1 KNX Gateway DMX-IP, DMX-Gate2 Tool software

2 Description of functions

The *KNX gateway DMX-IP* is an intelligent DIN-rail mounted system device for coupling of DMX512 systems to the KNX/EIB. To this effect, the KNX gateway DMX-IP is connected with the KNX and the DMX512 bus. The gateway requires 24 V AC/DC supply voltage.

For connection of the KNX gateway DMX-IP the mounting and operating instructions must be observed.

The functionality of the KNX gateway DMX-IP is set by programming.

3 Hardware description

3.1 Device configuration

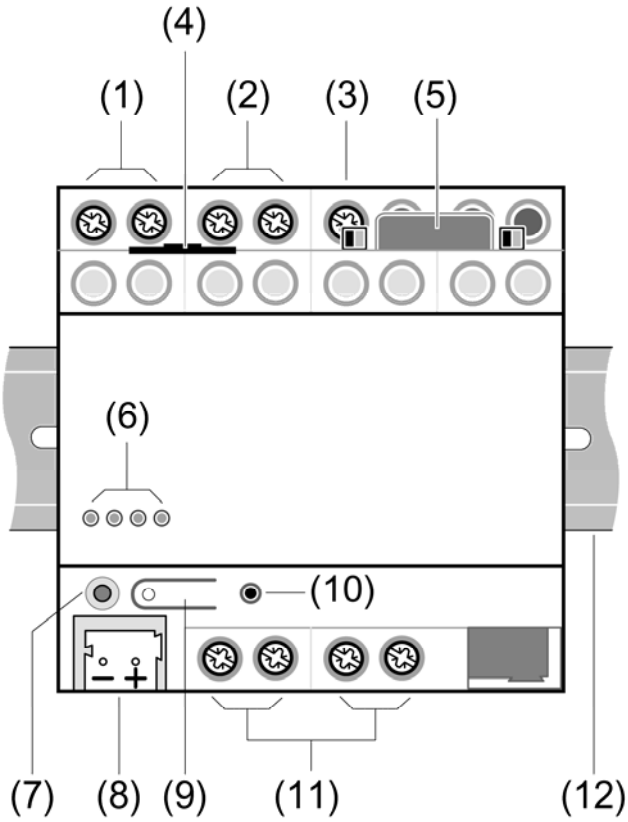

Fig. 3.1-1: Device configuration

(1)	DMX input (DMX IN - / DMX-IN +
(2)	DMX output (DMX OUT – / DMX-OUT +)
(3)	DMX ground (GND)
(4)	Ethernet/IP port
(5)	RS232 port
(6)	Status-LEDs
(7)	Programming LED
(8)	KNX port
(9)	Programming key
(10)	Reset key
(11)	External supply port
(12)	DIN-rail (not incl. in scope of supply)

3.2 Status displays

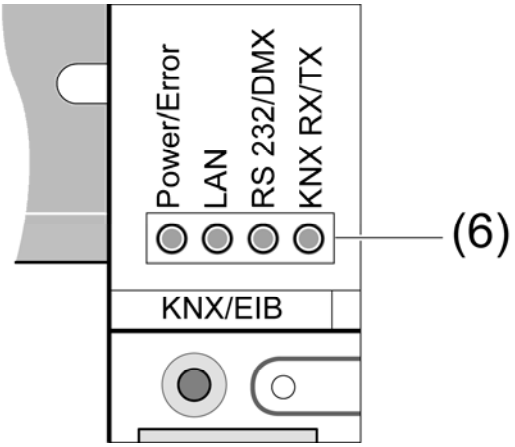

Fig. 3.2-1: Status LED

Power/Error	Shining green: normal operation Flashing orange: invalid or no project Flashing red: invalid firmware
LAN	Shining yellow: Reception via Ethernet/IP interface
RS232/DMX	Flashing green: Receiving/transmitting via RS232 interface Flashing red: Receiving/transmitting via DMX interface Shining red: For one second no receiving/transmitting of valid DMX messages
KNX RX/TX	Flashing red: Receiving from KNX bus. Flashing green: Transmitting to KNX bus. Flashing red-green: No KNX bus detected.

3.3 Technical data

External supply	
Mains voltage AC/DC	AC/DC 24 V SELV (± 10%)
Mains frequency	50 / 60 Hz
Power consumption	max. 2 VA
Ambient conditions	
Ambient temperature	- 5 °C to + 45 °C
Storage and transport temp.	- 25 °C to + 70 °C
Humidity (ambient / transport / storage)	
Protection class	III
Installation width	72 mm / 4 modules
Weight	approx. 175 g
Network communication	
Bit rate IP	10 / 100 Mbit/s
Ethernet/IP port	RJ45 socket
RS232	
Bit rate RS232	38,4 kbit/s
RS232 port	9-pol. D-Sub socket
Protective circuit	DCE
KNX	
KNX medium	TP 1
Commissioning mode	S-mode
Nominal voltage KNX	DC 21 V … 32 V SELV
KNX port	Standard KNX / EIB Bus connection terminals
Power consumption KNX	typ. 150 mW
DMX	
Input interface	USITT DMX512-A
Output interface	USITT DMX512-A
Supply and DMX port	
Port type	Screw terminal
Single-core	0.5 … 4 mm²
Finely stranded without wire-end sleeve	0.34 … 4 mm²
Finely stranded with wire-end sleeve	0.14 … 2.5 mm²

4 KNX Gateway DMX-IP

4.1 Operation modes

The *KNX Gateway DMX-IP* is used for unidirectional data exchange between KNX and a DMX system.
It supports the two operation modes *DMX-Master* and *DMX-Slave*

In operation mode *DMX-Master,* the gateway receives new values of its communication objects via the KNX group addresses. The gateway decodes these values into DMX data bytes and sends them via the connections *DMX Out* + and *DMX Out* -.

In operation mode *DMX-Slave* the gateway receives data bytes from the DMX via the connections *DMX In* + and *DMX In* -. The gateway encodes the DMX values into values of its communication objects and sends them via KNX group addresses.

The operation mode is set with starting the projection software *DMX-Gate2* or with creation of a new project. It cannot be changed within an existing project.

4.2 Interfaces

The gateway has five different interfaces which are used depending on the active operation mode.

4.2.1 KNX

KNX connection is effected via a standard KNX bus connection terminal (8).

4.2.2 DMX IN

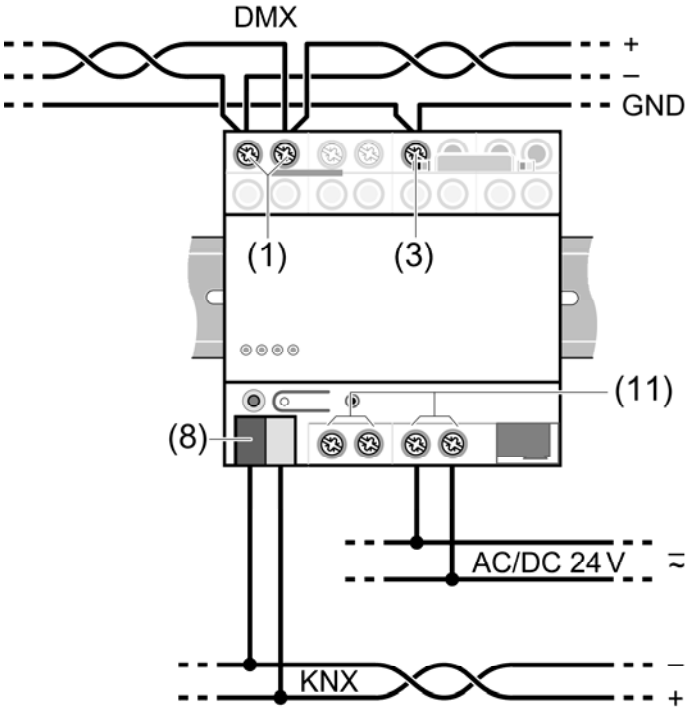

Fig. 4.2-1: Connection – operation mode Slave

Using the gateway in operation mode *DMX-Slave,* connection is made via the two screw terminals *DMX IN* (1) in combination with the *GND* port (3). The ports *DMX OUT* are not used in this operation mode.

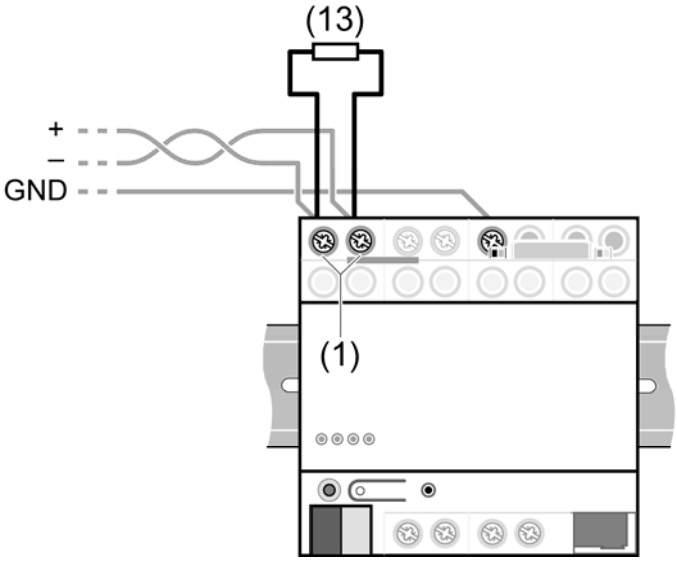

Fig. 4.2-2: Terminating resistance

At the last device within the DMX installation, the DMX bus should be terminated by means of the terminating resistance supplied (13).

4.2.3 DMX OUT

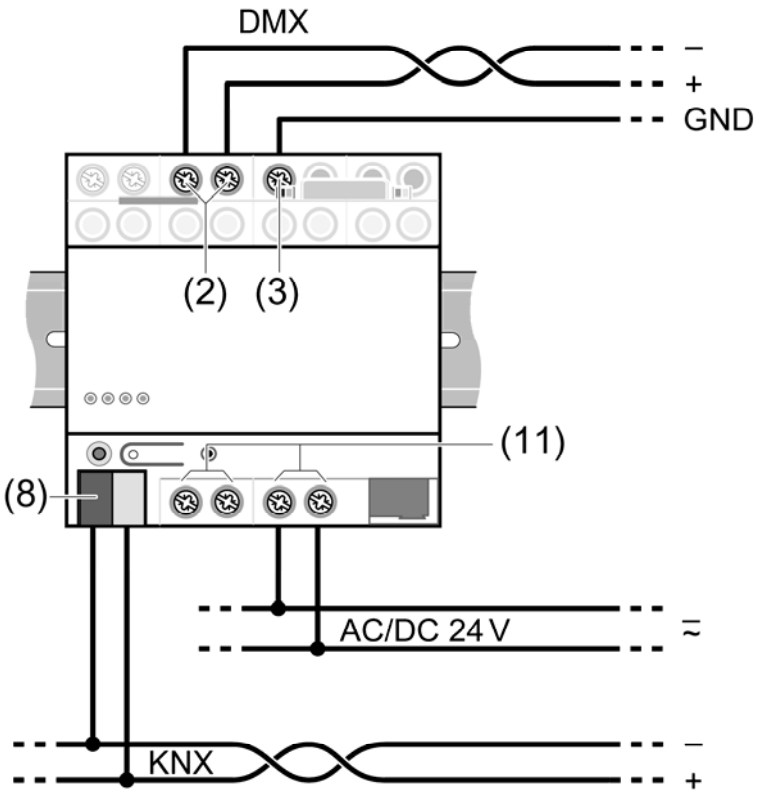

Fig. 4.2-3: Connection – Operation mode Master

Using the gateway in operation mode *DMX-Master,* connection is made via the two screw terminals *DMX OUT* (2) in combination with port *GND* (3). The ports *DMX IN* are not used in this operation mode.

In a DMX system only one single data generator is admissible. If the gateway is to be used with another DMX data generator, (e.g. DMX-lighting control desk), a so-called DMX merger is needed.

At the last device within the DMX installation, the DMX bus should be terminated by means of the terminating resistance supplied (13)

4.2.4 LAN

The gateway can be taken into operation via the Ethernet/IP-interface. Mains or PC connection is made via the RJ45 LAN socket.

For direct connection of a PC, a crosslink network cable might be needed.

4.2.5 RS232

The gateway can be taken into operation via RS232 interface.

The RS232 port is designed as 9-pole DCE (data communication end unit = modem). PC connection is effected via an RS232 cable (plug and socket) with 1:1 configuration (no null modem cable)

4.3 DMX function groups

In the two systems DMX and KNX, dimmers are controlled differently.

In the KNX system each dimmer can be controlled via three different communication objects, the last command received determining the resulting brightness value.

- With one 1-bit-object, the dimmer can be switched on or off. Mostly, the brightness value used for switch-on can be defined in the parameters of the dimmer.
- With a 4-bit-object, the brightness value of the dimmer, based on the current value, can be changed with the commands „brighter“, „darker“ and „stop“. The resulting brightness value is not determined exactly. The dimming speed can also be defined in the dimmer parameters.
- With a 1-byte-object defined brightness values between 0% and 100% can be set.

In the DMX system, one byte is used for the brightness value of each channel.

- Value 0 corresponds to OFF-state. (0%). Values 1 to 254 correspond to 0.4% to 99.6%. Value 255 corresponds to ON-state (100%)
- In dimming processes, the value of a channel is changed gradually.

The gateway has different function groups to adapt the two bus systems.

4.3.1 Switch, dimmer, value

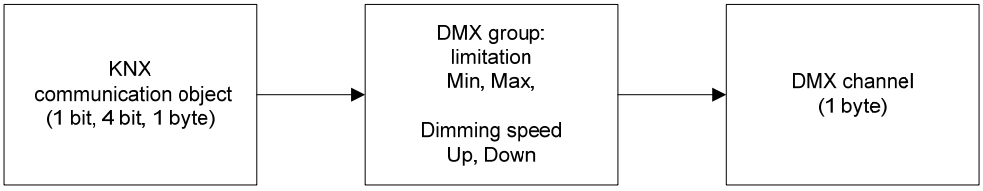

Fig. 4.3-1: Dimming function – Master

In operation mode *Master* the gateway corresponds to a dimmer of the KNX system.

Having received a new value from the KNX bus, the gateway calculates the new value of the DMX channel which is then sent.

For conversion, the gateway takes into account the adjustable sector limits and the adjustable speeds for dimming up and down.

During switching via a 1-bit-object, the defined maximum value corresponds to the switch-on command and the defined minimum value corresponds to the switch-off command.

During dimming via a 4-bit-object, the start and stop commands are converted into a sequence of new DMX values. The adjustable speeds determine the increment of the new DMX values.

During dimming via a 1-byte-object the gateway calculates the new DMX value from a characteristic in which the KNX value 0% corresponds to the minimum value and the KNX value 100% corresponds to the maximum value.

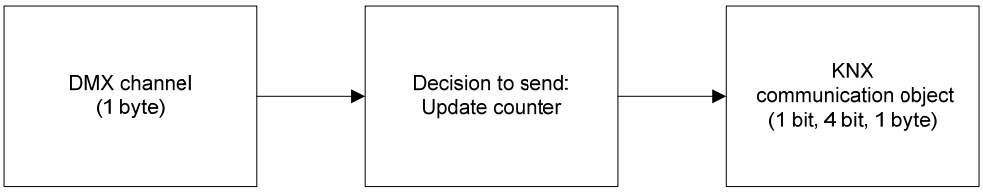

Fig. 4.3-2: Dimming function – Slave

In a DMX system, the values of all DMX channels are sent continuously. In operation mode Slave the gateway receives the values of all DMX channels.

Due to the different transmission speeds, the gateway must run a filtering before sending via KNX communication objects. To this effect, the gateway waits until the value of a DMX channel is back to constant after a change. The number of DMX transmission cycles is defined in the DMX settings of the gateway.

4.3.2 RGB, RGBW

The function groups RGB and RGBW are used especially for controlling luminaires with adjustable light colour. These function groups have got three or four DMX channels for the individual colour components and a common master input with which all colour components can be dimmed at a time.

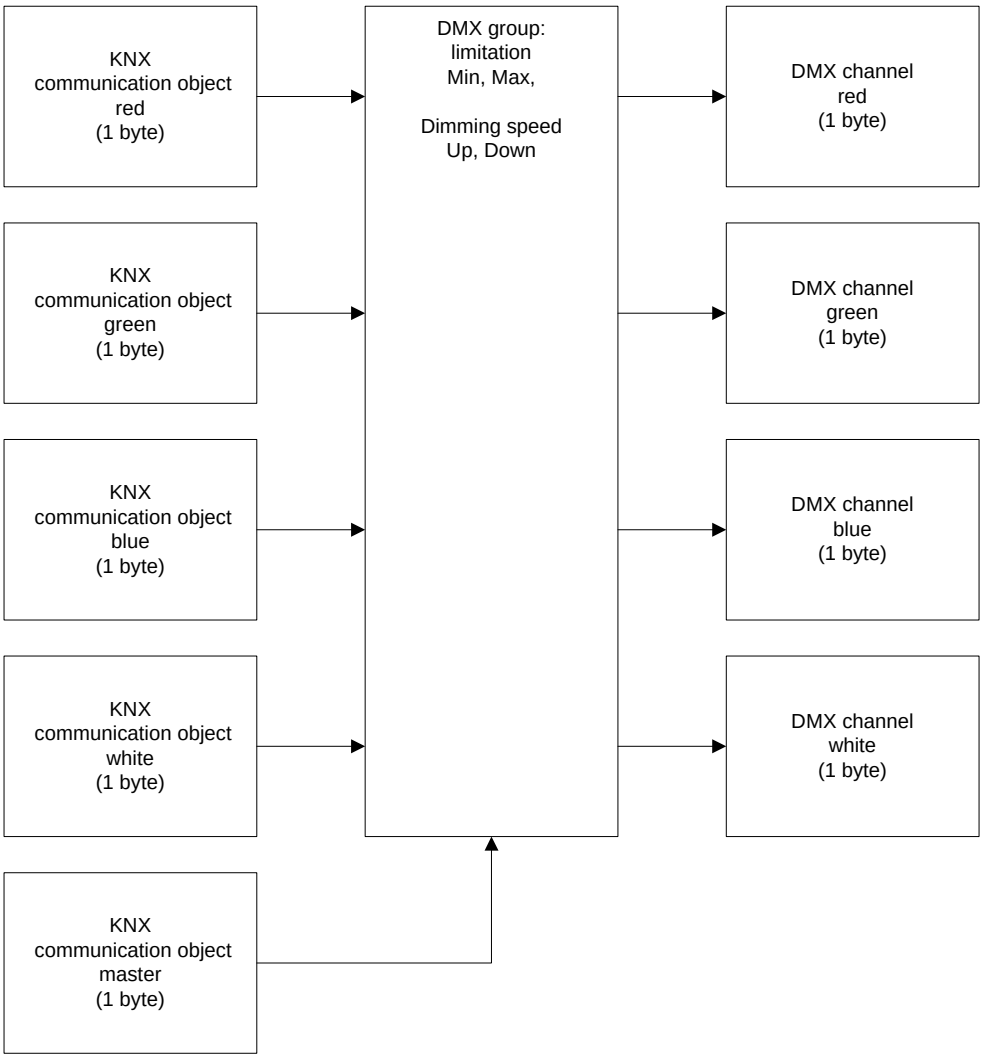

Fig. 4.3-3: RGBW – Master

After a restart of the gateway, the input master has the value 100%. So the input values of the colour components and the values of the simple function groups are converted to the relevant DMX channels.

If the desired light colour is set via the individual colour components, on receipt of a new value of the master communication object all colour channels are dimmed uniformly under consideration of the maximum and minimum value.

The new value of the DMX channels is calculated as follows:

DMX-channel = KNX-channel * KNX-master * (Max – Min) + Min

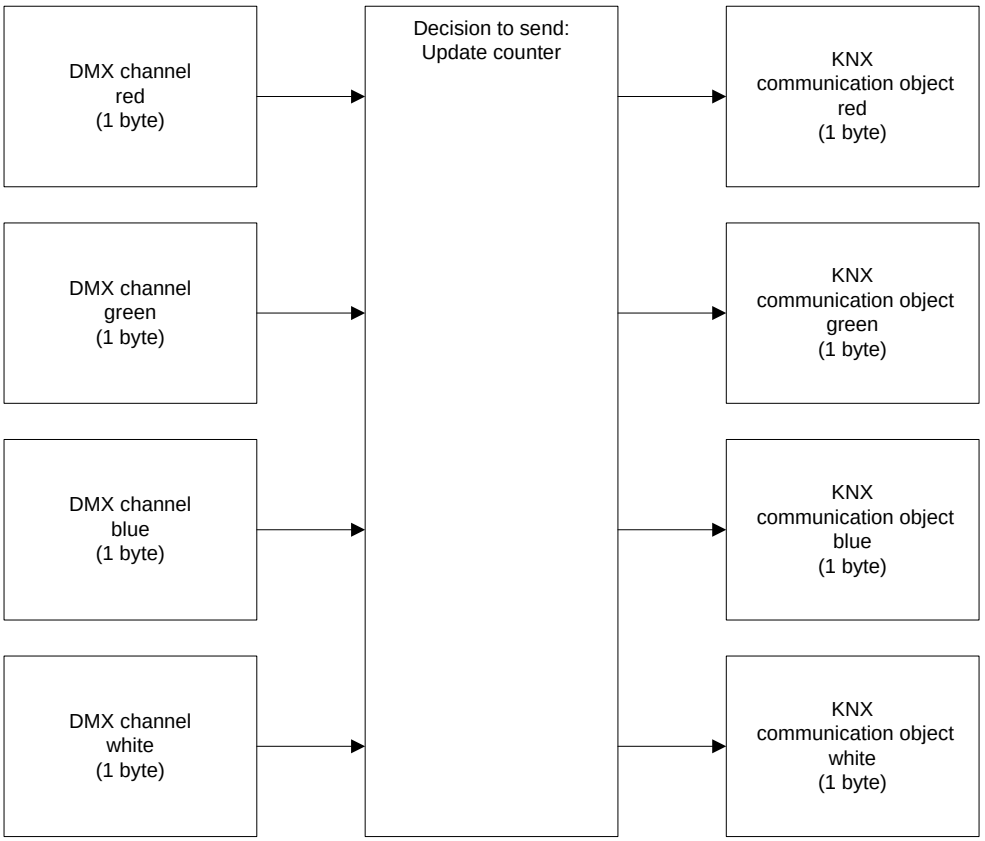

Fig. 4.3-4: RGBW – Slave

In operation mode *Slave* the working principle of the DMX function groups RGB and RGBW corresponds to the working principle of the individual function groups Switch or Value. Here also, after changing a DMX channel, the gateway waits until this channel is back to constant for a definable number of DMX transmission cycles.

4.3.3 Freely defined groups

The DMX groups can be extended by new DMX channels. This makes it possible, for instance, to control several RGW/RGBW luminaires via one master object.

5 DMX-Gate2

5.1 Starting the program

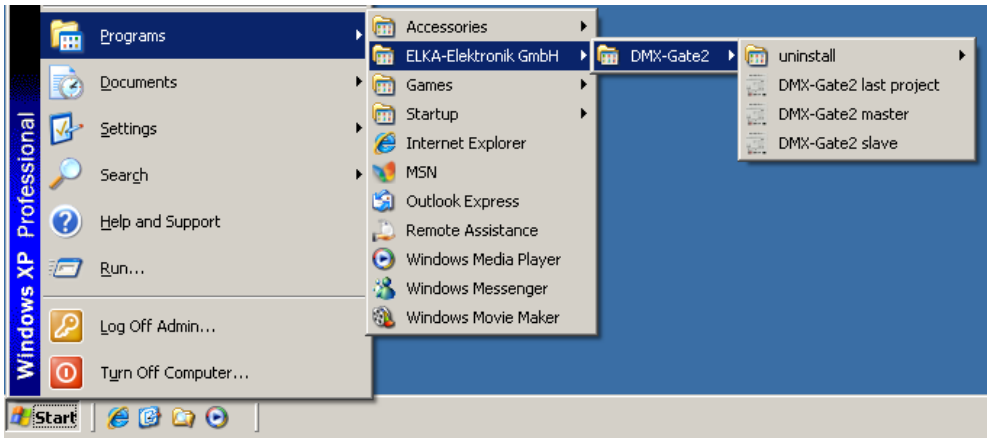

Fig. 5.1-1: Starting the program

In the start menu you can choose between two entries to call up DMX-Gate2. Depending on the menu item chosen, DMX-Gate2 starts with the suitable presetting for projection of the gateway as Master or as Slave.

Alternatively, via the menu item *File/New project…* a new project can be started. In this case, the basic function of the gateway can be set in the dialogue *new DMX-Gateway*.

5.2 Main window

The main window is splitted into six areas

- Menu
- Tool bar
- DMX tree topology
- KNX tree topology
- List view
- Status bar

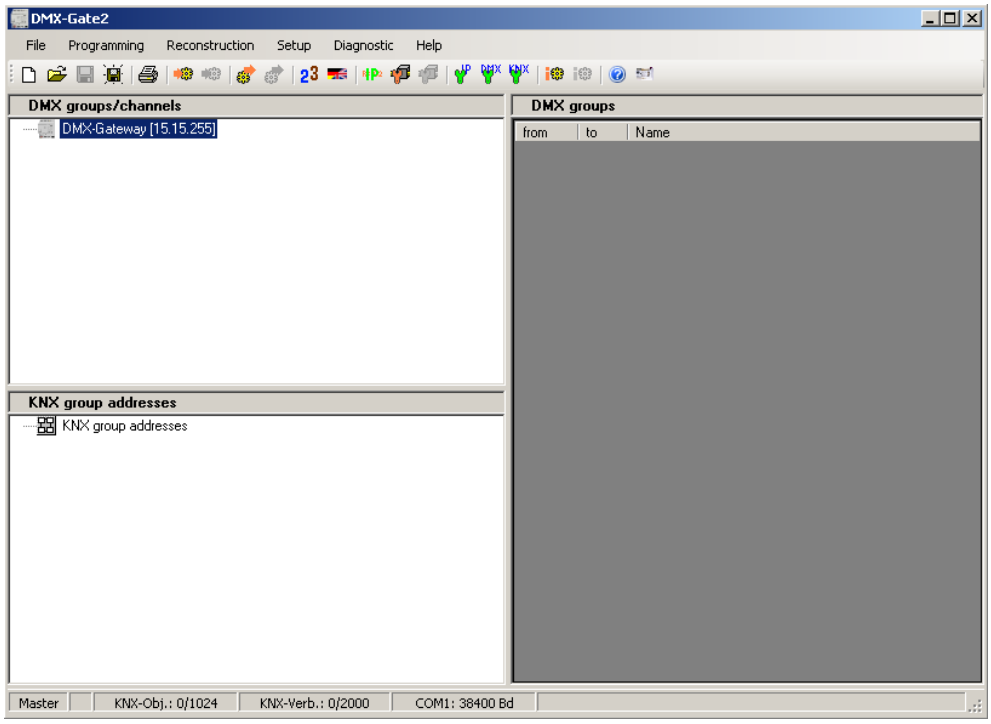

Fig. 5.2-1: Main window DMX-Gate2

In the DMX tree topology you can navigate on the DMX groups/channels of the gateway. By clicking one entry, the pertaining information is listed in the list view. By means of the right mouse key, new DMX groups and new DMX channels can be generated in the DMX tree topology.

In the KNX tree topology you can navigate on the KNX group addresses. By clicking one element, the pertaining information is listed in the list view. By means of the right mouse key, new DMX group addresses can be generated in the DMX tree topology. By means of Drag-and-Drop from KNX to DMX tree topology, KNX group addresses can be linked with DMX channels.

In the list view further information on the currently marked element of the DMX or KNX tree topology is shown.

In the status bar at the lower edge of the main window status information on the current project and on the device are shown.
Possible states:

- The gateway is projected as master or as slave.
- The current project has been modified but has not yet been changed.
- How many KNX objects and KNX connections are being used / are available.
- Which interface is set for commissioning of the gateway.

5.3 Project planning

5.3.1 Device parameters

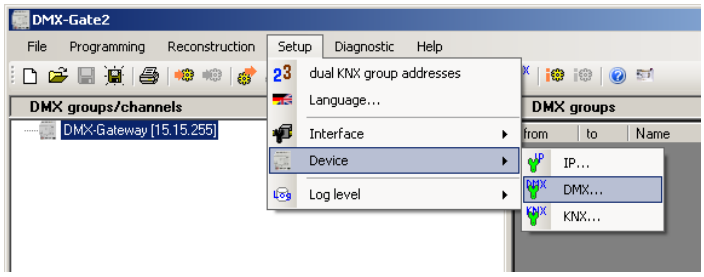

Fig. 5.3-1: Set device parameters

Via the menu item *Settings/Device parameters* the communication settings of the gateway are made. Separate dialogues are available for the KNX, DMX and Ethernet/IP ports.

5.3.1.1 KNX parameters

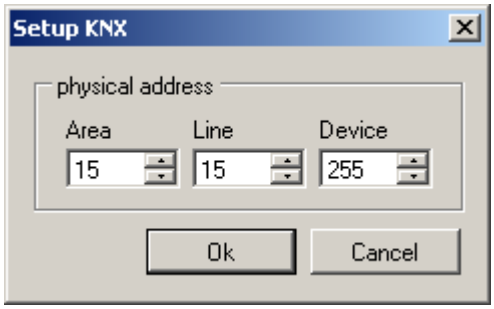

Fig. 5.3-2: Set KNX parameters

In the dialogue *KNX parameters* it is set which physical address the gateway uses on the KNX bus. With loading of the projects with DMX-Gate2, this address is written into the gateway automatically.

5.3.1.2 DMX parameters

Depending on the operation mode as Master or Slave, different parameters can be set for the DMX port of the gateway.

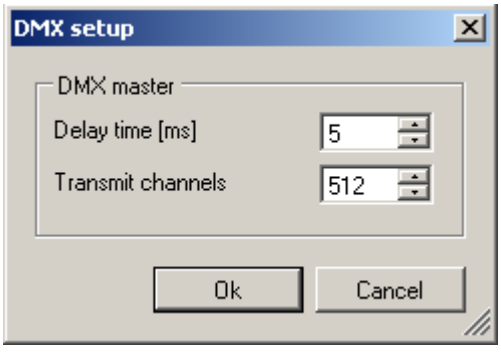

Fig. 5.3-3: Set DMX parameters for Master

In operation mode *Master*, the delay time and the number of transmission channels are set in the dialogue DMX parameters.

The delay time is the time between two DMX transmission processes.

The number of transmission channels used indirectly determines the maximum update speed of the DMX channels.

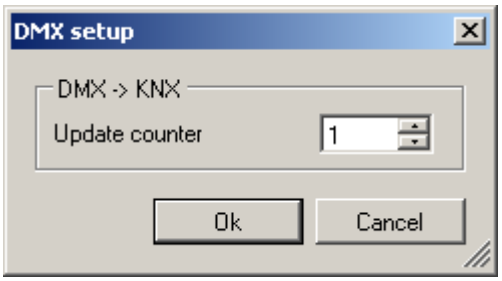

Fig. 5.3-4: Set DMX parameters for Slave

The update counter indicates how often the value of a DMX channel must be repeated unchanged before the gateway sends a new KNX telegram.

5.3.1.3 IP parameters

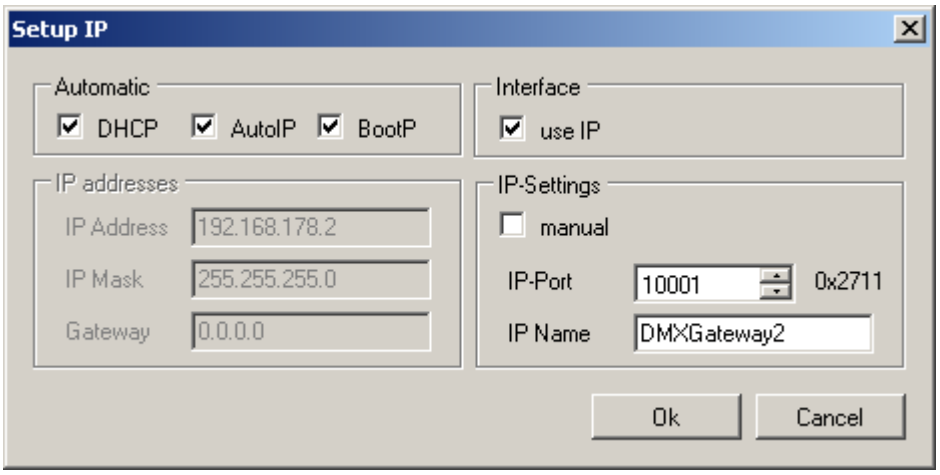

Fig. 5.3-5: Set IP parameters

In the dialogue *IP parameters* the basic communication parameters for the network connection of the gateway are set. If the IP port of the gateway is used, the gateway will normally receive an automatic IP address. Here, the processes DHCP, AutoIP and BootP are available. Alternatively, the IP settings can also be made manually. See also *Choice of the interface.*

5.3.2 Add DMX groups

Up to 32 devices with up to 512 DMX channels can be connected to one DMX bus.

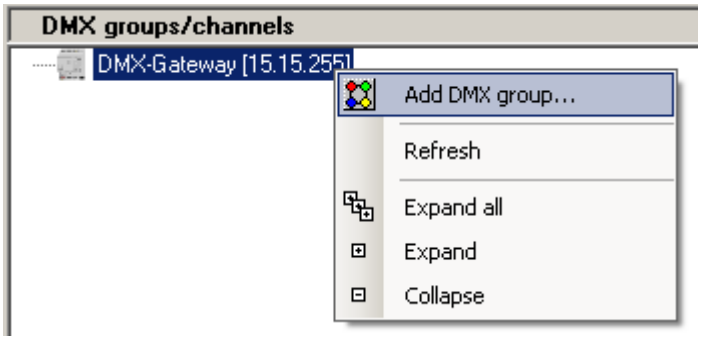

Fig. 5.3-6: Add DMX group

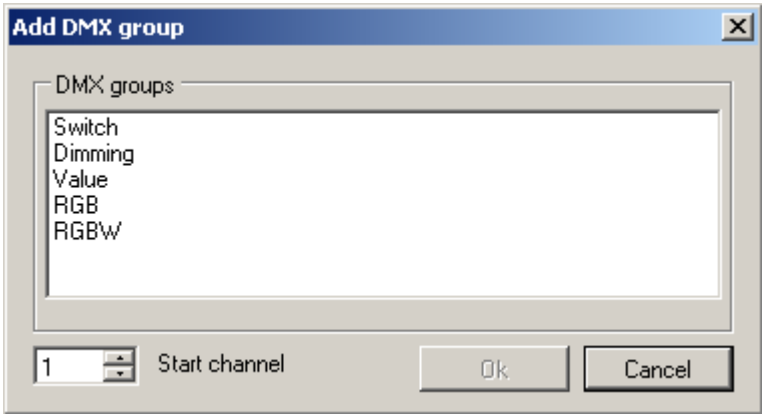

Fig. 5.3-7: Choice of the function group

In the *Fig.* of the devices in the DMX installation and of the functions requested in KNX installation, different DMX function groups can be added.

5.3.2.1 Switch, dimming, value

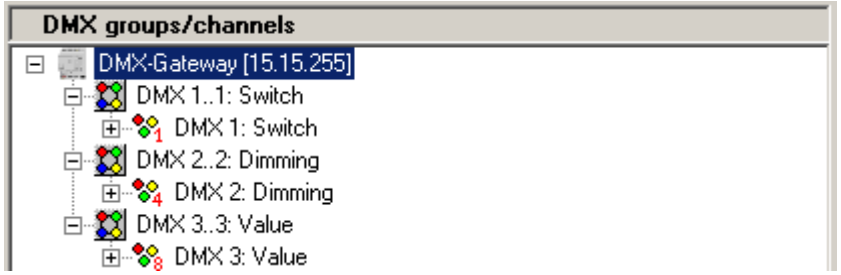

Fig. 5.3-8: DMX groups Switch, dimming, value

The DMX function groups Switch, dimming, value have one channel when they are inserted. To each of these channels belongs one KNX object each in the corresponding format.

5.3.2.2 RGB, RGBW

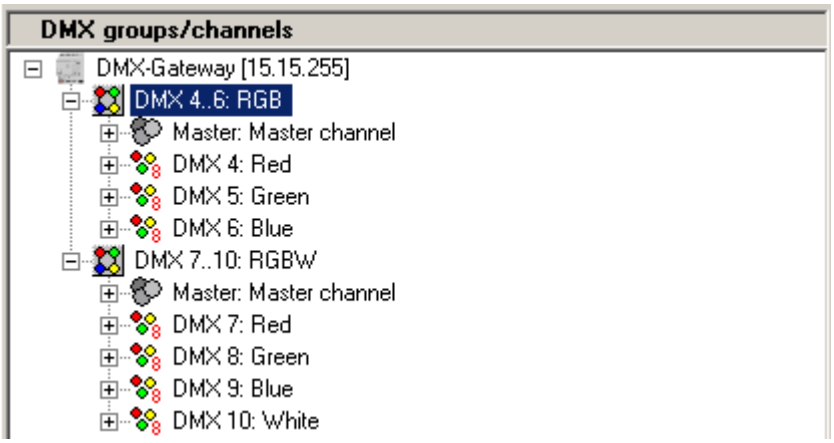

Fig. 5.3-9: DMX groups RGB, RGBW - Master

The DMX function groups RGB and RGBW have one channel each for each colour component when they are inserted. To each of these channels belongs one 1-Byte-KNX-object. In operation mode Master the two DMX groups also have a master channel by which all colour channels can be dimmed at a time.

5.3.3 Edit DMX group

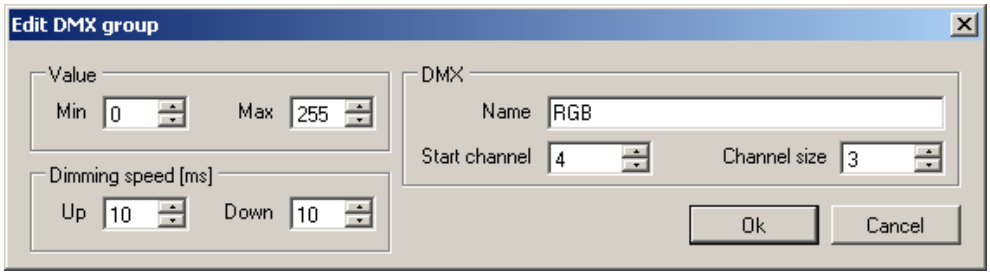

Fig. 5.3-10: Edit DMX group

For each DMX group some characteristics can be edited: the name, the assigned start channel and the number of DMX channels in this DMX group.

In operation mode *Master* you can also set the lower and upper limit of the dimming range and the dimming speed. The values for the dimming speed determine the time for one of 255 dimming steps.

The name should be a good description of the DMX group.

After inserting, the DMX groups Switch, dimming, value occupy one channel each. The DMX groups RGB or RGBW occupy three of four channels.

5.3.4 Add and edit DMX channels

In contrast to the DMX system, common dimmers in the KNX system have three different communication objects. For example: to control DMX channels with common KNX push-button sensors with dimming function, within one DMX group type Switch a further channel type Dimming can be added.

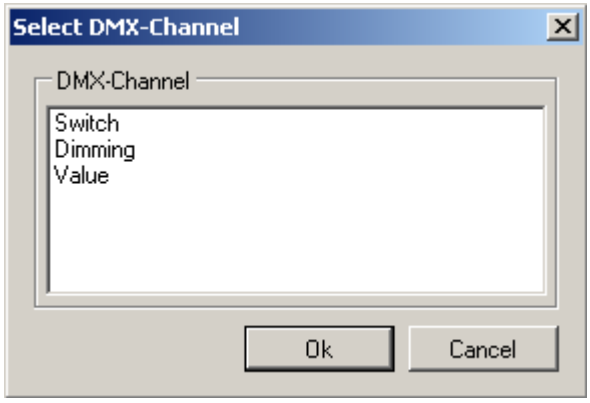

Fig. 5.3-11: Add DMX channel

This new channel automatically is given the type as name and a channel number.

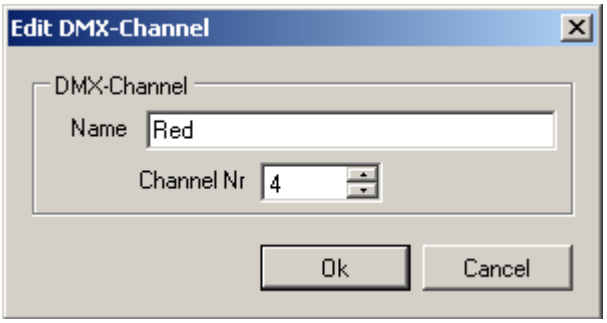

Fig. 5.3-12: Edit DMX channel

With a double click on DMX channel, the name and the channel number can be edited.

In operation mode *Master* different DMX groups can use the same DMX channels, if their KNX objects are linked with different group addresses. This way, for instance, it is possible to dim one luminaire from 10% to 90% only and to switch off completely the same luminaire with a different group address.

In operation mode *Slave* the assignments of the DMX channels and the channel numbers must be unambiguous.

5.3.5 Edit KNX object

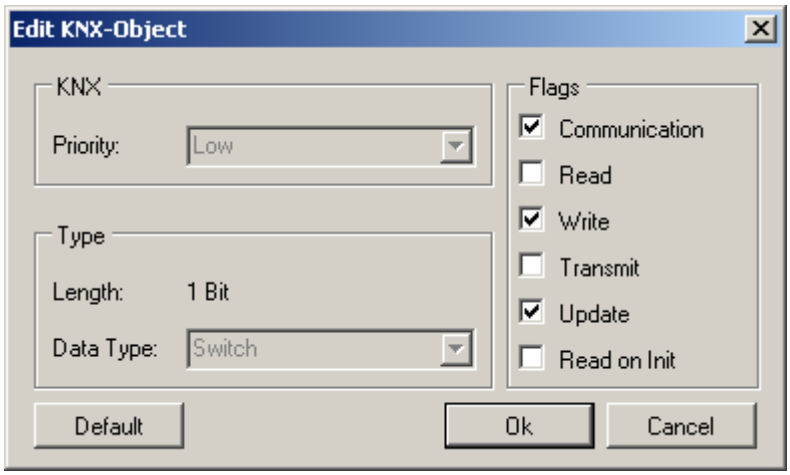

Fig. 5.3-13: Edit KNX object characteristics

With a double click on a communication object or via the right mouse key and the command *Edit KNX object* the characteristics of the object can be displayed and the object flags can be edited.

If the flag *Read on Init* is set, after reset the gateway sends a read request with the assigned transmitting group address. In this case the gateway takes over the value of the response telegram and transmits the new value to the DMX channel.

5.3.6 Group addresses

After creating the DMX channels they must be linked with the group addresses used in the KNX installation.

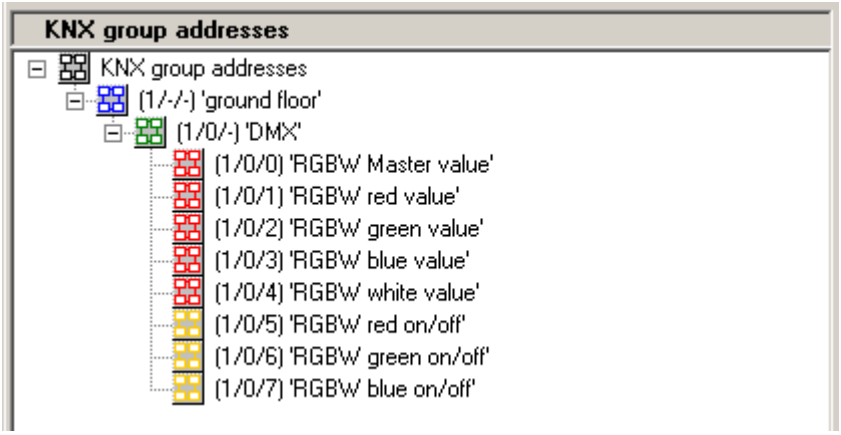

Fig. 5.3-14: Tree topology KNX group addresses

If a type has been assigned to a sub-group, the symbol in the tree topology is marked red. If no type has been assigned, the symbol is marked yellow.

The KNX group addresses can either be taken over from an existing ETS project or generated manually.

To take over the group addresses from an ETS project, the group addresses in the ETS must be exported into a CSV-file. The dialogue *Export group addresses* is opened in the ETS window *Group addresses* via the context menu of the node *Main groups*. In this dialogue the format *3/1 – three columns with Main/Middle/Sub group separated* must be set.

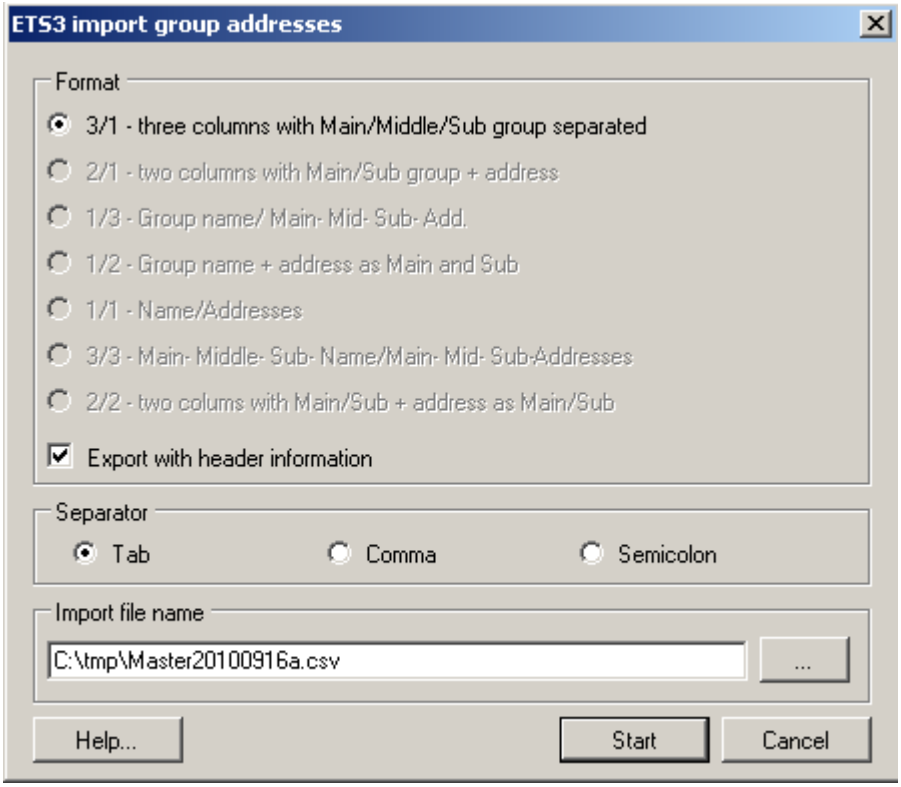

Fig. 5.3-15: Import of group addresses out of the ETS3

Afterwards, the group addresses in the *DMX-Gate2* can be taken over via the menu item *File -> Import -> ETS3 Group addresses*.

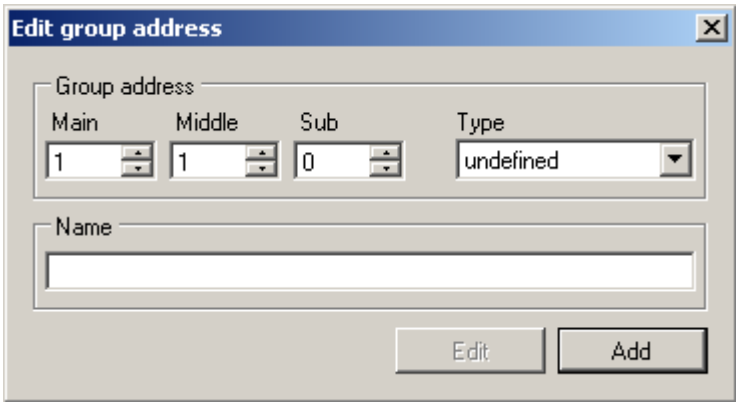

Fig. 5.3-16: Create or edit group addresses

To create new group addresses in the tree topology press the right mouse key to open the dialogue *Edit Group address* by means of the commands *Add main group*, *Add middle group*, *Add sub group*. Open the same dialogue to edit existing group addresses. Depending on the context in which the dialogue was opened, there might be some elements which cannot be edited.

5.3.7 Link DMX groups with KNX groups

There are two ways to assign group addresses to KNX communication objects.

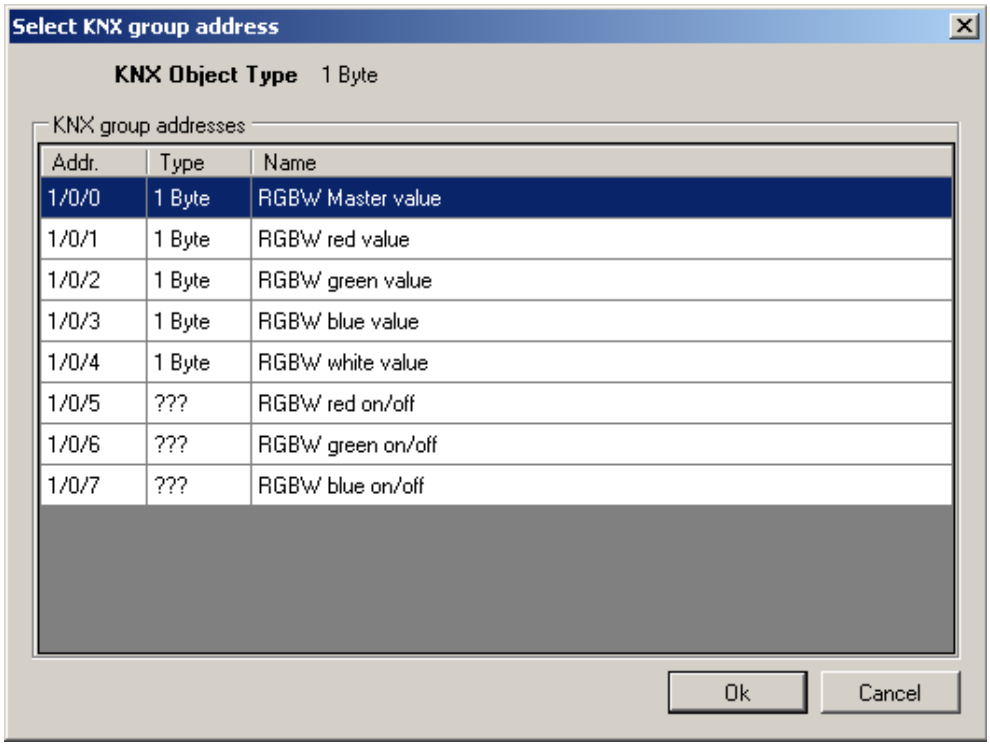

Fig. 5.3-17: Add group addresses to DMX channel

Clicking the right mouse key on a KNX communication object in the DMX tree topology you can choose the command *Add KNX group address …* to open the dialogue *Select KNX Group address.* In this dialogue all group addresses of the suitable type are listed or those whose type has not yet been determined.

If a sub-group out of the tree topology *KNX Group addresses* is pulled onto a DMX channel or a KNX communication object, the shape of the mouse pointer indicates whether an assignment is possible or not.

If two or more group addresses are assigned to a communication object, one of these group addresses can be defined as sending group address.

5.3.8 Documentation

To finalise the project planning, with *File -> Print…* the current state can be printed.

5.4 Commissioning

Commissioning of the gateway can be effected via RS232-interface or via Ethernet/IP interface.

5.4.1 Choice of interface

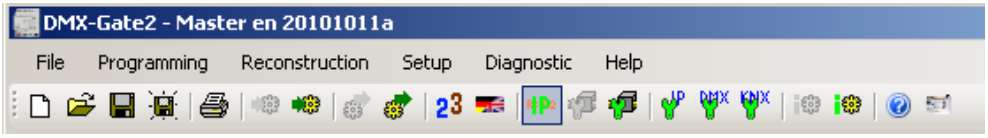

Fig. 5.4-1: Choice of interface

The currently set interface of the PC is shown in the status bar of the main window. Switch-over between Ethernet/IP interface and RS232 interface can be effected via the button in the tool bar or via the checkbox *Use IP* in the dialogue *IP parameters*.

5.4.2 IP settings

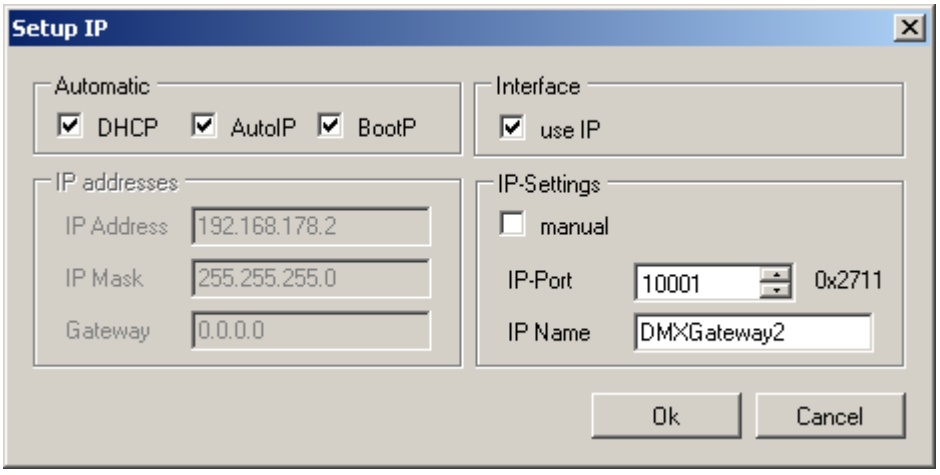

Fig. 5.4-2: IP parameter of the gateway

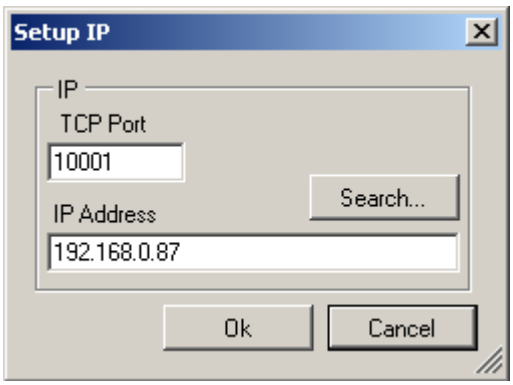

Fig. 5.4-3: IP parameters of the PC

If commissioning of the gateway is to be effected via the Ethernet/IP interface, the gateway can either be connected as part of the complete network or connected to the PC via crosslink line.

Unless there are any restrictions made by the network administrator, in most cases the gateway can automatically obtain the IP address. The IP address is assigned automatically after the supply voltage has been switched on.

Number 10001 is preset as port address of the gateway. If access via internet is intended, the firewall settings should be checked.

Communication on the Ethernet is effected via an unambiguous MAC address of the devices. For commissioning, the gateway can be identified unambiguously by its MAC address. You can find the MAC address on the label on the side of the device. In the dialogue *IP setting* the PC can look for suitable gateways. All IP addresses found are then listed together with the MAC addresses.

5.4.3 RS232 settings

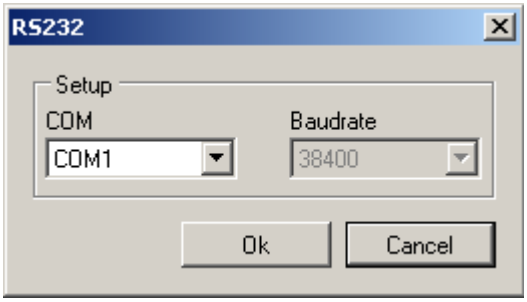

Fig. 5.4-4: RS232 parameters of the PC

The parameters of the RS232 interface in the gateway are firmly set. In the dialogue *RS232* the interface used by the PC can be selected. Further settings are not required.

5.4.4 Download

Depending on the interface set, the suitable command is available in the menu *Commissioning -> Download.* After selecting the command, the dialogue is opened for download if you start loading with the button *Start*.

5.5 Reconstruction

For reconstruction, the connection between PC and gateway must be the same as for commissioning.

To be able to identify the gateway unambiguously via the Ethernet/IP interface during reconstruction, it is advisable to connect the gateway (possibly via a crosslink cable) with the PC direct or to note down the MAC address of the label on the side of the gateway.

The reconstruction can read all functionally relevant data out of the gateway. The names of DMX channels and KNX group addresses are not stored in the gateway, thus they cannot be reconstructed.

5.6 Diagnosis

In case of a malfunction of the gateway, first of all the status information of the LED at the front of the device (see also Status information) should be checked.

Afterwards, via the menu *Diagnosis -> RS232* or *Diagnosis -> IP* the dialogue *Gateway information* can be opened.

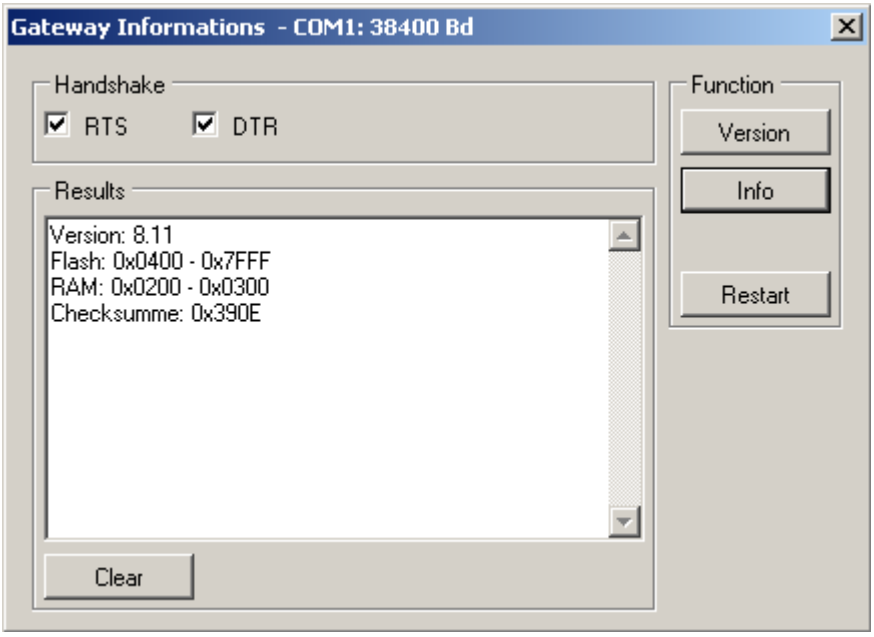

Fig. 5.6-1: Reading out of diagnosis information

After clicking the buttons *Version* or *Info,* the software tries to make a connection to the gateway and to read data out of the gateway. *Version* describes the firmware loaded in the device. On request, the current firmware can be loaded into the gateway via the menu *Commissioning*. The items Flash and RAM indicate the size of the memory installed. The checksum is written into the gateway when a project is loaded. If the gateway, in case of a restart, has detected by this checksum that the memory contents is erroneous, this is indicated via the status LED *Power/Error*. If the checksum was noted down after loading of a project, you can check afterwards whether the projection and thus the memory contents have been changed.

If possible, the function of both interfaces RS232 and Ethernet/IP should be tested. If a connection can be made via RS232 but not via IP, this might be caused by incorrect IP settings. For the gateway to obtain a new IP address, the supply voltage must be disconnected and connected again. The IP address does not change on activation of the button *Restart*.

To check the IP settings of the gateway, a reconstruction via the RS232 interface can be effected.

5.7 Logging

The projection software offers the possibility to log events occuring during project planning. The scope of logging can be set in several levels by means of the commands *Settings -> Log-level*. If you suspect a malfunction of the projection software, it can be agreed with the manufacturer to change this setting.

6 Appendix

6.1 DMX

DMX or DMX-512 describes a light control system having its roots in stage technology.

The original definition is derived from USITT (United States Institute for Theatre Technology)

Within the bus segment, the bus line runs from the transmitting device (Master) to maximum 32 receiving devices (Slaves). Its physical structure is a line terminated by a resistance.

In cases with more than one transmitter, a DMX merger must be used. In cases with more than 32 Slaves, splitters/boosters are used to split up the slaves into different bus segments.

In stage technology installation is made with shielded flexible cables equipped with five-pole plugs and sockets.

In building installation shielded network cables (CAT5 or CAT6) are recommended.

Maximum cable length is 1200 m. It depends on the quality of the cables used.

The electrical signal transmission corresponds to RS485 with a transmission speed of 250 kbit/s.

Each of the maximum 32 Slaves at one line can possess several logic channels for different functions. Maximum number of channels is 512. The relevant channel numbers used can be set in the devices.

The telegram frame consists of:
- Reset pulse (corresponding to 2 byte)
- 1 start byte
- Max. 512 data bytes (one byte per channel)

The length of the telegram frame is directly related to the number of channels used, for within a telegram frame the values of all channels used are transmitted. In case of 512 channels, up to 44 telegram frames per seconds can be transmitted.

6.2 KNX

KNX is a decentral bus system for building automation.

In one bus segment, up to 64 devices can be installed which all can send and receive. In case of larger installations, several electrically separated bus segments are connected logically via line or area couplers.

Each bus segment has its own power supply.

For installation, two wires of a four-wire lead of type IY(St)Y 2x2x0.8 are used. The line is laid in tree topology. Regarding the cable length in one bus segment, the following criteria have to be observed: The overall length including all branches must not exceed 1000 m. The distance between power supply and a device must not exceed 350 m. The distance between two stations must not exceed 700 m.

Each device has an unambiguous physical address within the installation which is also used for commissioning.

For definition of the function, each device has got logical communication objects. Number and size of these communication objects directly depend on the function of each device. The communication objects are linked with one another via group addresses.

Data transmission is effected with 9600 bit/s. The length of each telegram depends on the size of the communication objects.

To guarantee trouble-free interlinking of devices from different manufacturers, for basic functions the sizes of the communication objects and their functions are standardised by the KNX association.

Projection of all functions in a building and commissioning of the devices is effected by PC.