NI10
VIBRATING WIRE READER

NI10

DIN BAR RS-485
MODBUS RTU VIBRATING WIRE READER

next industries MILANO

USER MANUAL

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Redatto da R&D
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SPECIFIC WARNINGS

To guarantee the IP protection during the installation, expect to seal the instrument cables (with silicone or foam) after having tightened the cable-gland.
Through the installation expect suitable protections to avoid product overheating (eg. a shelter to avoid direct sunlight); similarly for low temperatures. Do not open in case of bad weather conditions (rain, snow, etc). Expect the recurring substitution of the hygroscopic salts.
Do not install in small locations and/or without ventilation, with high humidity, in potentially dangerous areas or where is prescribed the use of explosion proof components.
Electrical connections on the product must be executed only from qualified and expert personnel, in compliance with actual rules and regulations.
For external network powering, the plug at the end of the cord has ground contact; the grounding of the powering is provided from the plug inserted in the socket. The product powering source must be divided from dangerous voltage parts with double insulation and must guarantee an insulation of at least 3000 Vrms.
Be sure to have, in the plant, a suitable protection from electric short circuit (for example high sensitivity differential circuit-breaker at the root of the AC/DC power supply unit).
Before any maintenance on the product, the powering must be disconnected.
Avoid any action that can short-circuit the rechargeable battery poles.
To enable the product protections, expect a connection to the ground plant through a proper green-yellow grounding connector; this connector must be connected to the proper ground clamp (or to any bolt if it is a metal cabinet).
Verify periodically rechargeable battery voltage; expect a substitution after roughly 5 years and if the voltage measured on the poles is too low (eg. 10.5V for a battery with nominal voltage 12V) and investigate on the causes.
Using the product differently from the one expected from the manufacturer can compromise safety conditions.
The use of parts other than original spare parts could lead to irregular functioning or even dangerous situations for person and things.

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NI10 - ONE CHANNEL VIBRATING WIRE INTERFACE

NI10 is an interface between a vibrating wire sensor and a data acquisition system.
This device measures the resonance frequency and the temperature of the vibrating wire sensor.
Most vibrating wire sensors on the market can be connected.

Features

The NI10 uses frequency sweep search and FFT processing technology to obtain the wire vibration frequency, together with a voltage excitation capability of 24V pk-pk max. This allows precise and repeatable measurements also in noisy environments and with long cables; a quality index is also calculated and available to the user for each reading.
The device can transmit a new frequency/temperature measurement every around 2 seconds.
NI10 communicates with the data logger through an isolated RS-485 serial interface.
Two leds on the front panel indicate a valid measure and the RS-485 activity.
GDT (gas discharge tubes) are installed on the sensor inputs to provide lightning protection.

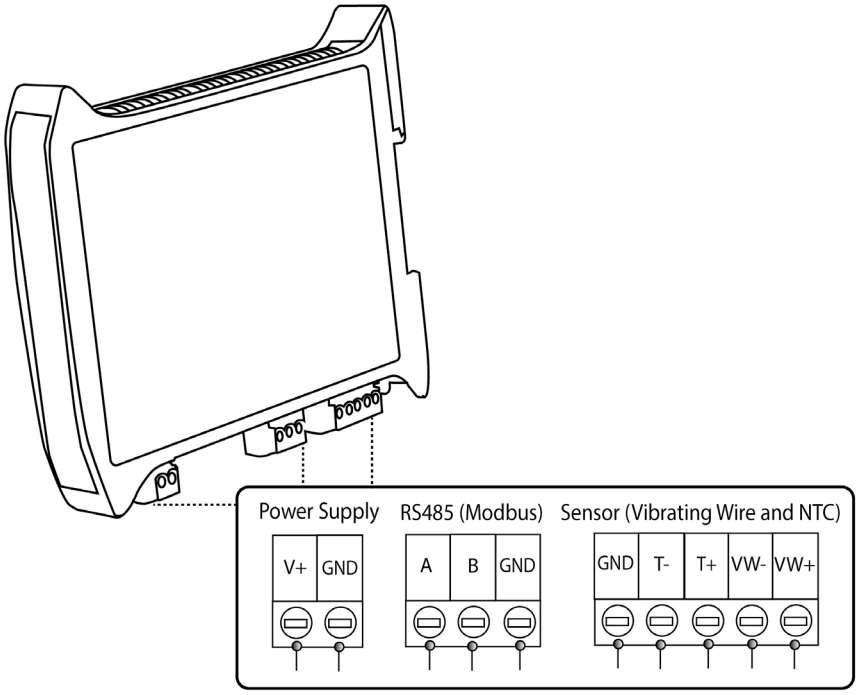
Use Cases

Thanks to RS485 Interface and Modbus RTU protocol, NI10 can be used in different ways:

- Vibrating Wire expansion for datalogger/data acquisition systems with RS485 and Modbus RTU capabilities
- Vibrating Wire interface for PC (with Next Industries' software)
- Daisy Chain with up to 32 NI10 @9600bps or 31 @115200bps

ELECTRICAL CONNECTION

Overview



Power Supply (V+ - GND)
11 to 24 V Direct Current
RS485 (A – B – GND)

A	+	Data+	RxD+	TxD+	Non-inverting
B	-	Data-	RxD-	TxD-	Inverting
GND	SC	G	Reference		

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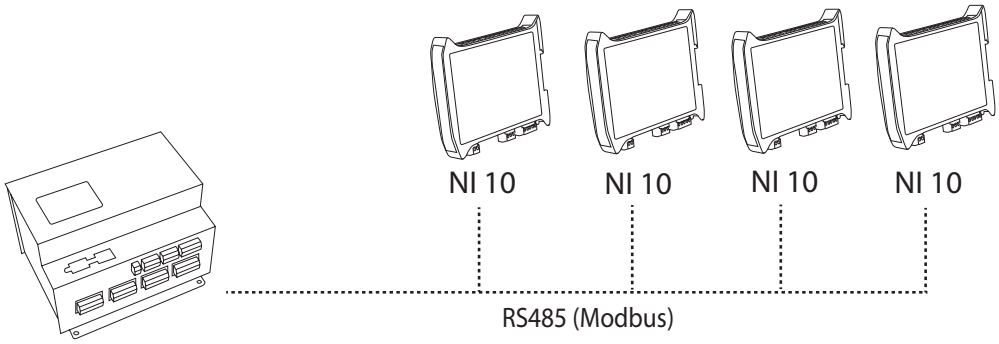
Sensor (Vibrating Wire and NTC)
GND (shield)
T- T+: Thermistor (NTC) clamps
VW- VW+: Vibrating Wire clamps

Daisy Chain

Thanks to RS-485 and Modbus RTU protocol it's possible to connect up to 30 NI10 at 115200bps or 32 NI10 at 9600bps in daisy chain.
Line termination Jumper (on last unit) could be needed for long cables.



USER INTERFACE

LEDs

Green LED

Green Led flashes every 4 seconds for a period of 500ms (reporting board turned on). For each Modbus packet received, the led is quickly blinking LED.

Red LED

Red Led means error or performed calibration procedure.
It has different meanings depending on the moment at which it flashes:

At powering:

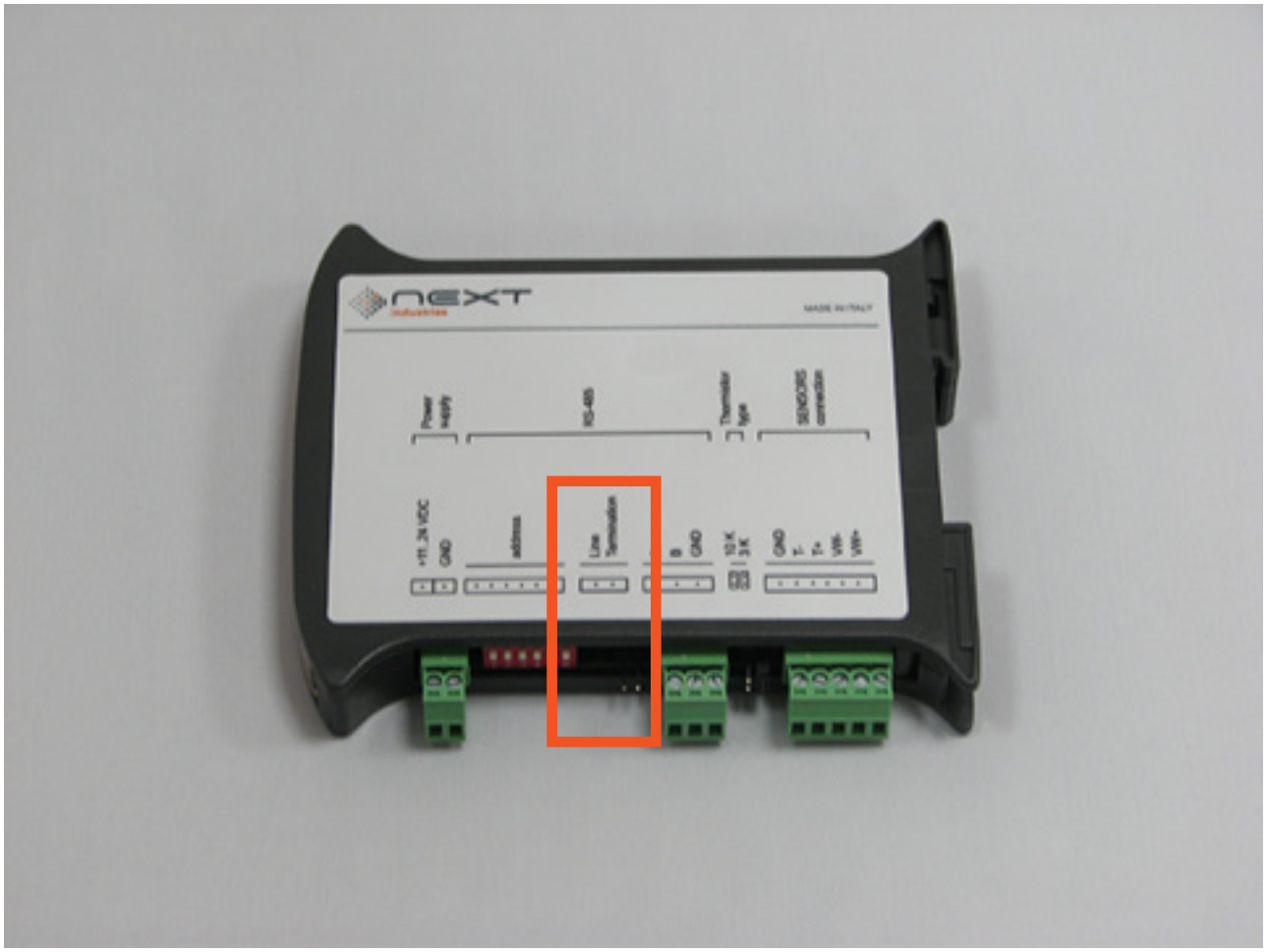
- it blinks 5 times quickly (with a period of 200ms) in the event of serious error SAR ADC. In this case, the thermistor reading is not performed. The vibrating wire reading can instead be performed
- it blinks 3 times quickly (with a period of 100ms) if the board is not calibrated (thermistor reading will not be accurate)

At the end of calibration:

- it blinks 4 times slowly (1000ms period) to indicate calibration point complete
- it does not blink if calibration procedure has failed (the old calibration point remains in memory) for a too different voltage from the theoretical setpoint

Jumper

Line Termination



Line Termination Jumper allows the user to select the internal line termination resistor (120 Ohm) when needed in long RS485 daisy chain configuration.

Thermistor Type

This set of jumpers allows the user to select the Thermistor (NTC) used. It's possible to select 3K Ohm or 10K Ohm (@25°C) NTC. Refer to Thermistor Jumper (0x69) paragraph in Modbus Chapter.

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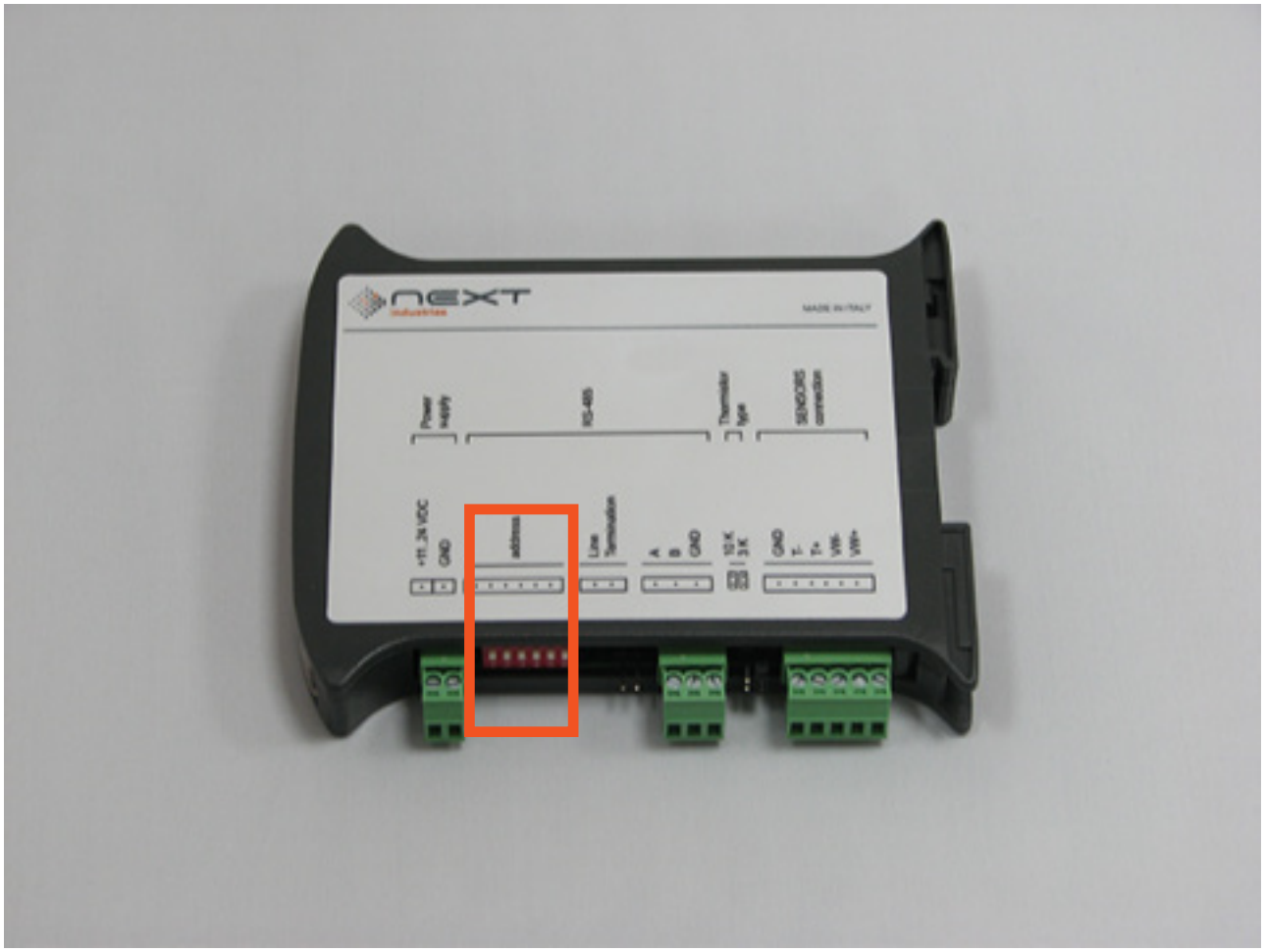
Dip Switch



NI10 is equipped with a 6-way dip switch to set the device address (for Modbus RTU protocol). Switch 1 controls the Less Significative Bit of the address, while Switch 6 controls Most Significative Bit.

To set a number here refer to this table:

Switch	1	2	3	4	5	6
Value	1	2	4	8	16	32

Example A. Number 5 is 4+1 so all switches are OFF except for 1 and 3 which are ON.

Switch	1	2	3	4	5	6
State	ON	OFF	ON	OFF	OFF	OFF

Example B. Number 23 is 1+2+4+16 so all all switches are ON except for 4 and 6 which are OFF.

Switch	1	2	3	4	5	6
State	ON	ON	ON	OFF	ON	OFF

Note:
Address 0 (Zero) is not available in Modbus RTU.
Address 63 is not available because is reserved for the bootloader operations.

For all addresses less or equal to 30, RS485 speed is 115200bps.
For all addresses greater than 30, RS485 speed is 9600bps.

WARNING: Mixing 9600bps and 115200bps devices is not allowed!
A daisy chain must be composed only by 9600bpd (address>30) or 115200bps (address<=30) devices.

More information can be found at Address paragraph.

COMMUNICATION

The communication at physical level with the VW boards is based on a RS485 bus.

Communication Parameters

Communication parameters are as it follows:

DESCRIPTION	VALUE
Speed	115200 bps
Bit number	8
Parity	None (N)
Stop bit number Numero	1

Protocol

Communication protocol is MODBUS RTU.
The VW Vibrating Wire boards are SLAVE and meet all Modbus commands.
The supported modbus functions are the following:

FUNCTION	DESCRIPTION
0x03	Read Holding registers (registers reading)
0x10	Write multiple registers (registers writing)

Address

The Modbus address is read by the VW Vibrating Wire board at powering, and it is configured through the dedicated dip switches (DS1 = LSB, DS6 = MSB). Now you should set address values from 1 to 63 (a 0 value is not allowed by the protocol).
Led flashes for 2 times every time the board receives a Modbus package. Led flashes only if the packet is destined to the board (if package is not for the board, led is not flashing).

Acronyms

SSHOT: Single Shot acquisition mode
CMOD: Continuous acquisition Mode
SLOT: is equal to 4 registers (Quality, LSB Float, MSB Float and Timestamp)
NSLOT: **Number of enabled Slots in data buffer in the bank** [0x0F;0x5E].
NEWDATA: Number of updated SLOT (new measures) in the bank from 0x0P, before the last reading on the whole enabled desk.

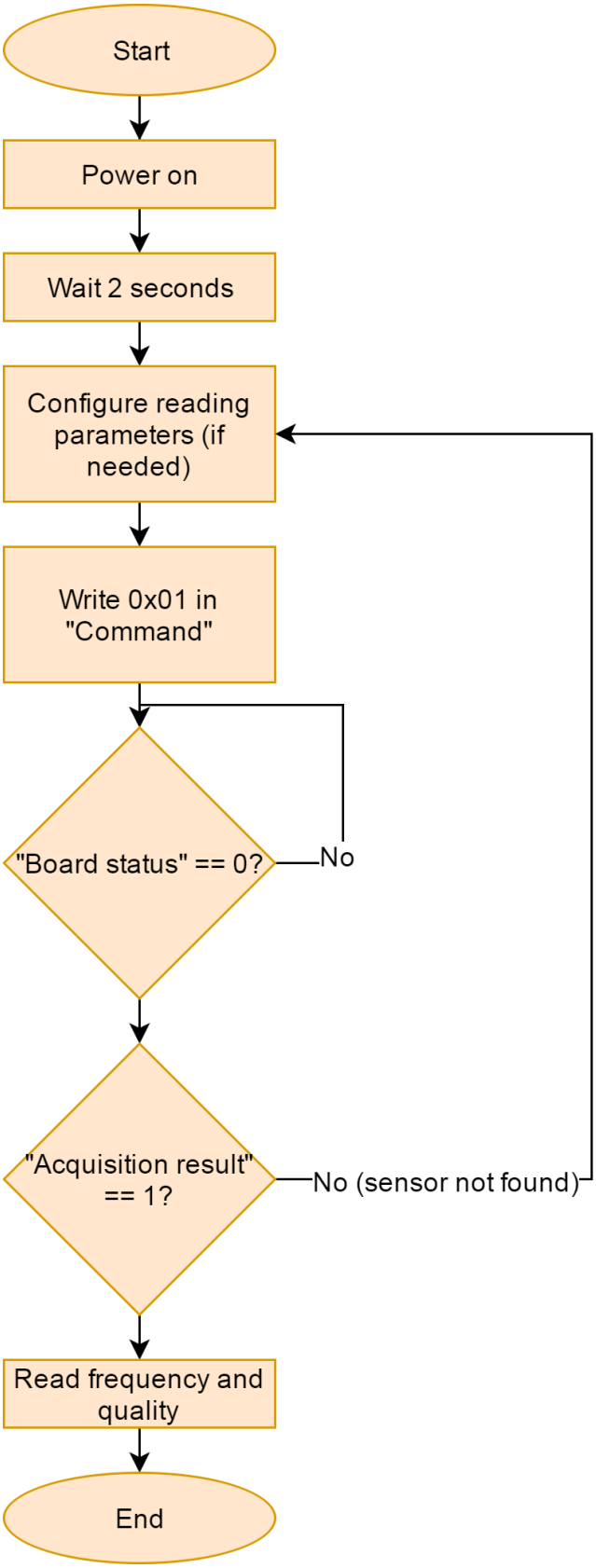
BOARD MANAGEMENT

Warning
This section list Modbus address for the firmware versione 3.01. For different firmware version, refer to the Modbus Registers list pdf matching our firmware version

Procedure for the reading of a vibrating wire sensor in Single-Shot (SSHOT) mode

1) Turn on the board
2) Wait 2 seconds for the board to be initialized
3) Configure the parameters for the sensor readi
ng (if the default values are not suitable for the sensor)
- Write in the special registers; excitation, delay, start frequency and stop frequency (0x60, 0x61, 0x62, 0x63 registers)
- Set number of readings of cycles (0x67 register) within the range **[1; 600]. (1 recommended)**
4) Write in the "command" registry value 0x01: in this way the board starts acquisition and reads the sensor.
5) Read continuously the "Board Status Register". When this register assumes the value 0x00 it means that the acquisition is complete and you can proceed further on
6) One acquisition is done, read the "acquisition Outcome" registry to see if the sensor has been found: if the sensor has been found it is possible to read the frequency and quality from the special registers.
7) Repeat steps from point 3 to acquire a new sensor

Flow chart of VW sensor acquisition in Single Shot (SSHOT) mode



Procedure for the reading of a vibrating wire sensor in Continuous Mode (CMOD)

1) Turn on the board
2) Wait 2 seconds for the board to be initialized
3) Configure the parameters for the sensor reading (if the default values are not suitable for the sensor)
- Write in the special registers; excitation, delay, start frequency and stop frequency (0x60, 0x61, 0x62, 0x63 registers)
- Set number of readings of cycles (0x67 register) equal to 0
Set number of enabled **SLOT** in the buffer **(NSLOT)** (0x6A register) in range [1; 20]
4) Write in the "command" registry value 0x01: in this way the board starts acquisition and reads the sensor.
5) Read continuously the "Board Status Register". When this register assumes the value 0x00 it means that the acquisition is complete and you can proceed further on
6) Read the "new data record to be read into the buffer" (0x0A) register, until it is equal to zero. Read the 0x0B register: if it is different from zero data were not lost, otherwise you may want to increase the buffer or increase the wait time between one read and the next one (0x68).
7) Read data from 0x0F to 0x0F + (**4 * NSLOT**) hex. The already acquired data slip in the next **SLOT** (+4 logs for the single register) after each acquisition with the exception of those in the last **SLOT** enabled with the highest address, which is lost. After reading the whole enabled databank, the 0x0A and 0x0B registers are set to zero.
8) Write in the "Command" register the value 0x04 to stop continuous acquisition mode; the board status returns to 0 and it is ready for new commands

Procedure for thermistor calibration

Turn the board on

"LOW" point calibration
Apply a 0.5V voltage between pin 1 (GND) and 2 (NTC) of the P2 connector
Shotcut to GND SWCLK signal of JTAG (use the special keyboard) for at least 2 seconds.
Red led flashes 4 times slowly: calibration is ok
Read led does not flash: calibration is failed. Check applied voltage with a tester

"HIGH" point calibration
Apply a 2.5V between pin 1 (GND) and 2 (NTC) of the P2 connector
Shortcut to GND SWDIO signal of JTAG (use the special keyboard) for at least 2 seconds.
Red led flashes 4 times slowly: calibration is ok
Read led does not flash: calibration is failed. Check applied voltage with a tester

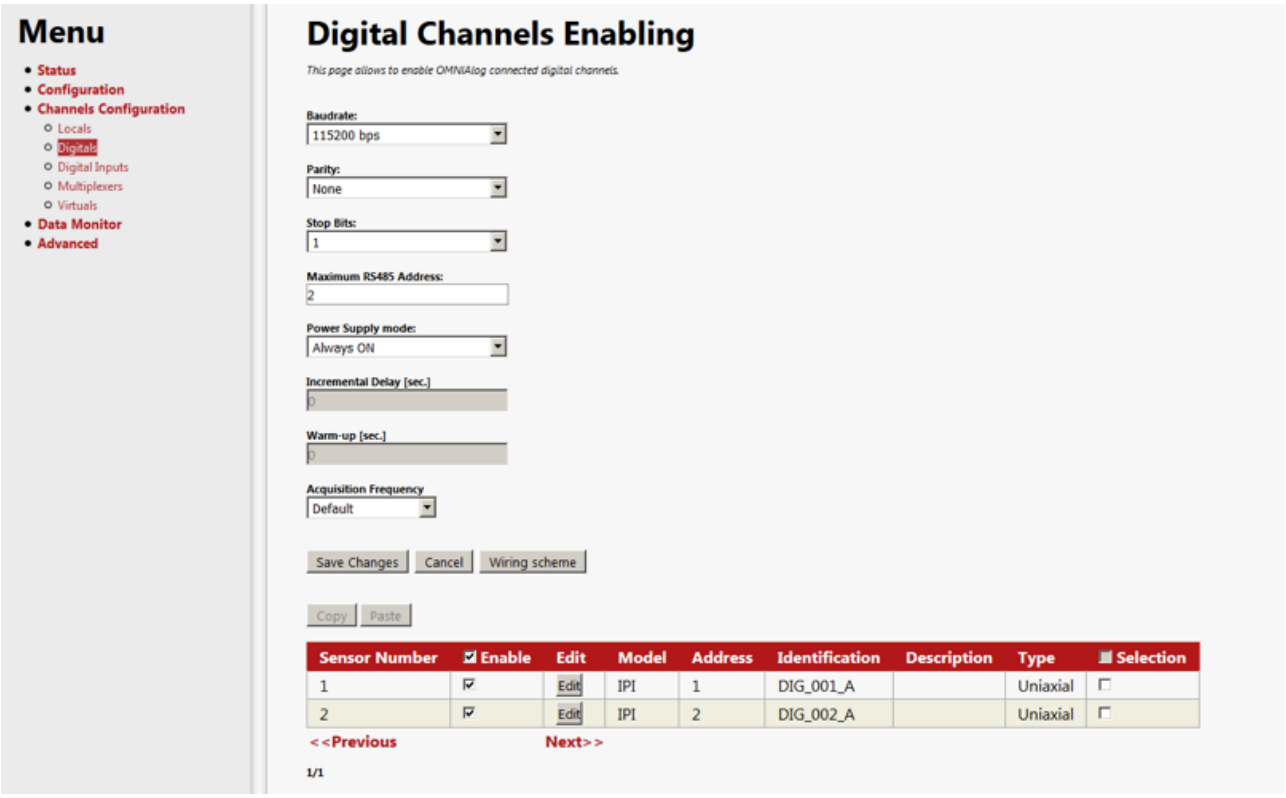
Calibration check
Do some thermistor readings to be sure of the correct calibration of the board

Calibration is automatically saved in the FLASH memory.

APPENDIX A.

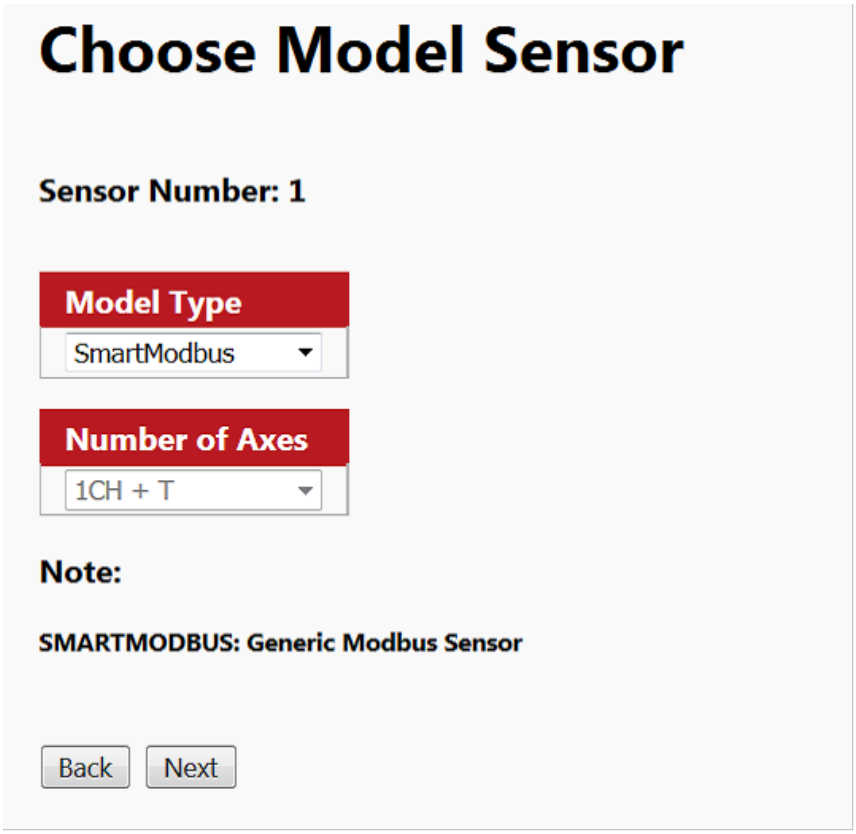
Connection to Next Industries' NI-series datalogger (NI100, NI200, NI400, NI2400)

It's possible connect NI10 to our datalogger. Settings are the same for all dataloggers. Open Datalogger's web interface, and select "Channels Configuration -> Digitals". Fill Maximum RS485 Address following your system configuration and save changes.



Enable sensors, save, and click EDIT button

Select SmartModbus



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And now you can populate fields to read NI10 (this is an example for Single Shot reading).

Smart Modbus Sensor Config

Sensor Number: 1

Modbus Address

1

Pre Measure Actions

Action	Enabled	Modbus Function	Reg Address (hex)	Comparision	Value	Endianess	Time Out (in seconds)
Send Command	☑	Force Multiple Reg (0x10)	77		1	Big	
Wait Condition	☑	Read Holding (0x3)	0	≠	1	Big	50

Acquire Measures

Action	Enabled	Modbus Function	Reg Address (hex)	Data Type	Registers Number&Order	Endianess
Measure 1	☑	Read Holding (0x3)	10	Float	W2 W1 (32 bit)	Big
Measure 2	☑	Read Holding (0x3)	c	Signed Integer	W1 (16 bit)	Big

Post Measure Actions

Action	Enabled	Modbus Function	Reg Address (hex)	Value	Endianess
Send Command	☐	Force Multiple Reg (0x10)	0	0	Big

NTC sensors (Measure B) needs a linear conversion with this parameters:

Measure 2

Output Configuration Measure 2	
Identification	MDB_001_B
Description	
Conversion	Linear ☐ Auto Zero
Zero Reading (Ez)	0.0
Sensibility (S)	0.1
Poly. Coeff. A	0
Poly. Coeff. B	0
Poly. Coeff. C	0
Poly. Coeff. D	0
Engineering Units	°C
Number of Decimals	1
Skipped	☐

Linear conversion: Sx-Ez

Polinomial conversion: $Ax^3+Bx^2+Cx+D-Ez$

Allarm Configuration Measure 2	
Alarm Type	None
High Threshold	0
Low Threshold	0
Derivate Threshold	0

APPENDIX B.

Smart Mux with NI100 and NI10

Overview

This manual is dedicated to Next Industries' Smart Mux. This device offers a smart system to read Vibrating Wire sensors.
Sections of this manual are structured to let the user learn advantages of the system, use the device in little to no time, then master and tweak it to his needs.

- System Architecture illustrates how the system is developed, how is expandable
- Quick start is a no-time consuming guide to learn how to start the first acquisition without danger for the instruments
- In depth configuration enumerates the possible tweaks to get 100% from the acquisition device

System Architecture

The core of this system is Next Industries' NI10 Vibrating Wire reader. Thanks to its RS485 Smart Modbus interface, it's possible to enable Vibrating Wire readings on NI100 datalogger.
Multiplexer increase number of Vibrating Wire sensors an NI10 can read, up to 24 sensors per multiplexer. NI100 can handle up to 16 Multiplexer, providing an astonishing 384 total sensors' channels.

Advantages

Compared to other system, if need to connect Vibrating Wire sensors (eventually with Thermistors) this system will result cheaper than others. By having separated electronic units, Datalogger, Vibrating Wire reader, and multiplexers, lower downtime in case of faults, and reduces external interferences of analog signals.
By placing Multiplexers and NI10 Vibrating Wire reader near sensors, and Datalogger near Power Source and LAN connection, will result in longer distances covered by RS485 signal instead of Vibrating Wire/Thermistor signal, with little to no data degradation (RS485 cables can reach 1km in optimal conditions).

Text Conventions

In this manual we'll use few conventions:
Axis: a sensor can be composed by one or more axis. Vibrating Wire is a single axis sensor as it outputs a single measurement (frequency in Hz). A Vibrating Wire with Thermistor is a two axis sensor as it outputs frequency (Hz) and Ohm (for NTC Temperature).

QUICK START

Overview

In this section you'll learn:

- Choose the right Power Supply
- How to connect NI100 Datalogger, NI10 Vibrating Wire reader and Multiplexer together
- Configure a Vibrating Wire sensor channel
- Read it

Power Supply

Power supply to NI10 and Multiplexers is provided by the NI100, and will be the same power supply applied to the datalogger itself. Beware to use a power supply sized to handle power consumption of all devices connected. We recommend a 12V 5A datalogger when using 16 Multiplexers. For most uses, a 12V 2A power supply is sufficient.
Power supply is connected to VIN terminal block, and can handle 11 to 24V DC. Battery, PV Panel with charge regulator, or AC/DC transformer can be used.

Connections

RS485 Overview

RS485 is a standard electrical interface for serial communications. Electrical signaling is balanced, and multipoint systems are supported.

This interface expose 3 standard connections:

A	+	Data+	D+	TxD+/RxD+	Non-inverting pin
B	-	Data-	D-	TxD-/RxD-	Inverting pin
C	SC	G			Reference pin

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Minimum cable length between point to point is 30 cm, maximum cable length is 1000m, but depends of devices hardware and environment interferences.

NI10+NI100+SmartMux wiring

Connections between NI100,NI10 and SmartMux is provided via RS485. This strong interface allows for long cables and relatively fast data transfers.
Here is an example configuration which uses one Multiplexer and one NI10 connected to the NI100 data logger.

Before connecting the NI10, be sure to set the address to 31 with Dip Switch:

Switch	1	2	3	4	5	6
State	ON	ON	ON	ON	ON	OFF

Before connecting the Multiplexer, be sure to set the address to 1, always on and 9600bps with Dip Switch:

Switch	1	2	3	4	5	6	7	8
State	ON	OFF	OFF	OFF	OFF	OFF	ON	ON

On NI100 the terminal block used is RS485#2.

NI100	NI10 (Address 31)	SmartMux (Address 1)
Data-	B	B
Data+	A	A
GND (Center) [optional]	GND	
+V	V+	+V
GND	GND	GND

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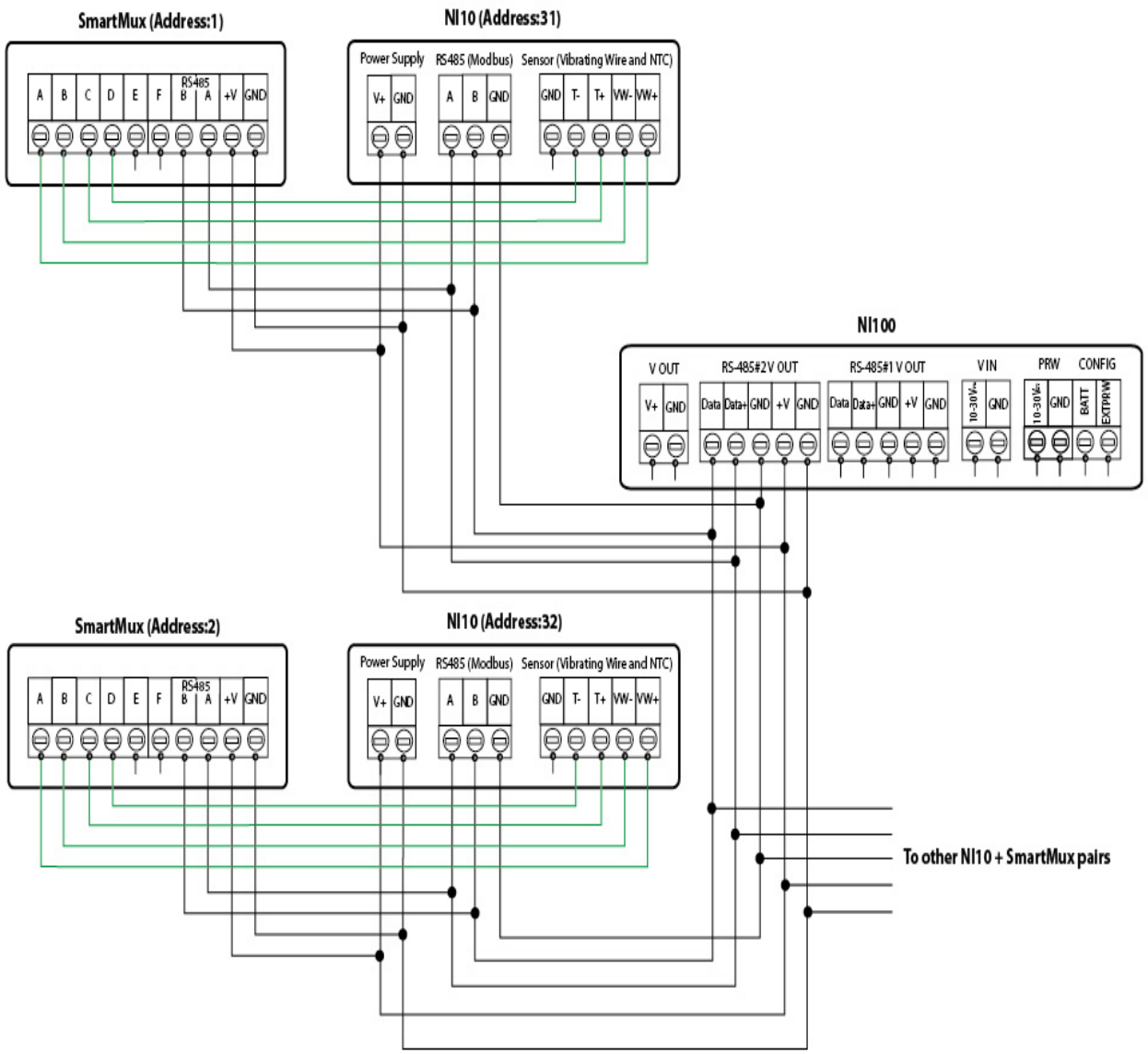
Furthermore, each NI10 and SmartMux pairs must be connected togheder in the following way:

NI10 (ADDRESS X+30)	SMARTMUX (ADDRESS X)
T-	D
T+	C
VW-	B
VW+	A

The following image show how to connect two SmartMux+NI10 pairs to the NI100.



Daisy Chain

To connect more than one multiplexer, a daisy chain is needed. Multiplexers offers a pass through connector to simplify this operation.

Vibrating Wire Sensor

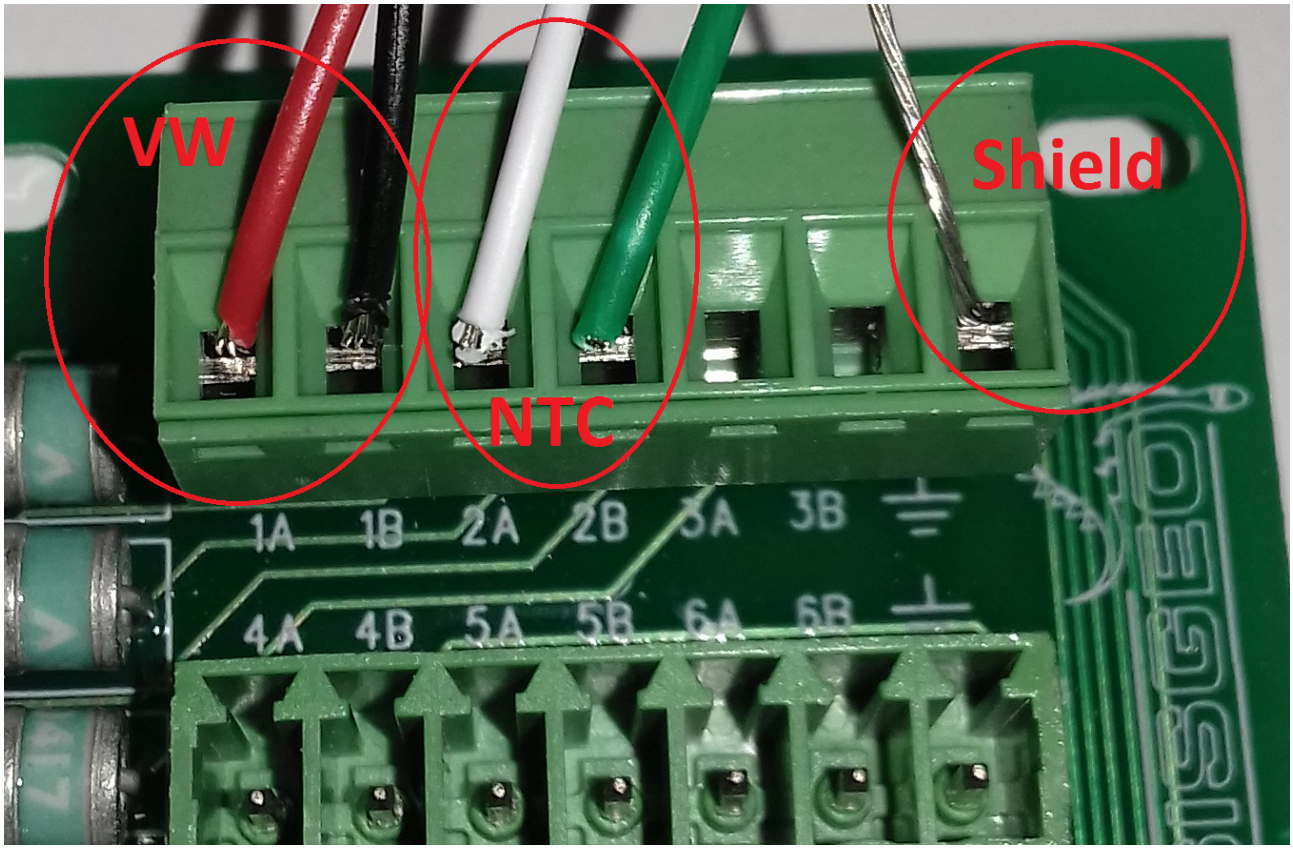
NI10 can read Vibrating Wire and Vibrating Wire + Thermistor (NTC) for compensation. In following paragraphs connections of both Vibrating Wire and NTC are showed.

Vibrating Wire signal

Vibrating Wire signal runs through 2 wires. Identify those two wires in sensor's manual and connect to Multiplexer's 1A and 1B clamps.

Thermistor (NTC) signal

NTC signal is also a two wires sensor. Identify those two wires in sensor's user manual and connect to Multiplexer's 2A and 2B clamps.



Limits

With this device is possible to connect a maximum of 384 sensors, by connecting Multiplexers in daisy chain.

For instance:
384 Vibrating Wire (without Thermistor)
384 Thermistors
192 Vibrating Wire + Thermistor

A combination of the three solutions, keeping in mind the maximum of 384 axis (Vibrating Wire with Thermistor is a 2 axis sensor, while a bare Vibrating Wire is 1 axis sensor, same as a bare NTC).

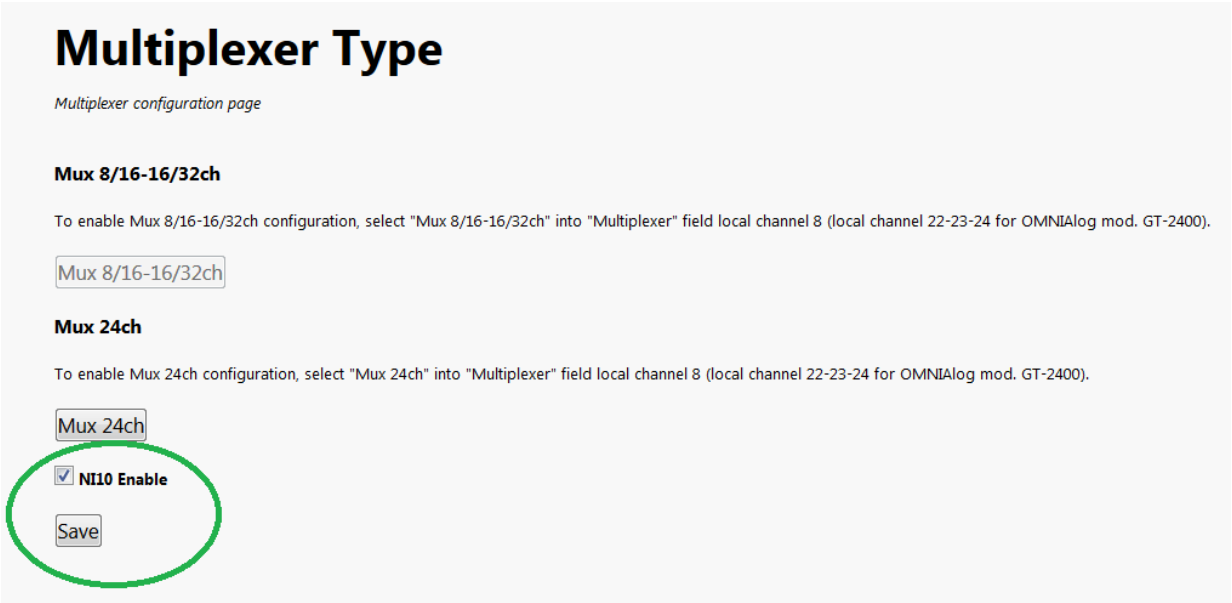
Configuration

In order to read this configured sensor, NI100 configuration is needed. Following NI100 user manual connect to it's web server and log in.

Enable NI10

The first step is to enable NI10+SmartMux from NI100.

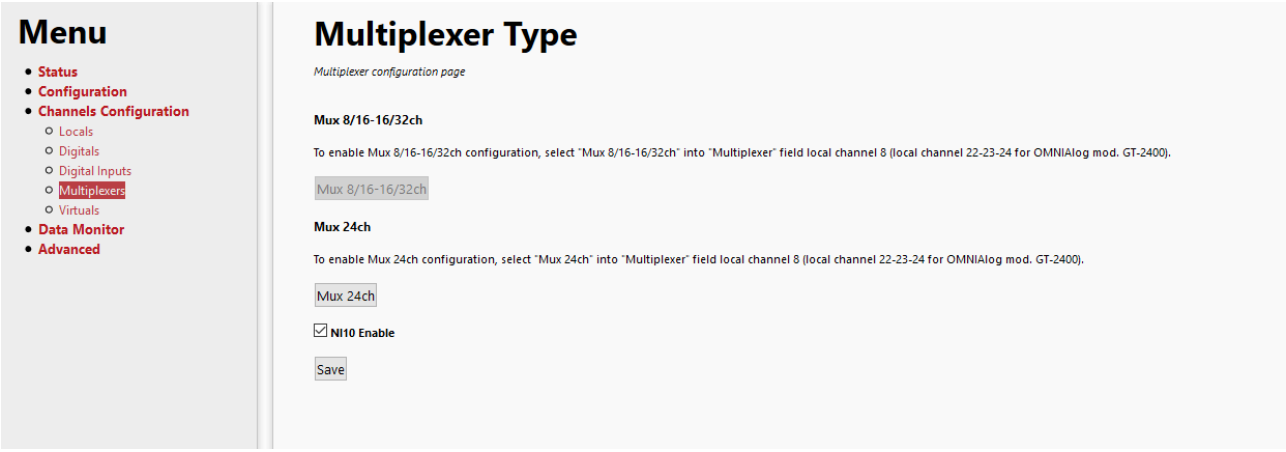
Open **Channel Configuration -> Multiplexers**
Enable the checkbox "NI10+Enable" and click on "Save". The button Mux24Ch will be enabled



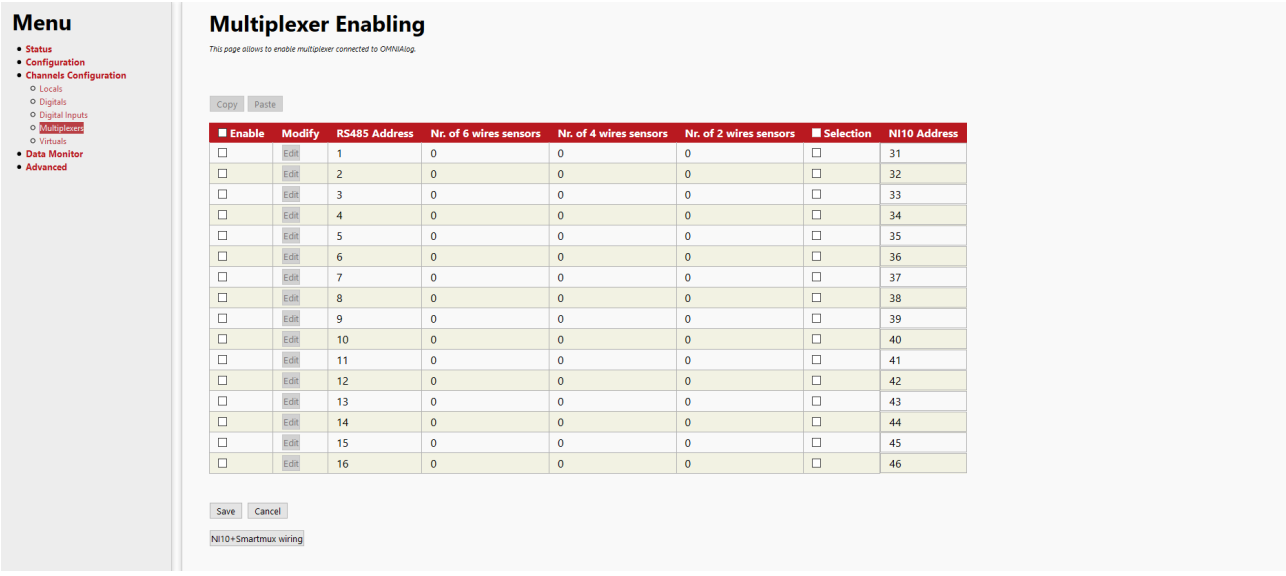
Now we can configure Multiplexer(s), as they are now enabled.

Configure Multiplexer

In this step we will enable Multiplexer and configure to read the previously connected Vibrating Wire sensor with Thermistor.
Open **Channels Configuration -> Multiplexers**, enabled in previous step.



Select Mux24ch and you're now in the Multiplexer's main page.



Enable	Modify	RS485 Address	Nr. of 6 wires sensors	Nr. of 4 wires sensors	Nr. of 2 wires sensors	Selection	NI10 Address
☐	Edit	1	0	0	0	☐	31
☐	Edit	2	0	0	0	☐	32
☐	Edit	3	0	0	0	☐	33
☐	Edit	4	0	0	0	☐	34
☐	Edit	5	0	0	0	☐	35
☐	Edit	6	0	0	0	☐	36
☐	Edit	7	0	0	0	☐	37
☐	Edit	8	0	0	0	☐	38
☐	Edit	9	0	0	0	☐	39
☐	Edit	10	0	0	0	☐	40
☐	Edit	11	0	0	0	☐	41
☐	Edit	12	0	0	0	☐	42
☐	Edit	13	0	0	0	☐	43
☐	Edit	14	0	0	0	☐	44
☐	Edit	15	0	0	0	☐	45
☐	Edit	16	0	0	0	☐	46

Enable the first Multiplexer by clicking on the right side checkbox on the first row. Click "Save" and then the Edit button on the first row.

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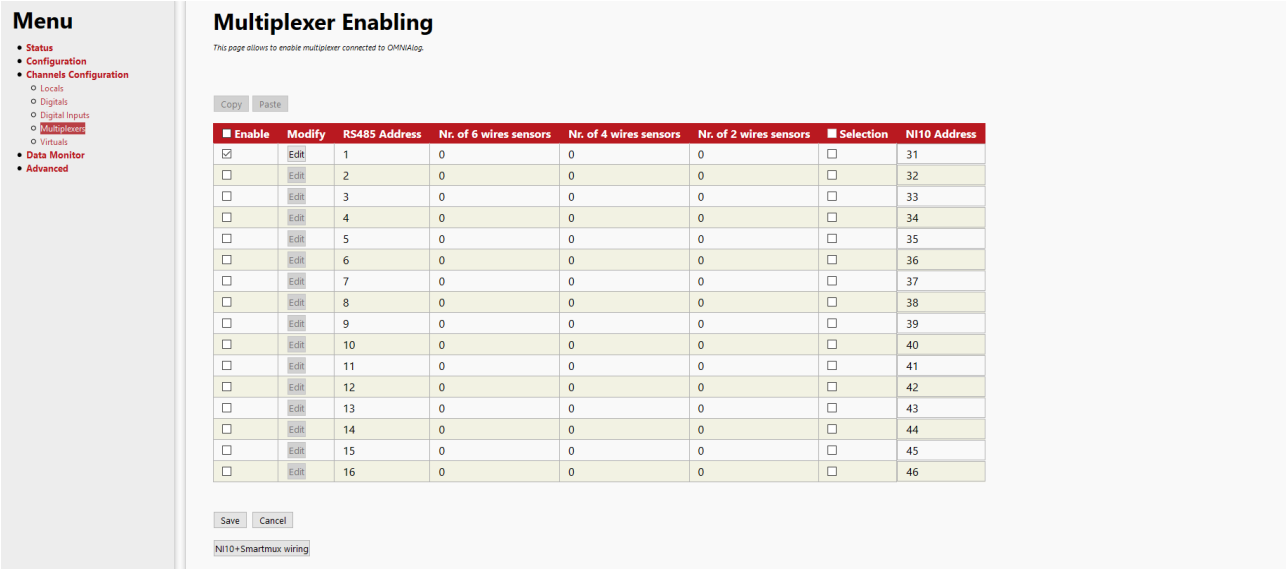
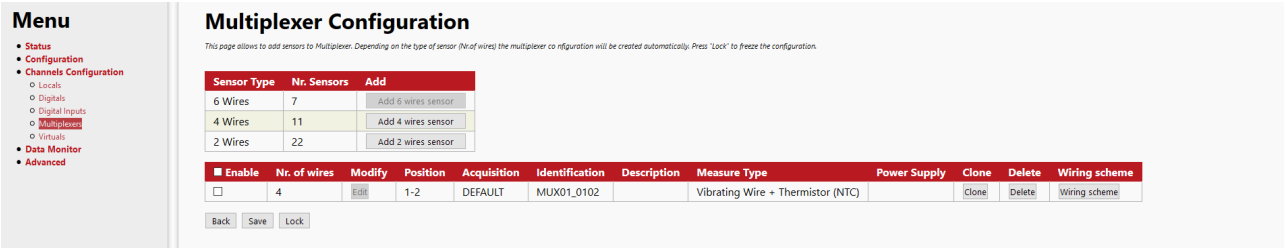


Enable	Modify	RS485 Address	Nr. of 6 wires sensors	Nr. of 4 wires sensors	Nr. of 2 wires sensors	Selection	NI10 Address
☑	Edit	1	0	0	0	☐	31
☐	Edit	2	0	0	0	☐	32
☐	Edit	3	0	0	0	☐	33
☐	Edit	4	0	0	0	☐	34
☐	Edit	5	0	0	0	☐	35
☐	Edit	6	0	0	0	☐	36
☐	Edit	7	0	0	0	☐	37
☐	Edit	8	0	0	0	☐	38
☐	Edit	9	0	0	0	☐	39
☐	Edit	10	0	0	0	☐	40
☐	Edit	11	0	0	0	☐	41
☐	Edit	12	0	0	0	☐	42
☐	Edit	13	0	0	0	☐	43
☐	Edit	14	0	0	0	☐	44
☐	Edit	15	0	0	0	☐	45
☐	Edit	16	0	0	0	☐	46

Since in the example we used a Vibrating Wire with Thermistor sensor, we're going to click "Add 4 wires sensor" to read both axis.



Sensor Type	Nr. Sensors	Add
6 Wires	7	Add 6 wires sensor
4 Wires	11	Add 4 wires sensor
2 Wires	22	Add 2 wires sensor

Enable	Nr. of wires	Modify	Position	Acquisition	Identification	Description	Measure Type	Power Supply	Clone	Delete	Wiring scheme
☐	4	Edit	1-2	DEFAULT	MUX01_0102		Vibrating Wire + Thermistor (NTC)		Clone	Delete	Wiring scheme

Click "Enable", "Save" and then "Edit".

Menu

- Status
- Configuration
- Channels Configuration
- Data Monitor
- Advanced

Multiplexer Channel Configuration

This page allows to configure OMNIAlog Multiplexer analog channels

Description	Parameters
Input	A
Identification	MUX01_0102_A
Description	
Measure Type	Vibrating Wire + Thermistor (N
Power Supply	
Acquisition	Default
Measure Unit	digit
Warm-Up [sec.]	0
Conversion	None ☐ Auto Zero
Zero Reading (Ez)	0.000
Sensibility (S)	0
Poly. Coeff. A	0
Poly. Coeff. B	0
Poly. Coeff. C	0
Poly. Coeff. D	0
Engineering Units	
Excitation (VW)	35
Delay (VW)	10
Range	Autorange
Start frequency (VW)	400
Stop frequency (VW)	6000
Gain	1640
Excitation factor [%] (VW)	100
Excitation scaling speed (VW)	8
Numbers of Decimals	DEFAULT
Skipped	☐

Linear conversion **Polynomial conversion: Ax^3+Bx^2+Cx+D**

Alarms Configuration	
Alarm Type	None
High Threshold	0
Low Threshold	0
Derivative Threshold	0
VC Alarm with Logical Operations	☐

Back Next Save Changes Cancel

The only available Measure Type here is Vibrating Wire + Thermistor (NTC).

We skip configuration details as they are shown in next Section.
Click “Next” and then “Save Changes”.

Test Reading

As now we have the sensor physically connected and software configured to read it, we can start a test measure.
Go on Data Monitor -> Measures, and click Test Measure and wait for acquisition.

IN DEPTH CONFIGURATION

Overview

In this section we'll look at configuration parameters and how to connect more than one sensor to Smart Mux device.

- Configuration of Multiplexers
- Configuration of Sensors

Multiplexers

Address

Smart Mux device can handle up to 16 Multiplexers (paired with an NI10 each) to allow readings of a maximum of 384 sensors.

Every Multiplexer is addressed by dip switches:

Switch	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Information	ADDR0	ADDR1	ADDR2	ADDR3	ADDR4	SLEEP	BAUD0	BAUD1
Address Value	1	2	4	8	16			

Switch 1 controls the Less Significative Bit of the address, while Switch 5 controls its Most Significative Bit.
Referring to the table above we also have SLEEP, BAUD0 and BAUD1.

SLEEP, when enabled, Will let the multiplexer sleep IF the first message he receives does not contain his address. To correctly interface with NI100, **this switch must be OFF**.

BAUD0 and **BAUD1** select baud rate of RS485 transmission. To correctly interface with NI100, **both switch must be ON.**

Examples of Modbus Addresses configuration:

To set up Multiplexer's address, it's necessary to set this dip-switch 1 to 5. Available addresses are from 1 to 16.

	1	2	3	4	5
1	ON	OFF	OFF	OFF	OFF
12	OFF	OFF	ON	ON	OFF
15	ON	ON	ON	ON	OFF
16	OFF	OFF	OFF	OFF	ON

WARNING: Remember to set every multiplexer's address to avoid communication issues. Every address can't be assigned to more than one multiplexer. RS485#1 and RS485#2 uses two separate circuits so devices connected to RS485#1 can use same addresses used by Multiplexers connected to RS485#2.

NI10

Address

Every NI10 is addressed by dip switches:

Switch	1	2	3	4	5	6
Information	ADDR0	ADDR1	ADDR2	ADDR3	ADDR4	ADDR5
Address Value	1	2	4	8	16	32

Switch 1 controls the Less Significative Bit of the address, while Switch 5 controls its Most Significative Bit.

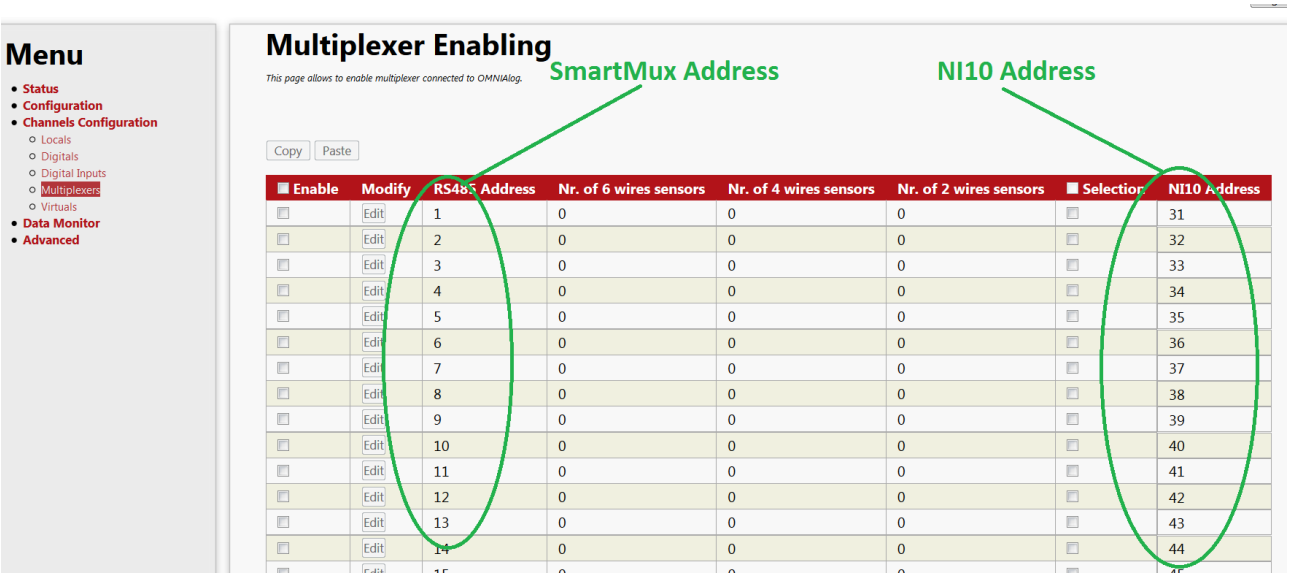
Examples of Modbus Addresses configuration:

To set up NI10 address, it's necessary to set this dip-switch 1 to 6. Available addresses, for the NI10+SmartMux configuration, are from 31 to 46.

	1	2	3	4	5	6
31	ON	ON	ON	ON	ON	OFF
32	OFF	OFF	OFF	OFF	OFF	ON
33	ON	OFF	OFF	OFF	OFF	ON
46	OFF	ON	ON	ON	OFF	ON

Each NI10 address must be equal to the following equation:
NI10 Address=SmartMux+30

For example, the NI10 connected to the SmartMux address 1 must be configured with the address 31 (30+1=31). The NI10 address is also visible in the rightmost column in the page Multiplexer configuration (see image and table below).

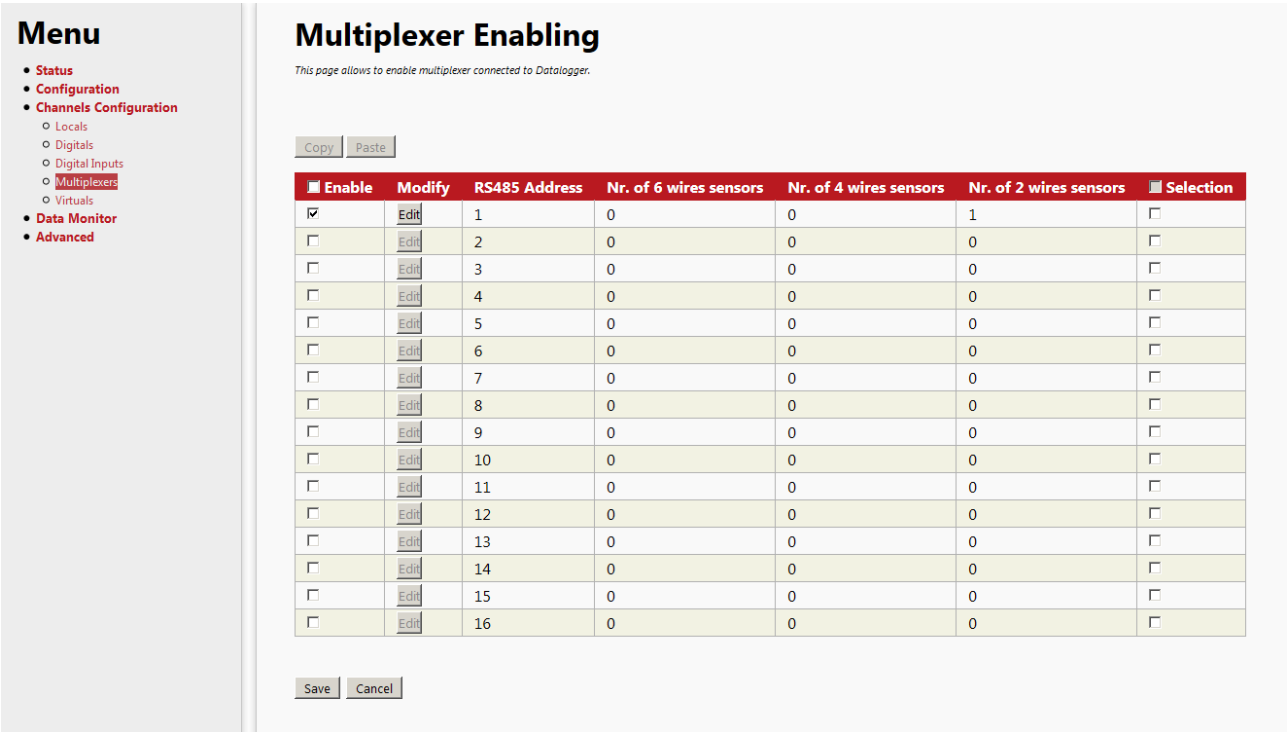


Enable	Modify	RS485 Address	Nr. of 6 wires sensors	Nr. of 4 wires sensors	Nr. of 2 wires sensors	Selection	NI10 Address
	Edit	1	0	0	0		31
	Edit	2	0	0	0		32
	Edit	3	0	0	0		33
	Edit	4	0	0	0		34
	Edit	5	0	0	0		35
	Edit	6	0	0	0		36
	Edit	7	0	0	0		37
	Edit	8	0	0	0		38
	Edit	9	0	0	0		39
	Edit	10	0	0	0		40
	Edit	11	0	0	0		41
	Edit	12	0	0	0		42
	Edit	13	0	0	0		43
	Edit	14	0	0	0		44

Enable Multiplexers

Once all Multiplexers are addressed and cabled, we can enable in the Multiplexer page (Channels Configuration -> Multiplexers).

Click on Mux 24ch button to proceed.



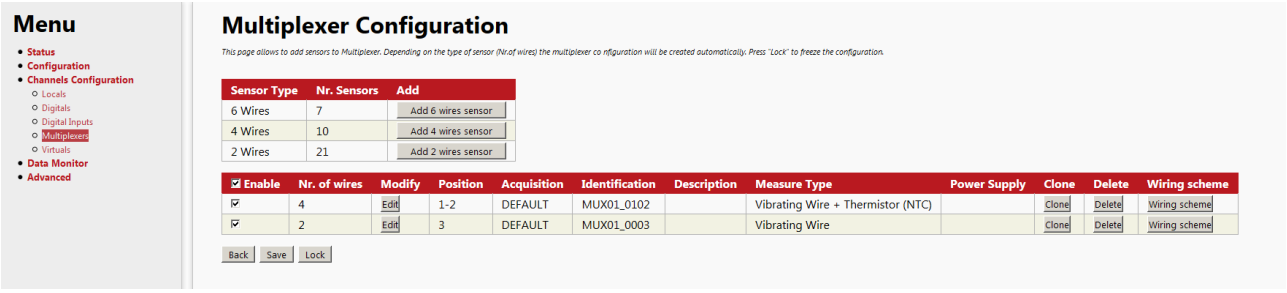
Enable	Modify	RS485 Address	Nr. of 6 wires sensors	Nr. of 4 wires sensors	Nr. of 2 wires sensors	Selection
☑	Edit	1	0	0	1	
	Edit	2	0	0	0	
	Edit	3	0	0	0	
	Edit	4	0	0	0	
	Edit	5	0	0	0	
	Edit	6	0	0	0	
	Edit	7	0	0	0	
	Edit	8	0	0	0	
	Edit	9	0	0	0	
	Edit	10	0	0	0	
	Edit	11	0	0	0	
	Edit	12	0	0	0	
	Edit	13	0	0	0	
	Edit	14	0	0	0	
	Edit	15	0	0	0	
	Edit	16	0	0	0	

VIBRATING WIRE READER
NI10

This page allows to enable multiplexers connected in the previous steps.

Once connected multiplexers are enabled, click “Save” button.

Edit button for each enabled multiplexer is now active. By clicking this button, we can enter in channel configuration page. This page permits to set sensors wires and quantity.



Possible 2 Wires sensors are:
- Vibrating Wire
- Thermistor (NTC)

Possible 4 Wires sensors are:
- Vibrating Wire + Thermistor (NTC)

Differents from other Next Industries products, 6 Wires sensors are not available in this configuration, as only Vibrating Wire and Thermistor (NTC) can be connected.
Repeat this for each sensors in each multiplexer.

Sensors

Once all channels are created, we configure sensors characteristics.
We can click edit on each of this channels and configure parameters.
Next paragraphs illustrates how to configure Vibrating Wire, Thermistor and Vibrating Wire + Thermistor.

Vibrating Wire

When a channel is configured as Vibrating wire, the following options are available:

PARAMETER	DESCRIPTION
Input	Non-editable field. It indicates the input that is configuring. The characters "_A" or "_B" are added in case of a channel with 2 inputs (ex: 1_A, 1_B)
Identification	Field editable from the user. Name to assign to the sensor. This field is exported as the heading of the column containing the measurements of sensor in the .CSV type "Measurements"
Description	Field editable from the user. Description ascribable to the sensor for a better identification. This field is present only in the .CSV file type "loag measurements"
Measure Type	Set this dropdown menu as Vibrating Wire to enable Vibrating Wire Reading
Acquisition	The acquisition interfal "personalized" for the channel
Measure Unit	Type of measurements to read this input (Hz, usec, digit)
Conversion	This field allows to select which conversion to realize between LINEAR and POLYNOMIAL. It is also possible to decide to realize NO conversion (in this case the reading is expressed in electrical unit). This field is necessary to convert the reading of the sensor from electrical unit (mA, mV, digit, etc.) to engineering unit (kPa, mm, mbar, etc.)
Zero Reading (Ez)	This field is enabled if the linear conversion has been selected. For further information, please refer to manual "Linear and Polynomial conversion Quick Start"
Sensibility (S)	This field is enabled if the linear conversion has been selected. For further information, please refer to manual "Linear and Polynomial conversion Quick Start"
Poly. Coeff. A-B-C-D	This field is enabled if the polynomialconversion has been selected. For further information, please refer to manual "Linear and Polynomial conversion Quick Start"

Engineering Units	Field editable from the user. This field is enabled if the linear or polynomial conversion is selected. It represents the acronym of the measure unit of the reading after the conversion in engineering unit
Excitation (VW)	Indicates (in msec) the period of each stimulation phase
Delay (VW)	Indicates (in msec) the stabilization period, i.e. how long the datalogger waits before starting the reading phase
Range	This field allows to set up the range of functioning of the sensor. Only AUTORANGE is available for Vibrating Wire
Start Frequency (VW)	Indicates the starting frequency of the research
Stop Frequency (VW)	Indicates the stop frequency of the research
Gain	Amplification factor applied to sensors' signal. Raise this parameter only if sensor is placed far from NI10 unit and it provides unexpected or wrong readings
Excitation Factor [%] (VW)	Maximum amplitude of sensor excitation signal. Lowering this parameter only if sensor is placed close to datalogger and provides unexpected or wrong readings
Excitation scaling speed (VW)	This parameter sets adapting speed of excitation signal during vibrating wire reading
Number of Decimals	Number of decimals recorded for this channel
Skipped	The datalogger does not read the channel, but CSV file will be populated with "skipped" values. This is to ensure compatibility with software population layer in case of sensor change/removal

Thermistor (NTC)

PARAMETER	DESCRIPTION
Input	Non-editable field. It indicates the input that is configuring. The characters "_A" or "_B" are added in case of a channel with 2 inputs (ex: 1_A, 1_B)
Identification	Field editable from the user. Name to assign to the sensor. This field is exported as the heading of the column containing the measurements of sensor in the .CSV type "Measurements"
Description	Field editable from the user. Description ascribable to the sensor for a better identification. This field is present only in the .CSV file type "loag measurements"
Measure Type	Set this dropdown menu as Thermistor (NTC) to enable Thermistor Reading
Power Supply	This value is fixed at 0.1mA, current flow through sensor's resistor
Acquisition	The acquisition interfal "personalized" for the channel
Measure Unit	Type of measurements to read this input (°C and Ohm)
Conversion	This field allows to select which conversion to realize between LINEAR and POLYNOMIAL. It is also possible to decide to realize NO conversion (in this case the reading is expressed in electrical unit). This field is necessary to convert the reading of the sensor from electrical unit (mA, mV, digit, etc.) to engineering unit (kPa, mm, mbar, etc.)
Zero Reading	This field is enabled if the linear conversion has been selected. For further information, please refer to manual "Linear and Polynomial conversion Quick Start"
Sensibility	This field is enabled if the linear conversion has been selected. For further information, please refer to manual "Linear and Polynomial conversion Quick Start"
Poly. Coeff. A-B-C-D	This field is enabled if the polynomialconversion has been selected. For further information, please refer to manual "Linear and Polynomial conversion Quick Start"

Engineering Units	Field editable from the user. This field is enabled if the linear or polynomial conversion is selected. It represents the acronym of the measure unit of the reading after the conversion in engineering unit
Range	This field allows to set up the range of functioning of the sensor. Only AUTORANGE is available for Vibrating Wire
Number of Decimals	Number of decimals recorded for this channel
Skipped	The datalogger does not read the channel, but CSV file will be populated with "skipped" values. This is to ensure compatibility with software population layer in case of sensor change/removal

Vibrating Wire + Thermistor (NTC)

When selecting 4 wires sensors, Only Vibrating Wire + Thermistor (NTC) will be available. Being this a two axis sensor, it will use two pages for configuration.
The first page is dedicated to Vibrating Wire configuration, so refer to that paragraph for further details.
The second page is dedicate to Thermistor (NTC) configuration, so refer to that paragraph for further details.

Differences from single axis sensors

Difference from single axis sensors is in naming, As seen in previous chapters, "Input" parameter is the name of the axis. Single axis sensors use only "A" while two axis sensors will name "A" and "B". This parameter is used as postfix in the default Identification to discriminate between axis.

Alarms

Alarm section is in common with both 2 wires sensors (Vibrating Wire and Thermistor) and 4 wires sensors (Vibrating Wire + Thermistor).
Alarms can be handled as:

- Send SMS
- Send email
- Upload on FTP
- Enable Digital Output
- Frequency Increase

Further details for alarms configuration and parameters can be found on NI100 User Manual.

PARAMETER	DESCRIPTION
Alarm Type	High: the input is in alarm only if the reading exceeds the value indicated in the field HIGH THRESHOLD Low: the input is in alarm only if the reading is lower than the value indicated in the field LOW THRESHOLD Derivate: the input is in alarm only if the reading differs from the previous reading of a value greater than or equal to de value indicated in the field DERIVATE THRESHOLD
High Threshold	Field editable from the user. It indicates the numerical value to assign to the high threshold. The value has to be inserted taking into account reading's unit measure
Low Threshold	Field editable from the user. It indicates the numerical value to assign to the low threshold. The value has to be inserted taking into account reading's unit measure
Derivate Threshold	Field editable from the user. It indicates the numerical value to assign to the derived threshold. The value has to be inserted taking into account reading's unit measure
VC Alarm with logical operations	Enabling this tick, the configured alarm is no longer connected to the single input. The channels that adopt this option will be "linked" to each other by logical operations (AND, OR, NOT and XOR). If this field is enabled, therefore it will be necessary to configure a virtual channel with an opportune logical operation

WARNING: the values inserted in alarm thresholds have to take into account the possible linear or polynomial conversion that has been configured. If the user configured a conversion, the threshold values have to be inserted in engineering unit. If the user didn't configure any conversion, the thresholds values have to be inserted in electrical unit.

ASSISTANCE

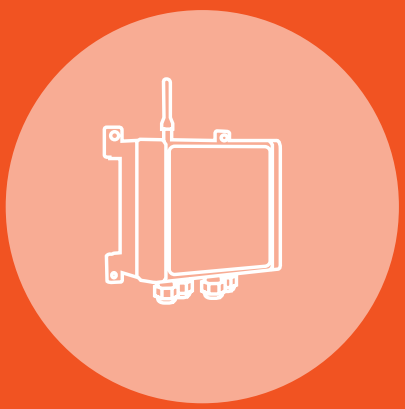
In the event that you need after-sale calibration, service or repair of your NI10, please contact Next Industries's Customer Service Department for an Authorized Return (AR) No.
Next Industries Customer Service email: **service@nextind.eu**

SPECIFICATIONS

1 Power supply
2 Rs-485
3 Thermistor type
4 sensors connections

TECHNICAL SPECIFICATIONS	
Vibrating wire sensors	standard two-wire vibrating wires sensors
Sweep frequency	400-6000 Hz (user-programmable in this interval)
Thermistors	3k or 10k (user selectable)
Accuracy	Frequency 0.018% of reading Temperature: +/- 0.2°C
Communication Port	RS-485, (9600 or 115200 kbps)
Communication Protocol	Modbus-RTU
Modbus Address	1 to 62
Operating Temperature	-40..+55°C
Power Requirements	11.24Vdc approx. 35mA in stand by, 100mA during measurement
Dimensions (LxWxH)	100x119x18 mm Din-rail mount enclosure

NI10
VIBRATING WIRE READER



DATALOGGERS

INTERNET OF THINGS
SENSORS

WEB **SOFTWARE**

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