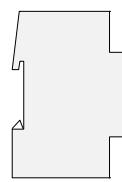


IP Router



System

| | |
|-------------------------|--|
| Product name: | IP router |
| Design: | REG (rail-mounted device) |
| Article-no.: | IPR 100 REG |
| ETS search path: | System devices / IP router / IP router |
| Issue: | 03.04.2007 |

Functional description:

The IP router interconnects KNX / EIB lines via data networks using the Internet Protocol (IP). The IP router implements the EIBnet/IP standard so that it cannot only be used for routing KNX / EIB telegrams between lines via an IP network, but also for access to the bus from a PC or from other DP devices (visualization displays and applications). The IP router can thus also be used as an IP data interface for the ETS 3.0 after version "c".

By using a LAN modem, an EIB installation can be remotely accessed even if there is no direct local data network connection between a PC and an IP router.

The use of the existing data network for communication between bus lines makes sense especially in non-residential buildings. The advantages are:

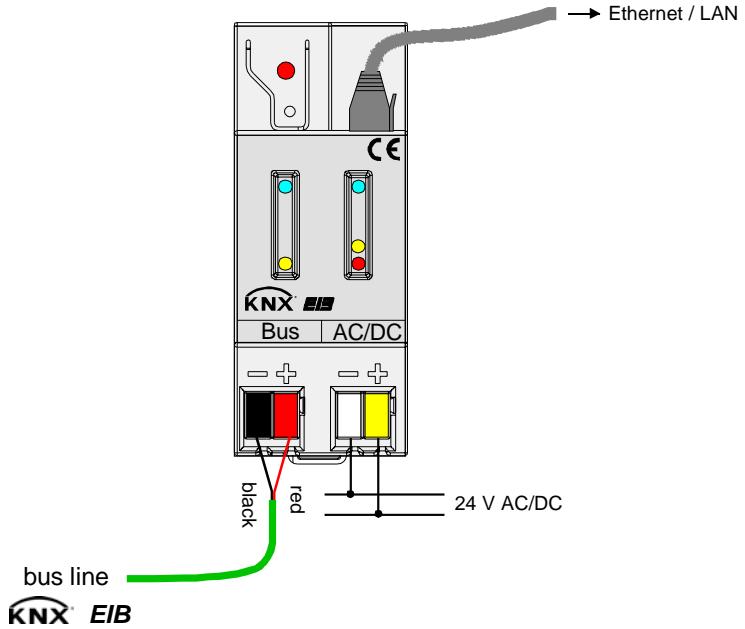
- fast communication between KNX / EIB lines,
- extending a KNX / EIB system by means of LAN and WAN beyond a building,
- direct routing of KNX / EIB data to each network user (not in bus monitor mode)
- KNX / EIB remote configuration from each network access point.

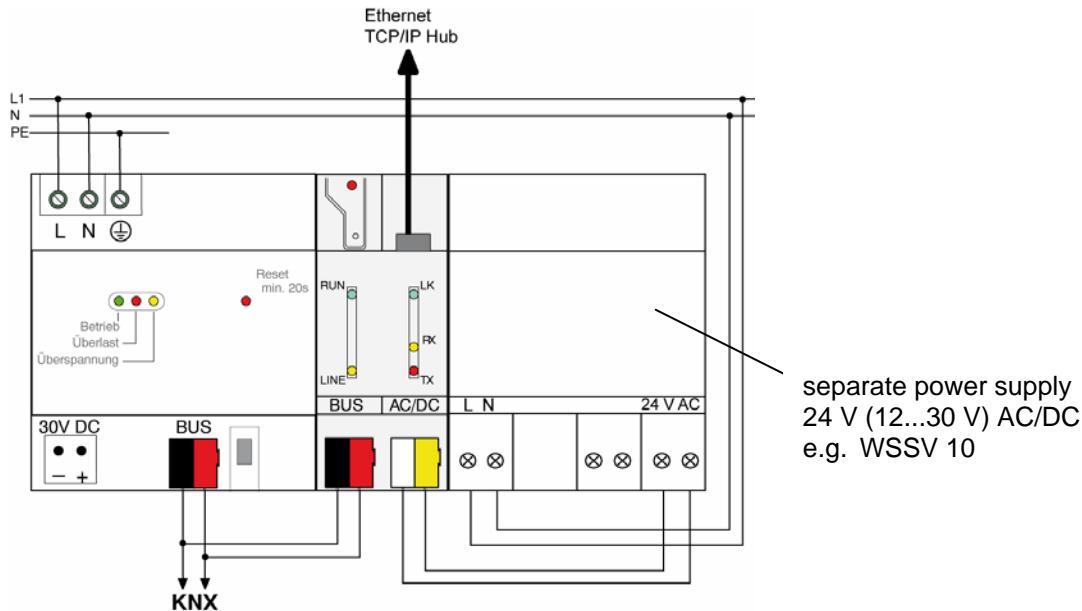
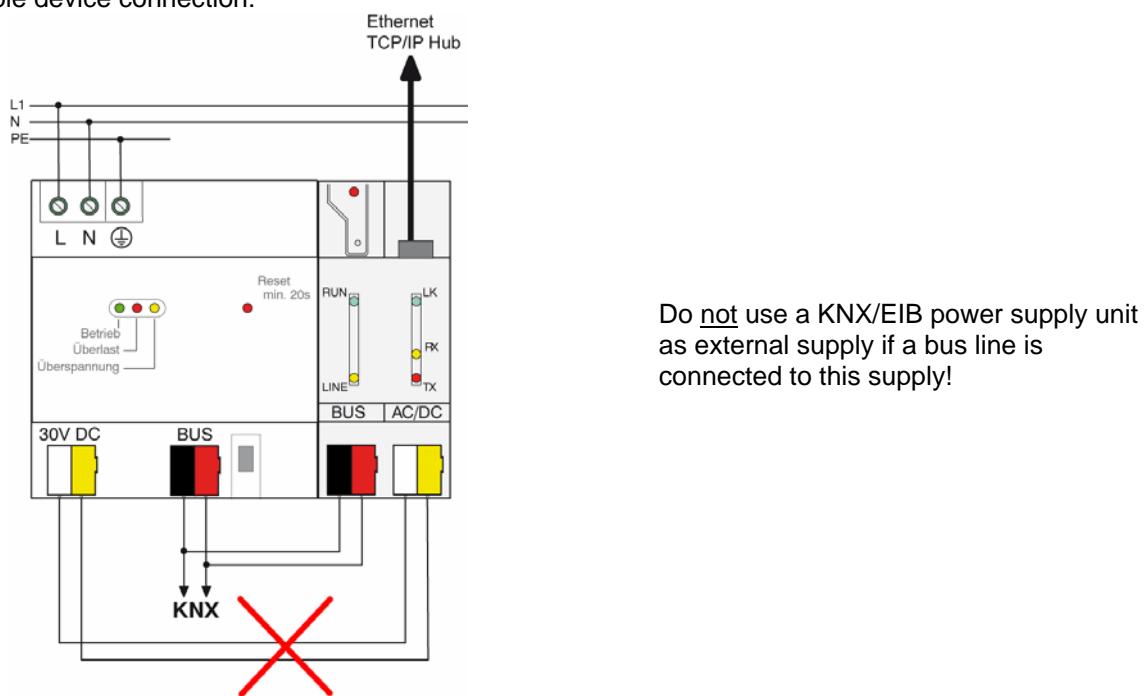
In its capacity as an area/line coupler, the IP router interconnects two KNX / EIB lines to form a logical functional area ensuring at the same time the electrical separation between these lines. Each bus line of a KNX / EIB installation is thus electrically independent of other bus lines.

The exact function of the device is determined by the physical address.

For operation, the IP router needs an external power supply of 24 V AC/DC. The IP router is powered via this operating voltage terminal connector. This feature enables the IP router to transmit a bus voltage failure message via the data network.

| | | |
|----------------------|--|--|
| Illustration: | | Dimensions: Width: 36 mm; 2 modules Height: 90 mm Depth: 60 mm |
| | | Controls / terminals: A connecting terminals for KNX / EIB line B connecting terminals for external power supply 24 V AC/DC C connecting terminals for Ethernet / LAN (RJ45 socket) D LED "Run" (green): ready for operation signal (external power supply active) E LED "Line"(yellow): active during reception of data at KNX / EIB bus connection F LED "LK"(green): signals active connection with the IP network (Ethernet Link) G LED "RX"(yellow): active during reception of valid IP telegrams (Ethernet Receive) H LED "TX"(red): active during transmission of IP telegrams (Ethernet Transmit) I Programming LED (red) J Programming button |

| Technical data | |
|--|--|
| Type of protection | IP 20 (acc. to EN 60529) |
| Safety class: | III (acc. to IEC 61140) |
| Mark of approval: | KNX / EIB |
| Ambient temperature: | - 5 °C to + 45 °C |
| Storage temperature | - 25 °C ... + 70 °C (storage above + 45 °C reduces the lifetime) |
| Type of fastening: | snap-fastening on DIN rail (no data rail required) |
| Bus connection: | |
| Voltage: | 21 – 30 V DC SELV |
| Power consumption: | typically 290 mW at 29 V DC |
| Current | typically 10 mW at 29 V DC |
| Connection: | with KNX / EIB connecting / branching terminal |
| External power supply: | |
| Voltage: | 24 V (12...30 V) AC/DC SELV |
| Power consumption: | max. 800 mW at 30 V DC |
| Current | max. 27 mW at 30 V DC |
| Connection: | typically 25 mW at 24 V DC with KNX / EIB connecting / branching terminal (preferably yellow/white) |
| Recommended power supplies: | suitable power supplies 24 V (12...30 V) AC/DC SELV e.g. doorbell transformer or... WSSV 10 power supply 24V AC Note: Do <u>not</u> use a KNX/EIB power supply unit as external supply if a bus line is connected to this supply! |
| Network: | |
| Connection: | Ethernet 10BaseT (10 Mbit/s) |
| Supported protocols: | ARP, ICMP, IGMP, UDP/IP, DHCP KNXnet/IP in acc. with KNX system specification: Core, Routing, Tunneling, Device Management |
| Response to bus voltage failure / recovery: | A voltage failure on the bus line is internally stored and – depending on parameterization – signalled via the KNXnet/IP. The message is cancelled via KNXnet/IP as soon as bus voltage recovery is detected. |
| Wiring diagram / Terminals: |  |

Wiring example:**Inadmissible device connection:****CAUTION!**

The router connects the external extra-low supply voltage with the potential of the LAN. The insulation from ground potential is no longer ensured (incompatible with SELV specifications!) when the LAN shield is grounded.

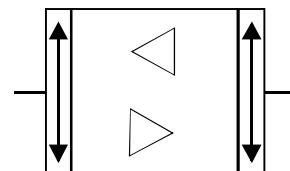
It is recommended to use the external power supply exclusively for the IP router and not to connect any other devices to the supply.

Hardware information

- The filter tables are stored in a non-volatile memory (flash). This means that the stored addresses are not lost after a system voltage failure. And internal backup battery is not needed.
- Depending on application, access requirements, data security and data volume it may be advisable to install independent network paths for individual services using the IP network.

Software information**ETS search path:**

System devices / IP router / IP router

ETS symbol:**PEI Type** 00 Hex 0 Dec No adapter used**Applications:**

| No. | Short description: | Name: | Version: |
|-----|--------------------|------------------|----------|
| 1 | IP router | IP router 901001 | 0.1 |

Application: 1. IP router 901001**Executable from mask version:** Coupler (\$91A)**Number of addresses (max):** 0 **dynamic table handling** Yes No **Number of assignments (max):** 0 **maximum length of table** 0**Communication objects:** 0

| Object | Function | Name | Type | Flag |
|--------|----------|------|------|------|
| - | - | - | - | - |

Object description

No objects

Scope of functions

- Simple connection to higher-level systems via the Internet Protocol (IP)
- Direct access to the KNX / EIB installation from any access point in the IP network (KNXnet/IP Tunneling – no bus monitor mode)
- Fast communication between KNX / EIB lines, areas and systems (EIBnet/IP Routing)
- Communication between buildings and facilities (networking of facilities)
- Filtering and routing of telegrams depending on...
 - physical address
 - group address
- Simple configuration with standard ETS 2 / 3
- Transmission of KNX/EIB system failure message to applications via KNXnet/IP
- Easy connection to visualization systems and Facility Management systems (see: Supported Software)

Functional description

Router working as an area or line coupler

General

In its capacity as an area/line coupler, the IP router interconnects two KNX / EIB lines to form a logical function area ensuring at the same the electrical separation between these lines. Each bus line of a KNX / EIB installation can thus be operated electrically independently from other bus lines.

A coupler either transmits telegrams using addressing via physical addresses and broadcast addressing (e.g. during start-up) or group telegrams (e.g. communication via group addresses during regular operation of a KNX / EIB-Installation).

For transmitting physically addressed telegrams, it is important that the coupler knows its own physical address, i.e. that its assignment to a line is fixed. The coupler compares the destination address of a received telegram with its own line address. Depending on parameterization, the coupler transmits telegrams, when the destination address corresponds to its line, blocks all physically addressed telegrams or transmits all telegrams, e.g. for testing purposes.

With respect to group communication, the coupler's behaviour can be parameterized depending on the transmitting direction. This way, the coupler either routes or blocks all group telegrams. During regular operation of an installation and especially in order to reduce bus loading, a filter table can be loaded into the coupler. In this case, the coupler only routes those group telegrams whose group address is included in the filter table.

This principle is valid with the exception of main groups "14" and "15". Addresses belonging to these main groups can no longer be included in the filter table due to its limited overall size. These addresses can be separately blocked by a parameter or transmitted. The filter table is generated by the ETS (automatically with ETS3) and programmed into the coupler by means of a download.

- i In conjunction with the IP router, the driver for bus communication of the ETS 3 does not support the "Diagnosis bus monitor" function and no local download of the application program.**

Topology

In its capacity as an area / line coupler, the IP router transmits telegrams between a subordinate line and the IP network. The exact function of the device is determined by the physical address as follows:

Area (backbone) coupler A.0.0 ($1 \leq A \leq 15$)
Line coupler A.L.0 ($1 \leq A \leq 15, 1 \leq L \leq 15$)

The IP router can, on principle, be used as a line coupler or as an area coupler (cf. Fig. 1).

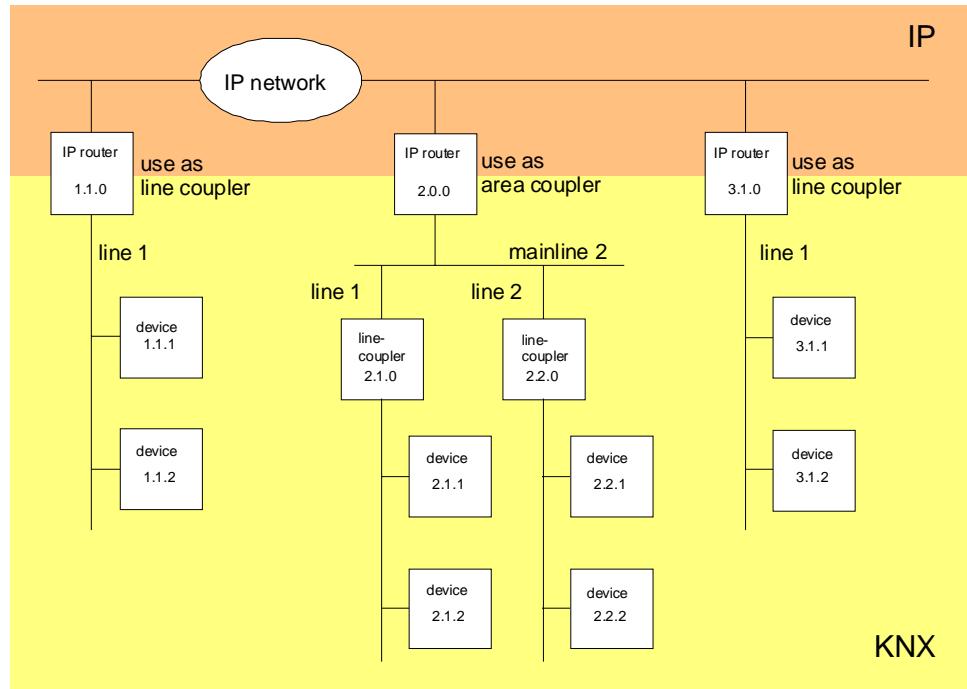


Fig. 1: IP router as area or line coupler

If the IP router is used as an area coupler with the physical address x.0.0 (x = 1...15), then no other IP router with line coupler address x.y.0 (y=1...15 – same area address) must be used topologically "below" this IP router (cf. Fig. 2).

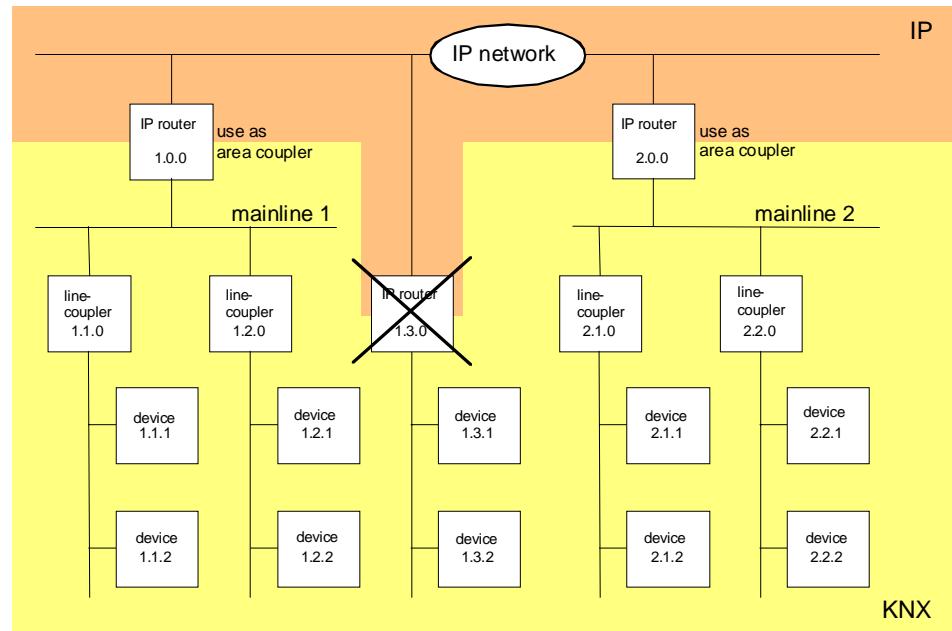


Fig. 2: IP router as area coupler

If an IP router is used as a line coupler with the physical address x.y.0 (x = 1...15, y = 1 ...15), then no other IP router with the same area coupler address x.0.0 must be used 'higher' in the system (cf. Fig. 3).

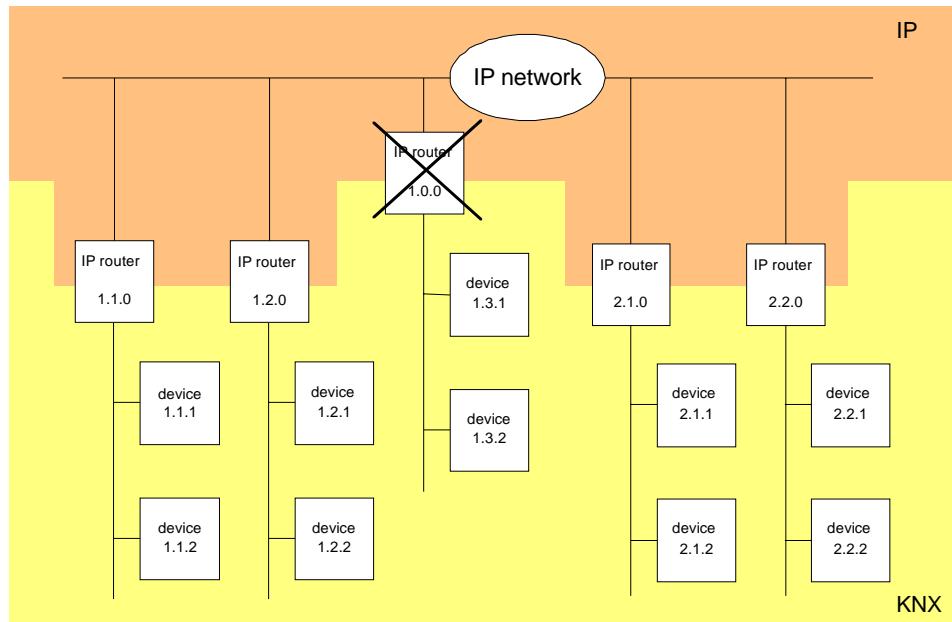


Fig. 3: IP router as line coupler

Note:

The perfect functioning of the IP router as an area or a line coupler (KNXnet/IP Routing) depends on network components supporting IP multicasting. Network / LAN routers in particular must permit a setting or be set in such a way that IP multicasting datagrams will be forwarded. For KNXnet/IP Routing, the IP multicast address reserved for this purpose is address 224.0.23.12.

Function as IP data interface

A direct connection between a networked PC or other DP terminal devices (e.g. visualization displays and applications) in the network and the KNX / EIB can be established via an IP data network and the IP router. In that case, the bus can be accessed from any point in the IP data network.

The ETS3 (from version 3.0c onwards) permits configuring KNX/EIB installations via the existing IP data network and uses the IP router like any other conventional serial RS232 or USB data interface for communication with the bus. This includes also downloading of bus devices or the function of the group bus monitor (no support of bus monitor mode).

For stable communication via KNXnet/IP Tunneling, a second physical address (similar to the local physical address with an RS232 or a USB link) must be specified. From a topological point of view (physical address of the device in the project), the IP router is projected into the KNX/EIB installation like a coupler.

To configure the communication interface, the following steps are required:

1. Start the ETS3 and open the Options menu with the communication properties (Extras → Options → Communication – cf. Fig. 4).

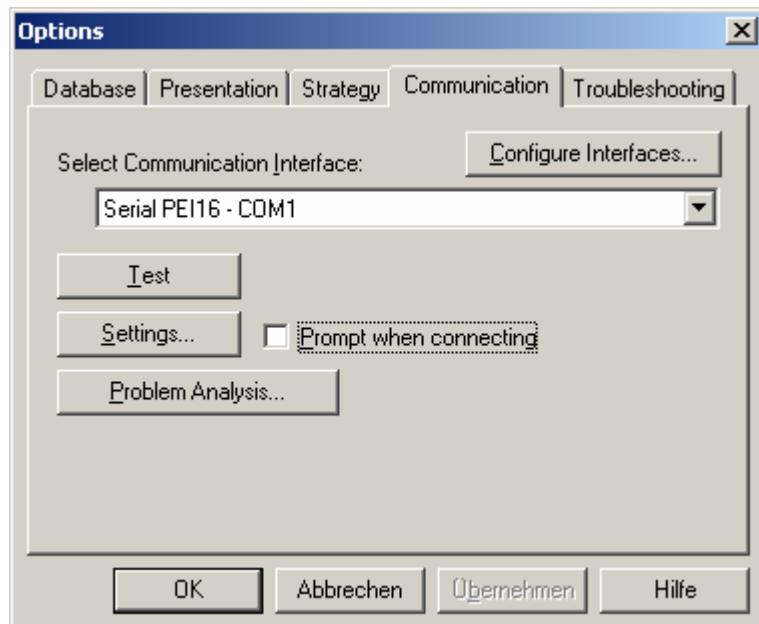


Fig. 4: Options dialog for communication properties of the ETS3

2. Select the "Configure interfaces" button. The "ETS Connection Manager" is opened (cf. Fig. 5).

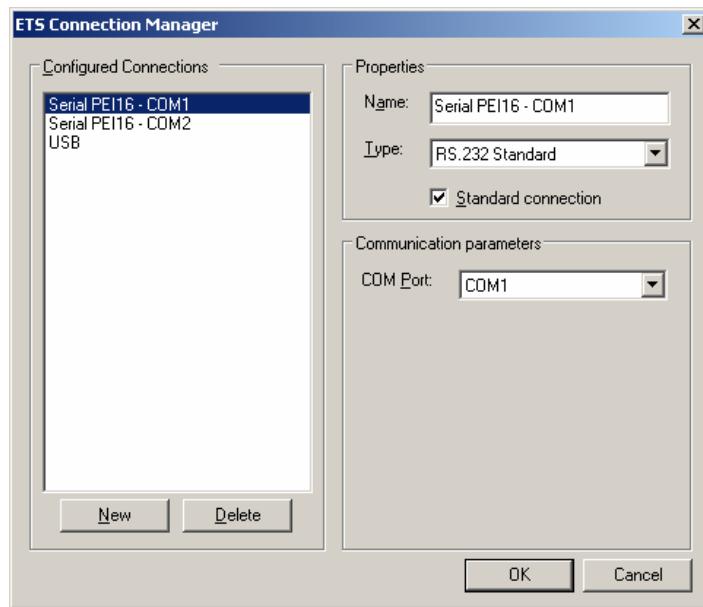


Fig. 5: ETS Connection Manager

3. Create a new connection. To do so, press the "New" button. Select a unique name for the new connection. Under "Type" select "Eibnet/IP" (cf. Fig. 6).
Thereafter, the ETS3 searches the IP data network automatically for available communication devices.

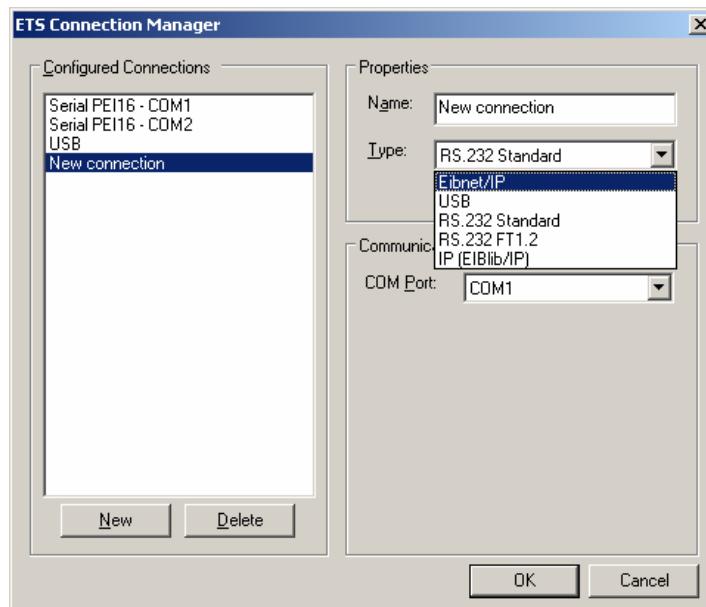


Fig. 6: Creating the new connection as EIBnet/IP connection

4. The "Eibnet/IP Device" list contains all IP routers found in the IP network (cf. Fig. 7). The name assigned in the ETS (default is "IP router") and the IP address of the IP router are indicated. The letter (P) behind these data signals that a programming mode is activated. By this means, it is possible to identify individual devices even in systems with several routers. The IP router which is to work in the configured connection as a "data interface" must be selected in the device list.

By clicking on the "Rescan" button, the ETS 3 starts a new scanning cycle to search for IP routers in the IP network.

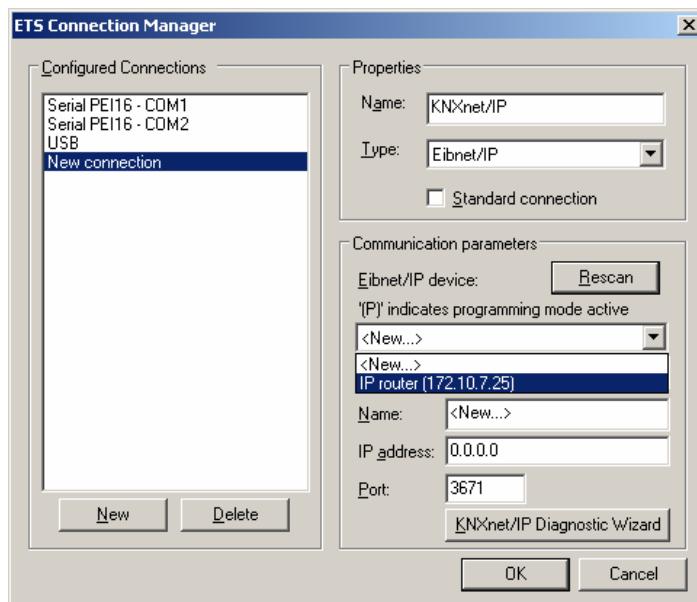


Fig. 7: List of devices in communication parameters with all IP routers found

5. Thereafter, the configuration of the new connection can be terminated by clicking on the "OK" button. The communication parameters (cf. Fig. 8) should remain unchanged.

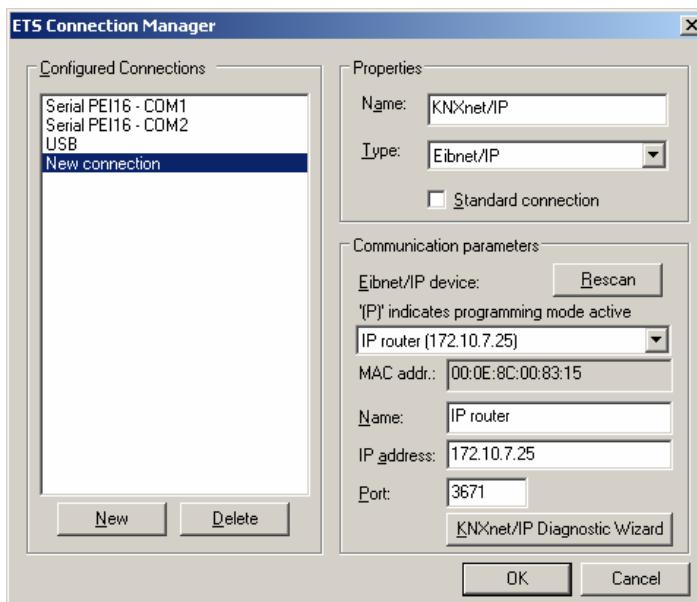


Fig. 8: Complete interface configuration of the IP router

6. For stable communication via KNXnet/IP Tunneling, a second physical address (similar to the local physical address with an RS232 or a USB link) must be specified. To do so, select the new KNXnet/IP connection (cf. Fig. 9) in the options dialog of the communication tab and click on the "Settings" button.

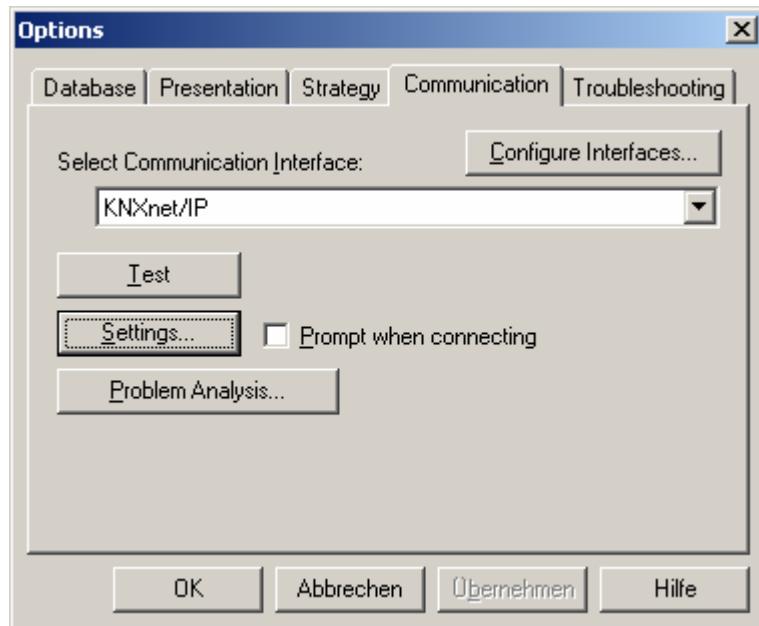


Fig. 9: Selecting the KNXnet/IP as communication interface and activating the settings

7. The local interface settings are accessible (cf. Fig. 10). Enter the physical address of the IP data interface in the "Individual address" field. It must be ensured that this address is not used by any other device in the ETS project (in case of doubt, verify with the "Is this address free ?" button). After successful assignment of an address, a dummy device should be inserted in the topologically correct place. The device is delivered with physical address "15.15.255".

A click on "OK" terminates the configuration of the IP data interface. The IP connection can now be used.

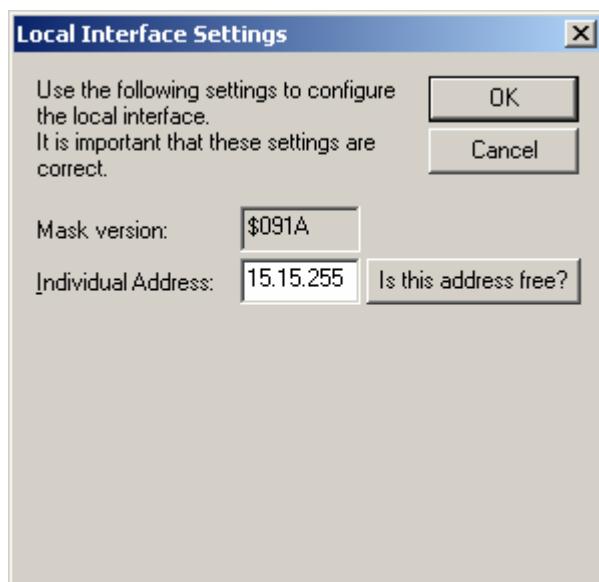


Fig. 10: Local interface settings

- i** In conjunction with the IP router, the driver for bus communication of the ETS 3 does not support the "Diagnosis bus monitor" function and no local download of the application program.
- i** After installation of the ETS3.0c and release of the IP router as a communication interface, a Windows fault message informing the user that the "class" is unknown may be displayed.
In this case, the Microsoft .Net Framework is to be installed the latest version of which can be downloaded from the Microsoft Update Page in the Internet.

IP address assignment

The IP address of the IP router is assigned manually in the ETS or automatically by a DHCP server in the IP network. Assignment of the IP address by a DHCP server permits changing the device IP address without using the ETS.

For queries in conjunction with the configuration of the device IP address, subnet mask and DHCP parameters the network administrator should be consulted.

Default factory settings

By default, the EIBnet/IP Routing function is active. When two IP routers are interconnected via a cross-over cable or when several IP routers are interconnected via a hub or a switch, bus telegrams are routed via the IP routers without any changes.

The following parameters are set:

- Physical address of the IP router: 15.15.0.
- Group telegrams are filtered.
- The IP router acknowledges routed telegrams only.
- Support with non-parameterized interfaces whose physical address is not compatible with the line.
- Broadcast telegrams are routed
- The bus line is monitored for voltage failure.
- IP address assignment via DHCP.

| Parameters | | |
|--|---|---|
| Description | Values: | Comment: |
|  General | | |
| Support of non-configured interfaces | disabled enabled | This parameter can be used for supporting data interfaces (RS232 or USB) with a topologically incorrect physical address (setting "enabled"). This permits commissioning also with non-parameterized interfaces over several lines. |
| Monitoring of bus voltage failure | disabled enabled | A bus voltage failure and a bus voltage recovery can be reported via the KNXnet/IP, for instance to the ETS3 or to another application. |
| Device name (max. 30 characters) | 30-character text, IP router | This parameter determines a unique name with 30 characters max. for the IP router, which is used for easy identification of the device when searched by a KNXnet/IP visualization or the ETS. |
|  Routing (Bus > IP) | | |
| Group telegrams of main groups 0 to 13 | for test operation only: transmit all block filter (normal) | Defines whether group telegrams of groups 0 to 13 from the bus will be transmitted on the KNXnet/IP. All group telegrams will be transmitted. The filter table will be disregarded. This setting should be parameterized for testing purposes only or during initial start-up of a KNX/EIB installation. All group telegrams will be blocked. No group telegram can pass the IP router. In accordance with the filter table generated and programmed in the ETS, group telegrams are either transmitted or blocked selectively. |
| Group telegrams of main groups 14 and 15 | block transmit all | Defines whether group telegrams of groups 14 to 15 from the bus will be transmitted on the KNXnet/IP. Main groups 14 and 15 are not programmed into the filter table. This parameter defines whether these main groups are to be filtered or not. All group telegrams with main group 14 or 15 are blocked. All group telegrams with main group 14 or 15 are transmitted. |

| | | |
|---|--|--|
| Individually addressed and broadcast telegrams | for test operation only: transmit all block filter (normal) | This parameter is used to set the filter function Bus > KNXnet/IP of the individually addressed telegrams and broadcast telegrams. All individually addressed telegrams and all broadcast telegrams are transmitted. This setting should be parameterized for testing purposes only or during initial start-up of a KNX/EIB installation. All individually addressed telegrams and all broadcast telegrams are blocked. In accordance with the individual address of the IP router, individually addressed telegrams are either transmitted or blocked selectively. Broadcast telegrams are routed. |
| Telegram confirmation of group-oriented telegrams | always only if routed | This parameter can be used to define whether the IP router confirms the telegrams received from the KNX/EIB side. On principle, the IP router confirms every telegram received on the KNX/EIB. The IP router confirms only such telegrams on the KNX/EIB that are routed to the KNXnet/IP. |

 Routing (IP > Bus)

| | | |
|--|--|---|
| Group telegrams of main groups 0 to 13 | for test operation only: transmit all block filter (normal) | Defines whether group telegrams of groups 0 to 13 from KNXnet/IP will be transmitted to the bus. All group telegrams will be transmitted. The filter table will be disregarded. This setting should be parameterized for testing purposes only or during initial start-up of a KNX/EIB installation. All group telegrams will be blocked. No group telegram can pass the IP router. In accordance with the filter table generated and programmed in the ETS, group telegrams are either transmitted or blocked selectively. |
| Group telegrams of main groups 14 and 15 | block transmit all | Defines whether group telegrams of groups 14 and 15 from the KNXnet/IP bus will be transmitted to the bus. Main groups 14 and 15 are not programmed into the filter table. This parameter defines whether these main groups are to be filtered or not. All group telegrams with main group 14 or 15 are blocked. All group telegrams with main group 14 or 15 are transmitted. |

| | | |
|--|---|--|
| Individually addressed and broadcast telegrams | for test operation only: transmit all block filter (normal) | This parameter is used to set the filter function KNXnet/IP > Bus of the individually addressed telegrams and broadcast telegrams. All individually addressed telegrams and all broadcast telegrams are transmitted. This setting should be parameterized for testing purposes only or during initial start-up of a KNX/EIB installation. All individually addressed telegrams and all broadcast telegrams are blocked. In accordance with the individual address of the IP router, individually addressed telegrams are either transmitted or blocked selectively. Broadcast telegrams are routed |
|--|---|--|

 IP Config 1

| | | |
|--|--|--|
| IP address assignment | from DHCP service manual entry | This parameter defines how the IP address is assigned. The required addresses are assigned to the IP router by a DHCP server in the network. The required IP addresses must be entered manually in the ETS. Parameter cards "IP Config 2" and "IP Config 3" are enabled. Note: The required setting should be fixed in cooperation with the responsible network administrator. |
| IP routing multicast address Byte 1 (224 ... 239) Byte 2 (224 ... 239) Byte 3 (224 ... 239) Byte 4 (224 ... 239) | 224 ... 239; 224 0 ... 255; 0 0 ... 255; 23 0 ... 255; 12 | This parameter is used to set the KNXnet/IP routing address. KNXnet/IP routing is used for routing bus telegrams from an IP router to all other IP routers. In this case, only those IP routers that use the same IP routing multicast address will communicate with one another. The IP routing multicast address preset at the factory is 224.0.23.12. This address is assigned to KNXnet/IP routing and reserved for this special of application. For general use in a network, all addresses from 239.0.0.0 to 239.255.255.255 are, however, available. The four bytes of the IP routing multicast address are set one by one. This results in the well-known dot notation of an IP address: byte 1 . byte 2 . byte 3 . byte 4. |

|  IP Config 2 (visible only in case of manual IP address assignment) | | |
|---|---------------------|--|
| IP address | | In case of manual IP address assignment, the IP address of the IP router is set here. |
| Byte 1 | 0 ... 255; 0 | The factory-set value for the IP address is 0.0.0.0. This default value must be replaced by a valid IP address. |
| Byte 2 | 0 ... 255; 0 | |
| Byte 3 | 0 ... 255; 0 | |
| Byte 4 | 0 ... 255; 0 | The four bytes of the IP address are set one by one. This results in the well-known dot notation of an IP address: byte 1 . byte 2 . byte 3 . byte 4. |
| IP Subnet Mask | | In case of manual IP address assignment, the IP subnet mask of the IP router is set here. |
| Byte 1 (224 ... 239) | 0 ... 255; 0 | The factory-set value for the subnet mask is 0.0.0.0. This default value must be replaced by a valid subnet mask. Valid subnet masks are, for instance: 255.255.255.0 or 255.255.240.0. |
| Byte 2 (224 ... 239) | 0 ... 255; 0 | |
| Byte 3 (224 ... 239) | 0 ... 255; 0 | |
| Byte 4 (224 ... 239) | 0 ... 255; 0 | The four bytes of the subnet mask are set one by one. This results in the well-known dot notation of a subnet mask: byte 1 . byte 2 . byte 3 . byte 4. |
|  IP Config 3 (visible only in case of manual IP address assignment) | | |
| IP Standard Gateway | | In case of manual IP address assignment, the IP address of the IP router is set here. |
| Byte 1 (224 ... 239) | 0 ... 255; 0 | The factory-set value for the IP address is 0.0.0.0. This default value must be replaced by a valid IP address. |
| Byte 2 (224 ... 239) | 0 ... 255; 0 | |
| Byte 3 (224 ... 239) | 0 ... 255; 0 | |
| Byte 4 (224 ... 239) | 0 ... 255; 0 | The Standard Gateway (e.g. a router) is used for transmitting IP telegrams addressed to a PC outside the local network. This is required, for instance, in case of a remote access via KNXnet/IP Tunneling (function of IP router as data interface). If the device is to be parameterized and used without a Standard Gateway, the predefined (invalid) address is to be used (0.0.0.0). The four bytes of the IP address are set one by one. This results in the well-known dot notation of an IP address: byte 1 . byte 2 . byte 3 . byte 4. |

Software information

- The IP router can be parameterized from ETS2V12 onwards.
- The IP router can be reset to the default factory settings by turning on the supply voltage (external 24 V AC/DC supply) while the programming button is kept depressed for more than six seconds. The transition to the default state is indicated by a blinking programming LED. By this measure, all parameter settings are set back to the default values.
- In conjunction with the IP router, the driver for bus communication of the ETS 3 does not support the "Diagnosis bus monitor" function and no local download of the application program.
- After installation of the ETS3.0c and release of the IP router as a communication interface, a Windows fault message informing the user that the "class" is unknown may be displayed.
In this case, the Microsoft .Net Framework is to be installed the latest version of which can be downloaded from the Microsoft Update Page in the Internet.