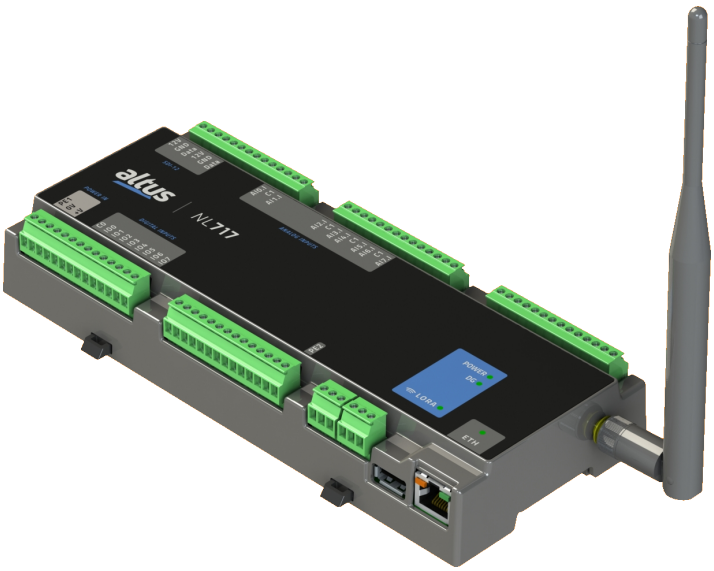
1. Product Description

Nexto Logger is a Datalogger belonging to the Nexto Series product family. It was developed to expand the Series' fields of activity and provides high-speed processing power in a compact design with digital and analog inputs, SDI-12 communication, and LoRa long-distance radio integrated into the same equipment.

This product was developed with a focus on monitoring and telemetry applications, in other words, systems that collect remote data, offering digital and analog inputs, all of them with high precision as required in the hydrological parameter monitoring market, solar energy generation applications, and other areas related to science and monitoring of physical quantities. In addition to the integrated inputs, it is possible to collect sensor data via SDI-12 network, the data is stored in the Datalogger's internal memory and sent to collection stations via the integrated ethernet network or via the long range radio frequency infrastructure, LoRa.

Nexto Logger is suitable for data collection in systems that require remote data collection. Its extended power supply range allows applications in different areas including powering with alternative energy sources such as solar power. It can be used in applications such as hydrology, sanitation (water and effluents), agribusiness, private and public urban infrastructure, sensor data collection for data analysis, and other scientific applications as a replacement for traditional analytical methods. In addition, it is an ideal solution to complement large applications together with the Nexto Series portfolio, extending the range of applications using the same technology and engineering environment. This is a great advantage for OEMs and integrators in these application areas where application scalability is required.



Its main features are:

- Compact design
- DIN rail mount
- High-speed 32-bit ARM-based processor
- 10/100 Mpbs Ethernet interface with protocols like OPC UA, EtherNet/IP, MODBUS and MQTT
- LoRa Long Range Radio
- Optoisolated digital inputs
- Analog current inputs
- Real-time clock (RTC)

2. Ordering Information

2.1. Included Items

The product package has the following items:

- Compact NL717 module
- Connectors
- 2dbi Omnidirectional Antenna

2.2. Product Code

The following code should be used to purchase the product:

Code	Description
NL717	NL717 - DATALOGGER 8DI 8AI LORA

Table 1: Product code

3. Related Products

The following products must be purchased separately when necessary:

Code	Description
MT8500	MasterTool IEC XE
NX9202	RJ45-RJ45 2 m Cable
NX9205	RJ45-RJ45 5 m Cable
NX9210	RJ45-RJ45 10 m Cable
AMJG0808	Simple cable RJ45-RJ45 2 m
GW700	GATEWAY LORA, ETH, USB

Table 2: Related Products

Notes:

MT8500: MasterTool IEC XE is available in four different versions: LITE, BASIC, PROFESSIONAL and ADVANCED. For more details, please check MasterTool IEC XE User Manual - MU299609.

NX92xx: Cable for programming the CPUs of the Nexto Series and Ethernet point-to-point with another device with Ethernet interface communication.

AMJG0808: Cable for programming the CPUs.

4. Product Features

4.1. General Features

	NL717
Digital Inputs	4
Fast Inputs	4
Max. number of high-speed counters	1
Max. number of external interruptions	2
Current Analog Inputs	8
Ethernet TCP / IP interface	1
USB interface	1
Max. number of tasks	16
Programming languages	Structured Text (ST) Ladder Diagram (LD) Sequential Function Chart (SFC) Function Block Diagram (FBD) Continuous Function Chart (CFC)
Online changes	Yes
Watchdog	Yes
Real-time clock (RTC)	Yes Resolution of 1 ms, max. variance of 95 seconds per year, retention time of 14 days.
Status and diagnostic indication	LEDs, web pages and CPU's internal memory
Isolation	
Protective earth ⏚	1500 Vdc / 1 minute (1000 Vac / 1 minute)
Ethernet	1500 Vdc / 1 minute (1000 Vac / 1 minute)
Power Supply/ SDI-12	1500 Vdc / 1 minute (1000 Vac / 1 minute)
Analog Inputs	1500 Vdc / 1 minute (1000 Vac / 1 minute)
Digital Inputs	1500 Vdc / 1 minute (1000 Vac / 1 minute)
Maximum power dissipation	15 W
Maximum wire size	0,5 mm^2 (20 AWG) with ferrule 1,5 mm^2 (16 AWG) without ferrule
Minimum wire temperature rating	75 °C
Wire materia	Copper only
IP level	IP 20
Conformal coating of electronic circuits	Yes
Operating temperature	-20 to 60 °C
Storage temperature	-25 to 75 °C
Operating and storage relative humidity	5% to 96%, non-condensing
Vibration resistance (IEC 60068-2-6, sinus)	7 mm from 5 to 8,4 Hz 2 G from 8,4 to 500 Hz 10 sweeps each axis, 1 octave per minute
Shock resistance (IEC 60068-2-27, half-sine)	15 G for 11 ms, 6 shocks in each of 3 axis
Product dimensions (W x H x D)	215,5 x 98,8 x 34,0 mm
Package dimensions (W x H x D)	270,0 x 102,0 x 40,0 mm
Weight	370 g

	NL717
Weight with package	430 g
Standards and Certifications  **RoHS – 2011/65/EU**	Yes
 **ANATEL (16956-22-14445)**	Yes

Table 3: General Features

Notes:

For more details, please consult: www.gov.br/anatel.

This equipment is not entitled to protection against harmful interference and may not cause interference to properly authorized systems.

This product is not suitable for use in domestic environments as it may cause electromagnetic interference in which case the user is required to take necessary steps to minimize this interference.

Maximum Number of Tasks: This value represents the maximum total of user and system tasks. The detailed description of possible user tasks can be found on Project Profiles section of User Manual.

Conformal coating of eletronic circuits: Conformal coating protects the electronic components inside the product from moisture, dust and other harsh elements to electronic circuits.

USB Interface: The functionalities of the USB interface is not supported on the NL717, and it is not possible to connect devices of this type to this interface on the NL717.

4.2. Memory

	NL717
Direct representation input variable memory (%I)	2 Kbytes
Direct representation output variable memory (%Q)	2 Kbytes
Direct representation variable memory (%M)	1 Kbytes
Symbolic variable memory	2 Mbytes
Full Redundant Data Memory	-
Direct representation input variable memory (%I)	-
Direct representation output variable memory (%Q)	-
Direct representation variable memory (%M)	-
Symbolic variable memory	-
Total memory **Program memory (limited to 2 MBytes) +** **Source code memory (backup)**	64 Mbytes
User files memory	8 Mbytes

Table 4: Memory

4.3. Protocols

	NL717	Interface
MODBUS TCP Client	Yes	NET 1
MODBUS TCP Server	Yes	NET 1
MODBUS RTU via TCP Client	Yes	NET 1
MODBUS RTU via TCP Server	Yes	NET 1
OPC DA Server	Yes	NET 1
OPC UA Server	Yes	NET 1
EtherNet/IP Scanner	Yes	NET 1
EtherNet/IP Adapter	Yes	NET 1
MQTT Client	Yes	NET 1
SNTP Client (for clock synchronism)	Yes	NET 1
SDI-12 Master Version 1.4	Yes	SDI-12

Table 5: Protocols

4.4. Ethernet

	Ethernet
Connector	Shielded female RJ45
Auto crossover	Yes
Maximum cable length	100 m
Cable type	UTP or ScTP, category 5
Baud rate	10/100 Mbps
Physical layer	10/100 BASE-TX
Data link layer	LLC
Network layer	IP
Transport layer	TCP (Transmission Control Protocol) UDP (User Datagram Protocol)
Diagnostic	LED (Link/activity)

Table 6: Ethernet Interface Features

4.5. LoRa Radio

	LoRa Radio
Connector	SMA female
Maximum cable length	10 m (Maximum)
Cable type	PigTail
Baud rate	290 bps to 50 kbps
Radio type	LoRaWan
Frequency Range	915-928MHz
Network layer	LoRaWan
Receiver Sensitivity	-140 dBm
Type of Antenna	Omnidirectional for outdoor environments
Output Power	27 dBm
Gain	2 dBi
Line-of-Sight Range	3 to 4km in urban areas and 10 to 12km in rural areas

Table 7: LoRa Radio Features

4.6. SDI-12

	SDI-12
Connector	3-pin connector block
Physical interface	SDI-12
Power Supply Output	12V
Maximum Current	500 mA
Communication Direction	Single data line in half-duplex
Cable length	60m (Maximum)
Transmission Rate	1200 bps
Protocols	SDI-12 Master Version 1.4
Max SDI-12 Sensors	10

Table 8: SDI-12 Interface Feature

Note:
For the correct operation of the SDI-12, the MainTask must be configured with a time lower than or equal to 20 ms.

4.7. Power Supply

	Power Supply
Nominal Input Voltage	12 / 24 Vdc
Input Voltage	10 to 30 Vdc
Maximum Input Current (in-rush)	50A / 300 us
Maximum Input Current	1500 mA

Table 9: Power Supply Features

4.8. Digital Inputs

	Digital Inputs
Input Type	Optoisolated point type 1 An isolated group of 8 inputs
Input Voltage	12 Vdc / 24 Vdc 5 to 30 Vdc for logic level 1 0 to 2 Vdc for logic level 0
Input Impedance	4,12 kΩ
Maximum Input Current	7,28 mA @ 30 Vdc
Input State Indication	Yes
Response Time	0,1 ms
Input Filter	Disabled or 2ms to 255ms - by software

Table 10: Digital Inputs Features

Note:

Input Filter: The filter sampling is performed on MainTask (or Refresh function), then it's recommended to use multiple values of the task interval.

4.9. Fast Inputs

	Fast Inputs
Number of fast inputs	4 (can be used as high-speed counter, External interrupt or normal input)
Max. number of high-speed counters	1
Max. number of external interrupts	2
Connector configuration	I00, I01, I02 and I03
Input voltage	12 Vdc / 24 Vdc 5 to 30 Vdc for logic level 1 0 to 2 Vdc for logic level 0
Input impedance	4,12 kΩ
Maximum input current	7,28 mA @ 30 Vdc
Configuration mode	**1-input modes:** Normal digital input External interrupt **2-input modes:** Up/Down (A count, B direction) with zero (uses I00, I01, I02) Quadrature 2x (uses I00, I01) Quadrature 2x with zero (uses I00, I01, I02) Quadrature 4x (uses I00, I01) Quadrature 4x with zero (uses I00, I01, I02)
Counting direction control	By software or hardware
Counting input detection edge	Rising edge, active at logic level 1 (except for quadrature 4x, where it counts on both edges)

	Fast Inputs
Data format	Signed 32-bit integer
Operation limit	From - 2.147.483.648 to 2.147.483.647
Maximum input frequency	100 kHz
Minimum pulse width @ 24 Vdc	2 μs

Table 11: Fast Inputs Features

4.10. Analog Inputs

	Analog Inputs
Input Type	Voltage or current input, single ended, individually configured
Data Format	16 bits in two's complement, justified to the left
Converter Resolution	24 bits monotonicity guaranteed, no missing codes
Conversion Time	24 ms
Input status indication	Yes
Module Protections	Yes, protection against surge voltages and polarity inversion

Table 12: Analog Inputs Features

	Current Input Mode		
Input ranges	Range	Engineering Scale	Resolution
	0 to 20 mA	0 to 30.000	5,12 μA
	4 to 20 mA	0 to 30.000	5,12 μA
Precision	$\pm$0,3 % of full scale @ 25 °C $\pm$ 0,015 % of full scale / °C		
Over scale	3 % of full scale		
Maximum input current	30 mA		
Input impedance	270 Ω		
Configurable parameters	Signal type per input Filters Open Channel		
Low pass filter time constant	100 ms, 1 s, 10 s or disabled		

Table 13: Analog Input Characteristics - Current

Note:

Input ranges: : When configured as 4 to 20 mA, input signals lower than 4 mA will result in negative values (-7,500 for 0 mA). In MasterTool IEC XE, there is a parameter called *Open Loop Value* was included to select the behavior in this situation. The default value is *Disabled* (which provides a linear reading as described above), having also the option to provide a fixed reading equal to lower and upper limits ("0" or "30000").

5. Compatibility with Other Products

To develop an application for Nexto Series CPUs, it is necessary to check the version of MasterTool IEC XE. The following table shows the minimum version required (where the controllers were introduced) and the respective firmware version at that time:

Controller model	MasterTool IEC XE	Firmware version
NL717	3.51	1.13.9.0

Table 14: Compatibility with other products

Additionally, along the development roadmap of MasterTool IEC XE some features may be included (like special Function Blocks, etc...), which can introduce a requirement of minimum firmware version. During the download of the application, MasterTool IEC XE checks the firmware version installed on the controller and, if it does not meets the minimum requirement, will show a message requesting to update. The latest firmware version can be downloaded from Altus website, and it is fully compatible with previous applications.

6. Installation

ATTENTION

Products with broken warranty seal are not covered in warranty.

CAUTION

The device is sensitive to static electricity (ESD). Always touch in a metallic grounded object before handling it.

DANGER

Nexto Series can operate with voltage up to 250 Vac. Special care must be taken during the installation, which should only be done by qualified technical personnel. Do not touch on the wiring field when in operation.

6.1. Electrical Installation

DANGER

When executing any installation in an electric panel, certify that the main energy supply is OFF.

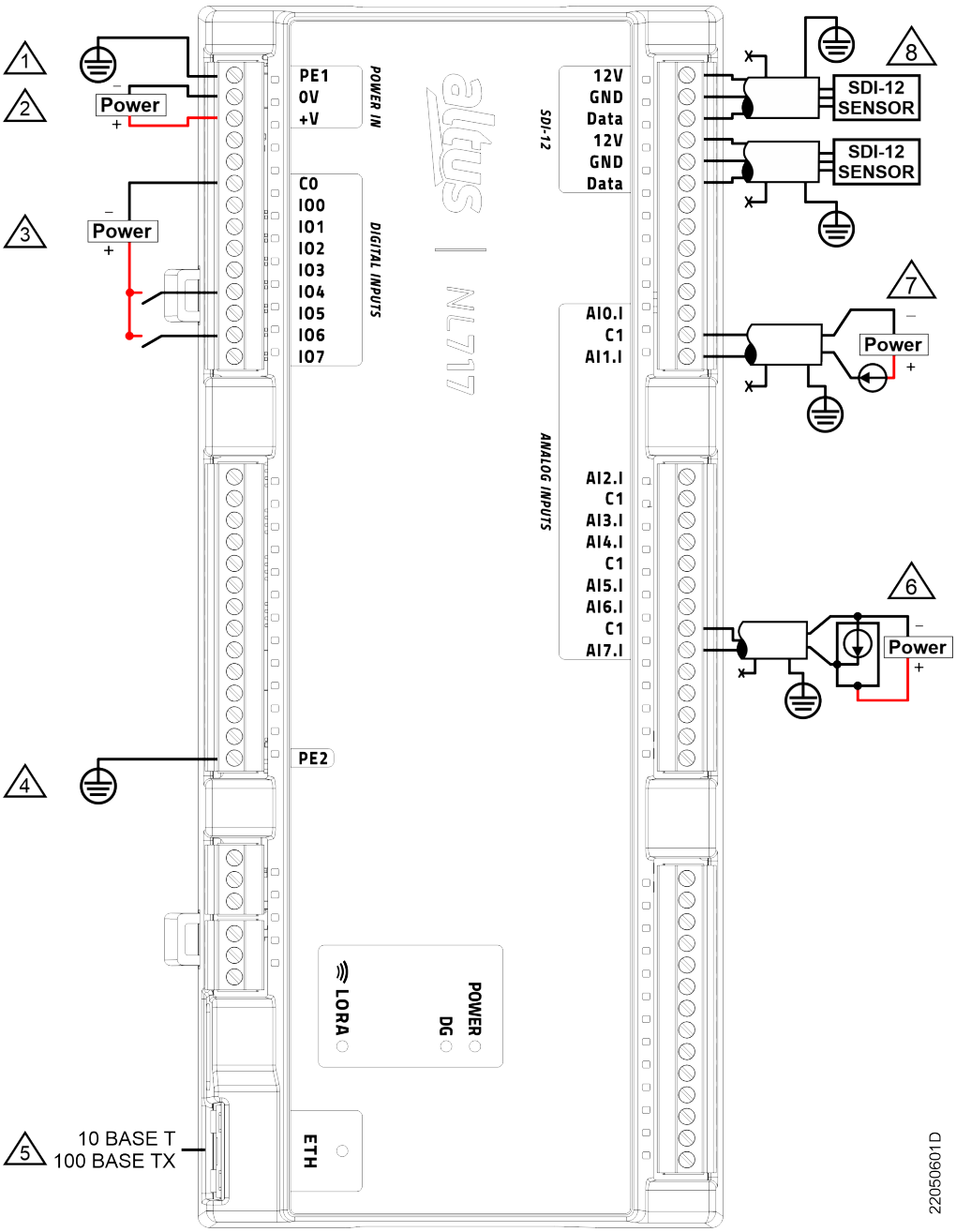


Figure 1: Electrical Installation

Diagram Notes:

1. Protective Earth terminal for power supply. Shall be externally connected to ground.
2. External power supply connection.
3. Typical connection of digital input (sink type). C0 is the common point for the isolated group I00 to I07.
4. Protective Earth terminal for communication ports. Shall be externally connected to ground.
5. Use Ethernet cables informed on Related Products section.
6. Typical connection of current analog input (field device with power supplied separately from analog signal).
7. Typical connection of current analog input (field device with power supply with the analog signal, 2-wire).
8. Typical sensor connection with 12Vdc power supply and SDI-12 communication.

6.2. Physical Dimensions

Dimensions in mm.

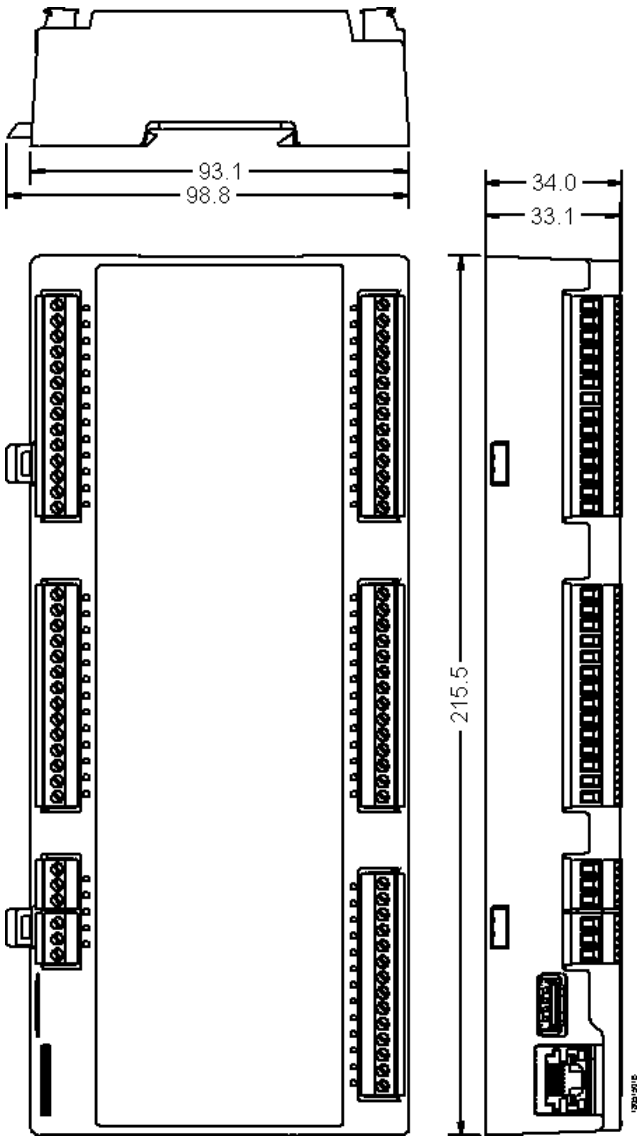


Figure 2: Physical Dimensions

7. Configuration and Usage

The configuration of the Nexto Logger NL717 in a LoRaWAN network is performed through an application for CPUs developed in the MasterTool IEC XE software in conjunction with the LoRa *"NextoLora"* library. Will be described in this topic the entire routine of creating an application and configuring the NL717 in a LoRa network, from registering the activation keys to using the library to send and receive data through the LoRaWAN network.

Registering a device in a LoRaWAN network requires prior configuration of the device on the server where it will be registered. This configuration will contain the radio frequency parameters that must be applied as well as the server access keys. During the creation of a new device (called ***end node***) in the server, several configurations should be noted for later use when configuring Nexto Logger in the LoRaWAN network.

Among these configurations are:

- **Frequency Plan (or Regional Band):** This parameter defines the frequency plan that the device will operate on. The setting of this parameter must be in absolute parity between all elements that involve the LoRaWAN network, such as the server, Gateway and End Device. (e.g. AU915).
- **Frequency sub-bands (or FSBs):** Some frequency plans also offer the configuration of communication sub-bands. As with frequency plans, sub-bands must be configured accordingly on all network elements (e.g. FSB1).
- **Adaptive Data Rate (ADR):** Defines the optimization of the choice of radio parameters in the device. When enabled, it allows the server to choose the parameters optimally (e.g. TRUE).
- **Unique Device Identifier (or Device EUI):** Unique identifier of an End node, can be generated by the server or provided by the device itself. This identifier is a 64-bit key, usually expressed in 8 hex bytes (e.g. [01 02 03 04 05 06 07 08]).
- **Class:** Defines the mode in which the end node will communicate over the LoRaWAN network. This parameter should be chosen according to the needs of energy use. Class A devices use less energy with some penalties in communication availability. Class C devices are always available on the network, but use more energy
- **Activation Modes:** Defines the mode in which the end device will be registered to the server. There are two ways of doing the device validation procedure on the server. The first, called Over the air activation (OTAA), activates the device via radio communication. During this process, the device communicates with the server using two identification keys for the server and the application, and then the security and encryption keys are exchanged between the server and the device in a secure manner. This activation process is called JOIN and ensures that the encryption keys are hidden, maintaining the security of the network and the secrecy of the communication content.
  The two keys required for the JOIN by OTAA process are:

  1. **Unique application identifier (APP EUI):** 8 byte key. (e.g. [01 02 03 04 05 06 07 08]).
  2. **Application Key (APP Key):** 16 byte key (e.g. [01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10]).

  The second activation mode is called Activation By Personalization (ABP), in this activation mode the security keys are generated by the server and loaded manually on the end device. Since these keys are responsible for encrypting the content of the communication, this activation mode is highly insecure and should not be used in applications that demand high reliability. This activation mode does not perform the JOIN process, since the keys will be written directly to the device. Altogether there are two security keys and one device address.

  1. **Application session key (APP Session KEY):** 16 byte key.
  2. **Network session key (NWK Session KEY):** 16 byte key.
  3. **Device Address (Dev ADDR):** 4 byte key (e.g. [01 02 03 04]).

Once you have the access keys and the other activation configuration parameters for the device, you can start the device on the network without difficulty. The first step is to open the MasterTool IEC XE development software and create a new project. The procedure for creating a new project can be seen in the following figures.

When opening MasterTool IEC XE access the menu *"File"* and then *"New Project..."* as illustrated in the figure below.

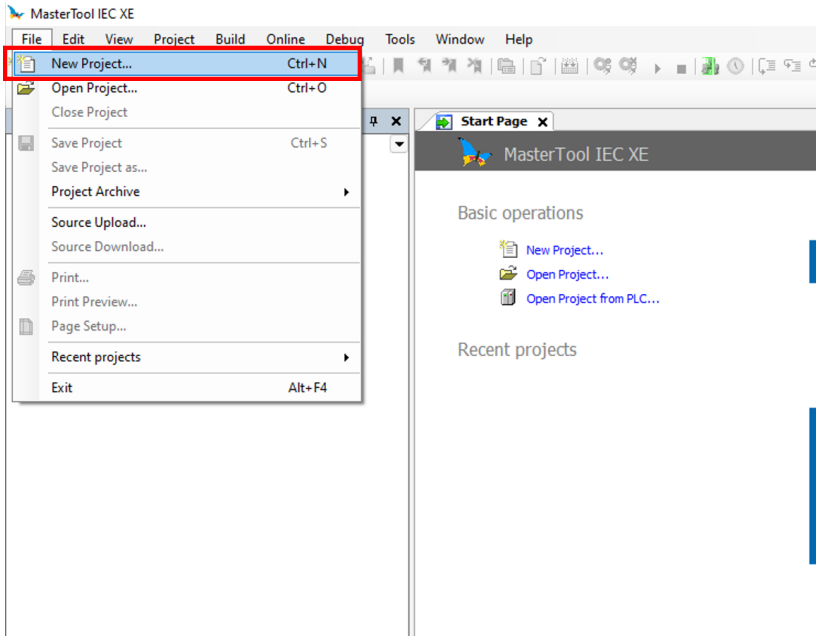


Figure 3: File -> New Project...

Next, select the *"MasterTool Standard Project"* template, indicate the project name and path to be saved, and continue by clicking the *"OK"* button as illustrated in the figure below.

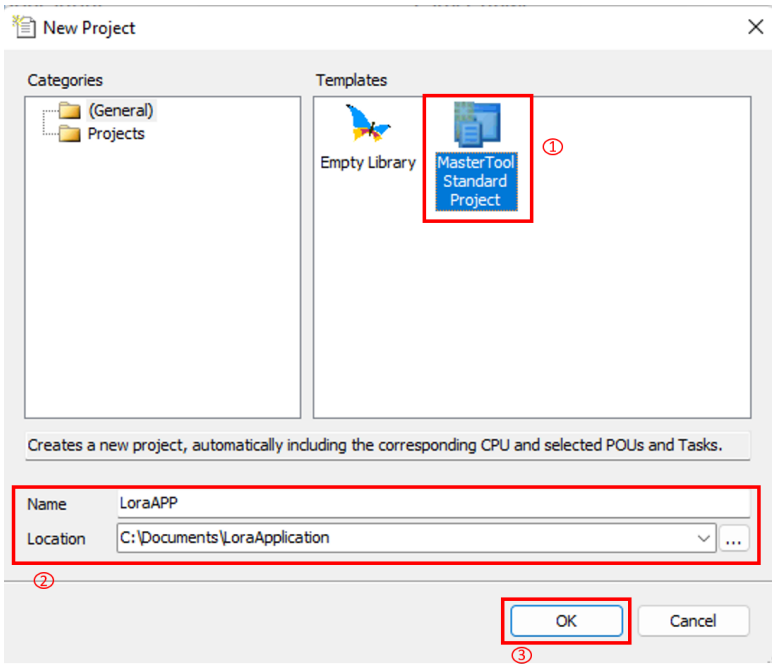


Figure 4: Configuring the project

Then choose the target device for the application. In this case, you should configure the Datalogger NL717 device, found in the *"Datalogger Controllers"* category. As illustrated in the figure below.

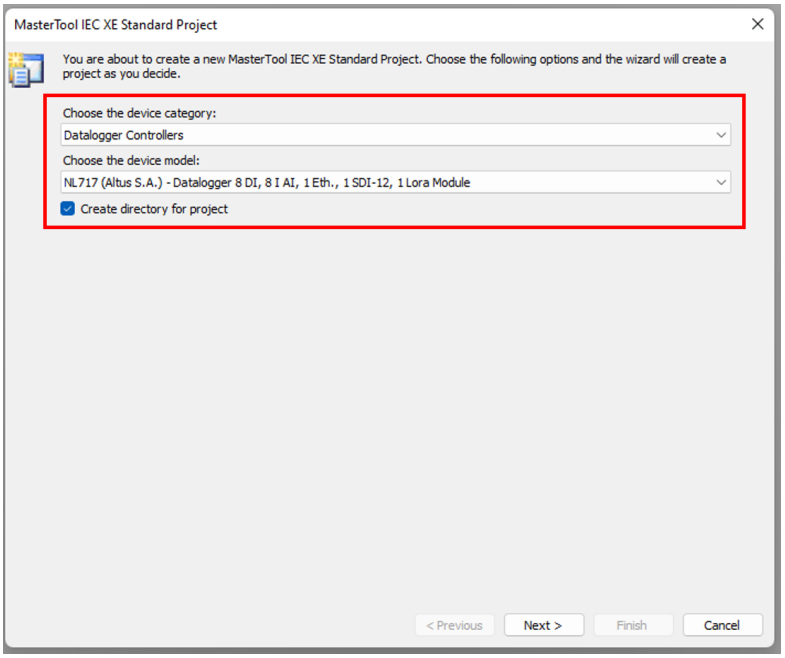


Figure 5: Selecting the device

With the new project created it's necessary to add the LoRaWAN interface library. To do this, access the *"Library Manager"* menu. The figure below illustrates the menu in question.

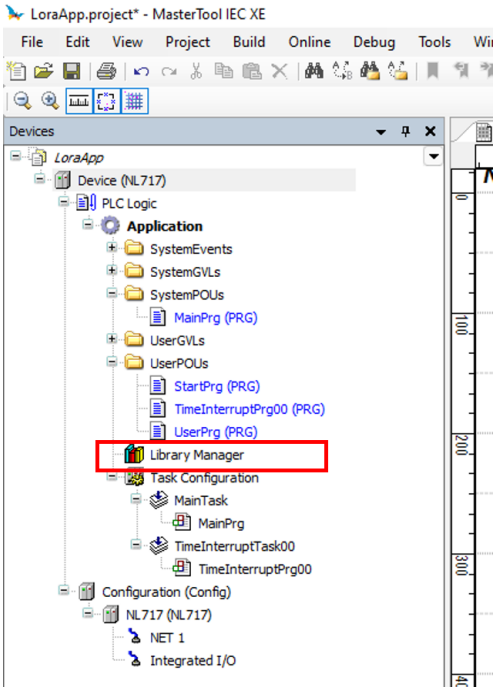


Figure 6: Library manager

A new library management tab will open in the main window of MasterTool IEC XE, click on the *"Add Library"* menu to access the menu for adding a new library to the project. The figure below illustrates the location of the access button.

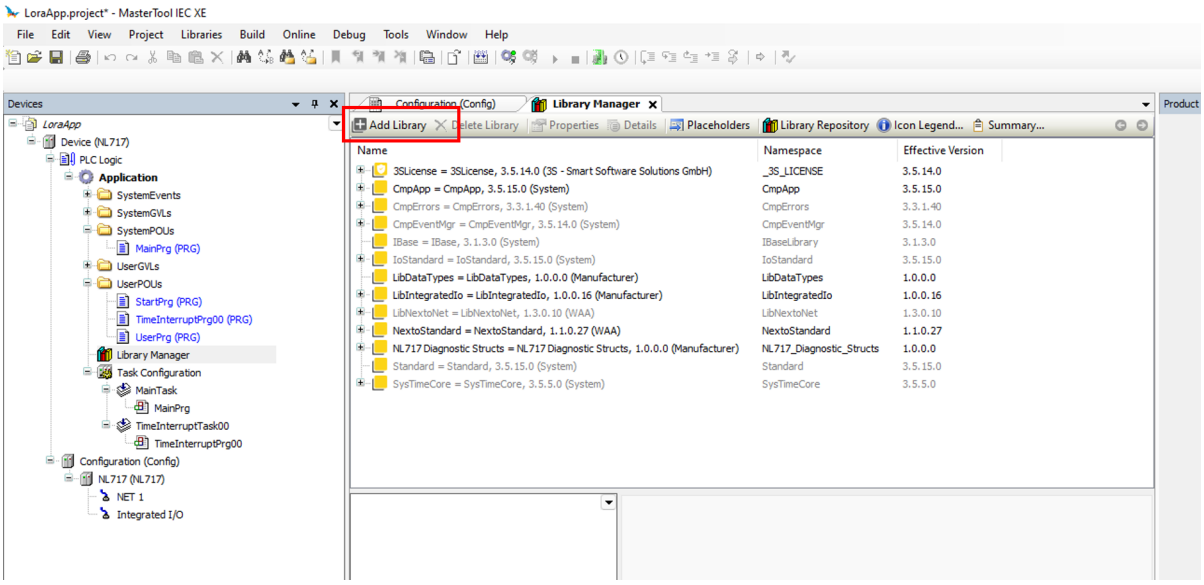


Figure 7: Add library

In the search bar type *"Nexto"* and in the results you will find the *"LibNextoLora"* library as shown in the figure below. Double-click on it to add it to the project.

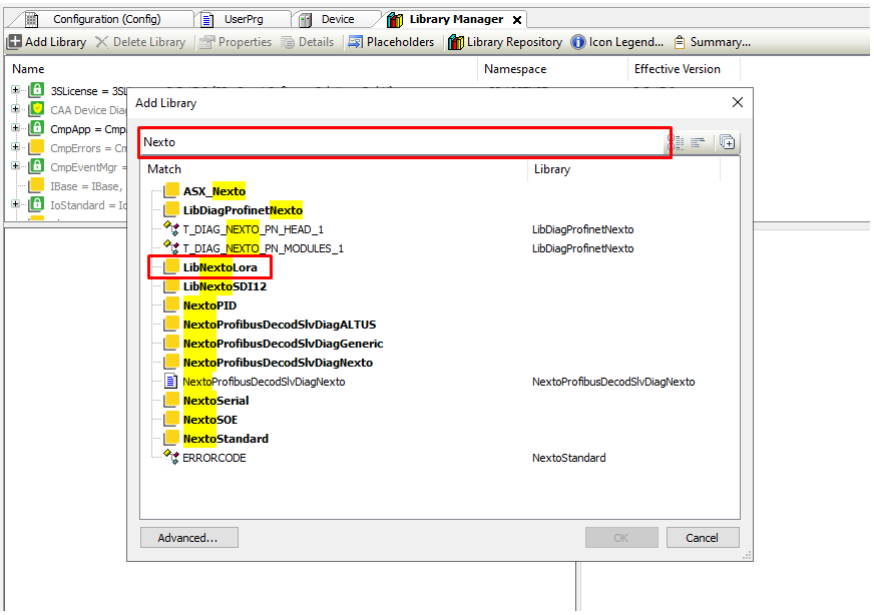


Figure 8: LibNextoLora library

Once included in the project it is possible to check the functional block of use, as well as the associated data structures. The block called *LORA_MASTER* is the only user interface of the library and provides all the operating states of the device through its state structures.

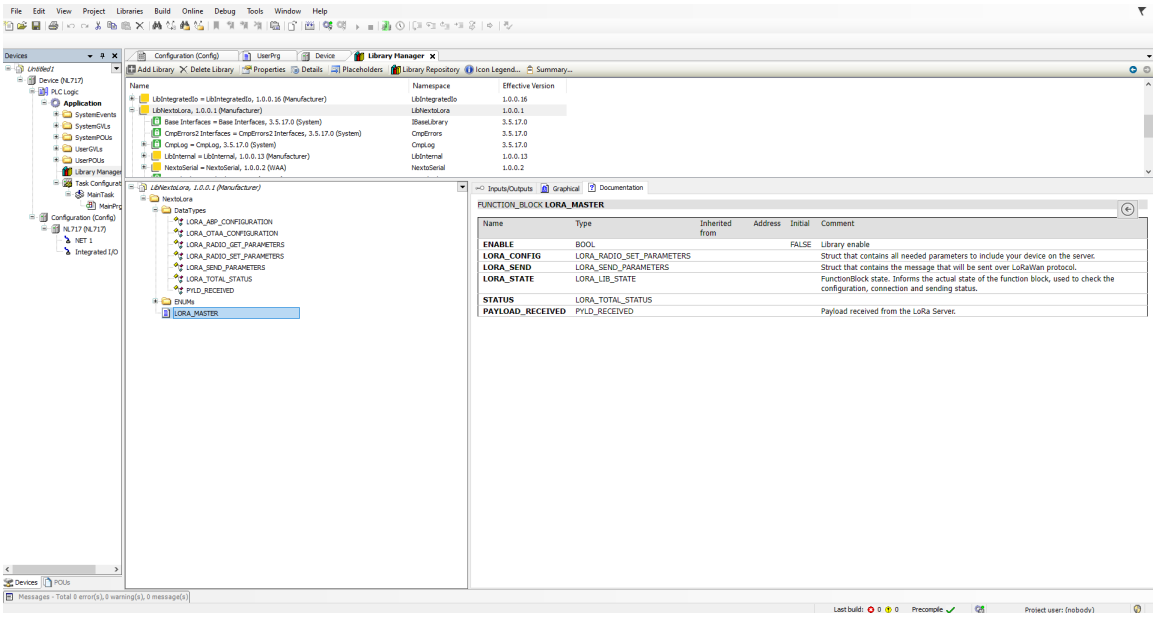


Figure 9: LibNextoLora library struct

To configure the LibNextoLora library blocks, see the following sections.

7.1. Usage of the LibNextoLora library

7.1.1. Configuration

The LibNextoLora library has a main block called *LORA_MASTER*, this block is responsible for executing the configuration and usage routines for the LoRa device. Device related settings are performed via the *LORA_CONFIG* input of the LORA_MASTER block, which receives a data structure of type *LORA_RADIO_SET_PARAMETERS*. Before executing the LORA_MASTER block via the *ENABLE* input, it is necessary to configure and assign its input parameters.

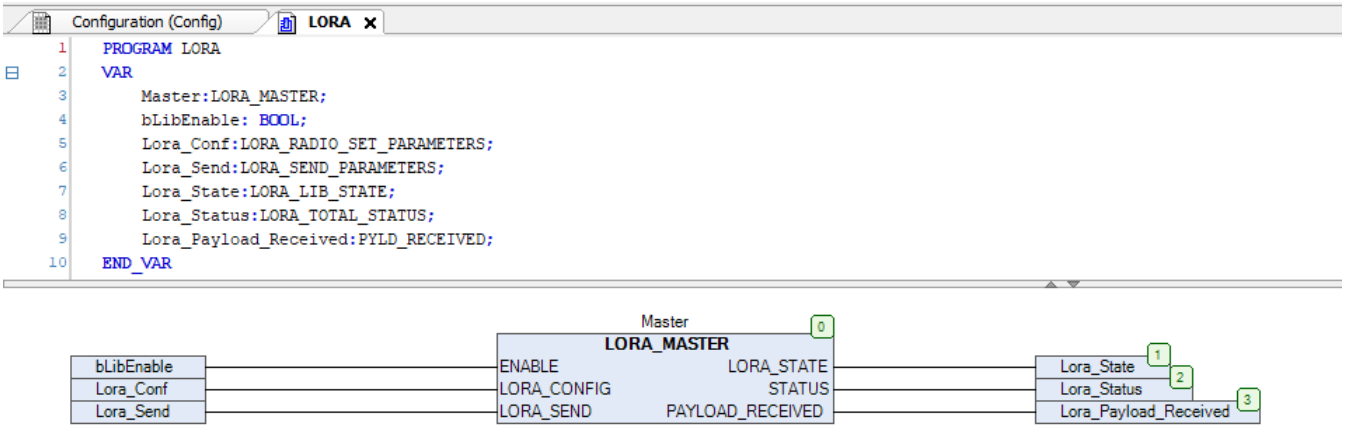


Figure 10: LORA_MASTER

7.1.1.1. LORA_RADIO_SET_PARAMETERS

With the development environment configured and having the keys and configuration parameters, it is possible to start the development of the application that will configure the device in the LoRaWAN network.

The device-related settings are made via the *LORA_CONFIG* input of the LORA_MASTER block, which receives a data structure of type *LORA_RADIO_SET_PARAMETERS* to be used as input parameters.

The use of this structure is quite simplified and can be seen in the figure below. Besides the access keys, which should be passed via a pointer to the array where they are stored, there is a variable type for each given parameter, in these types are listed the applicable configuration options available.

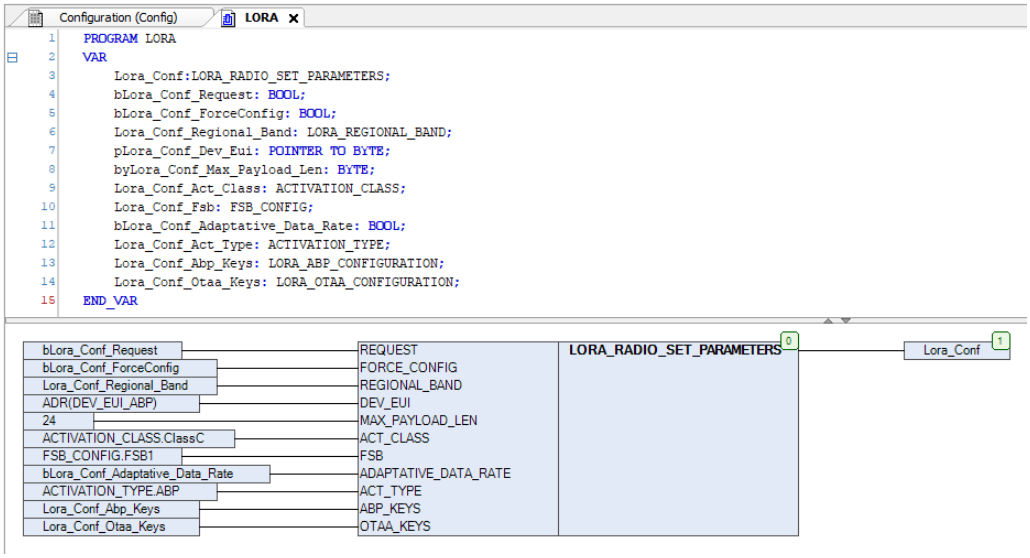


Figure 11: LORA_RADIO_SET_PARAMETERS

The types of configuration variables and their respective available options are:

- **REQUEST:** Enables a new configuration on the device, if the device does not yet have a valid join.
- **FORCE_CONFIG:** Forces a new configuration on the device, even if the device already has a valid join.
- **REGIONAL_BAND:** Defines the frequency band that will be used for LoRa communication. Frequency bands are groupings of frequency channels in which the device will communicate via the LoRa protocol. Each country has its own regulations and pre-definitions for the use of the radio spectrum for communication, so the device must operate in different frequency bands that fit the laws of the region where it will be used.
  Configuration options:
  1. According to the region where it is used. In Brazil: AU915.
- **DEV_EUI:** Unique device identification key. Receives the pointer to the vector containing the saved key.
- **MAX_PAYLOAD_LEN:** Defines the maximum size of the message that can be sent. Represents the maximum size in bytes that the device can send. Takes the integer value from 1 up to a maximum of 36.
- **ACT_CLASS:** The activation mode refers to the way the device sends and receives messages. When activated in *ClassA* the device prioritizes saving power and in *ClassC* prioritizes the availability of sending and receiving messages. It is recommended to use *ClassC* in all cases except when there is a need to save power.
  Configuration options:
  1. ClassA
  2. ClassC
- **FSB:** Frequency sub-band, within the regional bands there are also working frequency sub-divisions, the so-called frequency sub-bands (FSB). This should be chosen in parity with the working subband chosen in the Gateways and the server, by default the NL717 and GW700 devices use FSB2 for working.
  Configuration options:
  1. FSB1
  2. FSB2
  3. FSB3
  4. FSB4
  5. FSB5
  6. FSB6
  7. FSB7

8. FSB8

- **ADAPTATIVE_DATA_RATE:** The Data Rate parameter of LoRa communication indicates the bandwidth at which the message will be sent. The higher the Data Rate, the greater the capacity for sending data, i.e. more data can be sent in a single message. Conversely, the higher the Data Rate, the less effective the communication over long distances, significantly decreasing the communication distance. When the *ADAPTATIVE_DATA_RATE* mode is activated, the server takes care of choosing the ideal Data Rate for device communication, this adaptation process is time consuming and can cause a lot of communication instability, with few real gains associated with it. It is recommended to disable this function, so the device will communicate at the lowest Data Rate, but having a significant gain in communication distance.
- **ACT_TYPE:** Mode in which the device will be joined on the server. The first join mode, OTAA, allows the device to exchange access and encryption keys with the server during the join process. In this way the encryption keys are hidden and secure during the entire process, this is the most secure mode of join. In the second join mode, ABP, the access and encryption keys are pre-generated and loaded on the device before the join process. This mode offers a faster and easier join process but is less secure, since the encryption keys can be misappropriated.
  Configuration options:
  1. OTAA
  2. ABP
- **ABP_KEYS:** Receives a structure of type LORA_ABP_CONFIGURATION that must be filled in if the choice of join mode is of type *ABP*.
  - *LORA_ABP_CONFIGURATION:* Different from the others, which list available options, this is a data structure that contains the three keys needed for the join of ABP type.
    1. ABP_APP_SESSION_KEY: Receives the pointer of a vector that contains the saved key;
    2. ABP_NWK_SESSION_KEY: Receives the pointer of a vector that contains the saved key;
    3. ABP_DEV_ADDR: Receives the pointer of a vector that contains the saved key.

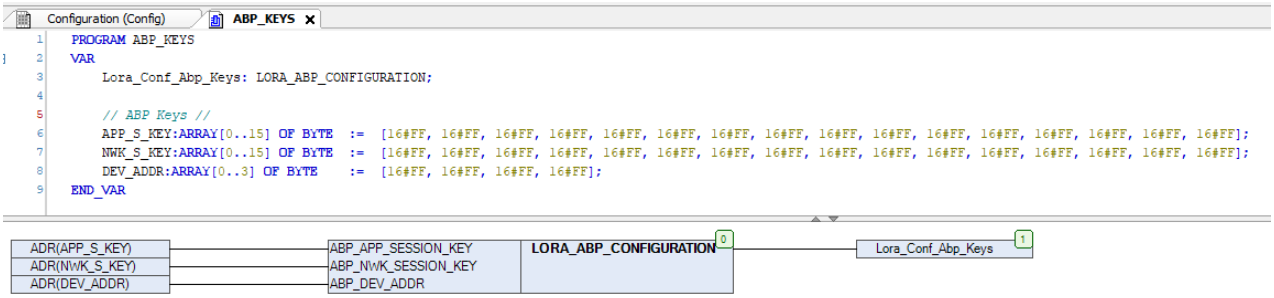


Figure 12: LORA_ABP_CONFIGURATION

- **OTAA_KEYS:** Receives a structure of type LORA_OTAA_CONFIGURATION that must be filled in if the choice of join mode is of type *OTAA*.
  - *LORA_OTAA_CONFIGURATION:* Data structure that contains the two keys needed for the join of OTAA type.
    1. OTAA_APP_EUI: Receives the pointer of a vector that contains the saved key;
    2. OTAA_APP_KEY: Receives the pointer of a vector that contains the saved key.

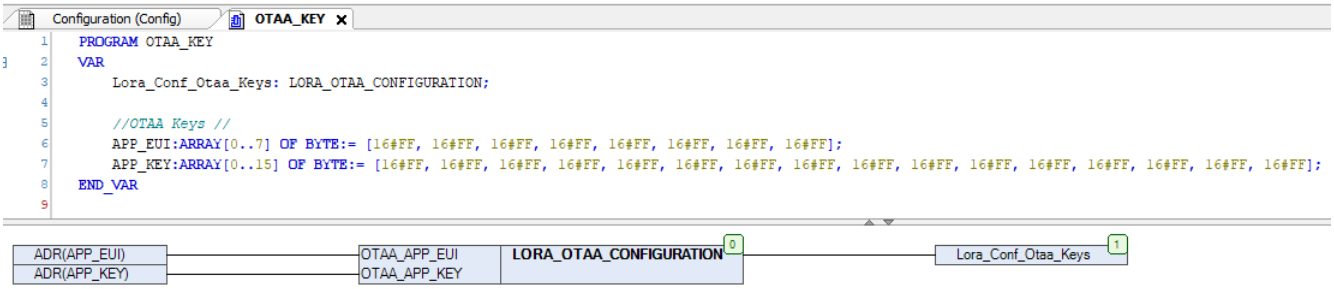


Figure 13: LORA_OTAA_CONFIGURATION

Once the configuration structure *LORA_RADIO_SET_PARAMETERS* has been properly filled in the *LORA_CONFIG* input and the *ENABLE* input of the *LORA_MASTER* block is set to *TRUE*, the block will run and start the library configuration and join of the LoRa device on the server with the entered keys, the progress of the process can be observed through the *LORA_STATE* output of the block.

7.1.2. Current status of the library

The *LORA_STATE* output informs the user of the current library and device state via the enumerable *LORA_LIB_STATE* that identifies what is happening in seven states. These are:

1. **DISABLED:** It informs that the block is disabled;
2. **INITIALIZING:** It informs that the block is initializing;
3. **INITIALIZATION_FAIL:** It informs that some failure occurred during block initialization;
4. **INTERNAL_ERROR:** It informs that there are internal errors preventing the block from working;
5. **NOT_JOINED:** It informs that the block has joined correctly but the device is not yet activated;
6. **JOINED_RDY_TO_SEND:** It informs that the device is joined and ready to send messages;
7. **JOINED_SENDING_DATA** It informs that the device is joined and performing the LoRa messaging process.

Once initialized, the block will perform a device join verification process, if the device already contains valid join information, this information will be used unless a new forced join is requested by the user via the *FORCE_CONFIG* variable of the *LORA_RADIO_SET_PARAMETERS* data structure. The join process is sometimes time consuming and can take anywhere from seconds to hours in extreme cases to complete successfully (it depends on the signal quality between the device and the LoRa Gateway). During the join process the library will remain in the *NOT_JOINED* state and will change to *JOINED_RDY_TO_SEND* once successfully joined.

Once joined, the device is ready to send LoRa messages. The process is done via the *LORA_SEND* input of the block that must be supplied with a structure of type *LORA_SEND_PARAMETERS* in this structure are all the necessary information for sending a message.

7.1.3. Message sending configuration

7.1.3.1. LORA_RADIO_SEND_PARAMETERS

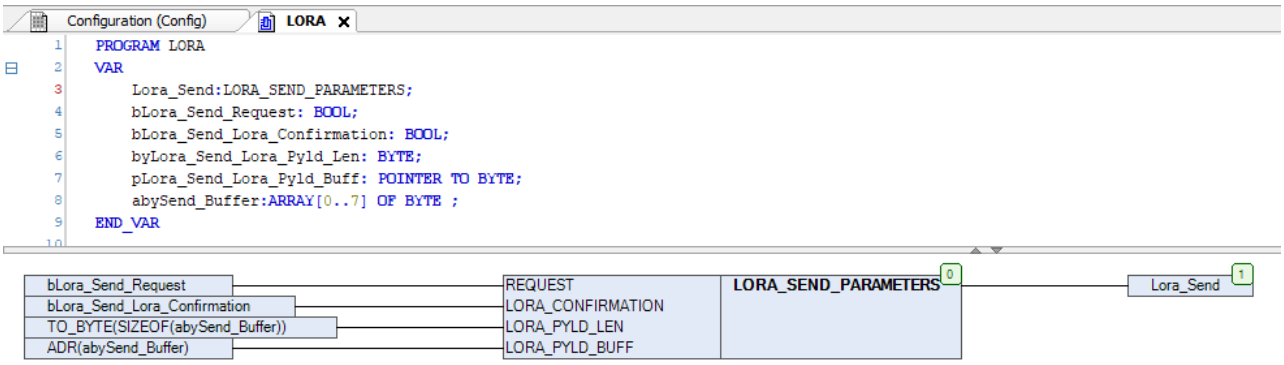


Figure 14: LORA_SEND_PARAMETERS

The description of each of the variables in this data structure is as follows:

- **REQUEST:** Requests a new message sending;
- **LORA_CONFIRMATION:** Sets the message confirmation mode;
- **LORA_PYLD_LEN:** Informs the size of the message that will be sent;
- **LORA_PYLD_BUFF:** Address of the buffer that contains the message that will be sent.

The state of the block will remain in *JOINED_SENDING_DATA* while the sending process is being performed, this process takes about 30 seconds. Once the sending is complete, the library state returns to *JOINED_RDY_TO_SEND* informing that the block is ready for a new sending.

7.1.4. Received messages

Messages received by the LoRa device can be viewed via the *PAYLOAD_RECEIVED* output of the block, a data structure of type *PYLD_RECEIVED* is used to report the received message data, these are:

- **PYLD_COUNTER:** Informs the total number of messages received;
- **PYLD_LEN:** Informs the size of the received message;
- **PYLD_BUFF:** Buffer that contains the received message.

7.1.5. Block Diagnostics

Via the *STATUS* output from the LORA_MASTER main block, it is possible to check all the information regarding the LoRa device, as well as the codes of the possible errors that might happen.

This output returns a data structure of type *LORA_TOTAL_STATUS*. This structure has three outputs (ERROR_CODE, LORA_GET_PARAM and ERROR_STATUS).

A binary variable is associated with the ERROR_STATUS output, which returns *TRUE* when an error occurs. The structures associated with the other outputs are:

- **TOTAL_ERROR_LIST:** Associated with the ERROR_CODE output, it contains a complete list of possible error causes, plus the error code of the last occurrence;
- **LORA_GET_PARAM:** Associated with the LORA_GET_PARAM output, it contains the activation information that was read from the LoRa device.

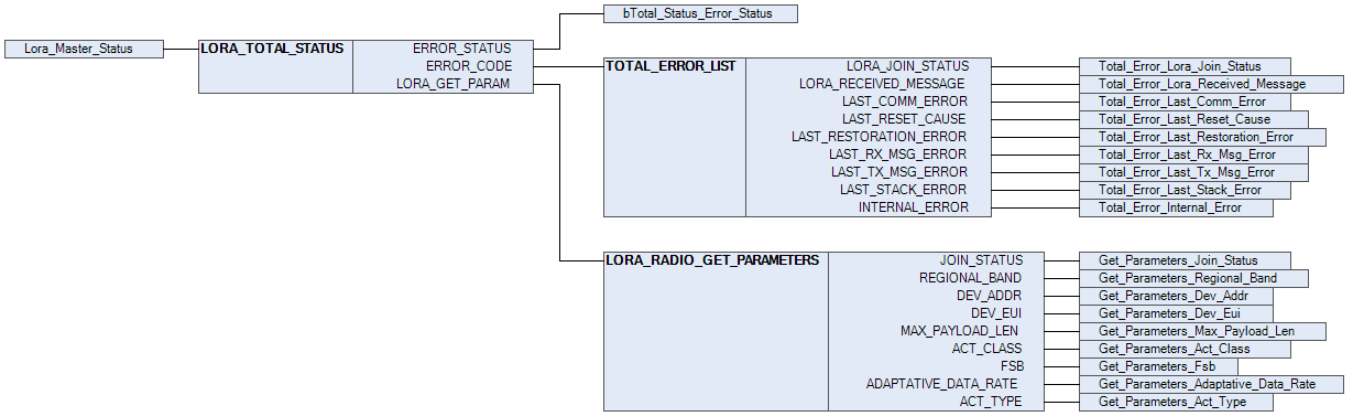


Figure 15: LORA_TOTAL_STATUS

8. Maintenance

8.1. LED Diagnostics

The Nexto Logger have a power (PWR) and a diagnostic indication (DG) LEDs. The following table shows the meaning of each state and its respective descriptions:

PWR	DG	Description	Causes	Priority
Off	**Off**	Not used	No power supply or Hardware problem	-
On	**Off**	Controller is booting	-	-
On	**On**	CPU is in RUN state, and there are no active diagnostics	-	5 (low)
On	**Blinking 1x**	CPU is in STOP state or no application loaded	-	2
On	**Blinking 2x**	There are active diagnostics	-	3
On	**Blinking 3x**	Data forcing	Some memory area is being forced by the user through MasterTool IEC XE	4
On	**Blinking 4x**	Hardware error	Internal hardware error	1
On	**Blinking 5x**	Power Failure	External power supply voltage is lower than acceptable threshold	0 (high)

Table 15: Description of the Diagnostic LEDs States

Note:
The *LoRa* LED is not used by the NL717.

9. Manuals

For further technical details, configuration, installation and programming, the table below should be consulted.

The table below is only a guide of some relevant documents that can be useful during the use, maintenance, and programming of this product.

Code	Description	Language
CE114000	Nexto Series – Technical Characteristics	English
CT114000	Série Nexto – Características Técnicas	Portuguese
CS114000	Serie Nexto – Características Técnicas	Spanish
MU214600	Nexto Series User Manual	English
MU214000	Manual de Utilização Série Nexto	Portuguese
MU299609	MasterTool IEC XE User Manual	English
MU299048	Manual de Utilização MasterTool IEC XE	Portuguese
MP399609	MasterTool IEC XE Programming Manual	English
MP399048	Manual de Programação MasterTool IEC XE	Portuguese
MU214606	MQTT User Manual	English
MU214609	OPC UA Server for Altus Controllers User Manual	English
NAP151	Utilização do Tunneller OPC	Portuguese

Table 16: Documents Related