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Industrial Electronic Devices

User Manual
Revision 1.000
English

Modbus Slave / LoRaWAN Gateway - Converter

(Order Code: HD67F02-2-B2-xxxMHz, HD67F02-5-B2-xxxMHz)

Benefits and Main Features:

Very easy to configure

Power Supply 12...35V DC and 8...24 V AC

Temperature range: -40°C/+85°C (-40°F/+185°F)

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INDEX:

UPDATED DOCUMENTATION:

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REVISION LIST:

Revision	Date	Author	Chapter	Description
1.000	03/03/2022	Ff	All	First release version

WARNING:

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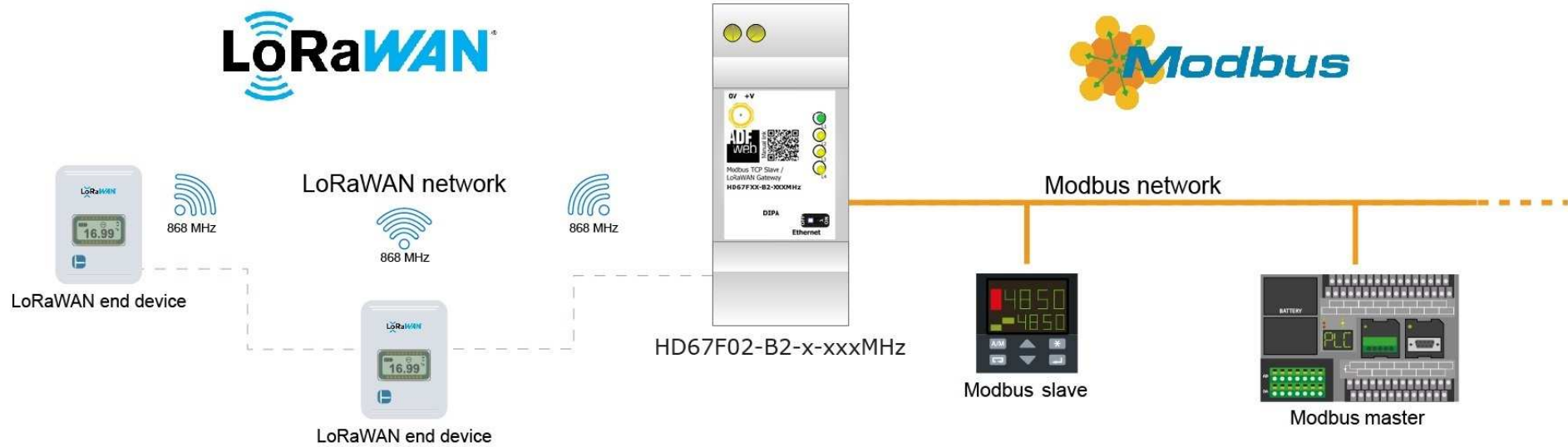
This symbol indicates that non-observance of the safety instructions is a danger for people that could lead to serious injury or death and / or the possibility of damage.

CE CONFORMITY
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EXAMPLE OF CONNECTION:

HD67F02-B2-x-xxxMHz

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CONNECTION SCHEME:

Connector3:
Ethernet Port
(RJ45 Plug)

Led5:
Green
Link Ethernet

Connector5:
Antenna

Led1:
Green
Device state

Led2:
Yellow
LoRaWAN
comm.

Led3:
Yellow
Modbus
comm.

0V +V   Rx Gnd Tx

Modbus Slave /
LoRaWAN Gateway
HD67F02-2-B2-868MHz

DIPA

Ethernet

Led4:
Yellow
Error state

Dip-Switch A:
-Dip1 – Functioning Mode

OFF
1
ON
= Normal Mode

OFF
1
ON
= Boot Mode

Connector4:
RS232 port

Tx = Device Tx
Rx = Device Rx
Shl = Shield (to Isolated Ground)

Connector1:
Power Supply

0V = Ground
+V = Positive wire

V AC: min 8V ; max 24V
V DC: min 12V ; max 35V

0V +V Rx Shl Tx

Figure 1a: Connection scheme for HD67F02-2-B2-xxxMHz

Connector3:
Ethernet Port
(RJ45 Plug)

Led5:
Green
Link Ethernet

Connector5:
Antenna

Led1:
Green
Device state

Led2:
Yellow
LoRaWAN
comm.

Led3:
Yellow
Modbus
comm.

Led4:
Yellow
Error state

Dip-Switch A:
-Dip1 – Functioning Mode

= Normal Mode

= Boot Mode

Connector1:
Power Supply

0V = Ground
+V = Positive wire

V AC: min 8V ; max 24V
V DC: min 12V ; max 35V
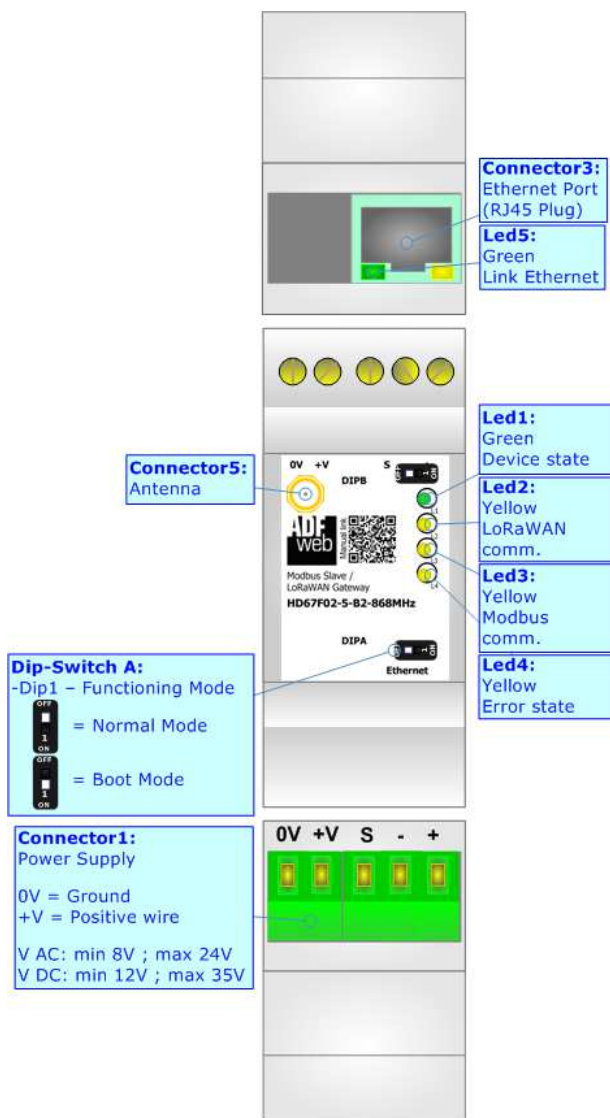
Figure 1b: Connection scheme for HD67F02-5-B2-xxxMHz

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CHARACTERISTICS:

The HD67F02-B2 is a Modbus Slave / LoRaWAN Gateway.

It allows the following characteristics:

- Electrical isolation between Serial 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 SW67F02 software on your PC in order to perform the following:

- Define the parameter of Modbus line;
- Define the parameter of LoRaWAN line;
- Define the list of LoRaWAN end-devices to connect;
- Define the LoRaWAN messages to send/receive from each LoRaWAN end-device;
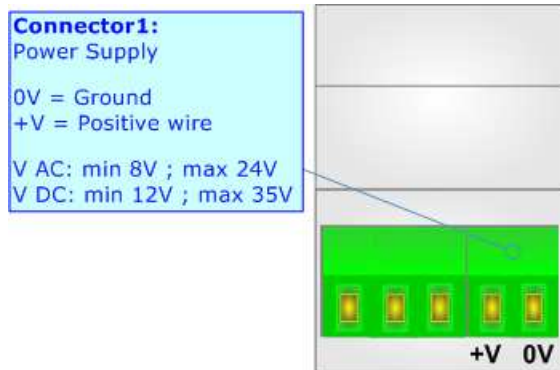- Update the device.

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POWER SUPPLY:

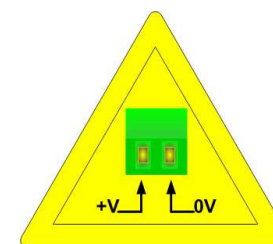The devices can be powered at 8…24V AC and 12…35V DC. For more details see the two tables below.

VAC $\sim$		VDC	
Vmin	**Vmax**	**Vmin**	**Vmax**
8V	**24V**	**12V**	**35V**

Consumption at 24V DC:

Device	Consumption [W/VA]
HD67F02-x-B2-xxxMHz	3.5

Connector1:
Power Supply

0V = Ground
+V = Positive wire

V AC: min 8V ; max 24V
V DC: min 12V ; max 35V

+V 0V

Caution: Not reverse the polarity power

+V   0V

HD67F02-x-B2-xxxMHz

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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.

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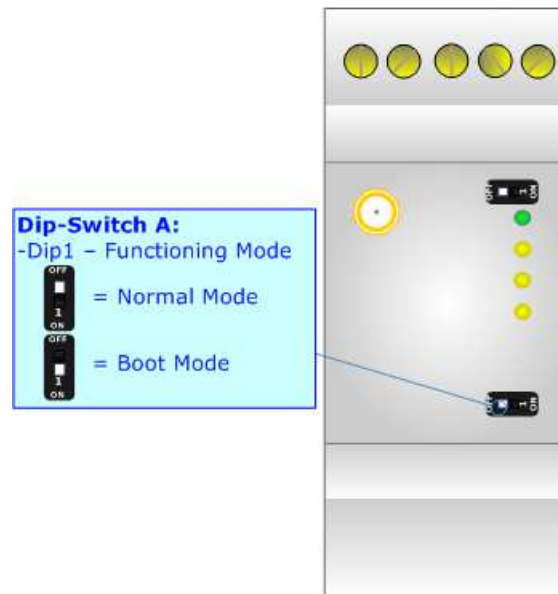
LEDS:

The device has got five 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 a LoRaWAN message is received	**Blinks quickly:** Boot state **Blinks very slowly (~0.5Hz):** update in progress
3: Modbus communication (yellow)	Blinks when a Modbus 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
5: Link Ethernet (Green)	**ON:** Ethernet cable inserted **OFF:** Ethernet cable not inserted	**ON:** Ethernet cable inserted **OFF:** Ethernet cable not inserted

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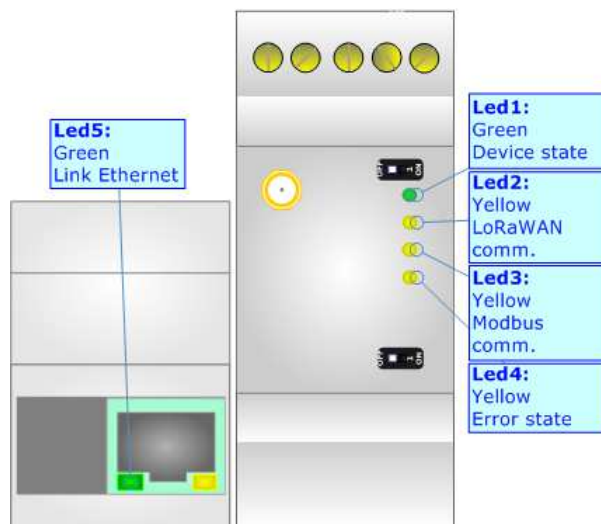
LORAWAN:

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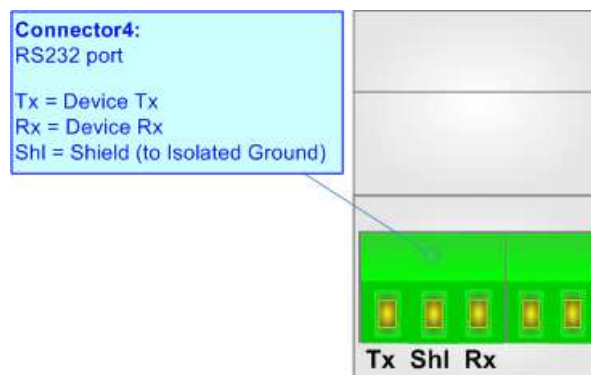
The converters support all the standard datarates and they work both on public and private networks.

Connector5:
Antenna

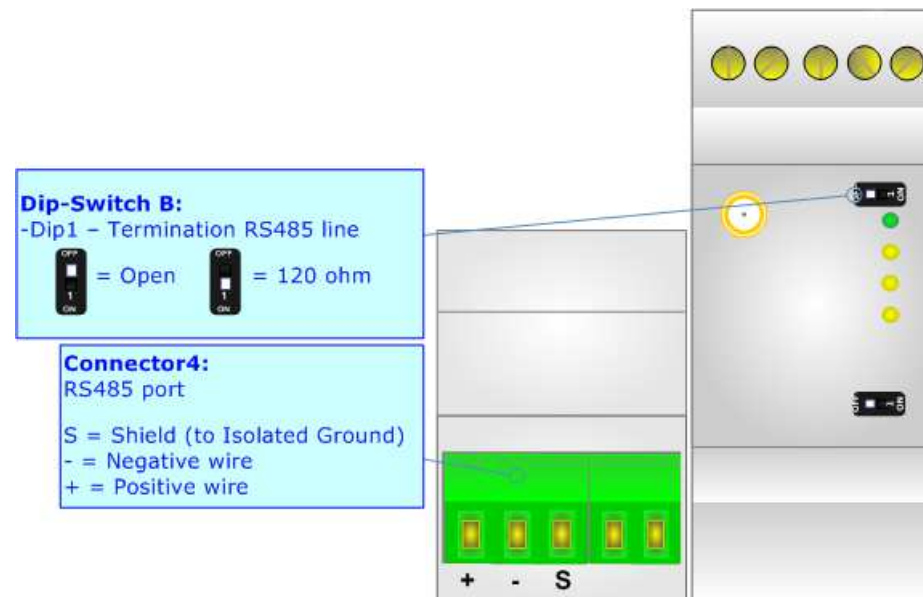*Industrial Electronic Devices*

RS232:

The connection from RS232 socket to a serial port (example one from a personal computer) must be made with a NULL MODEM cable (a serial cable where the pins 2 and 3 are crossed).
It is recommended that the RS232 cable not exceed 15 meters.

Connector4:
RS232 port

Tx = Device Tx
Rx = Device Rx
Shl = Shield (to Isolated Ground)

Tx Shl Rx

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RS485:

For terminating the RS485 line with a 120Ω resistor it is necessary to put ON dip 1, like in figure.

Dip-Switch B:
-Dip1 – Termination RS485 line

= Open   = 120 ohm

Connector4:
RS485 port

S = Shield (to Isolated Ground)
- = Negative wire
+ = Positive wire

+ - S

The maximum length of the cable should be 1200m (4000 feet).

Here some codes of cables:

- Belden: p/n 8132 - 2x 28AWG stranded twisted pairs conductor + foil shield + braid shield;
- Belden p/n 82842 - 2x 24AWG stranded twisted pairs conductor + foil shield + braid shield;
- Tasker: p/n C521 - 1x 24AWG twisted pair conductor + foil shield + braid shield;
- Tasker: p/n C522 - 2x 24AWG twisted pairs conductor + foil shield + braid shield.

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ETHERNET:

The Ethernet port is used for programming the device.

The Ethernet connection must be made using Connector3 of HD67F02-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.

Connector3:
Ethernet Port
(RJ45 Plug)
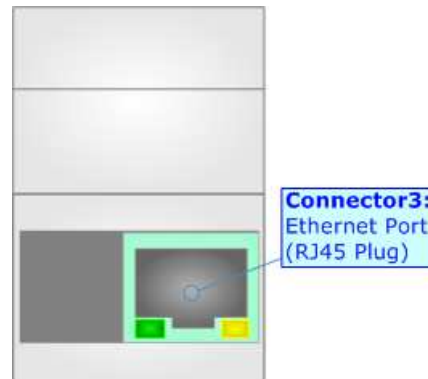
USE OF COMPOSITOR SW67F02:

To configure the Converter, use the available software that runs with Windows called SW67F02. 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, 11; 32/64bit).

When launching the SW67F02, the window below appears (Fig. 2).

Note:
It is necessary to have installed .Net Framework 4.


Figure 2: Main window for SW67F02

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NEW CONFIGURATION / OPEN CONFIGURATION:

The "**New Configuration**" button creates the folder which contains the entire device's configuration.
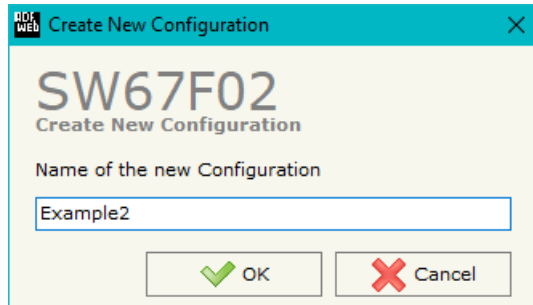
A device's configuration can also be imported or exported:

- To clone the configurations of a Programmable "Modbus Slave / LoRaWAN Gateway - 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**".
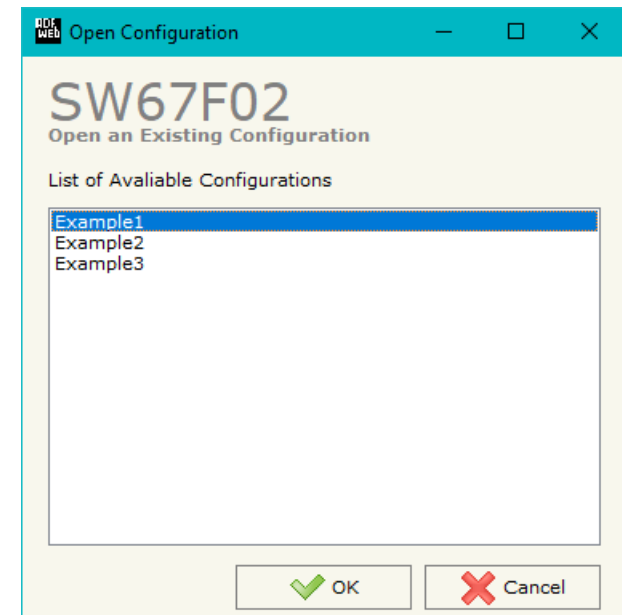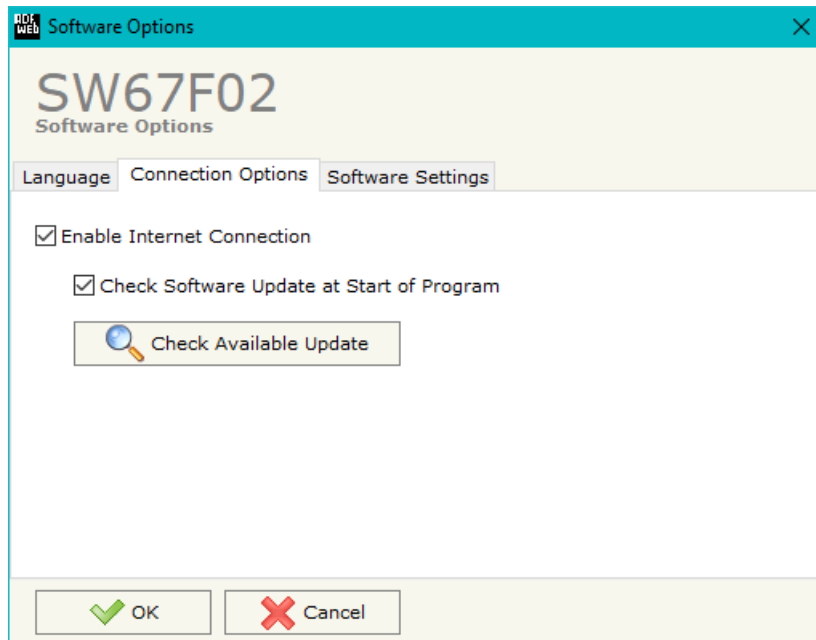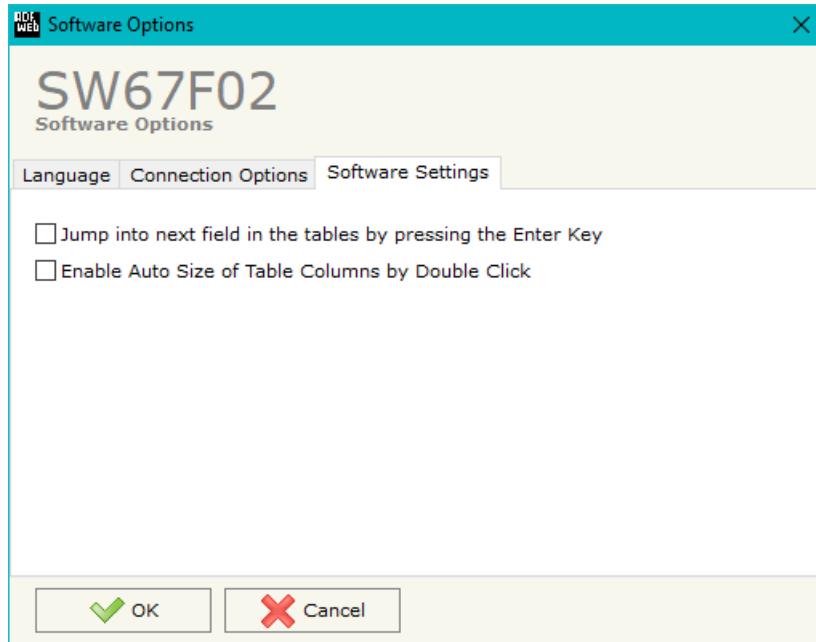
SOFTWARE OPTIONS:

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 SW67F02 check automatically if there are updatings when it is launched.

![ADFweb logo] Industrial Electronic Devices

Software Options

SW67F02
Software Options

Language | Connection Options | Software Settings

☐ Jump into next field in the tables by pressing the Enter Key

☐ Enable Auto Size of Table Columns by Double Click

✓ OK   ✗ Cancel

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.

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SET COMMUNICATION:

By Pressing the "**Set Communication**" button from the main window for SW67F02 (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:
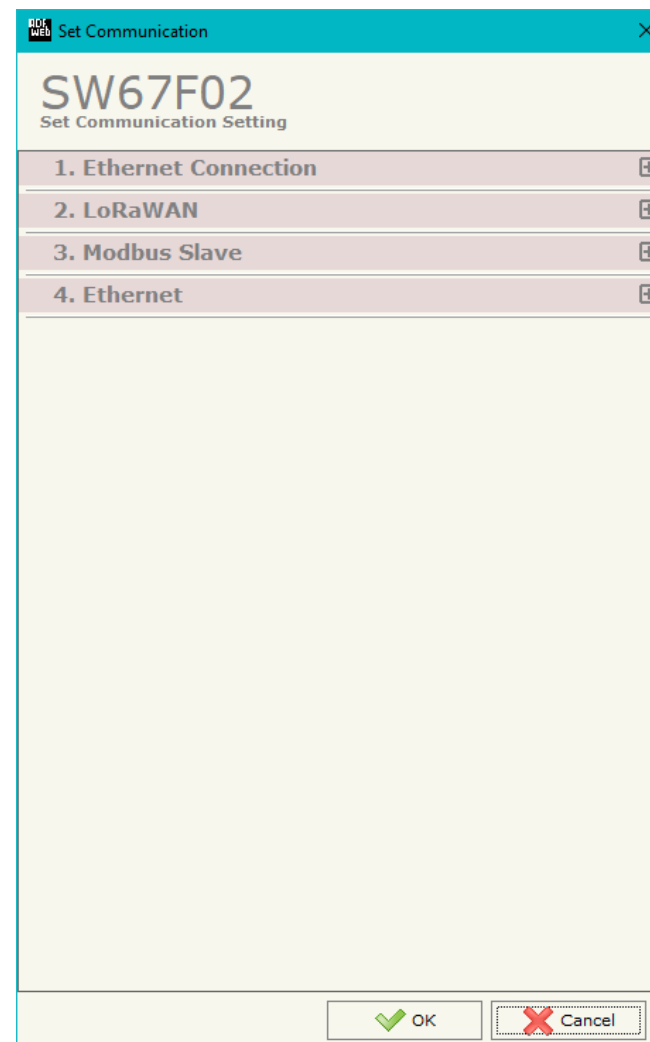
- Ethernet Connection
- LoRaWAN
- Modbus Slave
- Ethernet

Figure 3a: "Set Communication" window

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ETHERNET CONNECTION:

The means of the fields for "Ethernet Connection" are:

Figure 3b: "Set Communication → Ethernet connection" window

- In the field "**Device Name (Hostname)**" the Hostname to assign to the converter is defined;
- If the field "**Obtain an IP Address Automatically (DHCP for Cable Connection)**" is checked, DHCP for LAN connection is enabled;
- If the field "**Obtain an IP Address Automatically (DHCP for Wi-Fi Connection)**" is checked, DHCP for Wi-Fi connection is enabled;
- If the field "**Enable DNS**" is checked, DNS protocol is enabled;
- In the field "**Primary DNS**" the IP Address of the primary DNS server is defined;
- In the field "**Secondary DNS**" the IP Address of the secondary DNS server is defined.

LoRaWAN:

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

Figure 3c: "Set Communication→ LoRaWAN" window

- 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;
- In the field "**Diagnostic Position**" it is possible to define an offset into the internal memory array where the status of the LoRaWAN end devices configured is saved. The diagnostic is made bit to bit, so each bit will represent a status of a single end device:
  - o   1 → End device connected;
  - o   0 → End device not connected.

  The bits' order will be the same of the end devices' definition inside the LoRaWAN Access section;
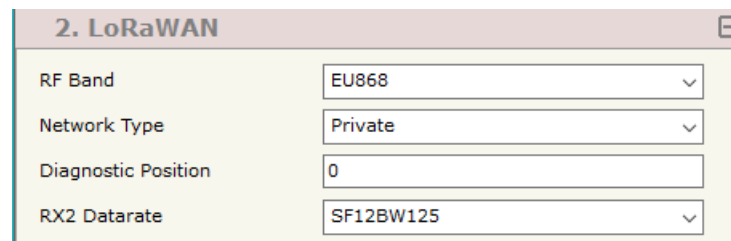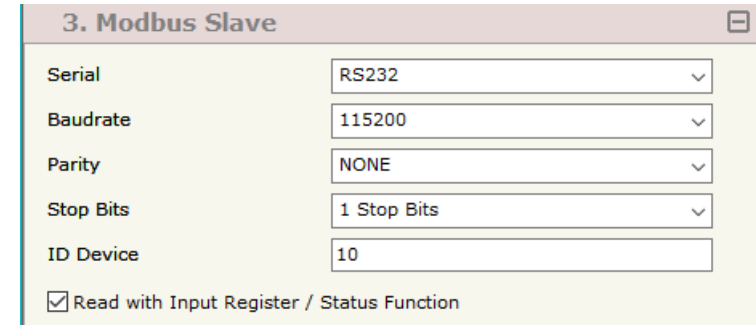- In the field "**RX2 Datarate**" the data rate on RX2 window is defined.

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MODBUS SLAVE:

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

- In the field "**Serial**" the serial port to use is defined;
- In the field "**Baudrate**" the baudrate for the serial line is defined;
- In the field "**Parity**" the parity of the serial line is defined;
- In the field "**Stop Bits**" the number of Stop Bits of the serial line is defined;
- In the field "**ID Device**" the ID of Modbus side of the converter is defined;
- If the field "**Read with Input Register / Status Function**" is checked, it is possible to read the Input bytes of LoRaWAN side with Input Registers (Function 04) and write the Output bytes of LoRaWAN side with Holding Registers (Function 06/16). The Output bytes are readable with Function 03. Otherwise, only Holding Registers will be used and the Output bytes of LoRaWAN side cannot be read back.
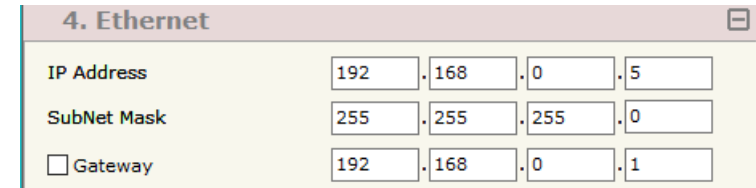
Figure 3d: "Set Communication→ Modbus Slave" window

ETHERNET:

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

- In the fields "**IP Address**" the IP address for Ethernet side of the converter is defined;
- In the fields "**SubNet Mask**" the SubNet Mask for Ethernet 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.

Figure 3e: "Set Communication→ Ethernet" window

LORAWAN ACCESS:

By Pressing the "**LoRaWAN Access**" button from the main window for SW67F02 (Fig. 2) the window "LoRaWAN Gateway Set Access" appears (Fig. 4). This section is used to define the LoRAWAN end devices that will connect to the converter and the list of LoRaWAN messages to read (Uplink Rules) and write (Downlink Rules) from each one.
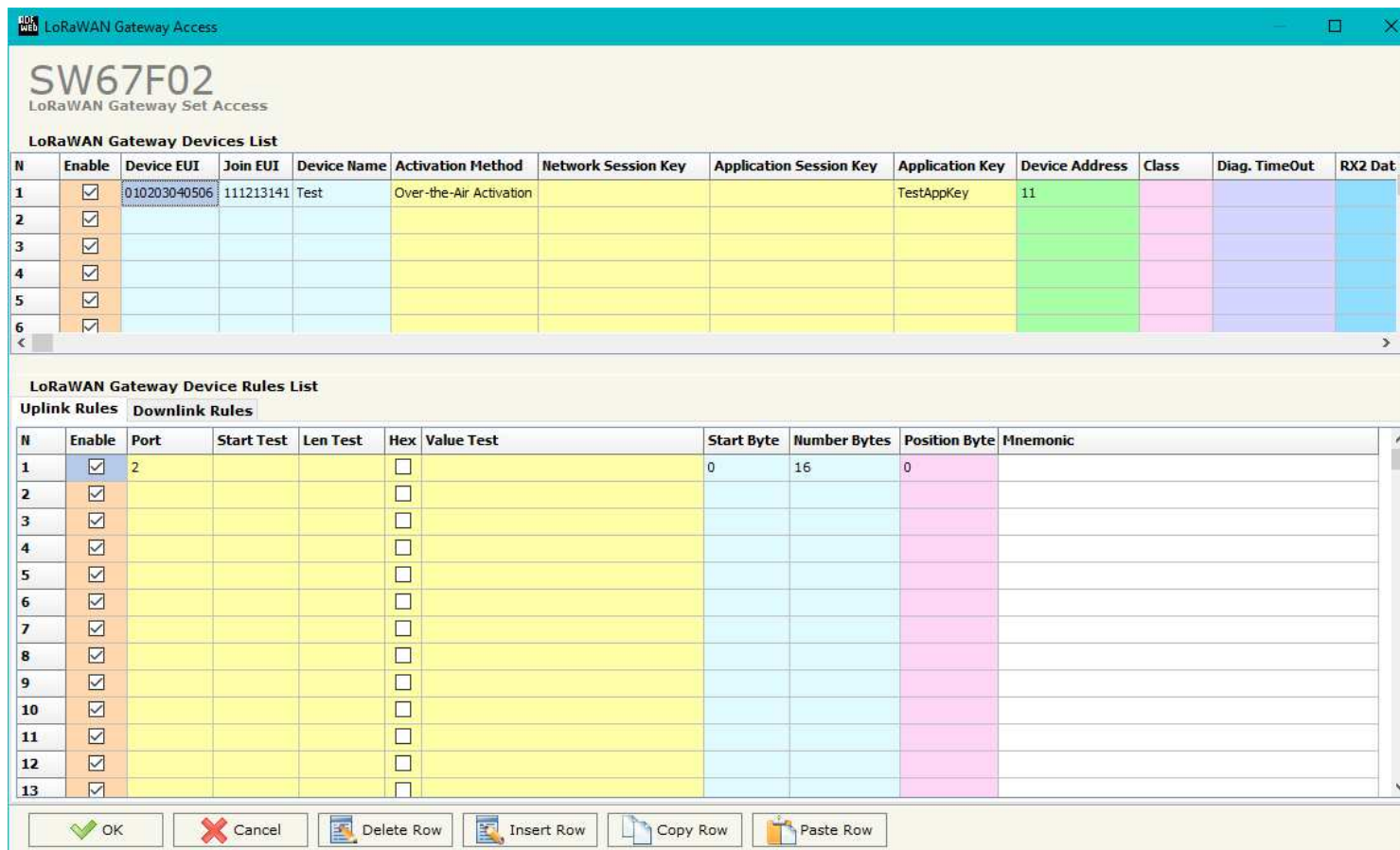

Figure 4a: "LoRAWAN Gateway Set Access" window

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In the "**LoRaWAN Gateway Devices List**", the list of LoraWAN end devices to connect is defined. The means of the fields for configuration are:

- If the field "**Enable**" is checked, the LoRaWAN end device is enabled;
- In the field "**Device EUI**" the Device EUI for the LoRaWAN device is defined;
- In the field "**Join EUI**" the Join EUI for the LoRaWAN device is defined;
- In the field "**Device Name**" the name of the LoRaWAN device is defined;
- In the field "**Activation Method**" the activation method for LoRaWAN device is defined;
- In the field "**Network Session Key**" the Network session key for LoRaWAN connection is defined;
- In the field "**Application Session Key**" the Application session key for LoRaWAN connection is defined;
- In the field "**Application Key**" the Application key for LoRaWAN connection is defined;
- In the field "**Device Address**" the address of the LoRaWAN device is defined;
- In the field "**Class**" the Class of the LoRaWAN device is defined;
- In the field "**Diag. TimeOut**" the timeout in ms for LoRaWAN communication is defined. If the LoRaWAN messages are received for this timeout, the correspondent bit for the diagnostic of Modbus side is set to 1;
- In the field "**RX2 Datarate**" the datarate used into the RX2 window is defined (optional).
- In the field "**Mnemonic**" a description of the LoRaWAN device is defined.

Note:
    It is recommended to set the "Diag. Timeout" with a higher time than the cyclic delay used by the LoRaWAN device to send data.

In the "**LoRaWAN Gateway Device Rules List**", the list of rules to get LoraWAN data from selected end device is defined. The table is splitted in two: "Uplink Rules" for the data to be received from LoRaWAN and mapped to Modbus side and "Downlink Rules" for the data to be written from Modbus to LoRaWAN side.

LoRaWAN Gateway Device Rules List

Uplink Rules | **Downlink Rules**

N	Enable	Port	Start Test	Len Test	Hex	Value Test	Start Byte	Number Bytes	Position Byte	Mnemonic
1	☑	2	0	2	☑	0000	2	4	0	
2	☐	2	0	2	☑	0001	2	4	4	
3	☐	2	0	2	☑	0002	2	12	8	
4	☑				☐					
5	☑				☐					
6	☑				☐					
7	☑				☐					
8	☑				☐					
9	☑				☐					
10	☑				☐					
11	☑				☐					
12	☑				☐					
13	☑				☐					

Figure 4b: "Uplink Rules" table

The means of the fields in the window "Uplink Rules" are the following:

- If the field "**Enable**" is checked, the LoRaWAN rule is enabled;
- In the field "**Port**" the port used for LoRaWAN communication is defined;
- In the field "**Start Test**" it is possible to define the starting byte to check (offset inside the LoRaWAN message) for recognizing specific LoRaWAN messages from end device (optional);
- In the field "**Len Test**" the number of bytes to check from the starting one is defined (optional);
- If the field "**Hex**" is checked, the data inside the LoRaWAN message is defined as Hex string (optional);
- In the field "**Value Test**" the data to look for inside the test bytes is defined (optional);
- In the field "**Start Byte**" the starting byte to save from the LoRaWAN message (offset) is defined;
- In the field "**Number Bytes**" the number of consecutive bytes to save from starting byte is defined;
- In the field "**Position Byte**" the address of internal memory array where mapping the data from LoRaWAN is defined;
- In the field "**Mnemonic**" a description of the LoRaWAN rule is defined.

Figure 4c: "Downlink Rules" table

The means of the fields in the window "Uplink Rules" are the following:

- If the field "**Enable**" is checked, the LoRaWAN rule is enabled;
- In the field "**Port**" the port used for LoRaWAN communication is defined;
- In the field "**Start Byte**" the starting byte of the LoRaWAN message to write from Modbus is defined;
- In the field "**Number Bytes**" the number of consecutive bytes to write from starting byte is defined;
- If the field "**On Change**" is checked, the LoRaWAN message is sent only when the data from Modbus change;
- If the field "**On CMD**" is checked, the LoRaWAN message is sent when a Modbus request is received;
- If the field "**On Timer**" is checked, the LoRaWAN message is sent cyclically with the delay defined in "**Time (ms)**" field;
- In the field "**Position Byte**" the address of internal memory array from which taking the data is defined;
- In the field "**Mnemonic**" a description of the LoRaWAN rule is defined.

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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.

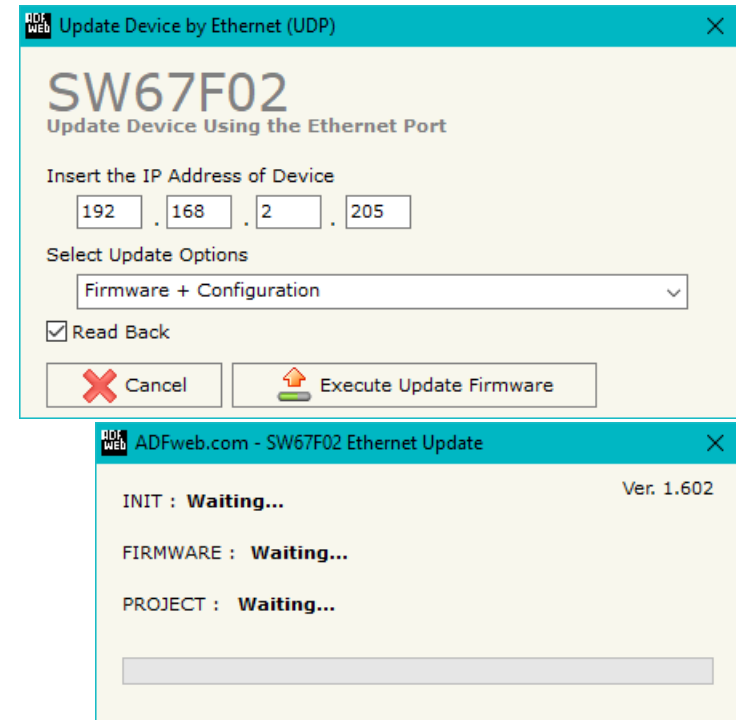At this point the configuration/firmware on the device is correctly updated.

Figure 5: "Update device" windows

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Note:
When you receive the device, for the first time, you also have to update the Firmware in the HD67F02 device.

Warning:
If Fig. 6 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;
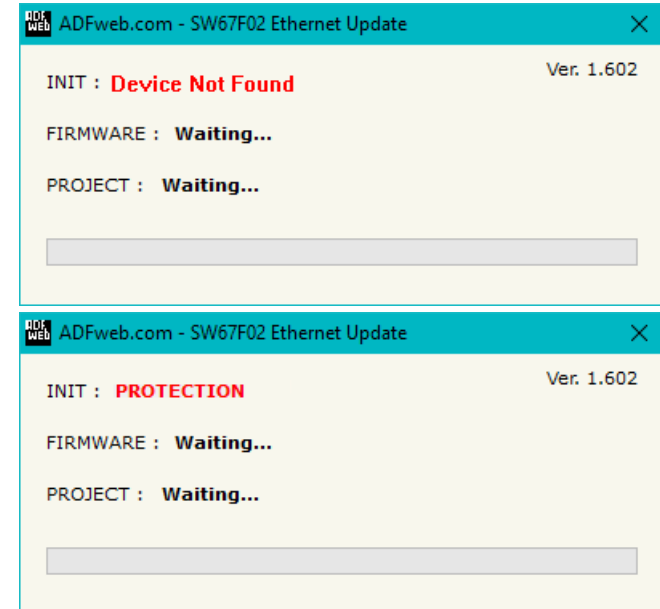+ Pay attention at Firewall lock.

Figure 6: "Error" window

Warning:
In the case of HD67F02 you have to use the software "SW67F02": www.adfweb.com\download\filefold\SW67F02.zip.

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MODBUS MAP:

On Modbus side, the map is created automatically. In relation to the configuration defined, it is possible to have two different maps.

Read with Input Register / Status Function not enabled

Data in reading:

Type	Address	Function	Description
Holding Register	0	03	Input Bytes 0-1 of internal array
Holding Register	1	03	Input Bytes 2-3 of internal array
Holding Register	2	03	Input Bytes 4-5 of internal array

.
.
.

Data in writing:

Type	Address	Function	Description
Holding Register	0	06/16	Output Bytes 0-1 of internal array
Holding Register	1	06/16	Output Bytes 2-3 of internal array
Holding Register	2	06/16	Output Bytes 4-5 of internal array

.
.
.

Note:
  The data can be read/written as single bits too using Coil Status (Function 01 and Functions 05/15).

Read with Input Register / Status Function enabled

Data in reading:

Type	Address	Function	Description
Input Register	0	04	Input Bytes 0-1 of internal array
Input Register	1	04	Input Bytes 2-3 of internal array
Input Register	2	04	Input Bytes 4-5 of internal array

.

.

.

Data in writing:

Type	Address	Function	Description
Holding Register	0	R: 03 W: 06/16	Output Bytes 0-1 of internal array
Holding Register	1	R: 03 W: 06/16	Output Bytes 2-3 of internal array
Holding Register	2	R: 03 W: 06/16	Output Bytes 4-5 of internal array

.

.

.

Note:
    The data can be read/written as single bits too using Input/Coil Status (Function 02 and Functions 01/05/15).
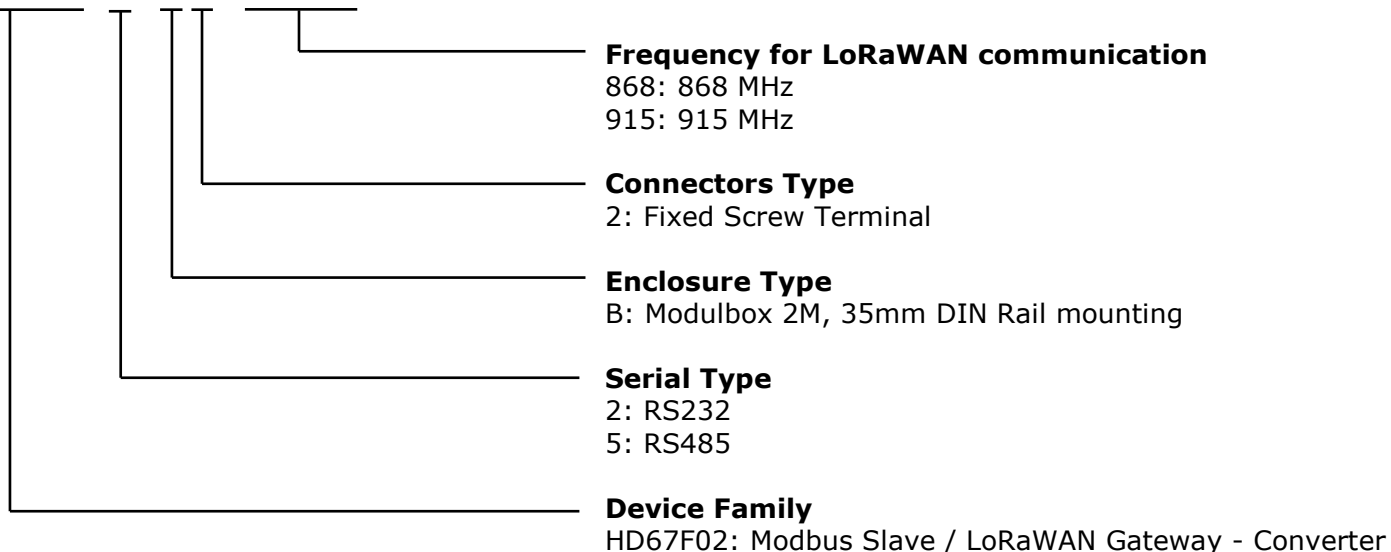
Industrial Electronic Devices
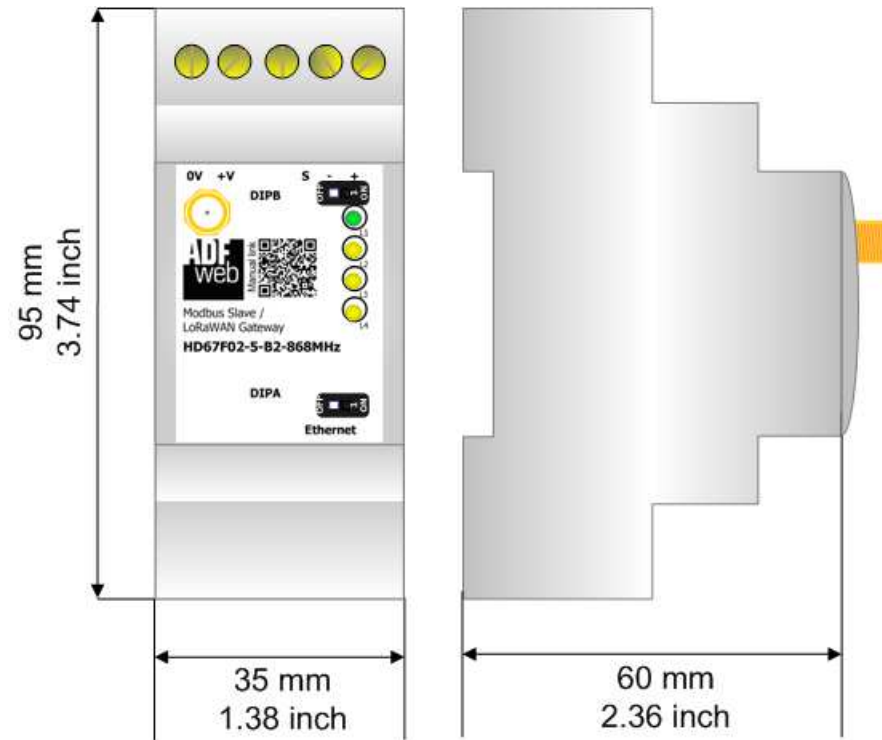
MECHANICAL DIMENSIONS:

Figure 7: Mechanical dimensions scheme for HD67F02-x-B2-xxxMHz

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ORDERING INFORMATIONS:

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

HD67F02 - x - B 2 - xxxMHz

Frequency for LoRaWAN communication
868: 868 MHz
915: 915 MHz

Connectors Type
2: Fixed Screw Terminal

Enclosure Type
B: Modulbox 2M, 35mm DIN Rail mounting

Serial Type
2: RS232
5: RS485

Device Family
HD67F02: Modbus Slave / LoRaWAN Gateway - Converter

Order Code: **HD67F02-2-B2-868MHz** -   Modbus Slave / LoRaWAN Gateway – Converter (RS232 port) (868MHz)
Order Code: **HD67F02-5-B2-915MHz** -   Modbus Slave / LoRaWAN Gateway – Converter (RS485 port) (915MHz)

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

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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.

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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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