NARVAL 1201

User's Manual

narval
1201

NETWORK
MANAGER

Contents:

1. Warnings

- Risk of fire or explosion if the battery is replaced by an incorrect type.
- DO NOT try to recharge the battery.
- DO NOT overheat the battery.
- Replace the battery respecting the + and – sign on the battery housing and the battery itself.
- Battery voltage must be in range 3.3V-4.2V.
- Use only the original SAFT LS 14250 battery.
- Dispose used battery safely
- Device can be powered via micro USB port using external power supply evaluated according to IEC/EN 62368-1 and comply with ES1and PS1 requirements . The voltage range on the micro USB port must 4.7V-6V.
- DO NOT expose to any liquid or hazardous materials.
- KEEP away from children. Small parts such as the antenna or the battery can cause choking.
- Operating temperature should be between 0° and 55°C.
- Device is intended for use by instructed person.
- Basic knowledge of LoRaWAN is needed to use the device and this manual

2. General Description

The Narval 1201 is an IoT solution for monitoring various types of metering devices that have a built-in optical head. Using the widely proven LoRaWAN technology ensures high coverage in sparse areas and high capacity in dense areas, while using a fraction of the energy that allows the battery to be used as a power source for many years. This makes it possible to realize large-scale tracking of metering devices over a long period of time using minimal efforts. Narval 1201 can be customized to read and transfer data from other types of sensors such as pressure, temperature...

3. Application

- Remote meter reading
- Individual meter reading
- Energy meters, electricity meters, water meters

4. Features

- LoRa Chipset SX1262 868 MHz, Maximum TX Power 22 ± 1dBm, Maximum Receiving Sensitivity -135dBm
- LoRaWAN 1.0.2 OTAA & ABP, Class A
- SMA F connector for antenna (included)
- Tested with The Things Network and Gotthardp LoRaWAN server.
- 1/2AA Battery holder for nonchargeable battery
- Micro USB interface for configuring device and display functional information
- IEC 62056-21 compatible optical head for acquiring data from the meter
- Estimated battery replace time over 5 years (1200 mAh battery, reading every 6h, average to good signal)
- Dimensions: 105x36x32mm
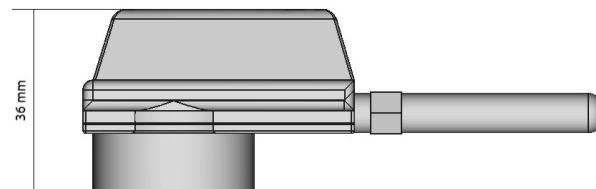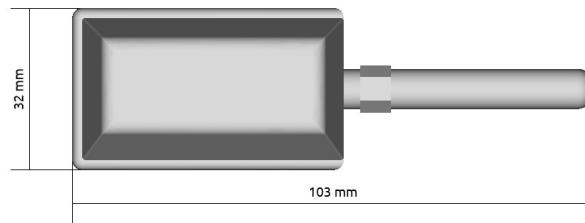
5. Package contents

- Label with default password, AppKey/AppSKey, nwkSKey
- Device:
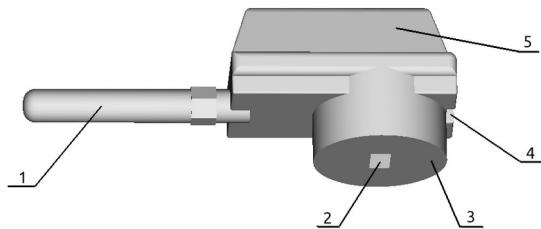
1. Antenna
2. Optical port
3. Magnet
4. Micro USB port
5. Cover-up

6. Mounting

The Narval 1201 is ready to be mounted directly from the box. It has built-in magnet for easy attachment to the optical port of the meter device. Some meter devices require special position of the Narval, see Final Notes.

7. Power supply

The device is powered by one 1/2AA non-rechargeable battery rated 3.3V-4.2V. The battery is included and mounted in the device in the package. Alternatively, the micro USB port can be used as a power source. In that case, the voltage range should be 4.7V-6V.

The micro USB and battery can be connected simultaneously and then the device will automatically use micro USB as a power source.

8. Quick setup

1. Add device to the LoRaWAN server (not necessarily the first step, can be done at any time).
2. Mount Narval 1201 on the meter device.
3. Connect a USB cable to the device and to some gadget with a console program (Laptop, phone...)
4. Use menu-driven console program to chose at least the meter device. Optionally adjust LoRaWAN parameters to match those set on the LoRaWAN server and other parameters such as the period.
5. Optionally test the meter device readout.
6. Start read/send cycle (LoRaWAN autostart).
7. Optionally, follow LoRaWAN messages in the console to debug the communication.

9. List of protocols and tested devices

- M-BUS – Danfoss Sonometer 1100 (Sharky, Brunata) , Sontex Supercal 531, Danfoss Sonometer 30, Axioma E1
- EN61107/IEC1107 mode A - Kamstrup Mulitcal 401
- KMP protocol – Kamstrup Multical 402, Kamstrup Multical 602
- EN 62056-21 – Landis&Gyr UH T550 (Siemens UH50)
- DLMS/COSEM - Mikroelektronika MET410 electric meter
- SML– DZG DVS7426

Reported data format:

M-BUS: 2 bytes battery voltage in mV, 1 byte M-BUS Status Field, variable byte length M-BUS encoded Energy readout – VIF codes 0000b and 0001b.
Example: 0D84000C0615044401 3.46 V, status No Error, 1440415 kWh

EN61107/IEC1107 mode A: 2 bytes battery voltage in mV, variable byte length ASCII encoded string.
Example: 0DC8303230303437322A6B5768 3.528 V, 200472 kWh

KMP protocol: 2 bytes battery voltage in mV, 4 bytes Energy in kWh.
Example: 0D780039D73A 3.448 V, 3790650 kWh

EN 62056-21: 2 bytes battery voltage in mV, variable byte length ASCII encoded string.
Example: 0CEC313235302E3339392A4D5768 3.308 V, 1250.399 MWh

DLMS/COSEM: 2 bytes battery voltage in mV, 4 bytes OBIS code 1.0.1.8.1.255, 4 bytes OBIS code 1.0.1.8.2.255.
Example: 0DA400F70ABE00813FB5 3.492 V, 16190142 kWh, 8470453 kWh

SML: 2 bytes battery voltage in mV, 3+ bytes per codes 1.8.0, 1.8.1, 1.8.2, 2.8.0, 2.8.1, 2.8.2 - 1 byte unit, 1byte scaler, 1+ SML encoded bytes value. Presence and order of the codes is dependent by the device configuration.
Example: 0D781E0362021E036201 3.448V, 2 kWh for the code 1.8.0 (total energy consumed), 1 kWh for the code 2.8.0 (total energy supplied to the system)

10. Device configuration

Access to the device is done through the console program like Putty or Serial USB Terminal for Android. Parameters are 115200 bps, 8N1, no flow control.

First screen:

```
Uptime: 0 days, 0 hours, 0 minutes, 16 seconds
FV: 1
HN: 444E73A0FE63262C
Enter password:
```

The default password is printed on the inner label in the packaging. It is also the first 8 characters of the AppKey/AppSKey.

Screen after entering the password:

```
Uptime: 0 days, 0 hours, 0 minutes, 34 seconds
HN: 444E73A0FE63262C
DevEUI: 444E73A0FE63262C
AppEUI: 0000000000000000
LoRaWAN status: disconnected
Device: Not configured
Number of readouts:  total 0; successful: 0
Period(min): 10000
LoRaWAN autostart: OFF
Password config lock: ON
LED signaling: ON
OTAA/ABP: OTAA
CONFIG MENU:
(1) Choose device
(2) Change period
(3) Change devEui
(4) Change appEui
(6) Switch password lock state
(7) Change config lock password
(L) Switch LED signal status
(N) Switch OTAA/ABP
(S) Save config
(R) Reboot device
(X) Factory reset
(Q) Quit menu
Enter selection:
```

Full menu options:

```
(1) Choose device
(2) Change period
(3) Change devEui
(4) Change devAddr
(5) Switch LoRaWAN autostart
(6) Switch password lock state
(7) Change config lock password
(8) Manual readout
(9) Readout counter reset
(L) Switch LED signal status
(N) Switch OTAA/ABP
(I) Set initial data rate (0-6):
(S) Save config
(R) Reboot device
(X) Factory reset
(Q) Quit menu
```

Options description:

`(1) Choose device` - always available. Entering submenu for choosing meter device:

```
(0) Not configured
(1) Danfoss Sonometer 1100
(2) Kamstrup Mulitcal 401
(3) Kamstrup Multical 402
(4) Kamsptrup Multical 602
(5) Sontex Supercal 531
(6) Danfoss Sonometer 30
(7) Axioma E1
(8) Landis&Gyr UH T550
(9) Mikroelektronika MET410
(10) DZG DVS7240
Enter selection number:
```

Press number for adequate device (press <Enter> after, if one-digit number). Default is 0, Not configured.

`2) Change period` - always available. Allowed values 1-65535 minutes. (press <Enter> after if less then five-digit number). It starts to apply after the next meter reading. Default is 10000.

`(3) Change devEui` - available if the device isn't in meter read/transfer cycle. Enter 16 hexadecimal characters, case insensitive. Default is equal to the HN (hardware number)

`(4) Change devAddr/appEui` - available if the device isn't in meter read/transfer cycle. devAddr if ABP mode, appEui if OTAA mode. For devAddr enter 8 hexadecimal characters, case insensitive. Default is equal to the last 8 characters of the HN. For appEui enter 16 hexadecimal characters, case insensitive. Default is 0000000000000000.

`(5) Switch LoRaWAN autostart` - available if meter device is configured. If set to ON, read/transfer cycle will start after exit the menu if not already started or after device boot. Once started the cycle can be stopped only by reboot. Default is OFF.

`(6) Switch password lock state` - always available. If set to ON the password will be requested after every enter the menu. Default is ON.

`(7) Change config lock password` - always available. Enter new password for accessing device menu/information. 1-16 character long, case sensitive. Default is the first 8 characters of the AppKey/AppSKey

`(8) Manual readout` - available if the device isn't in meter read/transfer cycle and meter device is configured. Manually read meter device and display returned bytes and bytes for sending.

`(9) Readout counter reset` - available if meter device is configured. The counter is also reset while device boot.

`(L) Switch LED signal status` – always available. If ON, the LED will flash 3 times when the LoRaWAN join (OTAA) or start sending (ABP). Flash once on successful meter reading.

`(N) Switch OTAA/ABP` - available if the device isn't in meter read/transfer cycle. Change the LoRaWAN mode.

`(I) Set initial data rate (0-6)` - available if the device isn't in meter read/transfer cycle and the LoRaWAN mode is ABP. Default is 5. Starting DR for the LoRaWAN.

`(S) Save config` – always available. Preserve current configuration across reboot.

`(R) Reboot device` – always available.

`(X) Factory reset` – always available. All settings will be reverted to the default.

`(Q) Quit menu` – always available. Also the menu will be exited automatically after 30 seconds of inactivity.

Some configuration settings could be changed by using downlink message.
Message format:
- =N (7 > N > 0) set antenna power to N.
  Example: 0x3D05 set antenna power to 5.
- +N (0 < N < 7) decrease (increase attenuation) antenna power by N.
  Example: 0x2B02 decrease antenna power by 2 (not exceed 7).
- -N (0 < N < 7) increase (decrease attenuation) antenna power by N.
  Example: 0x2D03 increase antenna power by 3 (not exceed 0).
- 1NN set meter device to NN (if exists).
  Example: 0x310003 set to Kamstrup Multical 402.
- 2NN set period to NN.
  Example: 0x322710 set to 10000 minutes.
- S save configuration.
  Example: 0x53.
- R reboot.
  Example: 0x52
- X reset to default.
  Example: 0x58.

Multiple commands could be sent in one downlink message. Order of commands is significant. Example 0x3D053227105352 – set antenna power to 5, set period to 10000, set device to Kamstrup Multical 402, save configuration reboot. Anything added after the reboot would have no effect. Antenna power after reboot would be set to the default value of 0.

11. Battery replacement

1. Unscrew the antenna.
2. Pull the cover-up and towards the antenna connector.
3. Replace the battery respecting the + and – sign on the battery housing and the battery itself. Use only the original SAFT LS 14250 battery.
4. Put the cover back in place.
5. Screw the antenna.
6. Dispose used battery safely

12. Final notes

- In order to use data from the device, it is necessary for the device to be within range of any LoRaWAN gateway that transmits data to the LoRaWAN server being used.
- If the device isn't in the read/transfer state, it will be in the sleeping mode with almost no power consumption.
- The device will occasionally send confirmed uplink messages. If all replays is received, it will increase data rate (max is DR6). If it is already at DR6, and it isn't manually set by downlink message, it would decrease antenna power. If replays aren't received, it will decrease data rate (min DR0). In any case of data rate decrease antenna power will be set to the maximum.
- Kamstrup Multical 402, Danfoss Sonometer 30, Axioma E1 requires pressing the button on the meter device to enable reading just before manual reading and before first start read/transfer cycle.
- Landis&Gyr UH T550, Axioma E1 requires that the device position must be such that the antenna is facing down.
- The antenna can be replaced with some other if needed. Use one intended for the 868 MHz. Please note that adding extra weight to the device may prevent the magnet from holding it in place.

13. Adding device to The Things Network

First go to + Register end device
Choose Enter end device specifics manually
Select Europe 863-870 MHz (SF12 for RX2) from the Frequency plan drop down list
Select LoRaWAN Specification 1.0.2 from the LoRaWAN version drop down list
Select RP001 Regional Parametars 1.0.2 revision B from the Regional Paramaters Version drop down list

If activation mode is OTAA then fill text boxes JoinEUI, DevEUI, AppKey, End device ID.
For the JoinEUI use the AppEUI. End device ID is just description field.

If activation mode is ABP then click on Show advanced activation, LoRaWAN and cluster settings
Choose Activation by presonalization (ABP)
Fill text boxes DevEUI, Device address, AppsKey, NwkSKey, End device ID. For the Device adress it is recommended to use the Generate button and set the given address in the device.
Click on the Register end device.

14. Troubleshooting

- **There are no responses from the device in the console program.**
  Check communication parameters. Check that connectors are properly plugged in. Verify that the USB cable is intended for data transfer. Use an OTG cable to connect the phone.

- **There are no readouts from the meter device.**
  Check that right meter device is set in the device configuration. Check that the optical port of the meter device is directly overlapped with the device optical port. Check that the meter device special requirements from the final notes is fulfilled. Verify that the optical head of the meter device is functional using some other optical head.

- **No communication with the LoRaWAN server.**
  Check that the LoRaWAN parameters are matched in the device configuration and in LoRaWAN server.
  Check that there are public/private LoRaWAN gateways available in the device range.

- **Lost the device password and/or keys.**
  Call the supplier.