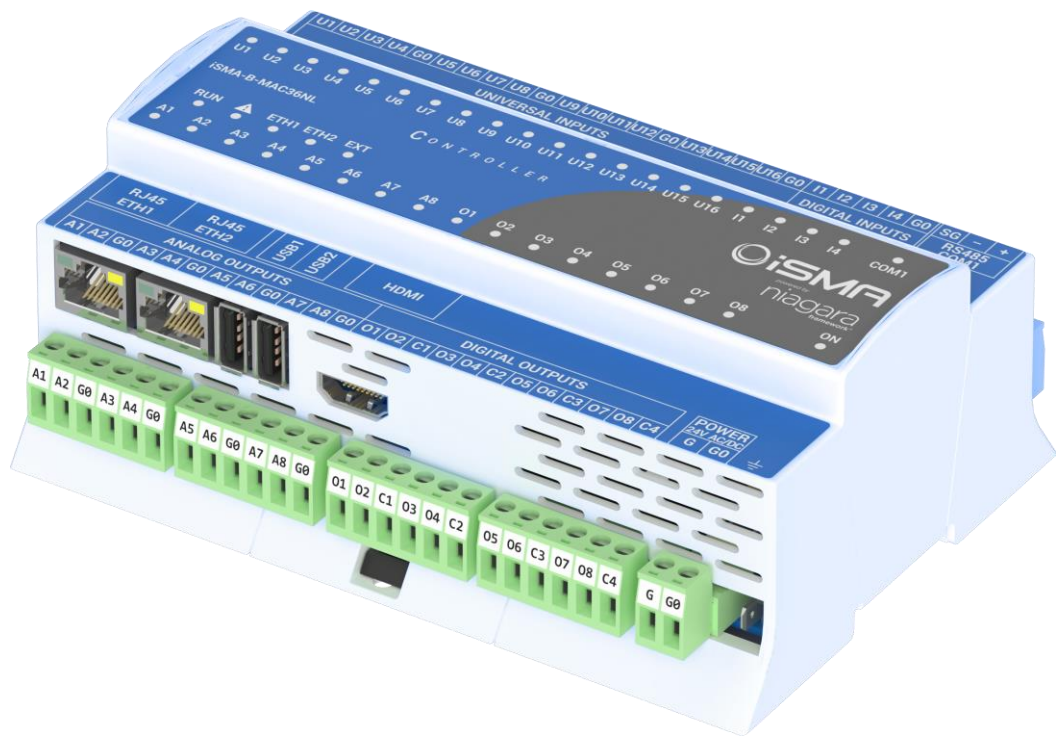


iSMA-B-MAC36NL

User Manual

Local IO



powered by
niagara⁴
framework

Global Control 5 Sp. z o.o.
Warsaw, Poland
www.gc5.pl

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1 Introduction

1.1 Revision history

Rev	Date	Description
1.0	01.10.2018	First edition

Table 1 - Revision history

1.2 Overview

The iSMA-B-MAC36NL is a compact Master Application Controller with built-in different types of I/O and operating in Niagara Framework environment.

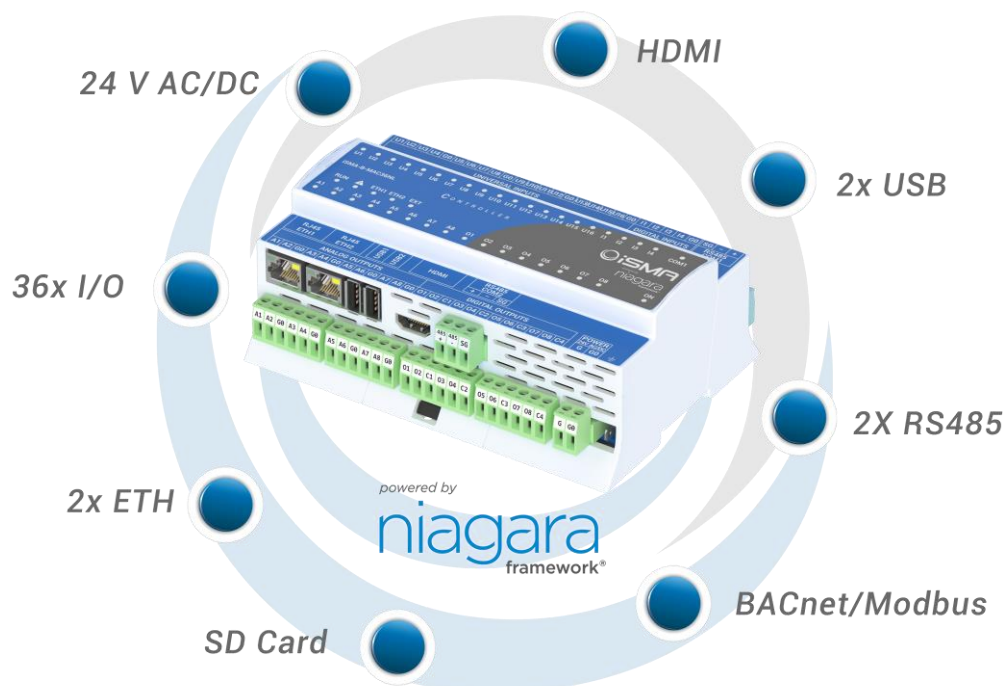


Figure 1 – iSMA-B-MAC36NL Key Features

2 Local IO Hardware Specification

The iSMA-B-MAC36NL has built-in different types of I/O. The specific local I/O set 16x UI, 8x AO, 4xDI and 8x DO allows using the device in different applications.

2.1 Terminals and Internal Connection Diagram

The iSMA-B-MAC36NL controller can be supplied by 24 V AC/DC. The power supply block is separated. The grounding pin located next to power supply terminals must be connected to the ground.

The device has 36x local I/O on board:

- 8x Digital Outputs (8DO), relay output with max. load 3 A @ 230 V AC/30 V DC.
- 8x Analog Outputs (8AO), voltage output 0-10 V DC maximum load up to 20 mA.
- 16x Universal Inputs (16UI), temperature, voltage, current, resistive or dry contact.
- 4x Digital Inputs (4DI), dry contact inputs or fast counter up to 100 Hz.

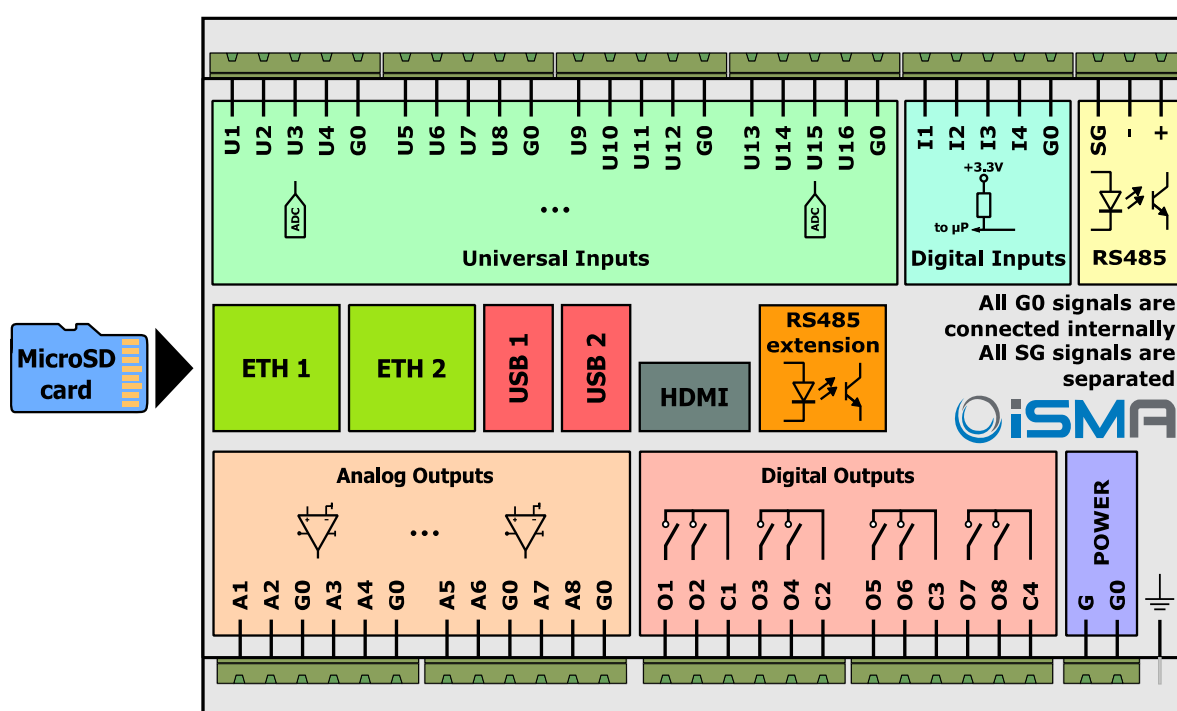


Figure 2 iSMA-B-MAC36NL Block Diagram

2.2 LED Indicators

The device is equipped with LEDs for quick status checking and diagnostics:

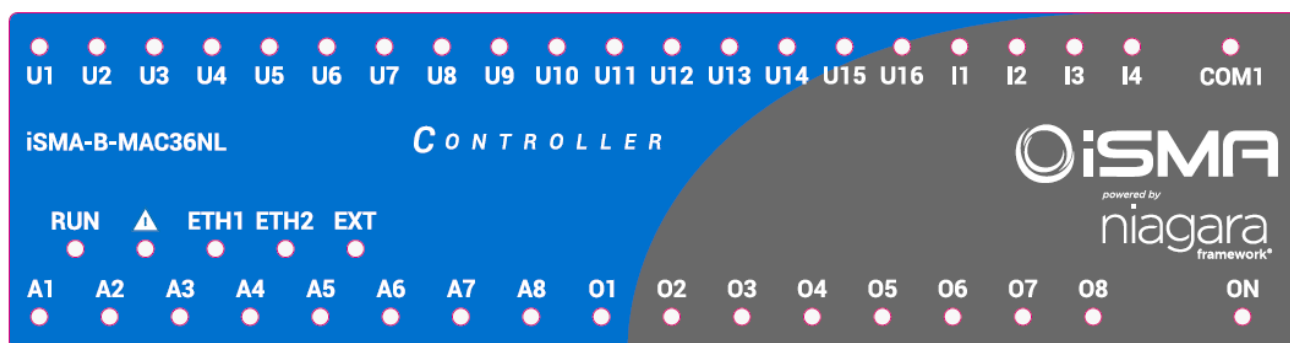


Figure 3 LEDs on the front panel of iSMA-B-MAC36NL.

- The Universal Inputs LEDs **U1-U16** indicate the statuses of the Universal Inputs. When the LED is ON, the resistance value connected to the input is lower than the switching threshold value (Dry Contact input is active).

Note: The LED also lights up when voltage connected to the input has very low potential.

- The Digital Inputs LEDs **I1-I4** indicate the statuses of the Digital Inputs. When the LED is ON, the Input is active (resistance value connected to the input is lower than the switching threshold value).
- The Analog Outputs LEDs **A1-A8** indicate the statuses of the Analog Outputs. When the LED is ON the Output voltage or PWM factor is different than 0.
- The Digital Outputs LEDs **O1-O8** indicate the statuses of the Digital Outputs. When the LED is ON the Outputs is active (closed circuit).

2.3 Universal Inputs (16x UI)

All the Universal Inputs have 16-bit ADC, which support the following types of the input signals:

- Voltage Input (0 – 10 V DC)
- Current Input (0 – 20 mA)
- Resistive Input (0-1000 k Ω)
- Temperature Input
- Dry Contact Input (Digital Input)

2.3.1 Voltage Input connection (0 – 10 V DC)

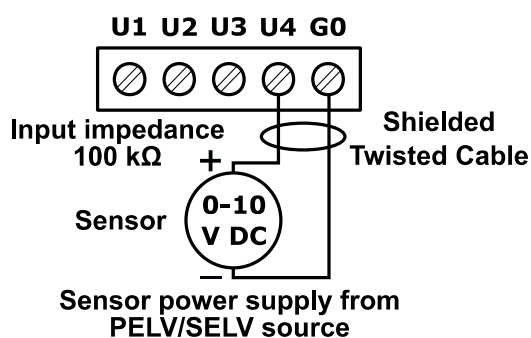


Figure 4 Connection of UI to measure voltage 0-10 V DC.

2.3.2 Current Input connection (0 – 20 mA)

Current measurement is realized by voltage measurement and 200 Ω resistance.

According to the Ohm's law the current is directly proportional to the voltage and the resistance is the constant of proportionality.

$$I = \frac{U}{R}$$

According to the Ohm's law equation for 20 mA current with 200 Ω resistance the output voltage is 4 V.

It means that the 4 V voltage measured on the Universal Input corresponds to 20 mA current.

The result is expressed in millivolts.

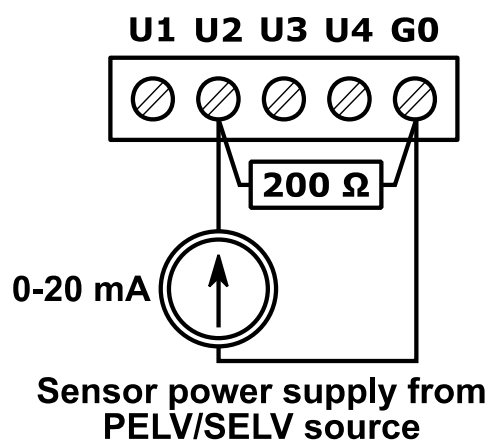


Figure 5 Connection of UI to measure current 0-20 mA.

2.3.3 Temperature Input connection

Temperature measurement based on resistance.

The Universal Inputs working as Temperature Inputs support the following types of sensors: series NTC 10K3A1, 10K4A1, Carel 10K, 20K6A1, 2.2K3A1, 3K3A1, 30K6A1, SIE1, TAC1, SAT1 and Pt1000, Ni1000.

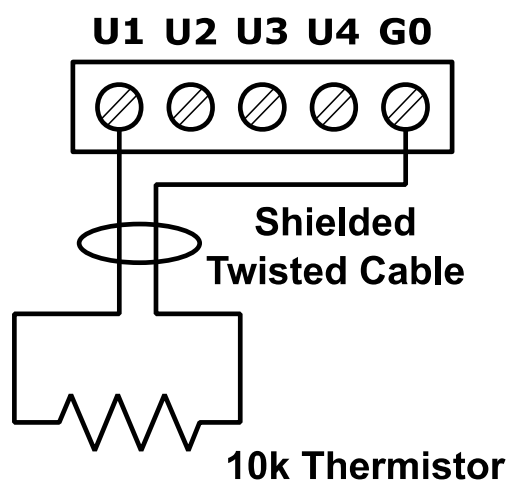


Figure 6 Connection of UI to measure temperature

2.3.4 Dry Contact Input connection (Digital Input)

The Universal Inputs can operate as standard Digital Inputs (Dry Contact Inputs).

The Input is active when it is connected to the ground (G0).

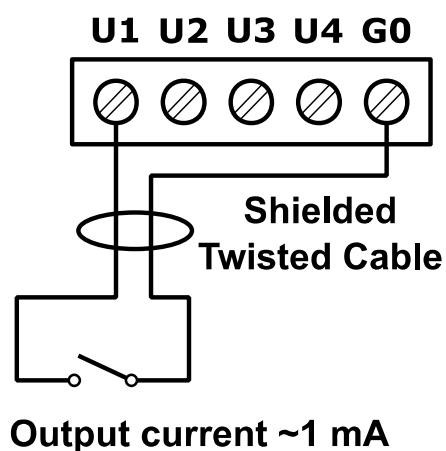


Figure 7 Connection of UI as Dry Contact Input (Digital Input)

2.4 Digital Inputs (4x DI)

In addition to the standard Dry Contact Input the Universal Inputs can operate as fast pulse counters with up to 100 Hz impulse frequency counting.

The Input is active when it is connected to the ground (G0).

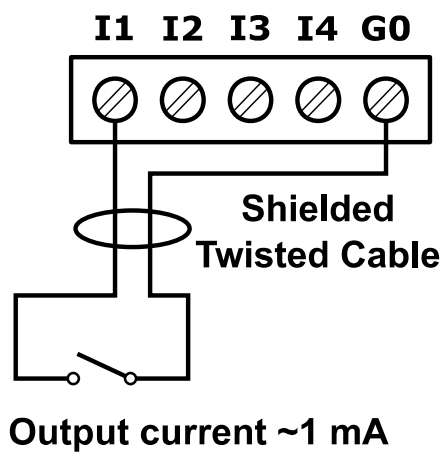


Figure 8 Connection to the Digital Input.

2.5 Analog Outputs (8x AO)

All the Analog Outputs have 12-bit ADC, provide 10 mV resolution and accuracy less than $\pm 0,5\%$. They support the following types of the output signals:

- Voltage Output (0 – 10 V DC) with max. load up to 20 mA
- PWM: 0,01 Hz, 0,1 Hz, 1 Hz, 10 Hz, 100 Hz

2.5.1 Voltage Output connection (0 – 10 V DC)

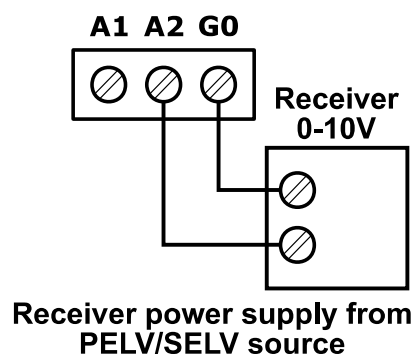


Figure 9 Connection of the 0 – 10 V DC signal from the Analog Output.

2.5.2 Relay to Analog Output connection

There is an option to control the 12 V DC relay from the Analog Outputs (max. load cannot exceed 20 mA!).

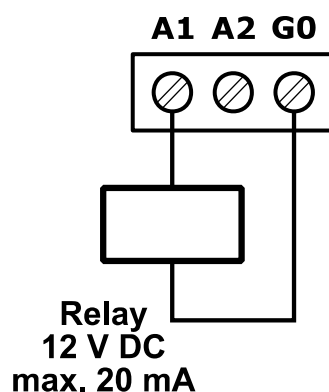


Figure 10 Relay connection to the Analog Output.

2.6 Digital Outputs (8x DO)

Relay Outputs (NO) have max. resistive load up to 3 A @ 230 V AC and 3 A @ 30 V DC.

2.6.1 Resistive Load connection

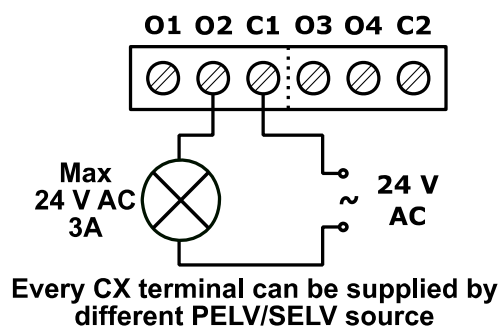


Figure 11 Connection of the resistive load to the Digital Output.

2.6.2 Solenoid Valve connection

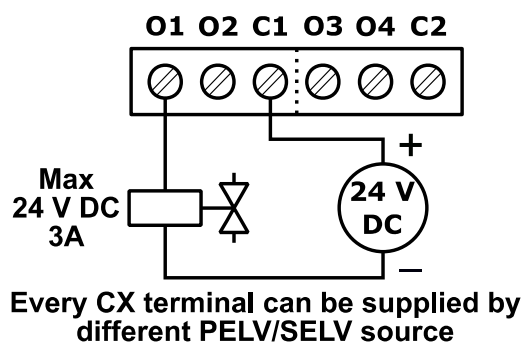


Figure 12 Connection of the solenoid valve to the Digital Output.

3 Local IO Driver

The Local IO Driver is dedicated to service, program and maintain local IOs.

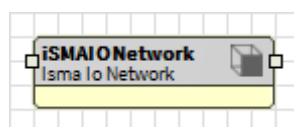
The driver and Local IO points added under Local IO Network do not need a license – they are **free of charge** and **do not consume points from the license**.

The driver contains the following components:

- iSMA IO Network
- Local IO Device
- Universal Input
- Digital Input
- Digital Input Counter
- Analog Output Voltage
- Digital Output

3.1 iSMA IO Network

The iSMA IO Network component is a network component for the Local IO Device such as the iSMA-B-MAC36NL devices (added using Local IO Device component). The iSMA IO Network component is the only right parent component for Local IO Device components. All the iSMA-B-MAC36NL devices with the points inside iSMA IO Network do not consume any of the license points.



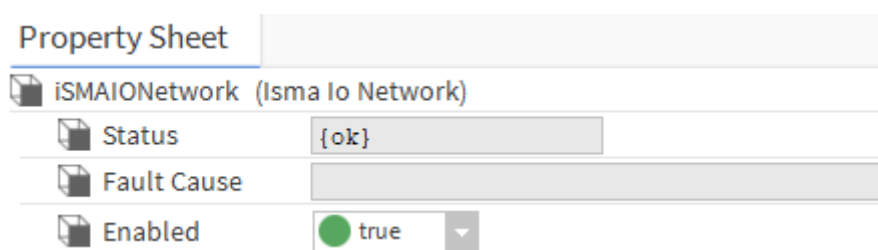
The iSMA IO Network component consists the following slots:

1. Status – status of IO Network, available states:
 - OK – network is working properly
 - Disabled – network is disabled (Slot “Enable” is in “false”)
 - Fault – some fault has occurred

2. Fault Cause – fault cause description:

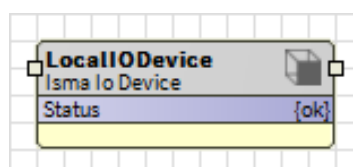
- None – there is no fault
- Bad Parent – iSMA IO Network component has been placed in the wrong place (Drives only)
- Duplicate Component – iSMA IO Network component has been placed twice
- Invalid Hardware – iSMA IO Driver has been used on a device other than iSMA-B-MAC36NL device

3. Enable – enable/disable iSMA IO Network component



3.2 Local IO Device

The Local IO Device is the component which represents local IO of the iSMA-B-MAC36NL device.



The component must be placed under iSMA IO Network component.

All the local IO points, which belong to the particular iSMA-B-MAC36NL device must be placed under Local IO Device.

Local IO component has the following slots:

1. Status – device status, available states:

- OK – device is working properly

- Disabled – device or his parent (network) is disabled (Slot “Enable” is in “false”)
- Fault – some fault has occurred

2. Fault Cause – fault cause description

- None – there is no fault
- Bad Parent – Local IO Device component has been placed in the wrong place (iSMA IO Network only)
- Duplicate Component – Local IO Device component has been placed twice with the same device address

3. Enabled – this option switches on or switches off the device („true“- device enabled, „false“- device disabled)

4. Fast Rate – time between messages in „Fast” mode poll frequency used for points

5. Normal Rate – time between messages in „Normal” mode poll frequency used for points

6. Slow Rate – time between messages in „Slow” mode poll frequency used for points

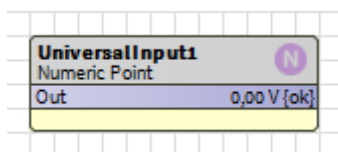
Slots hidden by default:

1. Write On Start – do the write action in a device „Writable” components in IO Network after reset or power up
2. Write On Up - do the write action in a device „Writable” components in IO Network after restoring the connection with the device
3. Write On Enable - do the write action in a device „Writable” components in IO Network after enabling the device

Property Sheet	
LocalIODevice (Isma Io Device)	
Status	{ok}
Fault Cause	
Enabled	<input checked="" type="checkbox"/> true
Fast Rate	00000h 00m 01.000s [1ms-+inf]
Normal Rate	00000h 00m 05.000s [1ms-+inf]
Slow Rate	00000h 00m 30.000s [1ms-+inf]

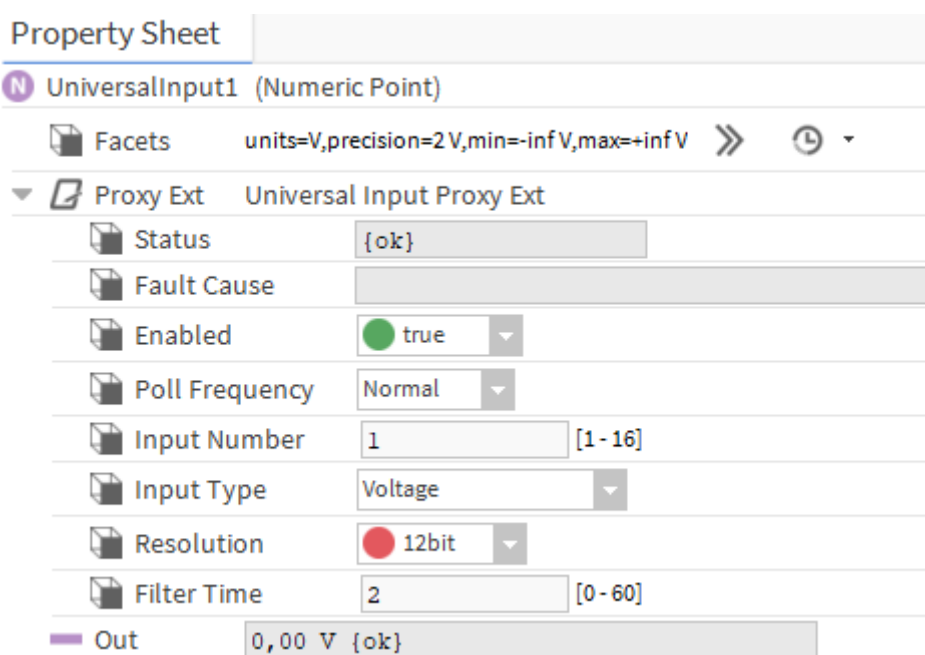
3.3 Universal Input

Universal Input component is designed for servicing physical local Universal Inputs.



The component must be placed under Local IO Device component.

The component can be configured to work in all modes of the Universal Input (resistance, temperature, voltage, current and digital).



The Universal Input component has the following slots:

- A. **Facets** - determines how the point's value displays in the station include engineering units and decimal precision. Units are automatically set depending on input type slot value (voltage measurement – V, current measurement – mA, resistance measurement – Ohm, temperature - °C, digital – without units)
- B. **Proxy Ext** – which consists of the following slots:
 1. Status – input status, available states:
 - OK – input is working properly
 - Disabled – input, its parent (device) or network component is disabled (Slot “Enable” is in “false”)

- Fault – some fault has occurred
2. Fault Cause – fault cause description:
 - None – there is no fault
 - Bad Parent – input component has been placed in the wrong place (Local IO Device only)
 - Duplicate Component – duplicate address of the component
 - Invalid Number– Input Number slot value is out of range
 - IO Fault – problem with handling IOs
 3. Enable – this option switches on or switches off the input („true“- input enabled, „false“- input disabled)
 4. Poll Frequency – reading poll frequency, available options: Fast, Normal, Slow
 5. Input Number – number of physical Input (1-16), must be unique inside Local IO Device
 6. Input type – choosing mode in which the Universal Input works. Slot can have the following values:



- Voltage – Universal Input works as a Voltage Input 0 – 10 VDC. The resistance measurement is disabled.
- Current - Universal Input works as a Current Input 0 – 20 mA. The resistance

measurement is disabled.

- Digital – Universal Input works in Digital Mode (Dry Contact Input - Output current ~1 mA). The voltage measurement is disabled.
- Resistance – Universal Input works in Resistance Measurement Mode (0 – 1000 kΩ). The voltage measurement is disabled.
- Reading of the Temperature sensors supported (The voltage measurement is disabled):
 - Temperature sensor NTC 10K3A1
 - Temperature sensor NTC 10K4A1
 - Temperature sensor NTC 10K Carel
 - Temperature sensor NTC 20K6A1
 - Temperature sensor NTC 2,2K3A1
 - Temperature sensor NTC 3K3A1
 - Temperature sensor NTC 30K6A1
 - Temperature sensor SIE1
 - Temperature sensor TAC1
 - Temperature sensor SAT1
 - Temperature sensor PT1000 (16-bit input resolution set by default)
 - Temperature sensor NI1000 (16-bit input resolution set by default)

7. Resolution – measurement resolution of a Universal Input

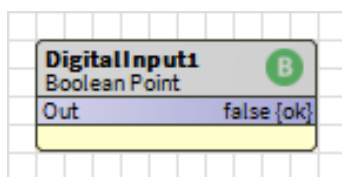
- 12-bit
- 16-bit – set by default in case of PT1000 and NI1000 sensor type

8. Filter Time – value from 0 to 60 s. The time constant of the low pass filter (to eliminate signal noise)

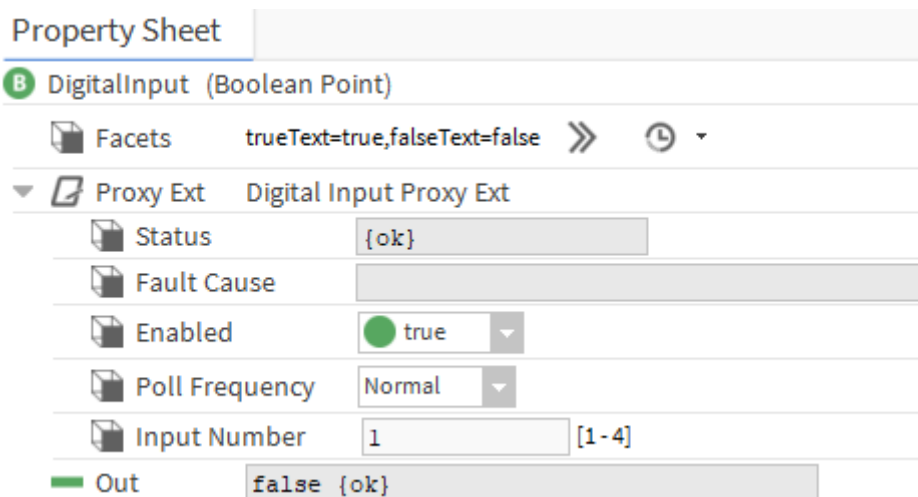
C. **Out** - provides real-time information about the current value of the input together with facets and the current status of the data item, meaning the health and validity of the value. Status is specified by a combination of status flags, such as fault, overridden, alarm, and so on. If no status flag is set, status is considered normal and appears with the default status of {ok}.

3.4 Digital Input

Digital Input component is designed for servicing physical local Digital Inputs.



The component must be placed under Local IO Device component.



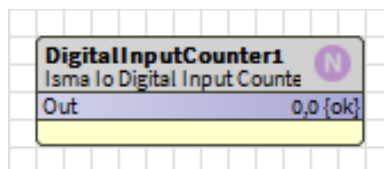
The Digital Input component has the following slots:

- A. **Facets** - determines how the point's value displays in the station, descriptive value (state)
- B. **Proxy Ext** – which consists of the following slots:
 1. Status – input status, available states:
 - OK – input is working properly
 - Disabled – input, its parent (device) or network component is disabled (Slot “Enable” is in “false”)
 - Fault – some fault has occurred
 2. Fault Cause – fault cause description:
 - None – there is no fault
 - Bad Parent – input component has been placed in the wrong place (Local IO Device only)
 - Duplicate Component – duplicate address of the component

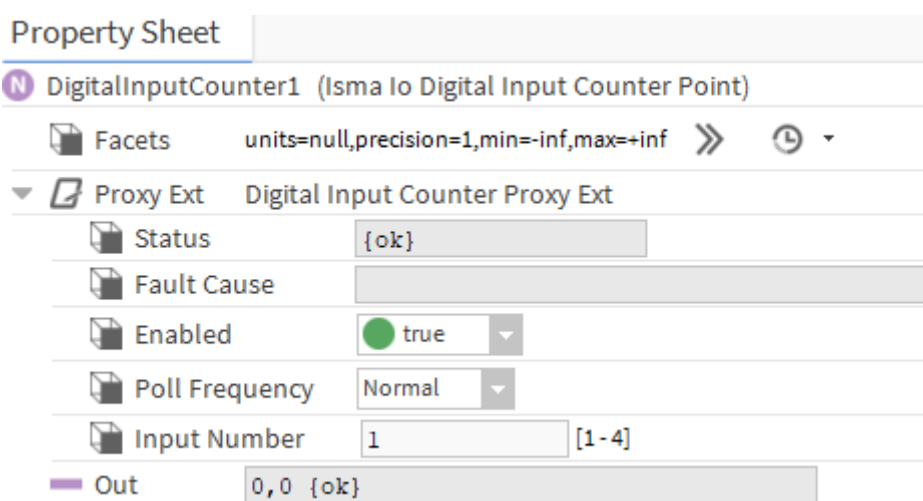
- Invalid Number – Input Number slot value is out of range
 - IO Fault – problem with handling IOs
 - 3. Enable – this option switches on or switches off the input („true“- input enabled, „false“- input disabled)
 - 4. Poll Frequency – reading poll frequency, available options: Fast, Normal, Slow
 - 5. Input Number – number of physical Input (1-4), must be unique inside Local IO Device
- C. **Out** - provides real-time information about the current value of the input together with facets and the current status of the data item, meaning the health and validity of the value. Status is specified by a combination of status flags, such as fault, overridden, alarm, and so on. If no status flag is set, status is considered normal and appears with the default status of {ok}.

3.5 Digital Input Counter

Digital Input Counter component is designed for reading high-speed counter of Digital Inputs.



The component must be placed under Local IO Device component.



The Digital Input Counter component has the following slots:

- A. **Facets** - determines how the point's value displays in the station include engineering units and decimal precision.
- B. **Proxy Ext** – which consists of the following slots:
 1. Status – input status, available states:
 - OK – input is working properly
 - Disabled – input, its parent (device) or network component is disabled (Slot “Enable” is in “false”)
 - Fault – some fault has occurred
 2. Fault Cause – fault cause description:
 - None – there is no fault
 - Bad Parent – input component has been placed in the wrong place (Local IO Device only)

- Duplicate Component – duplicate address of the component
 - Invalid Number – Input Number slot value is out of range
 - IO Fault – problem of handling IOs
3. Enable – this option switches on or switches off the input („true“- input enabled, „false“- input disabled)
 4. Poll Frequency – reading poll frequency, available options: Fast, Normal, Slow
 5. Input Number – number of physical Input (1-4), must be unique inside Local IO Device
- C. **Out** - provides real-time information about the current value of the input together with facets and the current status of the data item, meaning the health and validity of the value. Status is specified by a combination of status flags, such as fault, overridden, alarm, and so on. If no status flag is set, status is considered normal and appears with the default status of {ok}.

The Digital Input Counter component has the following actions:

- A. **Set** - allows to set the value of counter. Set value overrides Out and In slots.
- B. **Reset** - allows to set value to 0. Set value overrides Out and In slots.

3.6 Analog Output

Analog Output component is designed for servicing physical local Analog Outputs working as voltage output (range 0 mV – 10000 m) or PWM.

AnalogOutput1	
Numeric Writable	
Out	5,00 V {ok} @ def
In10	- {null}
In16	- {null}

The component must be placed under Local IO Device component.

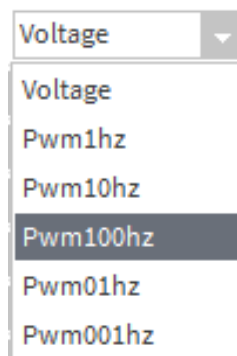
The default value of the component is null.

Property Sheet	
N AnalogOutput1 (Numeric Writable)	
Facets	units=V,precision=2 V,min=-inf V,max=+inf V
Proxy Ext	Analog Output Proxy Ext
Status	{ok}
Fault Cause	
Enabled	<input checked="" type="radio"/> true
Poll Frequency	Normal
Output Number	1 [1 - 8]
Analog Type	Voltage
Out	- {null} @ def
In1	- {null}
In2	- {null}
In3	- {null}
In4	- {null}
In5	- {null}
In6	- {null}
In7	- {null}
In8	- {null}
In9	- {null}
In10	- {null}
In11	- {null}
In12	- {null}
In13	- {null}
In14	- {null}
In15	- {null}
In16	- {null}
Fallback	- {null}
Override Expiration	null

The Analog Output component has the following slots:

- A. **Facets** - determines how the point's value displays in the station include engineering units and decimal precision.
- B. **Proxy Ext** – which consists of the following slots:
 1. Status – output status, available states:
 - OK – output is working properly

- Disabled – output, its parent (device) or network component is disabled (Slot “Enable” is in “false”)
 - Fault – some fault has occurred
2. Fault Cause – fault cause description:
- None – there is no fault
 - Bad Parent – output component has been placed in the wrong place (Local IO Device only)
 - Duplicate Component – duplicate address of the component
 - Invalid Number – Output Number slot value is out of range
 - IO Fault – problem with handling IOs
3. Enable – this option switches on or switches off the output („true“- output enabled, „false“- output disabled)
4. Poll Frequency – reading poll frequency, available options: Fast, Normal, Slow
5. Output Number – number of physical Analog Output (1-8), must be unique inside Local IO Device
6. Analog Type – allows choosing the mode in which the Analog Output works. Slot can have the following values:
- 0-10V – Analog Output works in Analog mode with a signal from 0 to 10 VDC
 - PWM1Hz – Analog Output works in PWM mode with 1 Hz frequency
 - PWM10Hz– Analog Output works in PWM mode with 10 Hz frequency
 - PWM100Hz– Analog Output works in PWM mode with 100 Hz frequency
 - PWM0.1Hz– Analog Output works in PWM mode with 0,1 Hz frequency
 - PWM0.01Hz– Analog Output works in PWM mode with 0,01 Hz frequency



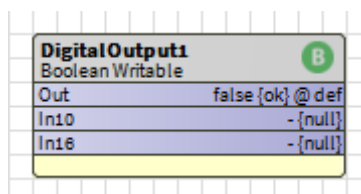
- C. **Out** - provides real-time information about the current value of the input together with facets and the current status of the data item, meaning the health and validity of the value. Status is specified by a combination of status flags, such as fault, overridden, alarm, and so on. If no status flag is set, status is considered normal and appears with the default status of {ok}.
- D. **In1 – In16** – priority inputs, In1 is the highest priority, and In16 is the lowest.
- E. **Fallback** - Whenever a writable point has a null or invalid value at inputs In1–In16 the Out slot is set to the value of this property. By default, an operator-level user can change the Fallback property, using the Set action.
- F. **Override Expiration** - expiration of the override period (executed by the action – “Override”).

The Analog Output component has the following actions:

- A. **Emergency Override** - overrides the point with the highest priority (In1), does not have durations—these overrides are “permanent”.
- B. **Emergency Auto** - sets the point previously overridden with emergency priority back to Auto
- C. **Override** - overrides the point (In8 priority). It prompts for an override duration.
- D. **Auto** - sets the point to Auto
- E. **Set** - changes the Fallback slot value

3.7 Digital Output

Digital Output component is designed for servicing physical local Digital Outputs.



The component must be placed under Local IO Device component.

The default value of the component is null.

Property Sheet

B DigitalOutput (Boolean Writable)

Facets trueText=true,falseText=false >> ⌚

Proxy Ext Digital Output Proxy Ext

Status {ok}

Fault Cause

Enabled true

Poll Frequency Normal

Output Number 1 [1-8]

Out	false {ok} @ 16
In1	- {null}
In2	- {null} ⌵
In3	- {null} ⌵
In4	- {null} ⌵
In5	- {null} ⌵
In6	- {null}
In7	- {null} ⌵
In8	- {null}
In9	- {null} ⌵
In10	- {null} ⌵
In11	- {null} ⌵
In12	- {null} ⌵
In13	- {null} ⌵
In14	- {null} ⌵
In15	- {null} ⌵
In16	false {ok} ⌵
Fallback	false {ok} ⌵
Override Expiration	null
Min Active Time	+00000h 00m 00s ⌵
Min Inactive Time	+00000h 00m 00s ⌵
Set Min Inactive Time On Start	<input type="radio"/> false

The Digital Output component has the following slots:

- A. **Facets** - determines how the point's value displays in the station, descriptive value (state)
- B. **Proxy Ext** – which consists of the following slots:
 1. Status – output status, available states:
 - OK – output is working properly
 - Disabled – output, its parent (device) or network component is disabled (Slot “Enable” is in “false”)
 - Fault – some fault has occurred
 2. Fault Cause – fault cause description:
 - None – there is no fault
 - Bad Parent – output component has been placed in the wrong place (Local IO Device only)
 - Duplicate Component – duplicate address of the component
 - Invalid Number – Output Number slot value is out of range
 - IO Fault – problem with handling IOs
 3. Enable – this option switches on or switches off the output („true”- output enabled, „false”- output disabled)
 4. Poll Frequency – reading poll frequency, available options: Fast, Normal, Slow
 5. Output Number – number of physical Digital Output (1-8), must be unique inside Local IO Device
- C. Out - provides real-time information about the current value of the input together with facets and the current status of the data item, meaning the health and validity of the value. Status is specified by a combination of status flags, such as fault, overridden, alarm, and so on. If no status flag is set, status is considered normal and appears with the default status of {ok}.
- D. In1 – In16 – priority inputs, In1 is the highest priority, and In16 is the lowest.
- E. Fallback - Whenever a writable point has a null or invalid value at inputs In1–In16 the Out slot is set to the value of this property. By default, an operator-level user can change the

Fallback property, using the Set action.

- F. Override Expiration - expiration of the override period (executed by the action – “Override”).
- G. Min Active Time - timer to specify minimum on time. Typical usage is to prevent short-cycling of equipment controlled by the point.
- H. Min Inactive Time - timer to specify minimum off time. Typical usage is to prevent short-cycling of equipment controlled by the point.
- I. Set Min Inactive Time on Start – true/false

The Digital Output component has the following actions:

- A. **Emergency Active** - overrides the point with the highest priority (In1) with the Active State (true), does not have durations—these overrides are “permanent”.
- B. **Emergency Inactive** - overrides the point with the highest priority (In1) with the Inactive State (false), does not have durations—these overrides are “permanent”.
- C. **Emergency Auto** - sets the point previously overridden with emergency priority back to Auto
- D. **Active** - overrides the point (In8 priority) with the Active State (true). It prompts for an override duration.
- E. **Inactive** - overrides the point (In8 priority) with the Inactive State (false). It prompts for an override duration.
- F. **Auto** - sets the point to Auto
- G. **Set** - changes the Fallback slot value