

# User Manual

## K-BUS®KNX IP Router\_V1.1

BNIPR-00/00.2



**KNX/EIB Home and Building Control System**

# Attentions

1. Please keep devices away from strong magnetic field, high temperature, wet environment;



2. Do not fall the device to the ground or make them get hard impact;



3. Do not use wet cloth or volatile reagent to wipe the device;



4. Do not disassemble the devices.

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## Chapter 1 Summary

The IP Router can be used as line or backbone coupler. It provides a data connection between the upper KNXnet/IP line (main line or backbone) and the lower TP KNX bus line (sub line). The basic functionality of the IP Router is to couple the Ethernet with one or more KNX-TP lines. The IP Router features a galvanic isolation between the Ethernet and the KNX-TP line(s). Due to its flexibility the IP Router can be used as a line coupler e.g. to connect several KNX TP lines via Ethernet. And it can be used as a backbone coupler to connect several TP areas or different TP installation systems via Ethernet.

The main task of the IP Router is filtering the traffic according to the installation hierarchy. For group oriented communication the traffic is filtered according to the built-in filter tables.

With the ETS or any other KNX compatible commissioning tool the IP Router can be used as the programming interface. For this purpose the device provides up to 4 additional physical addresses that can be used for IP tunneling. The IP Router has no KNX communication objects for itself.

The IP Router is a Tunneling and Routing device. These features are described in the following sections in detail. The device front panel consists of three LEDs and one buttons to indicate the running communication status, these are described in detail in the following chapters.

The IP Router is a modular installation device. It can be installed in the distribution board on 35mm mounting rails according to EN 60715.

This manual provides the technical information about the IP Router as well as assembly and programming in detail for users, and explains how to use the interface device by the application examples.

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## 1.1 Function overview

The IP Router has the follow functions:

- The IP Router is one of the rare KNX IP routers on the market that supports long messages up to 240 bytes. In combination with the line coupler and the long messages are made possible (e.g. for energy metering applications).
- The IP Router favorably replaces a line coupler or an area coupler. Using LAN as a fast medium to exchange telegrams between lines and/or areas is the great advantage.
- The IP Router works with external power supply.
- Providing tunneling protocols and a connection point for the ETS (or any other tool to enable commissioning and monitoring) the ETS address for tunneling is not necessarily the one that is already configured. Four parallel connections are possible, one separate address for each and every connection.
- IACK sending on sent out messages is ETS configurable
- After no IACK response on a sent message the IP Router can repeat it up to three times. For physically addressed or for group addressed telegrams this can be configured via ETS independently. In case of an IACK response there will be no repetition. The failure mechanism of a negative IACK or BUSY is still maintained hereby.
- For networks with a high bus load a high internal amount of communication buffers is suitable.
- The IP Router is featuring a high internal amount of communication buffers being capable of smoothing peaks in the communication load course.
- The IP Router's ETS database entries are available for the ETS4 and upward.
- The IP Router supports KNXnet/IP, ARP, ICMP, IGMP, HTTP, UDP/IP, TCP/IP and DHCP.

## **1.2 Tunneling**

The presence of the Internet Protocol (IP) has led to the definition of KNXnet/IP. KNXnet/IP provides the means for point-to-point connections like “KNXnet/IP Tunneling” for ETS and/or between a supervisory system and a KNX installation.

The KNXnet/IP Device Management provides configuring KNXnet/IP devices via the KNX network effectively. Additionally, with this the time required for network configurations is reduced.

## **1.3 Routing**

Routing is the way of interconnecting KNX lines or areas via IP network(s) using KNXnet/IP. In IP networks the KNXnet/IP Routing defines how KNXnet/IP routers communicate with each other.

## **1.4 KNX IP Routers**

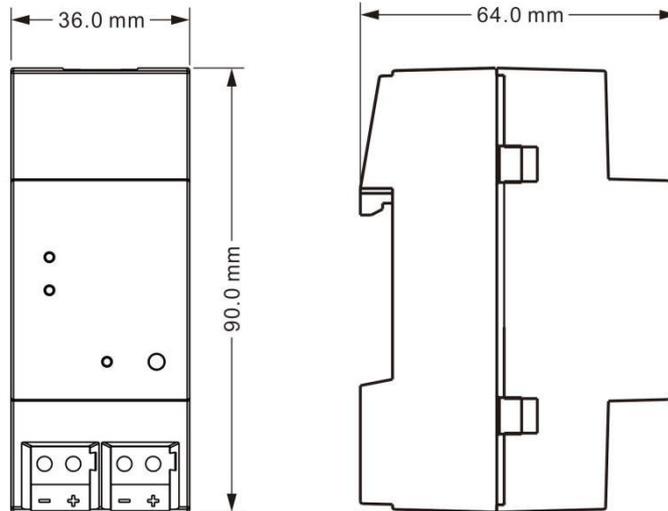
The IP Router is a KNX IP router. KNX IP routers are highly similar to TP line couplers. The only exception is that they use the communication medium Ethernet as their main line. However, it is also possible to integrate KNX end devices via IP directly. This makes the Ethernet a KNX medium.

## Chapter 2 Technical Data

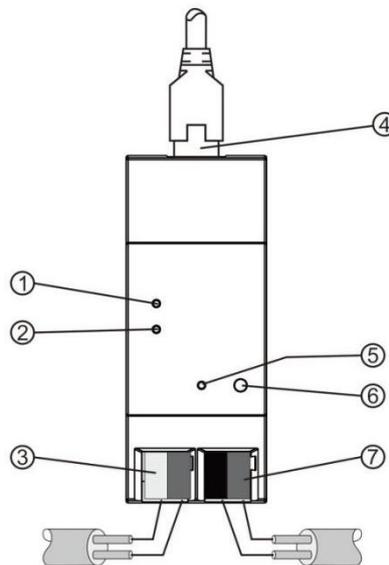
<b>Power supply</b>	Bus voltage	21-30V DC, via the KNX bus
	Bus current	<12 mA
	Bus consumption	<360mW
<b>Auxiliary supply</b>	Voltage	20-30V DC
	Current	<85mA
	Consumption	<2.5W
<b>Connections</b>	KNX	Bus connection terminal (Red/Black)
	Auxiliary supply	Connection terminal (Yellow/White)
	LAN	RJ45 socket for 100/10 Base-T
<b>Operating and display</b>	LAN/LINK LED	On: That network connect normally Flashing: The telegram traffic between device and network
	KNX/LINK LED	On: The KNX bus connect normally Flashing: The telegram traffic between KNX bus and device
	Programming/Running LED	Red: For assigning the physical address Green flashing: The device running normally
	Programming button	For assigning the physical address
<b>Temperature</b>	Operation	-5 °C ... + 45 °C
	Storage	-25 °C ... + 55 °C
	Transport	- 25 °C ... + 70 °C
<b>Ambient</b>	Humidity	<93%, except dewing
<b>Protection</b>	IP 20	to EN 60529
<b>Dimensions</b>	36×90×64mm	
<b>Weight</b>	0.1KG	
<b>Housing, colour</b>	Plastic housing, beige	
<b>Design</b>	Modular installation device, on 35mm mounting rail	

## Chapter 3 Dimension diagram and Connection diagram

### 3.1 Dimension diagram



### 3.2 Connection diagram



1	LAN/LINK LED	On: That network connect normally Flashing: The telegram traffic between device and network	5	Programming	Short press to assign the physical address Long press 5s to reset the IP address to the default address 192.168.2.200
2	KNX/LINK LED	On: The KNX bus connect normally Flashing: The telegram traffic between KNX bus and device	6	Programming /Running LED	Red: For assigning the physical address Green flashing: The device running normally
3	Auxiliary supply connection terminal (Yellow/White)		7	KNX bus connection terminal(Red/Black)	
4	LAN connection				

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## Chapter 4 Planning and Application

### 4.1 KNX Telegrams in the IP Network

The IP Router sends telegrams from/to the KNX to/from the IP network in accordance with the KNXnet/IP protocol specification. According to the default setting these telegrams are sent as multicast telegrams to the multicast IP address 224.0.23.12 port 3671. The multicast IP address 224.0.23.12 is the defined address for the KNXnet/IP from the KNX Association in conjunction with the IANA. This address should be preserved and used as defined. Only if it becomes necessary due to the existing network, it could be changed in the “General Parameters” as described in KNX Multicasting Address. During commissioning, it is important to note:

- **All KNX IP devices that are intended to communicate with each other via IP network must have the same IP multicast address**
- **Multicast IP address 224.0.23.12 may need to be changed corresponding to the type of network and the setting of the network components**
- **IGMP (Internet Group Management Protocol) is used for the IP configuration to establish multicast group memberships**
- **If the IP address is changed from the IP side, it may sometimes happen that the ETS does not recognize the device anymore and the connection can no longer be established (tunneling uses IP address)**
- **As a precaution, always run a restart or change the address from the TP side**
- **Please ask your administrator if problems occur for the IP Address assignment**
- **According to the topology, the additional physical addresses (for tunnelling) always have to be assigned in the range of sub line addresses. For more information about the IP tunneling addresses please refer to Chapter 6.**
- **If a KNX/USB or KNX/IP interface is used to program a device of another line connected to a KNX IP Router, you should pay close attention to have the correct topology!**

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### 4.1.1 The IP Router in a Network Installation

In a network installation the IP Router can either be used as a KNX area coupler or as a KNX line coupler.

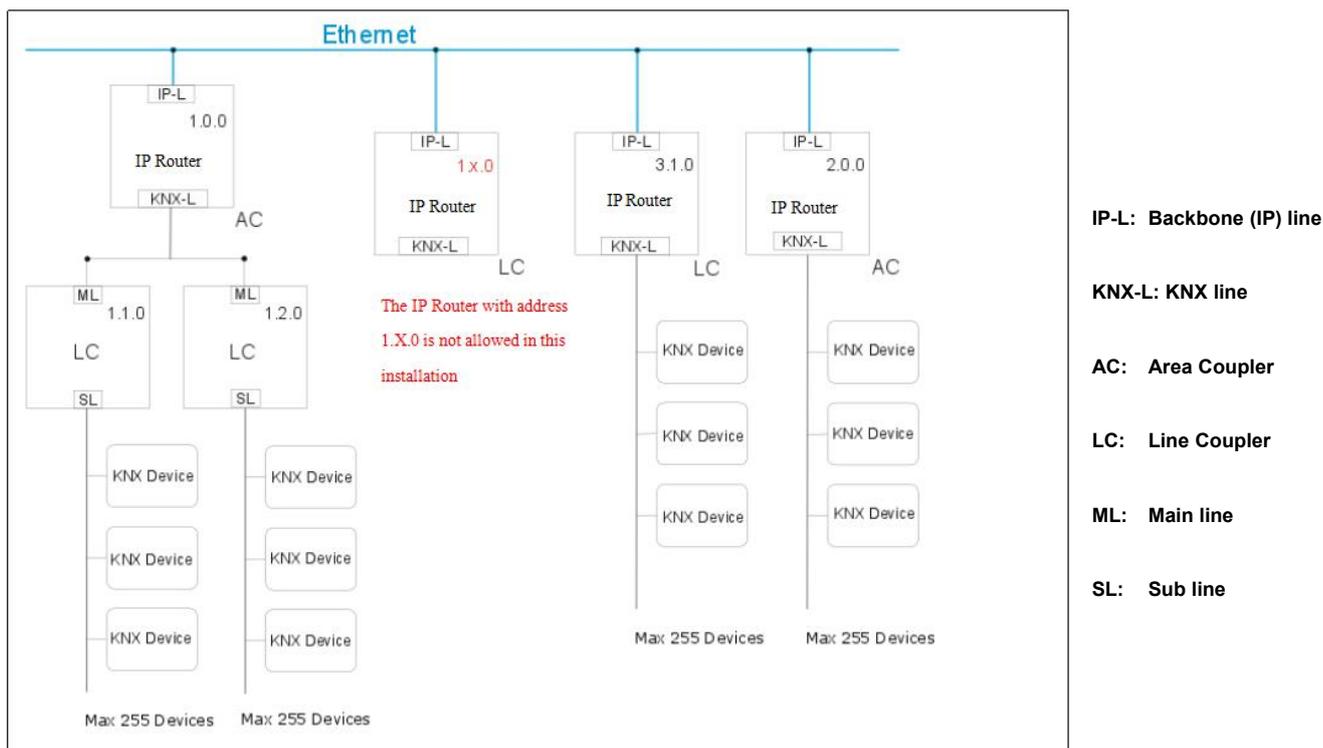
### 4.1.2 The IP Router as an Area Coupler

The IP Router can replace an area coupler in a KNX network. For this purpose it must receive the physical address of an area coupler (X.0.0,  $1 \leq X \leq 15$ ). In the ETS up to 15 areas can be defined with area couplers.

### 4.1.3 The IP Router in a Mixed System

If it is necessary in a KNX system to use the IP Router at one point as an area coupler, e.g. office or home complex, and at another point as a line coupler, e.g. a remote underground garage or a pool; this is possible. It is only necessary to ensure that the IP Router used as a line coupler uses a line coupler address from a free addressing area. The following picture best illustrates the topology with IP Router routers as area and/or line couplers. Special attention needs to be paid that if a IP Router area coupler with address "1.0.0" already exists in the installation, no other IP Router line coupler (or any other KNX IP router) with address "1.X.0,  $1 \leq X \leq 15$ " is allowed to be used in that network, and of course vice versa, if a IP Router line coupler with address "1.1.0" already exists in the installation, no other IP Router area coupler (or any other KNX IP router) with address "1.0.0" is allowed to be used in that network.

A direct connection between two IP Routers is possible as well. In this case, the auto IP will assign each IP Router an IP address and the two IP Routers will communicate over either a normal or a crossed network cable.



#### 4.1.4 The IP Router as a Line Coupler

The IP Router of a KNX network can assume the functionality of a line coupler. For this purpose it must have the physical address of a line coupler (X.Y.0,  $1 \leq X \text{ \& } Y \leq 15$ ). In the ETS up to 225 lines can be defined (from 1.1.0 to 15.15.0).

When the coupler receives telegrams (for example during commissioning) that use physical addresses as destination addresses, it compares the physical addresses of the receiver with its own physical address and then decides whether it has to route the telegrams or not.

Due to telegrams with group addresses the coupler reacts in accordance with its parameter settings. During normal operation (default setting), the coupler only routes those telegrams whose group addresses have been entered in its filter table.

If the coupler routes a telegram and does not receive an acknowledgement, or if a bus device discovers a transmission error, the coupler repeats the telegram up to three times (depending on the corresponding parameter that is set to the device through the last ETS download). With the parameters „Repetitions if errors...“, this behaviour can be set separately for both lines. These parameters should stay with the default setting.

**The ETS does not provide an unload procedure for the application of the IP-Router !**

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## Chapter 5 Parameter setting description in the ETS

### 5.1 Physical Address Assignment

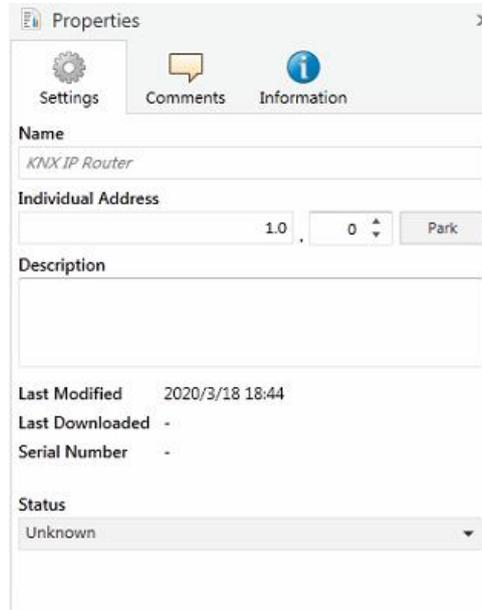


Fig.5.1 Properties window in ETS

The physical address can be assigned by the properties window of the ETS, download or full download, need to press the programming button. After assignment the device restarts itself, LAN/LINK LED is not on indicates that the Ethernet cable is not properly connected.

## 5.2 General

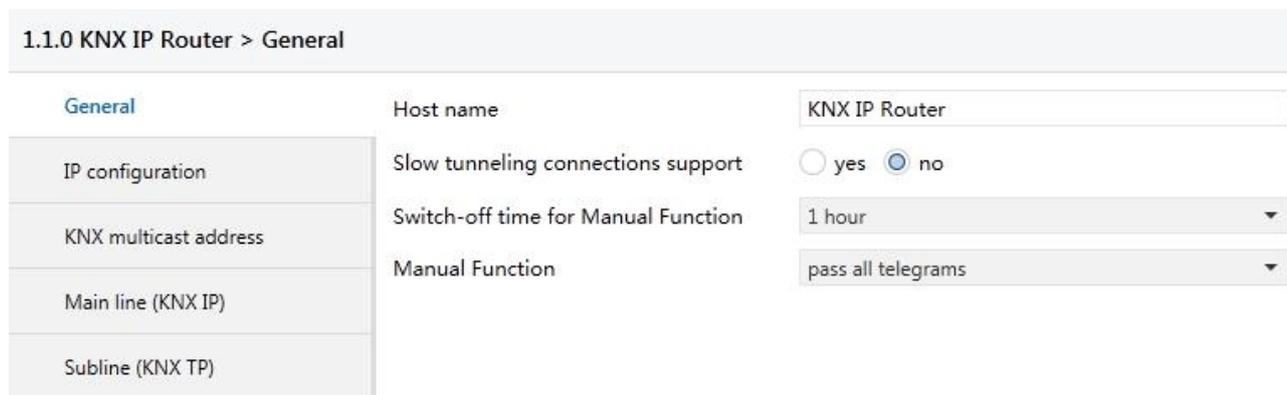


Fig. 5.2 Parameter window “General”

ETS-Text	Selection	Comment
Host name	<b>KNX IP Router</b>	Field to enter the device name (30 signs max.) providing an easy search of the device with the ETS or with a KNXnet/IP visualization system.
Slow tunneling connections support	Yes <b>No</b>	Enable to support slow tunneling connections.
Switch-off time for Manual Function	10min, <b>1hour</b> , 4hours, 8hours	After expiry of this time period the Manual Function is switched off automatically. <b>Note: Currently this device does not support manual functions, it is a reserve parameter.</b>
Manual Function	Disabled <b>Pass all telegrams</b> Pass all physical telegrams Pass all Group telegrams	Configuration setting for telegram routing when the Manual Function is active. <b>Note: Currently this device does not support manual functions, it is a reserve parameter.</b>

Please note that the factory state of the IP router:

- ① The IP coupler does block all telegrams because the filter table is not defined
- ② The physical address is 15.15.0.

### 5.3 IP Configuration

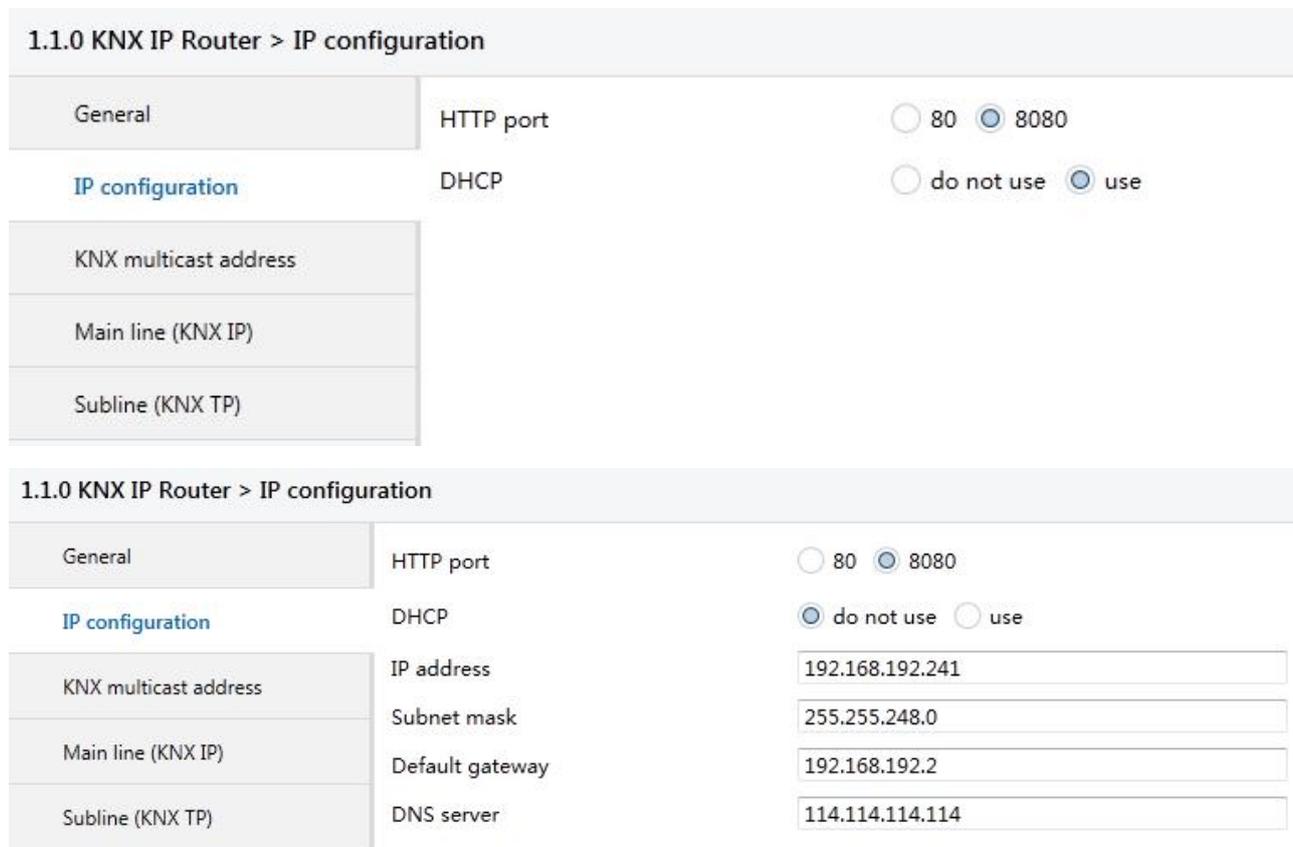


Fig 5.3 Parameter window “IP configuration”

ETS-Text	Selection	Comment
HTTP port	80 <b>8080</b>	Select one of the two official system ports.
DHCP	Do not use <b>Use</b>	If DHCP is not used, following parameters are to be set (see table below). If DHCP is used, no further IP parameters have to be set.
IP address	0-255.0-255.0-255.0-255	IP Byte 1 to 4: manual input.
Subnet mask	0-255.0-255.0-255.0-255	SM Byte 1 to 4: manual input.
Default gateway	0-255.0-255.0-255.0-255	DG Byte 1 to 4: manual input.
DNS server	0-255.0-255.0-255.0-255	DNS Byte 1 to 4: manual input.

## 5.4 KNX Multicasting Address

The multicast address 224.0.23.12 is the defined address for the KNXnet/IP from the KNX Association in conjunction with the IANA. This address shall only be changed if it becomes necessary due to the existing network.

1.1.0 KNX IP Router > KNX multicast address

General	System multicast	<input checked="" type="radio"/> do not use <input type="radio"/> use
IP configuration	Byte 1	239
<b>KNX multicast address</b>	Byte 2 [0 - 255]	0
	Byte 3 [0 - 255]	0
Main line (KNX IP)	Byte 4 [0 - 255]	0
Subline (KNX TP)		

ETS-Text	Range	Comment
System multicast	Do not use <b>Use</b>	If "do not use" is selected, the address is to be defined physically. If "use", the system multicast is 224.0.23.12
Byte 1 (of the IP routing multicast address) This range is reserved for the IP multicast address.	System: [224] Physical: <b>[239]</b>	If System multicast address is used, "224" is permanently set. If Physical multicast address is used, "239" is permanently set.
Byte 2 [0 - 255] (of the IP routing multicast address)	0-255	Can only be set manually if a physical multicast address is used.
Byte 3 [0 - 255] (of the IP routing multicast address)	0-255	Can only be set manually if a physical multicast address is used.
Byte 4 [0 - 255] (of the IP routing multicast address)	0-255	Can only be set manually if a physical multicast address is used.

Fig. 5.4 Parameter window "KNX multicast address"

**Note:** During commissioning it should be regarded that all KNX IP devices intended to communicate with each other via IP must use the same IP routing multicast address.

## 5.5 Main Line

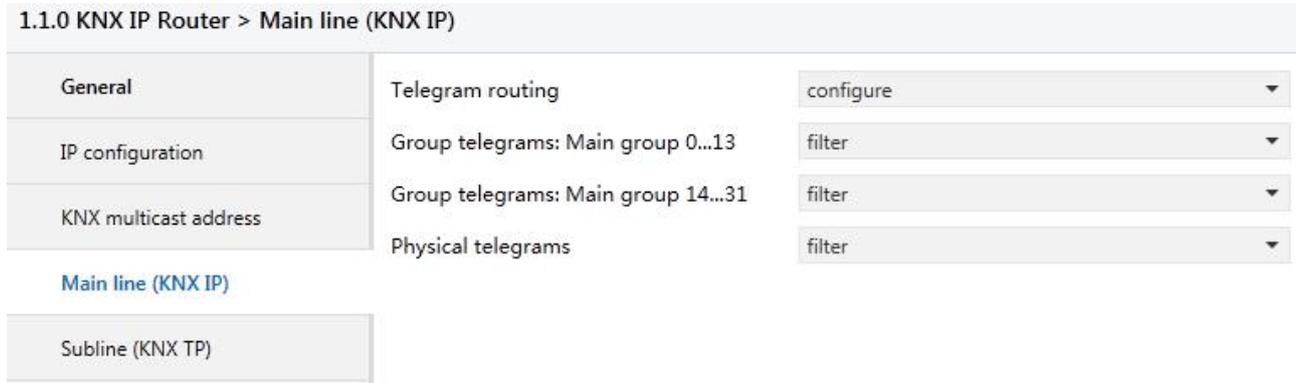


Fig. 5.5 Parameter window “ Main line”

ETS-Text	Selection	Comment
Telegram routing	Groups: filter, Physical: block <b>Groups and Physical: filter</b> Groups: route, Physical: filter Groups and Physical: route configure	- <u>Block</u> : no telegram is routed. - <u>Filter</u> : only telegrams are routed which are entered in the filter table. - <u>Route</u> : the telegrams are routed. - <u>Configure</u> : the following parameters can be set physically. This parameter is to be set depending on the planned configuration.
Group telegrams: Main group 0..13	1. transmit all(not recommended) 2. block <b>3. filter</b>	1. Group telegrams (main group 0...13) are all routed. 2. Group telegrams (main group 0...13) are all blocked. 3. Group telegrams (main group 0...13) are routed if entered in the filter table.
Group telegrams: Main group 14..31	1. transmit all(not recommended) 2. block <b>3. filter</b>	1. Group telegrams (main group 14...31) are all routed. 2. Group telegrams (main group 14...31) are all blocked. 3. Group telegrams (main group 14...31) are routed if entered in the filter table.
Physical telegrams	1. transmit all(not recommended) 2. block <b>3. filter</b>	1. All physical telegrams are transmitted. 2. No physical telegram is transmitted. 3. Only physical telegrams are routed based on the physical address.

**Note:** The parameter “transmit all” for Group telegrams and Physical telegrams is intended only for testing purposes and should not be set for normal operation.

## 5.6 Sub Line

1.1.0 KNX IP Router > Subline (KNX TP)

General	Telegram routing	configure
IP configuration	Group telegrams: Main group 0...13	filter
KNX multicast address	Group telegrams: Main group 14...31	filter
Main line (KNX IP)	Physical telegrams	filter
	Physical telegrams: Repetition if errors on subline	up to 3 repetitions
Subline (KNX TP)	Group telegrams: Repetition if errors on subline	up to 3 repetitions
	Telegram confirmation on subline	<input checked="" type="radio"/> if routed <input type="radio"/> always
	Send confirmation on own telegrams	<input type="radio"/> yes <input checked="" type="radio"/> no
	Configuration from subline (KNX TP)	<input checked="" type="radio"/> allow <input type="radio"/> block

Fig. 5.6 Parameter window “Sub line”

**Note:** If the parameter “Send confirmation on own telegrams” is set to “yes”, with sending any own routed telegram the IP Router will systematically send an ACK.

ETS-Text	Selection	Comment
Telegram routing	Groups: filter, Physical: block <b>Groups and Physical: filter</b> Groups: route, Physical: filter Groups and Physical: route Configure	- <b>Block</b> : no telegram is routed. - <b>Filter</b> : only telegrams are routed which are entered in the filter table. - <b>Route</b> : the telegrams are routed. - <b>Configure</b> : the following parameters can be set physically. This parameter is to be set depending on the planed configuration.
Group telegrams: Main group 0..13	1. transmit all(not recommended) 2. block <b>3. filter</b>	1. Group telegrams (main group 0...13) are all routed. 2. Group telegrams (main group 0...13) are all blocked. 3. Group telegrams (main group 0...13) are routed if entered in the filter table.
Group telegrams: Main group 14..31	1. transmit all(not recommended) 2. block <b>3. filter</b>	1. Group telegrams (main group 14...31) are all routed. 2. Group telegrams (main group 14...31) are all blocked. 3. Group telegrams (main group 14...31) are routed if entered in the filter table.

Physical telegrams	<ol style="list-style-type: none"> <li>1. transmit all(not recommended)</li> <li>2. block</li> <li><b>3. filter</b></li> </ol>	<ol style="list-style-type: none"> <li>1. All physical telegrams are transmitted.</li> <li>2. No physical telegram is transmitted.</li> <li>3. Only physical telegrams are routed based on the physical address.</li> </ol>
Physical telegrams: Repetition if errors on subline	<ol style="list-style-type: none"> <li>1. no</li> <li><b>2. up to 3 repetitions</b></li> <li>3. one repetition</li> </ol>	<p>After subline transmission error (e.g. due to missing receiver) Physical telegrams:</p> <ol style="list-style-type: none"> <li>1. The physical telegram is not repeated.</li> <li>2. The physical telegram is repeated up to 3 times.</li> <li>3. The physical telegram will be repeated only one time.</li> </ol>
Group telegrams: Repetition if errors on subline	<ol style="list-style-type: none"> <li>1. no</li> <li><b>2. up to 3 repetitions</b></li> <li>3. one repetition</li> </ol>	<p>After subline transmission error (e.g. due to missing receiver) Group telegrams:</p> <ol style="list-style-type: none"> <li>1. The group telegram is not repeated.</li> <li>2. The group telegram is repeated up to 3 times.</li> <li>3. The group telegram will be repeated only once.</li> </ol>
Telegram confirmations on subline	<ol style="list-style-type: none"> <li><b>1. if routed</b></li> <li>2. always</li> </ol>	<ol style="list-style-type: none"> <li>1. Routed telegrams to IP main line are confirmed by an ACK on the subline.</li> <li>2. Each telegram on the subline is confirmed by an ACK</li> </ol>
Send confirmation on own telegrams	<p>Yes <b>No</b></p>	<ol style="list-style-type: none"> <li>1. Telegrams sent out to the subline are confirmed by added ACK.</li> <li>2. No ACK confirmation</li> </ol>
Configuration from subline (KNX TP)	<p><b>Allow</b> Block</p>	<p>If blocked an ETS download to the IP Router can occur only via IP main line.</p>

## 5.7 ETS bus configuration interface

Generally, after obtaining the device, to make the device work normally, we first need to configure the device with reasonable parameters and physical addresses in the ETS. The configuration of IP parameters should be defined according to the network environment, and the physical address of the device is defined according to the topology of the KNX system. After completing the configuration, download it to the device.

When IP router work normally, it can view the IP address, physical address, port number and other information of the device, as shown in Fig.5.7 below. In this interface, the physical address of IP Tunneling connection can be modified, such as 15.15.241.

The screenshot displays the ETS configuration interface. On the left, under 'Current Interface', a blue bar highlights '1.0.0 KNX IP Router 123' with 'Individual Address: 15.15.241'. Below this are sections for 'Configured Interfaces' (containing '新连接' with address '0.0.0.0:3671') and 'Discovered Interfaces' (listing various hardware like '1.0.0 KNX IP Router 123', 'KNX USB Interface', and 'Realtek PCIe GBE Family Controller'). On the right, the 'IP Tunneling' settings are shown, including 'Name: KNX IP Router 123', 'Host Individual Address: 1.0.0', 'Individual Address: 15.15.241' (circled in red), 'IP Address: 192.168.192.241', 'Port: 3671', and 'MAC Address: 1C:87:76:8F:57:9E'.

Current Interface		
1.0.0 KNX IP Router 123 Individual Address: 15.15.241		
Configured Interfaces + Add Import... Export...		
新连接	0.0.0.0:3671	
Discovered Interfaces		
1.0.0 KNX IP Router 123	192.168.192.241:3671	1C:87:76:8F:57:9E
KNX USB Interface (Video-Star)		
Realtek PCIe GBE Family Controller	239.0.0.0	40:8D:5C:9A:10:E7
Realtek PCIe GBE Family Controller	239.0.0.0	40:8D:5C:9A:10:E7
USB-STKNX (STmicroelectronics International N.V.)		

IP Tunneling	
Name	KNX IP Router 123
Host Individual Address	1.0.0
Individual Address	15.15.241 <input data-bbox="1300 1093 1401 1120" type="button" value="Address free?"/>
IP Address	192.168.192.241
Port	3671
MAC Address	1C:87:76:8F:57:9E

Fig.5.7 ETS bus configuration interface

## Chapter 6 State of Delivery

The IP Router is delivered with the following default factory settings:

<b>Physical address</b>	15.15.0
<b>Physical address for IP tunneling connections</b>	15.15.241 15.15.242 15.15.243 15.15.244
<b>IP configuration</b>	
<b>IP address assignment</b>	DHCP/Auto IP
<b>IP routing multicast address</b>	224.0.23.12
<b>Main Line (IP Main line to TP Subline)</b>	
<b>Group telegrams (main group 0...13)</b>	Filter (Filter table is empty)
<b>Group telegrams (main group 14...31)</b>	Filter
<b>Physical telegrams</b>	Filter
<b>Sub Line (TP Subline to IP Main line)</b>	
<b>Group telegrams (main group 0...13)</b>	Filter (Filter table is empty)
<b>Group telegrams (main group 14...31)</b>	Filter
<b>Physical telegrams</b>	Filter
<b>Physical telegram: Repetition if errors on sub line (KNX TP)</b>	Up to 3 repetitions
<b>Group telegram: Repetition if errors on sub line (KNX TP)</b>	Up to 3 repetitions
<b>Telegram confirmations on line (KNX TP)</b>	If routed
<b>Send confirmation on own telegrams</b>	No
<b>Configuration from sub line (KNX TP)</b>	Allow

## Chapter 7 Web Configuration

Web configuration is typically used to modify IP addresses and device names, and upgrade devices. Specific filtering tables, multicast, and other functions need to be configured in the ETS.

Enter the IP address of the device in the web browser to enter the web configuration interface of the IP router, as shown in Fig.7.1 below.

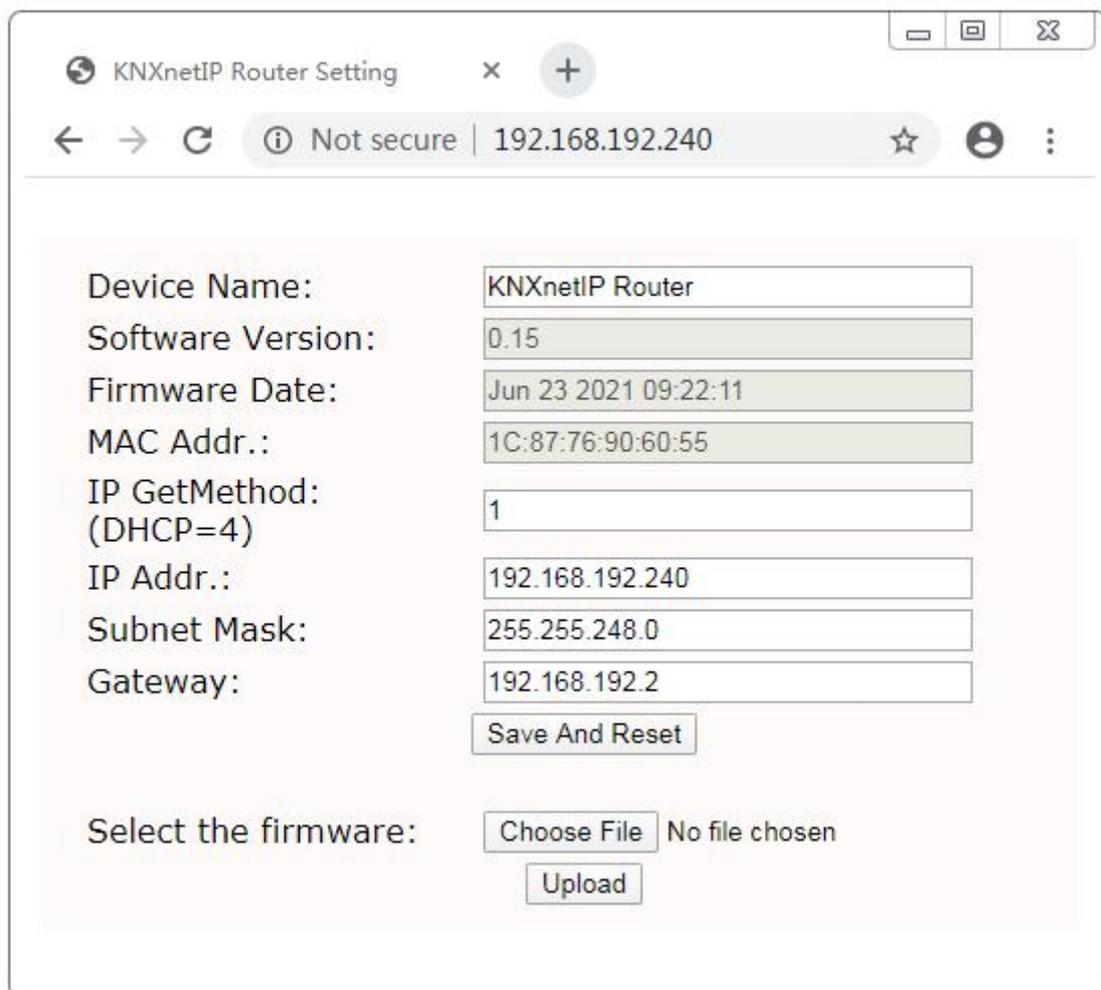


Fig.7.1 IP router web configuration interface

- ① **Device Name:** Display or set the device name.
- ② **Software Version:** Display the software version.
- ③ **Firmware Date:** Display the date of the device firmware.
- ④ **MAC Addr.:** Display the MAC address.

⑤ **IP GetMethod:** The method to get IP address. When the value is set to 1, it represents the fixed IP address. The custom IP address, subnet mask and default gateway can be entered below. When the value is set to 4, IP address is automatically assigned through the DHCP server.

⑥ **IP Addr.:** Display or set the IP address.

⑦ **Subnet Mask:** Display or set the subnet mask.

⑧ **Gateway:** Display or set the gateway.

⑨ **【Save And Reset】** : Click this button to save and reset after setting changes are completed. At this time, the page will jump to the interface as shown in Fig.7.2, indicating that the device is restarting. After restarting, the page will automatically return to the configuration interface.

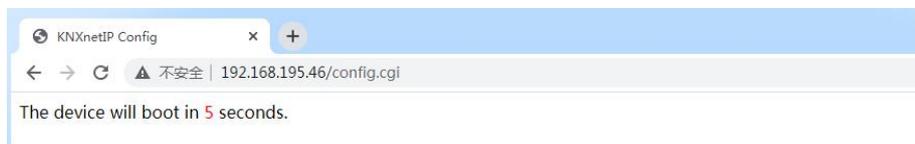


Fig.7.2

⑩ **Select the firmware:** It is used to upgrade the firmware of the device. Click the button [Choose File] to choose the firmware of the updated device, and then click the button [Upload] to update the device.

**Note:** If the user does not know or forget the IP address, reset the IP address of the device to the default address of 192.168.2.200 by long pressing the programming button 5s of the IP router, and then enter this IP address in the browser to enter the web configuration interface of the device and change the IP settings and then save.