# KNX LINE COUPLER

## LC-S.1

User Manual

Application Program: ver. 1.0
User Manual: ver. 1.0

module-electronic.ru

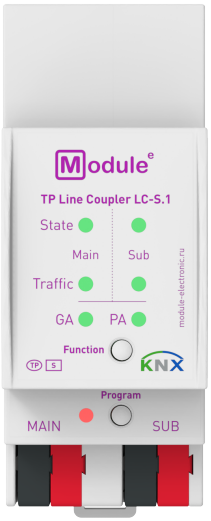
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# 1 BASIC INFORMATION

The KNX line coupler provides a bi-directional data connection between two KNX TP lines or areas and works as a KNX network. KNX TP main line and KNX TP subline are coupled having a galvanic isolation in between.

- Various routing filter for group and individual telegrams
- Temporary disabling of routing filter via button
- Long telegrams with up to 240 bytes APDU length are supported
- LED status indication
- Galvanic isolation of connected lines
- Integrated ACK generator
- Power supply via KNX bus
- Low power consumption
- DIN rail 35mm mounting

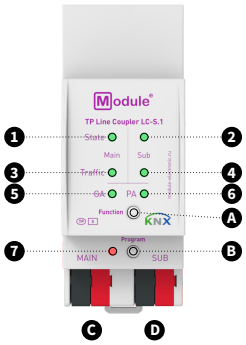



LC-S.1

## 1.1 SPECIFICATION

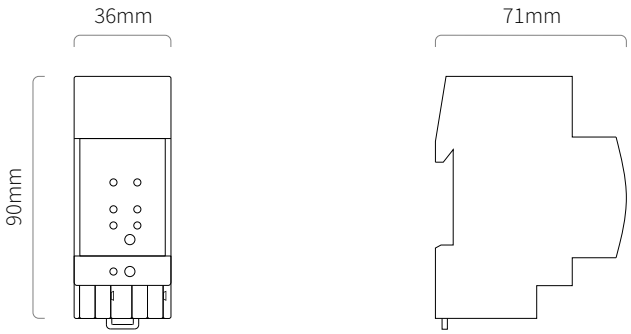
| **Device model** | **LC-S.1** | |
|---|---|---|
| **KNX interfaces (Main, Sub)** | | |
| Specification | TP-256 | |
| Available application software | ETS 4 and later | |
| KNX connector | 4-wire EIB connector (PUSH WIRE spring clips) for standard cable TP1 0,8мм Ø | |
| KNX physical address by default | 15.15.0 | |
| Power supply | via KNX bus: 21...30B DC | |
| Consumption on the KNX bus (29V DC) | < 10mA | < 300mW |
| Operation temperature | -5°C ... + 45°C | |
| Operation humidity | 5 ... 95% (no condensation) | |
| Degree of protection | IP 20, clean environment | |
| Mounting type | DIN rail 35mm | |
| Dimensions | 36 x 90 x 71mm (2TE) | |
| Weight | 62 g | |

## 1.2 APPEARANCE




A. Function button B. Programming button C. KNX TP main line connector D. KNX TP subline connector
1. LED bus state KNX TP (main line) 2. LED bus state KNX TP (subline) 3. LED telegram traffic KNX TP (main line)
4. LED telegram traffic KNX TP (subline) 5. LED group address routing 6. LED physical address routing
7. Programming LED

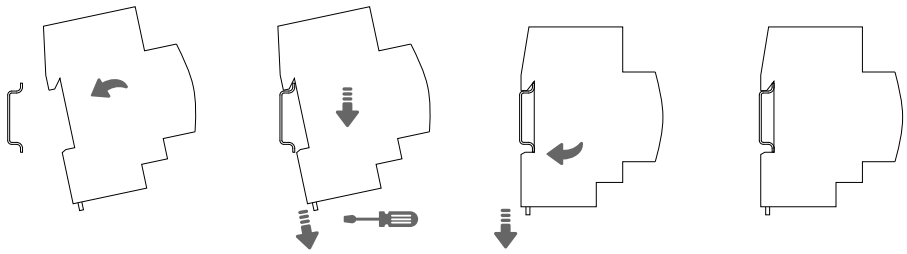
| | |
|---|---|
| **1. Bus state KNX TP (main line)** | Green: Main line OK<br>Orange: Manual function active |
| **2. Bus state KNX TP (subline)** | Green: Subline OK<br>OFF: Subline not connected |
| **3. Telegram traffic KNX TP (main line)** | Green (blinking): Telegram traffic<br>Red (blinking): Transmission error<br>OFF: No telegram traffic |
| **4. Telegram traffic KNX TP (subline)** | Green (blinking): Telegram traffic<br>Red (blinking): Transmission error<br>OFF: No telegram traffic |
| **5. Group address routing*** | Green: Filter table active<br>Orange: Route all<br>Red: Block all<br>OFF: Routing of group telegrams is different on main line and subline |
| **6. Physical address routing** | Green: Filter table active<br>Orange: Route all<br>Red: Block all<br>OFF: Routing of physical telegrams is different on main line and subline |
| **7. Programming** | Red: Programming mode active<br>OFF: Programming mode not active |



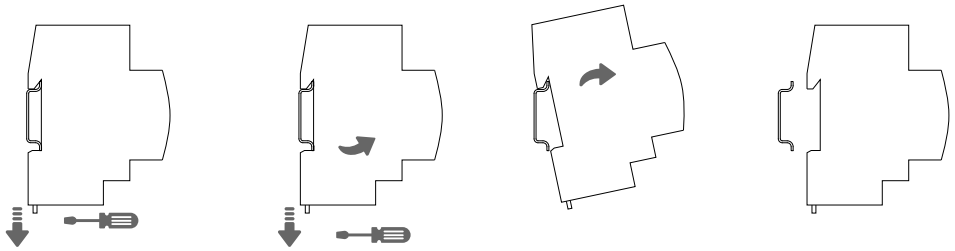
# 1.3 INSTALLATION AND CONNECTION

## INSTALLATION

Attaching to DIN rail



Removing from DIN rail



## WIRING DIAGRAMS




**ATTENTION!** Installation and connection of the device to the mains must only be carried out by qualified personnel! Be sure to turn off the power before installing or removing the device! Even when the device is turned off, the output terminals can be live! Do not connect to the outputs a load that exceeds the recommended values! The design of the device meets the requirements of electrical safety according to GOST 12.2.007.0-75.

# 2 OPERATIONAL DESCRIPTION

In network installations LC-S.1 can be used as KNX TP area/line coupler or KNX TP line repeater. After connecting the main line, LC-S.1 operates with its default settings. Setting the correct Individual Address is necessary. Only Individual Addresses x.y.0 are allowed.

## 2.1 TP COUPLER APPLICATION

When LC-S.1 receives telegrams (for example during commissioning) that use Individual Addresses as destination addresses, it compares the Individual Addresses of the receiver with its own Individual Address and decides on that whether it has to route the telegrams or not.

When LC-S.1 receives telegrams that use group addresses as destination addresses, it reacts in accordance with the parameter settings. During normal operation (with Group Telegram routing set to filter), LC-S.1 only routes telegrams whose group addresses are entered in its filter table.

If a telegram is routed by LC-S.1 without receiving the corresponding acknowledgement, i.e. due to a missing receiver or to a transmission error, the telegram will be repeated up to three times (depending on the ETS setting). With the parameters «Repetitions if errors...», this function can be configured separately for each line and both kinds of telegrams. It is recommended to use the default parameter setting.

If not already configured as «Line Coupler», the ETS application program «TP Coupler» has to be downloaded to the device. Under the Information tab the configuration setting can be changed by the drop-down menu «Change Application Program». After changing the configuration setting the filter table entries can be added manually. Updating the application program version can also be done here.

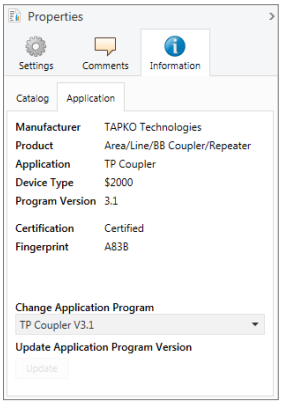



**Figure 1.** TP coupler application program

## 2.2 TP REPEATER APPLICATION

Any received telegram is routed to all lines irrespective of in which line it is processed. Line repeaters make no use of a filter table. It is therefore not important whether the telegram is generated within a line or whether it is sent from an upper line to a lower line via a coupler.

If a telegram is routed by LC-S.1 without receiving the corresponding acknowledgement, i.e. due to a missing receiver or to a transmission error, the telegram will be repeated up to three times (depending on the ETS setting). With the parameters «Repetitions if errors...», this function can be configured separately for each line and both kinds of telegrams. It is recommended to use the default parameter setting.

If not already configured as Line/Area/BB Repeater, the ETS application program «TP repeater» has to be downloaded to the device. Under the Information tab the configuration setting can be changed by the drop-down menu «Change Application Program». After changing the configuration setting the filter table entries can be added manually. Updating the application program version can also be done here.

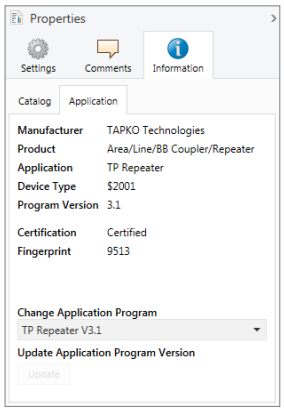



**Figure 2.** TP repeater application program

## 2.3 KNX NETWORK INSTALLATION

### 2.3.1 INDIVIDUAL ADDRESS

For line coupler functionality in a KNX network LC-S.1 has to use the correct Individual Address of a line coupler (x.y.0, 1≤ x & y ≤15). In ETS up to 225 addresses can be defined (from 1.1.0 to 15.15.0).

For area coupler functionality in a KNX network LC-S.1 has to use the correct Individual Address of an area coupler (x.0.0, 1≤ x ≤15). In ETS up to 15 areas can be defined.

If LC-S.1 is used in a KNX system for both purposes, it is only necessary to ensure that the LC-S.1 used as a line coupler has a line coupler address assigned from a free addressing area. Following figure illustrates the LC-S.1 router topology for KNX lines and KNX areas.

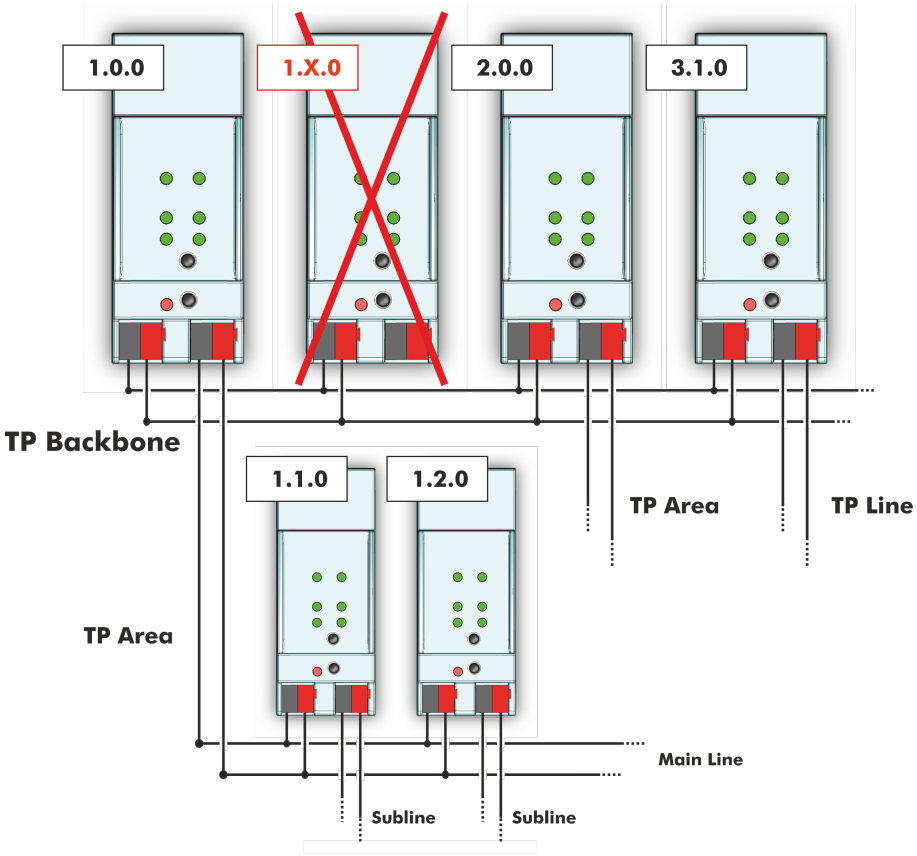



**Figure 3.** LC-S.1 network

Example: If an area coupler with address 1.0.0 already exists on the backbone no line coupler with address 1.x.0, 1≤ x ≤15 can be added here. Even if no line coupler with address 1.1.0 exists on the subline of the 1.0.0 area coupler. Vice versa, if a line coupler with address 1.1.0 already exists in the installation no area coupler with address 1.0.0 can be added.

## 2.3.2 KNX TOPOLOGY

Via a line/area coupler up to 15 lines can be connected to a main line called an area. It is possible to have up to 64 bus devices on one line. With use of line repeaters a line can theoretically be extended to 255 bus devices. This means up to four line segments form a single KNX TP line. But it is common practice on exceeding 64 bus devices to insert a new line instead of extending the originating one.

The free tree structure of the KNX topology prevents problems caused by circling telegrams and heavy bus load. To maintain this condition, interconnection between lines or line segments is strictly forbidden.

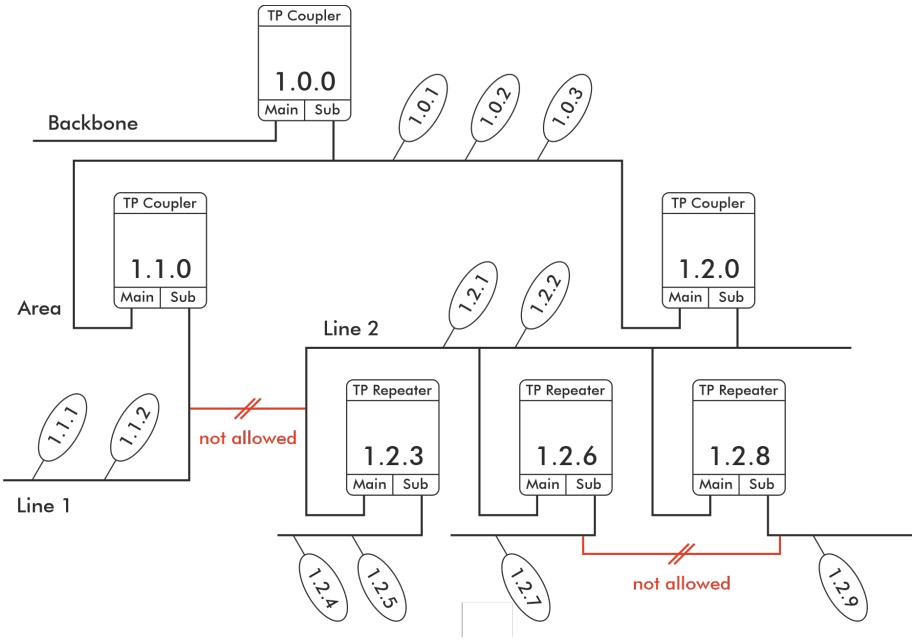



**Figure 4.** LC-S.1 network topology

Each line segment requires its own KNX power supply unit.

Using repeaters on the backbone and main lines is not allowed.

Interconnections are not allowed.

## 2.4 PROGRAMMING

### 2.4.1 PROGRAMMING BUTTON

To download the desired Individual Address or an ETS setting the Programming Mode must be activated. Successive pressing the Programming Button will turn on and off the Programming Mode. LED 7 lighting in red colour indicates Programming Mode is active. When Programming Mode is activated, the ETS is able to download the Individual Address.

### 2.4.2 INDIVIDUAL ADDRESS ASSIGNMENT

To configure the device an interface connection (IP, USB) to the KNX bus system is required. The device is supplied with the Individual Address 15.15.0. The KNX product database entry can be downloaded from the website and from the KNX Online Catalog.

The Individual Address can be assigned to the device by setting the desired address in the properties window of the ETS. After starting the ETS download and then pressing the Programming Button the device restarts itself.

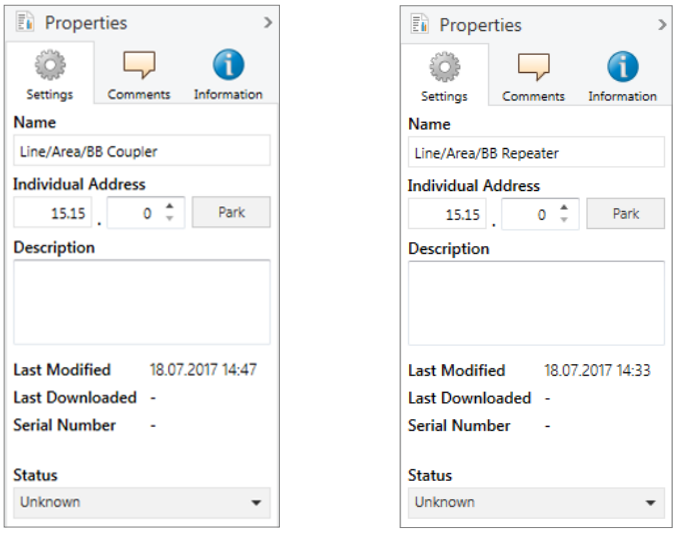



**Figure 5.** ETS properties window

## 2.5 SPECIAL FUNCTION

The Function Button activates LC-S.1´s special functions. Manual Function and Factory Reset can be activated. It depends on time the Function Button is being pressed.

### 2.5.1 MANUAL FUNCTION

During normal operation a rather short press (≈ 3 sec) activates and deactivates the Manual Function.

When the Manual Function is active, either all Physical Telegrams or all Group Telegrams or both pass the LC-S.1 without filtering. After the Switch-off time period has elapsed, LC-S.1 automatically switches back to normal operation. To configure the Manual Function and set the Switch-off time use the General parameter tab like shown in chapters 3.1 and 4.1 . After switching back from Manual Function to normal operation the latest downloaded parameter setting / filter table entries are active again.

### 2.5.2 FACTORY RESET

A long press (≈ 15 sec) of the Function Button soon followed by a short press (≈ 3 sec) executes the Factory Reset. After the first press, the LED display lights like described in Table 2. After the second press, all parameters will be set to factory default (incl. Individual Address). Subsequently, LEDs show the normal operation display again.

## 2.5.3 LED STATUS DISPLAY

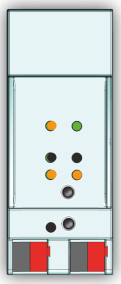
| Number | LED | Colour | Comment | |
|---|---|---|---|---|
| 1 | Bus state KNX TP (main line) | orange | |  |
| 2 | Bus state KNX TP (subline) | green | LED is <off> if not connected | |
| 5 | Group address routing | green:<br>orange:<br>red: | filter<br>route all<br>block all | |
| 6 | Individual address routing | | | |

**Table 1.** LED status display for manual function

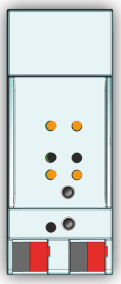
| Number | LED | Colour | Comment | |
|---|---|---|---|---|
| 1 | Bus state KNX TP (main line) | orange | |  |
| 2 | Bus state KNX TP (subline) | orange | LED lights red if not connected | |
| 5 | Group address routing | green:<br>orange:<br>red: | filter<br>route all<br>block all | |
| 6 | Individual address routing | | | |

**Table 2.** LED status display for factory reset after first button press

# 3 ETS DATABASE PARAMETERS COUPLER

All screen shots are related to the LC-S.1 database V3.1 in ETS5.

## 3.1 GENERAL

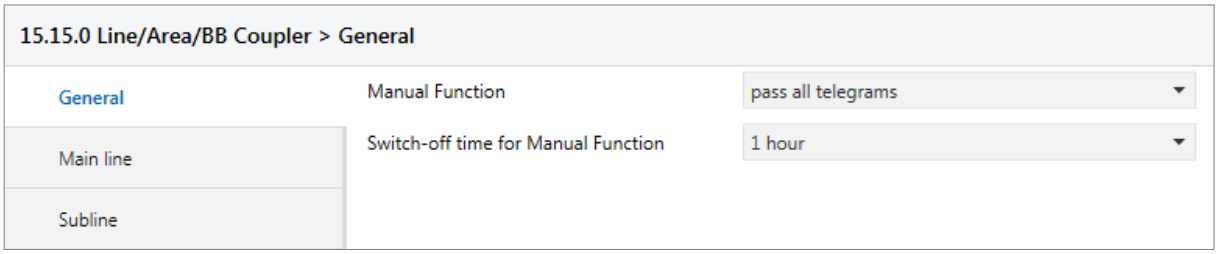



**Figure 6.** General tab parameters

| ETS Parameter | Setting<br>{Factory Default} | Comment |
|---|---|---|
| Manual function | disabled<br>pass all telegrams<br>pass all physical telegrams<br>pass all group telegrams<br>**{pass all telegrams}** | Configuration setting for telegram routing when the Manual Function is active. |
| Switch-off time<br>for manual function | 10 min, 1 hour, 4 hours, 8 hours<br>**{1 hour}** | After expiry of this time period the Manual Function is switched off automatically. |

**Table 3.** General tab parameters

## 3.2 MAIN LINE

For Group Telegrams and Physical Telegrams the setting «transmit all» is intended only for testing purposes. Please do not use for normal operation.

If the parameter «Send confirmation on own telegrams» is set to «yes», the LC-S.1 systematically sends an ACK on any own routed telegram.

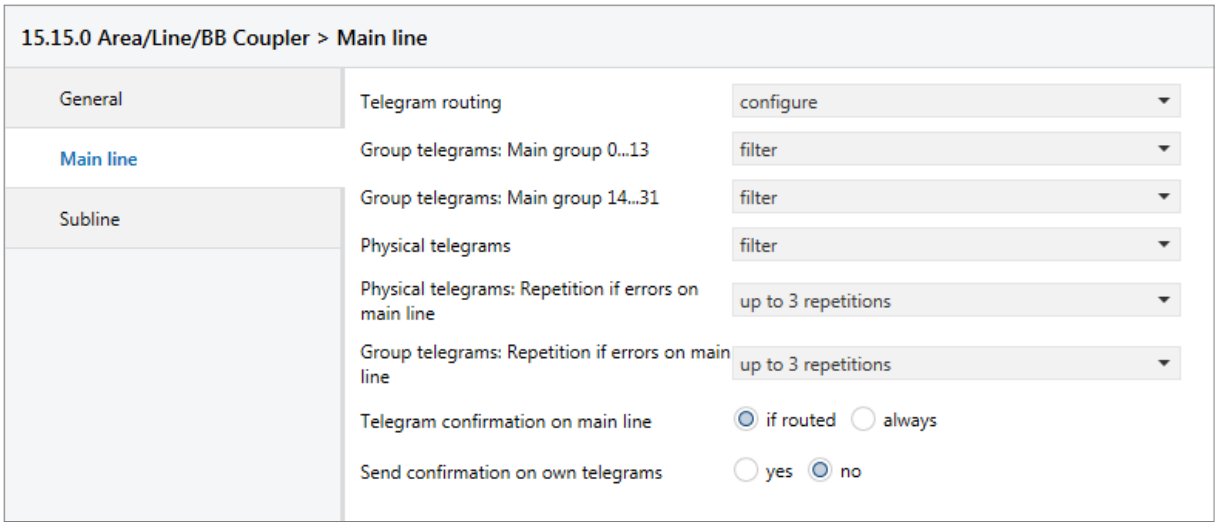



**Figure 7.** Main line tab parameters

| ETS Parameter | Setting<br>{Factory Default} | Comment | |
|---|---|---|---|
| Telegram routing | Group: filter, Physical: block<br>Group and Physical: filter<br>Group: route, Physical: filter<br>Group and Physical: route<br>configure<br>**{Group and Physical: filter}** | block: | no telegrams are routed |
| | | filter: | telegrams entered in the filter table are routed |
| | | route: | all telegrams are routed |
| | | configure: | the following parameters must be set manually |
| Group telegrams:<br>Main group 1...13 | transmit all (not recommended)<br>block<br>filter<br>**{filter}** | • Group telegrams (main group 0…13) are all routed.<br>• Group telegrams (main group 0…13) are all blocked.<br>• Group telegrams (main group 0…13) are routed if entered in the filter table. | |
| Group telegrams:<br>Main group 14...31 | transmit all (not recommended)<br>block<br>filter<br>**{filter}** | • Group telegrams (main group 14…31) are all routed.<br>• Group telegrams (main group 14…31) are all blocked.<br>• Group telegrams (main group 14…31) are routed if entered in the filter table. | |
| Physical telegrams | transmit all (not recommended)<br>block<br>filter<br>**{filter}** | • Physical telegrams are all routed.<br>• Physical telegrams are all blocked.<br>• Depending on the Individual Address Physical telegrams are routed. | |
| Physical telegrams:<br>Repetition if errors<br>on main line | no<br>up to 3 repetitions<br>only one repetition<br>**{up to 3 repetitions}** | After main line transmission error (e.g. due to missing receiver) Physical telegrams<br>• are not repeated.<br>• are repeated max. 3 times.<br>• are repeated once. | |
| Group telegrams:<br>Repetition if errors<br>on main line | no<br>up to 3 repetitions<br>only one repetition<br>**{up to 3 repetitions}** | After main line transmission error (e.g. due to missing receiver) Group telegrams<br>• are not repeated.<br>• are repeated max. 3 times.<br>• are repeated once. | |
| Telegram confirmation<br>on main line | if routed<br>always<br>**{if routed}** | • Routed telegrams to the subline are confirmed by an ACK on the main line.<br>• Each telegram on the mainline is confirmed by an ACK. | |
| Send confirmation<br>on own telegrams | yes<br>no<br>**{no}** | • Telegrams sent out to the mainline are confirmed by added ACK.<br>• No ACK confirmation. | |

**Table 4.** Main line tab parameter settings

## 3.3 SUBLINE

For Group Telegrams and Physical Telegrams the setting «transmit all» is intended only for testing purposes. Please do not use for normal operation.

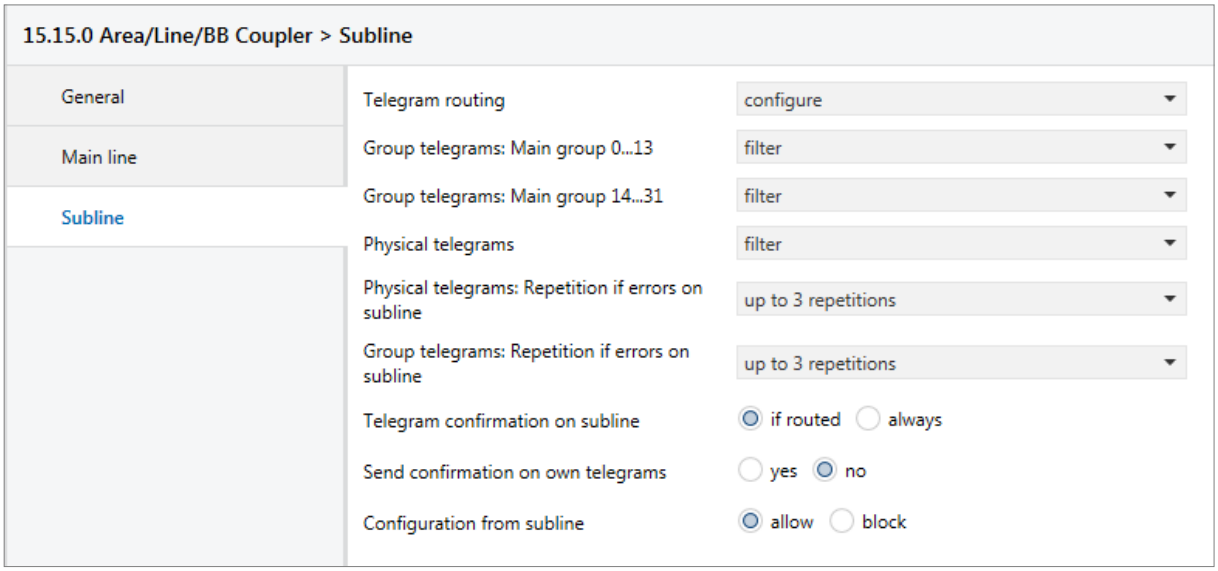



**Figure 8.** Subline tab parameters

| ETS Parameter | Setting<br>{Factory Default} | Comment | |
|---|---|---|---|
| Telegram routing | Group: filter, Physical: block<br>Group and Physical: filter<br>Group: route, Physical: filter<br>Group and Physical: route<br>configure<br>**{Group and Physical: filter}** | block: | no telegrams are routed |
| | | filter: | telegrams entered in the filter table are routed |
| | | route: | all telegrams are routed |
| | | configure: | the following parameters must be set manually |
| Group telegrams:<br>Main group 1...13 | transmit all (not recommended)<br>block<br>filter<br>**{filter}** | • Group telegrams (main group 0…13) are all routed.<br>• Group telegrams (main group 0…13) are all blocked.<br>• Group telegrams (main group 0…13) are routed if entered in the filter table. | |
| Group telegrams:<br>Main group 14...31 | transmit all (not recommended)<br>block<br>filter<br>**{filter}** | • Group telegrams (main group 14…31) are all routed.<br>• Group telegrams (main group 14…31) are all blocked.<br>• Group telegrams (main group 14…31) are routed if entered in the filter table. | |
| Physical telegrams | transmit all (not recommended)<br>block<br>filter<br>**{filter}** | • Physical telegrams are all routed.<br>• Physical telegrams are all blocked.<br>• Depending on the Individual Address Physical telegrams are routed. | |
| Physical telegrams:<br>Repetition if errors<br>on subline | no<br>up to 3 repetitions<br>only one repetition<br>**{up to 3 repetitions}** | After subline transmission error (e.g. due to missing receiver) Physical telegrams<br>• are not repeated.<br>• are repeated max. 3 times.<br>• are repeated once. | |
| Group telegrams:<br>Repetition if errors<br>on subline | no<br>up to 3 repetitions<br>only one repetition<br>**{up to 3 repetitions}** | After subline transmission error (e.g. due to missing receiver) Group telegrams<br>• are not repeated.<br>• are repeated max. 3 times.<br>• are repeated once. | |
| Telegram confirmation<br>on subline | if routed<br>always<br>**{if routed}** | • Routed telegrams to main line are confirmed by an ACK on the subline.<br>• Each telegram on the subline is confirmed by an ACK. | |
| Send confirmation<br>on own telegrams | yes<br>no<br>**{no}** | • Telegrams sent out to the subline are confirmed by added ACK.<br>• No ACK confirmation. | |
| Configuration<br>from subline | allow<br>block<br>**{allow}** | If blocked an ETS download to the LC-S.1 can occur only via main line. | |

**Table 5.** Subline tab parameter settings

# 4 ETS DATABASE PARAMETERS REPEATER

All screen shots are related to the LC-S.1 database file R3-0f in ETS5.

## 4.1 GENERAL

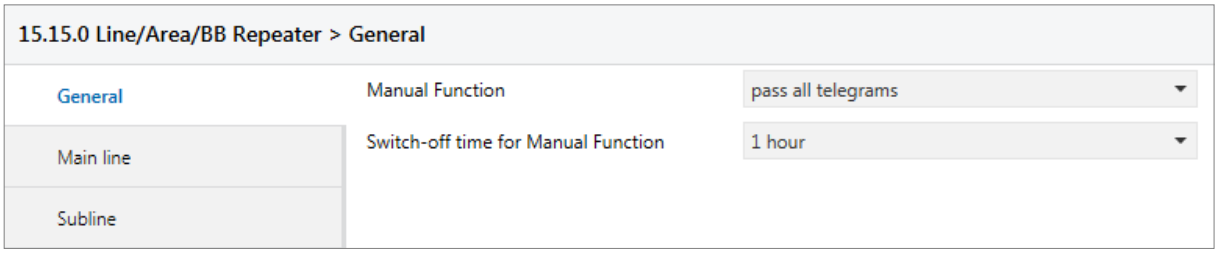



**Figure 9.** General tab parameters

| ETS Parameter | Setting<br>{Factory Default} | Comment |
|---|---|---|
| Manual function | disabled<br>pass all telegrams<br>pass all physical telegrams<br>pass all group telegrams<br>**{pass all telegrams}** | Configuration setting for telegram routing when the Manual Function is active. |
| Switch-off time<br>for manual function | 10 min, 1 hour, 4 hours, 8 hours<br>**{1 hour}** | After expiry of this time period the Manual Function is switched off automatically. |

**Table 6.** General tab parameter settings

## 4.2 MAIN LINE

For Group Telegrams and Physical Telegrams the setting «transmit all» is intended only for testing purposes. Please do not use for normal operation.

If the parameter «Send confirmation on own telegrams» is set to «yes», the LC-S.1 systematically sends an ACK on any own routed telegram. Since the repeater does not use a filter table, it is useful to have an ACK sent along with routed telegrams.

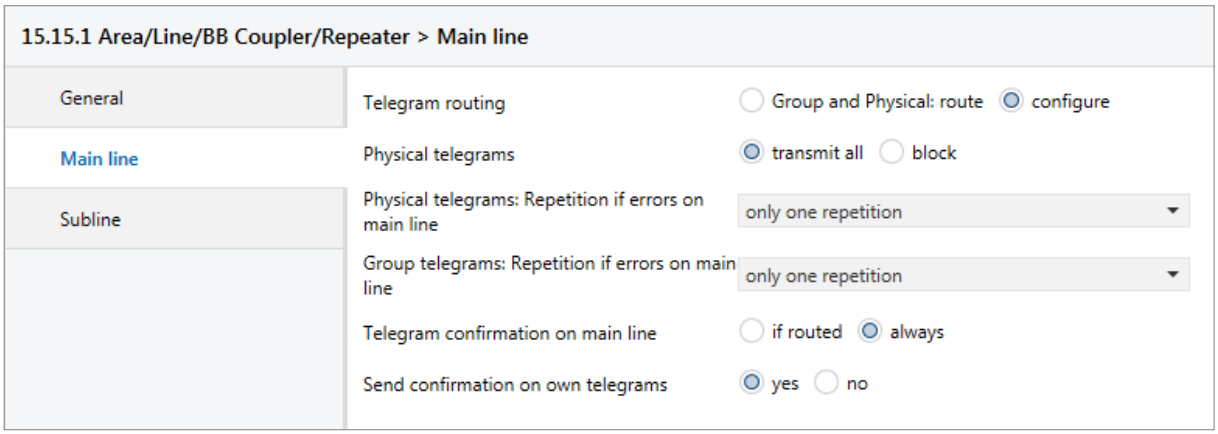



**Figure 10.** Main line tab parameters

| ETS Parameter | Setting<br>{Factory Default} | Comment | |
|---|---|---|---|
| Telegram routing | Group and Physical: route<br>configure<br>**{Group and Physical: route}** | route: | all telegrams are routed. |
| | | configure: | the following parameters must be set manually. |
| Physical telegrams | transmit all<br>block<br>**{transmit all}** | • Physical telegrams are all routed.<br>• Physical telegrams are all blocked. | |
| Physical telegrams:<br>Repetition if errors<br>on main line | no<br>up to 3 repetitions<br>only one repetition<br>**{up to 3 repetitions}** | After main line transmission error (e.g. due to missing receiver) Physical telegrams<br>• are not repeated.<br>• are repeated max. 3 times.<br>• are repeated once. | |
| Group telegrams:<br>Repetition if errors<br>on main line | no<br>up to 3 repetitions<br>only one repetition<br>**{up to 3 repetitions}** | After main line transmission error (e.g. due to missing receiver) Physical telegrams<br>• are not repeated.<br>• are repeated max. 3 times.<br>• are repeated once. | |
| Telegram confirmation<br>on main line | if routed<br>always<br>**{always}** | • Routed telegrams to the subline are confirmed by an ACK on the main line.<br>• Each telegram on the mainline is confirmed by an ACK. | |
| Send confirmation<br>on own telegrams | yes<br>no<br>**{yes}** | • Telegrams sent out to the main line are confirmed by added ACK.<br>• No ACK confirmation. | |

**Table 7.** Main line tab parameters

## 4.3 SUBLINE

For Group Telegrams and Physical Telegrams the setting «transmit all» is intended only for testing purposes. Please do not use for normal operation.

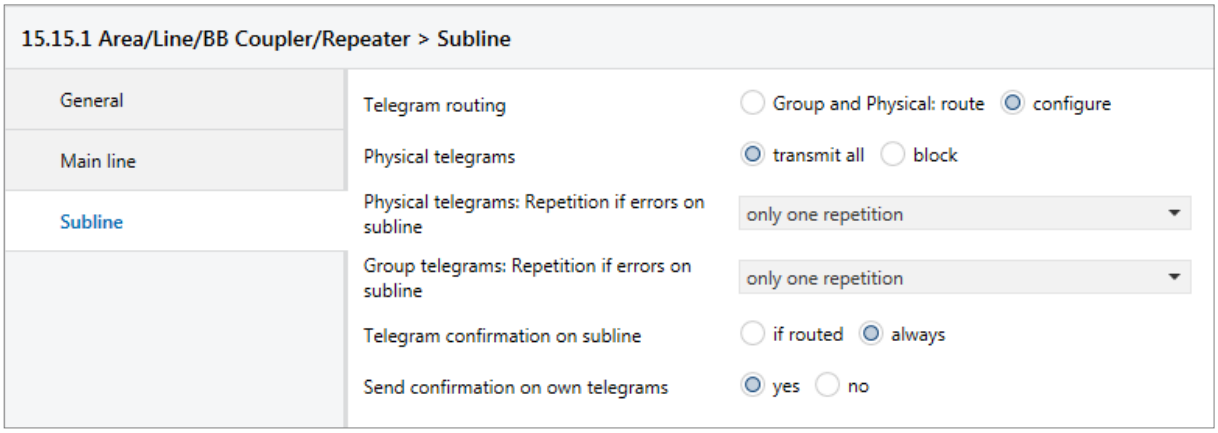



**Figure 11.** Subline tab parameters

| ETS Parameter | Setting<br>{Factory Default} | Comment | |
|---|---|---|---|
| Telegram routing | Group and Physical: route<br>configure<br>**{Group and Physical: route}** | route: | all telegrams are routed. |
| | | configure: | the following parameters must be set manually. |
| Physical telegrams | transmit all<br>block<br>**{transmit all}** | • Physical telegrams are all routed.<br>• Physical telegrams are all blocked. | |
| Physical telegrams:<br>Repetition if errors<br>on subline | no<br>up to 3 repetitions<br>only one repetition<br>**{up to 3 repetitions}** | After subline transmission error (e.g. due to missing receiver) Physical telegrams<br>• are not repeated.<br>• are repeated max. 3 times.<br>• are repeated once. | |
| Group telegrams:<br>Repetition if errors<br>on subine | no<br>up to 3 repetitions<br>only one repetition<br>**{up to 3 repetitions}** | After subline transmission error (e.g. due to missing receiver) Group telegrams<br>• are not repeated.<br>• are repeated max. 3 times.<br>• are repeated once. | |
| Telegram confirmation<br>on subline | if routed<br>always<br>**{always}** | • Routed telegrams to main line are confirmed by an ACK on the subline.<br>• Each telegram on the subline is confirmed by an ACK. | |
| Send confirmation<br>on own telegrams | yes<br>no<br>**{yes}** | • Telegrams sent out to the subline are confirmed by added ACK.<br>• No ACK confirmation. | |

**Table 8.** Subline (KNX TP) tab parameter settings

# 5 STATE OF DELIVERY

## 5.1 DEFAULT FACTORY SETTING

| **General** | |
|---|---|
| Individual Address | 15.15.0 |

| **Main line** | |
|---|---|
| Group telegrams (main group 0…13) | filter (filter table is empty) |
| Group telegrams (main group 14…31) | route all |
| Physical telegrams | filter |
| Physical: Repetition if errors on main line | up to 3 repetitions |
| Group: Repetition if errors on main line | up to 3 repetitions |
| Telegram confirmations on main line | if routed |
| Send confirmation on own telegrams | no |

| **Subline** | |
|---|---|
| Group telegrams (main group 0…13) | filter (filter table is empty) |
| Group telegrams (main group 14…31) | route all |
| Physical telegrams | filter |
| Physical: Repetition if errors on subline | up to 3 repetitions |
| Group: Repetition if errors on subline | up to 3 repetitions |
| Telegram confirmations on subline | if routed |
| Send confirmation on own telegrams | no |
| Configuration from subline | allow |