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NOKEVAL

Solid-Sky-2Pro-24VDC
Solid-Sky-2Pro-DIO-24VDC
Solid-Sky-2Pro-DIO-RS485

Manual

ID9828 V24 15.10.2021
Firmware 0.2-1.4

Contents

Introduction

Solid-Sky-2Pro is a wireless transmitter for measuring two mA or V signals, and also some models for digital inputs and/or Modbus master over RS485. The device can intermittently supply power to two external two-wire 4-20 mA transmitters even when running on battery power only.

Variants

- If the model name has -2Pro, then the device has two “process” inputs, i.e. mA or V.
- If the model name has -DI, then the device has three digital inputs.
- If the model name has -RS485, then the device has a RS-485 serial port.
- If the model name has -24VDC, then the device can be powered with an external 11 to 30 V DC supply in addition or instead of the batteries.

Sky radio

The Sky devices use the Semtech LoRa modulation technique that allows unforeseen wireless range in a battery powered transmitter. The protocol used is defined by Nokeval, called Sky, which means that this device is not compatible with the LoRaWAN infrastructure.

The modulation has some parameters to define its operation. With the “maximal” settings, a very long range can be reached, but at the expense of high battery and radio band consumption. One radio transmission can last approx. 2 seconds (compared to 20 ms of the Nokeval MTR series). This means that the number of transmitters within the range must be limited in order to avoid collisions and to allow radio time for each. It is not practical to use a short interval between transmissions; 10 to 30 minutes is the recommended interval range.

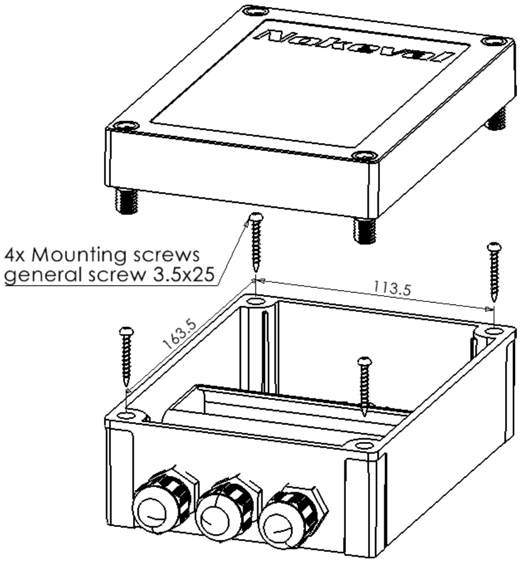
When the maximal range is not necessary, the parameters must be adjusted for lower battery and band consumption. All the devices within one network must share the parameters, because the receiver can only listen with one set of parameters at a time. Consequently, the parameters must be selected according to the most distant device. It is also possible to adjust the transmission power. The devices that are closer to the receiver can use a lower power setting.

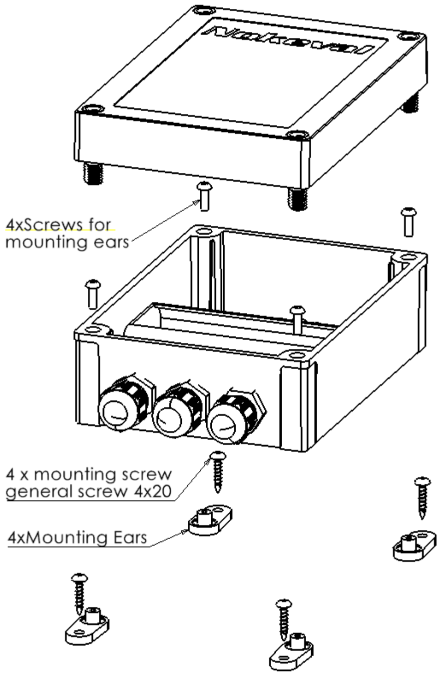
Before using the 433 MHz radio, make sure it is legal in your country.

Installation

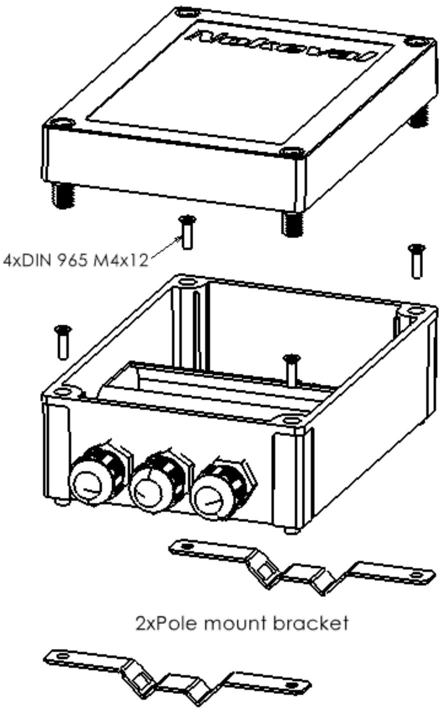
Mounting

Open the front cover. Use the four screw holes in the corners for mounting. Or use optional mounting ear kit.



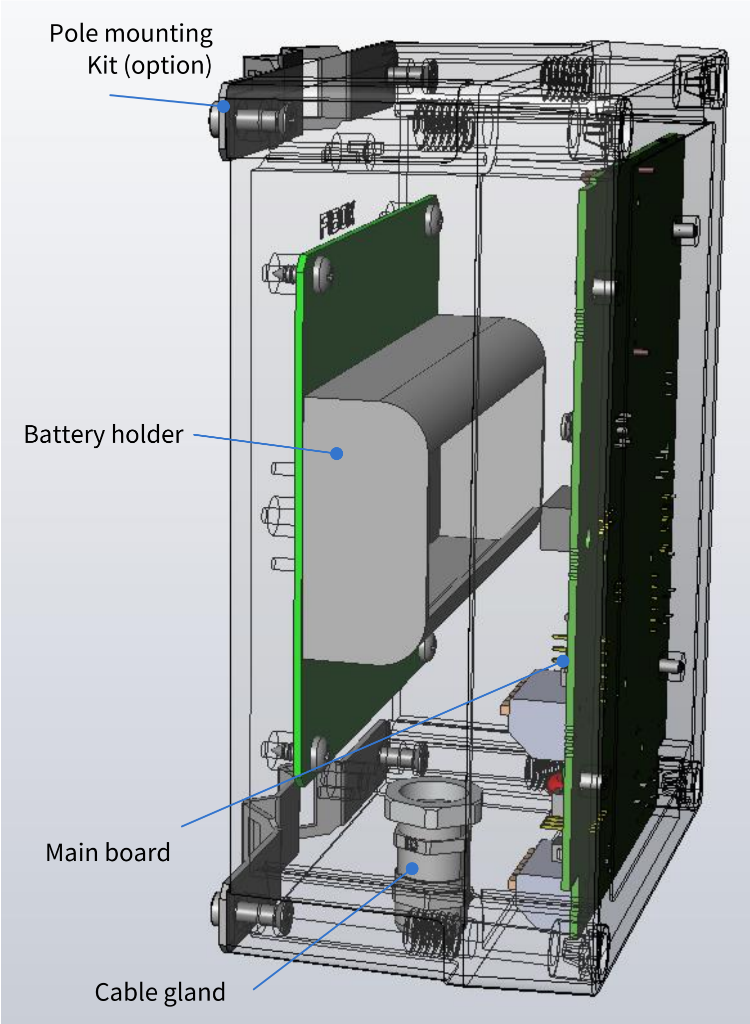


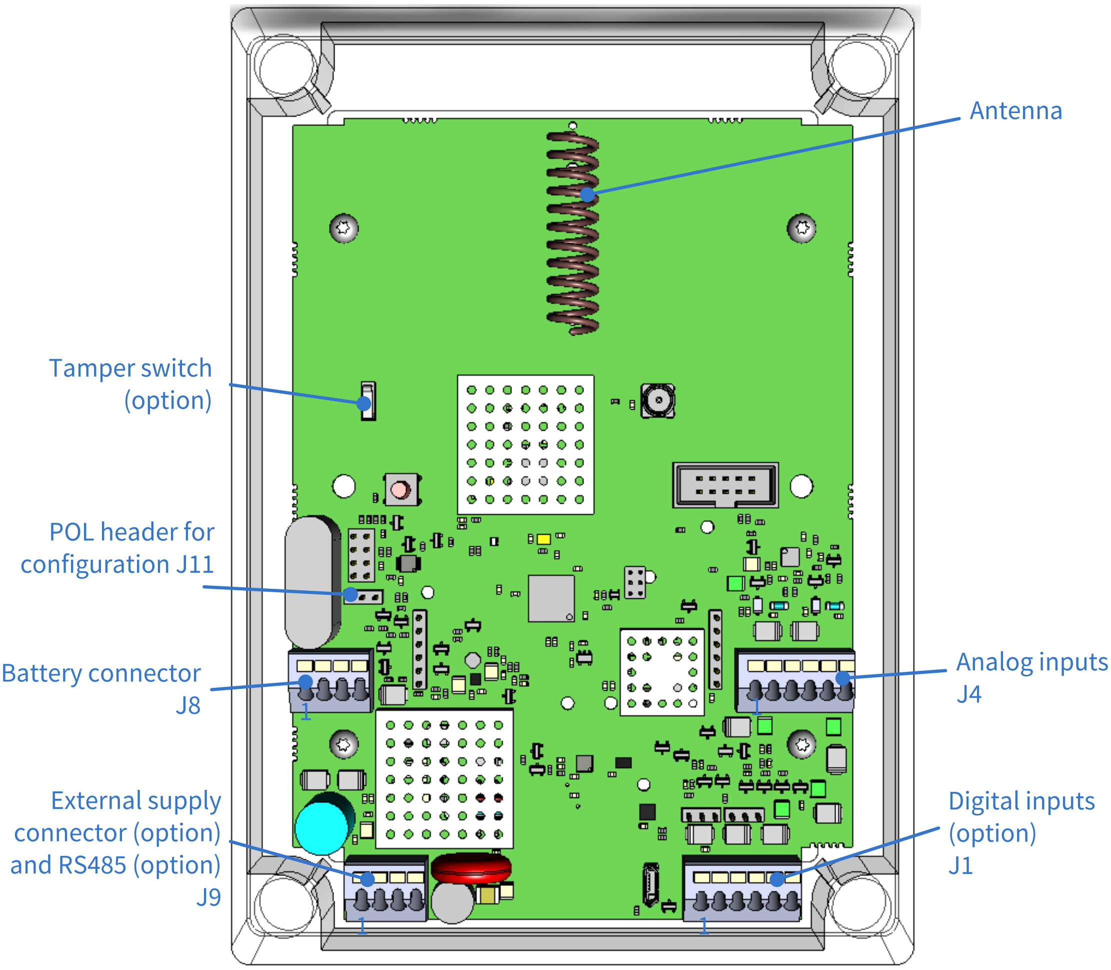
Alternatively use a pole mounting kit. Note that the radio transmission to the side where the pole is, is heavily attenuated. If possible, turn the device so that it is between the pole and the receiver.



Wiring and connections

Use the cable gland(s) to bring the cable in. Additional glands can be added by drilling new holes.





The analog and digital connections and the external supply are detailed in the corresponding chapters.

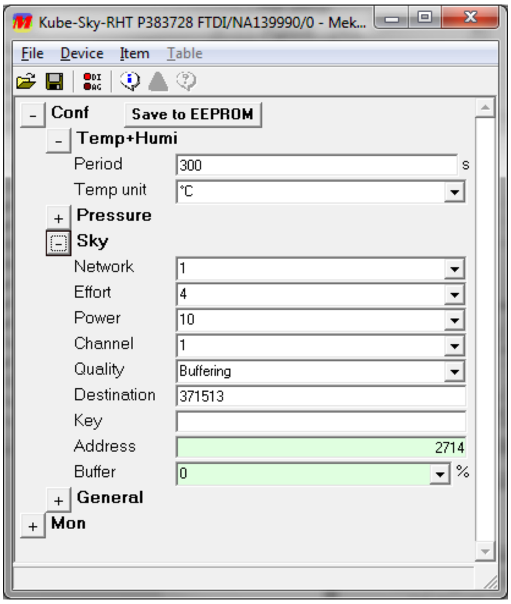
The battery connector is factory-wired to the 4xC battery holder. The terminal 1 is positive and 4 negative. A supercapacitor is electrically parallel connected with the batteries. Do not short-circuit the battery terminals. Beware that the charge in the capacitor may remain hours after disconnecting the batteries.

The POL header is used for configuration, see below.

Configuration

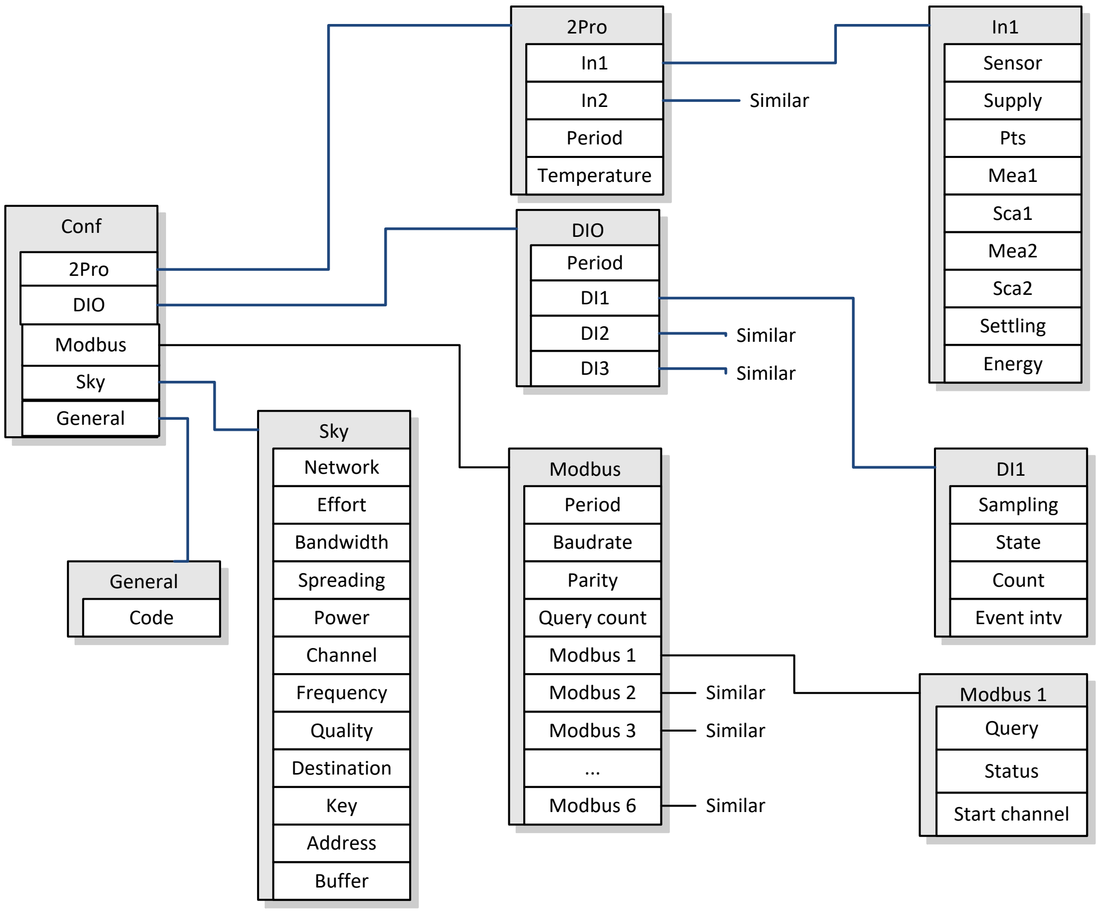
To access the configuration settings:

- Connect a Nokeval DCS772 programming adaptor using adaptor POL-3PIN to the three-pin header marked J11 on the circuit board. Either polarity will do. Use ESD precautions while connecting: touch one of the steel boxes on the board before connecting.
- Launch the Mekuwin program (available for free at www.nokeval.com).
- In Mekuwin, choose Port=DCS772, Protocol=SCL, Address=0. Click Direct.
- A new window will open. It has branches for different functionalities.



Menu chart

This is the configuration menu of firmware V1.0. The different versions may have slight differences and lacking features. The menu has a submenu for the analog input settings, possibly menus for the digital input settings and Modbus settings, another for the wireless settings, and finally a submenu for general settings.



Settings not covered elsewhere

General / Code

If a password (six letters or digits) is entered here, the same password must be known when next time accessing the settings.

Monitor menu

In the mon(itor) menu, you can watch the measurement readings.

- ***In1, In2:*** The measured and scaled input signals.
- ***Temperature:*** The temperature reading in °C.
- ***DI1State:*** The state of the first digital input, 1=active. Works only if the digital input is configured properly.
- ***DI1Count:*** The pulse count of the first digital input.
- ***DI2… and DI3…:*** like DI1.
- ***Modbus ch13…ch44:*** RS485/Modbus latest result for each defined value.
- ***Batt:*** The estimated remaining battery capacity in percent.
- ***ExtPow:*** Is an external power supply connected.
- ***Switches:*** The button and the tamper switch status for the manufacturer's testing.

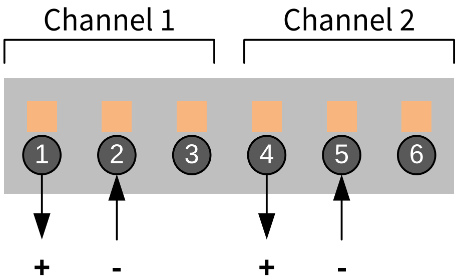
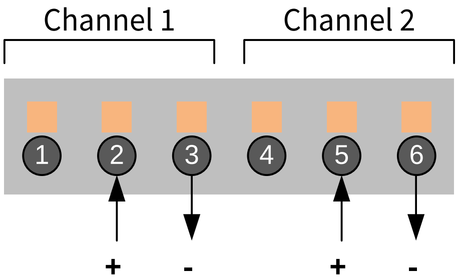
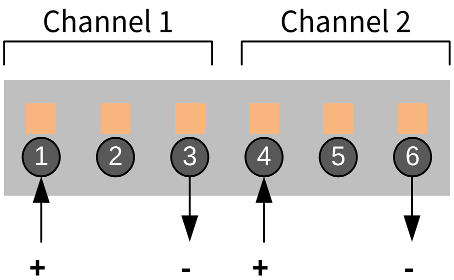
Cal menu

The calibration menu settings are only for the manufacturer use, and they are not explained in this manual.

Analog inputs

Wiring

Connect the analog signals to the connector J4 according to the signal type:

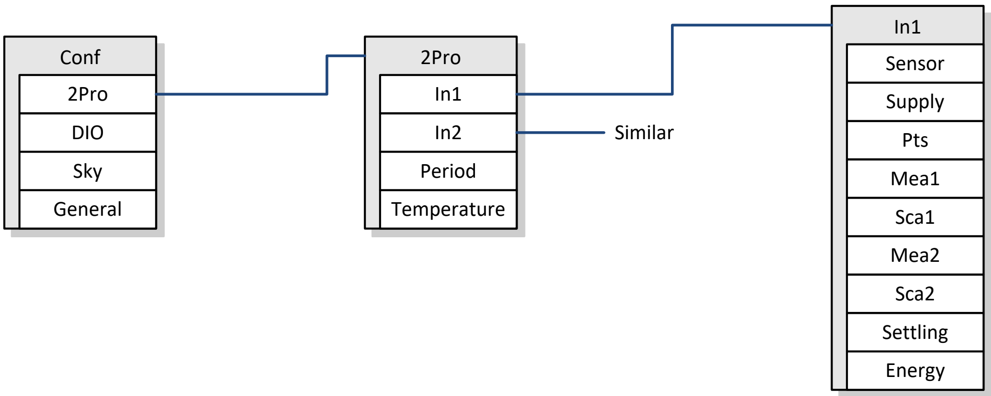
mA 2-wire (powered by Solid)	
mA active (not powered by Solid)	
V	

To aid inserting a wire, keep the connector button pressed. Use the same button to disconnect a wire.

The terminals 3 and 6 are internally interconnected.

Configuring

Use Mekuwin to configure the device according to page 5. There is a submenu for each input channel. They can be configured independently.



Sensor

This setting defines the input signal type and allows switching the channel off. The options are Off, mA, and V. It is advisable to switch an unused input channel off in order to save battery.

Supply
Should this device provide a power for an external device. Available only with the mA input signal. The options are None, Low, and High. Low gives approximately 12 V out while High gives 18 V. None does not provide any power.

Pts, Mea1, Sca1, Mea2, Sca2
These settings allow to scale the input signal to “engineering units” e.g. bars, metres, or kilograms.

If Pts=0, the input signal will not be scaled, instead the measured mA or V reading is used as is.

If Pts=2, the input signal is scaled with two freely selectable points. When the input signal (in mA or V) corresponds to the Mea1 value, it is converted to the Sca1 value, and the same for the other point. A linear interpolation and extrapolation is used elsewhere. An example how to scale a 4-20 mA signal to 0…6:

- Pts = 2
- Mea1 = 4 (mA)
- Sca1 = 0
- Mea2 = 20
- Sca2 = 6

Settling
This device can’t give a continuous power supply for an external device. The supply will be intermittently enabled. This setting defines how long the supply will be kept on before taking the reading. The value is in milliseconds. If the time is too short, the external device will not stabilize, resulting in an incorrect reading. If the time is too long, the battery will be consumed unnecessarily. The suitable value must often be found by experimenting different values:

- (Temporarily) enable both inputs and set some settling value for them, e.g. 500 ms. This will cause the device to power up and down each input at a turn, allowing to observe the effects of the settling time.
- Adjust the settling time and watch the reading in the Mon menu. Increase the Settling until the reading does not change anymore.
- This is best to do at the maximum signal of the transmitter because it usually takes the longest time to settle.

In a cold environment -30°C and below, settling times beyond 5 seconds (combined for both the channels) will not likely work, as the batteries are not able to give enough current and the supercapacitor will not have enough capacity.

Temperature
By enabling this setting, the device will measure its internal temperature and transmit it along the other readings. The temperature measurement is not accurate. The measurement unit is always °C. Using this option will increase the battery consumption but only a very little.

Period
This setting determines the measurement and transmission period of the analog inputs and the temperature. It is common for both the inputs. The allowed range is 5…7200 seconds. This setting has strong impact on the battery life together with the Settling settings. Avoid using too short periods, because it will cause faster battery exhaustion.

Digital inputs

General

There are three digital inputs, but they are not similar.

- DI1 and DI2 accept both NPN and PNP signals (the type must be selected with a jumper), while DI3 accepts NPN only.
- DI1 can use a hardware counter, which can count pulses without waking the microcontroller, resulting in lower battery consumption and possibly higher maximum frequency.
- DI2 and 3 share a common sensing current control, explained below.
- DI3 serves as a digital output also, but that option is not available yet.

Levels

The NPN inputs are pulled to approx. 2.3 V by Solid when its sensing is active. When they are pulled externally below approx. 1.9 V, this is recognized as an active state. It is allowed to pull them externally to up to 30 V DC.

The PNP inputs are always resistively pulled to 0 V by Solid. When they are pulled externally above approx. 3 V, this is recognized as an active state. The voltage can go up to 30 V DC.

Sensing modes

Unlike the analog inputs, which are “sensed” only once the configured transmission period, the digital inputs must be sensed more often to be able to detect changes in their states and to count pulses. Unfortunately, the sensing consumes current. A current must be injected in order to sense the status of the inputs:

With an NPN input, this device pulls the inputs up via a resistor, and senses if the voltage is externally pulled low. If it is, while the pull-up is enabled, there will flow a current that consumes the battery (unless an external supply is used).

The PNP inputs are constructed so that they internally utilize the NPN inputs, having current consumption when the terminal is externally pulled high.

To reduce the current flow, Solid has several sensing modes. Each digital input has a selection of its own, but the hardware is built so that the sensing of DI2 and DI3 are always controlled together, which means that the more consuming mode is used for both.

Sensing mode	Description	Current consumption
Off	The sensing current, and all the digital input functionality, is shut down. Select this for all the unused digital inputs.	Zero
Backoff 10s	The sensing is kept continuously on, until the input is detected to be active (NPN externally pulled low) which would consume current. Then the sensing is cut off for 10 seconds. After that time, the sensing is enabled, and if the input is detected to be passive, the sensing is continued, otherwise it is quickly cut again.	Lowest
Backoff 1s	The same as above but with 1 s back-off.	
Backoff 0.1s	The same as above but with 0.1 s back-off.	
Continuous	The sensing is kept continuously on. If the input is active (NPN externally pulled low), a continuous current will flow, consuming the battery. If the external pulses are narrow, then the consumption is not so heavy.	

Awake	The same as above but prevents the microcontroller from sleeping. This mode should not be necessary.	High

The Continuous mode is the easiest to use, as the sensing is always on. The downside is that if the external system is keeping the input at its active state (PNP high or NPN low) for a significant time, the battery is consumed. Naturally this is not an issue when an external power supply is used.

If an input is externally kept in its active state for a long time, and the device is battery operated, the Backoff modes may help. They will cut the sensing current once detected, and then intermittently but shortly test, if the input is still active. These modes are great when the frequency is low; in practice the input must be in its passive state more than the back-off time to be reliably detected.

Hardware counter

The DI1 can be internally connected to a hardware counter, which allows counting the pulses without waking the microcontroller for every pulse. This will happen automatically when the DI1 sensing mode is set to Continuous or Awake, the Count transmission is enabled, and the State transmission is disabled (as the state is not immediately recognized by the sleeping microcontroller).

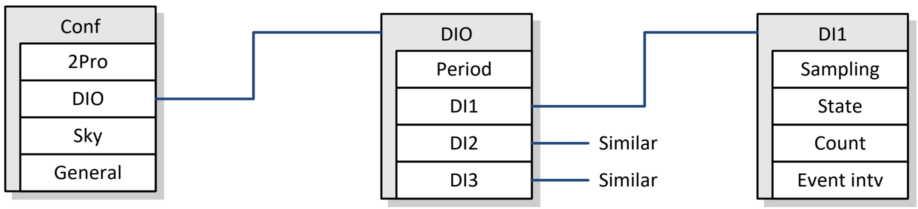
Maximum frequency

In the Continuous mode, the pulse counting works to at least 500 Hz, however the input must be in both states at least 1 ms. In the Backoff modes, the frequency is naturally limited by the back-off time.

Power output

While the DI1 sensing is active, the terminal 1 outputs a 2.9 V voltage to be used externally. The load should not exceed 20 milliamperes. A short-circuit must be avoided as there is no protection circuitry.

Settings



There is a common ***Period*** setting applying to all the digital inputs. With this period, the states and counts of the digital inputs are transmitted with the radio. In addition, there may be separate event transmissions as explained below. It is advisable that the analog period is a multiple of the digital period or vice versa, or they share the value, because then the transmissions stay in sync, allowing them to be combined in the same radio packet.

Another common setting, ***Reset***, will reset all the counters to zero.

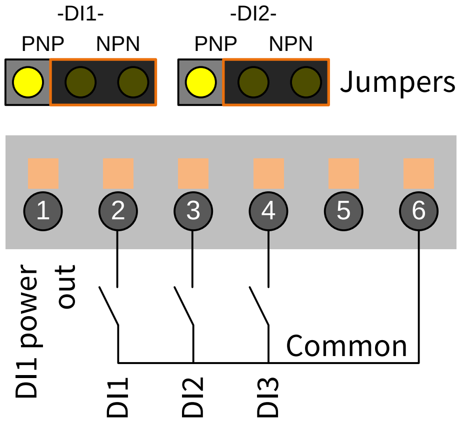
Each digital input has four settings:

- ***Sampling*** selects the sensing mode, see page 9.
- If ***State*** is enabled, the state (active or passive, 1 or 0) is transmitted. Use this when you are interested about the state itself, which applies to e.g. door switches.
- If ***Count*** is enabled, the pulse count is transmitted. Use this when you need the number of pulses, e.g. when measuring water or electricity consumption, or want to know how many times the state has changed. The counter is 32 bits, i.e. after 4 294 967 296 it will roll over to zero.
- If you need to have an instantaneous transmission when the state of the input changes, set the ***Event interval*** setting to some non-zero value. The value defines, how often a transmission can happen due to the change of the state. In practice, once an event transmission happens, the next is inhibited for the time set. These transmissions are independent of the regular transmissions based on the common Period setting. Do not use too small value, to not block the radio band and to exhaust the battery.

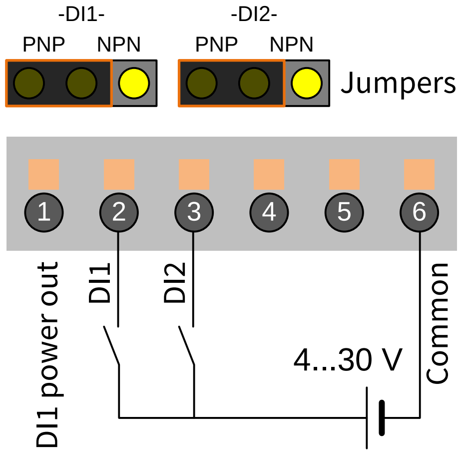
Wiring and jumpers

Connect the digital signals to the connector J1. For DI1 and DI2, select NPN or PNP with the jumpers.

NPN



PNP

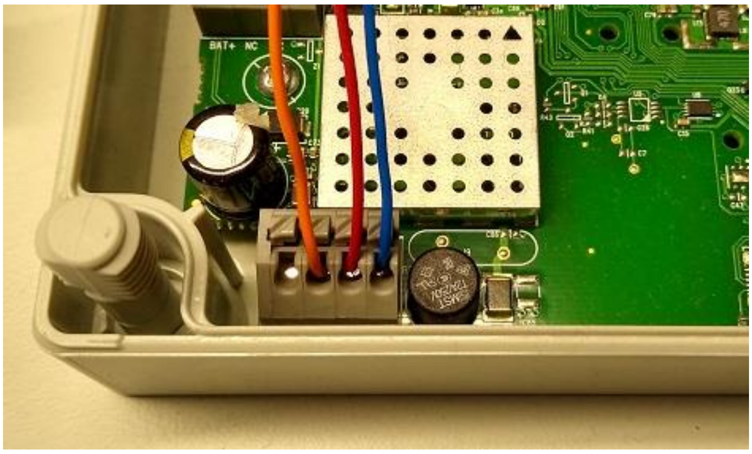


Modbus/RS485

The Solid-Sky-2Pro-DIO-RS485 can use Modbus over RS485 to read values as master with many possible data types and options for multiplier and offset. It can also write values as part of the Modbus routine, and can optionally wait between the Modbus commands. This first firmware version with this functionality is V1.3.

Wiring

On the RS485 spring connector the pins from left to right are VIN24 (not relevant), Ground, D1 and D0.



Modbus menu structure

The Modbus submenu is in the Conf menu.

- Period – interval between measurements in seconds
- Baud rate – UART baud rate. This and parity are shared between the definitions.
- Parity – UART parity.
- Query count – The number of used definitions; 0-6
- Modbus (1-6)
  - Query
    - The definition in text. See the next sections for instructions on how to write these.
  - Status
    - Information for whether the definition is valid. If not, it describes which kind of problem there is, and in which parameter it was found. Invalid definitions are skipped by the device.
  - Start channel
    - Information for the first channel number for values from this definition. The first read command starts at channel 13, next is 14 and so on. E.g. if the first command reads 4 values, the next read command starts at channel 17.

Modbus command definition

Structure of a definition:

1. A single write or read command which contains the slave address and register/coil address.
2. Optional parameters such as a delay before running the command.
3. One or more definitions for values to be read or written.

For example, this is a definition to first wait for 3 seconds, then read holding registers numbered 20 and 21 and interpret the results as two unsigned 16-bit integers.

- RHR(1,20) W(3) U16*2

Up to 6 commands with up to 60 characters each can be defined, and the **maximum total number of results is 32**.

- One read command can fetch multiple successive results (e.g. from holding registers 21…30) with different data types, offsets and multipliers.
- One write command can write multiple successive registers or coils.

Read and write commands

The commands are in format RHR(5,9) where 5=slave address, and 9=Modbus register address with lowest address being 0. A definition must contain exactly one read or write command, and it must be at the start of the definition.

Read functions:

- RHR(1,0) = read holding register (function code 3)
- RIR(1,0) = read input register (function code 4)
- RC(1,0) = read coil (function code 1)
- RD(1,0) = read discrete input (function code 2)

Write functions:

- WHR(1,0) = write holding register (function code 16)
- WC(1,0) = write coil (function code 15)

Note: the device always uses the function codes for reading or writing multiple values, regardless of whether one or more values are actually read or written.

Wait option

This can be used with both read and write commands.

Wait:

- W(3.5) = wait for 3.5 seconds before starting this command.
- Notes: a command can only contain one wait instruction, and the combined wait time for all commands can be up to 290 seconds.

Defining values for read commands

Types

When reading data, 16bit registers and 1bit inputs are treated in a similar way. The device fetches the correct amount of data, e.g. two 16-bit registers or 32 coils are fetched for one 32-bit value. This allows e.g. interpreting registers as bit fields or a group of coils as integer.

The following types are supported. The number describes the number of bits, e.g. U16 means 16-bit unsigned integer.

- Unsigned integers
  - U8
  - U16
  - U32
- Signed integers
  - S8
  - S16
  - S32
- Float: F32
- Bit field: B1
- Dummy value types:
  - D8
  - D16

Notes:

- 8-bit value types are read from registers in MSBF order
- Dummy types can be used to skip some data, e.g. D16*4 means skipping 4 registers. The dummy types aren't transmitted and don't consume radio channel numbers.
- Signed integer is always converted to float value, and if either multiplier or offset modifier is defined, signed integer is also changed to float in radio transmission.
- One read command can include up to 12 value type definitions (such as U16).

Value modifier options

Modifiers to change the read value are written in parentheses separated by commas, e.g. U16(X2.3,A5). If these are't used, the parentheses aren't needed.

- Multiplier **X5.2** = multiply result by 5.2
- Divisor **D25** = divide by 25
- Offset **A6.5** = add 6.5 to result. The addition is done after any multiplier or divisor.
  - Negative value can be used for subtraction, e.g. **A-6.2**

Reading multiple similar values

Multiple similar values can be read with "*", this can be combined with modifiers. E.g.

- U16*4
- U32(X2.5)*2

Separately written options

Endianness

- E(CDAB) = endianness CDAB for 32-bit values (U32, S32, F32). Options:
  - ABCD (=MSBF, default)
  - CDAB
  - DCBA (=LSBF)
  - BADC
- The endianness is used for all 32-bit values read by a command.

Example read commands with explanations

- RHR(1,1) U16
  - Read one unsigned 16-bit integer value from holding register 1
- RHR(1,2) W(2) U16(X12.5)*4
  - Wait 2 seconds, then read four 16-bit unsigned integers starting from holding register 2, and multiply each result by 12.5
- RC(1,0) B1*8
  - Read 8 one-bit values from coils, starting from the very first coil (0)
- RIR(1,50) E(CDAB) U32(D1000,A-30)*2 U8*4
  - Read two 32-bit unsigned integers starting from input register 50 with CDAB endianness, divide results by 1000 and subtract 30. Additionally read four 8-bit unsigned integers from the next two input registers.

Write command definitions

Holding registers and coils have separate write commands.

WHR = Write holding register

Writes one or more holding registers.

The values to write can be written as hexadecimal with the ”0x” prefix, or decimal without any prefix.

- WHR(1,0) U16(0x12AF) – write 0x12AF to first holding register. (allowed values 0x0000 – 0xFFFF)
- WHR(1,0) U16(12345) - write decimal value 12345 to first holding register (allowed values 0-65535)

Multiple successive registers can be written with one command as follows

- WHR(1,1) U16(0xABBA) U16(0xACDC) U16(12345)

WC = Write coil

Writes one or more coils. Only numbers 1 and 0 are allowed.

- WC(1,0) B(1) – write value 1 to coil 0.
- WC(1,6) B(100101010101110) – write successive coils starting from coil 6. Value for the first coil is the leftmost number.

Sky radio

Settings

The Sky menu contains the settings for the wireless network.

Network: To prevent mixing the different networks (and users) data, the network address should be set to some value not used nearby. In most cases a random value 1 to 255 is OK. All the devices within one network must share the value. The receiver will only accept packets that have the matching network address. If an encryption key is used, it is not necessary to use a unique network address as the encryption itself will prevent the networks from mixing. Default 1.

Effort: The modulation effort. The higher value, the longer range but the more battery and radio band consumption. This single setting controls the LoRa bandwidth and spreading parameters as in the table below. Increasing the effort one step will coarsely add 2.5 dB in the link budget, or 30% of open-space range, but also double the battery consumption caused by the radio.

The range estimates are merely approximate, the real range depends heavily on all objects on the radio path. Especially metal walls will severely attenuate the radio waves.

Effort setting	Bandwidth	Spreading factor	Estimated indoor range 40...35 dB/decade	Estimated outdoor range 30 dB/decade
1	250 kHz	7	90...260 m	1100 m
2	250 kHz	8	100...300 m	1300 m
3	250 kHz	9	120...360 m	1600 m
4	250 kHz	10	140...420 m	1900 m
5	250 kHz	11	160...500 m	2300 m
6	250 kHz	12	180...590 m	2800 m
7	125 kHz	12	220...720 m	3500 m

The Effort setting can be set to Custom position; then it is possible to set the LoRa bandwidth and spreading parameters independently, as well as adjust the frequency steplessly within 433.3 to 434.5 MHz. Normally this should not be necessary.

Power: The transmission power; 10 means the maximum power and each step reduces one dB. A lower value should be selected to conserve battery and to avoid disturbing other users of the band whenever possible. However, this setting will not affect the battery consumption as much as the Effort setting, which means that the first mean to lower the battery consumption should be lowering the effort if possible. While each device in the network must share the Effort setting, the Power can be adjusted individually. In practice, the Effort is defined by the most distant device, and the Power of the nearer devices can be lowered.

Channel: The radio frequency channel. If several LoRa/Sky networks exists within the same area, a different frequency should be selected for each network. The radio frequency is 433.3 + 0.2 MHz * (channel-1), i.e. the first channel is 433.3 MHz, second 433.5 etc. When using Efforts below 7 (bandwidth of 250 kHz), the nearby networks (systems) should have channels of at least two steps apart, e.g. 1 and 3 to avoid overlap. The channel 4 uses 433.9 MHz which is the most crowded frequency on this band, so it should be avoided. To sum up, good channels are 1, 3, 5, and 7. Each device must use the same channel.

Quality: This setting has options affecting the reliability of the packet delivery:

- Once: This device will transmit each reading once not expecting any acknowledgement. If the packet is lost due to a collision with another transmission or any disturbance, it is just lost.
- Twice: The device will transmit each reading twice, giving a higher probability for a successful delivery.
- Thrice: The device will transmit each reading three times.

- Bidirectional: After transmitting a packet, this device will listen for an acknowledgement from a receiver and retransmit up to two times if not getting acknowledged. If there is no acknowledgement, this device will discard the packet and try only once for the next time. This setting increases the probability of successful delivery significantly but does not guarantee it.
- Buffering: This device will keep retransmitting each reading until acknowledged. The readings will be buffered until delivered as far as the buffer is not full. The buffer can hold approximately 400 packets. When the buffer is more than half full, the measurement intervals will be temporarily increased to slow down the filling of the rest of the buffer.

Each device in the network can have an individual choice.

Destination: When using the Bidirectional or the Buffered quality, the receiver that is supposed to acknowledge must be manually defined. Enter the radio address of the receiver here. The system can have several receivers, each picking the same radio packets, but only one is chosen to acknowledge to avoid collisions.

Key: An authentication and encryption key for the radio. If an authentication is not desired, leave this blank. Then it is quite easy to eavesdrop and disrupt the radio traffic. To get a secured operation, enter any text string (up to 16 characters). Use the same key in the receiver, and consequently in all the other transmitters in the same network.

Address: The radio address of this device. Can't be changed here.

Buffer: Indicates how many percent of the buffer is used. Can't be manually adjusted. Should be 0 when the network is operating smoothly.

Quantity channels

The device sends the measurement data with its device address using the channels as follows:

Channel	Physical quantity	Unit
1	Analog input 1	mA, V, or user scaled
2	Analog input 2	
3	Temperature	°C
4	Digital input 1 state	0 or 1
5	Digital input 1 count	Pulse count
7	Digital input 2 state	
8	Digital input 2 count	
10	Digital input 3 state	
11	Digital input 3 count	

These channel numbers are used when configuring the device for the Ovaport service or any other type of receiving system.

External power supply

In addition, or instead, of the batteries, this device can be powered with an external 11 to 30 V DC supply. Connect it in the spring-loaded connector J9, terminal 1 positive, 2 negative. The idle current is a couple of milliamperes, but during the operation the current can briefly go over 100 mA.

When the external supply is available, the batteries are not consumed. The batteries can thus be used as a back-up.

The external power supply input must be protected with an external surge suppressor, if a surge is possible, e.g. when the supply cable goes outdoors. The power supply input itself is protected against a moderate surge, but as it is internally connected to the other ports (analog and digital inputs and the serial port), a line-to-earth surge will be conducted to those other ports, which are not so well protected.

Maintenance

Not used for a while

If the device is not used for months, it is recommended to remove at least one battery.

Changing the batteries

- Open the front cover.
- Replace the batteries with four new and similar LR14 (alkaline C) batteries observing the polarity. For maximum battery life and optimal operation in cold environment, use high quality batteries like Energizer EN93.

Test button

Some models are equipped with a pushbutton on the circuit board. By pressing it, the device transmits one radio packet immediately, which can be used to test the receiving system.

In addition, the on-board LED will either shortly light green, if everything is OK, or blink fault codes in red:

- 2 blinks: Battery low.
- 3 blinks: Radio hardware fault.
- 4 blinks: Radio network error, in practice this device is not getting acknowledgements from the receiving system.
- 5 or more blinks: Various sensor/input related faults.

If the on-board LED is quickly blinking in yellow, it means that the device is resetting itself. This is normal when inserting the batteries, but if it happens spontaneously, the batteries are likely dead.

Cleaning

The enclosure exterior can be wiped with a damp cloth soaked in soap water or isopropyl alcohol.

Specifications

Environment

Storage temperature	-40...+60 °C, non-condensing
Operation temperature	-40...+60 °C
Operation humidity	0...100 %RH
Protection class	IP65
Enclosure material	Polycarbonate

Measurements

Weight	Approx 850 g with the batteries
Dimensions	Width: 130 mm Height: 180 mm Depth: 75 mm without the pole mounting kit

Internal batteries

Type	LR14 (C 1.5 V alkaline). For the advertised battery life, a high-quality battery should be used, e.g. Energizer EN93.
Battery life	TBD

External power supply (option)

Voltage	11…30 V DC
Consumption	max 150 mA

mA inputs

Range	0…+21.0 mA or more
Load	50…80 Ω
Overcurrent protection	PTC fuse, max 30 V
Excitation	Low setting: 11.5…14 VDC High setting: 17.5…20 VDC
Accuracy 25 °C	±0.008 mA
Thermal drift	±60 ppm/°C

V inputs

Range	0…11 VDC
Load	110 kΩ
Accuracy 25 °C	±0.005 V
Thermal drift	±60 ppm/°C

Sky radio

Antenna	Internal
Center frequency	433.3…434.5 MHz user adjustable
Bandwidth	max 300 kHz OBW
Transmitting power	max 10 dBm E.R.P.
Open space range	about 10 km with maximal parameters
Typical range	See page 16.

Internal temperature measurement

Measurement range	-40…+60 °C
Accuracy	Typ ±0.5 °C
Step response time	TBD (63 % of a step change)

Warnings

The device must not be disposed of in household waste. Observe local regulations concerning the disposal of electrical waste. The device contains batteries.

The device contains a supercapacitor. Even with the batteries removed, the capacitor may hold a charge for several hours, even days. If short-circuited, very high current will flow.

The external power supply input must be protected with an external surge suppressor, if a surge is possible.

Manufacturer

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Finland

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Email sales@nokeval.com

Nokeval
made to measure

EU Declaration of Conformity

Object of declaration: Wireless measuring device
Model/Type: Solid-Sky-2Pro
Description: Wireless 433.92MHz 2-channel mA-input transmitter based on LoRa-modulation.

Manufacturer: Nokeval Oy
Rounionkatu 107, 37150 Nokia, Finland

www.nokeval.com
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This declaration of conformity is issued under the sole responsibility of the manufacturer.

The object of the declaration described above is in conformity with the relevant Union harmonization legislation:

Directive (RED) 2014/53/EU
Directive (RoHS) 2011/65/EU

The conformity is given based on the following harmonized standards:

RED: EN 300 220-2 V3.1.1 (2017-02)
EN 301 489-1 V2.1.1 (2017-02)
EN 301 489-3 V2.1.1 (2017-03)

EMC: EN 61326-1:2013

LVD: EN 61010-1:2010

RoHS: EN 50581:2012

Product is marked with CE mark to indicate compliance.
Product is designed and manufactured in Finland.

Signed for and on behalf of Nokeval Oy:

At Nokia 2.6.2020

Jani Vähäsöyrinki, Managing Director

www.nokeval.com