

Synco™

## KNX bus

Product range Synco 700, 900, RXB/RXL



- The KNX bus (Konnex) allows Synco devices to communicate among each other and with third-party products (interworking).
- The basic version of the KNX bus comprises a cable with one stranded wire pair.
- Area/line couplers and IP routers are used in KNX networks.

### Use

Synco devices for KNX

The Synco devices listed below have a KNX bus connection.

- Universal controllers RMU710, RMU710B / RMU720, RMU720B / RMU730, RMU730B
- Heating controllers RMH760, RMH760B
- Boiler sequence controller RMK770
- Central control unit RMB795
- Control & monitoring device RMS705
- Bus operator unit RMZ792
- Room unit QAW740
- Room controllers RXB21.1, RXB22.1 / RXL21.1, RXL22.1 / RXB24.1, RXL24.1
- Central communication units OZW771.04, OZW771.10, OZW771.64 / OZW775
- Service interface OCI700
- Central apartment unit QAX910 (Synco living)

Note: The KNX logo is clearly visible on devices certified by the KNX Association.

## Functions

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### Transmission medium

The KNX bus sends data using TP (twisted pair, stranded wire pair) as transmission medium. The following data is sent via the bus:

- Configuration data and operator entries.
- Fault and acknowledgement messages.
- Process values and history data.

### Communication

#### LTE mode

Synco devices intercommunicate via zone addresses (= logical tags) in LTE mode (LTE = logical tag extended).

#### S-mode

Synco and third-party KNX devices intercommunicate via group addresses in S-mode (S = System mode).

## Mechanical design

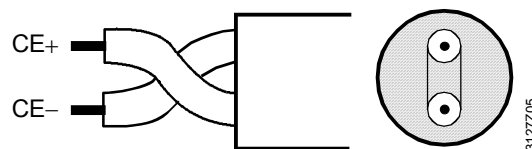
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### KNX bus cable

The basic version of the KNX bus comprises a cable with one stranded wire pair and a jacket.

#### Bus lines

The bus lines (= stranded wire pair) are connected via CE+ (red) and CE- (black).



#### Bus cable selection

Choose the bus cable as per country-specific offerings. You must observe the values indicated in this data sheet under "Technical data".

Recommended bus cables and associated specifications:

(n = 1 or 2)

- **YCYM nx2x0.8** Fixed installation  
Dry, humid, wet rooms. Surface-mounted, flush mounted, in pipes. Installation outdoors (do not expose to sunlight).
- **J-Y(St)Y nx2x0.8** Fixed installation  
Indoors only. Surface mounted, in pipes.
- **J-H(St)H nx2x0.8** Halogen-free conductor, laid separately.
- **A-2Y(L)2Y nx2x0.8** Outdoor cabling.
- **A-2YF(L)2Y nx2x0.8** Outdoor cabling.  
Body cavity filling: Petroleum jelly.

#### Bus cable screens

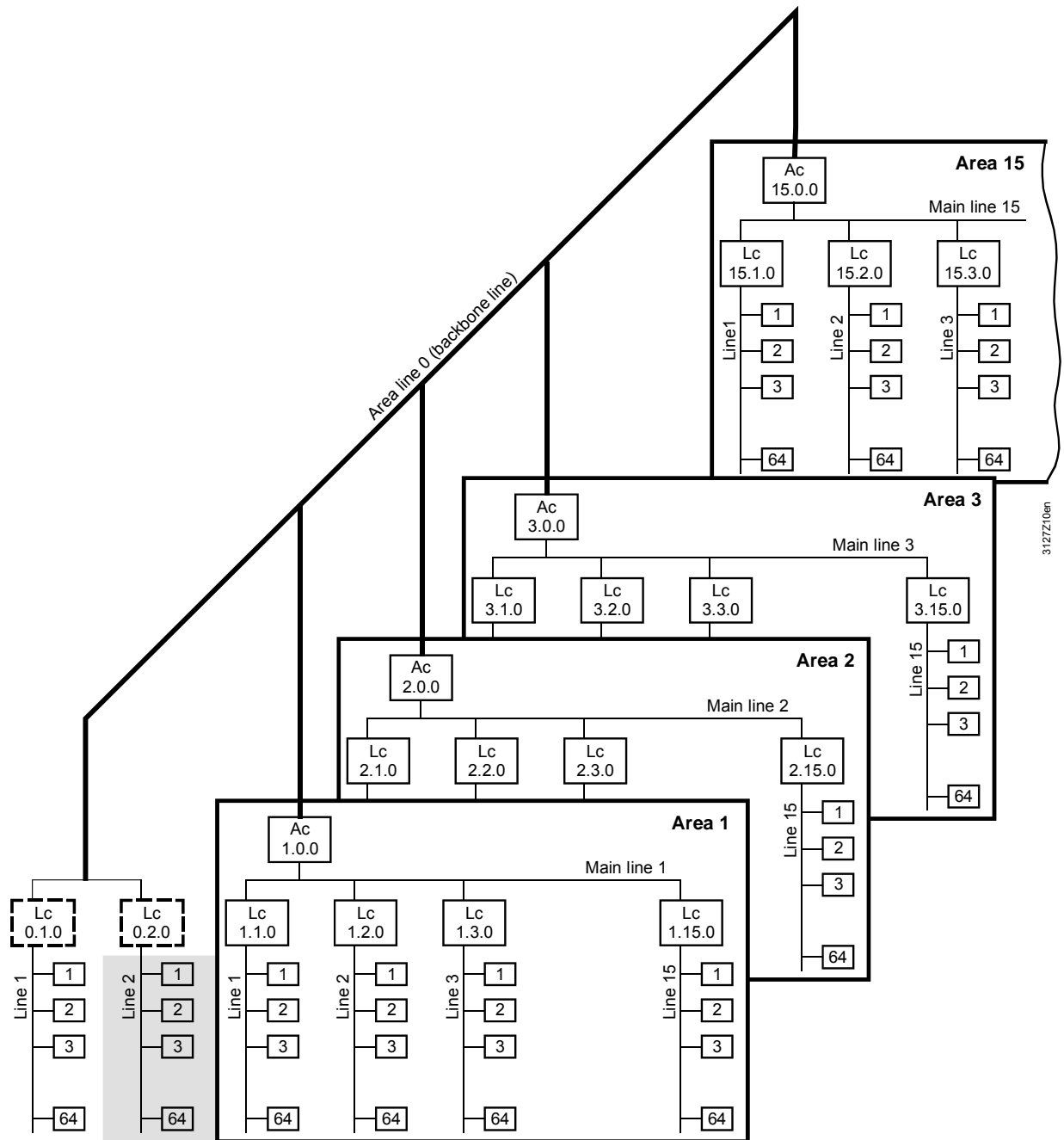
You can use bus cables without screen in plants with Synco devices. The screens available for bus cables do not need to be connected.

If interference is expected on the KNX bus, use a cable with screen. Connect the screen as per standard installation rules.

**KNX network**

A complete KNX network comprises three tiers. Area line 0 represents the network backbone.

15 main lines each branch off of the area line via area couplers Ac (area 1...15), and 15 lines (lines 1...15) each branch off of each main line via line couplers Lc.



**Notes**

Synco devices and third-party devices with KNX bus connection are also referred to as bus devices. Bus devices have a network address.

In the above illustration, the device arrangement arranged on the three-tier KNX network, with factory-set area/line address 0.2 on the Synco devices, corresponds to the grayed area.

Without area and line coupler, the network structure (due to the given area/line address 0.2) is limited to area 0, line 2, thus to one line.

<b>Addressing Network address</b>	<p>The network address is composed of the area, line, and device address (A.L.D) even if no area and line couplers are used.</p> <p>The network address reflects the bus device's unique position in a KNX network and is unique within the related network.</p> <p>Area and line coupler addressing must already be laid out during planning in accordance with the network structure. See document P3127 for more information on addressing.</p>
<b>64 bus devices on one line</b>	<p>Up to 64 bus devices can be installed on one line (also area line 0 and main lines 1...15). No restrictions apply to mixing Synco and third-party devices.</p>
Note	<p>Synco 700 extension modules RMZ78x and operator units RMZ790, RMZ791 as well as room units at room controllers RXB/RXL (connected via PPS2) have no KNX interface and thus need not be counted as bus devices.</p>
<b>Bus loading number E</b>	<p>Each bus device has a specific bus loading number E, considered the measure for average data traffic on the bus caused by the device.</p> <p><b>On a line with 64 Synco devices, the E-number need not be calculated (the total of 300 E-numbers is not reached).</b></p> <p>The bus loading numbers E are listed in the bus devices data sheets.</p>
<b>Bus power supply</b>	<p>A bus power supply is required for bus communications. We differentiate between "decentral (distributed) bus power supply unit DPSU" and "central bus power supply unit PSU" (PSU = power supply unit).</p>
Decentral bus power supply DPSU	<p>Synco 700 control devices supply power to the bus. In this case, a network line may contain max. eight supplying control devices.</p>
Central bus supply PSU	<p>A power supply unit supplies power to the bus. In this case, a network line may contain max. two power supply units.</p> <p>See document P3127 for more information on bus supplies DPSU and PSU.</p>
<b>Power supply unit PSU</b>	<p>Power supply units are used to establish a "central bus power supply". Commercially available power supply units feature power outputs of <b>160, 320 and 640 mA</b>.</p> <p>DC 29 V voltage for the bus supply requires a voltage source <u>with choke</u>. The DC 24 V auxiliary voltage for the Siemens IP router requires a voltage source <u>without choke</u>.</p>
Notes	<p>Calculate the power consumption of the bus devices (from KNX bus) to determine the PSU for the bus power supply.</p> <p>Depending on the bus topology and the number of bus devices (per line), several power supply units featuring different power outputs may be necessary in a KNX network.</p> <p>See document P3127 for more information on power consumption of the bus devices from the KNX bus.</p>

Siemens  
power supply units

Power supply units for KNX networks without IP router.

Ordering: 5WG1 125-1AB01, short description N125/01, power output **160 mA**.  
5WG1 125-1AB11, short description N125/11, power output **320 mA**.

Data: Operating voltage AC 120...230 V, 50...60 Hz.  
Bus supply output DC 29 V (21...30 V, with choke).

Notes: Both types feature an integrated choke. Both types may concurrently supply a line. Adhere to the min. distance of 200 meters between two power supply units.

Power supply unit for KNX networks with IP router.

Ordering: 5WG1 125-1AB11, short description N125/21, power output **640 mA**.

Data: Operating voltage AC 120...230 V, 50...60 Hz.  
Bus supply output DC 29 V (21...30 V, with choke).  
Auxiliary voltage output for IP router DC 24 V (12...30 V, without choke).

Note: Do not use this type for parallel line supply.

### Area and line couplers

Complex, large networks require area and line couplers based on the following two main reasons:

- KNX network comprises more than 64 bus devices.
- Permissible network size exceeded without couplers.

A network with area and line couplers allows for establishing "communication islands" aimed at keeping as low as possible any cross-area or cross-line data traffic.

Siemens  
area/line coupler

Ordering: 5WG1 140-1AB13, short description N140/13.  
Bus connection to main line and line via terminals.

### IP router

IP<sup>1)</sup> routers are required when you need to connect a KNX network to an IP network. The IP router in terms of device features is not identical to area/line couplers. Rather than coupling within KNX, a coupling "KNX - IP network" is created. Here, an IP router connects a KNX area or KNX line to an IP network.

<sup>1)</sup> IP = Internet protocol: Network protocol for data traffic, routing and internetworking for global addressing.

Siemens IP router

Ordering: 5WG1 146-1AB01, short description N146  
Bus connection via terminals, IP network connection via RJ45 plug.

See [www.automation.siemens.com/et/gamma/](http://www.automation.siemens.com/et/gamma/) for information on Siemens power supply units, area/line couplers, and IP routers.

### Lightning and over-voltage protection

#### **Adhere to local regulations on lightning protection and equipotential bonding.**

Depending on the probability of exposure to lightning or overvoltage, consider complex overvoltage protection measures covering bus devices and supply and signal lines (e.g. for outdoor sensors).

See document P3127 for more information on lightning and overvoltage protection.

Lay bus cables 

Local regulations on insulation against mains voltage (SELV as per EN 60730) apply if the bus cable is laid in parallel to lines of a three-phase network (3 x AC 400 V).

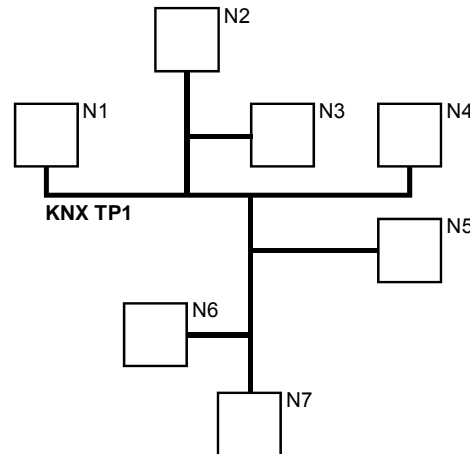
Bus topologies

Permissible bus topologies are: Tree, line, and star topologies. These topologies can be mixed as needed. However, ring topologies are not allowed.

Advantage:  
Tree topology

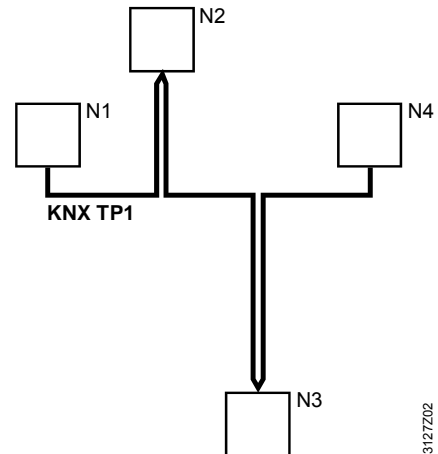
The tree topology is advantageous if a large KNX network must be created.

Tree topology (with stub lines)



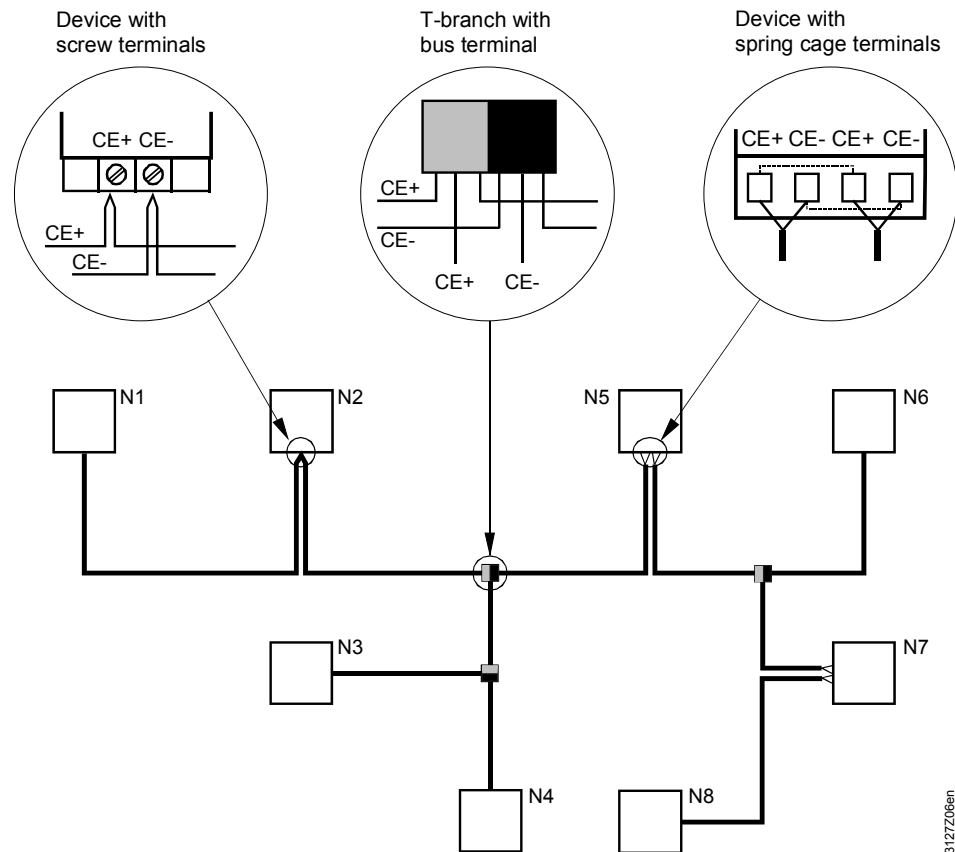
N1...N7 Bus devices

Line topology (with loops)



3127202

Branching and connection variants



N1...N8 Bus devices

3127206en

**Bus connection** In Synco devices, the bus lines are connected to terminals CE+ (red) and CE– (black). Observe the polarity of the bus lines CE+ and CE– and do not interchange them.

**Notes** In Synco devices with spring cage terminals, only one wire can be inserted per spring cage terminal. For this reason, terminals CE+ and CE– are available in double and connected inside the device.  
Identify the terminal polarity in third-party devices, e.g. CE+ at bus terminal 1, and CE– at bus terminal 2.

**Terminating resistor** KNX networks do not require bus terminating resistors.

**Distances and line lengths** The bus devices can be integrated anywhere in the KNX network by observing both the distance between bus devices and maximum network size.  
The following distances and line lengths are designed for KNX-specified bus cables. See Example 1 and Example 2 on the next page.

**Network with DPSU** In a KNX network with "decentral bus power supply DPSU", the distances depending on the number of devices featuring DPSU.

Number of devices with DPSU	Maximum distance		Total length of all lines on one line
	Device with DPSU to bus device <sup>1)</sup>	Bus device to bus device	
1	350 m	350 m	max. 350 m
2	350 m	700 m	max. 700 m
3 to 8	350 m	700 m	max. 1000 m

There is no minimum distance between devices with DPSU.

<sup>1)</sup> Bus device without power supply

**Network with PSU** Observe the following distances for a KNX network with "central bus power supply PSU":

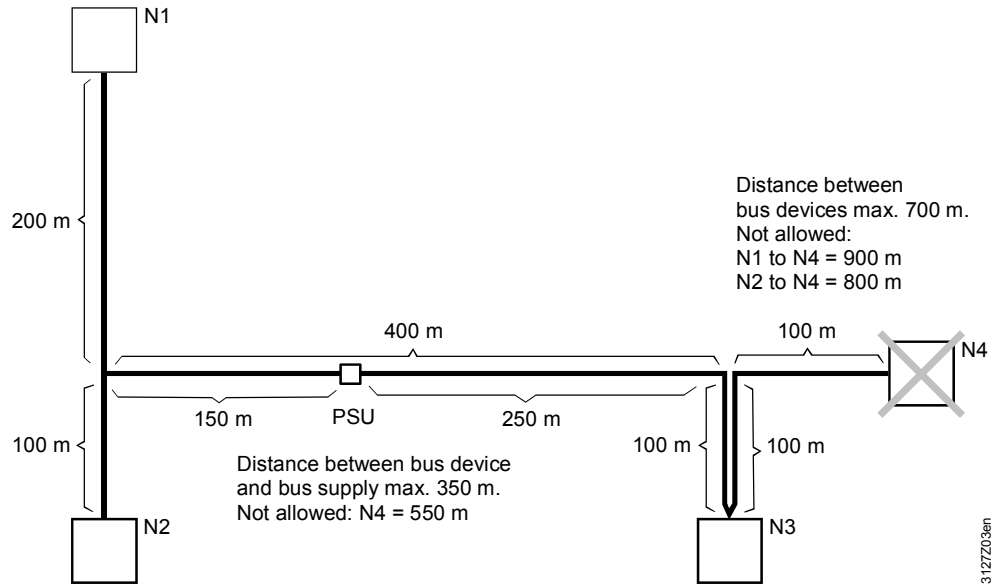
- Distance between two power supply units PSU min. 200 m
- Distance bus device to next neighboring PSU max. 350 m
- Distance between bus devices max. 700 m
- Total length of all lines on one line max.1000 m

**Notes** At least one PSU is required for each line, and max. two PSUs are allowed per line. Install the bus supply as close to the network center as possible to achieve maximum network size.  
The distance between the bus device and the next neighboring PSU may not exceed 350 meters. Therefore:

- Depending on the line size, two PSUs may need to be used or a network featuring several lines and PSUs may need to be established even if the bus device power consumption does not require it.

## Distances and line lengths (examples)

### Example 1



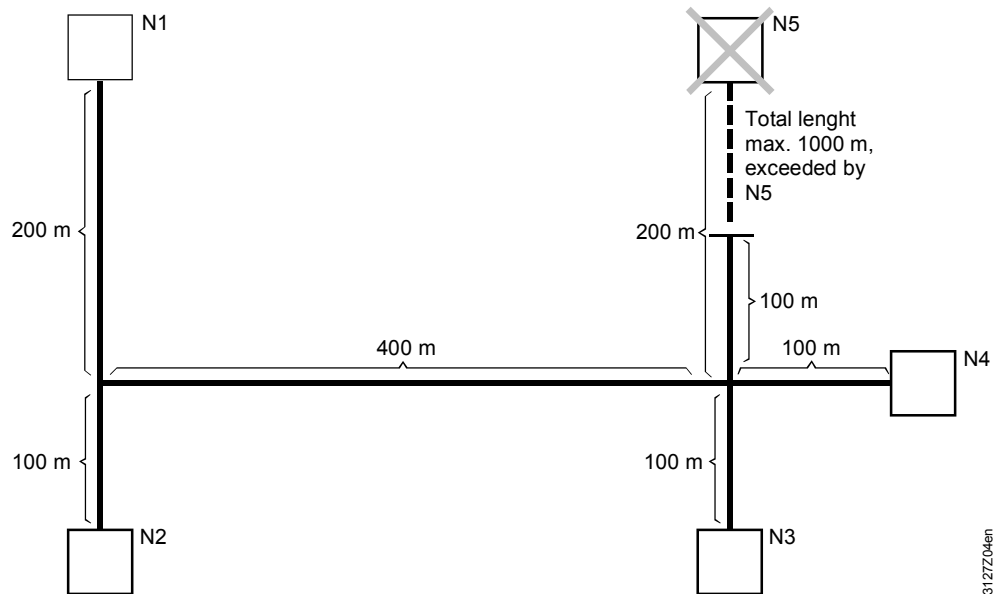
N1...N4 Bus devices

### Distances

Bus device N4, by adhering to the maximum distance of 700 m between bus devices, cannot be integrated in the bus if bus device N3 is integrated with a loop (instead of subline).

If the maximum distance between the centralized bus supply PSU and the bus device (without bus supply) is 350 meters, the bus supply must be placed at 150 m / 250 m on the 400 meter line.

### Example 2



N1...N5 Bus devices

### Total length

The permissible total length of 1000 m in the line is exceeded, if device N5 is integrated in the bus at the given bus wiring.



## Commissioning notes

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### Commissioning aspects

Observer the following commissioning aspects to commission a KNX network as intended.

### Wiring

#### KNX bus

Check the bus wiring prior to commissioning, and make sure that the bus line polarity is not interchanged (terminals CE+ and CE-).

**Important: Do not interchange the bus line polarity.**

#### Operating voltage

Check the operating voltage wiring to make sure that the devices are connected to AC 24 V or AC 230 V (as per the technical device information). Apply operating voltage only after this check.

### Bus power supply

Check to ensure that power is supplied to the bus after applying operating voltage. Supply via:

- DPSU Synco 700 devices set to "Decentral bus power supply = On".
- PSU Central bus power supply from power supply unit(s).

### Clock time master

The Synco devices are factory-set to function "Clock time operation = Autonomous". Determine the device that is to act as "Clock time master" in the KNX network, and the devices that are to be operated as "Clock time slaves" or "Autonomous".

**Important: In a KNX network, only one device or one radio clock may execute function "Clock time master".**

### Addressing

The network address is composed of the area, line, and device address (A.L.D). This is true also if no area or line coupler is used.

Begin by setting the area or line address in the couplers if area and line couplers are installed in the KNX network.

#### Area address

Set the area address A (A.0.0, with A = 1...15) for each area coupler.

#### Line address

Set the line address L (A.L.0, with L = 1...15) for each line coupler.

#### Device address

**Important: Synco devices assume area and line coupler addresses from the preceding couplers. If there is no coupler, network address 0.2.D (with D = 1...253) applies.**

**The device address may be used only once within a line.**

Change the factory-set device address 255, as devices with this address cannot send data. This avoids communication problems during commissioning. In normal mode, data exchange (send and receive) with devices featuring device address 255 is not possible.

The permissible device addresses are between 1 to 253, and addresses 150, 252 and 253 are reserved. The central communication unit OZW775 contains the factory-set address 150. The Synco devices RMZ792 and OZW771 prefer addresses 252 and 253 for automatic address searches. Address 254 must remain reserved for service tool OCI700.1.

See document P3127 for more information on setting the device address.

Zone addresses, LTE mode	<p>During commissioning, set the zone addresses as per the plant functions.</p> <p>Set the zone addresses in Synco 700 devices via operator units RMZ790 and RMZ791, and locally via QAX910 for the central apartment unit (Synco living).</p> <p>The service tool OCI700.1 (part of the ACS7... software package) allows for efficient zone addressing in complex plants featuring many Synco devices.</p>
Group addresses, S-mode	<p>You can only assign the group addresses to the group objects (= KNX S-mode data points) via the ETS3 tool. You can order the ETS3 tool from the KNX Association at <a href="http://www.knx.org/">www.knx.org/</a></p> <p>See document Y3110 for more information on the KNX S-mode data points.</p>
<b>Device name</b>	<p>An individual device name (e.g. plant designation) consisting of max. 21 characters can be assigned to the Synco devices.</p> <p>The device name is written to the Synco 700 devices via the operator units RMZ790 and RMZ791 as well as the service tool OCI700.1.</p> <p>For the central apartment unit (Synco living), write the device name locally at the QAX910 and via the service tool OCI700.1 to the QAX910.</p>

## Technical data

KNX bus	Transmission medium (bus cable)	TP (twisted pair)
	Baud rate	9.6 kbps (fixed for TP)
KNX bus cable	Bus line polarity	CE+, CE- (not interchangeable)
	Bus terminating resistor	Not required
	Communication signal	The communication signal (information) is transferred symmetrically, i.e., as voltage difference between the two bus lines (and not as a voltage difference to the earthing potential). The sign preceding the voltage between CE+ and CE- determines signal values 0 and 1.
	Cable type	2-wire, stranded (one wire pair) or 2x2-wire, stranded or Spiral quad
	Wire diameter	Min. 0.8 mm, max. 1.0 mm
	Wave resistance (ideal value)	120 Ω at 100 kHz
Bus power supply	Line resistance	20 Ω/km to max. 75 Ω/km
	Capacity, bus line to bus line	Max. 100 pF/m at 800 Hz Greater values require a proportional shortage of the perm. cable lengths.
	Screens	Not required Synco devices do not have a connection for bus cable screens
	Bus power supply via Synco device with DPSU	DC 30 V, 25 mA