IntesisBox® KNX

Arçelik Air Conditioning

Order Codes: **AK-AC-KNX-4**
AK-AC-KNX-8
AK-AC-KNX-16
AK-AC-KNX-64

Intesis
software

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Gateway for integration of Arçelik air conditioning systems into KNX TP-1 (EIB) control systems.

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

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

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

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

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

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1. Description

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

There are four models available: AK-AC-KNX-4, with capacity of up to 4 indoor units, AK-AC-KNX-8, with capacity of up to 8 indoor units, AK-AC-KNX-16, with capacity of up to 16 indoor units and AK-AC-KNX-64, with capacity of up to 64 indoor units. The compatible Arçelik units are listed in section 7.
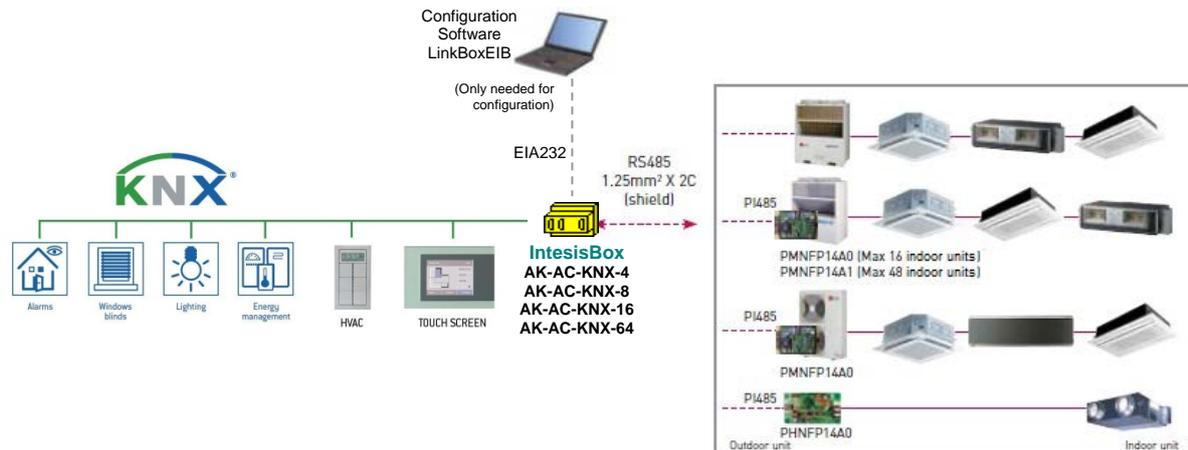
Figure 1.1 System integration using the *IntesisBox® KNX – Arçelik AC*

Main features:

- Direct connection to KNX TP-1 (EIB) bus.

- Direct connection to AK EIA485 bus.

- Bidirectional: Supervision and control.

- Independent communication management.

- Simple configuration using the software LinkBoxEIB supplied with the purchase of IntesisBox with no additional cost.

- Standard box for DIN module

- Power supply: selectable from 9 to 30 Vdc or 24 Vac

1.1 Functionality

IntesisBox KNX continuously *polls* (reads) the AK PI485 bus for all configured signals and keeps the updated status of all of them in its memory ready to be served when requested from KNX.

When a change of status is detected in a Arçelik's AC signal, a write telegram is sent to the KNX bus, of the associated *KNX Group.*

When it is received a telegram from the KNX bus, and if its *KNX Group address* is associated to an Arçelik's AC signal, a message is sent immediately to the Arçelik bus to perform the corresponding action in the Arçelik's AC system.

In the continuous polling if no response is detected, the corresponding virtual signal inside the gateway will be activated indicating communication error. There is a virtual signal for each AC indoor unit indicating communication error with the indoor unit – this signal will be normally activated if the indoor unit is not properly setup.

The IntesisBox KNX-Arçelik cannot work in a multimaster system. That means that when connected in the system no Central control or other gateways can be used. If this indication is not followed neither the IntesisBox nor the other master would work.

1.2 Capacity of IntesisBox KNX - Arçelik

Element	Capacity*	Notes
Number of indoor units	64	Maximum number 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 per object.	255	Maximum number of listening addresses that can be associated to an object.

Table 1.1 Capacity of IntesisBox KNX-Arçelik

* There are four different models of *IntesisBox KNX – Arçelik AC* with different capacities. The table above shows the capacity for the top model (with maximum capacity).

Their order codes are:

- Model supporting up to 4 indoor units. *Ref.: AK-AC-KNX-4*
- Model supporting up to 8 indoor units. *Ref.: AK-AC-KNX-8*
- Model supporting up to 16 indoor units. *Ref.: AK-AC-KNX-16*
- Model supporting up to 64 indoor units. *Ref.: AK-AC-KNX-64*

1.3 KNX system

In this section, a common description for all IntesisBox KNX series gateways is given, from the point of view of KNX system which is called from now on *internal system*.

1.3.1 Description

IntesisBox KNX connects directly to the KNX TP-1 bus and behaves as one more device of the KNX system, with the same configuration and functional characteristics as other KNX devices.

Internally, the electronic circuit part connected to the KNX TP-1 bus is opto-isolated from the rest of the electronics. IntesisBox KNX receives, manages and sends all the telegrams related to its configuration to the KNX bus.

On receiving telegrams of KNX Groups associated to the external system (Arçelik AC System in this case), the corresponding messages are sent to the external system to maintain both systems synchronized in every moment.

When a change in a signal of the external system is detected, a telegram is sent to the KNX bus (of the associated KNX group) to maintain both systems synchronized in every moment.

In case of KNX bus voltage failure, on bus recovery IntesisBox will retransmit the status of all the KNX groups marked as *"T" Transmit*. Also the *Updates* of the groups marked as *"U" Update* will be performed – this last behavior can be deactivated.

1.3.2 Points definition

Each signal of the external system (Arçelik AC system) to use has the following KNX properties:

Property	Description
Signal	Signal's Description. Only for informative purposes, allows identifying the signal conveniently.
EIS (DataPoint)	It's the KNX data type used to code the signal's value. It will depend on the type of signal associated in the external system in every case. In some integration it is selectable, in others it is fixed due to the intrinsic characteristics of the signal.
Group	It's the KNX group to which the signal is associated. It is also the group to which the read (R), write (W), transmit (T) and update (U) actions are applied. Is the sending group.
Listening addresses	They are additional addresses that can write the signal, additionally to the Group address.
R	Read. When active, read telegrams on signal's group will be allowed.
W	Write. When active, write telegrams on signal's group and listening addresses will be allowed.
T	Transmit. When active, a write telegram of the group will be sent to the KNX bus upon change of the signal. The write will be triggered using the address in field "Group".
U	Update. When active, on IntesisBox start-up or after a KNX bus voltage recovery, read telegrams using the address in field "group" will be sent to KNX bus. The received value for each read request will be sent to the external system as if it had been received by a write telegram.
Active	Enables or disables the signal in IntesisBox's configuration.

These properties are common for all IntesisBox KNX series gateways. Each integration may have specific properties according to the type of signals of the external system in every case.

1.4 Arçelik to KNX integration

The following list shows the available signals to integrate for each Arçelik AC or VENT indoor unit, and the type of KNX object on which their information is available.

Property	EIS type	Signal type (R/W)	Description / Status	
On / Off	1 – Switching (1bit)	R/W	**Start/Stop AC/VENT Unit** 0 – OFF, 1 – ON	
Mode	14 – Counter (8bit)	R/W	**AC Mode** 0 – COOL, 1 – HEAT, 2 – DRY, 3 – FAN, 4 – AUTO *Mode (VENT unit)* *0 – NORMAL, 1 – HEAT EXCHANGE, 2 – AUTO*	
Mode::Cool	1 – Switching (1bit)	R/W	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	0 – Inactive, 1 – Active	
Mode::Dry	1 – Switching (1bit)	R/W	0 – Inactive, 1 – Active	
Mode::Fan	1 – Switching (1bit)	R/W	0 – Inactive, 1 – Active	
Mode::Auto	1 – Switching (1bit)	R/W	0 – Inactive, 1 – Active	
Setpoint Temperature	EIS 5 – Float (2byte)	R/W	**Temperature Set Point** (only integer numbers allowed) 16..30 °C **(This parameter is not applicable for VENT units)**	
Ambient Temperature	EIS 5 – Float (2byte)	R	**Ambient Temperature (only integer numbers)** Read: 10°C to 40°C **(This parameter is not applicable for VENT units)**	
Swing	14 – Counter (8bit)	R/W	**AC Swing** 0 – Stop, 1 – Start **(This parameter is not applicable for VENT units)**	
Fan Speed	14 – Counter (8bit)	R/W	**AC Fan Speed** 0 – AUTO, 1 – LOW, 2 – MID, 3 – HIGH	
FanSpeed::Auto	1 – Switching (1bit)	R/W	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 FanSpeed change)
FanSpeed::Low	1 – Switching (1bit)	R/W	0 – Inactive, 1 – Active	
FanSpeed::Mid	1 – Switching (1bit)	R/W	0 – Inactive, 1 – Active	
FanSpeed::High	1 – Switching (1bit)	R/W	0 – Inactive, 1 – Active	
Remote Restriction	1 – Switching (1bit)	R/W	**Remote Control Enablement / Disablement** 0 – Remote control enabled, 1 – Remote control disabled	
Error Sign	1 – Switching (1bit)	R/W	**Error Code / Communication error with the Indoor Unit** 0 – No error present, 1 – Error code present, or communication error with the indoor unit	
Error Code	10 – Counter (16bit)	R/W	**Error Code** More info in section 8	
Filter Alarm	1 – Switching (1bit)	R/W	**Filter Alarm Status** 0 – No alarm, 1 – Filter alarm present **(This parameter is not applicable for AC units)**	
Filter Alarm Reset	1 – Switching (1bit)	W	**Filter Alarm Reset** Write: 1 – Filter alarm reset **(This parameter is not applicable for AC units)**	

2. Connection

The device uses a standard enclosure allowing DIN EN60715 TH35 rail mounting. Its plastic meets standard PC UL 94 V0.
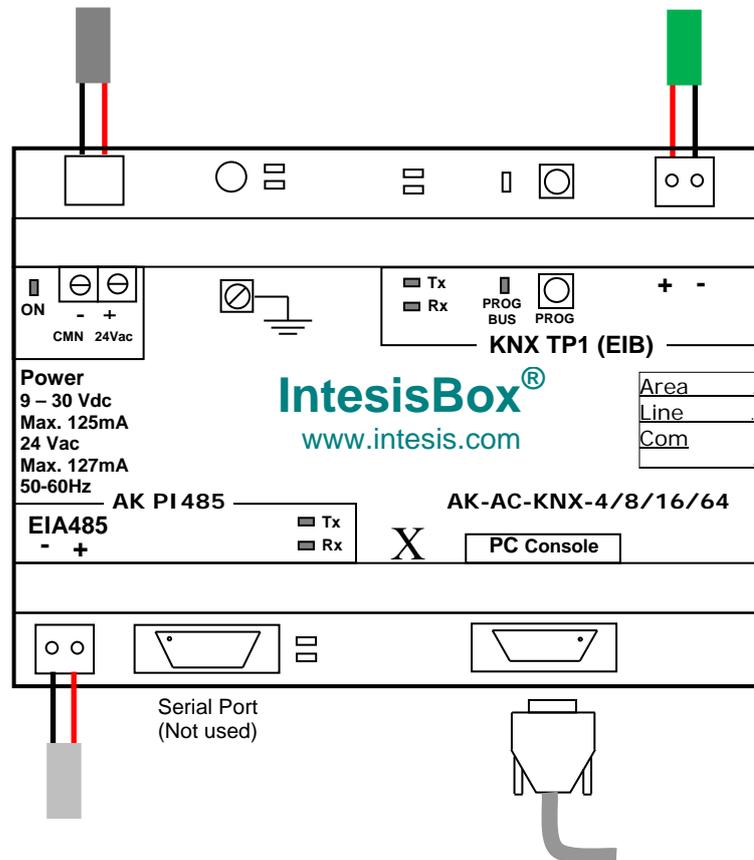
Figure 2.1 Device connection diagram

Ensure proper space for all connectors when mounted.

The items supplied by Intesis Software for this integration are:

- IntesisBox KNX - Arçelik hardware
- Console cable. Standard DB9F-DB9M cable 1.8 meter long.
- Installation sheet, containing a link to the *LinkBoxEIB* software and this manual.

2.1 Power device

The first step to perform is to power up the device. To do so a power supply working with any of the voltage range allowed is needed (check Table 5.1). Once connected the ON led (Figure 2.1) will turn on.

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

- The use of DC power supplies, floating or with the negative terminal connected to earth. **Never use a DC power supply with the positive terminal connected to earth**.

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- The use of AC power supplies only if they are floating and not powering any other device.

2.2 Connect to KNX

Connect + and – terminals of the KNX bus to the IntesisBox KNX connector (see Figure 2.1). The polarity is important. Once connected correctly the KNX Tx led (Figure 2.1) will start blinking. If that doesn't happen check that the cable is connected properly.

How to check if there is communication with the KNX bus is explained in section 3.

2.3 Connect to AK PI485

The EIA485 port (Figure 2.1) needs to be connected to the AK PI485 AC system. This integration requires, in some cases, the use of an additional PCB so the Arçelik AC system can connect to that bus. These additional interfaces can be connected to the outdoor units of the Arçelik AC system (PMNFP14A0 or PMNFP14A1) or directly to the indoor unit (PHNFP14A0). Further details about the needed PCB can be seen in Figure 1.1 and section 9.1.

The PMNFP14A0, PMNFP14A1 and PHNFP14A0 are supplied by Arçelik. Contact your nearest Arçelik AC Systems distributor for details.

How to check if there is communication with the AK PI485 bus is explained in section 3.

2.4 Connect to PC

To connect the device to the PC the serial cable supplied should be plugged to the PC console port (Figure 2.1). This action allows the user to have access to configuration and monitoring of the device (more information can be found in section 3).

3. **LinkBoxEIB.** Configuration & monitoring tool for IntesisBox® KNX series.

3.1 Introduction

LinkBoxEIB is a Windows® compatible software developed specifically to monitor and configure IntesisBox® KNX series.

The installation procedure and main functions are explained in the *LinkBoxEIB User Manual*. This document can be found in the Doc folder, or can be downloaded from the link indicated in the installation sheet supplied with the IntesisBox® device.

In this section, only the specific case of Arçelik indoor unit's integration to KNX networks will be covered.

3.2 Connections configuration

To configure the IntesisBox® connection parameters and to see the points list, press on the **Config** button in the *menu bar* (see Figure 3.1). The Arçelik *Configuration* window will open (see Figure 3.2). For integrations with large number of points, there is available an alternative CSV installation procedure explained in the LinkBoxEIB User Manual.

Figure 3.1 LinkBoxEIB *menu bar*

3.2.1   Configuration tab

Select the **Connection** tab to configure the connection parameters. Three subsets of information are shown in this window: EIB (KNX interface), IntesisBoxIP (IP interface for configuration) and Arçelik interface parameters (see Figure 3.2).
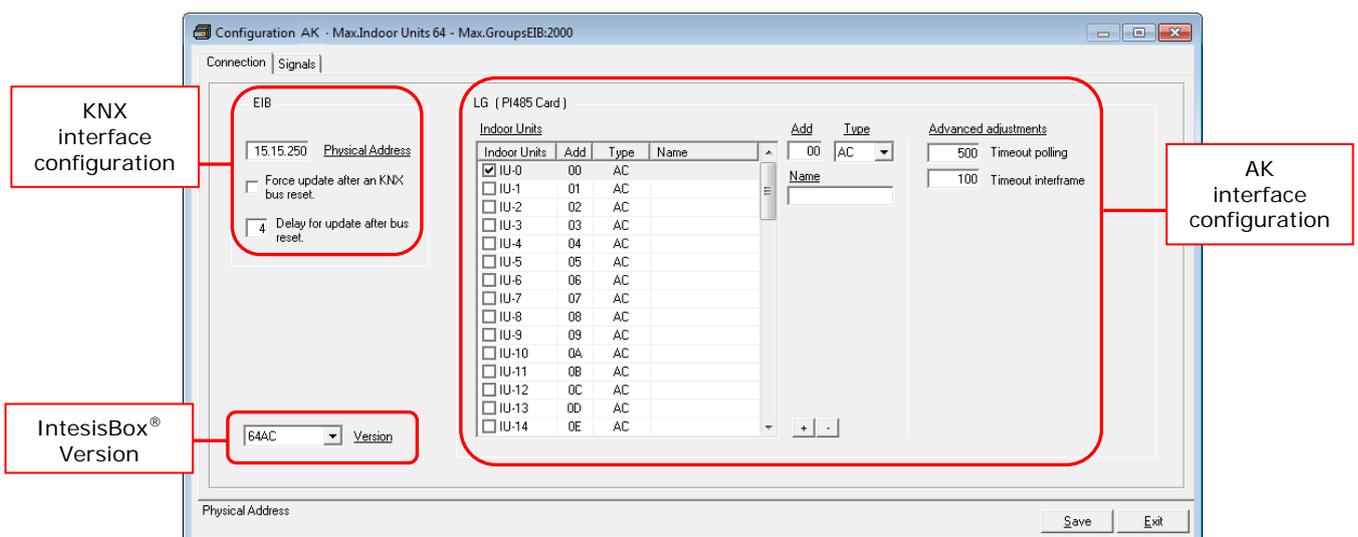
Figure 3.2 LinkBoxEIB configuration tab

Next, there is an explanation for each of the configuration parameters in each mode.
- KNX interface configuration parameters:

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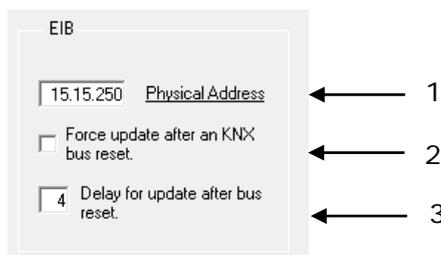
Figure 3.3 KNX interface configuration

1. **Physical Address:** Enter the KNX physical address for the gateway.

2. **Force update after a KNX bus reset:** Affects to the KNX groups with the Update feature activated (U).

3. **Delay for update after bus reset:** Enter the desired delay after a bus reset. It is expressed in seconds.

- IntesisBox version

Figure 3.4 KNX interface configuration

1. **Version:** Select which version of the IntesisBox KNX – Arçelik gateway you are to set up (4AC for AK-AC-KNX-4, 8AC for AK-AC-KNX-8, 16AC for AK-AC-KNX-16 and 64AC for AK-AC-KNX-64).

- AK AC PI485 interface configuration parameters:
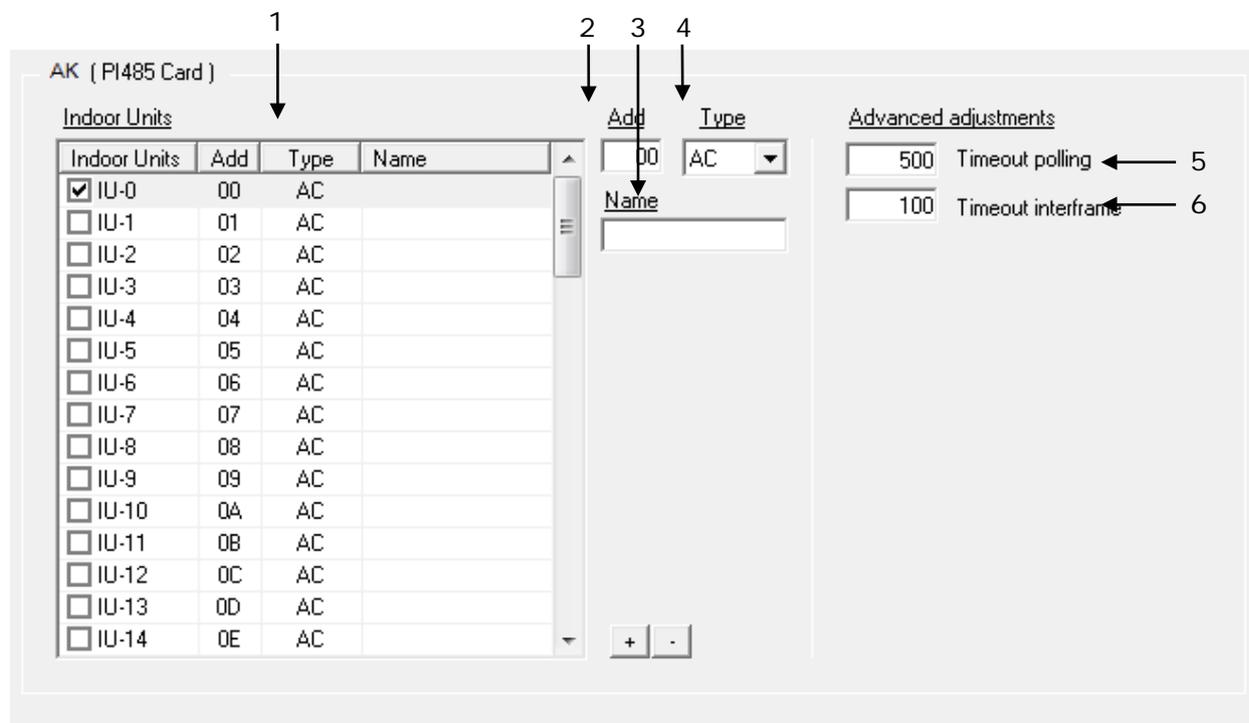
Figure 3.5 AK AC Configuration

1. **Indoor Units:** In this list, you can individually enable each of the 64 indoor units available on the system. The index in the column "Indoor units" (i.e. the number x in "IU-xx") is the reference that will be used later on (in tab "Signals") to refer to this AC indoor unit. Values for columns "Add", "Type" and "Name" in each indoor unit (IU) can be changed by selecting the IU in the list, by means of textboxes 2, 3 and 4.

2. **AC:** Address of the selected IU in the AK system. Its value has range 0..FF (Hex). More information about how to set this address in section 9.2

3. **Name:** Enter here the desired descriptive Indoor Unit name (optional).

4. **Type:** Each kind of IU (VENT or AC) has different characteristics. If the wrong one is selected the system might not work properly.

5. **Timeout polling:** Waiting time for the response after the polling is performed (from 300 to 30000 ms).

6. **Timeout interframe:** Minimum time between an RX and a TX frame (channel idle time). Can be set between 100 to 2000ms.

Additional configuration parameters should generally be left to their default value. They only might need to be tuned in some very specific cases (installations with large number of units, scenarios with large bursts of commands sent at once ...).

3.2.2 Signals configuration

Select the Signals tab to configure the signals list (the communication objects).
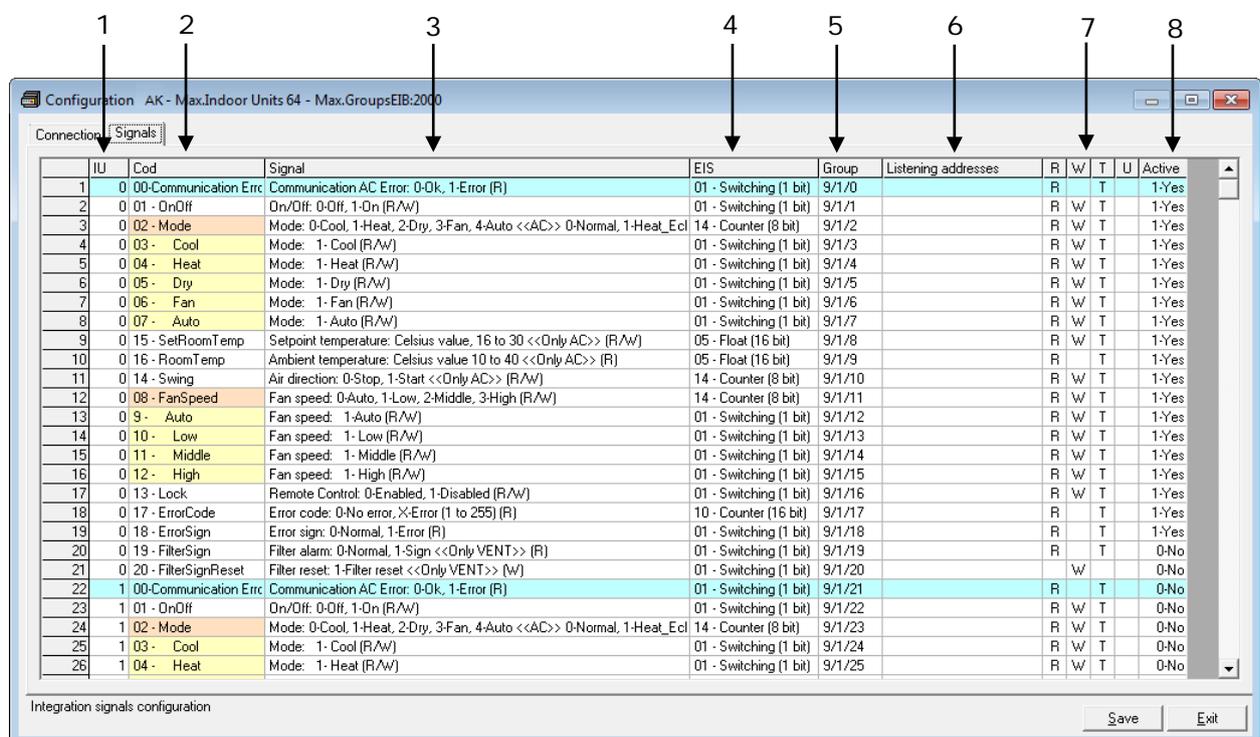
Figure 3.6 Signals list

1. **IU:** Indoor Unit identifier. This number is associated in the table "Indoor Units" of tab connections, with a certain Main Address (0..FF). Not editable.

2. **Signal Code.** Identifies available signals in each Arçelik Indoor Unit. An identification code is given to every different signal. In section 1.4, an explanation of each signal is given.

3. **Signal.** Signal's descriptive name (optional). Useful to identify the signal. The default descriptive name corresponds to the signal's code and shows its possible values, but can be modified.

4. **EIS.** KNX data type (Data point) to encode the signal's value. It will depend on the AK type of signal associated to it in every case. Edit using the mouse right-button-click pop-up menu available on the column. Only the EIS defined in values are allowed. Not editable.

5. **Group.** Main KNX group address for the signal. Addresses can be expressed as "2-level" (P/I/S) or "3-level"(P/S). Features *W,R,T,U* explained below will only apply for this main KNX group address, not for listening addresses (if defined).

6. **Listening addresses.** KNX group addresses that will be listened by IntesisBox® for this signal. If IntesisBox® receives a KNX telegram whose destination is one of these listening addresses, the telegram will be taken into account and the corresponding action will be performed on this signal (if W is active). Formats supported are P/I/S and P/S, comma separated.

7. **Communication object flags:**
    7.1 **R:** Indicates if this signal is allowed to be read from KNX system ("R" flag activated, "blank" flag not activated).
    7.2 **W:** Indicates if this signal is allowed to be written from KNX system ("W" flag activated, "blank" flag not activated).
    7.3 **T:** Indicates if this signal will generate a telegram sending to the KNX system following a change of the signal's value, that is to say, any change of value of this signal in AK side will be transmitted to the KNX system if this flag is activated ("T" flag activated, "blank" flag not activated).
    7.4 **U:** Indicates if this signal will be updated (sending read requests) whenever IntesisBox® starts up or after a KNX bus reset ("U" flag activated for the main group address, "U2" activated for the listening group address, "blank" flag not activated).[1]

8. **Active:** Indicates if the signal is active or not for the current configuration ("1-Yes" signal active, "0-No" signal not active).

3.3 Sending the configuration to IntesisBox®

When the configuration is finished, follow the next steps.

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[1] DO NOT BE CONFUSED: Philosophy of IntesisBox® point's U flag is not the same as KNX device's U flag. In KNX devices, U flag means that the point's value will be updated whenever a write telegram for the group address is received by the device.

1.- Click on **Save** button to save the project to the project folder on your hard disk (more information in LinkBoxEIB User Manual).

2.- You will be prompted to generate the configuration file to be sent to the gateway.
        a.- If **Yes** is selected, the binary file (AK.Lbox) containing the configuration for the gateway will be generated and saved also into the project folder.
        b.- If **NO** is selected, remember that the binary file with the project needs to be generated before the IntesisBox® starts to work as expected.

3.- Once in the configuration window again, click on **exit**. Configuration file is ready to be sent to the IntesisBox® device.

4.- Press the **Send File** button to send the binary file to the IntesisBox® device. The process of file transmission can be monitored in the IntesisBox® Communication Console window. IntesisBox® will reboot automatically once the new configuration is loaded.

After any configuration change, do not forget to send the configuration file to the IntesisBox® using button Send File.

3.4 Signals viewer

Once the gateway is running with the correct configuration, to supervise the status of the configured signals, press the **Signals** button on the *menu* bar (see Figure 3.1). The Signals Viewer window will open (see Figure 3.7).

This window shows all signals active within the gateway with its main configuration parameters and its real time value[1] in the **Value** column.

Figure 3.7 LinkBoxEIB Signals Viewer

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[1] In case you connect to the IntesisBox® when it's been running for a certain time, you should press the *Refresh* button to get updated values. After pressing *Refresh*, all signal values will keep continuously updated until the connection is closed.

The signals viewer can be used even though only one system is connected to the IntesisBox®, KNX or Arçelik AC. Therefore, it becomes convenient for supervision and testing the system.

In order to force a specific value to a signal, double-click its row in the table. This will display a dialog in which the desired value can be entered (see Figure 3.8). Changing its value in this way, will make:

- The content of the corresponding KNX group address will be changed to this value.
- If the signal is write-enabled, it will trigger a suitable command to Arçelik AC system.
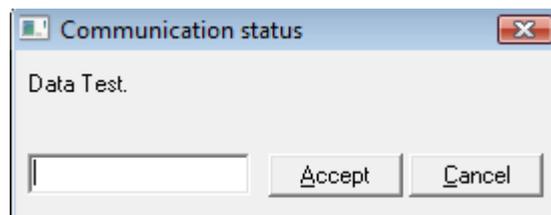
Figure 3.8 Signal value change window

3.5 Files

LinkBoxEIB saves the integration configuration in the following files inside the project folder:

PROJECT.INI	INI file containing general information related to the project.
AK.INI	INI file containing information related with the values configured through the "Connection" tab in IntesisBox® configuration.
AK.LBOX	Binary file created from the information in the files described above. This is the file downloaded to the IntesisBox®.
AK.dat	ASCII file containing the configuration of the project signals. It is the one to be used for bulk point configuration.

Table 4.1 LinkBoxEIB generated files during Project creation

It is strongly recommended to back up the project folder containing these files in external media, once the installation process is finished. This way you will be able to do future configuration changes in case of reinstallation of LinkBoxEIB due, for example, to a failure of the hard disk in the PC where LinkBoxEIB was installed.

The configuration cannot be uploaded from the gateway to LinkBoxEIB, it can only be downloaded.

4. Integration of IntesisBox® in ETS

As explained the IntesisBox® is configured with the LinkBoxEIB but in some projects it might be needed to integrate the gateway in the ETS project, for example to allow the line couplers have a correct configuration of their filter tables. To do so a Dummy device can be used in ETS to simulate the IntesisBox® and associate also to this Dummy device all group addresses used in IntesisBox®.

The dummy device can be downloaded from:
http://www.intesis.com/down/eib/Dummy_Intesis.zip

5. Electrical and Mechanical characteristics

Enclosure	Plastic type PC (UL 94 V-0). Size: 107mm x 105mm x 58mm.
Color	Grey. RAL 7035.
Power	9 to 30VDC +/-10% 1.4W. 24VAC +/-10% 1.4VA. Power connector is a 2 pole plug-in screw terminal block.
Mounting options	Wall DIN rail EN60715 TH35.
KNX (EIB) port	1 x KNX TP1 (EIB) opto-isolated (Plug-in screw terminal block 2 poles)
AK PI485 port	1 x EIA485 connector (Plug-in screw terminal block 2 poles)
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]
Console port	EIA232. DB9 female connector (DCE).
Configuration	Via console port.[2]
Firmware	Allows upgrades via console port.
Operational temperature range	0°C to +40°C
Operational humidity range	5% to 95%, non-condensing
Protection	IP20 (IEC60529).
RoHS conformity	Compliant with RoHS directive (2002/95/CE).
Certifications	CE conformity to EMC directive (2004/108/EC) and Low-voltage directive (2006/95/EC) EN 61000-6-2; EN 61000-6-3; EN 60950-1; EN 50491-3

Table 5.1 Device Electrical and Mechanical characteristics

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[1] Not operational for the moment. Reserved for future use.

[2] Along with the device it is also supplied a standard DB9 male - DB9 female 1.8 m. cable for configuring and monitoring the device using a PC via serial COM port. The configuration software LinkBoxEIB, compatible with MS Windows® operating systems, is also supplied with the device.

6. Dimensions
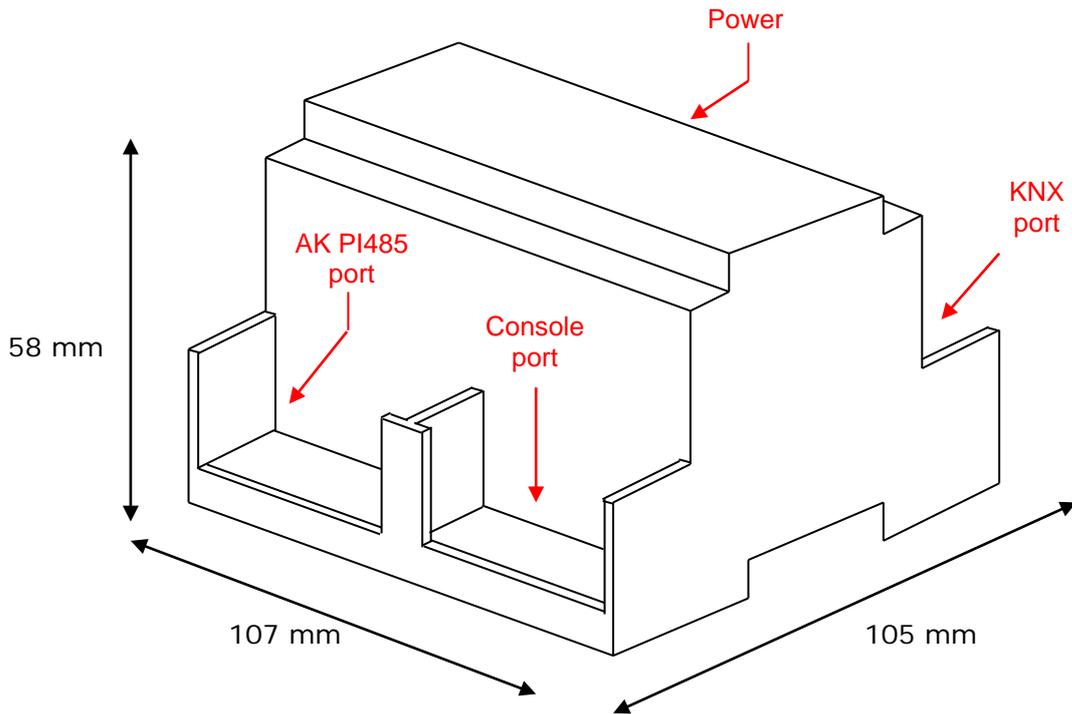
Recommended available space for its installation into a cabinet (wall or DIN rail mounting), with space enough for external connections:

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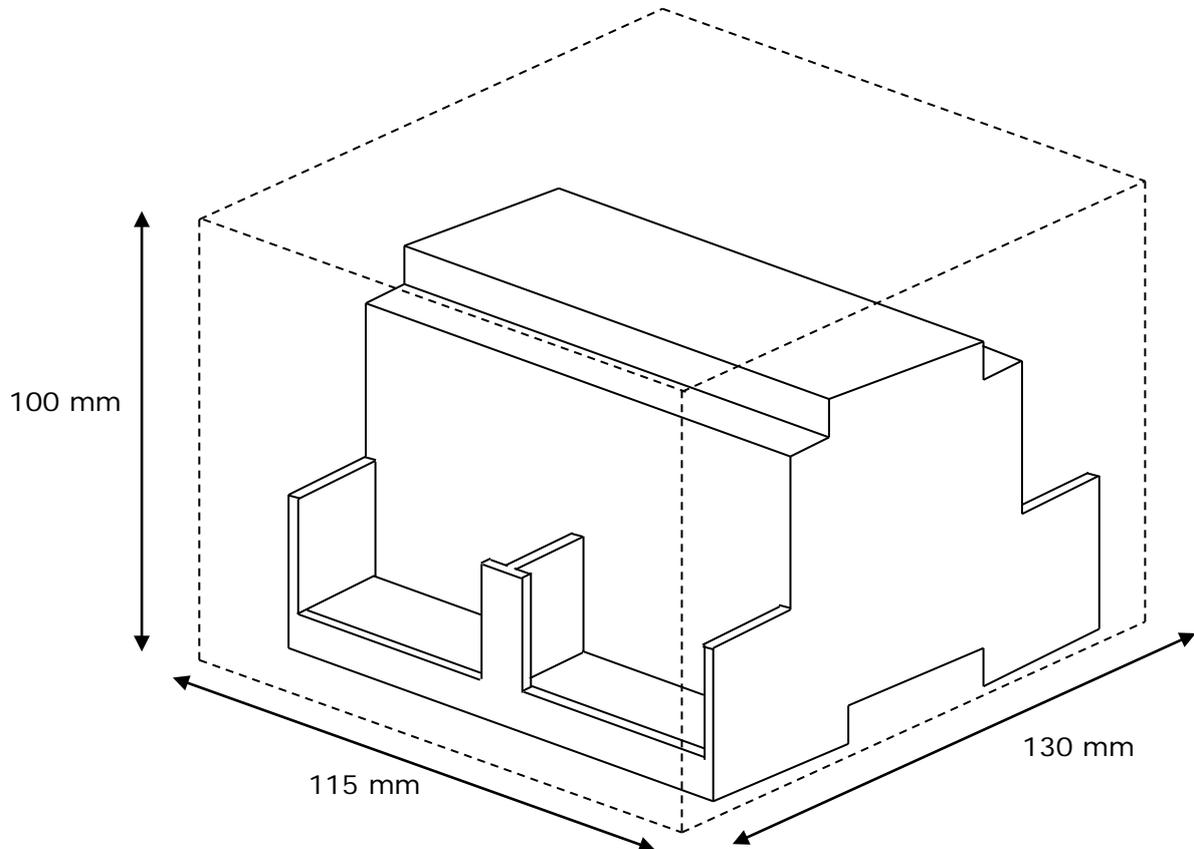
7. AC Unit Types compatibility

A list of Arçelik unit model references compatible with AK-AC-KNX-4/8/16/64 and their available features can be found in:

http://www.intesis.com/pdf/IntesisBox_AK-AC-xxx-MIU_AC_Compatibility.pdf

8. Error codes for Indoor Units

Refer to the Error Code table of Arçelik AC product manual for the error code.

9. Annexes

The explanations given in the following sections are just informative. Any action described should be performed by Arçelik qualified personnel.

9.1 PMNFP14Ax and PHNFP14A0 connection boards

9.1.1 PMNFP14Ax

In this section it can be found a brief description and configuration of the board PMNFP14A0. This board is to be used with MultiV Plus, Multi Standard and MPS Inverter Product.

1	CN_OUT: To be connected to the Indoor Unit
2	BUS_A: EIA485 (+) Terminal. Connected to the IntesisBox EIA485 + Terminal
3	BUS_B: EIA485 (-) Terminal. Connected to the IntesisBox EIA485 – Terminal
4	DIP Switch: Product Select
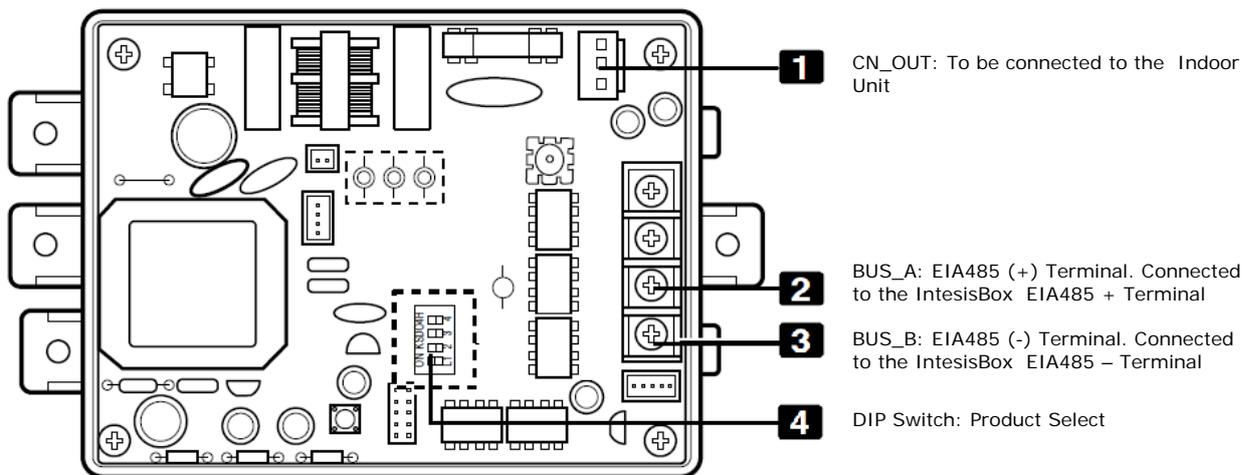
Figure 9.1 PMNFP14A0 board description

To allow the Arçelik system to work with the IntesisBOX KNX – Arçelik the DIP switch (number 4 in Figure 9.1) needs to be configured in as shown in Figure 9.2.

1 and 4 ON, All others OFF: MultiV Plus & MPS Inverter Product + IntesisBox

2 and 4 ON, All others OFF: Multi Standard Product Inverter Product + IntesisBox
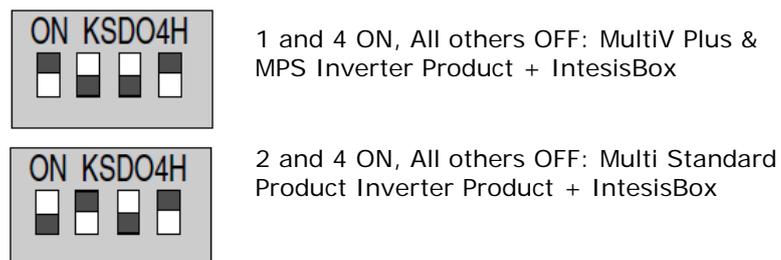
Figure 9.2 DIP switch configuration

9.1.2 PHNFP14A0

In this section it can be found a brief description and configuration of the board PHNFP14A0. This board is to be used with ECO-V products.

1	CN_OUT: To be connected to the Indoor Unit
2	BUS_B: EIA485 (-) Terminal. Connected to the IntesisBox EIA485 – Terminal
3	BUS_A: EIA485 (+) Terminal. Connected to the IntesisBox EIA485 + Terminal
4	LED01G,02G,03G: Communication Status LED
5	LED1: EIA485 Communication Status LED
6	Reset Switch: PI485(C) Reset
7	DIP Switch: Product Select
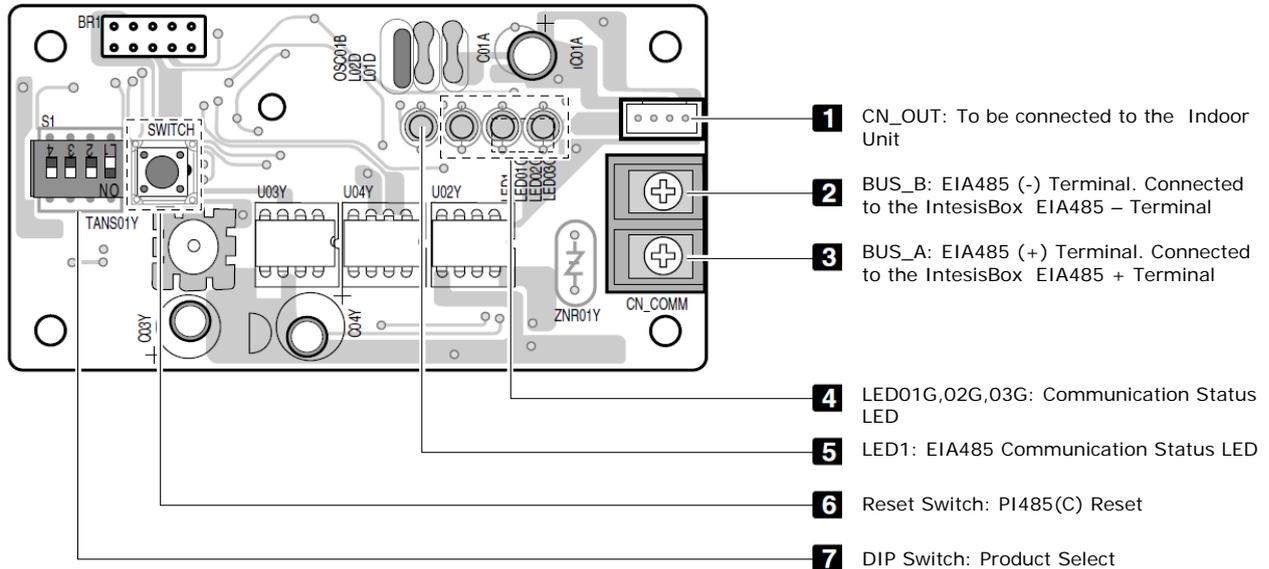
Figure 9.3 PHNFP14A0 board description

To allow the Arçelik system to work with the IntesisBOX KNX – Arçelik the DIP switch (number 7 in Figure 9.3) needs to be configured in as shown in Figure 9.4.

3, 4 ON+ALL OFF:
ECO-V Products + IntesisBox
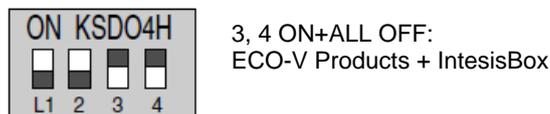
Figure 9.4 DIP switch configuration

For more information read the Arçelik PC Central Controller Installation Manual and the AK PI485 GATEWAY Installation Manual

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Intesis software

9.2 Indoor unit PCB address

Each indoor Unit needs to have an address so that the IntesisBox can communicate with it. Once set, this address is the one that is going to be used in the connection tab of LinkBoxEIB (section 3.2.1).

Setting the Indoor units addresses should be performed by Arçelik qualified personnel at installation time and the Arçelik installer needs to provide the list of addresses for Main addresses in an AC system before doing the configuration of IntesisBox.

To set the Indoor unit address there are two rotary switches (Figure 9.5), rotary low and Rotary High that allow the installer to set the desired address in the range.
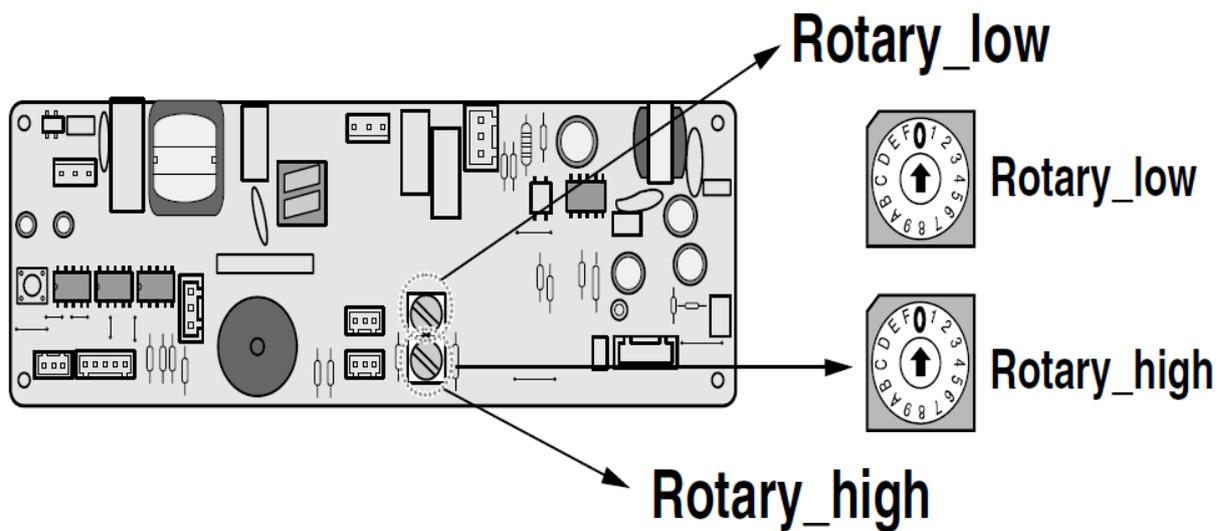
Figure 9.5 Ac Indoor address configuration

For more information read the Arçelik PC Central Controller Installation Manual