move
SOLUTIONS

Single Channel Node
Instruction Manual

Quick installation guide and system operation
Important safety, compliance and warranty information

Single Channel Node
Instruction Manual

English
Read manual before using the product

Index

Warnings

1

For the correct and safe operation of the product, it is recommended to read and follow the instructions in this manual.

Great attention should be paid to the following warnings. Move Solutions shall not be held responsible for inconveniences, damage or malfunctions due to lack of compliance to the prescriptions and suggested use in this manual.

- The declared IP rating is to be intended with both the cable gland tightened around a cable and the lid of the product correctly screwed in place. Do not expose the product to humidity or dust in any other condition.
- Before use, make sure that the product conforms to the description in this manual and that no damage is present.
- Do not use batteries other than those specified by Move Solutions without express approval from a Move Solutions representative.
- Before any operation on the product, disconnect the batteries.
- The product is not intended for use in applications where safety is extremely critical, such as medical-related applications or life-security systems.
- On top of the prescriptions in this manual, the user should operate in compliance with local standards for security and health, and according to the best engineering practices for a safe installation.
- The product must be kept clear of children, animals, and any unauthorized personnel.
- Do not disassemble the product except when explicitly instructed in this manual, as this could cause malfunctions and damage the product.
- Do not attempt to repair or modify the product.
- If the product releases smoke or heat during operation, immediately disconnect the batteries.
- Do not expose the product to high temperatures outside the specified range or heat sources.
- Do not expose the product to liquids of any kind and do not operate on it with wet hands. The product can only be exposed to water when the conditions to guarantee the IP rating are satisfied.
- Do not operate on the product in extreme weather conditions that may damage

the device or the user, such as thunderstorms or snowstorms.

- Do not disperse the product or part of it in the environment.
- Correct functioning of the product in environments with high radio activity is not guaranteed.
- The product is compliant to all regulations concerning the fair use of ISM radio bands. However, given the free nature of these bands, occasional conflict with nearby devices operating on the same bands cannot be fully prevented.

This product contains electronic components and batteries that must be disposed of separately from common household waste, according to local regulations. To ensure correct disposal of the product at the end of its lifecycle, please refer to your local authority. Failure to comply to the regulations could lead to penalties.

NOTE

- In case of deterioration or loss of this manual, a compliant copy may be requested by the customer from the manufacturer. For increased security, we suggest that you keep a copy of this manual in a place where it cannot be damaged or lost.

FCC Compliance

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

•   This device may not cause harmful interference
•   This device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

ISED Compliance

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:
 (1) l'appareil ne doit pas produire de brouillage, e (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This equipment complies with Industry Canada radiation exposure limits set forth for an uncontrolled environment.

Cet équipement est conforme à l'exposition aux rayonnements Industry Canada limites établies pour un environnement non contrôlé.

Symbols and provisions used in the documentation

The following symbols and conventions are used throughout the documentation. Please follow all warnings and instructions marked on the product.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, can result in minor or moderate injury.

❗ IMPORTANT

IMPORTANT indicates a potentially hazardous situation which, if not avoided, can result in property damage or loss of product functionality.

NOTE

NOTE specifies the operating environment, installation conditions, or special conditions of use.

Bold
Bold text highlights an important point or keywords for understanding the context.

Italic
Text in italics refers to a related topic explained more in detail in another chapter.

Fire Danger icons warn of the possibility of fire.

Electrical Danger icons warn of the risk of electric shock.

Prohibition icons indicate actions that must not be performed.

General description

2

The Single Channel Node is an outdoor wireless data logger that enables geotechnical probes for LoRaWAN wireless communication. Each node supports one geotechnical probe, and most models can also accomodate the probe's built-in NTC thermistor when present.. The Single Channel Node can be remotely configured through the Move Cloud Platform™, where it is also possible to visualize the data, convert it and analyze it.

This communication device can read and digitize geotechnical sensors in static regime such as: strain gauges, temperature sensors, load cells, crack meters, humidity sensors, piezometers, anemometers, inclinometers, rain gauges and radar-based probes among others. These sensors can be purchased through Move Solutions™ or other channels.

The Single Channel Node is thus suitable for use in geo-environmental, hydrogeological, geotechnical, and structural monitoring.

The Single Channel Node comes in eight different types, corresponding to different types of analog probes. This is because different kinds of analog probes use different ways to electrically communicate their measure to a datalogger.

The available types are:

Product Code	Interface
DECKSCN-MA0	Single Channel Node	4-20mA
DECKSCN-MVV	Single Channel Node	mV / V
DECKSCN-V05	Single Channel Node	Voltage Output (5 V)
DECKSCN-V12	Single Channel Node	Voltage Output (12 V)
DECKSCN-VBW	Single Channel Node	Vibrating Wire
DECKSCN-PT1	Single Channel Node	Pt100/Pt1000
DECKSCN-NTC	Single Channel Node	NTC
DECKSCN-POT	Single Channel Node	Potentiometer

IMPORTANT

- Each node is compatible with only one type of probe, so make sure you have chosen the right type when ordering.

The Single Channel Node is part of the Move Solutions range of LoRaWAN products for monitoring purposes; as such, the node needs a LoRaWAN gateway (such as the Move Solutions Gateway Pro) to connect to the Move Cloud Platform™. After correctly connecting to the platform, the settings and data can be personalized to fit the user's needs.

Sensor system … LoRaWAN long range … Gateway device … 4G/LTE/ETHERNET … Algorithms of data processing … Internet … Move Cloud Platform™
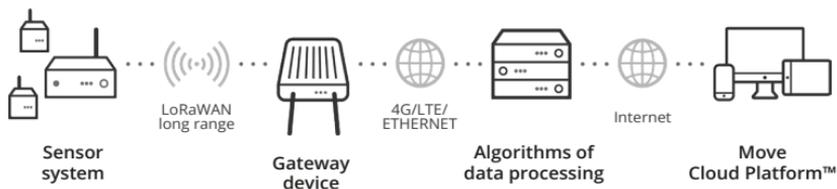
The data is sampled by the Single Channel Node in two possible modes:

- **Programmed sampling**, where the node acquires the data from the probe at fixed intervals configurable through the platform.
- **Triggered sampling**, where on top of the Programmed sampling a threshold can be selected on the internal accelerometer of the node to acquire data from the probe immediately after an extraordinary event has happened.

The data is thus sent to the platform in raw format, which is the electrical measure from the sensor, along with a few other data to help the user understand how the probe is performing. The raw data can then be converted to the output format desired by the user through a set of formulae.

Technical Data

3

Operation	
Operating temperature range	-40°C to +80°C
IP rating	IP67
Batteries	2 LiSOCl2 batteries (suggested: EVE ER34615EHR2)
Battery connector	JST EHR-2
Radio coverage	1 km in line of sight with gateway[1]
Current consumption (when idle, programmed acquisition mode)	0.25 mA
Current consumption (when idle, triggered acquisition mode)	0.65 mA
Current consumption (when acquiring)	Extremely dependent on the external probe attached
Maximum radiated power	< +15 dBm
Transmission Frequency	868 MHz in EU and UK, 902 MHZ in US and Canada
Operation Parameters	
Cadence of Programmed acquisitions	Once every 2 minutes, 10 minutes, 20 minutes, 30 minutes, 1 hour, 6 hours, 12 hours
Time accuracy	± 1 second
Integrated accelerometer resolution	1 mg
Integrated accelerometer full scale	± 2 g
Integrated accelerometer bandwidth	0.7 – 25 Hz

[1] This information is strictly dependent on environmental parameters such as humidity, presence of other radio devices, presence of obstacles and others.

Mechanical	
Cable gland accepted cable diameter	3 to 8 mm
Screw terminal accepted cable	30 to 14 AWG
Dimensions	130 x 171.2 x 62 mm
Material	Polycarbonate
Weight	500 g

3.1 Technical data specific for each type of Single Channel Node

Technical data for Single Channel Node	4-20 mA	
Probe supply voltage	12.3 VDC
Minimum accuracy	±0.1% of reading
Measurement span	0 – 24 mA
Auxiliary NTC channel	Yes

Technical data for Single Channel Node	mV/V	
Probe supply voltage	5 VDC
Minimum accuracy	±0.2% of reading or ±0.002 mV/V
Measurement span	±8 mV/V
Auxiliary NTC channel	Yes

Technical data for Single Channel Node	Voltage Output (5V)	
Probe supply voltage	5 VDC
Minimum accuracy	±0.2% of reading or ±2 mV
Measurement span	0 – 5 VDC
Auxiliary NTC channel	Yes

Technical data for Single Channel Node | Voltage Output (12V)	
Probe supply voltage	12.3 VDC
Minimum accuracy	±0.2% of reading or ±2 mV
Measurement span	0 – 12 VDC
Auxiliary NTC channel	Yes

Technical data for Single Channel Node | Potentiometer	
Probe supply voltage	2.7 VDC
Minimum accuracy	±0.02% of reading
Measurement span	0 – 100% of potentiometer span
Auxiliary NTC channel	Yes

Technical data for Single Channel Node | Vibrating Wire	
Measurement span	400 - 10'000 Hz
Auxiliary NTC channel	Yes

Technical data for Single Channel Node | Pt100/Pt1000	
Minimum accuracy	±0.03% of reading
Measurement span	Up to 1500 Ω
Auxiliary NTC channel	No

Technical data for Single Channel Node | NTC	
Minimum accuracy	±0.1% of reading
Measurement span	Up to 1 MΩ
Auxiliary NTC channel	No

What's in the box

4

The Single Channel Node is shipped in a cardboard box. The label on the box specifies the EUI and SN of the product. The EUI is very important as it used to identify the product inside the Move Cloud Platform™.
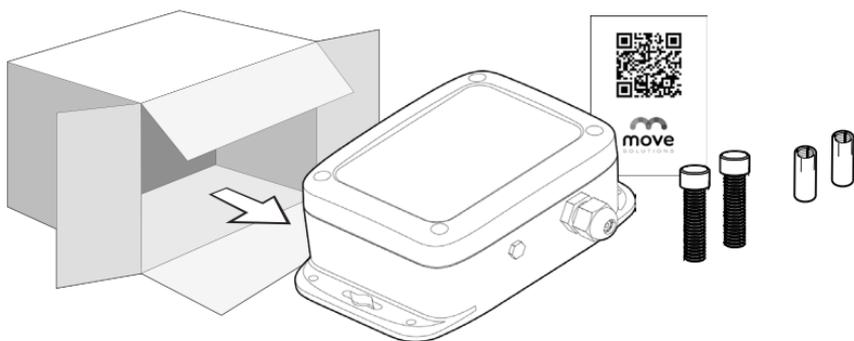
Inside the package you should find:

Number of pieces	Components
1 pc.	Single Channel Node of the type that you ordered (see following chapters for further explanation)
2 pcs.	Anchors (M6x25mm, fixing hole 8mm)
2 pcs.	Socket cap screws (M6x30mm)
1 pc.	Move Solutions flyer with a QR code linking to the most up-to-date documentation

Carefully examine what's inside the package and check that everything is present and in excellent condition.

CAUTION

· **DO NOT** use the Single Channel Node if any of the components looks broken or tampered with.

A label identical to the one on the packaging is affixed on the side of the Single Channel Node. On the back of the Single Channel Node another label specifies the product code and type of the Single Channel Node. Refer to the following chapters for more information on Single Channel Node types.

Opening the lid of the Single Channel Node you'll see:
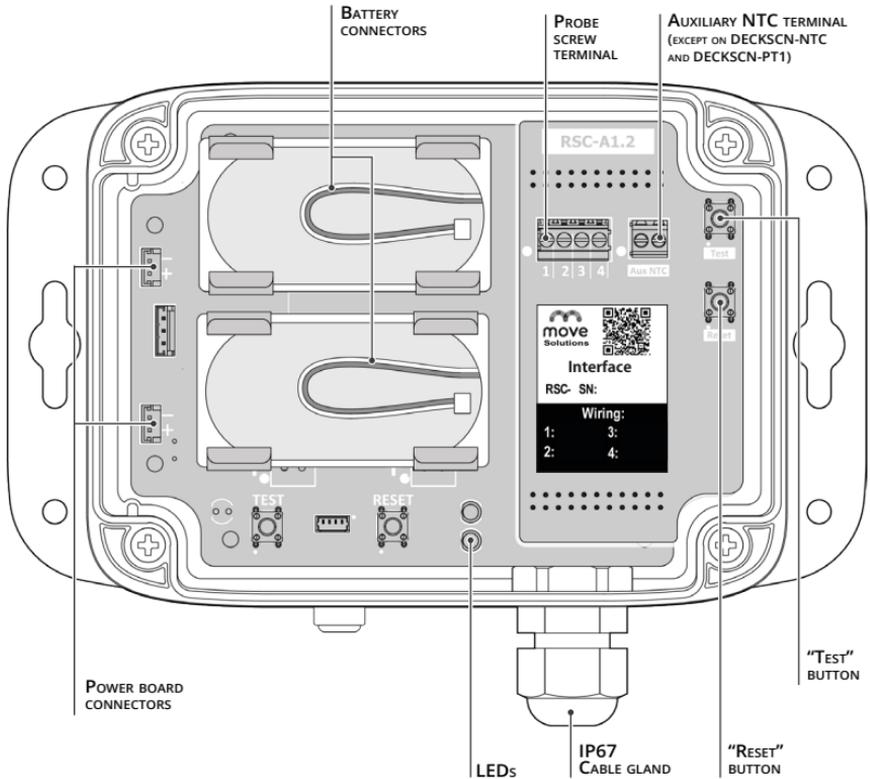
IMPORTANT

- **DO NOT** open the Single Channel Node in a dusty and/or humid environment. The IP rating of the node is guaranteed only after the lid is screwed on and a cable is tightly secured in the cable gland.

Quick guide to installation

<div style="text-align:right">**5**</div>

BEFORE THE INSTALLATION

1. Check that you have the correct type of node for the probe you intend to install.

2. Check that you have the right tools for the operation.

INSTALLATION

3. Correctly and securely install the Single Channel Node on site, following the instructions in chapter *Installation on site*.

4. If you don't plan on installing the probe inside the node immediately, remember to keep the node closed, put a piece of electrical cable through the cable gland and tighten it to prevent humidity, dirt, and water from entering the product.

5. With the batteries unconnected, insert the cable of the probe through the cable gland.

6. If necessary, strip the cable to reveal the wires. Insert and tighten the wires in the screw terminal according to the instructions in the following chapters. For the screw terminal of the node, use a 2.5 mm flat-head screwdriver.

7. Connect the batteries by inserting the cables in the connectors on the board.

8. The two LEDs light up for about 2 seconds for confirmation.

9. If desired, you can check the reading from the probe by using the feature described in *Annex C*.

10. Tighten the cable gland and close the lid.

11. If the gateway is already running, you can start checking your data on the Move Cloud Platform™ within a few minutes. Otherwise, a maximum time of 30 minutes after the installation of the gateway is required before the node can be viewed on the platform.

Wiring a probe

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⚠️ **CAUTION**

- When connecting a probe to the node, disconnect the batteries.
- Before connecting a probe, verify that it is compatible with the type of node you are planning to connect it to. This means checking that the type of node is suitable to read the output of the probe, and that the voltage supplied by the node is in the range of acceptable supply voltages for the probe.

Each probe connection cable will have a variable number of wires with different colors inside. The intended use and the consequent identification of a cable is managed through a color coding; thus each conductor is distinguished by a sheath of a different color. To understand the color convention used by a probe to distinguish the wires, refer to the product datasheet, the user manual or the calibration certificate of the probe or contact the supplier company directly.

A label indicating the wiring for each specific type of the Single Channel Node is present inside the node.

Here you'll find an example for the wiring label of a Voltage Output (5V) Single Channel Node:

QR CODE
LINK TO THE WIRING GUIDE

INTERFACE OF THE
SINGLE CHANNEL NODE

SERIAL NUMBER OF
THE RSC BOARD

TERMINAL NUMBERING FROM
LEFT TO RIGHT FOR PROBE CONNECTIONS

move Solutions

Voltage Output
RSC- SN: 21120745

Wiring:
1: 5 VDC   3: Signal
2: GND   4: N.C.
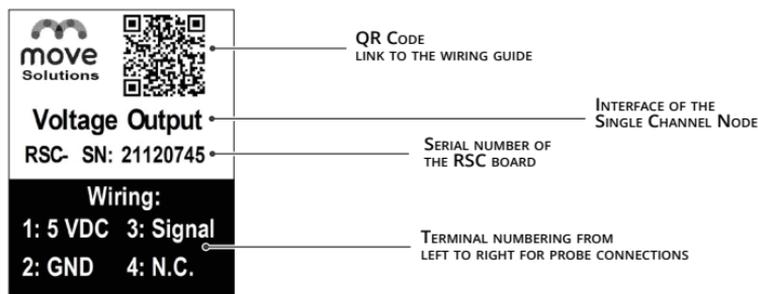
⚠ **CAUTION**
- Before reconnecting the batteries after wiring the probe, check the wiring to avoid damaging the node, the batteries, or the probe due to incorrect wiring.

6.1 Wiring instructions
Single Channel Node | 4 – 20 mA

The Single Channel Node supports 4-20 mA probes with 2 or 3 wires. Other types might be possible to read with an external power supply.

⚠ **CAUTION**
- The naming conventions and color code of wires is not standard and can vary significantly from probe to probe and manufacturer to manufacturer. Only act based on certain information. Refer to the manufacturer of your probe for specific information.

4-20 mA | 2 WIRES

The wires in 2-wire 4-20 mA probes are usually:

- A power wire (often called 'VCC', 'Power', 'E+'), usually red
- A signal wire (often called 'Signal', 'E-'), usually black

The wires should be connected as follows:

Position in the terminal	4-20 mA	2 wires Probe connectors
1	VCC (Power)
2	—
3	—
4	Signal

4-20 mA | 3 WIRES

The wires in 3-wire 4-20 mA probes are usually:

- A power wire (often called 'VCC', 'Power', 'E+'), usually red
- A ground wire (often called 'GND', 'E-', '0V'), usually black
- A signal wire (often called 'Signal', 'S', 'S+'), other colors, often white or green

The wires should be connected as follows:

Position in the terminal	4-20 mA	3 wires Probe connectors
1	VCC (Power)
2	GND (Ground)
3	—
4	Signal

CAUTION

- The signal and ground contact on the Single Channel Node are electrically referred to the same ground node. If your probe has separate Power Ground and Signal Ground wires, check with the manufactured if they can be shorted, in which case you can connect them together on position 2 of the screw terminal.

6.2 Wiring instructions
Single Channel Node | mV/V

mV/V probes usually come with 4 wires, sometimes 6.

CAUTION

- Resistor bridges are akin to mV/V probes, so they should be electrically compatible with the node. Data interpretation, however, might require further calculations on behalf of the user.

CAUTION

- The naming conventions and color code of wires is not standard and can vary significantly from probe to probe and manufacturer to manufacturer. Only act based on certain information. Refer to the manufacturer of your probe for specific information.

The wires in 4-wire mV/V probes are usually:

- A power wire (often called 'VCC', 'Power', 'E+'), usually red
- A ground wire (often called 'GND, 'Ground', 'E-'), usually black
- A positive signal wire (often called 'S+')
- A negative signal wire (often called 'S−')

The wires should be connected as follows:

Position in the terminal	mV / V Probe connectors
1	VCC (Power)
2	Signal +
3	Signal −
4	GND (Ground)

mV/V probes with 6 wires have 2 extra wires to read back the power supply voltage. This is not supported on the Single Channel Node. In this case it is sufficient to leave the two extra wires unconnected and proceed as described above.

CAUTION

- When leaving the extra wires unconnected, remember to wrap them separately in insulating tape to avoid short circuits.

6.3 Wiring instructions
Single Channel Node | Voltage Output (5V)

This node supports probes that can work with a power supply of 5 VDC, and output a signal between 0 and 5 Volts, referred to the same ground as the power supply. These probes usually have 3 wires, sometimes 4.

CAUTION

- The naming conventions and color code of wires is not standard and can vary significantly from probe to probe and manufacturer to manufacturer. Only act based on certain information. Refer to the manufacturer of your probe for specific information.

The wires in 3-wire voltage output probes are usually:

- A power wire (often called 'VCC', 'Power', 'E+'), usually red
- A ground wire (often called 'GND', 'E−', '0V'), usually black
- A signal wire (often called 'Signal', 'S', 'S+'), other colors, often white or green

The wires should be connected as follows:

Position in the terminal	Voltage Output (5V) Probe connectors
1	VCC (Power)
2	GND (Ground)
3	Signal
4	—

NOTE

- The signal and ground contact on the Single Channel Node are electrically referred to the same ground node. If your probe has separate Power Ground and Signal Ground wires, check with the manufactured if they can be shorted, in which case you can connect them together on position 2 of the screw terminal.

6.4 Wiring instructions
Single Channel Node | Voltage Output (12V)

This node supports probes that can work with a power supply of 12.3 VDC, and output a signal between 0 and 12 Volts, referred to the same ground as the power supply. These probes usually have 3 wires, sometimes 4.

CAUTION

- The naming conventions and color code of wires is not standard and can vary significantly from probe to probe and manufacturer to manufacturer. Only act based on certain information. Refer to the manufacturer of your probe for specific information.

The wires in 3-wire voltage output probes are usually:

- A power wire (often called 'VCC', 'Power', 'E+'), usually red
- A ground wire (often called 'GND', 'E−', '0V'), usually black
- A signal wire (often called 'Signal', 'S', 'S+'), other colors, often white or green

The wires should be connected as follows:

Position in the terminal	Voltage Output (12V) Probe connectors
1	VCC (Power)
2	GND (Ground)
3	Signal
4	—

NOTE

- The signal and ground contact on the Single Channel Node are electrically referred to the same ground node. If your probe has separate Power Ground and Signal Ground wires, check with the manufactured if they can be shorted, in which case you can connect them together on position 2 of the screw terminal.

6.5 Wiring instructions
Single Channel Node | Potentiometer

These probes typically accept any supply voltage and give a voltage output between 0 and the supplied voltage. These probes usually have 3 wires.

CAUTION

- The naming conventions and color code of wires is not standard and can vary significantly from probe to probe and manufacturer to manufacturer. Only act based on certain information. Refer to the manufacturer of your probe for specific information.

The wires in 3-wire voltage output probes are usually:

- A power wire (often called 'VCC', 'Power', 'E+'), usually red
- A ground wire (often called 'GND', 'E−', '0V'), usually black
- A signal wire (often called 'Signal', 'S', 'S+'), other colors, often white or green

The wires should be connected as follows:

Position in the terminal	Potentiometer Probe connectors
1	VCC (Power)
2	Signal
3	—
4	GND (Ground)

6.6 Wiring instructions
Single Channel Node | Vibrating Wire

Vibrating wire probes consist of a winding (or coil) which allows to excite a metal string and to read its vibration frequency, which varies according to the geotechnicalquantities of interest.

CAUTION

• The naming conventions and color code of wires is not standard and can vary significantly from probe to probe and manufacturer to manufacturer. Only act based on certain information. Refer to the manufacturer of your probe for specific information.

The 4 wires in vibrating wire probes are usually:

• A first coil wire (often called 'Coil', 'Coil +'), usually red
• A second coil wire (often called 'Coil', 'Coil −'), usually black
• A first NTC wire (often called 'NTC', 'NTC +'), usually white
• A second NTC wire (often called 'NTC', 'NTC −'), usually green

The coil wires can be swapped without consequences. The NTC wires are optional and not always present, and if present they can be swapped without consequences.

The wires should be connected as follows:

Position in the terminal	Vibrating Wire Probe connectors
1	Coil +
2	NTC + (optional)
3	NTC − (optional)
4	Coil −

6.7 Wiring instructions
Single Channel Node | Pt100/Pt1000

The Pt100 and Pt1000 probes consist of a platinum resistance whose value depends

on the temperature. By measuring the resistance of the sensor, it is therefore possible to trace its temperature.

These types of probes typically have 4 wires. These wires are combined in pairs marked with the same color, usually white and red.

If the wires have more than two colors, it is necessary to refer to the probe documentation to identify the matching pairs.

CAUTION

- The naming conventions and color code of wires is not standard and can vary significantly from probe to probe and manufacturer to manufacturer. Only act based on certain information. Refer to the manufacturer of your probe for specific information.

Here we will call "Signal+" the first pair of wires, and "Signal-" the other pair.

The wires should be connected as follows:

Position in the terminal	Pt100/Pt1000 Probe connectors
1	Signal +
2	Signal +
3	Signal −
4	Signal −

6.6 Wiring instructions
Single Channel Node | NTC

These types of probes typically have 2 wires. These wires can be swapped without consequences.

Here we will call "NTC+" the first wire, and "Signal -" the other. The wires should be connected as follows:

Position in the terminal	Vibrating Wire Probe connectors
1	—
2	NTC +
3	NTC −
4	—

Acquired Data

7

The Single Channel Node is most of the time in an idle state to save energy. This means that the probe is turned off every time the node has stopped reading the data.

Whenever an event happens, an acquisition starts.

The Single Channel Node has basically two functional modes:

- **Programmed Acquisition**
- **Triggered Acquisition**

In **Programmed Acquisition**, the Single Channel Node starts acquiring data once every given period, which can be set by the user through the Move Cloud Platform™. The Programmed acquisitions are aligned to 00:00 UTC. This means that if the acquisition cadence is set to 2 minutes, the acquisitions will start at 00:00, 00:02, 00:04, 00:06 UTC and so on. To give another example, if the acquisition cadence is set to 6 hours, the acquisitions will start at 00:00, 06:00, 12:00, 18:00 UTC.

In **Triggered Acquisition**, the Programmed acquisitions are still happening, but on top of that the user can activate the internal accelerometer of the Single Channel Node and set a threshold on its measure.

By doing so, the Single Channel Node starts monitoring the data from the accelerometer (refer to the chapter about technical data for more in-depth information of this accelerometer). If the given threshold is surpassed on any of the three axes, an acquisition starts. This acquisition works identically to a Programmed acquisition.

IMPORTANT

- Activating the accelerometer, even if the threshold is never exceeded, has a significant impact on battery life as it greatly raises the consumption of the node in idle state.

7.1 Procedure of acquisition for 4-20 mA, mV/V, Voltage (5V), Voltage (12V), Potentiometer, Pt100/Pt1000 and NTC Single Channel Nodes

At the beginning of an acquisition, whether it is a planned acquisition or due to exceeding the threshold of the integrated accelerometer, the probe is powered on and the node enters the warmup phase.

During the warmup phase the node does nothing and waits for a predetermined time, which can be managed via the Move Cloud Platform™, to give time to the probe to turn on and make sure that the data that is read is valid. For simpler probes a warmup of 1 second may be sufficient, while for more complex probes - especially 4-20 mA 3-wire, Voltage Output (5V) and Voltage Output (12V) - the warmup time can vary greatly.

Once the warmup time has passed, the node begins to acquire a sample roughly every 0.45 seconds. Once 3 consecutive samples have been acquired that differ from each other by less than 0.1%, the node considers the data sufficiently stable, calculates the average of these 3 samples and sends it to the platform.

NOTE

If the signal is outside the expected range of the product the acquisition might take longer as the node repeats the process multiple times.

If stability is not reached within 20 samples (approximately 9 seconds) the last detected data is still sent.

7.2 Procedure of acquisition for the Vibrating Wire Single Channel Node

For vibrating wire probes, there is no need for warmup. Instead, vibrating wire probes are read by exciting the coil with a signal around the resonant frequency of the probe and reading back the electromagnetic "echo" generated by the probe on the coil.

To do so, the node starts its first acquisition by sweeping all the frequencies between the minimum and the maximum frequencies set by the user on the platform. In doing so, the node tries to identify the current frequency of the probe. This operation may take some time, and thus some power.

After that, the node will use this information to reduce the time and power required for the next acquisitions.

Sometimes the vibrating conditions of the probe may prevent the node from latching to the correct frequency. In that case it's important to check the minimum and maximum frequencies and the advanced options on the platform. A reading of 100'000 Hz means that the node couldn't correctly identify the frequency of the probe.

7.3 Additional Data

Along with the probe reading, some other data is sent: the total acquisition time (warmup time + actual sampling duration), a timestamp of the acquisition of the last sample -which is the time shown in the graphs on the platform-, resistance of the auxiliary NTC measured at the end of the acquisition and the average current consumed by the entire node during the acquisition time.

For triggered sampling, additional information about the event is sent: based on a window of 960 milliseconds around the surpassing of the threshold, the peak acceleration and the RMS value are calculated for each axis. Subsequently, the highest peak among the three axes and the highest RMS among the three axes are sent.

All this information is available on the platform to allow the user to better understand the consumption and operating condition of the node, as well as helping to diagnose possible faults.

Installation on site

8

When installing the Single Channel Node, it is important to follow some basic prescriptions to ensure the correct operation of the product.

First, locate the antenna on the inside of the node. The antenna is on the shorter side of the node, on the inner side of the wall were the label is affixed.

INTERNAL
ANTENNA

INTERNAL
ANTENNA
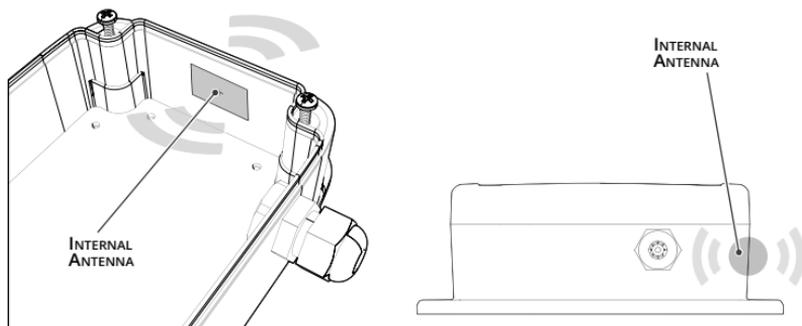
For optimal radio performance, the antenna should be oriented the same way as the gateway antenna, and the gateway should be on the side of the node.

PERSPECTIVE VIEW

BEST SIGNAL
POWER

LOW SIGNAL
POWER

BAD
POSITION

GOOD
POSITION
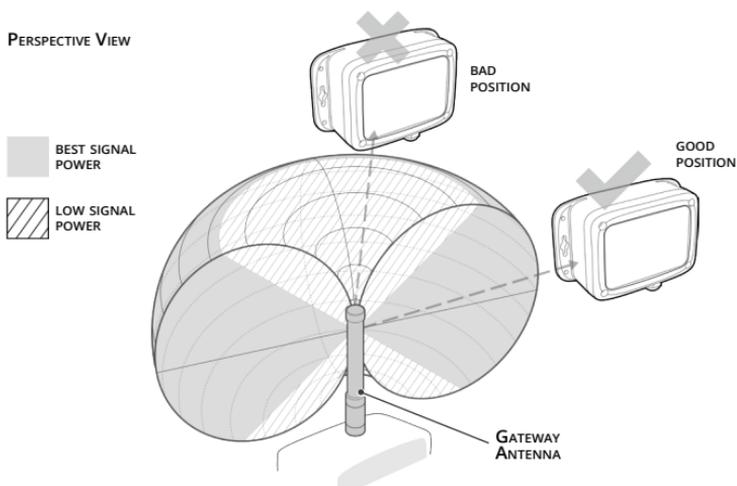
GATEWAY
ANTENNA

Avoid, if possible, to locate the gateway vertically above or under the node. If this cannot be avoided, it is best to keep the two antennas perpendicular to one another.

FRONTAL VIEW

BAD POSITION

GOOD POSITION

BEST SIGNAL POWER

LOW SIGNAL POWER

GATEWAY ANTENNA
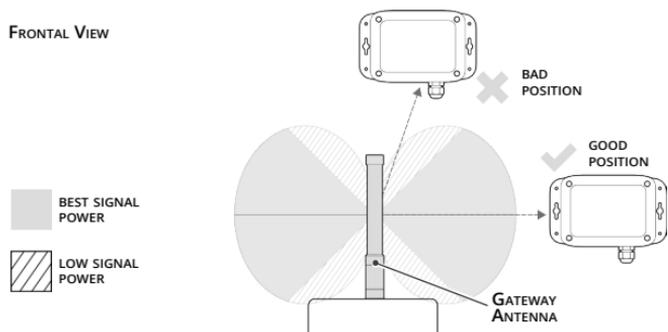
Keep the node and the gateway in line of sight as much as possible, as obstacles along the path of the signal could have a negative impact on the radio link.

Additional information on optimal positioning can be found on the gateway manual. Pay attention to the length of the probe's cable and the desired location of the probe before installing the node.

Try to keep the node, particularly the side on which the antenna resides, as far as possible from metallic materials that could alter the radiative performance of the antenna. Similarly, keep as clear as possible of high voltage power cables, radio and tv antennas and any other source of unwanted electromagnetic disturbance.

The Single Channel Node can be installed considerably away from the probe, but if you plan to use the triggered acquisition mode you should make sure that the Single Channel Node is located where it can detect significative events. For example, a node installed on a pole will probably detect accelerations that have no relevance to the probe.

Use the hardware supplied with the Single Channel Node to fix it to the wall, floor, or ceiling.

CAUTION

- Remember to install the Single Channel Node away from busy areas where it could be damaged by or cause damage to animals or people. For example, don't install the Single Channel Node on the floor unless it's in a completely secluded area.

Move Cloud Platform™   **9**

To access your Move Cloud Platform™, connect to the URL that you have been supplied with by Move Solutions™ and log in with your credentials.

Through the Move Cloud Platform™ you'll be able to:

- check the data of the last 24 hours and the current state of all your devices
- explore all the data that has been gathered by your probes since day 1
- convert your data into a desired unit of measurement
- set alarms and email notifications for each probe
- manage the sampling settings of your Single Channel Node
- access diagnostic data to understand what is happening with your probe
- and more

NOTE

- The Move Cloud Platform™ is frequently updated with new features, fixes, and reviews. Refer to its documentation for more detailed information.

9.1 General settings

NOTE

- All the settings that alter the Single Channel Node's behavior, which is to say all settings that don't concern data conversion, email alarms, and probe naming can require up to 30 minutes, sometimes 1 hour to become effective.

To access the settings of your Single Channel Node, go to **_Settings_** in the side navigation menu. Select **_Analog Node_** in the side bar, and the specific EUI of the node you wish to configure.

All types of Single Channel Node have a few common settings:

- **Probe name** allows you to specify a name that is shown near the graph. You can use this to track the position or function of the probe connected.

- **Data mode** allows you to choose between raw data and converted data:

  - **Raw data** shows you the electrical measurement from the probe (for example mA for 4-20 mA probes, Ohms for NTC and Pt100/Pt1000, Hz for Vibrating Wire and so on),

  - **Converted data** allows you to apply a variety of formulae (custom conversion) or choose a probe that has previously been validated by Move Solutions and apply a pre-configured conversion.

- **Warmup** allows you to select the amount of time that the node must wait between turning on the probe and starting to acquire. A few practical considerations on how to choose warmup time are given in the Annexes of this manual.

NOTE
- Warmup control is not available in the Vibrating Wire Single Channel Node

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- **Unit of measurement** allows you to specify the output unit of your converted data. This means that all conversion parameters that you insert should refer to the same unit of measurement. For example, if your unit of measurement is millimeters don't enter the conversion parameters in meters.

- **NTC** allows you to enable the auxiliary NTC probe (where supported), and in converted data mode you can also specify the A, B and C parameters of the Steinhart-Hart equation to convert the resistance value of the NTC into Celsius degrees. These values are usually found on the user manual, calibration report or datasheet of the probe.

$$T = \frac{1}{A + B\ln(R) + C\left[\ln(R)\right]^3}$$

Moving to the **Acquisition Parameters** tab in the settings menu of the node, you will be able to:

- Choose the cadence of the Programmed sampling
- Activate the accelerometer for Threshold sampling and set a threshold in mg.

Finally in the **Alarms** tab allows you to set a lower and upper threshold and receive email notifications when one of the thresholds is surpassed by the sensor.

9.2 Specific settings for 4-20 mA Single Channel Node

To setup the conversion of a 4-20 mA probe, the platform asks for 4 parameters, which are the minimum and maximum values in mA, and the relative conversion of each of the values. By doing so, the platform constructs a straight line between the two points to obtain a conversion rule.

The formula is:

$$Omeas = \frac{Rmeas - Rmin}{Rmax - Rmin} \times (Omax - Omin) + Omin$$

Where $Omeas$ is the output measurement, $Rmeas$ is the raw measurement, $Rmin$ and $Rmax$ are the minimum and maximum value in mA, and $Omax$ and $Omin$ are their respective conversion.

NOTE

- This conversion keeps working even for $Rmeas$ higher than $Rmax$ or lower than $Rmin$.

For example, a typical 4-20 mA, 200 mm extensometer would probably have $Rmin$ = 4 mA, $Rmax$ = 20 mA, $Omin$ = 0 mm, $Omax$ = 200 mm.

9.3 Specific settings for mV/V Single Channel Node

To setup the conversion of a mV/V probe, the platform offers the choice of two formulae. These formulae yield the same results, but have two different ways of inserting the parameters, depending on how the manufacturer has supplied them.

GAIN FORMULA

The gain formula only asks for one parameter, which is usually referred to as 'gain' or 'sensitivity'. This means: "how many mV/Vs correspond to 1 unit of measurement of the probe?".

Simply put, a load cell that ouputs 1.4 mV/V with 1 kN of load on it has a gain or sensitivity of 1.4 mV/V/kN. This is the parameter that needs to be input on the platform.

Note that the easiest way to recognize this parameter is its unit of measurement, which is mV/V divided by the unit of measurement of the probe. A few examples might be mV/V/kN, mV/V/mm, mV/V/ue, and so on.

The applied formula is simply:

$$Omeas = Rmeas \times Gain$$

Where $Omeas$ is the output measurement, $Rmeas$ is the raw measurement and Gain is the parameter input by the user.

FULLSCALE FORMULA

Sometimes the conversion parameters are given differently by the manufacturer, in which case this formula can be used.

In this case, the formula asks for the maximum raw value in mV/V and the maximum converted value corresponding to it.

These two parameters can usually be recognized as the first one has a unit of measurement of mV/V, while the other is the full scale measure of the probe in its own unit of measurement.

The applied formula is simply:

$$Omeas = Rmeas \times \frac{Omax}{Rmax}$$

Where $Omeas$ is the output measurement, $Rmeas$ is the raw measurement, $Omax$ is the full scale measure of the probe and $Rmax$ is the maximum raw value in mV/V.

For example, a 2 mV/V, 2000 kN load cell has a maximum raw value of 2mV/V and a maximum output value of 2000 kN.

NOTE

- This conversion keeps working even for $Rmeas$ higher than $Rmax$.

9.4 Specific settings for Voltage Output (5V) and Voltage Output (12V) Single Channel Node

To setup the conversion of a Voltage Output probe, the platform asks for 4 parameters, which are the minimum and maximum values in V, and the relative conversion of each of the values. By doing so, the platform constructs a straight line between the two points to obtain a conversion rule.

The formula is:

$$Omeas = \frac{Rmeas - Rmin}{Rmax - Rmin} \times (Omax - Omin) + Omin$$

Where $Omeas$ is the output measurement, $Rmeas$ is the raw measturement, $Rmin$ and $Rmax$ are the minimum and maximum value in mA, and $Omax$ and $Omin$ are their respective conversion.

NOTE

- This conversion keeps working even for $Rmeas$ higher than $Rmax$ or lower than $Rmin$

For example, a Voltage Output wind speed meter with a fullscale measure of 50 m/s and 0-4 V output will have $Rmin$ = 0V, $Rmax$ = 4V, $Omin$ = 0 m/s, $Omax$ = 50 m/s.

9.5 Specific settings for Potentiometer Single Channel Node

To setup the conversion of a Potentiometer probe, the platform asks for 2 parameters, which are the minimum value and the maximum value that can be measured by the prove. By doing so, the platform constructs a straight line between the two points to obtain a conversion rule. Put simply, the two values asked are those corresponding to 0% and 100% of the probe's range.

The formula is:

$$Omeas = \frac{Rmeas}{100} \times (Omax - Omin) + Omin$$

Where $Omeas$ is the output measurement, $Rmeas$ is the raw measurement, and $Omax$ and $Omin$ are the parameters input by the user.

For example, a potentiometric crackmeter with a fullscale measure of 100 mm will have $Omin$ = 0 mm, $Omax$ = 100 mm.

9.6 Specific settings for Vibrating Wire Single Channel Node

First, for optimal operation of the node, it is suggested to set the probe frequency range in the Probe configuration tab. The minimum and maximum frequency of the probe should be written on its instruction manual, calibration report or datasheet. When in doubt, try setting the minimum frequency as half the expected frequency, and the maximum frequency as slightly less than double the expected frequency.

Furthermore, if the readings seem unstable, the advanced options can be used to optimize the node's reading procedure. It's difficult to characterize the different profiles in the advanced options, so it's suggested to simply try them in order and experiment to find the optimal solution for the probe.

The conversion of the Vibrating Wire can be done through 3 different formulae.

LINEAR DIGIT

Linear digits don't have a direct translation in terms of geotechnical measurements, but are an industry standard in visualization of data from vibrating wire probes. A great amount of handheld data acquisition units show the readings directly in linear digits instead of Hz, so this formula can be useful when comparing the data to data from other readout units.

The formula is simply:

$$LD = \frac{Fmeas^2}{1000}$$

Where LD is the output measurement in linear digit and $Fmeas$ is the raw frequency measurement.

LINEAR FORMULA

The simplest way to convert the frequency from the vibrating wire probe to a geotechnical unit of measurement is applying a conversion factor to the corresponding linear digit. The linear formula requires the user to insert the conversion factor (referred to as "gain" or "gauge factor") for this reason. The conversion factor can usually be found on the calibration report, the datasheet, or the user manual of the probe.

The formula is thus:

$$Omeas = G \times \frac{Fmeas^2}{1000}$$

Where $Omeas$ is the output measurement in the desired unit of measurement, G is the conversion factor and $Fmeas$ is the raw frequency measurement.

QUADRATIC FORMULA

A more accurate way to convert the frequency measurement is to apply a polynomial formula to the linear digit representation. In this case, a second degree polynomial is used.

The formula is thus:

$$Omeas = A \times \left(\frac{Fmeas^2}{1000} \right)^2 + B \times \frac{Fmeas^2}{1000} + C$$

Where $Omeas$ is the output measurement in the desired unit of measurement, A, B and C are the coefficients of the polynomial and $Fmeas$ is the raw frequency measurement.

NOTE:

- A, B and C are arbitrary names.
- Where a more complex formula is supplied by the manufacturer, be careful to only use the coefficients up to second degree.

TEMPERATURE COMPENSATION

Vibrating wire probes often include an NTC thermistor to measure the probe's temperature as this information can be used to compensate thermal effects on the measure.

In the Probe configuration tab, after configuring the auxiliary NTC and its conversion formula it's possible to activate the temperature compensation function. The user only needs to input the temperature compensation parameter to apply. The compensation formula is simply:

$$Omeas, \; comp = Omeas - Kt \times T$$

Where $Omeas,comp$ is the measure after compensation, $Omeas$ is the measure before compensation as output by the linear or polynomial formulae, Kt is the temperature compensation parameter and T is the temperature measured by the auxiliary NTC.

9.7 Specific settings Pt100/Pt1000 Single Channel Node

To convert the Pt100/Pt1000 it's first necessary to select the Probe type at the bottom of the probe configuration tab. It's also necessary to insert a gain factor which corresponds to the temperature coefficient of the probe.

Basic values are:

- 2.5974 °C/Ω for Pt100
- 0.25974 °C/Ω for Pt1000

But the user is free to choose a custom value.

The resulting formulae are:

- $$Omeas = (Rmeas - 100) \times G$$
- $$Omeas = (Rmeas - 1000) \times G$$

Where $Omeas$ is the output measure, $Rmeas$ is the raw measure and G is the gain inserted by the user.

9.8 Specific settings NTC Single Channel Node

NTC probes readings in Ohms are usually converted to Celsius degrees through the Steinhart-Hart equation. The equation requires the user to enter three parameters, usually called A, B, C.

The equation is as follows:

$$T = \frac{1}{A + B \times \ln R + C \times (\ln R)^3}$$

These parameters should be available on the calibration report, datasheet or user manual of the probe.

Maintenance

10

10.1 Changing the batteries

Depending on the power consumption of the probe and a few other factors, a battery change may be necessary every few months to every few years.

In this event, only use the prescribed batteries.

For information on how to provision said batteries, please contact a Move Solutions representative.

If the prescribed batteries are unavailable, or provisioning is not possible, consult a Move Solutions representative to find a viable alternative.

Move Solutions is not responsible for malfunctions and damage caused by batteries supplied by other companies and/or use of batteries different from the specified part number.

To change the batteries:

1. Arrange the necessary tools to work safely where the node is installed,
2. make sure to work with dry hands and in a dry environment. It's advised not to change the batteries in humid, rainy, foggy, or snowy weather.
3. Open the lid.
4. Disconnect the batteries.
5. Insert the new batteries.
6. Connect the new batteries. The LEDs should flash for 2 seconds to signify correct restart of the node.
7. Properly close the lid tightening the screws.

Overall dmensions
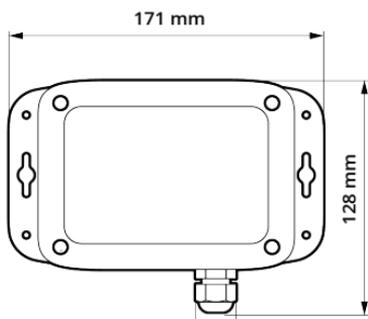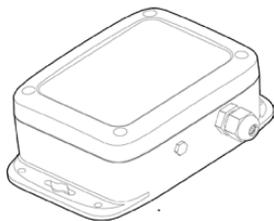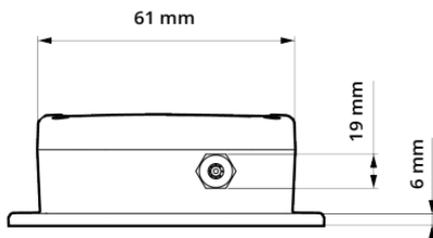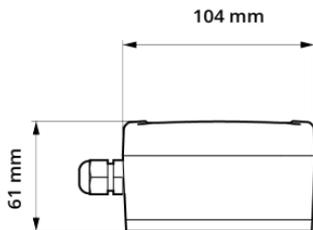
Annex A
About Warmup

A

Warmup is the time required for the probe to correctly turn on and respond with a valid data. The nature of the data can vary greatly depending on the technology employed on the probe: simple analog probes such as thermistors, potentiometers and such usually have a very fast warmup that is almost impossible to notice.

Other sensors, while still being analog, might require a little more time to respond. Their response could be shaped in two ways:

1. Purely analog probes usually have a gradual response: in that case, the node is able to sense that the reading is changing, and thus waits for the probe's output to stabilize.

2. On the other hand, probes that have some kind of converter or processing inside them might have a step-like response, where the output is stable on a not valid value for a few seconds and then steps up to the correct value as soon as the processing is done. This is a situation where the node cannot automatically configure itself, so the user has to specify a longer warmup time to get a valid output.

For energy saving purposes it's always best to start with minimum warmup of 1 second and let the Single Channel Node read the first data available. If the data is correct, then no further operation is needed, and the node is going to use the minimum amount of energy needed for the acquisition.

If the data obtained this way seems off, it might be worth trying to set a longer warmup and see if anything changes. You could also try and see if any "warmup time" or "response time" is cited on the datasheet or user manual of the probe.

Of course, the invalid data could be due other factors as well. To better understand what is happening it's advised to do this operation looking at the raw data, to avoid being deceived by an incorrect conversion formula.

Annex B
Optimizing battery life

B

The life of the Single Channel Node's batteries depends heavily on the needs of the probe connected to it. The main consumption factors for the node are:

1.   The number of acquisitions over a given time
2.   The duration of the acquisitions
3.   The average current consumption of the probe
4.   Whether the accelerometer is active or not

The average probe consumption and the duration of the acquisitions are parameters that depend on the operation of the probe, so they do not offer many opportunities for optimization. The only choice you can make in this regard is to be careful not to select an unnecessarily high warmup time to keep the acquisition time as low as possible.

A cause of long acquisition times might be a high variability of the data: if the data is too noisy, the node will struggle to find steady data and will thus prolong the acquisition.

As for the frequency of acquisitions, it is obviously possible to decrease the cadence (for example from 10 minutes to 30 minutes) for programmed acquisitions and raise the accelerometer threshold to reduce the number of acquisitions triggered. It is however important to keep in mind that activating the accelerometer even without it ever triggering significantly impacts the consumption of the node and reduces its duration.

Information on the current consumption and acquisition time of the probe can be accessed from the Events section of the platform, in the Energy consumption details subpage

Annex C
Field test function

C

Once the sensor has been connected to the node and the batteries have been reconnected, it is possible to carry out a first reading test to verify correct installation, even in the absence of the gateway.

The procedure for this test function is the following:

1. Press the RESET button and wait for the two LEDs to turn on. If the two LEDs do not light up, check that the batteries are charged and correctly inserted. If the problem persists, there could be a problem with the sensor.

2. Once the LEDs have turned on and off, you have approximately 10 seconds to press the TEST button. Press and hold it until the red LED turns on.

3. When the red LED is on, the sensor connected to the node is powered. Press and hold the TEST button again for the time necessary for the sensor to warm up (typically 2-3 seconds are enough, but some sensors may require longer times).

4. Once the TEST button has been released, the red LED will flash quickly. The node will then acquire the data from the sensor, and present it by flashing the LEDs in a specific order. Consult the following paragraph to interpret it.
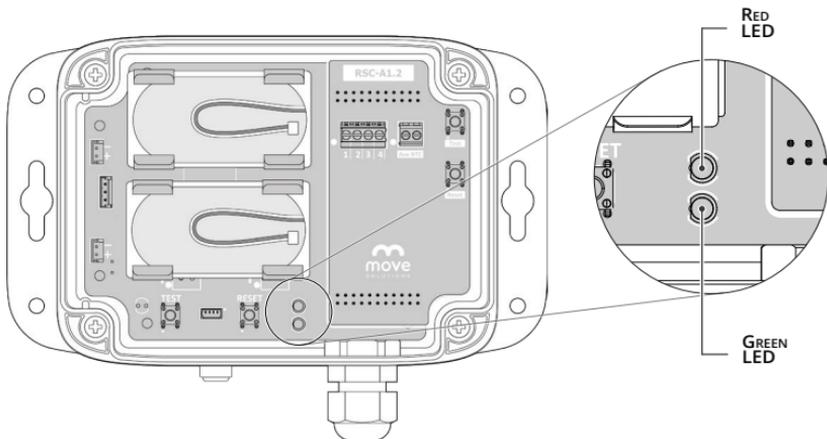
HOW TO INTERPET THE DATA

The data is represented on four digits by flashing first of the green LED, then of the red LED, then again of the green LED and then again of the red LED.

A series of quick flashes means '0', otherwise each LED flashes a number of times equal to the corresponding digit.

If the measurement is beyond the ordinary limits of the sensor, the LEDs will both flash quickly (0000).

For example:

1. **Green LED** → Fast flashing (0)
2. **Red LED** → 3 flashes
3. **Green LED** → 4 flashes
4. **Red LED** → Fast flashing (0)

It means the sensor is reading 0340, which is 340.

In this way it is possible to make an initial check of what the probe is reading, and verify that it corresponds at least roughly to what is expected.

UNIT OF MEASURMENT

The numbers indicated by the LEDs during the test reading are to be interpreted according to the following units of measurement.

This is a chart with a sample for each type of Single Channel Node Interface:

Interface	Unit of meas.	LEDs flashes (green / red / green / red)
4-20mA	mA (2 decimals)	1 / 2 / 3 / 4 = 12.34 mA
mV / V	mV / V (3 decimals)	1 / 3 / 4 / 5 = 1.345 mV / V
Voltage (5 V)	V (3 decimals)	4 / 3 / 0 / 3 = 4.303 V
Voltage (12 V)	V (3 decimals)	11 / 5 / 2 / 9 = 11.529 V
Vibrating Wire	Hz	0 / 9 / 8 / 0 = 980 Hz
Pt100 - Pt1000	Ohm	1 / 2 / 8 / 9 = 1289 Ohm
NTC	Ohm (exponential)	3 / 5 / 7 / 3 = $3.57 * 10^3$ Ohm = 3570 kOhm
Potentiometer	% (1 decimal)	0 / 7 / 8 / 5 = 78.5 %

Annex D
Zeroing

D

One useful feature on the Move Cloud Platform™ is the zeroing function, located in the Acquisition parameters tab, in the **Settings** menu.

By clicking on the **Zero the measure** button, the last measure from the probe is saved and used as a tare for future (and past) measurements. In simpler terms, the data visualized on the platform for the probe is going to be the difference between the current measure and the measure at the time when the button was pushed.

Zeroing is useful when the user wants to see the variation of the data instead of the absolute value. For example, when installing a crackmeter or a strain gauge, it's nearly impossible to install it perfectly in the center, which means that different probes of the same type on the same structure might have significant offsets between one another. Zeroing the measure in these cases simplifies comparison between probes on a structure.

If a conversion formula is selected, the zeroing is applied after converting the data.

The resulting formula would thus be:

$$Omeas = Mnow - Mzero$$

Where $Omeas$ is the output measurement as seen on the graphs, $Mnow$ is the current measurement after conversion and $Mzero$ is the measurement at the time of zeroing, converted with the same formula.

In vibrating wire probes, sometimes the manufacturer might give the conversion formula as:

$$G \times \left(\frac{Fmeas^2}{1000} - \frac{Finstallation^2}{1000} \right) - Kc \times (Tmeas - Tinstallation)$$

Where F_{meas} and T_{meas} are the current frequency and temperature measurements, while $F_{installation}$ a $T_{installation}$ are the frequency and temperature measurements when the probe was first installed. This case is covered automatically by zeroing, too, by pressing the ***Zero the measure*** button after correctly installing the probe. Of course the same goes without temperature compensation.

NOTE

- To view the non-zeroed data, you don't need to erase the zeroing. There is a switch next to the graphs that allows you to view the non-zeroed data temporarily.

Annex E
Troubleshooting

Here we seek to give a few pointers to the most common misfunctions and Suggested countermeasures.

WARNING
- Remember to always disconnect the batteries before physically operating on the node.

THE SINGLE CHANNEL NODE IS OFFLINE

First of all, check whether the gateway is online. If the gateway is offline, refer to its manual or to the customer service to solve the problem.

If the gateway is online, wait a few hours: the Single Channel Node might be functioning correctly but the data may not arrive due to high traffic on the radio channel. This might be the case in installations with a high density of LoRaWAN devices.

Try pushing the Reset button on the node. If the LEDs don't turn on, there's likely an issue with the batteries.

If the problem persists, and the wiring of the probe has not been checked before, check the wiring as it might be causing issues to the node. Also, try disconnecting the probe and see if the Single Channel Node goes back online. In that case, this might be an issue with the probe, or with the node's batteries.

If all these tests fail, refer to the customer support for assistance.

PROBE DATA IN CONVERTED MODE IS SIGNIFICANTLY DIFFERENT THAN EXPECTED

Try switching to raw data visualization. If the raw data is still different than expected try the other troubleshooting tips based on raw data. If the raw data is as expected, there's likely a problem with the conversion formula. Check whether you are using the correct formula and the right parameters.

PROBE DATA IS LOWER THAN EXPECTED

There may be a problem with warmup, try a longer warmup time. Check the raw data as well to make sure it's not a conversion problem.

4-20 mA: READING IN RAW MODE IS CLOSE TO 0 mA

Check the wiring. Either the probe is not receiving power, or the signal wire is not correctly wired. If the probe has multiple ground wires, make sure they are all connected, but first confirm with the manufacturer that they can be shorted together.

mV/V: READING IN RAW MODE IS CLOSE TO 0 MV/V

This may be a correct measure if the probe is very close to its halfway point. If it's not, check the wiring. It's likely that the power or ground wires are not correctly connected, or the two signal wires are touching.

mV/V: READING IN RAW MODE IS OVER 10 MV/V

If this is not an expected value, probably one or both of the signal wires are disconnected.

Pt100/Pt1000 AND NTC: VALUE IN RAW DATA IS CLOSE TO 0 Ohm

Check the wiring. It's likely two wires are touching each other or have been swapped.

Pt100/Pt1000: VALUE IN RAW DATA IS STUCK AT 1500 Ohm

Check the wiring. It's likely that some of the wires are not connected correctly.

VOLTAGE OUTPUT (5V) AND VOLTAGE OUTPUT (12V): READING IN RAW MODE IS CLOSE TO 0V

Check the wiring. Either the probe is not receiving power, or the signal wire is not correctly wired. If the probe has multiple ground wires, make sure they are all connected, but first confirm with the manufacturer that they can be shorted together.

VOLTAGE OUTPUT (5V): READING IN RAW MODE IS CLOSE TO 5V

Check the wiring. The signal wire might be touching the power wire.

VOLTAGE OUTPUT (12V): READING IN RAW MODE IS CLOSE TO 12V

Check the wiring. The signal wire might be touching the power wire.

POTENTIOMETER: READING IN RAW MODE IS CLOSE TO 0%

Check the wiring. The signal wire might be touching the ground wire.

POTENTIOMETER: READING IN RAW MODE IS CLOSE TO 100%

Check the wiring. The signal wire might be touching the power wire.

VIBRATING WIRE: READING IN RAW MODE IS STUCK AT 100'000 Hz

The probe is giving a very weak response. Check the wiring: the coil wires might be connected incorrectly. If this doesn't work, try tuning the minimum and maximum frequency around the expected frequency of the probe. If this doesn't work either, try changing the stimulus profile in the advanced options.

This problem could also be due to incorrect installation of the probe: check with the manufacturer to get information on how to best install the probe and obtain maximum vibration, and if possible, double check the reading with a different readout unit.

VIBRATING WIRE: READING IN RAW MODE IS BELOW 10'000 Hz, BUT CONSIDE-RABLY HIGHER THAN EXPECTED

Vibrating wire probes don't have one single vibration frequency, but they usually have harmonic vibrations at higher frequencies. Try lowering the maximum frequency in the probe configurations.

ACQUISITION TIME IS LONG FOR VIBRATING WIRES

The probe's response is very weak, try tuning the minimum and maximum frequency and the stimulus profile as instructed above (Vibrating Wire: reading in raw mode is stuck at 100'000 Hz). In this case as well there is a chance the problem resides in the probes installation.

ACQUISITION TIME IS LONG FOR OTHER TYPES OF PROBES

If the signal is stable, acquisition time should be around 2 seconds plus the warmup time. A longer acquisition time means that either the signal is very noisy or unstable, or the measurement is out of the typical range for the probe type (e.g. 2 mA for a 4-20 mA Single Channel Node).

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relating to office addresses and telephone numbers.

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