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State 09/2013

# Technical Manual



## MDT RF Line Coupler

### KNX RF+

#### RF-LK001.01

#### **Further Documents:**

##### **Datasheet:**

[https://www.mdt.de/EN\\_Downloads\\_Datasheets.html](https://www.mdt.de/EN_Downloads_Datasheets.html)

##### **Assembly and Operation Instructions:**

[https://www.mdt.de/EN\\_Downloads\\_Instructions.html](https://www.mdt.de/EN_Downloads_Instructions.html)

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## 2 Overview

### 2.1 Usage

The RF-LK connects KNX Twisted Pair lines with KNX RF+ lines. So the Line Coupler works as connector between these both transmission medium.

The RF Line Coupler can evaluate adjusted filter settings at the transmission between both medium. These can block certain addressing types or work with automatically or manually generated filter tables.

The RF-LK001.01 supports the new KNX RF+ protocol in system mode and is available in the version for ETS3/4 or ETS5.

Detailed information for planning and working with radio lines via the KNX RF+ protocol can be downloaded at [http://www.mdt.de/EN\\_Downloads\\_Manuals.html](http://www.mdt.de/EN_Downloads_Manuals.html).

### 2.2 Exemplary circuit diagram

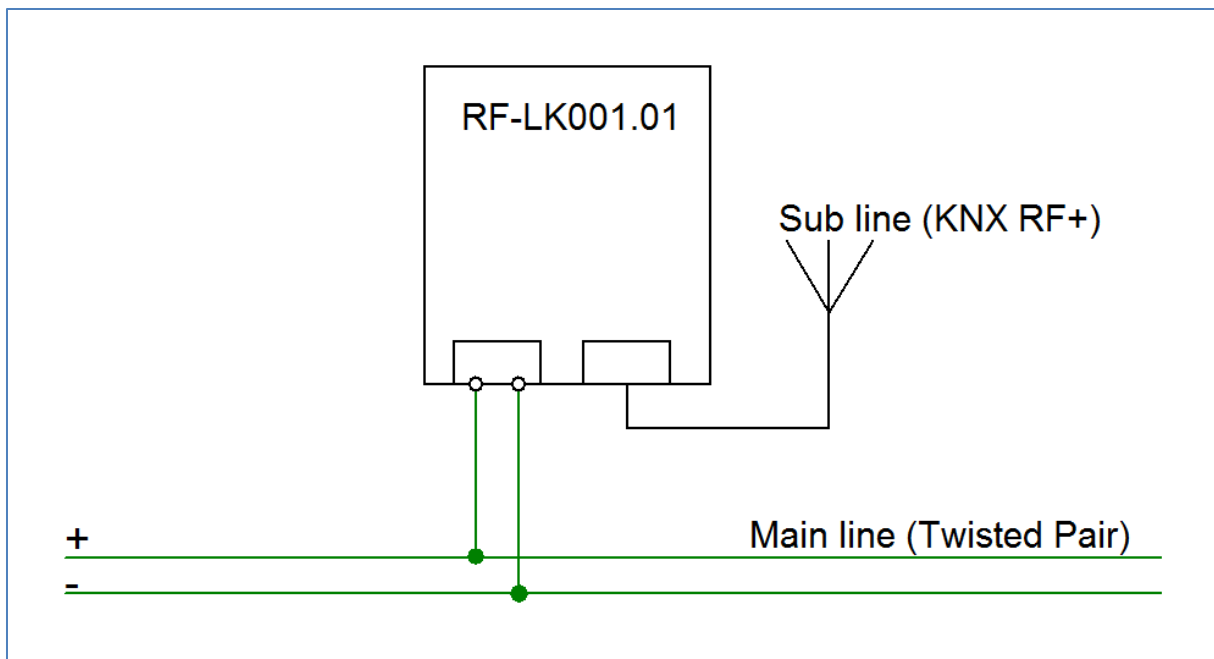


Figure 1: Exemplary circuit diagram

## 2.3 Functions

If the Coupler receives telegrams receives telegrams, which are physical addressed, the RF Line Coupler compares the physical address of the transmitter with its own and decides whether the address should be forwarded or not. Broadcast telegrams, which are used for programming devices, are always forwarded if needed.

Telegrams, which are addressed by group addresses, are evaluated by considering the individual settings of the RF Line Coupler. During the normal mode (Default-Settings), telegrams are forwarded, which are in the filter table.

If the Coupler does not receive a confirmation for a forwarded telegram or if a device recognizes a transmission error, the Coupler will repeat the telegram, concerning its settings, up to three times.

## 2.4 Structure & Handling

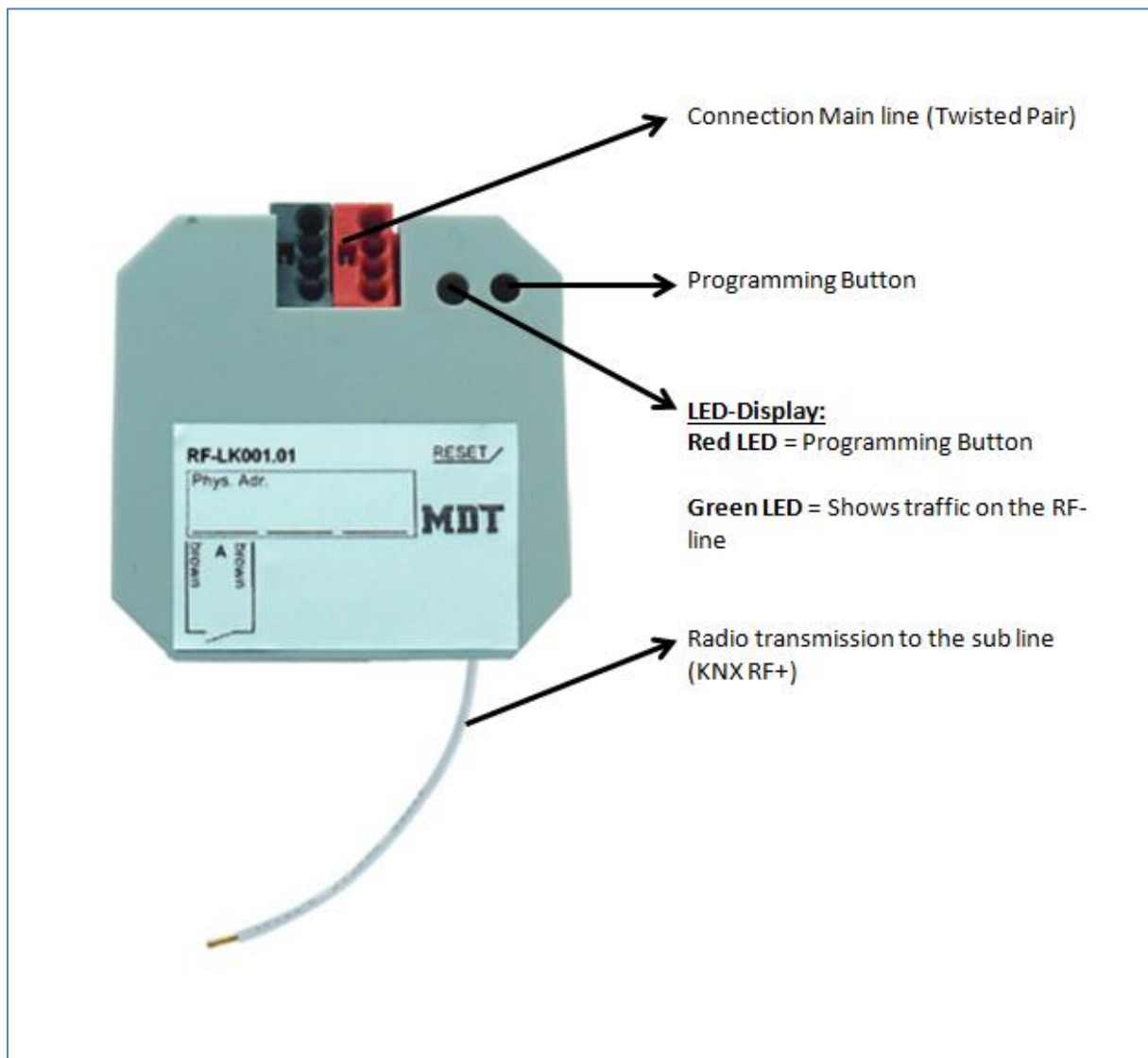


Figure 2: Overview hardware

## 2.5 Topology & Areas of use

The MDT RF Line Coupler can be used in every case, when KNX Twisted Pair lines and KNX RF+ lines should be connected. Although the MDT RF Line Coupler transmits only the telegrams from Twisted Pair to KNX RF+ and vice versa, which are set in the parameters. By using the new KNX RF+ standard, old gateways, which were earlier necessary for transmission on RF-lines, are no longer used. The communication at RF Line is in the same way self-sufficient as the communication at TP Lines. The following figure shows an exemplary topology of combining TP Lines and RF Lines:

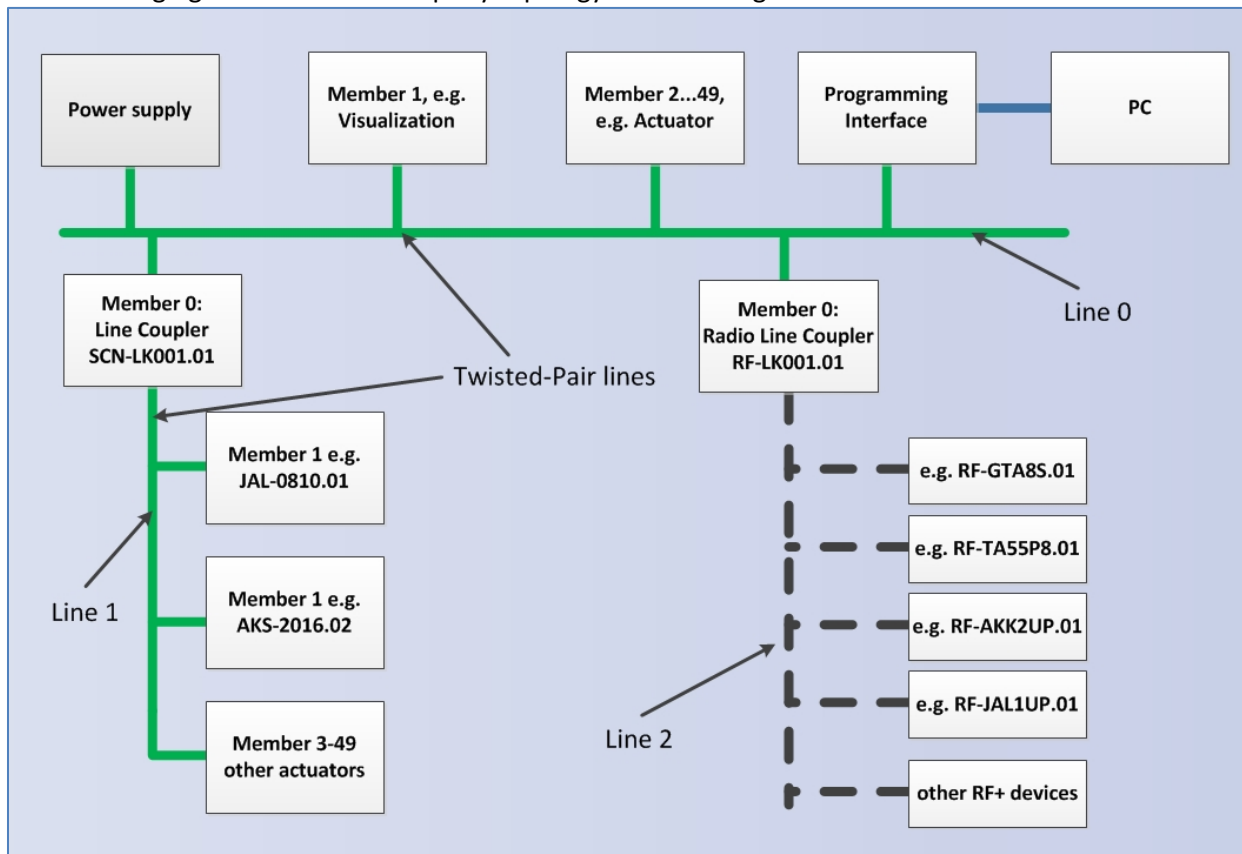


Figure 3: Topology

The topology at using KNX RF+ devices is the same as using normal TP devices. For connecting both lines, the KNX RF+ Line Coupler is necessary. Every TP Line must have an own bus power supply. KNX RF+ Lines does not need any external power supply and there is no limitation to 64 devices per line. At RF+ lines only the bus load is the limitation of each line. All MDT RF+ lines work without any batteries and can be connected directly to 230V AC.

### 3 ETS-Parameters

#### 3.1 Main Line

Configuration	configure
Group telegrams	filter
Main group telegrams 14 / 15	transmit all
Physical telegrams	filter
Physical: Repetition if errors on main line	normal
Group: Repetition if errors on main line	normal
Telegram confirmations on line	if routed
Send confirmation on own telegrams	no

Figure 4: Main Line

The following chart shows the available settings for the submenu “Main Line”:

ETS-text	Dynamic range [default value]	comment
Configuration	<ul style="list-style-type: none"> <li>▪ groups: filter, physical: block</li> <li>▪ <b>groups, physical: filter</b></li> <li>▪ groups: route, physical: filter</li> <li>▪ configure</li> </ul>	<ul style="list-style-type: none"> <li>- <b>Block</b>: no telegram is routed.</li> <li>- <b>Filter</b>: Only telegrams are routed which are entered in the filter table.</li> <li>- <b>Route</b>: the telegrams are routed.</li> <li>- <b>Configure</b>: the following parameters can be set individually.</li> </ul> <p>This parameter is to be set depending on the planed configuration.</p>
Group telegrams	<ol style="list-style-type: none"> <li>1. block</li> <li>2. <b>filter</b></li> </ol>	<ol style="list-style-type: none"> <li>1. No group telegram is transmitted.</li> <li>2. Only group telegrams are routed which are entered in the filter table.</li> </ol> <p>ETS 3/4 produces the filter table automatically.</p>
Main group telegrams 14/15	<ol style="list-style-type: none"> <li>1. block</li> <li>2. <b>transmit all</b></li> </ol>	<ol style="list-style-type: none"> <li>1. Group telegrams with the main group 14 or 15 (e.g. 14/1) are not routed.</li> <li>2. Group telegrams with the main group 14 or 15 (e.g. 14/1) are routed.</li> </ol>

Physical telegrams	<ol style="list-style-type: none"> <li>1. block</li> <li>2. <b>filter</b></li> </ol>	<ol style="list-style-type: none"> <li>1. No physical telegram is transmitted.</li> <li>2. Only physical telegrams are routed based on physical address.</li> </ol>
Physical: Repetition if errors on main line	<ol style="list-style-type: none"> <li>1. no</li> <li>2. reduced</li> <li>3. <b>normal</b></li> </ol>	<p>If a transmission error (e.g. due to missing receiver) is found when sending a physical telegram on the main line:</p> <ol style="list-style-type: none"> <li>1. The physical telegram is not repeated.</li> <li>2. The physical telegram will be repeated only one time.</li> <li>3. The physical telegram is repeated up to 3 times.</li> </ol>
Group: Repetition if errors on main line	<ol style="list-style-type: none"> <li>1. no</li> <li>2. reduced</li> <li>3. <b>normal</b></li> </ol>	<p>If a transmission error (e.g. due to missing receiver) is found when sending a group telegram on the main line:</p> <ol style="list-style-type: none"> <li>1. The group telegram is not repeated.</li> <li>2. The group telegram will be repeated only one time.</li> <li>3. The group telegram is repeated up to 3 times.</li> </ol>
Telegram confirmations on line	<ol style="list-style-type: none"> <li>1. always</li> <li>2. <b>if routed</b></li> </ol>	<ol style="list-style-type: none"> <li>1. Each telegram on the main line is confirmed (ACK).</li> <li>2. Only telegrams which are to be routed are confirmed on the main line (ACK).</li> </ol>
Send confirmation on own telegrams	<ol style="list-style-type: none"> <li>1. yes</li> <li>2. <b>no</b></li> </ol>	<ol style="list-style-type: none"> <li>1. Every telegram on the main line is confirmed with its own ACK (from the Line coupler).</li> <li>2. No confirmation with own ACK</li> </ol>

Table 1: Main Line

### 3.2 Sub/RF Line

Configuration	configure
Group telegrams	filter
Sub group telegrams 14 / 15	transmit all
Physical telegrams	filter
Physical: Repetition if errors on sub line	normal
Group: Repetition if errors on sub line	normal
Telegram confirmations on line	if routed
Send confirmation on own telegrams	no

Figure 5: Sub/RF Line

The following chart shows the available settings for the submenu “Line”:

ETS-text	Dynamic range [default value]	comment
Configuration	<ul style="list-style-type: none"> <li>▪ groups: filter, physical: block</li> <li>▪ <b>groups, physical: filter</b></li> <li>▪ groups: route, physical: filterconfigure</li> </ul>	<ul style="list-style-type: none"> <li>- <b>Block</b>: no telegram is routed.</li> <li>- <b>Filter</b>: Only telegrams are routed which are entered in the filter table.</li> <li>- <b>Route</b>: the telegrams are routed.</li> <li>- <b>Configure</b>: the following parameters can be set individually.</li> </ul> <p>This parameter is to be set depending on the planed configuration.</p>
Group telegrams	<ol style="list-style-type: none"> <li>1. block</li> <li>2. <b>filter</b></li> </ol>	<ol style="list-style-type: none"> <li>1. No group telegram is transmitted.</li> <li>2. Only group telegrams are routed which are entered in the filter table.</li> </ol> <p>The ETS 3/4 produces the filter table automatically.</p>
Sub group telegrams 14/15	<ol style="list-style-type: none"> <li>1. block</li> <li>2. <b>transmit all</b></li> </ol>	<ol style="list-style-type: none"> <li>1. Group telegrams with the sub group 14 or 15 (e.g. 14/1) are not routed.</li> <li>2. Group telegrams with the sub group 14 or 15 (e.g. 14/1) are routed.</li> </ol>
Physical telegrams	<ol style="list-style-type: none"> <li>1. block</li> <li>2. <b>filter</b></li> </ol>	<ol style="list-style-type: none"> <li>1. No physical telegram is transmitted.</li> <li>2. Only physical telegrams are routed based on physical address.</li> </ol>



Physical: Repetition if errors on sub line	<ol style="list-style-type: none"> <li>1. no</li> <li>2. reduced</li> <li>3. <b>normal</b></li> </ol>	<p>If a transmission error (e.g. due to missing receiver) is found when sending a physical telegram on the sub line:</p> <ol style="list-style-type: none"> <li>1. The physical telegram is not repeated.</li> <li>2. The physical telegram will be repeated only one time.</li> <li>3. The physical telegram is repeated up to 3 times.</li> </ol>
Group: Repetition if errors on sub line	<ol style="list-style-type: none"> <li>1. no</li> <li>2. reduced</li> <li>3. <b>normal</b></li> </ol>	<p>If a transmission error (e.g. due to missing receiver) is found when sending a group telegram on the sub line:</p> <ol style="list-style-type: none"> <li>1. The group telegram is not repeated.</li> <li>2. The group telegram will be repeated only one time.</li> <li>3. The group telegram is repeated up to 3 times.</li> </ol>
Telegram confirmations on line	<ol style="list-style-type: none"> <li>1. always</li> <li>2. <b>if routed</b></li> </ol>	<ol style="list-style-type: none"> <li>1. Each telegram on the sub line is confirmed (ACK).</li> <li>2. Only telegrams which are to be routed are confirmed on the sub line (ACK).</li> </ol>
Send confirmation on own telegrams	<ol style="list-style-type: none"> <li>1. yes</li> <li>2. <b>no</b></li> </ol>	<ol style="list-style-type: none"> <li>1. Every telegram on the sub line is confirmed with its own ACK (from the Line coupler).</li> <li>2. No confirmation with own ACK</li> </ol>

Table 2: Sub/RF Line

## 4 Settings at the ETS

### 4.1 Topology of the project

The project is identical with projects with Twisted Pair Line Coupler, but every connection from TP to radio can only be realized by using the Line Coupler RF-LK001.01.

An exemplary project could look like this:

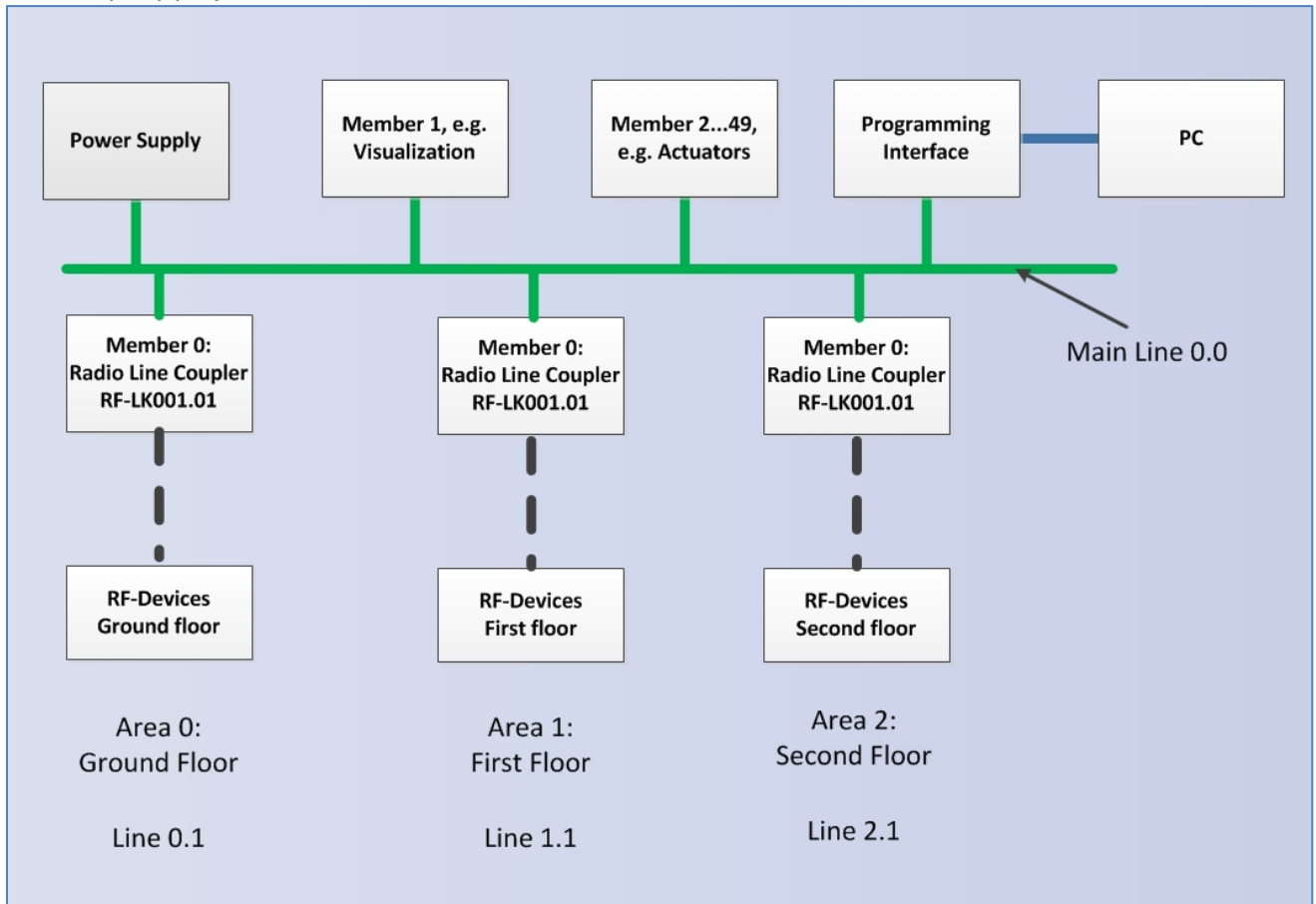


Figure 6: Topology Example

At the ETS, the topology looks like this:

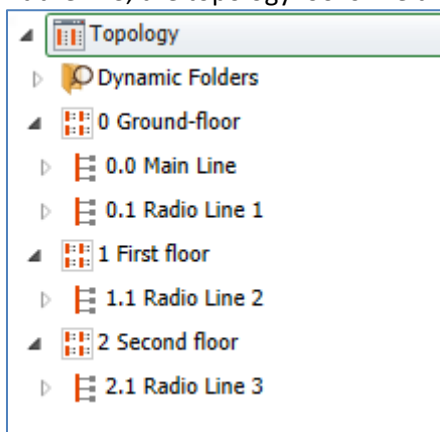


Figure 7: Topology ETS

If the presentation of one radio line is expanded, it looks like this:

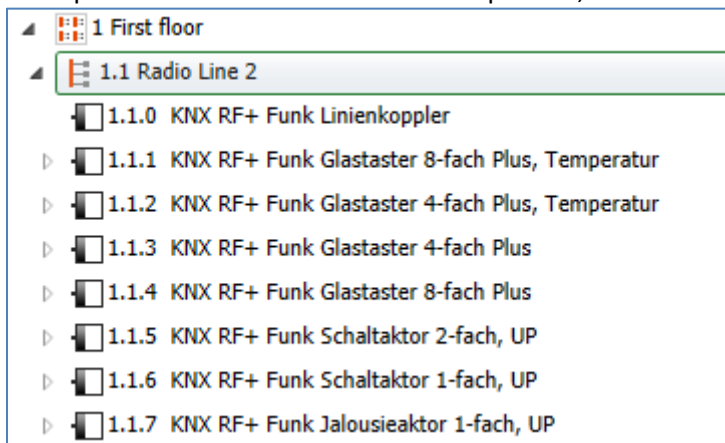


Figure 8: Radio Line ETS

As shown in the upper picture, a radio line in ETS has an easy design and looks like a normal TP-line. The Line Coupler, which must always be member 0, is the “connector” between Twisted Pair and KNX RF+. Every KNX RF+ device is used as a normal TP-device. An additional power supply is not necessary for radio lines, because every KNX RF+ device has a connector for 230V AC.

The main line has the same design like a normal TP-line:

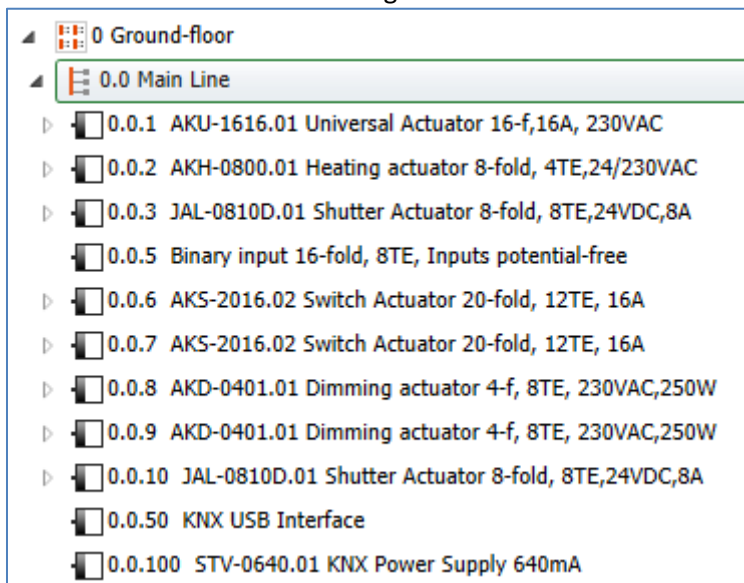


Figure 9: Main Line ETS

## 4.2 Telegram Forwarding

Two ways of telegram forwarding are differentiated:

1. Telegrams with physical addressing
2. Telegrams with group addressing

The addressing with physical addresses is, for example, used at the programming of the devices, whereas the addressing by group addresses is used at the “normal” bus communication.

The behavior of the Line Coupler at telegrams with physical addressing is easy. If the physical target address is in the line of the Line Coupler, the telegram is forwarded else not.

The behavior of the Line Coupler at group telegrams is defined by filter tables. For that matter, the filter tables indicate the group addresses, which are forwarded from KNX TP to KNX RF+ and vice versa.

For doing this, the Line Coupler listens at the TP line and at the RF+ line to all group telegrams and compares the target address with group addresses in the filter table. If the target address is in the filter table, the telegram will be forwarded to the other medium else not.

## 4.3 Generating Filter Table

The filter table will be generated automatically from the ETS. However there are exceptions in which it can be useful to add group addresses manually to the filter table.

Every group address, which connects communication objects of TP lines and RF+ lines, are automatically added to the filter table. So all group address are in the filter table, which are necessary for the communication between the devices. As mentioned at the beginning of this paragraph, in some cases it can be useful to add addresses manually to the filter table, e.g. for displaying the group addresses in Visualizations or for using the group address at diagnostics at the group/bus monitoring.

For adding the group addresses manually, the group address must be selected in the ETS and the option “Pass through Line Coupler” must be set from No to Yes:

Sub Gro...	Name	Descripti...	Cent...	Pass Through Line Coupler	Last Val...
0	Button 1 - Shutter		No	No	
1	Button 2 -Shutter		No	No	
2	Button 2 - Slats		No	No	
3	Button 3/4 - Switch On/Off		No	No	
4	Day/Night		No	No	
5	Temperature		No	Yes	

Yes
No

Figure 10: Set Filter Table manually

It should be considered, that manual added group addresses can pass all Line Couplers. So the bus load is increased on all lines. So only group addresses should be added, which are really needed.

## 4.4 Preview Filter Table

A preview of the current Filter table can be seen as follows:

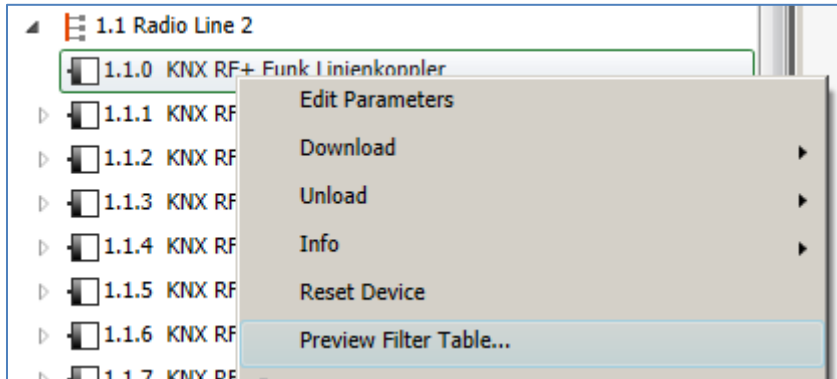


Figure 11: Preview Filter table

For that purpose, you click with the right mouse button at the Line Coupler. Now you can choose the entry “Preview Filter table...” in the context menu. The Filter table shows every group address, which will be transmitted from TP to radio and vice versa:



Figure 12: Preview Filter table 2

## 4.5 Approach at startup

After all devices are integrated in the project, appropriate the right topology like described in 4.1 Topology of the project, the devices can be parameterized according to the own wishes. It is recommended to use the RF-LK001.01 with the default settings. The right course of action at the startup is very important, because otherwise the exchange of data between TP and radio cannot be guaranteed.

### 1. Programming the Line Coupler

By programming the Line Coupler, the current settings are load into the Line Coupler. Furthermore the current Filter table is loaded into the Line Coupler.

### 2. Programming der MDT RF+ Devices

By programming the KNX RF+ Devices the parameter settings are load in the memory of the devices. This procedure is the same at radio devices as at TP-devices. Furthermore the programming of the KNX RF+ devices writes the domain address into the KNX RF+ devices. This domain address is unique for each line and guarantees that all device of a line can communicate with each other, but devices out of the lines does not disturb this devices.

**Important: At every change of the project, the Line Coupler must be load again(Download Application). Afterwards every device, which is changed, must be programmed again.**

**If Changes at the topology of the project are made, at first the Line Coupler must be downloaded and afterwards every device, which is involved of the change of the topology, must be downloaded again.**

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## 6 Attachment

### 6.1 Statutory requirements

The above-described devices must not be used with devices, which serve directly or indirectly the purpose of human, health- or lifesaving. Further the devices must not be used if their usage can occur danger for humans, animals or material assets.

Do not let the packaging lying around careless, plastic foil/ -bags etc. can be a dangerous toy for kids.

### 6.2 Routine disposal

Do not throw the waste equipment in the household rubbish. The device contains electrical devices, which must be disposed as electronic scrap. The casing contains of recyclable synthetic material.

### 6.3 Assemblage



#### **Risk for life of electrical power!**

All activities on the device should only be done by an electrical specialist. The county specific regulations and the applicable EIB-directives have to be observed.



## 6.4 Datasheet