Data collection and transmission device USPD PUMA 30.04.01.NB

# USER MANUAL

**Content**

## 1. Purpose

USPD PUMA 30.04.01.NB (hereinafter referred to as the device) is designed for the construction of automated information and measuring systems for resource accounting, as well as for the construction of systems for monitoring, dispatching, condition control and control of equipment modes at a remote facility.

The following types of devices can be connected to the USPD:

- pulse flow meters, counters;
- leak sensors;
- temperature sensors;
- alarm signals from external devices;
- metering devices with RS485.

List of supported counters:

- Mercury 203
- Mercury 230
- Mercury 234
- AIST A100
- AIST A300

The device provides data reading from external devices, with subsequent data transmission over NB-IoT cellular operator networks.

The device can be used:

- V composition information-measuring automated systemscommercial accounting of resources;
- as part of monitoring and dispatching systems;
- as part of the Smart City projects;
- as part of IoT (Internet of Things) projects.

## 2. Appearance and description of the device

The device is housed in a durable plastic case. Inside the case is a circuit board with a microcontroller, a memory device, an RS485 interface unit, a pulse output data readout circuit, a 1-Wire support circuit, and a wireless NB-IoT modem.

The battery is installed in the holder. Battery replacement is possible without the need for soldering.

The exterior of the housing features sealed entries for connecting the interface cable, external sensor wires, and antenna. LED indicators indicate the device's status.

The device's housing is flanged and can be mounted on a panel. It is equipped with a sealing gasket and has an IP65 protection rating. The device's appearance is shown in Figure 1.

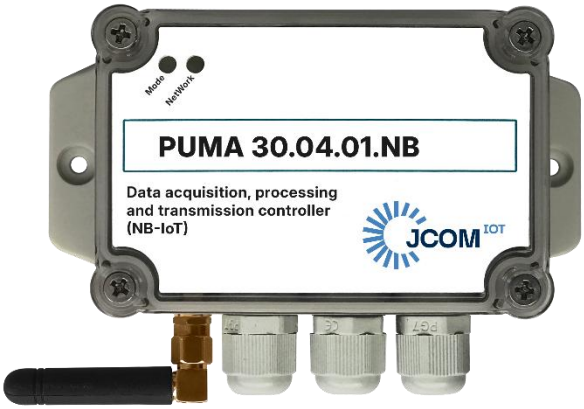



Fig. 1 – USPD PUMA 30.04.01.NB

## 3. Technical specifications

The technical characteristics of the device are given in Table 1. Table 1.

Technical characteristics of the USPD PUMA 30.04.01.NB

| **Name characteristics** | **Meaning** |
|---|---|
| Modification devices | **PUMA 30.04.01.NB** |
| Power specifications | Built-in lithium battery with a nominal voltage of 3.6 V, chemical composition: Li, SOCl2, battery size A, capacity 3.5 Ah, standard terminals<br>Continuous discharge current (max): 1A,<br>Pulse discharge current (max): 2A<br>Pipe: -55...85 °C, Size 18.5x18.5x50.5mm<br>**Battery type - ER18505M/T (FANSO)** |
| Built-in type modem | SIM7020E (SIMCOM) |
| Modem specifications | • LTE-Cat-NB1 (NB-IoT)<br>FDD-LTE:<br>• 1800 MHz (B3)<br>• /900 MHz (B8)<br>• /800 MHz (B20) |
| NB-IoT protocol stack | 3GPP Release 13 |
| Number of SIM cards | 1 |
| SIM card type | Mini SIM (2FF) |
| Indication (LEDs) | - Mode - the operating mode of the device<br>- Network - network status |
| Custom interface for configuration | RS485 |

| Name characteristics | Meaning | |
|---|---|---|
| Interface for connecting external devices | RS485 | |
| Opening sensor lids | There is | |
| Quantity independent inputs | 5 | |
| Input types | **Input 1, Input 2 (pulse, security).**<br>Configured to one of the types:<br>- to count pulses from a connected device<br>- Detection of the connected sensor's activation.<br>Typical applications:<br>- metering devices with pulse output (water meters, gas meters, flow meters).<br>- Water leak sensors, motion sensors, security sensors, opening sensors.<br><br>**Input 3, Input 4 (pulse, security, Namur).**<br>Configured to one of the types:<br>- to count pulses from a connected device<br>- recording the activation of the connected sensor.<br>- for counting pulses from a Namur standard device<br>Typical applications:<br>- metering devices with pulse output (water meters, gas meters, flow meters).<br>- Water leak sensors, motion sensors, security sensors, opening sensors.<br>- Meters with pulse output (water meters, gas meters) supporting the NAMUR standard, with recognition of open or short circuit in lines.<br><br>**Entrance 5**- connection of an external temperature sensor with a 1-wire interface | |
| Antenna | External magnetic base, with cable (3 m) | |
| Maximum length cables to sensors | RS485 | no more than 200 m |
| | Namur | no more than 3 m |
| | Pulse input from meters | no more than 3 m |
| | Discrete input | type reed switch for security sensors - no more than 20 m |
| Frame | Plastic (polycarbonate) | |
| Installation | To the panel | |
| Degree of protection | IP65 | |

| Name characteristics | Meaning |
|---|---|
| Cable entries | PG 7 cable glands |
| Connector type | Push-in terminal blocks for connecting external devices, SMA for antenna connection. |
| Operating range temperatures | -40 to + 70°C |
| Overall dimensions | No more than 145x90x55 mm (including flanges and cable glands) |
| Weight, no more than | 0.3 kg |
| Service life | 20 years (excluding battery) |

## 4. Configuring the device

### 4.1 List of configurable device parameters

Table 2 – Factory settings of the device (default)

| Parameter | Factory settings |
|---|---|
| **General settings** | |
| RS485 interface parameters | 115200-8-1-None |
| Frequency range | LTE- b3, b8, b20 |
| APN | iot |
| Server IP address | 195.34.49.28 |
| Server port | 5683 |
| Transfer protocol | COAP |
| Data transfer period to the server, min | 1440 |
| Data sampling period, min | 60 |
| Data format | *impact* |
| ClientID | *myclient* |
| Username | - |
| Password | - |
| Token | - |
| **Login Settings1** | |
| Input type (sensor or pulse input) | pulsed |
| Serial number of the connected meter | Not installed |
| Initial reading (m3) upon commissioning | Not installed |
| Volume (m3) per 1 pulse | 0.001 |
| **Login Settings2** | |
| Input type (sensor or pulse input) | pulsed |
| Serial number of the connected meter | Not installed |
| Initial reading (m3) upon commissioning | Not installed |
| Volume (m3) per 1 pulse | 0.001 |
| **Input Settings 3 (NAMUR)** | |
| Input type (sensor or pulse input) | pulsed |
| Serial number of the connected meter | Not installed |
| Initial reading (m3) upon commissioning | Not installed |
| Volume (m3) per 1 pulse | 0.001 |

| Input Settings 4 (NAMUR) | |
|---|---|
| Input type (sensor or pulse input) | pulsed |
| Serial number of the connected meter | Not installed |
| Initial reading (m3) upon commissioning | Not installed |
| Volume (m3) per 1 pulse | 0.001 |

### 4.2 Information security

Several access levels are available for using the device. The functionality associated with each access level is described in Table 3.

Table 3 - Functionality corresponding to the access level

| Access level | Description | |
|---|---|---|
| Administrator | This mode allows you to make changes to the device configuration (change the serial number, coefficients, etc.), as well as read the current settings and readings. | |
| | **Default access parameters values** | |
| | **Username** | **Password** |
| | admin | admin |
| User | In this mode, it is possible to read the values of the current settings and readings of the device. | |
| | **Default access parameters values** | |
| | **Username** | **Password** |
| | user | user |

When turning on the device for the first time, you must first change the default passwords for each user. Passwords must be 8 characters long and can contain uppercase and lowercase Latin letters, as well as numbers. Password transmission via the RS485 interface from the PC to the device is masked.

## 5. Protocols and formats of data packets for transmission to the server

### 5.1 MQTT protocol

Data in the current protocol is transmitted in three different formats. A description of these formats follows.

#### *5.1.1.* Formatthingsboard

In this format, the transmitted data is divided into two types: telemetry and attributes.

**- Telemetry**

**Telemetry Topic: Topic***(Table 2)/telemetry*

Example of a packet of instantaneous values:

***{"ICCID":** "89701011688875001899", "IN1": "2.162", "IN2": "0.000", "IN3": "3.154", "IN4": "0.000", "INS3": "0", "INS4": "0", "TEMP": "25.6", "CA": "0", **"LP":** "0", "RSSI": "-81", "VB": "3.56"}*

Table 3 - Description of keys

| ***key*** | ***value*** | ***Descriptio n*** |
|---|---|---|
| ***ICCID*** | *89701011688875001899* | SIM card identifier |
| ***IN1*** | *2.162* | Consumption per input |
| ***IN2*** | *0.000* | Consumption at input 2 |
| ***IN3*** | *3.154* | Consumption at input 3 |
| ***IN4*** | *0.000* | Consumption at input 4 |
| ***INS3*** | *0* | The state of the Namur input connected to input 3 (0 - ***NORMAL, 1 - OPEN, 2 - SHORT CIRCUIT***) |
| ***INS4*** | *0* | The state of the Namur input connected to input 4 |
| ***TEMP*** | *25.6* | Temperature measured by DT sensor connected to corresponding input. |
| ***CA*** | *0* | Device casing opening failure |
| ***LP*** | *0* | Low battery alarm |
| ***RSSI*** | *-81* | Signal level |
| ***VB*** | *3.56* | Battery charge |

Example of consumption profile package:

***[{"ts":** "1584399262000", "values": {"a": "0", "lp": "0", "t": "25", "d1": "2.15", **"d2":** "15.4", "d3": "0", "d4": "0"}}, {"ts": "1584402862000", "values": **"a": "0", "lp": "0", "t": "25", "d1": "2.18", "d2": "16.4", "d3": "0", "d4": "0"}}, {"ts":** "1584406462000", "values": {"a": "0", "lp": "0", "t": "25", "d1": "2.25", **"d2": "17.4", "d3": "0", "d4": "0"}}]*

Table 4 - Description of keys

| ***key*** | ***value*** | ***Descriptio n*** |
|---|---|---|
| ***ts*** | *1584399262000* | Time stamp of consumption values |
| ***values*** | | |
| ***a*** | *0* | Lid opening failure |

| | | |
|---|---|---|
| ***lp*** | *0* | Low battery level error |

| key | value | Description |
|---|---|---|
| ***t*** | *25* | Temperature |
| ***d1*** | *2.15* | Consumption per input |
| ***d2*** | *15.4* | Consumption at input 2 |
| ***d3*** | *0* | Consumption at input 3 |
| ***d4*** | *0* | Consumption at input 4 |

Example of a packet of instantaneous values from an electric meter:

***{"STS_1":*** *"OK",* ***"TM_1":*** *"M230",* ***"DTM_1":*** *"170320093842",* ***"SN_1":*** *"26939702",* ***"TFAE_1":*** *"2.71",* ***"TFRE_1":*** *"0.04",* ***"FAET1_1":*** *"1.66",* ***"FAET2_1":*** *"1.05",* ***"FAET3_1":*** *"0.00",* ***"FAET4_1":*** *"0.00",* ***"VPA_1":*** *"171.97", "VPB_1": "0.00", "VPC_1": "171.22", "APPS_1": "0.00", "RPPS_1": "0.00", "FR_1": "49.99"}*

Table 5 - Description of keys

| key | value | Description |
|---|---|---|
| ***STS_1 (_1 index of the counter being polled)*** | *OK* | Electricity meter polling status Possible response options:<br>- OK<br>- NO ANSWER<br>- NOT OPEN |
| ***TM_1*** | *M230* | Counter type |
| ***DTM_1*** | *170320093842* | *Date and time of the counter* |
| ***SN_1*** | *26939702* | Serial number |
| ***TFAE_1*** | *2.71* | Total active energy |
| ***TFRE_1*** | *0.04* | Total reactive energy |
| ***FAET1_1*** | *1.66* | Active energy at 1 tariff |
| ***FAET2_1*** | *1.05* | Active energy at tariff 2 |
| ***FAET3_1*** | *0.00* | Active energy at tariff 3 |
| ***FAET4_1*** | *0.00* | Active energy at tariff 4 |
| ***VPA_1*** | *171.97* | Voltage in phase A |
| ***VPB_1*** | *0.00* | Phase voltage B |
| ***VPC_1*** | *171.22* | Voltage in phase C |
| ***APPS_1*** | *0.00* | Total active power |
| ***RPPS_1*** | *0.00* | Total reactive power |
| ***FR_1*** | *49.99* | Network frequency |

***- Attributes***

**Topic attributes: Topic***(Table 2)/attributes*

Example of an attribute package:

{"ICCID": "89701011688875001899", "TD": "USPD", "VF": "0.0.6", "PF": "30", ***"PFP":*** *"1440", "PFS": "1440", "PFM": "60"***, "SNU1":** *"1111111"***, "SNU2":** *"2222222"***, "SNU3":** *"3333333"***, "SNU4":** *"4444444", "CF1": "0.001", "CF2": "0.01", "CF3": "0.001", "CF4": "0.1", "UTC": "5"}*

Table 6 - Description of keys

| ***key*** | ***value*** | ***Description*** |
|---|---|---|
| ***ICCID*** | *89701011688875001899* | SIM card identifier |
| ***TD*** | *USPD* | Device type |
| ***VF*** | *0.0.6* | Software version |
| ***PF*** | *30* | Period of sending instantaneous values |
| ***PFP*** | *1440* | Consumption profile sending period for inputs 1-4 |
| ***PFS*** | *1440* | Service packet sending period |
| ***PFM*** | *60* | Electric meter data packet sending period |
| ***SNU1*** | *1111111* | Device serial number connected to 1 input |
| ***SNU2*** | *2222222* | Device serial number connected to input 2 |
| ***SNU3*** | *3333333* | Device serial number connected to input 3 |
| ***SNU4*** | *4444444* | Serial number of the device connected to input 4 |
| ***CF1*** | *0.001* | Volume per 1 pulse 1 input per (m3) |
| ***CF2*** | *0.01* | Volume per 1 pulse 2 inputs (m3) |
| ***CF3*** | *0.001* | Volume per 1 pulse by 3 inputs (m3) |
| ***CF4*** | *0.1* | Volume per 1 pulse by 4 inputs (m3) |
| ***UTC*** | *5* | Time zone recorded in device |

### *5.1.2.* Formatimpact

When transmitting in this format, there are 2 self-sufficient types of packets.

**Topic of packages: Topic***(Table 2)*

Instantaneous value packets, service packet, and parameter packet

Electric meter packages are similar to the packages described in the previous section.
Example of a consumption profile package:

***[{"ts":****"1584399262000", "a": "0", "lp": "0", "t": "25", "d1": "2.15", "d2": "15.4", "d3": "0", "d4": "0"}, {"ts": "1584402862000", "a": "0", "lp": "0", "t": "25", "d1": "2.18", "d2": "16.4", "d3": "0", "d4": "0"},*
***{"ts":*** *"1584406462000", "a": "0", "lp": "0", "t": "25", "d1": "2.25", "d2": "17.4",* ***"d3": "0", "d4": "0"}]***

The description of the keys is given in Table 4.

### 5.1.3. Formatteleuchet

When transmitting in this format, there are 2 self-sufficient types of packets.

**Topic of packages: Topic***(Table 2)*

Example of a packet of instantaneous values:

***{"d": {"ICCID":*** *"89701011688875001899", "IN1": "2.162", "IN2": "0.000",* ***"IN3": "3.154", "IN4": "0.000", "INS3": "0", "INS4": "0", "TEMP": "25.6",*** ***"CA":*** *"0", "LP": "0", "RSSI": "-81", "VB": "3.56"}}*

The description of the keys is given in Table
3. Example of consumption profile:

***{"d": [{"ts":*** *"1584399262000", "values": {"a": "0", "lp": "0", "t": "25", "d1": "2.15", "d2": "15.4", "d3": "0", "d4": "0"}}, {"ts": "1584402862000", "values":* ***"a": "0", "lp": "0", "t": "25", "d1": "2.18", "d2": "16.4", "d3": "0", "d4": "0"}},*
***{"ts":*** *"1584406462000", "values": {"a": "0", "lp": "0", "t": "25", "d1": "2.25",* ***"d2": "17.4", "d3": "0", "d4": "0"}}]}***

The description of the keys is given in Table 4.
Example of an electric meter parameter package:

***{"d": {"STS_1":*** *"OK", "TM_1": "M230", "DTM_1": "170320093842", "SN_1": "26939702",* ***"TFAE_1":*** *"2.71",* ***"TFRE_1":*** *"0.04",* ***"FAET1_1":*** *"1.66",* ***"FAET2_1":*** *"1.05",* ***"FAET3_1":*** *"0.00",* ***"FAET4_1":*** *"0.00",* ***"VPA_1":*** *"171.97", "VPB_1": "0.00", "VPC_1": "171.22", "APPS_1": "0.00", "RPPS_1": "0.00", "FR_1": "49.99"}}*

The description of the keys is given in Table
5. Example of a service package:

***{"d": {"imsi":*** **"***250990284190501",* **"typeDevice": "***USPD",* **"pollFrequency": "***30",* ***"vFw":*** *"0.0.6",* ***"serialNumber1":*** *"1111111",* ***"serialNumber2":*** *"2222222",* ***"serialNumber3":*** *"3333333",* **"serialNumber4": "***4444444", "c1": "0.001", "c2": "0.01", "c3": "0.001", "c4": "0.1"}}*

The description of the keys is given in Table 6.

## 5.2 COAP protocol

### 1. Thingsboard format

The package structures and types are similar to those described in section 5.1.1, with one exception:
Attribute transfer topic:
**api/v1/$ACCESS_TOKEN (By default is used IMEImodule)/attributes**
Telemetry transmission topic:
**api/v1/$ACCESS_TOKEN (the module's IMEI is used by default)/telemetry**

**2. Impact format**

The structures of packages and topics are similar to those described in

section 5.1.2.**Uri-Path: Topic (Table 2)**

**3. Telechet format**

The structures of packages and topics are similar to those described in

section 5.1.3.**Uri-Path: Topic (Table 2)**

## 6. Working with the device

### 6.1 Pre-configuring the device

Pre-configuration of the device is required if settings other than factory settings are required. INTable 2 The parameters available for local configuration are listed.

### 6.2 Local device setup

To configure the device locally, connect a PC to the device's RS485 port and short contacts 4-5 of the XP1 connector using a jumper (this will enter the device's configuration mode). Launch the configuration program on the PC.

The parameters for setting are specified inTable 2.

In addition, you can issue commands from the configurator:

- unscheduled sending of a packet to the server via the NB-IoT network (used to check the correctness of the device registration and its location within the BS visibility zone),
- reading data from the device (used to check the correct connection of the device to the meter).

The following functionality is also available:

- Reading and changing device settings
- Reading IMSI of SIM card;

### 6.3 Device operating modes

There are several operating modes of the device:

- **energy-saving**Mode. The device operates in this mode during most of its operating time. It counts pulses, measures battery voltage, and records the activation of connected external sensors and the "Casement Lid Open Sensor." RS485 communication with the configuration software is not possible in this mode.

If any connected sensor or the “Cabinet Lid Opening Sensor” is triggered, an alarm message will be immediately transmitted to the server.

At this point, the device exits "power-saving mode," enters "server data exchange mode," and sends the packet to the server. After the exchange is complete, the device returns to "power-saving mode."

- **"server data exchange mode"**Data transfer to the server occurs at intervals determined by the "Polling Period" parameter. This exits the device's "power-saving" mode. After the transfer is complete, the device returns to "power-saving" mode.

- **"interface device polling mode"**A data slice is recorded in the log. The period must be pre-configured. No transmission to the server occurs.

- **"Local device configuration mode".**This mode can be activated using a button inside the device. This mode is intended for local device configuration from the configurator.

### 6.4 Indicator

Table 7 – Indicator states

| **State** | **State** |
|---|---|
| ***Mode Indicator*** | |
| ***Indicator operation in module loading mode*** | |
| ON – 5..15 sec – OFF | The indicator turns on when power is supplied (or the RES signal is supplied).<br>Remains on while the device initializes. Once initialization is complete, the indicator turns off.<br>the device is ready for use |
| ***Operation of the indicator in working mode*** | |
| ON – 0.1 sec – OFF | The indicator lights up and goes out once, which informs about the start<br>transfer process |
| ON – 0.1 sec – OFF–0.1 sec<br>ON – 0.1 sec – OFF | If the data is successfully sent to the server, the indicator will blink twice.<br>lights up briefly and goes out |
| ON – 0.1 sec – OFF–0.1 sec<br>ON – 0.1 sec – OFF–0.1 sec<br>ON – 0.1 sec – OFF | If data is unsuccessfully sent to the server, the indicator lights<br>up briefly and goes out 3 times. |
| ***Indicator operation in setup mode*** | |
| ON –0.1 sec –OFF –3 sec. | If no data is recorded or sent to the server,<br>The indicator turns on and off periodically. |
| ***Network Indicator*** | |
| 64ms ON, 800ms OFF | No online registration |
| 64ms ON, 3000ms OFF | Successful registration online |
| 64ms ON, 300ms OFF | Data transfer |
| OFF | Power off or PSM mode |

### 6.5 Crash sensor "Housing lid opening sensor"

After turning on the power (jumper XP4 pos2-3) or briefly short-circuiting ResetCPU (J1), the device enters operating mode and begins to analyze the states of the connected sensors.

The state of the “Casement Lid Opening Sensor” is analyzed 10 minutes after power is supplied (this makes it convenient when installing the device).

If the "Casement Lid Open Sensor" is triggered, the device's non-volatile memory records readings from all metering devices at the time of the triggering. Readings continue to be recorded. The ALARM status can be reset locally via the configurator ("Measurements"/Instantaneous Values, "Reset Alarms" button) or by sending a command from the server. An example is shown in Figure 2.

### 6.6 Contact assignment

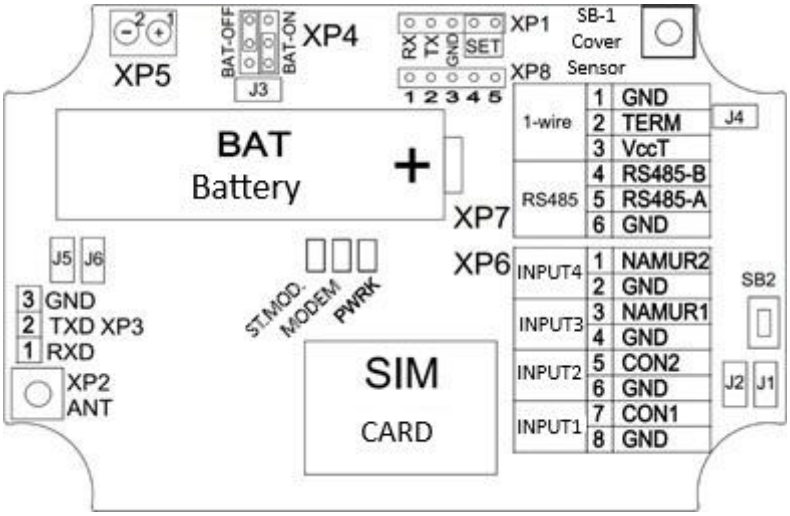



Fig. 2 – XP4 device contacts –

battery enable jumper
SIM-card – holder for installing a SIM card

XP7 – pins 4,5,6 – connection of devices with RS485 XP7
– pins 1,2,3 – connection of temperature sensor

XP6 – cont1,2 – NAMUR2–(Input4) – pulse input or sensor or counter with NAMUR XP6 – cont3,4 – NAMUR1–(Input3) – pulse input or sensor or counter with NAMUR XP6 – cont5,6 – CON1 – (Input1) – pulse input or sensor
XP6 – pin 7,8 – CON2 – (Input 2) – pulse input or sensor

SB1 – lid opening sensor
SB2 - on/off button for local device settings mode

J1 – ResetCPU
XP4 – Bat-ON - jumper for connecting the battery XP4 –
Bat-OFF - jumper for disconnecting the battery

XP5 – connection of constant power supply from an external power supply (instead of

a battery) XP1 – pin 4-5 – jumper for operation in the device setup mode

XP1 – UART pin 1(RX), pin 2(TX), pin 3(GND) – device firmware update J2 – jumper for device firmware update

XP3 – UART – modem firmware update

### 6.7 Typical equipment connection diagram

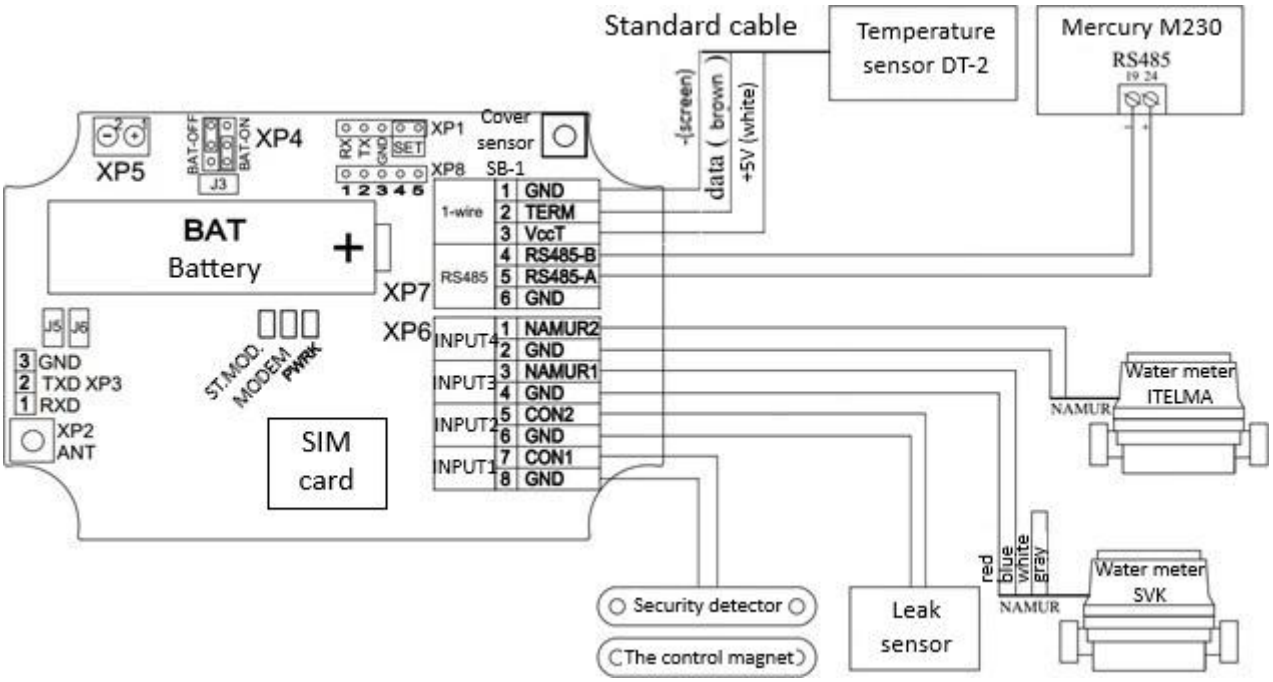
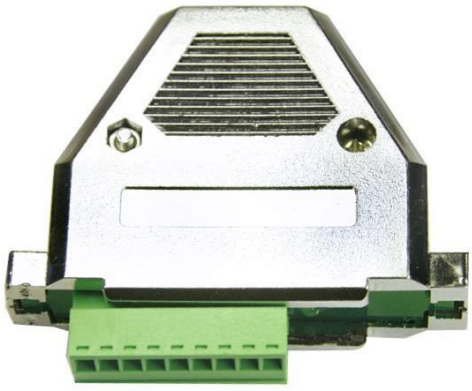



Fig. 3 - Typical device connection diagram

### 6.8 Connection to UART and RS485 interfaces

For this purpose, one universal converter from Jcom-IoT with USB, UART and RS485 is used - “Converter "USB-RS232-UART-CAN-RS485"” (Figure 4)



Rice. 4 - “Converter “USB-RS232-UART-CAN-RS485””

If there is no universal converter, two separate specialized converters can be used.

### 6.8.1 Typical connection diagram to the UART interface

The connection is made according to Figure 5.

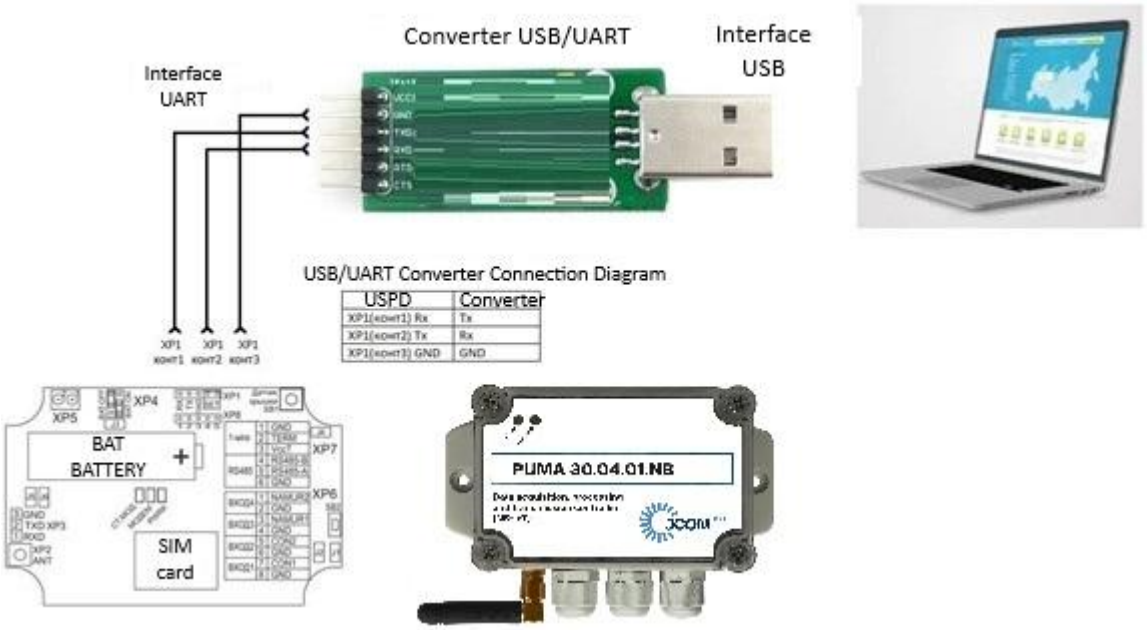



Fig. 5 – Connection to the UART interface

**USB/UART converter specifications**

- UART voltage levels: 3.3V
- USB converter connector for connecting to a PC (USB type A or USB type B with an additional cable)
- A converter with galvanic isolation is desirable.
- A converter with a terminal block is desirable.
- The XP1(USPD) connector type is PLS-3 (plug, 2.54mm pitch). A cable with a mating PBS-3 receptacle "for connection to PLS-3" is required for connection.
- You may also need a jumper (with a pitch of 2.54) to set “SET”

### 6.8.2 Typical connection diagram for the RS-485 interface

The connection is made according to Figure 6.

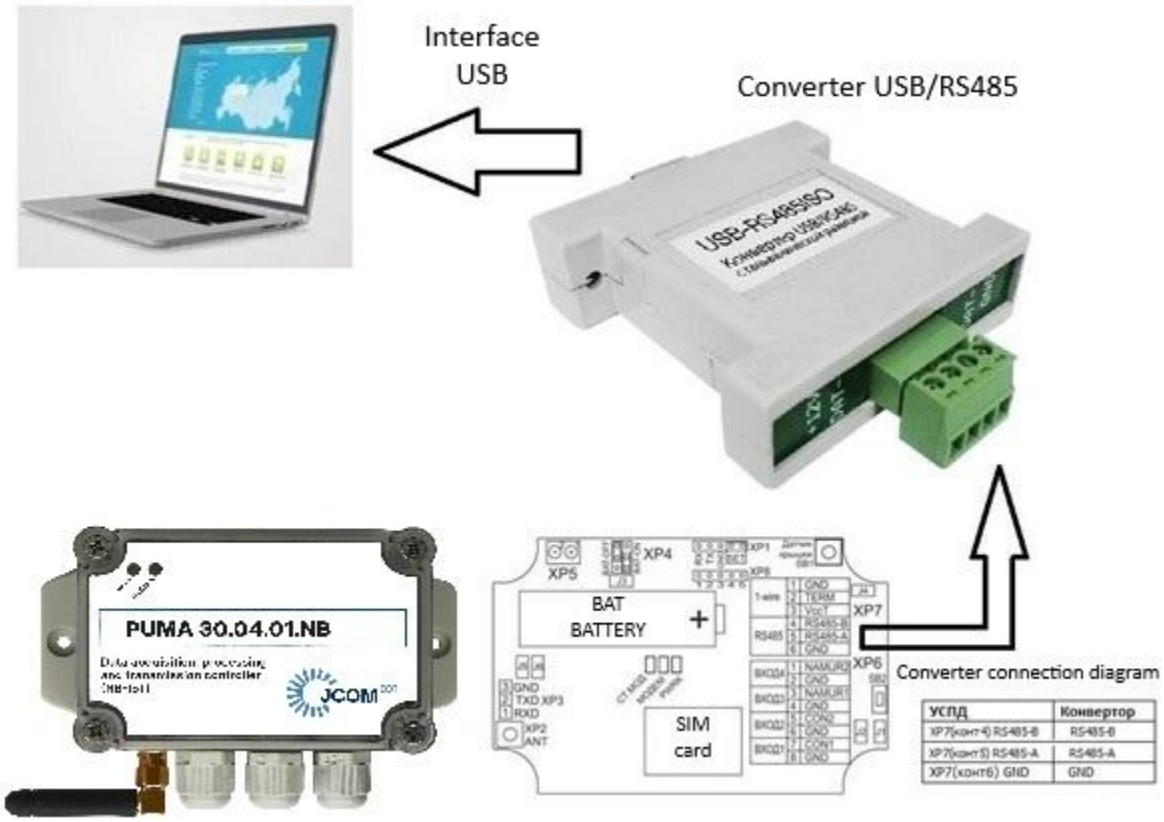



Fig. 6 – Connection to the RS-485 interface

**Characteristics of the USB/RS485 converter**

- USB converter connector for connecting to a PC (USB type A or USB type B with an additional cable)
- A converter with galvanic isolation is desirable.
- A converter with a terminal block is desirable.
- The XP7 (USPD) connector type is a terminal block. No special cable is required for connection.
- You may also need a jumper (with a pitch of 2.54) to set “SET” XP1(4-5).

## 9. Completeness

Table 10 - Completeness of PUMA 30.04.01.NB

| No. | Name | Quantity |
|---|---|---|
| 1 | Data collection and transmission device PUMA 30.04.01.NB | 1 |
| 2 | Antenna on a magnetic stand with a 3 m cable. | 1 |
| 3 | User manual | 1 (per batch) |
| 4 | Passport with warranty card | 1 |
| 5 | Package | 1 |

## 10. Maintenance

The device is maintenance-free and designed to operate indefinitely under the following operating conditions: stable power supply within the specified voltage range, proper humidity and temperature, non-aggressive gas environment, and absence of shock and vibration. There are no parts inside the device's housing that require periodic inspection and/or maintenance.

## 11. Storage and transportation rules

Climate conditions transportation should correspond nextconditions:

- ambient air temperature from minus 50 ℃ to plus 50 ℃;
- relative air humidity up to 98% at 25 ℃;
- atmospheric pressure from 84.0 to 107.0 kPa (from 630 to 800 mmHg).

The device can be transported by all types of transport (in covered wagons, closed vehicles, containers).

The device must be stored only in the manufacturer's packaging in heated rooms at temperatures ranging from +5°C to +400°C and relative humidity no more than 80%. Storage areas must be free of aggressive impurities (such as acid or alkali vapors) that could cause corrosion.

## 12. Guaranteesmanufacturer (supplier)

The manufacturer guarantees that the device complies with the technical specifications, subject to the conditions of transportation, storage, installation and operation.

The warranty period for the device is set at 2 years, counting from the date the device is put into operation.

During the warranty period of the device, the manufacturer has the right to supervise its correct operation in order to improve the quality and efficiency of operation.

Device components that fail during the warranty period are subject to replacement or repair by the manufacturer at the manufacturer’s expense.

The user loses the right to free repairs during the warranty period in the event of broken seals, mechanical damage by the user, or if the device was repaired by a person who is not authorized to perform repairs and maintenance.