

Product and Applications Description



The IP Router N146/02 is a DIN rail mounted device.

The device implements the KNXnet/IP standard and connects KNX/EIB lines via data networks using the Internet Protocol (IP). Also this device offers concurrent access to the bus line from any PC or other data processing equipment.

The physical connection to the KNX/EIB is established via a bus connector terminal block. For connection to the data network (IP via 10BaseT) the device contains an RJ45 socket.

By using a LAN modem an KNX/EIB installation can be remotely accessed even if there is no direct data network connection between a PC and an IP Router. LAN modems are available on the market for standard telephone, ISDN or DSL connections.

The IP Router requires additional operating power for its operation. The IP Router N146/02 can source this operating power via the network connection from "Power over Ethernet" according to IEEE 802.3af. Alternatively, the operating power can be provided via a second terminal block (white-yellow terminals) by a safety extra low voltage (SELV) power supply AC/DC 24 V or by a bus power supply (unchoked power, DC 29V). When a SELV power supply is connected the operating power is sourced from it.

The IP Router has these characteristics:

- Simple connection to hierarchically superimposed systems via Internet Protocol (IP)
- Direct access to the KNX/EIB installation from any access point to the IP network (KNXnet/IP Tunneling)
- Fast communication between KNX/EIB lines, areas and systems (KNXnet/IP Routing)
- Communication between buildings and facilities
- Filtering and routing of telegrams depending on
 - individual address
 - group address
- LED display of
 - operation
 - KNX/EIB communication
 - IP communication
- Simple configuration with standard ETS
- Easy connection to SCADA and Facility Management systems (see: Supported Software)

IP Router as line / area coupler (KNXnet/IP Routing)

Using the existing data network for communication between bus lines in non-residential buildings is a logical step. The advantages are: fast communication between KNX/EIB lines, extension of an KNX/EIB system beyond one building by using LAN and WAN connections, direct transmission of KNX/EIB data to any network user, KNX/EIB remote configuration from any network access point.

The IP Router logically connects KNX/EIB bus lines by transmitting KNX/EIB telegrams between them via a data network but separates them galvanically. This allows to run each bus line independently from other bus lines.

The IP Router can be used as line coupler or area coupler in existing *EIB* networks as well as in new *KNX/EIB* networks. The IP Router holds a filter table determining, which bus telegrams are transmitted or blocked from or to the bus line thus reducing the bus load. The filter table is automatically generated by the ETS (*EIB* Tool Software) during configuration and start-up of the system.

The physical address of the IP Router assigned by ETS automatically determines the IP Router function as a line coupler or area coupler. The definition follows these assignments:

Coupler function	Line
Area coupler	Main line 1- 15
Line coupler	Line 1- 15

Note

When assigning the physical address take care that IP Router and line couplers receive the topologically correct physical address (Fig. 1, IP Router as area coupler and line coupler).

Adhere to these rules:

Rule 1:

In general an IP Router is used as a line coupler or an area coupler. The physical address has the format x.y.0, with x=1...15, y=1...15.

Rule 2:

If an IP Router is applied as an area coupler with the physical address x.0.0 then no other IP Router with the line coupler address x.y.0 (y=1...15) shall be placed topologically „below“ this IP Router (Fig. 2, IP Router N 146 as area coupler).

Rule 3:

If an IP Router is applied as a line coupler (e.g. with physical address 1.2.0) then no other IP Router shall be used with a superior area coupler address (e.g. 1.0.0) in this installation (Fig. 3, IP Router N 146 as line coupler).

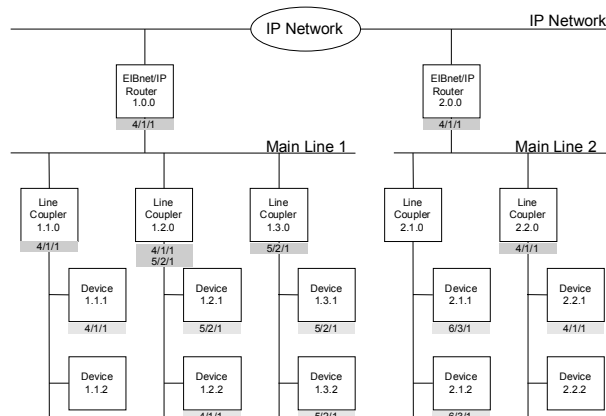


Figure 2. IP Router as area coupler

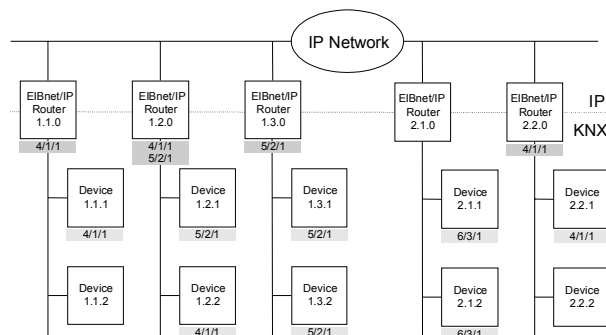


Figure 3. IP Router as line coupler

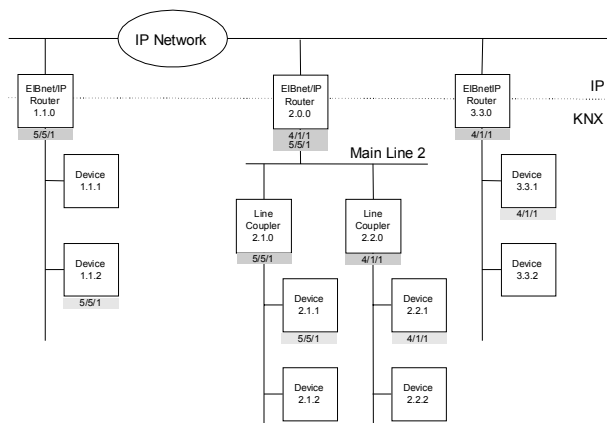


Figure 1. IP Router as area and line coupler

Note

Smooth operation of the IP Router as line coupler or back-bone coupler using KNXnet/IP Routing requires LAN network components that support IP multicasting. In particular, network / LAN routers must be configurable respectively configured to forward IP multicast datagrams. The IP multicast address 224.0.23.12 was specifically reserved for KNXnet/IP internationally for this purpose.

IP Router as interface to the bus (KNXnet/IP Tunneling)

A direct connection between a networked PC and the bus can be established via a data network and the IP Router. This allows for accessing the bus from any access point in the data network.

The IP Router N146/02 provides up to four KNXnet/IP Tunneling connections, allowing for e.g. simultaneous configuration with ETS and operation of a visualization.

Note

For stable communication via KNXnet/IP Tunneling the IP Router must use a separate individual address for each KNXnet/IP Tunneling connection. These additional individual addresses must be different from the individual address of the device and must not be used by any other bus device. In ETS (before ETS5) these individual addresses should be reserved by proxy devices.

ObjectServer interface to the bus

A direct connection between a networked PC and the bus can also be established via a data network and the IP Router N146/02 using ObjectServer. ObjectServer compared with KNXnet/IP Tunneling provides the advantage that the communication can be maintained even over network connections with a transmission time for the datagrams of over one second (e.g. satellite connections).

Assignment of additional individual addresses

Additional individual addresses are either assigned with ETS (refer to APB for detailed description) or alternatively without a tool automatically by the device itself.

The automatic address assignment for KNXnet/IP Tunneling and ObjectServer is started when the learning button is pressed during normal operation for more than 5 seconds but less than 10 seconds. The programming LED flashes during the address assignment process. The device checks which individual addresses are already used by other bus devices connected to the bus line. These addresses are not used for the address assignment.

By adding additional bus devices at a later time one or more of the additional individual addresses could be assigned twice. When during normal operation the learning button is pressed for more than 10 seconds all additional individual addresses in the IP Router N146/02 are reset to the default value (15.15.255) and the programming LED is turned off.

IP address assignment

The IP address of the IP Router N146/02 is assigned manually using ETS, automatically by a DHCP server in the IP network, or by the device itself (AutoIP). Assignment of the IP address by a DHCP server allows for changes of the device IP address without using ETS. Configuration of the DHCP server may require the MAC address, which is printed on the device. If a DHCP server

is not available the device assigns itself an IP address (AutoIP).

Please consult your network administrator regarding configuration of the parameters device IP address, subnet mask, and DHCP.

Default factory settings

By default the KNXnet/IP Routing function is active. When two KNXnet/IP routers are connected with each other via a cross-over cable or via a network hub, bus telegrams are routed by the KNXnet/IP Router without any configuration.

The IP Router ships with these default factory settings:

- Physical address of the IP Router:
15.15.0 (= FF00 hex)
- Filter group telegrams
- All bus telegrams are repeated in case of transmission errors
- The IP Router acknowledges routed telegrams only
- Support for devices with mis-matching physical address
- Route broadcast telegrams
- Monitor the bus line
- IP address assignment via DHCP

Behavior on bus voltage loss / recovery on the bus line

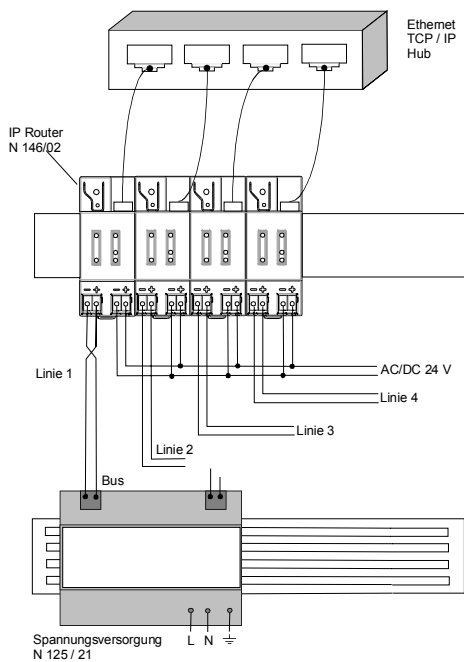
When the IP Router detects a loss of bus voltage on the bus line, this error is saved and annunciated via KNXnet/IP. When the IP Router detects recovery of bus voltage on the bus line, the error flag is deleted and the resumption of bus voltage is annunciated via KNXnet/IP.

Application programs

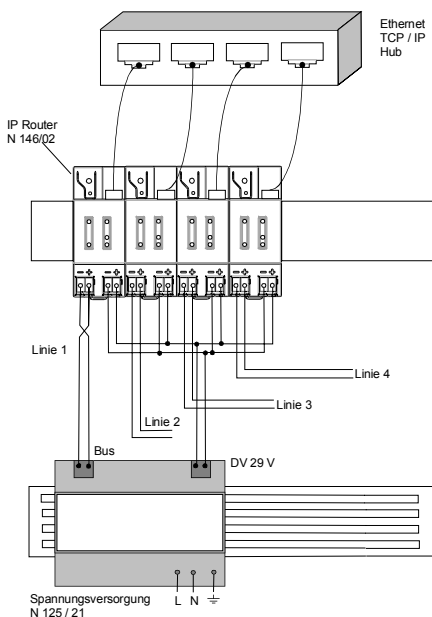
The IP Router N146/02 can be configured with the application program "**IP-Router 001002**" (from ETS2V12 on upwards) or with the application program "**IP-Router 001031**" from ETS5 on upwards.

When the device is configured with ETS5 and the application program "**IP-Router 001031**" then the respective functions of ETS5 for configuration of the IP addresses and the device name are utilized.

Example of Operation



Example of Operation 1 with external auxiliary power supply



Example of Operation 2 with auxiliary power supply from unchoked bus power supply

Installation Instructions

- The device may be used for permanent interior installations in dry locations within distribution boards or small casings with DIN rail EN 60715-TH35-7,5.

WARNING

- The device must be mounted and commissioned by an authorised electrician.
- Free DIN rail areas with sticked-in data rails must be covered with covers, order no. 5WG1 192-8AA01.
- The prevailing safety rules must be heeded.
- The device must not be opened.
- For planning and construction of electric installations, the relevant guidelines, regulations and standards of the respective country are to be considered.

Technical Specifications

Network communication

- Ethernet: 10BaseT (10 Mbit/s)
- Supported Internet Protocols: ARP, ICMP, IGMP, UDP/IP, DHCP, AutoIP
- KNXnet/IP according to KNX System Specification: Core, Routing, Tunneling, Device Management

Rated voltage

- Bus: DC 24V (DC 21...30V)
- Auxiliary power supply: from "Power over Ethernet" DC 48V (acc. to IEEE 802.3af) max. 0,8W alternatively from external power supply AC/DC 24V (AC 12...24V, DC 12...30V) max. 1,7W (57mA @ DC 24V)

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Power supply

- Bus voltage: via KNX/EIB bus line
- KNX bus current: 6 mA
- Operating voltage:
from "Power over Ethernet" according to IEEE 802.3af,
nominal voltage DC 48V
alternatively, from external SELV power supply AC/DC
24V nominal,
permissible input voltage range:
AC 12...24V, DC 12 ... 30 V
- Recommended power supplies:
DC 29V (before choke) from KNX/EIB power supply
N125/21

Power supply unit 4AC2 402
Primary voltage AC 85-265V / DC 85-300V, Secondary
voltage DC 24V, 2MU width

safety transformers 4AC3 724-0
Primary voltage 230V AC Secondary voltage AC 12V,
3MU width
safety transformers 4AC3 740-1
Primary voltage 230V AC Secondary voltage AC 12V
24V, 5MU width

**CAUTION**

It is recommended to use the external safety extra low
voltage power supply for the IP Router N146/02 only.

Power usage

- From the bus line: max. 10mA @ DC 29V
- From the auxiliary power supply: max. 1,7 W
(57mA @ DC 24V)

Control elements

1 learning button:
for switching between normal operating mode and
addressing mode

Display elements

- 1 green LED: device ready (ON)
- 1 yellow LED: Communication on bus line
- 1 green LED: Ethernet Link Signal available (Lk)
- 1 yellow LED: Receiving data from Ethernet (Rx)
- 1 red LED: Transmitting data to Ethernet (Tx)
- 1 red LED: for monitoring bus voltage and displaying
mode, selected with the learning button

Connections

- bus line: screwless bus connection block (red-black)
0,6...0,8 mm Ø single core
remove approx. 5mm of isolation
- Ethernet / IP network: RJ45 socket
- auxiliary power:
screwless extra low voltage terminal (yellow-white)
Ø 0,6 ... 0,8 mm Ø single core
remove approx. 5mm of isolation

Physical specifications

- housing: plastic
- N-system DIN-rail mounted device,
width: 2 SUs (1SU = 18mm)
- Installation: Snap-on mounting on DIN rail
EN 60715-TH35-7.50
- weight: approx. 105g
- Fire load: approx. 2840 kJ ± 10 %

Electrical safety

- degree of pollution (according to IEC 60664-1): 2
- protection (according to EN 60529): IP 20
- protection class (according to IEC 61140): III
- overvoltage class (according to IEC 60664-1): III
- bus: safety extra low voltage SELV DC 24 V
- the device complies with EN 50 090-2-2

Electromagnetic compatibility

complies with
EN 61000-6-2 and EN 61000-6-3 and EN 50090-2-2

Environmental specifications

- climatic conditions: EN 50090-2-2
- ambient temperature operating: - 5 ... + 45 °C
- storage temperature: - 25 ... + 70 °C
- relative humidity (non-condensing): 5 % to 93 %

Markings

KNX, EIB, CE

CE mark

complies with the EMC regulations (residential and
functional buildings), and low voltage regulations

Location and Function of the Display and Operator Elements

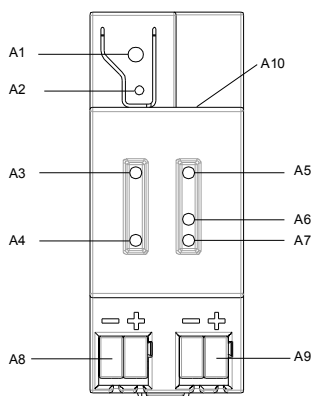


Figure 4: Location of the display and operator elements

- A1 LED red: indicating normal operating mode (LED off) and addressing mode (LED on)
- A2 learning button for switching between normal operating mode and addressing mode for receiving the physical address
- A3 LED green: Operation
- A4 LED yellow: data transmission on bus line (Line)
- A5 LED green: Ethernet Link signal (Lk)
- A6 LED yellow: Ethernet Receive signal (Rx)
- A7 LED red: Ethernet Transmit signal (Tx)

Note

When the learning button (A2) is pressed, this LED signals for 10 seconds how the IP address was assigned to the device:

- 1x flashing: fixed IP address
- 2x flashing: DHCP
- 3x flashing: AutoIP

- A8 extra low-voltage bus terminals (red-black)
- A9 extra low-voltage terminals (yellow-white)
- A10 RJ45 socket for data network cable

Mounting and Wiring

General description

The N-system DIN-rail device can be installed in N-system distribution boards, surface or flush mounted, or on any DIN rail complying with EN 60715-TH35-7,5. The connection to the bus line is established via the bus connector terminal (red-black) on the top side. The RJ45 socket on the device front side provides the connection to the Ethernet-IP data network.

Mounting DIN-rail devices (Figure 5)

- Slide the device (B1) onto the DIN-rail (B2) and
- swivel back the device until the slide clicks into place audibly.

Dismounting DIN-rail devices (Figure 5)

- Remove all connected wires,
- press down the slide (C3) with a screw-driver and
- swivel the device (C1) from the DIN-rail (C2).

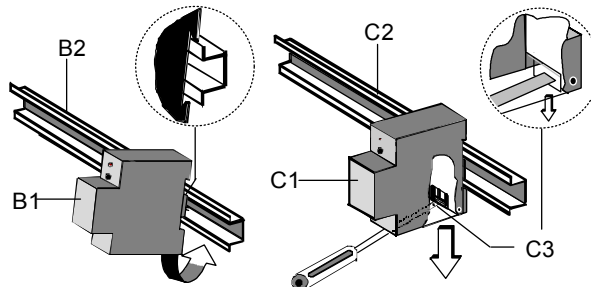


Figure 5: Mounting and dismounting a DIN-rail device

Slipping off bus connection blocks (Figure 6)

- The bus connection block (D2) is situated on the top of the device (D1).
- The bus connection block (D2) consists of two components (D2.1 and D2.2) with four terminal contacts each. Take care not to damage the two test sockets (D2.3) by accidentally connecting them to the bus cable or with the screw-driver (e.g. when attempting to unplug the bus connection block).
- Carefully put the screw-driver to the wire-inserting slit of the bus connection block's grey component and pull the bus connection block (D2) from the device (D1).

Slipping on bus connection blocks (Figure 6)

- Slip the bus connection block onto the guide slot and
- press the bus connection block (D2) down to the stop.

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Connecting bus cables (Figure 6)

- The bus connection block (D2) can be used with single core conductors $\varnothing 0,6 \dots 0,8$ mm.
- Remove approx. 5 mm of insulation from the conductor (D2.4) and plug it into the bus connection block (D2) (red = +, black = -).

Disconnecting bus cables (Figure 6)

- Unplug the bus connection block (E1) and remove the bus cable conductor (E1.4) while simultaneously wiggling it.

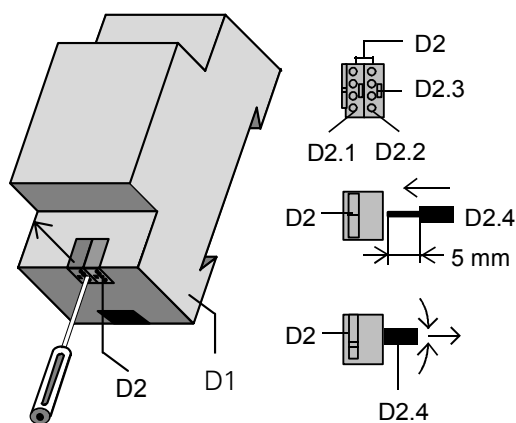


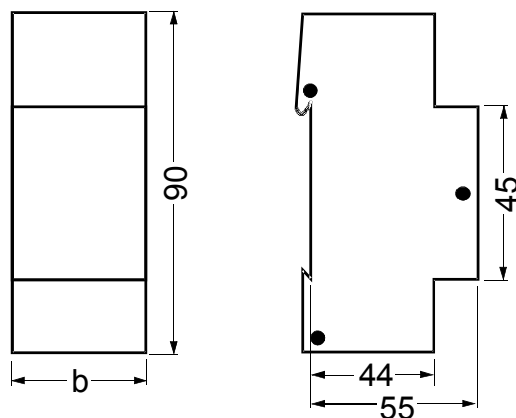
Figure 6: Connecting and disconnecting bus wires

Slipping off / on auxiliary power connection block

- Follow the instructions for the bus connection block when slipping off/on the auxiliary power connection block.

Dimension Diagram

Dimensions in mm



$b = 2 \text{ SU}$
 1 Standard unit (SU) = 18 mm

Notes on secured data transmission

This KNXnet/IP device is designed for operation in a network, which is only accessible by authorized users.

This device shall not be connected directly and unsecured with the Internet.

If Internet access to a KNX installation is needed, then a VPN connection to the Internet Router shall be implemented.

A Virtual Private Network (VPN) establishes an encrypted and authorized connection (VPN tunnel) from a remote point into a network via the Internet. This VPN connection allows secured and eaves-dropping protected communication between a remote device and the KNX installation. Administration of access rights to this KNXnet/IP device in an IP network shall be coordinated with the responsible IP network administrator.

Possible additional security measures are among others:

- Switches and routers are set in such a way that only known MAC addresses are able to access the communication medium.
- A separate IP network with own hardware is setup for KNX communication.
- Access to the (KNX) IP network is limited to authorized persons via appropriate user names and strong passwords.
- If WLAN is being used, the default SSID of the wireless access point is changed. The WLAN is encrypted with a secure (currently e.g. WPA2) method.
- Ports for incoming connections of routers, especially UDP port 3671 reserved for KNXnet/IP, are closed.

The network settings shall be documented and handed over to the building owner / operator or the LAN administrator.

For further information on KNX security refer to the KNX Secure Checklist

(https://www.knx.org/media/docs/downloads/Marketing/Flyers/KNX-Secure-Checklist/KNX-Secure-Checklist_en.pdf)

and the KNX Secure Position Paper

(https://www.knx.org/media/docs/downloads/Marketing/Flyers/KNX-Secure-Position-Paper/KNX-Secure-Position-Paper_en.pdf).

General Notes

- The operating instructions must be handed over to the client.
 - Any faulty device is to be sent together with a return delivery note of the local Siemens office.
 - For any technical questions, please consult:
 - ☎ +49 (911) 895-7222
 - ☎ +49 (911) 895-7223
 - ✉ support.automation@siemens.com
- www.siemens.com/automation/support-request