IntesisBox® KNX

LG Air Conditioning

User's Manual

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IntesisBox®

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Gateway for integration of LG Air Conditioning Systems into KNX TP-1 (EIB) Control Systems.

Four models are available for this gateway, with the following **Order Codes**:

LG-AC-KNX-4
Model supporting integration of up to 4 indoor units.

LG-AC-KNX-8
Model supporting integration of up to 8 indoor units.

LG-AC-KNX-16
Model supporting integration of up to 16 indoor units.

LG-AC-KNX-64
Model supporting integration of up to 64 indoor units.

INDEX

1. Description 6
1.1 Introduction 6
1.2 Functionality 7
1.3 Capacity of IntesisBox® LG-AC-KNX 7
1.4 KNX system 8
1.4.1 Description 8
1.4.2 Points definition 8
1.5 Integration of LG indoor units into KNX 9
2. Connection 11
2.1 Power Up 12
2.2 Connection to KNX 12
2.3 Connection to LG PI485 bus/LG bus 12
2.4 Connection to PC (LinkBoxEIB) 12
3. LinkBoxEIB Configuration and monitoring tool 13
3.1 Introduction 13
3.2 Connections Configuration 13
3.2.1 Configuration tab 14
3.2.2 Points configuration 18
3.2.3 Remember 19
3.2.4 Restrictions 20
3.3 Saving and sending the configuration to the IntesisBox 20
3.3.1 Monitoring 21
3.3.2 Signals Viewer's window 21
3.3.3 Bus monitoring 22
3.4 Files 23
4. Electrical and Mechanical features 24
5. Measures 25

6. AC indoor units compatibility 26
7. Error codes for Indoor Units..... 27
8. Annex 28
8.1 PCB PMNFP14A0/1 and PCB PHNFP14A0..... 28
8.1.1 PCB PI485 - PMNFP14A0/1 28
8.1.2 PCB PI485 - PMNFP14A0/1 model composed of 8 dip switches. 29
8.1.3 PCB PHNFP14A0 / PSNFP14A0 30
8.1.4 Address configuration of LG's AC indoor unit..... 31

1. Description

1.1 Introduction

IntesisBox® LG-AC-KNX is a communication gateway for the integration of LG air conditioning systems into KNX TP-1 (EIB) building automation systems.

Thanks to IntesisBox® LG-AC-KNX the installer is able to integrate up to 64 indoor units. The installer can integrate up to 4 indoor units in case of LG-AC-KNX-4, up to 8 indoor units in case of LG-AC-KNX-8, up to 32 indoor units in case of LG-AC-KNX-32 or up to 64 indoor units in case of LG-AC-KNX-64.

The integration may require the installation of an LG-PI485 interface into the LG Air Conditioning System. Only from Multi V III and Multi V Plus II onwards, you shall have direct connection to the outdoor units built-in RS485.

The PI485 interface is supplied by LG. Contact your nearest LG's AC Systems distributor for more details.

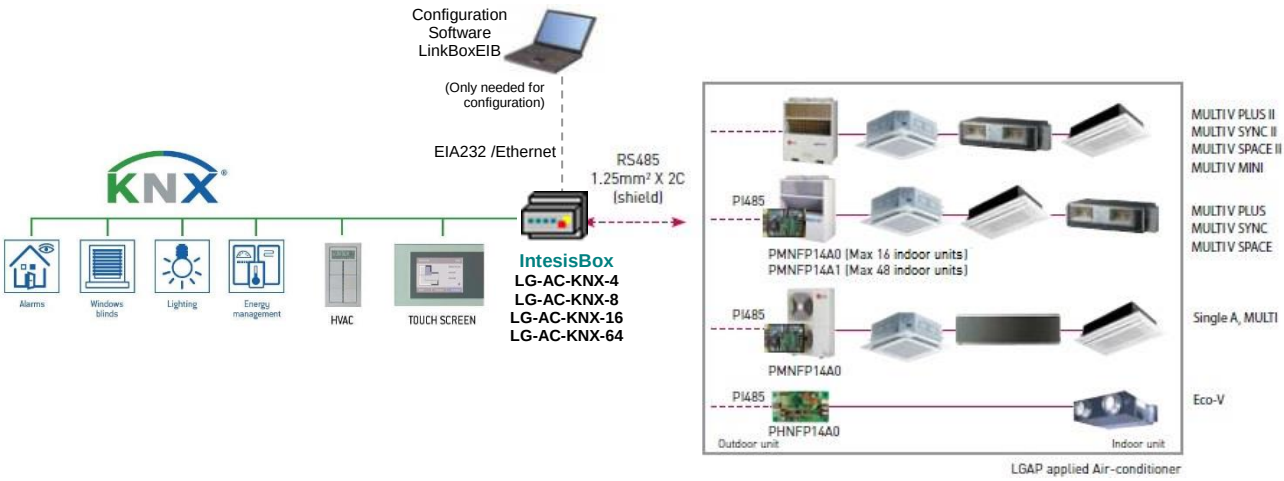


Figure 1.1 System integration using IntesisBox® LG-AC-KNX.

Main features:

- Direct connection to KNX TP-1 (EIB) bus.
- Direct connection into LG PI485 bus (EIA485 connector).
- Bidirectional: Supervision and control.
- Independent communication management.
- Simple configuration using the software tool LinkBoxEIB supplied with the purchase of IntesisBox® LG-AC-KNX with no additional cost.
- Standard DIN module box size.
- Power supply required: selectable from 9 to 30 VDC or 24 VAC.

1.2 Functionality

The IntesisBox® LG-AC-KNX gateway continuously *polls* (reads) the LG PI485/LG bus for all configured Signals and keeps the values updated in its memory, ready to be served when it's requested from KNX.

When a change of status is detected in the Signal of the LG's AC System, a writable telegram (message) associated with a *KNX Group* is sent to the KNX bus (when "T" flag is set).

When a write telegram (message) is received from the KNX bus, and if its *KNX Group address* is associated with a Signal from LG's AC System, a message is sent immediately to the LG PI485/LG bus to perform the corresponding action in the LG's AC System.

During the continuous reading (*polling*) of the LG PI485/LG bus, if no response is detected, the corresponding Error Signal is activated and shows a communication error. There is a virtual Signal for each AC indoor unit, which informs about the communication error between the gateway and the AC indoor unit. This Signal is normally activated if the AC indoor unit has not been properly configured.

The IntesisBox® LG-AC-KNX gateway is not able to work in a multi-Master System. This means that when the gateway is connected in the System, any other controller must be set as Slave in the LG-PI485 bus.

1.3 Capacity of IntesisBox® LG-AC-KNX

Element	Capacity	Notes
Number of indoor units	64 *	Maximum number of AC indoor units that can be controlled.
Number of KNX Groups	4000	Maximum number of KNX Groups that can be used in IntesisBox®.
Number of listening addresses for each object.	255	Maximum number of listening addresses that can be associated to an object.

Table 1.1 Capacity of IntesisBox® LG-AC-KNX

* There are four different models for IntesisBox® LG-AC-KNX series. Each model has a different capacity. The table above shows the capacity of the top model (maximum capacity). The other models, its references and its capacities are described below:

- Model which supports up to 4 indoor units. *Ref.: LG-AC-KNX-4*
- Model which supports up to 8 indoor units. *Ref.: LG-AC-KNX-8*
- Model which supports up to 16 indoor units. *Ref.: LG-AC-KNX-16*
- Model which supports up to 64 indoor units. *Ref.: LG-AC-KNX-64*

1.4 KNX system

In this Section, a common description for all IntesisBox® LG-AC-KNX series gateways is given. The Installer must consider the *internal system* as the installation between the gateway and the KNX system, and the *external system* as the installation between the gateway and the LG's AC System.

1.4.1 Description

IntesisBox® LG-AC-KNX connects directly to the KNX TP-1 bus and behaves as a standard device of the KNX System. It uses the same configuration and functional features of other KNX devices.

Internally, the electronic circuit's part connected to the KNX TP-1 bus is opto-isolated from the Power source and from the electronic system as well.

IntesisBox® LG-AC-KNX receives, manages and sends all telegrams (messages) related to its configuration to the KNX bus.

When telegrams associated with KNX Groups are received in the *external system* (LG's AC System), the reciprocal messages are sent to the *internal system* (KNX System) to maintain both systems synchronized continuously.

When a change in a Signal of the *external system* is detected, a telegram (message) (which is associated with KNX Group) is sent to the KNX bus to maintain both systems synchronized continuously.

In case of a KNX bus' voltage failure, while the bus performs the recovery, IntesisBox® LG-AC-KNX retransmits the status of all KNX Groups marked as *"T"*. Also, the *Updates* of all KNX Groups (marked as *"U")* are performed. This last functionality can be deactivated.

1.4.2 Points definition

Each Signal of the *external system* to use (LG AC's System) has the following KNX properties:

Property	Description
Signal	Signal description. This property has informative purposes. This property allows to identify the Signal object properly.
EIS (DataPoint)	It's the KNX Data type used to code the Signal value. It depends on the associated Signal type in the *external system*. In some integrations, this Data type is selectable, in other cases this one is not selectable due to the intrinsic features of the Signal.
Group	The KNX Group address to which the Signal is associated to. Actions like Read (R), *Write* (W), *Transmit* (T) and *Update* (U) are applied to this Group. This has to be a unique address for each Signal object.
Listening addresses	Additional Group addresses that can write to the Signal object. These are used as for central control (to manage more than one unit at the same time etc..). Multiple addresses are to be separated by comma.
R	Read property. When set active, the authorization to read telegrams (messages) on the Signal Group address is allowed.
W	Write property. When set active, the authorization to write telegrams (messages) on the Signal Group address and listening addresses is allowed.

T	Transmit property. When set active, any value change shall act as a write to the associated KNX Group address. The write is applied to the address in the field "Group".
U	Update property. When set active, in case of a IntesisBox® LG-AC-KNX start-up or after a KNX bus voltage recovery, the authorization to read telegrams (messages) using the address from the field "Group" is sent to KNX bus. The received value for each reading request is sent to the external system as if it had been received by a write telegram.
Active	This property enables or disables the Signal Object in the configuration of IntesisBox® LG-AC-KNX.

These properties are common for all IntesisBox® LG-AC-KNX series. Each integration may have specific properties according to Signals type of the external system.

1.5 Integration of LG indoor units into KNX

The following list shows the available Signals to integrate each LG indoor unit. It shows as well each KNX Signals type and its information.

Abbreviations: **AC**: Air Conditioner, **VENT**: Energy Recovery Ventilation, **DX**: ECO V DX-Type unit (AC+VENT), **AWHP**: Air-to-Water Heat Pump.

Property	EIS type	Unit Signals type				miraDescription / Status	
		AC	DX	VENT	AWHP		
On / Off AC	1 – Switching (1bit)	R/W	R/W	-	R/W	**Start/Stop Unit** 0 – OFF, 1 – ON	
Mode AC	14 – Counter (8bits)	R/W	R/W	R/W	R/W	**AC Mode Unit** 0 – COOL, 1 – HEAT, 2 – DRY, 3 – FAN, 4 – AUTO ***Mode Unit (DX, VENT)*** *0 – NORMAL, 1 – HEAT EXCHANGE, 2 – AUTO*	
Mode::Cool	1 – Switching (1bit)	R/W	R/W	-	R/W	**AC Unit** 0 – Inactive, 1 – Active	Only one of these objects will be set / read to "1" at the same time (all objects will be updated on bus upon a Mode change)
Mode::Heat	1 – Switching (1bit)	R/W	R/W	-	R/W	**AC Unit** 0 – Inactive, 1 – Active	
Mode::Dry	1 – Switching (1bit)	R/W	-	-	-	**AC Unit** 0 – Inactive, 1 – Active	
Mode::Fan	1 – Switching (1bit)	R/W	-	-	-	**AC Unit** 0 – Inactive, 1 – Active	
Mode::Auto	1 – Switching (1bit)	R/W	R/W	-	R/W	**AC Unit** 0 – Inactive, 1 – Active	
Setpoint Temperature	EIS 5 – Float (2byte)	R/W	R/W	-	-	**Temperature Set Point** (only integer numbers allowed) 18..30 ºC. AC Unit	
Ambient Temperature	EIS 5 – Float (2byte)	R	R	-	R	**Ambient Temperature** (only integer numbers) Read: -10ºC to 50ºC.	
Swing	14 – Counter (8bits)	R/W	-	-	-	**AC Swing** 0 – Stop, 1 – Start	
Fan Speed	14 – Counter (8bits)	R/W	R/W	R/W	-	**AC Fan Speed** 0 – AUTO, 1 – LOW, 2 – MID, 3 – HIGH	
FanSpeed::Auto	1 – Switching (1bit)	R/W	R/W	R/W	-	**Fan Speed Auto** 0 – Inactive, 1 – Active	Only one of these objects will be set / read to "1" at the same time (all objects will be updated on bus upon a Mode change)
FanSpeed::Low	1 – Switching (1bit)	R/W	R/W	R/W	-	**Fan Speed Low** 0 – Inactive, 1 – Active	

FanSpeed::Mid	1 – Switching (1bit)	R/W	R/W	R/W	-	**Fan Speed Mid** 0 – Inactive, 1 – Active	
FanSpeed::High	1 – Switching (1bit)	R/W	R/W	R/W	-	**Fan Speed High** 0 – Inactive, 1 – Active	
Remote Restriction	1 – Switching (1bit)	R/W	R/W	R/W	R/W	**Remote Control Enablement / Disablement** 0 – Remote control enabled, 1 – Remote control disabled	
Error Code	10 – Counter (16bits)	R	R	R	R	**Error Code** More info in section 7	
Error Sign	1 – Switching (1bit)	R	R	R	R	**Error Code / Communication error with the Indoor Unit** 0 – No error present, 1 – Error code present, or communication error with the indoor unit	
Accumulated power	11-Counter (32bits)	R	R	-	R	**Accumulated Power Consumption** Read: Wh value 0 to 9999990, only if DPI is present.	
On / Off VENT	1 – Switching (1bit)	-	R/W	R/W	-	**Start / Stop Unit** 0 – Off, 1 – On.	
Mode VENT	14 – Counter (8bits)	-	R/W	R/W	-	**Mode VENT** 0 – Normal, 1 – Heater-Exchange, 4 – Auto.	
Mode VENT:: Normal	1 – Switching (1bit)	-	R/W	R/W	-	**Mode VENT Normal** 0 – Inactive, 1 – Active	Only one of these objects will be set / read to "1" at the same time (all objects will be updated on bus upon a Mode change)
Mode VENT:: Heater	1 – Switching (1bit)	-	R/W	R/W	-	**Mode VENT Heat** 0 – Inactive, 1 – Active	
Mode VENT:: Auto	1 – Switching (1bit)	-	R/W	R/W	-	**Mode VENT Auto** 0 – Inactive, 1 – Active	
Filter Alarm Status	1 – Switching (1bit)	-	-	R	-	**Filter Alarm Status VENT Unit** 0 – No alarm, 1 – Filter alarm present	
Filter Alarm Reset	1 – Switching (1bit)	-	-	W	-	**Filter Alarm** Reset **VENT Unit** Write: 1 – Filter alarm reset	
SupplyAirTemp	EIS 5 – Float (2byte)	-	R	-	-	**Supply Air Temperature** (only integer numbers) Read: -10ºC to 50ºC.	
OutdoorTemp	EIS 5 – Float (2byte)	-	R	-	-	**Outdoor Air Temperature** (only integer numbers) Read: -10ºC to 50ºC.	
Heater	1 – Switching (1bit)	-	R/W	-	-	**Heater** 0 – OFF, 1 – ON.	
PowerSaving	1 – Switching (1bit)	-	R/W	-	-	**Power Saving** 0 – OFF, 1 – ON.	
Rapidity	1 – Switching (1bit)	-	R/W	-	-	**Rapidity** 0 – OFF, 1 – ON.	
Humidity	1 – Switching (1bit)	-	R	-	-	**Humidity** Read: 0 – OFF, 1 – ON.	
SetTempMode	1 – Switching (1bit)	-	-	-	R	**Set point Temperature Mode** Read: 0 – Air, 1 – Water.	
SetTemp	EIS 5 – Float (2byte)	-	-	-	R/W	**Set point Temperature:** Celsius Value. Air: 18ºC to 30ºC / Water: 6°C to 80°C.	
OnOff HW	1 – Switching (1bit)	-	-	-	R/W	**Hot Water On / Off.** 0 – OFF, 1 – ON.	
Mode HW	1 – Switching (1bit)	-	-	-	R	**Hot Water Mode.** Read: 0 – OFF, 1 – ON.	
SetTemp HW	EIS 5 – Float (2byte)	-	-	-	R/W	**Set point Temperature for Hot Water.** Water: 30°C to 80°C.	
WaterInTemp	EIS 5 – Float (2byte)	-	-	-	R	**Water Inlet Temperature:** Celsius Value. Read: 0°C to 100°C.	
WaterOutTemp	EIS 5 – Float (2byte)	-	-	-	R	**Water Discharge Temperature:** Celsius Value. Readr: 0°C to 100°C.	
TankTemp	EIS 5 – Float (2byte)	-	-	-	R	**Water Tank temperature:** Celsius Value. Readr: 0°C to 100°C.	

SolarTemp	EIS 5 – Float (2byte)	-	-	-	R	**Solar Source Temperature:** Celsius Value. Read: 0°C to 100°C.

2. Connection

IntesisBox® LG-AC-KNX uses a standard enclosure which allows DIN EN60715 TH35 rail mounting. The enclosure's material meets standard PC UL 94 V0.

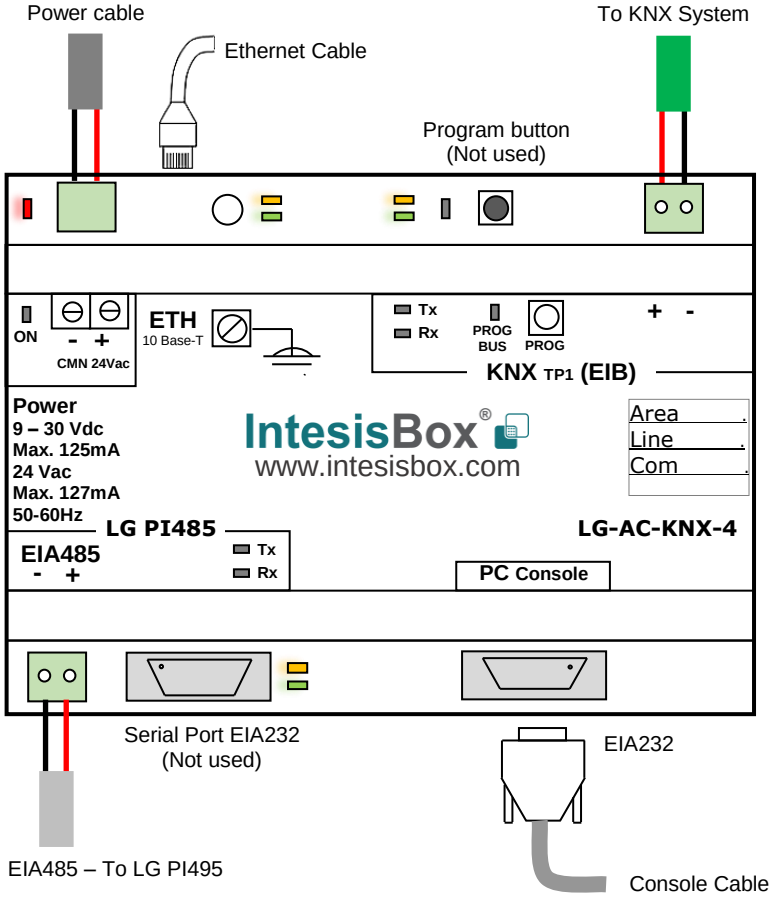


Figure 2.1 IntesisBox® LG-AC-KNX connection diagram

Make sure you keep proper space among all connectors when these ones are mounted.

The items supplied by Intesis Software for this integration are:

- IntesisBox® LG-AC-KNX hardware
- Console cable. Standard DB9F-DB9M cable (5.91 ft length) (1.8 meter length)
- Installation's Sheet. The sheet contains a link to find *LinkBoxEIB* software and to find this User's Manual on the web.

2.1 Power Up

The first step is to Power Up the device. For this, the installer has to use a Power Supply which should work with the allowed voltage's range (See Table 4.1). Once the device is connected, the ON LED (See Figure 2.1) turns on.

WARNING! In order to avoid earth loops that can damage the gateway and/or any other equipment connected to it, we recommend:

- The use of a DC Power Supply NEC Class 2 or Limited Power Source (LPS) and SELV classification. **Don't use a DC Power Supply with the positive terminal connected to earth**.
- The use of a AC Power Supply only if this one is floating and if it doesn't power any other device.

2.2 Connection to KNX

Connect + and – terminals of the KNX bus to the IntesisBox® LG-AC-KNX connector, labeled as **KNX TP1 (EIB)** (See Figure 2.1). Respect the polarity. If the connection has been done properly, the Tx LED (See Figure 2.1) starts blinking. If the blinking doesn't occur the Installer should check again the connection and make sure that the bus is connected properly.

To monitor communication between the KNX bus and IntesisBox® LG-AC-KNX. See Section 3.3.1.

2.3 Connection to LG PI485 bus/LG bus

The gateway's EIA485 communication port (see Figure 2.1) needs to be connected to the LG PI485 A/B bus, respecting the bus polarity. (A+, B-)

Up to 16 LG-PI485 interfaces/Outdoor units (OU) can be connected to the gateway's LG PI485 bus. (OU Addressing 00..15 (0x0F), IU Addressing 00..255 (0xFF)).

This integration may require the installation of an LG PI485 interface into the LG Air Conditioning System. Only from Multi V III and Multi V Plus II onwards, you shall have direct connection to the outdoor units built-in EIA485. Otherwise, you shall need the additional LG-PI485 communication module.

The PI485 interface is supplied by LG. Contact your nearest LG's AC Systems distributor for more details. More details about these PCBs can be found in Section 8.1.

To verify if there's communication between the PI485 bus and the IntesisBox® LG-AC-KNX, consult the Bus monitoring explanation in Section 3.3.3.

2.4 Connection to PC (LinkBoxEIB)

This action allows the Installer to have successful access to the device configuration and device's monitoring (more information related to this matter can be found in the LinkBoxEIB User's Manual installed with the software tool). Three available connection methods can be used:

- Ethernet: One can establish communication between a computer and the IntesisBox® LG-AC-KNX gateway using the ETH Port (RJ-45) (see **Error! Reference source not found.**) located on the gateway, using a crossed UTP Ethernet cable for direct connection. For communication with a computer over a Network Switch, use a straight wired UTP cable between the switch and the gateway. The LinkboxEIB tool uses UDP-IP communication, default port: 23. (Standart IP 192.168.100.246).

- Serial Port: One can establish communication between the PC and IntesisBox® LG-AC-KNX using the EIA232 "PC console Port" located on the gateway, using the serial cable provided with the interface (See Section 2) and using an EIA232 Port located on the Installers PC.

- Serial Port to USB: One can establish communication between a computer and the IntesisBox® LG-AC-KNX using the EIA232 "PC Console Port" located on the gateway, using the serial cable provided with the interface (See Section 2), and using a USB-to-RS232 to converter, using a USB Cable and using the USB Port located in the Installer's PC. One end of this USB Cable should be connected to the EIA232 Port from IntesisBox® LG-AC-KNX and the other end to a converter EIA232 -> USB. This converter is not provided within the interface. The USB Cable is not provided within the interface.

3. LinkBoxEIB Configuration and monitoring tool.

3.1 Introduction

LinkBoxEIB is a software tool compatible with Windows® Operation Systems developed specifically to monitor and configure interfaces from IntesisBox® KNX series, including IntesisBox® LG-AC-KNX series.

The installation procedure and main functions are explained in the *LinkBoxEIB User's Manual*. This document can be found in the *Doc* folder, or can be downloaded from the link typed on the Installation Sheet supplied with the IntesisBox® LG-AC-KNX device.

3.2 Connections Configuration

To configure the IntesisBox® LG-AC-KNX connection parameters and to visualize the list of points, press on the ***Config*** button in the *menu bar* (See Figure 3.1). A window named as ***LG Configuration*** pops up (see Figure 3.2). For integrations with a large number of points, there is available an alternative: the CSV based bulk point configuration's procedure (explained in the User's Manual from LinkBoxEIB)

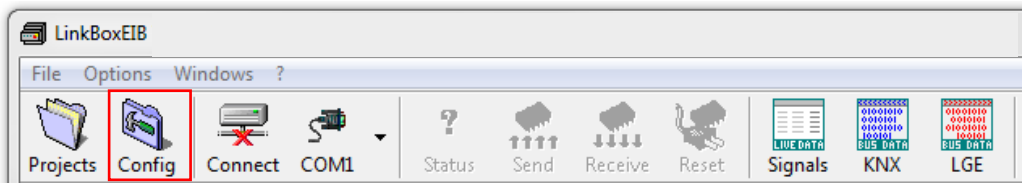


Figure 3.1 LinkBoxEIB menu bar.

3.2.1 Configuration tab

Select the ***Connection*** tab to configure the connection parameters. Four subsets of information are configured using this tab (see Figure 3.2):

1- Parameters of KNX (EIB) interface
2- IntesisBox® LG-AC-KNX Ethernet's connection (only for Ethernet's connection)
3- IntesisBox® LG-AC-KNX version
4- Parameters for LG's AC System (PCB PI485).

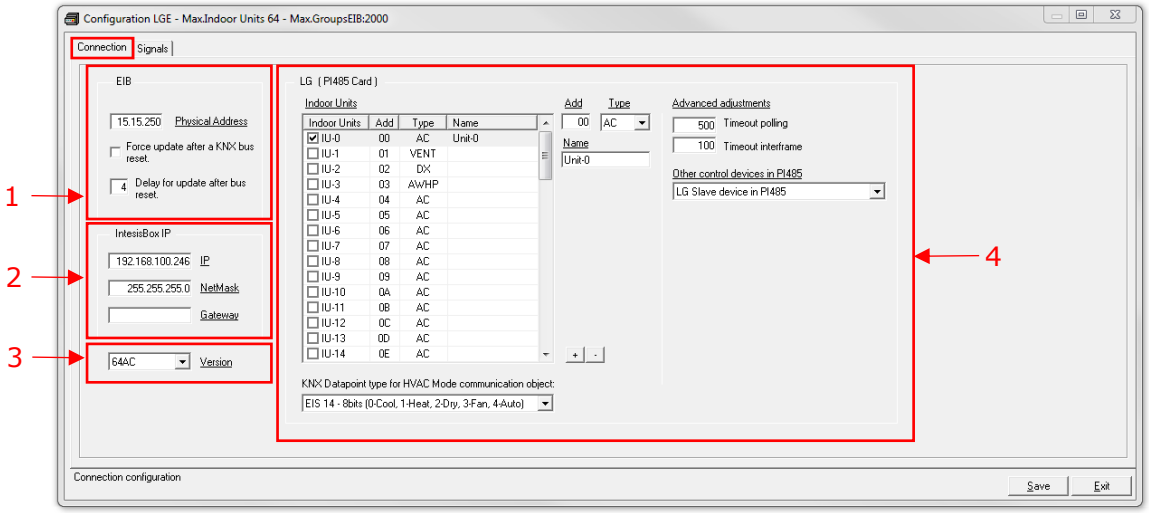


Figure 3.2 Configuration tab of LinkBoxEIB

1. Parameters of KNX (EIB) interface

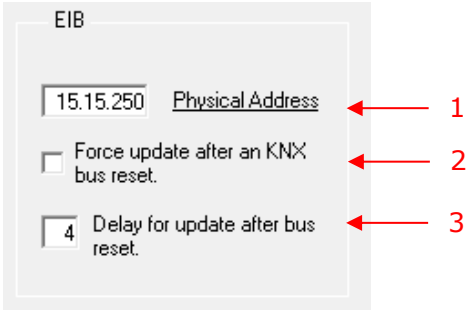


Figure 3.3 KNX interface configuration's parameters.

1. **Physical Address:** It's the Physical address desired to assign to IntesisBox® LG-AC-KNX in the KNX network.

2. **Force update after a KNX bus reset:** Mark this checkbox if you want IntesisBox® LG-AC-KNX to send "reading" requests to KNX bus each time that KNX bus is recovered. The update is triggered only for those signals that are setup with its "U" flag or "U2" flag.

3. **Delay for update after bus reset:** In case the Installer marked the last checkbox, the Installer can entry now a delay (it is measured in seconds). IntesisBox® LG-AC-KNX waits a period of time before trigger again the "reading" requests once the bus connection is recovered. This delay means to reduce initial bus loads in case to have other devices sending "reading" requests during a bus recovery.

2. IntesisBox® LG-AC-KNX Ethernet's connection (only for Ethernet's connection)

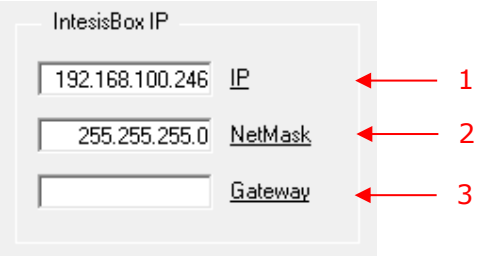


Figure 3.4 IntesisBox® KNX-LG-AC Ethernet's connection

1. **IP:** Enter the IP address for IntesisBox® LG-AC-KNX (The Installer finds at first time by default IP:192.168.100.246). Contact the Network Administrator for detailed information about the local net.

2. **NetMask**: Enter the Net Mask of IntesisBox® LG-AC-KNX (default: 255.255.255.0). Contact the Network Administrator for detailed information about the local net.

3. **Gateway**: Enter the Gateway IP Address for the KNX network. Leave blank if no router is needed. Contact the Network Administrator for detailed information about the local router used.

3. IntesisBox® LG-AC-KNX version

Select which one of the IntesisBox® LG-AC-KNX series are you going to set up:

4AC for use of *LG-AC-KNX-4*
8AC for use of *LG-AC-KNX-8*
16AC for use of *LG-AC-KNX-16*
64AC for use of LG-*AC-KNX-64*

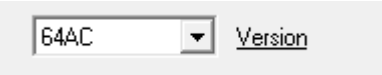


Figure 3.5 IntesisBox® LG-AC-KNX version

4. Parameters for LG's AC System (PCB PI485).

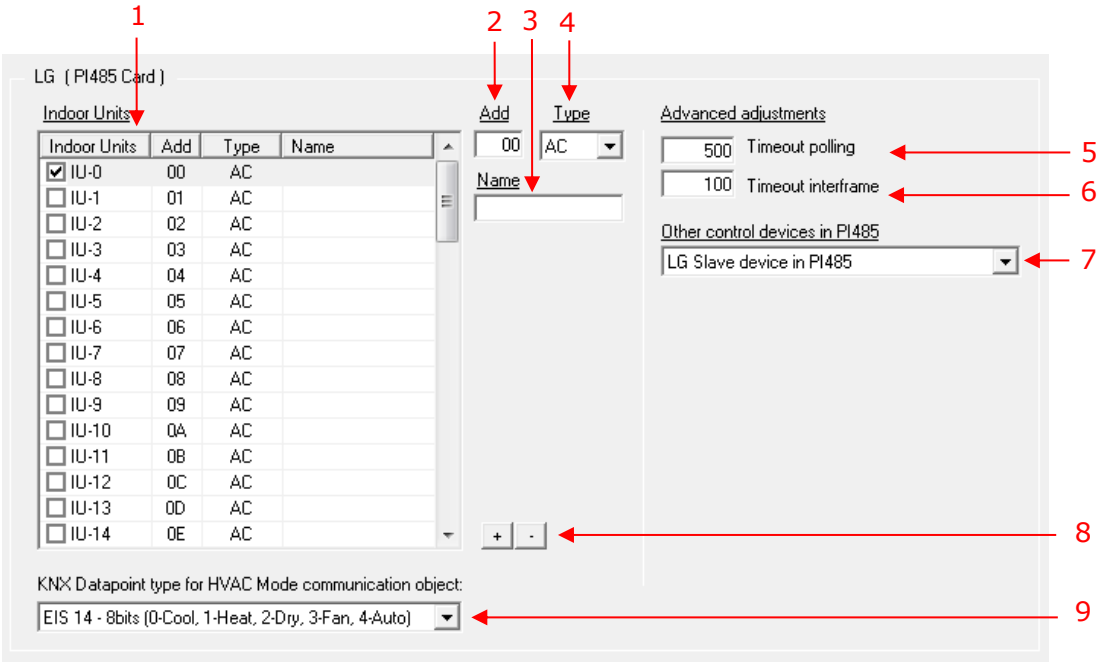


Figure 3.6 Parameters for LG'S AC System (PCB PI485)

1. **Indoor Units:** In this list, you can individually enable each one of the 64 indoor units available using the checkbox next to each indoor unit. The index of the column named as "Indoor Units" (the number xx) is the reference that is used later (in "Signals" tab) to refer to the unit number. The Installer should select one indoor unit at a time for each configuration. The values of the columns named as "Add", "Type" and "Name" change automatically upon the changes that the Installer does on the next parameters that are described below.

2. **Add:** Address of the selected indoor unit. Its value should be inside the range 0..FF (Hexadecimal base). More information about how to set this address can be found in Section 0.

3. **Name:** The Installer can enter a Name to call the IU. This parameter is optional.

4. **Type:** Indoor unit type. The available typologies are: AC, VENT, DX or AWHP. If the wrong type is selected the LG'S AC System may not work properly.

Advanced Adjustments: Additional configuration parameters should be left to their default value. They only might need to be modified in some specific cases (installations with large number of units, scenarios with large number of KNX commands sent at once, etc…)

5. **Timeout polling:** The time spent until receive a response from LG PI485 bus once the polling is performed.

6. **Timeout interframe:** Minimum time spent between a RX frame and a TX frame that have been sent to the LG PI485 bus (related channel idle time).

7. **Other control devices in PI485.** In this list the Installer is able to select among 3 options:

    a. **No Other controller in PI485.** In this setup, the IntesisBox® LG-AC-KNX is the only Controller present on the PI485 bus.

    b. **LG Slave device in PI485.** In this setup, there is a second Controller in the LG PI485 bus working and set as a Slave.

    c. **LG Slave device in PI485, with PDI feature.** In this setup, there is a second Controller in the LG PI485 bus working, set as a Slave, and this Controller supports the PDI feature (Power Distribution Indication).

8. **Indoor unit's selection buttons (+/-):**

    a. Press + to select all indoor units at once.

    b. Press – to unselect all indoor units at once.

9. **KNX Datapoint type selection for HVAC Mode communication object:**

Depending on the communication (DPT/EIS) used within KNX you can change and select the Datapoint type for the object for operating mode.

The available options are:

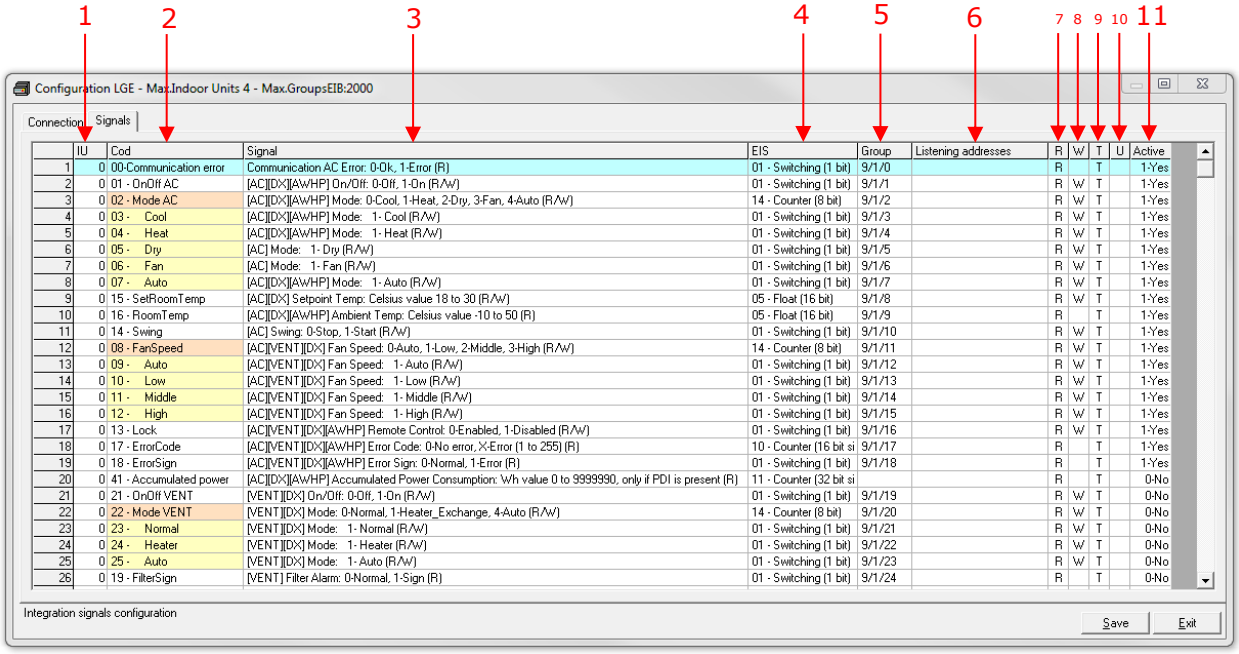
a. EIS 14 - 8bits (0-Cool, 1-Heat, 2-Dry, 3-Fan, 4-Auto) – Default value.

b. DPT 20.105 - 8bits (0-Auto, 1-Heat, 3-Cool, 9-Fan, 14-Dry).

c. DPT 1.100 - 1bit (0-Cool, 1-Heat).

3.2.2 Points configuration

Select the Signals' tab to configure the List of Signals and its parameters (called as well *List of Communication Objects*).



	IU	Cod	Signal	EIS	Group	Listening addresses	R	W	T	U	Active
1	0	00-Communication error	Communication AC Error: 0-Ok, 1-Error (R)	01 - Switching (1 bit)	9/1/0		R		T		1-Yes
2	0	01 - OnOff AC	[AC][DX][AWHP] On/Off: 0-Off, 1-On (R/W)	01 - Switching (1 bit)	9/1/1		R	W	T		1-Yes
3	0	02 - Mode AC	[AC][DX][AWHP] Mode: 0-Cool, 1-Heat, 2-Dry, 3-Fan, 4-Auto (R/W)	14 - Counter (8 bit)	9/1/2		R	W	T		1-Yes
4	0	03 - Cool	[AC][DX][AWHP] Mode: 1- Cool (R/W)	01 - Switching (1 bit)	9/1/3		R	W	T		1-Yes
5	0	04 - Heat	[AC][DX][AWHP] Mode: 1- Heat (R/W)	01 - Switching (1 bit)	9/1/4		R	W	T		1-Yes
6	0	05 - Dry	[AC] Mode: 1- Dry (R/W)	01 - Switching (1 bit)	9/1/5		R	W	T		1-Yes
7	0	06 - Fan	[AC] Mode: 1- Fan (R/W)	01 - Switching (1 bit)	9/1/6		R	W	T		1-Yes
8	0	07 - Auto	[AC][DX][AWHP] Mode: 1- Auto (R/W)	01 - Switching (1 bit)	9/1/7		R	W	T		1-Yes
9	0	15 - SetRoomTemp	[AC][DX] Setpoint Temp: Celsius value 18 to 30 (R/W)	05 - Float (16 bit)	9/1/8		R	W	T		1-Yes
10	0	16 - RoomTemp	[AC][DX][AWHP] Ambient Temp: Celsius value -10 to 50 (R)	05 - Float (16 bit)	9/1/9		R		T		1-Yes
11	0	14 - Swing	[AC] Swing: 0-Stop, 1-Start (R/W)	01 - Switching (1 bit)	9/1/10		R	W	T		1-Yes
12	0	08 - FanSpeed	[AC][VENT][DX] Fan Speed: 0-Auto, 1-Low, 2-Middle, 3-High (R/W)	14 - Counter (8 bit)	9/1/11		R	W	T		1-Yes
13	0	09 - Auto	[AC][VENT][DX] Fan Speed: 1- Auto (R/W)	01 - Switching (1 bit)	9/1/12		R	W	T		1-Yes
14	0	10 - Low	[AC][VENT][DX] Fan Speed: 1- Low (R/W)	01 - Switching (1 bit)	9/1/13		R	W	T		1-Yes
15	0	11 - Middle	[AC][VENT][DX] Fan Speed: 1- Middle (R/W)	01 - Switching (1 bit)	9/1/14		R	W	T		1-Yes
16	0	12 - High	[AC][VENT][DX] Fan Speed: 1- High (R/W)	01 - Switching (1 bit)	9/1/15		R	W	T		1-Yes
17	0	13 - Lock	[AC][VENT][DX][AWHP] Remote Control: 0-Enabled, 1-Disabled (R/W)	01 - Switching (1 bit)	9/1/16		R	W	T		1-Yes
18	0	17 - ErrorCode	[AC][VENT][DX][AWHP] Error Code: 0-No error, X-Error (1 to 255) (R)	10 - Counter (16 bit si	9/1/17		R		T		1-Yes
19	0	18 - ErrorSign	[AC][VENT][DX][AWHP] Error Sign: 0-Normal, 1-Error (R)	01 - Switching (1 bit)	9/1/18		R		T		1-Yes
20	0	41 - Accumulated power	[AC][DX][AWHP] Accumulated Power Consumption: Wh value 0 to 9999990, only if PDI is present (R)	11 - Counter (32 bit si			R		T		0-No
21	0	21 - OnOff VENT	[VENT][DX] On/Off: 0-Off, 1-On (R/W)	01 - Switching (1 bit)	9/1/19		R	W	T		0-No
22	0	22 - Mode VENT	[VENT][DX] Mode: 0-Normal, 1-Heater_Exchange, 4-Auto (R/W)	14 - Counter (8 bit)	9/1/20		R	W	T		0-No
23	0	23 - Normal	[VENT][DX] Mode: 1- Normal (R/W)	01 - Switching (1 bit)	9/1/21		R	W	T		0-No
24	0	24 - Heater	[VENT][DX] Mode: 1- Heater (R/W)	01 - Switching (1 bit)	9/1/22		R	W	T		0-No
25	0	25 - Auto	[VENT][DX] Mode: 1- Auto (R/W)	01 - Switching (1 bit)	9/1/23		R	W	T		0-No
26	0	19 - FilterSign	[VENT] Filter Alarm: 0-Normal, 1-Sign (R)	01 - Switching (1 bit)	9/1/24		R		T		0-No

Figure 3.7 Signals list

1. *IU*. This table is related to the indoor unit's index. This IU index number (0..63) is associated with the Indoor Units address (0x00..0xFF) as set in the "Connection-Tab". This field is not editable.

2. *Cod.* This table is related to the Signal Code. Each field is associated with available signals of each LG Indoor Unit. An identification code is given to each Signal type.

3. *Signal*. This table is related to the description of each Signal. The default name matches with the signal's code and shows its possible values. This description can be modified if desired.

4. *EIS*. This table is related to KNX Data point type (DPT) to encode the Signal value. It's not editable.

5. *Group*. This table is related to the main KNX Group address of the Signal. Addresses can be expressed as "3-level" (P/I/S), "2-level"(P/S) or free 16 bits address structure (See 3.2.4). Flags "*W,R,T,U"* explained below, apply for this main KNX Group address. The KNX Group address entered in this table, must be unique for each object.

6. *Listening addresses*. Additional KNX addresses from which the Signal can be written to (only if *W* flag is enabled). This address can be repeated to more than one Signal object of the same DPT, e.g. for central control of several units at a time. More than one address can be entered in this field, separating them by commas.

7. *R*. This table is related to the property that allows the Signal to be 'read' from KNX System. The Installer can enable or disable by right clicking on the cell. This field is

freely configurable, but the default value is recommended and should fit most scenarios.

8. *W*. This table is related to the property that allows the Signal to be 'written' from KNX System. The Installer can enable or disable by right clicking on the cell. This one is freely configurable, but the default value is recommended and should fit most scenarios.

9. *T*. This table is related to the property 'Transmit' When set active, this Signal generates a "writing" telegram to the group address, whenever the objects value changes. The Installer can enable or disable by right clicking on the cell. This one is freely configurable, but the default value is recommended and should fit most scenarios.

10. *U*. This table is related to the property 'Update'. When set, a value update is requested (by means of a "read" telegram) during the KNX bus recovery. There's a difference between letters: The "U" request is on Group address and "U2" is on first listening address. Note that this only makes sense if the Signal has its "W" flag enabled. The installer can enable or disable by right clicking on the cell.

11. *Active*. This table is related to the status of the Signal object. The installer can enable or disable a particular Signal in the integration. Objects not related to the selected type of unit, shall be disabled by default.

The columns called as *R, W, T, U* and *Active* can be modified by double-clicking the desired cell, selecting one or more cells in the same column and using the contextual menu appearing with mouse right button click over the cells selected, or just entering the first letter of the word (R,W,T,U…).

The values set by default of columns R, W, T, U have been tested and are the recommended ones for the integration. Do not modify these values if you are not sure on how they will affect to the integration's properly functioning.

Those cells appearing in orange background color at their "Code" cell, represent indoor unit parameters that can be controlled or monitored using either/both EIS-Counter and/or EIS-Switching types. Right-click the corresponding "Code" cell in order to Show/Hide its associated switching-signals, to your convenience.
By default, all multibit signals are unfolded (showed), if you do not want to use them you can *Hide-All* to reduce the size of the signals list and to work more comfortably.

3.2.3 Remember

- If "T" is not set as active, any value changes provoked from the indoor unit are not transmitted to KNX. This happens only in case of Signal or Signals that have the property "T" deactivated.

- If "R" is not active, other KNX devices are not able to read the Signal object.

- If "W" is not active, other KNX devices are not able to write to the Signal object.

- If "U" is active, the IntesisBox® LG-AC-KNX sends "read" telegrams (messages) on bus recovery/startup, for each corresponding main Group address.

- If "U2" is active, the IntesisBox® LG-AC-KNX sends "read" telegrams (messages) on bus recovery or bus startup, for each corresponding first listening address.

3.2.4 Restrictions

- KNX Group addresses can be expressed as most commonly used "3-level" (P/I/S), or "2-level" (P/S) format, or even by rare free address structure within 16 bits (1..65535). (format range: '15/7/255' and '15/2047'; rules: '0/0/0' and '0/0' is not used.)
- Use one Group address format for the entire project only. Suggested: "3-level" (P/I/S).
- P/I/S These letters stands for:
  - P: Main Group
  - I: Middle Group
  - S: SubGroup
- Use a unique Group address per object. Two or more different signals cannot have the same Group address.
- No signal is allowed with none of "R-W-T-U" flags being active.
- Empty KNX Groups addresses are allowed, but only if they have "W" as active flag and one or more listening addresses.
- Listening addresses have not any effect if the flag "W" is not active (therefore, these ones only have effect if the flag "W" is active). More than one listening address can be applied by placing a comma (,) as a separator.

3.3 Saving and sending the configuration to the IntesisBox.

When the configuration is finished, follow the next steps:

1. Click ***Save*** button. This action saves the project in the folder on the hard disk (there's more information about this matter in the User's Manual from LinkBoxEIB).
2. At this point, the Installer is prompted to generate the *Configuration* file by choosing one of the two available options.
   a. If ***YES*** is selected, the binary file (LG.LBOX) containing the configuration for IntesisBox® KNX-LG-AC is generated and saved also into the project folder.
   b. If ***NO*** is selected, the binary file is not generated. Just remember that the binary file (it contains the full project) needs to be created previous to the normal startup of the gateway.
3. Once the Installer is in the ***Configuration*** window, he has to click on ***Exit*** button. Right now the *Configuration* file is ready to be sent to IntesisBox® LG-AC-KNX.
4. Press ***Send File*** button to send the binary file to IntesisBox® LG-AC-KNX. The transmission process can be monitored over the window from IntesisBox® Communication Console. IntesisBox® LG-AC-KNX reboots automatically once the new configuration is loaded.

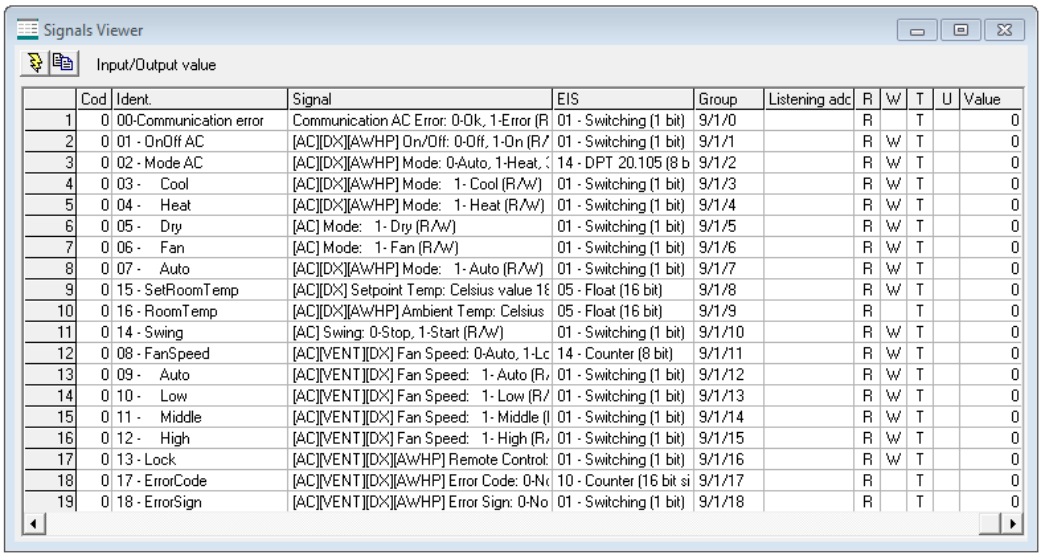
ATTENTION:
The configuration cannot be retrieved from IntesisBox® LG-AC-KNX to LinkBoxEIB Tool, it can only be downloaded "send" into the IntesisBox® LG-AC-KNX.

3.3.1 Monitoring

3.3.2 Signals Viewer's window

Once the gateway is running with the correct configuration, and if one wants to monitor the status of the configured Signals, press ***Signals*** button on the *menu* bar (see Figure 3.1), the Signals Viewer's window opens automatically (see Figure 3.8). This window shows all Signals that are active, their main configuration's parameters and the actual values.

If IntesisBox® LG-AC-KNX has been running for a long time, one should press the ***Refresh*** button (icon with a thunderbolt printed on it) (see Figure 3.8) to get new and updated values.



	Cod	Ident.	Signal	EIS	Group	Listening adc	R	W	T	U	Value
1	0	00-Communication error	Communication AC Error: 0-Ok, 1-Error (R	01 - Switching (1 bit)	9/1/0		R		T		0
2	0	01 - OnOff AC	[AC][DX][AWHP] On/Off: 0-Off, 1-On (R/	01 - Switching (1 bit)	9/1/1		R	W	T		0
3	0	02 - Mode AC	[AC][DX][AWHP] Mode: 0-Auto, 1-Heat,	14 - DPT 20.105 (8 b	9/1/2		R	W	T		0
4	0	03 - Cool	[AC][DX][AWHP] Mode: 1- Cool (R/W)	01 - Switching (1 bit)	9/1/3		R	W	T		0
5	0	04 - Heat	[AC][DX][AWHP] Mode: 1- Heat (R/W)	01 - Switching (1 bit)	9/1/4		R	W	T		0
6	0	05 - Dry	[AC] Mode: 1- Dry (R/W)	01 - Switching (1 bit)	9/1/5		R	W	T		0
7	0	06 - Fan	[AC] Mode: 1- Fan (R/W)	01 - Switching (1 bit)	9/1/6		R	W	T		0
8	0	07 - Auto	[AC][DX][AWHP] Mode: 1- Auto (R/W)	01 - Switching (1 bit)	9/1/7		R	W	T		0
9	0	15 - SetRoomTemp	[AC][DX] Setpoint Temp: Celsius value 18	05 - Float (16 bit)	9/1/8		R	W	T		0
10	0	16 - RoomTemp	[AC][DX][AWHP] Ambient Temp: Celsius	05 - Float (16 bit)	9/1/9		R		T		0
11	0	14 - Swing	[AC] Swing: 0-Stop, 1-Start (R/W)	01 - Switching (1 bit)	9/1/10		R	W	T		0
12	0	08 - FanSpeed	[AC][VENT][DX] Fan Speed: 0-Auto, 1-Lc	14 - Counter (8 bit)	9/1/11		R	W	T		0
13	0	09 - Auto	[AC][VENT][DX] Fan Speed: 1- Auto (R/	01 - Switching (1 bit)	9/1/12		R	W	T		0
14	0	10 - Low	[AC][VENT][DX] Fan Speed: 1- Low (R/	01 - Switching (1 bit)	9/1/13		R	W	T		0
15	0	11 - Middle	[AC][VENT][DX] Fan Speed: 1- Middle (I	01 - Switching (1 bit)	9/1/14		R	W	T		0
16	0	12 - High	[AC][VENT][DX] Fan Speed: 1- High (R/	01 - Switching (1 bit)	9/1/15		R	W	T		0
17	0	13 - Lock	[AC][VENT][DX][AWHP] Remote Control:	01 - Switching (1 bit)	9/1/16		R	W	T		0
18	0	17 - ErrorCode	[AC][VENT][DX][AWHP] Error Code: 0-N	10 - Counter (16 bit si	9/1/17		R		T		0
19	0	18 - ErrorSign	[AC][VENT][DX][AWHP] Error Sign: 0-No	01 - Switching (1 bit)	9/1/18		R		T		0

Figure 3.8 Signal Viewer's window

To force a specific value for a Signal, one could change this value by double clicking on the "*Value"* field. This action displays a pop-up window where the desired value can be entered (see Figure 3.9). After pressing the ***Accept*** button, the Signals Viewer's window is shown, and two things shall happen:

- If the Signal has its T flag active, a write telegram (message) with this value is sent to KNX System (using its Group address)
- If the Signal has its W flag active, the action is provoked on LG's AC System

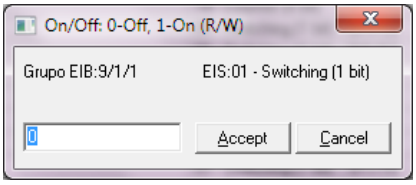


Figure 3.9 Value edition

The Signals Viewer's Copy to Clipboard function: The Signals Viewer's window has a button to copy all current contents to the Windows Clipboard for pasting is in other applications. (see the icon with two paper sheets printed on it) (see Figure 3.8).

3.3.3 Bus monitoring

To monitor the *external system* or the *internal system* the Linkbox software needs to be connected to IntesisBox® LG-AC-KNX (more info about this can be found in User's Manual of IntesisBoxEIB (*Doc* folder on PC)). To do so follow these steps:

- To monitor the communication between IntesisBox® LG-AC-KNX and KNX System (*internal system*), follow the steps: select menu *View* -> *Bus* -> *EIB*. A pop-up windows called **KNX -Internal Protocol Communication Viewer** appears. This pop-up window shows in real-time all the communication frames that run between IntesisBox® LG-AC-KNX and KNX System. This pop-up window shows also all debugging messages referred from the internal protocol (KNX) sent by IntesisBox® LG-AC.

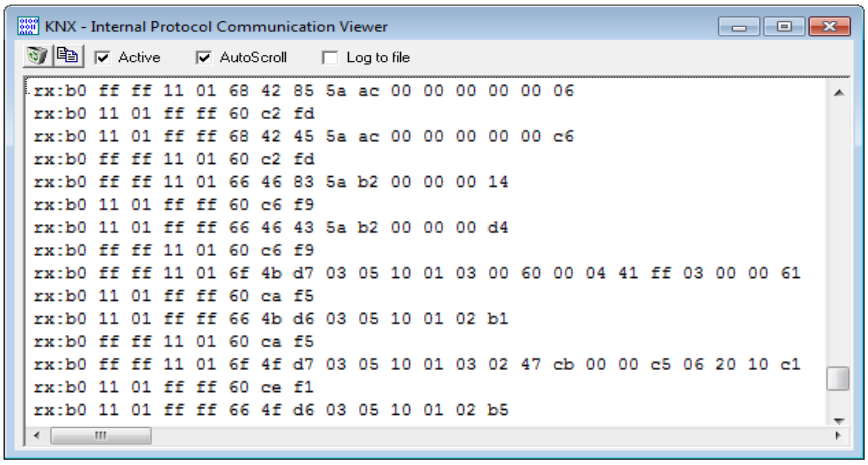


Figure 3.10 KNX -Internal Protocol Communication Viewer

- To monitor the communication between IntesisBox® KNX-LG-AC and LG's AC System (external system), follow the steps: select the menu *View* -> *Bus* -> *LGE*. A pop-up windows called **LGE – External Protocol Communication Viewer** appears.

- The *External protocol communication viewer* window will be opened. This pop-up window shows in real-time all the communication frames that run between IntesisBox® LG-AC-KNX and the LG's AC System. This pop-up window shows as well the debugging messages referred from the external protocol (LG) sent by the gateway.

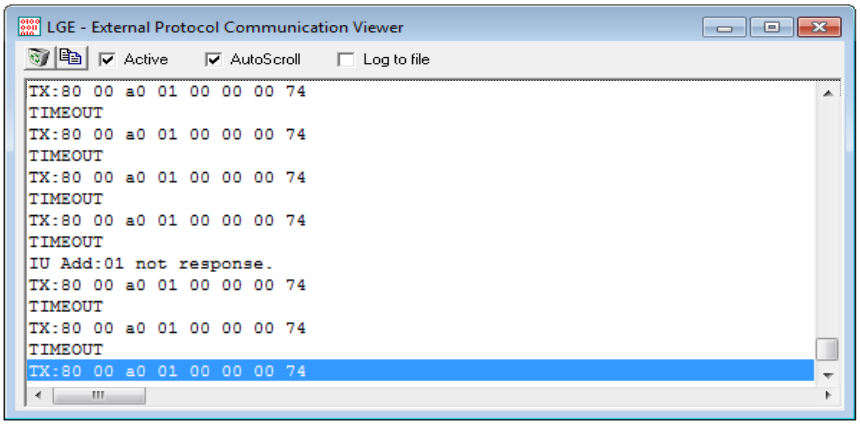


Figure 3.11 LGE – External Protocol Communication Viewer

3.4 Files

LinkBoxEIB saves the Configuration of the KNX integration in the following files (these ones are located inside the *Project* folder of LinkBoxEIB):

FILE NAME	DESCRIPTION
PROJECT.INI	The file called PROJECT.INI contains general information related to the project when the Installer configures IntesisBox® KNX-LG-AC.
LGE.INI	The file called LGE.INI contains information related to the values configured in "Connection" tab when the Installer configures IntesisBox® KNX-LG-AC.
LGE.LBOX	LGE.LBOX is a binary file created using the information from the files described previously. This is the file that the Installer can download from IntesisBox® KNX-LG-AC.

Table 3.1 Files generated in LinkBoxEIB during the KNX integration

It is strongly recommended to back up the "*Project*" folder containing these files in external media, once the installation process has been finished. In this way the Installer is able to do future changes in the configuration in case of reinstallation of LinkBoxEIB, for example, due to a failure of the hard disk in the Installer's PC where LinkBoxEIB has been installed.

ATTENTION:
The configuration cannot be retrieved from IntesisBox® KNX-LG-AC to LinkBoxEIB Tool, it can only be downloaded "send" into the IntesisBox® KNX-LG-AC.

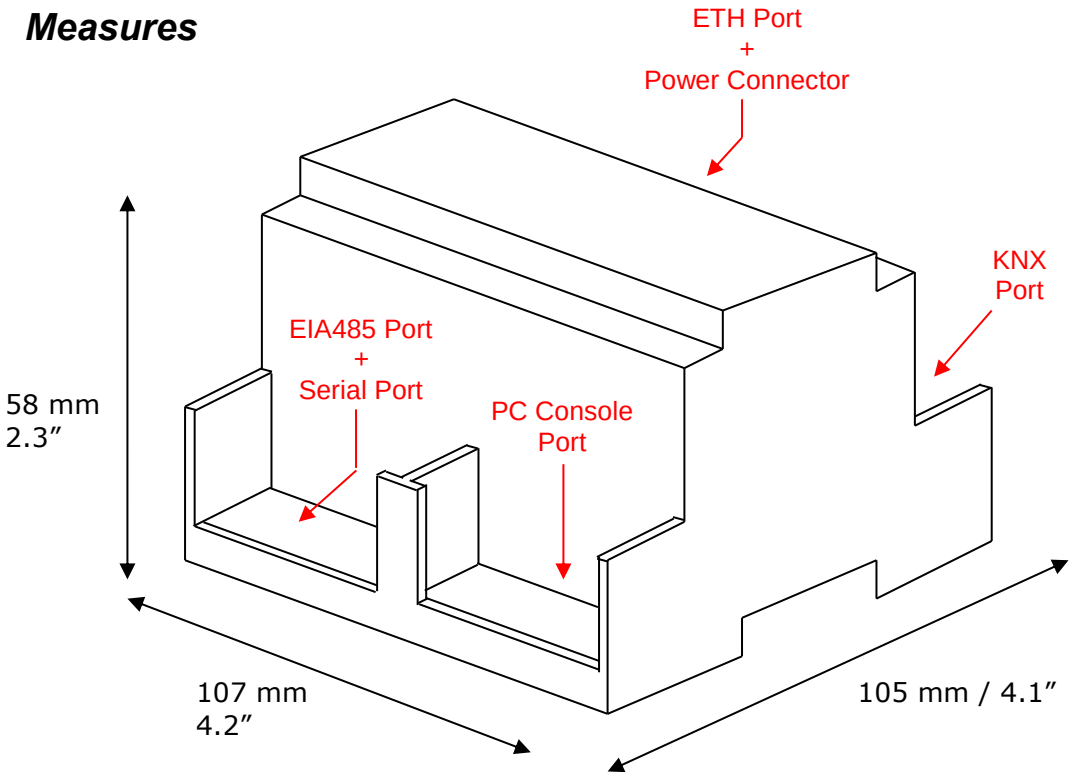
4. Electrical and Mechanical features

Enclosure	Plastic type PC (UL 94 V-0). Net dimensions (DxWxH): 107mm x 105mm x 58mm / 4.2'' x 4.1'' x 2.3'' Color: Light Grey. RAL 7035
Weight	180 g
Power	9 to 30VDC +/-10% 1.4 W 24 VAC +/-10% 1.4 VAC Power connector is a 2-pole Plug-in Screw terminal block. Precautions: NEC Class 2 or Limited Power Source (LPS) and SELV rated power supply.
Mounting	Wall DIN rail EN60715 TH35.
LED indicators	1 x Power. 2 x KNX Port Activity (Tx, Rx). 2 x EIA485 port (Tx, Rx). 1 x KNX programming/bus.[1]
Push buttons	1 x KNX programming.[1]
LG AC Port	1 x EIA485. Plug-in screw terminal block (2 poles). SELV
KNX (EIB) Port	1 x KNX TP1 (EIB) opto-isolated (Plug-in screw terminal block 2 poles) SELV
Console Port	EIA232 standard. DB9 female connector (DCE). SELV
Ethernet Port	10 Base-T. RJ-45 connector
Firmware Configuration	Via Console Port(DB9)[2] or ETH Port (Ethernet Port)(RJ-45) Allows upgrades via PC Console Port.
Operation temperature	0°C to +70°C
Operation Humidity	5% to 95%, non-condensing
Protection	IP20 (IEC60529)
RoHS conformity	Compliant with RoHS Directive (2011/65/CE).
Certifications	CE

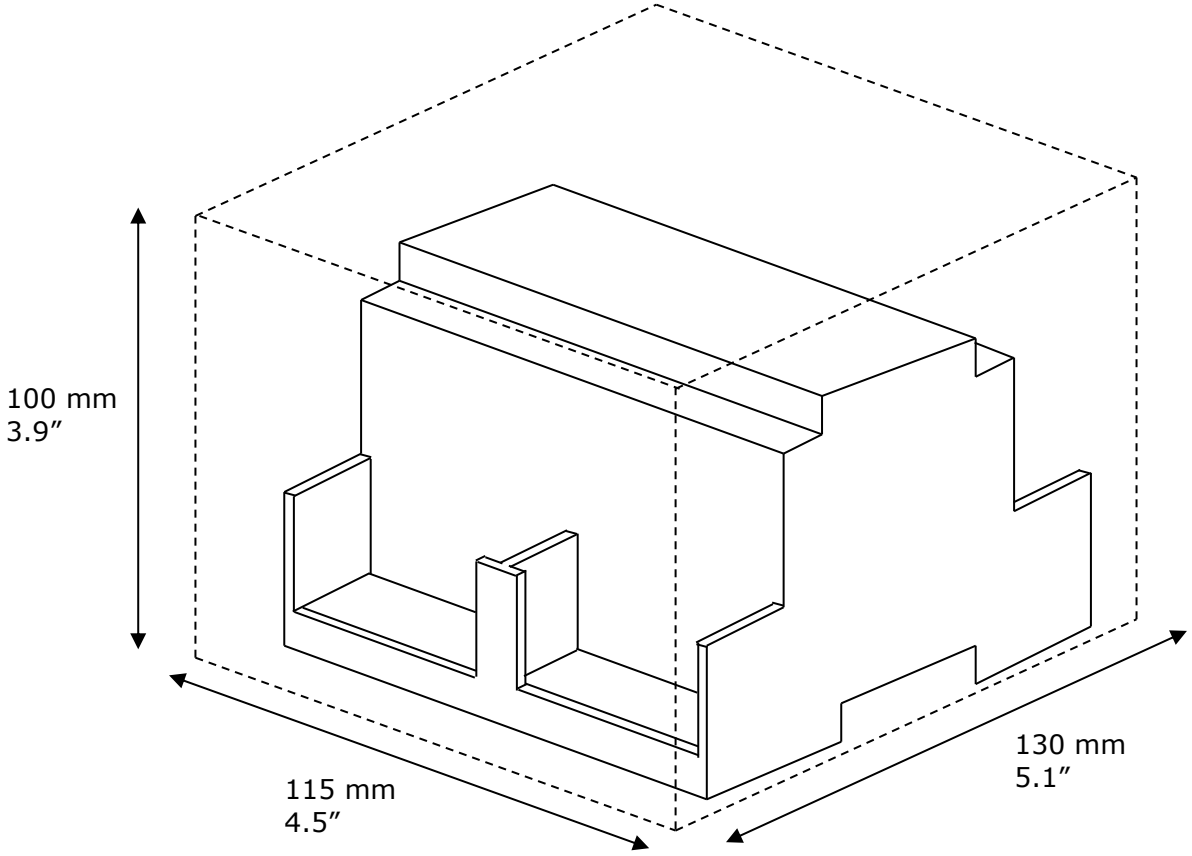
Table 4.1 Electrical and Mechanical features

[1] Not operational for the moment. Reserved for future use.
[2] Along with IntesisBox® KNX-LG-AC it is also supplied with a standard DB9 male - DB9 female cable to configure and monitor IntesisBox® KNX-LG-AC using a PC via PC Serial Port or USB Port.

5. Measures



Recommended available space for its installation (to keep proper space among all connectors when these ones are installed):



6. AC indoor units compatibility

A list of LG unit model references compatible with IntesisBox® KNX-LG-AC and their available features can be found in:

https://www.intesisbox.com/intesis/support/compatibilities/IntesisBox_LG-AC-xxx-MIU_AC_Compatibility.pdf

7. Error codes for Indoor Units

Look into Error Code List or Troubleshooting List of the User's Manual of each LG AC Machine.

8. Annex

The explanations given in the following sections are informative. Any action described should be performed by a LG authorized Installer.

8.1 PCB PMNFP14A0/1 and PCB PHNFP14A0

In this Section the Installer can find a brief description and configuration of the PCB's delivered by LG.

8.1.1 PCB PI485 - PMNFP14A0/1

Reference: PMNFP14Ax. This PCB should be used with Multi V Plus, Multi Standard and MPS Inverter Product.

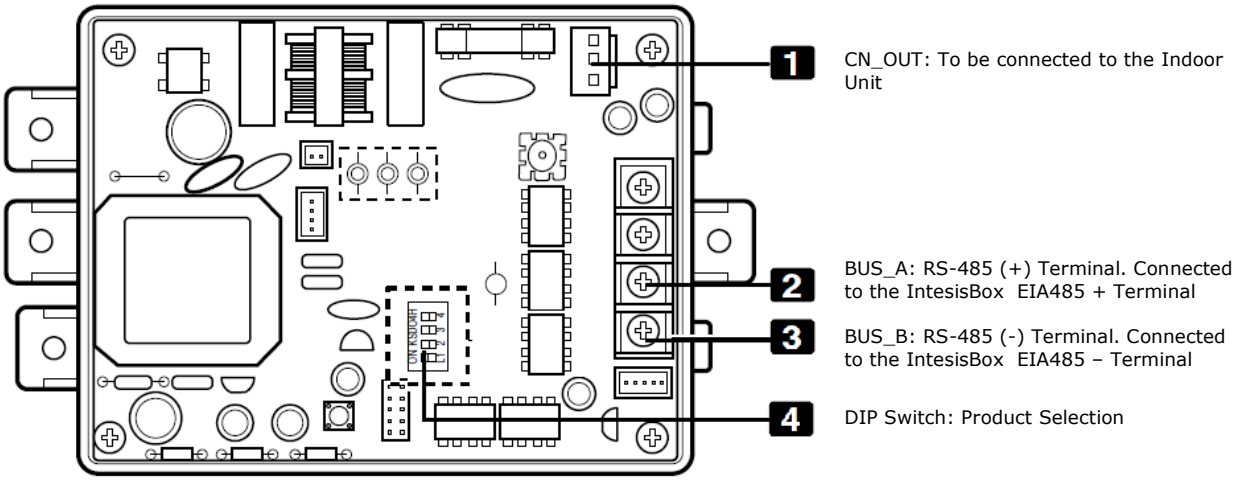


Figure 8.1 PCB PMNFP14A0

To allow LG's AC System to work with IntesisBox® LG-AC-KNX, DIP switches 1 to 4 (See Figure 8.1) needs to be configured in the way that is shown in Figure 8.2.

Multi V & Multi (LGAP applied) products Configuration Methods.

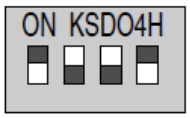
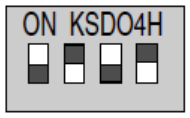
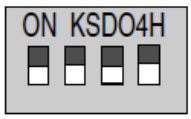
	**1 and 4 ON, All others OFF**: Multi V (Excluding CRUN, LRA), Multi Inverter, MPS with applied Common PCB, MPS Inverter + Central Control (IntesisBox® LG-AC-KNX) - Using LGAP
	**2 and 4 ON, All others OFF**: Multi Non-Inverter product, MPS without applied Common PCB + Central Control (IntesisBox® LG-AC-KNX) – Using LGAP.
	**1,2,3,4 ON, All others OFF**: Multi V CRUN, LRA product + Central Control (IntesisBox® LG-AC-KNX) – Using LGAP.

Figure 8.2 DIP Switch configuration

8.1.2 PCB PI485 - PMNFP14A0/1 model composed of 8 dip switches.

Reference: PMNFP14Ax. This PCB should be used with Multi V Plus, Multi Standard and MPS Inverter Products.

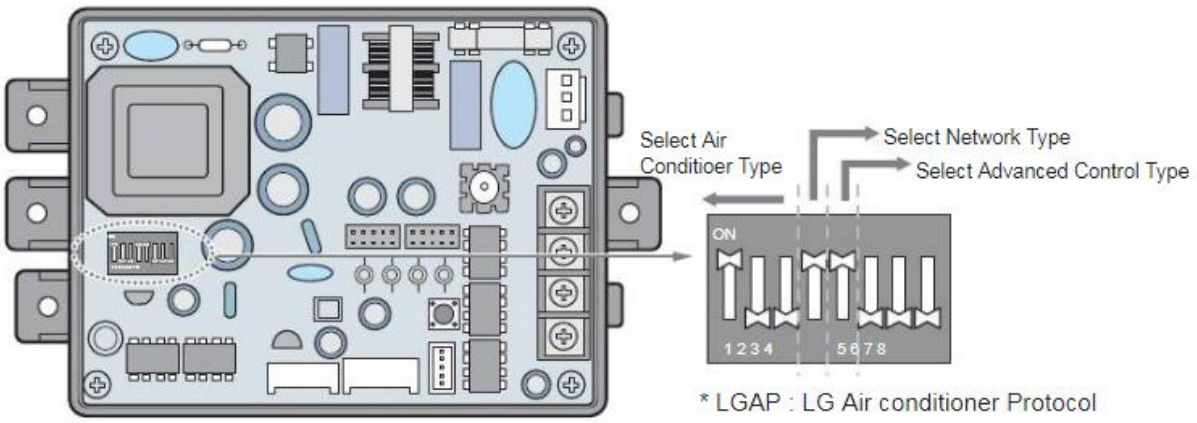


Figure 8.3 PCB PMNFP14Ax

To allow LG's AC System to work with IntesisBox® LG-AC-KNX, DIP switches 1 to 4 (See Figure 8.3) needs to be configured in the way that is shown in Figure 8.4.

Multi V & Multi(LGAP applied) products Configuration Methods.

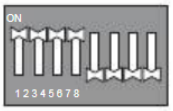
	**1 and 4 ON, All others OFF**: Multi V (Excluding CRUN, LRA), Multi Inverter, MPS with applied Common PCB, MPS Inverter + Central Control (IntesisBox® LG-AC-KNX) - Using LGAP.
	**2 and 4 ON, All others OFF**: Multi Non-Inverter product, MPS without applied Common PCB + Central Control (IntesisBox® LG-AC-KNX) – Using LGAP.
	**1,2,3,4 ON, All others OFF**: Multi V CRUN, LRA product + Central Control (IntesisBox® LG-AC-KNX) – Using LGAP.

Figure 8.4 DIP Switch configuration

8.1.2.1 Advanced Lock Control Type.

To use the advanced lock function (Run Mode lock, Fan Speed Lock, Temperature Lock, and Temperature Range Lock) from any other slave Central Controller, Set up the *fifth dip switch* according to the type of outdoor product. If all units support advanced lock function, it is recommended that the fifth dip switch be off.

Note that our gateway does not control any advanced lock functionality.

For more information consult the Installation Manual of the LG's PI485 module.

8.1.3 PCB PHNFP14A0 / PSNFP14A0

In this Section the Installer can find a brief description and configuration of the PCB PHNFP14A0. This board should be used with ECO-V products.

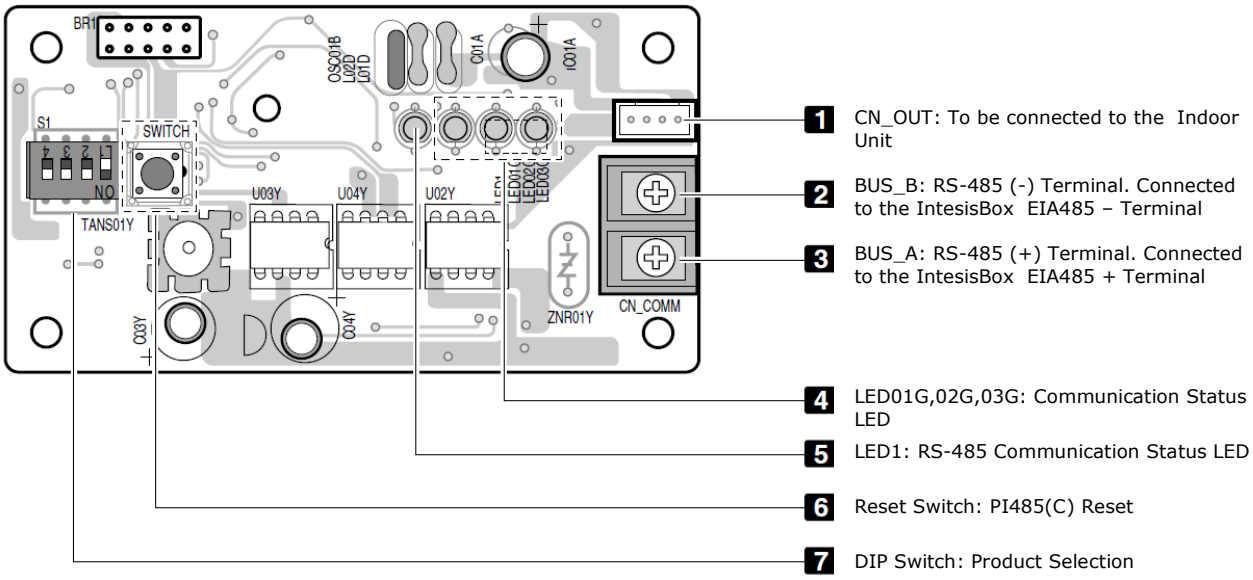


Figure 8.5 PCB PHNFP14A0

To allow LG's AC System to work with IntesisBox® LG-AC-KNX, DIP Switches 1 to 4 (See Figure 8.5) needs to be configured in the way that is shown in Figure 8.6.

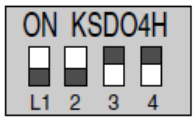
	**3 and 4 ON, All others OFF**: ECO-V Products.

Figure 8.5Figure 8.6 **DIP Switch configuration**

For more information consult the Installation Manual of the LG's PCB module.

CAUTION:
The wrong setting of air-conditioner switch could cause malfunctioning.
Switch setting must be done carefully.
Push the Reset button after changing the Dip switches.

8.1.4 Address configuration of LG's AC indoor unit

Besides the address set to each outdoor unit or PI485 in the system (Up to 16 OU; ranged 0x00-0x0F; 0-15), each indoor unit also needs to have a physical address set. This address is used by IntesisBox® LG-AC-KNX Central Controller to establish communication with the indoor units. This is the IU address to be set in the Configuration's, *Connection*-tab "Add"-field, of the LinkBoxEIB commissioning tool (See Figure 3.2).

Setting the indoor unit addresses should be performed by LG qualified Installers. The AC Installer must provide before the configuration of the gateway, the total list of addresses to use in the AC System (called as well "Main" addresses) (address range 0x00-0xFF = 00-255). Once this process is done, the Integrator can perform the configuration of IntesisBox® LG-AC-KNX.

To set the indoor unit addresses there are two rotary switches (See Figure 8.7) (Rotary low switch and Rotary High switch) that allow the Installer to set the desired address inside the range.

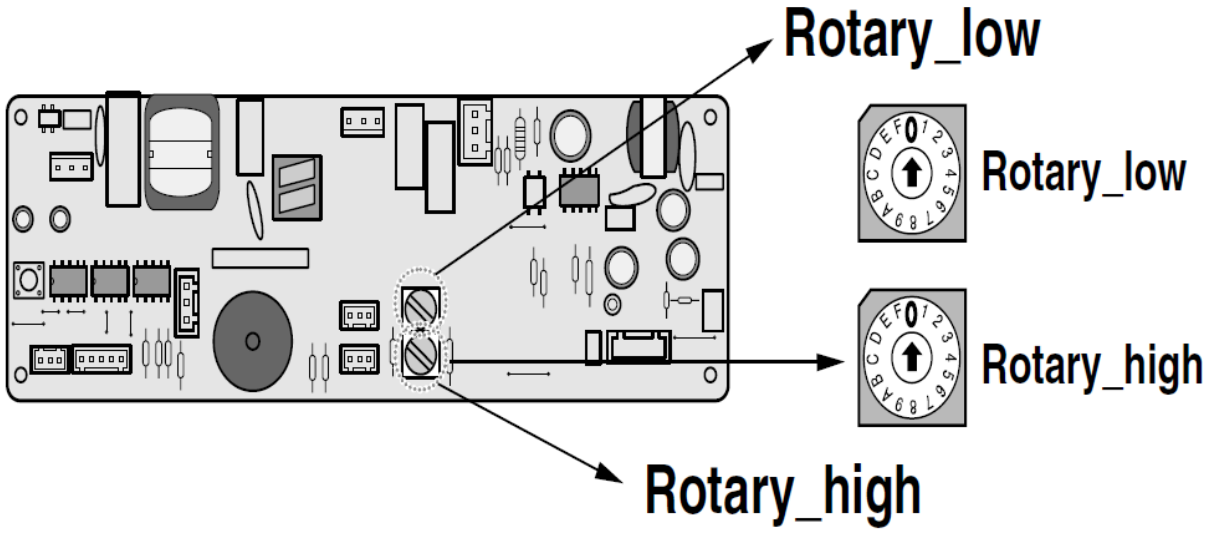


Figure 8.7 DIP Switch configuration

Depending of the type of Indoor Unit (IU) or the manufacture date of it, the IU Main address must be set either on the indoor unit's PCB (rotary micro-switches present on IU PCB) or for newer generations, from a connected Wired remote controller (no rotary switches present at IU PCB). On the remotes, the address for central control consists by a group address and main address of the indoor unit.

For more information about this matter, and how to set the address from a wired remote controller, please consult the Owners & Installation Manual of the LG's AC remote or contact your local LG distributor for details. (Procedures differ for each type of remote controller).