Zennio
Passion for KNX innovation

Zennio KNX-IP Router

KNX-IP Line / Area Coupler

ZSY-IP-ROU

USER MANUAL

Application Program version: [1.0]
User Manual version: [1.0]_a

www.zennio.com

CONTENTS

1 INTRODUCTION

1.1 ZENNIO KNX-IP ROUTER

Figure 1 Zennio KNX-IP Router

Zennio KNX-IP Router is the **KNX twisted pair to Ethernet line-coupling** solution from Zennio. IP routers are similar to twisted-pair line couplers, except that they use Ethernet as the main line.

Zennio KNX-IP Router can be used as a **line or area** coupler and provides a data connection between the upper KNXnet/IP line (area line or backbone) and the lower KNX twisted-pair bus line. It also provides a **connection point** for ETS to enable programming (up to four parallel connections) and monitoring the line.

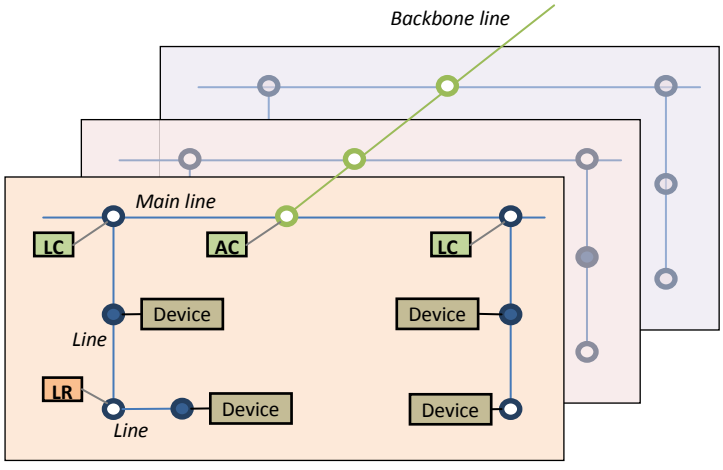

Figure 2. Context (Topology)

In contrast to the **Zennio KNX-IP Interface** device (which offers a simple KNX to IP coupling solution), **Zennio KNX-IP Router** incorporates an additional, configurable telegram filtering system according to their destination group / physical address.

These are the most outstanding features of the device:

- **Support for long messages** (up to 250 bytes).
- Use as an **area or line coupler** with a LAN as main line or main area line, offering a fast communication medium for telegram exchange.
- Up to **4 parallel connections from ETS** for programming and monitoring.
- **Low power consumption.**
- **Traffic filtering** according to the project topology and to the built-in address table.
- **Telegram dropping**.
- **Blockage of device-configuration telegrams** (telegrams destined to physical addresses).
- **High capacity buffer** for the reception of telegrams from the Ethernet network.
- **Web interface** to display the device settings, to switch to the programming mode and for firmware updates.
- **Customisable pushbutton** for triggering the manual mode, useful at runtime and for set-up and troubleshooting purposes.
- **7 lighting indicators (LEDs)**: two bus state indicators per line (with detection of abnormal situations: excessive bus load, message retransmissions, etc.), one more indicator per line for the state of the filtering function, and one additional indicator for the programming mode.

1.2 INSTALLATION

1. Main line (LAN) status LED.
2. Main line (LAN) traffic LED.
3. Group address filter status LED.
4. Manual function button.
5. Programming LED.
6. External power supply (12/24V).
7. Main line (LAN) connector.
8. Secondary line (KNX) status LED.
9. Secondary line (KNX) traffic LED.
10. Physical address filter status.
11. Programming button.
12. Secondary line (KNX) connector.

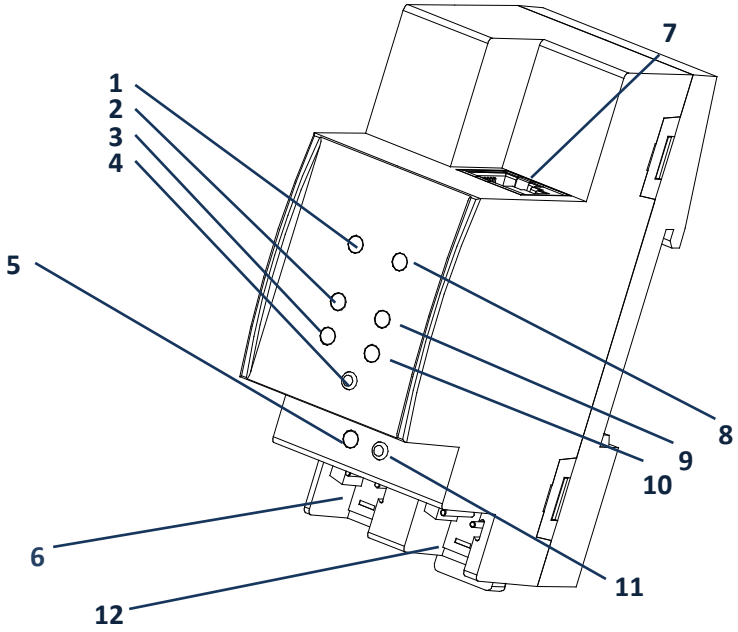

Figure 3 Element Diagram

This device requires an external power supply (12V to 30V DC) through connector (6), as it is not powered through the KNX bus.

Figure 3 shows a scheme with all the LED indicators and connections. To couple a KNX twisted-pair (TP) line and a LAN, the KNX bus (12) and Ethernet (7) cables as well as the external power (6) must be connected. After the connection, the device can be conveniently mounted on the DIN rail by the usual procedure

The programming button (11) shown in Figure 3 may be pressed to set Zennio KNX-IP Router in **programming mode**. After a short press, the programming LED (5) will light in red.

The behaviour of the additional LEDs and the manual function button will be described in section 2.4.

For detailed information about the technical features of the device, as well as on security and installation procedures, please refer to the device **Datasheet**, bundled within the original packaging of the device and also available at http://www.zennio.com.

1.3 ZENNIO KNX IP ROUTER AS A PROGRAMMER

Zennio KNX-IP Router can be used in ETS as a **programming interface**. In addition to an IP address, this device must be assigned a KNX individual address for this purpose.

Note: *to detect the device as a programmer in ETS, it needs to be powered up and connected to the same network as the PC, as well as to a TP line. If the latter line is disconnected, the device will no longer be visible as a programmer*.

1.3.1 PARALLEL DOWNLOADS

ETS offers the option to perform multiple parallel downloads from a single project. This option is only available for connections via a KNX-IP router or a KNX-IP interface. Certain conditions must be met:

- Each download must be performed on a different line.
- For each line, it is necessary to select one **Zennio KNX-IP Router** or one **Zennio KNX-IP Interface** to perform the download.

  This is configured by right-clicking on the line and, under "Set Connection", selecting the desired connection (once selected, it will not be available for other lines).

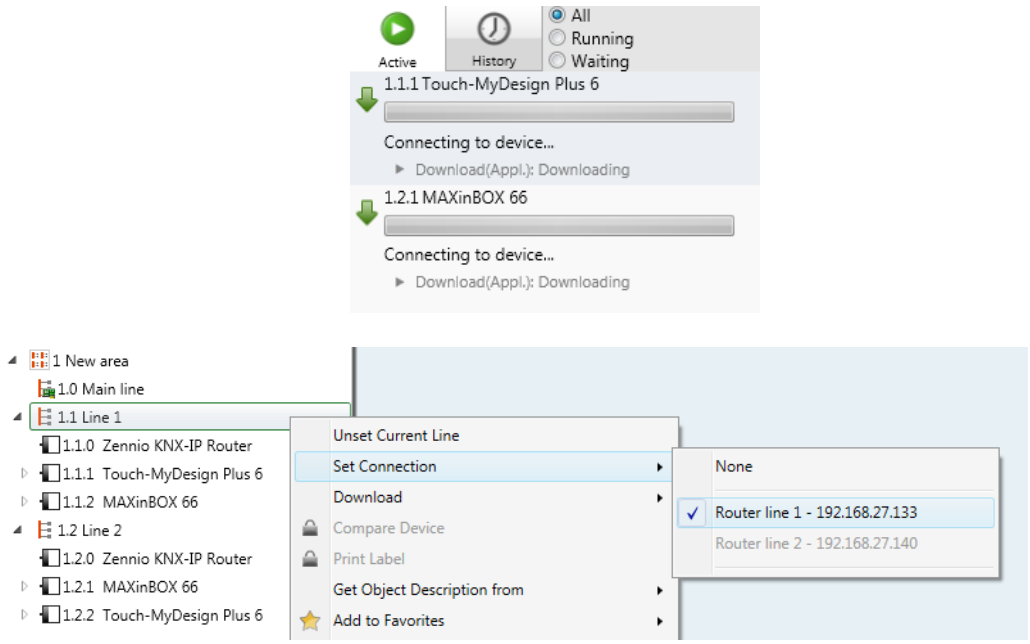

Figure 4 ETS parallel downloads.

An additional restriction applies to the parallel downloads: they are **not available to download physical addresses**. When performing this type of downloads, the link device used by ETS is not the one configured for the line but the general one.

1.3.2 LIMITATIONS

It is important to note that Zennio KNX-IP Router, when performing as a programmer, does not allow **bus monitoring** (the ETS bus monitor will not be available).

Moreover, Zennio KNX-IP Router does not allow being **unloaded (unprogrammed)** from ETS. Equivalently, it can be reset to the factory default state, as explained in section 2.4.1.

2 DESCRIPTION

2.1 LINE OR AREA COUPLER

Zennio KNX-IP Router can be used as a **line coupler** (for coupling both a line to a mainline) or as an **area coupler** (for coupling a main line to an area line, also referred to as *backbone line*). The operation on both cases is analogous – being a line coupler or an area coupler only depends on the location of the device within the topology.

Figure 5 shows a typical scenario where Zennio KNX-IP Router can be installed as any of the nodes the nodes labelled as “AC” (area coupler) or “LC” (line coupler):

- Coupling an area line and a main line requires an **area coupler** (AC). **Zennio KNX-IP Router** is intended for cases where the medium of the former is Ethernet while the medium of the latter is TP.

- Coupling a main line and a line requires a **line coupler** (LC). **Zennio KNX-IP Router** is intended for cases where the medium of the former is Ethernet while the medium of the latter is TP. In such cases, the medium of the area line (if any) is assumed to be Ethernet as well.

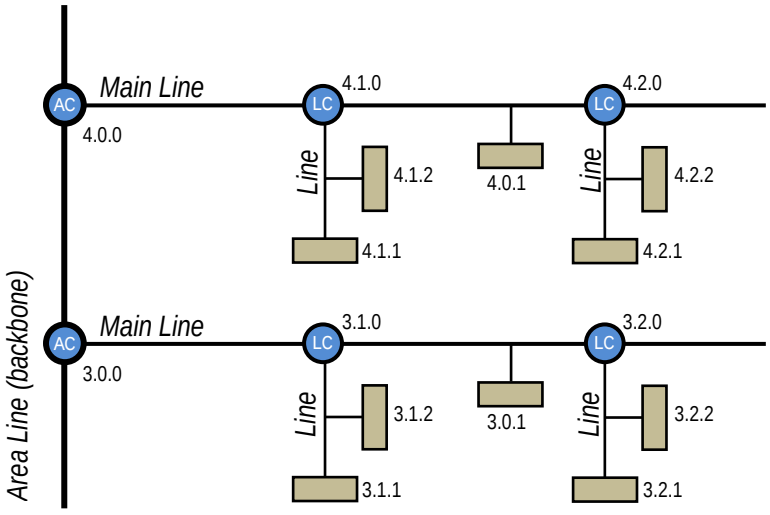

Figure 5 Line Coupling

Whatever the topology, Zennio KNX-IP Router offers an insulated coupling interface with the possibility of **filtering the traffic** according to the topology in the installation or

to group-oriented criteria. In other words, Zennio KNX-IP Router will (or will not) let telegrams pass from one medium to the other according to the parameterisation.

Note: *the individual address of a line coupler needs to be of the form **X.Y.0** (or **X.0.0** in case of working as a backbone coupler)*.

2.2 TELEGRAM FILTERING

The device provides two complementary (and optional) filter types:

- **Group address filtering**: ETS automatically generates a group address table for the project loaded. This table is transferred to the line coupler during complete ETS downloads over it.

  When a telegram containing a group address in the “destination address” field arrives, the line coupler will look up if such address exists in the group table, and eventually transmit the telegram to the other side –if the address is found– or drop (block) it –if it is not–.

  Note: *making further changes to a project (addresses, etc.) requires downloading the updated filter table to the line coupler*.

  Example: *if the line coupler has been parameterised to filter group addresses from both lines, when it receives a telegram from the mainline destined to a group address (e.g., 2/5/13) it will check that there is a device in the secondary line with objects that have been assigned such group address (or that such address has at least been marked in ETS to pass through the line coupler; see Figure 6). If so, then the line coupler will let it pass. Otherwise, it won’t be transferred to the secondary line. The same would also apply to the inverse case (a telegram originating in the secondary line).*

  Note: *main group addresses in the range 14 to 31 cannot be filtered – only routing or dropping all telegrams destined to them is possible. The "Preview of the filter table" option in ETS does show these addresses, but they are not downloaded to the device in the actual table.*

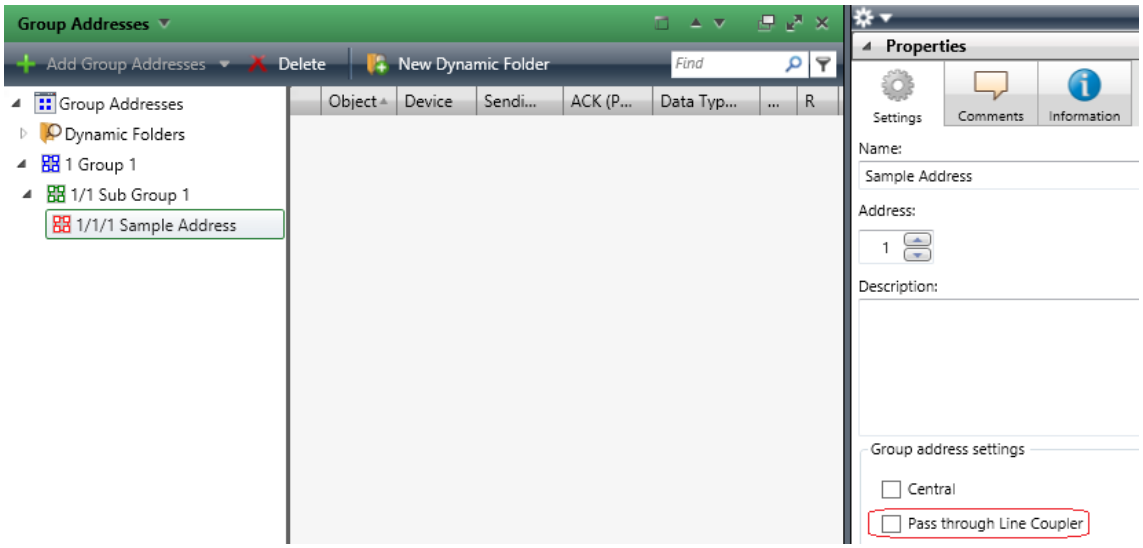

Figure 6 ETS Option to Force Passing a Group Address through the Line Coupler

- **Physical address filtering**: when the device receives a telegram where the destination address is a physical/individual address (for example, during downloads), it will compare such address with its own physical address (no particular filter table is required for physical address filtering, but a simple comparison).

  The physical address of the line coupler determines the line it belongs to, which then, and according to the parameterisation, determines if the telegram will be routed or eventually dropped (blocked). This can be parameterised separately for the mainline and for the line.

Example: *in the example shown in Figure 5, if the coupler with address 3.2.0 reads a telegram on the mainline destined to a device with individual address 3.1.2, it will compare both addresses and conclude that 3.1.2 does not belong to the secondary line, and therefore not transmit it.*

Notes:

- *The device that sends a telegram needs to have been assigned a physical address that really corresponds to its line. In Figure 5, if the device with address 3.1.1 (a KNX programmer, for instance) changes its address to 7.7.255, it will not be able to send telegrams to, for example, the device with address 4.0.1.*

- ***Important**: as device programming consists in sending telegrams destined to a physical address, in order to make downloads to a device in a certain line (for example, the device with address 4.1.1 in Figure 5) from a programmer not in that line, it is necessary that the line coupler is configured to let pass all physical addresses from the main line.*

2.3 LED INDICATORS

Zennio KNX-IP Router incorporates seven LED lights on the top of the device that make it easy to monitor the status of the buses and to detect typical communication problems, as detailed next.

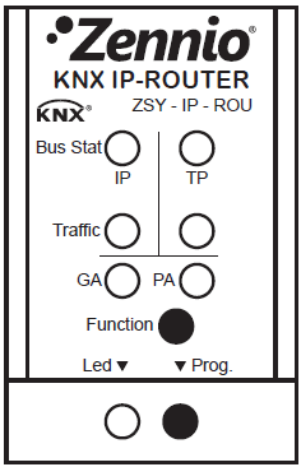

Figure 7 LEDs

- **Mainline (LAN) Status LED**: shows the status of the primary bus.
  - OFF: error or mainline not connected or not powered.
  - ON (green) = Ethernet connection OK.
  - ON (orange) = manual function in execution or factory reset preparation.

    Note: *the LED colours are independent. It must be taken into account that when the green and red colours are on at the same time, the result colour is orange.*

    The update of the LED status can be delayed a few seconds after the trigger event, e.g., after the disconnection of the main line.

- **KNX Line Status LED**: shows the status of the secondary bus.

- OFF: error or secondary line not connected.
- ON (green): OK
- BLINKING (green): boot mode (see section 2.5.1).
- ON (red): factory reset in execution (see section 2.4.1).

Note: *the LED colours are independent. It must be taken into account that when the green and red colours are on at the same time, the result colour is orange*.

- **Mainline (LAN) Traffic LED**: shows the traffic status in the Ethernet.
  - BLINKING (green): traffic.
  - OFF: no traffic.
  - ON (red): errors in the transmissions.
- **KNX Line Traffic LED**: shows the traffic status in the secondary bus.
  - BLINKING (green) = traffic.
  - OFF = no traffic.
  - BLINKING (red) = errors in the transmissions.
- **Group Address (GA) Filter Status LED**: shows the current configuration of the group address routing:
  - OFF: different configuration for the Ethernet and the secondary lines.
  - ON (green): filtering active.
  - ON (red and green = orange): all group addresses routed (filtering disabled).
  - ON (red): all group addresses blocked.
- **Physical Address (PA) Filter Status LED**: shows the current configuration of the individual address routing:

- OFF: different configuration for the Ethernet and the secondary lines.
- ON (green): filtering active.
- ON (red and orange = yellow): all physical addresses routed (filtering disabled).
- ON (dark orange): all physical addresses blocked.

Note: *please be careful not to confuse yellow and dark orange.*

- **Physical Address (PA) programing LED**:
  - OFF = normal operation.
  - ON (red) = programing mode active.
  - BLINKING (red) = Ethernet cable disconnected.

Please refer to section 3 for a detailed explanation of the different behaviours and parameterisations of the **Zennio KNX-IP Router** application program.

2.4 MANUAL FUNCTION BUTTON

Zennio KNX-IP Router features an additional pushbutton on the top cover, next to the status LEDs (see (4) in Figure 3). A **three-second press** on this button will set the device in manual mode, thus activating a customisable manual function, and will turn the main bus status LED orange or red (depending on the previous status of the LED: green or off). Depending on the parameterised manual function, other LEDs may also change their colours.

If the manual function button is pressed again for three seconds (or if the parameterised fall-back timer expires), the device will leave the manual mode and **recover the normal mode**. Note that switching from the normal mode to the manual mode and then back to the normal mode does not cause the loss of the parameters or filter tables previously downloaded.

In the application program of the device, the selectable manual functions are:

- Disabled,
- Pass all telegrams,
- Pass physical telegrams,
- Pass group telegrams.

Please refer to section 3.5 for the parameterisation in ETS of the manual function and for a detailed description of the different options.

2.4.1 HARD RESET TO FACTORY DEFAULTS

The manual function button permits performing a hard reset of the device, which will set it back to the factory default state, including the initial **individual address**. The default parameters of the device are:

- **Physical address:** 15.15.0.
- **Host name:** KNX-IP router (see section 3.2).
- **DHCP** activated.

- **KNX Multicast address**: 224.0.23.12 (see section 3.4).
- "Transmit all" for **group telegrams** and **physical telegrams**.

These are the steps to restore the factory settings:

- Press the manual function button for at least 15 seconds. The main line, KNX line, and group filter state LEDs will light in orange (or red if they were not green previously) and the physical address filter state LED will turn yellow (or orange if it was not green previously).
- Release the manual function button and press it again for about 5 seconds. The device will be then automatically reset.

Notes:

- *Keep in mind that, before entering the reset mode (~15s press), the device will first enter the manual function mode, which will also make some LEDs change.*

2.5 WEB INTERFACE

Zennio KNX-IP Router provides a web interface for **consulting the device configuration**, **activating the programming mode** or **updating the firmware**.

The web interface can be accessed through port 8080 of the IP address of the device. For example, if the IP address is 192.168.1.222:

- http://192.168.1.222:8080

The following URL will be equivalent:

- http://KNX-IPrt-xxxxxx:8080, where "xxxxxx" refers to the last six digits of the MAC address of the device.

The **IP address** of the device can be easily obtained in ETS as long as the device belongs to the same LAN segment than the PC. On the other hand, the **MAC address** must be printed on the cover of the device.

Figure 8 shows the information displayed in the web interface.

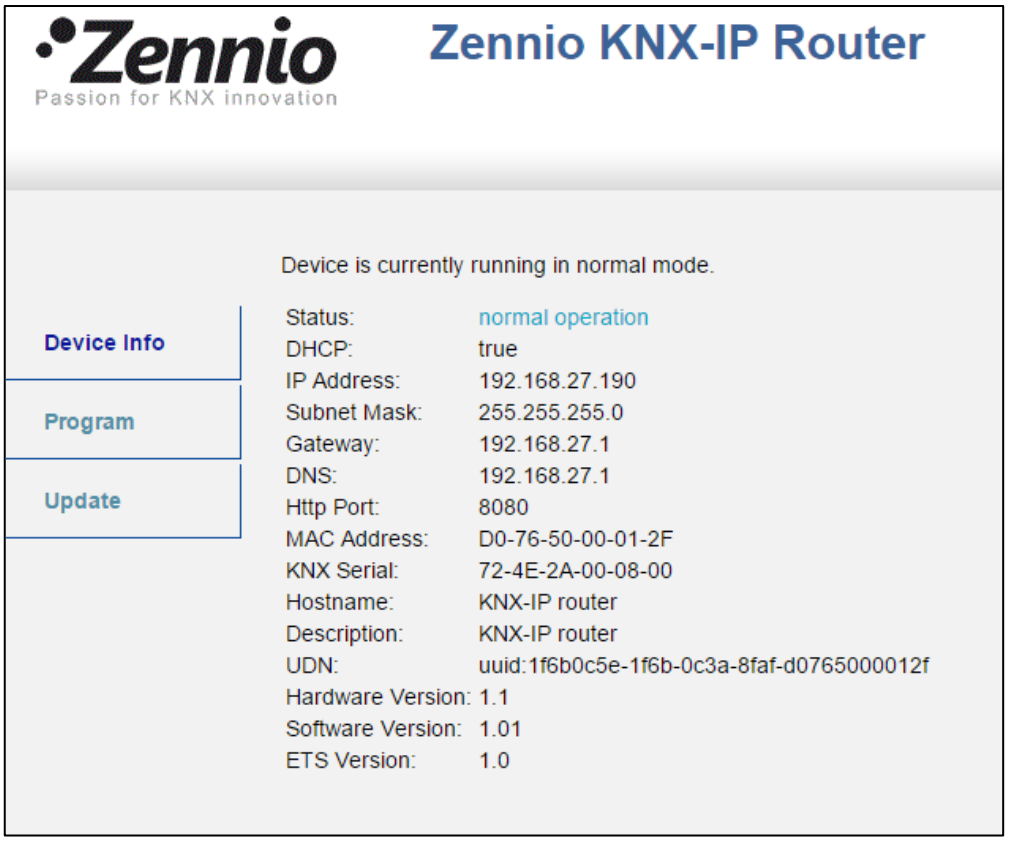

Figure 8 Web interface (device information).

2.5.1 FIRMWARE UPDATE

The "Update" section of the web interface permits updating the internal firmware of the device whenever Zennio releases a new firmware version (through the http://www.zennio.com website) by following these steps (please see Figure 9):

- **Authorise the update**:
  - Set the device into the programming mode.
  - Press the manual function button.
  - Wait for the "update authorized" message on the screen.
- **Request the update**:
  - From the "**Update**" section, press the "Request Update" button, and wait until the device reboots and enters Boot mode.
- **Upload the firmware**:
  - Browse for the hexadecimal file.
  - Press the "**Upload**" button.

Figure 9 Web interface (firmware update).

After the second step (update request), the device switches to Boot mode, which interrupts the normal device operation (telegram filtering, etc.), being no longer possible to connect to it. It will remain in this mode for **ten minutes** to allow the firmware update before returning to the normal mode.

During the Boot mode' the TP line status LED indicator blinks in green.

Notes:

- *The Boot mode can be alternatively accessed by disconnecting the power supply and re-connecting it while pressing the Programming or the Manual Function buttons, or both together.*

3 ETS PARAMETERISATION

To begin with the parameterisation process of the device, it is necessary, once the ETS program has been opened, to import the database of the product (**KNX-IP Router** application program).

Figure10 Properties of the Zennio KNX-IP Router Application Program

Next, the device should be added to the project where desired. Note that, depending on where the device is placed, the upper levels of the topology need to be **configured as KNXnet / IP**:

- The **backbone line**, in case of working as an area coupler.
- The **backbone line** and the **main line of the area** the device belongs to, in case of working as a line coupler.

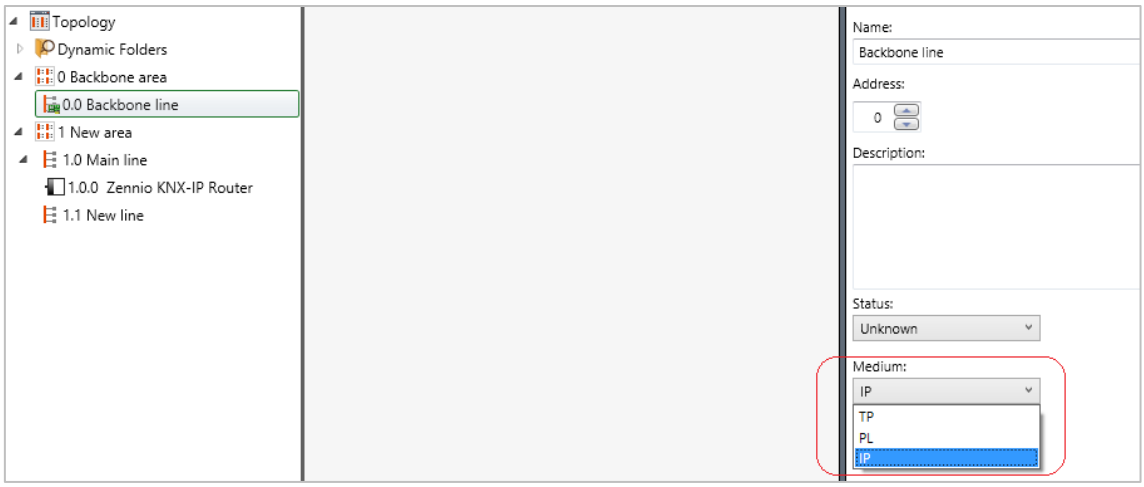

Figure 11 Zennio KNX-IP Router as an Area Coupler.

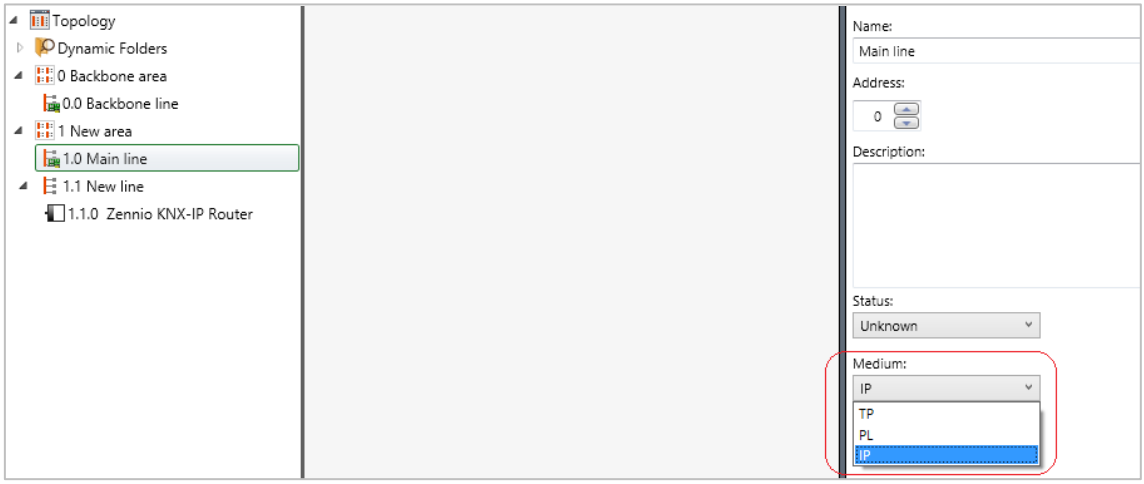

Figure 12 Zennio KNX-IP Router as a Line Coupler.

Finally, clicking on the device with the secondary mouse button will permit selecting "**Edit Parameters**", in order to start the configuration.

The following sections provide a detailed explanation about each of the different parameters of the device.

3.1 DEFAULT PARAMETERISATION

When entering the parameter edition of Zennio KNX-IP Router for the first time, a window similar to Figure 13 will be shown, where six main tabs are available: **General**, **IP Configuration**, **KNX multicast address**, **Manual Settings**, **Main line** and **Line**. Note that this application program does not implement communication objects.

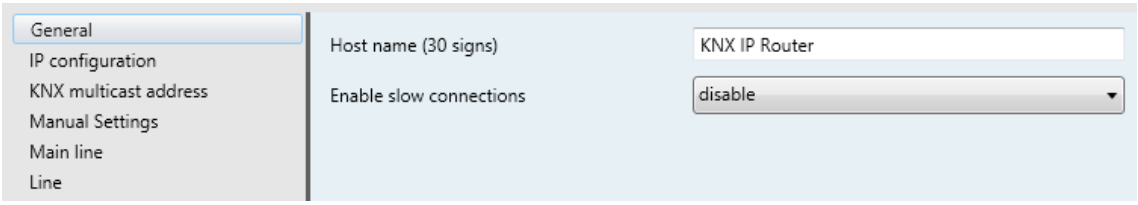

Figure 13 General.

3.2 GENERAL

As shown in Figure 13, this screen contains two parameters:

- **Host Name**: string of up to 30 characters to easily identify the device in ETS or from a KNXnet/IP system.
- **Enable Slow Connections**: allows slow connections between ETS and the device.

3.3 IP CONFIGURATION

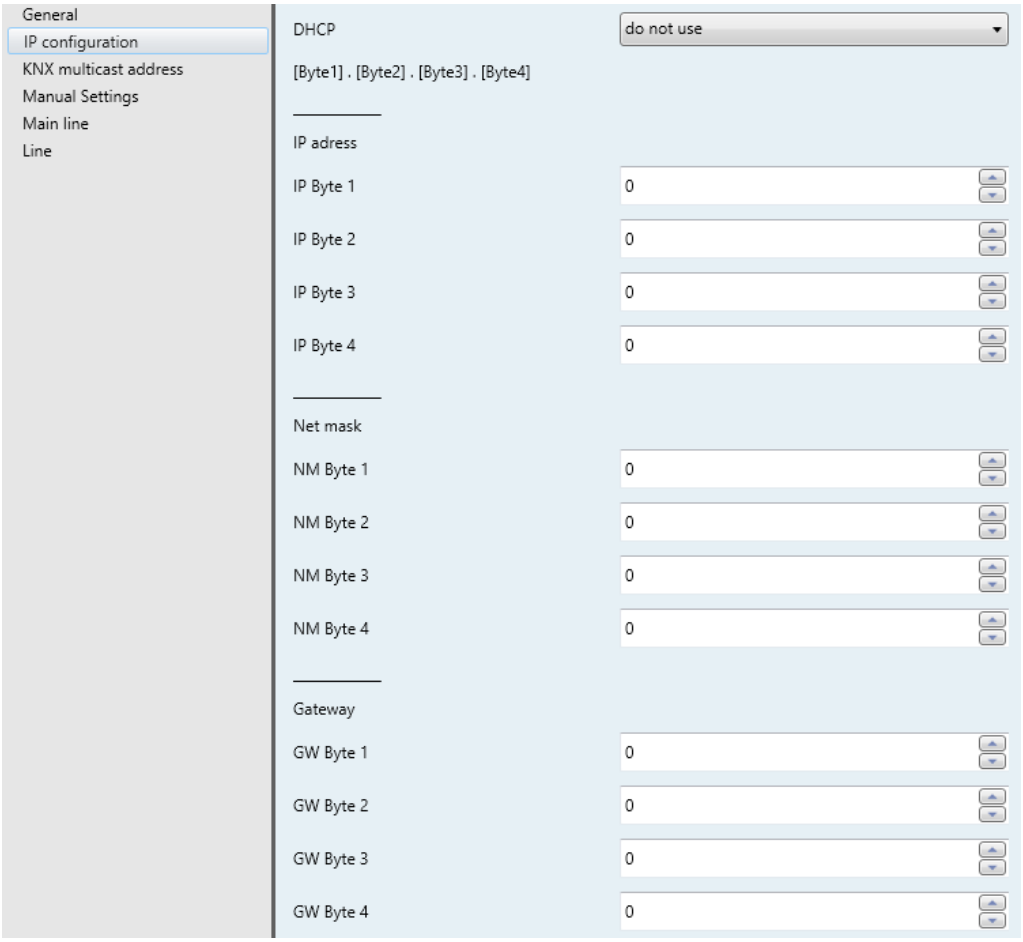

Figure 14 IP Configuration tab – DHCP: do not use.

Zennio KNX-IP Router is provided with the **DHCP protocol** enabled by default, and therefore can gain an IP address automatically as long as a DHCP server is available in the local network.

From ETS, it is possible to disable the use of the DHCP **and manually set an IP address** for the device, as well as the subnet mask and the IP address of the the network gateway. Thus, it is advisable to contact the manager of the local network.

Notes:

- *To make this configuration effective, after the download from ETS it is necessary to **interrupt the external power supply of the device for an instant**, and afterwards restore it.*
- *A **wrong configuration of these parameters** (e.g., IP address "0.0.0.0" or subnet mask "0.0.0.0") may leave the device locked, with the LAN traffic status LED lighting in red colour. To exit this status, it is necessary to disconnect the Ethernet cable and restore the factory defaults (section 2.4.1).*

3.4 KNX MULTICAST ADDRESS

Telegrams sent from the KNX bus to the IP network, or vice versa, travel through the latter as multicast IP packets, addressed to port 3671 at IP address number **224.0.23.12** so that they reach all KNX-IP interfaces available on the network.

Such address is reserved by the IANA organisation for the KNXnet/IP protocol, and should only be changed in parameters (Use Default Multicast Address = "No") in case the network configuration requires it or to create different, independent topologies within the same IP network.

Otherwise, it should be left as is (Use Default Multicast Address = "Yes")

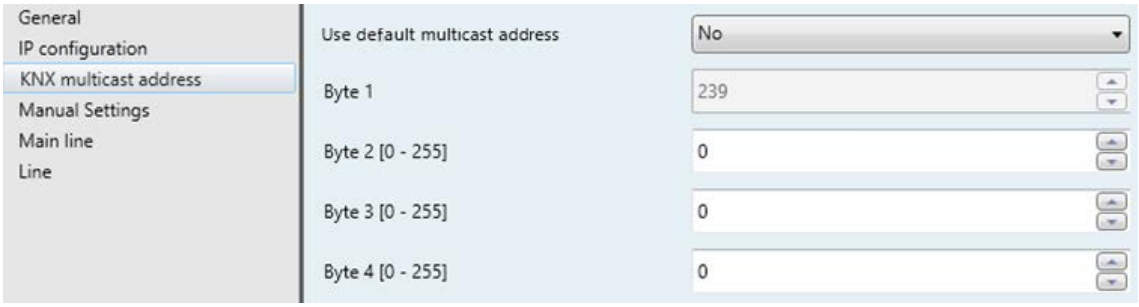

Figure 15 KNX multicast address configuration tab.

3.5 MANUAL SETTINGS

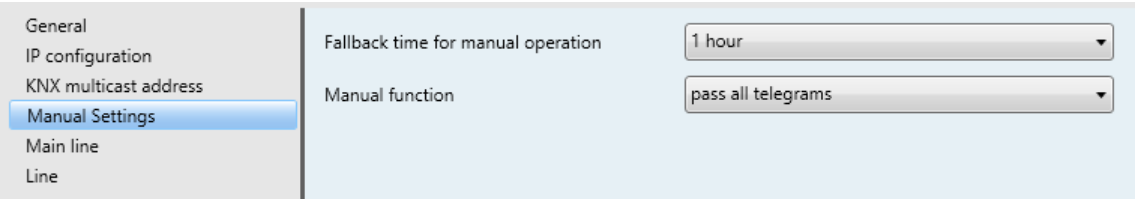

Figure 16 Router configuration tab.

As shown in Figure 16, this screen contains two parameters related to the device manual mode (see section 2.4):

- **Fallback Time for Manual Operation**: sets the maximum operation time for the manual mode. Once exceeded, the device will automatically leave manual mode and return to normal mode. The available values are: "10 minutes", "1 hour" (default), "4 hours" and "8 hours".

- **Manual Function**: sets the desired function to be executed by the device while in the manual mode. The available values are:

  - "Disabled" (no action),
  - "Pass all telegrams" (default option; the device will not filter/drop any telegram transferred from one line the other),
  - "Pass physical telegrams" (the device will not filter/drop physical addresses; in other words, all telegrams destined to physical addresses will be transmitted while in manual mode; on the other hand, group telegram filtering will stay the same as in normal mode),
  - "Pass group telegrams" (the device will not filter/drop group addresses; in other words, the group address filter table will stay *disabled* while in manual mode; on the other hand, physical address filtering will stay the same in normal mode).

3.6 MAIN LINE

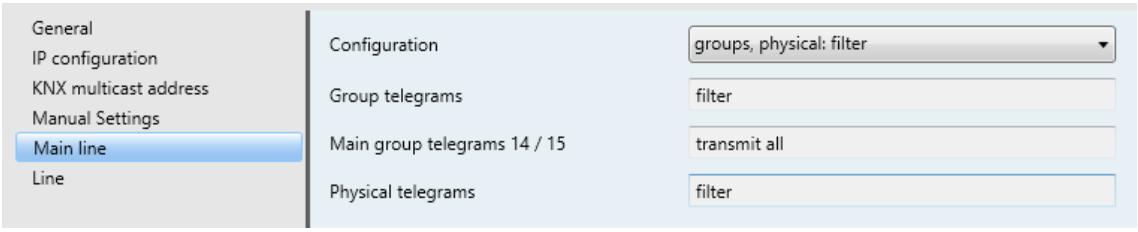

Figure 17 Main Line tab.

This screen permits parameterising the behaviour of Zennio KNX-IP Router regarding the telegrams received from the main line (Ethernet).

The available parameters are described next:

- **Configuration**: permits selecting a predefined set of parameters for the mainline, or enabling the manual configuration of each parameter (option "Configure"). The available options are:
  - "Groups: filter; Physical: block" (enables the group address filtering and drops all telegrams destined to physical addresses),
  - "Groups, Physical: filter" (default option; enables both the group address and the physical address filtering),
  - "Groups: route; Physical: filter" (performs no blocking or filtering over the group address but does filter telegrams destined to physical addresses),
  - "Groups, Physical: route" (performs no telegram filtering or dropping at all).

  Note: *transmitting all telegrams (no telegram filtering or dropping) is intended for diagnostic purposes and may cause risks or conflicts or generate a large amount of traffic in the KNX installation if permanently activated*.

  (The following parameters will be locked unless "Configure" has been selected under "Configuration").

- **Group Telegrams**: sets the behaviour of the device regarding telegrams destined to group addresses. The available options are:
  - "Transmit all" (no telegram filtering or dropping),

- "Block" (all telegrams will be dropped),
- "Filter" (default option; telegrams will be filtered, dropping only the corresponding ones, according to the filter table; see section 2.2).

Note: *transmitting all telegrams (no telegram filtering or dropping) is intended for diagnostic purposes and may cause risks or conflicts or generate a large amount of traffic in the KNX installation if permanently activated*.

- **Main Group Telegrams 14/15**: sets whether telegrams destined to group addresses beginning with "14" or greater (e.g., 14/1/1) will be dropped or transmitted. The options are "Transmit all" (default option) and "Block".

  Note ETS does not include in the filter table the following group addresses:

  - **14 / 0 / 0** to **31.7.255** in three-level topologies,
  - **14 / 0** to **31 / 2047** in two-level topologies,
  - **28672** (#7000) to **65535** (#FFFF) in level-free topologies.

- **Physical Telegrams**: sets the behaviour of the device regarding telegrams destined to individual addresses. The available options are:

  - "Transmit all" (no telegram filtering or dropping),
  - "Block" (all telegrams will be dropped),
  - "Filter" (default option; telegrams will be filtered, dropping the corresponding ones; see section 2.1).

  Note: *transmitting all telegrams (no telegram filtering or dropping) is intended for diagnostic purposes and may cause risks or conflicts or generate a large amount of traffic in the KNX installation if permanently activated*. *However, being able to **perform downloads** to devices in a different line than the programmer requires setting this option to "Transmit All".*

3.7 LINE

This screen permits parameterising the behaviour of Zennio KNX-IP Router regarding the telegrams received from the KNX line.

As shown in Figure 18, the available parameters are completely analogous to those in the “Main line” tab.

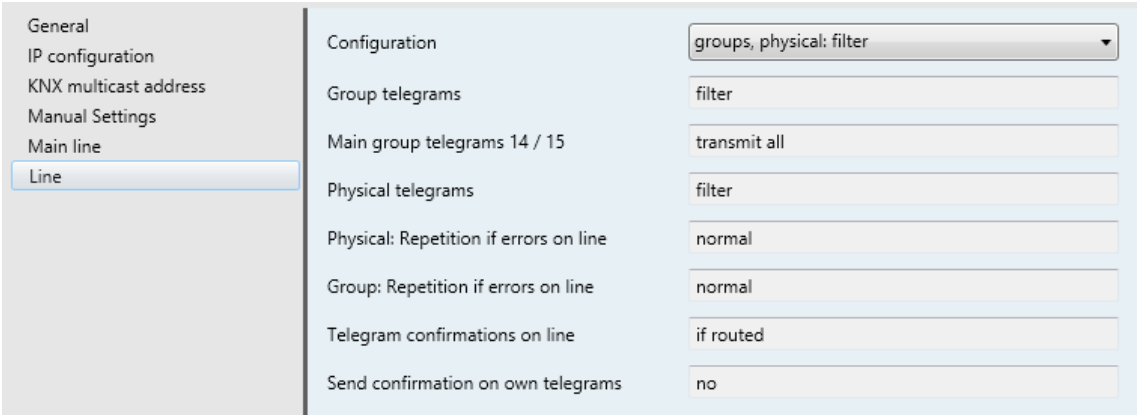

Figure 18 KNX line configuration tab.

Please refer to section 3.6 for a detailed description of these parameters; taking into account that section 3.6 applies to the main line instead of the line.

The following parameters are specific for the line (they are not available for the main line):

- **Physical: Repetition if errors on line**: sets the desired reaction upon transmission errors in the line (e.g.: busy receiver, acknowledgement not received, negative acknowledgement, etc.) of telegrams destined to physical addresses. The options are:

  - “No” (the undelivered telegram will not be re-sent),
  - “Normal” (default option; the undelivered telegram will be re-sent up to three times),
  - “Reduced” (the undelivered telegram will be re-sent once).

- **Group: Repetition if errors on line**: sets the desired reaction upon transmission errors in the line (e.g.: busy receiver, acknowledgement not

received, negative acknowledgement, etc.) of telegrams destined to a group address. The options are:

- "No" (the undelivered telegram will not be re-sent),
- "Normal" (default option; the undelivered telegram will be re-sent up to three times),
- "Reduced" (the undelivered telegram will be re-sent once).

- **Telegram confirmations on line**: sets when the device should confirm (by sending an immediate ACK message or IACK) the reception of telegrams.

  - "If routed" (default option) will make the device respond with an IACK message only if the received telegram is routed towards the mainline,
  - "Always" will make the device send a confirmation for every telegram it receives, even if not routed to the line on the other side.

- **Send confirmation on own telegrams**: permits enabling ("Yes") or disabling ("No"; default option) self-acknowledgment.

  This extra feature offers the possibility of sending an ACK to the destination line immediately after passing the telegram itself, so the telegram will show as confirmed on it (therefore preventing repetitions in case of faulty projects, etc.) even if no device is receiving it. In case of reception errors on the destination line, negative ACKs sent by the devices will overwrite this ACK, so having this parameter enabled will cause no damage or information loss.

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