

User Manual

Revision 1.000

English

LoRaWAN / IEC61850 Server - Converter

(Order Code: HD67D35-B2-868MHz)

For Website information:

www.adfweb.com?Product=HD67D35-B2

For Price information:

www.adfweb.com?Price=HD67D35-B2-868MHz

Benefits and Main Features:

- ⊕ Very easy to configure
- ⊕ Power Supply 18...35V DC and 8...24 V AC
- ⊕ Temperature range: -40°C/+85°C (-40°F/+185°F)



For others LoRaWAN products, see also the following links:

Converter LoRaWAN to

- www.adfweb.com?Product=HD67D01
- www.adfweb.com?Product=HD67D02
- www.adfweb.com?Product=HD67D03
- www.adfweb.com?Product=HD67D04
- www.adfweb.com?Product=HD67D05
- www.adfweb.com?Product=HD67D15
- www.adfweb.com?Product=HD67D16
- www.adfweb.com?Product=HD67D17
- www.adfweb.com?Product=HD67D18
- www.adfweb.com?Product=HD67D19
- www.adfweb.com?Product=HD67D20
- www.adfweb.com?Product=HD67D21
- www.adfweb.com?Product=HD67D22
- www.adfweb.com?Product=HD67D23
- www.adfweb.com?Product=HD67D24
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- www.adfweb.com?Product=HD67D34
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- www.adfweb.com?Product=HD67D37
- www.adfweb.com?Product=HD67D38
- www.adfweb.com?Product=HD67D39
- www.adfweb.com?Product=HD67D40
- www.adfweb.com?Product=HD67D41

- (Modbus Master)**
- (Modbus Slave)**
- (Modbus TCP Master)**
- (Modbus TCP Slave)**
- (Serial)**
- (M-Bus)**
- (BACnet Master)**
- (BACnet Slave)**
- (Ethernet)**
- (CAN)**
- (CANopen)**
- (DeviceNet Master)**
- (DeviceNet Slave)**
- (DMX)**
- (EtherNet/IP Master)**
- (EtherNet/IP Slave)**
- (J1939)**
- (KNX)**
- (NMEA 0183)**
- (NMEA 2000)**
- (PROFIBUS Master)**
- (PROFIBUS Slave)**
- (PROFINET Master)**
- (PROFINET Slave)**
- (IEC61850 Client)**
- (MQTT)**
- (OPC UA Client)**
- (OPC UA Server)**
- (S7comm)**
- (SNMP Manager)**
- (SNMP Agent)**



User Manual

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UPDATED DOCUMENTATION:

Dear customer, we thank you for your attention and we remind you that you need to check that the following document is:

- ✚ Updated
- ✚ Related to the product you own

To obtain the most recently updated document, note the “document code” that appears at the top right-hand corner of each page of this document.

With this “Document Code” go to web page www.adfweb.com/download/ and search for the corresponding code on the page. Click on the proper “Document Code” and download the updates.

REVISION LIST:

Revision	Date	Author	Chapter	Description
1.000	04/12/2020	Ff	All	First release version

WARNING:

ADFweb.com reserves the right to change information in this manual about our product without warning. ADFweb.com is not responsible for any error this manual may contain.

TRADEMARKS:

All trademarks mentioned in this document belong to their respective owners.

SECURITY ALERT:**GENERAL INFORMATION**

To ensure safe operation, the device must be operated according to the instructions in the manual. When using the device, legal and safety regulation are required for each individual application. The same applies also when using accessories.

INTENDED USE

Machines and systems must be designed so the faulty conditions do not lead to a dangerous situation for the operator (i.e. independent limit switches, mechanical interlocks, etc.).

QUALIFIED PERSONNEL

The device can be used only by qualified personnel, strictly in accordance with the specifications. Qualified personnel are persons who are familiar with the installation, assembly, commissioning and operation of this equipment and who have appropriate qualifications for their job.

RESIDUAL RISKS

The device is state-of-the-art and is safe. The instruments can represent a potential hazard if they are inappropriately installed and operated by untrained personnel. These instructions refer to residual risks with the following symbol:



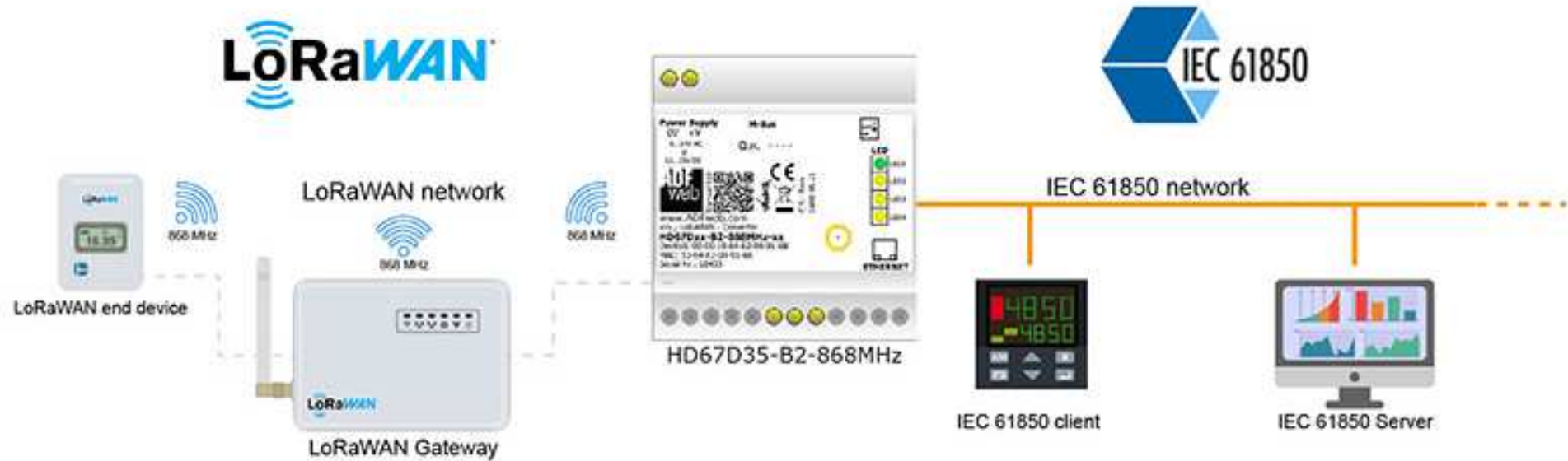
This symbol indicates that non-observance of the safety instructions is a danger for people that could lead to serious injury or death and / or the possibility of damage.

CE CONFORMITY

The declaration is made by our company. You can send an email to support@adfweb.com or give us a call if you need it.

EXAMPLE OF CONNECTION:

IEC61850 / LoRaWAN - Converter
 HD67D35-B2



ADFweb.com



+39 0438 309 131



+39 349 440 9592



support@adfweb.com

CONNECTION SCHEME:

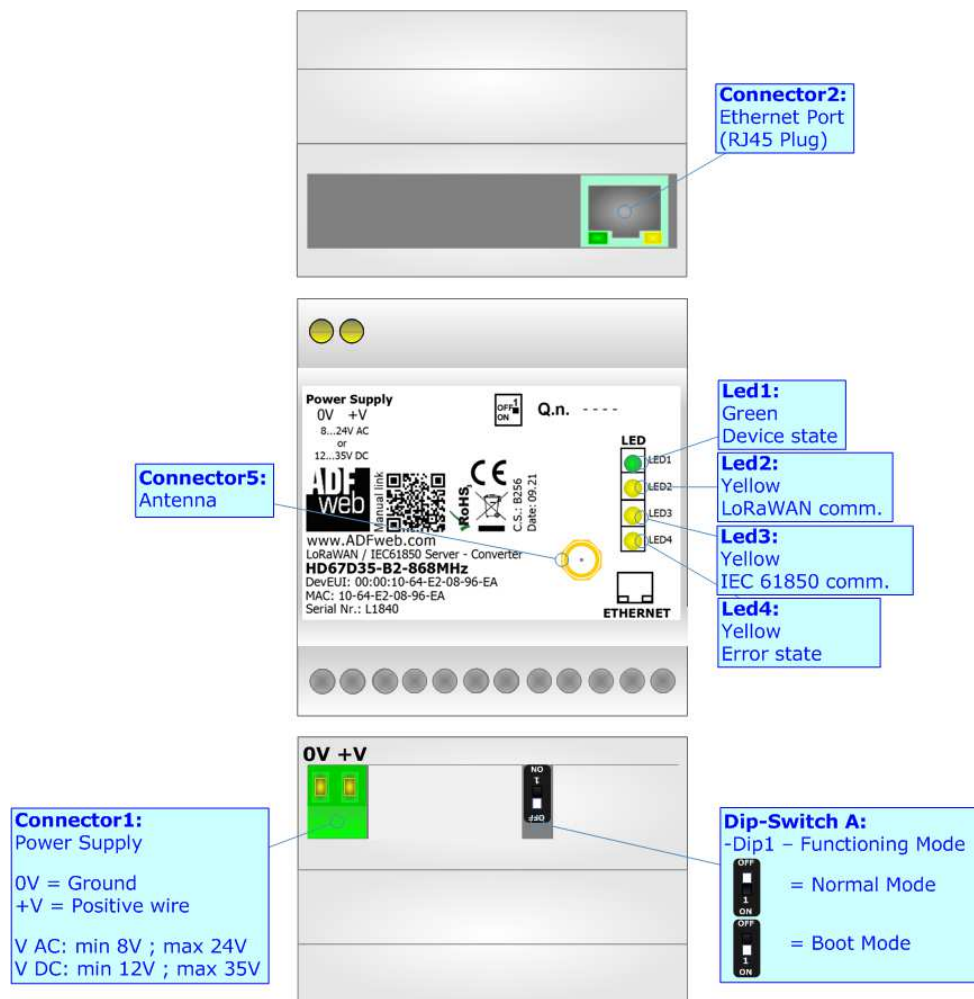


Figure 1: Connection scheme for HD67D35-B2-xxxMHz

CHARACTERISTICS:

The HD67D35-B2 is a LoRaWAN / IEC61850 Server Converter.

It allows the following characteristics:

- Electrical isolation between IEC61850 and Power Supply;
- Mountable on 35mm Rail DIN;
- Wide power supply input range: 12...35V DC and 8...24V AC;
- Wide temperature range: -40°C / 85°C [-40°F / +185°F].

CONFIGURATION:

You need Compositor SW67D35 software on your PC in order to perform the following:

- Define the parameter of IEC61850 line;
- Define the parameter of LoRaWAN line;
- Define the list of LoRaWAN messages in uplink and downlink to the LoRaWAN gateway;
- Define the list of IEC61850 variables available for the Client;
- Update the device.

POWER SUPPLY:

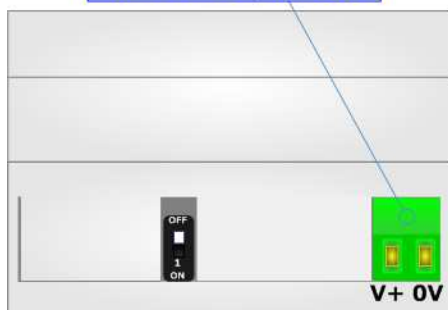
The devices can be powered at 8...24V AC and 12...35V DC. For more details see the two tables below.

VAC 		VDC 	
Vmin	Vmax	Vmin	Vmax
8V	24V	12V	35V

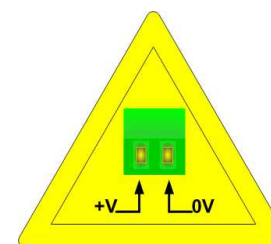
Consumption at 24V DC:

Device	Consumption [W/VA]
HD67D35-B2-xxxMHz	3.5

Connector1:
Power Supply
0V = Ground
+V = Positive wire
V AC: min 8V ; max 24V
V DC: min 12V ; max 35V



Caution: Not reverse the polarity power



HD67D35-B2-xxxMHz

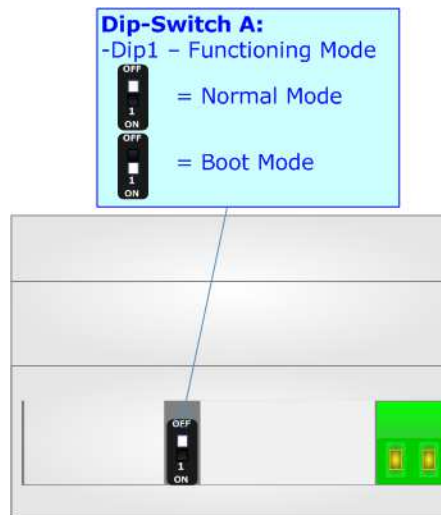
FUNCTION MODES:

The device has got two functions mode depending of the position of the 'Dip1 of Dip-Switch A':

- The first, with 'Dip1 of Dip-Switch A' at "OFF" position, is used for the normal working of the device.
- The second, with 'Dip1 of Dip-Switch A' at "ON" position, is used for upload the Project and/or Firmware.

For the operations to follow for the updating, see 'UPDATE DEVICE' section.

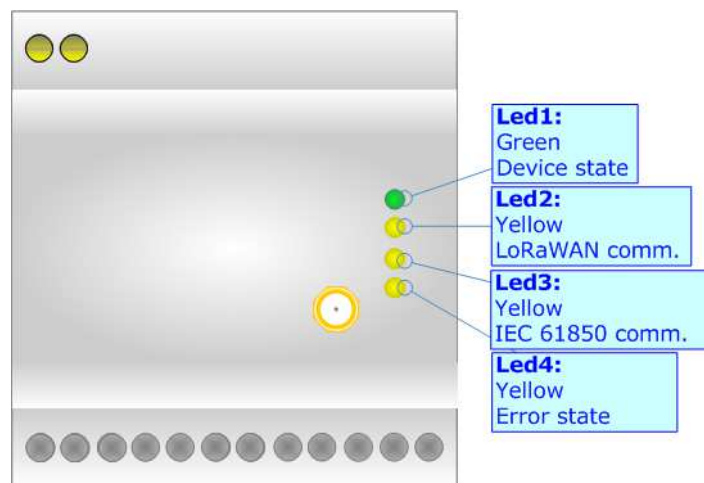
According to the functioning mode, the LEDs will have specifics functions, see 'LEDS' section.



LEDS:

The device has got four LEDs that are used to give information of the functioning status. The various meanings of the LEDs are described in the table below.

LED	Normal Mode	Boot Mode
1: Device State (green)	Blinks slowly (~1Hz)	Blinks quickly: Boot state Blinks very slowly (~0.5Hz): update in progress
2: LoRaWAN communication (yellow)	Blinks when LoRaWAN data is received	Blinks quickly: Boot state Blinks very slowly (~0.5Hz): update in progress
3: IEC61850 communication (yellow)	Blinks when a IEC61850 request is received	Blinks quickly: Boot state Blinks very slowly (~0.5Hz): update in progress
4: Error state (yellow)	ON: An error in the communication busses occurs OFF: No errors are present	Blinks quickly: Boot state Blinks very slowly (~0.5Hz): update in progress



LORAWAN:

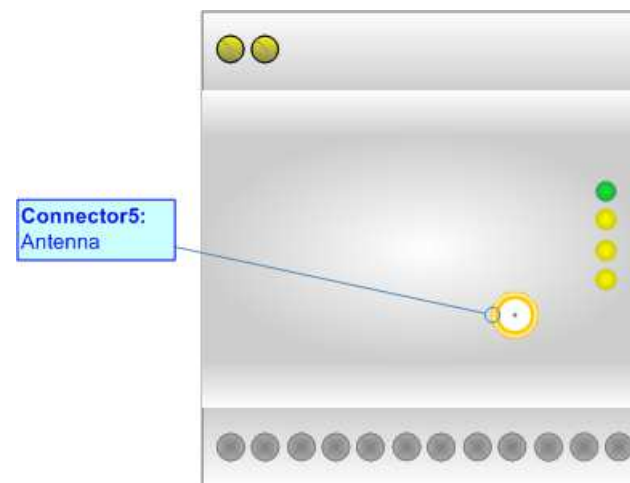
The LoRaWAN® specification is a Low Power, Wide Area (LPWA) networking protocol designed to wirelessly connect battery operated 'things' to the internet in regional, national or global networks, and targets key Internet of Things (IoT) requirements such as bi-directional communication, end-to-end security, mobility and localization services.

LoRaWAN® network architecture is deployed in a star-of-stars topology in which gateways relay messages between end-devices and a central network server.

The wireless communication takes advantage of the Long Range characteristics of the LoRa physical layer, allowing a single-hop link between the end-device and one or many gateways. All modes are capable of bi-directional communication, and there is support for multicast addressing groups to make efficient use of spectrum during tasks such as Firmware Over-The-Air (FOTA) upgrades or other mass distribution messages.

Converters from HD67D35 serie act as end-devices and they can communicate with one or more LoRaWAN Gateways.

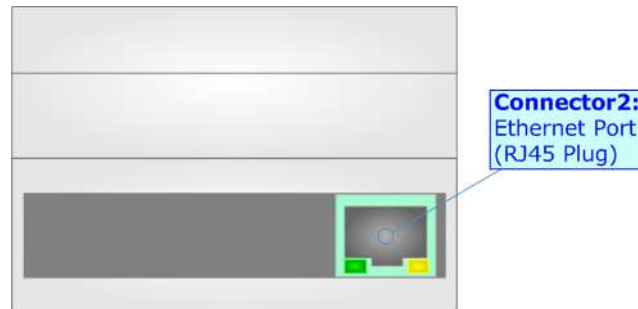
The converters support all the standard datarates and they work both on public and private networks.



ETHERNET:

The Ethernet port is used for programming the device and for IEC61850 communication.

The Ethernet connection must be made using Connector2 of HD67D35-B2 with at least a Category 5E cable. The maximum length of the cable should not exceed 100m. The cable has to conform to the T568 norms relative to connections in cat.5 up to 100 Mbps. To connect the device to an Hub/Switch is recommended the use of a straight cable, to connect the device to a PC is recommended the use of a cross cable.



USE OF COMPOSITOR SW67D35:

To configure the Converter, use the available software that runs with Windows called SW67D35. It is downloadable on the site www.adfweb.com and its operation is described in this document. The software works with MS Windows (XP, Vista, Seven, 8, 10; 32/64bit).

When launching the SW67D35, the window below appears (Fig. 2).



Note:

It is necessary to have installed .Net Framework 4.

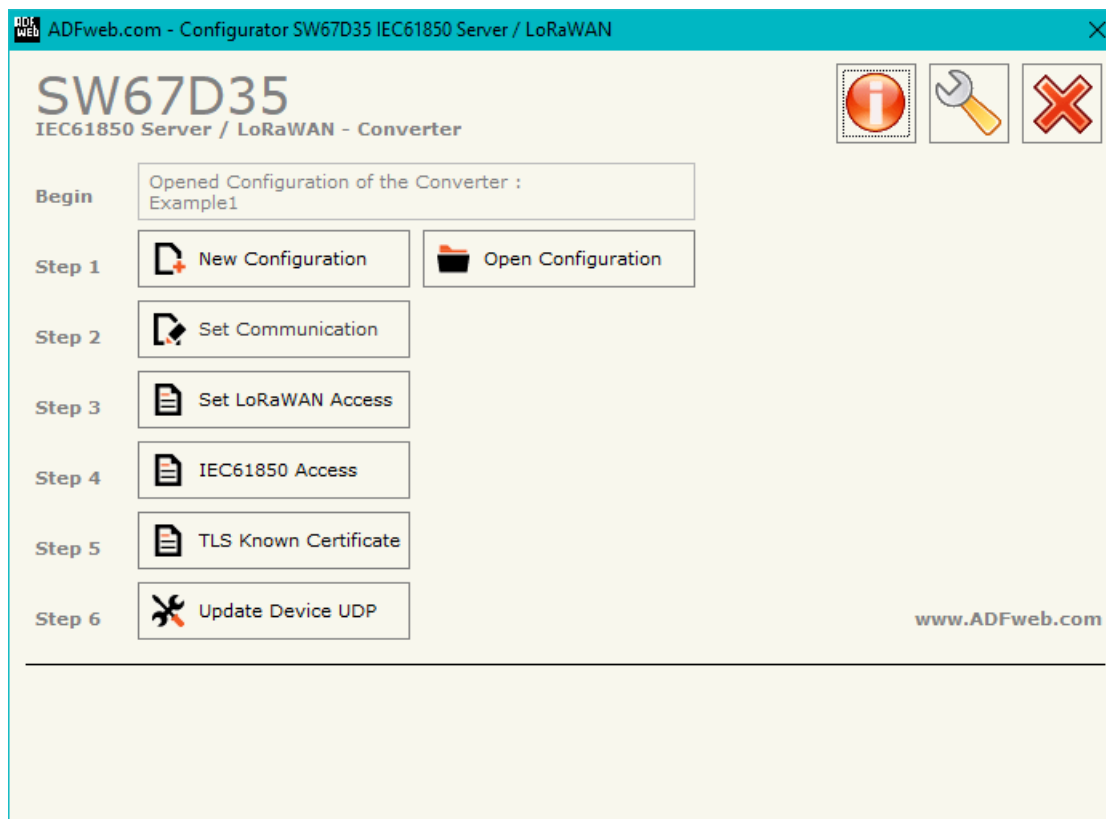
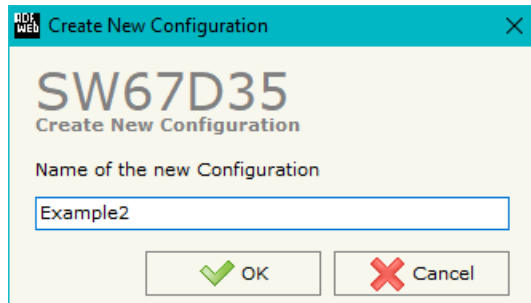


Figure 2: Main window for SW67D35

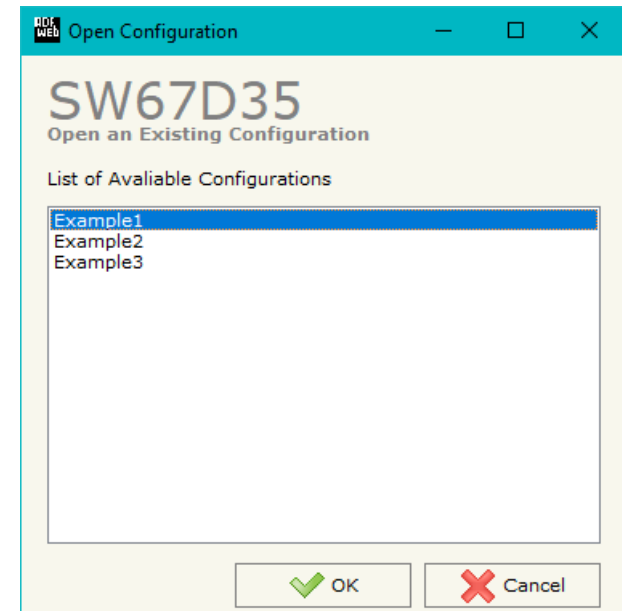
NEW CONFIGURATION / OPEN CONFIGURATION:

The “**New Configuration**” button creates the folder which contains the entire device’s configuration.




A device’s configuration can also be imported or exported:

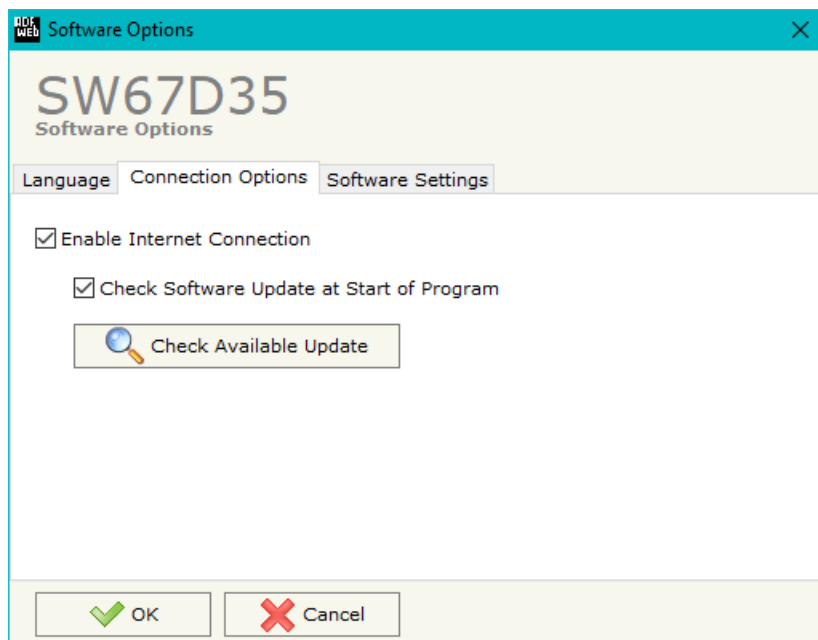
- To clone the configurations of a Programmable “LoRaWAN / IEC61850 Server - Converter” in order to configure another device in the same manner, it is necessary to maintain the folder and all its contents;
- To clone a project in order to obtain a different version of the project, it is sufficient to duplicate the project folder with another name and open the new folder with the button “**Open Configuration**”.



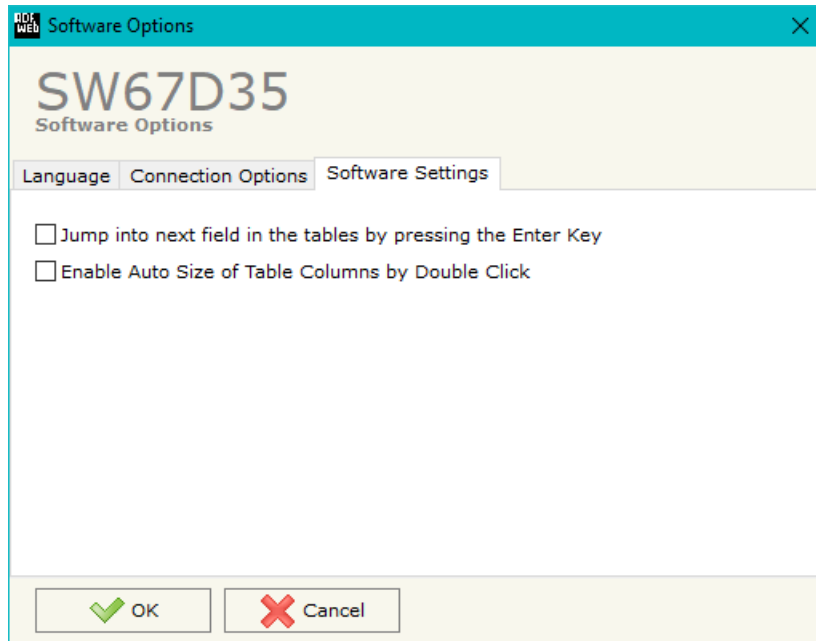
SOFTWARE OPTIONS:

By pressing the “**Settings**” () button there is the possibility to change the language of the software and check the updatings for the compositor.

In the section “Language” it is possible to change the language of the software.



In the section “Connection Options”, it is possible to check if there are some updatings of the software compositor in ADFweb.com website. Checking the option “**Check Software Update at Start of Program**”, the SW67D35 check automatically if there are updatings when it is launched.



In the section "Software Settings", it is possible to enable/disable some keyboard's commands for an easier navigation inside the tables contained in the different sections of the software.

SET COMMUNICATION:

This section define the fundamental communication parameters of two buses, LoRaWAN and IEC6158 Server.

By Pressing the **"Set Communication"** button from the main window for SW67D35 (Fig. 2) the window "Set Communication" appears (Fig. 3).

The window is divided in different sections in order to define the different parameters of the converter:

- LoRaWAN
- IEC61850 Server
- TLS (Transport Layer Security) Server
- NTP (Network Time Protocol)

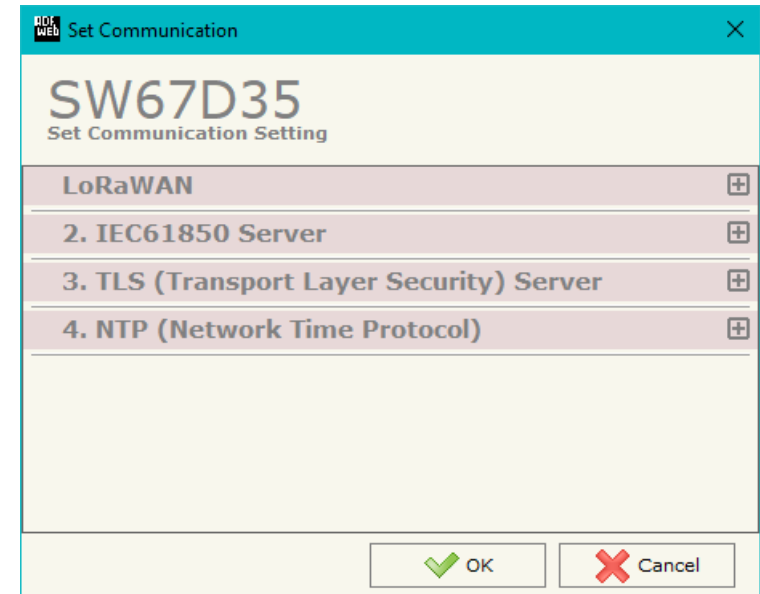
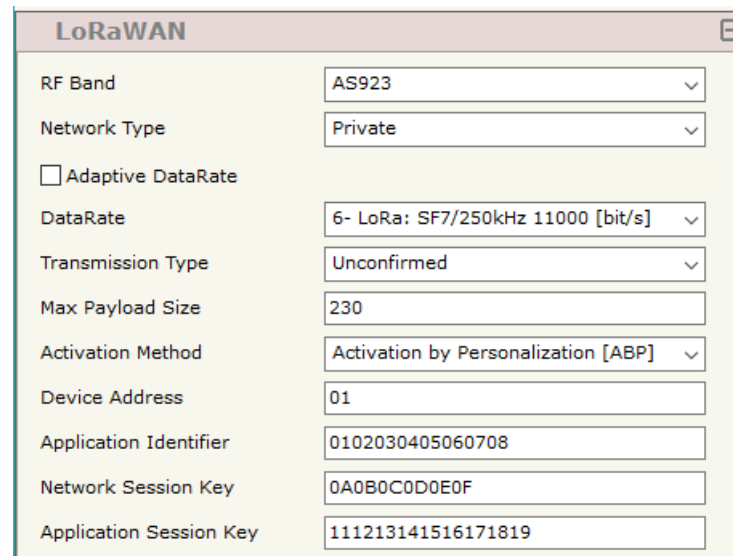


Figure 3a: "Set Communication" window

LoRaWAN:

This section is used to define the general parameters of LoRaWAN. The means of the fields are:

- In the field "**RF Band**" the wireless band used for LoRaWAN communication is defined;
- In the field "**Network Type**" the type of LoRaWAN network is defined;
- If the field "Adaptive Data Rate" is checked, the converter will enable the ADR functionalities to select the best data rate to be used in relation to the environmental conditions;
- In the field "**Data Rate**" the data rate for LoRaWAN communication is defined;
- In the field "**Transmission Type**" the type of LoRaWAN communication is defined;
- In the field "**Max Payload Size**" the maximum dimension of the LoRaWAN messages is defined (fixed in relation to the data rate selected);
- In the field "**Activation Method**" the method used to join into a LoRaWAN network is defined;
- In the field "**Device Address**" the device identifier (DevEUI) is defined (only for ABP method);
- In the field "**Application Identifier**" the application identifier (AppEUI) is defined (only for ABP method);
- In the field "**Network Session Key**" the key used for the communication with the LoRaWAN gateway (NwksKey) is defined (only for ABP method);
- In the field "**Application Session Key**" the key for encryption and decryption of the payload (AppSKey) is defined (only for ABP method);
- If OTAA method is selected, in the field "**Application Key**" the secret key for the dynamic activation of the converter in the LoRaWAN network is defined.



The screenshot shows a configuration window titled "LoRaWAN" with a close button in the top right corner. The window contains the following fields and values:

Field	Value
RF Band	AS923
Network Type	Private
<input type="checkbox"/> Adaptive DataRate	
DataRate	6- LoRa: SF7/250kHz 11000 [bit/s]
Transmission Type	Unconfirmed
Max Payload Size	230
Activation Method	Activation by Personalization [ABP]
Device Address	01
Application Identifier	0102030405060708
Network Session Key	0A0B0C0D0E0F
Application Session Key	111213141516171819

Figure 3b: "Set Communication → LoRaWAN" window

IEC61850 SERVER:

This section is used to define the main parameters of IEC61850 line. The means of the fields are:

- In the fields "**IP Address**" the IP address for IEC61850 side of the converter is defined;
- In the fields "**SubNet Mask**" the SubNet Mask for IEC61850 side of the converter is defined;
- In the fields "**Gateway**" the default gateway of the net is defined. This feature can be enabled or disabled pressing the Check Box field. This feature is used for going out of the net;
- In the field "**Port**" the port used for IEC61850 communication is defined;
- If the field "**Password**" the password used for accessing to IEC 61850 variables is defined.

TLS:

This section is used to define the main parameters of TLS line. The means of the fields are:

- If the field "**Enable TLS**" is checked, the TLS protocol for secure connection is enabled;
- In the field "**Key**" the key for the authentication is defined;
- In the field "**Key Password**" the password for decrypting the key is defined;
- In the field "**Server Certificate**" the certificate for the server is defined;
- In the field "**Root Certificate**" the root of the server is defined;
- If the field "**Enable Only Known Certificates**" is checked, the converter will accept just connection from known Clients (defined in the section "TLS Known Certificate").

2. IEC61850 Server				
IP Address	192	.168	.0	.10
SubNet Mask	255	.255	.255	.0
<input type="checkbox"/> Gateway	192	.168	.0	.1
<input type="checkbox"/> DNS	8	.8	.8	.8
Port	102			
Password				

Figure 3c: "Set Communication → IEC61850 Server" window

3. TLS (Transport Layer Security) Server
<input type="checkbox"/> Enable TLS

Figure 3d: "Set Communication → TLS Server" window

NTP:

This section is used to define the main parameters of NTP line. The means of the fields are:

- In the field "**Server URL**" the URL or the IP Address of the NTP Server is defined;
- In the field "**Poll Time (seconds)**" the polling time for the time synchronization is defined.



4. NTP (Network Time Protocol)	
Server URL	<input type="text" value="pool.ntp.org"/>
Poll Time (seconds)	<input type="text" value="1000"/>

Figure 3e: "Set Communication → NTP" window

LORAWAN ACCESS:

By Pressing the “**LoRaWAN Access**” button from the main window for SW67D35 (Fig. 2) the window “Set LoRaWAN Access” appears (Fig. 4).

This section is used to define the LoRaWAN messages where the converter will place the data read from IEC61850 (Uplink) and the LoRaWAN messages that the converter will take (Downlink) for writing the data to IEC61850.

LoRaWAN UPLINK

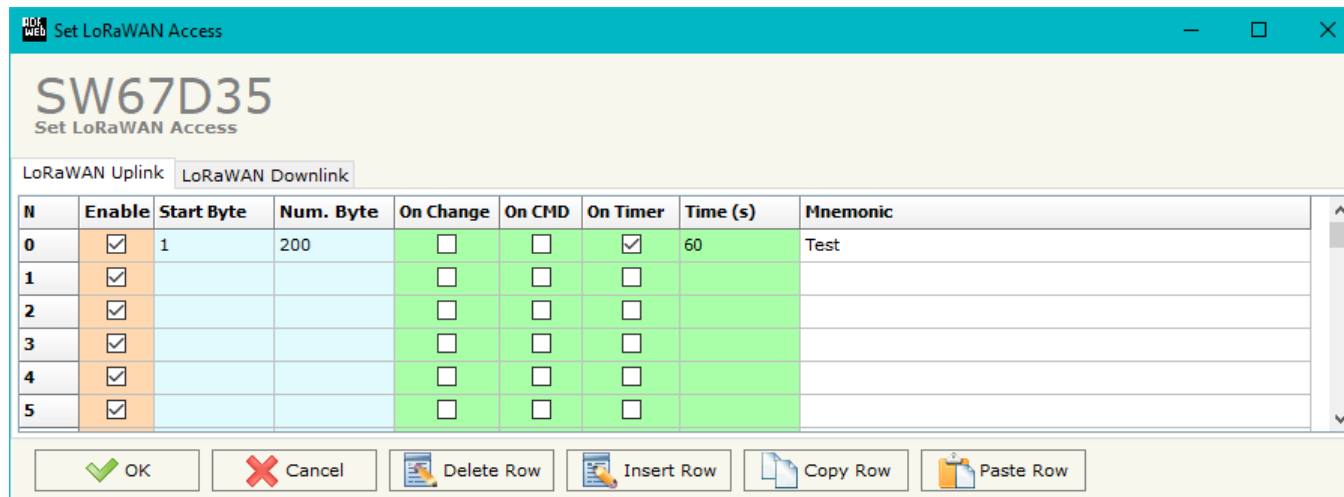


Figure 4a: “LoRaWAN Access → LoRaWAN Uplink” window

The means of the fields are:

- If the field “**Enable**” is checked, the LoRaWAN message is enabled;
- In the field “**Start Byte**” the starting byte of the internal memory array where taking the data is defined;
- In the field “**Num. Byte**” the number of consecutive bytes to take from the internal array starting from “Start Byte” is defined;
- If the field “**On Change**” is checked, the LoRaWAN message is sent only when the data from IEC61850 change;
- If the field “**On CMD**” is checked, the LoRaWAN message is sent when a IEC61850 request is received;
- If the field “**On Timer**” is checked, the LoRaWAN message is sent cyclically with the delay defined in “**Time (s)**” field;
- In the field “**Mnemonic**” a description of the message is defined.

LoRaWAN DOWNLINK

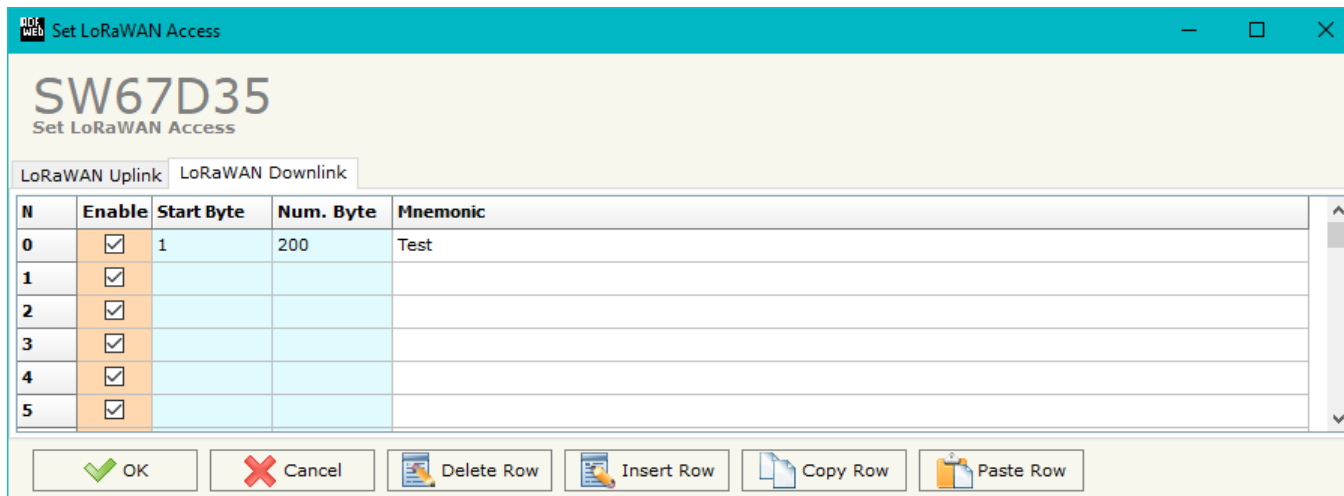


Figure 4b: "LoRaWAN Access → LoRaWAN Downlink" window

The means of the fields are:

- ➔ If the field "**Enable**" is checked, the LoRaWAN message is enabled;
- ➔ In the field "**Start Byte**" the starting byte of the internal memory array where placing the data is defined;
- ➔ In the field "**Num. Byte**" the number of consecutive bytes to write to the internal array starting from "Start Byte" is defined;
- ➔ In the field "**Mnemonic**" a description of the message is defined.

IEC61850 ACCESS:

By Pressing the “**IEC61850 Access**” button from the main window for SW67D35 (Fig. 2) the window “Set Variables Access for IEC 61850” appears (Fig. 5).

This section is used to define the IEC 61850 variables from/to which take/map the data of LoRaWAN side.

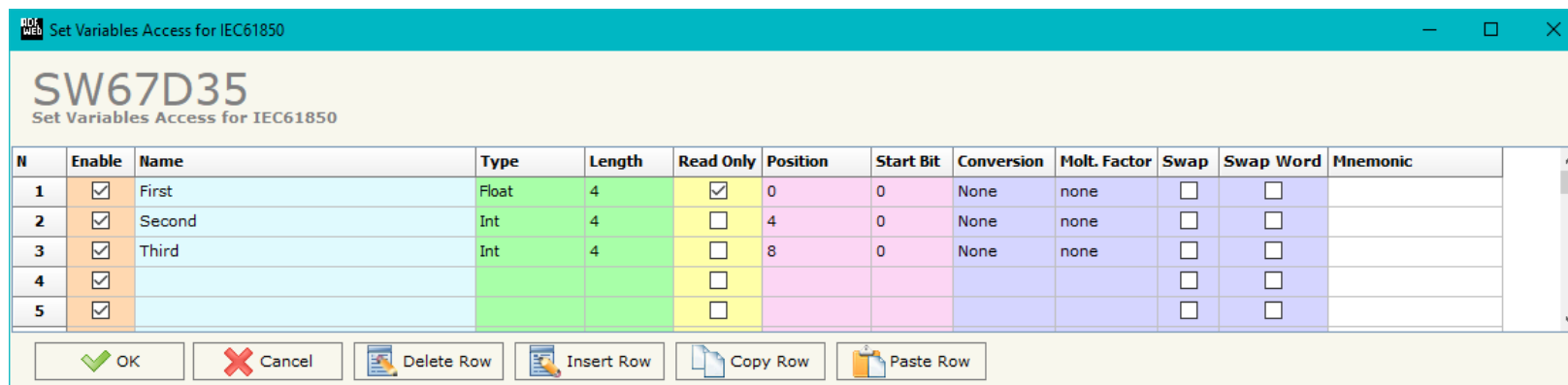


Figure 5: “IEC 61850 Access” window

The means of the fields are:

- If the field “**Enable**” is checked, the IEC 61850 variable is enabled;
- In the field “**Name**” the name of the IEC 61850 variable is defined;
- In the field “**Type**” the data format of the IEC 61850 variable is defined;
- In the field “**Length**” the dimension of the IEC 61850 variable is defined;
- If the field “**Read Only**” is checked, the IEC 61850 variable is just in reading. Otherwise, it is writeable too;
- In the field “**Position**” the starting byte of the internal memory arrays from/to which taking/mapping the data is defined;
- In the field “**Start Bit**” the starting bit of the byte of the field “Position” is defined;
- In the field “**Conversion**” the conversion of the data is defined. This option is used to convert the data format between LoRaWAN and IEC 61850;
- In the field “**Molt. Factor**” a multiplicative factor of the value is defined;
- If the field “**Swap**” is checked, the bytes’ order is reversed;
- If the field “**Swap Word**” is checked, the words’ order is reversed;
- In the field “**Mnemonic**” a description of the variable is defined.

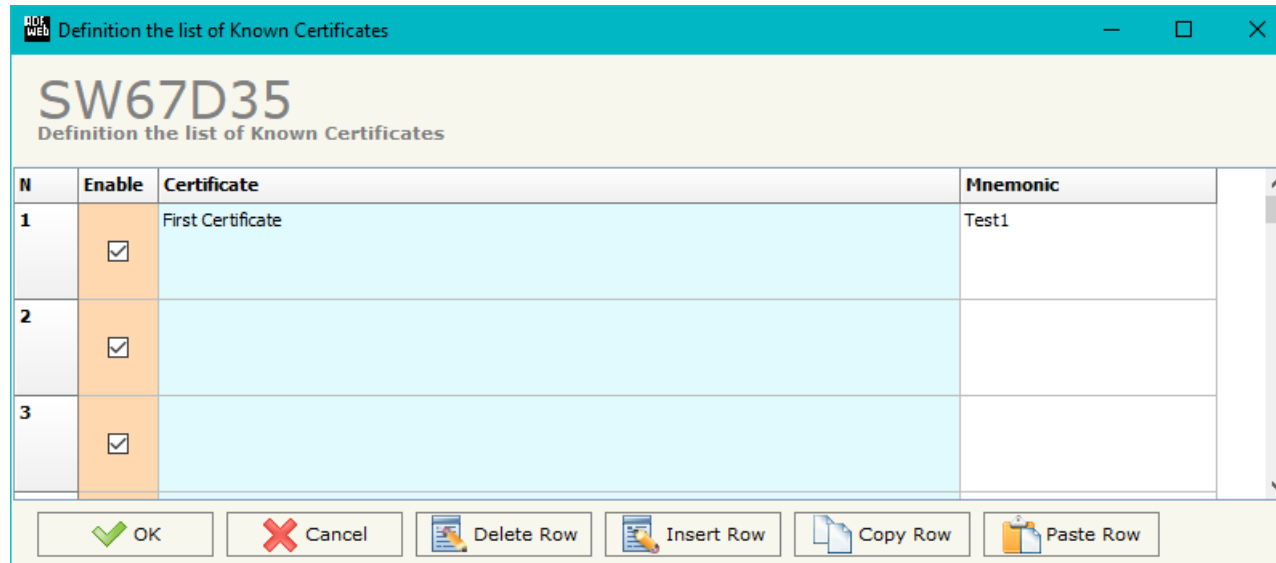
TLS KNOWN CERTIFICATE:

Figure 6: "TLS Known Certificate" window

By pressing the "**TLS Known Certificate**" button from the Main Window of SW67D35 (Fig. 2) the "Definition the list of Known Certificates" window appears (Fig. 6).

The data of the columns have the following meanings:

- If the field "**Enable**" is checked, the TLS certificate is allowed;
- In the field "**Certificate**" the certificate of the Client is defined;
- In the field "**Mnemonic**" a description is defined.

UPDATE DEVICE:

By pressing the “**Update Device**” button, it is possible to load the created Configuration into the device; and also the Firmware, if necessary. This by using the Ethernet port.

If you don’t know the actual IP address of the device you have to use this procedure:

- Turn OFF the Device;
- Put Dip1 of ‘Dip-Switch A’ in ON position;
- Turn ON the device
- Connect the Ethernet cable;
- Insert the IP “**192.168.2.205**”;
- Select which operations you want to do;
- Press the “**Execute update firmware**” button to start the upload;
- When all the operations are “OK” turn OFF the Device;
- Put Dip1 of ‘Dip-Switch A’ in OFF position;
- Turn ON the device.

If you know the actual IP address of the device, you have to use this procedure:

- Turn ON the Device with the Ethernet cable inserted;
- Insert the actual IP of the Converter;
- Select which operations you want to do;
- Press the “**Execute update firmware**” button to start the upload;
- When all the operations are “OK” the device automatically goes at Normal Mode.

At this point the configuration/firmware on the device is correctly updated.

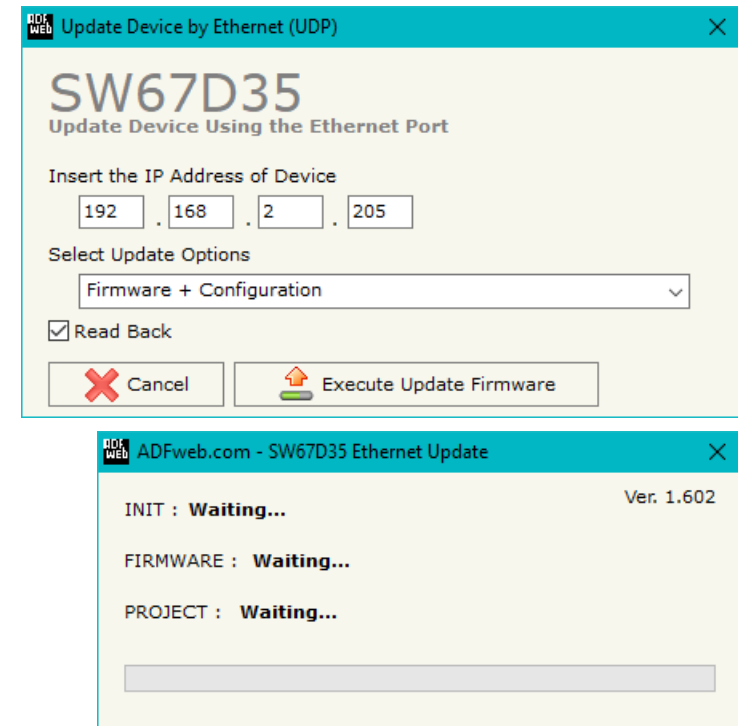


Figure 7: “Update device” windows

**Note:**

When you receive the device, for the first time, you also have to update the Firmware in the HD67D35 device.

**Warning:**

If Fig. 8 appears when you try to do the Update try these points before seeking assistance:

- Try to repeat the operations for the updating;
- Try with another PC;
- Try to restart the PC;
- Check the LAN settings;
- If you are using the program inside a Virtual Machine, try to use in the main Operating System;
- If you are using Windows Seven, Vista, 8 or 10 make sure that you have the administrator privileges;
- In case you have to program more than one device, using the "UDP Update", you have to cancel the ARP table every time you connect a new device on Ethernet. For do this you have to launch the "Command Prompt" and write the command "arp -d". Pay attention that with Windows Vista, Seven, 8, 10 you have to launch the "Command Prompt" with Administrator Rights;
- Pay attention at Firewall lock.

**Warning:**

In the case of HD67D35 you have to use the software "SW67D35": www.adfweb.com/download/filefold/SW67D35.zip.

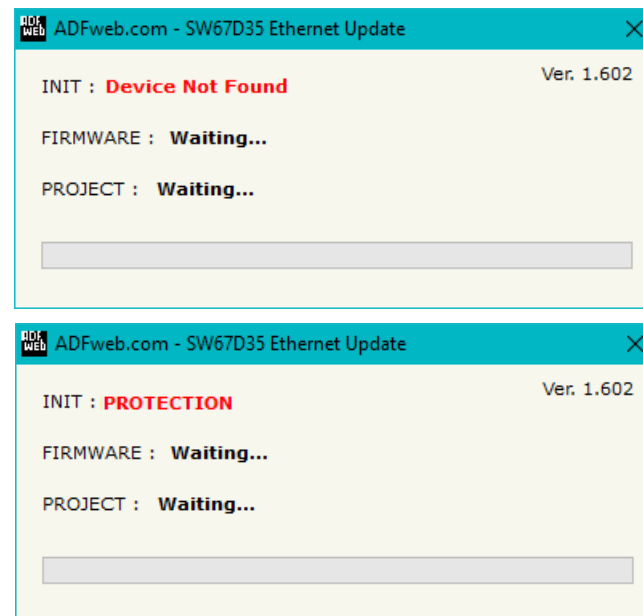


Figure 8: "Error" window

LORAWAN PAYLOAD

The LoRaWAN messages in Uplink and Downlink are structured into a defined format in order to recognize them from LoRaWAN gateway side and to understand to which IEC61850 requests they are associated.

The payload of the LoRaWAN messages is defined in Hex format:

- The first byte refers to the row of the tables defined into "LoRaWAN Access" section of SW67D35: it can have a value between 0 and 255 (0xFF);
- The following bytes will contain the data to be linked to the internal memory arrays of the converter (using "Start Byte" and "Num. Byte" of "LoRaWAN Access" section of SW67D35);

Example 1:

the converter is sending a LoRaWAN message related to row 4 of "LoRaWAN Access → LoRaWAN Uplink" table of "LoRaWAN Access" section of SW67D35 with a "Num. Byte" set of '4'. The data from these 4 bytes is "01 02 03 04" (hex).

The payload of the LoRaWAN message will look like "04 01 02 03 04" where:

- 04: index of the row of "LoRaWAN Access → LoRaWAN Uplink" table;
- 01 02 03 04: data taken from internal memory array of the converter.

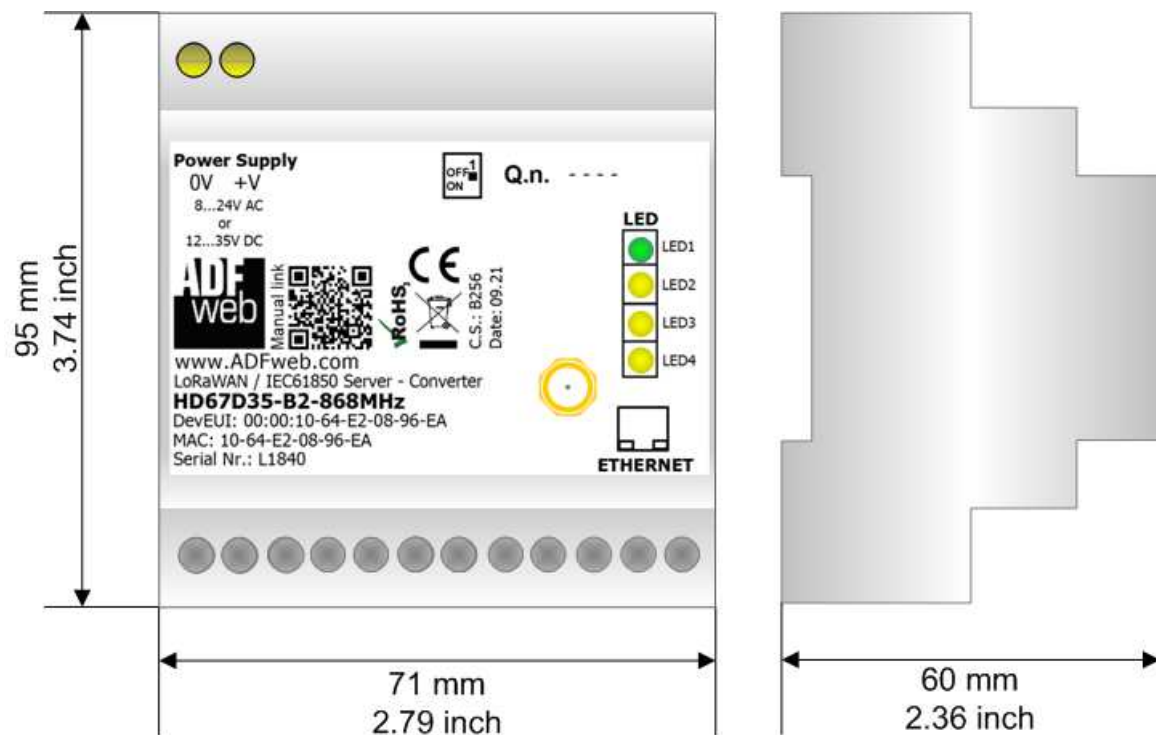
Example 2:

The external LoRaWAN gateway needs to send a LoRaWAN message to the converter and link it to row 3 of "LoRaWAN Access → LoRaWAN Downlink" table of "LoRaWAN Access" section of SW67D35. The "Num. Byte" set is '4' and the data to be written is "55 66 77 88" (hex).

The payload of the LoRaWAN message will look like "03 55 66 77 88" where:

- 03: index of the row of "LoRaWAN Access → LoRaWAN Downlink" table;
- 55 66 77 88: data to be written to the internal memory array of the converter.

MECHANICAL DIMENSIONS:



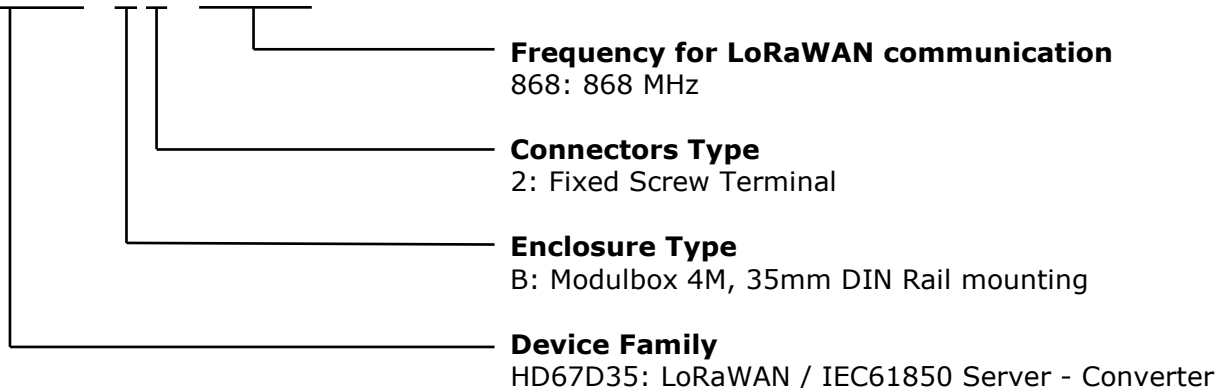
Housing: PVC
 Weight: 200g (Approx)

Figure 9: Mechanical dimensions scheme for HD67D35-B2

ORDERING INFORMATIONS:

The ordering part number is formed by a valid combination of the following:

HD67D35 - B 2 - xxxMHz



Order Code: **HD67D35-B2-868MHz** - LoRaWAN / IEC61850 Server – Converter

ACCESSORIES:

Order Code: **AC34011** - 35mm Rail DIN - Power Supply 220/240V AC 50/60Hz – 12 V DC

Order Code: **AC34012** - 35mm Rail DIN - Power Supply 220/240V AC 50/60Hz – 24 V DC

DISCLAIMER:

All technical content within this document can be modified without notice. The content of the document is a under continual renewal. For losses due to fire, earthquake, third party access or other accidents, or intentional or accidental abuse, misuse, or use under abnormal conditions repairs are charged to the user. ADFweb.com S.r.l. will not be liable for accidental loss of use or inability to use this product, such as loss of business income. ADFweb.com S.r.l. shall not be liable for consequences of improper use.

OTHER REGULATIONS AND STANDARDS:**WEEE INFORMATION**

Disposal of old electrical and electronic equipment (as in the European Union and other European countries with separate collection systems).

— This symbol on the product or on its packaging indicates that this product may not be treated as household rubbish. Instead, it should be taken to an applicable collection point for the recycling of electrical and electronic equipment. If the product is disposed correctly, you will help prevent potential negative environmental factors and impact of human health, which could otherwise be caused by inappropriate disposal. The recycling of materials will help to conserve natural resources. For more information about recycling this product, please contact your local city office, your household waste disposal service or the shop where you purchased the product.

RESTRICTION OF HAZARDOUS SUBSTANCES DIRECTIVE

The device respects the 2002/95/EC Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment (commonly referred to as Restriction of Hazardous Substances Directive or RoHS).

CE MARKING

The product conforms with the essential requirements of the applicable EC directives.

WARRANTIES AND TECHNICAL SUPPORT:

For fast and easy technical support for your ADFweb.com SRL products, consult our internet support at www.adfweb.com.
Otherwise contact us at the address support@adfweb.com

RETURN POLICY:

If while using your product you have any problem and you wish to exchange or repair it, please do the following:

- Obtain a Product Return Number (PRN) from our internet support at www.adfweb.com. Together with the request, you need to provide detailed information about the problem.
- Send the product to the address provided with the PRN, having prepaid the shipping costs (shipment costs billed to us will not be accepted).

If the product is within the warranty of twelve months, it will be repaired or exchanged and returned within three weeks. If the product is no longer under warranty, you will receive a repair estimate.



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