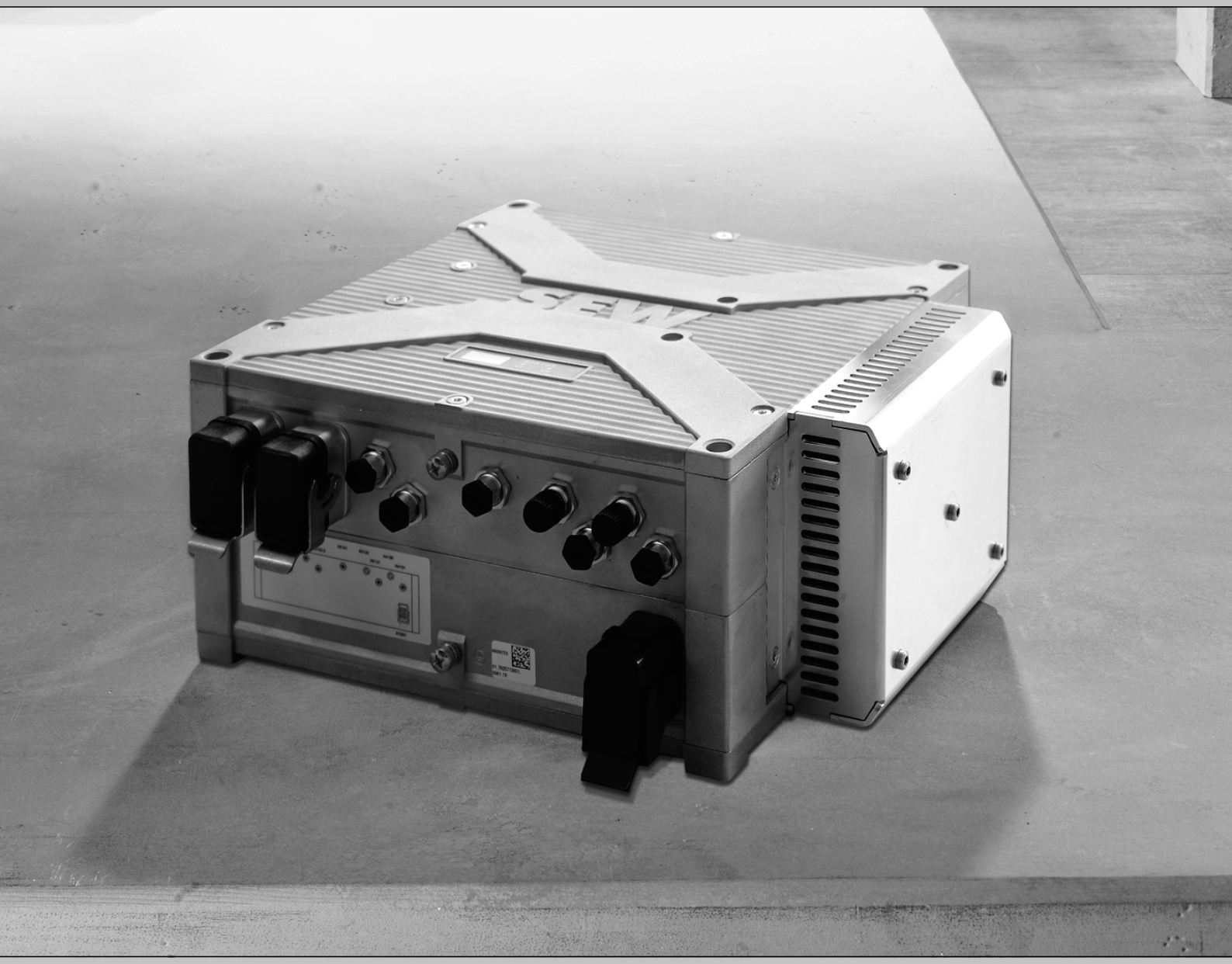
SEW EURODRIVE

Product Manual



Contactless Energy Transfer System

MOVITRANS® TES31A Decentralized Supply Unit Synchronization

Edition 04/2020

29190657/EN

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1 General information

1.1 About this documentation

The documentation at hand is the original.

This documentation is an integral part of the product. The documentation is intended for all employees who perform work on the product.

Make sure this documentation is accessible and legible. Ensure that persons responsible for the systems and their operation as well as persons who work on the product independently have read through the documentation carefully and understood it. If you are unclear about any of the information in this documentation or if you require further information, contact SEW-EURODRIVE.

1.2 Other applicable documentation

Observe the corresponding documentation for all further components.

1.3 Structure of the safety notes

1.3.1 Meaning of signal words

The following table shows the grading and meaning of the signal words for safety notes.

Signal word	Meaning	Consequences if disregarded
⚠ **DANGER**	Imminent hazard	Severe or fatal injuries
⚠ **WARNING**	Possible dangerous situation	Severe or fatal injuries
⚠ **CAUTION**	Possible dangerous situation	Minor injuries
NOTICE	Possible damage to property	Damage to the product or its environment
INFORMATION	Useful information or tip: Simplifies handling of the product.	

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INFORMATION ON EXPLOSION PROTECTION	Important information about explosion protection	

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Signal word	Meaning	Consequences if disregarded
INFORMATION	Useful information or tip: Simplifies handling of the product.	

1.3.3 Structure of section-related safety notes

Section-related safety notes do not apply to a specific action but to several actions pertaining to one subject. The hazard symbols used either indicate a general hazard or a specific hazard.

This is the formal structure of a safety note for a specific section:

SIGNAL WORD

Type and source of hazard.

Possible consequence(s) if disregarded.

- Measure(s) to prevent the hazard.

Meaning of the hazard symbols

The hazard symbols in the safety notes have the following meaning:

Hazard symbol	Meaning
	General hazard
	Warning of automatic restart

1.3.4 Structure of embedded safety notes

Embedded safety notes are directly integrated into the instructions just before the description of the dangerous action.

This is the formal structure of an embedded safety note:

⚠ **SIGNAL WORD!** Type and source of hazard. Possible consequence(s) if disregarded. Measure(s) to prevent the hazard.

1.4 Decimal separator in numerical values

In this document, a period is used to indicate the decimal separator.

Example: 30.5 kg

1.5 Rights to claim under limited warranty

Read the information in this documentation. This is essential for fault-free operation and fulfillment of any rights to claim under limited warranty. Read the documentation before you start working with the product.

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1.6 Product names and trademarks

The brands and product names in this documentation are trademarks or registered trademarks of their respective titleholders.

1.7 Copyright notice

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2 Safety notes

2.1 Preliminary information

The following general safety notes serve the purpose of preventing injury to persons and damage to property. They primarily apply to the use of products described in this documentation. If you use additional components, also observe the relevant warning and safety notes.

2.2 Duties of the user

As the user, you must ensure that the basic safety notes are observed and complied with. Make sure that persons responsible for the machinery and its operation as well as persons who work on the device independently have read through the documentation carefully and understood it.

As the user, you must ensure that all of the work listed in the following is carried out only by qualified specialists:

- Setup and installation
- Installation and connection
- Startup
- Maintenance and repairs
- Shutdown
- Disassembly

Ensure that the persons who work on the product pay attention to the following regulations, conditions, documentation, and information:

- National and regional safety and accident prevention regulations
- Warning and safety signs on the product
- All other relevant project planning documents, installation and startup instructions, and wiring diagrams
- Do not assemble, install or operate damaged products
- All system-specific specifications and conditions

Ensure that systems in which the product is installed are equipped with additional monitoring and protection devices. Observe the applicable safety regulations and legislation governing technical work equipment and accident prevention regulations.

2.3 Electromagnetic fields

Observe national installation regulations, such as the DGUV (German Social Accident Insurance) regulation 15 – "Electromagnetic fields" as well as DIN EN 12198-1:2000+A1:2008 during installation, startup, and operation of systems with contactless energy transfer by induction for use in industrial workplaces.

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2.4 Target group

Specialist for mechanical work

Any mechanical work may be performed only by adequately qualified specialists. Specialists in the context of this documentation are persons who are familiar with the design, mechanical installation, troubleshooting, and maintenance of the product who possess the following qualifications:

- Qualifications in the field of mechanics in accordance with the national regulations
- Familiarity with this documentation

Specialist for electrotechnical work

Any electrotechnical work may be performed only by electrically skilled persons with a suitable education. Electrically skilled persons in the context of this documentation are persons who are familiar with electrical installation, startup, troubleshooting, and maintenance of the product who possess the following qualifications:

- Qualifications in the in the field of electrical engineering in accordance with the national regulations
- Familiarity with this documentation

Additional qualifications

In addition to that, these persons must be familiar with the valid safety regulations and laws, as well as with the requirements of the standards, directives, and laws specified in this documentation.

The persons must have the express authorization of the company to operate, program, parameterize, label, and ground devices, systems, and circuits in accordance with the standards of safety technology.

Instructed persons

All work in the areas of transportation, storage, operation and waste disposal must be carried out by persons who are trained appropriately. The purpose of the training is to give persons the ability to perform the required tasks and work steps in a safe and correct manner.

2.5 Designated use

The product is intended for installation in electrical plants or machines.

The product is intended for stationary use in industrial and commercial systems with contactless energy transfer systems.

In case of installation in electrical systems or machines, startup of the product is prohibited until it is determined that the machine meets the requirements stipulated in the local laws and directives. For Europe, Machinery Directive 2006/42/EC as well as the EMC Directive 2014/30/EU apply. Observe EN 60204-1 (Safety of machinery - electrical equipment of machines). The product meets the requirements stipulated in the Low Voltage Directive 2014/35/EU.

The standards given in the declaration of conformity apply to the product.

Technical data and information on the connection conditions are provided on the nameplate and in chapter "Technical data" in the documentation. Always comply with the data and conditions.

Unintended or improper use of the product may result in severe injury to persons and damage to property.

2.5.1 Restrictions under the European WEEE Directive 2012/19/EU

You may use options and accessories from SEW-EURODRIVE exclusively in connection with products from SEW-EURODRIVE.

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2.6 Functional safety technology

The product must not perform any safety functions without a higher-level safety system, unless explicitly allowed by the documentation.

2.7 Transport

Inspect the shipment for damage as soon as you receive the delivery. Inform the shipping company immediately about any damage. If the product is damaged, it must not be assembled, installed or started up.

Observe the following notes when transporting the device:

- Ensure that the product is not subject to mechanical impact.

If necessary, use suitable, sufficiently dimensioned handling equipment.

Observe the information on climatic conditions in chapter "Technical data" of the documentation.

2.8 Installation/assembly

Ensure that the product is installed and cooled in accordance with the regulations in the documentation.

Protect the product from excessive mechanical strain. The product and its mounted components must not protrude into the path of persons or vehicles. Ensure that no components are deformed or no insulation spaces are modified, particularly during transportation. Electrical components must not be mechanically damaged or destroyed.

Observe the notes in chapter Mechanical installation in the documentation.

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2.9 Protective separation

The product meets all requirements for protective separation of power and electronics connections in accordance with EN 61800-5-1. The connected signal circuits must meet requirements according to SELV (**S**afety **E**xtra **L**ow **V**oltage) or PELV (**P**rotective **E**xtra **L**ow **V**oltage) to ensure protective separation. The installation must meet the requirements for protective separation.

2.10 Startup/operation

Observe the warning notes in the following chapters:

- Chapter "Startup" (→ 🗎 19) (multi-point synchronization)
- Chapter "Operation" (→ 🗎 25) (multi-point synchronization)
- Chapter "Startup" (→ 🗎 41) (single-point synchronization)
- Chapter "Operation" (→ 🗎 49) (single-point synchronization)

Make sure that any existing transport protection is removed.

Do not deactivate monitoring and protection devices of the machine or system, even for a test run.

Depending on the degree of protection, products may have live, uninsulated, and sometimes moving or rotating parts, as well as hot surfaces during operation.

Additional preventive measures may be required for applications with increased hazard potential. Be sure to check the effectiveness of the protection devices after every modification.

In the event of deviations from normal operation, switch the product off. Possible deviations are increased temperatures, noise, or vibration, for example. Determine the cause. Contact SEW-EURODRIVE if necessary.

When the device is switched on, dangerous voltages are present at all power connections as well as at any connected cables and terminals. This is also the case even if the product is inhibited.

Do not separate the connection to the product during operation. This may result in dangerous electric arcs damaging the product.

If you disconnect the product from the voltage supply, do not touch any live components or power connections because capacitors might still be charged. Observe the following minimum switch-off time:

10 minutes.

Observe the corresponding information signs on the product.

The fact that the operation LED and other display elements are no longer illuminated does not indicate that the product has been disconnected from the supply system and no longer carries any voltage.

Cover unused connections with the supplied protection caps during operation.

Mechanical blocking or internal protective functions of the product can cause the power to interrupt. Removing the cause of this problem or performing a reset can result in the machine or system restarting on its own. If this is not permitted for the drive-controlled machine or system for safety reasons, first disconnect the product from the supply system and then start troubleshooting.

Risk of burns: The surface temperature of the product can exceed 60 °C during operation. Do not touch the product during operation. Let the product cool down before touching it.

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3 System description

Several decentralized supply units with the same output frequency can be synchronized. In principle, you have two synchronization options:

- **Multi-point synchronization (MP)** for optimizing the energy transfer at junctions in line cables. Synchronization of several supply units for supplying electrically and magnetically isolated line cables.
- **Single-point synchronization (SP)** to increase the supply performance of a line cable. Synchronization of two or three TES31A supply units connected in parallel at a point, in order to supply a line cable.

3.1 Other applicable documentation

For technical details and additional information on the MOVITRANS® system and the current system components, refer to the following documentation:

- "MOVITRANS® TES31A Decentralized Supply Unit" operating instructions
- "MOVITRANS® TCS31A Compensation Box" operating instructions

Observe the applicable safety notes in these documents.

3.2 Multi-point synchronization

The "multi-point synchronization" function allows the user to synchronize separate line cable routes with each other, to ensure seamless energy transfer at any junctions. The "multi-point synchronization" function is enabled for all unit types.

MP master

In synchronization mode, one supply unit acts as the MP master and one or several supply units act(s) as the MP slave. The master transfers the synchronization signal to the slaves via the synchronization cable. If the master detects another synchronization signal, it performs the set "Sync timeout response" fault response. Note the following:

- There is only one master in the synchronization network.
- All synchronization stations (master and slaves) must have the same frequency.

MP slave

In synchronization mode, one or several supply unit(s) act as the MP slave. A slave expects the synchronization signal at the synchronization interface. The additional parameters "Sync phase angle" and "Sync timeout response" can be edited. If a slave receives a faulty synchronization signal, or none at all, it executes the set fault response.

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3.3 Single-point synchronization

The "single-point synchronization" function allows the user to operate individual TES31A decentralized supply units in a network. This produces an increase on the stationary side in the possibly transferable power in a MOVITRANS® installation. It is possible to use the "single-point synchronization" function whenever the power requirements of the application are greater than an individual supply unit at the highest performance level (14/16 kW) can provide. This function is therefore only available in supply units as from the performance class 14 kW.

SP master

In synchronization mode, one supply unit acts as the SP master and one or two supply units act(s) as the SP slave. The master transfers the synchronization signal and the defined setpoint to the slaves via the synchronization cable. A synchronous enable control (daisy chain) is produced in combination with the binary inputs/outputs.

The setting "Sync timeout response" is activated. If the master detects another synchronization signal, it performs the set "Sync timeout response" fault response. Note the following:

- There is only one master in the synchronization network.
- All synchronization stations (master and slaves) must have the same frequency.

SP slave

In synchronization mode, one or two supply unit(s) act as the SP slave. A slave expects the synchronization signal at the synchronization interface and also takes over the setpoint information sent by the master. In addition, the upstream synchronization station (master or slaves) expects and passes on the control information of the daisy chain at the digital inputs/outputs. The additional parameter "Sync phase angle" can be edited. The setting "Sync timeout response" is activated. If a slave receives a faulty synchronization signal, or none at all, the unit executes the set fault response.

3.4 System advantages

The essential advantages of the "Single-point synchronization" function are as follows:

- Output powers up to 48 kW
- No significant differences in the presentation of the synchronization network compared to a single station (MOVITOOLS® MotionStudio, I/O)
- No significant restrictions in the unit functionality
- Simple structure/cabling
- No additional periphery is required
- Fault detection and response for this operating mode

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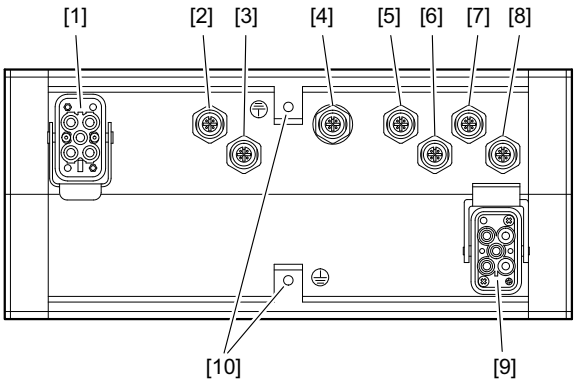
3.5 Terminal strip



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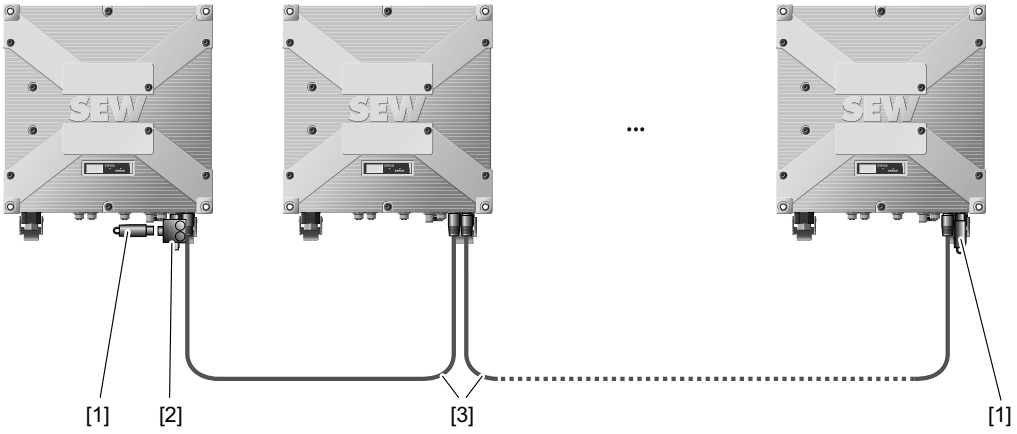
[1] X2337 Load connection TLS
[2] X5102_1 Digital inputs – power section
[3] X5102_2 Digital outputs – power section
[4] X5161 Unit interface for dual-channel disconnection – input without safety function
[5] X5122 MOVITRANS® synchronization signal – input
[6] X5121 MOVITRANS® synchronization signal – output
[7] X4108 CAN system bus – input (system bus 1)
[8] X4101 CAN system bus – output (system bus 1)
[9] X1201 AC 400 V input
[10] PE Ground connection

3.6 SBus installation of several devices

For the startup and diagnostics of a synchronization network, it is helpful to set up SBus communications. The following figure shows the installation diagram for SBus communications.



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[1] CAN terminating resistor
[2] CAN T-piece
[3] Cables

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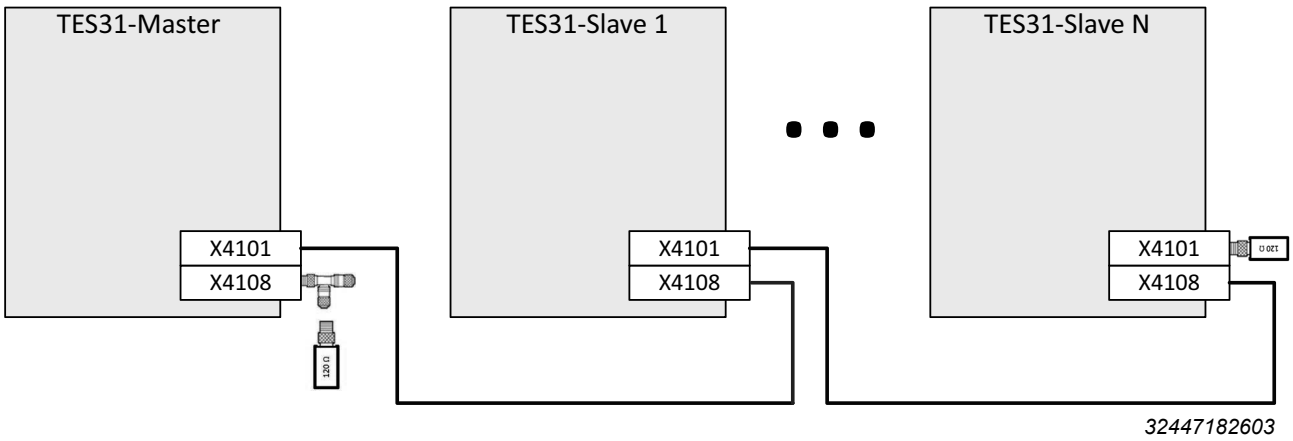
The total cable length permitted for SBus communications depends on the set SBus baud rate:

SBus baud rate	Total cable length
125 kBd	500 m
250 kBd	250 m
500 kBd (standard)	100 m
1000 kBd	25 m

The following figure shows the signal diagram for the SBus communications:



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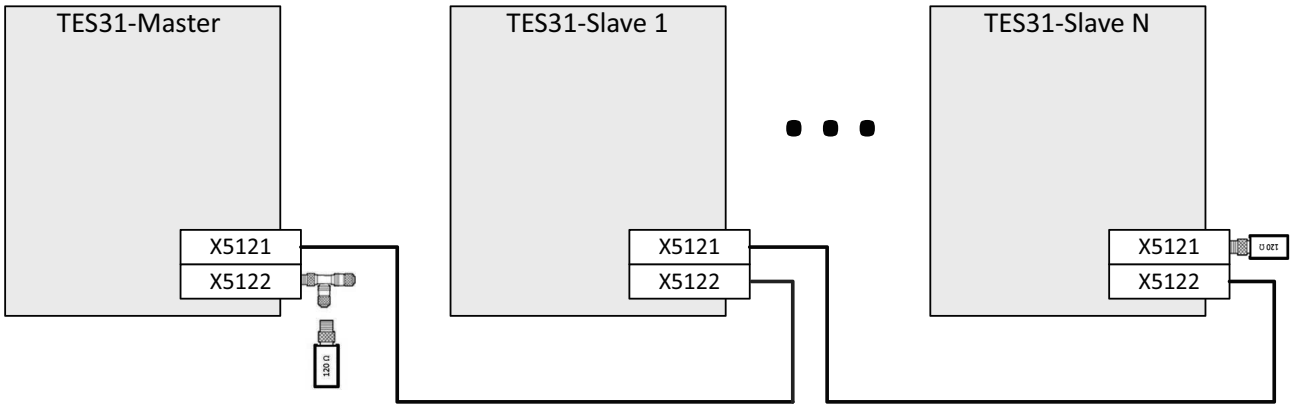
3.7 Signal diagram of the synchronization signal

For the synchronization of the units, it is necessary to connect the synchronization signals. The following figure shows the installation diagram for the synchronization.



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Block diagram

The synchronization signal is connected using the CAN bus cable. Make sure that the bus is terminated with 120 Ohm resistors.

Cable length

The permitted total cable length is 100 m.

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4 Multi-point synchronization

4.1 Requirements

4.1.1 General information

The project planning of a MOVITRANS® system calls for specified knowledge explained in this documentation.

The following information is based on the general guidelines that apply to project planning. This documentation is drawn up for users that are familiar with and have basic knowledge of drive project planning.

4.1.2 PC and software

The "Multi-point synchronization" function is part of the unit firmware. You will need the SEW-EURODRIVE software MOVITOOLS® MotionStudio for configuring the supply units.

4.1.3 Permitted operating modes

In the "Multi-point synchronization" mode, the supply units continue to operate in their individually set operating modes.

INFORMATION

For more information on the operating modes, refer to the following documentation:
MOVITRANS® TES31A Decentralized Supply Unit

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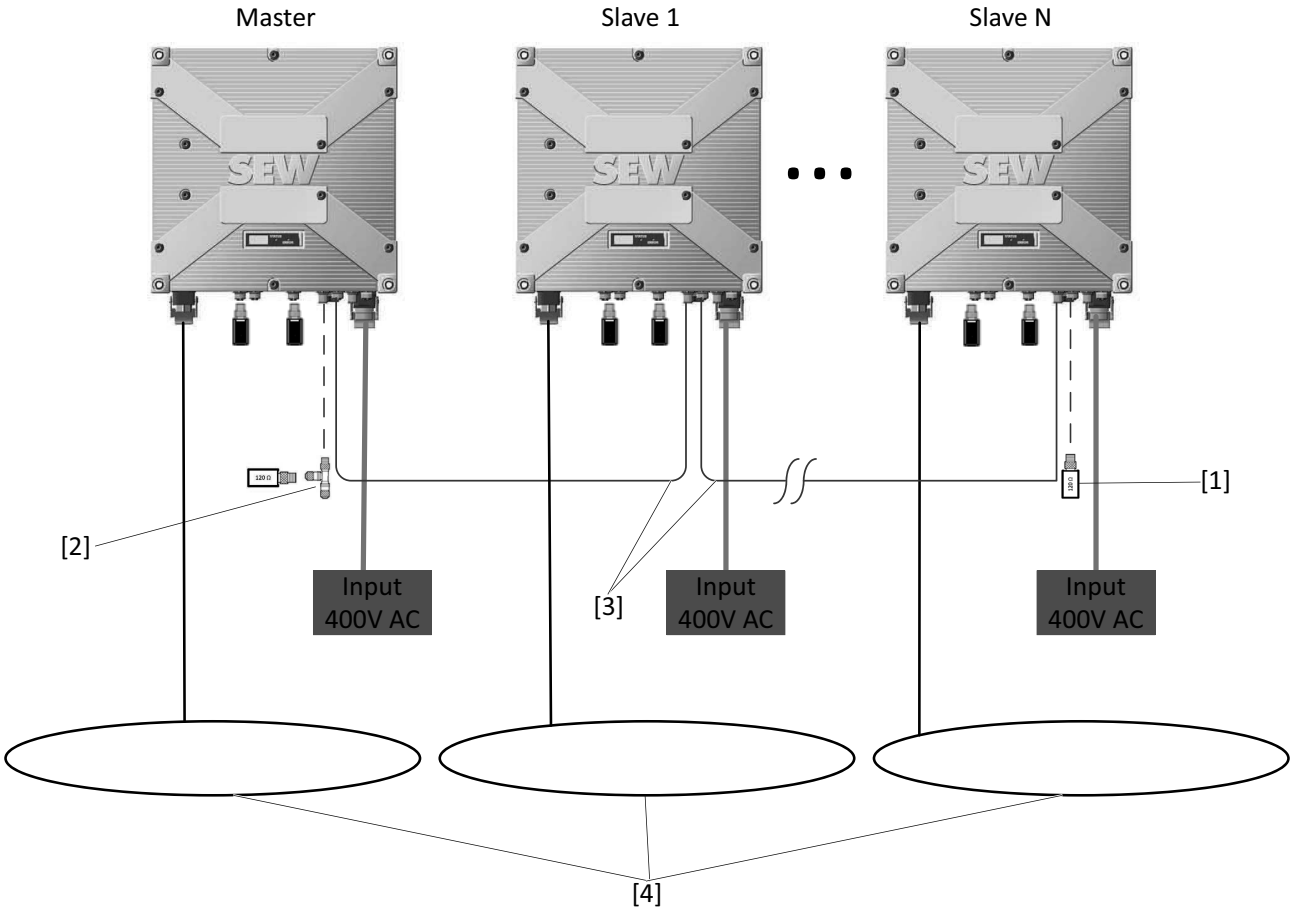
4.2 Connection of a TES31A decentralized supply unit

4.2.1 Overview



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[1] CAN terminating resistor
[2] CAN T-piece
[3] Synchronization signal
[4] Individual line cable routes

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4.3 Startup

4.3.1 For your safety

⚠ WARNING

Risk of injury and possible damage to property if the unit network is released independently.

Fatal or severe injuries and damage to property can occur.

- Before startup, make sure that the line cable is not energized and there are no impermissible operating states during configuration.
- In all network units, disconnect the jumper plugs of the unit interface X5161.
- Disconnect the load connection cable X2337.

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4.3.2 Requirements

- You have installed the unit correctly both mechanically and electrically.
- The system and connected drives must be configured correctly.
- Safety measures prevent accidental drive startup.
- Safety measures prevent danger to persons or machines.

4.3.3 General

INFORMATION

You can find detailed project planning information in the MOVITRANS® Project Planning and Planning manuals.

Correct project planning and installation are the prerequisites for successful startup.

4.3.4 Synchronization procedure

INFORMATION

If the control signal source of the master is set to "Terminals", the synchronization stations are enabled after the line voltage is applied. Observe the information in chapter "For your safety" (→ 🗎 19).

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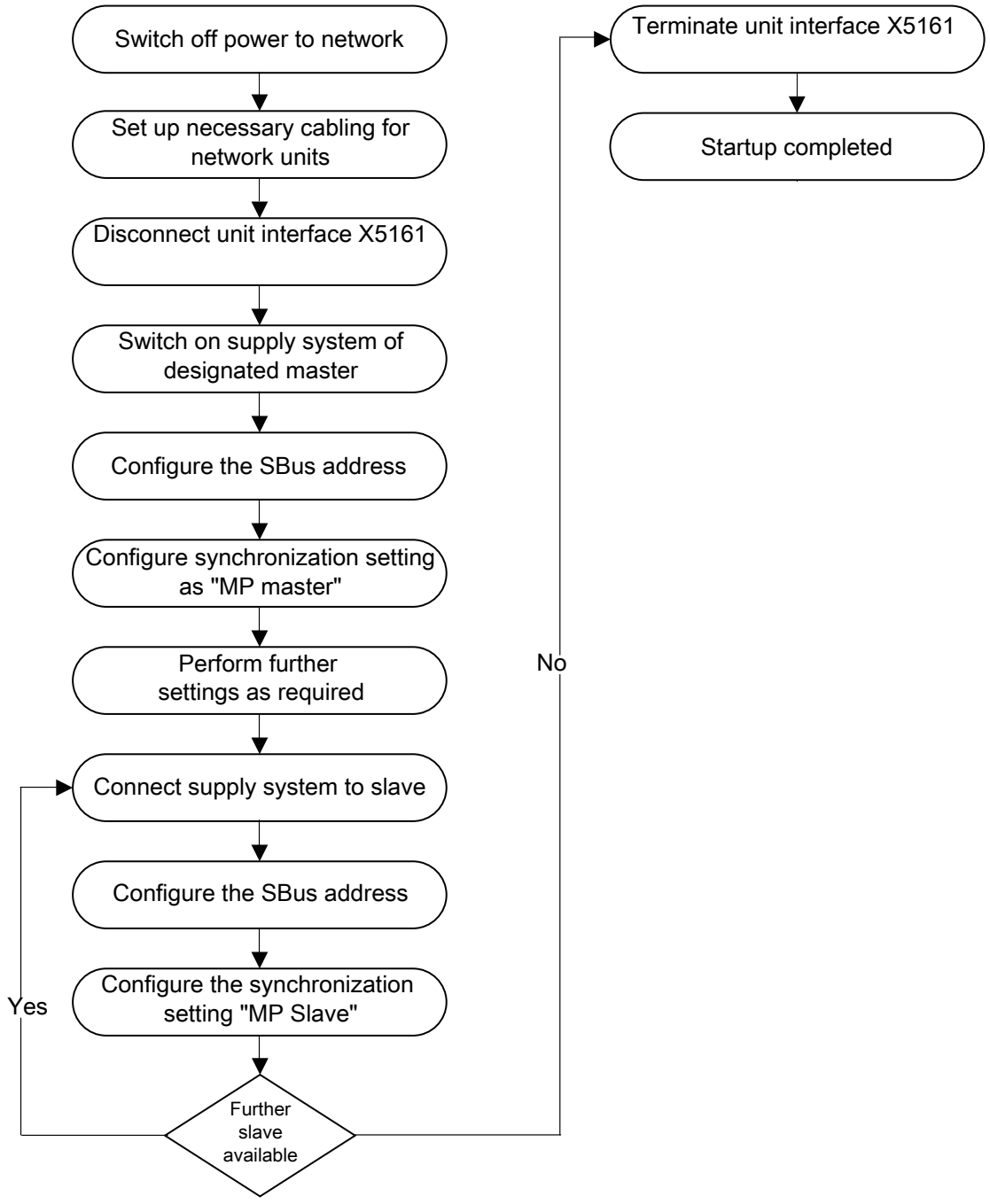
To perform startup, proceed as follows:



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4.3.5 Setting the synchronization

Perform the following steps before startup:

- Connect the synchronization station to the PC via the SBus interface.
- Install the MOVITOOLS® MotionStudio software (Version 6.4.0 or higher) from SEW-EURODRIVE.
- Perform a "basic initialization" of the stations before every configuration.
- Put the stations into operation in the network successively, according to their characteristics.

Starting up a master

INFORMATION

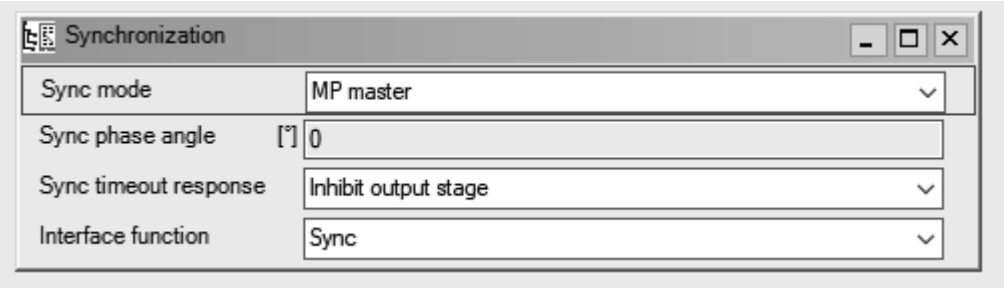
If the control signal source of the master is set to "Terminals", the synchronization stations are enabled after the line voltage is applied. Observe the information in chapter "For your safety" (→ 🗎 19).

INFORMATION

After the configuration as "MP master", the fault message "68.11 synchronization lost, sync signal invalid" may occur in other synchronization stations. Reset this fault with a manual reset in the "Setup" window or with the process data control word.

Proceed as follows if you would like to put the master into operation:

1. Select the "Synchronization" node in the parameter tree.
2. Set the "Interface function" setting to "Sync".
3. Under "Sync mode", select the setting "MP master".



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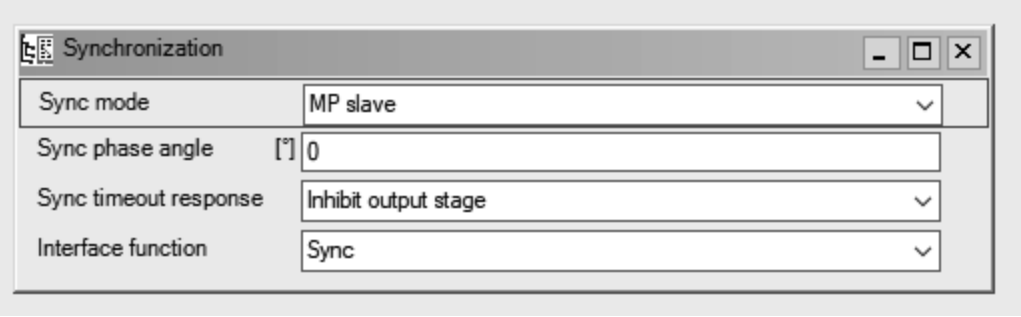
Starting up a slave

INFORMATION

After the configuration as "MP slave", the fault message "68.11 synchronization lost, sync signal invalid" may occur in other synchronization stations. Reset this fault with a manual reset in the "Setup" window or with the process data control word.

Proceed as follows if you would like to put the slave into operation:

1. Select the "Synchronization" node in the parameter tree.
2. Set the "Interface function" setting to "Sync".
3. Under "Sync mode", select the setting "MP slave".



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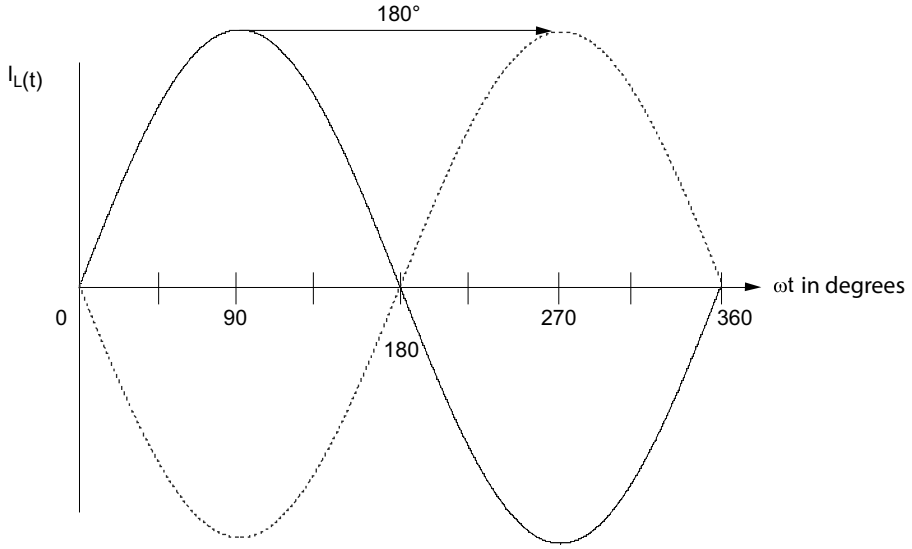
Sync phase angle in °

Setting range: **0** – 360°

To have the currents of two supply units flowing in phase, you can set the phase angle of the line cable current of an MP slave to that of an MP master in synchronization mode. If the phase angle remains at the factory setting 0°, the phase angles are the same. This means nearly the full power is available at the junctions of the respective line cable systems.

The setting 180° reverses the current direction.



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A phase shift of 180° is useful, if:

- The current direction is reversed at junctions due to unfavorable cabling.
- A re-cabling is to be prevented.

Runtime-related faults can be precisely adjusted with phase shifts that slightly vary from 0º or 180º. This, however, is usually not required.

Sync timeout response

If the supply unit receives a faulty synchronization signal, or no signal at all, in the "MP slave" synchronization mode, the fault response set here is executed.

The following settings are possible:

- No response
- Display only
- **Inhibit output stage**

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4.4 Operation

4.4.1 General

The supply units synchronized in multi-point mode can be controlled independently of each other and operated according to their set operating mode. For further information on the permitted operating modes, refer to chapter "Permitted operating modes" (→ 🗎 17).

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5 Single-point synchronization

5.1 Requirements

5.1.1 General information

The project planning of a MOVITRANS® system calls for specified knowledge explained in this documentation.

The following information is based on the general guidelines that apply to project planning. This documentation is drawn up for users that are familiar with and have basic knowledge of drive project planning.

5.1.2 PC and software

The "Single-point synchronization" function is part of the unit firmware. You will need the SEW-EURODRIVE software MOVITOOLS® MotionStudio for configuring the supply units.

5.1.3 Supply unit

The "Single-point synchronization" function can be implemented only with supply units with the power 14 kW and 16 kW. Control is possible either via terminals or bus. The selection of the unit type depends on the project-planned transmission system (frequency, power, line cable current).

5.1.4 Permitted operating modes

In the single-point synchronization mode, only the "Current control" operating mode is permitted.

INFORMATION

For more information on the operating modes, refer to the following documentation: MOVITRANS® TES31A Decentralized Supply Unit

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5.1.5 Permitted unit types

The permitted unit types are listed in the following table:

NOTICE

Exceeding the resulting line cable current

Destruction of the line cables and pick-ups

- Make sure that the resulting line cable current corresponds to the nominal current of the connected line cable and the coupled pick-ups.
- In particular, note when synchronizing three stations that the resulting line cable current must not exceed 85 A.
- Set the setpoint input in the master to 94% to provide a resulting line cable current of 85 A and to limit the load current per station to approx. 28 A. For further information, refer to chapter "Setting a setpoint" (→ 🗎 50).

Unit type	Nominal power	System frequency	Load current I_L	Units connected in parallel n_{TES}	Resulting line cable current	Resulting nominal power*
TES31A160-EF3-5B3-A	16 kW	A: 25 kHz	30 A	2	60 A	32 kW
TES31A160-EF3-5B3-A	16 kW	A: 25 kHz	30 A	3	85 A**	48 kW
TES31A160-EF4-5B3-A	16 kW	A: 25 kHz	42.5 A	2	85 A	32 kW
TES31A140-EF3-5B3-B	14 kW	B: 50 kHz	30 A	2	60 A	28 kW

* No overload capacity

** Maximum setpoint to be set 94%

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5.2 Restrictions of the parameters

Activating the synchronization function has the following effects:

- That certain parameters can no longer be set to the full extent.
- That the unit behavior changes in comparison to the unit behavior described in the relevant MOVITRANS® TES31A Decentralized Supply Unit documentation.

Index			Parameter	Restrictions
Dec	Hex	Sub		
8335	208E	0	Binary input DI01	Setting blocked.
8350	209E	0	Binary output DO01	Setting blocked.
8843	228B	0	Binary output DO00	Setting blocked.
8461	210D	0	Setpoint source	**Master:** All sources except for SBus2 can be set. **Slave:** Setting blocked.
8462	210E	0	Control signal source	**Master:** All sources except for SBus2 can be set. **Slave:** Setting blocked.
10235	27F9	1	"DC link under-voltage" fault re-sponse	Setting blocked.
10244	2804	1	"Sync timeout" fault response	Setting blocked.
9729	2601	4	"Line phase failure" fault response	Setting blocked.
10538	292A	100	Operating mode	Setting blocked.
10232	27F8	27	Ramp time T00	**Master:** Do not set ramps to under 500 ms. **Slave:** Setting is ignored.
10232	27F8	28	Ramp time T01	**Master:** Do not set ramps to under 500 ms. **Slave:** Setting is ignored.
10232	27F8	29	Ramp time T10	**Master:** Do not set ramps to under 500 ms. **Slave:** Setting is ignored.
10232	27F8	30	Ramp time T11	**Master:** Do not set ramps to under 500 ms. **Slave:** Setting is ignored.

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Index			Parameter	Restrictions
Dec	Hex	Sub		
8594	2192	0	Factory settings	In contrast to the conventional unit behavior, when performing factory settings with the setting "Basic initialization" or "Standard" a station configured as "SP slave" is also given its configuration. If the station was previously configured as "SP master", it is configured as an "SP slave" after the factory setting. The desired setting must therefore be adjusted accordingly.
10233	27F9	1	Frequency mode	Setting blocked.
10422	28B6	1	Sync phase angle	Setting range restricted to 0° - 10° (increasing) and 360° - 350° (decreasing).

Function	Restriction
Control word	For all slave stations, the control word is subject to the restriction that only the Bit6 can be used as a fault reset bit. All other commands are ignored in the configuration as a slave. Similarly, the control signal source cannot be set on SBus2 when the interface is used as the synchronization signal.
Technology function	Modify this only after consultation with SEW-EURODRIVE.

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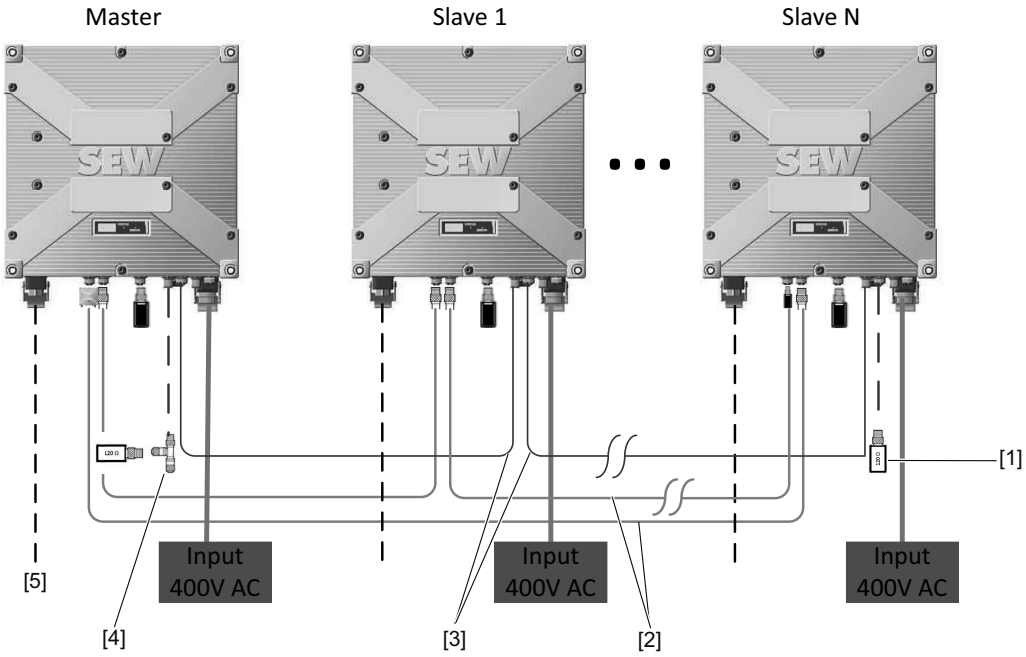
5.3 Connection of a TES31A decentralized supply unit

5.3.1 Overview

Single-point synchronization of two or three TES31A supply units. Necessary wiring components:



30903357067

[1] CAN terminating resistor
[2] I/O wiring
[3] Synchronization signal
[4] CAN T-piece
[5] Load cable

A master can be selected freely here. One or two slaves, according to the unit overview.

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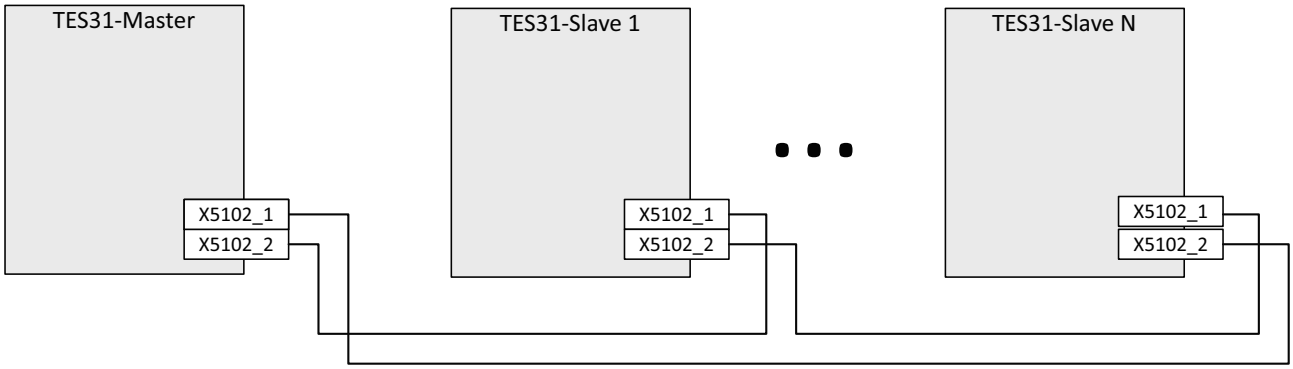
5.3.2 Digital inputs/outputs signal diagram

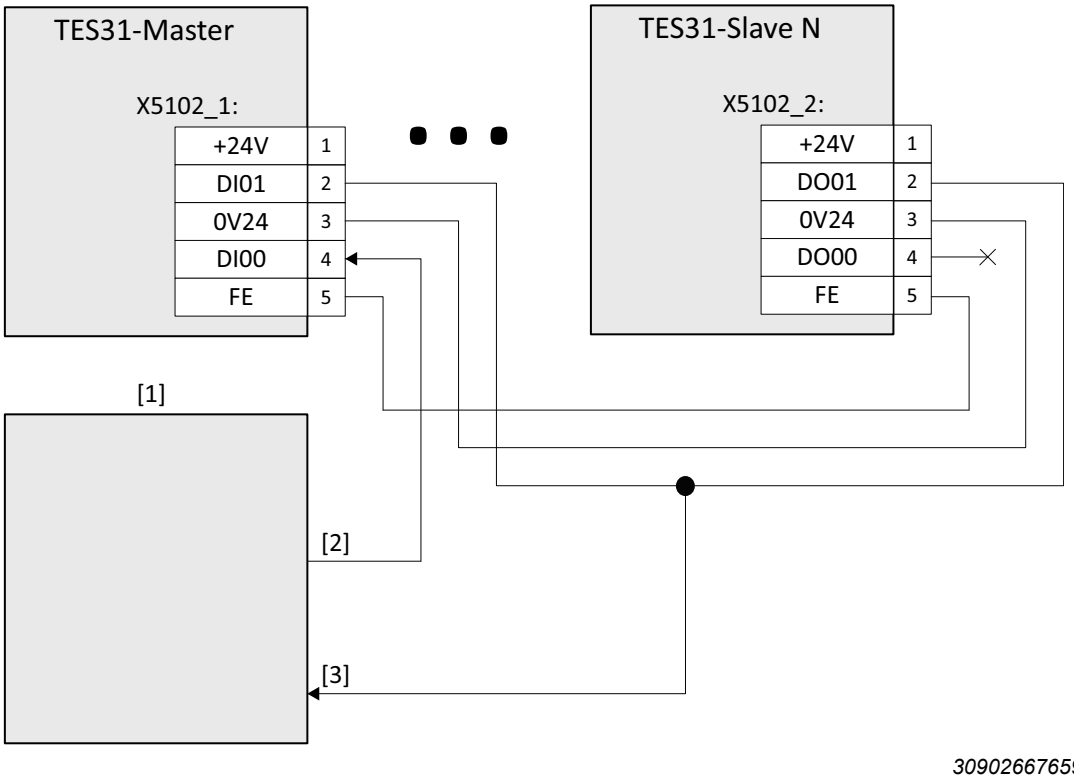
Block diagram

In each case, the digital output is connected 1 to 1 to the digital input of the next synchronization station. The digital output of the final slave is returned to the input of the master (daisy chain).



Signal diagram of digital inputs/outputs with external terminal enable and status request

If the enable is implemented via an external terminal signal, an external terminal signal may be connected at input DI00 of the master instead of output DO00 of the final slave N. Output DO01 of slave N must be returned without fail to input DI01. In addition, the signal of an external controller can be supplied to provide information about the system readiness.



[1] External controller
[2] External terminal signal "Output stage enable"
[3] External terminal signal "Synchronization: Ready signal"

5.4 Line cable connection

INFORMATION

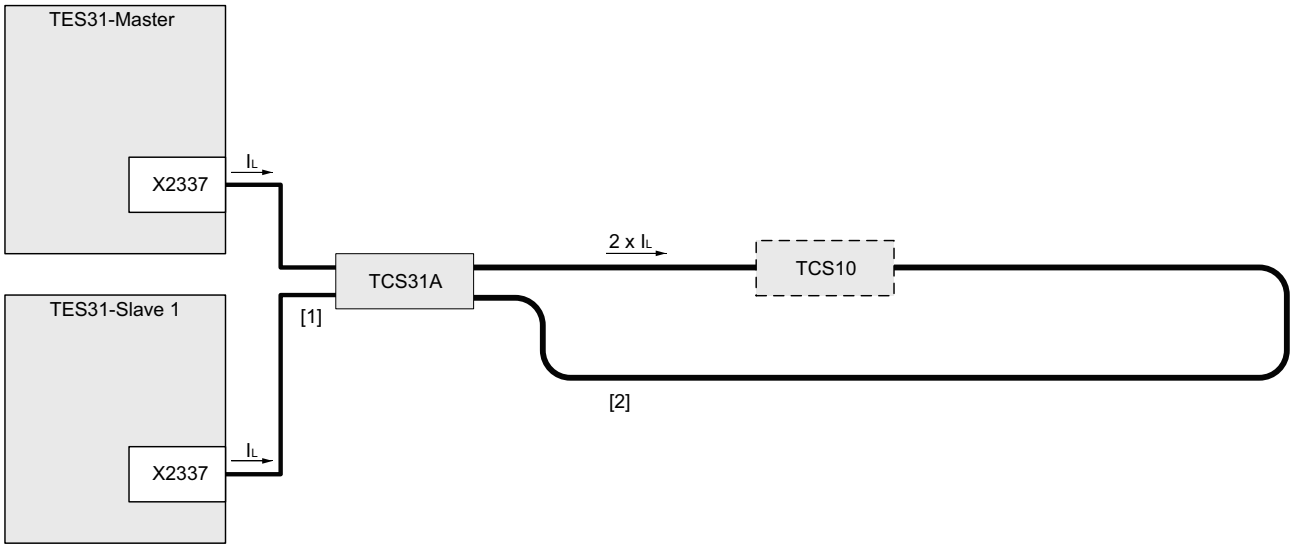
Make sure that all the synchronization stations are galvanically coupled via the connected line cable(s).

INFORMATION

Refer to the following documentation for a detailed depiction of the wiring in the compensation box: MOVITRANS® Compensation Box TCS31A

5.4.1 Connecting line cables to two supply units

When you are synchronizing two TES31A decentralized supply units, both the load cables can be positioned directly in the TCS31A compensation box. The following figure shows the topology in the synchronization of two TES31A decentralized supply units:



30903003147

I_L Load current
[1] Two load cables
[2] Line cable with supply and return cable

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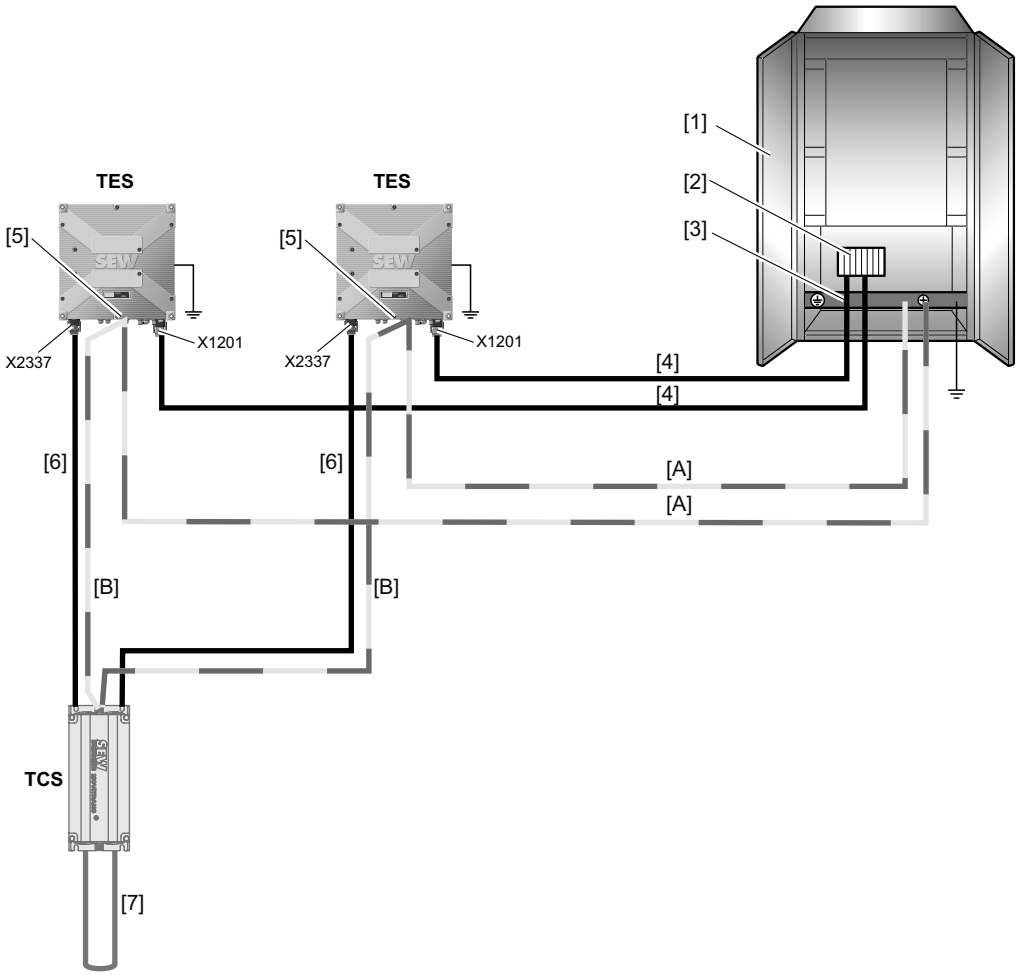
PE connection with parallel connection of two supply units

As an example, the following figure shows the connection of the PE with two supply units connected in parallel.



31554412811

[A] Protective earth (equipotential bonding cable) 10 mm²
[B] Protective earth 6 mm²
[1] Control cabinet
[2] Terminal strip AC 400 V
[3] Equipotential bonding rail
[4] Supply cable
[5] Connection position for ground connection
[6] Load cable
[7] TLS line cable

5.4.2 Connecting line cables to three supply units

At the highest expansion level with three TES31A decentralized supply units, you must set up the coupling via the TVS10A-E06-000-1 connection distributor, because there are not enough connections available on the compensation box. When using the TVS-PACK-1 accessories, the connection distributor is suitable for linking three supply units with a resulting line cable current of 85 A. The three load cables from the three supply units are merged into two load cables in the connection distributor.

The following components are included in the scope of delivery of the TVS10A connection distributor:

Connection distributor	Scope of delivery
TVS10A-E06-000-1	• 1 connection distributor with blanking plugs installed • 3 M5 combi pan head screws with lock washer and plain washer • 16 M6 hex nuts • 16 jumpers

The following components are available as accessories for the TVS10A:

Order number	Accessories	Scope of delivery
28269985	TVS-PACK-1 accessories	• 2 x M32 x 1.5 EMC • 3 x M25 x 1.5 EMV (20 mm) • 3 x PE conductor (6 mm^2, 26 cm, RT: M5/M6) • 1 x M25 x 1.5 metal screw plug

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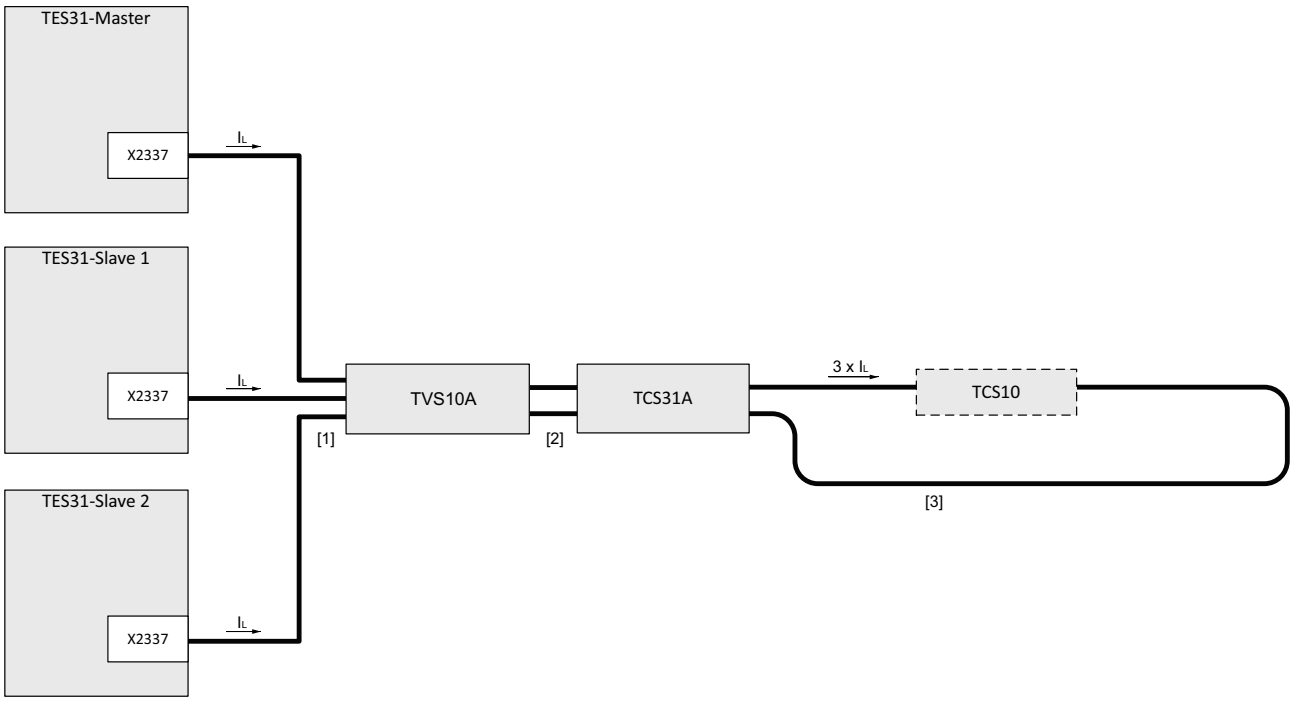
The following figure shows the topology at the highest expansion level with three supply units:

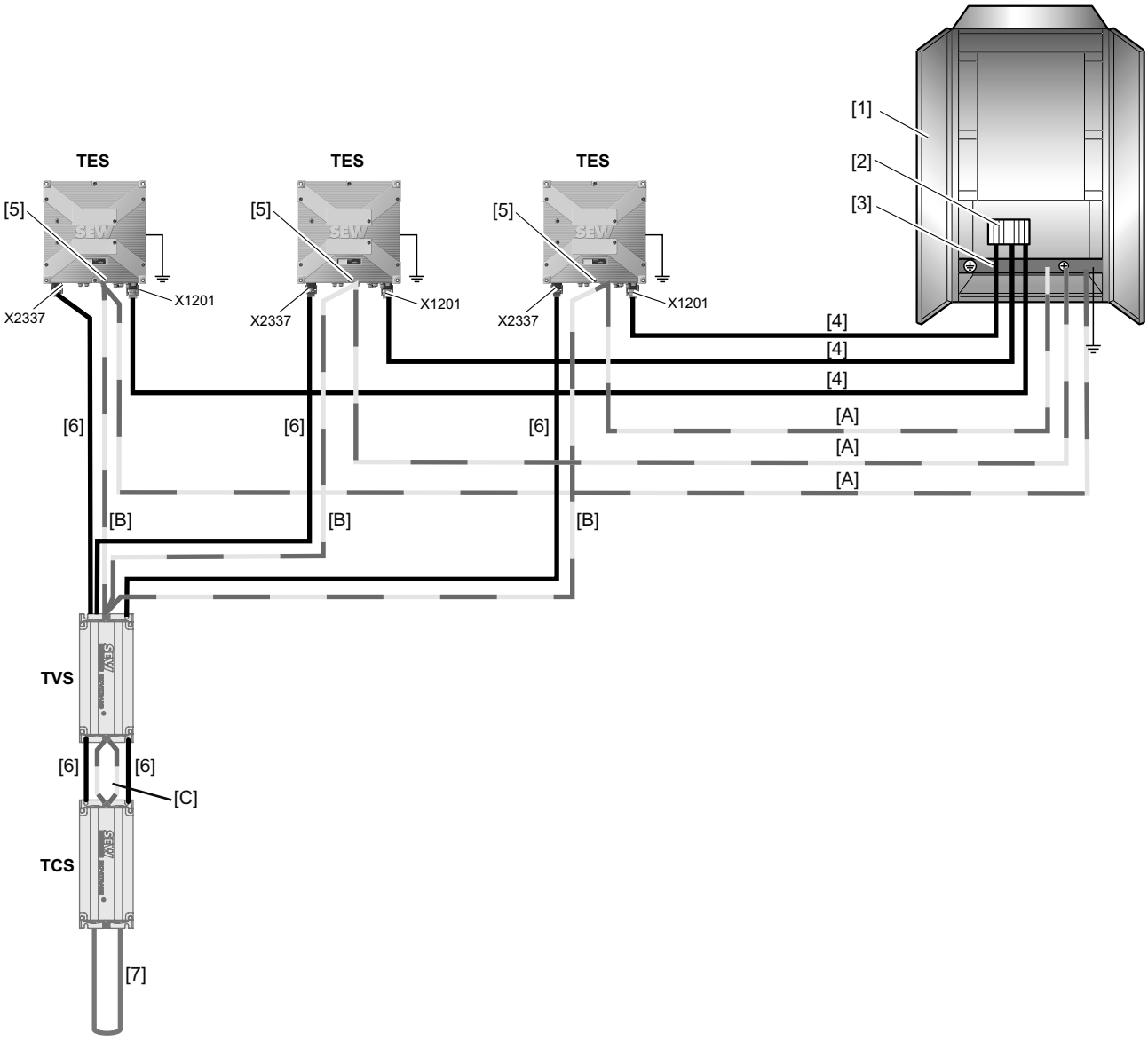


30903006731

I_L Load current
[1] Three load cables
[2] Two load cables
[3] Line cable with supply and return cable

PE connection with parallel connection of three supply units

As an example, the following figure shows the connection of the PE with three supply units connected in parallel.



31279689611

[A] Protective earth (equipotential bonding cable) 10 mm²
[B] Protective earth 6 mm²
[C] Protective earth 16 mm² (or 2 x 6 mm²)
[1] Control cabinet
[2] Terminal strip AC 400 V
[3] Equipotential bonding rail
[4] Supply cable
[5] Connection position for ground connection
[6] Load cable
[7] TLS line cable

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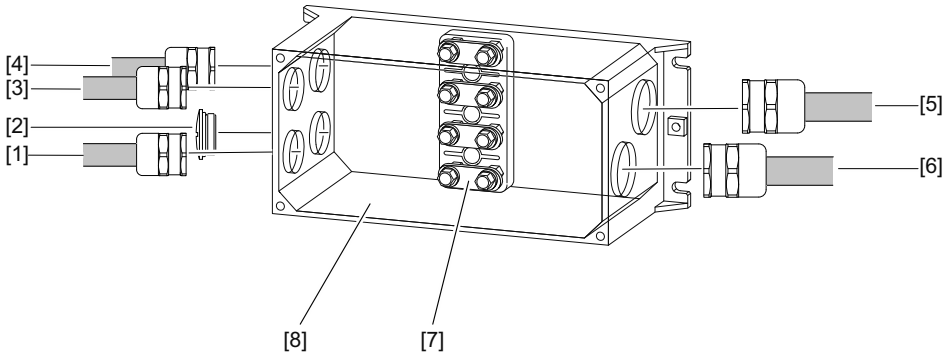
Observe the following when connecting the protective earth:

1. Route the equipotential bonding cable [A] parallel to the supply cable [4].
2. Route the protective earths [B], [C] connected to the TVS and TCS parallel to the load cables [6].

Prepare the connection distributor and connect the line cables

The following figure shows the TVS10A connection distributor:



31344529419

[1]	EMC screw fitting M25	[5]	EMC screw fitting M32
[2]	Screw plug made of metal	[6]	EMC screw fitting M32
[3]	EMC screw fitting M25	[7]	Terminal block in delivery state with four jumper connections in each case
[4]	EMC screw fitting M25	[8]	TVS10A connection distributor

Proceed as follows to connect the line cable:

1. To open the TVS10A connection distributor, loosen the four M5 hex head screws on the housing cover.
2. First screw in the lower cable glands, and then the upper cable glands and the screw plug in the following sequence: [4], [3], [1], [2].
3. Unscrew all the M6 connection screw fittings from the terminal studs.
4. Remove the 16 jumper connections.

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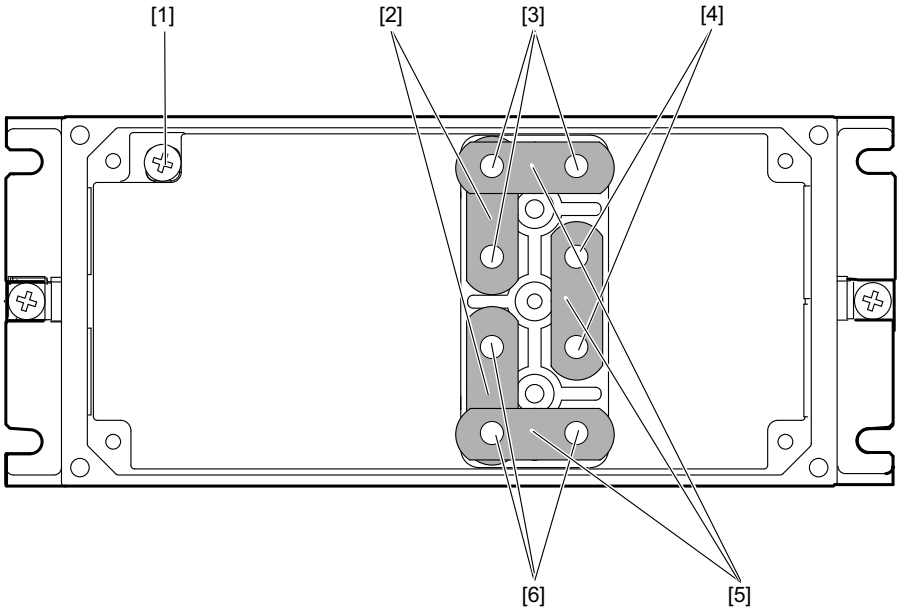
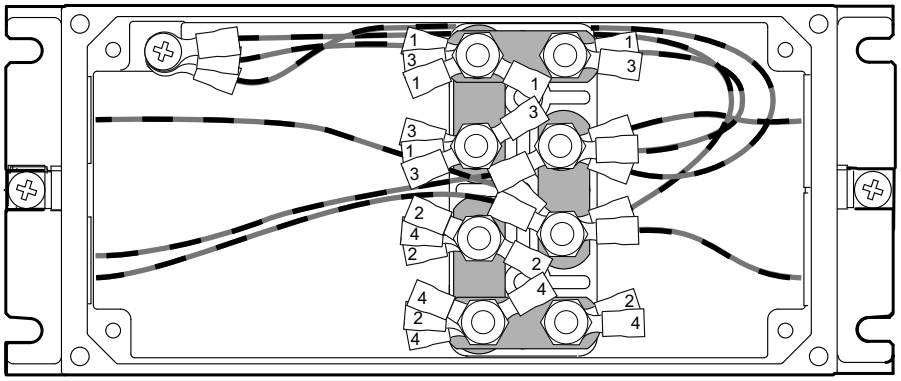
5. Place the jumper connections on the terminal board, as shown in the figure. In the process, note the number of jumper connections.



31281482379

[1]	Internal PE connection	[4]	PE connection points
[2]	Two jumper connections each	[5]	Four jumper connections each
[3]	Connections TLS 1 (cores 1 + 3)	[6]	Connections TLS 2 (cores 2 + 4)

6. Position the three PE conductors included in the accessories pack on the two PE connection points (M6).
7. Route the three PE conductors on the internal PE connection [1] of the housing (M5).
8. Route the load cable prefabricated with cable lugs through the EMC cable glands.
9. Position the cable shields in the EMC cable glands.
10. Position the green/yellow protective earths from the TES load cables on the PE terminal studs.
11. Place each of the cores 1 + 3 prefabricated with cable lugs on the connections TLS 1.
12. Place each of the cores 2 + 4 prefabricated with cable lugs on the connections TLS 2.



31193298187

13. Tighten all of the M6 connection screw fittings inside the housing again (2.5-3.0 Nm).

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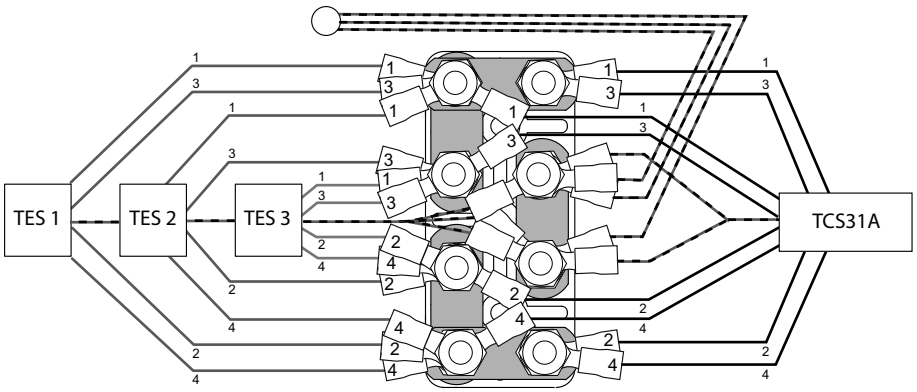
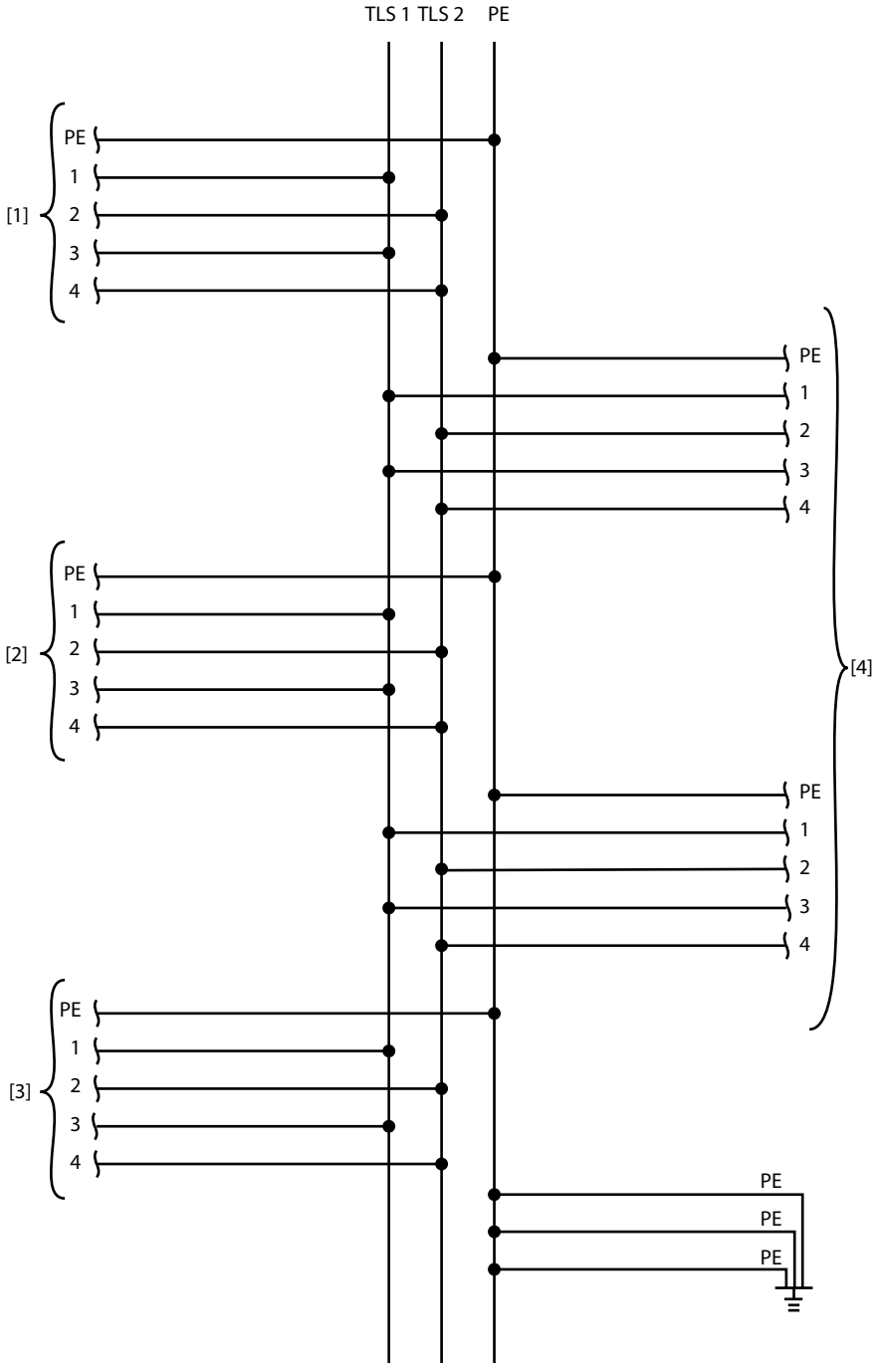
The following figure shows how the individual cores are positioned inside the connection distributor:



31281486347

The following figure shows the connection diagram for the connection distributor:



[1] Load cable TES 1
[2] Load cable TES 2
[3] Load cable TES 3
[4] Load cable to the TCS31A

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5.5 Startup

5.5.1 For your safety

⚠ WARNING

Risk of injury and possible damage to property if the unit network is released independently.

Fatal or severe injuries and damage to property can occur.

- Before startup, make sure that the line cable is not energized and there are no impermissible operating states during configuration.
- In all network units, disconnect the jumper plugs of the unit interface X5161.
- Disconnect the load connection cable X2337.

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5.5.2 Requirements

- You have installed the unit correctly both mechanically and electrically.
- The system and connected drives must be configured correctly.
- Safety measures prevent accidental drive startup.
- Safety measures prevent danger to persons or machines.

5.5.3 General

INFORMATION

You can find detailed project planning information in the MOVITRANS® Project Planning and Planning manuals.

Correct project planning and installation are the prerequisites for successful startup.

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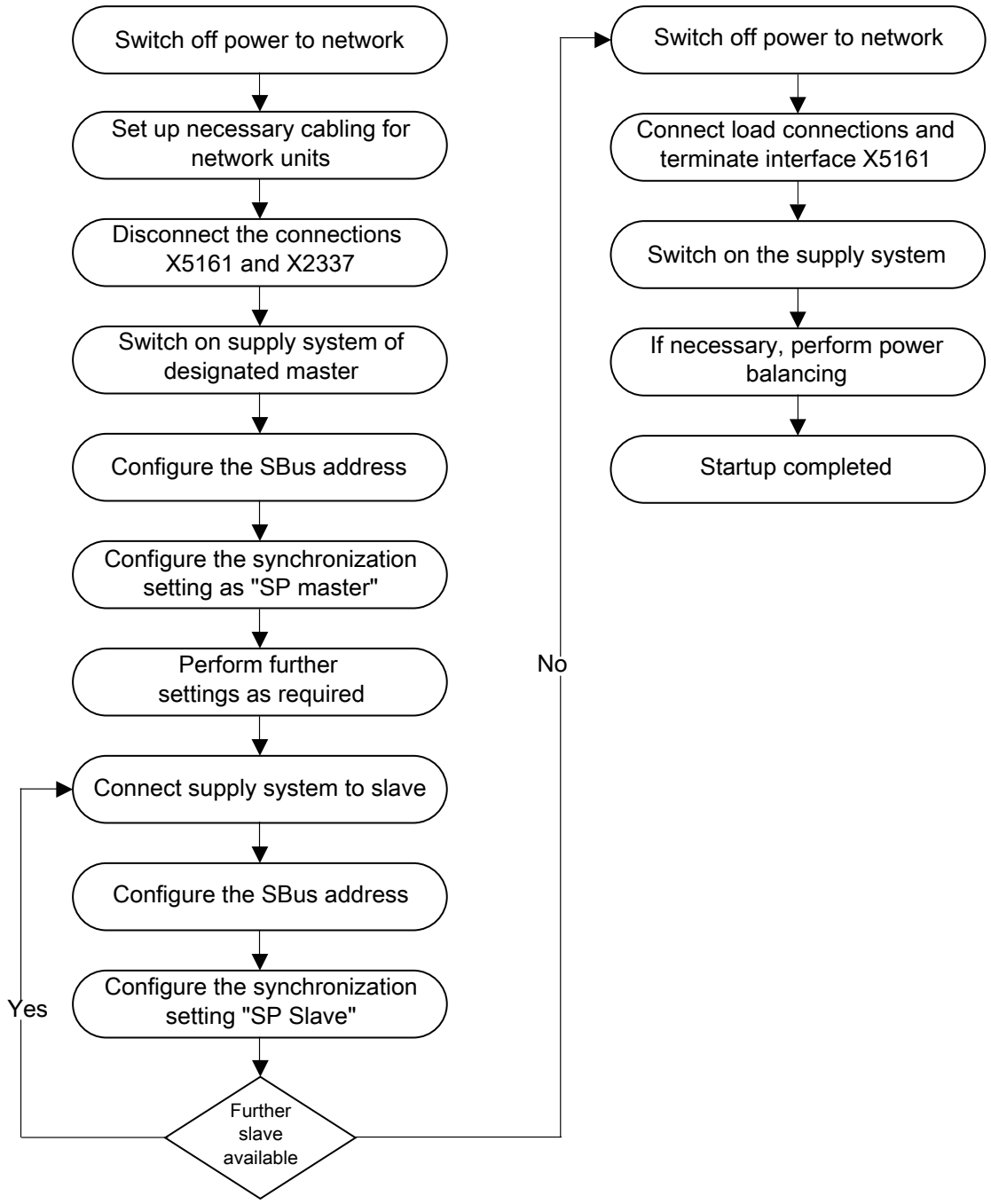
5.5.4 Synchronization procedure

To perform startup, proceed as follows:



30903721483

5.5.5 Setting the synchronization

Perform the following steps before startup:

- Connect the synchronization station to the PC via the SBus interface.
- Install the MOVITOOLS® MotionStudio software (Version 6.4.0 or higher) from SEW-EURODRIVE.
- Perform a "basic initialization" of the stations before every configuration.
- Put the stations into operation in the network successively, according to their characteristics.

Starting up a master

INFORMATION

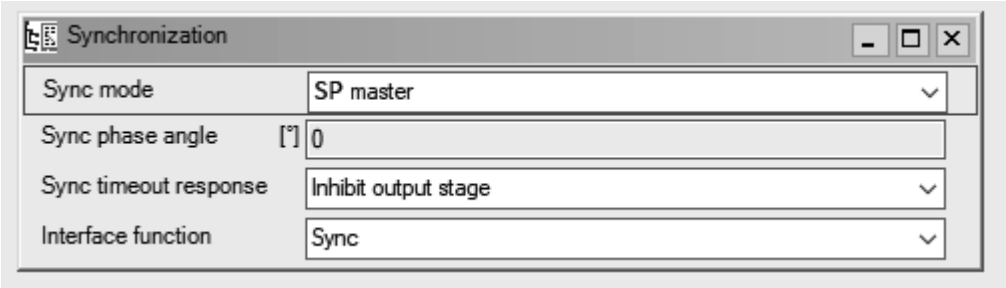
If the control signal source of the master is set to "Terminals", the synchronization stations are enabled after the line voltage is applied. Observe the information in chapter "For your safety" (→ 🗎 41).

INFORMATION

After the configuration as "SP master", the fault message "68.11 synchronization lost, sync signal invalid" may occur in other synchronization stations. Reset this fault with a manual reset in the "Setup" node or with the process data control word.

Proceed as follows if you would like to put the master into operation:

1. Select the "Synchronization" node in the parameter tree.
2. Set the "Interface function" setting to "Sync".
3. Under "Sync mode", select the setting "SP master".



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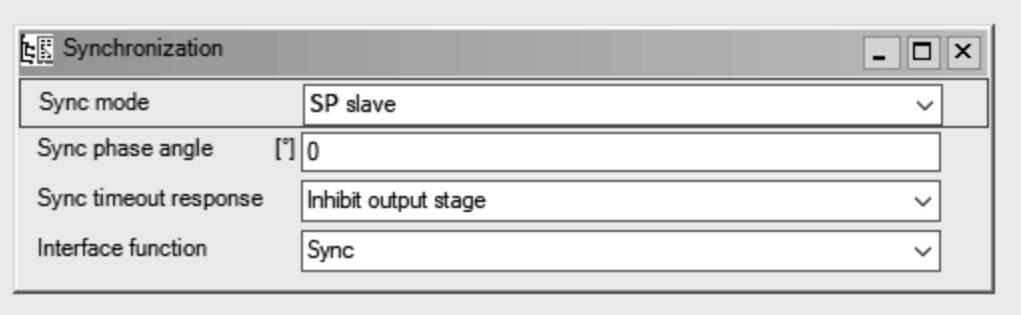
Starting up a slave

INFORMATION

After the configuration as "SP slave", the fault message "68.11 synchronization lost, sync signal invalid" may occur in other synchronization stations. Reset this fault with a manual reset in the "Setup" node or with the process data control word.

Proceed as follows if you would like to start up a slave:

1. Select the "Synchronization" node in the parameter tree.
2. Set the "Interface function" setting to "Sync".
3. Under "Sync mode", select the setting "SP slave".



30901723019

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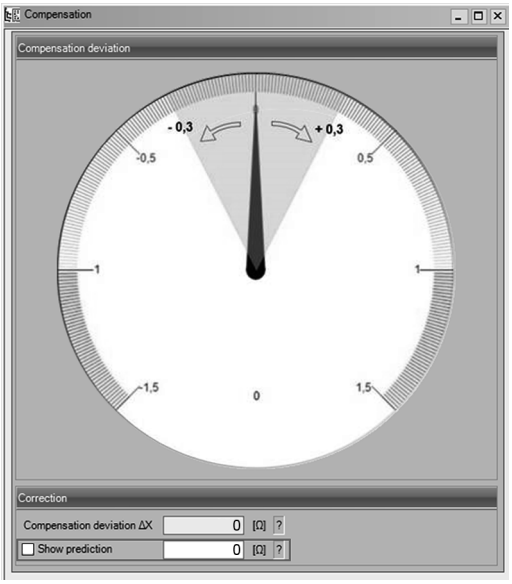
5.5.6 Compensation

INFORMATION

For more information about compensation, refer to the following documentation: MOVITRANS® TES31A Decentralized Supply Unit

It is necessary to compensate extremely precisely in single-point synchronization due to the high transmission power. To ensure that the power transmission is as efficient as possible, a reduced, standardized compensation range from -0.3 to +0.3 is necessary. This is easily possible with the TCS31A fine compensation.

The following figure shows the compensation range to be observed in single-point synchronization:



31169746571

The shown standardized compensation range indicates the correct range, regardless of the synchronization topology. However, it is necessary to interpret the displayed correction value ΔX differently when setting the TCS31A fine compensation, depending on the particular synchronization topology.

You can determine the correction value ΔX_{TCS} for the TCS31A fine compensation by dividing the displayed correction value ΔX by the number of synchronized decentralized supply units n_{TES}.

$$\Delta XTCS = \frac{\Delta X}{nTES}$$

31119537163

ΔX_{TCS}	Correction value for a single TCS compensation box
ΔX	Correction value
n_{TES}	Number of synchronized TES decentralized supply units

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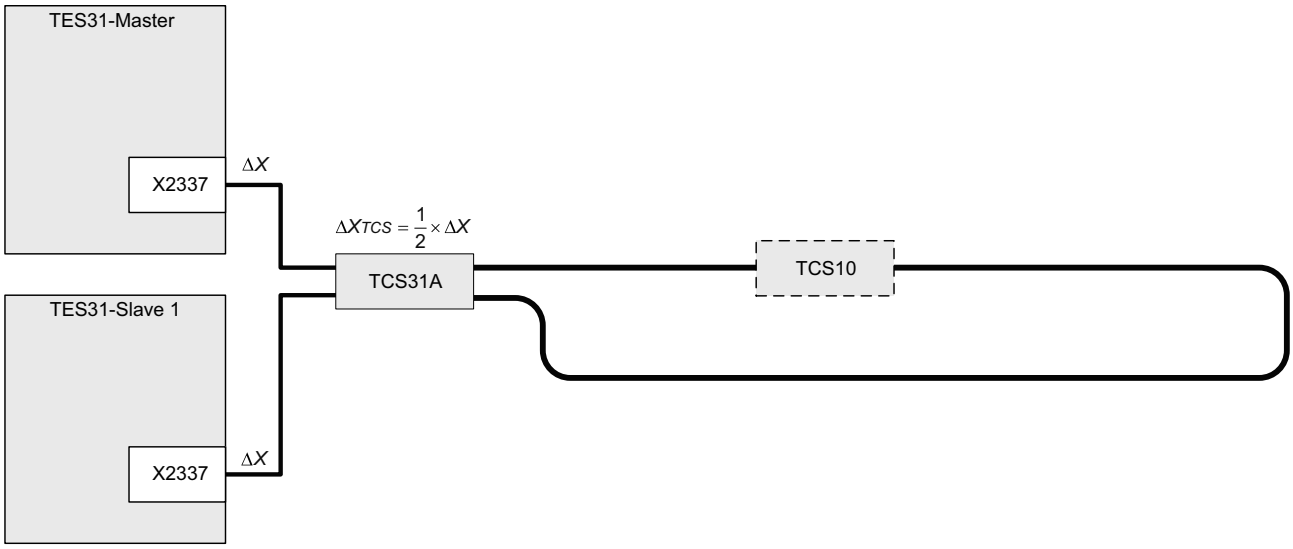
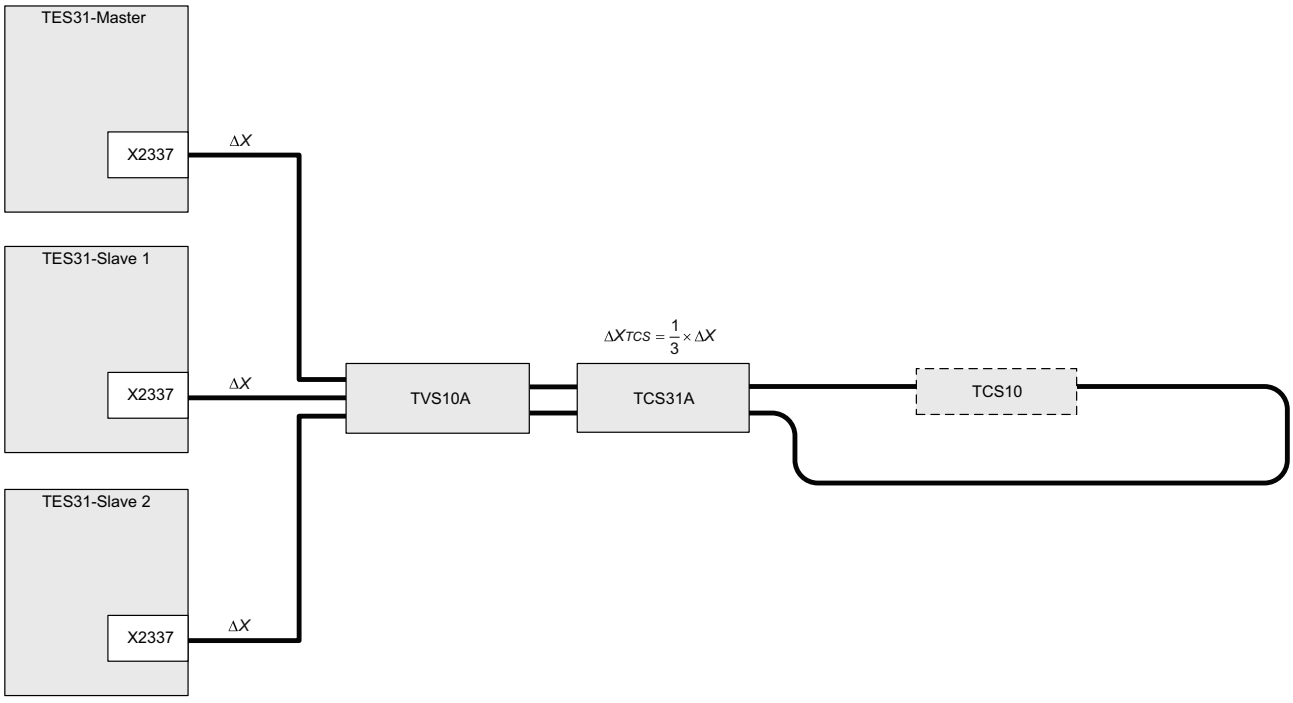
The following figure shows the line cable connection with two synchronized units:



30903363339

ΔX Displayed correction value on the TES31A
ΔX_{TCS} Correction value for a single TCS31A fine compensation box

The following figure shows the line cable connection with three synchronized units:



32446218123

ΔX Displayed correction value on the TES31A
ΔX_{TCS} Correction value for a single TCS31A fine compensation box

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5.5.7 Power balancing

The output power should be distributed as evenly as possible over all the synchronization stations. However, the power at the individual stations may be divided up differently due to system-based scattering. Proceed as follows to correct the active power difference:

1. With the help of MOVITOOLS® MotionStudio, check the "Active power" parameter in the "Process values" window on all the TES31A supply units.
2. If you discover a difference in the active power between the synchronization stations, correct it.
3. Begin with the slave with the largest discrepancy and observe the "Active power" parameter.
4. Select the "Synchronization" node.
5. Change the sync phase angle in steps of 1°. The possible setting ranges are from 0° - 10° (ascending) or from 360° - 350° (descending).
6. Check how the power distribution between all the synchronization stations changes:

- If the discrepancy increases, change the setting range as described in point 3.
- If no change occurs, reset the phase angle of the slave to 0. If available, change the phase angle of the next slave.

7. Continue changing the settings until the asymmetry in the power distribution between all the stations is minimal.

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5.6 Operation

5.6.1 Enabling the network

The master manages the enable control of the network. If the master receives the enable signal, all the synchronization stations switch from the status "Disabled" to the status "Enabled". The prerequisite for this is that every station reports the status "No enabling" and no fault is present.

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5.6.2 Setting a setpoint

Only the master can modify a setpoint. Depending on the selected setpoint source in the "Setpoint selection" window, the setpoint may be specified either with SBus process data or in the "Fixed setpoints" window. As soon as the enable signal has been sent to the master, the setpoint that has been set in the master is transmitted to the slaves. The slaves then display the setpoint under "Active setpoint" in the Process values window.

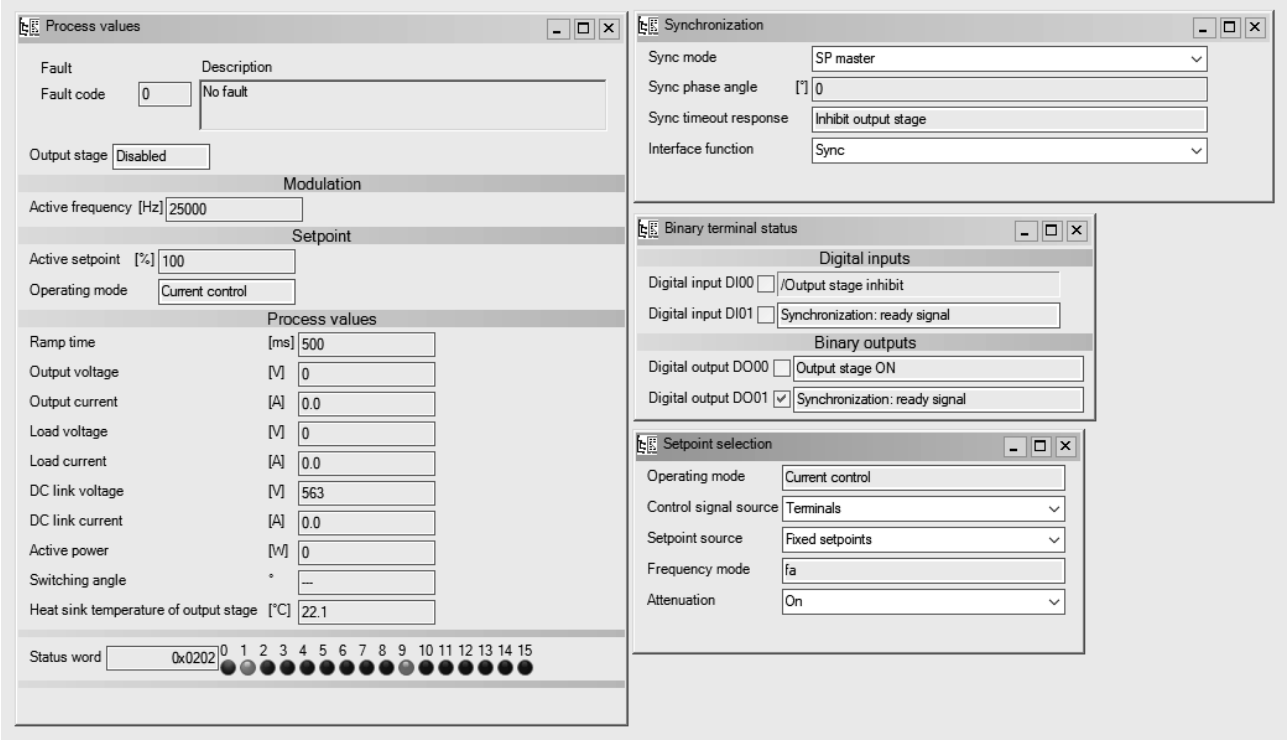
Proceed as follows when synchronizing three stations:

1. ⚠ **CAUTION!** Exceeded nominal current. Destruction of the line cables and pick-ups.
   The maximum set setpoint for three synchronization stations must not exceed 94%.
2. Set the setpoint input in the master to 94% to provide a resulting line cable current of 85 A and to limit the load current per station to approx. 28 A.

5.6.3 Typical process values

The typical process values for a synchronization station are shown below:

SP master configuration



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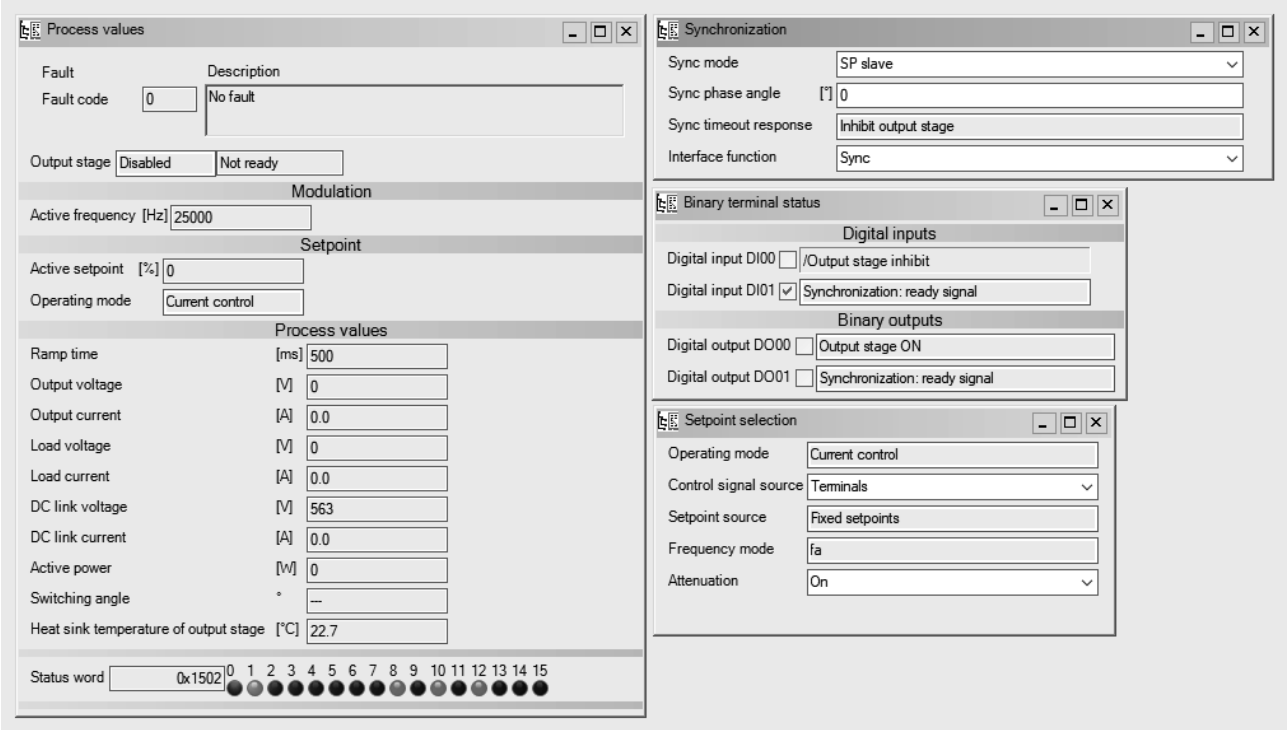
SP slave configuration



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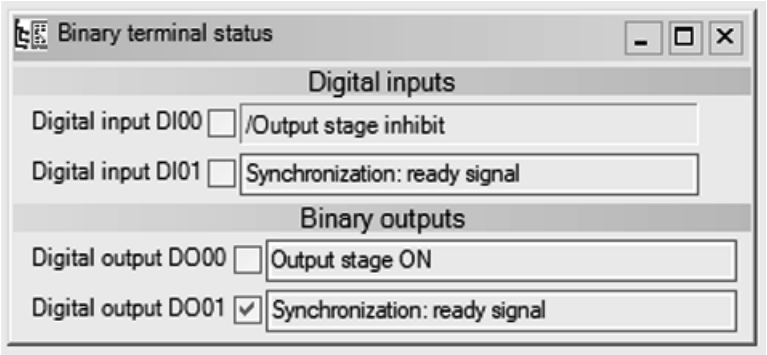
Status of binary terminals

Various process values arise at the binary input/output terminals, depending on the status of the individual synchronization stations in their roles as master or slave. The terminology for the various statuses is used in accordance with the texts in MOVITOOLS® MotionStudio. The following statuses are possible:



30901726987

	Master				Slave			
Status	**DI00**	**DI01**	**DO00**	**DO01**	**DI00**	**DI01**	**DO00**	**DO01**
Not ready (master)	0	0	0	0	0	0	0	0
Not ready (slave)	0	0	0	1	0	1	0	0
None Enabling	0	1	1	1	1	1	1	1
Enabled	1	1	1	1	1	1	1	1

5.6.4 Fault information

Behavior in the event of a fault	If a fault is triggered in a synchronization station which leads to an output stage inhibit, the entire synchronization network will immediately switch to the status "Output stage inhibit". The fault will then be displayed on the affected station until it is reset.
Reset	You can find information about resetting a fault in the MOVITRANS® TES31A Decentralized Supply Unit documentation in chapter "8.3 Fault reset". The master forwards a reset via edge change to all the slaves. Other reset types must be performed on the respective station. When resetting a station, refer to the information in chapter For your safety.

Behavior	Cause
A slave does not receive any readiness message at input DI01, although the upstream station sends this report (output DO01).	Check that the cabling on the units at interfaces X5102_1 and X5102_2 is correct and check for possible cable breakage.
A slave has the status "Not ready" although all the conditions are fulfilled.	The slave has not yet received a valid synchronization signal. Check the synchronization cable for: • Correct installation at interface X5122 • Cable breakage • Terminating resistors

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6 Electrical connections

6.1 Representation of connections

The wiring diagrams show the contact end of the connections.

6.2 Connection cables

Connection cables are not included in the delivery.

Prefabricated cables for connecting SEW-EURODRIVE components can be ordered. For each connection, the available prefabricated cables are listed. Specify the part number and length of the required cable in your order.

The number and design of the required connection cables depend on the device design and the components to be connected. This is why you do not need all listed cables.

6.3 Cable structure

6.3.1 Diagram

The following table shows the cable structure based on an example:

Depiction	Meaning
(	Cable shield
4	Number of core pairs (in twisted cables only)
X	
2	Number of cores
X	G - with green-yellow PE conductor X - without PE
0.25	Core cross section in mm^2
)	Cable shield
+	A plus sign is added to cores with other features.
…	

6.3.2 Examples

The following examples illustrate the cable structure:

- **3G1.5:**

  Cable with 3 cores of 1.5 mm^2 each, one of them is a green-yellow PE conductor.
- **((2X2X0.25)+4G2.5):**

  Shielded hybrid cable with
  - 4 twisted-pair cables of 0.25 mm^2 each, shielded, and
  - 4 power cores of 2.5 mm^2 each, one of them is a green-yellow PE conductor.

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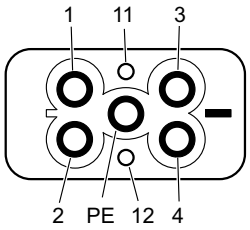
6.4 X2337: Load connection TLS

Function
Load connection of the line cables 1 and 2

Connection type
Han® Q 4/2, female

Connection diagram

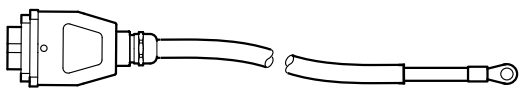


No.	Name	Function
1	TLS1	Line cable 1
2	TLS2	Line cable 2
3	TLS1	Line cable 1
4	TLS2	Line cable 2
11	DI00	Data reception direction 00
12	/OSI	/Output stage inhibit
PE	PE	PE connection

INFORMATION

Pins 11 and 12 must be jumpered to enable the output stage. The SEW-EURODRIVE cable that is configurable in length comes equipped with this jumper. In device variants with 2 load connections, you have to jumper pins 11 and 12 at both sockets.

6.4.1 Connection cable/cable lug M8

Cable	Length/installation type	Component
Part number: 18182313 Cable design: (5G6)  Han® Q 4/2, male ↔ cable lug M8	Variable length 	TES TCS31A

Cables are labeled according to the pin number of the connector.

Use in the synchronization of two units (direct connection to TCS31A).

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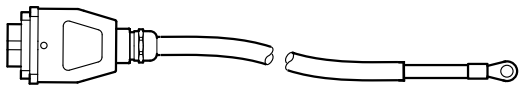
6.4.2 Connection cable / cable lug 5 x M6

Cables	Length/installation type	Component
Part number: 28135377 Cable design: (5G6)  Han® Q 4/2, male ↔ cable lug 5 x M6	Variable length 	TES TVS10A

This connection cable (cable lug 5 × M6) is required for synchronizing 3 decentralized supply units in combination with a TVS10A connection distributor.

6.4.3 Connection cable / cable lug 5 x M6 / cable lug 5 x M8

Cables	Length/installation type	Component
Part number: 28135385 Cable design: (5G6)  Cable lug 5 x M6 ↔ cable lug 5 x M8	Variable length 	TVS10A TCS31A

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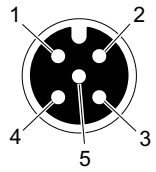
6.5 X5102_1: Digital inputs – power section

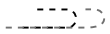
Function
Digital inputs/outputs of power section

Connection type
M12, 5-pin, female, A-coded

Wiring diagram


No.	Name	Function
1	+24V	DC 24 V output
2	DI01	Data reception direction 01
3	0V24	0V24 reference potential
4	DI00	Data reception direction 00:with fixed assignment "\output stage inhibit"
5	FE	Equipotential bonding / functional earth

6.5.1 Connection cable

Cable	Length/installation type	Component
Length 60 cm: Part number: 19078021 **Length 1 m:** Part number: 25640704 **Length 10 m:** Part number: 25640712 Cable design: (5X0.34)  M12, 5-pin, male, A-coded ↔ M12, 5-pin, male, A-coded	Fixed length 	–

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Cable	Length/installation type	Component
1.5 m: Part number: 19166214 **3 m:** Part number: 19166206 Cable design: 5X0.34  M12 male ↔ M12 female	Fixed length 	

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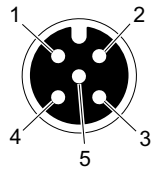
6.6 X5102_2: Digital outputs – power section

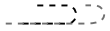
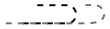
Function
Digital inputs/outputs of power section

Connection type
M12, 5-pin, female, A-coded

Wiring diagram


No.	Name	Function
1	+24V	DC 24 V output
2	DO01	Digital output nm 01
3	0V24	0V24 reference potential
4	DO00	Digital output nm 00
5	FE	Equipotential bonding / functional earth

6.6.1 Connection cable

Cable	Length/installation type	Component
Length 60 cm: Part number: 19078021 **Length 1 m:** Part number: 25640704 **Length 10 m:** Part number: 25640712 Cable design: (5X0.34)  M12, 5-pin, male, A-coded ↔ M12, 5-pin, male, A-coded	Fixed length 	–
1.5 m: Part number: 19166214 **3 m:** Part number: 19166206 Cable design: 5X0.34  M12 male ↔ M12 female	Fixed length 	

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6.7 X5121: MOVITRANS® synchronization signal

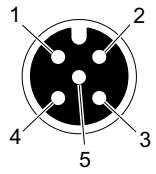
INFORMATION

If there is no station connected here, you must terminate the bus with a 120 Ω resistor.

Function
Synchronization signal MOVITRANS® – output

Connection type
M12, 5-pin, female, A-coded

Connection diagram



No.	Name	Function
1	FE/CAN_SHLD	Equipotential bonding / functional earth/Shield/equipotential bonding
2	+24V	DC 24 V output
3	GND	Reference potential
4	SYNC_H/ CAN_H	Synchronization signal (high)/CAN data line (high)
5	SYNC_L/ CAN_L	Synchronization signal (low)/CAN data line (low)

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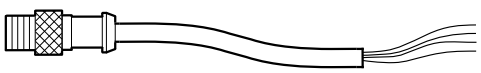
6.7.1 Connection cables

Cables	Length/installation type	Component
Standard lengths: 1 m: Part number: 13237748 2 m: Part number: 13237756 3 m: Part number: 13286315 4 m: Part number: 13286323 5 m: Part number: 13286331 10 m: Part number: 13286358 15 m: Part number: 13286366 **Custom lengths:** 1.5 m: Part number: 13286293 2.5 m: Part number: 13286307 Cable design: ((1X2X0.2)+(1X2X0.32)+1X0.32)  M12, male, A-coded ↔ M12, female, A-coded	Fixed length	–
Standard lengths: 2 m: Part number: 13281364 5 m: Part number: 13281402 **Custom lengths:** 1 m: Part number: 13281348 1.5 m: Part number: 13281356 2.5 m: Part number: 13281372 3 m: Part number: 13281380 4 m: Part number: 13281399 10 m: Part number: 13281410 15 m: Part number: 13281429 Cable design: ((1X2X0.2)+(1X2X0.32)+1X0.32)  M12, male, A-coded ↔ Open	Fixed length	–

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Conductor assignment

Part number	Signal name	Color coding
13281348	CAN_SHLD	–
13281356	+24V	Red
13281364	GND	Black
13281372	CAN_H	White
13281380	CAN_L	Blue
13281399		
13281402		
13281410		
13281429		

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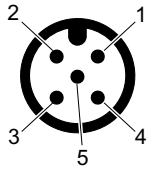
6.8 X5122: MOVITRANS® synchronization signal

INFORMATION

If there is no station connected here, you must terminate the bus with a 120 Ω resistor.

Function
Synchronization signal MOVITRANS® – input

Connection type
M12, 5-pin, male, A-coded

Connection diagram


No.	Name	Function
1	FE/CAN_SHLD	Equipotential bonding / functional earth/Shield/equipotential bonding
2	res.	Reserved
3	GND	Reference potential
4	SYNC_H/ CAN_H	Synchronization signal (high)/CAN data line (high)
5	SYNC_L/ CAN_L	Synchronization signal (low)/CAN data line (low)

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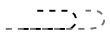
6.8.1 Connection cables

Cables	Length/installation type	Component
Standard lengths: 1 m: Part number: 13237748 2 m: Part number: 13237756 3 m: Part number: 13286315 4 m: Part number: 13286323 5 m: Part number: 13286331 10 m: Part number: 13286358 15 m: Part number: 13286366 **Custom lengths:** 1.5 m: Part number: 13286293 2.5 m: Part number: 13286307 Cable design: ((1X2X0.2)+(1X2X0.32)+1X0.32)  M12, female, A-coded ↔ M12, male, A-coded	Fixed length 	–
Standard lengths: 2 m: Part number 19111630 5 m: Part number 13295810 **Custom lengths:** 1 m: Part number 19111614 1.5 m: Part number 19111622 2.5 m: Part number 19111649 3 m: Part number 13301322 4 m: Part number 19111657 10 m: Part number 19129270 15 m: Part number 19129289 Cable design: ((1X2X0.2)+(1X2X0.32)+1X0.32)  M12, female, A-coded ↔ Open	Fixed length 	–

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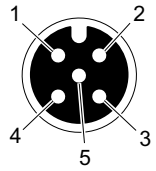
Conductor assignment

Part number	Signal name	Core color
19111630	CAN_SHLD	Gray
13295810	+24V	Red
19111614	GND	Black
19111622	CAN_H	White
19111649	CAN_L	Blue
19111657		

6.9 X5161: Device interface for dual-channel disconnection – input

Function
Input for dual-channel disconnection of the power section (output stage inhibit)

Connection type
M12, 5-pin, female, A-coded

Wiring diagram


No.	Name	Function
1	+24V	DC 24 V output
2	/OSI-	0V24 reference potential for "/output stage inhibit" dual-channel
3	0V24	0V24 reference potential
4	/OSI+	DC 24 V input for "/output stage inhibit" dual-channel
5	res.	Reserved

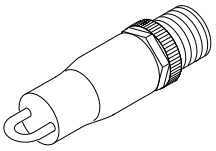
6.9.1 Connection component

Jumper plug

Part number: 11747099

Structure: bridged 1+4/2+3

Connection: M12



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7 Service

7.1 Status and fault messages

The status LEDs show status and error messages and so allow you to record the current state of the device.

For further information, refer to the chapter Status and fault messages. If you are unclear about any of the information in this documentation or if you require further information, contact SEW-EURODRIVE.

7.2 Exchanging supply units in a network

If it is necessary to exchange an individual supply unit in a network, e.g. due to a fault, proceed as follows:

1. ⚠ **DANGER!** Live product parts and power connections. Severe or fatal injuries. Do not touch any live product parts and power connections. Adhere to the minimum switch-off time of 10 minutes. Observe the information signs on the product.
2. Disconnect the synchronization network from the power supply.
3. Remove the plug at unit interface X5161 on all the supply units in the network.
4. Remove the faulty supply unit.
5. Install the replacement unit.
6. Connect the supply unit to the voltage supply again.
7. Start up the supply unit as described in chapter "Startup" (→ 🗎 41).

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7.3 Waste disposal

Dispose of the product and all parts separately in accordance with their material structure and the national regulations. Put the product through a recycling process or contact a specialist waste disposal company. If possible, divide the product into the following categories:

- Iron, steel or cast iron
- Stainless steel
- Magnets
- Aluminum
- Copper
- Electronic parts
- Plastics

The following materials are hazardous to health and the environment. These materials must be collected and disposed of separately.

- Oil and grease

  Collect used oil and grease separately according to type. Ensure that the used oil is not mixed with solvent. Dispose of used oil and grease correctly.
- Screens
- Capacitors

Waste disposal according to WEEE Directive 2012/19/EU

This product and its accessories may fall within the scope of the country-specific application of the WEEE Directive. Dispose of the product and its accessories according to the national regulations of your country.

For further information, contact the responsible SEW-EURODRIVE branch or an authorized partner of SEW-EURODRIVE.

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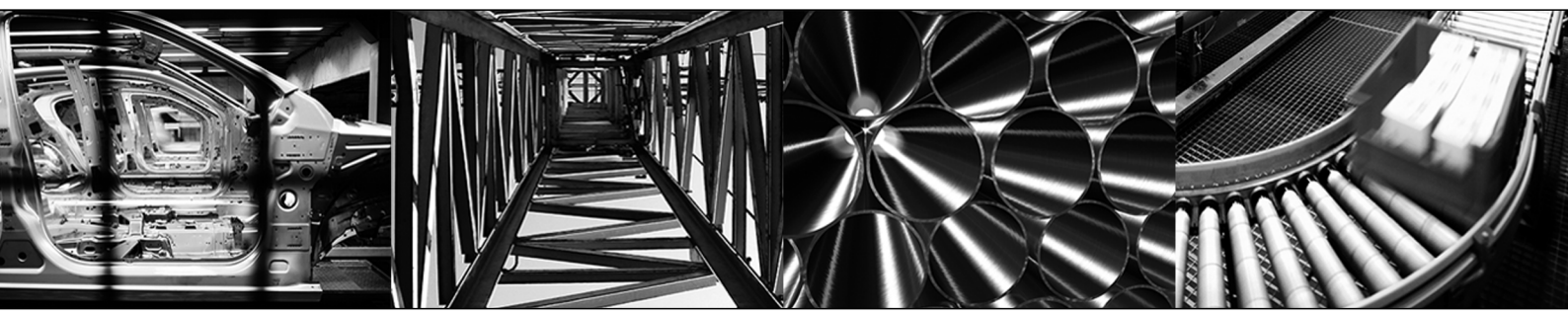

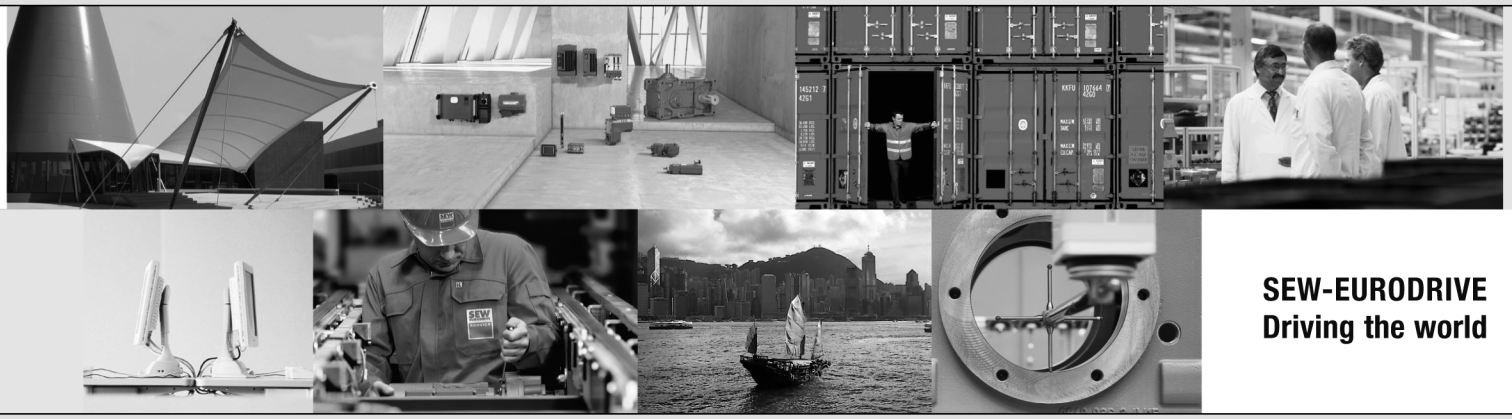

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