

|                          |                       |
|--------------------------|-----------------------|
| <b>IP Router N146/02</b> | <b>5WG1 146-1AB02</b> |
|--------------------------|-----------------------|

## 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      |

**IP Router N146/02** **5WG1 146-1AB02**

**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).

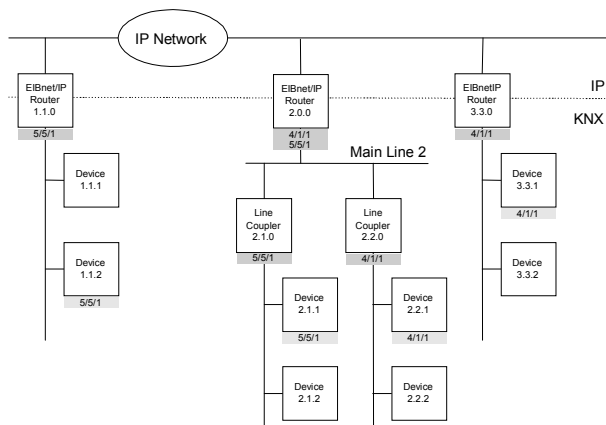


Figure 1. IP Router as area and line coupler

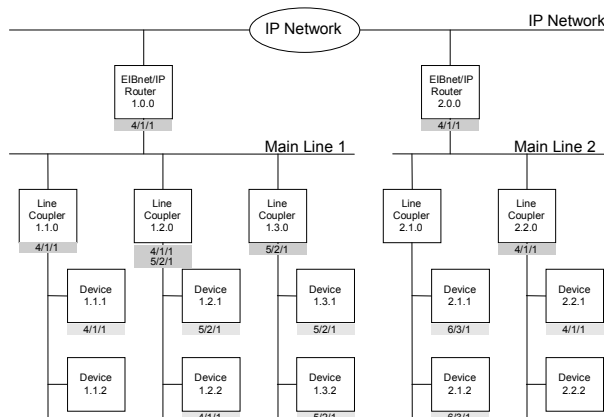


Figure 2. IP Router as area coupler

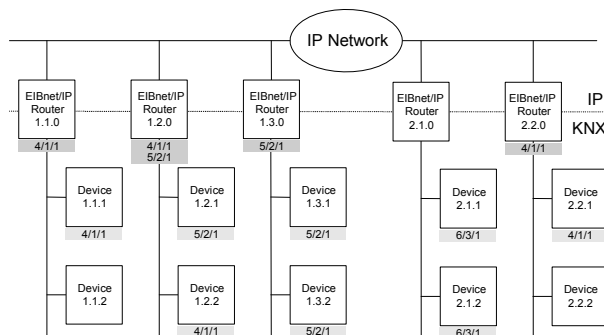


Figure 3. IP Router as line coupler

**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 ETS3 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 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 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 announced 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 announced via KNXnet/IP.

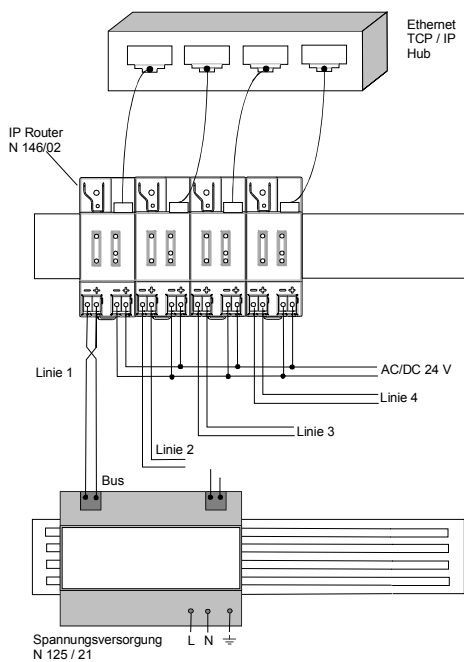
## Application programs

The IP Router can be configured with ETS2 v12 or higher.

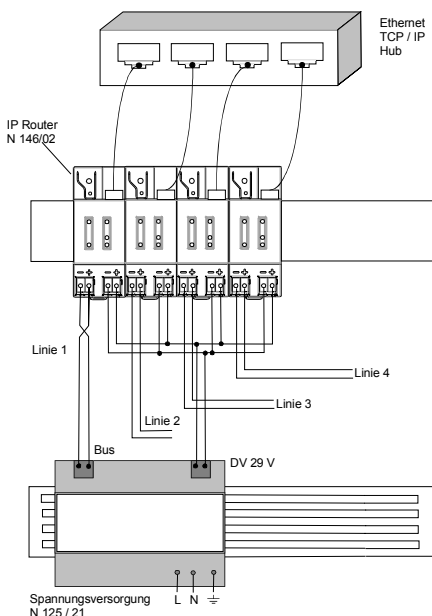
It requires the application program "**IP Router 001002**".

**IP Router N146/02** **5WG1 146-1AB02**

**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)

**Power supply**

- Bus voltage: via KNX/EIB bus line
- 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
  - door bell transformer 4AC3 108, AC 230V / AC

IP Router N146/02

5WG1 146-1AB02

2x12V  
 (primary / secondary), 2x0,33A, 2MU width  
 – door bell transformer 4AC3 116, AC 230V / AC 2x12V  
 (primary / secondary), 2x0,67A, 2MU width  
 – door bell transformer 4AC3 140, AC 230V / AC 2x12V  
 (primary / secondary), 2x1,67A, 3MU 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**

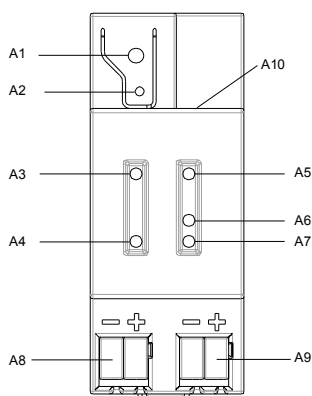


Figure 4: Location of the display and operator elements

- 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).

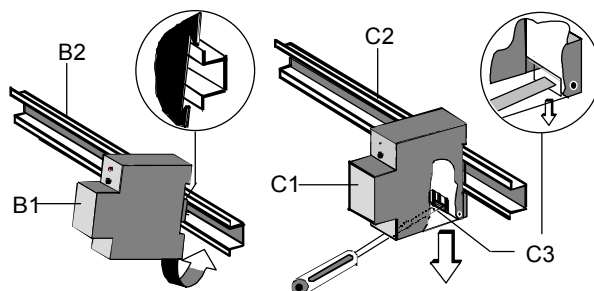


Figure 5: Mounting and dismounting a DIN-rail device

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.

IP Router N146/02

5WG1 146-1AB02

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.

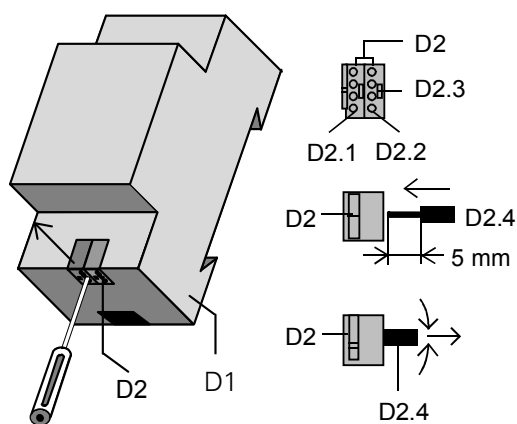


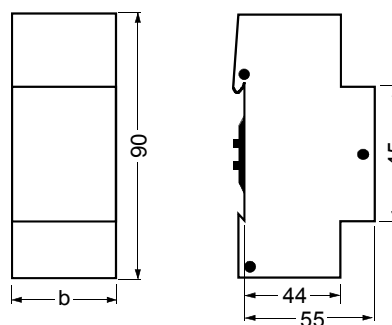
Figure 6: Connecting and disconnecting bus wires

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 SU

1 Standard unit (SU) = 18 mm

### Supported Software

Here is a list of software supporting the IP Router N 146.

#### ComBridge Studio

IPAS GmbH  
Grabenstr 149 a  
47057 Duisburg  
Germany  
[<http://www.ipas-products.com>]

Visualization, Database interface,  
Notification via email, OPC Server

ComBridge Studio is a visualization software that can use the IP Interface N148/22, the IP Router N146, the IP Controller N350E and the IP Viewer N151 as interface to KNX/EIB. Find more information in the GAMMA catalog or at the above listed web site.

#### ETS 3

KNX Association  
De Kleetlaan 5, Bus 11  
B-1831 Brussels-Diegem  
Belgium  
[<http://www.knx.org>]

Configuration of bus installations via existing data net works (ETS 3.0c or higher)

An KNXnet/IP driver is available for ETS3. When this driver is installed ETS3 may use the IP Interface N148/21, the IP Router N146, the IP Controller N350E and the IP Viewer N151 as interfaces to the bus just like a standard RS232 or USB serial interface. This function includes download of device configuration via the bus and the group monitor function of ETS3.

#### **Note**

The KNX Association has decided that IP routers shall not implement support for busmonitoring. The ETS3 driver currently does not support local download.

#### **Note**

After installing the ETS3 driver and selecting the IP Interface or the IP Router as communication interface a windows message may pop up announcing that a "Class" is unknown. In this case install the Microsoft .Net Framework that you can download from the Microsoft software update site (file size: approx. 25MB).

### General Notes

- The operating instructions must be handed over to the client.
- A faulty device shall be sent with a Return Good Note for Service provided by the appropriate Siemens sales office to the following address:  
SIEMENS AG, Siemensstr. 10, D-93055 Regensburg
- If you have further questions about the product, please contact our Technical Support:
  - ☎ +49 (0) 180 50 50-222  
(0,14 €/min. from the German landline network, deviating mobile communications prices are possible)
  - ☎ +49 (0) 180 50 50-223
  - E-Mail: [support.automation@siemens.com](mailto:support.automation@siemens.com)
  - ✉ <http://www.siemens.com/automation/service&support>