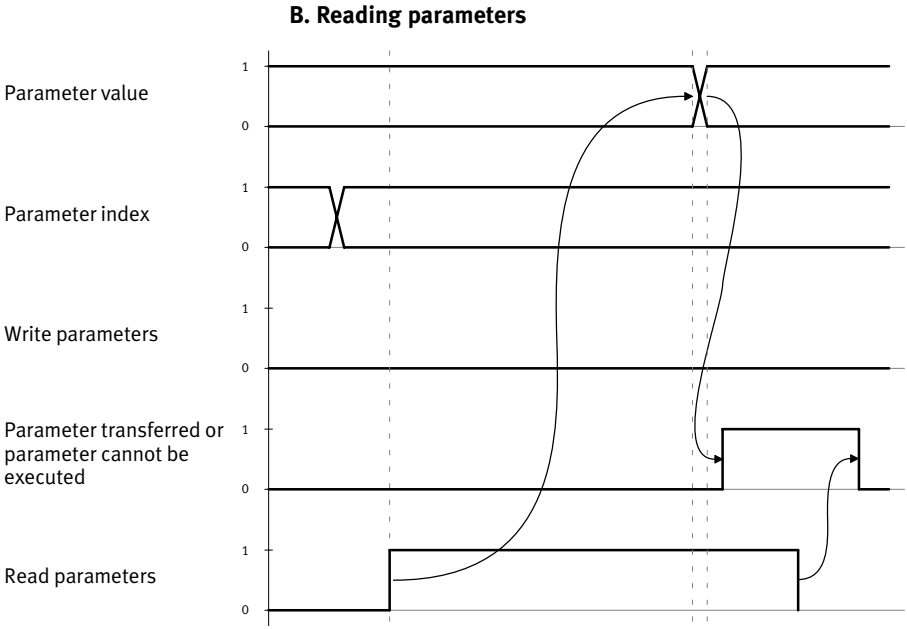


Fig. 5/3: I/O diagram for reading parameters

5.5 Parameterising via the I/O diagnostic interface

In principle, CPX bus node or CPX_FEC specific functions, e.g. acyclic services etc., can also be changed.

The CMPX parameters are accessed via the I/O diagnostic interface, see Tab. 5/7.

Function number [1]	Parameter entry
4828 + m*64 + 6	A Gain parameter
4828 + m*64 + 7	C Cushioning parameter
4828 + m*64 + 8	S System parameter
4828 + m*64 + 9	L Cylinder length low byte [2]
4828 + m*64 + 10	L Cylinder length high byte [2]
4828 + m*64 + 11	r Reference position low byte [2]
4828 + m*64 + 12	r Reference position high byte [2]
4828 + m*64 + 13	o Option parameter
4828 + m*64 + 14	Pos1 low byte (read-only)
4828 + m*64 + 15	Pos1 high byte (read-only)
4828 + m*64 + 16	Pos2 low byte (read-only)
4828 + m*64 + 17	Pos2 high byte (read-only)
4828 + m*64 + 18	Pos3 low byte
4828 + m*64 + 19	Pos3 high byte
4828 + m*64 + 20	Pos4 low byte
4828 + m*64 + 21	Pos4 high byte
4828 + m*64 + 22	Valve type
4828 + m*64 + 23	Measuring system (displacement encoder) type
[1] m = module number [2] Only effective with digital measuring systems	

Tab. 5/7: Parameters via the I/O diagnostic interface

5.6 Controlling the CMPX

Warning
During commissioning and during operation the moveable mass is moved at the highest possible acceleration and speed. Make sure that:

– Nobody can place his/her hand in the positioning range of the moveable mass, unless the compressed air supply is switched off.
– The complete positioning range is free collision contours.

5.6.1 Start-up characteristics performance

1. The operating voltage and the external load voltage are switched on at the same time.
2. READY is set when the powerup phases of the CMPX and CPX are completed. If an error exists then the error is displayed and READY is not set.
3. Data exchange with the PLC is not possible until the powerup time of the PLC is completed and the first READY signal is set by the CMPX, or an error is signaled by the CMPX.
4. It is recommended that the compressed air supply is not switched on until the READY signal has been set.
5. The brake output at the valve remains active (=0), until the READY signal is set and the 1st travel task changes the brake output as per the brake bit BRAKE.
6. If the axis is within the tolerance range of position 1 or 2, STATUS_AIR is set and STOP is not set, then the controller is activated and the axis is pressed into the corresponding position (Position 1 or 2).

7. If no error exists then the current position is adopted as the nominal position and the axis remains stationary and controlled in the current position.

The following exceptions apply to the DNCI/DDPC:
An initial positioning task (homing run to position 1 or 2) is always necessary for the axis to enter controlled operation.
The STOP signal is not regarded as the first positioning task.

5.6.2 Basic pressure monitoring function

Pressure monitoring is performed by the VPWP pressure sensors. It is activated in stages by the READY signal after switch on. The following different cases exist:

– The Ready signal causes the pressure in the valve chambers of the VPWP to be monitored and signaled as STATUS_AIR (status byte 2, bit 4). As long as the total of all pressures is ‹ 2.4 bar, Status_Air = 0.
When the total of all pressures is › 2.4 bar, then STATUS_AIR = 1. STATUS_AIR has a controlling function at switch-on, see section 5.6.1.

– Check that the operating pressure is ‹ 1.2 bar (Error E.50). Error E.50 is output when a pressure ‹ 1.2 bar is measured in both chambers at the same time.
During the switch-on pressurisation phase, error E.50 is not output unless the 1st positioning task has already been started.

– During the teaching travel, a continuous check for errors E.50 or E.56 is made.

– If a teaching travel has been successfully completed, **during** a positioning task (homing run, position 1 ... position 4, Stop set or reset, teaching of position 3 or 4) monitoring for error E.56 does not occur.

5.6.3 Inactive position or pressure control

Position or pressure control does not occur in the following states:

- For all errors except error group 2x.
- After quitting an error, except error group 2x.
- At switch-on, when no compressed air is present (< 2.4 bar).
- At switch-on, when the axis has not yet performed an identification travel.
- At switch-on, when the axis has not yet been referenced (digital incremental measuring systems only, e. g. DNCI/DDPC).
- When a parameter change makes a new teaching procedure (identification) necessary.

5.6.4 Handling of the “Brake” valve output

The brake can only be set or reset via BRAKE (control byte 2, bit 3). The CMPX never automatically switches the brake on or off.

A distinction is made between an error-free state and particular error states.

Error-free state

Setting the brake

A: The controller is active and the axis is stationary and controlled:
Setting BRAKE immediately resets the switching output at the valve to 0V (brake is immediately active).

B: The controller is active and the axis is still executing a positioning task, i.e. it is moving and no brake/clamping unit is present:
Setting BRAKE resets the switching output at the valve to 0 V. The CMPX automatically triggers a braking ramp.

Note
Make sure that the brake/clamping unit allows this operating state.

C: The controller is inactive:
Setting BRAKE resets the switching output at the valve to 0V (brake is immediately active). The controller does not change its state.

Once BRAKE is set and a task to move the axis is present (assuming no error exists) then this does not take effect and the error E.18 “Clamping unit/Brake is still active, no positioning task is possible” is signaled.

Releasing the brake

a: The controller is active, the axis is in state A (see “Setting the brake”), the current position lies within the internally determined tolerance:
The brake is released after a settling time of about 1 s.

c: The controller is inactive:
Resetting BRAKE immediately sets the switching output at the valve to 24 V (brake is immediately deactivated).

Note: Setting STOP can switch the axis from an uncontrolled to a controlled state and the subsequent releasing of the brake occurs with a minimum of axis motion.

STATUS_BRAKE (bit 4 in status byte 2) signals the state of the brake output.

System communication error (Errors 43, 60, 69, 71, 80, 89 are active)

In these cases, the load supply of the VPWP can be switched off by setting BRAKE.

The load supply is switched on again when the error is quitted.

5.6.5 Teaching procedure

Requirement

The drive must be ready for operation. A 0 signal must be present at the POS1 ... POS4 outputs.
Force_Mode must not be active at the CPX-MMI.

A positive edge at the START_TEACH output can be used to start the teaching procedure.
While the teaching procedure is running, the TEACH_ACTIVE input provides a 1 signal, the READY input provides a 0 signal.

The running teaching procedure can be stopped at any time with a positive edge at the STOP output.

After a successful teaching procedure, the TEACH_ACTIVE input provides a 0 signal, the READY input provides a 1 signal.

5.6.6 Manual procedure and teaching the intermediate positions

Requirement

The drive must be ready for operation. A 0 signal must be present at the POS1 ... POS4 outputs.
Force_Mode must not be active at the CPX-MMI.

The movable mass can be manually moved using the JOG_NEG and JOG_POS outputs.

Output	Description
JOG_NEG	Reduce the position value (the mass moves slowly in the direction of the measuring system zero point)
JOG_POS	Increase the position value (the mass moves slowly away from the measuring system zero point)

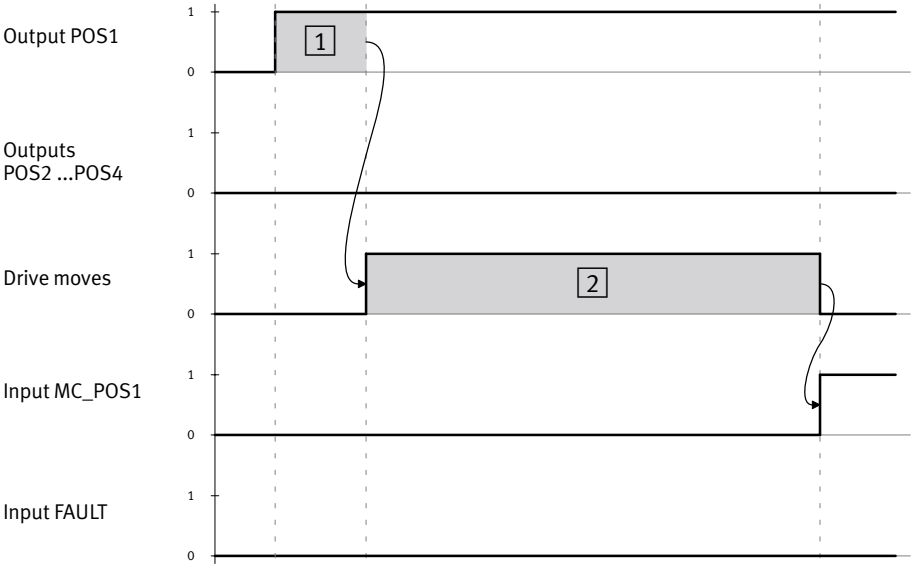
In order to move the mass manually:

- Set the corresponding output (JOG_NEG or JOG_POS), as long as the mass is to move (a positive edge is required to start).
- Reset the output to stop moving.

The current position can be stored as an intermediate position with a positive edge at one of the RETAIN_POS3 or RETAIN_POS4 outputs (see section 4.4.5).

5.6.7 Time behaviour in a positioning task

The outputs POS1 ... POS4 can be used to move the movable mass to the stored end positions or intermediate positions. When an end position is reached, the moveable mass will be pressed against the stop with a pressure equal at maximum to the operating pressure. When an intermediate position is reached, the moveable mass stands controlled in that position.



1 Switch-on time at least 20 ms

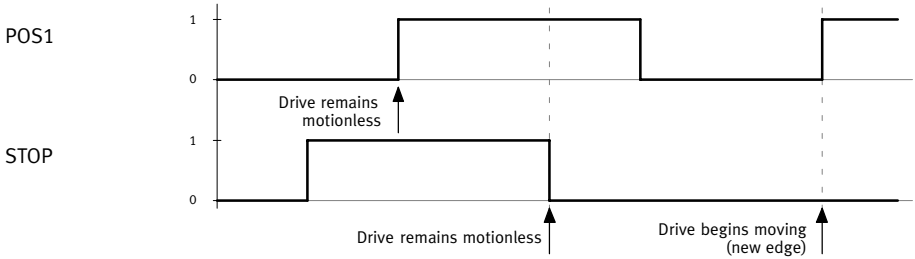
2 Motion to end position (position 1) reached

Fig. 5/4: Time behaviour when starting a positioning task (example position 1)

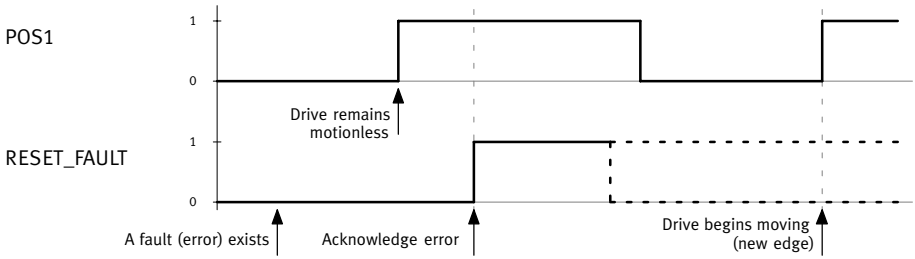
Note
A position task or stop procedure can be interrupted at any time and replaced by a new task.

5.6.8 Flow diagram of the output signals

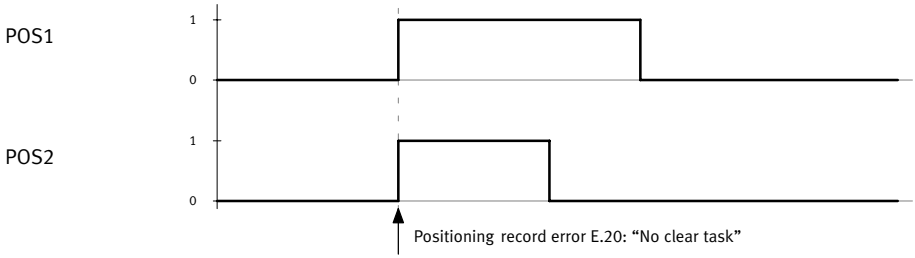
Case 1: Start and stop the drive



Case 2: Stop on error/Quit error



Case 3: Simultaneous error with multiple tasks



5.7 Using the taught intermediate position as the sensor position

The taught intermediate positions can also be used as sensor positions, because the relevant input MC_POS3 or MC_POS4 supplies a 1 signal for 50 ms when the intermediate positions are travelled over.

Note
If the CMPX is to be controlled directly by means of the "sensor signal", note that:

– the distance between the taught intermediate position and the mechanical end position must be of sufficient length, as the braking process is not started until the signal is recognised.

Example 1: Change of direction

A premature change of direction can be implemented with the aid of a taught intermediate position (positions 3 and 4). The corresponding input (MC_POS3, MC_POS4) provides a 1 signal for 50 ms when the movable mass passes over the intermediate position. The moveable mass can then for example, be moved back to the end position by means of an input signal.

Example: Target position = Position 2

1 Drive (here linear drive type DGP-...-...)

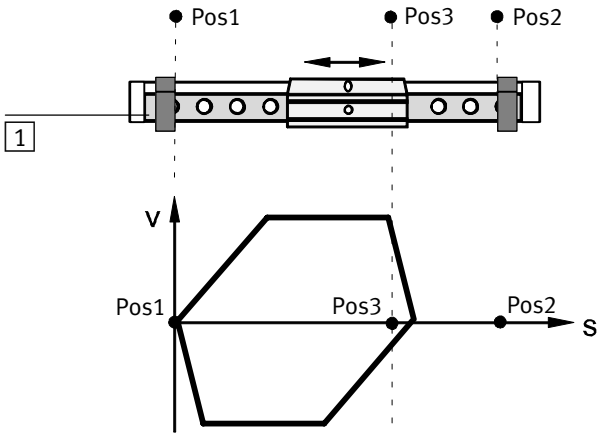
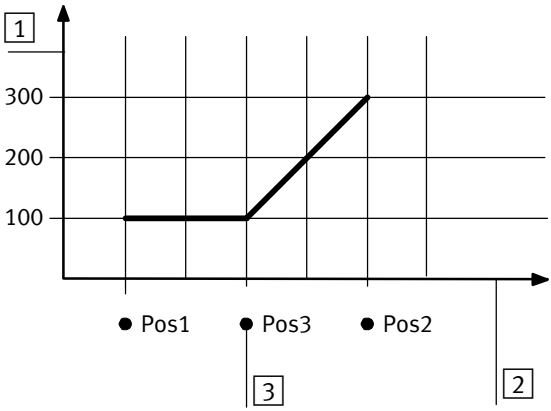


Fig. 5/5: Premature change of direction (example with linear drive)

The input signaling arrival at the intermediate position (here MC_POS3) can, if needed, be directly linked to the corresponding output (here POS1).

Example 2: Pre-select position for time-optimised moving around

The taught intermediate positions (positions 3 and 4) can also be used in order to start a second drive, e. g. to move around obstructions in a time-optimised manner.



1 Positioning path for the second, external drive

2 Positioning path for the CMPX

3 Preselected position Position 3

Fig. 5/6: Time-optimised bypassing

The second drive begins with positioning to position 300, when the drive controlled by the CMPX passes over the taught intermediate position 3 and has not yet completed the positioning task.

Diagnosis, Error Handling and Optimisation

Chapter 6

Contents

6.1 Overview of diagnostic possibilities

The CMPX supports a number of different methods for diagnosis and error handling with the CPX terminal. An overview shows Tab. 6/1.

Diagnostic possibilities	Brief description	Advantages	Detailed description
Error messages	The CMPX signals specific faults as error messages (error numbers).	The error messages can be accessed via the display, the Handheld, the CPX-FEC or the CPX bus node.	Section 6.2
LED display	The LEDs directly indicate error states.	Fast “on-the-spot” recognition of errors	Section 6.3
Display	The operating status and any error messages are shown on the display.	Fast “on-the-spot” recognition of operating status and errors	Section 6.4
Diagnosis via the Handheld	Diagnostic information can be shown on the CPX Handheld in a user-friendly manner by means of menus.	Fast “on-the-spot” recognition of operating status and errors	Section 6.5 and manual for the Handheld
Diagnosis via module output and input data	An error state is signaled via the error bit in status byte 1. Status byte 3 contains the specific error number.	Direct access to the operating state (e.g. current position) and error messages via the CPX bus node or CPX-FEC.	Section 6.6.1
Status bits, I/O diagnostic interface	The CPX error numbers signaled by the CMPX are sent to the CPX bus node or the CPX-FEC.	Direct access to the CPX error numbers. Optimum integration into the CPX module concept.	Section 6.6, CPX system manual and manual for the CPX bus node or CPX-FEC

Tab. 6/1: Diagnostic options

6.2 CMPX errors

The CMPX supports detailed error handling and analysis.
A list of errors is provided in section 6.2.3, Tab. 6/2.

6.2.1 Error reactions

If an error occurs, the CMPX will display an error number and react as follows:

- The drive will remain regulated or unregulated, depending on the error class.
- The Fault input supplies a 1 signal.
- The Ready input supplies a 0 signal.
- No new positioning task will be accepted.
- The brake output is not affected.

Depending on the error, the following error reactions are possible:

Positioning record error (error group 20)

- The controller is not switched off, i.e. the drive remains regulated. The valve load voltage supply is not interrupted.
  If the drive is moving when the error occurs, then it is brought to a standstill via a ramp.
- After quitting the error, the drive remains stationary and regulated in the current position.

All other errors (error groups 10 and 30 ... 80)

– The controller is switched off (valve slide in the electrical middle position – flow is blocked). The load voltage supply is not interrupted.

– After quitting the error, the drive remains unregulated.

– With communication errors, in some situations the valve can no longer be addressed. Also in this case the load voltage supply is not interrupted. After a Timeout period, the valve automatically moves to the mechanical middle position. When initialising the valve after powering on, a Timeout period of 5 ms is taken into account.

6.2.2 Quitting errors

Errors can basically only be quitted after the cause of the error has been rectified.

In order to delete the error:

– Quit the error with the RESET_FAULT output

or

– Quit the error with the Handheld (select CPX-CMPX, [Diagnostics] menu, [Reset Fault] button).

or

– Switch the operating voltage off and then on again.

6.2.3 CMPX error numbers

The CMPX error numbers are arranged in groups. The first digit indicates the error group and the second digit indicates the cause. Only the error occurring first is displayed. Subsequent errors resulting from this are not shown.

Error numbers on the CPX terminal

All CMPX errors are also signaled as CPX error messages 10x (100 ... 109). These can be examined via (e.g.) the I/O diagnostic interface.

Function number	**Module diagnostic data**
2008+m*4+1	Module error number

When reading the error via the function number of the CPX node, the CPX error number is always displayed. The last digit reflects the CMPX error group (for the first digit of the CMPX error number see Tab. 6/2).

Example:

Error number		**Description**	
CPX	**CMPX**		
10**1**		CPX error 100 ... 109: Example: CPX error 101:	Error in a positioning module error group **1**: Processing error
	13	CMPX error 10 ... 19: Example: CMPX error 13	Error group **1**: Processing error Wrong direction of movement (in a teach-in travel or in the 1st positioning task)

Error number		Description	Error handling
CPX	CMPX		
100	[Configuration error]		
	01	**[Actual configuration not the same as nominal configuration]**	• Check the configuration of the string allocation at the axis connection and correct if necessary, or • Accept the actual configuration via a new teaching procedure.
	02	**[Unknown type of valve]**	• Switch the power supply off and then on again. • Replace the valve.
	04	**[Unknown type of measuring system]**	• Switch the power supply off and then on again. • Replace the displacement encoder (measuring system).
101	[Execution error]		
	10	**[Drive is not referenced]**	For incremental measuring systems: • Carry out a homing run.
	12	**[Offset error during static identification – stiffness of the mechanical end-stop is too low]**	Stiffness of the mechanical end-stop is too low: • Improve the stiffness of the mechanical end-stop. • Perform a new teaching procedure with reduced pressure (then restore normal pressure afterwards).
	13	**[Incorrect direction of movement (during teach procedure or during the 1st drive command)]**	• The tubing may be wrongly connected, check and correct if necessary. For incremental measuring systems: • Check the sensor. The checking is switched off once successful travel to the target position has been achieved.
	14	**[Stop with non-permitted reversal of movement during the 1st drive command]**	Drive is uncontrolled. Direction of movement recognition remains active: • Only initiate a stop with reversal of movement after the first stroke.

Error number		Description	Error handling
CPX	**CMPX**		
to 101	15	**[Drive does not move during static identification or reference travel (teach procedure)]**	• Compressed air supply, check the tubing and system structure.
	16	**[Drive does not move during dynamic identification (teach procedure)]**	• Compressed air supply, check the tubing and system structure.
	17	**[Identification (teach procedure) not executed]**	• Perform a teaching procedure.
	18	**[Clamping unit is still active, no drive command possible]**	• Release brake.
102	**[Record error]**		
	20	**[No unambiguous drive command]**	Multiple positioning tasks via I/O: • Only set one of the POS1 ... POS4, JOG_NEG, JOG_POS, START_TEACH outputs. Simultaneous positioning tasks via keys or I/O: • Use only one control possibility.
	25	**[Position 3 is not taught or it is out of the actual end-position]**	Pos3/Pos4 has not yet been taught: • Teach the position(s) Pos3/Pos4 are no longer inside the travel range (e.g. after moving the fixed stops and performing a teaching procedure): • Carry out the teaching procedure again.
	26	**[Position 4 is not taught or it is out of the actual end-position]**	
103	**[Control error]**		
103	30	**[Time-out, position value or force value cannot be reached]**	Position is not reached quickly enough (Timeout is approx. 10 s). • Remove obstruction in positioning path or check compressed air supply.

Error number		Description	Error handling
CPX	CMPX		
104	**[System error A]**		
104	43	**[No periphery available or CAN-communication disturbed]**	• Check the axis string (see also section 3.2). After correction of the cause of the error and quitting of the error, the CMPX attempts to bring the axis string back into operation. This can take a few seconds.
	48	**[Wrong parameter L or r with DDPC/DNCI]**	• Correct the setting for parameter r or L (see also section 4.4.2).
	49	**[Parameter A, C or S wrong, system is over-shooting]**	• Correct the parameter. • Check the operating pressure and increase if necessary.
105	**[System error B]**		
	50	**[Operating pressure too low (< 1.5 bar)]**	• Check the compressed air supply and correct if necessary.
	51	**[Load voltage outside tolerance range (undervoltage)]**	• Check the valve load supply (V_{VAL}).
	52	**[Operating voltage outside tolerance range (undervoltage)]**	• Check the operating voltage supply for electronics/sensors ($V_{EL/SEN}$).
	53	**[Overload load supply]**	Excessive current in the axis string. • Check the cables and modules in the axis string (e.g. for a cable breakage), replace if necessary.
	54	**[Overload operation supply]**	
	56	**[Supply pressure is not sufficient to move the load correctly or to hold the load in the position]**	• Increase operating pressure.

Error number		Description	Error handling
CPX	**CMPX**		
106	**[Error in valve]**		
	60	**[Communication error or no valve available]**	• Check the axis string (see also section 3.2). • Servicing required.
	61	**[Valve hardware is defective]**	• Replace the valve. • Servicing required.
	62	**[Excess temperature at valve coil]**	• Switch off power supply, wait for while and then switch it on again. When the error is signaled again: • Servicing required.
	63	**[Valve jammed]**	• Check the air quality (e.g 5 µ filter). • Replace the valve.
	64	**[Load voltage outside tolerance range (undervoltage)]**	• Check the power supply. • Check the cables at the axis string.
	65	**[Operating voltage outside tolerance range (undervoltage)]**	• Check the power supply. • Check the cables at the axis string.
	66	**[Overload at digital output valve]**	• Check the connected valves/ components. • Eliminate short circuit.
	67	**[Overload at 24 V supply output of valve]**	• Check the connected valves/ components. • Eliminate short circuit.
	69	**[Faulty data, valve is defective]**	• Replace the valve.
107	**[Controller error]**		
	71	**[Hardware is defective]**	• Switch the power supply off and then on again. When the error is signaled again: • Replace the CMPX.

Error number		Description	Error handling
CPX	CMPX		
108	[Encoder error]		
	80	**[Communication error or no measuring system available]**	• Connect the displacement encoder or check the cables.
	81	**[Hardware defective]**	• Switch the power supply off and then on again. When the error is signaled again: • Replace the displacement encoder.
	82	**[Non-permitted position values or measuring system error]**	• Switch the power supply off and then on again. When the error is signaled again: • Replace the displacement encoder.
	83	**[Length information or offset of the measuring system type MTS is not available or not correct]**	• Replace the displacement encoder.
	85	**[Operating voltage outside tolerance range (undervoltage)]**	• Check the power supply. • Check the cables.
	86	**[Initialisation of the measuring system or the sensor-interface has failed]**	• Switch the power supply off and then on again. When the error is signaled again: • Replace the displacement encoder
	87	**[Defective measuring system cable or measuring system in the electrical end-position]**	• Move the measuring system (potentiometer) away from the end position. • Check the power supply. • Check the cables.
	89	**[Faulty data – sensor-interface is defective]**	• Switch the power supply off and then on again. When the error is signaled again: • Replace the displacement encoder (measuring system).

Tab. 6/2: CMPX error messages

Furthermore, the following errors can occur during the commissioning phase for the CPX bus node with the parameter “System start” = “saved parameterising and CPX system equipment status” or for the CPX-FEC:

Error number	Description	Error handling
16	**Module code incorrect** – The string allocation stored in the CMPX is different to the configuration stored in the CPX bus node or the CPX-FEC	• For the CPX bus node: Change parameter “System start...” to “... De-error parameterising and current CPX equipment status”. • With the CPX-FEC: Save the actual configuration as the set configuration using the FST software.

Tab. 6/3: Additional error message of the CPX terminal

6.3 Diagnostics via LEDs

LEDs for diagnosing the CPX terminal are provided on the field bus node as well as on the individual modules at the axis connection.

The meaning of the LEDs on the CPI/CP modules can be found in the manual for the relevant module.

LEDs on the CMPX

The light-emitting diodes on the cover indicate CMPX errors.

1 Error ϟ (red)

2 Power load PL (yellow)

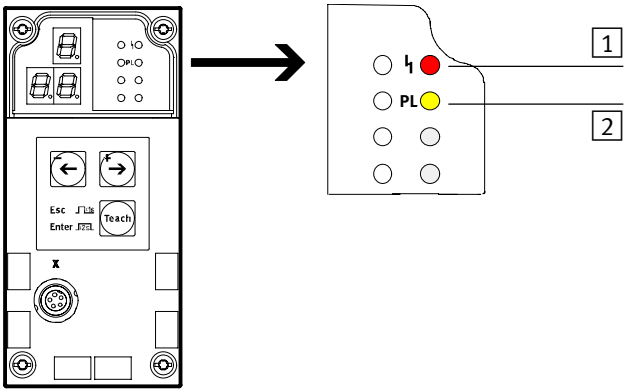
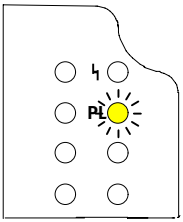


Fig. 6/1: LEDs on the CMPX

LED		Description
ϟ	Error LED	Lights up when CMPX errors occur.
PL	Power load	Lights up when the correct load voltage supply (V_{VAL}) is present.

Tab. 6/4: Functional overview of the CMPX LEDs

6.3.1 Normal operating status

LED display		Operating status
	The red error LED is not lit: – No error The yellow PL LED is lit: – The valve load supply is present	Standard

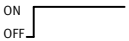
Tab. 6/5: LED display – normal operating status

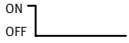
6.3.2 CMPX-specific LEDs

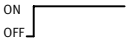
ϟ (Error) – CMPX error		
LED (red)	**Sequence**	**Installation**
○ LED is out	ON OFF	No error.
☀ LED lights up	ON OFF	CMPX error messages

PL (Power Load) – valve power load supply		
LED (yellow)	**Sequence**	**Installation**
☀ LED lights up	ON OFF	24 V valve load voltage supply is present
○ LED is out	ON OFF	Undervoltage at the valve load supply (V_{VAL}) or the load supply is not present.

6.3.3 LEDs on the VPWP

Power – VPWP logic supply		
LED (green)	**Sequence**	**Installation**
 LED lights up		24 V logic supply is present
 LED is out		VPWP logic supply is not present

Error – VPWP error		
LED (red)	**Sequence**	**Installation**
 LED is out		No error.
 LED flashes		Warning: – Switch-off temperature almost reached – Logic supply lies below 17 V
 LED lights up		Error [1]
[1] Message about a CMPX error, see section 6.2.3, Tab. 6/2		

PL – VPWP load supply		
LED (yellow)	**Sequence**	**Installation**
 LED lights up		24 V VPWP load supply is present
 LED is out		VPWP load supply is not present or an error exists.

6.3.4 LEDs on the sensor interface

LEDs on the CASM-S-D2-R3		
LED S1	**LED S2**	**Installation**
green	off	Ready to operate, without an error.
green	red	Initialising via CAN completed.
flashes green	red	24 V present.
off	off	24 V not present.
green	flashes red once	Error: Sensor error (supply voltage ‹ 12 V for longer than 15 ms).
green	flashes red twice	Error: Sensor error (cable break in sensor cable or electrical end position reached).
green	flashes red 3 times	Error: Supply voltage (‹ 17 V for longer than 15 ms).
green	flashes red 4 times	Error: Communication error (Bus Off state).

LEDs on the CASM-S-D3-R7		
LED S1	**LED S2**	**CASM-S-D2-R3 state**
green	off	Ready to operate, without an error.
green	red	Initialising via CAN completed.
flashes green	red	24 V present.
flashes green	off	Not yet referenced.
off	off	24 V not present.
green	flashes red once	Error: Sensor error.
green	flashes red twice	Error: Sensor cable (cable break in the sensor cable).
green	flashes red 3 times	Error: Supply voltage (‹ 17 V for longer than 15 ms).
green	flashes red 4 times	Error: Communication error (Bus Off state).

6.3.5 LEDs on the measuring system (DGCI only)

LEDs on the DGCI measuring system		
Power LED	**Error LED**	**Installation**
green	off	No error (normal operating status)
off	off	No power supply
off	red	Error: Initialising via CAN failed
green	red	Error: Magnet not recognised or incorrect number of magnets
flashes green	flashes red	Error: Operating voltage not within permissible range

6.4 Diagnosis via the display/7-segment display

LEDs for diagnosing the CPX terminal are provided on the CMPX as well as on the individual CPI/CP modules.

1 1st position (e.g. Identifying letters for parameters or status type)

2 Point for separation

3 2nd and 3rd positions (e.g. value, stage or status information)

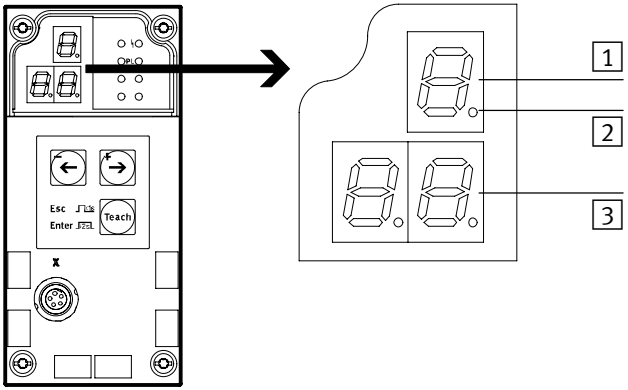


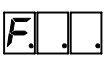
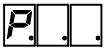
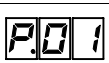
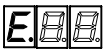
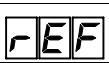
Fig. 6/2: Display/7-segment display

6.4.1 Firmware version

Display	Description
	When the power supply is switched on, the firmware version (e.g. 1.03) is displayed for approx. 1 s.

Tab. 6/6: Firmware version display

6.4.2 Status indicators

Possible status information	
Display	**Description**
	Teaching. – Letter (t) flashes: The CMPX waits for the **T**eaching task. – Dots (..) flash: The **T**each-in travel is being executed. The TEACH_ACTIVE input bit supplies a 1 signal.
	The CMPX searches for components at the axis connection (**F**ind valve and measuring system).
	The movable mass is not located at a taught **P**osition (Position 1 ... 4). Input bits MC_POS1 ... MC_POS4 supply a 0 signal. – After switching on: The movable mass is stationary and unregulated. – In operation (e.g. manual positioning): The movable mass moves or is stationary and regulated.
	The movable mass is stationary at end position **Position 1** (end position in a negative direction). Input bit MC_POS1 supplies a 1 signal.
	The movable mass is stationary at end position **Position 2** (end position in a positive direction). Input bit MC_POS2 supplies a 1 signal.
	The movable mass is stationary at intermediate position **Position 3** (taught intermediate position). Input bit MC_POS3 supplies a 1 signal.
	The movable mass is stationary at intermediate position **Position 4** (taught intermediate position). Input bit MC_POS4 supplies a 1 signal.
	**St**o**p**p signal via the STOP output bit or the CPX-MMI. Input bit ACK_STOP supplies a 1 signal.
	An error exists (**E**rror, for error numbers, see section 6.2, Tab. 6/2). Input bit FAULT supplies a 1 signal.
	**Ref**erence run (homing run) is being executed (for digital incremental measuring systems).

Tab. 6/7: Status information display

The parameter displays are described in section 4.3, Tab. 4/1.

6.5 Diagnosis functions with the Handheld

The universal Handheld type CPX-MMI-1 offers convenient extended functions which assist you in diagnosing and trouble shooting with the CMPX interface.

General information on operating and commissioning the CPX terminal using the Handheld can be found in the manual for the Handheld, type P.BE.CPX-MMI-1-... .

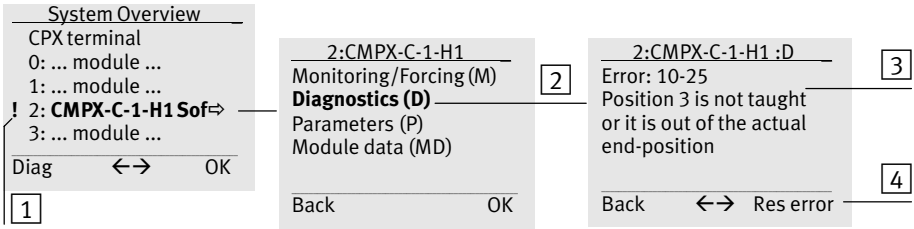
The additional diagnostic functions of the Handheld have already been described in the “Commissioning” chapter, section 4.5.

6.5.1 Error display and quitting errors ([Diagnostics] menu)

Modules that signal an error are marked in the main menu by an exclamation mark (!) in front of the module number.

Existing errors are displayed in plain text in the [Diagnostics] menu and can be quit using the “Reset Fault” function key.

If multiple errors exist simultaneously, these can be quit in the sequence that they occurred. The drive cannot be moved until all errors have been quit.



1 Existing errors

2 [Diagnostics] menu

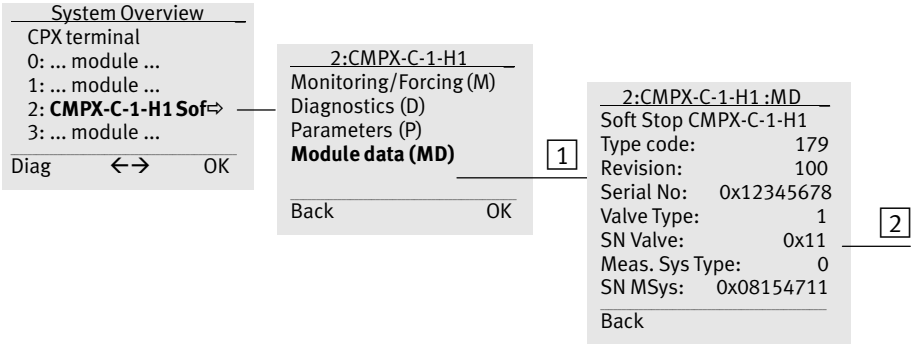
3 Error number and description

4 Quitting errors (resetting)

Fig. 6/3: Error display with the Handheld

6.5.2 Information on the CMPX ([Module Data] menu)

The module data of the CMPX is displayed in the [Module data] menu.



1 "Module data" menu 2 Information (page using ↑ or ↓)

Fig. 6/4: Displaying information with the Handheld

Module data	Description
Type code	Module code (CPX-specific, with the CMPX: 179)
Revision	Firmware version (e.g. '100' for V 1.00)
Serial No	Serial number of the CMPX
Valve Type	Valve type: 1: VPWP-2-... 2: VPWP-4-... 3: VPWP-6-... 4: VPWP-8-... 5: VPWP-10-...
SN Valve	Serial number of the valve
Meas. Sys Type	Measuring system (displacement encoder) type 1: Digital, absolute (new version, e.g. DGCI) 2: Digital, absolute (old version, e.g. DGPI..., MME-MTS-...) 3: Analogue, absolute (Potentiometer, e.g. DSMI, MLO-POT-..., etc.) 4: Digital, incremental (e.g. DNCI, DDPC)
SN MSys	Serial number of the measuring system (displacement encoder)

Tab. 6/8: Module data on the Handheld

6.6 Diagnosis via the CPX-FEC or CPX bus node

Errors in the CMPX or the connected modules are reported to the CPX bus node or CPX-FEC as CPX error messages. The following sections contain the special features of the representation for the CPX-specific diagnostic possibilities.

- I/O data module (see section 6.6.1),
- Status bits (see section 6.6.2),
- Diagnostic memory (I/O diagnostic interface, see section 6.6.3).

6.6.1 Module output and input data

Among other information, the following diagnostic information is available via the I/O data module (see section 5.3).

Error

A error (error) exists	The FAULT input (bit 6 of status byte 1) indicates that a error exists. The error can be quit via the RESET_FAULT output (bit 7 of control byte 1).
Error number	The error number of an existing error is provided in the second I-byte (status byte 3).

Status

POS1 ... POS4	If the drive is located at one of the end or intermediate positions then this is indicated by the outputs MC_POS1 to MC_POS4.
actual position	The actual current position can be read via the parameter transfer in I/O bytes 3 ... 5 (read/write parameter), see section 5.4.

6.6.2 Status bits of the CPX terminal

Tab. 6/9 shows the message indicating a CMPX error in the CPX terminal status bits.

Bit	Diagnostic information with 1-signal	Description	Cause of CMPX error
0	Error at valve	Module type on which a error has occurred	–
1	Error at output		–
2	Error at input		–
3	Error on analogue module/ technology module		Bit 3 is set for all CMPX errors.
4	Undervoltage	Type of error	–
5	Short circuit/overload		–
6	Wire break		–
7	Other errors		–

Tab. 6/9: Overview of status bits

Further instructions on the function and content of the status bits can be found in the CPX system manual.

6.6.3 I/O diagnostic interface and diagnostic memory

A range of different diagnostic information is accessible via the I/O diagnostic interface and the diagnostic memory of the CPX terminal.

Diagnostic memory data (Handheld and I/O diagnostic interface)

The specific representation of diagnostic messages of the CMPX in the diagnostic memory of the CPX terminal occurs as shown in Tab. 6/10.

Diagnostic memory data (10 bytes per entry, max. 40 entries)				**Function no. [1)]**
Byte	**Designation**	**Description**	**Value**	**3488 + n**
1 2 3 4 5	Days [day] Hours [h] Minutes [m] Seconds [s] Milliseconds [ms]	Time information for the reported error, measured from the point when the power supply was switched on (CPX standard).	0 ... 255 0 ... 23 0 ... 59 0 ... 59 0 ... 99 (128...227)	n = 10 * d + 0
6	Module code	CMPX module code: 179	0 ... 255	n = 10 * d + 5
7	Module position [Pos]	Module code of the CPX module that signaled the error.	0 ... 47	n = 10 * d + 6
8	Channel number	Bit 7 6 5 ... 0 Description 1 0 0 ... 0 Error in I-channel 1	128 (0 ... 255)	n = 10 * d + 7
9	Error number [FN]	CPX error number (see section 6.2)	90 ... 99 (0 ... 255)	n = 10 * d + 8
10	Following channels	Always 0 for the CMPX	0 (0 ... 63)	n = 10 * d + 9
[1)] d (diagnostic event) [NB] = 0 ... 39 ; most current diagnostic event = 0				

Tab. 6/10: CMPX diagnostic memory

Instructions on diagnosis with the I/O diagnostic interface can be found in the CPX system manual.

Example of diagnostic memory entry for error E.80

Diagnostic memory data			Value		
Byte	**Designation**	**Description**	**Dec**	**Hex**	**Bin**
1 2 3 4 5	Days [day] Hours [h] Minutes [m] Seconds [s] Milliseconds [ms]	Errors were signaled 22.66 ms after switching on the power supply (bit 7 in byte 5 is set if this is the first entry since Power ON).	0_d 0_d 0_d 22_d 194_d	00_h 00_h 00_h 16_h $C2_h$	00000000_b 00000000_b 00000000_b 00010110_b 11000010_b
6	Module code	CMPX module code: 179	179_d	$B3_h$	10110011_b
7	Module position [Pos]	In this case, the CMPX is CPX module No. 2.	2_d	02_h	00000010_b
8	Channel number	Bit 7 6 5 ... 0 Description 1 0 0 ... 0 Error in I-channel	128_d	81_h	10000001_b
9	Error number [FN]	CPX error number: 108	108_d	$6C_h$	01101100_b
10	Following channels	Always 0 for the CMPX	0_d	00_h	00000000_b

Tab. 6/11: Example of diagnostic memory entry

Diagnostic data of the module (I/O diagnostic interface)

The specific representation of module diagnostic data (error messages) of the CMPX interface occurs as shown in Tab. 6/12 and Tab. 6/13.

Module diagnostic data: Type of error and location where error arose	
Function no.	2008 + m * 4 + 0; m = module number (0 ... 47)
Description	Describes where the relevant error occurred.
Bit	Bit 0 ... 7 Type of error and location where error arose
Values	Bit 7 6 5 ... 0 : Description 1 0 00001 : Error in I-channel 1

Tab. 6/12: Type of error and location where error arose

Module diagnostic data: Module error number	
Function no.	2008 + m * 4 + 1; m = module number (0 ... 47)
Description	Error number
Bit	Bit 0 ... 7 : error number
Values	100 ... 108: CPX error number (see example Tab. 6/11)
Note	For CMPX error messages, see section 6.2.

Tab. 6/13: Module error number

CMPX parameters

The CMPX parameters are also accessible via the I/O diagnostic interface, see section 5.5, Tab. 5/7.

Further information

Module code

Function no: 16 + m*16 + 0:
Module code: 179

Revision code

Function no: 16 + m*16 + 13
Shows the module version: 0 ... 255 according to the name plate of the module

Serial number

Function no: 784 + m*4 + 0
784 + m*4 + 1
784 + m*4 + 2
784 + m*4 + 3
Serial number of the module.
Byte 0: lower nibble = year, higher nibble = month of the series.
Bytes 1 ... 3: each nibble contains one digit of the serial number (BCD encoded)

6.7 Eliminating errors on the system

Basic information on quitting errors is provided in section 6.2.2.

6.7.1 Malfunctions in operation

Poor behaviour during movement to end position

Cause	Remedial action	Remarks
System is not fitted correctly	Check fitting and mechanical parts	Check displacement encoder and drive for parallelism, check for mechanical play and sluggishness
System is not earthed correctly	Check	See section 3.1
Parameters are not set optimally	Check parameters	See appendix “CMPX Parameters”
High fluctuations in supply pressure (› 1 bar)	Check the supply pressure	If necessary, fit a compressed air reservoir
Non-permitted mass load	Check mass load and parameters	If necessary, place a basic load in position in order that the maximum permitted value range is not exceeded during positioning with different masses.
During too fast/hard movement into the end positions	Increase the cushioning stage (parameter C)	See section 4.4.3 or 4.5.1
During too slow/soft movement into the end positions	Reduce the cushioning stage (parameter C)	See section 4.4.3 or 4.5.1

Tab. 6/14: Malfunctions during operation: Poor behaviour during movement to end position

6.8 Optimisation

6.8.1 Optimise positioning behaviour

After the “teach” procedure the positioning behaviour is automatically optimised in the first 20 to 30 strokes by means of internal adaptation. If the quality of the positioning behaviour still does not fulfil expectations, proceed as follows:

- Check parameters A, C and S (see appendix “CMPX Parameters”).
- Check that the following mechanical connections
  Drive – moveable mass,
  Drive – measuring system,
  Drive – machine frame
  are backlash-free.
- Check that the installation of the pneumatic components fulfills the requirements listed in section 2.6. Make sure especially that the supply pressure is stable, that the tubing is of the correct length and diameter and that the correct screw connectors are used.
- Check the set options (o-parameters). The following options influence positioning behaviour (see section 4.3.3):
  - constant adaptation on/off,
  - soft end position behaviour on/off.

If, however, the moveable mass still moves into the end positions with too hard an impact, or brakes too heavily before reaching the end position, you can optimize the positioning behaviour by increasing or reducing the cushioning level and/or the amplification level.

Control parameter stage	Display
Amplification stage	
Cushioning stage	

Warning
Incorrect parameters can damage the fixed stops and the drive.

Be very careful when setting the parameters.

When parameters are modified, the saved end positions and adaptation values are deleted for safety reasons. Therefore, the “teach” procedure must then be carried out again. Intermediate positions already “taught” are retained.

All parameters are set to 0 at the factory. For more information on parameters, see appendix “CMPX Parameters”.

Cushioning stage

The cushioning stage serves to optimize the approach behaviour when moving to the end positions (lower stage = less cushioning).

Setting	Description
Too high	The positioning procedure is heavily cushioned. The positioning time is extended.
Too low	Leads to heavy overshooting and, as a result, to hard striking of the fixed stops.
Optimal	The braking phase (counter pressurisation) is started early enough. Less shaking when moving to end positions.

Amplification stage

The amplification stage should not normally be modified (lower stage = less amplification).

Optimisation procedure (example using control panel)

Note
If, after you have taught the end positions again, the previously taught intermediate positions (Pos3 and Pos4) now lie outside the positioning range, positioning commands to move to the intermediate positions will be ignored and error E.25 or E.26 will be signaled. As soon as the intermediate positions lie once again in the permitted positioning range, as a result of adjustment of the end stops and re-teaching of the end positions, positioning commands to move to the intermediate positions will be carried out again.

Requirement

0 signals must be present at outputs POS1 to POS4. The maximum mass load and, if applicable, the fixed stops must be fitted correctly.

1. First determine the cushioning stage recommended for the components you are using (see appendix “CMPX Parameters”).
2. Make sure that the drive is standing still.

Caution
When the modification mode is activated, the valve slide assumes the mid-position. During positioning the mass can therefore move uncushioned into an end position.

Make sure that the drive is standing still before you activate the modification mode.

3. To activate the editing mode, press all 3 buttons on the CMPX at the same time (the DISABLE_KEYS output must be 0 for this). The modification mode will then be activated. The CMPX shows the amplification stage set, e.g.:

(A.02)

4. With the +/- buttons you can increase or reduce the value by one stage, in accordance with the positioning characteristics of the drive.
   Hold the Enter key pressed down for at least 2 seconds (› 2 s) in order to accept the value. The cushioning stage will then be shown.

   
   (C.04)

5. With the +/- buttons you can increase or reduce the value by one stage, in accordance with the positioning characteristics of the drive.
   Hold the Enter key pressed down for at least 2 seconds (› 2 s) in order to accept the value. The system parameter will then be shown.

   
   (S.01)

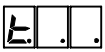
6. Check and, if necessary, correct the current setting.
   Hold the Enter button pressed down for at least 2 seconds (› 2 s) in order to accept the value. The next parameter will then be shown.

7. Check and correct the other parameters:

   – For digital incremental measuring systems:
     - nominal stroke length (L)
     - offset axis zero point (r)

   – With all types:
     - o-parameter (options)

   When the o-parameter is confirmed, the CMPX displays readiness to carry out the teaching procedure.

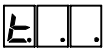
   
   The t flashes.

Note
During the teach procedure, the moveable mass moves at first slowly, then at the highest possible acceleration and speed. Make sure that:

– Nobody can place his/her hand in the positioning range of the moveable mass, unless the compressed air supply is switched off.
– The complete positioning range is free of any objects.

To teach using the operating panel, a 0 signal must be present at the Disable_Keys output.

8. Hold the Teach button pressed down for at least 2 seconds.
   The CMPX then carries out the teaching procedure. The moveable mass moves at first slowly, then dynamically. The display shows the following:



The dots flash at the same rate.

The teaching procedure can last several minutes, depending on the drive used. It is concluded when the drive is at end position 1. The display shows the following:

(Position 1)

The POS1 input supplies a 1 signal. The drive is now ready for operation. Intermediate positions 3 and 4 can be taught.

9. Check the positioning behaviour. Repeat points 2 to 8 if the positioning behaviour does not yet fulfil your expectations.

In order to influence the positioning times:

- Increase or reduce the supply pressure within the permitted range.
- Install exhaust restrictors in the exhaust lines of the proportional directional control valve.

Note
Make sure that the exhaust-air throttles are completely opened during the teach procedure.

If fluctuations in pressure of over 1 bar occur in front of the proportional directional control valve, install a compressed air reservoir (see section 2.6). Please observe the general installation instructions!

Technical appendix

Appendix A

Contents

A.1 CMPX Technical data

CMPX General information	
General technical data	See CPX system manual P.BE-CPX-SYS-...
Product weight (with CPX-GE-EV-S)	approx. 240 g
Protection class as per EN 60 529, completely installed, plug connector inserted or provided with protective cap	IP 65/IP 67
Protection against electric shock (protection against direct and indirect contact as per IEC/DIN EN 60204-1)	by means of a PELV circuit (Protected Extra-Low Voltage)
Module code (CPX-specific)	179
Module identifier (in the Handheld)	CMPX-C-1-H1 Soft Stop CMPX-C-1-H1

CMPX power supply	
Operating voltage/load voltage The following special features apply: – Permitted tolerance in load voltage supply for valves (V_{VAL})	See CPX system manual P.BE-CPX-SYS-... 20 ... 30 V
CMPX current consumption – From operating power supply Electronics/Sensors ($V_{EL/SEN}$) – of load voltage supply for valves (V_{VAL})	typically 200 mA at 24 V (see section 3.4.1), max. 300 mA typically 1 A ... 2 A at 24 V (see section 3.4.1), max. 2.5 A
Electrical isolation – between the operating voltage supply for the electronics/sensors ($V_{EL/SEN}$) and the load voltage supply for the valves (V_{VAL})	None
Power failure bridging time	10 ms (for systems with the DGCI, a power dropout › 1 ms causes an error E.85)

Soft Stop system with the CMPX	
Axis string Number of axis strings/Number of axes Max. total length (all cables) Type of axis connection	 1/1 30 m Socket M9, 5-pin

A.2 Accessories

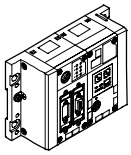
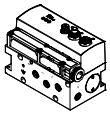
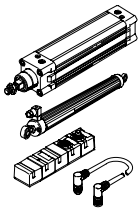
Necessary and useful CMPX accessories:
www.festo.com/catalogue/cmpx

Information on drives, and other modules on the axis string and their accessories, is provided in sections A.2.1, A.2.2 and also in the documentation for the modules used.
Information on accessories for the CPX terminal can be found in the CPX system manual or in the manual for the CPX modules used.

A.2.1 Components of a Soft Stop system

Tab. A/1 shows an overview of the components of a Soft Stop system with the CMPX.

Depending on the drive used, fixed stops for setting the end positions may be necessary in order to protect the drive.

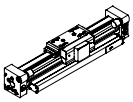
Component		Description	e.g. type
	CPX terminal with CMPX end position controller	The CMPX controls the connected Soft Stop system. Coupling to a PLC or control of the Soft Stop Systems is done via a CPX Fieldbus node or a CPX-FEC.	CPX terminal with CPX-CMPX-C-1-H1 end position controller
	Connection cable for the axis string	Establishes the connection between the CMPX end position controller and the VPWP proportional directional control valve and, if present, between the VPWP and a CASM sensor interface.	KVI-CP-3-...
	Proportional directional control valve	The VPWP transfers the signals from the displacement encoder and controls the drive by pressurising and depressurising the drive chambers according to the control signals.	VPWP-...
	Drive with displacement encoder, sensor interface, connection cables and, if present, additional fixed stops	Permissible drive and displacement encoder (in this example a DGC with MLO-POT-...-LWG) and possibly a sensor interface (depending on the measuring system).	see section A.2.2
	Pneumatic tubing	The VPWP is provided with supply pressure via correctly dimensioned tubing and the drive is connected to the VPWP.	PUN-..., QS...

Tab. A/1: Soft Stop system components

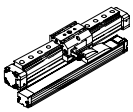
A.2.2 Supported drives

The following tables show show the supported drives (as of January 2008).

Permissible drive-valve combinations with mounting positions, load mass and associated parameters are listed in the product appendix ”CMPX Parameters”, type GDSP-CMPX-... .

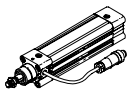
DGCI linear drive			
Fig.	**Component**	**Description**	**Type**
	Drive with measuring system	Linear drive with permanently installed displacement encoder (digital, absolute). With integrated connection cable for connecting to the VPWP.	DGCI-...

Tab. A/2: DGCI linear drive components

DGP(L) linear drive			
Fig.	**Component**	**Description**	**Type**
	Drive	Linear drive, can be combined with an external displacement encoder via the order code or as an accessory.	DGP(L)-...
	Displacement encoder	External displacement encoder (analogue, absolute – potentiometer)	MLO-POT-...-TLF
	Connection cable for the axis string	Connection cable between a VPWP and a CASM-S-D2-R3.	KVI-CP-3-...
	Sensor interface	Sensor interface for connection to an analogue absolute displacement encoder (potentiometer) on the axis string.	CASM-S-D2-R3
	Connection cable for the measuring system	Connection cable between a CASM-S-D2-R3 and a MLO-POT-...-TLF.	NEBC-A1W3-K-0.3-N-M12G5

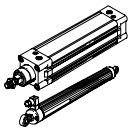
Tab. A/3: Components with a DGP(L) linear drive

DNCI/DDPC standard cylinder

Fig.	Component	Description	Type
	Drive with measuring system	Standard cylinder with integrated displacement encoder (digital, incremental). With an integrated connection cable for connection to the CASM-S-D3-R7.	DNCI-... DDPC-...
	Connection cable for the axis string	Connection cable between a VPWP and a CASM-S-D3-R7.	KVI-CP-3-...
	Sensor interface	Sensor interface for connection to a digital incremental displacement encoder on the axis string.	CASM-S-D3-R7

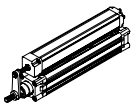
Tab. A/4: Components with a DNCI/DDPC standard cylinder

Standard cylinders DNC

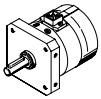
Fig.	Component	Description	Type
	Drive	Standard cylinder, which can be combined with an external displacement encoder using accessories. [1]	DGP-...
	Displacement encoder	External displacement encoder (analogue, absolute – potentiometer).	MLO-POT-...-LWG
	Connection cable for the axis string	Connection cable between a VPWP and a CASM-S-D2-R3.	KVI-CP-3-...
	Sensor interface	Sensor interface for connection to an analogue absolute displacement encoder (potentiometer) on the axis string.	CASM-S-D2-R3
	Connection cable for the measuring system	Connection cable between a CASM-S-D2-R3 and an MLO-POT-...-LWG.	NEBC-P1W4-K-0.3-N-M12G5

[1] **Note**: The following DNC variants are **not** permitted for use with the SPC11:
– Constant run variant S10 (slow speed),
– Light run variant S11 (low friction),
– Temperature-resistant variant S6 (only on request).

Tab. A/5: Components with DNC standard cylinder

DNCM standard cylinder			
Fig.	**Component**	**Description**	**Type**
	Drive	Standard cylinder with mounted external displacement encoder LWH (analogue, absolute – potentiometer).	DNCM-...
	Connection cable for the axis string	Connection cable between a VPWP and a CASM-S-D2-R3.	KVI-CP-3-...
	Sensor interface	Sensor interface for connection to an analogue absolute displacement encoder (potentiometer) on the axis string.	CASM-S-D2-R3
	Connection cable for the measuring system	Connection cable between a CASM-S-D2-R3 and a DNCM displacement encoder.	NEBC-A1W3-K-0.3-N-M12G5

Tab. A/6: Components with DNCM standard cylinder

DSMI semi-rotary drive			
Fig.	**Component**	**Description**	**Type**
	Drive	Semi-rotary drive with integrated displacement encoder (analogue, absolute – potentiometer).	DSMI-...
	Connection cable for the axis string	Connection cable between a VPWP and a CASM-S-D2-R3.	KVI-CP-3-...
	Sensor interface	Sensor interface for connection to an analogue absolute displacement encoder (potentiometer) on the axis string.	CASM-S-D2-R3
	Connection cable for the measuring system	Connection cable between a CASM-S-D2-R3 and a DSMI.	NEBC-P1W4-K-0.3-N-M12G5

Tab. A/7: Components with DSMI semi-rotary drive

A.3 Replacing components

When replacing components, observe the instructions in Tab. A/8.

Replacement	Description
... of a CMPX or CPX terminal	• Parameterisation: The CMPX parameters must be set anew. This can be done manually or automatically by the bus master if the parameters are appropriately configured in the bus master or configuration program, see appendix B. • Teaching procedure: The end positions Pos1 and Pos2 depend on the individual components and can therefore not be parameterised. A teaching procedure must therefore always be performed anew after replacement. • Intermediate positions: The intermediate positions Pos3 and Pos4 must be taught anew. If the drive and measuring system have not changed then the intermediate positions Pos3 and Pos4 might be parameterisable, see parameterisation.
... of drive, measuring system or VPWP and changes to the tubing	• Parameterisation: When identical components are replaced, the parameterisation remains unchanged. • Teaching procedure: The individual properties of the connected drive, measuring system or valve are not parameters. For this reason, a new teaching procedure must be performed when these components are replaced. In general, this is also highly recommended when the tubing is changed! • Intermediate positions: The intermediate positions position 3 and position 4 might be parameterisable via the bus master. However, note that the reference system may change when the drive or measuring system is replaced!
... other components	Electrically identical components can be replaced without further changes.

Tab. A/8: Replacing components

A.4 Additional pneumatic circuits

You may require additional pneumatic circuits in order to attain a particular status for the system in certain applications.

Note
If the operating voltage supply for the CMPX is switched off, the VPWP proportional directional control valve will move to the mid-position. Due to the asymmetrical voltage-pressure curve of the proportional directional control valve when the supply pressure is switched on, the slide can move slowly into one of the end positions.

Further information

The “Guide To Safety Technology” brochure contains detailed information on:

- Directives and norms
  - Machine guidelines and DIN EN ISO 13849-1
  - Definition and concept of risk
  - Risk assessment
  - Directive-compliant procedure for safe design (as per EN ISO 12100)
  - Control architectures (as per DIN EN ISO 13849-1)
  - Operating types and safety functions
- Sample circuit diagrams
- Festo products
- Services

The “Guide To Safety Technology” brochure is available in the Internet at:
➔ www.festo.com/en/safetyguide

Configuration with the CPX-FEC or CPX bus node

Appendix B

Contents

B.1 CPX-FEC

General information on configuration using the FST is provided in the CPX-FEC manual (Type P.BE-CPX-FEC-...). Detailed information on operating the FST can be found in the FST manual (type P.BE-FST-..).

B.1.1 Configuration

Use Festo Software Tools (FST 4.1 or higher) with the Hardware Configurator in order to configure your CPX terminal with CPX-FEC.

To configure the CMPX, this must be in the catalogue of the CPX configurator (CPX terminal/Technology module/ CPX-CMPX...). You may require an FST software update for this (CPX configuration update):

– www.festo.com/download
  → Download Software → Fieldbus GSD/EDS

Caution
If you have connected a CPX terminal to your PC for configuration: Test projects and programs at first without active actuators or without compressed air. You will then avoid damage in the test phase.

I/O configuration/CPX configuration

You can create the configuration in the following ways:

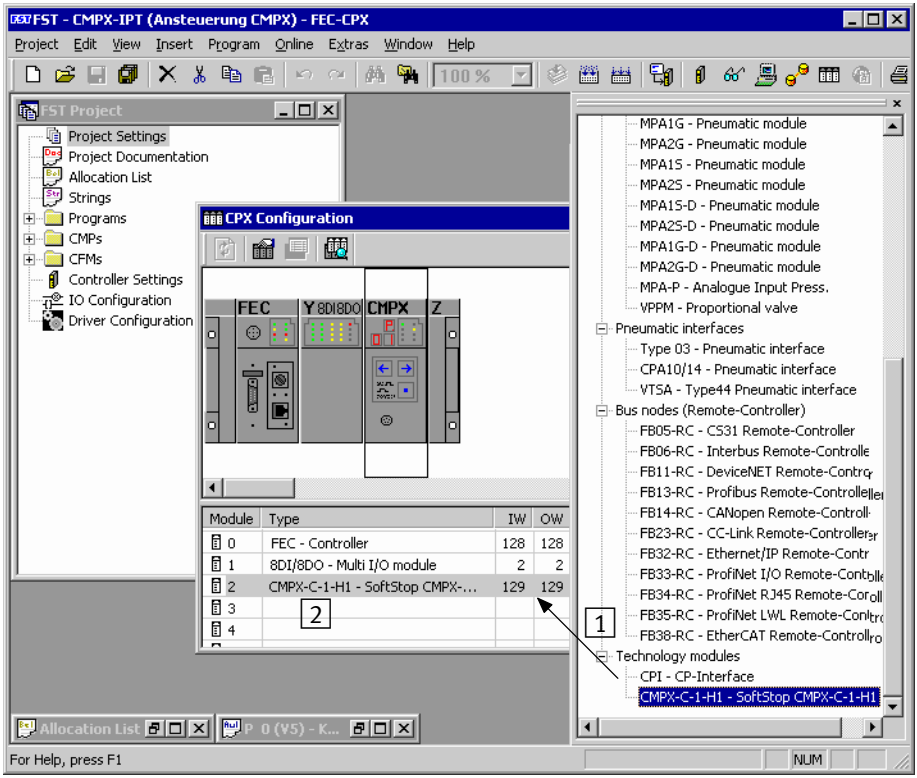
– Actual-nominal comparison in the editor mode

– Change to the online mode

– Manual configuration with the Hardware Configurator

The first two methods require the CPX terminal to be connected and ready for operation. The hardware configuration with the CMPX is automatically recognised.

With manual configuration, the CMPX can initially be configured without a connection to the CPX terminal.



1 Configuration with drag & drop

2 Configured modules in the configuration table

Fig. B/1: Manual configuration of the CPX terminal in the Hardware Configurator

Input word/Output word addresses

Set the start address of the input word and output word of the CMPX.

Module	Module identifiers	Allocated address space	Remarks
CPX-CMPX SoftStop	T20 CMPX	3 Input words (6 bytes) 3 Output words (6 bytes)	For assignment of the addresses, see section B.1.4.

Tab. B/1: CMPX Technology module

B.1.2 Parameterising the CMPX

The CMPX parameters cab be set as module parameters via the CPX configuration of the FST software.

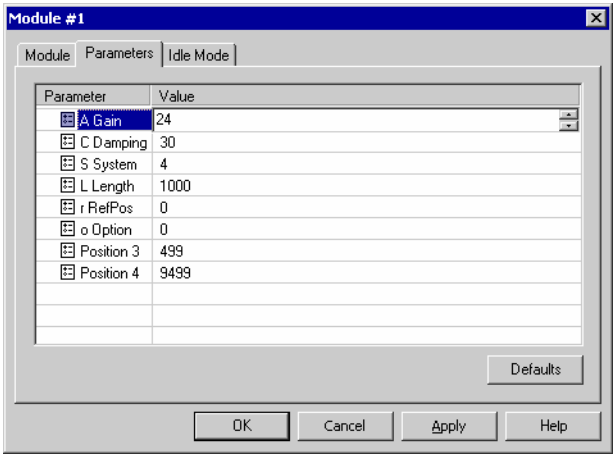


Fig. B/2: CMPX module parameters

Note
Note the general instructions on parameterising in section 5.4.

Information on the parameters is provided in section 4.3.

Idle mode parameterisation

Check your application to see if parameterisation of the idle mode is required.

Example

In the example as per Tab. B/2, the drive should be stopped and the brake activated.

Assignment		**CMPX inputs – Module output data**					
Bit	**Value**	**Control byte 1**	**Value**	**Control byte 2**	**Value**	**Control bytes 2 ... 6**	**Value**
0	1	POS1 = 0	0	RETAIN_POS4 = 0	0	– (no control function, all = 0)	0
1	2	POS2 = 0	0	RETAIN_POS4 = 0	0		0
2	4	POS3 = 0	0	START_TEACH = 0	0		0
3	8	POS4 = 0	0	**BRAKE = 1**	**8**		0
4	16	**STOP = 1**	**16**	– (reserved = 0)	0		0
5	32	JOG_NEG = 0	0	– (reserved = 0)	0		0
6	64	JOG_POS = 0	0	– (reserved = 0)	0		0
7	128	RESET_FAULT = 0	0	DISABLE_KEYS = 0	0		0
Idle mode		**Value for channel 0**	**16**	**Value for channel 1**	**8**	**Value for channels 2 ... 6**	**0**

Tab. B/2: Example of idle mode parameterisation

This results in a parameterisation as per Fig. B/3.

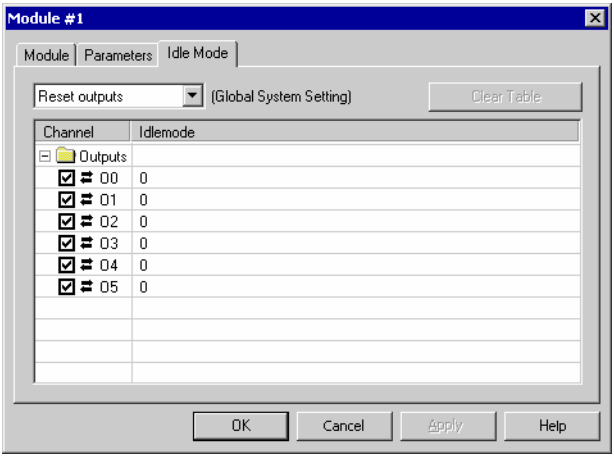


Fig. B/3: Idle mode parameterisation for example Tab. B/2

In order for the settings to take effect, the global system parameter must be set to “Use idle mode”.

B.1.3 Save actual configuration as the nominal configuration

In order to save the changes permanently, after the changes:

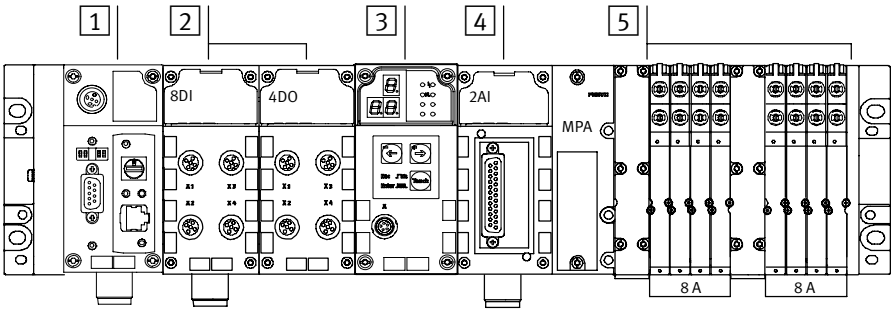
– the actual configuration must be saved as the nominal configuration

– or the project must be loaded into the CPX-FEC (a program must exist for this).

Note
Make sure that you have supplied taught parameters, or parameters edited via the keyboard or the CPX-MMI, to the CPX configurator.

B.1.4 Address assignment

Address assignment example



1 CPX-FEC

2 Digital I/O modules

3 CMPX Technology module

4 Analogue I/O modules

5 MPA1 pneumatics
(2 pneumatic modules)

Fig. B/4: CPX-FEC address assignment example

Location	Module	Input address	Output address	Remarks
0	CPX-FEC	128	128	The outputs are not used.
1	8-way digital input module (8DI)	0	–	–
2	4-way digital output module (4DO)	–	0	–
3	Soft Stop CMPX (T20)	129 ... 131	129 ... 131	For assignments, see Tab. B/4
4	2-way analogue input module (2AI)	64, 65	–	–
–	MPA pneumatic interface	–	–	Passive module.
5	MPA pneumatic module (CPX-type 32: 1-8V)	–	32	–
6		–	33	–

Tab. B/3: Configuration of address assignment for example Fig. B/4

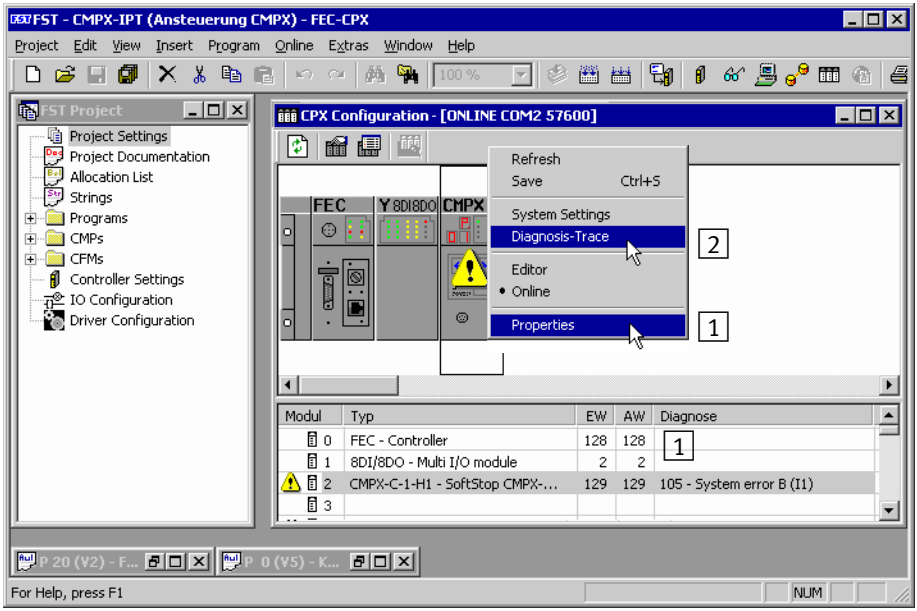
Module output data			**Module input data**		
AW	**Contents**	**Address**	**EW**	**Contents**	**Address**
AW129	Control byte 1: Bit Name 0 POS1 1 POS2 2 POS3 3 POS4 4 STOP 5 JOG_NEG 6 JOG_POS 7 RESET_FAULT	 A129.0 A129.1 A129.2 A129.3 A129.4 A129.5 A129.6 A129.7	EW129	Status byte 1: Bit Name 0 MC_POS1 1 MC_POS2 2 MC_POS3 3 MC_POS4 4 ACK_STOP 5 READY 6 FAULT 7 TEACH_ACTIVE	 E129.0 E129.1 E129.2 E129.3 E129.4 E129.5 E129.6 E129.7
	Control byte 2: Bit Name 0 RETAIN_POS3 1 RETAIN_POS4 2 START_TEACH 3 BRAKE 4 – (reserved) 5 – (reserved) 6 – (reserved) 7 DISABLE_KEYS	 A129.8 A129.9 A129.10 A129.11 A129.12 A129.13 A129.14 A129.15		Status byte 2: Bit Name 0 – 1 – 2 – 3 STATUS_BRAKE 4 STATUS_AIR 5 – 6 – 7 –	 E129.8 E129.9 E129.10 E129.11 E129.12 E129.13 E129.14 E129.15
AW130	– (reserved)	A130.0...7	EW130	CMPX error number (section 6.2.3)	E130.0...7
	Parameter index Bit Name 0 Read parameters 1 Write parameter 2 – (reserved) 3 – (reserved) 4 ... 7 Parameter index	 A130.8 A130.9 A130.10 A130.11 A130.12...15		Parameter response Bit Name 0 Parameter transferred/valid 1 Parameter task not executable 2 – (reserved) 3 – (reserved) 4 ... 7 Parameter index	 E130.8 E130.9 E130.10 E130.11 E130.12...15
AW131	Low byte of parameter	A131.0...7	EW131	Low byte of transferred/ read parameter.	E131.0...7
	High byte of parameter	A131.8...15		High byte of transferred/ read parameter.	E131.8...15

Tab. B/4: Addresses of the CMPX control and status bytes for example Fig. B/4

B.1.5 Diagnostic

Diagnosis with the Hardware Configurator

With the Hardware Configurator you can carry out a complete diagnosis of the CPX terminal. For this the CPX terminal must be connected **online** to your PC: Diagnostic messages of the modules are displayed directly in the Hardware Configurator with an icon on the appropriate module:



1 View current diagnostic message (properties or module entry)

2 View diagnostic memory (context menu)

Fig. B/5: Warning icon as diagnostic message in the Hardware Configurator

Looking at the diagnostic message

- Diagnostic message in the Hardware Configurator.
- Display the “Diagnostic” tab of the “Module...” dialog, by double-clicking or via the [Properties] context menu.

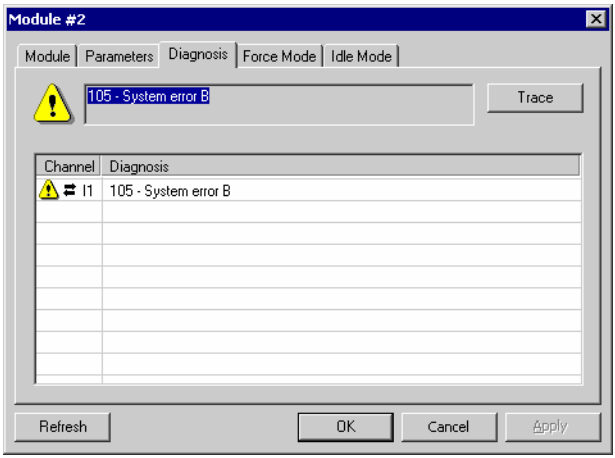


Fig. B/6: Diagnostic message in the properties dialog

Diagnostic memory

- Display the “Diagnostic memory” dialog via the [Diagnostic memory] context menu of the Hardware Configurator.

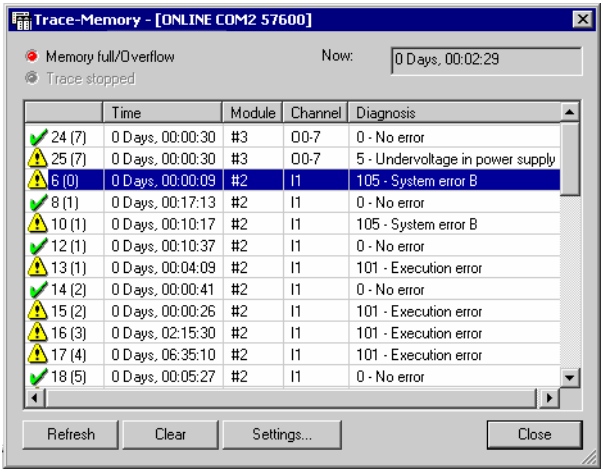


Fig. B/7: Diagnostic memory

Diagnosis with the online control panel

- Select [Online] [Control panel].

Coded diagnostic information is displayed under “Error”: Error type, CPX error number, module number

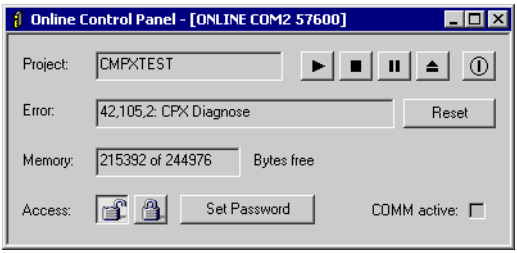


Fig. B/8: FST online control panel

Diagnosis in the user program

You can read out diagnostic information in your user program via function modules (CFM).

Modules	Description
C_STATUS	Interrogate diagnostic status
C_TR_rd	Read entries in diagnostic memory
C_MD_rd	Read module diagnostic data

Tab. B/5: CFM for diagnosing the CPX terminal

Error program

If a fault occurs during running time, an error number will be entered in the fault word (FW). Depending on whether an error program has been configured, the following applies:

– Error program = 0 (no error program defined): Programs will be stopped

– Error program › 0: Programs will be stopped and the error program with the entered number will be started

The following example shows a program for error treatment. Enter it as “Error program” in the register “Run mode” in the “Controller settings”.

```
STEP    1
                              "Wait for fault quitting

IF              I0.7          'Reset FEC Error
THEN    RESET   F             'Error
        LOAD    V0
         TO     FW            'Fault word
        RESET   P63           'Fault quitting
        SET     P0            'General - organisational
```

Fig. B/9: Sample extract from an error program

B.2 CPX-FB13 (PROFIBUS-DP)

General information on configuration is provided in the CPX-FB13 manual (Type P.BE-CPX-FB13-...).

B.2.1 General configuration information

Identifier

Module (order code)	**Module identifiers**	**Occupied bytes**	**Identifier** **Siemens / EN 50170**
SoftStop CPX-CMPX-C-1-H1 (T20)	CMPX	3 input words, 3 output words	6AE / 53_h

Device master file (GSD file) and icon files

Obtainable from

Current GSD files and icon files can be found on the Festo Internet pages at:

- www.festo.com/download
  ⟶ Download Software ⟶ Fieldbus GSD/EDS

GSD file

You will require one of the following GSD files for the CPX terminal with the CMPX:

- Cpx_059e.gsd (German version)
- Cpx_059e.gse (English version)

Depending on the configuration program used, install the GSD file and the icon files with the aid of the appropriate menu command or copy the files manually into a particular directory of your peripheral/PC.

Parameterising

Special care must be taken with the parameters when performing the start parameterisation. Observe here the instructions in section B.2.3.

B.2.2 Configuration with STEP 7

This manual refers to software version V 5.3.

An appropriate device master file (GSD file) must be installed for configuration.

Proceed as follows for configuration (see Fig. B/10):

1. Add a DP master system [1] and the CPX terminal [2] to the CPX-FB13, as per the instructions.

2. Fill the configuration table with the modules of your CPX system.
   Open the "Festo CPX terminal" module (folder\PROFIBUS-DP\Additional Field Devices\Valves\...) in the hardware catalogue [3].
   There are two entries for the CMPX:

Entry	Description
CPX-CMPX-C-1-H1 [6DE/6DA]	CMPX with 6 input bytes/6 output bytes, **without** Failsafe parameters (occupies 21 bytes of parameterisation data) 1)
CPX-CMPX-C-1-H1 [6DE/6DA Failsafe]	CMPX with 6 input bytes/6 output bytes, **with** Failsafe parameters (occupies 29 bytes of parameterisation data) 1)
1) The maximum number of parameterisation data for the CPX terminal is limited to 234.	

3. Assign each of the starting addresses in the "Properties – DP slave" window [4].

This concludes the station selection and configuration.

If the CMPX has already been commissioned via the control panel or Handheld, the parameters must be added before translation and loading, see section B.2.3.

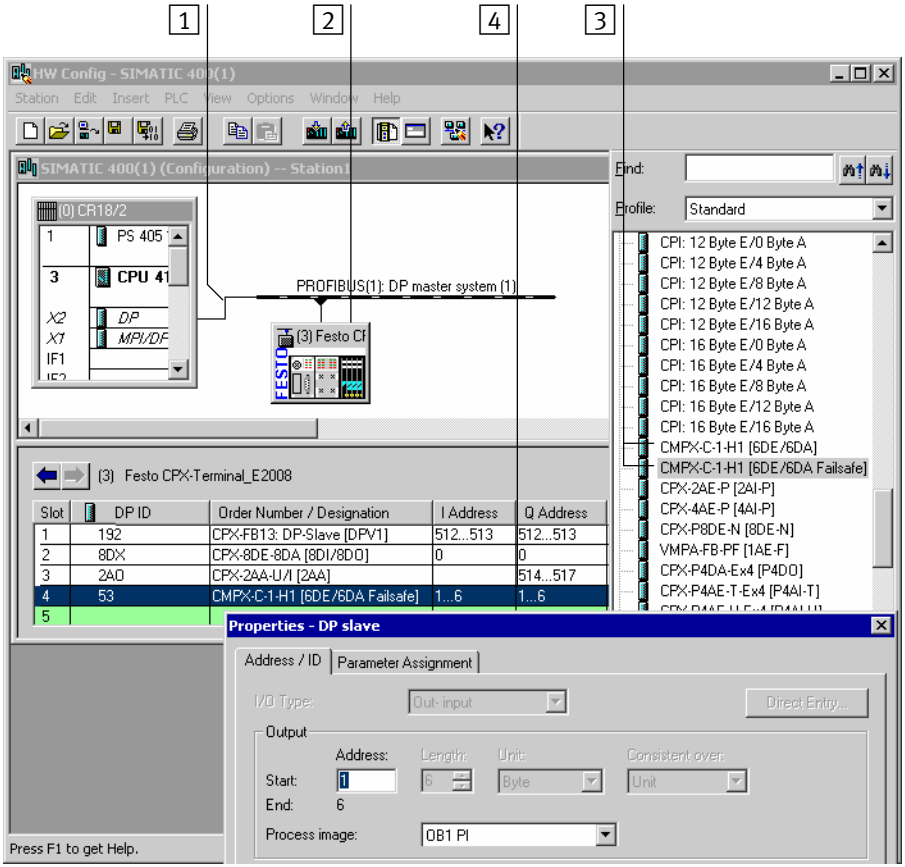


Fig. B/10: Configuration with STEP7 – Hardware catalogue

B.2.3 Parameterising

When setting the “System start with default parameterisation (factory settings) and current CPX structure” CPX system parameter, the parameters stored at the master are transferred to the CPX-FB13.

Note the general instructions on CPX parameterising in section 5.1.3.

Caution
If parameters are changed locally, e.g. when commissioning the CMPX via the control panel or Handheld, before using the Start parameterisation these must always be defined in the Master (configuration and modules if necessary).

Otherwise the changes are lost! This especially applied to taught intermediate positions.

Start parameterisation

1 Master loads the start parameter set into the node

2 The node distributes parameter set to the modules

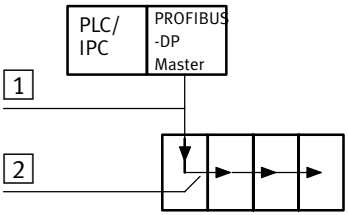


Fig. B/11: Sequence of start parameterising

When the field bus system is switched on, the CPX terminal is parameterised as “Start parameterising” by parameter set 1 saved in the PROFIBUS master. The field bus node then distributes the parameters module-orientated to the CPX modules 2.

Note
The number of start parameters is limited, depending on the software version of the CPX-FB13. Observe the notes in the manual for the CPX-FB13.

Note
After each interruption of the field bus system (e.g. after interruption of the power supply to the field bus node), the start parameter set will be sent again by the PROFIBUS master to the field bus node.

An exchange of individual CPX modules is therefore possible, without the need for new manual parameterising.

Enter parameter

Enter the parameter in the “Properties...” dialog of the CMPX.

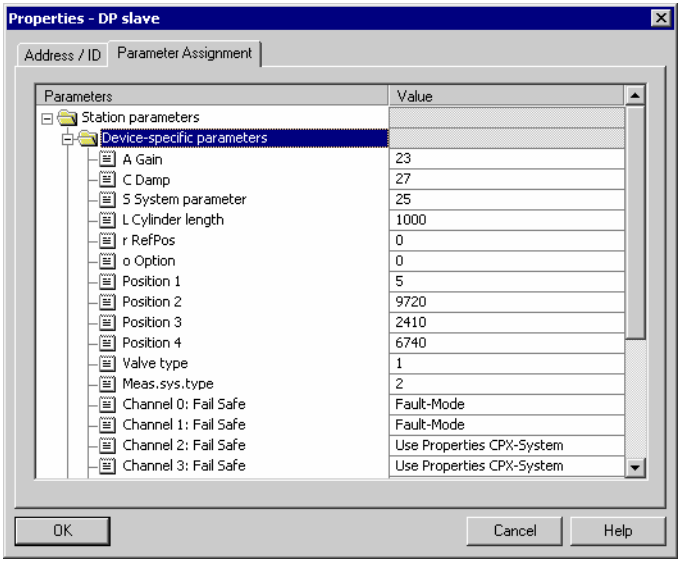


Fig. B/12: Parameterising

Before translating/loading the configuration, make sure that parameters are not unintentionally overwritten. If necessary, use an unload for this.

Note
Note the general instructions on parameterising in section 5.4.

Information on the parameters is provided in section 4.3. The parameters “Position 1”, “Position 2”, “Valve type” and “Encoder type” are “read-only”. Entered values are not adopted by the CMPX.

Fail Safe parameterising

Check your application to see if Fail Safe parameterisation is required.

Example

In the example as per Tab. B/6, the drive should be stopped and the brake activated.

Assignment		**CMPX inputs – Module output data**					
Bit	**Value**	**Control byte 1**	**Value**	**Control byte 2**	**Value**	**Control bytes 2 ... 6**	**Value**
0	1	POS1 = 0	0	RETAIN_POS3 = 0	0	– (no control function, all = 0)	0
1	2	POS2 = 0	0	RETAIN_POS4 = 0	0		0
2	4	POS3 = 0	0	START_TEACH = 0	0		0
3	8	POS4 = 0	0	**Brake = 1**	**8**		0
4	16	**STOP = 1**	**16**	– (reserved = 0)	0		0
5	32	JOG_NEG = 0	0	– (reserved = 0)	0		0
6	64	JOG_POS = 0	0	– (reserved = 0)	0		0
7	128	RESET_FAULT = 0	0	DISABLE_KEYS = 0	0		0
Fault Mode mask		**Value for channel 0**	**16**	**Value for channel 1**	**8**	**Value for channels 2 ... 6**	**0**

Tab. B/6: Fail-Safe parameterising example

For the values to take effect, the “Fail Safe” setting for the affected channel must be set to “Fault Mode”. The byte values as per Tab. B/6 must be entered into the “Fault Mode Mask” for the corresponding channel.

This results in a parameterisation as per Fig. B/13.

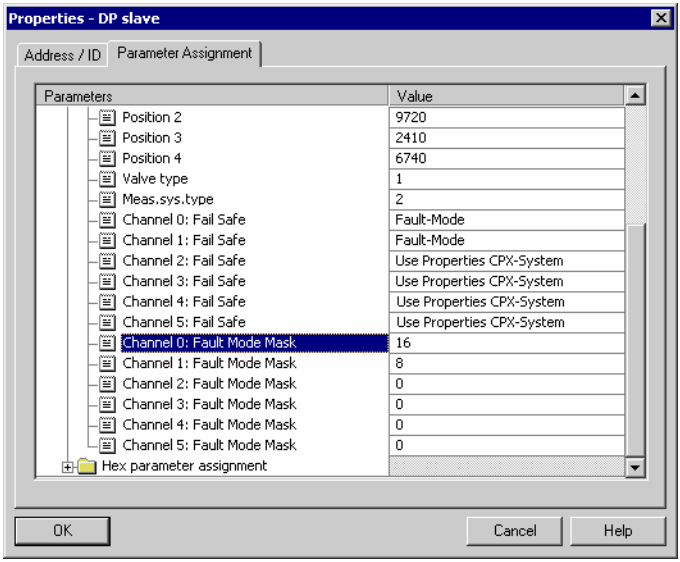


Fig. B/13: Fail Safe parameterising

In order for the settings to take effect, the global system parameter must be set to “Output fault mode”.

B.2.4 Addressing

Example: Addresses used as from input/output word 7

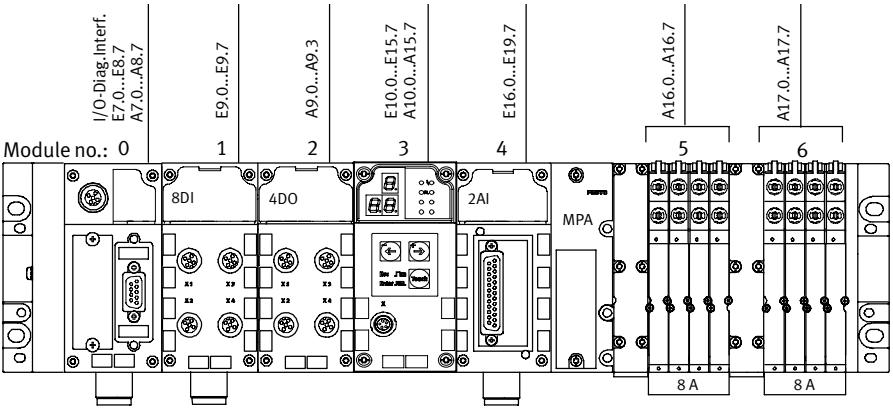


Fig. B/14: CPX-FB13 address assignment example

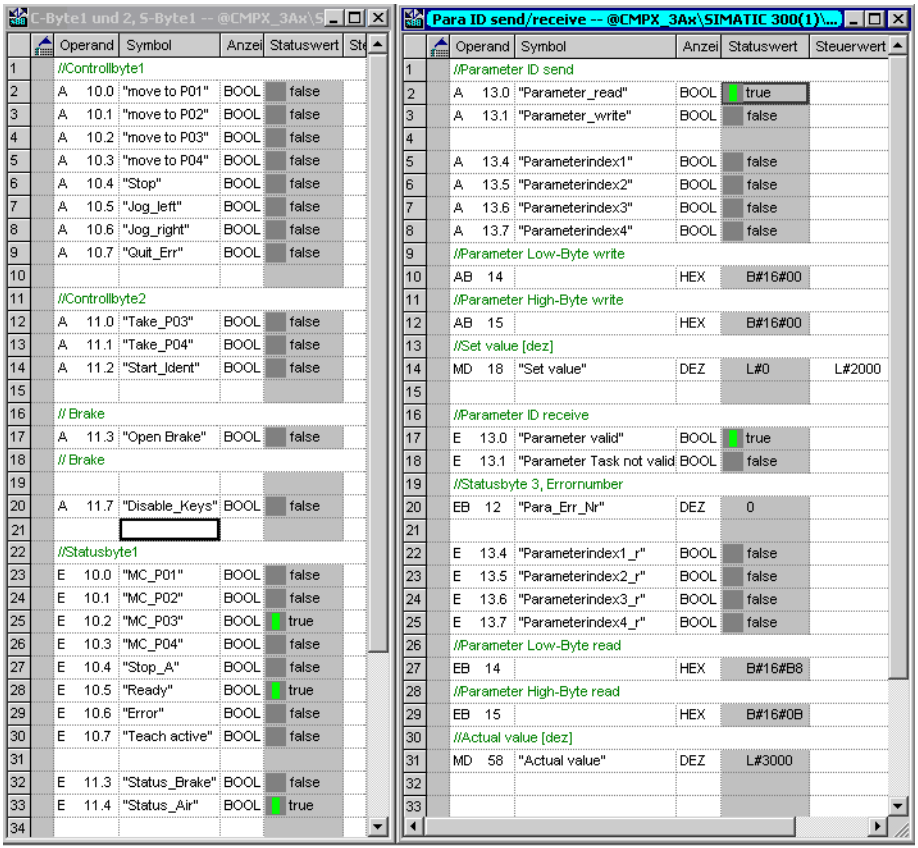
No.	Module	DP identifier Siemens	Addresses	
			Input address	Output address
0	CPX-FB13 (FB13: DPV1, I/O-Diag.Interface)	192	7 ... 8	7 ... 8
1	8-way digital input module (I: CPX-8DE)	8DE	9	–
2	4-way digital output module (O: CPX-4DA 2x)	8DA	–	9
3	Soft Stop CMPX (CPX-CMPX-C-1-H1), For assignments, see Tab. B/8 or Fig. B/15	53	10 ... 15	10 ... 15
4	Analogue input module (O: CPX4AE-I)	2AE	16 ... 19	–
–	MPA pneumatic interface (passive module)	–	–	–
5	MPA1 pneumatic module (VI: VMPA1-FB-EMS-8)	8DA	–	16
6		8DA	–	17

Tab. B/7: Input and output addresses for the example, see Fig. B/14

Module output data			**Module input data**		
AB	**Contents**	**Address**	**EB**	**Contents**	**Address**
AB10	Control byte 1: Bit Name 0 POS1 1 POS2 2 POS3 3 POS4 4 STOP 5 JOG_NEG 6 JOG_POS 7 RESET_FAULT	 A10.0 A10.1 A10.2 A10.3 A10.4 A10.5 A10.6 A10.7	EB10	Status byte 1: Bit Name 0 MC_POS1 1 MC_POS2 2 MC_POS3 3 MC_POS4 4 ACK_STOP 5 READY 6 FAULT 7 TEACH_ACTIVE	 E10.0 E10.1 E10.2 E10.3 E10.4 E10.5 E10.6 E10.7
AB11	Control byte 2: Bit Name 0 RETAIN_POS3 1 RETAIN_POS4 2 START_TEACH 3 BRAKE 4 – (reserved) 5 – (reserved) 6 – (reserved) 7 DISABLE_KEYS	 A11.0 A11.1 A11.2 A11.3 A11.4 A11.5 A11.6 A11.7	EB11	Status byte 2: Bit Name 0 – 1 – 2 – 3 STATUS_BRAKE 4 STATUS_AIR 5 – 6 – 7 –	 E11.0 E11.1 E11.2 E11.3 E11.4 E11.5 E11.6 E11.7
AB12	– (reserved)	A12.0...7	EB12	CMPX error number (section 6.2.3)	E12.0...7
AB13	Parameter index Bit Name 0 Read parameters 1 Write parameter 2 – (reserved) 3 – (reserved) 4...7 Parameter index	 A13.0 A13.1 A13.2 A13.3 A13.4...7	EB13	Parameter response Bit Name 0 Parameter transferred/valid 1 Parameter task not executable 2 – (reserved) 3 – (reserved) 4...7 Parameter index	 E13.0 E13.1 E13.2 E13.3 E13.4...7
AB14	Low byte of parameter	A14.0...7	EB14	Low byte of transferred/ read parameter.	E14.0...7
AB15	High byte of parameter	A15.0...7	EB15	High byte of transferred/ read parameter.	E15.0...7

Tab. B/8: Addresses of the CMPX control and status bytes for example Fig. B/14

Fig. B/15 shows an example of a variable table.



C-Byte1 und 2, S-Byte1 -- @CMPX_3Ax\S

	Operand	Symbol	Anzei	Statuswert	St
1	//Controllbyte1				
2	A 10.0	"move to P01"	BOOL	false	
3	A 10.1	"move to P02"	BOOL	false	
4	A 10.2	"move to P03"	BOOL	false	
5	A 10.3	"move to P04"	BOOL	false	
6	A 10.4	"Stop"	BOOL	false	
7	A 10.5	"Jog_left"	BOOL	false	
8	A 10.6	"Jog_right"	BOOL	false	
9	A 10.7	"Quit_Err"	BOOL	false	
10					
11	//Controllbyte2				
12	A 11.0	"Take_P03"	BOOL	false	
13	A 11.1	"Take_P04"	BOOL	false	
14	A 11.2	"Start_Ident"	BOOL	false	
15					
16	// Brake				
17	A 11.3	"Open Brake"	BOOL	false	
18	// Brake				
19					
20	A 11.7	"Disable_Keys"	BOOL	false	
21					
22	//Statusbyte1				
23	E 10.0	"MC_P01"	BOOL	false	
24	E 10.1	"MC_P02"	BOOL	false	
25	E 10.2	"MC_P03"	BOOL	true	
26	E 10.3	"MC_P04"	BOOL	false	
27	E 10.4	"Stop_A"	BOOL	false	
28	E 10.5	"Ready"	BOOL	true	
29	E 10.6	"Error"	BOOL	false	
30	E 10.7	"Teach active"	BOOL	false	
31					
32	E 11.3	"Status_Brake"	BOOL	false	
33	E 11.4	"Status_Air"	BOOL	true	
34					

Para ID send/receive -- @CMPX_3Ax\SIMATIC 300(1)\...

	Operand	Symbol	Anzei	Statuswert	Steuerwert
1	//Parameter ID send				
2	A 13.0	"Parameter_read"	BOOL	true	
3	A 13.1	"Parameter_write"	BOOL	false	
4					
5	A 13.4	"Parameterindex1"	BOOL	false	
6	A 13.5	"Parameterindex2"	BOOL	false	
7	A 13.6	"Parameterindex3"	BOOL	false	
8	A 13.7	"Parameterindex4"	BOOL	false	
9	//Parameter Low-Byte write				
10	AB 14		HEX	B#16#00	
11	//Parameter High-Byte write				
12	AB 15		HEX	B#16#00	
13	//Set value [dez]				
14	MD 18	"Set value"	DEZ	L#0	L#2000
15					
16	//Parameter ID receive				
17	E 13.0	"Parameter valid"	BOOL	true	
18	E 13.1	"Parameter Task not valid	BOOL	false	
19	//Statusbyte 3, Errornumber				
20	EB 12	"Para_Err_Nr"	DEZ	0	
21					
22	E 13.4	"Parameterindex1_r"	BOOL	false	
23	E 13.5	"Parameterindex2_r"	BOOL	false	
24	E 13.6	"Parameterindex3_r"	BOOL	false	
25	E 13.7	"Parameterindex4_r"	BOOL	false	
26	//Parameter Low-Byte read				
27	EB 14		HEX	B#16#B8	
28	//Parameter High-Byte read				
29	EB 15		HEX	B#16#0B	
30	//Actual value [dez]				
31	MD 58	"Actual value"	DEZ	L#3000	
32					
33					

Fig. B/15: Variable table example

If the position values are to be treated as marker double-words, then the high and low bytes must be swapped (as per Fig. B/15: EB 14 and EB 15, result in MD 58).

B.3 CPX-FB11 (DeviceNet)

General information on configuration is provided in the CPX-FB11 manual (Type P.BE-CPX-FB11-...).

B.3.1 Configuring DeviceNet slave features (EDS)

When you commission a new DeviceNet slave the first time, you must inform your configuration program about certain features of the slave.

The features of the various slaves are usually administered by the configuration program in a list or library e. g. EDS library (EDS for electronic data sheets).

The following possibilities can be used with an CMPX:

– Install an EDS file: **modular EDS**.
  Parameterising of technology modules such as the CMPX is **only** supported via modular EDS.

– Manually enter the slave features (no parameter setting possible).

Observe the notes in the manual for the CPX-FB11.

Reference source for EDS files

Reference source

Current EDS files, icon files and information on the EDS files can be found under the following address in Internet:

– www.festo.com/download
  → Download Software → Fieldbus GSD/EDS

Installing a modular EDS file

You will require the following files for the CPX terminal:

File type	File name	Language	Description
EDS	cpx_chassis.eds	English	Base file for modular EDS.
EDS	cpx_fb11...eds	English	Provides the communication adapter in the configuration program.
EDS	cpx_...eds	English	There is an EDS file for every module type. It contains the information needed for configuration and parameterisation.
ICO	cpx_...ico	–	Icon file for representing the CPX terminal or mode in the configuration program.

Tab. B/9: Configuration files (modular EDS) for the CPX terminal for DeviceNet

Installing modular EDS files

- Install the files with your configuration program.

You must install at least the Chassis EDS and the EDS files of the required modules.
Recommendation: Install all EDS files.

Icon files

Depending on the configuration program used, you can assign icon files (.ico format) to the CPX terminal or the CPX modules. The CPX terminal or the modules will then be represented accordingly in the configuration program.

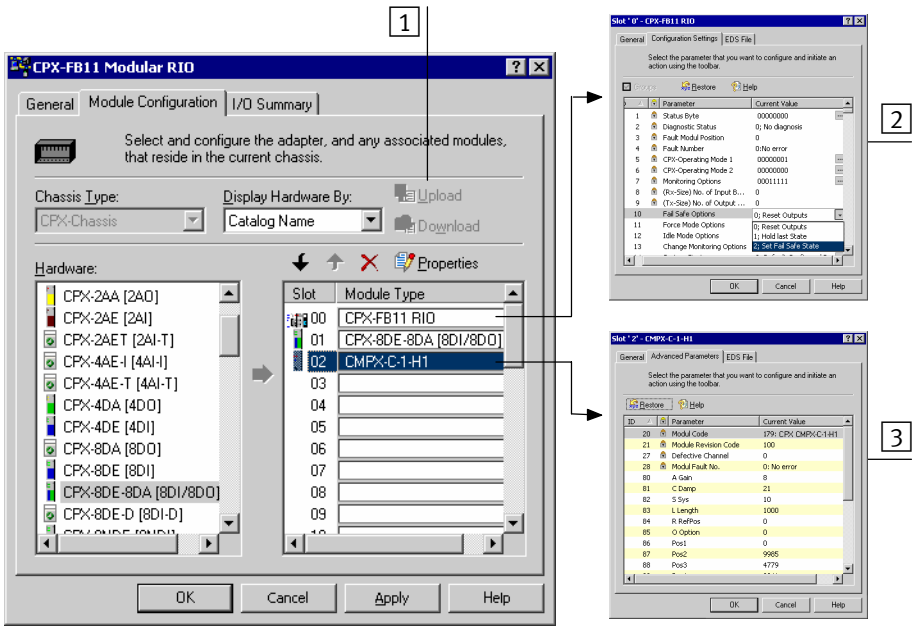
Notes on installing the EDS files and the icon files can be found in the documentation for your configuration program.

B.3.2 Parameterising (RSNetworx example)

When modular EDS is used, you can set the parameters by module with RSNetWorx.

Note the general instructions on CPX parameterising in section 5.1.3.
Make sure that parameters cannot be unintentionally overwritten. If necessary, carry out an upload.

The following diagram shows the “Module Configuration” register of the CPX terminal. Double clicking on the module in the configuration table brings you to the window for setting the parameters.



1 Buttons for upload and download of the parameters

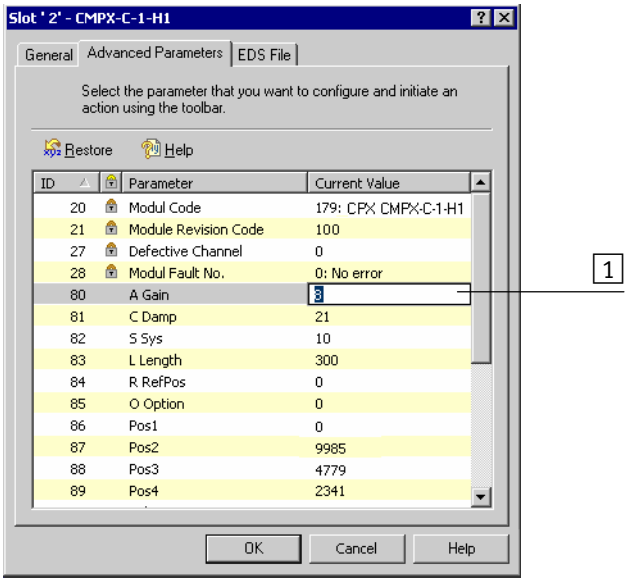
2 System parameters and data

3 Module parameters

Fig. B/16: Parameterisation with modular EDS

Module parameters

- Double-click on the CPX modules in the configuration table. Set the module parameters in the displayed window in the “Advanced Parameters” register. Confirm twice with OK.



1 Setting parameters

Fig. B/17: Example of parameterising the CMPX with RSNetworx

The settings saved in the project are displayed in offline mode.

Note
Note the general instructions on parameterising in section 5.4.

Information on the parameters is provided in section 4.3. The parameters “Pos1”, “Pos2”, “Valve type” and “Meas.sys.type” are “read-only”. Entered values are not adopted by the CMPX.

Fail-Safe and Idle-Mode parameterising

Check your application to see if Fail-Safe or Idle-Mode parameterisation is required.

Example

In the example as per Tab. B/10, the drive should be stopped and the brake activated.

Bit	CMPX inputs – Module output data		
	Control byte 1	**Control byte 2**	**Control bytes 2 ... 6**
0	POS1 = 0	RETAIN_POS3 = 0	– (no control function, all = 0)
1	POS2 = 0	RETAIN_POS4 = 0	
2	POS3 = 0	START_TEACH = 0	
3	POS4 = 0	**BRAKE = 1**	
4	**STOP = 1**	– (reserved = 0)	
5	JOG_NEG = 0	– (reserved = 0)	
6	JOG_POS = 0	– (reserved = 0)	
7	RESET_FAULT = 0	DISABLE_KEYS = 0	

Tab. B/10: Fail-Safe or Idle-Mode parameterising example

These settings apply to both Fail-Safe and Idle-Mode.

This results in a parameterisation as per Fig. B/18.

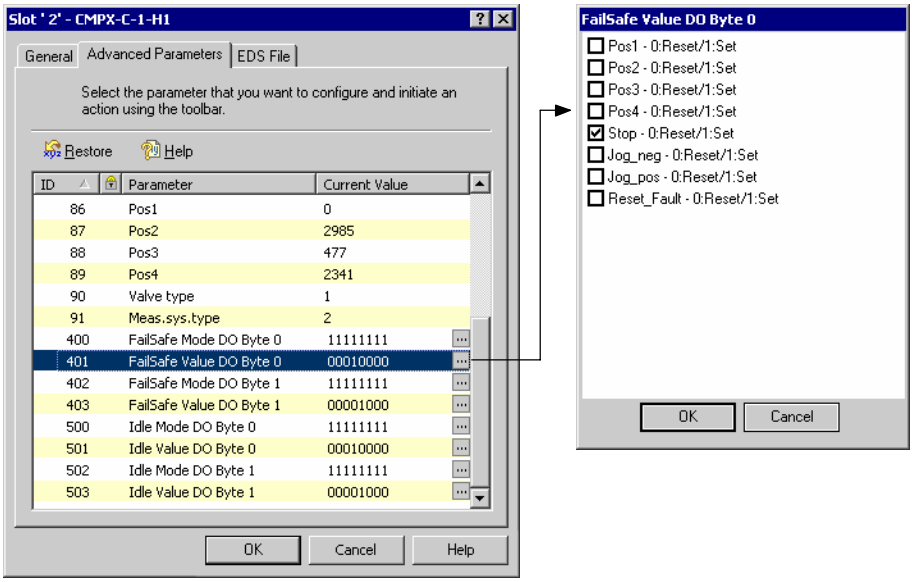


Fig. B/18: Fail-Safe and Idle-Mode parameterising

The global system parameter of the CPX-FB11 must also be set for the settings to take effect:

– “Fail Safe Options”: “Set Fail Safe State”.

– “Idle Mode Options”: “Set Idle Mode State”.

B.3.3 Addressing

Assign the I/O addresses of the slave (RSNetworx example)

1. Double-click **on the scanner** in the network. A dialogue box will open.
2. With the registers “Input” and “Output”, you assign the I/O addresses of the CPX terminal to the PLC operands.

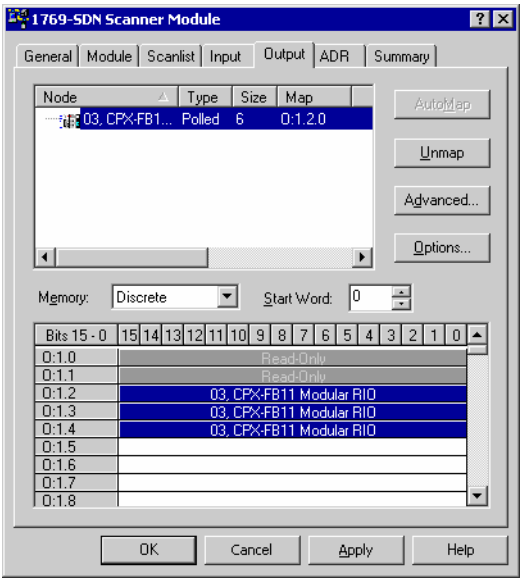
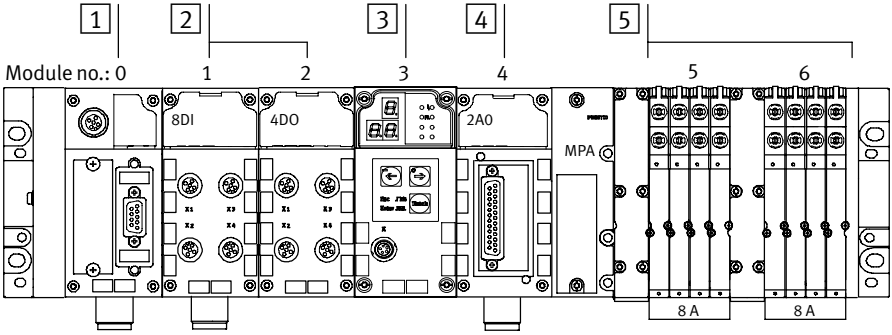


Fig. B/19: Output address assignment

Example: scanner 1747-SDN (SLC 500 series)

Addressing for example terminal with:

- 2 input bytes for status bits (strobed data)
- 11 input bytes, input address from I:1.1.0
- 9 output bytes, output address from O:1.1.0



1 CPX-FB11 (with status bits)

2 Digital I/O modules

3 CMPX Technology module

4 Analogue I/O modules

5 MPA pneumatics (2 pneumatic modules)

Fig. B/20: CPX example terminal 3 (address example for scanner 1747-SDN, see Tab. B/11)

Module no.	Module	Addressing	
		Input address	Output address
0	Fieldbus node CPX-FB11	I:1.1.0 ... I:1.1.15 (for status bits)	–
1	Digital 8-input module CPX-8DE	I:1.7.0 ... I:1.7.7	–
2	Digital 4-output module CPX-4DA	–	O:1.4.0 ... O:1.4.3
3	SoftStop CPX-CMPX-C-1-H1	I:1.4.0 ... I:1.4.15 I:1.5.0 ... I:1.5.15 I:1.6.0 ... I:1.6.15	O:1.1.0 ... O:1.1.15 O:1.2.0 ... O:1.2.15 O:1.3.0 ... O:1.3.15
4	Analogue 2-input module CPX-2AE	O:1.2.0 ... O:1.2.15 O:1.3.0 ... O:1.3.15	–
5	MPA1 pneumatic module	–	O:1.4.8 ... O:1.4.15
6	MPA1 pneumatic module	–	O:1.5.0 ... O:1.5.7

Tab. B/11: Addressing example for scanner 1747-SDN

Module output data			**Module input data**		
OW	**Contents**	**Address**	**IW**	**Contents**	**Address**
OW:1.4	Control byte 1: Bit Name 0 POS1 1 POS2 2 POS3 3 POS4 4 STOP 5 JOG_NEG 6 JOG_POS 7 RESET_FAULT	 O:1.4.0 O:1.4.1 O:1.4.2 O:1.4.3 O:1.4.4 O:1.4.5 O:1.4.6 O:1.4.7	IW:1.1	Status byte 1: Bit Name 0 MC_POS1 1 MC_POS2 2 MC_POS3 3 MC_POS4 4 ACK_STOP 5 READY 6 FAULT 7 TEACH_ACTIVE	 I:1.1.0 I:1.1.1 I:1.1.2 I:1.1.3 I:1.1.4 I:1.1.5 I:1.1.6 I:1.1.7
	Control byte 2: Bit Name 0 RETAIN_POS3 1 RETAIN_POS4 2 START_TEACH 3 BRAKE 4 – (reserved) 5 – (reserved) 6 – (reserved) 7 DISABLE_KEYS	 O:1.4.8 O:1.4.9 O:1.4.10 O:1.4.11 O:1.4.12 O:1.4.13 O:1.4.14 O:1.4.15		Status byte 2: Bit Name 0 – 1 – 2 – 3 STATUS_BRAKE 4 STATUS_AIR 5 – 6 – 7 –	 I:1.1.8 I:1.1.9 I:1.1.10 I:1.1.11 I:1.1.12 I:1.1.13 I:1.1.14 I:1.1.15
OW:1.5	– (reserved)	O:1.5.0...7	IW:1.2	CMPX error number (section 6.2.3)	I:1.2.0...7
	Parameter index Bit Name 0 Read parameters 1 Write parameter 2 – (reserved) 3 – (reserved) 4...7 Parameter index	 O:1.5.8 O:1.5.9 O:1.5.10 O:1.5.11 O:1.5.12...15		Parameter response Bit Name 0 Parameter transferred/valid 1 Parameter task not executable 2 – (reserved) 3 – (reserved) 4...7 Parameter index	 I:1.2.8 I:1.2.9 I:1.2.10 I:1.2.11 I:1.2.12...15
OW:1.6	Low byte of parameter	O:1.6.0...7	IW:1.3	Low byte of transferred/ read parameter.	I:1.3.0...7
	High byte of parameter	O:1.6.8...15		High byte of transferred/ read parameter.	I:1.3.8...15

Tab. B/12: Addresses of the CMPX control and status bytes for example Fig. B/20

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Appendix C

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