# KNX LINE COUPLER SECURE

# CO KNT LC1

# USER MANUAL

## Application

The KNX Line Coupler Secure is a KNX line coupler in a compact design. It connects two KNX bus segments (for example, a KNX line with a KNX area).

The device supports KNX Security. The option can be activated in the ETS. As a secure line coupler, the device enables the forwarding of both secured and unsecured communication. In addition, access to the device itself (e.g. for a download) is protected by KNX Security.

The device has a filter table (8k bytes) and ensures a galvanic separation between the lines. The coupler supports KNX long frames and is compatible with the ETS® software.

The buttons on the front side allow to deactivate the telegram filters for test purposes. The LEDs indicate operating conditions as well as communication errors on the KNX bus.

The power is supplied via the KNX bus (main line).

## KNX Security

The KNX standard was extended by KNX Security to protect KNX installations from unauthorized access. KNX Security reliably prevents the monitoring of communication as well as the manipulation of the system.

KNX Data Security describes the encryption at telegram level. This means that the telegrams are encrypted on the twisted pair bus.

### KNX Data Security for the device

The KNX Line Coupler Secure supports KNX Data Security to protect the device from unauthorized access from the KNX bus. The line coupler is programmed via the KNX bus using encrypted telegrams.

⇒ *Note: Encrypted telegrams are longer than the previously used unencrypted ones. For secure programming via the bus, it is therefore necessary that the interface used (e.g. USB) and any intermediate line couplers support the so-called KNX long frames.*

### KNX Data Security for forwarded telegrams

Telegrams from the bus that do not address the KNX Line Coupler as a device are forwarded or blocked according to the filter settings (parameters and filter table). It does not matter whether the telegrams are unencrypted or encrypted. Forwarding takes place exclusively on the basis of the destination address. The security properties are checked by the respective recipient.

## Coupler function

The KNX Line Coupler Secure operates as a line or backbone coupler. In both cases, KNX TP is used as a backbone.

The following table shows the application possibilities of the KNX Line Coupler Secure compared to the IP based topology:

|  | Classical Topology (without IP) | IP coupling of areas (IP area coupl.) | IP coupling of lines (IP line coupler) |
|---|---|---|---|
| **Area (Backbone)** | TP | IP | IP |
| **Coupling** | KNX Line Coupler (max. 15 Pcs.) | KNX IP Router (max. 15 Pcs.) | Directly via LAN Switch |
| **Main Line** | TP | TP | IP |
| **Coupling** | KNX Line Coupler (max. 15x15 Pcs.) | KNX Line Coupler (max. 15x15 Pcs.) | KNX IP Router (max. 225 Pcs..) |
| **Line** | TP | TP | TP |
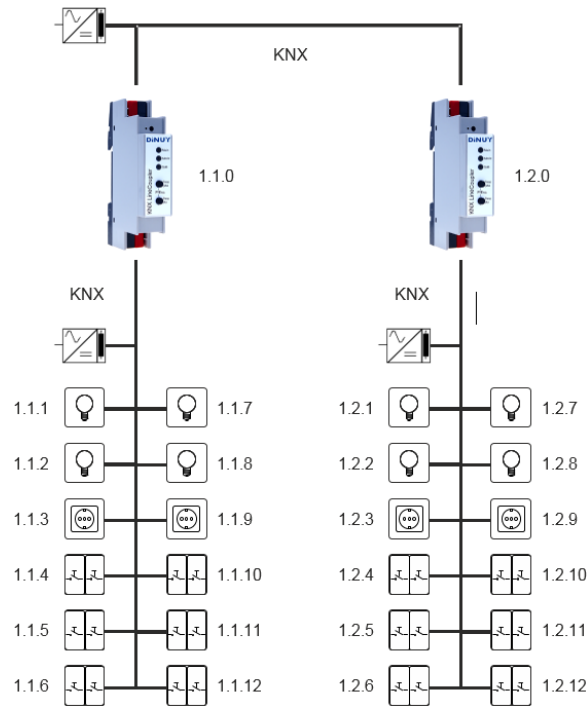
KNX Line Coupler Secure as line coupler

The individual address assigned to the KNX Line Coupler Secure determines whether the device operates as a line or area coupler. If the individual address is in the form of x.y.0 (x, y: 1..5), the device operates as a line coupler. If it is in the form of x.0.0 (x: 1..5), the router acts as a backbone coupler.
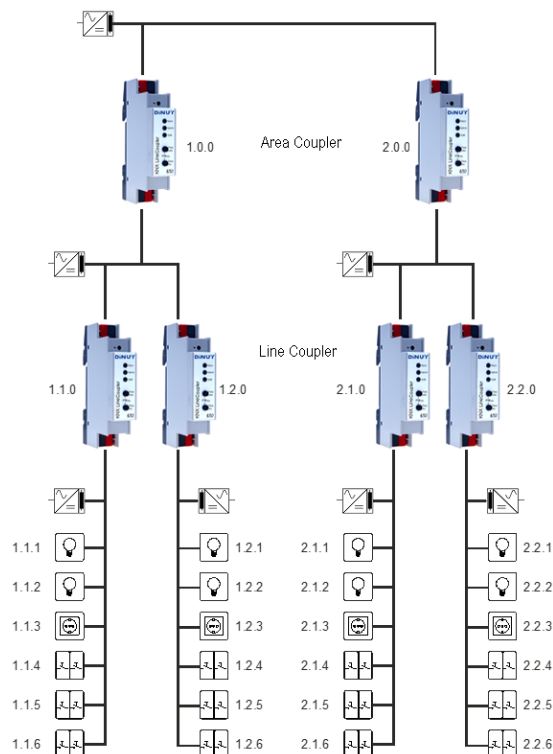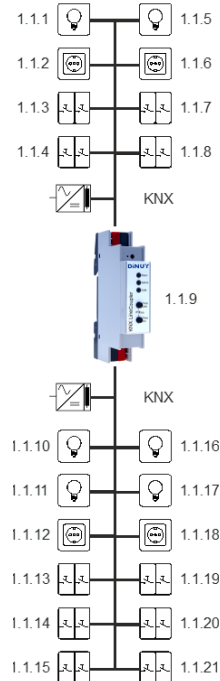


KNX Line Coupler Secure as area and line coupler

The KNX Line Coupler Secure has a filter table and thus contributes to reducing the bus load. The filter table (8kB) supports the extended group address range and is automatically generated by the ETS.

## Repeater Function

The KNX Line Coupler Secure can also be used as a repeater. In this case, the individual address has the form x.y.z, where z must not be equal to 0. The filter settings in the parameter dialog of the ETS are ineffective in repeater mode.



KNX Line Coupler Secure as repeater

## Installation and Connection

The KNX Line Coupler Secure is designed for installation on a DIN rail with a width of 1 unit (18mm). It features the following controls and displays:
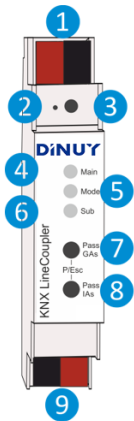


1. KNX bus connector (main line)
2. Programming LED
3. Button f. programming mode
4. KNX LED (main line, multicolor)
5. Mode LED (multicolor)
6. KNX LED (sub line, multicolor)
7. Button „Pass GAs"
8. Button „Pass IAs"
9. KNX bus connector (sub line)

An external power supply is not necessary as the device is powered by the KNX bus.

⇒ Note: The device is not working without bus power (main line).

## KNX Programming mode

The KNX programming mode is activated/deactivated either by pressing the flushed KNX programming button ③ or by simultaneously pressing the buttons ⑦ and ⑧.

## Manual operation and status display

The KNX main line LED ④ lights up green if the device is successfully powered by the KNX bus. This LED indicates telegram traffic on the KNX bus by flickering.

Communication failures (e.g. repetitions of telegrams or telegram fragments) are indicated by a short change of the LED color to red.

Overview of the different indications of KNX main line LED ④:

| LED Status | Meaning |
|---|---|
| LED lights green | KNX Bus power (main line) active. |
| LED flashes green | Telegram traffic on the KNX bus (main line). |
| LED turns red (short) | Communication error on the KNX Bus (main line). |

The KNX sub line LED ⑥ lights up green when the device is ready for operation (supplied by the main line) and the KNX bus voltage is present on the sub line. If the LED is flickering, telegram traffic takes place on the sub line.

Errors in the communication (such as telegram repeats or telegram fragments) are indicated by a short-time color change to red.

Overview of the different indications of KNX sub line LED ⑥:

| LED Status | Meaning |
|---|---|
| LED lights green | KNX Bus power (sub line) active. |
| LED flashes green | Telegram traffic on the KNX bus (sub line). |
| LED turns red (short) | Communication error on the KNX Bus (sub line). |

For testing purposes (for example, during commissioning) the configured routing settings (filter or block) can be by-passed via manual operation.

With the button "Pass GAs" ⑦ the forwarding of group addressed telegrams can be activated.

With the button "Pass IAs" ⑧ the forwarding of individually addressed telegrams can be activated.

This is visualized with a single flash of the Mode LED ⑤ (orange). If both modes are activated the Mode LED ⑤ flashes two times.

Pressing button "Pass GAs" ⑦ or button "Pass IAs" ⑧ again these settings can be selected and deselected on demand. Via the Escape function (Esc) the manual operation can be stopped by simultaneously pressing the buttons "Pass GAs" ⑦ and "Pass IAs" ⑧.

If neither programming mode nor manual mode are active the LED ⑤ can visualize configuration errors (for details see table below).

Overview of the different indications of the Mode LED ⑤:

| LED Status | Meaning |
|---|---|
| LED lights green | Device is working in standard operation mode. |
| LED light red | Programming mode is active. |
| LED flashes 1x orange | Programming mode is not active. Manual operation is active. Forwarding IA or GA |
| LED flashes 2x orange | Programming mode is not active. Manual operation is active. Forwarding IA and GA |
| LED flashes red | Programming mode is not active. Manual operation is not active. The device is not properly loaded e.g. after an interrupted download. |

## Factory default settings

The following configuration is set by factory default:

| | |
|---|---|
| Individual device address: | 15.15.0 |

Routing (sub line → main line):
| | |
|---|---|
| Individual addressed telegrams: | Filter |
| Group addressed telegrams: | Lock |

Routing (main line → sub line):
| | |
|---|---|
| Individual addressed telegrams: | Filter |
| Group addressed telegrams: | Lock |

## Reset to factory device settings (Master-Reset)

It is possible to reset the device to its factory settings:

- Disconnect the KNX Bus connector (main line) ❶ from device.
- Press the KNX programming button ❸ and keep it pressed down.
- Reconnect the KNX Bus connector (main line) ❶ of device.
- Keep the KNX programming button ❸ pressed for at least another 6 seconds.
- A short flashing of the programming LEDs ❷ visualizes the successful reset of the device to factory default settings.

## ETS database

The ETS database (for ETS 4.2 and ETS 5) can be downloaded from the product website of the KNX Line Coupler Secure (www.dinuy.com) or via the KNX online catalogue.

If the first product is inserted into a project with KNX Security, the ETS prompts you to enter a project password.
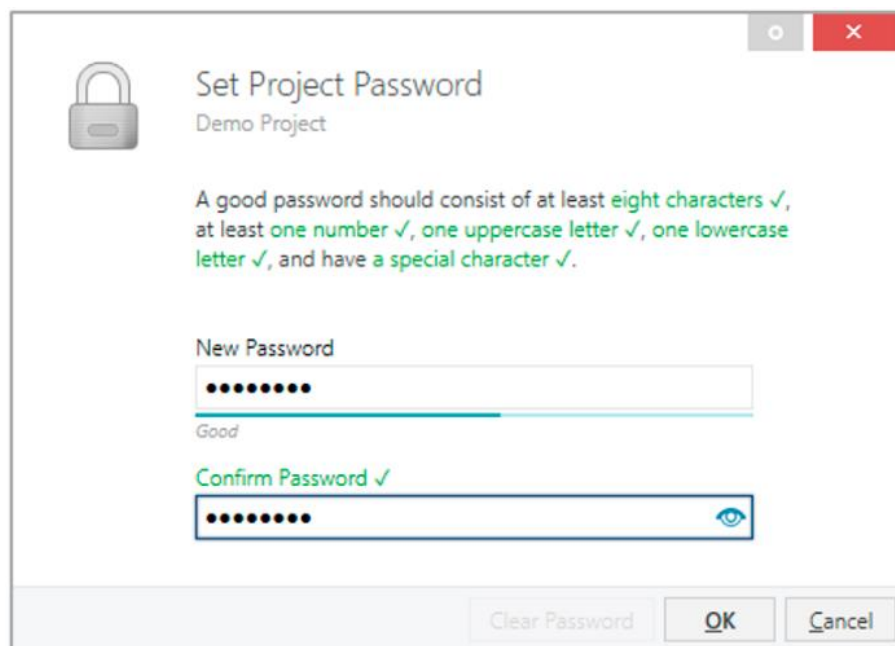


This password protects the ETS project from unauthorized access. This password is not a key that is used for KNX communication. The entry of the password can be by-passed with "Cancel", but this is not recommended for security reasons.

ETS requires a device certificate for each device with KNX Security that is created in the ETS. This certificate contains the serial number of the device as well as an intangible key (FDSK = Factory Default Setup Key).
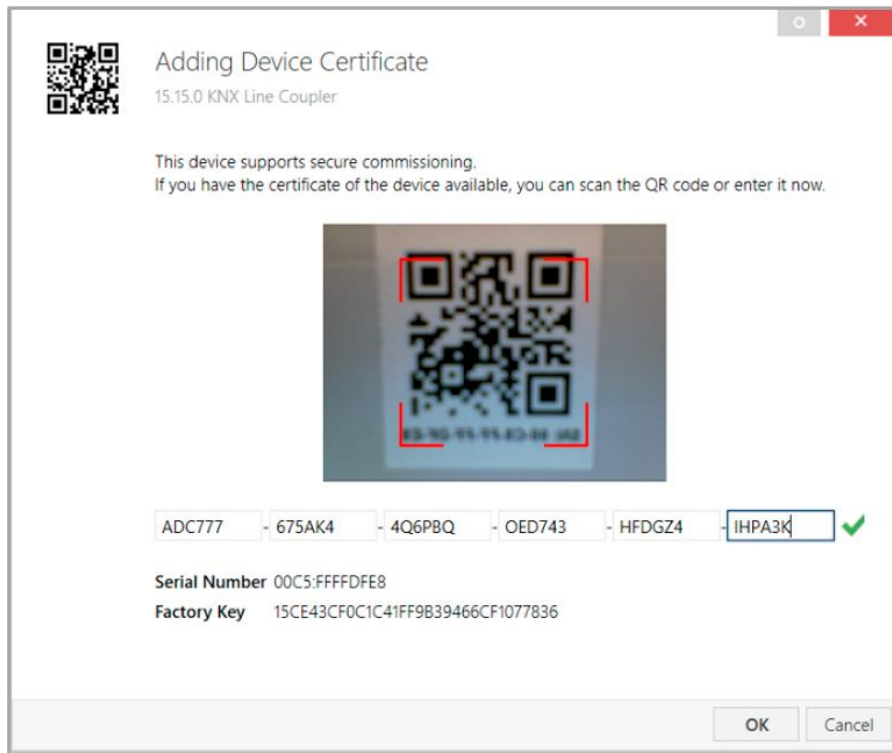
The certificate is printed as text on the device. It can also be conveniently scanned from the printed QR code via a webcam.

The list of all device certificates can be managed in the ETS Overview - Projects - Security window.

This initial key is required to safely put a device into operation from the start. Even if the ETS download is recorded by a third party, the third party has no access to the secured devices afterwards. During the first secure download, the initial key is replaced by the ETS with a new key that is generated individually for each device. This prevents persons or devices who may know the initial key from accessing the device. The initial key is only reactivated after a master reset.

The serial number in the certificate enables the ETS to assign the correct key to a device during a download.

## ETS parameter dialogue

The following parameters can be set using the ETS.

### General settings
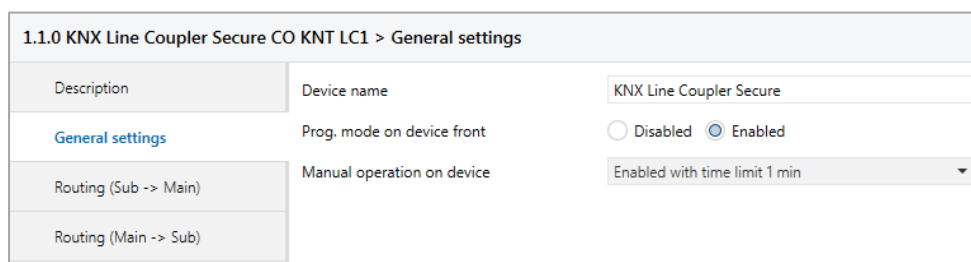


### Prog. mode on device front

In addition to the normal programming button ③ the device allows activating the programming mode on the device front without opening the switchboard cover. The programming mode can be activated and deactivated via pressing simultaneously both buttons ⑦ and ⑧.

This feature can be enabled and disabled via the parameter "Prog. mode on device front". The recessed programming button ③ (next to the Programming LED ②) is always enabled and not influenced by this parameter.

**Manual operation on device**

This parameter sets the duration of the manual mode. Upon completion the normal display mode is restored.

**Routing (Sub line → Main line)**



### Group telegrams (main group 0 to 13)

Block: No group telegrams of this main group are routed to the main line.

Route: All group telegrams of this main group are routed to the main line independent of the filter table. This setting is for test purposes only.

Filter: The filter table is used to check whether or not the received group telegram should be routed to the main line.

### Group telegrams (main group 14 to 31)

Block: No group telegrams of main groups 14 to 31 are routed to the main line.

Route: All group telegrams of main groups 14 to 31 are routed to the main line. This setting is for test purposes only.

Filter: The filter table is used to check whether or not the received group telegram should be routed to the main line.

### Individually addressed telegrams

Block: No individually addressed telegrams are routed to the main line.

Route: All individually addressed telegrams are routed to the main line. This setting is for test purposes only.

Filter: The individual address is used to check whether the received individually addressed telegram should be routed to the main line.

### Broadcast telegrams

Block: No received broadcast telegrams are routed to the main line.

Route: All received broadcast telegrams are routed to the main line.

### Repetition of group telegrams

Disabled: The received group telegram is not resent to the main line in case of a fault.

Enabled: The received group telegram is resent up to three times in case of a fault.

### Repetition of individually addressed telegrams

| Disabled: | The received individually addressed telegram is not resent to the main line in case of a fault. |
| Enabled: | The received individually addressed telegram is resent up to three times in case of a fault. |

**Repetition of broadcast telegrams**

| Disabled: | The received broadcast telegram is not resent to the main line in case of a fault. |
| Enabled: | The received broadcast telegram is resent up to three times in case of a fault. |

**Acknowledge (ACK) of group telegrams**

| Always: | A acknowledge is generated for every received group telegram (from the sub line). |
| Only if routed: | A acknowledge is only generated for received group telegrams (from the sub line) if they are routed to the main line. |

**Acknowledge (ACK) of individually addressed telegrams**

| Always: | A acknowledge is generated for every received individual addressed telegram (from the sub line). |
| Only if routed: | A acknowledge is only generated for received individually addressed group telegrams (from the sub line) if they are routed to the main line. |

Answer with NACK: Every received individually addressed telegram (from the sub line) is responded to with NACK (Not acknowledge). This means that communication with individually addressed telegrams on the corresponding KNX line is not possible. Group communication (group telegrams) is not affected. This setting can be used to block attempts at manipulation.

⇒ *Note: When using "Answer with NACK" an access to the device via the KNX sub line is no longer possible. The configuration must be performed via the main line.*

**Routing (Main line → Sub line)**



**Group telegrams (main group 0 to 13)**

| Block: | No group telegrams of this main group are routed to the sub line. |
| Route: | All group telegrams of this main group are routed to the sub line independent of the filter table. This setting is for test purposes only. |
| Filter: | The filter table is used to check whether or not the received group telegram should be routed to the sub line. |

**Group telegrams (main group 14 to 31)**

| Block: | No group telegrams of main groups 14 to 31 are routed to the sub line. |

| | |
|---|---|
| Route: | All group telegrams of main groups 14 to 31 are routed to the sub line. This setting is for test purposes only. |
| Filter: | The filter table is used to check whether or not the received group telegram should be routed to the sub line. |

## Individually addressed telegrams

| | |
|---|---|
| Block: | No individually addressed telegrams are routed to the sub line. |
| Route: | All individually addressed telegrams are routed to the sub line. This setting is for test purposes only. |
| Filter: | The individual address is used to check whether the received individually addressed telegram should be routed to the sub line. |

## Broadcast telegrams

| | |
|---|---|
| Block: | No received broadcast telegrams are routed to the sub line. |
| Route: | All received broadcast telegrams are routed to the sub line. |

## Repetition of group telegrams

| | |
|---|---|
| Disabled: | The received group telegram is not resent to the sub line in case of a fault. |
| Enabled: | The received group telegram is resent up to three times in case of a fault. |

## Repetition of individually addressed telegrams

| | |
|---|---|
| Disabled: | The received individually addressed telegram is not resent to the sub line in case of a fault. |
| Enabled: | The received individually addressed telegram is resent up to three times in case of a fault. |

## Repetition of broadcast telegrams

| | |
|---|---|
| Disabled: | The received broadcast telegram is not resent to the sub line in case of a fault. |
| Enabled: | The received broadcast telegram is resent up to three times in case of a fault. |

## Acknowledge (ACK) of group telegrams

| | |
|---|---|
| Always: | A acknowledge is generated for every received group telegram (from the main line). |
| Only if routed: | A acknowledge is only generated for received group telegrams (from the main line) if they are routed to the sub line. |

## Acknowledge (ACK) of individually addressed telegrams

| | |
|---|---|
| Always: | A acknowledge is generated for every received individual addressed telegram (from the main line). |
| Only if routed: | A acknowledge is only generated for received individually addressed group telegrams (from the main line) if they are routed to the sub line. |
| Answer with NACK: | Every received individually addressed telegram (from the main line) is responded to with NACK (Not acknowledge). This means that communication with individually addressed telegrams on the corresponding KNX line is not possible. Group communication (group telegrams) is not affected. This setting can be used to block attempts at manipulation. |

⇒ *Note: When using "Answer with NACK" an access to the device via the KNX main line is no longer possible. The configuration must be performed via the sub line.*

## Filter table

The filter table is automatically created by the ETS. The group addresses of the telegrams which shall be forwarded via the coupler are added to the filter table. The contents of the filter table can be displayed via the preview:
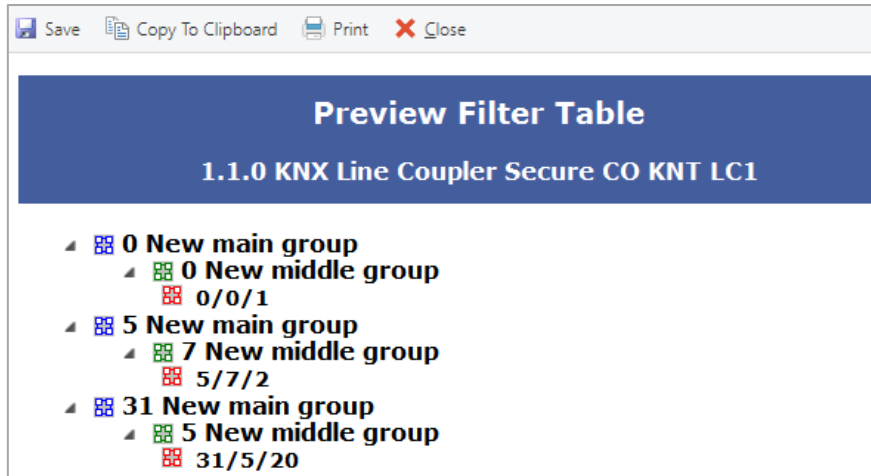


Preview of the filter table

The filter table can be extended by manually adding group addresses. This requires activating "Pass through Line Coupler" in the property window of the corresponding group address.
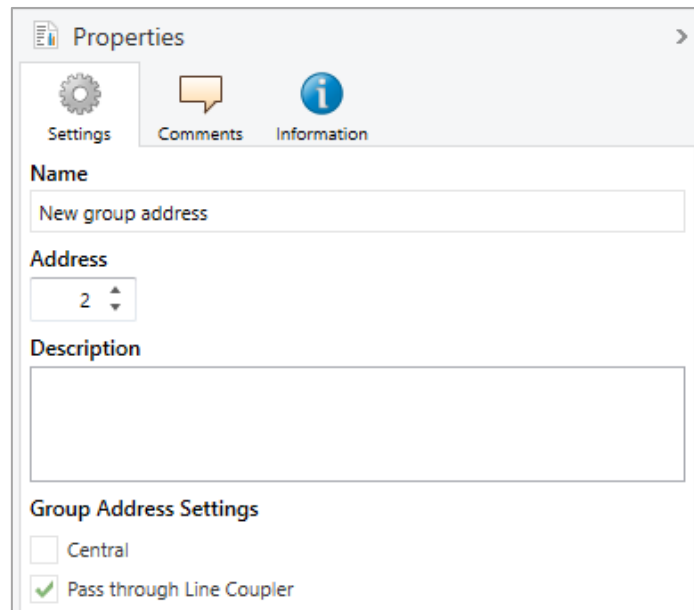


Property window of a group address

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⚠ **WARNING**

- The device must be mounted and commissioned by an authorized electrician.
- The prevailing safety rules must be heeded.
- The device must not be opened.
- For planning and construction of electric installations, the relevant guidelines, regulations and standards of the respective country are to be considered.

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