COMPAX User Guide
Compact Servo Controller

From software version V6.26
August 2006
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The parameter and program memory are created using ZP-RAM. This memory is unaffected by mains power failure.
This module has a guaranteed service life of 10 years (calculated from the first start-up).
ZP-RAM failure causes data loss; COMPAX contains wild data.
If you encounter problems of this kind, contact HAUSER.

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2. Unit assignment:

This documentation applies to the following units:

- COMPAX 10XXSL
- COMPAX 25XXS
- COMPAX 45XXS
- COMPAX 85XXS
- COMPAX P1XXM
- COMPAX 02XXM
- COMPAX 05XXM
- COMPAX 15XXM
- COMPAX 35XXM

XX: Unit variants

Key to unit designation

e.g.: COMPAX 0260M:

<table>
<thead>
<tr>
<th>COMPAX: name</th>
<th>02: performance class</th>
</tr>
</thead>
<tbody>
<tr>
<td>02: Variant</td>
<td>e.g. &quot;00&quot;: Standard model</td>
</tr>
<tr>
<td>60: Variant</td>
<td>&quot;60&quot;: electronic transmission</td>
</tr>
<tr>
<td>M: unit type</td>
<td>&quot;M&quot;: multi-axis model</td>
</tr>
<tr>
<td>&quot;S&quot;: single-axis unit</td>
<td></td>
</tr>
</tbody>
</table>

HAUSER type plate

The type plate is located on the upper side of the unit and contains the following:

- option name
- serial number
- equipment name
- part number

Notes for repeat customers regarding modified software versions:

Please check the software version of your unit.

Despite all efforts on our part, software modifications may change procedures as well as cause functional changes.

Please notify us immediately if you detect unexplainable problems when using a new software version.
3. Safety instructions

3.1 General dangers

General dangers when safety instructions are not complied with
The unit described contains leading edge technology and is operationally reliable. However, hazards may occur if the unit is employed incorrectly or for improper use.
Energized, moving or rotating parts can
• cause fatal injury to the user
• cause material damage

Proper use
This unit is designed for use in high voltage units (VDE0160). This unit automates motion processes. The ability to switch several units at once makes it possible to combine several motion processes. Reciprocal interlocks must be installed in such cases.

3.2 Safe working practices

The unit must be operated by skilled staff only.
• When used in this manual, the term "trained staff" refers to people who,
  • due to their training, experience and knowledge of current standards, guidelines, accident prevention regulations and operating conditions, have received authorization from the head of health and safety at the site to perform the necessary activities, while recognizing and avoiding any associated dangers (definition of personnel as per VDE105 or IEC364)
  • are familiar with first aid and the on-site safety equipment,
  • have read and observed the safety instructions
  • have read and observed the User Guide (or the section which applies to the tasks to be executed).
This applies to all tasks relating to set-up, start-up, configuration, programming and modification of the operating conditions, operating modes and maintenance. Please note in particular the functions contained in the start-up manual relating to operational readiness and emergency stop.
The User Guide must be present at the unit at all times.

3.3 Special safety instructions

• Check the arrangement of unit and documentation.
• Never disconnect the electrical connections when energized.
• Use safety equipment to ensure that moving or rotating parts cannot be touched.
• Ensure that the unit is in perfect working order before operation.
• Include the operational readiness and emergency stop functions of the unit (see start-up manual) in the safety and emergency stop functions of your machine.
• Only operate unit with the front cover attached.
• Ensure mains module has sufficient nominal and peak power ratings.
• Ensure that the unit arrangement enables the units with higher power ratings to be fitted more closely to the power unit than the units with lower ratings (COMPAX-M).
• Ensure that motors and linear drive units (if available) are sufficiently secured.
• Ensure that all energized connectors cannot be touched. The unit carries voltages ratings of up to 750V, which could fatally injure the operator.
• Please mind the limits of the mechanical equipment connected.
3.4 Conditions of warranty

- The unit must not be opened.
- Do not make any alterations to the unit, except for those described in the User Guide.
- Only activate inputs, outputs and interfaces as described in the User Guide.
- When installing units, ensure that the heat sinks receive sufficient ventilation.
- Secure units as per the assembly instructions contained in the start-up manual using the securing bores provided for this purpose. We cannot assume any responsibility for any other methods used for securing the units.

Note on option exchange
In order to check hardware and software compatibility, it is necessary for COMPAX options to be changed at the factory.

4. COMPAX – CD

On the accompanying CD, you will find all instructions for COMPAX and the operating software "ServoManager".

Once the CD is inserted in a Windows – computer, the HTML desktop (default.htm) is normally automatically started – if an Internet browser is present. If you do not have an Internet browser on your computer, please install a version: the software is usually available to download free of charge.

If the desktop does not start automatically, please execute the file "default.htm" (e.g. by double clicking on the file or via "Start"."Run"). The "default.htm" file is located directly on the CD (not in the sub-directory).

Use Language selection (top right in window) to select the language required. Follow the CD instructions shown on the window in the center of the screen. Use the list on the left-hand side to select the required instructions or software.
5. Switch-on status

5.1 Configuration when supplied

When supplied, COMPAX is not configured. Parameter P149 is set to "0": 
P149="0": COMPAX is not configured and switches to OFF mode when switched on (24V DC and operating voltage) (motor switched off). In addition to this, when switched on, all parameters (apart from bus settings P194, P195, P196 and P250) are set to their default values.
P149="1": COMPAX is configured and once switched on (24V DC and operating voltage) tries to engage the motor.

5.2 Commissioning

Meaning of LEDs on the front panel

<table>
<thead>
<tr>
<th>LED</th>
<th>Color</th>
<th>Meaning, when switched on</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ready</td>
<td>green</td>
<td>24V DC present and initialization complete</td>
</tr>
<tr>
<td>Error</td>
<td>red</td>
<td>COMPAX - Error (E1...E56) present or COMPAX is initialized.</td>
</tr>
</tbody>
</table>

Mains module

<table>
<thead>
<tr>
<th>LED red Error</th>
<th>LED green Ready</th>
<th>Possible errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>off</td>
<td>on</td>
<td>no errors</td>
</tr>
<tr>
<td>on</td>
<td>off</td>
<td>Heat sink temperature too high or error in logic voltage (24V DC too low or unit is defective)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Emergency stop is activated and ready contact is released.</td>
</tr>
<tr>
<td>on</td>
<td>on</td>
<td>Ballast switching unit overload or undervoltage (&lt;100V DC or &lt;80V AC).</td>
</tr>
</tbody>
</table>

COMPAX 1000SL

<table>
<thead>
<tr>
<th>Status</th>
<th>Red LED (H2)</th>
<th>Green LED (H1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24V not available</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>24V are switched on, boot up</td>
<td>on</td>
<td>off</td>
</tr>
<tr>
<td>Unit OFF</td>
<td>off</td>
<td>blinking</td>
</tr>
<tr>
<td>Unit error; drive switched off</td>
<td>on</td>
<td>blinking</td>
</tr>
<tr>
<td>Unit error; drive powered</td>
<td>on</td>
<td>on</td>
</tr>
<tr>
<td>Unit RUNNING</td>
<td>off</td>
<td>on</td>
</tr>
</tbody>
</table>

Caution!
If there is no control voltage, no displays will appear to indicate that operating voltage is present.

Note: With Error E40, external enabling is missing with COMPAX 45XXS, COMPAX 85XXS and COMPAX 1000SL (Hardware input).
After 24V DC of control voltage is switched on, COMPAX has two statuses available once the initialization phase has been completed:

1. COMPAX is OFF
   - COMPAX is not configured (P149="0") or with COMPAX XX70:
     - I12="0" (final stage blocked).
   - Now configure COMPAX (e.g. using the ServoManager / ParameterEditor).
   - Set P149="1"
     - Configuration is accepted with VC and VP of COMPAX.

2. COMPAX displays error E57
   - COMPAX is configured (P149="1"). However, operating voltage is not present.
   - Check COMPAX configuration.
   - Alterations are accepted with VC and VP of COMPAX.

    *Configuring*
    a) Using ServoManager:
       - P149="1", VP and VC are transferred when being downloaded to COMPAX from the ServoManager.
    b) Using hand-held terminal:
       - P149="1", VP and VC are generated by the hand-held terminal.
    c) Without an auxiliary device, e.g. a terminal:
       - P149="1", VP and VC must be transmitted after COMPAX configuration.

   Switch on operating voltage
   - With E57: acknowledge error by pressing Enter.
   - When OFF: command: "OUTPUT O0=0" or switch 24V DC on / off

Motor is powered; COMPAX display shows "RUN".

Flow chart:
5.3 Equipment replacement

**Previous software ≥V2.0**
- Procedure for copying the complete COMPAX setting onto a new unit
- Start ServoManager.
- Connect old COMPAX via RS232.
- Use menu "Insert: Axis: From controller" to set up an axis which contains all COMPAX settings (all parameters: including system parameters, data records and (with COMPAX XX70) existing curves).
- Connect new COMPAX.
- Use menu "Online: Download" to transfer data (without system parameters) into the new COMPAX.

**Transferring system parameters**
- Call up ParameterEditor (Menu: PC Tools: ParameterEditor)
- Use menu "Online: Copy" menu to transfer all parameters (including system parameters) to COMPAX.

**Previous software ≤V2.0**
Procedure for copying the complete COMPAX setting onto a new unit
- Start ServoManager.
- Connect old COMPAX via RS232.
- Use menu "Insert: Axis: New" to set up a new axis.
- Use menu "Online: Upload" to load all COMPAX settings (all parameters: including system parameters, data records, and (in COMPAX XX70) existing curves) into the new axis.
- Connect new COMPAX.
- Use menu "Online: Download" to transfer data (without system parameters) into the new COMPAX.

**Transferring system parameters**
- Call up ParameterEditor (Menu: PC Tools: ParameterEditor)
- Use menu "Online: Copy" menu to transfer all parameters (including system parameters) to COMPAX.

---

1 System parameters are internal parameters; you will only obtain an identical COMPAX – setting if these are also transferred.
6. Conditions for usage

- for CE-compliant operation in industrial and business sectors -

The EU guidelines on electromagnetic compatibility 89/336/EEC and electrical means of production for use within particular voltage limits 73/23/EEC are satisfied, if the following peripheral conditions are complied with.

Only operate the units in the condition in which they are supplied, i.e. with all housing plates and the front cover.

COMPAX P1XXM, COMPAX 02XXM, COMPAX 05XXM and COMPAX 15XXM may only be operated with HAUSER mains modules (NMD10 or NMD20) or on COMPAX 35XXM.

Power filter: A power filter is required in the power line. The filtering can be executed once for the entire system or as separate process for each unit.

The following power filters are required for standalone operation:

- **NMD10 / COMPAX 45XXS / COMPAX 85XXS:** Order No.: NFI01/02
- **NMD20:** Order No.: NFI01/03
- **COMPAX 35XXM:** Order No.: NFI01/04 or /05
- **COMPAX 25XXS:** Order No.: NFI01/01 or /06
- **COMPAX 10XXSL:** Order No.: NFI01/01 or /02

Length of connection: connection between power filter and unit: unscreened: < 0.5m screened: < 5m

Motor and resolver cable: Only operate the unit with a HAUSER motor and resolver cable (with connectors containing special surface screening).

In such cases, the following cable lengths are permitted.

<table>
<thead>
<tr>
<th>Motor cable</th>
<th>100m (the cable must not be rolled up)</th>
</tr>
</thead>
<tbody>
<tr>
<td>For motor lines of &gt;20m, a motor output throttle must be used</td>
<td></td>
</tr>
<tr>
<td>Up to 16A nominal motor current: Type: MDR01/01 16A / 2mH.</td>
<td></td>
</tr>
<tr>
<td>Between 16A and 30A: Type: MDR01/02 30A / 1.1mH.</td>
<td></td>
</tr>
<tr>
<td>Over 30A nominal motor current: Type: MDR01/03 &gt;30A / 0.64mH.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resolver cable</th>
<th>100m</th>
</tr>
</thead>
</table>

Motors: Operation with HAUSER motors.

Control: Only operate with calibrated controller (avoid feedback oscillation).

Earthing:

- The filter housing, the mains module and the COMPAX must be surface connected with good metal conductivity and low inductivity to the cabinet ground.
- Never secure the filter housing or the unit to coated surfaces.

Cable laying:

- Ensure that you have largest spacing possible between the signal and load lines.
- Signal lines must never pass sources of strong interference (motors, transformers, relays,...).

Accessories

- Only use accessories recommended by HAUSER (absolute value sensor, encoder,...).
- Provide large surface contact areas down both sides of all cable screening.

Warning: This is a product of the restricted sales class as per IEC 61800-3. In a domestic environment, this product may cause high frequency disturbances, in which case the user can be requested to implement suitable measures.
7. Start-up manual

Compact Servo Controller

7.1 Overview:

7.1.1 Components required

In addition to a COMPAX, you will require the following components for a COMPAX application:

◆ a motor with or without a transmission.
◆ mains supply.
◆ emergency stop circuit.
◆ various cables for connecting components.
◆ motor cable and resolver cable.
◆ supply line for voltage supply.
◆ supply line for 24V DC control voltage.
◆ hand-held terminal or PC (with RS232 cable) containing the ServoManager program for configuring COMPAX.
COMPAX-M and COMPAX-S

◆ work with the same firmware, yet have differences with regard to
◆ housing and assembly technology and
◆ power areas.

The following table shows the main features of the range of available units:

<table>
<thead>
<tr>
<th>Common function characteristics:</th>
<th>Interfaces: 16 (8 with COMPAX 1000SL) digital inputs/outputs, RS232; machine zero, limit switch, override input</th>
<th>Fieldbus options: RS485, Interbus-S, Profibus, CS31, CAN – Bus, CANopen, HEDA (synchronous serial realtime interfaces)</th>
<th>Other options (excluding COMPAX 1000SL): absolute encoder sensor; encoder input; encoder simulation; D/A monitor</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPAX P1XXM</td>
<td>Supply via central mains module: NMD10 / NMD20: Up to max. 3*500V AC</td>
<td>Dimensions (DxHxW): COMPAX P1XXM: 340<em>400</em>60 [mm]</td>
<td>COMPAX-M: 340<em>400</em>85 [mm]</td>
</tr>
</tbody>
</table>
| COMPAX 02XXM                    |                                                | Design: COMPAX-M with NMD mains module           | Power: COMPAX ...
| COMPAX 05XXM                    |                                                | Installation: in series                         | P1XXM: 3.8 kVA
| COMPAX 15XXM                    |                                                |                                                | 02XXM: 4.5 kVA
| COMPAX 35XXM                    | Supply: Up to max. 3 * 500V AC (integrated power unit) | Dimensions (DxHxW): 40 * 400 * 220 [mm]        | 05XXM: 8.0 kVA |
|                                 |                                                | Design:                                          | 15XXM: 17 kVA |
|                                 |                                                | Power                                            | 35.0 kVA |

Supply via central mains module: NMD10 / NMD20: Up to max. 3*500V AC

Dimensions (DxHxW): COMPAX P1XXM: 340*400*60 [mm] COMPAX-M: 340*400*85 [mm]

Design: COMPAX-M with NMD mains module

Installation: in series

Power: COMPAX ...

P1XXM: 3.8 kVA
02XXM: 4.5 kVA
05XXM: 8.0 kVA
15XXM: 17 kVA

Supply: Up to max. 3 * 500V AC (integrated power unit)

Dimensions (DxHxW): 40 * 400 * 220 [mm]

Power 35.0 kVA
<table>
<thead>
<tr>
<th>Model</th>
<th>Supply</th>
<th>Dimensions (DxHxW)</th>
<th>Design</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPAX 1000SL</td>
<td>Up to max. 1*250V AC (integrated power unit)</td>
<td>146<em>180</em>85 [mm]</td>
<td><img src="image" alt="Design" /></td>
<td>1 kVA</td>
</tr>
<tr>
<td>COMPAX 25XXS</td>
<td>Up to max. 1 (3)*250V AC (integrated power unit)</td>
<td>220<em>240</em>130 [mm]</td>
<td><img src="image" alt="Design" /></td>
<td>2.5 kVA</td>
</tr>
<tr>
<td>COMPAX 45XXS</td>
<td>Up to max. 3*500V AC (integrated power unit)</td>
<td>275<em>350</em>125 [mm]</td>
<td><img src="image" alt="Design" /></td>
<td>4.5 kVA</td>
</tr>
<tr>
<td>COMPAX 85XXS</td>
<td>Up to max. 3*500V AC (integrated power unit)</td>
<td>275<em>350</em>125 [mm]</td>
<td><img src="image" alt="Design" /></td>
<td>8.6 kVA</td>
</tr>
</tbody>
</table>
### 7.2 COMPAAX-M unit features

#### 7.2.1 Connector and terminal assignment

**Before wiring up, always de-energize the unit.**

Even once the mains supply has been switched off, dangerous levels of voltage can remain in the system for up to 5 min.

<table>
<thead>
<tr>
<th>LED</th>
<th>Color</th>
<th>Meaning, when switched on</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ready</td>
<td>green</td>
<td>24V DC present and initialization complete</td>
</tr>
<tr>
<td>Error</td>
<td>red</td>
<td>COMPAAX - fault (I1...E56) present.</td>
</tr>
</tbody>
</table>

**Meaning of LEDs on front plate**

- **X1** motor
- **X2** intermediate loop power connections
- **X3** 24V control voltage
- **X4** control- and status signals / bus signals or short circuit plug
- **X5** control- and status- signal bus-signals input
- **X6** RS232
- **X8** Input / Output
- **X9** Test
- **X10** Input / Output
- **X11** Control
- **X12** resolver
- **X13** Encoder
- **X14** HEDA
- **X15** HEDA
- **X16** absolute encoder
- **X17** initiators
- **X18** fan

**Technical data**

**Configuration**

**Positioning and control functions**

**Optimization functions**

**Interfaces**

**Accessories / options**

**Status**

**Parameter**

**Error list**
A COMPAX-M drive system consists of one mains module and one or more drive controllers. The units are coupled with one another with flatband cables (see below). These are arranged behind the front plate cover of the power unit and the drive controller.

The power unit converts mains power (up to 3 * 500V AC) into DC current for the intermediate circuit.

The two connectors for connection to the bus systems are located on the front plate of the power unit. The connection assignment complies with the specifications for 2-cable remote bus.

The 24V DC control voltage required by the system network is supplied from the power unit.

A connector terminal on the front of the power unit is used for connecting the control and status signals (EMERGENCY STOP, readiness) which you can incorporate in the control of the entire system.

These signals and the bus lines are connected internally via a preformed doublesided flatband cable. These cables are included with the drive controller.

The connectors which receive these connection cables are housed under the front plate cover of the mains module and the drive controller.

**Short circuit connectors**

Attach a short circuit connector to the outgoing connector on the drive controller that is furthest away from the mains module. The short circuit connector (order No. 102-908000) is included with the mains module.

**Installation arrangement**

Before wiring up, always de-energize the unit. Even once the mains supply has been switched off, dangerous levels of voltage can remain in the system for up to 5 min.

**Wiring up the system network**

The wires required for creating the system network are included in the delivery.

Open the front cover (upper section of front side) by loosening the top right knurled screw and wire up the following:

- 24V DC voltage supply.
- PE and DC current.
- Emergency stop, ready and bus signals with a terminating connector on the last unit.

From the mains module to the individual COMPAX-M.

When delivered, the terminating connector is located on the mains module.
Wiring up the motor

Unit side

Screened connection

Note the screened connection of the motor cable on the upper unit side.
Clamp the motor cable with the open place of the screen braid under the ground terminal (see figure on the right).

⚠️ Only wire up brake in motors which have a holding brake! If not, do not wire.

Wiring up mains power / control voltage

The mains supply and the control voltage supply are provided by the mains module.

**Power supply:**
- 3*80V AC – max. 3*500V AC; 45 - 65Hz
- Fuse protection:
  - NMD10: 20A
  - NMD20: 35A
  - all poles switch off circuit breaker K

**Control voltage**
- 24V DC ±10%
- Ripple <1VSS
  - Fuse protection: max. 16A

Power supply: L1 L2 L3 PE 24V

Control voltage:

<table>
<thead>
<tr>
<th>Wire</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>PE</td>
</tr>
<tr>
<td>L2</td>
<td></td>
</tr>
<tr>
<td>L3</td>
<td></td>
</tr>
<tr>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>24V</td>
<td></td>
</tr>
</tbody>
</table>

Note the screened connection of the motor cable on the upper unit side.
Clamp the motor cable with the open place of the screen braid under the ground terminal (see figure on the right).

⚠️ Only wire up brake in motors which have a holding brake! If not, do not wire.
7.2.3 COMPAX-M dimensions/installation

The specific design of the COMPAX-M controller allows for wall installation (distance: 61mm in COMPAX P1XXM and 86mm in larger units) in two different ways.

**Direct wall installation:**

Direct wall installation and dimensions of COMPAX-M and the mains modules.

- COMPAX-M
- 02XXM, 05XXM, 15XXM, NMD10 & NMD20
- P1XXM

Attach with four 6-mm hex-socket-head-screws

The controllers are attached to the mounting plate with the back of the heat sink.

**Indirect wall installation:**

Indirect wall installation of COMPAX 02XXM, COMPAX 05XXM and COMPAX 15XXM and the mains modules NMD10 and NMD20.

- COMPAX-M
- 02XXM, 05XXM, 15XXM, NMD10 & NMD20

The heat sink is pushed back through a hole in the panel (on right of diagram). A separate heat chamber is created between the installation plate and the rear wall of the control cabinet. The angles required under designation MTS2 must be complied with.

→ Indirect wall installation is not possible with COMPAX P1XXM.

**Fan configuration**

- **Units with fan:** COMPAX P1XXM, COMPAX 05XXM, COMPAX 15XXM
- **Units without fan:** COMPAX 02XXM, NMD10, NMD20
7.2.4 Connector assignment COMPAX-M

The assignment of X12 does not apply for the S3 option.

The bus connections are made via the mains module.
7.3 Mains module NMD10/NMD20

The mains module ensures the supply of current to the COMPAX-M (not COMPAX 35XXM) axis controller and the SV drive connected into the network. It is connected to the 3-phase power supply with 3 * 400V AC and PE. 24V DC voltage must be provided for the control electronics.

### 7.3.1 Overview NMD

Before wiring up, always de-energize the unit.

Even once the mains supply has been switched off, dangerous levels of voltage can remain in the system for up to 5 min.

The PE connection must be a 10mm² version

### 7.3.2 Dimensions / installation

Dimensions and installation of the NMD10 and NMD20 power units correspond to the data for COMPAX-M (see Page 20).
7.3.3 NMD connector assignment

![Diagram of connector assignment]

7.3.4 Technical data / power features NMD

**Function**
Generates DC current when run directly off a mains source.

**CE conformity**
- EMC immunity/emissions as per EN61800-3.
- Safety: VDE 0160/EN 50178.

**Output power**

<table>
<thead>
<tr>
<th></th>
<th>Nominal power</th>
<th>Peak power</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMD10:</td>
<td>10 kW</td>
<td>20 kW (&lt;3s)</td>
</tr>
<tr>
<td>NMD20:</td>
<td>20 kW</td>
<td>40 kW (&lt;3s)</td>
</tr>
</tbody>
</table>

**Mains fuse protection**
NMD10: 20A
NMD20: 35A
all poles switch off circuit breaker K.

**Supply voltage up to max. 3*500V AC**
- Operating range: 3*80V AC - 3*500V AC, 45 - 65 Hz.
  - Typical AC mains: 400V ±10%; 460V ±10%; 480V ±5%
- Layout of contactors for the power supply:
  Capacity according to device performance: Application group AC3.

**Control voltage**
- 21.6V up to 26.4V DC (0.8A)
- Ripple: < 1VSS
- Fuse protection: max. 16A

**Dissipation power**
- without fan: max. 120W (standard)
- with fan: max. 250W.
Overvoltage limitation
Energy recuperated during braking is stored in the supply capacitors. The capacity and storable energy is:

NMD10/NMD20: 1100µF / 173Ws

If the energy recuperated from braking causes overvoltage, then ballast resistances are engaged.

Activation of the internal ballast resistance for NMD20

The internal ballast resistance is activated by a bridge between +LS and X5/1. In the NMD20 delivery status this bridge is fitted.

Maximum braking power:

<table>
<thead>
<tr>
<th>Braking power</th>
<th>Duration</th>
<th>Cooling down time</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMD10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 kW</td>
<td>&lt;50 ms</td>
<td>≥ 10s</td>
</tr>
<tr>
<td>4.0 kW</td>
<td>&lt;1s</td>
<td>≥ 50s</td>
</tr>
<tr>
<td>Without fan: 120W</td>
<td>unlimited</td>
<td></td>
</tr>
<tr>
<td>With fan: 250W</td>
<td>unlimited</td>
<td></td>
</tr>
<tr>
<td>NMD20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.5 kW</td>
<td>&lt;50 ms</td>
<td>≥ 10s</td>
</tr>
<tr>
<td>2.5 kW</td>
<td>&lt;1s</td>
<td>≥ 50s</td>
</tr>
<tr>
<td>Without fan: 120W</td>
<td>unlimited</td>
<td></td>
</tr>
<tr>
<td>With fan: 200W</td>
<td>unlimited</td>
<td></td>
</tr>
</tbody>
</table>

External ballast resistances can be used with NMD20 (see Page 193).

If the braking power of the internal ballast resistance is insufficient, an external ballast resistance can be connected.

Connecting the external ballast resistance

The external ballast resistance is connected between +LS and X5/2.

To do this, the bridge between +LS and X5/1 must be removed.

The full braking power cannot be used with this bridge present.

Output X5 is protected from short circuits.

Thermal protection
An emergency stop is triggered at 85°C heat sink temperature, the ready contact is released and the red LED lights up.
If a phase malfunctions, no displays appear

<table>
<thead>
<tr>
<th>LED red Error</th>
<th>LED green Ready</th>
<th>Possible errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>off</td>
<td>on</td>
<td>no errors</td>
</tr>
<tr>
<td>on</td>
<td>off</td>
<td>• Heat sink temperature too high or • error in logic voltage (24V DC too low or unit is defective) ➡️ Emergency stop is activated and ready contact is released.</td>
</tr>
<tr>
<td>on</td>
<td>on</td>
<td>• Ballast switch overloaded or • undervoltage (&lt;100V DC or &lt;80V AC).</td>
</tr>
</tbody>
</table>

嗟！Ready contact and green LED are coupled.

Caution!
If the unit has no control voltage, no displays will indicate that operating voltage is present.
7.4 COMPAX 35XXS unit features

The 35 kW servo control COMPAX 35XXM - a performance upgrade to the COMPAX family.

- Compact unit with output currents of 50 Aeff / 100 Aeff (<5s) with integrated power unit.
- Additional COMPAX-M controllers of up to 15 KW can be arranged in rows.

7.4.1 Plug and connection assignment COMPAX 35XXM

Before wiring up, always de-energize the unit. Even once the mains supply has been switched off, dangerous levels of voltage can remain in the system for up to 5 min.

When working with motors without a holding brake, the brake lines must not be connected to COMPAX.

Caution!
If the unit has no control voltage, no displays will indicate that operating voltage is present.
**Specific technical data**

Supply voltage up to max. 3 * 500V AC
Operating range: 3*80V AC - 3*500V AC; 45 - 65 Hz.
Typical AC mains: 400V ±10%; 460V ±10%; 480V ±5%

- Layout of contactors for the power supply:
  - Capacity according to device performance: Application group AC3

Note!

Switching on the operating voltage for a second time:
Before switching on the operating voltage for a second time, you must wait for at least 2.5 minutes otherwise you may overload the condenser load resistance.

Control voltage

- 21.6V to 26.4V DC • Ripple: < 1V_{ss} • fuse protection: max. 16A

Mains supply fuse protection

62A K circuit breaker or suitable Neozed conventional fuse.

Regeneration mode

- Storable energy: 3450µF/542 Ws
- External ballast resistance: 10Ω/2 kW
  - For the external ballast resistors available, please see Page 193

**7.4.2 Installation and dimensions of COMPAX 35XXM**

Fastening with 4 M6 hex-socket head screws.
7.4.3 Wiring COMPAX 35XXM

Wiring up motor, mains power / control voltage and external ballast resistance

* max. 1.6A

The PE connection must be a version of at least 10mm²

Wiring up system network
The assignment of X12 does not apply for the S3 option.
7.5 COMPAX 25XXS unit characteristics

7.5.1 COMPAX 25XXS connector and connection assignment

<table>
<thead>
<tr>
<th>LED / color</th>
<th>Meaning, when switched on</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ready / green</td>
<td>24V DC present and initialization complete</td>
</tr>
<tr>
<td>Error / red</td>
<td>COMPAX - fault (E1...E56) present.</td>
</tr>
</tbody>
</table>

Meaning of the LEDs on the front plate

Plan view of COMPAX 25XXS
Before wiring up, always de-energize the unit. Even once the mains supply has been switched off, dangerous levels of voltage can remain in the system for up to 5 min.

When working with motors without a holding brake, the brake lines must not be connected to COMPAX.

The PE connection occurs with 10mm² under a fixing bolt.

Caution!
If the unit has no control voltage, no displays will indicate that operating voltage is present.

Wiring up motor

On unit side

- Note the screened connection of the motor cable on the upper side of the unit.
- Clamp the motor cable with the open section of the screen braid under the ground terminal.

Motor side
- Via connectors.

The mains supply and control voltage supply are located on the upper side of the unit.

Power supply: there are 2 options (with the same output power):
- 3 * 80V AC - 3 * 250V AC • 45-65Hz • fuse protection: 10A
- 1 * 100V AC - 1 * 250V AC • 45-65Hz • Fuse protection: 16A

Layout of contactors for the power supply:
Capacity according to device performance: Application group AC3.
Control voltage 24V DC ±10% ripple <1VSS
Fuse protection: 16A

Fuse protection: 16A

Note! Do not apply 3 * 400V AC.

Only wire up brake in motors with a holding brake! Otherwise, do not wire up.

7.5.2 COMPAX 25XXS-specific technical data

Overvoltage limitation

Energy recuperated during braking is stored in the supply capacitors. The capacity and storable energy is:

COMPAX 25XXS: 1000 µF / 27 Ws

If the recuperated energy causes overvoltage, then external ballast resistances can be engaged.

Maximum braking power with external ballast resistance

<table>
<thead>
<tr>
<th>Braking power</th>
<th>Duration</th>
<th>Cooling down time</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPAX 25XXS: ≤1.0 kW</td>
<td>unlimited</td>
<td></td>
</tr>
<tr>
<td>with R_{ext} ≥ 56Ω</td>
<td>≤2.5 kW</td>
<td>&lt;2s</td>
</tr>
<tr>
<td></td>
<td></td>
<td>≥ 10s</td>
</tr>
</tbody>
</table>

We can supply external ballast resistances for COMPAX 25XXS (see Page 193).

Connecting ballast resistance to COMPAX-S

The ballast resistance is connected to B+, B- and, if necessary, PE. Output X4 is protected from short circuits.

Mating connectors X1, X2, X3 and X4

Mating connectors for X1,...X4 from Phoenix are included with the following type designations:

- X1: MSTB2.5/8/STF-5.08 (with screw connection)
- X2: MSTB2.5/4/ST-5.08 (without screw connection)
- X3: MSTB2.5/2/ST-5.08 (without screw connection)
- X4: MSTB2.5/3/STF-5.08 (with screw connection)

You can acquire Phoenix housings for these connectors and these can be used once adapted to our cables. Designation: KGG-MSTB2.5/(pin number).
7.5.3 COMPAX 25XXS dimensions / installation

The two retaining plates supplied can be attached to the back/left side or the heat sink side. Retaining screws: 4 M6 hex-socket head screws.

**Design in series**

![Diagram showing dimensions and installation](image)

The left-hand side of the unit heat sink is fastened to a metal wall using 2 retaining plates. Installation distance: 135mm (device distance: 5mm)

**Delivery status**

The design is delivered ready for connection in series!

**Flat design**

![Diagram showing dimensions and installation](image)

The left-hand side of the unit heat sink is fastened to a metal wall using 2 retaining plates.

**Converting the front plates**

- Install the retaining plate on the required side.
- Unfasten front plate and blind plate. There are 2 screws on both the upper and lower sides of the unit. Install the front plate and then the blind plate at the required point.
7.5.4 Connector assignment COMPAX 25XXS

The assignment of X12 does not apply for the S3 option.

You will find the assignment of the connectors X5 and X7 (bus systems) on Page 33.
7.6 COMPAX 45XXS/85XXS unit characteristics

7.6.1 Plug and connection assignment COMPAX 45XXS/85XXS

Plan view
### 7.6.2 COMPAX 45XXS/85XXS installation / dimensions

![Diagram of COMPAX 45XXS/85XXS dimensions](image)

Fastening: 4 M5 hex SOCKET head screws  
Installation distance: 130mm (device distance: 5mm)

<table>
<thead>
<tr>
<th>LED</th>
<th>Color</th>
<th>Meaning, when switched on</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ready</td>
<td>Green</td>
<td>24V DC present and initialization complete</td>
</tr>
<tr>
<td>Error</td>
<td>red</td>
<td>CPX error present.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>mains supply or control voltage absent.</td>
</tr>
</tbody>
</table>

**Warning:**
Before wiring up, always de-energize the unit.
Even once the mains supply has been switched off, dangerous levels of voltage can remain in the system for up to 5 min.

**Warning:**
When working with motors without a holding brake, the brake lines must not be connected to COMPAX.
COMPAX 45XXS/85XXS specific wiring

**Wiring up mains power / enabling internal ballast resistance**

- **Bus system**
  - X5 IN
  - X7 OUT
  - HV: DC current output

- **Power supply**: 3 * 80V AC - max. 3 * 500V AC
- **Fuse protection**: max. 16A

- **Layout of contactors for the power supply**
- **Capacity according to device performance**: Application group AC3
- **Control voltage**: 24V DC ±10% ripple <1VSS

**Wiring up motor / control voltage / enable**

- **Sheetshielding of motor cable**
- **Enable**
- **Enable**
- **+24V DC**
- **0V**

- **Brake**
  - black 5
  - black 4
  - green/yellow
  - black 3
  - black 2
  - black 1

- **Note the screened connection of the motor cable on the lower side of the unit.**

- **Clamp the motor cable with the open section of the braided screen under the ground terminal.**

**WARNING**

Risk of electric shock

- If case is not erthed
- Connect earth before connecting supply

**Only wire up brake lines in motors which have a holding brake. Otherwise, do not wire up.**
Enable bridges: X3/1 - X3/2

The final stage is enabled using a bridge between X3/1 - X3/1.
If this connection is missing, the final stage is voltage-free and error message E40 appears (see from Page 223).

Overvoltage limitation

Energy recuperated during braking is stored in the supply capacitors. The capacity and storable energy is:
- COMPAX 45XXS: 330µF/52 Ws
- COMPAX 85XXS: 500µF/80 Ws
If the recuperated energy causes overvoltage, then the internal ballast resistance is engaged.

Enable internal ballast resistance: X2/5 - X2/6

The internal ballast resistance is enabled by a bridge between X2/5 and X2/6.
If this connection is missing, the controller operates without ballast resistance; in braking mode, error message E38 may appear (see from Page 223).

Maximum braking power of the internal ballast resistance

<table>
<thead>
<tr>
<th>Braking power</th>
<th>Duration</th>
<th>Cooling down time</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPAX 45/85S: 300W</td>
<td>unlimited</td>
<td></td>
</tr>
<tr>
<td>≤1.5 kW</td>
<td>&lt;10s</td>
<td>≥10s</td>
</tr>
</tbody>
</table>

We provide external ballast resistances for COMPAX 45XXS / 85XXS (see Page 193).

Connecting a ballast resistance to COMPAX 4500S/ COMPAX 8500S

The ballast resistance is connected to HV, T0 and PE.
The output is protected from short circuits.

Note!
When an external ballast resistance is connected, the bridge between R0 and T0 must be removed.
## 7.6.4 COMPAX 45XXS/85XXS connector and pin assignment

### Releasing internal ballast resistance

<table>
<thead>
<tr>
<th>X1: motor brake</th>
<th>X2: AC supply</th>
<th>X3: control voltage</th>
<th>X6: RS232</th>
</tr>
</thead>
<tbody>
<tr>
<td>X8/1 I</td>
<td>X8/2 I</td>
<td>X8/3 I</td>
<td>X8/4 I</td>
</tr>
<tr>
<td>X8/5 I</td>
<td>X8/6 I</td>
<td>X8/7 I</td>
<td>X8/8 I</td>
</tr>
<tr>
<td>X8/9 O</td>
<td>X8/10 O</td>
<td>X8/11 O</td>
<td>X8/12 O</td>
</tr>
<tr>
<td>X8/13 O</td>
<td>X8/14 O</td>
<td>X8/15 O</td>
<td>X8/16 O</td>
</tr>
</tbody>
</table>

### Releasing final stage

<table>
<thead>
<tr>
<th>X11 +24V</th>
<th>X11 GND</th>
<th>X11 Override</th>
<th>X11 DA-channel 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>X11 DA-channel 1</td>
<td>X11 Shield</td>
<td>X11 OVERRIDE (old)</td>
<td></td>
</tr>
</tbody>
</table>

### Interfaces

<table>
<thead>
<tr>
<th>X8: Input / Output 1...8</th>
<th>X9: I1...I8</th>
</tr>
</thead>
</table>

### Accessories / options

<table>
<thead>
<tr>
<th>X9: I1...I8</th>
<th>X10: Input / Output I9...I16</th>
</tr>
</thead>
</table>

### Status

<table>
<thead>
<tr>
<th>X10: Input / Output I9...I16</th>
<th>X10: O9...O16</th>
</tr>
</thead>
</table>

### Parameter

<table>
<thead>
<tr>
<th>X12: resolver / SinCos</th>
<th>X13: encoder</th>
</tr>
</thead>
</table>

---

The assignment of X12 does not apply for the S3 option.

You will find the assignment of the connectors X5 and X7 (bus systems) on Page 63.
7.7 COMPAX 1000SL Unit characteristics

7.7.1 Connector and terminal assignment for COMPAX 1000SL

![Diagram of COMPAX 1000SL unit]

**Before wiring up, always de-energize the unit.**
Even once the mains supply has been switched off, dangerous levels of voltage can remain in the system for up to 5 min.

**Warning!**
When working with motors without a holding brake, the brake lines must not be connected to COMPAX.

**Caution!**
If the unit has no control voltage, displays will not indicate if operating voltage is present.

**PE – terminal:** at least 2.5mm²

**LED display**
The following statuses are shown by the LEDs.

<table>
<thead>
<tr>
<th>Status</th>
<th>Red LED (H2)</th>
<th>Green LED (H1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24V not available</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>24V are switched on, boot up</td>
<td>on</td>
<td>off</td>
</tr>
<tr>
<td>Unit OFF</td>
<td>off</td>
<td>blinking</td>
</tr>
<tr>
<td>Unit error; drive switched off</td>
<td>on</td>
<td>blinking</td>
</tr>
<tr>
<td>Unit error; drive powered</td>
<td>on</td>
<td>on</td>
</tr>
<tr>
<td>Unit RUNNING</td>
<td>off</td>
<td>on</td>
</tr>
</tbody>
</table>
Clamp the motor cable with the open section of the screen braid under the ground terminal.

Power supply:
- 1*100V AC - 1*250V AC • 45-65Hz • Fuse protection: 10A
- Layout of contactors for the power supply
  Capacity according to device performance: Application group AC3
- Control voltage 24V DC ±10% ripple <1VSS • Fuse protection: max. 16A
The screen clamp for the screen connection of the motor cable is included and must be screwed on in the illustrated position.

Only wire up brake in motors with a holding brake! Otherwise, do not wire up.

Energy recuperated during braking is stored in the supply capacitors. The capacity and storable energy is:

**COMPAX 10XXSL:** 660 µF / 17 Ws

If the recuperated energy causes overvoltage, then external ballast resistances can be engaged.

<table>
<thead>
<tr>
<th>Braking power</th>
<th>Duration</th>
<th>Cooling down time</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPAX 10XXSL:</td>
<td>≤ 1.6kW</td>
<td>unlimited</td>
</tr>
</tbody>
</table>

We provide external ballast resistances for COMPAX 1000SL (see Page 193).

Connecting the ballast resistance

The ballast resistance is connected to B+, B- and, if necessary, PE. Output X4 is protected against short circuiting.
Mating connectors for X1,...X4 from Phoenix are included with the following type designations:

- X1: MSTB2.5/6/STF-5.08 (with screw connection)
- X2: MSTB2.5/3/ST-5.08 (without screw connection)
- X3: MSTB2.5/2/ST-5.08 (without screw connection)
- X4: MSTB2.5/3/STF-5.08 (with screw connection)

You can acquire Phoenix housings for these connectors and these can be used once adapted to our cables. Designation: KGG-MSTB2.5/(pin number).

### 7.7.2 Connector assignment COMPAX 1000SL (overview)

**X12**: resolver / SinCos©

**X13**: encoder

The assignment of X12 does not apply for the S3 option.

**X19**: In- and output/ Emergency stop/ enable/ override/ stand by

**X17**: DA-monitor initiators

**X14/X15**: HEDA

**X7**: bus systems output

**X5**: bus systems input

Assignment depends on the bus system.
7.7.3 Mounting and dimensions COMPAX 1000SL

Fastening: 3 M4 hex-socket head screws
Installation distance: 100mm (device distance: 15mm)
7.7.4 Safety chain / emergency stop functions

Readiness, safety chain

Establishing a safety chain for monitoring the drives and other control components or a superordinate control unit usually requires a connection protected from wire breaks. The contact outputs (closer) P (X8(9)/3) and S (X8(9)/4) are used for this purpose. This closer establishes sequential switching for the mains module and the axis controller. When the unit is operating correctly, the contacts are closed (P and S are connected) and thereby indicate the readiness of the unit. If an error occurs or if the drive system is switched off, the readiness is not displayed and the chain is interrupted (see below).

Emergency stop

The emergency stop input is used to activate or deactivate all drive controllers or an individual controller supplied by the mains module. In accordance with the safety chain described above, this input must be activated to power the motors. This occurs either via an external contact between X8(9)/5 and X8(9)/6 (as is shown in the figure below) or by applying voltage of between 15V and 24V to the input X8(9)/6 against GND (X8(9)/2). If the contact is opened or the voltage is removed from X8(9)/6 or routed to GND24V, the emergency stop sequence is processed, e.g. all motors of the connected drive controller are decelerated and switched off (no torque on the motor shaft); the ready contact drops.

After an emergency stop: error E55 (even in OFF status) and O1="0". The current command is interrupted.

The controller brakes the motor (P10 = braking time from 100% speed to 0%).

When at a standstill, the controller is switched off and any idle holding brake is closed.

Once the problem has been rectified, E55 must be acknowledged.

The current command is continued after START.

Emergency stop characteristics:

<table>
<thead>
<tr>
<th>NMD: X8</th>
<th>COMPAX-S: X9:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connectors: Phoenix MC1.5/7-ST-3.81</td>
<td>Pin</td>
</tr>
<tr>
<td>1</td>
<td>+24V DC (&lt;50mA)</td>
</tr>
<tr>
<td>2</td>
<td>0V</td>
</tr>
<tr>
<td>3</td>
<td>P: Ready contact</td>
</tr>
<tr>
<td>4</td>
<td>S: Ready contact</td>
</tr>
<tr>
<td>5</td>
<td>+24V DC – Output for emergency stop</td>
</tr>
<tr>
<td>6</td>
<td>Emergency stop input (activated by 15V – 24V)</td>
</tr>
<tr>
<td>7</td>
<td>Screen</td>
</tr>
</tbody>
</table>

| COMPAX 35XXM: X19 |
|---|---|
| Connectors: Phoenix MC1.5/7-ST-3.81 | Pin | Assignment |
| 1 |  +24V DC (<50mA) |
| 2 |  0V |
| 3 |  P: Ready contact |
| 4 |  S: Ready contact |
| 5 |  +24V DC – Output for emergency stop |
| 6 |  Emergency stop input (activated by 15V – 24V) |
| 7 |  +24V DC (<50mA) |
| 8 |  reserved |
| 9 |  +24V DC (<50mA) |
| 10 |  Enable |
| 11 |  Screen |
COMPAX 1000SL Unit characteristics

COMPAX 1000SL X19

<table>
<thead>
<tr>
<th>Pin</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>+24V DC (&lt;50mA)</td>
</tr>
<tr>
<td>1</td>
<td>0V</td>
</tr>
<tr>
<td>24</td>
<td>P: Ready contact</td>
</tr>
<tr>
<td>25</td>
<td>S: Ready contact</td>
</tr>
<tr>
<td>11</td>
<td>Emergency stop input (activated by 15V – 24V)</td>
</tr>
</tbody>
</table>

Emergency stop input direct to COMPAX-M X9

<table>
<thead>
<tr>
<th>Pin</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24V DC (&lt;50mA)</td>
</tr>
<tr>
<td>2</td>
<td>0V</td>
</tr>
<tr>
<td>3</td>
<td>reserved</td>
</tr>
<tr>
<td>4</td>
<td>reserved</td>
</tr>
<tr>
<td>5</td>
<td>+24V DC – Output for emergency stop</td>
</tr>
<tr>
<td>6</td>
<td>Emergency stop input (activated by 15V – 24V)</td>
</tr>
<tr>
<td>7</td>
<td>Screen</td>
</tr>
</tbody>
</table>

*Emergency stop input on COMPAX-M*

The emergency stop input on COMPAX-M X9 is enabled via parameter P219.

**Meaning:**
- P219="0": No emergency stop input on COMPAX-M X9
- P219="7": Emergency stop input on COMPAX-M X9 with the following data
  - Stop with P10 as relative ramp time (P10 = braking time from 100% speed to 0%).
  - The motor is switched off.
  - Error message E56 is generated.
  - The ready contact drops.

**Principle of safety chain and emergency stop function**

**Ready contact:** max. 0.5A, 60V, 30W

Applies to potential - 24V power supply.
## 7.8 Connections to the motor

### 7.8.1 Resolver / SinCos

<table>
<thead>
<tr>
<th>Pin from X12</th>
<th>Standard assignment Assignment with resolver or option S1/ S2²</th>
<th>Assignment with option S3³</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Housing</td>
<td>Housing</td>
</tr>
<tr>
<td>2</td>
<td>+8V</td>
<td>+8V</td>
</tr>
<tr>
<td>3</td>
<td>NC</td>
<td>HALL3</td>
</tr>
<tr>
<td>4</td>
<td>REF-</td>
<td>+5V</td>
</tr>
<tr>
<td>5</td>
<td>SIN-</td>
<td>SIN- / A/</td>
</tr>
<tr>
<td>6</td>
<td>NC</td>
<td>HALL2</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td>GND</td>
</tr>
<tr>
<td>8</td>
<td>ST+</td>
<td>+5V</td>
</tr>
<tr>
<td>9</td>
<td>+5V</td>
<td>+5V</td>
</tr>
<tr>
<td>10</td>
<td>TEMP</td>
<td>TEMP</td>
</tr>
<tr>
<td>11</td>
<td>COS-</td>
<td>COS- / B/</td>
</tr>
<tr>
<td>12</td>
<td>COS+</td>
<td>COS+ / B</td>
</tr>
<tr>
<td>13</td>
<td>SIN+</td>
<td>SIN+ / A</td>
</tr>
<tr>
<td>14</td>
<td>REF+</td>
<td>HALL1</td>
</tr>
<tr>
<td>15</td>
<td>ST-</td>
<td>GND HALL</td>
</tr>
</tbody>
</table>

² The S1/2 options are required for operation with the sensor system SinCos.
³ The S3 option is required for operation of linear motors.
Connections to the motor

Connecting cable to motor

<table>
<thead>
<tr>
<th>Resolver cable</th>
<th>Sensor cable (SinCos®)</th>
<th>Motor cable With connectors: (HJ96, HJ116, HDY55, HDY70, HDY92, HDY115)</th>
<th>With terminal boxes: (HJ155, HJ190, HDY142)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5mm² up to 13.8A</td>
<td>2.5mm² up to 18.9A</td>
<td>2.5mm² up to 18.9A</td>
<td>6mm² up to 32.3A</td>
</tr>
<tr>
<td>REK32/..</td>
<td>GBK16/..</td>
<td>MOK42/..</td>
<td>MOK43/..</td>
</tr>
<tr>
<td>Connector set: 085-301312, 800-030031</td>
<td>085-301317, 800-030031</td>
<td>085-301306, 085-301306, 125-518162, 125-216800</td>
<td>125-518211, 125-217000, 125-518200</td>
</tr>
<tr>
<td>Cable: 102-150200, 102-150210</td>
<td>102-508902, 102-508902, 102-150030, 102-150040</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable data in mm²: 8.0/80/120, 7.5/38/113</td>
<td>10.7/107/107, 13.7/137/137, 13.7/137/137, 16.5/124/124, 22.5/168/168</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard cable: REK32/..</td>
<td>GBK17/..</td>
<td>MOK44/..</td>
<td>MOK45/..</td>
</tr>
<tr>
<td>Connector set: 085-301312, 800-030031</td>
<td>085-301317, 800-030031</td>
<td>085-301306, 085-301306, 125-518162, 125-216800</td>
<td>125-518211, 125-217000, 125-518200</td>
</tr>
<tr>
<td>Cable: 102-000030, -</td>
<td>102-000020, 102-000010, 102-000010, 102-150030, 102-150040</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable data in mm²: 8.2/61,5/61,5, 8.0/40/64, 9.2/69/69, 11/82,5/82,5, 11/82,5/82,5, 16,5/124/124, 22,5/168/168</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Resolver cable for HJ and HDY motors

REK32

In HJ – motors, ensure that the thermal sensor has the correct terminal arrangement.

Version in high-flex: REK33 (same layout)

Packaging

Packaging of motor in accordance with connector manufacturer’s specification

Packaging of device
- Strip 26mm sheathing off.
- Cut sheath down to 6mm.
- Strip 4mm of insulation of ends and coat in tin.

Length codes for preformed cables

<table>
<thead>
<tr>
<th>Length [m]</th>
<th>1.0</th>
<th>2.5</th>
<th>5.0</th>
<th>7.5</th>
<th>10.0</th>
<th>12.5</th>
<th>15.0</th>
<th>20.0</th>
<th>25.0</th>
<th>30.0</th>
<th>35.0</th>
<th>40.0</th>
<th>45.0</th>
<th>50.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>01</td>
<td>02</td>
<td>03</td>
<td>04</td>
<td>05</td>
<td>06</td>
<td>07</td>
<td>08</td>
<td>09</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
</tr>
</tbody>
</table>

Example REK32/09: length 25m
Motor cable for HJ and HDY – motors

MOK42 (max. 13.8A)

Version in high-flex: MOK44 (same layout)

MOK43/.. (max. 18.9A): HJ (version in high-flex: MOK45)
Layout corresponds to MOK42, however motor lines in 2.5 mm²

Packaging

Packaging of motor in accordance with connector manufacturer's specification
Contacts for 1.5 mm² and 2.5 mm² are supplied with the connector set.

Packaging of device

Material:
- 6 x crimping sleeves.
- 6 cm shrink-fit hose.

Procedure:
- Strip 110 mm sheathing off cable.
- Cut down sheath to approx. 35 mm, loosen,
- fold back over outer cover (approx. 75 mm) and stick with insulating tape.
- Shorten sw1,sw2,sw3,sw4,sw5 approx. 15 mm ; (gn/ge approx. 15 mm longer); cut down sw6.
- Attach 2 x approx. 30 mm shrink-fit hose (sticky).
- Strip 10 mm of insulation of ends of wires and secure with crimping sleeve 1.5.
Connections to the motor

MOK21 (max. 18.9A)

Version in high-flex: MOK14 (same layout)

MOK11 (max. 32.3A) in high-flex (same layout to MOK21, however in 6 mm²)

MOK46 (max. 47.3A) in high-flex (same layout to MOK21, however in 10 mm²)

Packaging

Packaging of device

Material:
6 x crimping sleeves.
6 cm shrink-fit hose.

Procedure:
- Strip 110 mm sheathing off cable.
- Cut sheath down to approx. 35 mm, loosen,
- fold back over outer cover (approx. 75 mm) and stick with insulating tape.
- Shorten sw1,sw2,sw3,sw4,sw5 ca. 15 mm (gn/ge approx. 15 mm longer) cut down sw6.
- Attach 2 x approx. 30 mm shrink-fit hose (sticky).
- Strip 10 mm of insulation off ends of wires and secure with crimping sleeves 2.5.

Packaging of motor in accordance with manufacturer's specification
- Strip 190 mm sheathing of cable.
- Cut sheath down to approx. 170 mm, stick remaining 20 mm with insulating tape.
- Shorten sw1,sw2,sw3,sw4,sw5 by approx. 15 mm (gn/ge approx. 15 mm longer) cut down sw6.
- Strip 10 mm of insulation of ends of wires and secure with crimping sleeves 2.5.
SinCos® cable for HJ and HDY motors

Version in high-flex: GBK17 (same layout)

Packaging

Packaging of motor in accordance with connector manufacturer's specification

Packaging of device

- Strip 26mm sheathing off.
- Cut sheath down to 6 mm.
- Strip 4mm of insulation of ends and coat in tin.
- Place sheath over large area of housing (e.g. fold sheath over outer cover and fasten down by relieving tension).
7.8.2 Additional brake control

COMPAX controls the motor retaining brake independently (also see Page 123). When running applications which require additional brake control note the following, based on the unit type used.

**COMPAX-M / COMPAX 45XXS / COMPAX 85XXS, COMPAX 1000SL**

With these units, you must implement measures for suppression. Note the following application example:

![diagram](image-url)

These protective measures are available in COMPAX-M / COMPAX 45XXS / COMPAX 85XXS for applications without external brake control.

**COMPAX 25XXS / COMPAX 35XXM**

In COMPAX 25XXS (X1/7 and X1/8) and in COMPAX 35XXM (X23: bridge), 2 connections are available for connecting the external contact. These connections are already bridged in the connector when supplied. External protective measures are not required for COMPAX 25XXS and COMPAX 35XXM.

**External contact connection:**
The bridge is removed and is replaced by connecting an external contact.
### 7.9 Interfaces

#### 7.9.1 Digital inputs and outputs (excluding COMPAX 1000SL)

The inputs and outputs have PLC voltage levels (High signal = 24V DC)

<table>
<thead>
<tr>
<th>X8 Pin</th>
<th>Assignment</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Input I1</td>
<td>SHIFT</td>
<td>=&quot;0&quot;</td>
</tr>
<tr>
<td>2. Input I2</td>
<td>Manual+</td>
<td>Find machine zero</td>
</tr>
<tr>
<td>3. Input I3</td>
<td>Manual–</td>
<td>Approach real zero</td>
</tr>
<tr>
<td>4. Input I4</td>
<td>Quit</td>
<td>Teach real zero</td>
</tr>
<tr>
<td>5. Input I5</td>
<td>Start</td>
<td>-</td>
</tr>
<tr>
<td>6. Input I6</td>
<td>Stop (interrupt data record)</td>
<td>Break (breaks off data record)</td>
</tr>
<tr>
<td>7. Input I7</td>
<td>Freely assignable in the standard unit.</td>
<td></td>
</tr>
<tr>
<td>8. Input I8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Output O1</td>
<td>=&quot;1&quot;:No fault =&quot;0&quot;:errors E1 ... E58; the drive does not accept any positioning commands. After &quot;Power on&quot; O1 remains at &quot;0&quot; until after the self test.</td>
<td></td>
</tr>
<tr>
<td>10. Output O2</td>
<td>=&quot;1&quot;:No warning =&quot;0&quot;:error ≥ E58</td>
<td></td>
</tr>
<tr>
<td>11. Output O3</td>
<td>Machine zero has been approached</td>
<td></td>
</tr>
<tr>
<td>12. Output O4</td>
<td>Ready for start</td>
<td></td>
</tr>
<tr>
<td>13. Output O5</td>
<td>Programmed set point reached</td>
<td></td>
</tr>
<tr>
<td>14. Output O6</td>
<td>Idle after stop</td>
<td></td>
</tr>
<tr>
<td>15. Output O7</td>
<td>Freely assignable in the standard unit.</td>
<td></td>
</tr>
<tr>
<td>16. Output O8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The "SHIFT signal" (I1) must be assigned before or at the same time as the relevant input.

<table>
<thead>
<tr>
<th>X10 Pin</th>
<th>Assignment</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Input I9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Input I10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Input I11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Input I12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Input I13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Input I14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Input I15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Input I16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Output O9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Output O10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Output O11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Output O12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Output O13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Output O14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Output O15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Output O16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note the assignment for unit variants and for special functions.
COMPAX 1000SL physically has 8 digital inputs and 8 digital outputs which are assigned to connector X19.

COMPAX internally has 16 logic inputs and 16 logic outputs, some of which have functions assigned to them. This means that not all logic inputs and outputs can be interrogated or output via physical inputs and outputs. In order to enable flexible assignment, a matrix was created for input and output assignment respectively which makes it possible to assign the logic inputs and outputs to any of the physical inputs and outputs. The matrices for allocation are realized via parameters P156 to P160 (see Page 140). The assignment described below applies to COMPAX 1000SL (standard unit) with default settings for parameters P156 to P160.

### Assignment X19 for COMPAX 1000SL

<table>
<thead>
<tr>
<th>X19 Pin</th>
<th>Assignment</th>
<th>Meaning for COMPAX 1000SL standard unit and default settings for parameters P156 to P160</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Input</td>
<td>SHIFT =&quot;0&quot; =&quot;1&quot;</td>
</tr>
<tr>
<td>3.</td>
<td>Input</td>
<td>Manual+ Find machine zero</td>
</tr>
<tr>
<td>4.</td>
<td>Input</td>
<td>Hand– Approach real zero</td>
</tr>
<tr>
<td>5.</td>
<td>Input</td>
<td>Quit Teach real zero</td>
</tr>
<tr>
<td>6.</td>
<td>Input</td>
<td>START -</td>
</tr>
<tr>
<td>7.</td>
<td>Input</td>
<td>Stop (interrupts data record) Break (breaks off data record)</td>
</tr>
<tr>
<td>8.</td>
<td>Input</td>
<td>Freely assignable in the standard unit. (I12)</td>
</tr>
<tr>
<td>9.</td>
<td>Input</td>
<td>Freely assignable in the standard unit. (I16)</td>
</tr>
<tr>
<td>10.</td>
<td>reserved</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Emergebcy stop</td>
<td>Emergency stop input (emergency stop is triggered by voltage &lt; 15V DC)</td>
</tr>
<tr>
<td>12.</td>
<td>Enable</td>
<td>COMPAX 1000SL is enabled by 24V DC at X19/12</td>
</tr>
<tr>
<td>13.</td>
<td>Override</td>
<td>Input voltage 0 - +5V.</td>
</tr>
<tr>
<td>14.</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Output</td>
<td>=&quot;1&quot;: No fault =&quot;0&quot;: errors E1 ... E58; the drive does not accept any positioning commands. After &quot;Power on&quot; O1 remains at &quot;0&quot; until after the self test.</td>
</tr>
<tr>
<td>16.</td>
<td>Output</td>
<td>=&quot;1&quot;: No warning =&quot;0&quot;: Error ≥ E58</td>
</tr>
<tr>
<td>17.</td>
<td>Output</td>
<td>Machine zero has been approached</td>
</tr>
<tr>
<td>18.</td>
<td>Output</td>
<td>Ready for start</td>
</tr>
<tr>
<td>19.</td>
<td>Output</td>
<td>Programmed set point reached</td>
</tr>
<tr>
<td>20.</td>
<td>Output</td>
<td>Idle after stop</td>
</tr>
<tr>
<td>21.</td>
<td>Output</td>
<td>Freely assignable in the standard unit. (O7)</td>
</tr>
<tr>
<td>22.</td>
<td>Output</td>
<td>Freely assignable in the standard unit. (O8)</td>
</tr>
<tr>
<td>23.</td>
<td>24VDC</td>
<td>Load &lt; 50mA</td>
</tr>
<tr>
<td>24.</td>
<td>Ready P</td>
<td>Ready contact for building a safety chain</td>
</tr>
<tr>
<td>25.</td>
<td>Ready S</td>
<td>Ready contact for building a safety chain</td>
</tr>
</tbody>
</table>

Note the assignment for unit variants and for special functions.
7.9.3 Technical data / Connections of inputs and outputs

Detection of input signals:

0 → 1 over 9.15V means that "1" is recognised
1 → 0 over 8.05V means that "0" is recognised

Load on outputs (not applicable for COMPAX 1000SL):

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>O1...O16</td>
<td>Total of max. 1.6A</td>
</tr>
<tr>
<td>2.</td>
<td>O1...O4, O5...O8, O9...O12, O13...O16</td>
<td>Per group of 4, max. 0.8A; taking due account of 1.</td>
</tr>
<tr>
<td>3.</td>
<td>O per output, max. 0.3A and 40nF capacitive</td>
<td>taking into account 1. and 2.</td>
</tr>
</tbody>
</table>

Load on outputs for COMPAX 1000SL:

Per output, max. 0.3A • In total a sum load for all 8 outputs of max. 0.48A and 40nF capacitive

If overload occurs, an error message appears (E43: can be acknowledged with Power off/on); the corresponding group of four is switched off.

For reasons of interference protection, we would recommend that you use a screened cable for the digital inputs and outputs.

With COMPAX 1000SL, the screen is connected with the Sub-D housing.

A protective connection is required when there is inductive load present.

---

4 A maximum of 4 COMPAX – inputs can be connected to one output.
5 A maximum of 4 COMPAX – inputs can be connected to one output.
### 7.9.4 Initiators and D/A monitor

#### Connection assignment on X17

<table>
<thead>
<tr>
<th>Pin</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DA channel 0 (option D1) Ri=2.8kΩ; <strong>COMPAX 1000SL</strong>: DA channel 2; Ri=0.33kΩ;</td>
</tr>
<tr>
<td>2</td>
<td>DA channel 1 (option D1) Ri=2.8kΩ; <strong>COMPAX 1000SL</strong>: DA channel 3; Ri=0.33kΩ; reserved</td>
</tr>
<tr>
<td>3</td>
<td>Ground 24V (Initiators supply)</td>
</tr>
<tr>
<td>4</td>
<td>+24V (Initiators supply) &lt;50 mA</td>
</tr>
<tr>
<td>5</td>
<td>Ground for DA channels</td>
</tr>
<tr>
<td>6</td>
<td>Input MZ initiator</td>
</tr>
<tr>
<td>7</td>
<td>Input I2 initiator</td>
</tr>
<tr>
<td>8</td>
<td>Input I1 initiator</td>
</tr>
</tbody>
</table>

**Connection plan for the initiators with initiator connector**

**Standard**

When **operating with one initiator** (machine zero), this must be attached to one side of the stroke. When attaching the initiator, ensure that an initiator attached to the left-hand side can no longer be cleared to the left. The flank to be analyzed can therefore also be positioned before the end of the travel distance. The same applies correspondingly for the right-hand side.

**Extended operation**

When **operating with three initiators** (not standard), initiators I1 and I2 must be attached to the outer limits of the stroke range. The machine zero initiator is fitted between I1 and I2. The following limitation applies in such cases: the flank of the machine zero initiator must not be activated at the same time as a limit switch.

If COMPAX is only operating as a speed controller or in the "continuous mode" or normal operating mode with a special machine zero mode (P212="10" see Page 80 onwards), then no initiators are required.

Ensure that the initiator is rebound-free!
### 7.9.5 Service D/A monitor / override

#### Assignment of X11 (not applicable for COMPAX 1000SL)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24V</td>
</tr>
<tr>
<td>2</td>
<td>Ground 24V</td>
</tr>
<tr>
<td>3</td>
<td>Override for speed reduction</td>
</tr>
<tr>
<td>4</td>
<td>Standard DA channel 2: 8 Bit, R=2.21kΩ</td>
</tr>
<tr>
<td>5</td>
<td>Standard DA channel 3: 8 Bit, R=2.21kΩ</td>
</tr>
<tr>
<td>6</td>
<td>Override; previous input for existing applications</td>
</tr>
<tr>
<td>7</td>
<td>Screen</td>
</tr>
</tbody>
</table>

With COMPAX 1000SL, the override input is on X19/13 (see Page 53), the Service D/A monitors on X17/1 und X17/2 (see Page 55).

#### Override connection (not applicable for COMPAX 1000SL)

The override input is read in a cycle of 100 ms. You can continue to use the previous override connection for current applications.

#### Override - Connection for COMPAX 1000SL

The override input is read in a cycle of 100 ms.

**Note:** Wiring of override with screened cables only

### 7.9.6 Service D/A monitor

The service D/A monitor gives you the option of outputting internal measurement and intermediate parameters from COMPAX in the form of analogue voltage in the range of ±10V via X11 (X17 with COMPAX 1000SL) and visualizing these by means of an oscilloscope. This provides you with a capable aid for making the unit functions clear and qualifiable, especially during the start-up.

This function (which is available in all units) provides you with two analogue output channels with a resolution of 8 bit and these are updated every 100 µs.
Using the parameters P76 and P77, you can select 2 parameters and adapt them to the required measuring range.

**Assignment of the channels**

Channel 2: X11/4; X17/1 for COMPAX 1000SL
Channel 3: X11/5; X17/2 for COMPAX 1000SL

**Meaning and range of values of P76 / P77**

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>P76</td>
<td>Value before decimal point</td>
<td>Measuring parameter of channel 2. (see below for meaning).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0...18</td>
</tr>
<tr>
<td>P76</td>
<td>Value after decimal point</td>
<td>Gain factor from channel 2. (factor = value * 10 000 000)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.1... 10 000 000</td>
</tr>
<tr>
<td>P77</td>
<td>Value before decimal point</td>
<td>Measuring parameter of channel 3. (see below for meaning).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0...18</td>
</tr>
<tr>
<td>P77</td>
<td>Value after decimal point</td>
<td>Gain factor from channel 3. (factor = value * 10 000 000)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.1... 10 000 000</td>
</tr>
</tbody>
</table>

The parameters can only be actuated once you have entered the password. They are validated using VP.

**D/A monitor standard measuring parameters**

Service D/A monitor: Selection of measuring parameter using P76 / P77
D/A monitor (option D1): Selection of measuring parameter using P73 / P74

<table>
<thead>
<tr>
<th>Measuring parameter No.</th>
<th>Measuring parameter</th>
<th>Reference value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Nominal speed value sensor</td>
<td>20 000 min⁻¹</td>
</tr>
<tr>
<td>1</td>
<td>Tracking error</td>
<td>128 Motor revolutions</td>
</tr>
<tr>
<td>2</td>
<td>Advance speed control</td>
<td>20 000 min⁻¹</td>
</tr>
<tr>
<td>3</td>
<td>Nominal speed value of position controller</td>
<td>20 000 min⁻¹</td>
</tr>
<tr>
<td>4</td>
<td>Actual speed value</td>
<td>20 000 min⁻¹</td>
</tr>
<tr>
<td>5</td>
<td>Speed deviation</td>
<td>20 000 min⁻¹</td>
</tr>
<tr>
<td>6</td>
<td>Not assigned</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Not assigned</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Nom. value of transverse current (torque)</td>
<td>200A</td>
</tr>
<tr>
<td>9</td>
<td>Intermediate circuit voltage</td>
<td>1000V</td>
</tr>
<tr>
<td>10</td>
<td>Sine for co-ordinate transformation</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Voltage positioning signal for phase U</td>
<td>2 * U_LS</td>
</tr>
<tr>
<td>12</td>
<td>Voltage positioning signal for phase V</td>
<td>2 * U_LS</td>
</tr>
<tr>
<td>13</td>
<td>Phase current for phase U</td>
<td>200A</td>
</tr>
<tr>
<td>14</td>
<td>Phase current for phase V</td>
<td>200A</td>
</tr>
<tr>
<td>15</td>
<td>Actual value of transverse current (torque)</td>
<td>200A</td>
</tr>
<tr>
<td>16</td>
<td>Longitudinal current</td>
<td>200A</td>
</tr>
<tr>
<td>17</td>
<td>Scaled transverse voltage (For amplification of 1 use: 10V = 2 * U_LS)</td>
<td>2 * U_LS</td>
</tr>
<tr>
<td>18</td>
<td>Scaled longitudinal voltage (For amplification of 1 use: 10V = 2 * U_LS)</td>
<td>2 * U_LS</td>
</tr>
</tbody>
</table>

You will find additional measuring parameters on Page 210.

---

6 The initiator signals are looped through the monitor box ASS1/01.
7 .0000001=factor 1
   .000001=factor 10
   .999999=factor 10 000 000
8 Physical value with 10V output voltage and an amplification of 1
9 To determine torque:
   \[ \text{torque} = \text{transverse current} \times 0.71 \times \text{total torque constant} \]
10 To determine torque:
   \[ \text{torque} = \text{transverse current} \times 0.71 \times \text{total torque constant} \]
**D/A monitor option D1**

**Calculation of physical parameter using the measured value:**

\[
PG = \frac{MW \times BG}{VS \times 10V}
\]

**Example:**

\[
P76 = 4.000 \ 0010 \quad P77 = 13.000 \ 0005
\]

Therefore the following applies:

- Channel 2: measuring parameter 4 (actual speed value).
  - Gain factor = 10
- Channel 3: measuring parameter 13 (phase current for phase U).
  - Gain factor = 5

**Measured values:**

\[
\text{Channel 0: } MW = 2.5V \Rightarrow PG = \frac{2.5 \times 20000 \text{min}^{-1}}{10 \times 10V} = 500 \text{ rpm}
\]

\[
\text{Channel 1: } MW = 3V \Rightarrow PG = \frac{3 \times 200A}{5 \times 10V} = 12A
\]

The parameters of the D/A monitor can also be set to status S15 or be viewed via the optimization display (see Page 133).

**7.9.7 D/A monitor option D1**

The option D1 cannot be used for COMPAX 1000SL.

This option provides you with two additional analogue output channels with a resolution of 12 bit. These channels are updated every 100 µs. Use the parameters P73 and P74 (as you do with the service D/A monitor) to select 2 quantities and to adapt them to the required measuring range using 2 parameters (P71 and P72).

D/A monitor option D1 must be ordered as a separate item.

To obtain output from the measured signals, you will need an externally connected monitor box (ASS1/01) with 2 BNC bushes for connecting the measurement instruments. This is connected as follows:

- Monitor box is connected to COMPAX connector X17.
- The initiator line is connected from X17 to the monitor box. The signals are fed through the monitor box.

**Meaning and range of values of P71 - P74**

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>P71</td>
<td>Gain factor from channel 0.</td>
<td>1...10 000</td>
</tr>
<tr>
<td>P72</td>
<td>Gain factor from channel 1.</td>
<td>1...10 000</td>
</tr>
<tr>
<td>P73</td>
<td>Measuring parameter of channel 0. (For the meaning, see table on Page 56).</td>
<td>0...18</td>
</tr>
<tr>
<td>P74</td>
<td>Measuring parameter of channel 1. (For the meaning, see table on Page 56).</td>
<td>0...18</td>
</tr>
</tbody>
</table>

The parameter can only be actuated once you have entered the password.

The measuring parameters are selected using P73 or P74.

Example: P71=10  P72=5  P73=4  P74=13

Therefore, the following applies:

- Channel 0: measuring parameter 4 (actual speed value).
  - Gain factor = 10
- Channel 1: measuring parameter 13 (phase current for phase U).
  - Gain factor = 5
7.9.8 RS232 interface

Wiring diagram SSK1/...: COMPAX - PC/terminal

<table>
<thead>
<tr>
<th>X6</th>
<th>PC / terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>9-way Sub-D-pin</td>
<td></td>
</tr>
<tr>
<td>plug shell</td>
<td></td>
</tr>
<tr>
<td>screwed connection UNC4-40</td>
<td></td>
</tr>
<tr>
<td>n.c. 1</td>
<td></td>
</tr>
<tr>
<td>RxD</td>
<td>2</td>
</tr>
<tr>
<td>TxD</td>
<td>3</td>
</tr>
<tr>
<td>DTR</td>
<td>4</td>
</tr>
<tr>
<td>DSR</td>
<td>6</td>
</tr>
<tr>
<td>GND</td>
<td>5</td>
</tr>
<tr>
<td>RTS</td>
<td>7</td>
</tr>
<tr>
<td>CTS</td>
<td>8</td>
</tr>
<tr>
<td>+5V</td>
<td>9</td>
</tr>
</tbody>
</table>

9pol. Sub-D-socket board

7 x 0.25mm² + shield

Apply screen on both sides to surface.

7.9.9 Absolute value sensor (option A1)

The option A1 cannot be used for COMPAX 1000SL.

Cable plan

GBK1/...: COMPAX absolute value sensor

plug: 9-way Sub-D-pin
plug housing with screwed connection UNC4-40

plug: C12FUR

4 x (2 x 0.25mm²) + shield

housing
7.9.10 X13: Encoder interfaces, ...

The encoder interfaces are available as options for COMPAX (excluding COMPAX 1000SL). 2 channels are present; channel 1 can be equipped as the encoder input and channel 2 as the encoder simulation. The necessary options are described on Page [179].

With COMPAX 1000SL, an encoder interface is integrated in the standard unit. This can be configured either as the encoder input or encoder simulation.

### 7.9.10.1 Encoder interfaces / analogue rpm specification for COMPAX

<table>
<thead>
<tr>
<th>Connector X13</th>
<th>X13 Pin</th>
<th>Designation</th>
<th>Function with encoder input or simulation</th>
<th>Function of channel 1 with option I7 for COMPAX XX6X or COMPAX XX70</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 pin</td>
<td>1</td>
<td>Housing</td>
<td>Screen terminal:</td>
<td></td>
</tr>
<tr>
<td>Sub-D socket</td>
<td>2</td>
<td>N2</td>
<td>Channel 2 zero impulse</td>
<td></td>
</tr>
<tr>
<td>terminal strip</td>
<td>3</td>
<td>B2</td>
<td>Channel 2 track B</td>
<td></td>
</tr>
<tr>
<td>Screws</td>
<td>4</td>
<td>2A</td>
<td>Channel 2 track A</td>
<td>Enable</td>
</tr>
<tr>
<td>UNC4-40</td>
<td>5</td>
<td>N1</td>
<td>Channel 1 zero impulse</td>
<td>Output +5V</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>B1</td>
<td>Channel 1 track B</td>
<td>+15V (&lt;10mA)</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>1A</td>
<td>Channel 1 track A</td>
<td>Input (±10V)</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>+5V</td>
<td>Output +5V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>N2/</td>
<td>Channel 2 zero impulse inverted</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>B2/</td>
<td>Channel 2 track B inverted</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>A2/</td>
<td>Channel 2 track A inverted</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>N1/</td>
<td>Channel 1 zero impulse inverted</td>
<td>Direction of rotation</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>B1/</td>
<td>Channel 1 track B inverted</td>
<td>-15V (&lt;10mA)</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>A1/</td>
<td>Channel 1 track A inverted</td>
<td>Input (±10V)</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>GND</td>
<td>Reference point</td>
<td></td>
</tr>
</tbody>
</table>

The "Incremental encoder" function is an option for which additional boards are required. If the relevant options are available, the following applies:

- Channel 1: encoder input
- Channel 2: encoder emulation

We can provide the relevant cables and a bus distributor for wiring up the encoder signals. Use these to implement various applications (see Page [179]).

When working with COMPAX XX6X (electronic transmission) and COMPAX XX70 (electronic curve control) variants, you can use option I7 via channel 1 to implement an analogue speed specification (see Page [186]).

### 7.9.10.2 Area of application of process interfaces

<table>
<thead>
<tr>
<th>Unit variants</th>
<th>COMPAX XX00</th>
<th>COMPAX XX30</th>
<th>COMPAX XX60</th>
<th>COMPAX XX70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encoder emulation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Encoder input</td>
<td>• External pos. localization</td>
<td>• External position localization (actual value)</td>
<td>• Master position (set value)</td>
<td>• Master position (set value)</td>
</tr>
<tr>
<td>Analogue input</td>
<td>• SPEED SYNC</td>
<td>-</td>
<td>• Master speed</td>
<td>• Master speed</td>
</tr>
<tr>
<td>Cycle / direction input</td>
<td>• SPEED SYNC</td>
<td>-</td>
<td>• Master position (set value)</td>
<td>• Master position</td>
</tr>
</tbody>
</table>
7.9.10.3 Encoder interfaces / Analogue rpm specification / Step direction input for COMPAX 1000SL

COMPAX 1000SL has an interface which can be configured either as encoder input, encoder simulation, analogue input or step direction input. Encoder simulation and analogue input can be used simultaneously. This interface is a fixed part of COMPAX 1000SL. No other encoder interfaces are possible. The connections are on connector X13:

<table>
<thead>
<tr>
<th>Connector assignment X13 for COMPAX 1000SL</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Connector X13 Pin</th>
<th>Designation:</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Housing</td>
<td>Screen terminal:</td>
</tr>
<tr>
<td>2</td>
<td>nc</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>nc</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2A</td>
<td>A2 (Analogue input)*</td>
</tr>
<tr>
<td>5</td>
<td>N1</td>
<td>Channel 1 zero impulse</td>
</tr>
<tr>
<td>6</td>
<td>B1</td>
<td>Channel 1 track B or direction</td>
</tr>
<tr>
<td>7</td>
<td>1A</td>
<td>Channel 1 track A or step</td>
</tr>
<tr>
<td>8</td>
<td>+5V</td>
<td>Output +5V</td>
</tr>
<tr>
<td>9</td>
<td>nc</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>nc</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>A2/</td>
<td>A2/ (Analogue input)*</td>
</tr>
<tr>
<td>12</td>
<td>N1/</td>
<td>Channel 1 zero impulse inverted</td>
</tr>
<tr>
<td>13</td>
<td>B1/</td>
<td>Channel 1 track B inverted</td>
</tr>
<tr>
<td>14</td>
<td>A1/</td>
<td>Channel 1 track A inverted</td>
</tr>
<tr>
<td>15</td>
<td>GND</td>
<td>Reference point</td>
</tr>
</tbody>
</table>

Process interfaces
Configuration options

<table>
<thead>
<tr>
<th>Setting</th>
<th>Outputs</th>
<th>Inputs</th>
</tr>
</thead>
</table>
| P144 = 4 or 6  
P146 = 0 | Not possible! | Encoder input |
| P144 = 5  
P146 = 0 | Not possible! | Cycle / direction input |
| P144=7 | Encoder emulation | Analogue input ± 10V* |
|         | P146=8   | 512 Pulse/rev. |
|         | P146 = 0 | 1024 Pulse/rev. |
| P144 = 0 | Encoder emulation | switched off |
|         | P146 = 8 | 512 Pulse/rev. |
|         | P146 = 0 | 1024 Pulse/rev. |

*The analogue input is only available with COMPAX XX60 and COMPAX XX70!
### Configuring the process interfaces

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>P144: 4/6 = 0</td>
<td>Encoder input (without terminator) for individual connections, use bus termination BUS06/01</td>
</tr>
<tr>
<td>P146: 5 = 0</td>
<td>Cycle / direction input (counter cycle signal (RS485/422))</td>
</tr>
<tr>
<td>P146: 5 = 0</td>
<td>Cycle input: O1 – O1/</td>
</tr>
<tr>
<td>P146: 5 = 0</td>
<td>Direction input: B1 – B1/</td>
</tr>
<tr>
<td>P146: 7 = 0</td>
<td>Encoder simulation: 1024 pulse / revolution without analogue input</td>
</tr>
<tr>
<td>P146: 7 = 0</td>
<td>Encoder simulation: 1024 pulse / revolution with analogue input</td>
</tr>
<tr>
<td>P146: 7 = 8</td>
<td>Encoder simulation: 512 pulse / revolution without analogue input</td>
</tr>
<tr>
<td>P146: 7 = 8</td>
<td>Encoder simulation: 512 pulse / revolution with analogue input</td>
</tr>
<tr>
<td>P146: 7 = 0</td>
<td>Analogue input ±10V</td>
</tr>
<tr>
<td>P146: 7 = 8</td>
<td>Input on A2 and A2/ Resolution: 20mV</td>
</tr>
<tr>
<td>P146: 7 = 0</td>
<td>Rpm specification as with option I7, however without direction of rotation input</td>
</tr>
</tbody>
</table>

### * function analogue input

The I7 function "direction of rotation" can be implemented in COMPAX 1000SL by exchanging the differential inputs or by changing the rotation direction with parameter P214 Bit 0.

The I7 function "enable" can be implemented via Input I11. Use P232=4 to assign this function to Input I11 (COMPAX 1060/70SL only).

I11 ="1": Release analogue input

I11 ="0": Digital input value = 0 (input is set drift-free to 0)

### Applications with COMPAX 1000SL and encoder

1. Direct encoder – COMPAX 1000SL connection
   - Cable: GBK11
   - Bus terminal: BUS06/01 (the bus terminal is allocated to X13 as adapter)

2. Direct COMPAX (simulation) – COMPAX 1000SL (input) connection
   - Cable: SSK7

3. Direct COMPAX 1000SL (simulation) – COMPAX (including COMPAX 1060SL or COMPAX 1070L) connection (input); Cable: SSK17

4. An encoder distributor (EAM4/01) is used for the integration of COMPAX 1000SL into an encoder bus consisting of several COMPAX, as described in the COMPAX User Guide.

It should be noted that COMPAX 1000SL always uses channel 1 (encoder input and simulation).

---

11 The operation mode is also configured via the parameters P143 and P98. These have the following significance:

\[
P98 = \text{Reference dimension} \quad P143 = \frac{\text{Impulses per Reference dimension}}{4}
\]

**Example:** Reference dimension = 100mm

10 000 input pulses should give a movement of 100mm

\[
P143=10 000/4 = 2500
\]
7.9.11 HEDA interface (option A1/A4)

The HEDA interface is available for COMPAX XX00, COMPAX XX60 and COMPAX XX70.

HEDA option A4: for COMPAX 1000SL
HEDA option A1: for all other COMPAX

Cable plan

SSK14/..:

IPM - COMPAX and COMPAX - COMPAX

X14/PC X15

<table>
<thead>
<tr>
<th>Master: X15</th>
<th>Slave: X14</th>
</tr>
</thead>
<tbody>
<tr>
<td>TxC 3</td>
<td></td>
</tr>
<tr>
<td>TxC/ 7</td>
<td></td>
</tr>
<tr>
<td>TxD 5</td>
<td></td>
</tr>
<tr>
<td>TxD/ 9</td>
<td></td>
</tr>
</tbody>
</table>

4 x 2 x 0.25mm² + shield

SSK14 must not be used on a COMPAX which is configured as a master (P243=1).

Cables for COMPAX master and COMPAX slave coupling:

Terminating connector (BUS2/01).

The last unit on the HEDA has a terminating connector (BUS2/01).

X15 BUS 2/01

<table>
<thead>
<tr>
<th>Terminating connector (BUS2/01).</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC 1</td>
</tr>
<tr>
<td>RxC 2</td>
</tr>
<tr>
<td>RxC/ 6</td>
</tr>
<tr>
<td>RxD 4</td>
</tr>
<tr>
<td>RxD/ 8</td>
</tr>
<tr>
<td>TxC 3</td>
</tr>
<tr>
<td>TxC/ 7</td>
</tr>
<tr>
<td>TxD 5</td>
</tr>
<tr>
<td>TxD/ 9</td>
</tr>
</tbody>
</table>

7.9.12 Bus connection

Special operating instructions are available for the bus systems.
7.10 Technical data

Power characteristics

Functional capability
- Position, speed and current controller.
- IGBT final stage protected from short circuits and ground/earth faults.
- Digital positioning controller.
- Motion controller.

Supported motors/resolvers
- Sine-commuted synchronous motors up to a max. speed of 9000 rpm.
- Asynchronous motors.
  - Tamagawa: 2018N321 E64
  - Siemens: 23401-T2509-C202
  - SinCos support (Stegmann).
- 3-phase synchronous linear motors
  - Sine-cosine linear encoder (1Vₛₛ) or TTL (RS422)
  - Digital Hall sensor commutation (5V).

Output data for individual units

<table>
<thead>
<tr>
<th>Unit</th>
<th>Nom. current [Aeff]</th>
<th>Peak current [Aeff] &lt;5s</th>
<th>Power [kVA]</th>
</tr>
</thead>
<tbody>
<tr>
<td>with mains supply: 230V AC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10XXSL</td>
<td>2.5</td>
<td>5.0</td>
<td>1.0</td>
</tr>
<tr>
<td>25XXS</td>
<td>6.3</td>
<td>12.6</td>
<td>2.5</td>
</tr>
<tr>
<td>at mains supply: 400V AC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45XXS</td>
<td>6.5</td>
<td>13.0</td>
<td>4.5</td>
</tr>
<tr>
<td>85XXS</td>
<td>12.5</td>
<td>25.0</td>
<td>8.6</td>
</tr>
<tr>
<td>P1XXM</td>
<td>5.5</td>
<td>8.5</td>
<td>3.8</td>
</tr>
<tr>
<td>02XXM</td>
<td>6.5</td>
<td>8.5</td>
<td>4.5</td>
</tr>
<tr>
<td>05XXM</td>
<td>11.5</td>
<td>17.0</td>
<td>8.0</td>
</tr>
<tr>
<td>15XXM</td>
<td>25.0</td>
<td>50.0</td>
<td>17.0</td>
</tr>
<tr>
<td>35XXM</td>
<td>50.0</td>
<td>100.0</td>
<td>35.0</td>
</tr>
<tr>
<td>with mains supply: 460V AC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45XXS</td>
<td>5.4</td>
<td>13.0</td>
<td>4.5</td>
</tr>
<tr>
<td>85XXS</td>
<td>10.5</td>
<td>25.0</td>
<td>8.6</td>
</tr>
<tr>
<td>P1XXM</td>
<td>4.5</td>
<td>8.5</td>
<td>3.8</td>
</tr>
<tr>
<td>02XXM</td>
<td>5.4</td>
<td>8.5</td>
<td>4.5</td>
</tr>
<tr>
<td>05XXM</td>
<td>9.6</td>
<td>17.0</td>
<td>8.0</td>
</tr>
<tr>
<td>15XXM</td>
<td>21.0</td>
<td>50.0</td>
<td>17.0</td>
</tr>
<tr>
<td>35XXM</td>
<td>42.0</td>
<td>100.0</td>
<td>35.0</td>
</tr>
</tbody>
</table>

CE conformity
- EMC immunity/emissions as per EN61800-3.
- Safety: VDE 0160/EN 50178.

Supply voltage (limit values)
- COMPAX-M (NMD)
  - 3 * 80V AC - 3 * 500V AC; 45-65Hz.
- COMPAX 35XXM
  - 3 * 250V - 3 * 500V AC; 45 - 65 Hz.
- COMPAX 25XXS
  - 3 * 80V AC - 3 * 250V AC; 45 - 65 Hz
  - 1 * 100V AC-1 * 250V AC; 45-65Hz
- COMPAX 10XXSL
  - 1 * 100V AC-1 * 250V AC; 45-65Hz
- COMPAX 45XXS/85XXS
  - 3 * 80V AC - 3 * 500V AC; 45-65Hz.

Mains supply fuse protection
K circuit breaker or similar Neozed fusible cut-out.
- NMD (COMPAX-M)
  - NMD10: 16A (K circuit breaker: 20A) NMD20: 35A
  - COMPAX 35XXM: 62A
  - COMPAX 25XXS: 1x230V AC: 16A
  - 3 * 230V AC: 10A
- COMPAX 10XXSL: 16A
- COMPAX 45XXS/85XXS: 16A

DC bus voltage
- 300V DC with 3(1) * 230V AC.
- 560V DC of 3 * 400V AC supply.
- 650V DC with 3 * 460V AC.

Output voltage to motor
Ignoring power losses, motor output rating is the maximum motor output voltage of the AC supply voltage available

Braking operation
- Storable energy
  - NMD10/20: 1100µF / 173Ws
  - COMPAX 35XXM:3450µ / 542Ws
  - COMPAX 25XXS: 1000µF/27Ws
  - COMPAX 45XXS: 330µF/52Ws
  - COMPAX 85XXS: 500µF/80Ws
  - COMPAX 1000SL: 660µF/17Ws.
- Ballast resistances (see Page 193)

Control voltage
- 24V DC ±10%, Ripple <1Vₛₛ
  - Current required:
    - 1.3A for COMPAX 35XXM.
    - 1A for COMPAX 45XXS/85XXS.

12 Reduced nominal data apply for linear motors; see Page 177.
Technical data

- 0.8A for the other units (incl. NMD).
- Digital outputs, each 100 mA.
- If needed, for fan approx. 100 mA.
- For motor holding brake (0.35A-1.6A).
- If needed, absolute encoder: 0.3A.

Accuracy
- Positioning on the motor shaft:
  - Resolution: 16 bits (= 0.3 minutes of angle)
  - Absolute accuracy: +/-15 minutes of angle

Maximum power dissipation
- COMPAK 10XXSL: .................. 50W
- COMPAK P1XXM: .................. 140W
- COMPAK 02XXM / NMD10/20: . 120W
- COMPAK 05/10/15XXM: .......... 250W
- COMPAK 25XXS: ................... 80W
- COMPAK 45XXS/85XXS.......... 170W
- COMPAK 35XXM: ................... 610W

Data record memory
250 data records, protected from power failure.
- Positioning commands, I/O instructions, program commands:
  ACCEL, SPEED, POSA, POSR, WAIT, GOTO, GOSUB, IF, OUTPUT, REPEAT, RETURN, END, WAIT START, GOTO EXT, GOSUB EXT, SPEED SYNC, OUTPUT A0, GOTO, POSR SPEED, POSR OUTPUT, +, -, *, /.

Target value generator
- Ramps: linear, quadr., smooth; 10ms...60s.
- Travel specified in increments, mm, inch or variable using a scaling factor.

Monitoring functions
- Mains power/auxiliary control voltage.
- Motor and final stage temperature/blocking protection.
- Tracking error monitoring.
- Ready contact: 0.5A; 60V; 30W.

Ambient conditions
- Temperature range: 0...45°C.
- Max. relative air humidity as per DIN 40040 class F (≤75%); no condensation.

Interfaces

Control inputs: 16 (8 for COMPAX 1000SL)
- 24V DC, 10 kOhm (see ex page 52).

Control outputs: 16 (8 for COMPAX 1000SL)
- active HIGH, short circuit protected; 24V (see ex page 52).

RS 232
- 9600 baud or 4800 baud (for COMPAX 1000SL, fixed at 9600 baud).
- Length of words 8 bits, 1 start bit, 1 stop bit.
- Software handshake XON, XOFF.

Programmable controller data interface (excluding COMPAX 1000SL)
- via 5 binary inputs and outputs.

Encoder interface (option; standard for COMPAX 1000SL)
- Encoder emulation: 512 or 1024 counts/rev
- Encoder input: RS422 interface; supply: 5V 120-10000 lines/rev

COMPAX 1000SL signal interfaces (optional)
- Encoder emulation or
- encoder input or
- step/direction input or
- analogue input ± 10V

Absolute value sensor interface (option A1) (excluding COMPAX 1000SL)
- Supply voltage: 24V +/-10%.
- Sensing code: grey code, single step.
- Direction of counting: in clockwise direction when looking at the shaft: rising.
- Data interface: RS422 /24 bit data format (start: MSB). ● Cycle frequency: 100 kHz.

SinCos® (option S1/S2/S3)
- High-resolution encoder instead of resolver.
- Single-turn or multi-turn (absolute value over 4096 motor revolutions).
- Option S2 with multi-turn: absolute value sensor with programmable transmission factor.
- Option S3 for linear motors.

HEDA: synchronous, serial real time interface
Included in option A4 or option A1.

Bus connection: optional
dc-insulated bus connection.

RS485
- Max. 115k baud ● 2 or 4 wire/RS485

Interbus S
- 2-conductor remote bus ● 500 kBaund.
- max. 64 participants per ring.

Profibus
- 1.5 MBit ● Sinec L2-DP and FMS.
CS31
• COMPAX - ABB interface.

CANbus
• Up to 1.0 MBaud • Basic CAN.
• CAN protocol as per specification 1.2.
• Hardware as per ISO/DIS 11898

CANopen
• Protocol as per CiA DS 301.
• Profile CiA DS 402 for drives.

Operation
Parameter input/status request
• Via COMPAX hand-held terminal.
• Via RS232 and bus interface.
• Via the programmable controller data interface (excluding COMPAX 1000SL).
• Status query also via the 3-digit LED display on the front plate (excluding COMPAX 1000SL).

Housing
Housing
• Fully-enclosed metal housing.
• Insulation: VDE 0160/protection class IP20.
• IP54 on request.

Connections
• Motor, power bus, control inputs/outputs via terminals.
• Sensor cables, interfaces via connectors.

Installation
• Wall mounting, suitable for installation in industrial control cabinets.

Dimensions
• NMD/COMPAX-M: see Page 20
• COMPAX 25XXS: see Page 33
• COMPAX 10XXSL: see Page 43
• COMPAX 45XXS/85XXS: see Page 36
• Weights: COMPAX P1XXM: .............5.6 kg
COMPAX 10XXSL: ..........1.6 kg
COMPAX 25XXS: ..........4.6 kg
COMPAX 45XXS/85XXS: ..6.5 kg
COMPAX 02XX:...............7.1 kg
COMPAX 05/15: ............8.8 kg
COMPAX 35XXM:............22.5 kg
NMD10:.....................7.6 kg
NMD20:....................8.1 kg

Standard delivery
• COMPAX with User Guide.

ServoManager.

Mains module
For technical data, see Page 23

Permissible 3-phase mains
The units (COMPAX or NMD) can be operated on all mains types. Examples:

IT mains

TN mains

When using Delta mains, note that CE requirements (low voltage guideline) are no longer met when the voltage between a phase and earth >300V AC (isolated measurement voltage).

Leakage current
The leakage current (current on the mains PE) is mainly caused by the capacitive resistance between the conductor and screening of the motor cable. Additional leakage current occurs when using a radio interference suppressor as the filter circuit is connected to earth via the capacitors.

The size of the leakage current depends on the following factors:
• length of motor cable.
• cycle frequency.
• with or without radio interference suppresser.
• motor cable screened or not.
• motor earthed at site or not.

The leakage current is very important regarding safety when handling and operating the unit.

Please note
The unit must be operated with an effective earth connection which satisfies the appropriate specifications for high levels of leakage current (>3.5 mA).
The Servo booster must not be operated with a fault current circuit breaker due to the risk of higher levels of leakage current. If an F1 circuit breaker is installed, it must not interrupt the current circuit despite the following conditions (e.g. from ABB series F804):
• DC component in leakage current (3-phase rectifier bridge).
• Brief occurence of pulse-shaped leakage currents when switching on.
• High levels of leakage current.
8. Operating Instructions

Compact Servo Controller

8.1 Overview:

The COMPAX digital positioning system has been designed for multi-axis applications in handling and automation technology. COMPAX contains all the functions required for a compact positioning system. These functions are:

- digital inputs and outputs (PLC interface)
- a serial interface (RS232)
- a data record memory
- an integrated IGBT final stage.

You will need auxiliary equipment (PC, hand-held terminal) to configure and program COMPAX. COMPAX is very flexible and offers all the advantages of digital control technology thanks to its completely digital design which encompasses positioning, speed and current control. The main features are:

- controller parameters which can be reproduced and are drift-free
- simple copying of set values
- no offset problems
- the implementation of efficient, flexible and adaptable setpoint generation.
8.1.1 Block structure of the basic unit (not applicable for COMPAX 1000SL)

Interfaces for data and status

PLC data interface
- Query the most important status values
- Setting the most important parameters

RS232 / RS485 Bus-Systems
- for connection of PLC, IPC, PC or general control unit (e.g.: COMTAC from Hauser)

16 Binary inputs and outputs

Functions

Status queries
- Actual values
- Diagnostic values
- Device IDs

Setting parameters
- Configuration
- Optimization
- General settings

Direct commands
- ACCEL, SPEED
- POSA, POSA HOME, POSR, OUTPUT, GOTO, ...

Programming
- 250 lines
- Positioning commands
- I/O instructions
- Program flow commands

Controlling
- manual+, manual-
- Start, Stop, Break
- Machine zero, real zero
- Teach real zero, program line

System controller
Program memory / parameter memory

Travel commands
Settings, data

Setpoint generator
Position controller
Rotational speed controller
Current controller
Output stage

Rotational speed and position generation
Encoder simulation

Servo control

Interfaces for signals

<table>
<thead>
<tr>
<th>Override input</th>
<th>Absolute encoder</th>
<th>Encoder input</th>
<th>Encoder emulation</th>
<th>D/A monitor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Externally controlled</td>
<td>reference drives not required</td>
<td>Synchronization to external speeds and position</td>
<td>Output of actual speed and position</td>
<td>2 analogue outputs for internal values (rotational speed, current, etc.)</td>
</tr>
</tbody>
</table>
### Overview:

**Block structure of the basic unit (not applicable for COMPAX 1000SL)**

#### Explanations for the block structure

#### Interfaces for data and status

**PLC data interface**
The following commands are available via 5 binary inputs (I7...I11) and 5 binary outputs (O7...O11):
- POSA, POSR, SPEED, ACCEL, GOTO, VP, modifying parameters P1...P49, querying status S1...S12. (Function not available with the COMPAX 1000SL)

**RS 232**
All functions are available via RS232.

**Bus systems**
All functions are available via the bus interface (Interbus S, Profibus, CAN bus, CANOpen, CS31 or RS485 (ASCII/binary with 2 or 4 wires). A description is available as a separate item.

**Binary inputs and outputs**
- Inputs:
  - I1...I6: control functions or freely assignable.
  - I7...I16: freely assignable or programmable.
- Outputs:
  - O1...O6: control outputs or freely assignable.
  - O7...O16: freely assignable or programmable.

#### Functions

**Query status**
The status can be queried via the PLC data interface, the bus interface and partially via the front plate display.

#### Setting parameters

**Configuring**
Operating mode, units for travel data, motor types, ramp shapes, directions, drive types, reference systems, ....

**Optimizing**
Via the uncoupled stiffness, damping and advance control parameters.

**General settings**
Replacement and specification values, limitations, control parameters.

**Programming data records**
Programming a sequential program with up to 250 data records.

**Controlling**
Functions: manual mode, start, stop, break, teach functions ....
Messages no fault, no warning, machine zero has been approached, ready for start, position reached, idle after stop or break.
Program control: external data record selection, analyzing binary inputs, setting binary outputs, triggering positioning processes, ....

### System controller
Function monitoring and co-ordination

### Control
Digital control with robust control loops. Automatic calculation from existing design quantities.
Interfaces for signals

<table>
<thead>
<tr>
<th>Override input</th>
<th>Analogue input (see Start-up manual) for continual reduction of the set speed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute value sensor (option)</td>
<td>This option supports an absolute value sensor attached to the motor; reference travel is therefore no longer required after initialization has been executed once (see Start-up manual and Accessories and options). (Function not available with the COMPAX 1000SL)</td>
</tr>
</tbody>
</table>
| HEDA (option) | Real time data channel  
For implementing track and contour tasks using the HAUSER "IPM" interpolation module for PC and IPC or direct COMPAX - COMPAX coupling with one COMPAX as the master. |
| Encoder input | COMPAX can be synchronized to an external speed (and/or position, e.g. with the "Electronic transmission" unit variant) via this input (see Start-up manual and Accessories and options). |
| Encoder simulation | The actual position value can be made available to other units via this channel (see Start-up manual and Accessories and options).  
An encoder bus can also be created. (see description in "Accessories and options") |
| D/A monitor | 18 internal measuring and intermediate parameters are output as analogue voltage (+/-10V) via two 8 bit channels (or optionally 12 bit channels). |

8.1.2 Password protection

COMPAX contains password protection to prevent unwanted data manipulation. Before you configure COMPAX or set your parameters, you must enable these functions with a password. When the axis is at standstill, proceed as follows to enable and block:

- transmit GOTO 302 to COMPAX
- switch the unit off
- or
- transmit GOTO 270 to COMPAX.

All parameters, except P40-P49, are protected by password.

- The COMPAX program is not protected by a password.

Conditions for password input:
- There must not be any programs running.
8.2 Configuration

8.2.1 Front plate operation (not available with COMPAX 1000SL)

Using the COMPAX front plate, you can query particular status values and perform the most important bus settings. Also whenever an error occurs, COMPAX shows the error number on the display.

The following status values can be displayed via the front plate: S03-S08, S11, S19-S26 (hexadecimal display), S27, S30, S31, S37-S39 (description of the status values: see Page 207).

The remaining status values can be queried via the interfaces.

<table>
<thead>
<tr>
<th>C parameters</th>
<th>COMPAX parameters</th>
<th>Meaning</th>
<th>Valid from</th>
</tr>
</thead>
<tbody>
<tr>
<td>C01</td>
<td>P194</td>
<td>Address of unit</td>
<td>Power on</td>
</tr>
<tr>
<td>C02</td>
<td>P195</td>
<td>Baud rate:</td>
<td>Power on</td>
</tr>
<tr>
<td>C03</td>
<td>P196</td>
<td>Bus protocol</td>
<td>Power on</td>
</tr>
<tr>
<td>C11</td>
<td>P250</td>
<td>HEDA address</td>
<td>immediately</td>
</tr>
<tr>
<td>C04 - C10</td>
<td>reserved</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please see operating instructions for the bus option used for the relevant range of values and the precise setting options.

Acknowledging error messages

Once you have rectified the cause of the error, you can acknowledge the error by pressing the "Enter" key.
8.2.2 Configuration when supplied

When supplied, COMPAX is not configured. Parameter P149 is set to "0":

P149 = "0": COMPAX is not configured and switches to OFF mode when switched on (24V DC and operating voltage) (motor switched off). In addition to this, when switched on, all parameters (apart from bus settings P194, P195, P196 and P250) are set to their default values.

P149 = "1": COMPAX is configured and once switched on (24V DC and operating voltage) tries to engage the motor.

If you are configuring using ServoManager, P149 is automatically set to "1" once ServoManager has executed successful configuration.

To operate the COMPAX controller design concept, you must have a basic level of technical control knowledge. COMPAX calculates the internal system and controller parameters required using simple, application-specific values, which are generally accessible.

A strong controller design obviates the need for tedious controller optimization. This configuration provides you with a stable controller.

If the control process is unstable because COMPAX has been incorrectly configured, you can switch on COMPAX so that the drive remains switched off even with power on. To do this, when switching on COMPAX simultaneously press the "-" key. The following will then happen:

♦ the drive is switched off.
♦ the digital outputs O1...O6 are set to "0".
♦ when the PLC data interface is switched on: O7=1, O8, O11=0
♦ the password protected functions are enabled.

Once you have correctly configured COMPAX or you have corrected the relevant parameters, you can engage the drive and outputs again using the command "OUTPUT O0 = 0".

(Function not available with the COMPAX 1000SL)

8.2.3 Configuration process

Before you configure COMPAX or modify the configuration, the drive must be switched off e.g. using the command OUTPUT O0=1 or 2 (see Page 98).

The COMPAX configuration is carried out using parameters as follows:

♦ select operating mode.
♦ specify units for the travel data.
♦ select motor from the motor list or configure an external motor.
♦ select ramp shape.
♦ define direction.
♦ use the design data to specify the drive type.
♦ define the reference system.
The ParameterEditor (part of the ServoManager) automatically guides you into the "Guided configuration" menu through the input masks with the configuration settings.

From the next page, there is a clear description of the configuration process for implementing new configurations. If this process is followed, you can specify all the parameters required for your application.

In Chapter "Machine zero mode", you will find a description of options for machine zero and limit switch configurations which deviate from the standard.

The configuration parameter are not accepted directly once they have been modified. COMPAX will only accept the new parameters once the VC commands (valid configuration) have been issued.

The ServoManager automatically sets the parameters as valid after configuration!

Using the command OUTPUT O0=0.

Note that once a configuration has been set or modified, there is a risk if some parameters have been incorrectly programmed.
You must secure the displacement area of your system when switching on the drive.

Please mind the limit values of the mechanical component!
Defiance of the limit values may lead to destruction of the mechanical component!

8.2.4 Safety instructions for initial start-up

Risks from incorrect wiring!
In order to avoid the risks from incorrectly wired systems during initial start-up, use the following settings for personal safety and protection of the mechanical system:

- \( P15 = 10\% \) (motor speed limited to 10% nominal value)
- \( P16 = 100\% \) (torque limited to 100% nominal value)

- The drive must remain at standstill after the system switch on.
- Execute a travel operation e.g. with POSR * or manually +/-.

If this travel operation is executed correctly, then \( P15 \) and \( P16 \) can be reset to their original values.

The following faults may occur:
- The drive does not remain at standstill when switched on, or
- the drive runs out of control after the start command.

In both cases, either error E10 or error E54 is triggered.

If error E54 occurs, the drive is switch off.

A possible cause of the error is incorrect wiring in the motor or resolver systems.
8.2.5 Configuration parameters

Operating mode

Parameter P93: valid from next move command.

Normal mode:  
P93 = "1"  
Positioning processes refer to real zero.  
To set the reference, use the "Find machine zero" function (Input I1="1" and I2="1", see Page 148) once the system is switched on.  
Various machine zero modes are described from Page 80

Continuous mode:  
P93 = "2"  
Positioning processes always refer to the relevant start position.  
The "Find machine zero" function is not necessary but possible.  
Set P1 (real zero) = 0.  
To avoid inaccuracies during conversions, use the "Increments" measurement units in continuous mode (see below).  
Operation with absolute value sensors is not permitted when working in continuous mode.

Speed controller  
P93 = "4":  
In this operating mode, the drive controller operates as a speed controller, the position controller is switched off. The following applies:  
♦ Commands not permitted: POSA, POSR, POSR SPEED, POSR OUTPUT, POSA HOME, ACCEL-.  
♦ The SPEED command contains a prefix for the direction of rotation.  
♦ Output O3 is not assigned;  
O5 has the "Programmed nominal speed reached" function (see Page 120).  
♦ The data record indicator is set to N001 using "Approach real zero".  
♦ The "Find machine zero" function (I1&I2) is not assigned.

Unit for travel data

Parameter P90

mm  
P90 = "1"  
Inch  
P90 = "2"  
Increments  
P90 = "0": Accurate increment operation without conversion inaccuracies.  
This measuring unit is only useful when using the "General drive" drive type and especially in continuous mode. The levels of accuracy are not increased when working with other drive types.

The "Travel per motor revolution" (P83) is specified in increments.  
Meaning: P83 = 2^n when n = 4, 5, 6, ... 16  
This corresponds to a resolution of 16 .... 65 536 increments per motor revolution.  
P83 influences the resolution and also the max. travel distance:
the max. travel distance is limited to ±4 million units. This corresponds to 61 revolutions at a maximum resolution of 65 536 increments per motor revolution. The maximum travel distance can be increased by reducing P83. Meaning:

<table>
<thead>
<tr>
<th>P83</th>
<th>Maximum travel in motor revolutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>±250 000</td>
</tr>
<tr>
<td>32</td>
<td>±125 000</td>
</tr>
<tr>
<td>64</td>
<td>±62 500</td>
</tr>
<tr>
<td>128</td>
<td>±31 250</td>
</tr>
<tr>
<td>256</td>
<td>±15 625</td>
</tr>
<tr>
<td>512</td>
<td>±7812</td>
</tr>
<tr>
<td>1024</td>
<td>±3906</td>
</tr>
<tr>
<td>2048</td>
<td>±1953</td>
</tr>
<tr>
<td>4096</td>
<td>±976</td>
</tr>
<tr>
<td>8192</td>
<td>±488</td>
</tr>
<tr>
<td>16 384</td>
<td>±244</td>
</tr>
<tr>
<td>32 768</td>
<td>±122</td>
</tr>
<tr>
<td>65 536</td>
<td>±61</td>
</tr>
</tbody>
</table>

In **continuous mode**, this limitation applies to a single command. In **normal mode**, this limit applies to the entire displacement area.

### Motor type

Parameter P100

The motor parameters are required for COMPAX motor-specific settings. The motor parameters of the HAUSER motors recommended for COMPAX are available in a list in ServoManager / ParameterEditor and can be selected from there.

You can configure additional motors using the "External motor" function.

### Basic conditions for external motors:

- Sine-commuted motors (sinusoidal EMC)
- Resolver / SinCos (see start-up manual under "Technical data" on Page 64).

The nominal currents of the motors and units must be adapted.

If you are using nominal currents which are smaller in relation to the unit nominal current, current recording will be less accurate.

### Ramps

Parameter P94

**P94 ="1"**

Simplest, time-oriented function; not smooth

![Graph of linear ramps](image)

Current requirement: 1 times
Operating Instructions

.Configuration parameters

**smooth**

\[ P94 = "2" \]

The mechanics are subject to minimum load when using the smooth function.

\[ V(t) \]

\[ a(t), M(t) \]

\[ t_a = 1.9 \]

Current required: 1.9 times

**quadratic**

\[ P94 = "3" \]

Gentle running in to the nominal value; overswings are prevented.

\[ V(t) \]

\[ a(t), M(t) \]

\[ t_a = 2.0 \]

Current required: 2 times

\[ t_a: \text{ Ramp time (can be set using the command "ACCEL", see Page 87)} \]

\[ v: \text{ Speed} \]

\[ a: \text{ Acceleration.} \]

\[ M: \text{ acceleration torque} \]

**Transfer of P94**

Modifications to P94 become effective from the next move command.

**Exception:**

For the functions:

- stop after passing a limit switch and
- synchronous stop via I13 (see Page 151),

the ramp type only becomes valid with VC

---

**Drive type:**

Parameter P80: select drive type

Various data are required for additional configuration depending on the drive type selected. This modifies the assignment of the parameters P81 - P85. Continue configuration with the drive type selected.

**Spindle drive:**

P80=2:

- **P81**: length
  
  Length of spindle
  
  Range: 0 ... 5000mm

- **P82**: diameter
  
  Diameter of spindle
  
  Range: 8 ... 80mm

- **P83**: Pitch
  
  Pitch per spindle revolution.
  
  Range: 1 ... 400mm
**Configuration parameters**

**P85: ratio**  
Motor / spindle ratio.  
Range: 1 (1:1)...100 (100:1) ≡ motor: transmission

**P84: moment of inertia**  
Moment of inertia of transmission and clutch referenced to the drive side.  
Range: 0...200kgcm²

**P92: Minimum mass**  
Minimum translational mass moved [kg].  
Range: 0...P88

**P88: Maximum mass**  
Maximum translational mass moved in [kg].  
Range: 0...500kg

---

**Rack+pinion/toothed belts**

**P80= "4" or "8"**

**P82: Number of teeth on pinion**  
Range: see tooth pitch

**P83: tooth pitch**  
The range of values for the number of teeth and tooth pitch is determined by the pitch. Meaning:  
\[ \text{pitch} = \text{number of teeth} \times \text{tooth pitch} \]  
Range of pitch values: 1 ... 410 mm

**P85: ratio**  
Ratio from motor to rack-and-pinion/toothed belt.  
Range: motor: transmission = 1 (1:1)...100 (100:1)

**P84: moment of inertia**  
Moment of inertia of transmission and clutch referenced to motor shaft.  
Range: 0...200kgcm²

**P92: minimum mass**  
Minimum translational mass moved [kg].  
Range: 0...P88

**P88: maximum mass**  
Maximum translational mass moved in [kg].  
Range: 0...500kg

<table>
<thead>
<tr>
<th>HLE / HPLA data for the drive type: &quot;Toothed belt&quot;</th>
<th>HLE80C</th>
<th>HLE100C</th>
<th>HLE150C</th>
<th>HPLA80</th>
<th>HPLA120</th>
<th>HPLAB180</th>
<th>HPLAR180 rack+pinion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teeth on pinion (P82)</td>
<td>19</td>
<td>17</td>
<td>24</td>
<td>18</td>
<td>27</td>
<td>21</td>
<td>28</td>
</tr>
<tr>
<td>Tooth pitch (P83)</td>
<td>10mm</td>
<td>10mm</td>
<td>10mm</td>
<td>10mm</td>
<td>10mm</td>
<td>20mm</td>
<td>10mm</td>
</tr>
</tbody>
</table>

---

**General drive**

**P80=16:**

**P81: Minimum moment of inertia**  
Total minimum moment of inertia: motor, transmission and load referenced to the motor shaft.  
Range: 0...P82 [kgmm²]

**P82: maximum moment of inertia**  
Total maximum moment of inertia: motor, transmission and load referenced to the motor shaft.  
Range: P81...200 000kgmm²

**P83: travel per motor revolution**  
Range: 10 ... 4 000 000µm  
or 16 ... 65 536 increments.
Reference system

Parameter P213: direction of machine zero
(this describes the default setting, for more information see Page 80)

Standard reference system: no end or reversing initiators; one machine zero initiator at the end of the displacement area
The machine zero initiator must be attached so that it can only cleared in one direction; i.e. attached to one side.
Use parameter P213 to inform COMPAX of the side on which the MZ\(^{13}\) (machine zero) initiator is attached.

P213="0": The machine zero initiator is approached with the motor turning clockwise (when facing the motor shaft).

P213="1": The machine zero initiator is approached with the motor turning anti-clockwise.

Setting aid
Set P215="0":
Actuate Hand+; the drive moves in the direction of the MZ initiator, then the following applies: P213="0", if this is not the case, set P213="1".

The following basic setting applies for this standard reference system (≡ no end or reversing initiators; one machine zero initiator at the end of the displacement area): P212="1", P217="0", P216="0". You will find other options for defining a reference system in the next chapter.

Specifying software end limits
Specify the software end limits of the displacement area by using parameters P11 and P12. Each time a positioning command is issued, COMPAX checks whether the target is within the travel distance. If this is not the case, error E25 is reported.

When working in continuous mode, these limits always apply for the current positioning process.

P11: maximum position
Range: ±4 000 000 [units corresp. P90]

P12: minimum position
Range: ±4 000 000 [units corresp. P90]

Specifying point of real zero (RZ)
Absolute positioning commands refer to RZ.
RZ is specified relative to machine zero.
P1 must be set to 0 in continuous mode.

P1: point of real zero
Range: ±4 000 000 [units corresp. P90]

P215: direction of rotation
P215 establishes the positive direction of travel (positive end of displacement area) referenced to the motor direction of rotation.
P215="0" the motor is turning clockwise when traveling in the positive direction
P215="1" the motor is turning anti-clockwise when traveling in the positive direction
• Clockwise means when looking at the motor shaft.

Setting aid:
Proceed with Hand+; the motor must move in the direction which is defined as being the positive direction. If this is not the case, then P215 must be modified.
P215 has no influence on the setting of the machine zero direction (P213); if it has the same mechanical design.

---

\(^{13}\) MZ: machine zero
8.2.6 Absolute value function with standard resolver

Activated with P206=2

Absolute value function without special sensor for up to 4096 rpm

- Parameter P206=2 is used to activate the absolute value resolver.
- COMPAX reads the current actual position cyclically every 2ms and stores this data alternatively onto 2 memory stores (Pos 2, Pos 3) protected against power failure.
- The current imported position is shown in Status S12.
- After Power On, the last stored actual positions (Pos 2 and Pos 3) are read and compared with each other and the current read resolver angle (Pos 1).

A3 is set, when

- the last saved actual position (Pos 2) lies within a definable window (P161) around Pos 1, and when
- Pos 2 and Pos 3 are less than P161 from one another (to ensure that the drive stops when switched off).

Renewed referencing (find machine zero) is not required.
S12 is copied after Power On, enabling of the controller or after an error in S1.

If the last saved actual position (Pos 4) lies outside a definable window (P161), then A3 is not set, so a renewed referencing (find machine zero) is necessary.

Condition: in the switched off status, the motor or mechanics must not be moved. Ensure this by using e.g. a motor brake or self-braking gearbox.

Maximum angle difference P161: P161 gives the maximum permissible angle difference between the saved and the current actual position when switching on.

Range: 1 ... 2047; default value 100; where 4096 = 1 motor revolution.
If P161 is exceeded, then a new reference is necessary (find machine zero).

Note

- After error E42 (resolver/sensor error), referencing must always be implemented.
- The absolute value sensor function described above only functions with resolvers.
- The absolute value function with resolvers is not supported by COMPAX XX30.

Value range S12

The value range of the absolute value S12 lies between –2048 and 2047.9999 (0 corresponds to the machine zero when P1=0). In addition, a value sign conversion occurs (value jumps from the positive maximum value to the negative maximum value; or vice versa), whereby at the next comparison S12→S1 an error of precisely 4096 occurs.

Use a real zero P1 to shift the value range (around –P1).

Ex. 1: P1=-2000 value range S12: -48 ... 4047 rpm.

With knowledge of this relationship, it is possible to create a positive travel area of maximum 0 ... 4096 by the following actions:

- Travel to center of total travel area
- PH with P1=-2048 and P212=10
- S1 = S12 = 2048 at this point

Travel from POSA 0 ... POSA 4095.9999 possible without value sign conversion.
8.2.7 Machine zero mode

Overview:

P212: setting the machine zero mode

- "0": MZ equals external initiator rounded with resolver zero & machine zero travel using 2 reversing initiators.
- "1": MZ equals external initiator rounded with resolver zero.
- "3": MZ equals external zero pulse*
- "4": MZ equals external initiator rounded with the external zero pulse.*
- "5": MZ equals resolver zero
- "6": reserved
- "7": MZ equals external initiator (without resolver zero).
- "8": MZ equals a limit switch
- "10": MZ teach
- "11": Machine zero - initiator (without resolver zero) with 2 reversing initiators

P212 becomes valid immediately after a modification.

* P212=3 & P212=4 is only permitted for COMPAX XX00 and COMPAX XX30.

Function of the machine zero mode

<table>
<thead>
<tr>
<th>P212</th>
<th>Start search direction / initiator side</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;0&quot;</td>
<td>P213: defines the initiator flank of the machine zero initiator that is being evaluated; i.e. the side from which the initiator is approached.</td>
<td>Linear movements</td>
</tr>
<tr>
<td></td>
<td>P3: the prefix defines the start search direction.rium.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>P215: influences the start search direction during find machine zero.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>P29: shifts the actual machine zero in the direction of the clockwise rotating motor.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>P216: sets the limit switch position (must also then be set if there are no configured limit switches (P217=0))</td>
<td></td>
</tr>
</tbody>
</table>

Example of a reference system definition

P215="0": the motor rotates clockwise when traveling in the positive direction; i.e. the positive end in the diagram is on the right-hand side.
P212="0": operating mode with reversing initiators; i.e. with 3 initiators.
P217="0": operating mode without end initiators. I1 and I2 act as reversing initiators during "Find machine zero".
P216="0": the I1 initiator is started by the clockwise rotating motor.
P3 = positive (when P3 = negative, reverses start search direction)

E2 MN E1
gear doesn’t change the direction  direction "clockwise rotating motor"
Real zero

The position reference for positioning process is real zero; this can be freely defined over the entire displacement area. Real zero is defined with reference to machine zero.

Movement process during find machine zero, depends on start point:

The speed used for find machine zero is specified by P3; the accelerating and braking time by P7.
Additional machine zero modes

The machine zero modes described below are all used without reversing initiators. The search direction and the evaluated initiator side are influenced as follows with these machine zero modes:
P213: defines the start search direction and (if there is an initiator fitted) the initiator flank of the machine zero initiator which is being evaluated; i.e. the side from which the initiator is approached
P3: no influence in the start search direction during find machine zero.
P215: no influence on find machine zero.
P29: shifts the actual machine zero in the direction of the clockwise rotating motor (see below).

<table>
<thead>
<tr>
<th>Machine zero equals external initiator &amp; resolver zero</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>P212 = &quot;1&quot;</th>
<th>Find machine zero</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>P213 = &quot;0&quot;</td>
<td>clockwise rotating motor</td>
<td>Standard machine zero mode for linear movements</td>
</tr>
<tr>
<td>P213 = &quot;1&quot;</td>
<td>clockwise rotating motor</td>
<td></td>
</tr>
</tbody>
</table>

P213 = "0"

- Resolver zero pulse
- MN-Ini.
- Actual machine zero
- P29 = 0° - 270°
- P29 = 270° - 360°

P213 = "1"

- Resolver zero pulse
- MN-Ini.
- Actual machine zero
- P29 = 100° - 360°
- P29 = 0° - 100°
Shifting machine zero

Explanation for shifting machine zero using P29, taking the example of P212="1"

The machine zero initiator (MZ-INI) is low active

The resolver zero pulse is a fixed position of the rotor position

The actual machine zero (MZ) results from the "AND" connection of the machine zero initiator with the resolver zero pulse

**Example 1:** $\alpha_0 = 90^\circ$; clockwise rotating motor in direction of mechanical limitation

P29 shifts the actual machine zero in the direction of the clockwise rotating motor

**Example 2:** $\alpha_0 = 90^\circ$; clockwise rotating motor away from the direction of the mechanical limitation travel

P29 shifts the actual machine zero in the direction of the clockwise rotating motor
### Machine Zero Mode

**P212="3"** (only permitted for COMPAX XX00 and COMPAX XX30!)

#### Find Machine Zero

<table>
<thead>
<tr>
<th>P213=&quot;0&quot;</th>
<th>P29=0°</th>
<th>P29=90°</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>external zero pulse command</td>
<td>external zero pulse command</td>
<td>external zero pulse command</td>
<td>General Rotatory Movements</td>
</tr>
</tbody>
</table>

#### P213="1"

- Command: "search MZ"
- 90° external zero pulse command

**Conditions for this operating mode:**

- External encoder; read via an encoder input module (I2, I4)
- Encoder input parametrized by: P144="6"
  - Specify P98 (travel per encoder revolution), P214 (encoder direction) and P143 (encoder pulse number).
Machine zero equals external initiator & external zero pulse

<p>| P212=&quot;4&quot; (only permitted for COMPAX XX00 and COMPAX XX30!) |</p>
<table>
<thead>
<tr>
<th>Find machine zero.</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>P213=&quot;0&quot;</td>
<td>[Diagram] Linear and rotatory movements. If you have an encoder on the load, with this setting you obtain a reproducible machine zero response to any transmission factor which does not round to whole digits (i.e. not precisely displayable).</td>
</tr>
<tr>
<td>P213=&quot;1&quot;</td>
<td>Example of a transmission factor that cannot be displayed exactly: 17 teeth 11 teeth</td>
</tr>
</tbody>
</table>

**Note!**
If P75 ≠ 0 for this setting, external position localization is switched on.

**Conditions for this operating mode:**
- External encoder; read via an encoder input module (E2, E4)
- Encoder input parametrized by: P144="6"
  - Specify P98 (travel per encoder revolution), P214 (encoder direction) and P143 (encoder pulse number).
**Operating Instructions**

**COMPAX-M / -S**

**Machine zero mode**

### Machine zero equals resolver zero

<table>
<thead>
<tr>
<th>P212 = &quot;5&quot;</th>
<th>Find machine zero</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>P213 = &quot;0&quot;</td>
<td>resolver zero pulse command</td>
<td>General rotatory movements. This is a simple method of implementing machine zero, especially if the transmission runs at high speeds.</td>
</tr>
<tr>
<td>P29 = 0°</td>
<td>&quot;search MZ&quot;</td>
<td></td>
</tr>
<tr>
<td>P29 = 90°</td>
<td>resolver zero pulse command</td>
<td></td>
</tr>
<tr>
<td>&quot;search MZ&quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Machine zero equals external initiator (without resolver zero)

<table>
<thead>
<tr>
<th>P212 = &quot;7&quot;</th>
<th>Find machine zero</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>P213 = &quot;0&quot;</td>
<td>clockwise rotating motor</td>
<td>Linear and rotatory movements. If you have an encoder on the motor side, with this setting you obtain a reproducible machine zero response to any transmission factor which does not round to whole digits (i.e. not precisely displayable).</td>
</tr>
<tr>
<td>signal of MZ-ini.</td>
<td></td>
<td>Example of an transmission factor that cannot be displayed exactly: 17 teeth 11 teeth</td>
</tr>
<tr>
<td>P29 = 0° - 360°</td>
<td></td>
<td>Accuracy: depends on P3.</td>
</tr>
<tr>
<td>position of actual MZ</td>
<td></td>
<td>Accuracy in motor revolutions:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1ms • P3 • P104</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100 60 • 1000</td>
</tr>
<tr>
<td>P213 = &quot;1&quot;</td>
<td>clockwise rotating motor</td>
<td></td>
</tr>
<tr>
<td>signal MZ-ini.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P29 = 0° - 360°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>position of actual MZ</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Machine zero equals a limit switch

P212 = "8"

Find machine zero

Application
Linear movements. No need for a machine zero initiator.

Function
Travels during "Find machine zero":
• to the relevant limit switch.
• back to the 3rd resolver zero pulse.
The 3rd resolver zero pulse is evaluated as machine zero.

Supplement
With P202, the distance between initiator and machine zero can be increased (e. g. for large gear ratios). Meaning: P202=0 or 3; function as described.
With P202>3, the distance of the machine zero can be moved by further resolver zero pulses.
P202 unit: Resolver zero pulses = motor revolutions

Condition:
P217 = "1"
P216 = set correctly.
In the above diagram: P216="1": (limit switch E1 is approached with anti-clockwise rotating motor)

Wiring up:
The input of the machine zero initiator (X17/7) must be wired up with the relevant limit switch:
P213="0": X17/8 must be connected to X17/7.
P213="1": X17/9 must be connected to X17/7.

Teach machine zero

P212="10": Teach machine zero
When activated via the command "Find machine zero" (Input I1&I2 or command "POSA Home"), the current position of the motor is defined as the machine zero.

A machine zero initiator is not required with this method.
Via parameter P29, machine zero can be moved from the taught point by up to one motor revolution. The drive then executes machine zero travel from the current position by the angle P29 in a clockwise direction.
Range of values for P29: 0...360 degrees (other values are considered as 0).
If P29=0, machine zero travel is not implemented.
Machine zero mode

Machine zero - initiator (without resolver zero) with 2 reversing initiators

P212="11": Machine zero - initiator (without resolver zero) with 2 reversing initiators

Application: Applications with belt drives where the belts may skip during operation.
8.2.8 Limit switch operation

P217 = "0" Operating mode without end initiators
P217 = "1" Operating mode with two end initiators

2 initiators are required.
The displacement area is limited by the initiators attached at both ends of it. When one of the end initiators is activated, an error message appears, the drive is decelerated using P10; this does not apply to the "Find machine zero" function. Subsequently, the limit switches can be deactivated with Hand+ or Hand-.

When P212 = 0 (or = "2"), the initiators are used as reversing initiators during "Find machine zero".

In other machine zero modes, the initiators can be switched to end initiators by P217 via bit 0 = "1".

---

Limit switch monitoring during the reference travel

Bit 1[P217] = 0: limit switches are not monitored during reference travel.

= 1: (P217 = 3) limit switches are monitored during "Find machine zero" (when P212<>0 and P212<>2).

The operating mode bit 1 (P217) = 1 assumes that 3 initiators are connected. Here it is not possible to use one of the two end initiators as a machine zero initiator.

Regardless of the search direction P213, both limit switches are monitored.

Response when the limit switch is reached:

When one of the two limit switches is reached, COMPAX responds with an emergency stop.

Then the following applies: move out of the danger zone using Hand+/-, then acknowledge.

In such cases, the "MZ approached" output is not set.

---

Limit switch monitoring without locking the movement

Bit 2 (P217) = 0: function corresponding to Bit 0 and Bit 1.

= 1: (P217 = 5) after activation of a limit switch, the drive is braked with P10 (standard), however travel movements are still possible afterwards using POSA and POSR.

The operating mode bit 1 (P217) = 5 assumes that 3 initiators are connected. Here it is not possible to use one of the two end initiators as a machine zero initiator.

---

P216: specifying the limit switch position

Initiator I1 is assigned the direction of motor rotation using P216.

P216: = "0": initiator I1 is approached with the clockwise rotating motor.

P216: = "1": initiator I1 is approached with the anti-clockwise rotating motor.

Clockwise rotation defined when looking at the motor shaft.

Setting aid:

Move to a limit switch using Hand+ (when P215="0"); an error message appears in the COMPAX display:

♦ error 50: I1 has been activated; i.e. P216="0"
♦ error 51: I2 has been activated; i.e. P216="1"

This allocation only applies if P215="0"; if P215="1" the allocation is reversed.

When operating with the reversing initiators, but no limit switches, an error message will not appear. You then have two options:

14 Bit-counting begins with Bit 0.
Limit switch operation

- to set P216, switch on operation with limit switches (P216="1") or
- in status value S24, see bits 3 and 4 (from the left) to determine which initiator is activated. Meaning:
  
  Bit 3: I2 is activated, i.e. P216="1"
  Bit 4: I1 is activated, i.e. P216="0"
8.3 Configuration via PC using "ServoManager"

There is a separate manual describing how to work with ServoManager.

8.3.1 Installing ServoManager

**Preparation**
Before installation, deactivate the following programs:
- any virus detection software.
- the Miro Pinboard in Miro graphic cards.
Information concerning these programs.
Following installation, the virus software can be reactivated.
Problems may also occur during program execution with Miro Pinboard.

**Installation**
Start the "Setup.exe" program on disk 1. The installation is a menu-guided process.
Following the installation, a Windows program group will appear containing the ServoManager and the terminal.

8.3.2 Configuring COMPAX

- Create connection to COMPAX: cable SSK1 (see Page 59).
- Call up ServoManager.
- Create a new project (Menu: Project: New).
- Using the menu "Axis: Insert: From controller" to set up an axis which contains all COMPAX settings (all parameters: including system parameters and data records, curves are also available for COMPAX XX70).
- Use the menu "Servo-Tools: to switch to ParameterEditor.
- Call up menu "Configuration: Guided configuration".
  All configuration parameters are queried one after another.

8.3.3 Individual configuration of synchronous motors

In addition to the motors contained in ServoManager / ParameterEditor, you can configure almost all synchronous motors. The conditions required for the motors and resolvers are listed in the start-up manual under "Technical data".

To modify motor parameters, the motor must be switched off (use OUTPUT O0=1 or press the "-" button on the front plate while switching on COMPAX).

You will find the data required for this on the HAUSER motor type plate.
Operating Instructions  COMPAX-M / -S

Individual configuration of synchronous motors

Motor type plate

Proceed as follows:

The following parameters can be read directly from the motor type plate:

- **P101**: number of motor terminals
- **P102**: EMC [V/1000 rpm]

These two values are included in the motor type description (type).

- **P103**: motor moment of inertia (inertia) [kgmm²]
- **P109**: stator inductivity (ind) [µH]
- **P113**: maximum mechanical speed (max) [rpm]
- **P116**: stator resistance (res) [Ω]
- **P105**: effective value of nominal current \( I_N \) [mA]
  - HBMR motors: \( I_N = 0.95 \times I_0 \)
  - HDY motors: \( I_N = 0.85 \times I_0 \)
  - HBMR 55 and 70: \( I_N = 0.85 \times I_0 \)
- **P106**: nominal torque MZ
  - HBMR motors: \( M_N = 0.92 \times M_0 \)
  - HDY motors: \( M_N = 0.82 \times M_0 \)
  - HBMR 55 and 70: \( M_N = 0.82 \times M_0 \)

These parameters are derived from the type plate data:

Nominal motor speed for the HBMR motors

- **P104**: nominal motor speed [rpm]

<table>
<thead>
<tr>
<th>EMC</th>
<th>( U_{ZW}=300V )</th>
<th>( U_{ZW}=560V )</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>5000</td>
<td>5000</td>
</tr>
<tr>
<td>44</td>
<td>4000</td>
<td>5000</td>
</tr>
<tr>
<td>64</td>
<td>2600</td>
<td>5000</td>
</tr>
<tr>
<td>88</td>
<td>3500</td>
<td>5000</td>
</tr>
<tr>
<td>130</td>
<td>2400</td>
<td>1700</td>
</tr>
<tr>
<td>180</td>
<td>1700</td>
<td>1200</td>
</tr>
<tr>
<td>260</td>
<td>1250</td>
<td>800</td>
</tr>
<tr>
<td>360</td>
<td>800</td>
<td></td>
</tr>
</tbody>
</table>

with

- **EMC**: counter EMC
- \( n_N \): nominal speed
- \( U_{ZW} \): intermediate circuit voltage
  - 300V: with 230V AC
  - 560V: with 3 * 400V AC
Nominal motor speed for HDY motors:
- P104: nominal motor speed [rpm]

<table>
<thead>
<tr>
<th>EMC</th>
<th>$n_N$ [min$^{-1}$]</th>
<th>$U_{ZW}=300V$</th>
<th>$U_{ZW}=560V$</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>5000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>4400</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>2800</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>88</td>
<td>2000</td>
<td>3800</td>
<td></td>
</tr>
<tr>
<td>130</td>
<td>1400</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>180</td>
<td>1800</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

With:
- EMC: counter EMC
- $n_N$: nominal speed
- $U_{ZW}$: intermediate circuit voltage
  - 300V: with 230V AC
  - 560V: with 3 * 400V AC

Parameter for saturation characteristic curve:
- P119: start of saturation [%]
- P120: end of saturation [%]
- P121: minimum stator inductivity [%]

<table>
<thead>
<tr>
<th>Flange size</th>
<th>P119</th>
<th>P120</th>
<th>P121</th>
</tr>
</thead>
<tbody>
<tr>
<td>HBMR &lt;= 115 mm</td>
<td>100</td>
<td>280</td>
<td>40</td>
</tr>
<tr>
<td>HBMR &gt;= 142 mm</td>
<td>70</td>
<td>240</td>
<td>40</td>
</tr>
<tr>
<td>HDY/ HJ</td>
<td>100</td>
<td>400</td>
<td>100</td>
</tr>
</tbody>
</table>

Saturation is switched off when P119 = P121 = 100% and P120 = 400%.

If the saturation is unknown, use the HDY values.

The additional parameters in the motor table should only be modified under exceptional circumstances.

Default values of the HBMR and HDY motors:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Standard</th>
<th>Meaning</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>P107</td>
<td>300</td>
<td>Pulse current</td>
<td>%</td>
</tr>
<tr>
<td>P108</td>
<td>3000</td>
<td>Pulse current time</td>
<td>ms</td>
</tr>
<tr>
<td>P129</td>
<td>0</td>
<td>Resolver offset</td>
<td>Degree</td>
</tr>
<tr>
<td>P130</td>
<td>&quot;2&quot;</td>
<td>Resolver frequency</td>
<td></td>
</tr>
<tr>
<td>P131</td>
<td>&quot;2&quot;</td>
<td>Resolver amplification</td>
<td></td>
</tr>
<tr>
<td>P132</td>
<td>&quot;2&quot;</td>
<td>Position sensor</td>
<td></td>
</tr>
<tr>
<td>P133</td>
<td>65 536</td>
<td>Sensor dash count</td>
<td>Increments</td>
</tr>
</tbody>
</table>

Holding brake

For motors with holding brake.

Calculate the braking delay in P17 (for more information, see Page [123]).

The parameters for Parker motors can be found in the motor catalogue (Art. No.190-060011)

Drive type

If you initially want to operate the motor without mechanics, select:
- P80=16: general drive.
- P81=P82=moment of inertia of the motor.
- P93=2: continuous mode.
- Call up the "Parameter: Guided parameter setting" menu.
  - The remaining parameters are queried one after the other.
  - Use menu "Online: Download" to transfer the data into COMPAX and validate the settings.

Caution!
Secure the displacement area of your system or the motor. When switching on, a risk may be posed by incorrect configuration data.
Risks from incorrect wiring!

In order to avoid risks caused by incorrect system wiring during first start-up, use the following settings for personal safety and to protect the mechanics:

- \( P15 = 10\% \) (motor speed limited to 10\% nominal value)
- \( P16 = 100\% \) (torque limited to 100\% of nominal torque)

- The drive must remain at standstill after the system has been switched on.
- Execute a travel operation, e.g. with POSR x or manually +/-.

If this travel operation is executed correctly, reset P15 and P16 to their original values.

The following faults may occur:

- The drive does not remain at standstill once switched on, or
- the drive runs out of control after the start command.

In both cases, either error E10 or error E54 is triggered.

If error E54 occurs, the drive is switched off.

A possible cause of the error is incorrect wiring in the motor or resolver systems.

The servo controller will operate once error E55 is acknowledged on the front plate using "Enter".

If the controller is set to "OFF", it will be brought into operation by switching the 24V control voltage off and then on.

- Use menu “Online: Command” to transmit commands to COMPAX (e.g. POSR 100: the motor travels 100 units in the positive direction).

COMPAX is now configured.

For more information, please use the table of contents or the glossary at the end of the User Guide.
8.4 Positioning and control functions

The COMPAX basic unit is designed to meet the technical control requirements of a servo axis. Special control commands are implemented in the different unit variants for synchronisation or gearing functions. The support of a superordinate control unit is required for more complex systems, especially for the co-ordination of several axes. Parker supplies solutions based on PCs and PLCs, as well as the compact industrial computer COMTAC as a multi-axis simultaneous control unit. Up to 250 sequentially numbered sets of commands can be stored in the COMPAX program memory. Program execution can be controlled via data interfaces or binary inputs/outputs. It is possible to select addresses (data record selection) using the interpretation of the adjoining binary input signals (external data record selection).

The command set structure has been deliberately kept simple and resembles the well-known programming language Basic. Program control instructions, comparator functions, setting/resetting of outputs and the motion-related commands for specifying velocity, position, acceleration time, etc. are also possible.

Program example:

```
N001: ACCEL 250   acceleration time 250 ms
N002: SPEED 80    velocity 80%
N003: REPEAT 10   specified wait loop 1s
N004: IF I7=1 GOTO 9  query I7 to log. 1
N005: WAIT 100    waiting time 100 ms
N006: END         end REPEAT loop
N007: OUTPUT O7=1 sets output; no positioning
N008: GOTO 13
N009: POSA 1250   positioning
N010: OUTPUT O8=1 sets O8 for 500 ms
N011: WAIT 500
N012: OUTPUT O8=0
N013: END
```

The range of commands used with the compact COMPAX servo control unit is deliberately different in terms of type and range to the standardized NC programming standards as described in DIN 66024 and DIN 66025. COMPAX is not designed with the control and calculation capability of a complete CNC controller, even though it can perform many CNC functions. All commands are processed in sequence (sequential step programming). The program can be interrupted or suspended using a break or stop signal. The axis is then decelerated using the preset time delay. The program can then be continued from another point.

Start program

Once "Power on" is in place, the data record indicator is at 1. If the program is to started at another point, the data record indicator can be adjusted using the command "GOTO xxx" (The direct command is only recognized by COMPAX if A4 “Ready for start” = “1”).

Using the “START” command (via the digital Input I5 or using the direct "START" command via an interface), you can start the program from the selected data record number.

- The data record indicator is set to 001 using the "Find machine zero" or "Approach real zero".
- This function can be set to binary inputs using parameter P211.
8.4.1 Absolute positioning [POSA]

**POSA**
Reference point is real zero (RZ).
Positioning is executed with the acceleration speed set using ACCEL and the velocity set using SPEED. If these values have not previously been set, substitute values will apply:
SPEED: parameter P2;
ACCEL: parameter P6 (see Page 212)

Syntax: **POSA** value

Value: figure with two digits after the decimal point (three for inches) in the unit defined in P90; a control parameter (P40..P49) or a variable (V1..V39)
e.g. **POSA** .P40
The range is defined by the software end limits P11 and P12.

Example:
N005: **POSA** 150.50 Absolute positioning to +150.5 units
N006: **POSA** -500 Absolute positioning to -500 units

Additional function:
- A position approached manually can be transferred as a POSA command into a previously selected data record using "TEACH data record" (via an interface).
- POSA HOME command via interface triggers "find machine zero".
- POSA HOME is not permitted in the COMPAX – program.
- When in continuous mode, relative positioning is also adopted with POSA.

8.4.2 Relative positioning [POSR]

**POSR**
The reference point is the current position.

Syntax: **POSR** value

Value: two digits after the decimal point (three for inches) in the unit defined in P90; a control parameter (P40..P49) or a variable (V1..V39)
e.g. **POSR** .P40
The range is defined by the software end limits P11 and P12.

Example:
N005: **POSR** 2000 Relative positioning by +2000
N006: **POSR** -100.25 Relative positioning by -100.25

The positioning commands POSR and POSA can be controlled using binary input I15 "Fast start". This function is switched on using P18. COMPAX then waits until I15="1" before it executes POSR or POSA (see Page 212).
8.4.3 Process velocity [SPEED]

**SPEED**

Process velocity as % of nominal velocity
(Nominal velocity = nominal speed * travel per motor rotation).
- valid until a new value is programmed.

When in speed control mode, direction of rotation is specified by the prefix.

**Syntax:** SPEED value
Value: 0.0000001...100% a control parameter (P40..P49) or a variable (V1..V39) e.g. SPEED .P40
Smallest steps = 0.002384 min⁻¹

**Example:** N005: SPEED 70 sets velocity to 70% of nominal speed.

The set velocity can be reduced using the analogue override input (X11.6) (see start-up manual).

8.4.4 Acceleration and braking time [ACCEL]

**ACCEL**

Specification for acceleration and braking time.
- without prefix: time specification for acceleration and decceleration process.
- negative prefix: separate time specification for decceleration process.
- valid until a new value is programmed.
- Acceleration process can be specified using parameter P94 (see Page 75).

**Syntax:** ACCEL value
Value: 10...65 000 ms, a control parameter (P40..P49) or a variable (V1..V39) e.g. ACCEL .P40 (timescale = 10 ms)

The negative prefix for the decceleration time specification must be set before the control parameters e.g.: ACCEL- .P40 (P40 > 0)

The time specified in ms applies for nominal velocity (100%). The actual time is proportional to the velocity selected. Meaning: \( ta = \frac{SPEED}{100\%} \) ACCEL

**Example:**
N005: ACCEL 300 sets the acceleration and deceleration ramp to 300 ms
N006: ACCEL -200 sets the deceleration ramp to 200 (≈200 ms when SPEED=100%)

---

15 For asynchronous motors, up to a max. of 300%.
8.4.5 Setting/resetting an output [OUTPUT]

**OUTPUT**

Syntax: \[OUTPUT \text{ output} = 1/0\]

Example: N005: OUTPUT O8=1 Sets output 8  
N005: OUTPUT O8=0 Resets output 8

8.4.6 Setting multiple digital outputs [OUTPUT O12=1010]

**OUTPUT O12=1010**

Multiple outputs can be set simultaneously.

Syntax: \[OUTPUT O12=1010\]

Example: \[OUTPUT O10=01--011 \text{ ("-" is not modified)}\]

Note:
- A maximum of 8 outputs can be processed per OUTPUT command.
- The comparator command "POSR .... OUTPUT ...." is still limited to setting one output.

8.4.7 Switch off drive unit. [OUTPUT O0]

**OUTPUT O0**

Syntax: \[OUTPUT O0 = \text{ number}\]

Example: OUTPUT O0=1 Drive switched off when brake closed.

Note: The command can only be set within a program with COMPAX XX00 and COMPAX XX60! (see below!)

8.4.8 OUTPUT O0=... in program

Limitation: The command OUTPUT O0=0,1,2 can only be programmed on the COMPAX XX00 and COMPAX XX60 in the program. No error monitoring is executed during switched off status except for emergency stop (E55/E56).

16 O1...O6 only if masked via P225.
17 Instead of "-", "." is also an option
This means that all errors which can be acknowledged (e.g. lag errors or resolver errors), which occur during the switched off status (e.g. by separating the resolver line) are ignored.
Only errors still present after Power On are displayed.

8.4.9 Password [GOTO]

GOTO

Syntax: GOTO number
Number ="302": Deactivates password protection
"270": Activates password protection

Note: You can also use this command in the data record memory.

Example: GOTO 302 Enables programming levels and parameters.

8.4.10 External velocity specification. [SPEED SYNC]

ENTRY at BDF2: SPEED Ent

COMPAX synchronizes itself to an external velocity specification.

Note: function only applies to COMPAX XX00 with options E2, E4 or E7!
SPEED SYNC cannot be used at the same as the external position adjustment (switched on via P75 ≠ 0)!

Instead of specifying velocity using the SPEED command, the process command velocity is read externally from the encoder interface when you use SPEED SYNC.

Setting condition: P144="4" and P188="0"

Setting aid: the speed of the motor and sensor is the same when using P98=P83 and the correctly set parameter P143 (pulse speed sensor).

♦ No travel synchronization; use our "Electronic transmission" or "Electronical curve control" unit variant for this purpose.

External speed set via option E7

Meaning: 10V = 100% of nNominal (P104)
P93=1 or 2
P80=16 (general drive)
P83= distance per motor revolution [µm]
P90=1 [mm]
P144=7 (analogue rpm specification)

Calculation of P98:

\[ P98 = \frac{P83 \times P104 \times P143}{1000 \times 60 \times 1000000} \]

with: P143=1 000 000
P104 in [1/min]

Accuracy data can be found on Page 186
8.4.11 Mark-related positioning [POSR]

POSR

Use this command to position e.g. a mark relative to an external signal.

**Syntax:**

POSR value

Value: two digits after the decimal point (three for inches) in unit corresp. to P90; a control parameter (P40..P49) or a variable (V1..V39)
e.g. POSR .P40.

The prefix determines the direction in which the mark is approached.

**Note!**

POSR 0 is not permitted!

**Example:**

POSR 100 P35="1"; P37=+300; P38=+600; P39=+800; I14="1".

If the mark is between +300 and +600, mark +100 is positioned, if the mark is outside the window it is positioned to 800.

**Note!**

The drive positioning is not limited by P39.

If the mark is within the mark window, COMPAX executes positioning using the POSR value for a value of the corresponding size, even after P39.

The process range can be limited using P11 and P12.

When the mark reference is switched on, the inputs I14, I15, and I16 are no longer available for external data record selection (GOTOEXT, GOSUBEXT).
8.4.12 Preparatory instructions

The following command combinations are preparatory instructions for creating speed step profiles or setting comparator switch points. The prepared positioning process is started using POSA or POSR. Note the following:

- Combined commands can be mixed (POSR SPEED, POSR OUTPUT).
- A total of 8 combined commands can be programmed per positioning process.
- The positioning values of the command combinations are always positive and refer to the start point of the positioning process. They represent differences in travel. The direction is specified by the next positioning command. This can be relative (POSR) or absolute (POSA).

- The positioning values for speed steps, ramp times or comparators always apply from the point at which positioning starts (for POSA and POSR).
- The positioning values for speed steps, ramp times or comparators are numerical values:
  - If the following positioning is positive, COMPAX calculates them as positive values.
  - If the following positioning is negative, COMPAX calculates them as negative values.
  - If a process cycle has been interrupted by "Stop", continue the cycle using "Start".
- The preparatory instructions are canceled by the "Hand+-", "Find machine zero" and "Approach real zero" commands.

8.4.13 Changes in speed within a positioning process [POSR SPEED]

POSR SPEED

Each speed step profile can have a maximum of 8 speed steps. The comparator value is specified as a relative dimension. It is referenced to the positioning start point.

**Syntax:**

**POSR value 1 SPEED value 2**

Value 1: only positive values permitted (unit corresponds to P90); two digits after the decimal point (three for inches), a control parameter (P40..P49) or a variable V1 .. V39.

Value 2: no digits after the decimal point; numerical value, a control parameter (P40..P49) or a variable V1 .. V39.

E.g.: POSR .P40 SPEED .P41

**Example:**

N001: ACCEL 250  Acceleration and braking time = 250 ms
N002: SPEED 20  Starting velocity = 20%
N003: POSR 150 SPEED 30  1st speed step when starting position ±150, sets velocity to 30%.
N004: POSR 300 SPEED 50  2st speed step when starting position ±300, sets velocity to 50%.
N005: POSR 500 SPEED 80  3st speed step when starting position ±500, sets velocity to 80%.
N006: POSR 900 SPEED 60  4st speed step when starting position ±900, sets velocity to 60%.
N007: POSA -1000  Positioning command to position -1000 (position -1000 is approached with all of or one part of the speed step profile depending on the start point).
N008: POSR 200 SPEED 50  Prepares a new speed step profile.
N009: ...
Changes in speed within a positioning process [POSR SPEED]

Compatibility:

Speed step profile extended by ramp time

Function:
- In addition to the new velocity, the acceleration time can be defined for the speed step profile. This becomes effective at the transition to the defined velocity and remains valid until a new acceleration time is defined.
- The braking time is assigned within the speed step profile, not by using ACCEL-, but defined by the velocity change.
- The deceleration ramp for the target position is defined by the previously set ramp (braking time applicable before the speed step profile).

POSR x SPEED y
ACCEL z

Abbreviation: PR x SD y AL z
x, y, z: number, parameter .P40 (P40-P49) or variable .V1 (V1-V39)

Example: PR .P40 SD .V31 AL 200

Note:
- The last ramp time selected using a prepared command from ACCEL remains valid for future positioning processes.
- The situation with SPEED is the same.
- A braking time previously defined with ACCEL- remains unaffected.

Example:
ACCEL 1000
ACCEL -2000
SPEED 25
POSR x SPEED 100 ACCEL 300
POSR y SPEED 10 ACCEL 100
POSA z
POSA 0

Return with SD 10, AL100 and AL-2000

Position monitoring
Idle display
Speed monitoring
Engage / disengage brake / final stage
Variable voltage

1. Position x is reached at 25% velocity and 1000ms acceleration time.
2. Position y is reached at 100% velocity and 300ms acceleration time.
3. Position z is reached at 10% velocity and 100ms acceleration time.
4. To stop at position z, a braking ramp of 2000ms is used for early deceleration.
5. After the command POSA 0, the drive returns to the starting point (= position 0). The drive accelerates for the last set 100 ms to the last set velocity of 10% and returns to position 0. The braking time of 2000 ms set before the speed step profile is used as the braking ramp.
8.4.14 Comparators during positioning [POSR OUTPUT]

**POSR OUTPUT**

Setting and resetting freely assignable outputs within a positioning process. A maximum of 8 comparators can be set in one positioning process. The comparator value is specified as a relative dimension. It is referenced to the positioning start point.

**Syntax:**

POSR value OUTPUT output = 1/0

Value: only positives value are permitted (unit corresponds to P90); two digits after the decimal points (three for inches) a control parameter (P40..P49) or a variable (V1..V39)

e.g. POSR .P40 OUTPUT A7=1.

**Examples:**

N001: ACCEL 250  
Acceleration and braking time = 250 ms

N002: SPEED 50  
Starting velocity = 50%

N003: POSR 150 OUTPUT A8=1  
1st comparator at start position 150, sets output O8 to 1.

N004: POSR 300 OUTPUT A7=1  
2nd comparator at start position 300, sets output O7 to 1.

N005: POSR 500 OUTPUT O7=0  
3rd comparator at start position 500, sets output O7 to 0.

N006: POSR 900 OUTPUT O8=0  
4th comparator at start position ±900, sets output O8 to 0.

N007: POSA 1000  
Positioning command to 1000 (Position +1000 is approached; the travel-dependent comparators are set once the relative positions have been reached).

N008: POSR 200 OUTPUT O7=1  
Prepares new comparators.

Outputs O1 to O6 can also be used as comparators once enabled via P225 (see Page 139).

Diagram of specified example for POSR OUTPUT

Diagram of example using POSA -1000 as positioning
8.4.15 Cam controller with compensation for switching delays

With the function "Cam controller", you can switch 4 actuators (switch elements) dependent on position.

- The switching positions are fixed positions within the positioning range.
- The reference value for the switching positions can be selected from:
  - the position actual value (S1)
  - the position set point
  - the absolute value (S12)
- The switching delay of the actuators is compensated for dependent on the speed.

Outputs O9 ... O12

Parametrization occurs via variables in the range V50 ... V70.

<table>
<thead>
<tr>
<th>No.</th>
<th>Contents</th>
<th>Unit</th>
<th>min</th>
<th>standard</th>
<th>max</th>
<th>valid from</th>
</tr>
</thead>
<tbody>
<tr>
<td>V50</td>
<td>Operation mode cam controller</td>
<td></td>
<td>0</td>
<td>0</td>
<td></td>
<td>VP</td>
</tr>
<tr>
<td></td>
<td>0: inactive</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1: position actual value</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(without consideration of P1 and P215)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2: position set point</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(without consideration of P1 and P215)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3: reserved</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4: S1 (position actual value)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number range: +/- 4 mill. units (P90)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5: position set point</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number range: +/- 4 mill. units (P90)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6: absolute value (S12)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number range: +/- 2048 units (P90)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V51</td>
<td>Polarity O9...O12 Valence</td>
<td></td>
<td>0</td>
<td>0</td>
<td>3840</td>
<td>VP</td>
</tr>
<tr>
<td></td>
<td>Bit 9: Polarity O9 256</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bit 10: Polarity O10 512</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bit 11: Polarity O11 1024</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bit 12: Polarity O12 2048</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>If the corresponding bit is set, then the</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>relevant output is inverted.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V52</td>
<td>reserved</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VP</td>
</tr>
<tr>
<td>V53</td>
<td>reserved</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VP</td>
</tr>
<tr>
<td>V54</td>
<td>reserved</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VP</td>
</tr>
<tr>
<td>V55</td>
<td>Position control cam 1 (O9) on*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VP</td>
</tr>
<tr>
<td></td>
<td>P90 -4 000 000 0.00 +4 000 000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V56</td>
<td>Switch-on lag control cam 1</td>
<td>ms</td>
<td>0</td>
<td>0</td>
<td>1000</td>
<td>VP</td>
</tr>
<tr>
<td>V57</td>
<td>Position control cam 1 (O9) off*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VP</td>
</tr>
<tr>
<td></td>
<td>P90 -4 000 000 0.00 +4 000 000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V58</td>
<td>Switch-off lag control cam 1</td>
<td>ms</td>
<td>0</td>
<td>0</td>
<td>1000</td>
<td>VP</td>
</tr>
<tr>
<td>V59</td>
<td>Position control cam 2 (O10) on*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VP</td>
</tr>
<tr>
<td></td>
<td>P90 -4 000 000 0.00 +4 000 000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V60</td>
<td>Switch-on lag control cam 2</td>
<td>ms</td>
<td>0</td>
<td>0</td>
<td>1000</td>
<td>VP</td>
</tr>
<tr>
<td>V61</td>
<td>Position control cam 2 (O10) off*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VP</td>
</tr>
<tr>
<td></td>
<td>P90 -4 000 000 0.00 +4 000 000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V62</td>
<td>Switch-off lag control cam 2</td>
<td>ms</td>
<td>0</td>
<td>0</td>
<td>1000</td>
<td>VP</td>
</tr>
<tr>
<td>V63</td>
<td>Position control cam 3 (O11) on*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VP</td>
</tr>
<tr>
<td></td>
<td>P90 -4 000 000 0.00 +4 000 000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V64</td>
<td>Switch-on lag control cam 3</td>
<td>ms</td>
<td>0</td>
<td>0</td>
<td>1000</td>
<td>VP</td>
</tr>
<tr>
<td>V65</td>
<td>Position control cam 3 (O11) off*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VP</td>
</tr>
<tr>
<td></td>
<td>P90 -4 000 000 0.00 +4 000 000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V66</td>
<td>Switch-off lag control cam 3</td>
<td>ms</td>
<td>0</td>
<td>0</td>
<td>1000</td>
<td>VP</td>
</tr>
<tr>
<td>V67</td>
<td>Position control cam 4 (O12) on*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VP</td>
</tr>
<tr>
<td></td>
<td>P90 -4 000 000 0.00 +4 000 000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V68</td>
<td>Switch-on lag control cam 4</td>
<td>ms</td>
<td>0</td>
<td>0</td>
<td>1000</td>
<td>VP</td>
</tr>
<tr>
<td>V69</td>
<td>Position control cam 4 (O12) off*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VP</td>
</tr>
<tr>
<td></td>
<td>P90 -4 000 000 0.00 +4 000 000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V70</td>
<td>Switch-off lag control cam 4</td>
<td>ms</td>
<td>0</td>
<td>0</td>
<td>1000</td>
<td>VP</td>
</tr>
</tbody>
</table>

* The switching processes described apply for increasing setpoint and P215=0; with decreasing setpoint switch off occurs at the same position where switch on previously occurred.

The variables for parametrization of the cam controller are not password protected!
Note! With the instruction V0=x (global instruction to all variables), variables V50 ... V70 will also be changed!

Example 1: Normal positioning

COMPAX calculates a travel difference from the lag times of the switch elements ($\Delta p_{\text{on}}$ and $\Delta p_{\text{off}}$). A constant speed is assumed.
The switching signal is (with increasing setpoint) activated by $\Delta p_{\text{on}}$ before the control cam position for On and deactivated again by $\Delta p_{\text{off}}$ before the control cam position for Off.

Requirements for safe and time correct switching of the cam controller:
The cam positions, as well as the range $\Delta p$ before the cam position must be moved through at constant speed.

Problem point:
In Example 1, point ➀, the idle position is located just above V57, so that the control cam 1 cannot be activated too early. This means that the switch-on lag of the actuator cannot be compensated. This causes a switching error.
In this case, COMPAX activates the control cam output immediately after the relevant positioning command is received.
Behaviour of the control signal during negative position values, falling position and P215=0

The relevant distances $\Delta p$ resulting from the times are shown.

Example 2: Positioning with subsequent cam operation (COMPAX XX70)

Explanation: At position ② (reset function to next curve) no compensation is implemented for the switching delay.

Note:
The cam controller is calculated using a cycle of 1ms.
8.4.16 Programmable waiting time [WAIT]

**WAIT**

Programmable waiting time in ms before the next data record is processed.

- **Syntax:**\n  \- WAIT value\n  \- Value: 10...65 000 [ms] a control parameter (P40..P49) or a variable (V1..V39)\n  \- e.g. WAIT .P40 (time pattern 10 ms)

- **Example:**\n  \- N005: WAIT 500 Sets the waiting time to 500 ms before the next data record is processed.

8.4.17 Program jump [GOTO]

**GOTO**

Program jump to specified data record number.

- **Syntax:**\n  \- GOTO data record number\n  \- Data record number: 1...250

- **Example:**\n  \- N045: GOTO 60 Jumps to data record N060

8.4.18 Sub-program jump [GOSUB]

**GOSUB**

Jump to a sub-program.

- **Syntax:**\n  \- GOSUB data record number\n  \- Data record number: 1...250

- **Example:**\n  \- N005: GOSUB 100 Calls up sub-program\n  \- N100: ... Starts sub-program\n  \- N101: ...\n  \- ...\n  \- Nxxx: RETURN Ends sub-program, jumps back to N006

**Note:**\n
\[→\] Never use GOTO to jump out of a sub-program or to a sub-program.

8.4.19 Instruction to end a sub-program. [RETURN]

**RETURN**

This executes a return jump to the main program.

- **Syntax:** RETURN

8.4.20 END instruction [END]

**END**

END instruction for a REPEAT loop or for the program.

**To end a program, you implement a program stop. The data record indicator is not modified.**

- **Syntax:** END
8.4.21 Start a program loop [REPEAT]

**REPEAT**

The following program sequence is run through the number of times specified until an END instruction appears.

**Syntax:** REPEAT value

Value: 1...65 000 a control parameter (P40..P49) or a variable (V1..V39)
e.g. REPEAT .P40

**Example:**

N005: REPEAT 10
N006: ...
N007: END

A loop can be prematurely exited using GOTO.

8.4.22 Branching [IF I7=1]

**IF I7=1**

Branching related to a control input

**Syntax:** IF control input=1/0 GOTO/GOSUB data record number

Control input: I1...I16

**Examples:**

IF I7=1 GOTO 010 If I7 = "1", a jump is made to data record N010
IF I7=0 GOSUB 010 If I7 = "0", a jump is made to the sub-program in data record N010

8.4.23 Binary IF query of inputs [IF I12=101-1]

**IF I12=101-1**

Multiple inputs can be queried simultaneously.

The inputs are compared with a mask. The mask contains individual bits 1 or 0,
and a space marker (-) for "not taken into consideration".

**Syntax:**

IF I12=101-1 GOTO 123

-> I12 = 1, I13=0, I14=1, I15= "not considered", I16 = 1.

Binary IF querying of status values or outputs is not possible.

A maximum of 8 inputs can be queried per IF instruction.

18 I1...I6 only if masked via P221.
19 Instead of ",", "." is also an option
8.4.24 Comparative operations

Syntax: IF <single Operand> <compare> <Operand> GOTO xxx
or
IF <single Operand> <compare> <Operand> GOSUB xxx

Simple Operand: a parameter Pxxx or
a variable Vxxx or
a status value Sxxx (S1-S15, S30, S40ff)

Operand: A simple Operand or
A constant with max. 8 significant digits

Comparison: <smaller
>larger
=equals
<> not equal
<= equal to/less than
>= equal to/greater than

Depending on the result of the comparison, a GOTO or GOSUB is carried out.

Examples: IF P40>100 GOTO 234
IF V030<>P49 GOTO 123

Limitation: Within the IF query, operations with logic operators (AND, OR) are not possible.

Writing convention of variables (V0-V39) and control parameters (P40-P49)

For reasons of compatibility, a preceding point (full stop) is expected in the syntax for motion commands:
e.g.: POSA .P40, ACCEL .V10
The new comparison and arithmetic commands will operate without a preceding point (full stop): e.g.:
P41=V10+S1, IF V20 > S2 GOTO 10

8.4.25 Specific processing of data record groups. WAIT START.

WAIT START

Entry at BDF2 21 WAIT Ent
When this instruction is issued, COMPAX interrupts the programming procedure
until a external START (E5 or via interface) is issued (reaction time <30 ms). For
shorter reaction times, refer to 115 on Page 151

Syntax: WAIT Start

8.4.26 Jump with data record selection [GOTO EXT]

GOTO EXT

Jump with data record selection via the inputs I9 to I16.
Entry at BDF2: GOTO Ent
Data record selection as for GOSUB EXT (see below).

20 for variables, see Page 114.
21 Applies to the manual terminal BDF2/01
8.4.27 Sub-program jump with data record selection [GOSUB EXT]

**GOSUB EXT**

**Entry at BDF2: GOSUB Ent**

Jump into a sub-program with data record selection via the inputs I9 to I16.

The bit pattern of inputs I9 to I16 is interpreted as a data record number (binary).

\[ I16\ldots\ldots I9 \Rightarrow 2^7\ldots\ldots 2^0 \]

\[ \text{e.g. } 00\ 010\ 100 = 20 \Rightarrow \text{jumps to sub-program at data record } 20. \]

**Note!**

If inputs have been assigned functions (e.g. fast start I15 or external position adjustment I11), they are not taken into consideration when using GOSUB EXT (read logically as "0"):

- The assignments of each of the binary inputs I16...I9 must be taken into consideration for the individual unit variants (COMPAX XX50M,...).
- When the PLC data interface is activated, the commands GOTO EXT and GOSUB EXT are blocked!

8.4.28 Error handling [IF ERROR GOSUB]

**IF ERROR GOSUB**

To influence the error reactions.

**Syntax:**

```plaintext
IF ERROR GOSUB xxx
```

This instruction can only be programmed as normal IF instructions in the program. Use this instruction to define the program procedure when an error status occurs.

**Note!**

The error sub-program is called up with a delay by P17 (brake delay). When performing a WAIT START, COMPAX does not branch into the error sub-program if an error occurs!

**Function:**

Normally, an error in the COMPAX will cause an actively running move to be interrupted. Depending on the type of error, the drive is switched off. The program is however stopped no matter what the error type.

The instruction 'IF ERROR GOSUB xxx' allows you to, e.g. set the outputs to defined statuses when an error occurs.

If such an instruction has been run once in the program and then an error later occurs,

- the current move is interrupted,
- if necessary, the axis is (depending on the error) switched off and
- the 'Error program', which has been programmed from program number xxx, is executed.

**Priority:**

The error program has priority over the stop program.

A running stop program is interrupted by the error program and continued after the error program is executed.

**Error program:**

The error program must not contain

- any motion commands (POSA, POSR, POSR ..., WAIT POSA, WAIT POSR, SPEED in the speed control mode, ),
- any sub-program jumps (GOSUB, IF ... GOSUB, ...),
- any COMPAX XX70 commands,
- any approach real zero and find machine zero commands,
- any speed step commands (POSR ... SPEED ...) or
- comparator commands (POSR ... OUTPUT ...)

---

POSA
POSR
SPEED
ACCEL
OUTPUT
Password
SPEED
SYNC
Mark reference
POSR
SPEED
POSR
OUTPUT
Cam controller
WAIT
GOTO
GOSUB
RETURN
END
REPEAT
IF I...
Comparison
WAIT Start
GOTO / GOSUB EXT
IF Error/Stop
Arithmetic
Position monitoring
Idle display
Speed monitoring
Engage / disengage brake / final stage
Variable voltage
and is used to bring the individual outputs (e.g. the control output for a pump or a valve) into a safe status.

Error program with WAIT START
Each error program must contain a 'WAIT START' instruction. The 'WAIT START' instruction causes the programming procedure to stop until an external QUIT and START occurs. Then OUTPUT instructions can again be present for resetting the outputs.

There must be a RETURN or END instruction at the end of the error program.

- The END instruction stops the program.
- The RETURN instruction executes a jump back into the program line which was previously interrupted. If necessary, an interrupted movement is continued (provided that the error has been acknowledged).

Example:

<table>
<thead>
<tr>
<th>Main Program</th>
<th>Error Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>N001: IF ERROR GOSUB 200</td>
<td>N200: OUTPUT O9=0</td>
</tr>
<tr>
<td>N002: OUTPUT O9=1</td>
<td>N201: WAIT START</td>
</tr>
<tr>
<td>N003: POSA 0</td>
<td>N202: OUTPUT O9=1</td>
</tr>
<tr>
<td>N004: POSA 4000</td>
<td>N203: RETURN</td>
</tr>
<tr>
<td>N005: OUTPUT O9=0</td>
<td></td>
</tr>
<tr>
<td>N006: GOTO 002</td>
<td></td>
</tr>
</tbody>
</table>

If the axis is now stopped and switched off due to an error, e.g. during POSA 4000 positioning, a sub-program jump is then executed to program line 200 and output O9 is set to zero at this point. The program then stops in program line 201 and waits until the error has been acknowledged and, if necessary, a new start is made. At program line 202, output O9 is switched on again, at program line 203, a jump is made back to the previously interrupted program line N004. The axis executes the rest of the travel to position 4000, and the main program is then continued at program line N005. If the error program is concluded with END rather than RETURN, the program indicator remains in the same position. The program stops running at this point. Machine zero then has to be approached or the program indicator must be reset explicitly.

8.4.29 STOP / BREAK handling [IF STOP GOSUB xxx]

IF STOP GOSUB xxx
For influencing behavior after STOP or BREAK.

Syntax:

IF STOP GOSUB xxx
This instruction can only be programmed, like normal IF instructions, in the program. It controls the procedure executed in the program when a stop status occurs.

Normally, a STOP / BREAK command in the COMPAX will cause a actively running move to be interrupted; the program is stopped. The 'IF STOP GOSUB xxx' instruction makes it possible to set the outputs to defined states in a stopped condition. If such an instruction has already run in the program and a stop command occurs later:

- the current travel motion is interrupted and then
- a 'Stop program' is run, this is stored from program line number xxx.
Stop program:
The stop program must not contain
- any motion commands (POSA, POSR, POSR ..., WAIT POSA, WAIT POSR, SPEED in the speed control mode, ),
- any sub-program jumps (GOSUB, IF ... GOSUB, ...),
- any COMPAX XX70 commands,
- any approach real zero and find machine zero commands,
- any speed step commands (POSR ... SPEED ...) or
- comparator commands (POSR ... OUTPUT ...)
and is used to bring the individual outputs (e.g. the control output for a pump or a valve) into a safe status.

The 'WAIT START' instruction must be included; it stops the programming procedure before an external START is executed again.

Then OUTPUT instructions can again be present for resetting the outputs.
There must be a RETURN or END instruction at the end of the stop program.
- The END instruction stops the program.
- The RETURN instruction executes a jump back into the previously interrupted program line, a travel motion which was interrupted by STOP is continued; the next command is executed after the BREAK.

The error program has priority over the stop program.
A running stop program is interrupted by the error program and continued after the error program has run.

Example:

<table>
<thead>
<tr>
<th>Main Program</th>
<th>Stop Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>N001: IF STOP GOSUB 240</td>
<td>N240: OUTPUT O9=0</td>
</tr>
<tr>
<td>N002: OUTPUT O9=1</td>
<td>N241: WAIT START</td>
</tr>
<tr>
<td>N003: POSA 0</td>
<td>N242: OUTPUT O9=1</td>
</tr>
<tr>
<td>N004: POSA 4000</td>
<td>N243: RETURN</td>
</tr>
<tr>
<td>N005: OUTPUT O9=0</td>
<td></td>
</tr>
<tr>
<td>N006: GOTO 002</td>
<td></td>
</tr>
</tbody>
</table>

If the axis has been stopped due to a STOP, e.g. during POSA 4000 positioning, sub-program jump is then made to program line 240 and output O9 is set to zero at this point.

The program then stops in program line 241 and waits until a new start occurs.
At program line 242, output O9 is switched on again, at program line 243, a jump is made back to the previously interrupted program line N004.
The axis therefore executes the rest of the travel to position 4000 and the main program is then continued at program line N005.
If the stop program is concluded using END rather than RETURN, the program indicator remains in the same position. The program stops running at this point. Machine zero has to approached or the program indicator must be reset explicitly.
8.4.30 Arithmetic

8.4.30.1 Parameter assignments

Syntax:

N001: P40 = 123.456
N002: V19 = P1

The assignments for parameters and variables are defined with an equal sign. The variables are represented by V0 to V39.

Note: The assignment of variables is also possible as a direct command, e.g. from a terminal.

Items permitted to the left of the equal sign:

• a parameter Pxxx or
• a variable Vxxx (V0 - V39) or
• a curve point Ixxxx (digital or analogue auxiliary functions when using COMPAX XX70) or
• a curve point Fxxxx (set points when using COMPAX XX70)

Items permitted to the right of the equal sign:

• an operand
  or
• a simple arithmetic term22

An operand is:

• a parameter Pxxx or
• a variable Vxxx (V1 - V39) or
• a status value Sxxx or
• a constant with max. 8 significant digits + sign + decimal point.

All parameters may be assigned. The commands "VP" and "VC" (with which the parameters are validated) can be programmed in the program.

Example:

N123: P081=30 (modifies moment of inertia)
N124: VC
N234: P013=10 (modifies lag tolerance)
N235: VP

Curve memory

COMPAX XX70: the curve memory is also accessible:

Example:

N200: F5450=0.5 (modifies idle postion of 1st curve)
N201: I5460=128 (modifies master cycle route of 1st curve)
N202: VF (validates curve)

For more information, see operating instructions for electronical curve control.

22 Curve points can only be modified using an assignment; an arithmetic term is not allowed.
### 8.4.30.2 Arithmetic and variables

Values can be linked with one another using the four basic types of calculation and the result can be assigned to a parameter or a variable.

**Syntax:**

A simple arithmetic term is:

- `<Operand> <Operator> <Operand>`
- `<Befehl> <Operand>`

<table>
<thead>
<tr>
<th>Operators</th>
<th>Function</th>
<th>Example:</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>for addition</td>
<td>P10+10</td>
</tr>
<tr>
<td>-</td>
<td>for subtraction</td>
<td>V1-S1</td>
</tr>
<tr>
<td>*</td>
<td>for multiplication</td>
<td>2 * P13</td>
</tr>
<tr>
<td>/</td>
<td>for division</td>
<td>P13/P14</td>
</tr>
<tr>
<td>\</td>
<td>for whole number division (formation of the whole number component)</td>
<td>V7/V3: where V7=30 and V3=7, the result is: V7/V3=4 (V7/V3=4.2857...; whole number component= 4)</td>
</tr>
<tr>
<td>%</td>
<td>for the formation of the division remainder (Modulo)</td>
<td>S12%P40 with S12=30 and P40=7, the result is: S12/P40=2 remainder 2; division remainder = 2</td>
</tr>
</tbody>
</table>

**Operands**

The following operands may be used:
- constants,
- parameters,
- status values, (S1-S15, S30, S40ff)
- variables (V1-V39); after commands with preceding point (full stop): POSA .V1

**Status values:**

Not all status values can be used as operands. Status values S01 to S15, S30, and S40ff are permitted.

**Variables:**

In addition to the 10 user parameters P40 to P49, **39 variables V1-V39** are available. V0 is used for global assigning of a value to all variables. The variables are automatically buffer-stored in the ZPRAM, i.e. after Power On they contain the old value.

**Note:**

When the cam controller is switched off (V50=0), it is possible to use the variables V51 ... V70 as free variables.

**Note:**

After commands the variables (like user parameters P40 to P49) are preceded by a "point" (full stop): POSA .V1, ACCEL .V22

**Global assignment:**

V0 is used for globally assigning a value to all variables.

Example:

V0=0: V1...V70=0
V0=17: V1...V70=17

**Note!**

With the instruction V0=x, variables V50 ... V70 and therefore the settings of the cam controller are also changed!
Arithmetic and variable examples:

N001: P013 = 2 * P013  (Multiplication)
N002: P010 = P040 + 1000.1234  (Addition)
N003: P005 = P005 / 2  (Division)
N004: P250 = P250 - 1  (Subtraction)
N005: V002 = V001 \ 1  (Whole number division)
N006: V3 = S15 % P12  (Modulo)
N007: POSR .V30

Only one operation or command is permitted per program line.

Number format:
All calculations are executed in 48 bit format (real number); 24 bits before the decimal point and 24 bits after the decimal point.
Such a real number can be represented with a maximum of 10 places, incl. prefix and decimal point.
Up to 7 places can be recorded after the decimal point.
Ex. 1234567.89; -1.2345678

Dealing with calculation errors:
If a number overrun occurs while an arithmetic term is being calculated (because the range of values is not sufficient or if divided by 0), COMPAX reacts as follows:
• collective error message E07 is activated.
• the program is stopped for safety reasons.
• the drive remains powered.
• any travel movements are interrupted using the stop ramp.
After Quit and Start, the same command would be processed again and probably cause another error message.
For this reason, appropriate care should be taken when programming.
The causes of the error are stored in the optimization display (P233/P234=39) and the last calculation error stored is always the first to be displayed.

Accuracy of calculations:
Errors occur in the arithmetic due to the systematic errors which arise during the display of figures in the control processor (the smallest number which can be displayed is $2^{-24}$).
The calculation error can usually be ignored for addition, subtraction and multiplication.

Note! When dividing, significant discrepancies can result.

Division $y = x_1 / x_2$
The "maximum relative input error" for the division $y = x_1 / x_2$ is calculated using the following formula:

\[
\delta \leq \frac{\Delta x_1}{x_1} + \frac{\Delta x_2}{x_2} \quad \text{when } \Delta x_1 = \Delta x_2 = 2^{-24}
\]

or absolute:

\[
\Delta y = \left(\left|x_1\right|^* \Delta x_1 + \left|x_2\right|^* \Delta x_2\right) / x_2^2 \quad \text{when } \Delta x_1 = \Delta x_2 = 2^{-24}
\]

Example:
$x_1=12345.6; x_2 = 0.0001$
Result:  $y = 123456000$

max. relative error:  $\delta \leq \frac{2^{-24}}{12345.6} + \frac{2^{-24}}{0.0001} = 0.000596$

max. absolute error:  $\Delta y = \left(\left|12345.6\right|^* 2^{-24} + \left|0.0001\right|^* 2^{-24}\right) / 0.0001^2 = 73585.51$
Operating Instructions

Arithmetic

Read status and assign variables

To include the actual position in a calculation, for example, you may assign as follows:

N100: V030=S1

or

N100: V030= S1 + 10

The variable V030 derived in this way can be used later, for example, in a positioning instruction as a preset target.

Initializing variables:

After Power On, the variables retain the old value as before Power Off as they are stored in the ZPRAM. With the special instruction V000=x, all variables (on the cam controller settings) are set to the value x.

Writing convention of variables (V0-V39) and control parameters (P40-P49)

For reasons of compatibility, a preceding point (full stop) is expected in the syntax for motion commands:

e.g.: POSA .P40, ACCEL .V10

The new comparison and arithmetic commands will operate without a preceding point (full stop): e.g.: P41=V10+S1, IF V20 > S2 GOTO 10
### 8.4.31 Position monitoring (P93=1, 2, 3)

There are 2 settings for O5 "Position reached" which are set with P227:

<table>
<thead>
<tr>
<th>P227 bit 4</th>
<th>Meaning / function</th>
</tr>
</thead>
<tbody>
<tr>
<td>O5 toggles when the position is reached</td>
<td>OM1: O5 ( \text{toggles when the position is reached} )</td>
</tr>
<tr>
<td>O5 toggles after every new positioning when position is reached.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P227 bit 4</th>
<th>&quot;0&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>P14&gt;0, small values (small in comparison with the process travel)</td>
<td>OM1: O5 ( \text{toggles when the position is reached} )</td>
</tr>
<tr>
<td>P14&lt;&gt;0, large value (large in comparison with process travel)</td>
<td>OM2: O5 ( \text{toggles after every new positioning when position is reached.} )</td>
</tr>
</tbody>
</table>

**Functional description:**

O5 is toggled (=changed, i.e. from O5="1" to O5="0", from O5="0" to O5="1") after every positioning move (set point generator has reached target position).

When an error occurs (Exx is indicated), O5 stays at the current value.

Can be adjusted using: **P227 bit 4 =“1”**

---

**OM1: O5 toggles when the position is reached**

Example:

![Diagram showing O5 toggling](image)

**PLC - sequential step tracking**

With this function you can use a host PLC for precise tracking of the COMPAX positioning. You will find a description of this from Page **122**.

---

23 Bit counting begins with 0.

24 OM: Operating mode
**OM2: O5 = "1": nominal value reached and lag error < P14**

O5="1": nominal value on nominal value sensor reached and lag error < P14. If the lag error is again > P14, then O5="0" is set. Can be adjusted using: \textbf{P227 bit 4 ="0"} (default setting)

![Position monitoring diagram](image)

For purposes of clarity a poor loop setting is shown here.

---

**OM3: O5 = "1": nominal value reached (independent of P14)**

O5="1": nominal value on nominal value generator reached (independent of P14, since P14 is set as very large value). Can be adjusted using: \textbf{P227 bit 4\textsuperscript{25} ="0"} (default setting)

![Position monitoring diagram](image)

A poor controller setting has been selected by way of illustration.

---

\textsuperscript{25} Bit counting begins with 0.
8.4.32 Idle display

Display showing whether the axis is at standstill or moving.
The display is set to output O2 using the setting P227 bit 1 = "1"; the standard function of O2 "No warning" no longer applies in this case.
P229 then serves as a switching threshold, above which an idle condition is reported with O2 = "1" and indicated in per-thousands (€ of P104) of nominal speed.
- Nominal speed < P229: O2 = "1"; drive at standstill
- Nominal speed ≥ P229: O2 = "0"; drive moving
- P229 = 0: O2 = "0"; no idle display

Range of numbers P229: 0 - 255%

P227 bit 1 = "0" O2 assigned the "No warning" display (default value).

Example:

To avoid O2 continuously switching over during nominal speed value disturbance (during synchronization applications), a minimum pulse time (= minimum positioning time) is defined.
Once nominal speed < P229 has been detected and P229 has then been exceeded again, the next nominal speed check is executed after 50 ms.

---

Example:

Disturbance

---

26 Bit counting begins with 0.
8.4.33 Speed monitoring in speed control mode (P93="4")

There are 2 settings for O5 "Position reached" which are set with P227:

<table>
<thead>
<tr>
<th>P227 Bit 4=1⑴</th>
<th>Meaning / function</th>
</tr>
</thead>
<tbody>
<tr>
<td>OM1⑵</td>
<td>O5 toggles when speed is reached&lt;br&gt;O5 toggles after every new speed definition when speed is reached.</td>
</tr>
<tr>
<td>P227 bit 4 = &quot;0&quot;</td>
<td></td>
</tr>
</tbody>
</table>
| P14>0, small values  
(small in comparison with the changes in speed) | O5 = "1": nominal value reached and < P14
O5="1" if set point generator has finished the ramp and the speed difference is smaller than P14.
If, after O5="1", the speed difference is again greater than P14, then O5 = 0 until the difference is again less than P14. |
| P14>P15  
(large in comparison with changes in speed) | O5 = "1": nominal value reached (independent of P14)
O5=1 as soon as the set point generator has reached the set speed, and stays at "1" until the next speed change. |

Functional description:

In speed control mode, P14 is given as a percentage of the set speed. In addition, the speed is checked against the speed tolerance defined in P13. P13 is defined in speed control mode as a percentage of the set speed and is an absolute limit.

Speed difference > P13: error E10 is triggered
                   When P13=0, error E10 (and E49) can be switched off.

O5 is toggled (=changed, i.e. from O5="1" to O5="0", from O5="0" to O5="1") following every speed change (set point generator has reached demanded speed)
In case of error (Exx is indicated), O5 remains at the current value.
Can be adjusted using: P227 bit 4 = "1"

Special features in speed control mode:

OM1: O5 toggles when speed is reached

Example:

<table>
<thead>
<tr>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>t</td>
</tr>
<tr>
<td>O5</td>
</tr>
</tbody>
</table>

⑴ Bit counting begins with 0.
⑵ OM1: operating mode 1
OM2: O5 = "1": nominal value reached and speed error < P14.
If the speed deviation returns to > P14, O5="0" is set.
Can be adjusted using: P227 bit 4 ="0" (default setting)

OM3: O5 = "1": nominal value reached (independent of P14)

Example:

29 Bit counting begins with 0.
8.4.34 PLC sequential step tracking

Use the function "O5 toggles when position/speed reached" and a marker in the PLC to implement precise tracking of the COMPAX. This also recognizes positioning processes which are completed again during the next PS cycle.

**Implementation:**

The PLC marker is toggled when a positioning command is transmitted. The "EXCLUSIVE-OR" operation of the PLC marker and output O5 can be processed as a PLC-internal "Position reached" message.
8.4.35 Engaging and disengaging the motor brake

COMPAX controls the idle holding brake of the motor and final stage. The time behaviour can be set using P17 and P211 Bit 2.

Application: If you are using an axis which is under torque when idle (e.g. when using a z axis), the drive can be engaged and disengaged in a manner which ensures that the load does not move. To do this, the drive remains powered during the reaction time of the idle holding brake. This can be set using P17 (see following diagrams).

Final stage blocked by:
- error or
- OUTPUT O0="1" or
- emergency STOP.

The final stage is enabled via:
- quit or
- OUTPUT O0="0" or
- once Power is on with P211 Bit 2="0".

The final stage is enabled via:
- OUTPUT O0="0"
P211 Bit 2="1"
(the lag of 0.5s is switched off)

<table>
<thead>
<tr>
<th>P17=0</th>
<th>P17&gt;0</th>
</tr>
</thead>
<tbody>
<tr>
<td>power output stage enable</td>
<td>disabled</td>
</tr>
<tr>
<td>disable</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Range of values for P17:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Meaning</strong></td>
</tr>
<tr>
<td>Braking delay</td>
</tr>
</tbody>
</table>
Output of variable voltage

8.4.36 Output of variable voltage

The direct output of variable voltage is supported via the D/A monitor channels 0 to 3.

**Service D/A monitor (channels 2 & 3):**

Addressable using parameters P76 (channel 2) and P77 (channel 3)

P76 Channel 2 X11/4
P77 Channel 3 X11/5

Resolution: 8 bit (incl. sign); corresponds to a resolution of 80 mV
Range: -10V...+10V

The calculation for output on the 8 bit channels 2 & 3 is as follows:

Parameter setting for required voltage U (-10V ... +10V)
P76 (P77) = 39 + Y (39,Y)

39: selection of voltage output

For positive voltage: \( Y = \frac{U}{10V} \times 0.0101067 \)
For negative voltage: \( Y = \left( \frac{U}{10V} + 0.0202134 \right) \)
(Note: set U negative in the 2nd formula)

**Option D/A monitor (channels 0 & 1):**

Addressable using P71 (channel 0) and P72 (channel 1)

P71 Channel 0 X17/1
P72 Channel 1 X17/2

Resolution: 12 bit (incl. sign); corresponds to a resolution of 5 mV
Range: -10V...+10V

The calculation for the output on the 12-bit channels 0 and 1 is as follows:

Parameter setting for required voltage U (-10V ... +10V)
P71 (P72) = Y
P73 (P74) = 39: selection of voltage output

Calculating the output value:

\( Y = \frac{U}{10V} \times 101067 \)
8.5  Optimization functions

Important requirements for a rapid, stable adjustment are the correct information about the physical characteristic values of the application. COMPAX requires the following data:

- **The parameters of the motor.**
  - For Parker – standard motors, select the connected motor type from a list; the relevant parameters are stored in the ServoManager.
  - For other motors, the relevant parameters P100-P133 must be set according to the connected motor (see from Page 91).

- **The parameters of the application.**
  - These are mainly the moments of inertia (with and without load) that the drive has to move, which are set, depending on the drive type, via the parameters P80 ... P92.
  - Dependent on the sensor system, you can select from 2 structure variants; these also contain (set via the ServoManager) fixed settings of optimizing parameters.
    - The standard structure corresponds to the previous COMPAX control structure.
    - With the standard structure, you can directly transfer previous, already optimized parameter sets.

- **After this, the optimal control dynamic is set by increasing the stiffness (P23).**
  - This is usually sufficient to obtain good control results.

**User-defined settings**

- For further optimization, you can adapt the parameters of the set structure variants optimally to your application (user-defined settings).
- As another alternative, you can select structure variant 3 and optimize it with the relevant parameters.

**Optimizing the movement cycle**

- At the end of every optimization of the control accuracy, the movement cycle must be optimized. For this, use the pre-control parameters P25, P26, P69 and P70.

- **Optimizing with the ServoManager:**
  - Use the menu "Online: Parameters" to change the optimizing parameters directly in COMPAX (these settings are accepted after modification with "Return").
Optimization process:

Select structure/parameter variant 1
P59=4 (Optimise P24 if necessary)

Sensor

Select structure/parameter variant 2
P59=3 (Optimise P24 if necessary)

Motor with resolver

Motor with SinCos

Set motor
Configure drive type:
Parameters P81 ... P92

Increase control dynamic
Increase P23
Travel slowly over the positioning range
⇒ stable, quiet travelling
⇒ unstable, unquiet travelling
(no longer corresponds to the requirements)
Reset P23 to the last setting

Further optimization?

yes

no

Further optimization?

yes

no

Evaluate results.
Set best result.

Optimizing the movement cycle
Optimise pre-control parameters P25 ↓↑ (rpm pre-control), P26 ↓ (acceleration pre-control), P69 ↓ (current pre-control) and P70 ↓ (return pre-control).

Check current restriction:
During acceleration/braking, the current limit should not be reached or only briefly.
The optimizing display (P233/234=13 and 14) shows the time in which the controller is operating at the current limit.
Use the pre-control parameters or increase ACCEL to reduce the "time at current limit".

User-defined settings
Modify P56 ↓↑ (D section rpm controller)
Increase P23
Travel slowly over the positioning range
⇒ stable, quiet travelling
⇒ unstable, unquiet travelling
(no longer corresponds to the requirements)
Reset P23 & P56 to the last setting
Implement the same process for P57 ↓ (lag D section), P58 ↓ (lag rpm filter) and P151 ↓↑ (monitor speed)!

User-defined settings with variant 3
(P59= 8)
Modify P56 ↓↑ (D section rpm controller)
Increase P23
Travel slowly over the positioning range
⇒ stable, quiet travelling
⇒ unstable, unquiet travelling
(no longer corresponds to the requirements)
Reset P23 & P56 to the last setting
Implement the same process for P57 ↓ (lag D section), P58 ↓ and (lag rpm filter)!

Note
• The arrows behind the parameters show the preferred direction for the parameter optimization.
  ↓ Reduce parameter
  ↑ Increase parameter
  ↓↑ Both directions could lead to a better setting.
• The optimizing direction shown usually leads to a good control result in our experience: however, this cannot apply to every application case!
8.5.1 Optimization parameters

Structure variants:

In addition to the standard structure (which corresponds to the previous COMPAX control structure), you can select from 3 structure variants. These include, in addition to a specific control structure, pre-defined settings for specific optimizing parameters. By selecting the individual structures in the ParameterEditor, the following parameters can be set:

<table>
<thead>
<tr>
<th>No.</th>
<th>Meaning</th>
<th>Standard</th>
<th>Variant 1</th>
<th>Variant 2</th>
<th>Variant 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>P59</td>
<td>Structure switch measuring</td>
<td>0</td>
<td>4</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>P56</td>
<td>D section rpm controller (%)</td>
<td>0</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>P57</td>
<td>Filter acceleration (%)</td>
<td>100</td>
<td>175</td>
<td>350</td>
<td>100</td>
</tr>
<tr>
<td>P58</td>
<td>Lag rapid rpm signal (%)</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>P50</td>
<td>Monitor</td>
<td>100</td>
<td>101</td>
<td>101</td>
<td>100</td>
</tr>
<tr>
<td>P151</td>
<td>Monitor speed (%)</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>P27</td>
<td>Moment of inertia (%)</td>
<td>100</td>
<td>100</td>
<td>85</td>
<td>100</td>
</tr>
<tr>
<td>P69</td>
<td>Return pre-control (%)</td>
<td>0</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>P70</td>
<td>Current pre-control value (%)</td>
<td>0</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Standard: Previous COMPAX control structure; use this structure if you already have optimized parameter sets.

Variant 1: Structure switch: Variant 1 for resolver

Variant 2: Structure switch: Variant 2 for SinCos®

Variant 3: Structure switch: Variant 3 “Rapid rpm controller”

P59: Structure switch measuring

The structure switch measuring (P59) permits the following settings:

<table>
<thead>
<tr>
<th>No.</th>
<th>Meaning</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>P59</td>
<td>Structure switch measuring</td>
<td>0: Standard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4: Variant 1 (for resolver)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3: Variant 2 (for SinCos®)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8: Variant 3 (rapid rpm controller)</td>
</tr>
<tr>
<td></td>
<td>Sensitive stiffness (P23)</td>
<td>+16</td>
</tr>
<tr>
<td></td>
<td>Larger setting range for P23</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sensitive D section (P56)</td>
<td>+65536</td>
</tr>
<tr>
<td></td>
<td>Larger setting range for P56</td>
<td>The D section is reduced by 1/256.</td>
</tr>
</tbody>
</table>

By selecting a structure variant with the structure switch P59, no further parameters are influenced. Only by selecting a variant through ServoManager (menu parameters: controller structure / monitor) can complete parameter sets (as described above) be set.

P23: stiffness of drive

The stiffness is proportional to the controller speed.
Nominal value: 100% Range: 10%...5000%

Increase stiffness

Control is faster. The control circuit starts from a critical value. Set the stiffness so that sufficient safety distance from the critical value is ensured.

Reduce stiffness

Control is slower. This increases lag error. Current limitation is reached later.
Damping influences the height of the harmonies and reduces the vibrations. Nominal value: 100%  Range: 0%...500%

Increase damping
Harmonies become smaller. The drive vibrates at high frequency from a specific value.

Reduce damping
The harmonies of the actual value increase and it vibrates longer around the nominal value. The drive vibrates permanently from a specific value.

---

P56: D section rpm controller
Nominal value: 0  Range: 0%...500%
The D section should generally be set for elastically coupled double mass systems. These are systems in which the connection between the motor and the load is not rigid. It must be noted here, that with sufficiently high torques being transmitted, even supposedly rigid connections can become elastic.

P57: Lag D section rpm controller
Nominal value: 100%  Range: 0%...550%

P58: Lag rpm filter
Nominal value: 100%  Range: 0%...550%

P27: moment of inertia
Use this parameter to adapt the controller to very large changes in load. Nominal value: 100%  Range: 10%...500%
COMPAX is informed of the relative change in moment of inertia which occurs before a change in load when the motor is idle (e.g. via the RS232 interface). The nominal value (100%) corresponds to the value calculated by parameters P81 to P92.

Note: After changing P27, P23 usually needs modification P23 in order to achieve optimal control results.
Advance control of speed, acceleration and power

Advantages:
- Minimum lag error
- Better attenuation characteristics
- Higher dynamic levels with lower maximum current

Principle:
The positioning process is calculated in the nominal value setter and is specified to the position controller as the nominal value. This ensures that the nominal value setter contains the advance information required for positioning: speed, acceleration and power processes. This information is switched to the controller so the lag error is reduced to a minimum, the controller has better attenuation characteristics and drive dynamics are increased.

Main structure:

Without advance control measures:

Reference value, actual value
Driving fault, current

1: Nominal speed value
2: Actual speed value
3: Motor speed value
4: Lag error
Operating Instructions

Optimization parameters

P25: Advance speed control:
Nominal value: 100% Range: 0%...500%

1: Nominal speed value
2: Actual speed value
3: Motor power
4: Lag error

P26: Advance acceleration control
Nominal value: 100% Range: 0%...500%

1: Nominal speed value
2: Actual speed value
3: Motor power
4: Lag error

P70: Advance power control
Nominal value: 100% Range: 0%...500%

1: Nominal speed value
2: Actual speed value
3: Motor power
4: Lag error

Advance reverse control

The advance reverse control can be engaged to increase optimization of guide characteristics and reduce dynamic lag error by using P69. Nominal value: 100% Range: 0 ... 500% default value: 0; applies to VP
## Control processes for optimization

<table>
<thead>
<tr>
<th>Targets / problems</th>
<th>Stiffness (P23)</th>
<th>Damping (P24)</th>
<th>Advance contr. factors (P25, P26, P70)</th>
<th>Acceleration time (ACCEL)</th>
<th>Ramp shape (P94)</th>
<th>Other measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimizing lag error</td>
<td>increase</td>
<td>-</td>
<td>=100% optimize if necessary</td>
<td>increase</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>No harmonies</td>
<td>-</td>
<td>increase</td>
<td>decrease</td>
<td>increase</td>
<td>quadratic (P94=&quot;3&quot;)</td>
<td>increase max. torque (P16)</td>
</tr>
<tr>
<td>Unusually high harmonies caused by power limitation</td>
<td>decrease</td>
<td>decrease</td>
<td>decrease</td>
<td>increase</td>
<td>linear (P94=&quot;1&quot;)</td>
<td>increase max. torque (P16)</td>
</tr>
<tr>
<td>Vibrating at higher frequencies (perceptible as noise)</td>
<td>decrease</td>
<td>decrease</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>check min. mass (P92) and min. moment of inertia (P81)</td>
</tr>
<tr>
<td>Vibrating at lower frequencies (perceptible as motion)</td>
<td>-</td>
<td>increase</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>check max. mass (P88) and max. moment of inertia (P82)</td>
</tr>
<tr>
<td>High motor or final stage temperatures</td>
<td>decrease</td>
<td>-</td>
<td>-</td>
<td>increase</td>
<td>linear (P94=&quot;1&quot;)</td>
<td>decrease max. torque (P16)</td>
</tr>
</tbody>
</table>
8.5.2 Speed monitor

**Speed determination standard:**
In COMPAX the drive speed is required as an actual value for speed control (loop underlying the position control).
The actual speed value is derived by differentiating the position signal.
In certain applications, such as with large ratios \( J_{\text{load}} / J_{\text{motor}} \), the loop response time is limited by quantization noise.

**Speed monitor:**
COMPAX includes a speed monitor for determining speed, which can be turned on using parameter P50.
Use the speed monitor to set a higher level of stiffness corresponding to a faster control process.

**Function:**
The monitor reproduces the dynamic behavior of the drive. It receives the same input signal as the physical drive. An additional loop is used to compare the output magnitude with the actual output magnitude of the drive (actual position value from resolver) and hold it at the same value. This additional loop makes corrections to the internal monitor values.
The advantage is that the speed is available directly as an intermediate value of the monitor and can be used for speed control.
Use this speed signal to attain a stable control process or to operate the drive control process with higher levels of stiffness (P23) and the same levels of damping.

**Settings:**
P50=100: without monitor (default setting and function as before)
P50=101: with monitor
  P151: responsiveness of the monitor control (standard 30%)
  P151>30%: monitor loop becomes faster
  P151<30%: monitor loop becomes slower

**Using the speed monitor:**
- For large ratios \( J_{\text{load}} / J_{\text{motor}} \).

→ Note! Do not use the speed monitor when operating asynchronous motors.
8.5.3 Optimization display

The optimization display (status S13 and S14) is an aid for optimizing COMPAX without the need for an additional visual aid. It provides access to the characteristic parameters of the positioning process (optimization parameters).

From a selection of 14 different parameters for the positioning process, you can assign 2 parameters to the status values S13 and S14 by using the parameters P233 (S13) and P234 (S14).

The optimization parameters are reset before each new positioning process and they are continually updated during the positioning process.

<table>
<thead>
<tr>
<th>P233/P234</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Positioning time (from start of positioning to &quot;Position reached&quot;)</td>
</tr>
<tr>
<td>2</td>
<td>max. intermediate circuit voltage in [V]</td>
</tr>
<tr>
<td>3</td>
<td>reserved</td>
</tr>
<tr>
<td>4</td>
<td>max. undershoot referenced to max. position (amount) (only for highly shifted loops)</td>
</tr>
<tr>
<td>5</td>
<td>max. position overshoot [units corresp. P90] (amount)</td>
</tr>
<tr>
<td>6</td>
<td>max. position undershoot [units corresp. P90] (amount)</td>
</tr>
<tr>
<td>7</td>
<td>max. acceleration lag error [units corresp. P90]</td>
</tr>
<tr>
<td>8</td>
<td>max. braking lag error [units corresp. P90]</td>
</tr>
<tr>
<td>9</td>
<td>max. acceleration speed in [%] of motor nominal speed</td>
</tr>
<tr>
<td>10</td>
<td>max. braking speed in [%] of motor nominal speed</td>
</tr>
<tr>
<td>11</td>
<td>max. acceleration current in [%] of motor nominal current</td>
</tr>
<tr>
<td>12</td>
<td>max. braking current in [%] of motor nominal current</td>
</tr>
<tr>
<td>13</td>
<td>max. time in current limit for acceleration, in [ms]</td>
</tr>
<tr>
<td>14</td>
<td>max. time in current limit for braking, in [ms]</td>
</tr>
<tr>
<td>56</td>
<td>square of peak motor current (reference value: 80 000A²)</td>
</tr>
</tbody>
</table>

Enter the corresponding number in the first column in the parameter. This means ♦ P233 determines status S13 ♦ P234 determines status S14

P233/P234 are set as valid with VP
You will find a complete status list on Page 207.

**Square of peak motor current**

**Reference value: 80 000A^2**

The maximum peak current of a motor phase is continually determined once COMPAX is switched on and this is stored as status S13 or S14 using P233/234=56.

This display is generated as long as the motor is powered. The value is reset when COMPAX is switched off (after “OFF”).

Obtaining the peak motor current using S13 (P233=56) as an example:

\[
I_{max} = \sqrt{S13 \times 80000A^2}
\]

Use the effective value

\[
I_{eff} = \frac{I_{max}}{\sqrt{2}}
\]

to calculate the peak load within the motor cycle.

If this value rises to 1.5 times the peak current of the system, error E41 is triggered.

You will find more detailed explanations on the limiting characteristics of COMPAX on Page 222.
### Access to additional parameters via S13 and S14:

<table>
<thead>
<tr>
<th>P233/P234</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Current number of HEDA transmission errors</td>
</tr>
<tr>
<td>16</td>
<td>Average no. of HEDA transmission errors per second</td>
</tr>
<tr>
<td>17</td>
<td>Total number of HEDA transmission errors since beginning of synchronization</td>
</tr>
<tr>
<td>18</td>
<td>Process nominal value received via HEDA</td>
</tr>
<tr>
<td>19</td>
<td>HEDA control word</td>
</tr>
<tr>
<td></td>
<td>Bit 3: Transmission error COMPAX -&gt; IPM</td>
</tr>
<tr>
<td></td>
<td>Bit 8: fast start via HEDA</td>
</tr>
<tr>
<td>20</td>
<td>HEDA status word</td>
</tr>
<tr>
<td></td>
<td>Bit 0=“1”: no errors (corresponds to COMPAX output O1)</td>
</tr>
<tr>
<td></td>
<td>Bit 1=“1”: no warnings (corresponds to COMPAX output O2)</td>
</tr>
<tr>
<td></td>
<td>Bit 3=“1”: transmission error IPM -&gt; COMPAX</td>
</tr>
<tr>
<td></td>
<td>Bit 8=“1”: COMPAX lag warning (=“1” - in position, i.e. within lag warning window)</td>
</tr>
<tr>
<td></td>
<td>Bit 9=“1”: HEDA interface active (COMPAX synchronized)</td>
</tr>
<tr>
<td></td>
<td>Default setting: Bit 0=“1”, Bit 1=“1”, Bit 3=“0”, Bit 8=“1”, Bit 9=“1”: S13/S14=771</td>
</tr>
<tr>
<td>21</td>
<td>CPX X50 max. pos. synchronous lag error [units corresp. P90]</td>
</tr>
<tr>
<td>22</td>
<td>CPX X50 max. neg. synchronous lag error [units corresp. P90]</td>
</tr>
<tr>
<td>23</td>
<td>Output value of D/A monitor channel 0 (10V corresponds to 1)</td>
</tr>
<tr>
<td>24</td>
<td>Output value of D/A monitor channel 1 (10V corresponds to 1)</td>
</tr>
<tr>
<td>25</td>
<td>Output value of service D/A monitor channel 2 (10V corresp. to 1)</td>
</tr>
<tr>
<td>26</td>
<td>Output value of service – D/A monitor channel 3 (10V corresp. to 1)</td>
</tr>
<tr>
<td>27</td>
<td>External encoder position [units corresp. P90]</td>
</tr>
<tr>
<td>28</td>
<td>Measuring error (Difference between resolver position and external encoder position in the unit corresponding to P90)</td>
</tr>
<tr>
<td>29</td>
<td>Effective motor load in % of the permitted continuous motor load (E53 is indicated from 100%)</td>
</tr>
<tr>
<td>30</td>
<td>Effective unit load in % of the permitted continuous unit load (E53 is indicated from 100%)</td>
</tr>
<tr>
<td>31</td>
<td>Mark synchronization function indicator (COMPAX XX70)</td>
</tr>
<tr>
<td>32</td>
<td>“Scaled correction factor” (COMPAX XX70)</td>
</tr>
<tr>
<td>33</td>
<td>“Cycle counter” (COMPAX XX70)</td>
</tr>
<tr>
<td>35</td>
<td>Digital inputs I1-I16</td>
</tr>
<tr>
<td>36</td>
<td>Status S16 (bits 16...23) and digital outputs O1-O16 (bits 0...15)</td>
</tr>
<tr>
<td>37</td>
<td>Encoder frequency channel 4 in incr./ms” (COMPAX XX60, COMPAX XX7X)</td>
</tr>
<tr>
<td>39</td>
<td>Cause of calculation error E07</td>
</tr>
<tr>
<td></td>
<td>0  Invalid Operator</td>
</tr>
<tr>
<td></td>
<td>1  Division by 0</td>
</tr>
<tr>
<td></td>
<td>2  Overflow</td>
</tr>
<tr>
<td></td>
<td>3  Underflow</td>
</tr>
</tbody>
</table>

The corresponding number in the first column should be entered in the parameter. This means

- P233 determines status S13
- P234 determines status S14

You will find additional special diagnosis values on Page 210.

---

31 Bit counting begins with 0.
8.5.4 External position localization with position adjustment

Only available in COMPAX XX00!

The external position localization with position adjustment described below is only available in the standard unit (COMPAX XX00). Solutions adapted to specific applications are available in the unit variants.

A slip between motor position and the position of the drive (e.g. a material feed) is not detected. If the slip is too large, the external position can be entered (e.g. recorded by a measuring wheel) using encoder channel 1. In this way, COMPAX corrects the internal actual position value.

To limit access to the position adjustment, use P36 to limit the speed correction value resulting from the difference in positions.

This can be especially useful in the acceleration phase, if the material is slipping through because of the higher correction speed.

Recommendation: To avoid all inaccuracies during internal calculations, it is important to use the measuring unit "Increments".

Configuring the external position adjustment:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Meaning</th>
<th>valid from..</th>
</tr>
</thead>
<tbody>
<tr>
<td>P75</td>
<td>Maximum permitted measuring error (difference between resolver position and encoder position) <strong>The external position adjustment is enabled using measuring error P75 &gt; 0.</strong> When P75 is reached, error E15 is generated and the drive is switched off.</td>
<td>VP</td>
</tr>
<tr>
<td>P36</td>
<td>Limitation of speed correction value for external position adjustment (only available in COMPAX XX00 and COMPAX XX30) &quot;0&quot;: switched off (default value) When P36=0, the speed correction value is not limited. P36 is specified in % of the nominal speed (P104). <strong>Note! When position localization is switched off, P36 must = 0!</strong></td>
<td>VP</td>
</tr>
<tr>
<td>P144</td>
<td>Sets encoder channel 1 =&quot;4&quot;: without external position localization =&quot;6&quot;: external position localization switched on via channel 1.</td>
<td>VC</td>
</tr>
<tr>
<td>P143</td>
<td>Number of encoder pulses per encoder rotation from channel 1; range: 120...2 000 000.</td>
<td>VC</td>
</tr>
<tr>
<td>P98</td>
<td>Travel of load per encoder rotation units (corresp. to P90).</td>
<td>VC</td>
</tr>
</tbody>
</table>
**Optimization functions**

*External position localization with position adjustment*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Meaning</th>
</tr>
</thead>
</table>
| P214 | Encoder direction.  
  *="0": positive direction for encoder rotating clockwise.  
  *="1": positive direction for encoder rotating anti-clockwise.  
  **Setting aid:**  
  ♦ Switch off external position adjustment (P144=4) and data record P214=0.  
  ♦ Note S42 (position of external sensor).  
  ♦ Proceed with POSR x axis.  
  ♦ S1 and S42 must change by the same value (x).  
  • If the prefix of the modification is different, set data record P214="1".  
  • If the modification has a different amount, check P143 and P98.  

Using  
\[ K = \frac{P98 \times 16384}{P83 \times P143} \]

**Limit values of parameters**

A number overrun is possible in special applications. To prevent this occurring, the following condition must be met: \( V \geq 1 \)

Determine \( V \) depending on drive type and measuring unit:

<table>
<thead>
<tr>
<th>Drive type</th>
<th>Measuring unit</th>
<th>Determining ( V )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spindle drive</td>
<td>mm (inch)</td>
<td>( V = K \times P85(\times 25.4) )</td>
</tr>
<tr>
<td>Rack-and-pinion/toothed belt</td>
<td>mm (inch)</td>
<td>( V = K \times P85(\times 25.4) )</td>
</tr>
<tr>
<td>General drive</td>
<td>mm (inch)</td>
<td>( V = K \times 1000(\times 25.4) )</td>
</tr>
<tr>
<td>General drive</td>
<td>Incr.</td>
<td>( V = K )</td>
</tr>
</tbody>
</table>

**Slip filter for external position localization**

A slip filter with a differentiating element (D-element) is provided to optimize external position adjustment.

<table>
<thead>
<tr>
<th>No.</th>
<th>Meaning</th>
<th>Unit</th>
<th>Minimum value</th>
<th>Default value</th>
<th>Maximum value</th>
<th>Valid from...</th>
</tr>
</thead>
<tbody>
<tr>
<td>P67</td>
<td>D-element slip filter</td>
<td>%</td>
<td>0</td>
<td>100</td>
<td>500</td>
<td>VP</td>
</tr>
<tr>
<td>P68</td>
<td>Slip filter lag</td>
<td>%</td>
<td>0</td>
<td>100</td>
<td>5000</td>
<td>VP</td>
</tr>
</tbody>
</table>

Both parameters are set to 100% as standard. The time constants are then identical and the filter ineffective. Meaning:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Effect</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>P67 = P68</td>
<td>Filter ineffective (standard)</td>
<td></td>
</tr>
</tbody>
</table>
| P67 < P68 or P67 = 0 | Filter has delaying effect | ♦ Low resolution of measuring system  
  ♦ Interference on the measuring signal |
| P67 > P68 | Filter has differentiating effect | at high dynamic requirements.  
  **Conditions:** high-resolution measuring system and low interference on the measuring signal. |
8.6 Interfaces

The COMPAX interfaces for data and status are digital inputs with an PLC data interface, an RS232 interface and an optional bus interface (Interbus S, CAN bus, CANopen, profibus, CS31 or RS485). The RS232 interface can be operated simultaneously with other interfaces.

8.6.1 Digital inputs and outputs

To control the program process, 16 inputs and 16 outputs are available (8 inputs and 8 outputs with COMPAX 1000SL).

O7-O11 and I7-I11 are assigned when the PLC data interface is switched on.

<table>
<thead>
<tr>
<th>Input</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1 (X8/1; X19/x)</td>
<td>SHIFT</td>
</tr>
<tr>
<td>I2 (X8/2; X19/x)</td>
<td>Manual+</td>
</tr>
<tr>
<td>I3 (X8/3; X19/x)</td>
<td>Hand–</td>
</tr>
<tr>
<td>I4 (X8/4; X19/x)</td>
<td>Quit</td>
</tr>
<tr>
<td>I5 (X8/5; X19/x)</td>
<td>START</td>
</tr>
<tr>
<td>I6 (X8/6; X19/x)</td>
<td>Stop (interrupts data record)</td>
</tr>
<tr>
<td>I7 (X8/7; X19/x)</td>
<td>Freely assignable in the standard unit.</td>
</tr>
<tr>
<td>I8 (X8/8; X19/x)</td>
<td>Freely assignable in the standard unit.</td>
</tr>
<tr>
<td>SHIFT I2</td>
<td>Find machine zero (MZ)</td>
</tr>
<tr>
<td>SHIFT I3</td>
<td>Approach real zero (RZ)</td>
</tr>
<tr>
<td>SHIFT I4</td>
<td>Teach real zero</td>
</tr>
<tr>
<td>SHIFT I5</td>
<td>reserved</td>
</tr>
<tr>
<td>SHIFT I6</td>
<td>Break (breaks off data record)</td>
</tr>
<tr>
<td>I9 (X10/1; X19/x)</td>
<td>Freely assignable in the standard unit.</td>
</tr>
<tr>
<td>I10 (X10/2; X19/x)</td>
<td>Freely assignable in the standard unit.</td>
</tr>
<tr>
<td>I11 (X10/3; X19/x)</td>
<td>Assigned when P232=4 (activates position adjustment); otherwise free.</td>
</tr>
<tr>
<td>I12 (X10/4; X19/x)</td>
<td>Freely assignable in the standard unit.</td>
</tr>
<tr>
<td>I13 (X10/5; X19/x)</td>
<td>Freely assignable in the standard unit.</td>
</tr>
<tr>
<td>I14 (X10/6; X19/x)</td>
<td>Assigned when mark reference is activated (P35=1) (activates mark reference); otherwise free.</td>
</tr>
<tr>
<td>I15 (X10/7; X19/x)</td>
<td>Fast start (can be activated using P18)</td>
</tr>
<tr>
<td>I16 (X10/8; X19/x)</td>
<td>Is assigned if mark reference is activated (P35=1) (mark input); otherwise free.</td>
</tr>
</tbody>
</table>

The assignment of inputs on X19 applies only to COMPAX 1000SL.
<table>
<thead>
<tr>
<th>Output</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>O1 (X8/9; X19/x)</td>
<td>=&quot;1&quot;: No fault &lt;br&gt;=&quot;0&quot;: errors E1 ... E58; the drive does not accept any positioning commands. After &quot;Power on&quot; O1 remains at &quot;0&quot; until after the self test.</td>
</tr>
<tr>
<td>O2 (X8/10; X19/x)</td>
<td>=&quot;1&quot;: No warning &lt;br&gt;=&quot;0&quot;: error ≥ E58</td>
</tr>
<tr>
<td>O3 (X8/11; X19/x)</td>
<td>Machine zero has been approached</td>
</tr>
<tr>
<td>O4 (X8/12; X19/x)</td>
<td>Ready for start</td>
</tr>
<tr>
<td>O5 (X8/13; X19/x)</td>
<td>Programmed nominal position reached</td>
</tr>
<tr>
<td>O6 (X8/14; X19/x)</td>
<td>Idle after stop</td>
</tr>
<tr>
<td>O7 (X8/15; X19/x)</td>
<td>Freely assignable in the standard unit.</td>
</tr>
<tr>
<td>O8 (X8/16; X19/x)</td>
<td>Freely assignable in the standard unit.</td>
</tr>
<tr>
<td>O9 (X10/9; X19/x)</td>
<td>Freely assignable in the standard unit.</td>
</tr>
<tr>
<td>O10 (X10/10; X19/x)</td>
<td>Freely assignable in the standard unit.</td>
</tr>
<tr>
<td>O11 (X10/11; X19/x)</td>
<td>Freely assignable in the standard unit.</td>
</tr>
<tr>
<td>O12 (X10/12; X19/x)</td>
<td>Freely assignable in the standard unit.</td>
</tr>
<tr>
<td>O13 (X10/13; X19/x)</td>
<td>Freely assignable in the standard unit.</td>
</tr>
<tr>
<td>O14 (X10/14; X19/x)</td>
<td>Freely assignable in the standard unit.</td>
</tr>
<tr>
<td>O15 (X10/15; X19/x)</td>
<td>Freely assignable in the standard unit.</td>
</tr>
<tr>
<td>O16 (X10/16; X19/x)</td>
<td>For &quot;0&quot;: mark disappears after max. feed length 32</td>
</tr>
</tbody>
</table>

The assignment of outputs on X19 applies only to COMPAX 1000SL.

---

32 Only assigned if the mark reference is activated (P35=1).
## Digital inputs and outputs for COMPAX 1000SL

### Allocation of logic inputs for input pins of X19

The source (input pin on X19) from which the respective logic input is to be read is specified via parameters P156, P157 and P158. Inputs which are not read by an input pin on X19 can be allocated a fixed "0" or "1" (this is not, of course, applicable for all inputs). The parameters are 24 bits large with 4 bits defined per logic input. This allocation can be easily done with the assistance of the ServoManager.

With direct access via RS232, a terminal or a fieldbus, the following table can be used for setting the parameters.

<table>
<thead>
<tr>
<th>Source</th>
<th>fixed logical value (0 or 1) or pin of X19</th>
<th>factor</th>
<th>computed values</th>
<th>Allocation: Input reads from which source</th>
<th>Logical inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>=0 /1 /2 /3 /4 /5 /6 /7 /8 /9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value:</td>
<td>0 1 2 3 4 5 6 7 8 9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SOURCE</td>
<td>factor</td>
<td>computed values</td>
<td>Allocation: Input reads from which source</td>
<td>Logical inputs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>=0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>/1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>/2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>/3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>/4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>/5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>/6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>/7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>/8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>/9</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Note

Note that only one selection can be made per line, i.e. only one cross is permitted!
Example:

The following assignment must be configured:

<table>
<thead>
<tr>
<th>Source</th>
<th>Logical inputs</th>
<th>Allocation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;0&quot;</td>
<td>→ input 1</td>
<td>Input 1</td>
</tr>
<tr>
<td>X19 pin 3</td>
<td>→ input 2</td>
<td>Input 2</td>
</tr>
<tr>
<td>X19 pin 4</td>
<td>→ input 3</td>
<td>Input 3</td>
</tr>
<tr>
<td>X19 pin 5</td>
<td>→ input 4</td>
<td>Input 4</td>
</tr>
<tr>
<td>X19 pin 6</td>
<td>→ input 5</td>
<td>Input 5</td>
</tr>
<tr>
<td>X19 pin 7</td>
<td>→ input 6</td>
<td>Input 6</td>
</tr>
<tr>
<td>&quot;0&quot;</td>
<td>→ input 7</td>
<td>Input 7</td>
</tr>
<tr>
<td>&quot;0&quot;</td>
<td>→ input 8</td>
<td>Input 8</td>
</tr>
<tr>
<td>&quot;0&quot;</td>
<td>→ input 9</td>
<td>Input 9</td>
</tr>
<tr>
<td>&quot;0&quot;</td>
<td>→ input 10</td>
<td>Input 10</td>
</tr>
<tr>
<td>X19 pin 8</td>
<td>→ input 12</td>
<td>Input 12</td>
</tr>
<tr>
<td>X19 pin 9</td>
<td>→ input 13</td>
<td>Input 13</td>
</tr>
<tr>
<td>&quot;1&quot;</td>
<td>→ input 14</td>
<td>Input 14</td>
</tr>
<tr>
<td>&quot;0&quot;</td>
<td>→ input 15</td>
<td>Input 15</td>
</tr>
<tr>
<td>X19 pin 10</td>
<td>→ input 16</td>
<td>Input 16</td>
</tr>
</tbody>
</table>

The remaining inputs stay open and are therefore not imported.
You can see the calculation of the setting values on the right.

Note
- It is in principle possible to read 2 inputs from the same input pin. Of course note should be taken of the resulting function.
- If you do not need the enable input I12, fixed logic "1" can be allocated.
- With P233=49 (or P234=49), physical inputs pin 9 – pin 2 are written to the optimization display status S13 (S14). Meaning: pin 2 = bit 0 ... pin 9 = bit 7.
Allocation of output pins of X19 to the logic outputs

The target (output pin on X19) on which the respective logic output is to be written is specified via parameters P159 and P160. The parameters are 24 bits large with 4 bits defined for allocating each output to an output pin. This allocation can be easily done with the assistance of the ServoManager.

With direct access via RS232, a terminal or a fieldbus, the following table can be used for setting the parameters.

<table>
<thead>
<tr>
<th>Outputs</th>
<th>factor</th>
<th>computed values</th>
<th>Allocation: output is assigned to pin X19 Output Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>value: 0</td>
<td>1</td>
<td>Value * factor</td>
<td>P159 bit 0...3 /15</td>
</tr>
<tr>
<td>1</td>
<td>16</td>
<td>Value * factor</td>
<td>P159 bit 4...7 /16</td>
</tr>
<tr>
<td>2</td>
<td>256</td>
<td>Value * factor</td>
<td>P159 bit 8...11 /17</td>
</tr>
<tr>
<td>3</td>
<td>4096</td>
<td>Value * factor</td>
<td>P159 bit 15...11 /18</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>Value * factor</td>
<td>P160 bit 0...3 /19</td>
</tr>
<tr>
<td>5</td>
<td>16</td>
<td>Value * factor</td>
<td>P160 bit 4...7 /20</td>
</tr>
<tr>
<td>6</td>
<td>256</td>
<td>Value * factor</td>
<td>P160 bit 8...11 /21</td>
</tr>
<tr>
<td>7</td>
<td>4096</td>
<td>Value * factor</td>
<td>P160 bit 15...15 /22</td>
</tr>
</tbody>
</table>

Value of P159: Σ

Value of P160: Σ

Example:
The following assignment must be configured:
Output 1 → X19 Pin 15
Output 3 → X19 Pin 16
Output 4 → X19 Pin 17
Output 5 → X19 Pin 18
Output 8 → X19 Pin 19
Output 10 → X19 Pin 20
Output 14 → X19 Pin 21
Output 16 → X19 Pin 22
You can see the calculation of the setting values on the right.

Note
* With P233=49 (or P234=49 respectively) physical outputs pin 22 – pin 15 are written to the optimization display status S13 (S14). Meaning: pin 15 = bit 8 ... pin 22 = bit 15.
### Free assignment of inputs

You can make the permanently assigned standard inputs I1 to I6 available for assignment using parameter P221. Meaning:

<table>
<thead>
<tr>
<th>Input</th>
<th>Function without SHIFT</th>
<th>Function with SHIFT</th>
<th>Valency</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1 (X8/1)</td>
<td>SHIFT</td>
<td>-</td>
<td>1 (Bit 1)</td>
</tr>
<tr>
<td>I2 (X8/2)</td>
<td>Manual+</td>
<td>Find machine zero (MZ)</td>
<td>2 (Bit 2)</td>
</tr>
<tr>
<td>I3 (X8/3)</td>
<td>Hand–</td>
<td>Approach real zero (RZ)</td>
<td>4 (Bit 3)</td>
</tr>
<tr>
<td>I4 (X8/4)</td>
<td>Quit</td>
<td>Teach real zero</td>
<td>8 (Bit 4)</td>
</tr>
<tr>
<td>I5 (X8/5)</td>
<td>START</td>
<td>reserved</td>
<td>16 (Bit 5)</td>
</tr>
<tr>
<td>I6 (X8/6)</td>
<td>STOP</td>
<td>Break (breaks off data record)</td>
<td>32 (Bit 6)</td>
</tr>
</tbody>
</table>

### Setting P221

Each input is assigned a valency. Calculate the sum of the valencies of the required free inputs and enter this in parameter P221.

**Example:**

Hand+ and Hand- should be possible via the inputs; I1, I4, I5 and I6 should be freely available.

1 (I1) + 8 (I4) +16 (I5) +32 (I6) = 57

You will obtain this setting using P221 = 57.

Note that when I1 is freely assigned (SHIFT), you can no longer perform any “Functions with shift” via the inputs!

You can directly cancel all input functions (apart from Hand+ and Hand-) as commands using interfaces (RS232, bus system).

### Free assignment of outputs

- The status outputs O1 to O6 can be freely assigned using parameter P225.
- Use P223 and P224 to assign the outputs of the OUTPUT WORD command of the bus systems (Interbus-S, Profibus, CAN – Bus, ...).
- Use P245 and P246 to assign the outputs of the HEDA bus (COMPAX with IPM via the option A1).
- Permanently assigned outputs of unit variants (COMPAX XX30, ...) cannot be masked.

### Structural diagram

![Structural diagram](image-url)

33 Counting starts at 1.
Explanation:

The permanently assigned standard outputs O1 to O6 can be made freely available using parameter P225. Meaning:

<table>
<thead>
<tr>
<th>Output</th>
<th>Function</th>
<th>Valency</th>
</tr>
</thead>
<tbody>
<tr>
<td>O1 (X8/1)</td>
<td>&quot;1&quot;: No fault</td>
<td>1 (Bit 1)</td>
</tr>
<tr>
<td></td>
<td>&quot;0&quot;: errors E1 ... E58</td>
<td></td>
</tr>
<tr>
<td>O2 (X8/2)</td>
<td>&quot;1&quot;: No warning</td>
<td>2 (Bit 2)</td>
</tr>
<tr>
<td></td>
<td>&quot;0&quot;: Error ≥ E58</td>
<td></td>
</tr>
<tr>
<td>O3 (X8/3)</td>
<td>Machine zero has been approached</td>
<td>4 (Bit 3)</td>
</tr>
<tr>
<td>O4 (X8/4)</td>
<td>Ready for start</td>
<td>8 (Bit 4)</td>
</tr>
<tr>
<td>O5 (X8/5)</td>
<td>Programmed nominal position reached</td>
<td>16 (Bit 5)</td>
</tr>
<tr>
<td>O6 (X8/6)</td>
<td>Idle after stop</td>
<td>32 (Bit 6)</td>
</tr>
</tbody>
</table>

Each output is assigned a valency. Calculate the total of the valencies for the required free outputs and enter this in parameter P225.

Example:

"Ready for start" and "Idle after stop" should be possible via the outputs; O1, O2, O3 and O5 should be freely available.

\[1 \times (O1) + 2 \times (O2) + 4 \times (O3) + 16 \times (O5) = 23\]

You will obtain this setting using P225 = 23.

Using the interfaces (RS232, bus systems) and using the data record program, the outputs can optionally (in parallel) be described using OUTPUT Ox=y.

PLC data interface

When the PLC data interface is activated, the outputs must not be addressed using the interfaces (RS232, bus systems) or using the data record program.

Note!

Simultaneous operation with the OUTPUT WORD command or with HEDA is not permitted!

Switching to OUTPUT WORD command or to HEDA bus

P223 / P224: switching to OUTPUT WORD command

P245 / P246: switching to HEDA bus

Access to the outputs can be assigned as bits to the OUTPUT WORD command or to HEDA. Only the enabled outputs are then described by the OUTPUT WORD command or by HEDA.

34 Counting starts at 1.
Each output is assigned a valency. Calculate the total of the valencies of the required outputs and enter this in the relevant parameter.

Example: O4 to O16 should be influenced by the OUTPUT WORD command; O1, O2 and O3 should be available via OUTPUT Ox=y.

8 (O4) + 16 (O5) + 32 (O6) + 64 (O7) + 128 (O8) = 248

When P223 = 248 and P224 = 255 (total of all valencies), you will obtain this setting.

### 8.6.1.3 COMPAX virtual inputs

COMPAX provides 48 logic inputs. These are divided into:

- Inputs I1 ... I16 which are actuated via the physical inputs.
- Virtual inputs I17 ... I32 which are activated via a fieldbus (object CPX_STW).
- Virtual inputs I33 ... I48 which are activated via a COMPAX command (OUTPUT O33 ... OUTPUT O48, or abbreviated: OT O33 ... OT O48).

**Access to COMPAX control functions**

Access to COMPAX control functions (functions which are allocated to inputs I1...I16 by default) can be configured via parameters P221 and P222 (see structural diagram on the right).

The allocation of the bits in P221 and P222 respectively to the relevant inputs can be found in the parameter description.

---

35 Counting starts at 1.
### Digital inputs and outputs

#### Logical inputs *

- **I1...I8**
- **I9...I16**

#### Field bus I17...I24

- Logical I1...I8

#### Field bus I25...I32

- Logical I9...I16

#### COMPAX - control functions

- (for P222=0” corresponds to arrangement of inputs I1 to I8)
- SHIFT, Hand+, Hand-, Quit, Start, Stop, approach Mn, approach RN, Tech RN

#### COMPAX – control functions

- (for P221=0” corresponds to arrangement of inputs I1 to I16)

### Structural diagram: Access to COMPAX control functions via inputs

- * The logic inputs I1 ... I16 are, excluding COMPAX 1000SL, also the physical inputs I1 ...I16 on connectors X8 and X10.
- With COMPAX 1000SL, the 8 physical inputs on connector X19 are allocated (via parameters P156 ... P158) to 8 logic inputs from the range I1 ... I16 (see Page 140)

### Remarks regarding the structural diagram

- The control functions corresponding to I1.. I8 cannot be activated via OT O33...OT O40.
- The control functions corresponding to I9...I16 can be activated simultaneously via the physical inputs and via OT O41...OT O48.
- The enable input I12 (in COMPAX 1000SL, COMPAX XX70 and COMPAX XX30) must also be activated when allocated to the fieldbus (via P222).

### Interrogation of inputs in the COMPAX program (IF I ..)

All inputs can be interrogated independently of parameters P221 and P222 in the COMPAX program with IF I .. .

The virtual inputs I33...I48 in the COMPAX program can also be set via the commands OT O33...OT O48.

### COMPAX – program

**Interrogation of inputs with IF I1=**

To IF I48=

Regardless of parameters P221 and P222

With P233=48 (or P234=48), virtual inputs I48 – I25 are written to the optimization display status S13 (S14). Meaning: I25 = bit 0 ... I48 = bit 23.
8.6.1.4 I/O assignment of variants

**COMPAX XX30: Round table control**

| I12: | final stage enable |
| I13: | measuring error compensation by external position measurement |
| I14: | release brake |
| O14: | no measuring error |
| O16: | no power to final stage |

**COMPAX XX50: Synchronous cycle control**

| I6: | STOP ineffective during synchronization process. |
| I1 & I6: | BREAK interrupts the synchronization process. |
| I12: | Material simulation |
| I13: | Manual step |
| I14: | Switches on mark reference |
| I15: | Ends synchronous travel. (The "Fast start" function is not possible) |
| I16: | Mark input |
| O5: | Position reached at synchronization command (WAIT POSA, WAIT POSR) ="0"; when the axis starts ="1"; after return run. |
| O14: | Synchronous comparator |
| O15: | Chaff length |
| O16: | Reject length |

**COMPAX XX60: Electronic transmission**

| I14: | Switches over the dimension reference |
| I15: | Transmission factor selection |
| I16: | Enable master nominal value |

**COMPAX XX70: Cam control**

| I12: | Enable final stage |
| I13: | ="0": Decoupling ="1": Coupling |
| I14: | Mark input |
| I15: | ="0": Disables auxiliary functions ; ="1": Enables auxiliary functions |
| I16: | Enables master position |
| O7...O14: | Digital auxiliary functions. |
| O13/O14: | Cannot be used via OUTPUT. |
| O14: | Mark not in mark window. |
| O15: | Lag warning |
| O16: | Synchronous run |

---

Please refer to the instructions for the variant you are using for up-to-date information!
8.6.1.5 Function of inputs

When working with pre-assigned inputs, always note the following:

♦ The SHIFT signal (I1) may only change if I2...I5 ="0".

![Signal Timing Diagram]

♦ The "STOP" and "BREAK" functions (input I6) have top priority.

♦ For the inputs I1 to I5, only the first input present will be detected and the relevant function activated. The other functions are then blocked; this means, e.g.:
If Quit (I4) is set during a process involving Hand+ (I2="1"), Quit is not detected even after I2="0". A new rising flank will be required for Quit (I4).

Exception: START

If a program is interrupted by STOP when START is present (I5), the program is then continued using I6="0" (STOP is deactivated).

Length of signal ≥ 1ms

For sure detection, the signals must be present for ≥ 1ms.

SHIFT

Input I1

♦ Switches to the functions for inputs I2 to I6.
♦ Signal I1 may only change if I2...I6 ="0".

Hand+/Hand–

Input I2/I3

♦ Processes the axis in manual mode (velocity: P5; ramp time: P9).
♦ Conditions for manual procedure:
  ♦ The axis must be stationary and powered.
  ♦ There must not be any programs running (exception: program is at WAIT START).
♦ When the end limits are reached (P11, P12), the drive is stopped.
♦ The outputs O5 "Nominal position reached" and O4 "Ready for START" are at "0" during manual mode; O5 remains at "0" even once manual mode has been completed.

QUIT

Input I4

♦ Acknowledges an error message or warning.
 ♦ If the error is rectified, O1 "No fault" or O2 "No warning" is set.
 ♦ The following functions are possible when there is an error present:
  ♦ VP, VC, VF
  ♦ Quit
  ♦ OUTPUT O0
  ♦ GOTO data record indicator / password
**START**

<table>
<thead>
<tr>
<th>Input I5</th>
</tr>
</thead>
</table>

- Starts the program data record at WAIT START, after Power On and after STOP.
- Performs the next data records (commands) before the next WAIT START command, an END instruction or a STOP or BREAK signal.
- O4 “Ready for start” is reset.

**Note!**
- Once a positioning process has been interrupted by STOP (I6=“1”), the process can be continued, when START (I5=“1”) is present, using a descending flank at STOP (I6=“0”).

---

**STOP**

| Input I6 |

- The positioning process is interrupted using “1” and the axis is stopped in a controlled manner.
- O4 “Ready for start” and O6 "Idle after stop” =“1”.
- A new start command is required to complete the positioning process. When START is present, resetting the STOP signal is sufficient (I6=“0”).

---

**Find MZ**

| Input SHIFT I2 |

- Finds the machine zero point (when using reversing initiators: process velocity: P3 - the direction of the search can be determined using the P3 sign; ramp time: P7).
- Once the MZ is reached, output O3 "Machine zero approached“ is set. This remains set until another “Find MZ" order is issued.
- Output O5 "Programmed position reached" ="0".
- The data record indicator is reset to N001.
- Reference travel, prompted by the digital inputs, interrupts a positioning command specified by the interfaces (POSA, POSR, LOOP).

---

**Approach RZ**

| Input SHIFT I3 |

- The axis travels to the real zero point (process velocity: P4; ramp time: P8).
- O4 “Ready for start” =“0” until RZ is reached.
- Output O5 "Programmed position reached" ="0", and once real zero is approached =“1”.
- Data record indicator is reset to N001.
- In continuous mode the axis does not move; the data record indicator is set to N001.

---

**Teach in real zero (Teach Z)**

| Input SHIFT I4 |

- The current position of the axis is used as the reference point (real zero) for all positioning instructions; i.e. P1 is modified.
- The data record indicator is set to 1.
- The real zero is stored protected against power failure.
- O4 “Ready for start” is not modified.
- The teach in function can be switched off using P211.
- The function does not operate in continuous mode.
**Input SHIFT I5**

- When P211="3", the data record indicator is set to 1 using "Shift I5".

<table>
<thead>
<tr>
<th>P211</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>The functions I1 + I4, Teach N, I1 + I5 and Teach Z are enabled.</td>
</tr>
<tr>
<td>1</td>
<td>Teach Z is blocked; the data record indicator is set to 1 using I1 + I4 or &quot;Teach Z&quot;.</td>
</tr>
<tr>
<td>2</td>
<td>Teach N is blocked; the data record indicator is set to 1 using I1 + I5 or &quot;Teach N&quot;. (Teach Z is enabled)</td>
</tr>
<tr>
<td>3</td>
<td>The functions Teach N and Teach Z are blocked. With I1 + I4, Teach N, I1 + I5 or Teach Z, the data record indicator is set to 1.</td>
</tr>
</tbody>
</table>

**Break**

- The positioning process is interrupted, the axis is stopped.
- O4 "Ready for start" is reset.
- The program data record is not ended after a start. The next data record applies.

**EMERGENCY STOP**

- During an EMERGENCY STOP, the data record is interrupted, the drive brakes with braking time P10; after P10, the motor is switched off.
- The interrupted data record is continued to its completion after acknowledgment and START.

Transfers that trigger functions are described. All other transfers and statuses do not trigger any functions.

<table>
<thead>
<tr>
<th>Function</th>
<th>I1</th>
<th>I2</th>
<th>I3</th>
<th>I4</th>
<th>I5</th>
<th>I6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Hand+</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End Hand+</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start Hand-</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End Hand-</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QUIT</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>START</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>START</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STOP</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Find MZ</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approach RZ</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teach - RZ</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHIFT I5</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BREAK</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Activate position adjustment**

- Function is switched on by P232="4" (see Page 136).
- I11="0": External position adjustment switched off (reaction time approx. 5 ms).
- I11="1": External position adjustment switched on.
8.6.1.6 Synchronous STOP using I13

I13 in the standard model (COMPAX XX00) provides a STOP function with which you can stop and idle multiple COMPAX units simultaneously, regardless of the current speed.

P219=128 or 135 enables the synchronous stop via I13 (P219 bit 7 = 1).

I13="1": Normal mode
I13="0": Synchronous STOP is activated.

After I13="0"

- the drive is stopped using P10 as the absolute ramp time and
- the ramp type selected via P9437
- Error message E08 is output,
- O1 is set to 0 and
- the ready contact is opened.

While I13=0, any further positioning attempts are negatively acknowledged with E08. No negative acknowledgment comes from HEDA.

Synchronous STOP function using I13 is only available on the standard unit (COMPAX XX00).

Diagram:

Using I13 for stop bring both axes to a stop simultaneously.

---

36 Bit counting begins with bit 0.
37 A modified ramp time is used after "VC" for the "Synchronous stop via I13" function.
### Note for MZ travel:
If MZ travel is interrupted by the synchronous stop, then O3 "Machine zero approached" is not output.

### Additional assignment of P219:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P219 = xx000000=0</td>
<td>COMPAX-M does not evaluate the additional emergency stop input. (Additional emergency stop input: X9/5-X9/6 (front plate); COMPAX-M only)</td>
</tr>
<tr>
<td>P219 = xx000111=7</td>
<td>Emergency stop with P10 as relative ramp time, then switch off, message E56, display E56, output O1 = 0, ready contact removed. Also effective in programming mode!</td>
</tr>
</tbody>
</table>
### 8.6.1.7 Function of outputs

<table>
<thead>
<tr>
<th>No fault</th>
<th>O1</th>
</tr>
</thead>
<tbody>
<tr>
<td>♦ O1=&quot;1&quot; if there is no error for group E1 ... E57.</td>
<td></td>
</tr>
<tr>
<td>♦ O1=&quot;0&quot; if there is an error for group E1 ... E57; the drive does not accept positioning commands.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No warning</th>
<th>O2</th>
</tr>
</thead>
<tbody>
<tr>
<td>♦ O2=&quot;1&quot; if there are no errors ≥E58.</td>
<td></td>
</tr>
<tr>
<td>♦ O2=&quot;0&quot; if there is an error ≥E58.</td>
<td></td>
</tr>
<tr>
<td>O2 is assigned the &quot;Idle display&quot; function via P227 bit 1=&quot;1&quot; (see Page 119)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Machine zero has been approached</th>
<th>O3</th>
</tr>
</thead>
<tbody>
<tr>
<td>♦ When &quot;1&quot; is displayed, this indicates that a reference system has been defined, i.e. there is information about the position of machine zero.</td>
<td></td>
</tr>
<tr>
<td>♦ When in &quot;Normal mode&quot;, positioning is only possible when O3=&quot;1&quot;.</td>
<td></td>
</tr>
<tr>
<td>♦ By using an absolute value sensor and the relevant option (O1), O3=&quot;1&quot; remains as such even if the unit has been switched off in the meantime.</td>
<td></td>
</tr>
<tr>
<td>♦ Once the &quot;Find machine zero&quot; function has been activated (I1&amp;I2=&quot;1&quot;), O3=&quot;0&quot; until machine zero is found.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ready for start</th>
<th>O4</th>
</tr>
</thead>
<tbody>
<tr>
<td>♦ &quot;Ready for START&quot; is used for program control.</td>
<td></td>
</tr>
<tr>
<td>♦ O4 is set,</td>
<td></td>
</tr>
<tr>
<td>♦ if the program is at a WAIT START instruction and waiting for the START signal,</td>
<td></td>
</tr>
<tr>
<td>♦ after an interruption with STOP or BREAK and these signals are no longer present,</td>
<td></td>
</tr>
<tr>
<td>♦ after a corrected error condition and</td>
<td></td>
</tr>
<tr>
<td>♦ after Power On.</td>
<td></td>
</tr>
<tr>
<td>♦ at program end with the END command.</td>
<td></td>
</tr>
<tr>
<td>♦ O4 has no significance for direct command specifications.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Position reached</th>
<th>O5</th>
</tr>
</thead>
<tbody>
<tr>
<td>♦ O5 is set to &quot;0&quot; when starting a positioning process; this applies for POSA, POSR, WAIT POSA, WAIT POSR, approach real zero, approach machine zero, Hand+, Hand-.</td>
<td></td>
</tr>
<tr>
<td>♦ O5 is set once the positioning has been completed in the correct manner. This applies for POSA, POSR, WAIT POSA, WAIT POSR, approach real zero. POSR 0 causes the brief resetting of O5.</td>
<td></td>
</tr>
<tr>
<td>♦ Conditions for O5=&quot;1&quot;:</td>
<td></td>
</tr>
<tr>
<td>♦ The actual position value is in the positioning window (+/-P14) and</td>
<td></td>
</tr>
<tr>
<td>♦ the nominal value sensor has reached the target point of the nominal value specification.</td>
<td></td>
</tr>
<tr>
<td>♦ O5 is set in speed control mode, if the nominal value generator has processed the speed ramp.</td>
<td></td>
</tr>
</tbody>
</table>
**Idle after stop or break**

- O6="1" indicates that the axis is at a standstill due to a STOP (I6) or BREAK (I1&I6).
- O6 is reset when the axis moves again.

---

**Mark missing after maximum feed length**

- Only assigned if mark reference is activated (P35=1).
- With "0", the mark disappears once the maximum feed length is reached (see Page 100).

---

### 8.6.1.8 Diagrams:

**In data record memory mode**

- 0 COMPAX ready for new start.
- 1 When using START at input I5, the outputs O4 and O5 are reset. The axis moves.
- 2 Interruption using STOP at input I6. After idle, message at output O6 (3).
- 4 START using I5. Positioning process is continued.
- 5 Positioning process ended. Message via O4 and O5="1".
- 6 Manual processing of axis. O5 and O4 ="0".

*Caption:*
Interfaces
Digital inputs and outputs

Direct command specification

* When using this START, a processing command interrupted by STOP and specified by an interface is restarted.

Finding machine zero in normal mode

Approaching real zero

Before the 1st machine zero travel, O3="0"
This universal data interface allows data to be exchanged with all PLC types, regardless of manufacturer and origin. You will need five binary inputs and outputs for this process. These can be divided into four data lines (BCD format) and one control line.

**Functions available:**
- Direct commands
- Absolute and relative positioning commands (POSA, POSR)
- Specification of acceleration time and velocity (ACCEL, SPEED)
- Password enabling or modifying data record indicator (GOTO)
- Queries of status S1...S12 (actual values).
- Modifying parameters P1...P49 with defined parameter acceptance (VP).

**Activation:**
The PLC data interface is activated by setting P18 \((P18=\"1\" \text{ or } \"3\")\). When it is "3", the "Fast start" function I15 is also switched on) and by switching off and on. The following binary inputs and outputs are assigned:

<table>
<thead>
<tr>
<th>Input/output</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>I7 (X8/7)</td>
<td>Control line &quot;UBN&quot;</td>
</tr>
<tr>
<td>I8 (X8/8)</td>
<td>Data bit 2(^0)</td>
</tr>
<tr>
<td>I9 (X10/1)</td>
<td>Data bit 2(^1)</td>
</tr>
<tr>
<td>I10 (X10/2)</td>
<td>Data bit 2(^2)</td>
</tr>
<tr>
<td>I11 (X10/3)</td>
<td>Data bit 2(^3)</td>
</tr>
<tr>
<td>O7 (X8/15)</td>
<td>Control line &quot;RDY&quot;</td>
</tr>
<tr>
<td>O8 (X8/16)</td>
<td>Data bit 2(^0)</td>
</tr>
<tr>
<td>O9 (X10/9)</td>
<td>Data bit 2(^1)</td>
</tr>
<tr>
<td>O10 (X10/10)</td>
<td>Data bit 2(^2)</td>
</tr>
<tr>
<td>O11 (X10/11)</td>
<td>Data bit 2(^3)</td>
</tr>
</tbody>
</table>

\(\rightarrow\) O7...O11 are no longer available for the OUTPUT command. The GOSUB EXT and GOTO EXT commands are no longer permitted when \(P18=\"1\"\). Instead use the GOTO command.

Each transfer begins with the start letter "E" and ends with the end letter "F". In between them is the command. This consists of two BCD numbers (called function code) for the command type and of numerical values for position, velocity, acceleration time, etc. The numerical values can contain special figures:

<table>
<thead>
<tr>
<th>Figure</th>
<th>BCD coded</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;D&quot;</td>
<td>&quot;1101&quot;</td>
<td>Negative prefix</td>
</tr>
<tr>
<td>&quot;0&quot;</td>
<td>&quot;0000&quot;</td>
<td>Positive prefix</td>
</tr>
<tr>
<td>&quot;C&quot;</td>
<td>&quot;1100&quot;</td>
<td>Decimal point</td>
</tr>
<tr>
<td>&quot;A&quot;</td>
<td>&quot;1010&quot;</td>
<td>Assignment &quot;=&quot;</td>
</tr>
</tbody>
</table>

\(\rightarrow\) Use status S29 to e.g. track the interface data via the front plate display.
### Syntax of individual commands:

#### Positioning commands POSA, POSR

- **Start sign**: 
  
  - E = "1110"

- **Function code 1**: 
  
  - 0 = "0000"

- **Function code 2**: 
  
  - 1 = "0001": POSA
    
  - 2 = "0010": POSR

- **Sign** 
  
  - 0 = "0000": positive
  
  - D = "1101": negative

- **Numerical value**: 
  
  - 10^0
  
  - 10^1
  
  - 10^2
  
  - 10^3
  
  - 10^4
  
  - 10^5

- **Decimal point** 
  
  - C = "1100"

- **End sign**: 
  
  - F = "1111"

#### Velocity specification SPEED

- **Start sign**: 
  
  - E = "1110"

- **Function code 1**: 
  
  - 0 = "0000"

- **Function code 2**: 
  
  - 4 = "0100"

- **Sign** 
  
  - 0 = "0000": positive
  
  - D = "1101": negative

- **Numerical value**: 
  
  - 10^1
  
  - 10^2
  
  - 10^3
  
  - 10^-1
  
  - 10^-2
  
  - 10^-3

- **End sign**: 
  
  - F = "1111"

#### Acceleration time ACCEL

- **Start sign**: 
  
  - E = "1110"

- **Function code 1**: 
  
  - 0 = "0000"

- **Function code 2**: 
  
  - 5 = "0101"

- **Sign** 
  
  - 0 = "0000": positive
  
  - D = "1101": negative

- **Numerical value**: 
  
  - 10^2
  
  - 10^3
  
  - 10^4
  
  - 10^5
  
  - 10^-1
  
  - 10^-2
  
  - 10^-3

- **End sign**: 
  
  - F = "1111"

#### Adjust data record indicator / enable password: GOTO

- **Start sign**: 
  
  - E = "1110"

- **Function code 1**: 
  
  - 0 = "0000"

- **Function code 2**: 
  
  - 6 = "0110"

- **Numerical value**: 
  
  - 10^1
  
  - 10^2
  
  - 10^-1
  
  - 10^-2
  
  - 10^-3

- **End sign**: 
  
  - F = "1111"
## Modify parameters P1...P49

<table>
<thead>
<tr>
<th>Start sign</th>
<th>&quot;E&quot; = &quot;1110&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function code 1</td>
<td>&quot;1&quot; = &quot;0001&quot;</td>
</tr>
<tr>
<td>Function code 2</td>
<td>&quot;3&quot; = &quot;0011&quot;</td>
</tr>
<tr>
<td>Parameter No. tens column</td>
<td></td>
</tr>
<tr>
<td>Parameter No. digits column</td>
<td></td>
</tr>
<tr>
<td>Assignment code</td>
<td>&quot;A&quot; = &quot;1010&quot;</td>
</tr>
<tr>
<td>Sign</td>
<td>&quot;0&quot; = &quot;0000&quot;; positive</td>
</tr>
<tr>
<td></td>
<td>&quot;D&quot; = &quot;1101&quot;; negative</td>
</tr>
<tr>
<td>Numerical value 10^8</td>
<td></td>
</tr>
<tr>
<td>Numerical value 10^7</td>
<td></td>
</tr>
<tr>
<td>Numerical value 10^6</td>
<td></td>
</tr>
<tr>
<td>Numerical value 10^5</td>
<td></td>
</tr>
<tr>
<td>Numerical value 10^4</td>
<td></td>
</tr>
<tr>
<td>Numerical value 10^3</td>
<td></td>
</tr>
<tr>
<td>Numerical value 10^2</td>
<td></td>
</tr>
<tr>
<td>Numerical value 10^1</td>
<td></td>
</tr>
<tr>
<td>Numerical value 10^0</td>
<td></td>
</tr>
<tr>
<td>Decimal point</td>
<td>&quot;C&quot; = &quot;1100&quot;</td>
</tr>
<tr>
<td>Numerical value 10^-1</td>
<td></td>
</tr>
<tr>
<td>Numerical value 10^-2</td>
<td></td>
</tr>
<tr>
<td>End sign</td>
<td>&quot;F&quot; = &quot;1111&quot;</td>
</tr>
</tbody>
</table>

## Acceptance of VP parameter

<table>
<thead>
<tr>
<th>Start sign</th>
<th>&quot;E&quot; = &quot;1110&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function code 1</td>
<td>&quot;1&quot; = &quot;0001&quot;</td>
</tr>
<tr>
<td>Function code 2</td>
<td>&quot;4&quot; = &quot;0100&quot;</td>
</tr>
<tr>
<td>End sign</td>
<td>&quot;F&quot; = &quot;1111&quot;</td>
</tr>
</tbody>
</table>

## Status query S1...S12 (actual values)

<table>
<thead>
<tr>
<th>Start sign</th>
<th>&quot;E&quot; = &quot;1110&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function code 1</td>
<td>&quot;1&quot; = &quot;0001&quot;</td>
</tr>
<tr>
<td>Function code 2</td>
<td>&quot;6&quot; = &quot;0110&quot;</td>
</tr>
<tr>
<td>Numerical value 10^1</td>
<td></td>
</tr>
<tr>
<td>Numerical value 10^0</td>
<td></td>
</tr>
<tr>
<td>End sign</td>
<td>&quot;F&quot; = &quot;1111&quot;</td>
</tr>
</tbody>
</table>

## Status response S1...S12 (actual values)

<table>
<thead>
<tr>
<th>Start sign</th>
<th>&quot;E&quot; = &quot;1110&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sign</td>
<td>&quot;0&quot; = &quot;0000&quot;; positive</td>
</tr>
<tr>
<td></td>
<td>&quot;D&quot; = &quot;1101&quot;; negative</td>
</tr>
<tr>
<td>Numerical value 10^8</td>
<td></td>
</tr>
<tr>
<td>Numerical value 10^7</td>
<td></td>
</tr>
<tr>
<td>Numerical value 10^6</td>
<td></td>
</tr>
<tr>
<td>Numerical value 10^5</td>
<td></td>
</tr>
<tr>
<td>Numerical value 10^4</td>
<td></td>
</tr>
<tr>
<td>Numerical value 10^3</td>
<td></td>
</tr>
<tr>
<td>Numerical value 10^2</td>
<td></td>
</tr>
<tr>
<td>Numerical value 10^1</td>
<td></td>
</tr>
<tr>
<td>Numerical value 10^0</td>
<td></td>
</tr>
<tr>
<td>Decimal point</td>
<td>&quot;C&quot; = &quot;1100&quot;</td>
</tr>
<tr>
<td>Numerical value 10^-1</td>
<td></td>
</tr>
<tr>
<td>Numerical value 10^-2</td>
<td></td>
</tr>
<tr>
<td>Numerical value 10^-3</td>
<td></td>
</tr>
<tr>
<td>End sign</td>
<td>&quot;F&quot; = &quot;1111&quot;</td>
</tr>
</tbody>
</table>

The following signs are not necessary when transferring:
- Positive prefixes and initial zeros.
- For whole number values: the decimal point and the figures after the decimal point.
**Function codes of commands**

<table>
<thead>
<tr>
<th>Function code</th>
<th>BCD coded</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-code1</td>
<td>F-code2</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>POSA</td>
</tr>
<tr>
<td>0</td>
<td>2</td>
<td>POSR</td>
</tr>
<tr>
<td>0</td>
<td>4</td>
<td>SPEED</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
<td>ACCEL</td>
</tr>
<tr>
<td>0</td>
<td>6</td>
<td>GOTO</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>Modify parameters (P1-P49)</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>VP (valid parameter)</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>Query status (S1-S12)</td>
</tr>
</tbody>
</table>

**Procedure for transmitting a sign**
- PLC assigns the sign (4 bit) to I8...I11.
- Once the data is stable, the PLC sets the UBN to "1".
- COMPAX reads the sign and sets RDY to "0".
- PLC sets UBN to "0".
- COMPAX sets RDY to high.

**Exception:** If the data direction is then reversed, COMPAX can set the RDY line to "0". This is the case for the last sign of a status query.

**Process for receiving a sign**
- PLC sets UBN to "1".
- COMPAX assigns the sign (4 bit) to O8...O11.
- COMPAX sets RDY to "1".
- PLC reads the sign and sets UBN to "0".
- COMPAX sets RDY to "0".

**Exception:** If the data direction is then reversed, COMPAX can set the RDY line to "1". This is the case for the last sign of a status response.

**Signal procedure using the example of a status query**

- It is important that the data ready message is only assigned after the data (when using PLC, one cycle later); i.e. once the data has been safely assigned.

**Reset interface**
- If a fault means that the signal "RDY" is missing, the interface can be reset to its initial status using signal "E" (start sign). The next "UBN" is then detected even though "RDY" is missing.
8.6.3 RS232 interface

You can communicate with COMPAX via an RS232 interface on a PC. The following functions are available.

- Direct command input and execution in on-line mode.
- Read status values.
- Read and write program data records (the complete stock of commands is available here).
- Read and write (password protected) parameters.
- Transmit control instructions.

8.6.3.1 Interface description

<table>
<thead>
<tr>
<th>Interface parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface</td>
<td>RS 232</td>
</tr>
<tr>
<td>Baud rate:</td>
<td>9600* or 4800 (selected with P19)</td>
</tr>
<tr>
<td>COMPAX 1000SL:</td>
<td>fixed setting 9600</td>
</tr>
<tr>
<td>Word length:</td>
<td>8 bit</td>
</tr>
<tr>
<td>Stop bit:</td>
<td>1</td>
</tr>
<tr>
<td>Parity:</td>
<td>none</td>
</tr>
<tr>
<td>Hardware handshake:</td>
<td>yes (RTS, CTS)</td>
</tr>
<tr>
<td>Software handshake:</td>
<td>XON, XOFF (can be selected using P20)</td>
</tr>
<tr>
<td>Entry buffer:</td>
<td>error string, max. 30 characters</td>
</tr>
<tr>
<td>Output buffer:</td>
<td>status string, max. 30 characters</td>
</tr>
<tr>
<td>Data format:</td>
<td>ASCII</td>
</tr>
<tr>
<td>End sign:</td>
<td>( CR ) (carriage return) or ( C_R \text{ LF} ) (carriage return, line feed)</td>
</tr>
</tbody>
</table>

* Default setting; simultaneously press the three front plate buttons while switching on to set COMPAX to 9600 Baud.

COMPAX receives

- all displayable ASCII characters
- any inserted spaces
- a function sign, if nec. (\$, ?, !)
- \( C_R \) (carriage return) for storing the command in the intermediate memory. If no function signs have been transmitted, the command is accepted and executed if necessary (see next page).
- \( L_F \) (line feed) has no meaning to COMPAX

COMPAX only receives a command if a previously transmitted command was answered with \( C_R \text{ LF} > \).

COMPAX responds:

Meaning of function signs

<table>
<thead>
<tr>
<th>Function sign</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>$</td>
<td>Automatic &quot;Position reached&quot; message</td>
</tr>
<tr>
<td>1.</td>
<td>only applies to POSA and POSR</td>
</tr>
<tr>
<td>2.</td>
<td>COMPAX transmits: ( C_R \text{ LF} &gt; ) when the position is reached.</td>
</tr>
<tr>
<td>`</td>
<td>Interpreting and storing commands</td>
</tr>
<tr>
<td></td>
<td>COMPAX stores the instruction in the intermediate memory (capacity: one instruction) without executing it.</td>
</tr>
<tr>
<td>?</td>
<td>Echo</td>
</tr>
<tr>
<td></td>
<td>COMPAX sends the data received with ( C_R \text{ LF} &gt; ).</td>
</tr>
<tr>
<td>!</td>
<td>Executing commands</td>
</tr>
<tr>
<td></td>
<td>Whenever a &quot;!&quot; occurs, the instruction is executed from the intermediate memory.</td>
</tr>
</tbody>
</table>

Example:

These function signs can be attached to any instruction.

POS A 100 \$ C_R \text{ LF} >

COMPAX moves and responds once position 100 is reached with: \$ C_R \text{ LF} >
## P20: Software handshake (SH) / error transmission

<table>
<thead>
<tr>
<th>Function</th>
<th>Activation using P20</th>
<th>Valid from</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software handshake</td>
<td>&quot;0&quot;: without XOFF, XON</td>
<td>Power on</td>
</tr>
<tr>
<td></td>
<td>&quot;1&quot;: with XON, XOFF</td>
<td></td>
</tr>
<tr>
<td>Error transmission</td>
<td>&quot;0&quot;: Error only when there is activity at the interface and if the transmitted command triggers an error. No negative command acknowledgement (E90 ...E94). &quot;2&quot;: No transmission of error or negative command acknowledgments (E90 ...E94). &quot;4&quot;: Messages are indicated for all errors and negative command acknowledgments (E90 ...E94) when they occur using Exx $C_R$ $L_F$ $.&quot; $6&quot;: Error and negative command acknowledgement (E90 ...E94) only when there is activity at the interface.</td>
<td>Immedi-ately</td>
</tr>
<tr>
<td>End sign selection</td>
<td>&quot;0&quot;: $C_R$ $L_F$ &gt; &quot;8&quot;: $C_R$</td>
<td>Power on</td>
</tr>
<tr>
<td>Binary transfer</td>
<td>&quot;0&quot;: without &quot;16&quot;: with</td>
<td>imme-diately</td>
</tr>
<tr>
<td>BCC: Block check</td>
<td>&quot;0&quot;: without &quot;128&quot;: with (EXOR via all signs apart from the end sign)</td>
<td></td>
</tr>
</tbody>
</table>

Example in Quick-Basic of how to transmit and receive COMPAX data via the RS232 interface.

```
DIM text$(30)  ' The text string "text$" is defined with a length of 30.
a$="com1:9600,N,8,1"  ' The interface parameters are assigned to the "a$" string. Meaning:
                        ' com1: the com1 serial interface is used. 
                        ' 9600: sets baud rate to 9600
                        ' N: no parity
                        ' 8: 8 bit word length
                        ' 1: one stop bit
OPEN a$ for RANDOM AS #1  ' The interface is initialized and marked with #1 (channel 0).
text$="S1"  ' Status S1 must be queried.
PRINT #1,text$  ' text$ is output on channel 1.
text$=""  ' text$ is deleted so that the response can be accepted.
INPUT #1, text$  ' S1 is read by channel 1 in text$
PRINT text$  ' S1 is output on screen
END
```
When making direct command entries via RS232, use the abbreviated form for most instructions (two letters).

When using "Direct command entry", write an "END" instruction in data memory No. 1 because the start command refers to the program memory if the unit contains no direct commands.

### Preparatory positioning commands

3. These commands can be transmitted to COMPAX when idle and during a positioning process.

4. The commands are accepted with the next positioning command.

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Abbreviated form</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCEL AL</td>
<td>AL</td>
<td>Accelerating and braking time in ms</td>
</tr>
<tr>
<td>ACCEL- AL-</td>
<td>AL-</td>
<td>Separate specification of braking time.</td>
</tr>
<tr>
<td>SPEED SD</td>
<td>SD</td>
<td>Velocity in %</td>
</tr>
<tr>
<td>POSR value1 PR</td>
<td>SD</td>
<td>Preparation for speed step profiling.</td>
</tr>
<tr>
<td>SPEED value2 PR</td>
<td>OT</td>
<td>Sets comparator function. The comparators are also indicated using &quot;CRLF&gt; comparator No.&quot; via RS232 (see example 2).</td>
</tr>
</tbody>
</table>

**Example 1:**

- POSR 100 SPEED 50 CRLF or
- PR 100 SD 50 CRLF

Prepares a speed step.

**Example 2:**

- PR 200 OT O9=1 1st comparator
- PR 100 OT O10=1 2nd comparator
- POSA1000$

The following signs are returned:

- ♦ 2 CRLF > after 100 units
- ♦ 1 CRLF > after 200 units
- ♦ $ CRLF > after 1000 units

### Positioning commands

- Positioning commands can be transmitted to COMPAX when idle and during a positioning process.
- If the axis is moving, the command is acknowledged negatively.
- The current settings (ACCEL, SPEED, ...) apply to the positioning command; i.e. these settings can still be modified before the positioning command is transmitted.
- A positioning command specified by the interfaces is interrupted by a reference journey prompted by the digital inputs. (POSA, POSR, LOOP).

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Abbr. form</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>POSA PA</td>
<td>PA</td>
<td>Absolute position</td>
</tr>
<tr>
<td>POSA HOME PH</td>
<td>PH</td>
<td>Find machine zero</td>
</tr>
<tr>
<td>POSR PR</td>
<td>PR</td>
<td>Relative position</td>
</tr>
<tr>
<td>OUTPUT O0 OT O0</td>
<td>OT O0</td>
<td>Switch off drive</td>
</tr>
</tbody>
</table>

**Example 1:**

- POSA 2500CRLF or PA 2500CRLF

Proceed to position 2500

### Influencing the active positioning process

This command is only permitted if COMPAX has not received any more commands since the positioning command currently being processed (excluding commands which are not position dependent, such as OUTPUT, GOTO and ACCEL, ACCEL-).
Direct modification of velocity of an active positioning process.

The type of speed transfer and the ensuing braking ramp can be influenced by previously modified acceleration times (ACCEL, ACCEL-).

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Abbreviated form</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>POSR 0 SPEED value</td>
<td>PR 0 SD</td>
<td>Direct speed modification.</td>
</tr>
</tbody>
</table>

### Commands which are not position-dependent

- These commands are processed regardless of a positioning process specified by the interface (not during an internal data record procedure).

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Abbreviated form</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTPUT OT</td>
<td>Set output</td>
<td></td>
</tr>
<tr>
<td>GOTO GO</td>
<td>Adjusts data record indicator and enables / blocks password.</td>
<td></td>
</tr>
</tbody>
</table>

### Commands which are only permitted when drive is idle

- The axis must be at a standstill if modified VP parameters are to be transferred.
- The axis must be switched off if modified VC parameters are to be transferred (e.g. via OUTPUT O0=1).

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Abbreviated form</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALID PARAMETER VP</td>
<td>Modified parameter accepted (not configuration parameters).</td>
<td></td>
</tr>
<tr>
<td>VALID CONFIGURATION VC</td>
<td>All parameters are accepted with VC.</td>
<td></td>
</tr>
</tbody>
</table>

### Read the status values

Use the serial interface to query all status values, even during a positioning process.

- \( S_{xx} \) transmitted, \( xx \) = number of the status value.
- COMPAX returns the current value.

**Example:**

\[ S1 \ C_R \ L_F \]

Response: \( S001: xxxxxxx, xxxmm \ C_R \ L_F > \)

- The decimal point for \( S1 - S12 \) is always the ninth digit after the ":".

### 8.6.3.3 Read and write program sets and parameters

Also possible during a positioning process.

#### Download: writing the sets and parameters

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nxxx: Instruction</td>
<td>Write set xxx with instruction.</td>
</tr>
<tr>
<td>Pxxx=value</td>
<td>Write parameter xxx with value.</td>
</tr>
<tr>
<td>Pxxx=&quot;name&quot; (Only for P40-P49)</td>
<td>Assigns parameter xxx with name.</td>
</tr>
</tbody>
</table>

**Example:**

N005: POSA 100 \( C_R \ L_F \) or N005: PA 100 \( C_R \ L_F \)

The POSA 100 instruction is written in data record 5.

#### Upload: read the sets and parameter

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nxxx</td>
<td>Read data record xxx.</td>
</tr>
<tr>
<td>Pxxx</td>
<td>Read parameter xxx.</td>
</tr>
</tbody>
</table>
**Operating Instructions**

**COMPAX-M / -S**

**RS232 Interface**

**Example:**

P40 CR LF  
COMPAX transmits the contents of P40: P40=value name CR LF>

---

### Transmitting control instructions

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Abbreviated form</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>START Nxxx</td>
<td>SNxxx</td>
<td>Execute program set xxx (this set only).</td>
</tr>
<tr>
<td>START</td>
<td>ST</td>
<td>Start program.</td>
</tr>
<tr>
<td>STOP</td>
<td>SP</td>
<td>Stop program/positioning. SP corresponds to a STOP pulse</td>
</tr>
<tr>
<td>QUIT</td>
<td>QT</td>
<td>Acknowledge error</td>
</tr>
<tr>
<td>TEACH Z</td>
<td>TZ</td>
<td>Accepts current position as real zero point. (P1 is modified). The data record indicator is set to 1.</td>
</tr>
<tr>
<td>TEACH Nxxx</td>
<td>TNxxx</td>
<td>Current position is written into set xxx using the POSA command. Not possible in &quot;Reset mode&quot;.</td>
</tr>
<tr>
<td>BREAK</td>
<td>BK</td>
<td>Interrupts positioning or program step.</td>
</tr>
</tbody>
</table>

**Example:**

START N010 CR LF or SN 010 CR LF  
Set 10 is executed

---

### P211: blocking and modifying the teach in functions

<table>
<thead>
<tr>
<th>P211</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>= 0</td>
<td>The functions I1 + I4, Teach N, I1 + I5 and Teach Z are enabled.</td>
</tr>
<tr>
<td>= 1</td>
<td>Teach Z is blocked; the data record indicator is set to 1 using I1 + I4 or &quot;Teach Z&quot;.</td>
</tr>
<tr>
<td>= 2</td>
<td>Teach N is blocked; the data record indicator is set to 1 using I1 + I5 or &quot;Teach N&quot;. (Teach Z is enabled)</td>
</tr>
<tr>
<td>= 3</td>
<td>The functions Teach N and Teach Z are blocked. With I1 + I4, Teach N, I1 + I5 or Teach Z, the data record indicator is set to 1.</td>
</tr>
</tbody>
</table>

---

### Negative command acknowledge-ment

If commands are issued using RS232 and they cannot be executed (invalid commands, missing password or COMPAX is busy), a warning is sent back. Meaning:

<table>
<thead>
<tr>
<th>E90</th>
<th>Syntax error; command not valid</th>
</tr>
</thead>
<tbody>
<tr>
<td>E91</td>
<td>Command cannot be executed in this COMPAX operating mode.</td>
</tr>
<tr>
<td>E92</td>
<td>Function running, command cannot be executed</td>
</tr>
<tr>
<td>E93</td>
<td>Data record memory active, command cannot be executed</td>
</tr>
<tr>
<td>E94</td>
<td>Password missing</td>
</tr>
</tbody>
</table>

These warnings are not entered in status S18 (error history).
### Authorization of commands in different modes of operation

<table>
<thead>
<tr>
<th>Operating status</th>
<th>Commands available</th>
</tr>
</thead>
</table>
| **Commands available in all operating modes / statuses** | ♦ Status query (Sxx)  
♦ Parameter query and assignment (Pxxx, Pxxx=value)  
♦ Data record query and assignment (Nxxx, Nxxx=value)  
♦ Set / reset outputs (OUTPUT Ox=y); **Not OUTPUT O0**! |
| ♦ Stop  
♦ Emergency stop  
♦ OFF (motor switched off)  
♦ Error present | ♦ VP, VC, VF  
♦ Quit  
♦ OUTPUT O0  
♦ GOTO data record indicator / password |
| ♦ In data record operation | ♦ VP |
| ♦ During positioning process (as preparation for the next command) | ♦ VP  
♦ SPEED38 ACCEL  
♦ POSR value SPEED value / POSR value OUTPUT Ox=y  
♦ GOTO data record indicator / password |
| ♦ Find machine zero  
♦ Approach real zero  
♦ Manual +/- | No other commands possible! |
| ♦ During RUN and motor under torque | All commands and functions are possible! |
| ♦ No positioning!  
♦ No stop present!  
♦ No error present! |  |

---

38 SPEED is not available in speed control mode.

---

**Interfaces**

**RS232 interface**

---

**Unit hardware**

**Connector assignment / cable**

**Technical data**

**Configuration**

**Positioning and control functions**

**Optimization functions**

**Accessories / options**

---

**Status**

**Parameter**

**Error list**

---

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8.6.3.4 Binary data transfer using RS232

A series of commands can be transferred in the COMPAX internal binary format for time-critical applications. This saves times as ASCII into COMPAX internal binary format conversion is not required. You can still transfer data in the normal ASCII format (mixed mode).

**P20: switching on binary data transfer**

\[ P20 = P20 + 16 \]

Adds 16 to the required P20 setting (see interface parameters section in the User Guide). This ensures that binary data transfer is available in addition to normal transfer (ASCII).

**Example:**

- **P20=“3”:** with XON, XOFF; no error response message; no binary data transfer.
- **P20=“19”:** with XON, XOFF; no error response message; binary data transfer.

- The end sign must not be transmitted!
- The entire length of the binary format must always be transferred!
- Function signs ("$", ",", "?" "!") are not available when using binary transfer.

**COMPAX response**

as ASCII transfer:

- without error: using "CR LF >".
- with error: depending on the value of P20 (refer to "Error transmission" in the User Guide).

### Meanings of the binary command codes

<table>
<thead>
<tr>
<th>Command</th>
<th>Binary format (hexadecimal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>POSA value</td>
<td>88 41 xx xx xx xx xx xx</td>
</tr>
<tr>
<td></td>
<td>LSB MSB</td>
</tr>
<tr>
<td>POSR value</td>
<td>88 52 xx xx xx xx xx xx</td>
</tr>
<tr>
<td></td>
<td>LSB MSB</td>
</tr>
<tr>
<td>SPEED value</td>
<td>88 53 xx xx xx xx xx xx</td>
</tr>
<tr>
<td></td>
<td>LSB MSB</td>
</tr>
<tr>
<td>ACCEL value</td>
<td>84 4C yy yy</td>
</tr>
<tr>
<td>ACCEL- value</td>
<td>84 44 yy yy</td>
</tr>
<tr>
<td>OUTPUT Oyy=0</td>
<td>85 4F yy yy 30</td>
</tr>
<tr>
<td>OUTPUT Oyy=1</td>
<td>85 4F yy yy 31</td>
</tr>
<tr>
<td>POSR value OUTPUT Oyy=0</td>
<td>8C 52 xx xx xx xx xx xx 4F yy yy 30</td>
</tr>
<tr>
<td>POSR value OUTPUT Oyy=1</td>
<td>8C 52 xx xx xx xx xx xx 4F yy yy 31</td>
</tr>
<tr>
<td>POSR value1 SPEED value2</td>
<td>8F 52 xx xx xx xx xx xx xx 53 xx xx xx xx xx</td>
</tr>
</tbody>
</table>

### Numerical formats

**Numerical formats of "xx xx xx xx xx xx"**

3 bytes after the decimal point, 3 bytes before the decimal point.

**Valency:**

\[ 2^{-24} 2^{-23} ... 2^{-2} 2^{-1} , 2^0 2^1 2^2 ... 2^{22} 2^{23} \]

Transmission sequence, e. g.: "88 41 LSB....MSB"

**Numerical formats of "yy yy"**

2 bytes before the decimal point.

no digits after the decimal point.
**Valency:** *1

$2^1 2^4 ... 2^2 2^1 2^0$.

Transmission sequence, e.g.: “84 4C MSB LSB”.

**Negative numbers**

Negative numbers are represented in complement to two format. Creating the complement to two:
- Determine bit combination of the positive numerical value.
- Negate the binary value.
- Add 1.

**Format conversion**

You can generate this format from any number (as long as it has digits after the decimal place) as follows.

**Example:**

Number = 450.5

1. Multiply number by $2^{24}$.
   $$450.5 \times 2^{24} = 7,558,135,808.$$  
2. 7,558,135,808: convert into a hexadecimal number (if necessary into an integer first) $\Rightarrow$ 0x00 01 C2 80 00 00 = before decimal place, after decimal place = MSB,..., LSB, MSB,..., LSB.
3. These bytes must now be entered into the commands in the sequence specified. The sequence of the bytes is reversed. Do not alter the sequence of the bits.

This conversion also applies to negative numbers.

**Examples of the number format of "xx xx xx xx xx xx"**

<table>
<thead>
<tr>
<th>Number</th>
<th>MSB</th>
<th>LSb</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>00</td>
<td>00</td>
</tr>
<tr>
<td>360</td>
<td>00</td>
<td>01</td>
</tr>
<tr>
<td>450,5</td>
<td>00</td>
<td>01</td>
</tr>
<tr>
<td>-1</td>
<td>FF</td>
<td>FF</td>
</tr>
</tbody>
</table>

The following string will be produced, e.g. for **POSA 360.0**:

"88 41 00 00 00 68 01 00"

**Note:** transfer all digits!

**Start-up during binary transfer**

**Note:** when binary transfer is switched on, note the following.

Only create RS232 connection when participants are switched on or when participants are enabled, the RS232 can be re-initialized by COMPAX using Power on.
### 8.6.4 Process coupling using HEDA (Option A1 / A4)

**Synchronization and fast start via HEDA:**

HEDA (SSI interface) can be used for synchronization of several axes with simultaneous ($\pm 2.5 \mu s$) processing of individual controller time slices. The master (operating mode 1) transmits 2 synchronization words to the slave axes, enabling them to synchronize. The slave axes (operating mode 2) synchronize automatically. No response is transmitted from the slave axes to the master. The master only transmits to axis address 1. Therefore, all slaves must also be set to address 1 (P250=1).

**Variant support:**

- COMPAX XX00 as slave to transmit "Fast start" or as master
- COMPAX XX60 as master or slave not when P212=3 and P212=4
- COMPAX XX70 as master or slave only when P31=9 or 0

**Physical limits:**

Max. 16 participants in the master/passive slave operating mode and max. 50m cable length.

**Hardware requirements:**

The units must be fitted with the O1 / A4 (COMPAX 1000SL) option. There must be a terminating connector bus 2/01 on the last slave.

**HEDA parameters:**

<table>
<thead>
<tr>
<th>Parameter No.</th>
<th>Meaning</th>
<th>Valid from</th>
<th>Default value</th>
</tr>
</thead>
<tbody>
<tr>
<td>P243</td>
<td>HEDA operating mode</td>
<td>VP</td>
<td>0</td>
</tr>
<tr>
<td>P245*</td>
<td>Assgn outputs O1 ... O8 to the HEDA bus</td>
<td>imme- diately</td>
<td>0</td>
</tr>
<tr>
<td>P246*</td>
<td>Assgn outputs O9 ... O16 to the HEDA bus</td>
<td>imme- diately</td>
<td>0</td>
</tr>
<tr>
<td>P247</td>
<td>Max. average transmission errors</td>
<td>VP</td>
<td>5</td>
</tr>
<tr>
<td>P248</td>
<td>Max. transmission errors</td>
<td>VP</td>
<td>15</td>
</tr>
<tr>
<td>P249</td>
<td>Synchronization monitoring</td>
<td>VP</td>
<td>10</td>
</tr>
<tr>
<td>P250</td>
<td>Unit addresses (in master – slave mode =1)</td>
<td>VP</td>
<td>0</td>
</tr>
</tbody>
</table>

*In the HEDA master - HEDA slave operating mode (passive slave to COMPAX master), P245=P246=0 is set.

**Operating modes:**

<table>
<thead>
<tr>
<th>No.</th>
<th>P243</th>
<th>P250</th>
<th>Operating mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Not relevant</td>
<td>0</td>
<td>Independent single axis</td>
<td>No coupling, no synchronization</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>= 1 ... 9</td>
<td>Slave on IPM via HEDA</td>
<td>Coupled operation and acyclic communication possible via HEDA</td>
</tr>
<tr>
<td>1</td>
<td>Bit 0=“1” (P243=1)</td>
<td>= 1</td>
<td>COMPAX as master</td>
<td>Master axis transmits synchronous word and 7 words to address 1</td>
</tr>
<tr>
<td>2</td>
<td>Bit 1=“1” (P243=2)</td>
<td>= 1</td>
<td>Passive slave to COMPAX master</td>
<td>Slave receives at address 1 (P250=1), but does not send anything back</td>
</tr>
</tbody>
</table>

**Note!**

If HEDA coupling is activated and the master executes "Find machine zero", this will result in a positional offset between master and slave. You should therefore execute machine zero travel when the HEDA coupling is deactivated.

---

39 The interpolation module IPM can also be used as a master, but only with COMPAX XX00; COMPAX XX60, COMPAX XX70
Fast start

P18 is expanded with the following bits:

<table>
<thead>
<tr>
<th>Bit</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>=0 without PLC data interface</td>
</tr>
<tr>
<td></td>
<td>=1 with PLC data interface</td>
</tr>
<tr>
<td>1</td>
<td>=0 fast start on I15 not active</td>
</tr>
<tr>
<td></td>
<td>=1 fast start on I15 active</td>
</tr>
<tr>
<td>2</td>
<td>reserved</td>
</tr>
<tr>
<td>3</td>
<td>=0 fast start on HEDA bit 8 not active</td>
</tr>
<tr>
<td></td>
<td>=1 fast start on HEDA bit 8 active</td>
</tr>
<tr>
<td></td>
<td>only permitted with P18: bit 1=1 (see below).</td>
</tr>
</tbody>
</table>

The fast start is synchronized using P18 bit 3 for HEDA with master and slave, i.e. input 15 must be on the slave and the master fast start (triggered by I15 in master) must also be on HEDA so that it can be executed.

This operating mode is also set with P18=10.

If I15 is not required on the slave, then set I15="1".

**Note:** The fast start is additionally delayed by 1 ms for all axes; i.e. in total 2.5ms (+1.5ms reaction time I15)

Transmittable parameters:

The master transmits one data block per ms to address 1, consisting of

- HEDA control word, inc. fast start on bit 8 (bit 8 is automatically generated in the master from I15 "Fast start")
- Process value, selected with parameter P184 depending on family (COMPAX XX00, COMPAX XX60, COMPAX XX70) between:

<table>
<thead>
<tr>
<th>Output quantity</th>
<th>Master</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encoder position (COMPAX XX70) + master channel duration period</td>
<td>P184=40</td>
</tr>
<tr>
<td>Internal time base / encoder velocity before P35* (COMPAX XX70)</td>
<td>P184=42</td>
</tr>
<tr>
<td>Scaled master position before P35* (COMPAX XX70)</td>
<td>P184=43</td>
</tr>
<tr>
<td>Nominal position value in resolver increments [65536 increments/revolution]</td>
<td>P184=44</td>
</tr>
<tr>
<td>Actual position value in resolver increments [65536 increments/revolution]</td>
<td>P184=45</td>
</tr>
<tr>
<td>Differentiated resolver position [increments/ms]</td>
<td>P184=46</td>
</tr>
</tbody>
</table>

* The quantity is unaffected by P35.

Master output quantity:

Coupling the slave to the transmitted quantity is implemented with P188.

<table>
<thead>
<tr>
<th>Input quantities</th>
<th>Slave</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encoder coupling (P184 in master =40)</td>
<td>P188=40</td>
</tr>
<tr>
<td>The input signal is used as an encoder signal.</td>
<td></td>
</tr>
<tr>
<td>Internal time base / encoder velocity before P35* (COMPAX XX70)</td>
<td>P188=42</td>
</tr>
<tr>
<td>The input signal is used as a master velocity.</td>
<td></td>
</tr>
<tr>
<td>Application: coupling several axes to one master signal (e.g. an internal time base)</td>
<td></td>
</tr>
<tr>
<td>Scaled master position before P35* (COMPAX XX70)</td>
<td>P188=43</td>
</tr>
<tr>
<td>The input signal is used as a master position.</td>
<td></td>
</tr>
<tr>
<td>Application: coupling several axes to one master signal (e.g. an internal time base)</td>
<td></td>
</tr>
<tr>
<td>Input quantity is interpreted as an encoder signal even though it is not an encoder signal (P184 in master ≠ 40) see below for more information.</td>
<td>P188=140</td>
</tr>
</tbody>
</table>

* The quantity can be influenced by P35.
Permissible combinations and required parameter settings:

<table>
<thead>
<tr>
<th>Master output quantities: P184=</th>
<th>Slave input quantities: P188=</th>
<th>Can be used in slave unit versions:</th>
<th>Settings in master and slave for adapting the process quantities: P98 is identical in all units</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 (CPX 00 CPX 60, CPX 70)</td>
<td>40 CPX 60, CPX 70</td>
<td>P143s=P143M</td>
<td></td>
</tr>
<tr>
<td>42 (CPX 70)</td>
<td>42 CPX 70</td>
<td>P143s=P143M</td>
<td></td>
</tr>
<tr>
<td>43 (CPX 70)</td>
<td>43 CPX 60, CPX 70</td>
<td>P143s=P143M</td>
<td></td>
</tr>
<tr>
<td>44 (CPX 00 CPX 60, CPX 70)</td>
<td>44 CPX 60, CPX 70</td>
<td>P143s=P143M</td>
<td></td>
</tr>
<tr>
<td>45 (CPX 00 CPX 60, CPX 70)</td>
<td>45 CPX 60, CPX 70</td>
<td>P143s=P143M</td>
<td></td>
</tr>
<tr>
<td>46 (CPX 00 CPX 60, CPX 70)</td>
<td>46 CPX 70</td>
<td>P143s=P143M</td>
<td></td>
</tr>
</tbody>
</table>

* When the encoder position P184=40 is transferred, the encoder position is transferred into high word and the duration period of the pulses is transferred into low word to support a duration period measurement in the slave.

If a mixture of application purposes is undertaken, e.g. master P184=44 (nominal value) and slave with encoder coupling, then the slave must be informed using P188=140 (in such cases only the high word is processed).

**Application examples:**

**Coupling of several axes to one encoder; HEDA distributes the signals**

1st unit: Master

- COMPAX XX60
- COMPAX XX70 (P31=1)
- Encoder input
- P184=40 (encoder position + duration period)
- P188=40

Slave

- COMPAX XX60
- COMPAX XX70 (P31=9)
- P188=40

Note: There is a time misalignment between master and slave of 2ms; Remedy: activate identical program sets together using "Fast start".

**Replacing the encoder emulation using HEDA bus**

1st unit: Master

- COMPAX XX00
- COMPAX XX60
- COMPAX XX70
- P184=44 (nominal position value) or P184=45 (actual position value)
- P188=0

Slave

- COMPAX XX60
- COMPAX XX70
- P188=140
- Setting P143 = 16384

Note: There is a time misalignment between master and slave of 2ms; Remedy: activate identical program sets together using "Fast start".

**Parameter settings:**

- P143s: parameter P143 of the slave
- P143M: parameter P143 of the master
Interfaces

Process coupling using HEDA (Option A1 / A4)

<table>
<thead>
<tr>
<th>Coupling of several cams with the same time base and separate master or slave oriented label synchronization (see above)</th>
<th>1st unit: Master</th>
<th>Slave</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPAX XX70</td>
<td>COMPAX XX70</td>
<td></td>
</tr>
<tr>
<td>P184=42 (time base)</td>
<td>P188=42</td>
<td></td>
</tr>
<tr>
<td>P188=42</td>
<td>P143s=P143M</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Linking of several cams with the same time base and absolute zero drift between the axes due to the transfer of a position value (see above)</th>
<th>1st unit: Master</th>
<th>Slave</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPAX XX70</td>
<td>COMPAX XX70</td>
<td></td>
</tr>
<tr>
<td>P184=43 (scaled master position)</td>
<td>P188=43</td>
<td></td>
</tr>
<tr>
<td>P188=43</td>
<td>P143s=P143M</td>
<td></td>
</tr>
</tbody>
</table>

Error handling

Only position signals can be completely restored following HEDA transmission errors. When transmitting velocities, transmission errors can lead to drift tendencies between the axis positions. For this reason use of the position values is preferred.

Error messages:

E76: HEDA transmission or synchronization errors are errors E76, E77 and E78. Synchronization is interrupted with E76, therefore an alignment is implemented whereby the process position value is aligned in such a manner that a position leap does not occur.

E77/E78: With E77/E78, the slave attempts to reach the new undisturbed process position value in order to maintain the reference system.

Transmission error procedure:

Position values / position (P184=40/43/44/45): linear interpolation using old values

Velocity values / frequencies (P184=42/46): retains old value

Synchronizing process values:

In cases when P188>0 on the master side, a fixed delay in the associated process value is implemented, amounting to a total of 2 ms. This ensures that the master waits until all axes have received the process value. This ensures that all axes, including the master, continue to process the new nominal values simultaneously.

Note:

- Except for fast start, no additional I/O's are sent.
- There can be only one master on the bus!

Note:

- The position values for P184=44 and P184=45 are derived independently of the current positioning operating mode (normal, continuous, reset). They are obtained from the nominal position value and the actual position value and made available in 24-bit format, as if with counter channels. This avoids jerky changes in the start torque (in continuous mode) or when reading the end of the curve (in reset mode). Only the lower 24 bits of these values are transmitted, consisting of the resolver value and maximum 256 motor revolutions.

The required cable types are listed on Page 63.
Please note: the operating instructions (pages 67 - 171) as well as the application examples (pages 225 - 237) can be found in the complete product manual which is available as PDF file on CD.
9. Accessories and options

Compact Servo Controller

9.1 System concept

The COMPAX system concept is based on a basic unit which contains the function-important components and additional system components. These can be used to extend a system for your specific requirements.

The system consists of the following components:

- COMPAX
  This contains:
  - digital inputs and outputs (PLC interface)
  - serial interface (RS232)
  - front plate with status and error display
  - data record memory
  - integrated IGBT final stage
- mains module to produce power voltage (without transformer); with emergency stop function.
- drive unit (motor, transmission and cable).
- aids for controlling COMPAX using the digital inputs and outputs.
- interface cable for operating COMPAX via the serial interface RS232.
- options which support other application areas.
- hand-held terminal for menu-guided configuration and programming of COMPAX.
- PC software for supported parameter specification and for creating programs.

Please note: the operating instructions (pages 67 - 171) as well as the application examples (pages 225 - 237) can be found in the complete product manual which is available as PDF file on CD
## 9.2 Overview

The following table shows the COMPAX system components and the relevant associated cables.

<table>
<thead>
<tr>
<th>Drives</th>
<th>Interfaces</th>
<th>Other motor types</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOK 21 / MOK11 / MOK46</td>
<td>RS485 ASCII / binary</td>
<td>initiators: IN HE 521506</td>
</tr>
<tr>
<td>REK 32</td>
<td>Interbus-S</td>
<td>initiator set IVD 1/.. for 3 initiators</td>
</tr>
<tr>
<td>MOK 42 / MOK43</td>
<td>Profibus</td>
<td>initiators: IN HE 521506</td>
</tr>
<tr>
<td>REK 32</td>
<td>CAN Bus</td>
<td>hand held terminal BDF 2/01</td>
</tr>
<tr>
<td>HDY055.. HDY070.. HDY1092.. HDY115.. HJ96.. HJ116..</td>
<td>CANopen</td>
<td></td>
</tr>
</tbody>
</table>
## Overview

### Interfaces

<table>
<thead>
<tr>
<th>Operating panel BDF 1/02</th>
<th>Operating panel BDF 1/03</th>
</tr>
</thead>
<tbody>
<tr>
<td>SinCos Option S1/S2</td>
<td>GBK 16/..</td>
</tr>
<tr>
<td>SinCos Option S3 für Linearmotoren</td>
<td>GBK 18/..</td>
</tr>
<tr>
<td>Absolute encoder Interface A1</td>
<td>Absolute encoder STEGMANN AA100</td>
</tr>
</tbody>
</table>

### Options

- **Absolute encoder**: STEGMANN AA100
- **Encoder**: Litton G71SSLDBI-4096-151-050BX
- **Encoder distributor**: EAM 4/01

### Configuration

- **Positioning and control functions**
- **Optimization functions**
- **Interfaces**
- **Accessories / options**
- **Status**
- **Parameter**
- **Error list**

### Technical data

- **Status Number**: X6 X8 X10
- **Value**: Digital

### Accessories / options

- **Ballast resistor**: BRM 4/.. with 1.5m cable for connection to the power module NMD20
- **Ballast resistor**: BRM 7/01 with 1.5m cable for connection to COMPAX 35XXM
- **Ballast resistor**: BRM 6/01 with 1.5m cable for connection to COMPAX 45XXS / COMPAX 85XXS
- **Ballast resistor**: BRM 5/01 with 0.3m cable for connection to COMPAX 25XXS
- **Ballast resistor**: BRM 8/01 with 0.25m cable for connection to COMPAX 10XXSL

### Interfaces

- **COMPAX-M**: with Power module NMD
- **COMPAX P1XXM**:
- **COMPAX 25XXS**: COMPAX 45XXS COMPAX 85XXS
- **COMPAX 10XXSL**:
- **COMPAX 10XXSL**:
- **COMPAX 10XXSL**:
- **COMPAX 10XXSL**:
- **COMPAX 10XXSL**:

### Operating panel

- **D/A Monitor D1 (12 Bit)**
- **ASS 1/01**
- **Analogue output of intermediate values**

### Interfaces

- **Fieldbus In**: Encoder Input I 2
- **Fieldbus Out**: Encoder Input I 4

### Accessories / options

- **Ballast resistor**: BRM 8/01 with 0.25m cable for connection to COMPAX 10XXSL
- **Ballast resistor**: BRM 5/01 with 0.3m cable for connection to COMPAX 25XXS
- **Ballast resistor**: BRM 6/01 with 1.5m cable for connection to COMPAX 45XXS / COMPAX 85XXS
- **Ballast resistor**: BRM 7/01 with 1.5m cable for connection to COMPAX 35XXM

### Technical data

- **Status Number**: X6 X8 X10
- **Value**: Digital

### Interfaces

- **Fieldbus In**: Encoder Input I 2
- **Fieldbus Out**: Encoder Input I 4

### Accessories / options

- **Ballast resistor**: BRM 8/01 with 0.25m cable for connection to COMPAX 10XXSL
- **Ballast resistor**: BRM 5/01 with 0.3m cable for connection to COMPAX 25XXS
- **Ballast resistor**: BRM 6/01 with 1.5m cable for connection to COMPAX 45XXS / COMPAX 85XXS
- **Ballast resistor**: BRM 7/01 with 1.5m cable for connection to COMPAX 35XXM
9.3 Motors

**EMD motors**

Suitable motors are described in the motor catalogue (Article No.: 192-060011)!

**Linear motor:**

COMPAX also supports the operation of linear motors. For this, COMPAX requires option S3 (interface to linear encoder and Hall sensor; assignment X12 see Page 46).

Conditions regarding the linear motor:

- 3 phase synchronous linear motors with:
  - sine-cosine linear encoder (1V_{ss}), or TTL (RS422)
  - digital Hall sensor commutation (5V) with following signal sequence:

```
   Phase V-U   Phase U-W   Phase W-V

   Hall 1
   Hall 2
   Hall 3
```

The depicted signal sequence applies for positive direction.

**Note concerning the reference mode:**

Only the modes P212=7 and P212=11 are presently available as reference modes for linear motors!

**Linear motor LXR**

For highly dynamic and precise applications, we provide the linear motor LXR, which can be operated with COMPAX 25XXS or COMPAX 10XXSL (with the S3 option and GBK18 and GBK20 cable). Ask for our leaflet.

**Note:**

When operating the linear motor LXR, reduced nominal and peak currents apply to COMPAX:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Nominal current [Aeff]</th>
<th>Peak current [Aeff] &lt;5s</th>
<th>Power [kVA]</th>
</tr>
</thead>
<tbody>
<tr>
<td>with mains supply: 230V AC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10XXSL</td>
<td>2.1</td>
<td>4.2</td>
<td>0.8</td>
</tr>
<tr>
<td>25XXS</td>
<td>4.1</td>
<td>8.2</td>
<td>1.4</td>
</tr>
</tbody>
</table>
9.4 HAUSER linear actuators

The HAUSER "HLEc" linear unit is available with various cross sections:

- **HLE80C**  cross section: 80 mm x 80 mm up to 6m long
- **HLE100C**  cross-section: 100 mm x 100 mm up to 7m long
- **HLE150C**  cross-section: 150 mm x 150 mm up to 10m long

Highly dynamic, modular linear axis "HPLA" with toothed belt drive or rack-and-pinion drive:

- **HPLA80**:  cross section: 80 mm x 80 mm
  up to 50m for rack-and-pinion, up to 20m for toothed belt
- **HPLA120**:  cross section: 120 mm x 120 mm
  up to 50m for rack-and-pinion, up to 20m for toothed belt
- **HPLA180**:  cross section: 180 mm x 180 mm
  up to 50m for rack-and-pinion, up to 20m for toothed belt

Electric cylinder ET: with 50 - 1500 mm stroke. Tensile and shear forces up to 21000 N

Vertical actuators with toothed belt: up to 2500mm stroke; up to 100kg payload

The attached transmissions are available with ratios of 3:1, 5:1, 7:1, 10:1 and 25:1.

Please contact us if you require more information.

If you are using, e.g. a rack-and-pinion drive, toothed belt drive or spindle drive, you can obtain the necessary initiators and initiator connectors and cable from us. We can also supply you with retaining material on request.
9.5 Data interfaces

9.5.1 RS232

Use the RS232 interface, fitted as standard in COMPAX, to connect COMPAX with a PC or terminal. This can then be used to operate COMPAX. The SSK1/.. interface cable is available as a connecting cable (for available lengths, see Page 206).

9.5.2 Bus systems

The bus systems are options which you can select to use or not. They require an additional board to be fitted in COMPAX. The connection is located on the mains module or, in COMPAX-S and COMPAX 35XXM, directly on the unit. The controllers, connected to the mains module or COMPAX 35XXM, are already connected via the flatband cable available in the system network.

9.5.2.1 Interbus-S / Option F2

You will find an object directory in the special documentation. The connection arrangement is based on the specifications of 2-conductor remote bus.

9.5.2.2 RS485 / Option F1/F5

The RS485 interface is described in the special documentation. 2 different options are available:
- F1: 4 wire RS485
- F5: 2 wire RS485

9.5.2.3 Profibus / option F3

The Profibus is described in the special documentation. Functions:
- Sinec L2-DP and FMS
- 1.5M Baud
- Communication with Simatic S7 is supported by special function modules.

9.5.2.4 CAN - Bus / Option F4

The Profibus is described in the special documentation. Functions:
- BasicCAN
- up to 1M Baud
- CAN protocol as per specification 1.2
- Hardware as per ISO/DIS 11898

9.5.2.5 CANopen / Option F8

- Protocol as per CiA DS 301.
- Profile CiA DS 402 for drives.

9.5.2.6 CS31system bus / Option F7

- COMPAX – ABB – interface.
9.6 Process interfaces

9.6.1 Encoder interface

The encoder interface option E2 (E4) enables the connection of an external incremental encoder (such as: Litton encoder G71SSLDBI-4096-151-05BX). Use this to synchronize COMPAX with an external speed using the "SPEED SYNC" command. The encoder pulses per revolution and the translational travel per encoder revolution are set via the COMPAX parameters P143 and P98.

<table>
<thead>
<tr>
<th>No.</th>
<th>Meaning</th>
<th>Unit</th>
<th>Minimu value</th>
<th>Default value</th>
<th>Maximum value</th>
<th>Valid from...</th>
</tr>
</thead>
<tbody>
<tr>
<td>P98</td>
<td>Travel of axis per encoder revolution</td>
<td>corresp. P90</td>
<td>0</td>
<td>0.00000000</td>
<td>4 000 000</td>
<td>VC</td>
</tr>
<tr>
<td>P143</td>
<td>Encoder pulses per revolution (channel 1)</td>
<td>120</td>
<td>4096</td>
<td>2 000 000</td>
<td>VC</td>
<td></td>
</tr>
<tr>
<td>P146</td>
<td>Resolution of encoder emulation (channel 2)</td>
<td>=0: 1024</td>
<td>=8: 512</td>
<td></td>
<td>VC</td>
<td></td>
</tr>
</tbody>
</table>

Technical data:
- RS422 interface
- 5V supply;
- 120-10 000 increments/revolution (f_{min}: 4 kHz; f_{max}: 500 kHz).

Dimension diagram: Dimensional diagram for Litton encoder G71SSLDBI-4096-151-05BX:

---

41 Does not apply for COMPAX 1000SL. COMPAX 1000SL allows to configure the generally available signal interface either as encoder input or as encoder emulation (See page 61).
Encoder module and accessories:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>E2</td>
<td>Encoder input module with line terminator for individual connections; not for creating an encoder bus.</td>
</tr>
<tr>
<td>E3</td>
<td>E3: Encoder emulation</td>
</tr>
<tr>
<td>E4</td>
<td>Encoder input module without line terminator for creating an encoder bus.</td>
</tr>
<tr>
<td>EAM4/01</td>
<td>Encoder distributor for creating an encoder bus.</td>
</tr>
</tbody>
</table>

**Assignment of EAM4/01 (corresp. X13)**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Channel 1</th>
<th>Channel 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X1: IN</td>
<td>X2: OUT</td>
</tr>
<tr>
<td>1</td>
<td>Screen</td>
<td>Screen</td>
</tr>
<tr>
<td>2</td>
<td>NC</td>
<td>N1</td>
</tr>
<tr>
<td>3</td>
<td>NC</td>
<td>B1</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>1A</td>
</tr>
<tr>
<td>5</td>
<td>N1</td>
<td>NC</td>
</tr>
<tr>
<td>6</td>
<td>B1</td>
<td>NC</td>
</tr>
<tr>
<td>7</td>
<td>1A</td>
<td>NC</td>
</tr>
<tr>
<td>8</td>
<td>+5V</td>
<td>NC</td>
</tr>
<tr>
<td>9</td>
<td>NC</td>
<td>N1/</td>
</tr>
<tr>
<td>10</td>
<td>NC</td>
<td>B1/</td>
</tr>
<tr>
<td>11</td>
<td>NC</td>
<td>O1/</td>
</tr>
<tr>
<td>12</td>
<td>N1/</td>
<td>NC</td>
</tr>
<tr>
<td>13</td>
<td>B1/</td>
<td>NC</td>
</tr>
<tr>
<td>14</td>
<td>O1/</td>
<td>NC</td>
</tr>
<tr>
<td>15</td>
<td>GND</td>
<td>NC</td>
</tr>
</tbody>
</table>

Applications with encoder:

**Individual connections**

- **Encoder COMPAX**
  - Cable: GBK 11/..
  - Encoder input module E2 with line terminator, or for
  - COMPAX 1000SL: Configured as encoder input (P144=4; P146=0) and with bus termination BUS 6/01 (sits as an intermediate connector on X13).

- **SV drive COMPAX**
  - Cable: SSK 7/..
  - Note! Note direction.
  - Cable in: SV drive
  - Cable out: COMPAX
  - Encoder input module E2 with line terminator, or for
  - COMPAX 1000SL: Configured as encoder input (P144=4; P146=0) and with bus termination BUS 6/01 (sits as an intermediate connector on X13).
COMPAX COMPAX
- Cable: SSK 7/.. or SSK17 (see principal diagrams below)
  Note! Note direction.
  cable in: COMPAX with encoder emulation
  cable out: COMPAX with encoder input
- Encoder simulation E3 for COMPAX (master) (in COMPAX 1000SL encoder
  simulation configured)
- Encoder input module E2 for COMPAX (slave) (in COMPAX 1000SL encoder
  input configured and with bus termination BUS 6/01)

Requirements per COMPAX:
- one encoder distributor ............................................................. EAM 4/01
- one cable for the COMPAX and encoder distributor connection ... SSK 4/..
- one bus cable for connecting the encoder distributors ................ EAM 7/..
- Encoder simulation in the master .............................................. E3
- Encoder input module in each slave ...................................... E4
- Bus terminator................................................................. BUS 1/01

Additional COMPAX

SSK4 SSK4 SSK4

SSK7 SSK7 SSK7

COMPAX –
COMPAX (both not
COMPAX 1000SL)

COMPAX (not
COMPAX 1000SL) –
COMPAX 1000SL

COMPAX 1000SL –
COMPAX 1000SL

Slaves
Slave 1
Slave n
Master

EAM4/01 X5
Channel 1
IN OUT
X1 X2 X3 X4

EAM4/01 X5
Channel 2
IN OUT
X1 X2 X3 X4

Bus termina-
channel 1
channel 2

IN OUT
X1 X2 X3 X4

Bus1/01
EAM4/01 X5
Channel 1
IN OUT
X1 X2 X3 X4

EAM4/01 X5
Channel 2
IN OUT
X1 X2 X3 X4

Bus termina-
channel 1
channel 2

IN OUT
X1 X2 X3 X4

SSK7
SSK7
SSK7

SSK4
SSK4
SSK4

SSK7
SSK7
SSK7

Encoder bus
with COMPAX

Other
encoder
distributors

BUS1/01

IN OUT IN OUT
X1 X2 X3

EAM4/01 X5
Channel 1
IN OUT
X1 X2 X3 X4

EAM4/01 X5
Channel 2
IN OUT
X1 X2 X3 X4

Bus termina-
channel 1
channel 2

IN OUT
X1 X2 X3 X4

From encoder (GBK11) or SV drive encoder emulation (SSK7)
The following are required:

- per COMPAX
  - one encoder distributor ....................................................... EAM 4/01
  - one cable for the COMPAX and encoder distributor connection ... SSK 4/..
  - one bus cable for the connection between the encoder distributors ... SSK7/..
  - Encoder input module ............................................................... E4
  - Bus terminator........................................................................... BUS 1/01

- For the encoder: encoder cable .................................................. GBK11/..
- For the SV drive: Cable: ................................................................. SSK7/..

COMPAX 1 and COMPAX 2 receive the signals from one encoder.
COMPAX 3 receives the actual COMPAX 1 value concerning its emulation.

The following are required:

- per COMPAX
  - one encoder distributor ....................................................... EAM 4/01
  - one cable for the COMPAX and encoder distributor connection ... SSK 4/..
  - 3 bus cables ............................................................................ SSK 7/..
  - 2 bus terminators ...................................................................... BUS1/01

Encoder module:

- COMPAX 1 (not possible with COMPAX 1000SL as there is only 1 encoder channel present!):
  - Encoder input module.............................................................. E4
  - Encoder emulation ................................................................. E3

- COMPAX 2, 3:
  - Encoder input module.............................................................. E4
  - Encoder cable: ......................................................................... GBK11/..
9.6.2 Absolute value sensor (A1)

The option A1 cannot be used for COMPAX 1000SL. When using option A1 (the absolute value sensor interface), the reference travel (find machine zero) normally required in normal mode after switching on is not required. The reference travel is then only required during start-up. The current read sensor position can be found in Status S12.

Supported absolute value sensors
The following Stegmann - absolute value sensors types are supported:
- AG100MS/GRAY 4096/4096
- AG626XSR 4096/4096.

Technical data
- Supply voltage: 24V ±10%.
- Sensing code: grey code, single step.
- Direction of counting: in clockwise direction when looking at the shaft: rising.
- Data interface: RS422 /24 bit data format (starting with: MSB).
- Cycle frequency: 100 kHz.

Enable absolute value sensor input
When using equipped A1 option (if this is not already being executed by HAUSER), the absolute value sensor input is enabled using parameter P206. Meaning: P206 = "1" absolute value sensor input enabled.

Note!
- Only activate the absolute value sensor input if an absolute value sensor has been connected correctly and physically.
- Continuous mode is not permitted when the absolute value sensor is active.

Option A1 also contains the HEDA interface.

Further information on the value range of S12 can be found on Page 79

9.6.3 High resolution SinCos sensor system (S1/S2)

COMPAX uses option S1 to support the high-resolution, optical motor position recording process via the Stegmann SinCos sensor system (as a substitute for the motor position recording via resolver).

SinCos single-turn: Type SRS50
SinCos multi-turn: Type SRM50

A SinCos sensor provides the following improvements.
- Better concentricity.
- Position recorded with greater absolute accuracy:
  - Resolver: ± 0.25°
  - SinCos: ± 0.005°
- Resolution of motor speed:
  - Resolver: 16/12 bit (speed-dependent; 12 bit at higher speeds)
  - SinCos: 19 bit over the whole range of motor speeds.
- Less noise at a higher dynamic level via the motor speed resolution.
- With the SinCos multi-turn you also get economical absolute value sensor function.
  4096 motor revolutions detected absolute.

Further information on the value range of S12 can be found on Page 79
S2 – option:

**SinCos multi-turn with programmable transmission factor**

When using a SinCos multi-turn, you can use the S2 option to adapt the range of the absolute position S12 to your application via a transmission factor. S12 then always contains the position value referenced to the reset path P96. Positioning is still implemented with reference to the actual value in Status S1.

**Standard:**

SinCos multi-turn records an absolute position of 4096 rotations. In applications such as controlling a round table via a transmission, the position of the table cannot be determined very accurately because 4096 rotations usually signifies several rotations of the table.

By specifying the transmission factor P96 (ratio of motor : table), the absolute position S12 is reset to 0 after a table rotation. After "Power on" and after an error has occurred, S12 is transferred as the actual value (S1=S12). The function is switched on via P206="1".

<table>
<thead>
<tr>
<th>No.</th>
<th>Meaning</th>
<th>Unit</th>
<th>Minimum value</th>
<th>Default value</th>
<th>Maximum value</th>
<th>Valid from...</th>
</tr>
</thead>
<tbody>
<tr>
<td>P96</td>
<td>Transmission factor for the reset path of S2 – option (&quot;0&quot;: no reset function)</td>
<td>.</td>
<td>0</td>
<td>0</td>
<td>2048</td>
<td>VC</td>
</tr>
<tr>
<td>P206</td>
<td>Enabled absolute value sensor input or the reset functions of the S2 option</td>
<td>=&quot;1&quot;: absolute value sensor input enabled or reset function switched on.</td>
<td></td>
<td></td>
<td></td>
<td>VP</td>
</tr>
</tbody>
</table>

**Please note**

- Set P1=0. Using P212=10 (see Page 80) you can still select the machine zero point as required.

**Note!**

This function does not affect the actual positioning process.

Example: P96=10 (sensor revolutions); P83=40 000μm (40mm)

After POSA 450 and then POSA 0, the drive reverses by 450 mm (and not just 50 mm).

To execute a positioning process within the reset path after traveling in one direction for a long time, evaluate S12.

E.g.: required position within the reset path = 10 mm

V1=10-S12

POSR .V1

---

9.6.4  Option S3 for linear motors.

See Page 176
9.6.5 HEDA interface

HEDA using option A1 (e.g., A4 for COMPAX 1000SL) for COMPAX XX00 and the interpolation module IPM as master, or for a COMPAX – COMPAX – coupling with the unit variants COMPAX XX00, COMPAX XX60 and COMPAX XX70, see from Page 168.

Implementing tracking and contouring tasks with the HAUSER interpolation module (IPM) for PCs and industrial PCs. Communication occurs via the HEDA interface, a rapid synchronous serial interface.

Functional scope of the IPM and COMPAX network:
- Contours can be stored for up to 9 axes with up to 100000 points.
- 16 zero-related digital outputs.
- Exchange of data between 9 axes within 1 ms (setpoint values, auxiliary functions, position, lag error, speed, torque).
- Freely programmable inputs and outputs.
  (Once enabled via P221, P222 and P225, and allocation of outputs to HEDA via P245 and P245; see Page 139).
- Internal data record memory can still be used to its full extent.
- Can be independently operated as a single axis positioning system.

Physical transfers:
- RS485 level (counter-cycle driver);
- DC decoupled using an optical coupler;
- Cycle frequency: 5 Mbit/s.

Working with the HEDA interface is described from Page 168, where used with the interpolation module IPM, a special manual is available!

9.6.6 D/A monitor (D1) (option not available with COMPAX 1000SL)

- The D/A monitor offers you the option of outputting COMPAX internal measurement and intermediate parameters in the form of analogue voltage in the range of ±10 V. For description, see Page 58.
Option E7 “Analogue speed specification” is available with COMPAX XX6X “Electronic transmissions” and COMPAX XX70 “Cam controller”.

Exception:
In addition, E7 can be used with COMPAX XX00 to implement an external speed specification with the command “SPEED SYNC”; see Page 99.

The "Encoder input" option (E2 or E4) cannot be used at the same time as E7.

Using option E7, you can specify a nominal speed value via connector X13 as analogue voltage in the range -10V to +10V. Use 2 digital inputs (PLC level), to define a nominal speed value of 0 and to initiate a change in the rotational direction.

The following configuration data must therefore be assigned permanent values:
- P80 = "16" (general drive).
- P90 = "1" (mm unit).
- P83 = 100000 µm (travel per motor revolution).
- P93 = "4" (speed control mode).
- P143 = 600 000
- P144 = "7" (analogue speed specification).
- P35 = "1" (transmission factor 1) (I15="0")
- I16 = "1" (external nominal value is valid)

These parameters influence the interrelation between voltage and speed; they must therefore be specified and fixed. Specify the required speed directly in P98 in min⁻¹ when input voltage is +10V.

Accuracy
Linearity error: <1%
Amplification error: <5% (you can compensate for these with P98).
Offset: <15 mV
Temperature drift: 100 ppm/K

Connector X13:

<table>
<thead>
<tr>
<th>Pin X13 or EAM4/01 X1: (encoder assignment)</th>
<th>COMPAX-Input I</th>
<th>Signal</th>
<th>Circuit proposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 (B1)</td>
<td>A</td>
<td>+15V &lt;10 mA</td>
<td></td>
</tr>
<tr>
<td>7 (O1)</td>
<td>E</td>
<td>UE</td>
<td></td>
</tr>
<tr>
<td>13 (B1)</td>
<td>A</td>
<td>-15V &lt;10 mA</td>
<td></td>
</tr>
<tr>
<td>15 (GND)</td>
<td>A</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>14 (O1)</td>
<td>E</td>
<td>UE\</td>
<td></td>
</tr>
<tr>
<td>5 (N1)</td>
<td>E</td>
<td>Enable</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;1&quot; for enable &quot;0&quot; = nominal digital value 0</td>
<td></td>
</tr>
<tr>
<td>12 (N1)</td>
<td>E</td>
<td>Direction of rotation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;1&quot; for positive direction of rotation</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Screen</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Level on the “Enable” and "Direction of rotation" inputs: 5.5V...30V = "1".

Ue and Ue\ is a differential input. Actively assign Ue\ to a potential (e.g. to GND).
9.7 Accessories

9.7.1 External control panel (not available for COMPAX 1000SL)

Use the control panels to control COMPAX via the digital inputs. They contain the following functions:

- Release
- TEACH
- Search machine zero
- Move to machine zero
- Move to real zero
- Break block
- TEACH real zero point
- TEACH block
- Error/warning/quit
- No error
- No warning
- I7 / I8
- O7 / O8
- ZERO
- JOG+
- JOG-
- START
- READY
- BREAK
- STOP
- HOME
- QUIT
- OK
- WARNING
- NO
- ERROR
- I7
- O7
- I8
- O8
- ZERO
- JOG+
- JOG-
- START
- READY
- BREAK
- STOP

The control panel is available for front plate installation or with housing.

BDF1/02: for front plate installation

BDF1/03: with housing

The control panels are connected with COMPAX via the cable SSK6/..
9.7.2 Terminal module for COMPAX 1000SL (EAM)

The terminal module EAM3/.. is used for the onward wiring of the COMPAX 1000SL connector X19 (physical inputs / outputs, ...) to a terminal series and a Sub-D connector.

The module can be fixed in the control cabinet to an installation rail with a mounting rail.

The terminal module EAM3/.. contains the cable for connecting with COMPAX 1000SL.

Available lengths of connection lead: 1m; 2.5m; 5m

Terminal assignment

The terminal assignment corresponds to the pin assignment on X19.
9.7.3 EAM5/01: DC feed for COMPAX-M

The power supply is normally over a central mains module; NMD10 or NMD20. With the component EAM5/01, available as an accessory, DC voltage can be supplied: the component contains the connections of the mains module.

**Input voltage range** 100V DC – 650V DC.

The DC intermediate circuit must be limited to 750V in braking mode.

Power voltage is connected directly to COMPAX-M X2.

**Design of EAM5/01:**

Supply voltage for functions of X8.

---

**Note**

- UMK housing from Phoenix
- to be attached to top hat rail of various sizes
- without mating connector approx. 4.5 cm deep

**Terminal assignment**

The component contains the connections of the mains module.

- EAM5/01 X6 = mains module X6: input bus systems
- EAM5/01 X7 = mains module X7: output bus systems
- EAM5/01 X3 = mains module X3: 24V DC supply
EAM5/01 X8 = mains module X8: control
EAM5/01 X4 = mains module X4: signal connection to COMPAX-M X5; connection cable included
EAM5/01 F21: 24V DC fuse 0.5A/M

**Delivery scope:**
EAM5/01.
Mating connector X8.
Signal connection EAM5/01 - COMPAX-M (0.5m).
Short circuit connector for the last COMPAX-M on X4.
9.7.4 EMC measures

9.7.4.1 Power filter

The following power filters can be used for RF suppression and compliance with the emission limit values specified in EN61800-3. Type: NFI01/02

NMD10 / COMPAX
45XXS / 85XXS

COMPAX 1000SL (in COMPAX 1000SL for motor lines >50m):

NMD20: Type: NFI01/03

Dimension diagram:

COMPAAX 35XXM: Type: NFI01/04

COMPAX 35XXM with serially mounted COMPAX-M contr.: Type: NFI01/05

Do not loosen the locking nut!
### 9.7.4.2 Motor output throttle

We supply motor output throttles for use with long motor lines (greater than 20m)

- **Up to 16A nominal motor current:**
  - Type: MDR01/01 16A / 2mH

- **Up to 30A nominal motor current:**
  - Type: MDR01/02 30A / 1.1mH

- **Over 30A nominal motor current:**
  - Type: MDR01/03 >30A / 0.64mH

---

**Wiring of motor output throttle**

---

**MDR01/01 | MDR01/02 | MDR01/03**

<table>
<thead>
<tr>
<th>A [mm]</th>
<th>150</th>
<th>180</th>
<th>205</th>
</tr>
</thead>
<tbody>
<tr>
<td>B [mm]</td>
<td>67</td>
<td>76</td>
<td>107</td>
</tr>
<tr>
<td>D [mm]</td>
<td>113</td>
<td>136</td>
<td>157</td>
</tr>
<tr>
<td>E [mm]</td>
<td>50</td>
<td>57</td>
<td>83</td>
</tr>
<tr>
<td>F [mm]</td>
<td>6</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>H [mm]</td>
<td>195</td>
<td>195</td>
<td>260</td>
</tr>
<tr>
<td>I [mm]</td>
<td>95</td>
<td>110</td>
<td>150</td>
</tr>
</tbody>
</table>

Weight [kg] | 4 | 6 | 17 |
9.7.5 External ballast resistors

<table>
<thead>
<tr>
<th></th>
<th>Braking power</th>
<th>Duration</th>
<th>Cooling down time</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMD20 with</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>external ballast</td>
<td>6.8 kW</td>
<td>&lt;1s</td>
<td>&gt;20s</td>
</tr>
<tr>
<td>resistance of 15Ω</td>
<td>37 kW</td>
<td>&lt;0.4s</td>
<td>&gt;120s</td>
</tr>
<tr>
<td>resistance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.9 kW</td>
<td>1s</td>
<td>&gt;20s</td>
</tr>
<tr>
<td></td>
<td>37 kW</td>
<td>&lt;0.4s</td>
<td>&gt;120s</td>
</tr>
<tr>
<td></td>
<td>18 kW</td>
<td>&lt;1s</td>
<td>&gt;20s</td>
</tr>
<tr>
<td></td>
<td>37 kW</td>
<td>&lt;0.4s</td>
<td>&gt;120s</td>
</tr>
<tr>
<td>COMPAX 25XXS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>with external</td>
<td>1 kW</td>
<td>&lt;1s</td>
<td>&gt;10s</td>
</tr>
<tr>
<td>ballast</td>
<td>2.3 kW</td>
<td>&lt;0.4s</td>
<td>≥8s</td>
</tr>
<tr>
<td>resistance of 56Ω</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COMPAX 45XXS/85XXS with external ballast resistance of 22Ω</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Braking power</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BRM6/01: 450W</td>
<td>6.9 kW</td>
<td>&lt;1s</td>
<td>&gt;20s</td>
</tr>
<tr>
<td></td>
<td>28 kW</td>
<td>&lt;0.4s</td>
<td>≥120s</td>
</tr>
<tr>
<td>COMPAX 35XXM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>with external</td>
<td>56 kW</td>
<td>&lt;1s</td>
<td>&gt;100s</td>
</tr>
<tr>
<td>ballast</td>
<td>17 kW</td>
<td>&lt;1s</td>
<td>&gt;10s</td>
</tr>
<tr>
<td>resistance of 10Ω</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COMPAX 10XXSL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>with external</td>
<td>Dynamic 253W</td>
<td>&lt;1s</td>
<td>≥10s</td>
</tr>
<tr>
<td>ballast</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>resistance of 100Ω</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The ballast resistors are fitted with a 1.5m connecting cable. The maximum permitted length is 2m.

**Dimension diagram:**
- BRM4, BRM6 and BRM7
- BRM5/01

BRM5/01 is fitted with a 0.3m connecting cable. The maximum permitted length is 2m.
Accessories and options

External ballast resistors

Housing temperature may reach 200°C.

Dangerous voltage!
The device may only be used if completely fitted!
The external ballast resistances should be fitted so that contact protection is provided.
The housing temperature of the ballast resistance may rise to 200°C depending on the application.
Fit the connection lines underneath.
Observe the information on the resistances (warning signs).

Diagrams: Brake pulse power - cooling period

Authorised braking impulse power with NMD20

Example 1: For a braking time of 0.8s, a braking power of 700W is required.
The following can be determined from the diagram:
At the required magnitudes, this is between factor F=2 and factor F=5.
To maintain operating safety, select factor F=5; therefore the required cooling down time equals:

Cooling down time = F * braking time = 5 * 0.8s = 4s

Example 2: For a braking time of 0.3s, a braking power of 1000W is required.
The following can be determined from the diagram:
At the required magnitudes, this is between factor F=2 and factor F=5.
To maintain operating safety, select factor F=5; therefore the required cooling down time equals:

Cooling down time = F * braking time = 5 * 0.3s = 1.5s
Accessories and options

External ballast resistors

Authorised braking impulse power for NMD20 with BRM4/01

F: Factor
Cooling down time = F * braking time

Authorised braking impulse power for NMD10

F: Factor
Cooling down time = F * braking time
Authorized braking impulse power for COMPAX 2500S with BRM5/01

F: Factor
Cooling down time = F * braking time

Authorized braking impulse power for COMPAX 4500S and COMPAX 8500S

F: Factor
Cooling down time = F * braking time
Authorised braking impulse power for COMPAX 4500S and COMPAX 8500S with BRM 6/01

- Cooling down time = F * braking time

Authorised braking impulse power for COMPAX3500M with BRM7/01

- Cooling down time = F * braking time
### Permissible brake pulse power for COMPAX 1000SL with BRM8/01

<table>
<thead>
<tr>
<th>PBdyP [W]</th>
<th>F=50</th>
<th>F=20</th>
<th>F=10</th>
<th>F=5</th>
<th>F=2</th>
<th>F=1</th>
<th>F=0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0.0</td>
<td>0.5</td>
<td>1.0</td>
<td>1.5</td>
<td>2.0</td>
<td>2.5</td>
<td>3.0</td>
</tr>
</tbody>
</table>

F: Factor
Cooling down time = F * braking time
9.7.6 ServoManager

Use the ServoManager to process complete COMPAX projects; it is included with COMPAX. It contains the following program modules:
- ParameterEditor: for configuring and parametrizing COMPAX.
- ProgramEditor: for creating COMPAX programs
- Terminal: for working directly on the connected COMPAX.

The ServoManager and the program modules are described in a separate manual.

9.7.7 Hand-held terminal

The BDF2/01 hand-held terminal is a simple aid with which you can operate and easily configure COMPAX with the guided menus. The hand-held unit is connected to COMPAX X6 and powered via the RS232 interface. It is therefore suitable for rapid diagnosis and supporting start-up.

Design:
Functions

The hand-held terminal contains the following functions:

- display any status value.
- menu-guided configuration
- view and edit programs.
- view and edit parameters
- direct entry of commands

Key functions

The keys are all assigned two functions. Press the SHIFT key to activate the second function of a key. The second function is displayed in turquoise in the lower section of the key.

<table>
<thead>
<tr>
<th>Keys</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</td>
<td>Answers a question negatively</td>
</tr>
<tr>
<td>YES</td>
<td>Answers a question positively</td>
</tr>
<tr>
<td>ESC</td>
<td>Escape</td>
</tr>
<tr>
<td>ENT</td>
<td>Confirms and accepts</td>
</tr>
<tr>
<td>SHIFT</td>
<td>Selects second function of the key: press once: on; press again: off</td>
</tr>
<tr>
<td>DELETE</td>
<td>Deletes program data record, all jumps to addresses are automatically corrected</td>
</tr>
<tr>
<td>INSERT</td>
<td>Inserts program data record, all jumps to addresses are automatically corrected</td>
</tr>
<tr>
<td>P</td>
<td>Directly select parameter input</td>
</tr>
<tr>
<td>N</td>
<td>Directly select program memory</td>
</tr>
<tr>
<td>F3</td>
<td>Quit</td>
</tr>
</tbody>
</table>

Special functions

| WAIT Ent | WAIT START                                      |
| GOTO Ent | GOTO EXT                                       |
| GOSUB Ent| GOSUB EXT                                      |
| SPEED Ent| SPEED SYNC                                     |

Special COMPAX XX70 commands

| F1 | SETC x                                      |
| F2 | SETM x                                      |
| F3 | SETS                                        |
| F4 | LOOP x                                      |
| POSR Ent | POSR CAM                                  |

Lit display

<table>
<thead>
<tr>
<th>Lit display</th>
<th>Function dark</th>
<th>bright</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1 (red)</td>
<td>No error</td>
<td>Error</td>
</tr>
<tr>
<td>H2 (amber)</td>
<td>No warning</td>
<td>Warning: heat sink temperature &gt;70°C</td>
</tr>
<tr>
<td>OK (green)</td>
<td>Unit not ready</td>
<td>Unit ready for operation</td>
</tr>
<tr>
<td>SH (amber)</td>
<td>First key function</td>
<td>Second key function (SHIFT key pressed)</td>
</tr>
<tr>
<td>All</td>
<td>No voltage</td>
<td>Unit not ready for operation</td>
</tr>
</tbody>
</table>

Supply

The cable is 1.5 m long. The hand-held terminal is also powered through this cable. If the distances involved are longer (>5m), the hand-held terminal will require a direct power supply for fault-free operation.

Error handling

When an error message is present, you can modify the parameter and configuration. To do this, press ESC; the error display goes out and the menu appears. The H1 LED indicates that the error is still present. Once you have modified the parameter, acknowledge the error using F3.
When the hand-held terminal is connected to COMPAX, the password remains the same.

The menu items of the setting levels are described below.
View, edit, delete program

Commands or numerical values are modified by overwriting them.

Direct command entry

Once you have transmitted the command using "Ent", this command reappears in the display and it can be modified and transmitted again.

Special control function

When OUTPUT O. = "X", the cursor is positioned under "X" after the command is transmitted. The value can be modified and transmitted.
When you exit the "Parameter edit" menu using "Esc", the "VC" command (transfer configuration) is transmitted to COMPAX. The configuration parameters are therefore only valid from this moment.

When exiting the "Parameter edit" menu using "NO", the "VC" command is not transmitted.
Set configuration

Switch off Motor? NO

Mode: Normal? NO

Mode: Endless? NO

Input unit: mm? NO

Input unit: inch? NO

Input unit: incr NO

Accel: linear? NO

Selected motor? NO

Motor type 1 P100 = XXX NO

Motor type n P100 = XXX

HDX/Individual motor P100 = 0

Motor number P100 = ...

Spindle Drive? NO

Rack and pinion? NO

Timing belt? NO

Universal Drive? NO

Spindle Length YES

Spindle Diameter YES

Spindle Slope YES

Gear ratio YES

Inertia gear YES

Minimal load YES

Maximal load YES

Teeth in pinion YES

Inertia minimum

HDX/Individual motor

Spin on motor? YES

Switch on motor?

Switch off motor? NO

Changes values and continue with or

Changes values and continue with or

Changes values and continue with or

Enter motor parameter from P100 enable drive by power off/on or by command output O0=0

The standard motors (HBMR- and HDS-Motors) can be configured via the motor number.

You can configure a motor individually by setting P100=0. Therefore fill in the motor data and the motor parameters (from P101).
## 9.8 Appendix: COMPAX components

<table>
<thead>
<tr>
<th>Mains module for COMPAX-M (excluding COMPAX 35XXM)</th>
<th>NMD10</th>
<th>Up to 3 x 500 V AC mains supply connection; direct mains supply operation 10 kW cont. output</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMD20</td>
<td>As NMD10, but with 20 kW continuous output; external ballast resistances available in 3 sizes.</td>
<td></td>
</tr>
</tbody>
</table>

### HDY and HJ motors

You will find information about our range of motors in the motor documentation.

### Motor and resolver cable for HDY and HJ motors

You will find motor and resolver cables on Page 46.

### HAUSER linear unit and initiator equipment

**HLE** 80mm / 100mm / 150mm edge length (ask for information material!)

**HPLA** 80mm / 120mm / 180mm edge length (ask for information material!)

**Initiator equipment**

**IVD1/** Initiator distr. connect. w. cables of the f. lengths [m]: 2.5; 5; 7.5; 10; 12.5; 15; 20; 25; 30; 35; 40; 45; 50

**Initiator**

PNP induction proximity switch: IN HE 521 506 with 6m cable.

### Accessories

**BDF2/01** Hand-held terminal for configuring and operating COMPAX

**BDF1/03** External control panel with housing and without cable

**BDF1/02** External control panel for front plate installation without cable

**SSK6/..** Interface cable between contr. panel and COMPAX av.- in the following lengths: 2.5; 5; 7.5; 10; 12.5; in [m]

**SSU1/01** RS232 - RS485 converters used in conjunction with option F1

**GBK16** COMPAX – motor cable for disposing of SinCos.

**Encoder:**

**EAM4/01** Encoder distributor for creating an encoder bus.

**BUS1/01** Bus termination for encoder bus

**SSK4/..** Connector cable between COMPAX and encoder distributor.

**SSK7/..** Connector cable between encoder distributors or from an encoder emulation.

**ASS1/01** Monitor box for outputting internal measurement signals with D1 option.

**SSK1/..** RS 232 Interface cable for PC COMPAX, available in the following lengths: 2.5; 5; 7.5; 10; in [m]

### Ballast resistors

<table>
<thead>
<tr>
<th>NMD20</th>
<th>BRM4: 0.57 kW-1.5 kW (15Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPAX 25XXS:</td>
<td>BRM6/01: 250W (56Ω)</td>
</tr>
<tr>
<td>COMPAX 45XXS/85XXS:</td>
<td>BRM6/01: 450W (22Ω)</td>
</tr>
<tr>
<td>COMPAX 35XXM:</td>
<td>BRM7/01: 2 kW (10Ω)</td>
</tr>
<tr>
<td>COMPAX 1000SL</td>
<td>BRM8/01: 60W (100Ω)</td>
</tr>
</tbody>
</table>

### AC power filter

<table>
<thead>
<tr>
<th>NMD10 / COMPAX 45XXS/85XXS:</th>
<th>NF01/02 COMPAX 25XXS:</th>
<th>NF01/01 or NF01/05 (w additional COMPAX-M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMD20:</td>
<td>COMPAX XX6X and COMPAX XX70</td>
<td>COMPAX 35XXM:</td>
</tr>
<tr>
<td>COMPAX 25XXS:</td>
<td>NF01/01 or NF01/05 (w additional COMPAX-M)</td>
<td>NMD20:</td>
</tr>
<tr>
<td>COMPAX 45XXS/85XXS:</td>
<td>NF01/01 or NF01/05 (w additional COMPAX-M)</td>
<td>NMD20:</td>
</tr>
<tr>
<td>COMPAX 1000SL:</td>
<td>NF01/01 (&lt;60m motor cable) or NF01/02 (&gt;60m motor cable)</td>
<td>NMD20:</td>
</tr>
<tr>
<td>NMD20:</td>
<td>NMD20:</td>
<td></td>
</tr>
<tr>
<td>NMD20:</td>
<td>NMD20:</td>
<td></td>
</tr>
<tr>
<td>NMD20:</td>
<td>NMD20:</td>
<td></td>
</tr>
</tbody>
</table>

### Motor outp. throttle

For motor lines >20m: MDR01/01 (16A/2mH) • MDR01/02 (30A/1.1mH) • MDR01/03 (>30A/0.64mH)

### Ass. angle bracket

MTS2: for indirect wall installation (heat sink in separate heat chamber) of COMPAX 02/05/15XXM

### Fan set for NMD

Fan set for NMD10 and NMD20 to increase max. brake performance

### ServoManager

To read and write COMPAX parameters and programs

### Bus terminal

**BUS1/01:** Encoder bus

**BUS2/01:** HEDA

**BUS3/01:** Profibus

**BUS4/01:** RS485

**BUS6/01:** Encoder terminal for COMPAX 1000SL

### Options

**F1** 4-wire RS485 interface

**F2** Interbus S Interface

**F3** Profibus

**F4** CANbus

**F5** 2-wire RS485 interface

**F6** CS31

**F7** CANopen

### Encoder interface with line terminator for individual connections.

**E2**

**E3** Encoder simulation for resolver

**E4** Encoder interface without line terminator for creating an encoder bus.

**E7** Analogue speed specification only for COMPAX XX6X and COMPAX XX70 or for SPEED SYNC with COMPAX XX00!

**A1** Absolute value sensor/HEDA Cable to COMPAX: GBK1/.. lengths: 2.5; 5; 7.5; 10; 12.5; 15; 20; 25; 30; 35; 40; 45; 50 [m]

**A4** HEDA f. COMPAX 1000SL Cable COMPAX/COMPAX: SSK14/.. lengths: 2.5; 5; 7.5; 10; 12.5; 15; 20; 25; 30; 35; 40; 45; 50 [m]

**D1** D/A monitor To output the measurement signals, you will need monitor box ASS1/01.

**S1** Sensor interface for SinCos, single-turn or multi-turn

**S2** Programmable sensor interface for SinCos multi-turn

**S3** Sensor interface for linear motors (cable: GBK18)
10. Appendix

10.1 Status values of the standard unit (COMPAX XX00)

### Actual values

<table>
<thead>
<tr>
<th>Designation</th>
<th>Status No.</th>
<th>Unit</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual position</td>
<td>S01</td>
<td>corresp. P90</td>
<td>Current position referenced to real zero.</td>
</tr>
<tr>
<td>Target position</td>
<td>S02</td>
<td>corresp. P90</td>
<td>End position of current or last positioning cycle implemented.</td>
</tr>
<tr>
<td>Lag error</td>
<td>S03</td>
<td>0.1 [corresp. P90]</td>
<td>Difference between nominal and actual position during a positioning cycle.</td>
</tr>
<tr>
<td>Velocity</td>
<td>S04</td>
<td>[%]</td>
<td>Current axis traversing speed.</td>
</tr>
<tr>
<td>Torque</td>
<td>S05</td>
<td>[%]</td>
<td>Current torque as a percentage of the nominal motor torque.</td>
</tr>
<tr>
<td>Temperature</td>
<td>S06</td>
<td>[°C]</td>
<td>Temperature of power final stage ($\leq 85^\circ$C)</td>
</tr>
<tr>
<td>Control voltage</td>
<td>S07</td>
<td>[V]</td>
<td>Value of control voltage</td>
</tr>
<tr>
<td>Mains power</td>
<td>S08</td>
<td>[V]</td>
<td>Value of power or intermediate circuit voltage</td>
</tr>
<tr>
<td>Travel cycle</td>
<td>S09</td>
<td>-</td>
<td>Number of axis motion cycles</td>
</tr>
<tr>
<td>Operating hours</td>
<td>S10</td>
<td>[h]</td>
<td>COMPAX controller operating hours</td>
</tr>
<tr>
<td>Repeat counter</td>
<td>S11</td>
<td>-</td>
<td>Loop counter of an active REPEAT loop.</td>
</tr>
<tr>
<td>Sensor position</td>
<td>S12</td>
<td>corresp. P90</td>
<td>Position of absolute value sensor (option A1) not available in COMPAX XX10 and COMPAX XX30.</td>
</tr>
<tr>
<td>Optimization display</td>
<td>S13</td>
<td></td>
<td>With optimization parameter selected using P233.</td>
</tr>
<tr>
<td>Optimization display</td>
<td>S14</td>
<td></td>
<td>With optimization parameter selected using P234.</td>
</tr>
<tr>
<td>Status monitor</td>
<td>S15</td>
<td></td>
<td>D/A monitor value selected using P182.</td>
</tr>
<tr>
<td>Status bits 1</td>
<td>S16</td>
<td></td>
<td>Information from the status outputs O1...O6 and the last OUTPUT O0 command</td>
</tr>
<tr>
<td>Status bits 2</td>
<td>S17</td>
<td></td>
<td>Information about COMPAX status.</td>
</tr>
<tr>
<td>Error history</td>
<td>S18</td>
<td></td>
<td>The last 4 errors and type of acknowledgement. See below. (all errors but E00, E47, E72 and &gt;E90)</td>
</tr>
</tbody>
</table>

### Diagnosis values

<table>
<thead>
<tr>
<th>Designation</th>
<th>Status No.</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1-I8</td>
<td>S19</td>
<td>Logic signal level of inputs 1...8</td>
</tr>
<tr>
<td>I9-I16</td>
<td>S20</td>
<td>Logic signal level of inputs 9...16</td>
</tr>
<tr>
<td>O1-O8</td>
<td>S21</td>
<td>Logic signal level of outputs 1...8</td>
</tr>
<tr>
<td>O9-O16</td>
<td>S22</td>
<td>Logic signal level of outputs 9...16</td>
</tr>
<tr>
<td>Status drive</td>
<td>S23</td>
<td>Diagnosis values for the status of the drive. (see below for meaning)</td>
</tr>
<tr>
<td>Status switch</td>
<td>S24</td>
<td>Diagnosis values for the status of the switch. (see below for meaning)</td>
</tr>
<tr>
<td>Status limits</td>
<td>S25</td>
<td>Diagnosis values for the limit value monitoring . (see below for meaning)</td>
</tr>
<tr>
<td>Status final stage</td>
<td>S26</td>
<td>Diagnosis value for the status of the final stage.</td>
</tr>
<tr>
<td>Current data record</td>
<td>S27</td>
<td>Display of the data record currently being executed.</td>
</tr>
<tr>
<td>RS232 data</td>
<td>S28</td>
<td>reserved</td>
</tr>
<tr>
<td>Bus data</td>
<td>S29</td>
<td>Interbus-S data / PLC data interface / RS485</td>
</tr>
<tr>
<td>Last error</td>
<td>S30</td>
<td>Error number of the last error to occur (all errors but E00, E72 and &gt;E90).</td>
</tr>
</tbody>
</table>
Appendix COMPAX-M/S

Hand-held terminal

Unit designations

<table>
<thead>
<tr>
<th>Designation:</th>
<th>Status No.</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software version</td>
<td>S31</td>
<td>Designation of software version.</td>
</tr>
<tr>
<td>Software date</td>
<td>S32</td>
<td>Date when program was created.</td>
</tr>
<tr>
<td>Order</td>
<td>S33</td>
<td>Order number (6 digits) Order&amp;part (10 digits) is a unique unit no.</td>
</tr>
<tr>
<td>Part</td>
<td>S34</td>
<td>Serial four-digit number</td>
</tr>
<tr>
<td>Version</td>
<td>S35</td>
<td>Not assigned.</td>
</tr>
<tr>
<td>IFM identification</td>
<td>S36</td>
<td>Date, version and designation of the bus option (hardware module)</td>
</tr>
<tr>
<td>Unit family</td>
<td>S38</td>
<td>E.g. &quot;00&quot;: COMPAX XX00 &quot;30&quot;: COMPAX XX30 ...</td>
</tr>
<tr>
<td>Unit</td>
<td>S39</td>
<td>&quot;0&quot;: COMPAX E &quot;1&quot;: COMPAX-M &quot;2&quot;: COMPAX-S &quot;4&quot;: COMPAX-SL &quot;9&quot;: SV drive</td>
</tr>
<tr>
<td>Status values</td>
<td>S40</td>
<td>Number of status values present</td>
</tr>
</tbody>
</table>

Special COMPAX XX00 status values

<table>
<thead>
<tr>
<th>Designation:</th>
<th>Status No.</th>
<th>Unit</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>S41</td>
<td>%</td>
<td>External velocity when using the SPEED SYNC command.</td>
</tr>
<tr>
<td>Encoder position</td>
<td>S42</td>
<td>P90</td>
<td>External position when using external position localization.</td>
</tr>
<tr>
<td>Measuring error</td>
<td>S47</td>
<td>P90</td>
<td>During external position localization: difference between resolver position and encoder position.</td>
</tr>
<tr>
<td>Current nominal value</td>
<td>S49</td>
<td>P90</td>
<td>Current internal nominal value (output of nominal value setter and track nominal value directly specified by HEDA).</td>
</tr>
</tbody>
</table>

Meaning of status bits

The status bits are not relevant for normal operation; they must not be used for control purposes. They do provide accurate error analysis if you contact HAUSER in case of problems. - The bits are counted from the left to the right.

**S23, S24, S25**

<table>
<thead>
<tr>
<th>Bit</th>
<th>Drive status (S23)</th>
<th>Switch status (S24)</th>
<th>Limits status (S25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (left)</td>
<td>Not assigned</td>
<td>Not assigned</td>
<td>Not assigned</td>
</tr>
<tr>
<td>2</td>
<td>Drive not at standstill</td>
<td>Override function</td>
<td>reserved</td>
</tr>
<tr>
<td>3</td>
<td>Deceleration phase</td>
<td>Limit switch 2 (-) activated</td>
<td>reserved</td>
</tr>
<tr>
<td>4</td>
<td>Acceleration phase</td>
<td>Limit switch 1 (+) activated</td>
<td>Not assigned</td>
</tr>
<tr>
<td>5</td>
<td>Speed reached (speed regulation)</td>
<td>Not assigned</td>
<td>Not assigned</td>
</tr>
<tr>
<td>6</td>
<td>Not assigned</td>
<td>Not assigned</td>
<td>No motor current</td>
</tr>
<tr>
<td>7</td>
<td>Not assigned</td>
<td>Zero initiator activated</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Not assigned</td>
<td>reserved</td>
<td>Not assigned</td>
</tr>
<tr>
<td>9</td>
<td>Not assigned</td>
<td>reserved</td>
<td>Not assigned</td>
</tr>
<tr>
<td>10</td>
<td>Not assigned</td>
<td>Not assigned</td>
<td>Position not OK.</td>
</tr>
<tr>
<td>11</td>
<td>Not assigned</td>
<td>Not assigned</td>
<td>Tracking error</td>
</tr>
<tr>
<td>12</td>
<td>Speed reached (positioning)</td>
<td>reserved</td>
<td>Not assigned</td>
</tr>
<tr>
<td>13</td>
<td>Positioning process complete</td>
<td>Do not change data record (emergency stop)</td>
<td>Not assigned</td>
</tr>
<tr>
<td>14</td>
<td>Drive blocked</td>
<td>reserved</td>
<td>Speed limit reached</td>
</tr>
<tr>
<td>15</td>
<td>Machine zero reference present</td>
<td>Not assigned</td>
<td>Current limit reached</td>
</tr>
<tr>
<td>16 (right)</td>
<td>Not assigned</td>
<td>Not assigned</td>
<td>Not assigned</td>
</tr>
</tbody>
</table>

42 The "0" is not shown on the front plate.

208
Output of status bits via the front plate

The status bits are output via the front plate using 2 hex values.

S16, S17

<table>
<thead>
<tr>
<th>S16:</th>
<th>Bit</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&quot;1&quot;:No fault&lt;br&gt;=&quot;0&quot;:errors E1 ... E57; the drive does not accept any positioning commands. After &quot;Power on&quot;, bit 1 remains at &quot;0&quot; until the self-test has been executed.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>&quot;1&quot;:No warning&lt;br&gt;=&quot;0&quot;:Error ≥ E57</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Machine zero has been approached</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Ready for start</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Programmed nominal position reached</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Idle after stop</td>
<td></td>
</tr>
</tbody>
</table>
| 7, 8 | Bit 7 Bit 8<br>0 0 after OUTPUT O0 = "0"
1 0 after OUTPUT O0 = "1"
0 1 after OUTPUT O0 = "2" |

<table>
<thead>
<tr>
<th>S17:</th>
<th>Bit Meaning when &quot;1&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Password 302 active</td>
</tr>
<tr>
<td>2</td>
<td>Service password active</td>
</tr>
<tr>
<td>3</td>
<td>Command active; move commands (POSA, POSR; speed in speed control mode) are rejected using E92.</td>
</tr>
<tr>
<td>4</td>
<td>Program memory running</td>
</tr>
<tr>
<td>5</td>
<td>Stop via input I6</td>
</tr>
<tr>
<td>6</td>
<td>reserved</td>
</tr>
<tr>
<td>7</td>
<td>RUN (&quot;0&quot; = OFF or switched off when error occurs)</td>
</tr>
<tr>
<td>8</td>
<td>---</td>
</tr>
</tbody>
</table>

Bit sequence during transmission of S16 / S17: Bit 1 is on the left (the transmission starts with bit 1)

**E.g.:** S17 = "1000 0000" during ASCII transfer.

- COMPAX front plate: display "01"
- **E.g.:** password 302 active S17 = 0x80 (if all other bits ="0").

Explanation of error history S18

The errors which occur are recorded by COMPAX in an 8-stage shift register. The entire contents of this memory can be read using a status query. Once the error has been acknowledged, "99" is inserted. Once a new error occurs, this is inserted in the shift memory.

When querying using S18, the contents of the shift register are output separated by spaces.

Once the unit is switched off, S18 is retained. If the unit is switched off while an error is present, a Power On acknowledgement is created when the unit is switched on, i.e. a "98" is inserted in the shift memory.

**Example:**

S18CRLF<br>
Response: S018: 99 55 10 99 53 98 10 99CRCRLF

- The last error, an emergency stop (E55), has been acknowledged.
- E10 occurred before this (E10 has not been acknowledged).
- E53 has been acknowledged.
- E10 has been acknowledged by Power on.

The error memory is completely reset to "00" by the reset parameter, i.e. "00" means no errors.
Appendix

Hand-held terminal

Status monitor S15

You can assign the values of the service D/A monitor to status S15 using parameter P182.

Selection of status value using P182

<table>
<thead>
<tr>
<th>P182</th>
<th>Measuring parameter</th>
<th>Reference parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Nominal speed value sensor</td>
<td>20 000 min⁻¹</td>
</tr>
<tr>
<td>1</td>
<td>Tracking error</td>
<td>128 motor revolutions</td>
</tr>
<tr>
<td>2</td>
<td>Advance speed control</td>
<td>20 000 min⁻¹</td>
</tr>
<tr>
<td>3</td>
<td>Nominal speed value of position controller</td>
<td>20 000 min⁻¹</td>
</tr>
<tr>
<td>4</td>
<td>Actual speed value</td>
<td>20 000 min⁻¹</td>
</tr>
<tr>
<td>5</td>
<td>Loop difference for speed</td>
<td>20 000 min⁻¹</td>
</tr>
<tr>
<td>6</td>
<td>Not assigned</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Not assigned</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Nominal value of transverse current (torque)</td>
<td>200A</td>
</tr>
<tr>
<td>9</td>
<td>Intermediate circuit voltage</td>
<td>1000V</td>
</tr>
<tr>
<td>10</td>
<td>Sine for co-ordinate transformation</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Voltage positioning signal for phase U</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Voltage positioning signal for phase V</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Phase current for phase U</td>
<td>200A</td>
</tr>
<tr>
<td>14</td>
<td>Phase current for phase V</td>
<td>200A</td>
</tr>
<tr>
<td>15</td>
<td>Actual value of transverse current (torque)</td>
<td>200A</td>
</tr>
<tr>
<td>16</td>
<td>Longitudinal current</td>
<td>200A</td>
</tr>
<tr>
<td>17</td>
<td>Scaled transverse voltage (For amplification 1 use: 10V = 2 * ULS)</td>
<td>2 * ULS</td>
</tr>
<tr>
<td>18</td>
<td>Scaled longitudinal voltage (For amplification 1 use: 10V = 2 * ULS)</td>
<td>2 * ULS</td>
</tr>
</tbody>
</table>

The reference parameter corresponds to value 1.

Note concerning status monitor S15

Scaling status monitor S15:
S15 does not have the same scaling as S13/S14.
For S15 use: S15=1 for the reference value which is given for the D/A monitor.

10.2 Additional COMPAX measuring quantities

<table>
<thead>
<tr>
<th>D/A monitor channels 0 ... 3</th>
<th>Signal indicators (optimization display) S13 / S14 (P233/P234)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status monitor S15 (P182); HEDA</td>
<td>Selection</td>
</tr>
<tr>
<td>Nominal speed value sensor</td>
<td>1</td>
</tr>
<tr>
<td>Tracking error</td>
<td>2</td>
</tr>
<tr>
<td>Advance speed control</td>
<td>3</td>
</tr>
<tr>
<td>Nominal speed value of position controller</td>
<td>4</td>
</tr>
<tr>
<td>Actual speed value</td>
<td>5</td>
</tr>
<tr>
<td>Loop difference for speed</td>
<td>6</td>
</tr>
<tr>
<td>Not assigned</td>
<td>7</td>
</tr>
<tr>
<td>Speed controller output (nominal current value)</td>
<td>8</td>
</tr>
<tr>
<td>Nominal value of transverse current (torque)</td>
<td>9</td>
</tr>
<tr>
<td>Intermediate circuit voltage</td>
<td>10</td>
</tr>
<tr>
<td>Voltage positioning signal for phase U</td>
<td>11</td>
</tr>
<tr>
<td>Voltage positioning signal for phase V</td>
<td>12</td>
</tr>
<tr>
<td>Phase current for phase U</td>
<td>13</td>
</tr>
<tr>
<td>Phase current for phase V</td>
<td>14</td>
</tr>
<tr>
<td>Actual value of transverse current (torque)</td>
<td>15</td>
</tr>
<tr>
<td>Longitudinal current</td>
<td>16</td>
</tr>
</tbody>
</table>

43 To determine torque: torque = 3 * transverse current * 0.71 * torque constant
44 To determine torque: torque = 3 * transverse current * 0.71 * torque constant
### Additional COMPAX measuring quantities

**D/A monitor channels 0 ... 3**

**Status monitor S15 (P182); HEDA**

<table>
<thead>
<tr>
<th>Selection</th>
<th>Measuring quantity</th>
<th>Reference value</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>Scaled transverse voltage</td>
<td>2 * ULS</td>
</tr>
<tr>
<td>18</td>
<td>Scaled longitudinal voltage (For amplification of 1 use; 10V = 2 * ULS)</td>
<td>2 * ULS</td>
</tr>
<tr>
<td>19</td>
<td>Host frequency 12/18 Mhz</td>
<td>2 *</td>
</tr>
<tr>
<td>20</td>
<td>Analogue HF1 CPX 70 / IPM</td>
<td>100% = 0.1V</td>
</tr>
<tr>
<td>21</td>
<td>Analogue HF2 CPX 70 / IPM</td>
<td>100% = 0.1V</td>
</tr>
<tr>
<td>22</td>
<td>Master position (CPX 70)</td>
<td>Mt = 0.1 V</td>
</tr>
<tr>
<td>23</td>
<td>Slave nominal position (CPX 70)</td>
<td>St = 0.1V</td>
</tr>
<tr>
<td>24</td>
<td>Master speed (CPX 60, CPX 70)</td>
<td>2000 min⁻¹ = 1V</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Signal indicators (optimization display) S13 / S14 (P233/P234)**

<table>
<thead>
<tr>
<th>Selection</th>
<th>Meaning</th>
<th>Reference value</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>Total number of HEDA transmission errors since beginning of synchronization</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Process nominal value HEDA</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>HEDA control word</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>HEDA status word</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>CPX X50 max. pos. synchronous lag error [units corresp. P90]</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>CPX X50 max. neg. synchronous lag error [units corresp. P90]</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Output value of D/A monitor channel 1 (10V corresponds to 1)</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Output value of D/A monitor channel 2 (10V corresponds to 1)</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Output value of service D/A monitor channel 3 (10V corresponds to 1)</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Output value of service D/A monitor channel 4 (10V corresponds to 1)</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>External encoder position (units corresp. P90)</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Measuring error (Difference between resolver position and external encoder position in the unit corresponding to P90)</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Effective motor load in % of the permissible motor continuous load (from 100% = 1.1INominal E53 is indicated)</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Effective unit load in % of the permitted continuous unit load (E53 is displayed from 100%)</td>
<td></td>
</tr>
</tbody>
</table>

**Meaning**

<table>
<thead>
<tr>
<th>Variant</th>
<th>Reference values</th>
</tr>
</thead>
<tbody>
<tr>
<td>7x</td>
<td>10V = 2²</td>
</tr>
<tr>
<td>7x</td>
<td>10V = 2² per thousands</td>
</tr>
<tr>
<td>7x</td>
<td>10V = 2² cycles</td>
</tr>
<tr>
<td>00,60,7x</td>
<td>10V = 2² ms</td>
</tr>
<tr>
<td>00,60,7x</td>
<td>10V = 2²</td>
</tr>
<tr>
<td>00,60,7x</td>
<td>10V = 2²² encoder increments/ms</td>
</tr>
<tr>
<td>00,60,7x</td>
<td>10V = 2² encoder increments/ms</td>
</tr>
<tr>
<td>00,60,7x</td>
<td>10V = 128 motor revolutions</td>
</tr>
<tr>
<td>00,60,7x</td>
<td>10V = 128 motor revolutions</td>
</tr>
<tr>
<td>00,60,7x</td>
<td>10V = 2⁵ encoder increments/ms</td>
</tr>
<tr>
<td>47</td>
<td>Mark position (units corresp. P90) (COMPAX XX70)</td>
</tr>
</tbody>
</table>

**Bit 23...8:** virtual inputs I33...I48

**Bit 7...0:** virtual inputs I32...I25

45 The peak value is deleted after 24V off/on or after shut down of the final stage (OTA=1/2).
10.3 COMPAX parameter

10.3.1 VP parameter can be modified "On Line"

VP parameters can be modified and transferred and the password specified in any COMPAX operating mode.

Note!

Note the following points.

1. Processor load
When parameters are being validated using the "VP" command, the response time and command execution time is temporarily extended due to the increased computing time. e.g. when the parameters are transferred, a "Stop signal" is recognized after a short delay. Typical delay times would be:

- range of parameters: P1 ... P79: approx. 0.5 ms per parameter.
- >P79: approx. 20 ms.

2. Modifying the controller setting
When modifying the controller setting via parameters P23, P24, P25, P26, P27 or P70, comparison processes may occur. These may be detected as short axis readjustments. Therefore: only modify parameters in small steps when the axis is active.

3. Area of application
This extension to the function is used for the start-up and for optimizing the axis. It is not intended for the implementation of control tasks.

Please note: The axis must be switched off if modified VP parameters are to be transferred (e.g. via OUTPUT O0=1).

10.3.2 COMPAX standard parameters

Parameter groups:

<table>
<thead>
<tr>
<th>Control parameters</th>
<th>P40 ... P49</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limitations</td>
<td>P11 ... P16</td>
</tr>
<tr>
<td>Bus parameters</td>
<td>P135 ... P142, P190 ... P196</td>
</tr>
<tr>
<td>D/A monitor, status monitor S15</td>
<td>P71 ... P74, P76, P77, P182</td>
</tr>
<tr>
<td>Inputs/outputs: assignment / meaning</td>
<td>P18, P211, P221 ... P225, P227, P245, P246</td>
</tr>
<tr>
<td>Define encoder interfaces(option)</td>
<td>P75, P98, P143, P144, P146, P232</td>
</tr>
<tr>
<td>Substitution and specification values:</td>
<td>P1 ... P10</td>
</tr>
<tr>
<td>HEDA</td>
<td>P181, P184 ... P188, P243, P247 ... P250</td>
</tr>
<tr>
<td>Configuration parameters</td>
<td>P80 ... P85, P88, P90, P92, P93, P98</td>
</tr>
<tr>
<td>Mark reference</td>
<td>P35, P37, P38, P39</td>
</tr>
<tr>
<td>Define mechanical reference system</td>
<td>P29, P206, P212 ... P217,</td>
</tr>
<tr>
<td>Motor parameters</td>
<td>P100 ... P133</td>
</tr>
<tr>
<td>Optimization parameters, optimization display</td>
<td>P21 ... P27, P50, P67 ... P70, P94, P151, P233, P234</td>
</tr>
<tr>
<td>Parameters of software variants</td>
<td>P30 ... P39</td>
</tr>
<tr>
<td>RS232</td>
<td>P19, P20</td>
</tr>
<tr>
<td>Other parameters</td>
<td>P17, P218, P219, P229</td>
</tr>
<tr>
<td>PLC data interface</td>
<td>P18</td>
</tr>
</tbody>
</table>

* Parameters not described here are reserved.

46 VP means "Valid Parameter" and is a COMPAX command with which COMPAX accepts a modified parameter from a specific parameter group. The VP parameters are marked in the following parameter lists in the column "Valid from...".
Remark

The specified limit values refer to all parameters. Theoretical combinations are possible within these limits, however they could cause an internal number overrun. The following limitation applies.

Travel per motor revolution:
- Spindle drive: P83;
- Rack-and-pinion/toothed belt P82 * P83;
- General drive: P83 (/1000 in mm)

List of parameters, sorted by number

<table>
<thead>
<tr>
<th>No.</th>
<th>Meaning</th>
<th>Unit</th>
<th>Minimum value</th>
<th>Default value</th>
<th>Maximum value</th>
<th>Valid from...</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Real – zero point (distance real zero-machine zero).</td>
<td>corresp.</td>
<td>- 1 000 000</td>
<td>0.00</td>
<td>+1 000 000</td>
<td>immediat.</td>
</tr>
<tr>
<td>P2</td>
<td>Substitute for non-programmed velocity.</td>
<td>%</td>
<td>1.00</td>
<td>10.00</td>
<td>100.00</td>
<td>immediat.</td>
</tr>
<tr>
<td>P3</td>
<td>Velocity for find machine zero.</td>
<td>%</td>
<td>-100.00</td>
<td>10.00</td>
<td>100.00</td>
<td>immediat.</td>
</tr>
<tr>
<td>P4</td>
<td>Velocity for approach real zero.</td>
<td>%</td>
<td>1.00</td>
<td>10.00</td>
<td>100.00</td>
<td>immediat.</td>
</tr>
<tr>
<td>P5</td>
<td>Velocity for processing by hand.</td>
<td>%</td>
<td>1.00</td>
<td>10.00</td>
<td>100.00</td>
<td>immediat.</td>
</tr>
<tr>
<td>P6</td>
<td>Substitute value for non-programmed ramp time.</td>
<td>ms</td>
<td>1</td>
<td>1000</td>
<td>60 000</td>
<td>immediat.</td>
</tr>
<tr>
<td>P7</td>
<td>Ramp time for approach machine zero.</td>
<td>ms</td>
<td>1</td>
<td>1000</td>
<td>60 000</td>
<td>immediat.</td>
</tr>
<tr>
<td>P8</td>
<td>Ramp time for approach point of real zero.</td>
<td>ms</td>
<td>1</td>
<td>1000</td>
<td>60 000</td>
<td>immediat.</td>
</tr>
<tr>
<td>P9</td>
<td>Ramp time for processing by hand.</td>
<td>ms</td>
<td>1</td>
<td>1000</td>
<td>60 000</td>
<td>immediat.</td>
</tr>
<tr>
<td>P10</td>
<td>Ramp time after limit switch or emergency stop is activated.</td>
<td>ms</td>
<td>1</td>
<td>250</td>
<td>60 000</td>
<td>immediat.</td>
</tr>
<tr>
<td>P11</td>
<td>Max. positive position referenced to machine zero.</td>
<td>corresp.</td>
<td>P12</td>
<td>+4 000 000.00</td>
<td>+4 000 000.00</td>
<td>VP</td>
</tr>
<tr>
<td>P12</td>
<td>Max. negative position referenced to machine zero.</td>
<td>corresp.</td>
<td>P13</td>
<td>0</td>
<td>10.00</td>
<td>4 000 000.00</td>
</tr>
<tr>
<td>P13</td>
<td>Max. permitted lag tolerance (error E10 is triggered when exceeded); E10 &amp; E49 are switched off with specification &quot;0&quot;.</td>
<td>corresp.</td>
<td>P14</td>
<td>0.00</td>
<td>1.00</td>
<td>4 000.00</td>
</tr>
<tr>
<td>P14</td>
<td>Max. permitted positioning zone (applies for message O5 : “Position reached”)</td>
<td>corresp.</td>
<td>P15</td>
<td>0.00</td>
<td>100.00</td>
<td>100.00</td>
</tr>
<tr>
<td>P15</td>
<td>Max. permitted velocity</td>
<td>%</td>
<td>100.00</td>
<td>100.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P16</td>
<td>Max. permissible torque</td>
<td>%</td>
<td>0</td>
<td>200</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>P17</td>
<td>Engine brake lag</td>
<td>ms</td>
<td>0</td>
<td>0</td>
<td>4000</td>
<td></td>
</tr>
<tr>
<td>P18</td>
<td>PLC data interface</td>
<td>Bit(s)</td>
<td>4800</td>
<td>9600</td>
<td>9600</td>
<td>Power on</td>
</tr>
</tbody>
</table>

47 In speed control mode in % of nominal speed (P104), otherwise corresponds to P90
48 In speed control mode in % of nominal speed (P104), otherwise corresponds to P90
49 For asynchronous motors, the maximum permitted velocity may be up to 300% of the nominal velocity.
50 Bit counting begins at bit 0.
51 By simultaneously pressing the three front plate keys when switching on, the baud rate is set to 9600. With COMPAX 1000SL, the baud rate is always set to 9600.
## Appendix

### COMPAX-M/S

#### COMPAX standard parameters

<table>
<thead>
<tr>
<th>No.</th>
<th>Meaning</th>
<th>Unit</th>
<th>Minimum value</th>
<th>Default value</th>
<th>Maximum value</th>
<th>Valid from...</th>
</tr>
</thead>
<tbody>
<tr>
<td>P20</td>
<td>RS232 handshake</td>
<td>Software handshake</td>
<td>&quot;0&quot;: without &quot;1&quot;: with XON, XOFF</td>
<td></td>
<td></td>
<td>Power on</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Error transmission / negative command acknowledgement (E90 - E94)</td>
<td>&quot;0&quot;: Error only with interface activity and if the transmitted command triggers an error. No neg. command acknowledgement (E90 - E94). &quot;2&quot;: no transmission of error and no neg. command acknowl. (E90 – E94). &quot;4&quot;: Messages are indated for errors and neg. command acknowl. (E90 – E94) as soon as th. occur w. Exx C&lt;sub&gt;R&lt;/sub&gt; l&lt;sub&gt;F&lt;/sub&gt; &gt;. &quot;6&quot;: errors &amp; neg. command acknow. (E90 – E94) only with interface activity.</td>
<td></td>
<td></td>
<td>immediat.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>End sign selection</td>
<td>&quot;0&quot;: C&lt;sub&gt;R&lt;/sub&gt; l&lt;sub&gt;F&lt;/sub&gt; &gt; &quot;8&quot;: C&lt;sub&gt;R&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>Power on</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Binary transfer</td>
<td>&quot;0&quot;: without &quot;16&quot;: with</td>
<td></td>
<td></td>
<td>immediat.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BCC: block check EXOR via all signs apart from the end sign</td>
<td>&quot;0&quot;: without &quot;128&quot;: with</td>
<td></td>
<td></td>
<td>Power on</td>
</tr>
<tr>
<td>P21</td>
<td>Factor for influencing the travel per motor revolution</td>
<td></td>
<td>0.1000</td>
<td>1.0000</td>
<td>10.0000</td>
<td>VP&amp;VC</td>
</tr>
<tr>
<td>P22</td>
<td>Factor for modifying the speed which is allocated to speed SPEED 100%</td>
<td></td>
<td>0.5000</td>
<td>1.0000</td>
<td>2.0000</td>
<td>VP&amp;VC</td>
</tr>
<tr>
<td>P23</td>
<td>Stiffness of drive</td>
<td>%</td>
<td>10</td>
<td>100</td>
<td>2000</td>
<td>VP</td>
</tr>
<tr>
<td>P24</td>
<td>Speed controller damping</td>
<td>%</td>
<td>0</td>
<td>100</td>
<td>500</td>
<td>VP</td>
</tr>
<tr>
<td>P25</td>
<td>Speed – advance control value</td>
<td>%</td>
<td>0</td>
<td>100</td>
<td>500</td>
<td>VP</td>
</tr>
<tr>
<td>P26</td>
<td>Acceleration – advance control value</td>
<td>%</td>
<td>0</td>
<td>100</td>
<td>500</td>
<td>VP</td>
</tr>
<tr>
<td>P27</td>
<td>Moment of inertia</td>
<td>%</td>
<td>10</td>
<td>100</td>
<td>500</td>
<td>VP</td>
</tr>
<tr>
<td>P29</td>
<td>Machine zero comparison</td>
<td>Degre e</td>
<td>0</td>
<td>0</td>
<td>360</td>
<td>VP</td>
</tr>
<tr>
<td>P35</td>
<td>Switch on mark reference</td>
<td>&quot;0&quot;: switched off &quot;1&quot;: switched on</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P36</td>
<td>Limitation of speed correction value for external position adjustment (only COMPAX XX00 and COMPAX XX30)</td>
<td>% of nominal speed (P104)</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>VP</td>
</tr>
<tr>
<td>P37</td>
<td>Minimum travel to mark</td>
<td>corr. P90</td>
<td>0.00</td>
<td>0.00</td>
<td>&lt;P38</td>
<td>VP</td>
</tr>
<tr>
<td>P38</td>
<td>Maximum travel to mark</td>
<td>corr. P90</td>
<td>&gt;P37</td>
<td>0.00</td>
<td>4 000 000.00</td>
<td>VP</td>
</tr>
<tr>
<td>P39</td>
<td>Maximum feed length</td>
<td>corr. P90</td>
<td>≥P38</td>
<td>0.00</td>
<td>&lt;P11 or P12</td>
<td>VP</td>
</tr>
<tr>
<td>P40</td>
<td>Control parameters</td>
<td></td>
<td>-4 000 000</td>
<td>0</td>
<td>+4 000 000</td>
<td>immediat.</td>
</tr>
<tr>
<td>P41</td>
<td>Control parameters</td>
<td></td>
<td>-4 000 000</td>
<td>0</td>
<td>+4 000 000</td>
<td>immediat.</td>
</tr>
<tr>
<td>P42</td>
<td>Control parameters</td>
<td></td>
<td>-4 000 000</td>
<td>0</td>
<td>+4 000 000</td>
<td>immediat.</td>
</tr>
<tr>
<td>P43</td>
<td>Control parameters</td>
<td></td>
<td>-4 000 000</td>
<td>0</td>
<td>+4 000 000</td>
<td>immediat.</td>
</tr>
<tr>
<td>P44</td>
<td>Control parameters</td>
<td></td>
<td>-4 000 000</td>
<td>0</td>
<td>+4 000 000</td>
<td>immediat.</td>
</tr>
<tr>
<td>P45</td>
<td>Control parameters</td>
<td></td>
<td>-4 000 000</td>
<td>0</td>
<td>+4 000 000</td>
<td>immediat.</td>
</tr>
<tr>
<td>P46</td>
<td>Control parameters</td>
<td></td>
<td>-4 000 000</td>
<td>0</td>
<td>+4 000 000</td>
<td>immediat.</td>
</tr>
<tr>
<td>P47</td>
<td>Control parameters</td>
<td></td>
<td>-4 000 000</td>
<td>0</td>
<td>+4 000 000</td>
<td>immediat.</td>
</tr>
<tr>
<td>P48</td>
<td>Control parameters</td>
<td></td>
<td>-4 000 000</td>
<td>0</td>
<td>+4 000 000</td>
<td>immediat.</td>
</tr>
<tr>
<td>P49</td>
<td>Control parameters</td>
<td></td>
<td>-4 000 000</td>
<td>0</td>
<td>+4 000 000</td>
<td>immediat.</td>
</tr>
</tbody>
</table>

52 When motor nominal speeds have been modified, use this factor to perform a simple adaptation to the current program.

53 When P93 = 4, P25 must be >0.

214
<table>
<thead>
<tr>
<th>No.</th>
<th>Meaning</th>
<th>Unit</th>
<th>Minimum value</th>
<th>Default value</th>
<th>Maximum value</th>
<th>Valid from...</th>
</tr>
</thead>
<tbody>
<tr>
<td>P50</td>
<td>Enable speed monitor (=101)</td>
<td>=100:</td>
<td>without monitor (default setting)</td>
<td></td>
<td></td>
<td>VP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>=101:</td>
<td>with monitor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P56</td>
<td>D section rpm controller</td>
<td>%</td>
<td>0</td>
<td>0</td>
<td>10 000</td>
<td>VP</td>
</tr>
<tr>
<td>P57</td>
<td>Filter acceleration</td>
<td>%</td>
<td>100</td>
<td>550</td>
<td></td>
<td>VP</td>
</tr>
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<td>P58</td>
<td>Lag rapid rpm signal</td>
<td>%</td>
<td>100</td>
<td>550</td>
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<td>P59</td>
<td>Structure switch measuring</td>
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<td>4:</td>
<td>Variant 1 (for resolver)</td>
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<td>3:</td>
<td>Variant 2 (for SinCos°)</td>
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<td>Variant 3 (Rapid rpm controller)</td>
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<td></td>
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<td>+16:</td>
<td>Sensitive stiffness (P23)</td>
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<td>+65536:</td>
<td>Sensitive D section (P56)</td>
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<tr>
<td>P67</td>
<td>D-element slip filter</td>
<td>%</td>
<td>0</td>
<td>100</td>
<td>500</td>
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<tr>
<td>P68</td>
<td>Slip filter lag</td>
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<tr>
<td>P69</td>
<td>Reverse advance control (&quot;0&quot;: without reverse advance control)</td>
<td>%</td>
<td>0</td>
<td>0</td>
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<td>P70</td>
<td>Current – advance control value</td>
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<td>P72</td>
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<td>P73</td>
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<td>18</td>
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<td>P74</td>
<td>Address of D/A monitor 2</td>
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<tr>
<td>P75</td>
<td>Max. permitted measuring error (difference betw. resolver pos. and external encoder pos.)</td>
<td>P90</td>
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<td>0</td>
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<tr>
<td>P76</td>
<td>Address of D/A monitor 3 (decimal place =0 = amplification 1)</td>
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<td>P77</td>
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<td>VP</td>
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<td>P80</td>
<td>Drive type</td>
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<td></td>
<td></td>
<td>&quot;4/8&quot;: rack-and-pinion/toothed belt</td>
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<td></td>
<td></td>
<td>&quot;16&quot;: general drive / linear motor</td>
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<td></td>
</tr>
</tbody>
</table>

**Drive type "Spindle drive" (P80="2")**

| P81 | Length                     | mm   | 0.00 | 0.00 | 5000.00 | VC   |
| P82 | Diameter                   | mm   | 8.00 | 0.00 | 80.00   | VC   |
| P83 | Pitch                      | mm   | 1.00 | 0.00 | 400.00  | VC   |
| P84 | Moment of inertia for transmission and coupling                          | kgcm²| 0.00 | 0.00 | 200.00  | VC   |
| P85 | Ratio                      |      | 1.000000 | 1.000000 | 100.000000 | VC   |
| P88 | Max. translational mass moved | kg  | 0    | 500   |       | VC   |
| P92 | Min. translational mass moved                                      | kg   | 0    | P88   |       | VC   |

**"Rack-and-pinion/toothed belt" drive type (P80="4/8")**

| P82 | Tooth number              | Tooth number * tooth pitch | VC   |
| P83 | Tooth pitch               | mm   | 1.00 | 410.00 | VC   |
| P84 | Moment of inertia for transmission and coupling                          | kgcm²| 0.00 | 0.00 | 200.00 | VC   |
| P85 | Ratio                      |      | 1.000000 | 1.000000 | 100.000000 | VC   |
| P88 | Max. translational mass moved | kg  | 0    | 500   |       | VC   |
| P92 | Min. translational mass moved                                      | kg   | 0    | P88   |       | VC   |

**"General drive" drive type (P80="16")**

| P81 | Min. total moment of inertia | kgmm²| 0.00 | 0.00 | Jmax.(82) | VC   |

With linear motors: \( P81 = \frac{m_{\text{min}} \cdot P126}{(1000 \cdot 2 \cdot II)^2} \)
### Appendix COMPAX-M/S

#### COMPAX standard parameters

<table>
<thead>
<tr>
<th>No.</th>
<th>Meaning</th>
<th>Unit</th>
<th>Minimum value</th>
<th>Default value</th>
<th>Maximum value</th>
<th>Valid from...</th>
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<tr>
<td>P82</td>
<td>Max. total moment of inertia</td>
<td>kgmm²</td>
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<td>0.00</td>
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<tr>
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<td>With linear motors: $P82 = \frac{m_{\text{max}} \cdot P126}{(1000 \cdot 2 \cdot \Pi)^2}$</td>
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<td>P83</td>
<td>Travel per motor revolution</td>
<td>µm or incr.</td>
<td>10</td>
<td>0.00</td>
<td>4 000 000µm</td>
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<td>With linear motors: $P83 = P126$</td>
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<td>P90</td>
<td>Unit for travel</td>
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<td></td>
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<td>*&quot;2&quot;: inch</td>
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<td>P93</td>
<td>Operating mode</td>
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<td>P94</td>
<td>Ramp shape</td>
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<td>VC</td>
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<td></td>
<td>*&quot;1&quot;: linear</td>
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<td></td>
<td>*&quot;2&quot;: smooth</td>
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<td>P96</td>
<td>Transmission factor for the reset route of S2</td>
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<td>option. *=&quot;0&quot;: no reset function.</td>
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<td>P98</td>
<td>Travel of axis per encoder revolution</td>
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<td></td>
<td>Corresponds to $P90$</td>
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</table>

### Parameters Explained

54 When in speed control mode, $P25$ must > 0.
55 From next process command
56 From next process command
57 A: parameter for asynchronous motors
   S: parameter for synchronous motors
   L: parameter for linear motors

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<table>
<thead>
<tr>
<th>No.</th>
<th>Meaning</th>
<th>Unit</th>
<th>Minimum value</th>
<th>Default value</th>
<th>Maximum value</th>
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<tr>
<td>P112</td>
<td>Slip frequency</td>
<td>A</td>
<td>mHz</td>
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<td>20 000</td>
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<td>P113</td>
<td>Maximum speed</td>
<td>A,S</td>
<td>min⁻¹</td>
<td>0</td>
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<td>Linear motor:</td>
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<td></td>
<td>$P113 = \frac{V_{\text{max}} \cdot 1000 \cdot 60000}{P126}$</td>
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<td>P115</td>
<td>Angular speed</td>
<td>A</td>
<td>% of $P104$</td>
<td>50</td>
<td>100</td>
<td>200</td>
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<tr>
<td>P116</td>
<td>Stator resistance</td>
<td>A,S,L</td>
<td>mOhm</td>
<td>0</td>
<td>150 000</td>
<td>VC</td>
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<tr>
<td>P119</td>
<td>Start of saturation</td>
<td>S,L</td>
<td>%</td>
<td>70</td>
<td>100</td>
<td>&lt;P120</td>
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<tr>
<td>P120</td>
<td>End of saturation</td>
<td>S,L</td>
<td>%</td>
<td>&gt; P119</td>
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<td>P121</td>
<td>Minimum stator inductivity</td>
<td>S,L</td>
<td>% of $P109$</td>
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<td>P123</td>
<td>Rotor - scatter inductivity</td>
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<td>μH</td>
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<td>P124</td>
<td>Rotor resistance</td>
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<td>mOhm</td>
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<td>Nominal voltage</td>
<td>A</td>
<td>V</td>
<td>10</td>
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<tr>
<td>P126</td>
<td>Pitch length of motor magnets in μm (2 * Pole distance)</td>
<td>L</td>
<td>20 000</td>
<td>100 000</td>
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<tr>
<td>P127</td>
<td>Denominator: Dash count linear encoder per pitch length (see P133)</td>
<td>L</td>
<td>-</td>
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<td>1</td>
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<tr>
<td>P128</td>
<td>Cut-off value of temperature sensor for E48</td>
<td>A,S,L</td>
<td>Ω</td>
<td>0</td>
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<td>&quot;0&quot;: HDX / HDY – motors</td>
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<td>&quot;1270&quot;: HJ – motors</td>
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<td>P129</td>
<td>Resolver offset</td>
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<td>P130</td>
<td>Resolver frequency</td>
<td>A,S,L</td>
<td>&quot;2&quot;:5kHz(P4)</td>
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<td>&lt;P133</td>
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<tr>
<td>P131</td>
<td>Resolver – transformation ratio</td>
<td>A,S,L</td>
<td>&quot;2&quot;: $\hat{u} = 0.5$ (e.g. P4 resolver)</td>
<td>%</td>
<td>70</td>
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<tr>
<td></td>
<td>Level adaptation (1/$\hat{u}$) for resolver or SinCos sensitive sensor (from V5.61) setting aids</td>
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<td></td>
<td>&quot;0&quot;: 100% = 0.5; 200% = 0.25; 70% = 0.71;</td>
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<td>70</td>
<td>100</td>
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<td>VC</td>
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<tr>
<td>P132</td>
<td>Position sensor</td>
<td>A,S</td>
<td>&quot;2&quot;: 2-pol. resolver (P4)</td>
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<td>&quot;10&quot;: TTL linear encoder</td>
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<td>With linear motors:</td>
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<td>&quot;11&quot;: SinCos linear encoder</td>
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<tr>
<td>P133</td>
<td>Sensor dash count</td>
<td>A,S</td>
<td>-</td>
<td>65 536</td>
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<td>With linear motors:</td>
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<tr>
<td></td>
<td>Dash count linear encoder per pitch length (counter: see P127)</td>
<td>L</td>
<td>1/μm</td>
<td>&gt; P127</td>
<td>&lt; 8388607</td>
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<td>Dash count per pitch length = P133/P127</td>
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<td>P134</td>
<td>Nominal load capacity of the external ballast resistance (100Ω) in [W]</td>
<td>Watts</td>
<td>2</td>
<td>60</td>
<td>8000</td>
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<td>P135 – P142</td>
<td>Bus – parameter</td>
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<td>P143</td>
<td>Encoder pulses per revolution (channel 1)</td>
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<td>128</td>
<td>4096</td>
<td>2 000 000</td>
<td>VC</td>
</tr>
</tbody>
</table>

---

58 Resolver transformation ratio $\hat{u} = \text{resolver output voltage} / \text{resolver input voltage}$

59 The read-in level is displayed in the square of the channel 57 optimizing display.

With $P233 = 57$ this value is in S13. Meaning:

- $P131 = 0.405 \cdot 100\%$ (rounded to the nearest percent)
- $P131 = \left[ \frac{0.405}{S13} \right] \times 100\%$

The current default setting "2" is still possible.

Note: Resolver with $\hat{u}=1$ cannot be operated!

60 Select P133 as large as possible to achieve maximum accuracy. P133 does not have fractional digits.
## Appendix COMPAX-M/S

### COMPAX standard parameters

<table>
<thead>
<tr>
<th>No.</th>
<th>Meaning</th>
<th>Unit</th>
<th>Minimum value</th>
<th>Default value</th>
<th>Maximum value</th>
<th>Valid from...</th>
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<tbody>
<tr>
<td>P144</td>
<td>Setting encoder channel 1</td>
<td>=&quot;4&quot;: without external position localization</td>
<td>X19/2→i1</td>
<td>VC</td>
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<td>=&quot;6&quot;: external position localization switched on via channel 1.</td>
<td>X19/3→i2</td>
<td>VC</td>
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<td>VC</td>
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<td>P146</td>
<td>Resolution of encoder emulation (channel 2)</td>
<td>=0: 1024</td>
<td>=8: 512</td>
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<td>P148</td>
<td>End stage designation</td>
<td>&quot;Read only&quot; – parameter ≡ S37</td>
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<td>P149</td>
<td>Configuration</td>
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<td>&quot;1&quot;: valid</td>
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<td>P151</td>
<td>Responsiveness of the monitor control</td>
<td>%</td>
<td>0</td>
<td>30</td>
<td>500</td>
<td>VP</td>
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<td>P156</td>
<td>Allocation of inputs I1...I6 to the input pins on X19</td>
<td>Bits</td>
<td>-8388608</td>
<td>8388607</td>
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<td>Bit 20 – 23 input 6</td>
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<td>P157</td>
<td>Allocation of inputs I7...I12 to the input pins on X19</td>
<td>Bits</td>
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<td>8388607</td>
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<td>Bit 8 – 11 input 9</td>
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<td>Bit 20 – 23 input 12</td>
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<td>P158</td>
<td>Allocation of inputs I13...I16 to the input pins on X19</td>
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<td>Bit 20 – 23 free</td>
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<td>P159</td>
<td>Allocation of output pins X19/15 ... X19/18 to the logic outputs</td>
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<td>Bit 12 – 15 Pin X19/22</td>
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<td>P161</td>
<td>Maximum angle difference with absolute resolver function (4096 = 1 motor revolution)</td>
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<td>100</td>
<td>2047</td>
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<td>P181</td>
<td>HEDA – parameter: coupling window (µm or increments)</td>
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<td>10</td>
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<td>P182</td>
<td>Setting status monitor S15</td>
<td>0</td>
<td>0</td>
<td>532 767</td>
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61 When P149="0", all parameters apart from the bus settings P194, P195, P196, P250 are set to default values when switched on.
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<th>No.</th>
<th>Meaning</th>
<th>Unit</th>
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<th>Default value</th>
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<td>P184</td>
<td>Selection parameters for HEDA – process value (master)</td>
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<td>40: encoder position</td>
<td>42: internal time base</td>
<td>43: scaled master position</td>
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<td>Default value: P184=0</td>
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<td>P185 – P187</td>
<td>HEDA – parameter</td>
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<td>40: encoder coupling for encoder input signals (P184=40)</td>
<td>140: encoder coupling for other input signals (P184≠40)</td>
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<td>Selection parameters for HEDA – process value (slave)</td>
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<td>Default value: P188=0</td>
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<td>P191 – P196</td>
<td>Bus – parameter</td>
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<td>&quot;Read only&quot; – parameter</td>
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<td>P197</td>
<td>Order (status S33)</td>
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<td>P198</td>
<td>Part (status S34)</td>
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<td>&quot;Read only&quot; – parameter</td>
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<tr>
<td>P202</td>
<td>With machine zero mode P212=&quot;8&quot;: Distance machine zero – limit switch (setting &quot;0&quot; corresponds to &quot;3&quot;)</td>
<td>motor revol.</td>
<td>3</td>
<td>0</td>
<td>255</td>
<td>VP</td>
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<td>P206</td>
<td>Enables the absolute value sensor input / the reset function of option S2 / absolute value sensor</td>
<td>=$1$: absolute value sensor input enabled or reset function switched on (S2 opt.)</td>
<td>=$2$: absolute value sensor enabled</td>
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<td>P211</td>
<td>Disable and modify the Teach In – function</td>
<td>&quot;0&quot;: The teach data record and teach real zero functions are enabled.</td>
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<td>immediately</td>
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<td>Also: enable final stage with OUTPUT O0=&quot;0&quot; without lag (Bit 2=&quot;1&quot;)</td>
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<td>P212</td>
<td>Machine – zero – mode</td>
<td>&quot;0&quot;: MZ equals external initiator &amp; resolver zero / 2 reversing initiators.</td>
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<td>immediately</td>
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<td>Settings &quot;3&quot; and &quot;4&quot; with COMPAX XX00 and COMPAX XX30 only</td>
<td>&quot;1&quot;: MZ equals external initiator &amp; resolver zero.</td>
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<td>&quot;3&quot;: MZ equals external zero pulse</td>
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<td>&quot;4&quot;: MZ equals external initiator &amp; external zero pulse.</td>
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<td>&quot;5&quot;: MZ equals resolver zero</td>
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<td>&quot;6&quot;: reserved</td>
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<td>&quot;7&quot;: MZ equals external initiator (without resolver zero).</td>
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<td>&quot;8&quot;: MZ equals limit switch</td>
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<td>&quot;10&quot;: teaches machine zero</td>
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<td>&quot;11&quot;: MZ equals initiator (without resolver zero) / 2 reversing initiators.</td>
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<td>P213</td>
<td>Machine zero direction</td>
<td>&quot;0&quot;: to the right &quot;1&quot;: to the left</td>
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<td>VP</td>
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<td>P214</td>
<td>Encoder direction</td>
<td>&quot;0&quot;: positive direction when encoder is turning clockwise.</td>
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<td>&quot;1&quot;: positive direction when encoder is turning anti-clockwise.</td>
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<tr>
<td>P215</td>
<td>Direction of rotation</td>
<td>&quot;0&quot;: motor to the right &quot;1&quot;: motor to the left</td>
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### Appendix COMPAX-M/S

#### COMPAX standard parameters

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<th>Unit</th>
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<tr>
<td>P216</td>
<td>Limit switch position E1 is approached when ...</td>
<td></td>
<td>&quot;0&quot;: motor turns clockwise</td>
<td>&quot;1&quot;: motor turns anti-clockwise</td>
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<td>P217</td>
<td>Limit switch mode</td>
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<td>&quot;0&quot;: without limit switch</td>
<td>&quot;1&quot;: with limit switch (do not find during MZ)</td>
<td>&quot;3&quot;: with limit switch (find during MZ)</td>
<td>&quot;5&quot;: with limit switch (without pos. locking)</td>
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<tr>
<td>P218</td>
<td>Error cutout</td>
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<td>Bit 0 = &quot;0&quot; E57 active = &quot;1&quot; E57 switched off</td>
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<td>immediat.</td>
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<td>P219</td>
<td>Emergency stop input on COMPAX-M / Synchronous STOP on COMPAX XX00</td>
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<td>=0 no evaluation of emergency stop input on COMPAX-M</td>
<td>=7 emergency stop input on COMPAX-M active</td>
<td>=128 synchronous STOP on COMPAX XX0X without evaluation of emergency stop input on COMPAX-M</td>
<td>=135 synchronous STOP on COMPAX XX0X with evaluation of emergency stop input on COMPAX-M</td>
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<tr>
<td>P221</td>
<td>Freely assign standard inputs I1 ...I8 with &quot;1&quot;</td>
<td></td>
<td>E1 (1) [1] • E2 (2) [2] • E3 (4) [3] • E4 (8) [4] • E5 (16) [5] • E6 (32) [6] • E6 (64) [7] • E6 (128) [8]</td>
<td>P221 = sum of valencies of all required free inputs.</td>
<td>The control functions are assigned to the fieldbus with the bit set (I17 ... I24)</td>
<td>immediat.</td>
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<tr>
<td>P222</td>
<td>Freely assign standard inputs I9 ...I16 with &quot;1&quot;</td>
<td></td>
<td>I9 (1) [1] • I10 (2) [2] • I11 (4) [3] • I12 (8) [4] • I13 (16)[5] • I14 (32)[6] • I15 (64)[7] • I16 (128)[8]</td>
<td>P222 = sum of valencies of all required free inputs.</td>
<td>The control functions are assigned to the fieldbus with the bit set (I25 ... I32)</td>
<td>immediat.</td>
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<td>P227</td>
<td>Assign special functions to outputs</td>
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<td>Bit 1= &quot;0&quot;: O2 is assigned the default function (=no warning).</td>
<td>Bit 1= &quot;1&quot;: O2 is assigned the &quot;Idle monitor&quot; function.</td>
<td>Bit 4=&quot;0&quot;: O5 is assigned the default function (position reached with evaluation of P14)</td>
<td>Bit 4=&quot;1&quot;: O5 is assigned with the &quot;O5 toggles when position reached&quot; function.</td>
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<td>P229</td>
<td>Speed threshold for &quot;Idle display&quot; function (only switched on if P227 bit 1=&quot;1&quot;)</td>
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<td>% 0</td>
<td>0</td>
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<td>VP</td>
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<td>P232</td>
<td>Function I11</td>
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<td>=0: I11 can be freely assigned</td>
<td>With external position adjustment switched on (P75&gt;0):</td>
<td>=4: I11 switches the external position adjustment (I11=&quot;0&quot;: off and I11=&quot;1&quot;: switched on)</td>
<td>COMPAX 1060/70SL: With analogue ±10V – interface</td>
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<td>P233</td>
<td>Setting the optimization display S13</td>
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<td>1...255</td>
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<td>P234</td>
<td>Setting the optimization display S14</td>
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<td>immediat.</td>
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</table>

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62 OUTPUT WORD – command is available with bus systems.
63 Bit-counting starts with Bit 0.
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<thead>
<tr>
<th>No.</th>
<th>Meaning</th>
<th>Unit</th>
<th>Minimum value</th>
<th>Default value</th>
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<td>P243</td>
<td>HEDA operation mode</td>
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<td></td>
<td>//=&quot;0&quot;: single axis (when P250=0) or slave on IPM (P250=1 ... 9)</td>
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<td></td>
<td>//=&quot;1&quot;: COMPAX as master</td>
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<td>//=&quot;2&quot;: COMPAX as slave on a COMPAX master</td>
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<td>P245</td>
<td>Assign outputs O1 - O8 to the HEDA bus</td>
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<td>Output (valency) [Bit No]:</td>
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<td>O4 (8) [4]</td>
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<td>O8 (128) [8]</td>
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<td>P245</td>
<td>P245 = sum of valencies of the outputs allocated to the HEDA bus</td>
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<td>P246</td>
<td>Assign outputs O9 - O16 to the HEDA bus</td>
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<td>O16 (128) [8]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P246</td>
<td>P246 = sum of valencies of the outputs allocated to the HEDA bus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P247-P250</td>
<td>HEDA parameter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
10.3.3 Monitoring and limitation characteristics

This section examines the relationships of COMPAX monitoring and limitation characteristics in more detail:

**Structural diagram:**

---

Dynamic monitoring:
In COMPAX, the nominal current value is limited to the smallest value of the following 3 quantities.
- $I_{UP}$: unit peak current
- $P105 \times P107$: nominal motor current (P105) $\times$ maximum pulse current permitted for the motor (P107)
- $P105 \times P16$: nominal motor current (P105) $\times$ maximum permitted (user-set) torque (P16)

Static monitoring
This executes triple monitoring:
- **Unit monitoring**
  - Using the unit-specific time constant $T_G$, a current greater than $I_{Unom}$ is permitted for a specific period; E53 then switches the unit off.
- **Motor monitoring**
  - Using the time constant $T_M$, a current greater than $1.1 \times I_{Mnom}$ is permitted for a specified period; E53 then switches the unit off.
  - $T_M$ is set so that the pulse current P107 can flow for the period set in P108.
- **Final stage / short circuit monitoring**
  - Absolute monitoring to $1.5 \times I_{UP}$. 

---
10.4 Error handling and error messages

- All errors are indicated by messages on the front plate error LED.
- An error number EXX appears in the display. You can modify parameters when an error message is present.
- When you have rectified the cause of the error, acknowledge the error using Enter, Quit or by switching the unit on again (Power on).
- When the LED (error) turns off, COMPAX is ready for operation.
- Switch off COMPAX if you are experiencing hardware errors (e.g. short circuit to outputs).
- The errors I1...I57 are also reported with the binary output O1="0"; the drive does not accept any positioning commands and the ready contact is opened.
- If COMPAX executes a travel motion, the drive is then decelerated using the programmed ramp time (for E50, E51 and E55 using ramp time P10) and, if specified in the error table, the unit is switched off after this time.
- The errors ≥ E58 are also indicated with the binary output O2="0" (if O2 is configured in this manner, see parameter P227).

If the specified measures cannot rectify the problem, there may be an electrical defect. Please send the unit and an error description to HAUSER.

<table>
<thead>
<tr>
<th>No.</th>
<th>Cause</th>
<th>Action</th>
<th>Acknowledge with</th>
<th>Drive volt.-free</th>
</tr>
</thead>
<tbody>
<tr>
<td>E00</td>
<td>Interruption of a positioning command using STOP / BREAK; is only reported via RS232.</td>
<td>Not necessary</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>E01</td>
<td>Not configured.</td>
<td>Configure.</td>
<td>Quit</td>
<td>yes</td>
</tr>
<tr>
<td>E05</td>
<td>Machine zero initiator not found. Error is only generated when using reversing initiators.</td>
<td>Check initiator.</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E07</td>
<td>Calculation error</td>
<td>Check programmed arithmetic. (more accurate cause shown in the optimizing display P233/243=39; see Page 133)</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E08</td>
<td>Synchronous STOP present</td>
<td>Check P219</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E09</td>
<td>Drive not running.</td>
<td>Remove mechanical blockage (tools, foreign bodies).</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E10</td>
<td>Lag error too large. Check mechanics for smooth operation, reduce load or feed force or increase P13.</td>
<td>This error message can be turned off by setting P13=&quot;0&quot;.</td>
<td>Quit</td>
<td>see below</td>
</tr>
<tr>
<td>E11</td>
<td>Programmed position not reached.</td>
<td>Remove mechanical obstacles or increase P14.</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E15</td>
<td>Error in 2nd position measuring system.</td>
<td>Check configuration and wiring.</td>
<td>Quit</td>
<td>yes</td>
</tr>
<tr>
<td>E16</td>
<td>The data record number selected does not exist.</td>
<td>Select data record number between 1...250.</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E17</td>
<td>The data record number selected is too large.</td>
<td>Select data record number between 1...250.</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E18</td>
<td>The maximum data record 250 is already assigned.</td>
<td>Free data record 250.</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E19</td>
<td>No space available in data record memory.</td>
<td>Delete data records or entire data record memory.</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E20</td>
<td>Target position beyond positive end limit.</td>
<td>Correct target position.</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E21</td>
<td>Target position beyond negative end limit.</td>
<td>Correct target position.</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E22</td>
<td>Machine zero is not approached.</td>
<td>Find machine zero. This must be found after power on.</td>
<td>Quit</td>
<td>no</td>
</tr>
</tbody>
</table>

64 with COMPAX 70: Curve number not present.
## Appendix
### Monitoring and limitation characteristics

<table>
<thead>
<tr>
<th>No.</th>
<th>Cause</th>
<th>Action</th>
<th>Acknowledge with</th>
<th>Drive volt.-free</th>
</tr>
</thead>
<tbody>
<tr>
<td>E23</td>
<td>The current command is not allowed.</td>
<td>♦ Positioning command in the speed control mode. ♦ Approach MZ in speed control mode. ♦ Travel command when drive is switched off. ♦ Hand +/- when an error is present. ♦ More than 8 consecutive comparator commands (preparatory commands) in the data record memory.</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E24</td>
<td>The speed selected is not valid.</td>
<td>Enter speed between 0...100 %.</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E25</td>
<td>The position selected is not valid.</td>
<td>Note end limits and &quot;Software end limit monitoring&quot; chapter in variant documentation.</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E26</td>
<td>REPEAT without END or GOSUB without RETURN.</td>
<td>Insert END / RETURN command.</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E27</td>
<td>Parameter must not be written.</td>
<td>Check parameter.</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E29</td>
<td>Motor values missing.</td>
<td>Send unit to HAUSER.</td>
<td>Quit</td>
<td>yes</td>
</tr>
<tr>
<td>E30</td>
<td>Hardware fault.</td>
<td>Remove extreme external sources of fault.</td>
<td>Quit</td>
<td>yes</td>
</tr>
<tr>
<td>E31</td>
<td>Error in parameters.</td>
<td>Check parameter.</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E32</td>
<td>Error in parameters.</td>
<td>Check parameter.</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E33</td>
<td>Error in program memory.</td>
<td>Check data record memory.</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E34</td>
<td>Error in program memory.</td>
<td>Check data record memory.</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E35</td>
<td>Hardware fault.</td>
<td>Remove extreme external sources of fault.</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E36</td>
<td>Hardware fault.</td>
<td>Faulty or incorrect unit hardware.</td>
<td>Power on</td>
<td>yes</td>
</tr>
<tr>
<td>E37</td>
<td>Auxiliary voltage +15 V missing.</td>
<td>Switch on again.</td>
<td>Power on</td>
<td>yes</td>
</tr>
<tr>
<td>E38</td>
<td>Voltage in intermediate circuit too high; e.g. if braking output is too high. Limits: COMPAX 25XXS: &gt;400 V COMPAX 10XXSL: &gt;400 V otherwise: &gt;800 V</td>
<td>Increase braking and idle times / check mains power. COMPAX 25XXS: external ballast resistance missing. COMPAX 45XXS/85XXS: bridges X2/5 - X2/6 missing. COMPAX 1000SL: Check value P134.</td>
<td>Quit</td>
<td>yes</td>
</tr>
<tr>
<td>E39</td>
<td>Temperature too high (&gt;85°), cycle too hard.</td>
<td>Increase acceleration times.</td>
<td>Quit</td>
<td>yes</td>
</tr>
<tr>
<td>E40</td>
<td>Input &quot;Enable final stage&quot; (45/85S: X3/1-/2; 1000SL X19/24-X19/12, 35XXM: X19/9-/10) not assigned Only with COMPAX 35XXM, COMPAX 45XXS, COMPAX 85XXS and COMPAX 1000SL!</td>
<td>Note! With E40 there is no braking delay; the final stage is immediately switched off. The input has a direct effect on the hardware.</td>
<td>Quit</td>
<td>yes</td>
</tr>
<tr>
<td>E41</td>
<td>Final stage reports error. COMPAX 35XXM: Short circuit of the ballast resistance or undervoltage 24 V COMPAX 1000SL: Overvoltage or ballast switching</td>
<td>Check motor and cable for ground fault, short circuit fault and function; remove extreme external sources of fault.</td>
<td>Quit</td>
<td>yes</td>
</tr>
<tr>
<td>E42</td>
<td>Resolver / sensor error.</td>
<td>Check resolver cable and connector for correct connections and faults. A special error code can be found in channel 67 of the optimization display. This means Error No. 1 ... 30: Sensor indicates error Error No. &gt; 30: COMPAX indicates error Error No. =160: Sensor level too high Error No. =161: Sensor level too low (implement level adaptation using parameter P131)</td>
<td>Quit</td>
<td>yes</td>
</tr>
<tr>
<td>E43</td>
<td>Output overloaded.</td>
<td>Check I/O cables, connectors and external circuits. Note load limits (refer to start-up manual).</td>
<td>Quit</td>
<td>yes</td>
</tr>
<tr>
<td>E44</td>
<td>Positive auxiliary voltage outside tolerances.</td>
<td>Switch unit on again.</td>
<td>Power on</td>
<td>yes</td>
</tr>
<tr>
<td>E45</td>
<td>Negative auxiliary voltage outside tolerances.</td>
<td>Switch unit on again.</td>
<td>Power on</td>
<td>yes</td>
</tr>
<tr>
<td>E46</td>
<td>Supply voltage +24 V is too high.</td>
<td>Check +24V DC power unit.</td>
<td>Power on</td>
<td>yes</td>
</tr>
<tr>
<td>E47</td>
<td>Supply voltage +24 V is too low.</td>
<td>Check +24V DC power unit.</td>
<td>Power on</td>
<td>yes</td>
</tr>
</tbody>
</table>

**Please note:** the operating instructions (pages 67 - 171) as well as the application examples (pages 225 - 237) can be found in the complete product manual which is available as PDF file on CD.
## Error handling and error messages

<table>
<thead>
<tr>
<th>No.</th>
<th>Cause</th>
<th>Action</th>
<th>Acknowledge with</th>
<th>Drive volt.-free</th>
</tr>
</thead>
<tbody>
<tr>
<td>E48</td>
<td>Motor thermostatic switch reports error.</td>
<td>Check resolver cable, motor type and motor / remove external sources of heat.</td>
<td>Power on</td>
<td>yes</td>
</tr>
<tr>
<td>E49</td>
<td>Motor or drive reports blockage. Drive remains in the current limit (P16) for longer than P108</td>
<td>Free mechanics. This error message can be switched off by setting P13=&quot;0&quot;. Check motor cable.</td>
<td>Quit</td>
<td>yes</td>
</tr>
<tr>
<td></td>
<td>COMPAX-S: speed controller oscillating</td>
<td>Optimize controller (reduce P23 stiffness).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E50</td>
<td>Limit switch 1 activated.</td>
<td>Move by hand or POSA from limit switch. see P217</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E51</td>
<td>Limit switch 2 activated.</td>
<td>Move by hand or POSA from limit switch.</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E52</td>
<td>Error in emergency stop circuit.</td>
<td>Check emergency stop switch contacts.</td>
<td>Quit</td>
<td>yes</td>
</tr>
<tr>
<td>E53</td>
<td>Motor overloaded.</td>
<td>Check dimensions.</td>
<td>Quit</td>
<td>yes</td>
</tr>
<tr>
<td>E54</td>
<td>Speed higher than the maximum motor speed or higher than P15 * 1.21</td>
<td>Reduce nominal speed or, if speed is too high due to harmonics, optimize controller.</td>
<td>Quit</td>
<td>yes</td>
</tr>
<tr>
<td>E55</td>
<td>External emergency stop. Intermediate circuit not enabled. Temperature overload.</td>
<td>Check system, then switch unit on again. Voltage must be at least 2s &gt;320V. External load too great.</td>
<td>Quit</td>
<td>yes</td>
</tr>
<tr>
<td>E56</td>
<td>Emergency stop directly in COMPAX-M via X9/6 (switched on via P219=7)</td>
<td>Check system, then switch unit on again.</td>
<td>Quit</td>
<td>yes</td>
</tr>
<tr>
<td>E57</td>
<td>Voltage in intermediate circuit too low (&lt;70V).</td>
<td>Check mains connection. Switch off E57 using P218 =&quot;1&quot;.</td>
<td>Quit</td>
<td>yes</td>
</tr>
<tr>
<td>E58</td>
<td>Temperature is too high (&gt;75°) or SinCos® - temperature error</td>
<td>Increase acceleration times.</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E65</td>
<td>Encoder error</td>
<td>Check encoder cable. Axis is brought to a stop through speed control. (switch off using P218)</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E76</td>
<td>HEDA synchronisation interrupted</td>
<td>Check physical connection and P249</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E77</td>
<td>HEDA transmission error</td>
<td>Check physical connection and P247</td>
<td>Quit</td>
<td>no</td>
</tr>
<tr>
<td>E78</td>
<td>Successive HEDA transmission errors</td>
<td>Check physical connection and P248</td>
<td>Quit</td>
<td>no</td>
</tr>
</tbody>
</table>

### Negative command acknowledgement (only for warnings)

<table>
<thead>
<tr>
<th>No.</th>
<th>Cause</th>
<th>Action</th>
<th>Acknowledge with</th>
<th>Drive volt.-free</th>
</tr>
</thead>
<tbody>
<tr>
<td>E72</td>
<td>Block Check Character - error or general fault.</td>
<td>Re-send the characters</td>
<td>*</td>
<td>no</td>
</tr>
<tr>
<td>E90</td>
<td>Syntax error; command not valid</td>
<td>Check command structure.</td>
<td>*</td>
<td>no</td>
</tr>
<tr>
<td>E91</td>
<td>Command cannot be executed in this COMPAX operating mode.</td>
<td>Check COMPAX status</td>
<td>*</td>
<td>no</td>
</tr>
<tr>
<td>E92</td>
<td>Function running, command cannot be executed</td>
<td></td>
<td>*</td>
<td>no</td>
</tr>
<tr>
<td>E93</td>
<td>Data record memory active, command cannot be executed</td>
<td></td>
<td>*</td>
<td>no</td>
</tr>
<tr>
<td>E94</td>
<td>Password missing</td>
<td></td>
<td>*</td>
<td>no</td>
</tr>
</tbody>
</table>

* Quit is not required.

### Response to lag error (error E10)

#### Position controller

COMPAX is switched from position control mode to speed control mode and speed 0 specified. The drive remains powered. (Does not apply for COMPAX xx60)

The next move command after the error acknowledgement brings the system back to position control.

### Response to E15

COMPAX is switched from position control mode to speed control mode and speed 0 specified. The drive remains powered.

#### Speed controller

In speed control mode, control is referenced to speed 0.
Application examples

Overview

11. Application examples

11.1.1 Overview

External data record selection.................................................................................................................227
Application:
One of eight various workpieces should be made available at a data collection station. The number of the
desired workpiece is set using a BCD selector switch. The transportation process is then triggered by a
starting pulse.

Mark-referenced positioning..................................................................................................................229
Application:
Pieces with lengths of between 100 mm and 500 mm should be cut from a plate roller. The cut-off
positions are specified by marks on the plate. If two marks are separated by more than 500 mm, the plate
should be pulled back to the last cut-off position.

Speed step profiling / comparator switching points ..............................................................................231
Application:
A bore spindle should be guided to the surface of the workpiece using a rapid feed movement. The bore
is then bored to a defined depth using a considerably longer feed. When reversing the bore spindle, the
unit should travel at a slow velocity while the drill is still in the bore. The remaining travel to the idle
position is performed at a rapid speed.

The bore spindle should be switched on just before the boring process commences and should be
switched off immediately after it has been removed from the bore. Movement of the conveyor belt should
be blocked for as long as there is a risk of collision between the workpiece and drill.

SPEED SYNC............................................................................................................................................233
Application:
Cartons should be transferred from one conveyor belt (conveyor belt A), a belt operating at a very
variable belt speed, to another conveyor belt (conveyor belt C), a belt which has a constant belt speed.
This task should be performed using a transfer belt (conveyor belt B) installed between the two other
belts. This belt receives cartons from conveyor belt A and, when triggered by a pulse, passes them on to
conveyor belt B. In addition to this, when conveyor belt B is assigned, conveyor belt A should be blocked.
Conveyor belt B is controlled by COMPAX.

Speed control mode ...............................................................................................................................234
Application:
A centrifuge for manual operation should be operated by an operating mode switch. The centrifugal
process should either be run at a permanently set speed or the test tubes should be removed, one after
another, through the removal aperture. The shutter on the removal aperture must only be able to open
when the centrifuge is at a standstill.

Fast start..................................................................................................................................................236
Application:
Material should be fed to an extender stamping machine which operates at a maximum speed of 150
rpm. The material may only be supplied if the stamping tool is open and if the workpiece (already
stamped) has been thrown up. The material supply should be released or blocked via a switch.

Implementing a torque converters........................................................................................................237
2 options are available for implementing a torque converters.
11.1.2 External data record selection

Application:

One of eight various workpieces should be made available at a data collection station. The number of the desired workpiece is set using a BCD selector switch. The transportation process is then triggered by a starting pulse.

Assignments:

The horizontal movement is implemented using an NC axis controlled by COMPAX. A pneumatic cylinder, which is controlled by COMPAX using a double solenoid valve, raises and lowers the workpiece pick-up. COMPAX performs all the functions required without superordinate control.

Wiring up the digital inputs and outputs:

Comments:

• The inputs I9, I14, I15 and I16 have to be placed on GND or left open.
• The BCD switch has eight settings. The outputs are encoded with binary.
• The "Data collection station empty" switch is closed when the data collection station is closed. The switch operation prevents the workpiece pick-up being lowered for as long as there is a workpiece in the data collection station.

Function:

The first event after COMPAX has been started is the approaching of the data collection station. If the workpiece pick-up is not lowered, the assumption is made that there is still a workpiece in the workpiece pick-up. This is deposited in the data collection station by lowering the workpiece pick-up. The system is now ready for the first transportation process.
To move one particular workpiece to the data collection station, the number of the station in question is first set on the BCD switch. The process is then triggered by a start pulse. To do this, the BCD switch setting must remain the same until the start of the first axis movement. The lowered workpiece pick-up is positioned under the station which is specified by the BCD switch. When the workpiece pick-up is raised, the front workpiece is taken out of the station. The axis returns to the data collection station. The workpiece pick-up is lowered there. The workpiece is thereby deposited in the data collection station. COMPAX now waits for the next transportation process.

**Programming:**

**Configuration:**

P93 = +1 i.e. normal operating mode (absolute and relative positioning)

**Names of inputs and outputs:**

| I7  | pick-up raised | 0 → no  | 1 → yes |
| I8  | pick-up lowered| 0 → no  | 1 → yes |
| O7  | raise pick-up  | 0 → off | 1 → on  |
| O8  | lower pick-up  | 0 → off | 1 → on  |

**List of programs:**

- N001: SPEED 50 ............................................... ; sets the speed
- N002: ACCEL 500.............................................. ; sets the acceleration and braking ramps
- N003: OUTPUT O7=0 ........................................ ; pick-up raise function = off
- N004: OUTPUT O8=0 ........................................ ; pick-up lowering function = off
- N005: POSA -60................................................. ; moves to data collection station
- N006: IF I8=0 GOSUB deposits workpiece (36). ; if pick-up is not lowered: deposits workpiece
  - Wait for START: ........................................... ; mark
  - N007: WAIT START........................................... ; waits for the start pulse
  - N008: GOSUB EXT. .......................................... ; calls up the corresponding inputs I9-I16 for the sub-program
  - N009: GOSUB raises workpiece (32)....................... ; calls "Raise workpiece" sub-program
  - N010: POSA -60................................................. ; proceeds to data collection station
  - N011: GOSUB deposits workpiece (36)....................... ; calls up "Deposit workpiece" sub-program
  - N012: GOTO waits for START (7).......................... ; goes to data record N007

- N016: POSA 120................................................ ; proceeds to station 0
- N017: RETURN.................................................. ; returns to main program
- N018: POSA 240................................................ ; proceeds to station 1
- N019: RETURN.................................................. ; returns to main program
- N020: POSA 360................................................ ; proceeds to station 2
- N021: RETURN.................................................. ; returns to main program
- N022: POSA 480................................................ ; proceeds to station 3
- N023: RETURN.................................................. ; returns to main program
- N024: POSA 600................................................ ; proceeds to station 4
- N025: RETURN.................................................. ; returns to main program
- N026: POSA 720................................................ ; proceeds to station 5
- N027: RETURN.................................................. ; returns to main program
- N028: POSA 840................................................ ; proceeds to station 6
- N029: RETURN.................................................. ; returns to main program
- N030: POSA 960................................................ ; proceeds to station 7
- N031: RETURN.................................................. ; returns to main program

  **Raise workpiece:** ......................................... ; mark
  - N032: OUTPUT O7=1 ........................................ ; activates "Raise" solenoid valve
  - N033: IF I7=0 GOTO 33 ..................................... ; waits until workpiece pick-up is raised
  - N034: OUTPUT O7=0 ........................................ ; deactivates "Raise" solenoid valve
  - N035: RETURN.................................................. ; returns to main program

  **Deposit workpiece:** ....................................... ; mark
  - N036: OUTPUT O8=1 ........................................ ; activates "Lower" solenoid valve
  - N037: IF I8=0 GOTO 37 ..................................... ; waits until the workpiece pick-up is lowered
  - N038: OUTPUT O8=0 ........................................ ; deactivates "Lower" solenoid valve
  - N039: RETURN.................................................. ; returns to main program

........................................................................... ; Link table for external data record selection

- N016: POSA 120................................................ ; proceeds to station 0
- N017: RETURN.................................................. ; returns to main program
- N018: POSA 240................................................ ; proceeds to station 1
- N019: RETURN.................................................. ; returns to main program
- N020: POSA 360................................................ ; proceeds to station 2
- N021: RETURN.................................................. ; returns to main program
- N022: POSA 480................................................ ; proceeds to station 3
- N023: RETURN.................................................. ; returns to main program
- N024: POSA 600................................................ ; proceeds to station 4
- N025: RETURN.................................................. ; returns to main program
- N026: POSA 720................................................ ; proceeds to station 5
- N027: RETURN.................................................. ; returns to main program
- N028: POSA 840................................................ ; proceeds to station 6
- N029: RETURN.................................................. ; returns to main program
- N030: POSA 960................................................ ; proceeds to station 7
- N031: RETURN.................................................. ; returns to main program

  **Raise workpiece:** ......................................... ; mark
  - N032: OUTPUT O7=1 ........................................ ; activates "Raise" solenoid valve
  - N033: IF I7=0 GOTO 33 ..................................... ; waits until workpiece pick-up is raised
  - N034: OUTPUT O7=0 ........................................ ; deactivates "Raise" solenoid valve
  - N035: RETURN.................................................. ; returns to main program

  **Deposit workpiece:** ....................................... ; mark
  - N036: OUTPUT O8=1 ........................................ ; activates "Lower" solenoid valve
  - N037: IF I8=0 GOTO 37 ..................................... ; waits until the workpiece pick-up is lowered
  - N038: OUTPUT O8=0 ........................................ ; deactivates "Lower" solenoid valve
  - N039: RETURN.................................................. ; returns to main program
11.1.3 Mark-referenced positioning

Application:

Pieces with lengths of between 100 mm and 500 mm should be cut from a plate roller. The cut-off positions are specified by marks on the plate. If two marks are separated by more than 500 mm, the plate should be pulled back to the last cut-off position.

Assignments:

The plate is fed by a roller feed controlled by COMPAX. A reflex light barrier detects the marks on the plate and reports this to COMPAX. The distance between the light barrier and the shears is 50 mm. The shears are controlled and monitored by COMPAX.

Wiring up the digital inputs and outputs:

Function:

The first event after COMPAX has been started is a rest of the control outputs. Once assurance has been received that the blades of the shears are open, COMPAX is ready for the initial cutting to length. The cutting to length process is triggered by a start pulse. COMPAX firstly activates the mark reference (I14) using O14. After a waiting time of 10 ms (which is used to compensate for any possible COMPAX timing offset), the mark-referenced positioning process is started using the "POSR 50 mm" command. The mark input (I16) is approved after a travel distance of 50 mm (P37). If the light barrier now detects a mark, COMPAX pushes the plate another 50 mm. This distance corresponds to the distance between the light barrier and the shears and is programmed using "POSR 50 mm". If no mark has been detected after a travel distance of 650 mm (P38), COMPAX stops the feed movement after a total of 680 mm (P39).

At the end of the positioning process, output O16 indicates whether a mark has been detected within the mark window or not. This output is queried using I15. If I15 is at 1 (i.e. mark found), COMPAX sets the message output O15 to 0 and activates the shears. Once the blades have opened, COMPAX waits for the next start pulse. If I15 is 0 (i.e. no mark found), COMPAX sets the message output O15 to 1, blocks the mark reference (I14) via O14, pulls the plate back by 680 mm to the last cut-off position and waits for the next start pulse.
Mark-referenced positioning

Programming:

Configuration:
P93 =+2 i.e. continuous operating mode
P35 =+1 i.e. mark reference switched on
P37 =+50 i.e. minimum travel to mark = 50 mm
P38 =+650 i.e. maximum travel to mark = 650 mm
P39 =+680 i.e. maximum feed length, if no marks appear in the mark window = 680 mm

Names of inputs and outputs:
- I7 shears 0 ⇔ closed 1 ⇔ open
- I15 mark 0 ⇔ missing 1 ⇔ found
- O7 shears 0 ⇔ block 1 ⇔ activate
- O14 mark reference 0 ⇔ block 1 ⇔ activate
- O15 message 0 ⇔ mark found 1 ⇔ mark missing

List of programs:
- N001: SPEED 50 ;sets the speed
- N002: ACCEL 250 ;sets the acceleration and braking ramp
- N003: OUTPUT O7=0 ;shears = block
- N004: OUTPUT O14=0 ;mark reference = block
- N005: OUTPUT O15=0 ;message = mark found

Wait for start: ;mark
- N006: IF I7=0 GOTO 6 ;waits until shears are open
- N007: WAIT START ;waits for start pulse
- N008: OUTPUT O14=1 ;activates mark reference
- N009: WAIT 10 ;waits until mark reference is activated
- N010: POSR 50 ;mark-referenced positioning
- N011: WAIT 10 ;waits until mark is missing or set
- N012: IF I15=0 GOTO reverses (18) ;if mark is missing, reverses plate
- N013: OUTPUT O15=0 ;sets "Mark found" message
- N014: OUTPUT O7=1 ;activates shears
- N015: IF I7=1 GOTO 15 ;waits until shears are closed
- N016: OUTPUT O7=0 ;blocks shears
- N017: GOTO waits for start (6) ;goes to data record N006

Reverse: ;mark
- N018: OUTPUT O15=1 ;sets "Mark missing" message
- N019: OUTPUT O14=0 ;blocks mark reference
- N020: WAIT 10 ;waits until mark reference is blocked
- N021: POSR -680 ;returns to start point
- N022: GOTO waits for start (6) ;goes to data record N006
11.1.4 Speed step profiling / comparator switching points

Application:
A bore spindle should be guided to the surface of the workpiece using a rapid feed movement. The bore is then bored to a defined depth using a considerably longer feed. When reversing the bore spindle, the unit should travel at a slow velocity while the drill is still in the bore. The remaining travel to the idle position is performed at a rapid speed.

The bore spindle should be switched on just before the boring process commences and should be switched off immediately after it has been removed from the bore. Movement of the conveyor belt should be blocked for as long as there is a risk of collision between the workpiece and drill.

Assignments:

Function:
The feed movement is implemented using speed step profiling. The initial speed is first set to 100 mm/s using the “SPEED 100%” command (N007). This speed can be used until the start of the boring process. After a travel distance of 120 mm, the boring begins and the speed should then be 10 mm/s. The “POSR 120 mm SPEED 10%” command (N011) ensures that the speed is reduced from 100 mm/s to 10 mm/s for the following positioning after a distance of 120 mm. The position as of which the speed is then 10 mm/s depends on the set braking ramp (N001) and the output speed (N007). This means that braking is initiated from an appropriate stopping distance from the position where the bore starts.

When returning, the initial speed is set to 50 mm/s (N012) and, as of a travel distance of 70 mm, is accelerated to 100 mm/s (N013).

The bore spindle is switched on and off with the aid of the comparator switching points. During the feed movement, the spindle is switched on after a travel distance of 100 mm (N009). By the time the boring process begins after 130 mm, the spindle must have reached its operating speed. The spindle is switched off again when returning once the drill has left the bore (N014).

The conveyor belt is blocked for as long as the axis is located at a position of between 25 mm and 200 mm (N008 and N015).
Application examples

Speed step profiling / comparator switching points

Programming:

Configuration:
P93 =+1  i.e. normal operating mode (absolute and relative positioning)
P94 =+1  i.e. linear ramp shape

SPEED 100%  corresponds to 100 mm/s

Names of the inputs and outputs:
O7  bore spindle  0  off  1  on
O8  conveyor belt  0  block  1  release

List of programs:
N001: ACCEL 200.................................; sets the acceleration and braking ramps
N002: SPEED 100.................................; sets the speed
N003: POSA 0.................................; approaches idle position
N004: OUTPUT O7=0..............................; bore spindle = off
N005: OUTPUT O8=1..............................; conveyor belt = release

Wait for start: ......................................; mark
N006: WAIT START...............................; waits for start pulse
N007: SPEED 100.................................; sets starts speed to 100%
N008: POSR 25 OUTPUT O8=0...................; sets the comparator point of the "Block conveyor belt"
N009: POSR 100 OUTPUT O7=1..................; sets the comparator point of the "Switch on bore spindle"
N010: POSR 120 SPEED 10.......................; sets the speed steps
N011: POSA 200.....................................; performs the positioning command with the set procedure

N012: SPEED 50 ......................................; sets starts speed to 50%
N013: POSR 70 SPEED 100........................; sets speed step
N014: POSR 80 OUTPUT O7=0...................; sets the comparator point of the "Switch off bore spindle"
N015: POSR 175 OUTPUT O8=1..................; sets the comparator point of the "Release conveyor belt"
N016: POSA 0.......................................; performs the positioning command with the set procedure
N017: GOTO waits for start (6)....................; goes to data record N006
11.1.5 SPEED SYNC

Application:
Cartons should be transferred from one conveyor belt (conveyor belt A), a belt operating at a very variable belt speed, to another conveyor belt (conveyor belt C), a belt which has a constant belt speed. This task should be performed using a transfer belt (conveyor belt B) installed between the two other belts. This belt receives cartons from conveyor belt A and, when triggered by a pulse, passes them on to conveyor belt B. In addition to this, when conveyor belt B is assigned, conveyor belt A should be blocked. Conveyor belt B is activated using COMPAX.

Assignments:

Function:
The first event after COMPAX has been started is the release of conveyor belt A. The system then waits until the reflex light barrier (on I7) detects a carton (N003). Should a carton be received, the speed of conveyor belt B is set to that of conveyor belt A (N004). This speed is recorded using an encoder on conveyor belt A transmitting via the COMPAX encoder interface (channel 1). The positioning command (N005) now starts a feed movement using the distance which is required to transfer the whole carton onto conveyor belt B. Since the feed time is always the same as the speed of conveyor belt A, no errors occur due to slip between the carton and one of the conveyor belts. Once the whole carton has been received, the system waits until I8 reports that the carton has been passed to conveyor belt C (N008). If, during this waiting time, another carton arrives via conveyor belt A, this is blocked via O7. When the carton is passed on and conveyor belt A is blocked, the speed of conveyor belt B is set to that of conveyor belt C (N010). The carton is transferred to conveyor belt C at this constant speed using N011. Conveyor belt A is then released again (N002).

Programming:

Configuration:
Encoder input E2 option
P93 = +2 i.e. continuous operating mode
P98 = 314 i.e. travel per axis per encoder revolution = 314 mm
P143 = 4096 i.e. encoder pulse number = 4096

Names of the inputs and outputs:

I7 receive carton 0 ≡ no 1 ≡ yes
I8 deposit carton 0 ≡ no 1 ≡ yes
O7 conveyor belt A 0 ≡ block 1 ≡ release

List of programs:
N001: ACCEL 200..............................................; sets the acceleration and braking ramps
N002: OUTPUT O7=1 ........................................ ; releases conveyor belt A
N003: IF I7=0 GOTO 3.................................; waits until carton is to be received
N004: SPEED SYNC..........................................; sets the speed to that on conveyor belt A
N005: POSR 360 ............................................... ; transfers the carton
N006: IF I7=0 GOTO 8.................................; queries whether carton is to be received
N007: OUTPUT O7=0...........................................; blocks conveyor belt A
N008: IF I8=0 GOTO 6.................................; waits until carton is to be deposited
N009: OUTPUT O7=0...........................................; blocks conveyor belt A
N010: SPEED 85 ............................................... ; sets the speed to that on conveyor belt C
N011: POSR 350 ............................................... ; deposits the carton
N012: GOTO transfers carton (2).......................; goes to data record N002
11.1.6 Speed control mode

Application:
A centrifuge for manual operation should be operated by an operating mode switch. The centrifugal process should either be run at a permanently set speed or the test tubes should be removed, one after another, through the removal aperture. The shutter on the removal aperture must only be able to open when the centrifuge is at a standstill.

Design and wiring up of the digital inputs and outputs:

<table>
<thead>
<tr>
<th>Function:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The first event after COMPAX has been started is the setting of the accelerating and braking time 10s (N001). A check is then run to find out whether the shutter is closed (N002). If it is not closed, the interlock is opened (N003) and the system waits until the shutter is closed (N004). If the shutter is closed, the interlock is also closed (N005). The interlock is checked for safety reasons (N006). The operating mode switch is then queried (N007). If this is set to &quot;Removal&quot;, the speed is set to 0.1 % using N008. The system waits until the light barrier is activated by a test tube (N010). When this occurs, the speed is set to 0 (N011) and the interlock is opened (N012). The shutter can now be opened to insert or remove a test tube. COMPAX monitors the opening and closing of the shutter (N013 / N014) to lock this again after the closing (N015 / N016) and to return to the operating mode query. If &quot;Removal&quot; is still set, the centrifuge is turned further to the next test tube. (N009 ensures that once the speed has accelerated to 0.1% (N008), the system waits until the previous test tube no longer activates the photoelectric barrier.) If the operating mode switch is set in the &quot;Centrifuge&quot; position, the centrifuge is accelerated to 100% within 10s (N018). This speed is retained until the operating mode switch is set to &quot;Removal&quot; (N019 / N020). Then, the centrifuge is decelerated to 0.1% (N008) and stops at the next test tube. The test tubes can then be removed one after another.</td>
</tr>
</tbody>
</table>
Programming:

Configuration:
P93 = +4 i.e. speed control operating mode
P94 = +2 i.e. smooth ramp shape

Names of the inputs and outputs:
I7  light barrier  0 ⇔ not activated  1 ⇔ activated
I8  shutter       0 ⇔ open       1 ⇔ closed
I9  interlock     0 ⇔ open       1 ⇔ closed
I10 operating mode 0 ⇔ remove    1 ⇔ centrifuge
O7  interlock     0 ⇔ closed     1 ⇔ open

List of programs:
N001: ACCEL 10  000................................. ; sets the accelerating and braking ramps to 10s
N002: IF I8=1 GOTO locks (5).................... ; checks whether the shutter is closed
N003: OUTPUT O7=1.................................. ; opens interlock
N004: IF I8=0 GOTO 4............................... ; waits until the shutter is closed
                 Lock:....................................... ; mark
N005: OUTPUT O7=0.................................. ; closes interlock
N006: IF I9=0 GOTO 6............................... ; checks whether interlock is closed

Operating mode query:
N007: IF I10=1 GOTO centrifuges (18).......... ; queries operating mode switch
                     Remove:................................. ; mark
N008: SPEED 0.1..................................... ; sets the speed to 0.1%
N009: WAIT 500....................................... ; waits 500 ms
N010: IF I7=0 GOTO 10............................. ; waits until the light barrier is activated
N011: SPEED 0......................................... ; sets the speed to 0
N012: OUTPUT O7=1.................................. ; opens interlock
N013: IF I8=1 GOTO 13............................. ; waits until shutter is opened
N014: IF I8=0 GOTO 14............................. ; waits until shutter is closed again
N015: OUTPUT O7=0.................................. ; closes interlock
N016: IF I9=0 GOTO 16............................. ; checks whether interlock is closed
N017: GOTO operating mode query (7)......... ; goes to data record N007
                     Centrifuge:................................. ; mark
N018: SPEED 100..................................... ; sets speed to 100%
N019: IF I10=0 GOTO removing (8)............... ; operating mode query
N020: GOTO 19........................................ ; goes to data record N019
11.1.7 Fast start

Application:
Material should be fed to an extender stamping machine which operates at a maximum speed of 150 rpm. The material may only be supplied if the stamping tool is open and if the workpiece (already stamped) has been thrown up. The material supply should be released or blocked via a switch.

Assignments:

Function:

When the stamping machine runs at an operating speed of 150 strokes a minute, an operating cycle lasts 400 ms. The operating angle (at which the material can be fed) is 210°. 233 ms therefore remain for the feed movement. To ensure that the necessary drive dynamics are kept within these limits, as much of this time as possible must be used for the actual feed movement. This is why, the fast START is used here as it has a response time of only 1.5 ms. The feed movement is triggered by the signal that the initiator (on the eccentric axis) transfers via the release switch to COMPAX (I15) at an angle of ϕ = 90°.

Once the system has been switched on, COMPAX is started via a start pulse on I5. The values for the accelerating and braking time are set in N001 and N002, as are those for the feed speed. The positioning command in N003 is only performed, if a rising flank (from 0 to 1) is detected on I15 (fast START). The time between the rising flank and the start of the feed movement is 1.5 ms. Data record N004 is used to return to N003 which ensures that the next positioning command is prepared. This is then performed after a rising flank on I15.
Implementing a torque controller

**Programming:**

**Configuration:**

P93 =+2 i.e. continuous operating mode  
P94 =+1 i.e. linear ramp shape  
P18 =+2 i.e. fast START activated

**Names of the inputs and outputs:**

I15  fast START  a flank from 0 to 1 triggers the fast START

**List of programs:**

N001: ACCEL 100……………………………………;sets the accelerating and braking ramps  
N002: SPEED 100……………………………………;sets the speed  
Feed: ………………………………………;mark  
N003: POSR 225 ………………………………………;feed movement (triggered by fast START)  
N004: GOTO feed (3)……………………………………;goes to data record N003

### 11.1.8 Implementing a torque controller

2 options are available:

**Using speed control mode**  
You can attain a defined constant torque in speed control mode using the following setting.  
* Set a high speed which cannot be reached.  
* Define the desired torque using P16 in % of the nominal torque (max. 100%).  
* Switch off errors E10 and E49 using P13=0.  
COMPAX tries to reach the specified speed and increases the torque to the maximum permitted torque P16. This value is maintained regardless of the load.

**In position controller mode**  
* Specify a position which cannot be approached (which is beyond the load position).  
* Define the desired torque using P16 in % of the nominal torque (max. 100%).  
* Switch off errors E10 and E49 using P13=0.  
* You can now use SPEED to also define the speed at which you can run up to the load (block position).  
COMPAX tries to reach the specified position and increases the torque in the load position to the maximum permitted torque P16. This value is maintained regardless of the load.

**Changing error response:**  
E49 can also be switched off individually:  
E49 occurs when the current (and/or the torque) remains in the limitation for longer than P108.
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