

OY1400 LoRaWAN[®] converter 0-10V, 4-20 mA

Product manual

version 1.0

January 24, 2023

support@propeye.se



OY1400 LoRaWAN® converter 0-10V, 4-20 mA

Table of contents

1	Disclaimer	3
1.1	Technical support	3
2	Warnings.....	4
3	Environmental.....	5
4	Product Description	6
5	Installation and activation	7
5.1	LoRaWAN Configuration	7
6	Sensor connection	9
6.1	Voltage measurement	9
6.2	Current measurement.....	9
6.3	Digital measurement.....	9
6.4	Standard measurement cycle.....	10
6.5	Manual trigger.....	10
6.6	Measurement grouping.....	10
6.7	Applications type	10
7	Protocol.....	11
7.1	Payload Data	11
7.2	Startup sequence	11
7.3	Commands	12
7.4	Examples.....	13
8	LoRa MAC Commands.....	13
9	Special pre-configurations	14
9.1	OY1400 Leakage rope	14

OY1400 LoRaWAN® converter 0-10V, 4-20 mA

1 Disclaimer

This document represents information on products at the time of publication and is subject to change without prior notice due to product improvements or other reasons. Nordic Propeye makes no warranties based on the accuracy or completeness of the contents of this document and reserves the right to make changes to specifications and product descriptions at any time without notice. Nordic Propeye reserves all rights to this document and the information contained herein.

1.1 Technical support

Please visit www.nordicpropeye.com for additional information, or contact support@propeye.se

EC DECLARATION OF CONFORMITY

certify that the design and manufacturing of this product


DATA LOGGER /
DATENLOGGER /
DATA LOGGER /
PULSGIVER /
PULSZENDER
OY1400 868

conforms to the following directives and standards

The Radio Equipment Directive (2014/53/EU),
EN 300 220-1 V2.4.1, EN 300220-2 V2.4.1,
EN 301 489-1 V1.9.2, EN 301 489-3 V1.6.1,
EN 60950-1:2006+A11+A1+A12+A2

RoHS Directive 2011/65/EU

This product was CE marked in year -19



2019-01-01

Managing Director

Stefan Lindgren

OY1400 LoRaWAN® converter 0-10V, 4-20 mA

2 Warnings

The following safety precautions must be observed during all phases of the operation, usage, service or repair of this Nordic Propeye product.

- Read the product manual.
- Do not modify the product.
- The product should not be exposed to extreme heat or open flame.
- The device must not be exposed to harsh chemical agents or solvents.
- The labelling of the product may not be changed, removed or made unrecognizable.

OY1400 LoRaWAN[®] converter 0-10V, 4-20 mA

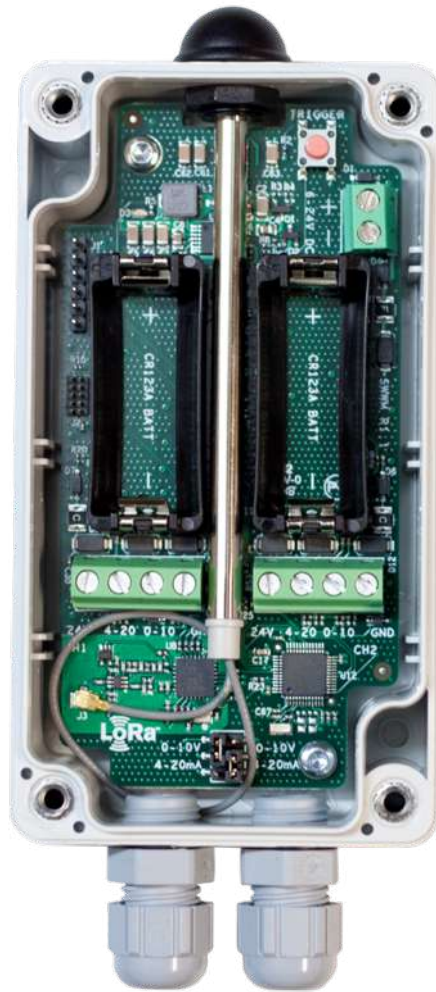
3 Environmental



This symbol on the product or on its packaging indicates that this product must not be disposed of with your other household waste. Instead, it is your responsibility to dispose of your waste by taking it to a collection point designated for the recycling of electrical and electronic appliances. Separate collection and recycling of your waste at the time of disposal will contribute to conserving natural resources and guarantee recycling that respects the environment and human health. For further information concerning your nearest recycling center, please contact your nearest local authority/town hall offices, your household waste collection company or the shop where you bought the product.

OY1400 LoRaWAN[®] converter 0-10V, 4-20 mA

4 Product Description



The OY1400 Industrial communication and control unit is designed with focus on ease-of-use and reliable operation in LoRaWAN networks. The product is suited for a huge variety of use cases, as external probes can be connected to the unit.

OY1400 LoRaWAN® converter 0-10V, 4-20 mA

5 Installation and activation

5.1 LoRaWAN Configuration

Configuration on the network server is done with the AppEUI. It is possible to order a batch of devices configured with a customer unique AppEUI from the Nordic Propeye OUI range.

The device is configured with device unique DevEUI and AppKey. The device is default configured for OTA provisioning. Contact the Nordic Propeye team for ABP configuration. The device follows the LoRaWAN standard related Join configuration parameters, such as RX1 and RX2 windows, RX2 downlink frequency etc. The default setting is ADR enabled.

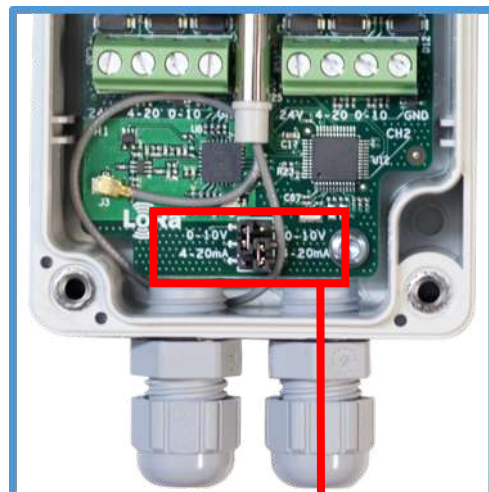
5.1.1 Physical activation

When the sensors have been digitally configured it is time to physically activate and install them. The OY1400 Industrial communication and control unit can be used for dozens of unique use cases, which are of course all slightly different in installation. This is a general guideline to get started with the sensor.

The product comes with 2 batteries and a plug. The plug is meant for when you only wish to use one of the probe inputs, so you can plug the other one to close it off and protect it from water or dust. The product has 2 openings in the backside for wall mounting.

After you open the OY1400 with a screwdriver you can connect the external probe(s) to the desired slot (more on that in the next chapter). The next step is to correctly set the jumpers, depending on what kind of probe you would like to use.

As can be seen in the picture to the right, you can set the jumper either to 0-10V or 4-20mA, which should correspond to the probe you are connecting. In this picture, the jumper on the left side is set to 0-10V, the jumper to the right side is set to 4-20mA. In the case you connect a probe to the 24V option, one of your probe's threads goes into the 24V



OY1400 LoRaWAN® converter 0-10V, 4-20 mA

option, the other one in either 0-10V or 4-20mA and possibly a third into the ground option (indicated GND). Then you set the jumper accordingly (either 0-10V or 4-20mA).

After that you install the (replaceable) batteries, which activates the unit, you close the box and start measuring your data!

OY1400 LoRaWAN® converter 0-10V, 4-20 mA

6 Sensor connection

The OY1400 supports up to two sensors. Each sensor can independently be configured either to measure 0-10V or 4-20mA. It is also possible to configure a threshold for a channel and then the channel becomes digital and the measurement is only 0 or 1.

6.1 Voltage measurement

Each channel can independently be setup to measure a 0-10V signal. The input is 24V tolerant.

Setting up a channel for voltage measurement is done by configuring the input selection jumper to position “0-10V”, left side of the jumper block is channel 1 and right side is channel 2.

The measurement on the LoRa network shall be multiplied by a factor of 4.1 to get the correct measured voltage.

6.2 Current measurement

Each channel can independently be setup to measure a 4-20mA signal. The shunt resistor is 120 Ohm.

Setting up a channel for current measurement is done by configuring the input selection jumper to position “4-20mA”, left side of the jumper block is channel 1 and right side is channel 2.

The measurement on the LoRa network shall first be multiplied by a factor of 4.1 (to get a voltage reading across the shunt resistor) and then divided with by 120 to get the correct measured current.

6.3 Digital measurement

Each channel can independently be setup to make a “digital” measurement. This is done by configuring a threshold. When the measured voltage is above the threshold the signal is considered to be “1”, otherwise it is considered to be “0”.

OY1400 LoRaWAN® converter 0-10V, 4-20 mA

The benefit of configuring the channel as digital is that the transmission requires less power.

The threshold can be configured using a downlink command. Configuring the threshold to 0 makes the channel analog.

As an example, a threshold of 5V is achieved by configuring a threshold value of 9756 (0x261C), $9756 * 1/8\text{mV} * 4.1 = 5000\text{mV}$.

6.4 Standard measurement cycle

For the standard application type the measurement cycle measures both channels simultaneously. The measurement cycle is performed with a configurable period. First the 24V power output is enabled. Then there is a configurable delay before both channels are measured. This delay must be set to match the slower of the two channels. After the measurement the 24V power is disabled directly.

6.5 Manual trigger

It is possible to trigger a measurement manually by pressing the button of the OY1400. The measurement cycle is performed directly and the measurement is then transmitted (regardless of measurement grouping setting),

6.6 Measurement grouping

In order to reduce the power consumption, it is possible to configure the OY1400 to group a number of measurements in one transmission.

6.7 Applications type

It is possible to order a different application type than the standard. An application specific type typically has a customized measurement cycle including specific logic.

It is possible to read the Application type using downlink but it can only be configured during production.

The standard application is type 0.

OY1400 LoRaWAN® converter 0-10V, 4-20 mA

6.7.1 LoV application type

The LoV (“Luft och Vatten”) application is type 1. Battery life

7 Protocol

7.1 Payload Data

This describes the payload data that is sent to and from the application server.

Uplink command device => network				
Field	Bytes	Value	Description	Note
Type	1	xx	0x01: Data 0x02: Command NACK	
Index	1	xx	Command Index	
Data			As defined for Command Index (only for Type: Data)	

Downlink command network => device				
Field	Bytes	Value	Description	Note
Type	1	xx	0x01: Set 0x02: Query 0x03: Action	
Index	1	xx	Command Index	
Data			As defined for Command Index	

7.2 Startup sequence

When the device has joined the network, startup transmissions are performed in order to make it easier to configure the device using downlink commands. When the startup sequence is completed normal operation is started.

There are at least five startup transmissions. The Status command (index 0x20) is sent unless a reply to a downlink is sent. If no replies are sent the Status commands are sent with increasing intervals starting with 15 seconds and ending with two minutes.

7.3 Commands

Index	Description	Datatype	Encoding	Valid range	Access	Unsolicited	Description	Note
0x03	FW build hash	6 x Uint8			Query	No	Unique number that identifies the firmware version	
0x05	Device reset				Action	No	Reset of device	
0x06	CPU voltage	Uint8	25mV/ LSB	0-3.6V	Query	No	Read CPU voltage. Max/min ranges depend on battery chemistry.	
0x0A	CPU temperature	Uint16 Big endian	0.01C / LSB	-50- +125 C	Query	No	Temperature from CPU sensor with 50 °C offset. Approximately 5 °C accuracy.	
0x21	Sensor values Ch1 Analog Ch2 Analog	TxGroupSize * (Uint16, Uint16) Big endian	1/8 mV 1/8 mV	0-26400 0-26400	Query	Yes	Sensor reading when both Ch1 and Ch2 are analog.	The payload length can be used to determine the number of measurements that are grouped.
0x22	Sensor values Ch1 Digital Ch2 Analog	TxGroupSize * (Uint8, Uint16) Big endian	- 1/8 mV	0-1 0-26400	Query	Yes	Sensor reading when Ch1 is Digital and Ch2 is Analog.	
0x23	Sensor values Ch1 Analog Ch2 Digital	TxGroupSize * (Uint16, Uint8) Big endian	1/8 mV -	0-26400 0-1	Query	Yes	Sensor reading when Ch1 is Analog and Ch2 is Digital.	
0x24	Sensor values Ch1 Digital Ch2 Digital	TxGroupSize * (Uint8, Uint8) Big endian	- -	0-1 0-1	Query	Yes	Sensor reading when both Ch1 and Ch2 are analog.	
0x25	Application type		-	0-1	Query	No	0 = Standard application 1 = LoV application	
0x26	Measurement interval	Uint16 Big endian	Minutes	1-10080	Query Set	No	Measurement interval in minutes	
0x27	Tx Group size	Uint8	-	1-12	Query Set	No	Number of measurements to group in each transmission.	
0x28	Sensor delay	Uint16 Big endian	ms	0-20000	Query Set	No	Delay between activation of the 24V power and the measurement of both channels.	
0x29	Ch1 Threshold	Uint16 Big endian	1/8 mV	0-26400	Query Set	No	Threshold setting for the digital sensor. Setting the threshold to 0 makes Ch1 analog.	
0x2A	Ch2 Threshold	Uint16 Big endian	1/8 mV	0-26400	Query Set	No	Threshold setting for the digital sensor. Setting the threshold to 0 makes Ch2 analog.	

OY1400 LoRaWAN® converter 0-10V, 4-20 mA

7.4 Examples

Uplink: 012147901738

Single measurement result when both Ch1 and Ch2 is configured as analog channels. Ch1 is 2.29V and Ch2 is 0.743V. If configured for voltage measurement this would translate to 9.389V and 3.0463V. If configured for current measurement this would translate to 19.083mA and 6.192mA.

Uplink: 0121479017383860218832482520

Three combined measurements when both Ch1 and Ch2 is configured as analog channels. Ch1 is 2.29V, 1.804V and 1.609V for the first, second and third measurement. Ch2 is 0.743V, 1.073V and 1.188V for the first, second and third measurement.

Uplink: 0122011738002188

Two combined measurements when Ch1 is configured as digital and Ch2 is configured as analog. Ch1 is 1 and 0 for the first and second measurement. Ch2 is 0.743V and 1.073V for the first and second measurement.

Uplink: 0123479000

Single measurement when Ch1 is configured as analog and Ch2 is configured as digital. Ch1 is 2.29V and Ch2 is 0.

Uplink: 01240101000100000001

Four combined measurements when both Ch1 and Ch2 is configured as digital channels. Ch1 is 1, 0, 0 and 0. Ch2 is 1, 1, 0, 1.

Downlink: 012605A0

Uplink: 012605A0

Sets the measurement interval to 1440 minutes = 24 hours.

Downlink: 0227

Uplink: 012702

Query the Tx group size. The reply is 2 combined measurements.

Downlink: 0305

Uplink: -

This resets the device, bringing it back to an inactive state.

8 LoRa MAC Commands

The OY1400 can be controlled over by sending downlink commands.

OY1400 LoRaWAN® converter 0-10V, 4-20 mA

The following MAC commands per LoRaWAN specification 1.0.2

CID	Command	Transmitted by	Short Description
0x02	LinkCheckReq	End-device	Used by an end-device to validate its connectivity to a network.
0x02	LinkCheckAns	Gateway	Answer to LinkCheckReq command. Contains the received signal power estimation indicating to the end-device the quality of reception (link margin).
0x03	LinkADRReq	Gateway	Requests the end-device to change data rate, transmit power, repetition rate or channel.
0x03	LinkADRAns	End-device	Acknowledges the LinkRateReq.
0x04	DutyCycleReq	Gateway	Sets the maximum aggregated transmit duty-cycle of a device
0x04	DutyCycleAns	End-device	Acknowledges a DutyCycleReq command
0x05	RXParamSetupReq	Gateway	Sets the reception slots parameters
0x05	RXParamSetupAns	End-device	Acknowledges a RXSetupReq command
0x06	DevStatusReq	Gateway	Requests the status of the end-device
0x06	DevStatusAns	End-device	Returns the status of the end-device, namely its battery level and its demodulation margin
0x07	NewChannelReq	Gateway	Creates or modifies the definition of a radio channel
0x07	NewChannelAns	End-device	Acknowledges a NewChannelReq command
0x08	RXTimingSetupReq	Gateway	Sets the timing of the of the reception slots
0x08	RXTimingSetupAns	End-device	Acknowledges RXTimingSetupReq command

9 Special pre-configurations

The OY1400 is available with a number of pre-configured probes.

9.1 OY1400 Leakage rope

OPN: TP-T1400-WLR-1-EU

The device is pre-configured for the water leakage rope. It's based on the standard OY1400 with 0-10V settings. There are 2 different payloads available:

No leakage=01240000 ; Leakage=01240100.