

Arno Schöchlin



- ▶ For KNX beginners and advanced
- ▶ Simple implementation of the learned with the help of numerous pictures and practical tips
- ▶ Contains a variety of templates for everyday use

# KNX programming made easy

The practice book for  
learning and looking up

Current  
version

**ETS3**  
**ETS4**  
**ETS5**



**EBOOK24-7**

*The side that creates knowledge*

## Inhaltsverzeichnis

<b>1. Project planning</b>	<b>12</b>
1.1 Customer meeting.....	12
1.2 Meeting with the customer.....	13
1.3 Determining the bus participants.....	14
<b>2. Configuration</b>	<b>15</b>
2.1 The structure of the building.....	15
2.2 The structure of the group addresses.....	16
2.2.1 Structure of the group address.....	18
2.2.2 Creating links to the group addresses.....	20
2.3 The physical address.....	22
2.3.1 Structure of a physical address.....	22
2.4 Coupler as line amplifier.....	23
2.5 Line and backbone coupler.....	24
2.6 Topology.....	25
2.6.1 Topology structure.....	25
2.6.2 Topology with line amplifier.....	26
2.7 Line lengths.....	27
2.8 Routing counter.....	28
2.9 Bus participants.....	31
2.9.1 Adding bus participants.....	31
2.9.2 Bus participant parameterising.....	32
2.10 Communication objects.....	33
2.10.1 The switching object.....	33
2.10.2 The dimming object.....	33
2.10.3 The long-term object.....	34
2.10.4 The short-term object.....	35
2.10.5 The position object.....	35
2.11 Data types.....	36
2.12 Of bit and byte.....	39
2.13 The flags.....	40
2.14 The communication flag (C flag).....	40
2.15 The reading flag (R flag).....	40
2.16 The writing flag (W flag).....	41
2.17 The transfer flag (T flag).....	41
2.18 The update flag (U flag).....	41
2.19 The priority of a telegram.....	42
2.19.1 Types of priority.....	42
2.19.2 What happens if telegrams have the same level of priority?.....	42
2.19.3 When should you use which type of priority?.....	42
<b>3. Programming</b>	<b>43</b>
3.1 Programming modes.....	43
3.1.1 Programming a physical address only.....	43
3.1.2 Program application only.....	43
3.1.3 Program physical address and application.....	43
3.1.4 Partial programming.....	43
3.1.5 This can save you time in large applications.....	44
3.2 Assigning a physical address.....	45

---

3.3 Load application (user software).....	45
3.4 Programming filter tables.....	46
3.5 Programming state.....	46
3.6 Unloading participants.....	47
3.7 Resetting participants.....	49
<b>4. ETS3</b> .....	<b>50</b>
4.1 ETS database settings.....	50
4.1.1 Creating a new database in ETS3.....	51
4.1.2 Template database for ETS3.....	51
4.1.3 Importing a manufacturer database.....	52
4.2 Installing the plug-in.....	53
4.3 Group monitor.....	59
4.3.1 Send a telegram to the bus.....	60
4.3.2 Reading a telegram.....	61
4.3.3 Meaning of the columns in the group monitor.....	62
4.3.4 Storing telegrams.....	63
4.3.5 Opening a telegram from a file.....	63
4.3.6 Telegram continuous recording.....	64
4.3.7 Playing telegram files.....	65
4.4 Bus monitor.....	65
4.4.1 Meaning of ACK (acknowledge).....	65
4.4.2 Colourings of telegrams in the group and bus monitor.....	66
4.5 Creating a new project in ETS3.....	67
<b>4.6 Setting up data interfaces</b> .....	<b>67</b>
4.6.1 The local access type.....	68
4.6.2 Access type via the bus.....	68
4.7 Diagnosis.....	69
4.7.1 Device(s) in programming mode.....	70
4.7.2 Check if an address exists and locate a device.....	70
4.7.3 Device LED.....	70
4.7.4 List all addresses of a line.....	71
4.7.5 Reading out device information.....	72
4.8 Testing the programming.....	73
4.9 Add it and run the test again.....	75
4.9.1 Building window.....	76
4.9.2 Devices window.....	77
4.9.3 Topology window.....	78
4.9.4 Group addresses window.....	79
4.9.5 Modified devices window.....	80
4.9.6 Devices not assigned to a line window.....	80
4.9.7 Devices not assigned to a room / system.....	81
4.10 Programming.....	81
<b>5. ETS4</b> .....	<b>84</b>
5.1 Database settings.....	84
5.1.1 Creating a new database with ETS4.....	85
5.1.2 Template database for ETS4.....	86
5.1.3 Importing a manufacturer database.....	89
5.2 Installing the plug-in.....	94
5.3 Group monitor.....	104
5.3.1 Sending a telegram to the bus.....	105

---

---

5.3.2 Reading a telegram .....	105
5.3.3 Meaning of the columns in the group monitor .....	106
5.3.4 Storing telegrams .....	107
5.3.5 Opening a telegram from a file .....	107
5.3.6 Telegram continuous recording .....	107
5.3.7 Playing telegram files .....	109
5.4 Bus monitor .....	110
5.4.1 Meaning of ACK (acknowledge) .....	110
5.4.2 Colourings in the group and bus monitor .....	111
5.5 Diagnosis .....	111
5.5.1 Device info .....	111
5.5.2 Physical addresses .....	112
5.5.3 Device(s) in programming mode .....	113
5.5.4 Check if an address exists and locate a device .....	113
5.5.5 List all addresses of a line .....	113
5.5.6 Project review .....	114
5.5.7 Device verification .....	115
5.5.8 Group address test .....	115
5.5.9 Topology verification .....	116
5.5.10 Product information verification .....	116
5.5.11 Result of the project review .....	117
5.6 Working areas .....	118
5.6.1 Building window .....	119
5.6.2 Group addresses window .....	120
5.6.3 Topology window .....	120
5.6.4 Entire project window .....	121
5.6.5 All devices window .....	122
5.6.6 Favourites window .....	123
5.7 Creating a new project with ETS4 .....	124
5.8 Setting up the data interface .....	126
5.9 Programing .....	127
<b>6. ETS5 .....</b>	<b>129</b>
6.1 Settings .....	130
6.2 Managing and creating projects .....	131
6.3 Create a new project .....	132
6.4 Line type .....	132
6.4.1 TP Twisted Pair .....	132
6.4.2 PL Power Line .....	132
6.4.3 RF Radio Frequency, Radio .....	133
6.4.4 IP Ethernet .....	133
6.5 Importing / exporting a project .....	134
6.6 The project wizard .....	134
6.7 Interfaces and communication .....	137
6.7.1 Connections .....	137
6.7.2 EIBlib/IP (IP routing) .....	139
6.8 Diagnosis .....	140
6.9 Group monitor .....	140
6.9.1 Sending a telegram to the bus .....	141
6.9.2 Reading a telegram .....	141
6.9.3 Meaning of the columns in the group monitor .....	142
6.9.4 Storing telegrams .....	143

---

6.9.5 Opening telegrams from a file.....	143
6.9.6 Playing telegram file.....	144
6.10 Bus monitor.....	144
6.10.1 Meaning of ACK (acknowledge).....	145
6.10.2 Colourings of the telegrams in the group and bus monitor.....	145
6.11 Unloading a device.....	146
6.12 Device info.....	147
6.13 Programming mode.....	148
6.14 Physical address verification.....	148
6.15 Working areas.....	150
6.15.1 Building.....	151
6.15.2 Group addresses.....	152
6.15.3 Topology.....	153
6.15.4 Entire project.....	154
6.15.5 Devices.....	155
6.15.6 Reports.....	156
6.15.7 Line scan.....	158
6.16 Template database for ETS5.....	160
6.17 Programming.....	160
6.18 Importing databases.....	162
<b>7. Creating a project.....</b>	<b>163</b>
7.1 Project description.....	164
7.2 KNX device list.....	165
7.3 Creating a building structure.....	172
7.3.1 Adding a building.....	172
7.3.2 Adding building parts.....	172
7.3.3 Adding rooms.....	172
7.3.4 Adding a control cabinet.....	173
7.3.5 Adding bus participants.....	174
7.3.6 Bus participant parameterising.....	178
7.3.6.1 The parameters of the 1.1.1 switching actuator.....	179
7.3.6.2 The parameters of the 1.1.2 switching actuator.....	185
7.3.6.3 Parameters of the 2-fold dimming actuator 1.1.3.....	187
7.3.6.4 Parameterisation of the push button sensors.....	190
7.4 Creating the structure of group addresses.....	203
7.4.1 Adding main groups.....	204
7.4.2 Creating a middle group.....	204
7.4.3 Creating a group address.....	204
7.4.4 Group address for a switched lighting.....	204
7.4.5 Group addresses for a dimmed Lighting.....	204
7.4.6 Group addresses for a blind.....	205
7.5 Links.....	206
7.5.1 Link a group address from the context menu.....	207
7.5.2 Programming a dimming circuit.....	208
7.5.3 The switching object of a lighting lighting.....	208
7.5.4 Linking the dimming object of a lighting.....	209
7.5.5 Linking a deactivation.....	211
7.5.6 Linking a blinds circuit.....	212
7.5.7 Creating a central circuit.....	213
<b>8. The setup.....</b>	<b>218</b>
8.1 Programming KNX devices.....	218

---

8.2 Testing the applications .....	219
8.2.1 Push button sensors .....	220
8.2.2 Weather station .....	220
8.2.3 Heating .....	220
8.2.4 Light control .....	221
8.2.5 Sample recordings of the group monitor .....	221
8.3 Troubleshooting .....	223
8.3.1 Short test with a bus coupler .....	223
8.3.2 Problems when overlaying the Application .....	223
8.3.2.1 USB interface .....	223
8.3.2.2 IP router .....	224
8.3.3 Troubleshooting with the group monitor .....	225
8.3.3.1 Telegram repetitions .....	225
8.3.3.2 No group address assigned .....	225
8.3.3.3 Flag incorrectly set. ....	225
8.3.3.4 Wrong application module .....	225
8.3.3.5 Actuator error .....	225
8.3.3.6 Wrong KNX device .....	226
8.3.3.7 Error due to line coupler .....	226
<b>9. Sample circuits .....</b>	<b>227</b>
9.1 Twilight-dependent circuits .....	227
9.2 Linking functions .....	230
9.3 WC circuit .....	231
9.4 Applications of the locking function .....	235
9.5 Motion detector .....	236
9.5.1 Application type: .....	237
9.5.2 Switching telegram at the beginning of a recording: .....	237
9.5.3 Twilight stage: .....	237
9.5.4 Switching telegram at the end of a recording: .....	238
9.5.5 Locking time: .....	238
9.5.6 Locking function: .....	238
9.5.7 Switching telegram at the beginning of the .....	238
9.5.8 Switching telegram at the end of the lock: .....	238
9.5.9 Single device: .....	239
9.5.10 Example with two motion detectors .....	239
9.5.10.1 Parameterise the main unit .....	239
9.5.10.2 Parameterise an extension .....	241
9.5.10.3 Creating links .....	243
9.5.10.4 Controlling the motion detector by a push button .....	244
9.5.10.5 Parameterise a single device .....	245
9.6 Logic function .....	246
9.6.1 Two workstations, three lights .....	246
9.6.2 Partition circuit with a partition wall .....	251
9.7 Individual room temperature control .....	256
9.7.1 2-point controller .....	256
9.7.1.1 Parameter settings for the heating actuator .....	256
9.7.1.2 Parameter settings of the continuous controller .....	258
9.7.1.3 The linking of a heating actuator and .....	261
9.7.2 PI controller with normal control valve .....	263
9.7.2.1 Parameter settings for the heating actuator .....	263

---

9.7.2.2 Parameter settings of the continuous controller	264
9.7.2.3 The linking of a heating actuator and Continuous controller	268
9.7.3 PI controller with KNX control valve	270
9.7.3.1 Parameter settings of the continuous controller	270
9.7.3.2 Parameter settings for the actuator	274
9.7.3.3 Linking of the continuous controller and the control valve	275
9.7.3.4 Window monitoring	277
9.7.3.5 Linking of the continuous controller and the control valve for the window status	279
9.7.4 Operating mode	281
9.7.4.1 Comfort mode (Priority 1)	281
9.7.4.2 Standby mode (Priority 2)	281
9.7.4.3 Night mode (Priority 3)	281
9.7.4.4 Frost / heat protection mode (Priority 4)	281
9.7.4.5 Comfort extension (Priority 5)	281
9.7.4.6 Presence button	282
9.7.4.7 Operating mode changeover with the 1 bit	283
9.7.4.8 Operating mode changeover with the 1-byte communication object	286
9.7.5 Valve protection	289
9.8 The safety object with a weather station	290
9.8.1 Parameterisation of the switching actuator	290
9.8.2 Parameterisation of the weather station	293
9.8.3 Linking the weather station	297
9.8.3.1 Blind actuator link	297
<b>10. KNX security</b>	<b>299</b>
10.1 Smarthome security	299
10.2 What are the weaknesses of the system?	299
10.3 How real are the attacks on KNX?	300
10.4 More security for KNX	300
10.5 Possible security measures for the KNX bus	300
10.6 Possible network security	301
10.6.1 Using a firewall	301
10.6.2 Reducing DHCP	301
10.6.3 Assigning manual IP addresses	301
10.6.4 Allow new devices only with a known MAC number	301
10.6.5 Granting guest access	302
10.6.6 Separate networks	302
10.6.7 Do not assign a default gateway	302
10.6.8 Set up a VPN	302
10.6.9 Restrict the WLAN range	302
<b>11. Appendix</b>	<b>303</b>
11.1 EIB customer meeting checklist	303
11.2 EIB room list	304
11.2.1 KNX device list	305
11.3 Specification sheet (template)	307

### 1.3 Determining the bus participants

It is now time to put together the switching actuators and the push button sensors. To do this, you need to know the number of dimmed circuits (consider power per channel), the number of normal circuits, if present the number of conventional switching devices to be integrated by 230 V binary inputs (push button, 230 V motion detector, limit switch, etc.) and if available, the number of alarm contacts which are implemented in 24 V technology and integrated in the bus by means of 24 V / DC binary inputs.

I have designed a form for this, called the list of devices (see appendix), you should have a good amount of these printed out. Here you list the planned switching actuators and push button sensors as well as all other bus participants, and note the function you assign to each channel and the location of the circuit. For push button sensors, please also consider the assignment of the push button areas and note this in the form. Thus, you already have an overview of the number of required KNX devices needed for this project. Based on this, you also know if and how many couplers you have to use or how many power supplies you need. Do not forget at least one USB interface and, possibly when using a visualisation via network, an IP router and its power supply.

At this point, you may notice that there are some providers on the internet who offer such forms with far more functionalities as software, which also makes it easier to list the required devices. You are right, but here is a question from me: Do you always take your laptop to the construction site? Because in most cases you walk around the construction shell with the customer and talk with him about the items and circuits to be installed.

In my experience, using a writing pad and multiple form sheets in the construction site will give you more flexibility than a laptop.

So far, we have not talked about the building structure. So let us get to it. By now you know which actuators and sensors go in each distribution board or room. And at this point, there are different ways of proceeding. There are programmers who generally add and parameterise the devices in KNX only in the topology view. This can work for small projects and remains an option to program quickly. However, as the number of devices increases, the clarity of the arrangement is soon negatively affected.



That is why I recommend this structured way.



### 2.2.2 Creating links to the group addresses

The next step is to create the links. Links can be imagined as the connection terminals in the junction box in a conventional installation.

The corresponding communication objects (functions) of the actuators and sensors are stored in a group address. Each bus participant has different objects.

There are a number of communication objects. Just to name a few:

- Switching
- Reporting switching
- Locking
- Dimming
- Brightness value
- Reporting brightness value
- Long-term operation
- Short-term operation
- Position blind
- Position slat
- Feedback blind position
- Feedback slat position
- etc.

The largest three-level group address is 15/7/255

This means that there are: 32.768 Group addresses

16 main groups (0 – 15)

8 middle groups per each main group (0 - 7)

256 group addresses per each middle group (0 – 255)

The largest two-level group address is 15/2047

This means that there are: 32.768 Group addresses

16 main groups (0 – 15)

2048 group addresses per each main group (0 - 2047)

Both types of display allow up to 32,768 group addresses in a project. Whoever reaches this limit must have a huge project;

I would say that he has found his life's work.

## 2.7 Line lengths

The following line lengths are permitted for each line:

- $\leq 350$  m from the power supply to the participant
- $\leq 700$  m from participant to participant
- $\leq 1000$  m total line length
- $\geq 200$  m minimum distance from two power supplies on one line

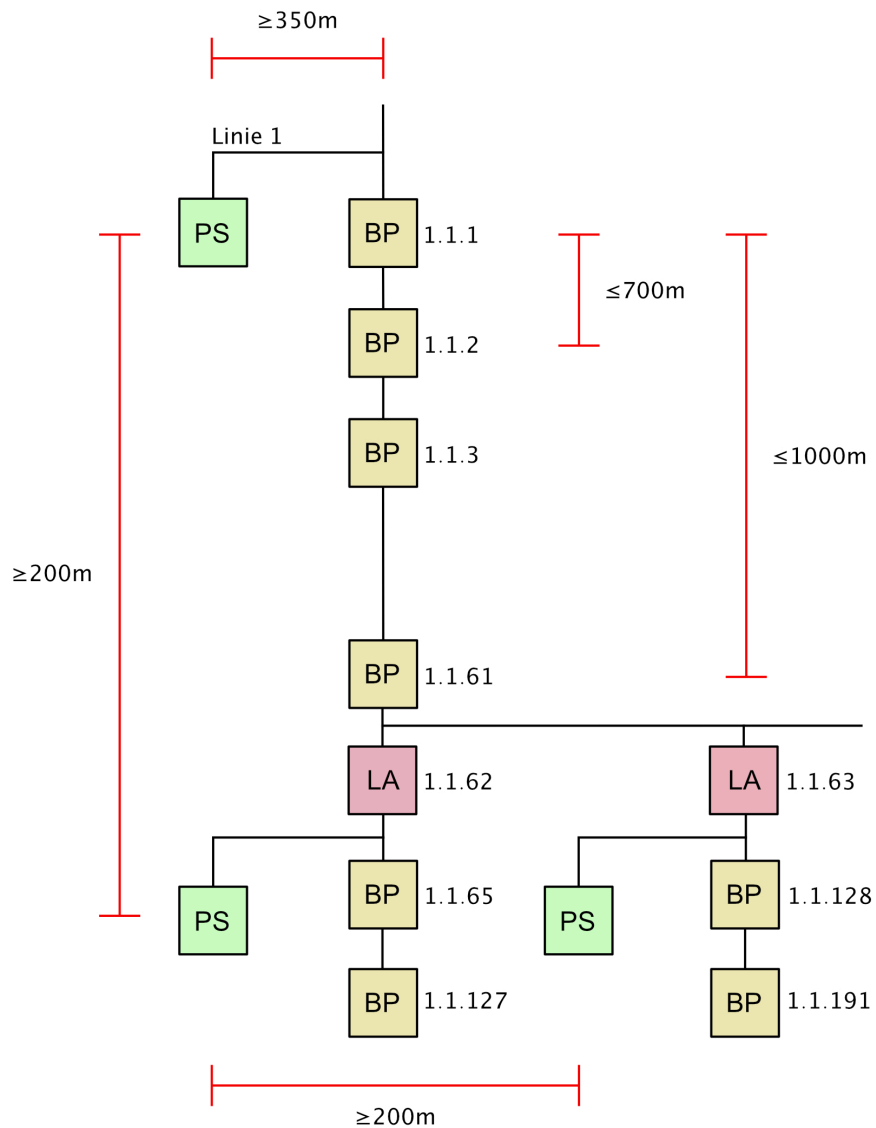


Fig. 8 Line lengths of a line

## 2.8 Routing counter

I would like to explain the function of the routing counter in detail, because it is related to the topology..

In a KNX system, all bus devices “listen» to all telegrams. There are no secrets. B When transferring the telegrams from one line to another one via a coupler, however, telegrams can be filtered out.

The bus participants check whether the received telegram has a meaning for them. If so, the content of the telegram is processed accordingly by the application of the device and the device acknowledges the telegram positively if it has been received correctly. If the telegram could not be received correctly, it will be acknowledged negatively. This indicates to the sender that he must resend it. If the sender does not receive an acknowledgment at all, he resends the telegram two more times.

If the content of a telegram has no meaning for a device, it is discarded.

Telegrams contain a routing counter, which the sender sets to “6”. Each time a coupler (line coupler, backbone coupler or line amplifier) passes through, the routing counter is decreased by “1”. If the coupler has reached “0”, the telegram is no longer forwarded. This prevents a telegram from “circling” due to a wiring error in the system.

The routing counter therefore limits the number of telegrams. Thus, the routing counter prevents circling telegrams in the case of a cross-line “loop”, which is not permitted in a KNX system.

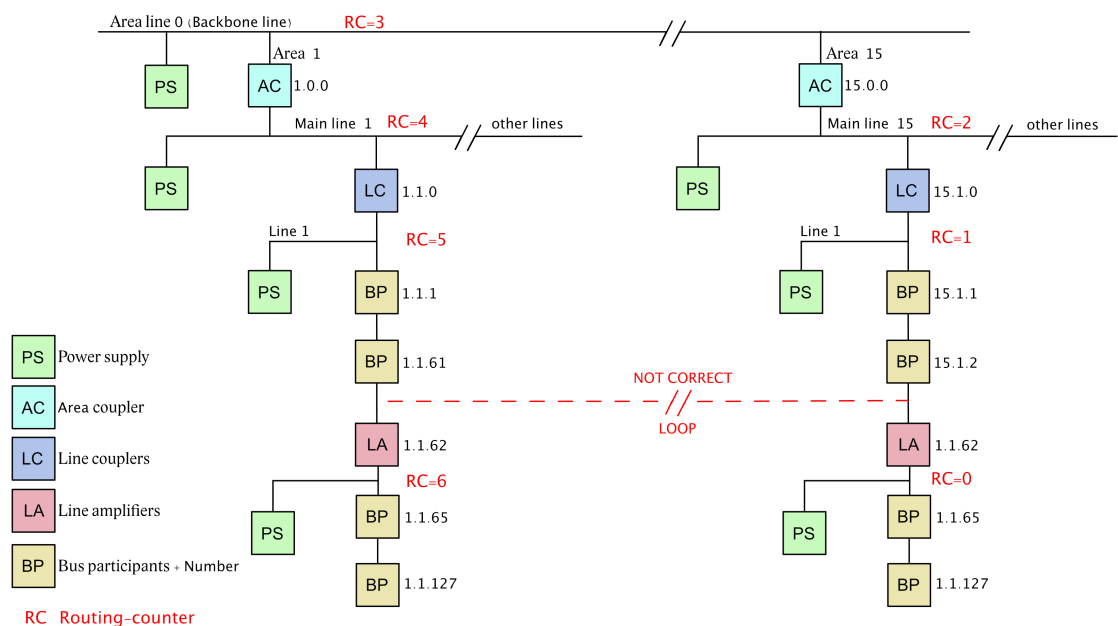


Fig. 9 Routing counter

## 2.13 The flags

Flags can be set for each bus user. When the device is delivered, flags are already set so that the KNX device functions optimally, and should only be modified in exceptional cases.

By setting the flags, the behaviour of the bus device can be modified.

The flags can be set in an object's properties window. You can access the properties window by right-clicking on a communication object of a KNX device. In the window that opens, select the "Properties" menu item. The properties window opens.

You can set or delete the flags in the properties window. Whether a flag is set or not is also shown in the overview window, in the corresponding column for each communication object.

Specifically, these flags mean:

## 2.14 The communication flag (C flag)

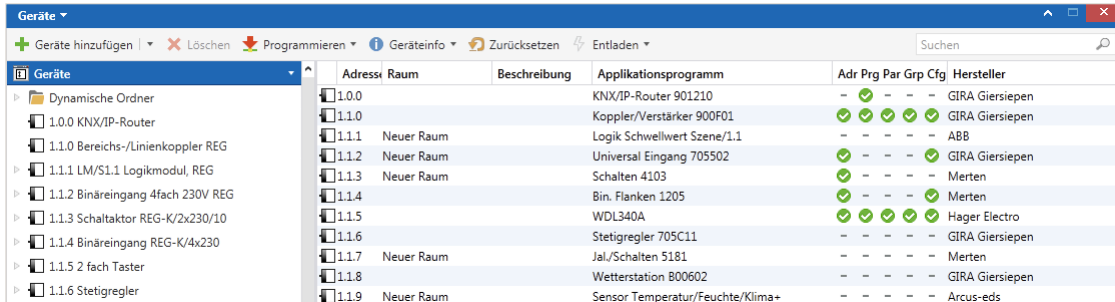
If this flag is set, the participant is connected with the bus and responds to incoming telegrams. If the flag is disabled, the station acknowledges a telegram, but does not change its communication object.

## 2.15 The reading flag (R flag)

If this flag is set, the object value of one participant can be read out by another participant. If this flag is disabled, then it is not possible.

This flag is usually set in the context of a visualisation. This means that a visualisation during the start-up phase asks all participants what their status is. Participants respond by setting the reading flag and thus sending their object values. The visualisation knows whether a participant is switched on or not, and can represent this graphically.

From ETS4 onwards, the programming states are indicated by a grey (ETS4) or green (ETS 5) dot with a checkbox. A set dot means that the settings have been successfully transferred to the KNX device. An unchecked dot means that something has been modified in the corresponding settings, but that these settings have not yet been transferred.



Geräte	Adresse	Raum	Beschreibung	Applikationsprogramm	Adr	Prg	Par	Grp	Cfg	Hersteller
Dynamische Ordner	1.0.0			KNX/IP-Router 901210	-	✓	-	-	-	GIRA Giersiepen
1.0.0 KNX/IP-Router	1.1.0			Koppler/Verstärker 900F01	✓	✓	✓	✓	✓	GIRA Giersiepen
1.1.0 Bereichs-/Linienkoppler REG	1.1.1	Neuer Raum		Logik Schwellwert Szene/1.1	-	-	-	-	-	ABB
1.1.1 LM/S1.1 Logikmodul, REG	1.1.2	Neuer Raum		Universal Eingang 705502	✓	-	-	-	✓	GIRA Giersiepen
1.1.2 Binäreingang 4fach 230V REG	1.1.3	Neuer Raum		Schalten 4103	✓	-	-	-	-	Merten
1.1.3 Schaltaktor REG-K/2x230/10	1.1.4			Bin. Flanken 1205	✓	-	-	-	✓	Merten
1.1.4 Binäreingang REG-K/4x230	1.1.5			WDL340A	✓	✓	✓	✓	✓	Hager Electro
1.1.5 2 fach Taster	1.1.6			Stetigregler 705C11	-	-	-	-	-	GIRA Giersiepen
1.1.6 Stetigregler	1.1.7	Neuer Raum		Jal./Schalten 5181	-	-	-	-	-	Merten
	1.1.8			Wetterstation 800602	-	-	-	-	-	GIRA Giersiepen
	1.1.9	Neuer Raum		Sensor Temperatur/Feuchte/Klima+	-	-	-	-	-	Arcus-eds

Fig. 20 ETS5 – Programming states of KNX devices



Geräte	Adresse	Raum	Gewerk	Beschreibung	Applikationsprogramm	Adr	Prg	Par	Grp	Cfg	Hersteller	Bestellnummer	Produkt
Alle Geräte	1.0.0				KNX/IP-Router 901210	-	✓	-	-	-	GIRA Giersiepen	2167 00	KNX/IP-Router
Dynamische Ordner	1.1.0				Koppler/Verstärker 900F01	✓	✓	✓	✓	✓	GIRA Giersiepen	1023 00	Bereichs-/Linienkoppler REG
1.0.0 KNX/IP-Router	1.1.1	Neuer Raum			Logik Schwellwert Szene/1.1	-	-	-	-	-	ABB	GH Q631 0080 R0111	LM/S1.1 Logikmodul, REG
1.1.0 Bereichs-/Linienkoppl...	1.1.2	Neuer Raum			Universal Eingang 705502	-	-	-	-	-	GIRA Giersiepen	1067 00	Binäreingang 4fach 230V REG
1.1.1 LM/S1.1 Logikmodul,...	1.1.3	Neuer Raum			Schalten 4103	✓	-	-	-	-	Merten	6472 29	Schaltaktor REG-K/2x230/10
1.1.2 Binäreingang 4fach 23...	1.1.4				Bin. Flanken 1205	✓	-	-	-	✓	Merten	6449 29	Binäreingang REG-K/4x230
1.1.3 Schaltaktor REG-K/2x2...	1.1.6				Stetigregler 705C11	-	-	-	-	-	GIRA Giersiepen	2100 ..	Stetigregler
1.1.4 Binäreingang REG-K/4...	1.1.7	Neuer Raum			Jal./Schalten 5181	-	-	-	-	-	Merten	6213 99	Tastereinsatz 4fach
1.1.6 Stetigregler	1.1.8				Wetterstation 800602	-	-	-	-	-	GIRA Giersiepen	101000	Wetterstation
1.1.7 Tastereinsatz 4fach	1.1.9	Neuer Raum			Sensor Temperatur/Feuchte/Klima+	-	-	-	-	-	Arcus-eds	30401xxx	Sensor Temperatur/Feuchte/
1.1.8 Wetterstation													

Fig. 21 ETS4 – Programming states of KNX devices

What they mean:

- Addr: Physical address
- Prg: Application
- Par: Parameter settings
- Grp: Group addresses
- Cfg: Media-specific settings (which are set during the programming of the physical address)

### 3.6 Unloading participants

If you suspect that a KNX device is not functioning as expected and you are 100% sure that the assignments of the group addresses and parameterisation of the device are correctly set, then you can unload and reprogram the faulty device.

It may well happen that, while the parameters are correctly set, for some reason, some old parameter settings remain in the device and cannot be overwritten. This can lead to unexplained malfunctions.



If you switch on the LED of a KNX device with the “On” button, then the KNX device is in programming mode. If you forget to switch off the LED, and then program another device, it may cause a malfunction.

However, you can also use this function deliberately to assign a different physical address to an already installed and programmed KNX device.

#### 4.7.4 List all addresses of a line

If you want to determine which physical addresses are already assigned in a line, you can display them in the lower window.

To do this, enter the line address that you want to check in the “Line address:” field.

Clicking on the “Search” button will start the search process.

The result is displayed in the window.

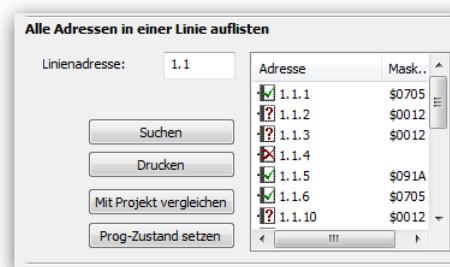


Fig. 58 Display addresses of all lines

Clicking on the “Compare with project” button compares the devices found with those already in the project.

The icons in front of the displayed addresses have the following meaning:

The icon means that the device was found and configured in ETS.

The icon means that the device was found but not configured in ETS.

The icon means that the device was not found, but is configured in ETS.

If “(local)” is displayed behind the physical address of a device found, then this is the data interface.

## 5.6 Working areas

The working windows serve to display a project in different views and to have multiple windows opened at the same time. The windows can be arranged randomly. Drag & drop makes it easy to create links.

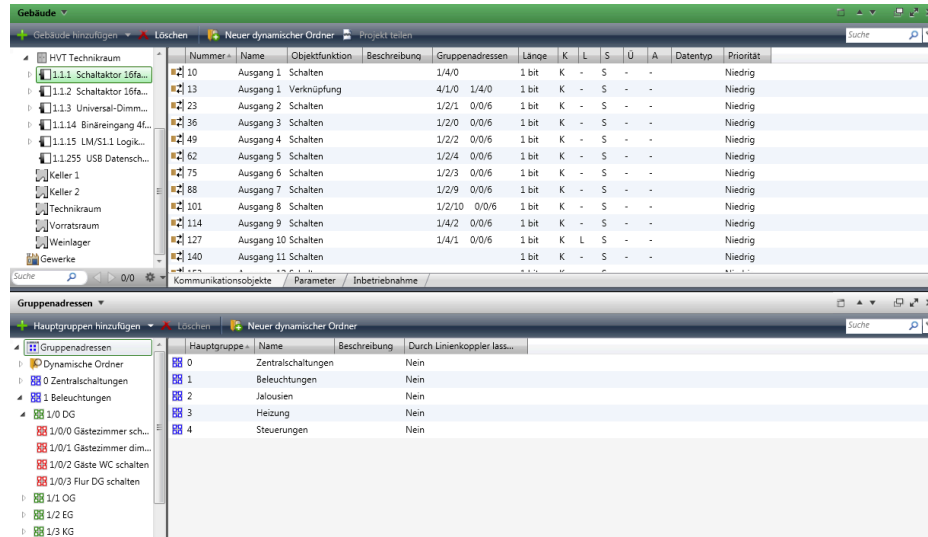




Fig. 126 Working window overview

Open one of the following windows in the “Working area” menu under the “Open new window” menu item or from the “Working area  ” toolbar:

- Building 
- Group addresses 
- Topology 
- Entire project 
- Devices 
- Favourites 

Another way to open another working window is to click the  arrow next to the current window name. A drop-down menu opens, from which you can select the desired working window. The current window is replaced by this.

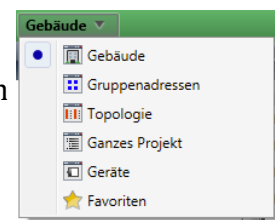



Fig. 127 Drop-down menu

The arrangement of the windows can be defined in the “Window” menu. Choose from:

- Split windows horizontally
- Split windows vertically

## 5.7 Creating a new project with ETS4

To create a new project with ETS4, switch to the “Projects ” tab.

Since the new database is still empty, no projects can be found in it yet. That is why there is not much to see in this view. But we will change that now.

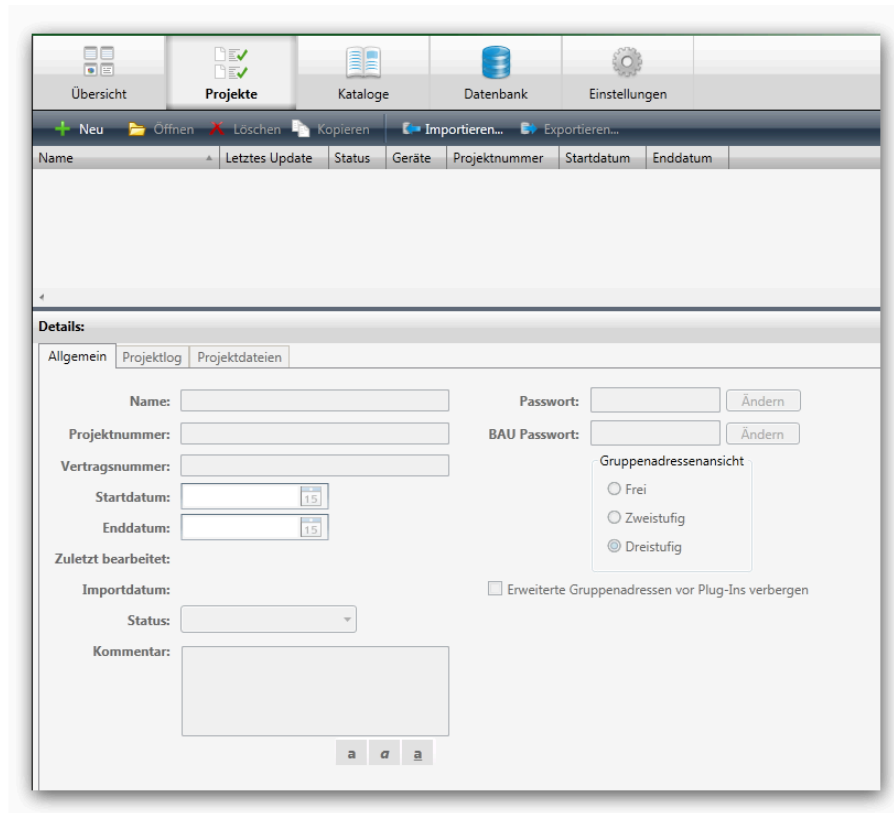


Fig. 135 Project settings

On the toolbar, click on “New ” to create a new project.

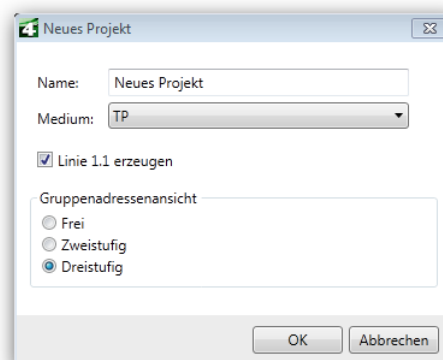


Fig. 136 Create a new project and select the group address views

In the “Name” field, assign an appropriate name for the project. This can be the name of a customer or, if you create several projects for a customer, the name of the corresponding customer project, e.g. Maier House, Office Maier Office Hamburg, Maier Office Berlin, etc.



#### Column 10

The value of the routing counter is displayed in the “Rout” column. More in Chapter 2.8 Routing counter.

#### Column 11

The data type of the sent telegram is displayed in the “DPT” column.

#### Column 12

The “Type” column displays whether it is a write telegram, a read telegram or a response telegram.


A write telegram means that a KNX device is protected by an external influence, e.g. was sent to the bus by the push of a button, a motion detector, a logic function, etc.

A read telegram usually comes from a visualisation. Visualisations require the status of the KNX devices. This ensures that they switch the KNX devices correctly. In order to determine the status of the KNX devices, the visualisations request this on the KNX bus on start-up.


The requested device responds by a response telegram. This tells the visualisation what the requested status or value is. But only if its read flag, also called R flag, is set. What each flag means can be read about in Chapter 2.13 The flags.


### 6.9.4 Storing telegrams

If you have recorded telegrams in the group monitor, you can save them on a hard disk. To do this, you must stop any active recording of telegrams by clicking on “Stop ”.

You can now save the recorded telegrams by clicking on “Save ”. Windows Explorer opens, in which you can select or enter the storage location and the name. Then, a file with the “.xml” extension is created.

### 6.9.5 Opening telegrams from a file

If you want to open a stored telegram recording in the group monitor, you must stop any active recording of telegrams in the group monitor by clicking on “Stop ”.

Now you can open a stored telegram recording by clicking on “Open ”. Windows Explorer opens, in which you can specify the path to the desired file. Subsequently, the stored telegrams are displayed in the group monitor.

## 7.1 Project description

For our project, I have created a small floor plan from the ground floor of a sample house.

Here I have drawn the lights, sockets that are switched, electric roller shutters and the positions of the push button sensors.

I assign numbers to all circuits. With the associated switch or sensor, I enter the number of the circuit that the switch or the sensor should switch.

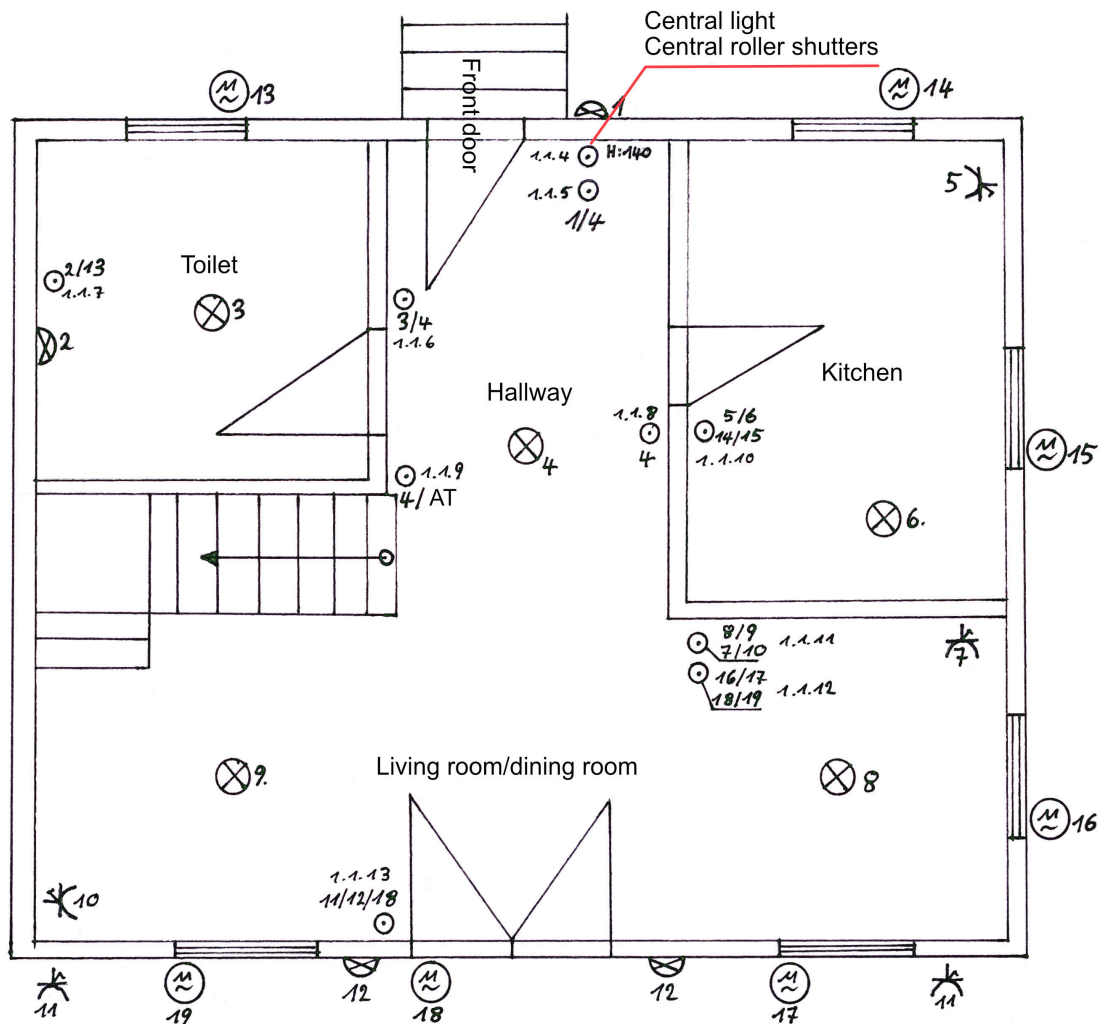


Fig. 184 Floor plan of the sample house

In addition, I enter the associated physical address next to each sensor. Of course, this can only be entered later, i.e. when the devices have been added in ETS or in the building structure and assigned a physical address.

At the entrance of the apartment there are two tactile sensors at different heights. The sensor at 1.40 m has a special function. It should act as a central switch for the lighting and roller shutters.

## 7.3 Creating a building structure

It is now time to start creating our project in ETS.

### 7.3.1 Adding a building

To do this, go to the “Buildings” view, right click on “Buildings / systems” and select “Add building” from the context menu. In the window that opens, “New: buildings”, enter an appropriate name under the “Name” field. For our example, enter “Residential house”.

### 7.3.2 Adding building parts

Of course, this house also has floors. To add them to the project, right click on “Residential house” and select “Add building parts...” from the context menu. In the window that opens, “New: building part”, enter an appropriate name for the building part under the “Name” field. For our example, assign the name “1 AT” for attic.

Repeat this procedure to add several floors; “2 FF” for first floor, “3 GF” for ground floor and “4 BA” for basement.

Are you wondering why a number goes before each name?

The numbers have the following meaning:

The structure of a building is as follows: basement (BA), ground floor (GF), first floor (FF) and attic (AT). If we labelled the floors without a number and sort the list alphabetically, the building would look like this after sorting:

AT (attic), BA (basement), FF (first floor) and GF (ground floor). This order does not match that of an actual building; the ground floor comes at the end instead of at second position, before the basement, where it should actually be. To prevent this from happening, AT is assigned the number 1, followed by 2 for FF, etc.

If the list is now sorted alphabetically, the order of the floors will be corresponding to the actual building. First “1 AT”, second “2 FF”, third “3 GF” and last “4 BA”.

### 7.3.3 Adding rooms

Now, the individual floors have rooms. To add a room, right click on the “GF” building part and select “Add rooms” from the context menu. In the “New: room” window that appears, enter an appropriate name under the “Name” field (kitchen, for example). In this way, you can create the corresponding rooms for each floor.

## 9.6 Logic function

Logic functions can solve a wide variety of tasks. To this end, logic functions that are partially integrated into switching actuators can be used. For more complex tasks, however, the logic functions of switching actuators are usually not enough and you must resort to a special KNX device that provides the logic functions needed.

In the following examples, I would like to introduce you to such a special KNX device.

The LM / S 1.1 logic module from ABB provides you with a large number of logic functions, which, in combination with others, allow you to handle rather complex tasks.

### 9.6.1 Two workstations, three lights

I once had a customer who had a T-shaped table arrangement in his office (see figure below). There were two employees working at this table. A suspended light was mounted above each table, i.e. a total of three.

The following task was requested:

If a person switches the lighting of workstation 1 on, lights 1 and 3 should also switch on.

If a person switches the lighting of workstation 2 on, lights 2 and 3 should also switch on.

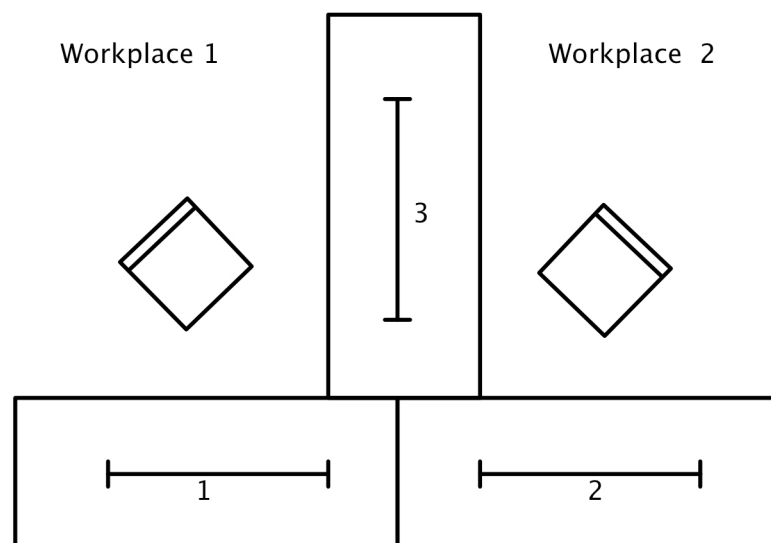


Fig. 237 Task

That sounds easy, right?

## 9.7 Individual room temperature control

A room thermostat ensures a constant room temperature around the clock. For this purpose, the sensor integrated in most controllers or via an external temperature sensor records the current room temperature and adapts it to the target specifications of the inhabitants.

Most room temperature controllers have a large number of settings that enable a comfortable and cost-efficient individual room temperature control via KNX. But discussing all these settings in this e-book would go beyond the scope.

### 9.7.1 2-point controller

The simplest type of room temperature control is the 2-point control. A room temperature sensor records the room temperature and compares it with the set base temperature. Depending on the result, a telegram is sent to the bus, which opens or closes a valve. The room temperature is verified at cyclic intervals.

As an example, the following devices are added to the project:

6-fold heating actuator from Gira with the item number: 1018 00

Continuous controller from Gira with the item number: 2100 xx

#### 9.7.1.1 Parameter settings for the heating actuator

For our example, the parameter settings in the “General”, “Monitoring” and “Emergency” windows do not need to be adjusted.

##### Output parameter window

If valves are used in the project that are “de-energised closed”, then you can leave the parameter settings in the “Valve in de-energised state” field at the default value.

However, if valves are in use, which are “de-energised open”, then this parameter must be modified. To do this, open the parameter window and select the output to which a valve is connected.

## 9.8 The safety object with a weather station

The safety objects of some switching and blind actuators can help you protect outside components such as awnings, blinds, external blinds or skylights from wind and rain. To achieve this, a weather station is needed. Manufacturers usually also offer a suitable sensor for your weather station, which contains wind, rain, brightness and twilight functions. Alternatively, analogue sensors with 0-10 V technology can be connected to most weather stations. However, they require a slightly greater effort, since the individual sensors must be adapted to the weather stations.

In the following example, I would like to show you how to protect an awning from wind and rain.

This requires a blind actuator that has the required safety objects and a weather station. In the example, I use the 16-fold switching actuator with the 103800 item number and the weather station comfort with the 101000 item number. Both devices are from Gira.

### 9.8.1 Parameterisation of the switching actuator

Add the switching actuator to your project and open the parameter window.

Under “Blind outputs safety”, set the following:

First, in the “Safety functions” field, select “enable”. As a result, further input fields are unlocked or visible below the field.

Under “Wind alarm 1”, set “enable”.

Under “Rain alarm”, set “enable”.

The remaining settings are left at their default values.

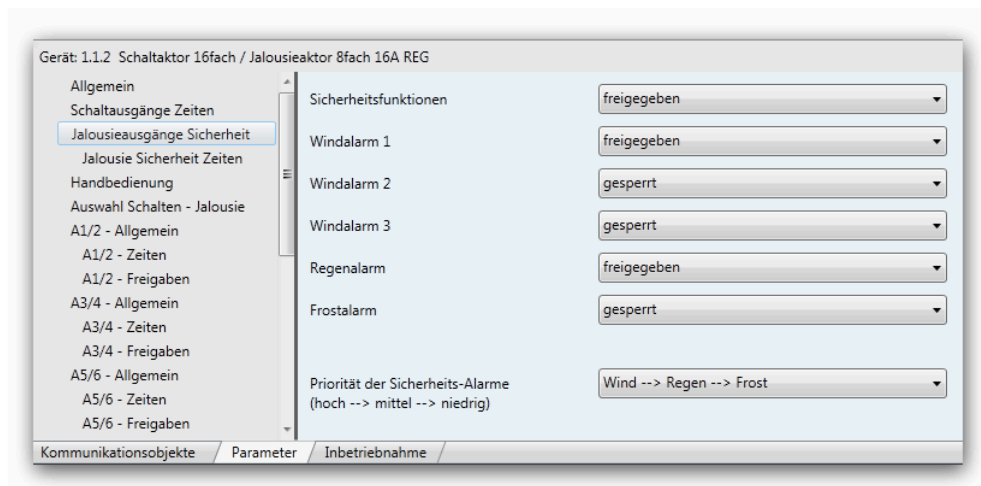


Fig. 291 Parameter settings for “Blind outputs safety” of the blind actuator

## 10. KNX security

Many readers keep asking me how secure the KNX system is. Unfortunately, I currently only have a bad answer:

“KNX, as the worldwide standard for building technology, is vulnerable.”

### 10.1 Smarthome security

The time of classic wiring is long gone. In contemporary architecture the and high-end residential construction industry, a building management system is already standard. EIB, or its successor KNX, has established itself as a pan-European or even worldwide standard.

In addition to the basic wiring, the connection of the building to the EDP has become much easier. It is now no longer rocket science to monitor and control a building on a PC, tablet or smartphone. And it is possible from any place in the world! But what are the pitfalls of this change?

### 10.2 What are the weaknesses of the system?

In principle, there are 2 main weaknesses of KNX; the bus itself and the controlling EDP or access via PC or the internet. Both need to be taken into account when considering the overall security. The following areas should be looked at carefully:

#### EDP

- Network architecture
- Network isolation
- Network access control
- Firewall
- Visualisation access

#### The bus

- Network architecture
- Network isolation
- Network access control

Attacks on IT infrastructures are the order of the day and thus well-known; they should be avoided or at least limited by a variety of measures. By contrast, things are different in the world of the KNX bus.

2-point controller	256	Cyclic sending	229
A write telegram	63, 107, 143	Data type	36
Absolute dimming	33	Data types	38
Access type via the bus	68	Database settings ETS4	84
ACK (acknowledge)	65, 110, 145	Deactivation	211
Actual value	263	Default gateway	302
Actuation	191	Delay after bus voltage recovery	179
Add it and run the test again	75	Device info	72, 111, 147
Adding a building	172	Device LED	70
Adding a control cabinet	173	Device(s) in programming mode	113
Adding building parts	172	Devices	77, 155
Adding bus participants	31, 174	Devices not assigned to a line window	80
Adding main groups	204	Devices not assigned to a room / system	81
Adding rooms	172	Devices window	77
Additional functions	182	DHCP	301
Alarm function	191	Diagnosis	69, 111, 140
All devices window	122	Dimmed lighting	204
Application Program	45	Dimming circuit	208
Applications	162	Dimming object	33
ARead telegram	63	Drag & drop	207
Assigning a data type (DTP)	37	Editing parameters	178
Assigning a physical address	45	EIB room list	304
Base temperature	258	EIBlib/IP (IP routing)	137, 139
Basic brightness	188	Entire project	154
Behaviour on bus voltage recovery	188	Entire project window	121
Binary input	227	ETS database settings ETS3	50
Blinds	205	ETS Einstellungen	50
Building	151	ETS4	84
Building view	15, 76	ETS5	129
Building window	76, 119	evice verification	115
Bus monitor	65, 110, 144	Favourites window	123
Bus participant parameterising	178	Filtertabellen programmieren	46
Bus participants	14, 31	Firewall	301
Central circuit	213	Flags	40
Check if an address exists and locate a device	113	Frost / heat protection mode	281
Colourings in the group and bus monitor	111	Group address test	115
Colourings of telegrams in the group and bus monitor	66	Group address window	79
Colourings of the telegrams in the group and bus monitor	145	Group addresses	16, 20, 152
Comfort extension mode	281	Group addresses window	79, 120
Comfort mode	281	Group monitor	140
Communication flag	40	Guest access	302
Communication objects	20	Heating actuator	256
Connections	137	Heating control	258
Continuous controller	256	Importing / exporting a project	134
Control value	263	Importing databases	162
Control valve	257	Individual room temperature control	256
Coupler	23	Installing the plug-in	53
Create a new project	132	Interfaces and communication	137
Creating a building structure	172	IP addresses	301
Creating a group address	204	IP Ethernet	133
Creating a middle group	204	IP router	224
Creating a new database with ETS4	85	IP tunnelling	137
Creating a new project in ETS3	67	KNX device list	305
Creating a new project with ETS4	124	KNX security	299
Creating a project	163	LED flashing	70
Customer meeting checklist	303	LED off	70
		LED on	70
		Lighting duration of the actuation display	190



Line	22	Programming state	122
Line amplifier	23, 26	Project review	114
Line and backbone coupler	24	rea	22
Line lengths	27	Read telegram	107, 143
Line scan	158	Reading a telegram	61, 105, 141
Line type	132	Reading flag	40
Linking a blinds circuit	212	Reading out device information	72
Linking functions	230	Relative dimming	33
Linking the dimming object of a lighting	209	Releases	182, 186, 188
Links	206	Reporting	189
List addresses of a line	71	Reports	156
List all addresses of a line	113	Response telegram	63, 107, 143
List of devices	14, 165	RF Radio Frequency, Radio	133
listening	233	Room temperature sensor	256
Load application	45	Routing counter	28
Load failure reporting	189	Safety	180
Locking behaviour	191	sending	233
Locking function	189, 235	Sending a telegram to the bus	105, 141
Logic function	246	Separate networks	302
Long-term object	34	Setpoints	258
MAC number	301	Setting up data interfaces	67
Main groups	20	Setting up the data interface	126
Managing and creating projects	131	Settings in ETS5	130
Middle groups	20	Setup	218
Modified devices	219	Short circuit reporting	189
Modified devices window	80	Short-term object	35
More security for KNX	300	Specification sheet	163, 308
Motion detector	236	Staircase function	184
Network security	301	Standby mode	281
Night mode	281	Storing telegrams	63, 107, 143
Off functions	189	structure of group addresses	203
Opening a telegram from a file	63, 107	Sun protection	187
Operating LED	190	Switched lighting	204
Operating mode	281	Switching object	33, 208
Operating mode changeover with the 1 bit	283	Teilnehmer entladen	47
Operating mode changeover with the 1-byte com- munication object	286	Teilnehmer zurücksetzen	49
Partial programming	43	Telegram continuous recording	64, 107
Participants	22	Template database for ETS4	86
Phys.addr. & Appl.-progr.	43	Template database for ETS5	160
Physical address	22	Testing the programming	73
Physical address verification	148	The local access type	68
Physical addresses	112	The project wizard	134
PI controller	263	Three-level group address	20
PL Power Line	132	Time delays	183
Playing telegram files	65, 109	Time functions	189
Position object	35	Topology	25, 78, 153
Possible security measures for the KNX bus	300	Topology structure	25
Presence button	282	Topology verification	116
Priority of a telegram	42	Topology window	78, 120
Product finder	174	Topology with line amplifier	26
Product information verification	116	TP Twisted Pair	132
Program phys. addr."	43	Transfer flag	41
Programming	81, 127, 160	Troubleshooting	223
Programming a physical address only	43	Twilight-dependent circuits	227
Programming KNX devices	218	Two-level group address	20
Programming mode	148	Types of priority	42
Programming modes	43	Unloading a device	146
		UP-data interface	68

---

Update flag	41
USB interface	223
User software	45
Valve protection	289
Verknüpfungen	20
VPN	302
Window monitoring	277
WLAN range	302
Working areas	118, 150
Writing flag	41