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1 Important Notes

Safety and warning instructions

Always follow the safety and warning instructions contained in this publication!

- **Electrical hazard**
  Possible consequences: Severe or fatal injuries.

- **Hazard**
  Possible consequences: Severe or fatal injuries.

- **Hazardous situation**
  Possible consequences: Slight or minor injuries.

- **Harmful situation**
  Possible consequences: Damage to the unit and the environment.

- **Tips and useful information.**

A requirement of **fault-free operation** and fulfillment of any rights to claim under guarantee is that you adhere to the information in the **operating instructions**. Consequently, read the **operating instructions** before you start operating the unit!

The **operating instructions** contain **important information about servicing**; as a result, they should be kept in the vicinity of the unit.

**Designated use**

MOVIDRIVE® drive inverters are intended for use in industrial and commercial systems for the operation of AC asynchronous motors or permanent-field AC synchronous motors. These motors must be suitable for operation with frequency inverters. No other loads may be connected to the units.

MOVIDRIVE® drive inverters are units intended for stationary installation in switch cabinets. Observe all instructions referring to the technical data and the permitted conditions where the unit is operated.

Do not start up the unit (take it into operation in the designated fashion) until you have established that the machine complies with the EMC Directive 89/336/EEC and that the conformity of the end product has been determined in accordance with the Machinery Directive 89/392/EEC (with reference to EN 60204).
Application environment

The following uses are forbidden unless measures are expressly taken to make them possible:

- Use in explosion-proof areas
- Use in areas exposed to harmful oils, acids, gases, vapors, dust, radiation, etc.
- Use in non-stationary applications which are subject to mechanical vibration and shock loads in excess of the requirements in EN 50178

Safety functions

MOVIDRIVE® drive inverters are not allowed to perform any safety functions unless the inverters are subordinate to other safety systems.

Use superordinate safety systems to guarantee the protection of machinery and people.

Waste disposal

Please follow the current instructions: Dispose in accordance with the material structure and the regulations in force, for instance as:

- Electronics scrap (printed-circuit boards)
- Plastic (housing)
- Sheet metal
- Copper
- etc.

MOVIDRIVE® Multi-Motor Drives
2 System Description

Definition

A multi-motor drive in the sense of this manual is a drive in which several individual motors are mechanically interconnected without slip and jointly drive one axis. At any particular time, the individual motors generate the same torque (the same amount and in the same direction). All motors in a multi-motor drive must be of the same type and must have the same winding data.

A multi-motor drive can be implemented using a MOVIDRIVE® drive inverter as follows:

- With asynchronous motors: Connect the motor windings in parallel (several motors on one inverter).
- With synchronous or asynchronous motors: Master/slave operation (only one motor per inverter).
- With asynchronous motors: Combination of parallel connection and master/slave mode.

The slip-free mechanical connection differentiates multi-motor drives from the ones referred to as group drives. Group drives can be made up of motors with different power values which may either not be interconnected at all or may be in a connection that is subject to slip. Synchronous applications such as travel drives for gantry cranes are not multi-motor drives in the sense of this manual.

Multi-motor drive

Example of a multi-motor drive: Two geared motors driving a cardan shaft.

![Diagram of multi-motor drive](03906AXX)

Fig. 1: Example of a multi-motor drive

1. Geared motor
2. Load
3. Cardan shaft

Group drive

Example of a group drive: Several motors driving the transport rollers of a roller conveyor. The mechanical connection is subject to slip and is temporary. It is only established as a function of the load.

![Diagram of group drive](03907AXX)

Fig. 2: Example of a group drive

1. Motor
2. Load
3. Transport rollers
3 Project Planning
3.1 Drive variants

There are three variants available for implementing a multi-motor drive using MOVIDRIVE® drive inverters. These are:

1. Parallel connection of the motor windings.
2. Master/slave mode.
3. Combination of parallel connection and master/slave mode.

You must clarify which is the appropriate option for you on the basis of the peripheral conditions. The peripheral conditions of the individual options are explained in the table below. The multi-motor drive example assumes that there are four geared motors jointly driving one cardan shaft with two external loads.

Overview of the variants

The following table lists the three variants and the peripheral conditions for their application:

<table>
<thead>
<tr>
<th>Parallel connection</th>
<th>Master/slave mode</th>
<th>Mixed mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>All motors are powered by one inverter. As a result, there is only one inverter to start up.</td>
<td>One motor per inverter. Can be implemented with asynchronous or synchronous motors. More than six motors can be included in the master/slave combination. It is also possible with less rigid shaft connections or shaft connections which are subject to play.</td>
<td>More than six motors can be included in the particular master/slave combination. Each group of motors is powered by one inverter, which means less time and effort has to be spent on startup. Less time and effort spent on installation and lower unit costs.</td>
</tr>
<tr>
<td>Less time and effort spent on installation and lower unit costs.</td>
<td>Only possible with asynchronous motors. Asynchronous or synchronous motors possible.</td>
<td>Only possible with asynchronous motors.</td>
</tr>
<tr>
<td>Up to six motors can be connected in parallel.</td>
<td>Operation is possible with more than six motors.</td>
<td>Operation is possible with more than six motors, although no more than six motors per parallel connection.</td>
</tr>
<tr>
<td>Sufficiently rigid shaft connection required: ( Z_p \times \Delta \phi \leq 20^\circ ).</td>
<td>No particular requirement in terms of the rigidity of the shaft connection.</td>
<td>Sufficiently rigid shaft connection required between the motors connected in parallel: ( Z_p \times \Delta \phi \leq 20^\circ ).</td>
</tr>
<tr>
<td>Possible operating modes: • VFC • VFC-n-CONTROL • CFC</td>
<td>Possible operating modes: • Master: CFC or SERVO • Slave: CFC &amp; M-CONTROL or SERVO &amp; M-CTRL.</td>
<td>Possible operating modes: • Master: CFC • Slave: CFC &amp; M-CONTROL</td>
</tr>
<tr>
<td>Operation without a tachometer is possible.</td>
<td>Tachometer required on each motor.</td>
<td>Tachometer required on one motor in each parallel connection.</td>
</tr>
</tbody>
</table>
3.2 Variant 1: Parallel connection

Project planning notes

- Only possible with asynchronous motors (DR, DT, DV, CT, CV).
- With 4-pole SEW motors: VFC, VFC-n-CONTROL and CFC operating modes are possible.
- Other SEW asynchronous motors or non-SEW motors: Only VFC and VFC-n-CONTROL operating modes are possible. CFC operating mode is not possible.
- Use geared motors of the same type and with the same winding data only.
- Up to six motors can be connected in parallel.
- Note the permitted length of all motor leads connected in parallel:

\[ l_{ges} \leq \frac{l_{max}}{n} \]

\[ l_{ges} \quad \text{Total length of the motor leads connected in parallel} \]
\[ l_{max} \quad \text{Recommended maximum motor lead length} \]
\[ n \quad \text{Number of motors connected in parallel} \]

- Use unshielded motor leads only.
- The shaft connection must be sufficiently rigid. This is the case if the product of the motor pole pair number \( Z_p \) and the maximum torsion angle of the shaft connection \( \Delta \phi \) relating to the motor shaft is less than or equal to \( 20^\circ \Rightarrow Z_p \times \Delta \phi \leq 20^\circ \) (→ Sec. "Calculation of the torsion angle" on page 12).
- With speed control: Make sure the tachometer is installed on the geared motor which has the greatest play or elasticity with respect to the load inertia. In the example with the four geared motors on one cardan shaft and the two external loads, this means one of the two internal motors must be fitted with the tachometer.

- VFC & GROUP mode are not permitted for multi-motor drives (→ System description).

- Calculate the motor power $P_{\text{Mot}}$ of the individual motors using the required drive power $P_{\text{drive}}$ (including the required safety margin, e.g. in the case of hoists) and the number of motors $n_{\text{Mot}}$. Include a control reserve of 10% in this calculation.
  
  $P_{\text{Mot}} = 1.1 \times P_{\text{drive}} / n_{\text{Mot}}$

- The drive power $P_{\text{drive}}$ including the safety margin and the control reserve of 10% then gives the required inverter power.
  
  $P_{\text{Inverter}} = 1.1 \times P_{\text{drive}}$

- In VFC mode: Recommended motor power of the inverter under constant load.
- In CFC mode: Inverter power corresponding to the maximum torque under dynamic load.
3.3 **Variant 2: Master/slave mode**

![Diagram](image)

*Fig. 4: Variant 2: Master/slave mode*

- **Project planning notes**
  - Possible with 4-pole SEW asynchronous motors (DR, DT, DV, CT, CV) or SEW synchronous motors (CM, DS, DY) only. Operation is not possible with other SEW asynchronous motors or non-SEW motors.
  - Master drive: Only CFC and SERVO operating modes are possible.
  - Slave drives: Only CFC & M-CONTROL and SERVO & M-CTRL. operating modes are possible.
  - Use geared motors of the same type and with the same winding data only.
  - Make sure the geared motor is assigned to the master inverter which has the greatest play or elasticity with respect to the load inertia. In the example with the four geared motors on one cardan shaft and the two external loads, this means one of the two internal motors must be assigned to the master inverter.
  - Calculate the motor power $P_{Mot}$ of the individual motors using the required drive power $P_{drive}$ (including the required safety margin, e.g. in the case of hoists) and the number of motors $n_{Mot}$. Include a control reserve of 10% in this calculation.
    - $P_{Mot} = 1.1 \times P_{drive} / n_{Mot}$
  - The motor power $P_{Mot}$ including the safety margin and the control reserve of 10% then gives the required inverter power.
    - Inverter power corresponding to the maximum torque under dynamic load.
  - The inverters must be interconnected via SBus, RS-485 interface or analog connection. In the case of an analog connection, the master inverter must be equipped with the "input/output card type DIO11A" (analog output) option.
  - The SBus or analog connections should be preferred over the RS-485 connection in order to achieve the best possible control characteristics.
### 3.4 Variant 3: Mixed mode

**Project planning notes**

- Possible with 4-pole SEW asynchronous motors (DR, DT, DV, CT, CV) only. Operation is not possible with synchronous motors, other SEW asynchronous motors or non-SEW motors.
- Master drive: Only CFC operating mode is permitted.
- Slave drives: Only CFC & M-CONTROL operating mode is permitted.
- Use geared motors of the same type and with the same winding data only.
- Up to six motors can be connected in parallel.
- Make sure the tachometers are installed on the geared motors which have the greatest play or elasticity with respect to the load inertia. In the example with the four geared motors on one cardan shaft and the two external loads, this means both of the two internal motors must be fitted with tachometers.
- Calculate the motor power $P_{\text{Mot}}$ of the individual motors using the required drive power $P_{\text{drive}}$ (including the required safety margin, e.g. in the case of hoists) and the number of motors $n_{\text{Mot}}$. Include a control reserve of 10% in this calculation.
  \[ P_{\text{Mot}} = 1.1 \times P_{\text{drive}} / n_{\text{Mot}} \]
- The drive power $P_{\text{drive}}$ including the safety margin and the control reserve of 10% then gives the required inverter power.
  \[ P_{\text{drive}} \]
- Inverter power corresponding to the maximum torque under dynamic load.
- The inverters must be interconnected via SBus, RS-485 interface or analog connection. In the case of an analog connection, the master inverter must be equipped with the "input/output card type DIO11A" (analog output) option.
- The SBus or analog connections should be preferred over the RS-485 connection in order to achieve the best possible control characteristics.
3.5 **Calculation of the torsion angle**

**Prerequisite**
A sufficiently rigid shaft connection is a prerequisite for variant 1, parallel connection. This is the case if the product of the motor pole pair number $Z_p$ and the maximum torsion angle of the shaft connection $\Delta \varphi$ relating to the motor shaft is less than or equal to $20^\circ$ → $Z_p \times \Delta \varphi \leq 20^\circ$.

This requirement must also be met in the drives connected in parallel in variant 3, mixed mode including parallel connection and master/slave mode.

The multi-motor drive is only allowed to be implemented in straightforward master/slave mode (variant 2) if this requirement is not met. Parallel operation or mixed mode is then not permitted.

**Example**
The prerequisite for variant 1, parallel operation, is examined below taking the example with four geared motors driving one cardan shaft.

**Settings**
- Motor pole pair number: $Z_p = 2$ (4-pole)
- Maximum motor torque: $M_{\text{Mot, max}} = 25 \text{ Nm}$
- Gear unit reduction ratio: $i = 12$
- Torsional rigidity of the individual shaft connections: $C_1 = C_2 = C_3 = C = 10^5 \text{ Nm/\text{rad}}$

![](image)

*Fig. 6: Settings*

**Calculation**
Maximum output torque: $M_{\text{G, max}} = i \times M_{\text{Mot, max}} = 300 \text{ Nm}$

Torsion of shaft segments 1 and 3 with motors acting against one another:
$\Delta \varphi_1' = \Delta \varphi_3' = M_{\text{G, max}} / C = 0.003 \text{ rad} = 0.172^\circ$

Motors 1 and 2 may operate against motors 3 and 4 in the most unfavorable case (oscillation). As a result, twice the value of the motor torque is taken into account for shaft segment 2:
$\Delta \varphi_2' = 2 \times M_{\text{G, max}} / C = 0.006 \text{ rad} = 0.344^\circ$

Total torsion of the shaft driveline:
$\Delta \varphi = \Delta \varphi_1' + \Delta \varphi_2' + \Delta \varphi_3' = 0.012 \text{ rad} = 0.688^\circ$

Torsion angle relating to the motor shaft: $\Delta \varphi = \Delta \varphi' \times i = 0.144 \text{ rad} = 8.25^\circ$

Product of the pole pair number and torsion angle: $Z_p \times \Delta \varphi = 2 \times 8.25^\circ = 16.5^\circ < 20^\circ$

Variant 1, parallel connection, is permitted for this configuration. Any play in the shaft connection must also be taken into account.
3.6 Project planning for hoists

In practice, the question of setting the size of hoists is addressed with regard to special thermal and safety-related criteria.

Thermal considerations

In contrast to trolleys, hoists require approx. 70 – 90 % of the rated motor torque assuming constant speed upwards or downwards and the standard configuration.

Starting torque

The highest operating torque is required in the event of acceleration with maximum load in the UPWARDS hoisting direction.

VFC&HOIST

The 4-pole geared motor should always be designed for a maximum speed of 2100 rpm (70 Hz) with a transition speed of 1500 rpm (50 Hz) and 2500 rpm (83 Hz) at a transition speed of 1800 rpm (60 Hz). This means the gear unit input speed is increased by a factor of 1.4. Consequently, it is also necessary to choose a gear ratio which is higher by a factor of 1.4. This measure means that no torque is lost on the output shaft in the field weakening range (50 – 70 Hz or 60 – 83 Hz), since the higher gear ratio compensates for the inversely proportionate fall in torque in relation to speed (frequency). Furthermore, the startup torque is 1.4 times greater in the range from 0 – 1500 rpm (0 – 50 Hz) or 0 – 1800 rpm (0 – 60 Hz). Other advantages are that the speed range is greater and the self-cooling of the motor more powerful.

![Diagram of voltage/speed characteristic curve and resultant torque characteristic](image)

Fig. 7: a = Recommended voltage/speed characteristic curve and resultant torque characteristic

The motor power for hoists is selected according to the load type.

- S1 (100 % c.d.f.): Motor power 1 level higher than the selected inverter power, e.g. for lengthy upwards travel or continuous elevators.
- S3 (40 % c.d.f.): Motor power according to the selected inverter power.

The hoist function on the inverter should be activated regardless of the above guidelines.

Encoder monitoring

MOVIDRIVE® has encoder monitoring for TTL sensors and sin/cos encoders. There is no encoder monitoring for HTL sensors.

SEW recommends using TTL sensors or sin/cos encoders for speed controlled hoist drives and activating encoder monitoring (P504).

Avoid using an HTL encoder, if possible.
4 Installation

During installation, it is essential to follow the safety and installation instructions in the MOVIDRIVE® operating instructions!

4.1 Encoder connection

Note the following points with regard to the encoder connection:

- Encoders with a 24 V<sub>DC</sub> power supply can be powered directly by the MOVIDRIVE® unit. Encoders with a 5 V<sub>DC</sub> power supply must be connected via the "5 V encoder power supply type DWII11A" option.

- Always connect the encoder with a 1:1 assignment.

<table>
<thead>
<tr>
<th>Encoder</th>
<th>MOVIDRIVE® connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Track A (K1)</td>
<td>X15:1</td>
</tr>
<tr>
<td>Track B (K2)</td>
<td>X15:2</td>
</tr>
<tr>
<td>Track C (K0)</td>
<td>X15:3</td>
</tr>
<tr>
<td>Track /A (/K1), do not connect with HTL sensors!</td>
<td>X15:6</td>
</tr>
<tr>
<td>Track /B (/K2), do not connect with HTL sensors!</td>
<td>X15:7</td>
</tr>
<tr>
<td>Track /C (/K0), do not connect with HTL sensors!</td>
<td>X15:8</td>
</tr>
</tbody>
</table>

- The negated tracks must not be connected with HTL sensors (ES1C, ES2C, EV1C). Use pre-fabricated encoder cables from SEW for connecting the encoders correctly.
4.2 Torque setpoint connection

In master/slave operation, the master inverter must transmit the torque setpoint to the slave inverter. This can take place as follows:

- **MOVIDRIVE® MD_60A and MOVIDRIVE® compact**: Via system bus (SBus), no option necessary.
- **MOVIDRIVE® MD_60A only**: Via RS-485 interface X13:10/11, no option necessary.
- **MOVIDRIVE® MD_60A only**: Via an analog setpoint connection, the master inverter must be equipped with the “input/output card type DIO11A” option.

**SBus connection**

![Diagram of SBus connection](image)

**Fig. 8: System bus connection MOVIDRIVE® MD_60A**

![Diagram of SBus connection](image)

**Fig. 9: System bus connection MOVIDRIVE® compact MCF/MCV/MCS4_A**
**Torque setpoint connection**

**Cable specification**
- Use a 2-core twisted and shielded copper cable (data transmission cable with shield comprising copper braiding). The cable must meet the following specifications:
  - Conductor cross section 0.75 mm² (AWG 18)
  - Cable resistance 120 Ω at 1 MHz
  - Capacitance per unit length ≤ 40 pF/m (12 pF/ft) at 1 kHz

Suitable cables are CAN bus or DeviceNet cables, for example.

**Shield contact**
- Connect the shield at either end to the electronics shield clamp of the inverter or the master control and ensure the shield is connected over a large area. Also connect the ends of the shield to DGND.

**Line length**
- The permitted total cable length depends on the baud rate setting of the SBus (P816):
  - 125 kbaud → 320 m (1056 ft)
  - 250 kbaud → 160 m (528 ft)
  - 500 kbaud → 80 m (264 ft)
  - 1000 kbaud → 40 m (132 ft)

**Terminating resistor**
- Switch on the system bus terminating resistor (S12 = ON) at the start and finish of the system bus connection. Switch off the terminating resistor on the other units (S12 = OFF).

- There must not be any potential displacement between the units which are connected together using the SBus. Take suitable measures to avoid a potential displacement, e.g. by connecting the unit ground connectors using a separate lead (equipotential bonding).
RS-485 connection (MOVIDRIVE® MD_60A only)

**Cable specification**
- Use a 2-core twisted and shielded copper cable (data transmission cable with shield comprising copper braiding). The cable must meet the following specifications:
  - Conductor cross section 0.5 – 0.75 mm² (AWG 20 – 18)
  - Cable resistance 100 – 150 Ω at 1 MHz
  - Capacitance per unit length ≤ 40 pF/m (12 pF/ft) at 1 kHz
- The following cable is suitable, for example:
  - BELDEN (www.belden.com), data cable type 3105A

**Shield contact**
- Connect the shield at either end to the electronics shield clamp of the inverter or the machine control and ensure the shield is connected over a large area. Also connect the ends of the shield to DGND.

**Line length**
- The permitted total line length is 200 m (660 ft).

**Terminating resistor**
- Dynamic terminating resistors are fitted. Do not connect any external terminating resistors!

**STOP**
- There must not be any potential displacement between the units which are connected together using the RS-485. Take suitable measures to avoid a potential displacement, e.g. by connecting the unit ground connectors using a separate lead (equipotential bonding).
**Analog connection (MOVIDRIVE® MD_60A only)**

The master inverter must be equipped with the "input/output card type DIO11A" option if the torque setpoint is to be transmitted via an analog connection. The analog output of the DIO11A (either AOV1 or AOV2) is connected to analog inputs n1 of the slave inverter.

**Number of units**
- A maximum of 10 analog inputs n1 can be connected to one analog output AOV1 (AOV2).

**Cable specification**
- Use a 2-core twisted and shielded cable.

**Shield contact**
- Connect the shield at either end to the electronics shield clamp of the MOVIDRIVE® MD_60A and ensure the shield is connected over a large area.

**Permitted total line length**
- The permitted total line length is 10 m (33 ft).

**No potential displacement**
- There must not be any potential displacement between the units. Take suitable measures to avoid a potential displacement, e.g. by connecting the unit ground connectors using a separate lead.

**Terminal control**
- Make sure the master and slave inverters receive "/Controller inhibit," "Enable" and "CW/CCW" signals at the same time when using terminal control.

---

**Fig. 12: Analog connection**

- **Master Control unit**
  - AOV1
  - AOC1
  - AGND
  - AOV2
  - AOC2
  - AGND

- **Slave Control unit**
  - AOV1
  - AOC1
  - AGND
  - AOV2
  - AOC2
  - AGND

---

**DIO11A**

- REF1
- AI11
- AI12
- AGND
- REF2

**X11:**

- REF1
- AI11
- AI12
- AGND
- REF2

---

**X21:**

- AOV1
- AOC1
- AGND
- AOV2
- AOC2
- AGND

---

**03918AEN**
4.3 Variant 1: Parallel connection

**Motor connection**
- With speed control: Connect the motor and tachometer to the inverter with a 1:1 phase assignment.
- Connect the motors with the same phase assignment if the mechanical connection is the same. Swap over two phases in the motor terminal box if the mechanical connection is reversed (= opposite direction of rotation required).

![Phase assignment diagram](image)

*Fig. 13: Phase assignment*
### 4.4 Variant 2: Master/slave mode

**Motor connection**

- Always connect the motors to the inverter with a 1:1 phase assignment.
- For inverters of the slave drives with the same mechanical connection as the master drive: Set parameter P350 "Change direction of rotation 1" to OFF (= factory setting).
- For inverters of the slave drives with the opposite mechanical connection to the master drive (opposite direction of rotation required): Set parameter P350 "Change direction of rotation 1" to ON.

![Diagram](image-url)

**Fig. 14: Phase assignment and P350 "Change direction of rotation 1"**
4.5 Variant 3: Mixed mode

Motor with tachometer

- Always connect the motors and tachometers (master and slave) to the inverter with a 1:1 phase assignment.
- For inverters of the slave drives with the same mechanical connection as the master drive: Set parameter P350 “Change direction of rotation 1” to OFF (= factory setting).
- For inverters of the slave drives with the opposite mechanical connection to the master drive (opposite direction of rotation required): Set parameter P350 “Change direction of rotation 1” to ON.

Fig. 15: Phase assignment and P350 “Change direction of rotation 1”
Motor without tachometer

- Also use a 1:1 phase assignment if the mechanical connection is the same as for the motor with tachometer. Swap over two phases in the motor terminal box if the mechanical connection is reversed (= opposite direction of rotation required).

Fig. 16: Phase assignment and P350 "Change direction of rotation 1"
5 Startup

During startup, it is essential to follow the safety and startup instructions in the MOVIDRIVE® operating instructions!

- Correct installation of the units is the pre-requisite for successful startup.

5.1 Variant 1: Parallel connection

**Standard startup**

- Perform startup using the current MOVITOOLS version. The current MOVITOOLS version can be downloaded from the SEW website (www.sew-eurodrive.com).
- The following operating modes are available:
  - VFC (asynchronous)
  - VFC-n-CONTROL (asynchronous)
  - CFC (asynchronous)
- Set the "Number of identical motors" in the startup dialog box. Enter the value "4" in the example with the four geared motors on one cardan shaft.

![Fig. 17: Setting the number of motors connected in parallel](image)

- Continue the startup procedure through to the end.
5.2 Variant 2: Master/slave mode

**Master inverter**

- Perform startup using the current MOVITOOLS version. The current MOVITOOLS version can be downloaded from the SEW website (www.sew-eurodrive.com).
- The following operating modes are possible:
  - CFC (asynchronous)
  - SERVO (synchronous)
- The "Number of identical motors" value must be set to "1".

---

**Fig. 18: Setting the number of motors connected in parallel**

---

05265AEN
• Set the value for "Number of slave axes" in the speed controller startup window. In the example of three slave inverters on one master inverter, the value is "3".

```
CFC Speed Controller

Stiffness
Load inertia [10e-4 kg*m*m] 0
Drive
Brake
z can
Shortest required ramp [s] 1
Ext. control time ref. [ms] 1
JC motor [10e-4 kg*m*m] 0
Number of slave axes 3

[Speed Controller Parameters]
```

**Fig. 19: Number of slave axes**

• In "Load inertia [10e-4 kg*m*m]", enter the value of the entire load inertia in relation to the motor speed (do not divide by the number of motors). You can ascertain the load inertia using the MOVITOOLS <Test> function.

• Always set "WITH BACKLASH" for the drive.
• Set the "Stiffness" to optimize the control characteristics.
  – Recommended setting range: 0.90 – 1 – 1.10
  – If the drive is tending to oscillate: Setting < 1
  – Transient recovery time is too long: Setting > 1

**Slave inverter**

• Perform startup using the current MOVITOOLS version. The current MOVITOOLS version can be downloaded from the SEW website (www.sew-eurodrive.com).

• The following operating modes are available:
  – CFC & M-CONTROL (asynchronous)
  – SERVO & M-CTRL. (synchronous)

• The "Number of identical motors" value must be set to "1".
• The "Number of slave axes" value must be set to "0".

• Enter the following value for "Load inertia":
  – Master inverter value divided by number of motors
  – Example: 1 master and 3 slaves → Master inverter value / 4

• Enter the same "Stiffness" value as for the master inverter.
### Parameters

- Set the following parameters once startup has been performed successfully:

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Master inverter</th>
<th>Slave inverter</th>
</tr>
</thead>
</table>
| **P100 Setpoint source** | For example, BIPOL./FIX.SETPT | • With SBus connection: MASTER-SBus.  
• With RS-485 connection: MASTER-RS-485  
• With analog connection (AO1 → AI1): BIPOL./FIX.SETPT |
| **P101 Control signal source** | For example, TERMINALS | • Not effective with SBus and RS-485 connection.  
• With analog connection (AO1 → AI1), for example TERMINALS. |
| **P110 AI1 scaling** | Effective with analog connection only (AO1 → AI1) | - |
| **P136 Stop ramp t13**  
**P137 Emergency ramp t14** | As required | • Not effective with SBus and RS-485 connection.  
• With analog connection (AO1 → AI1), for example TERMINALS. |
| **P350 Change direction of rotation 1** | - | • Set differently from the master inverter if there is an opposite mechanical connection. |
| **P640 Analog output AO1** | Effective with analog connection only (AO1 → AI1) | ACTIVE CURRENT |
| **P641 Scaling AO1** | Effective with analog connection only (AO1 → AI1) | 1 |
| **P642 Operating mode AO1** | Effective with analog connection only (AO1 → AI1) | -10V..10V |
| **P700 Operating mode 1** | CFC or SERVO | CFC & M-CONTROL or SERVO & M-CTRL. |
| **P750 Slave setpoint** | • With SBus connection: TORQUE (SBus).  
• With RS-485 connection: TORQUE (RS-485)  
• With analog connection (AO1 → AI1): MASTER-SLAVE OFF | MASTER-SLAVE OFF |
| **P751 Scaling slave setpoint** | Effective with SBus and RS-485 connection only | - |
| **P811 RS-485 group address** | With RS-485 connection only: Set to the same value. |
| **P814 SBus group address** | With SBus connection only: Set to the same value. |
| **P816 SBus baud rate** | With SBus connection only: Set to the same value. |
### 5.3 Variant 3: Mixed mode

**Parallel connection**

- Perform startup using the current MOVITOOLS version. The current MOVITOOLS version can be downloaded from the SEW website (www.sew-eurodrive.com).
  - For the master inverter in CFC mode.
  - For the slave inverter(s) in CFC & M-CONTROL mode.
  - Set the "Number of identical motors" value for the master and slave to the number of motors connected in parallel.
  - For the master, set the value for "Number of slave axes" to the correct number.
  - For the slave, always set "Number of slave axes" to "0".

**Master/slave mode**

- Set the following parameters once startup has been performed successfully:

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Master inverter</th>
<th>Slave inverter</th>
</tr>
</thead>
<tbody>
<tr>
<td>P100 Setpoint source</td>
<td>For example, BIPOL./FIX.SETPT</td>
<td>• With SBus connection: MASTER-SBus.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• With RS-485 connection: MASTER-RS-485</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• With analog connection (AO1 → AI1): BIPOL./FIX.SETPT</td>
</tr>
<tr>
<td>P101 Control signal source</td>
<td>For example, TERMINALS</td>
<td>• Not effective with SBus and RS-485 connection.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• With analog connection (AO1 → AI1), for example TERMINALS.</td>
</tr>
<tr>
<td>P110 AI1 scaling</td>
<td>-</td>
<td>• Always set 1 (= factory setting). Use P350 if there is an opposite mechanical connection.</td>
</tr>
<tr>
<td>Effective with analog connection only (AO1 → AI1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P136 Stop ramp t13</td>
<td>As required</td>
<td>• Same values as master inverter</td>
</tr>
<tr>
<td>P137 Emergency ramp t14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P350 Change direction of rotation 1</td>
<td>-</td>
<td>• Set differently from the master inverter if there is an opposite mechanical connection.</td>
</tr>
<tr>
<td>P640 Analog output AO1</td>
<td>ACTIVE CURRENT</td>
<td></td>
</tr>
<tr>
<td>Effective with analog connection only (AO1 → AI1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P641 Scaling AO1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Effective with analog connection only (AO1 → AI1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P642 Operating mode AO1</td>
<td>-10V..10V</td>
<td></td>
</tr>
<tr>
<td>Effective with analog connection only (AO1 → AI1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P700 Operating mode 1</td>
<td>CFC</td>
<td>CFC &amp; M-CONTROL</td>
</tr>
<tr>
<td>P750 Slave setpoint</td>
<td>• With SBus connection: TORQUE (SBus).</td>
<td>MASTER-SLAVE OFF</td>
</tr>
<tr>
<td></td>
<td>• With RS-485 connection: TORQUE (RS-485)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• With analog connection (AO1 → AI1): MASTER-SLAVE OFF</td>
<td></td>
</tr>
<tr>
<td>P751 Scaling slave setpoint</td>
<td>-</td>
<td>• Always set 1 (= factory setting). Use P350 if there is an opposite mechanical connection.</td>
</tr>
<tr>
<td>Effective with SBus and RS-485</td>
<td></td>
<td></td>
</tr>
<tr>
<td>connection only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P811 RS-485 group address</td>
<td>With RS-485 connection: Set to the same value.</td>
<td></td>
</tr>
<tr>
<td>P814 SBus group address</td>
<td>With SBus connection: Set to the same value.</td>
<td></td>
</tr>
<tr>
<td>P816 SBus baud rate</td>
<td>With SBus connection: Set to the same value.</td>
<td></td>
</tr>
</tbody>
</table>