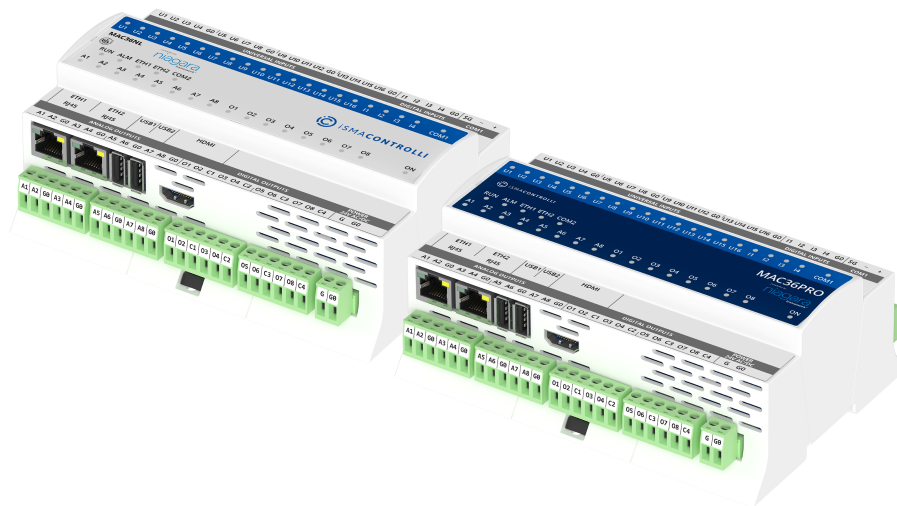


# iSMA-B-MAC36NL

# iSMA-B-MAC36PRO

User Manual

## Local I/O



powered by  
**niagara**<sup>4</sup>  
framework



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# 1 Introduction

MAC36 are compact Master Application Controllers powered by the Niagara Framework, with various types of 36 onboard inputs and outputs. Using the specific local I/O set of 16 UI, 8 AO, 4 DI, and 8 DO allows to employ the devices in different applications. MAC36 controllers provide control, data logging, alarming, scheduling, integration, and visualization.

The range of MAC36 controllers consists of:

- iSMA-B-MAC36NL;
- iSMA-B-MAC36PRO.

## 1.1 Revision History

Rev.	Date	Description
1.6	23 Feb 2024	BTL certification for MAC36NL controllers
1.5	10 Nov 2023	MAC36PRO references
1.4	25 May 2022	<ul style="list-style-type: none"> <li>• Rebranded</li> <li>• DigitalUniversalInput component description added</li> <li>• Polarity conversion functionality added to DigitalInput and DigitalOutput components</li> </ul>
1.3	16 Dec 2020	Document corrections
1.2	31 Mar 2020	Rotary and DIP switches support added
1.1	31 Oct 2019	<ul style="list-style-type: none"> <li>• New temperature sensors supported</li> <li>• New features: universal input resistance offset, linear conversion, custom table, analog output linear conversion</li> </ul>
1.0	1 Oct 2018	First edition

Table 1. Revision history

## 2 LocalIO Hardware Specification

MAC36 controllers have various types of 36 onboard inputs and outputs. Using the specific local I/O set of 16 UI, 8 AO, 4 DI, and 8 DO allows to employ the devices in different applications.

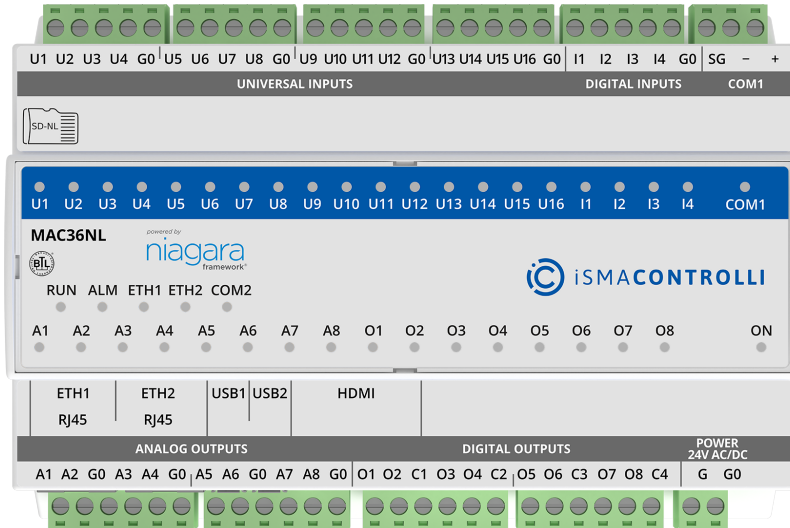


Figure 1. MAC36NL controller

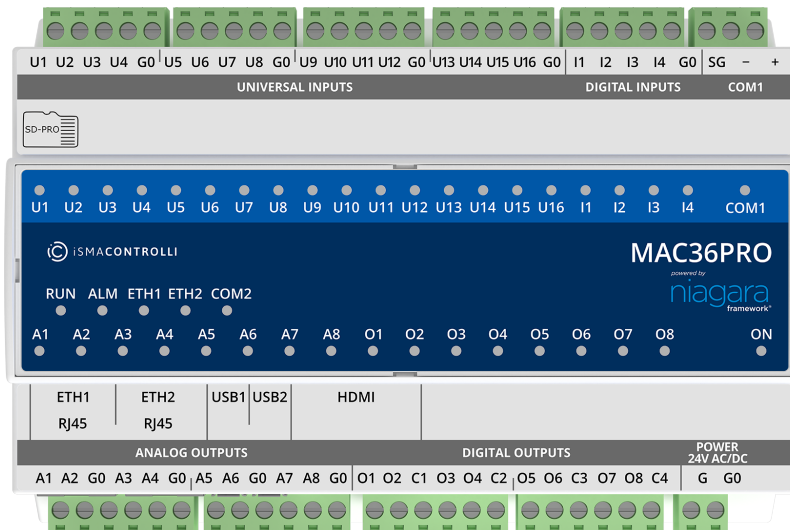


Figure 2. MAC36PRO controller

### 3 Terminals and Internal Connection Diagram

MAC36 controllers are 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 36 local I/O on board:

- 8 digital outputs (8 DO), relay output with max. load 3 A at 230 V AC/30 V DC;
- 8 analog outputs (8 AO), voltage output 0-10 V DC maximum load up to 20 mA;
- 16 universal inputs (16 UI), temperature, voltage, current, resistive, or dry contact;
- 4 digital inputs (4 DI), dry contact inputs or fast counter up to 100 Hz.

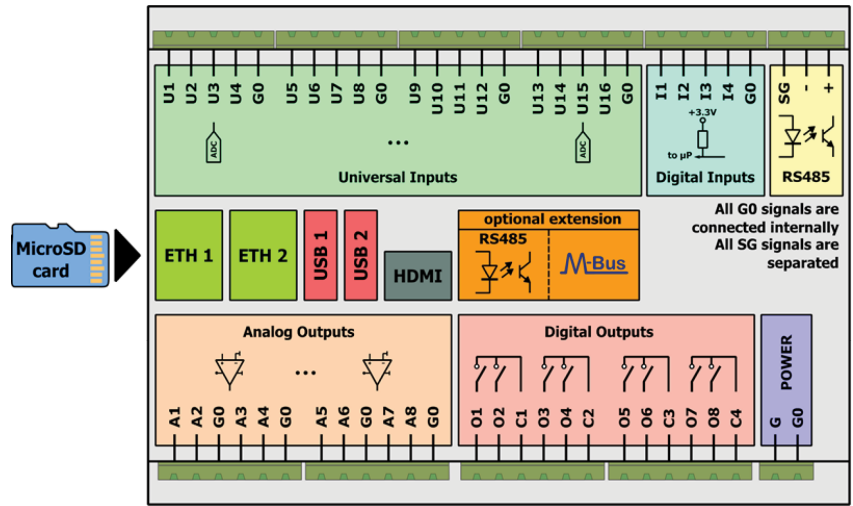


Figure 3. Block diagram

## 4 LED Indicators

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

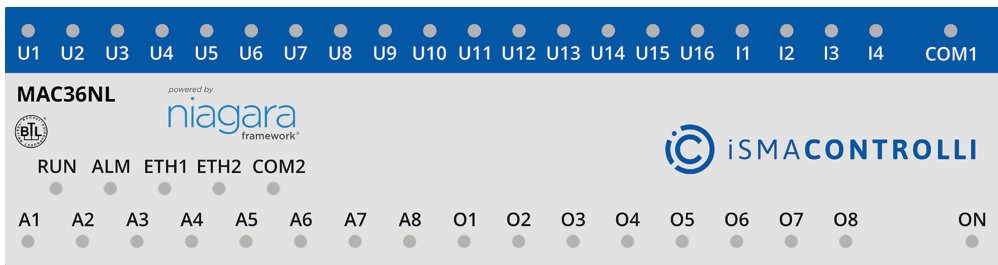


Figure 4. LEDs of a front panel of the iSMA-B-MAC36NL-RS

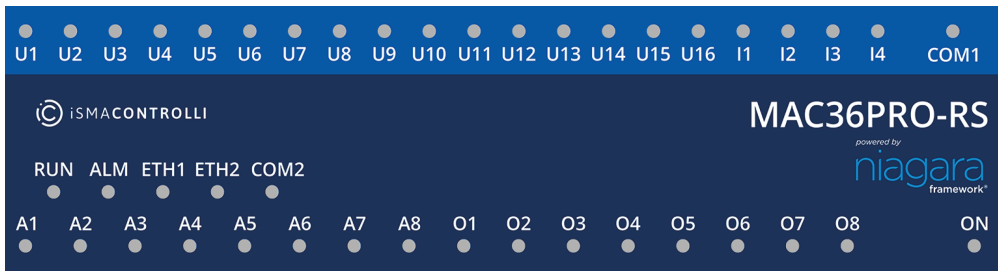


Figure 5. LEDs of a front panel of the iSMA-B-MAC36PRO-RS

- The universal inputs LEDs **U1-U16** indicate the statuses of the universal inputs. If 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 if the voltage connected to the input has a very low potential.

- The digital inputs LEDs **I1-I4** indicate the statuses of the digital inputs. If 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. If 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. If the LED is ON, the output is active (closed circuit).

## 5 Universal Inputs

All universal inputs have 16-bit ADC, which supports the following types of input signals:

- voltage input (0-10 V DC);
- current input (0-20 mA);
- resistive input (0-1000 kΩ);
- temperature input;
- dry contact input (digital input).

### 5.1 Voltage Input Connection (0-10 V DC)

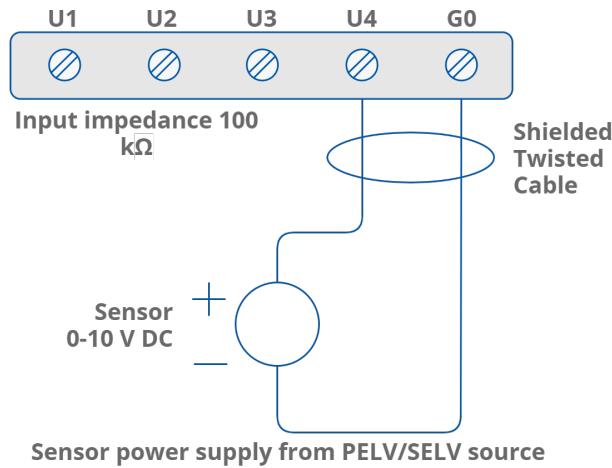


Figure 6. Universal input voltage connection

### 5.2 Current Input Connection (0-20 mA)

The current measurement is realized by a voltage measurement and a 200 Ω resistance.

According to Ohm's law, the current is directly proportional to the voltage, and the resistance is the constant of proportionality ( $I = U / R$ ).

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.

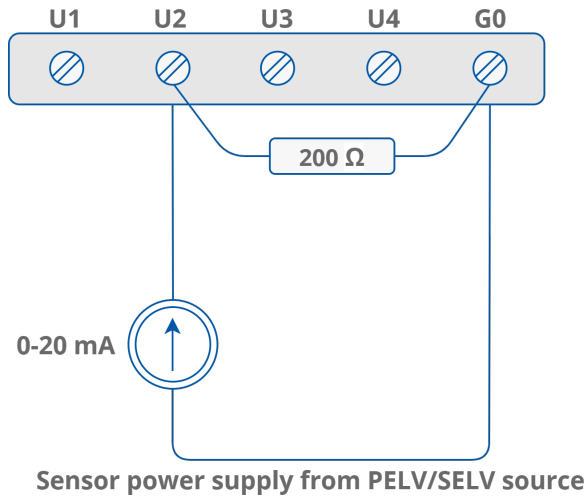


Figure 7. Universal input voltage connection

### 5.3 Temperature Input Connection

The temperature measurement is based on a 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.

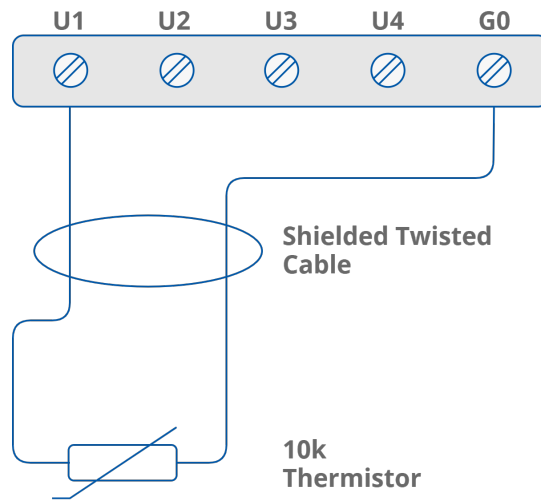


Figure 8. Universal input voltage connection

### 5.4 Dry Contact Input Connection (Digital Input)

The universal inputs can operate as standard digital inputs (dry contact inputs).

The input is active if it is connected to the ground (G0).



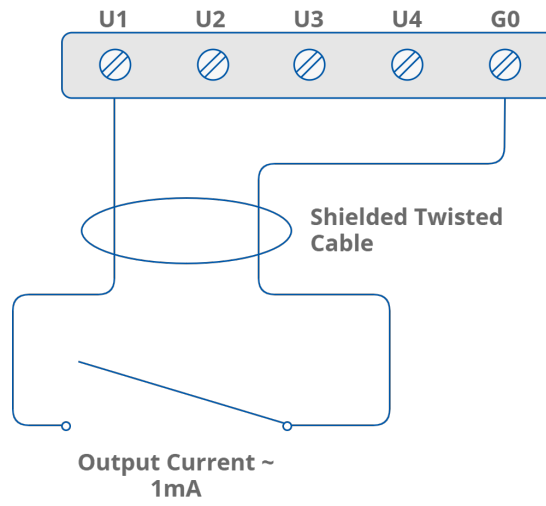


Figure 9. Universal input voltage connection

## 6 Digital Inputs

In addition to a standard dry contact input, digital inputs can operate as fast pulse counters with up to 100 Hz pulse frequency counting.

The input is active if it is connected to the ground (G0).

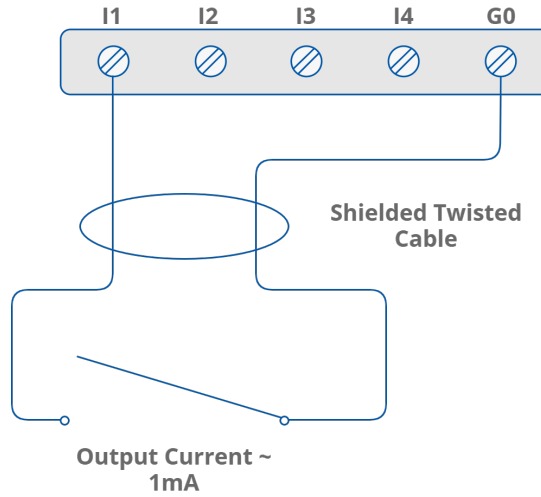


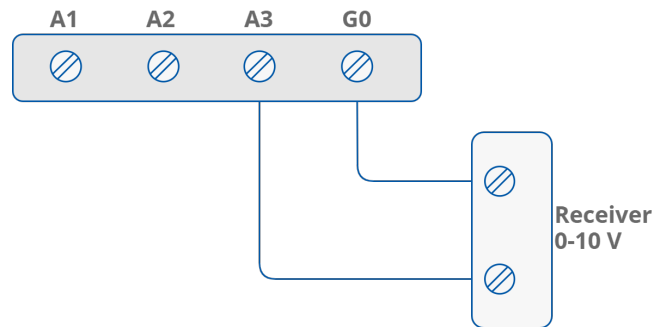
Figure 10. Digital input in dry contact mode

## 7 Analog Outputs

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

### 7.1 Voltage Output Connection (0-10 V DC)



Receiver power supply from PELV/SELV source

Figure 11. Analog output voltage connection

### 7.2 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!).

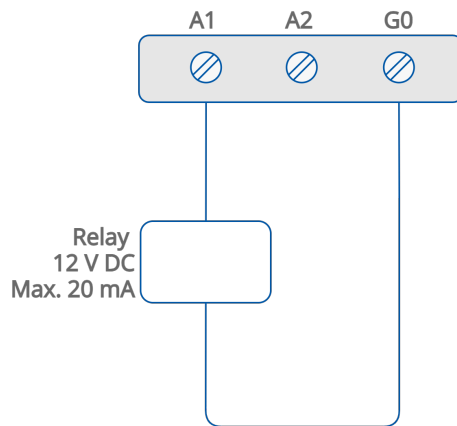


Figure 12. The analog output relay connection

## 8 Digital Outputs

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

### 8.1 Resistive Load Connection

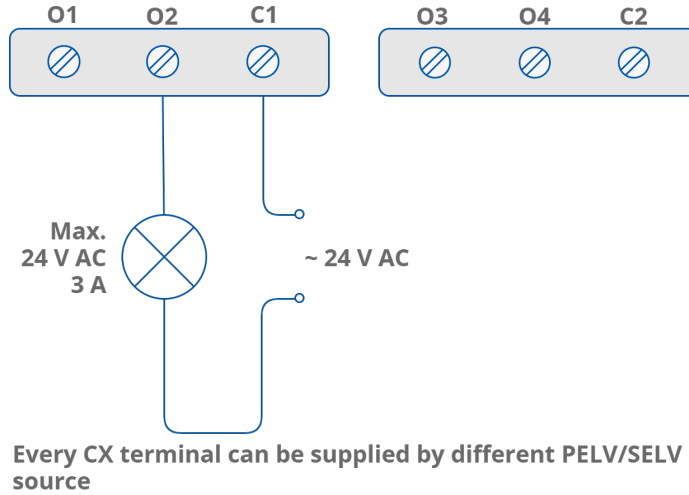


Figure 13. The digital output connection of a resistive load

### 8.2 Solenoid Valve Connection

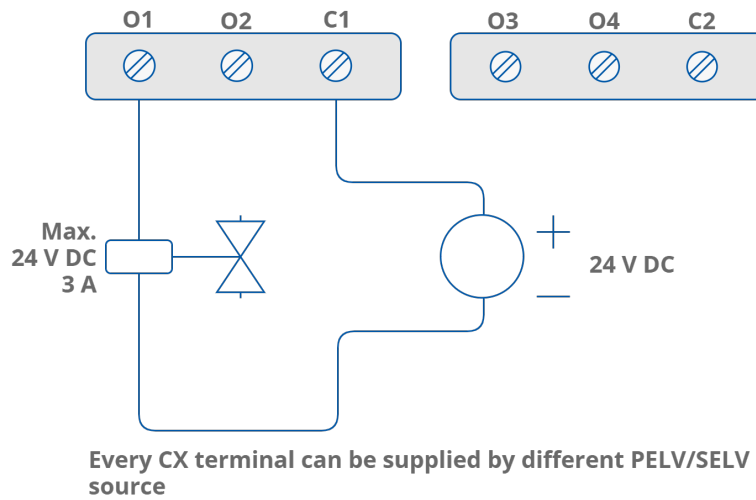


Figure 14. The digital output connection of a solenoid valve

## 9 LocalIO Driver

The LocalIO driver is dedicated to service, program, and maintain local I/Os.

The driver and local I/O points added under the iSMAIONetwork do not need a license—they are **free of charge** and **do not consume any points from the license**.

The driver contains the following components:

- iSMAIONetwork
- LocalIODevice
- UniversalInput
- DigitalUniversalInput
- DigitalInput
- DigitalInputCounter
- AnalogOutput
- DigitalOutput
- RotarySwitch
- DIPSwitch

### 9.1 iSMAIONetwork

The iSMAIONetwork component is a network component for the local I/O device such as MAC36 controllers (added using the LocalIODevice component). The iSMAIONetwork component is the only right parent component for LocalIODevice components. MAC36 devices with points inside the iSMAIONetwork do not consume any of the license points.

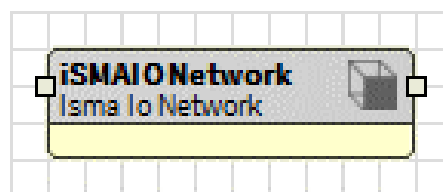


Figure 15. The iSMAIONetwork component

The iSMAIONetwork component has the following slots:

- Status: defines a current status of the component;
  - **Ok:** the component is working properly;
  - **Disabled:** the component has its communication disabled—the Enabled slot is set to false;
  - **Fault:** indicates an incorrect configuration of the component;
- Fault Cause: describes a cause of an error if there is a fault or down status;
  - **None:** no fault;
  - **Bad Parent:** the iSMAIONetwork component has been placed under a wrong parent component (Drivers only);
  - **Duplicated Component:** the iSMAIONetwork component has been added twice;
  - **Invalid Hardware:** the iSMAIONetwork has been used on a device other than the iSMA-B-MAC36NL or iSMA-B-MAC36PRO device;
- Enabled: enables/disables the iSMAIONetwork component.

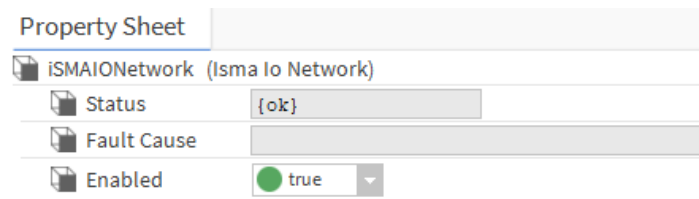


Figure 16. iSMAIONetwork in the Property Sheet

## 9.2 LocalIODevice

The LocalIODevice is a component that represents local I/Os of the iSMA-B-MAC36NL and iSMA-B-MAC36PRO devices.

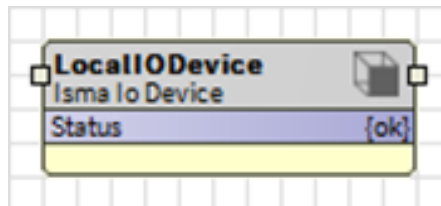


Figure 17. The LocalIODevice component

The component must be placed under the iSMAIONetwork component.

All local I/O points, which belong to a particular iSMA-B-MAC36NL or iSMA-B-MAC36PRO device, must be placed under the LocalIODevice.

The LocalIODevice component has the following slots:

- Status: defines a current status of the component, available states:
  - **Ok**: the component is working properly;
  - **Disabled**: the component or his parent (iSMA IO Network) is disabled (the Enabled slot is false);
  - **Fault**: indicates an incorrect configuration of the component;
- Fault Cause: describes a cause of an error if there is a fault or down status;
  - **None**: no fault;
  - **Bad Parent**: the component has been inserted in a wrong place in the structure (the only correct place is the Device component or a subfolder of the Device component);
  - **Duplicated Component**: appears if a component with the given address already exists (prevents double representation of the input/output within an application);
- Enabled: enables/disables the component;
- Fast Rate: the time interval that specifies the target poll interval for components assigned to this rate group;
- Normal Rate: the time interval that specifies the target polling interval for the components that can be polled and are assigned to a normal polling rate;
- Slow Rate: the time interval that specifies the target polling interval for components that can be polled and are assigned to a slow polling rate.

Slots hidden by default:

- Write On Start: perform a writing action in the device's writable components in the iSMA IO Network after a reset or power-up;
- Write On Up: perform a writing action in the device's writable components in the iSMA IO Network after restoring a connection with the device;
- Write On Enable: perform a writing action in the device's writable components in the iSMA IO Network after enabling the device.

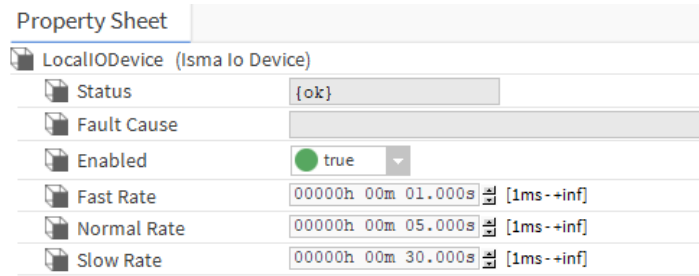


Figure 18. The LocalIODevice in the Property Sheet

### 9.3 UniversalInput

The UniversalInput component is a numeric point used for supporting physical local universal inputs.

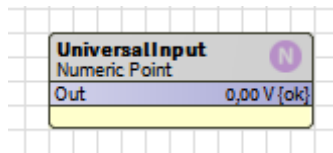


Figure 19. The UniversalInput component

The component must be placed under the LocalIODevice component.

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

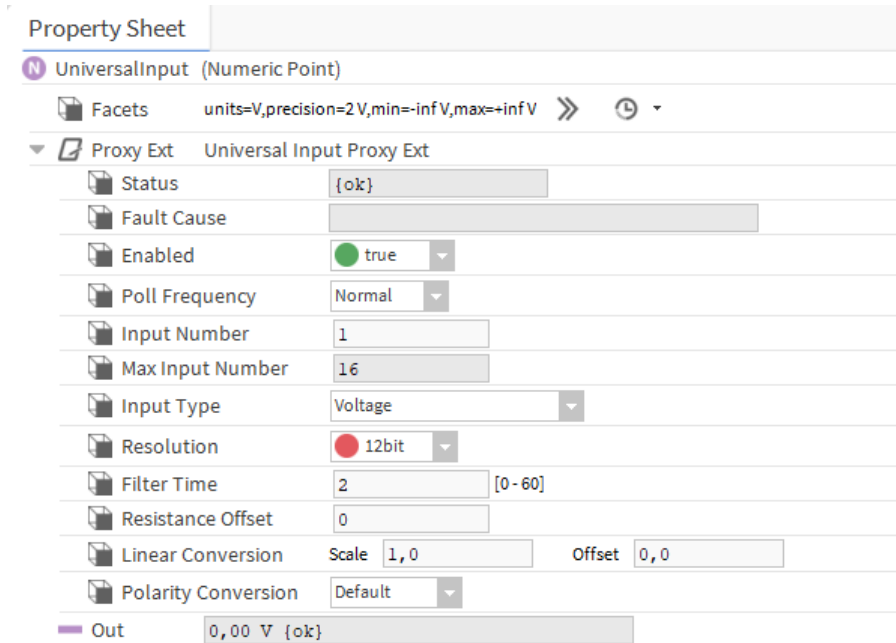


Figure 20. The UniversalInput in the Property Sheet

The UniversalInput component has the following slots:

- Facets: determines how an input value is displayed on available views in the station with its unit and decimal point accuracy. By default, a value of the Facets slot depends on a type of the input selected in the ProxyExt/Input Type slots. If the resistive input type is set, the Facets slot will be set to Ohm and a number of decimal places to 0;
- Proxy Ext: the component's extension that handles the point's configuration and has the following slots:
  - Status: indicates a current status of the component;
  - Ok: the component is working properly;

- **Disabled:** the component or its parent (device or network) is disabled (the Enabled slot is set to false);
- **Fault:** indicates an incorrect configuration of the component;
- **Down:** no response from the point;
- **Fault Cause:** describes a cause of an error if there is a fault or down status;
  - **None:** no fault;
  - **Bad Parent:** the component has been inserted in a wrong place in the structure (the only correct place is the Device component or a subfolder of the Device component);
  - **Duplicated Component:** appears if a component with the given address already exists (prevents double representation of the input/output within an application);
  - **Invalid Type:** a type of component is not supported by the device;
  - **Parent Disabled:** a parent component (device or network) is disabled;
  - **Point Down:** the point is unavailable.
- **Enabled:** enables/disables the component;
- **Poll Frequency:** allows to select a poll frequency of the points, the available options are: fast, normal, slow;
- **Input Number:** allows to select an input number; if a point is added to the device, the component selects the first unused input number automatically;
- **Max Input Number:** shows the number of inputs available in the device;
- **Input Type:** allows to select the input type (voltage, current, digital, resistive, temperature).

### Supported Input Types

The following input types are available:




- **Voltage:** a universal input works as a voltage input: 0-10 V DC. The resistance measurement is disabled;
- **Current:** a universal input works as a current input: 0-20 mA. The resistance measurement is disabled;
- **Digital:** a universal input works like a digital input (dry contact input–output current ~1 mA). The voltage measurement is disabled;
- **Resistance:** a universal input works in a resistive measurement mode (0 - 1000 kΩ). The voltage measurement is disabled;



- Reading one of the supported types of temperature sensors (the voltage measurement is disabled):

Temperature sensor type NTC 10K3A1 (°C)  
 Temperature sensor type NTC 10K4A1 (°C)  
 Temperature sensor type NTC 10K Carel (°C)  
 Temperature sensor type NTC 20K6A1 (°C)  
 Temperature sensor type NTC 2,2K3A1 (°C)  
 Temperature sensor type NTC 3K3A1 (°C)  
 Temperature sensor type NTC 30K6A1 (°C)  
 Temperature sensor type SIE1 (°C)  
 Temperature sensor type TAC1 (°C)  
 Temperature sensor type SAT1 (°C)  
 Temperature sensor type PT1000 (16-bit resolution pre-set by the manufacturer) (°C)  
 Temperature sensor type NI1000 (16-bit resolution pre-set by the manufacturer) (°C)  
 Temperature sensor type NI1000 LG (°C)  
 Temperature sensor type NI1000 21C (°C)  
 Temperature sensor type NTC 10K Type 2 (°F)  
 Temperature sensor type NTC 10K Type 3 (°F)  
 Temperature sensor type NTC 20K (°F)  
 Temperature sensor type NTC 3K (°F)  
 Temperature sensor type PT1000 (°F)  
 Temperature sensor type NI1000 32F (°F)  
 Temperature sensor type NI1000 70F (°F)  
 Custom Table: users can enter their own sensor characteristics using up to 32 points of characteristics.

	Resistance	Outvalue
 Custom Table	Point0 1000,00	21,00
	Point1 1050,00	22,00
	Point2 1070,00	23,00
	Point3 nan	nan

After selecting a drop-down list from the Custom Table, an additional Custom Table slot is displayed. This slot has the Resistance and Out value subslots for the next points of the characteristics. If both subslots are filled in and approved with the Enter key, the next subslots open in the next row. It is possible to enter up to 32 points of characteristics (32 rows of Point 0...31). The characteristics are saved in the component in the station. If the user changes the input mode, the characteristic will be saved and it can be accessed by selecting the Custom Table again. To delete the entered characteristic, right-click on the Custom Table slot and select Delete. The UniversalInput component, with a saved characteristic, can be copied and used repeatedly without having to re-enter it. The UniversalInput component can also be copied between stations, both online and offline (PC copy). The Custom Table slot can also be copied itself and pasted into a new UniversalInput component under the ProxyExt (where there is no Custom Table yet). There can only be one Custom Table slot in the UniversalInput component.

- Resolution: allows to select resolution bits (16-bit resolution is recommended for PT1000 and NI100 sensors);
- Filter Time: allows to set the filter time 0-60 s;
- Resistance Offset: allows to set the resistance offset value;

- Linear Conversion: calculates a conversion of the input value according to the formula:  $y=ax+b$ , where  $x$  = read input value;  $a$  = slot scale;  $b$  = slot offset;
- Polarity Conversion: allows for the input to operate in a reversed polarity. The following options are available from a drop-down list:
  - **Direct:** real-time value from a physical input is directly transferred to the Out slot (default);
  - **Reverse:** real-time value from a physical input is reversed (1 to 0, 0 to 1), and then transferred to the Out slot.

**WARNING!**

The Polarity Conversion slot works only if the UniversalInput component is set to work in a digital input type.

**Note:** Please be cautious when using a reversed polarity, as this can lead to later confusion when solving logic issues.

- Out: provides a real-time information about the current value of the input data, according to parameters set in the Facets slot, Polarity Conversion slot, and current state of the point. If the input works correctly, the status is considered normal, and the value is displayed with the default status {ok}.

The ProxyExt extension has the following actions:

- **Force Write Config:** instantly saves point configurations to the physical device;
- **Force Read:** sends a query immediately, despite the settings in the Poll Frequency slot.

Any change of the Input Number, Input Type, Resolution, or Filter Time slots results in sending this configuration to the device immediately.

## 9.4 DigitalUniversalInput

The DigitalUniversalInput component is a Boolean point used for supporting physical local universal inputs working as digital inputs.

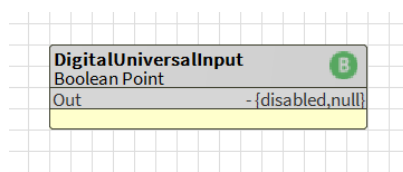


Figure 21. The DigitalUniversalInput component

The component must be placed under the LocalIODevice component.

The component can work parallel with the UniversalInput point or on its own, and it does not consume any additional license points.

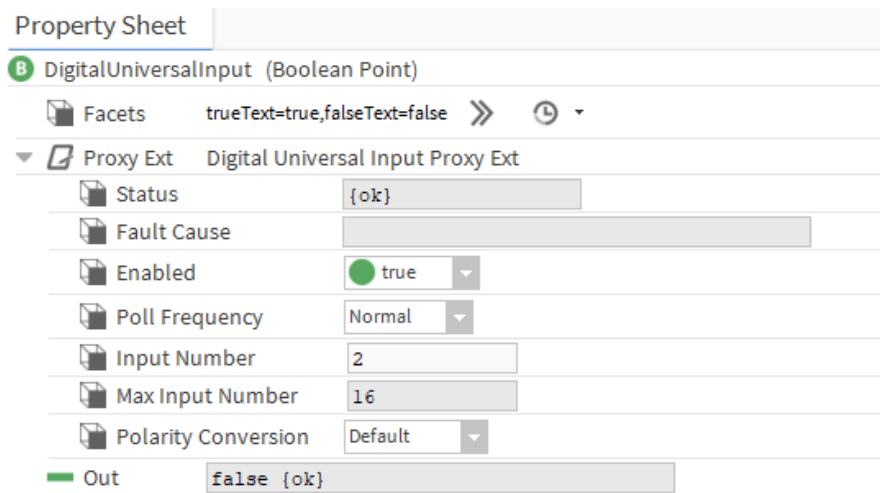


Figure 22. The UniversalInput in the Property Sheet

The DigitalUniversalInput component has the following slots:

- Facets: determines how an input value is displayed on the available views in the station:
  - trueText: allows to set a text displayed for a true value;
  - falseText: allows to set a text displayed for a false value;
- Proxy Ext: the component's extension that handles the point's configuration and has the following slots:
  - Status: indicates a current status of the component;
    - **Ok**: the component is working properly;
    - **Disabled**: the component or its parent (device or network) is disabled (the Enabled slot is set to false);
    - **Fault**: indicates an incorrect configuration of the component;
    - **Down**: no response from the point;
  - Fault Cause: describes a cause of an error if there is a fault or down status;
    - **None**: no fault;
    - **Bad Parent**: the component has been inserted in a wrong place in the structure (the only correct place is the Device component or a subfolder of the Device component);
    - **Duplicated Component**: appears if a component with the given address already exists (prevents double representation of the input/output within an application);
    - **Invalid Type**: a type of component is not supported by the device;
    - **Parent Disabled**: a parent component (device or network) is disabled;
    - **Point Down**: the point is unavailable.
  - Enabled: enables/disables the component;
  - Poll Frequency: allows to select a poll frequency of the points, the available options are: fast, normal, slow;
  - Input Number: allows to select an input number; if a point is added to the device, the component selects the first unused input number automatically;
  - Max Input Number: shows the number of available inputs in the device;
  - Polarity Conversion: allows for the input to operate in a reversed polarity. The following options are available from a drop-down list:
    - **Direct**: real-time value from a physical input is directly transferred to the Out slot (default);

- **Reverse:** real-time value from a physical input is reversed (true to false, false to true), and then transferred to the Out slot.

**Note:** Please be cautious when using a reversed polarity, as this can lead to later confusion when solving logic issues.

- **Out:** provides a real-time information about the current value of the input data, according to parameters set in the Facets slot, Polarity Conversion slot, and current state of the point. If the input works correctly, the status is considered normal, and the value is displayed with the default status {ok}.

The ProxyExt component has the following actions:

- **Force Write Config:** instantly saves point configurations to the device;
- **Force Read:** sends a query immediately, despite the settings in the Poll Frequency slot.

Any change to the Input Number configuration slot results in sending this configuration to the device automatically.

## 9.5 DigitalInput

The DigitalInput component is designed to support local physical digital inputs.

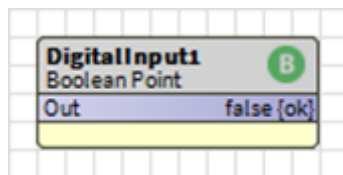


Figure 23. The DigitalInput component

The component must be placed under the LocalIODevice component.

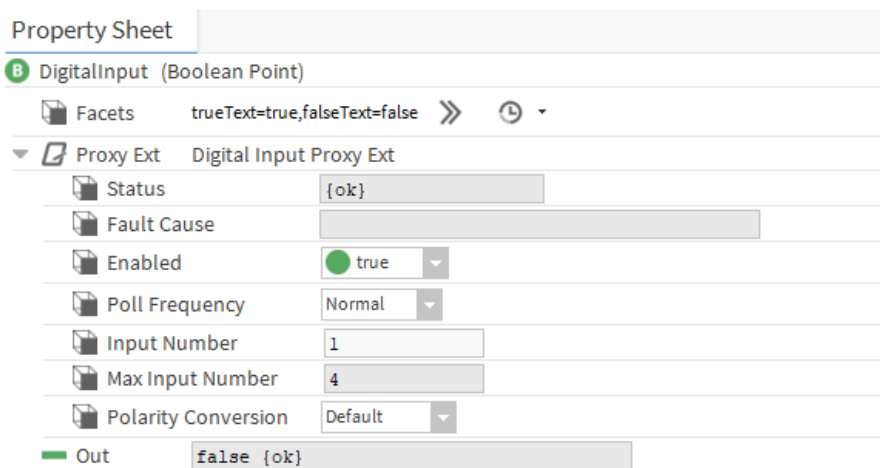


Figure 24. The DigitalInput in the Property Sheet

The DigitalInput component has the following slots:

- **Facets:** determines how an input value will be displayed;
- **Proxy Ext:** the component's extension that handles the point's configuration and has the following slots:
  - **Status:** indicates a current status of the component;
    - **Ok:** the component is working properly;
    - **Disabled:** the component or its parent (device or network) is disabled (the Enabled slot is set to false);
    - **Fault:** indicates an incorrect configuration of the component;

- **Down:** no response from the point;
- **Fault Cause:** describes a cause of an error if there is a fault or down status;
  - **None:** no fault;
  - **Bad Parent:** component has been inserted in an incorrect place in the structure (the only correct place is the Device component or a subfolder of the Device component);
  - **Duplicated Component:** appears if a component with the given address already exists (prevents double representation of the input/output within an application);
  - **Invalid Type:** a type of component is not supported by the device;
  - **Parent disabled:** a parent (device or network) is disabled;
  - **Point down:** the point is unavailable.
- **Enabled:** enables/disables the component;
- **Poll Frequency:** allows to select a poll frequency of the points, the available options are: fast, normal, slow;
- **Input Number:** allows to select an input number; if a point is added to the device, the component selects the first unused input number automatically;
- **Max Input Number:** shows the number of available inputs in the device;
- **Polarity Conversion:** allows for the input to operate in a reversed polarity. The following options are available from a drop-down list:
  - **Direct:** real-time value from a physical input is directly transferred to the Out slot (default);
  - **Reverse:** real-time value from a physical input is reversed (true to false, false to true), and then transferred to the Out slot.

**Note:** Please be cautious when using a reversed polarity, as this can lead to later confusion when solving logic issues.

- **Out:** provides a real-time information about the current value of the input data, according to parameters set in the Facets slot, Polarity Conversion slot, and current state of the point. If the value of the Out slot is forced by one of the available component actions, the value is followed by an information about the executed action, e.g., {overridden}. If the component is working correctly, the status is considered normal and the value appears with the default status {ok}.

The ProxyExt component has the following actions:

- **Force Write Config:** instantly saves point configurations to the device;
- **Force Read:** sends a a query immediately, despite the settings in the Poll Frequency slot.

Any change to the Input Number configuration slot results in sending this configuration to the device automatically.

## 9.6 DigitalInputCounter

The DigitalInputCounter component is designed to read high-speed counters of digital inputs.

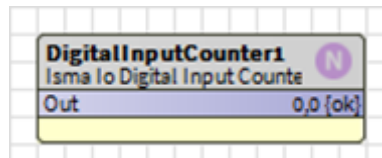


Figure 25. The DigitalInputCounter component

The component must be placed under the LocalIODevice component.

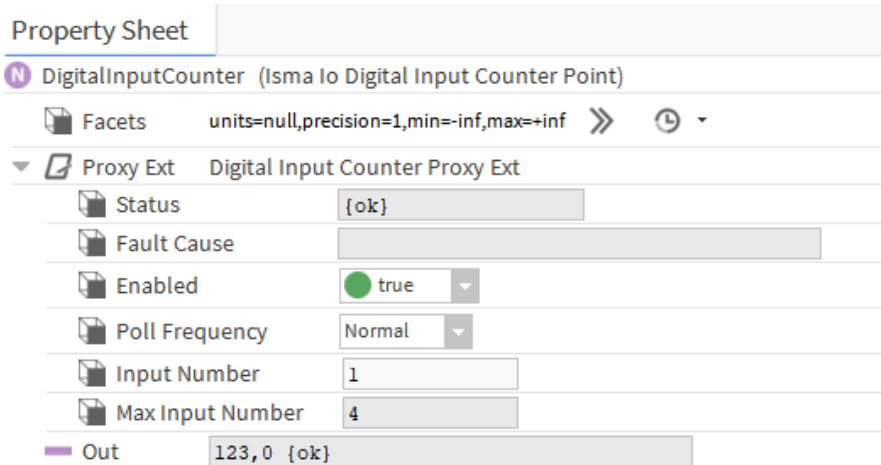


Figure 26. The DigitalInputCounter in the Property Sheet

The DigitalInputCounter component has the following slots:

- Facets: determines how an input value will be displayed;
- Proxy Ext: the component's extension that handles the point's configuration and has the following slots:
  - Status: indicates a current status of the component;
    - **Ok**: the component is working properly;
    - **Disabled**: the component or its parent (device or network) is disabled (the Enabled slot is set to false);
    - **Fault**: indicates an incorrect configuration of the component;
    - **Down**: no response from the point;
  - Fault Cause: describes a cause of an error if there is a fault or down status;
    - **None**: no fault;
    - **Bad Parent**: component has been inserted in an incorrect place in the structure (the only correct place is the Device component or a subfolder of the Device component);
    - **Duplicated Component**: appears if a component with the given address already exists (prevents double representation of the input/output within an application);
    - **Invalid Type**: a type of component is not supported by the device;
    - **Parent disabled**: a parent (device or network) is disabled;
    - **Point down**: the point is unavailable.
  - Enabled: enables/disables the component;
  - Poll Frequency: allows to select a poll frequency of the points, the available options are: fast, normal, slow;
  - Input Number: allows to select an input number; if a point is added to the device, the component selects the first unused input number automatically;
  - Max Input Number: shows the number of available inputs in the device;

- **Out:** provides a real-time information about the current value of the input data, together with the units selected in the Facets slot and the current state of the point. If the value of the Out slot is forced by one of the available component actions, the value is followed by an information about the executed action, e.g., {overridden}. If the component is working correctly, the status is considered normal and the value appears with the default status {ok}.

The DigitalInputCounter component has the following actions:

- **Set:** sets the value of the counter; the action overwrites the Out and In slots;
- **Reset:** resets the value of the counter to 0; the action overwrites the Out and In slots;

Additionally, the ProxyExt component's extension has the following actions:

- **Force Write Config:** instantly saves point configurations to the device;
- **Force Read:** sends a query immediately, despite the settings in the Poll Frequency slot.

Any change to the Input Number configuration slot results in sending this configuration to the device automatically.

## 9.7 AnalogOutput

The AnalogOutput component is designed for supporting local physical analog outputs working as voltage outputs (range 0 V-10 V) or PWM.

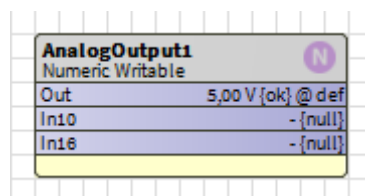


Figure 27. The AnalogOutput component

The component must be placed under LocalIODevice component.

The default value of the component is 0.00 V.

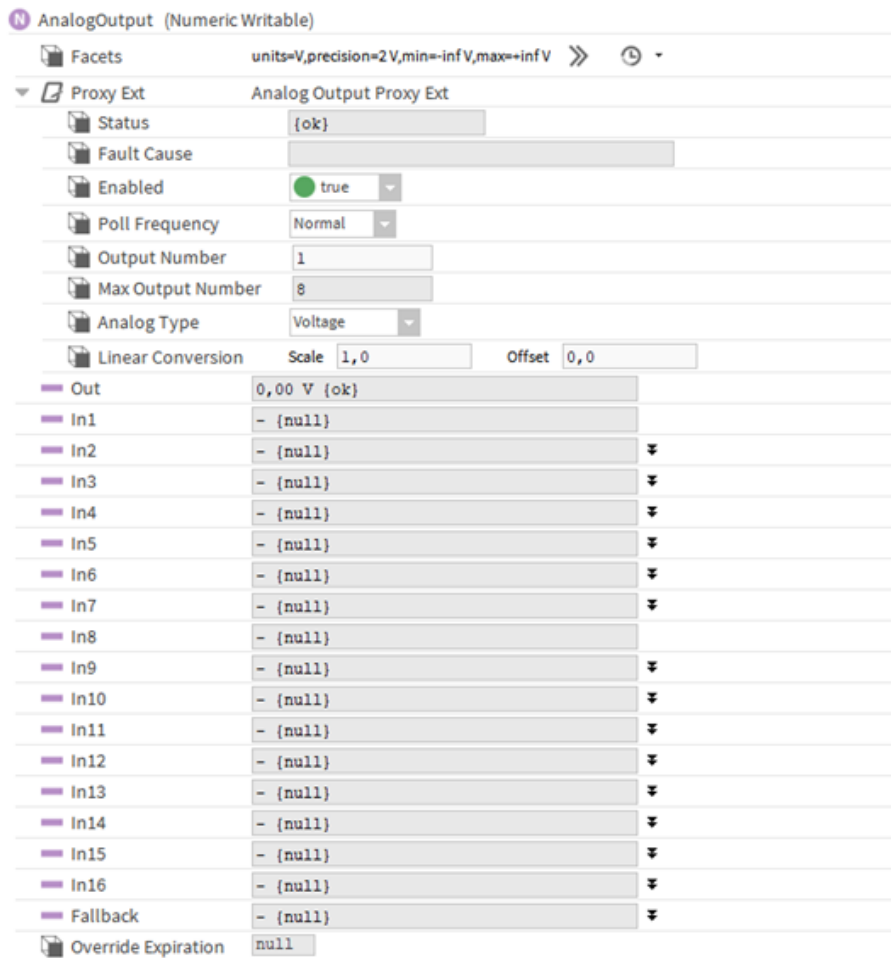


Figure 28. The AnalogOutput in the Property Sheet view

The AnalogOutput component has the following slots:

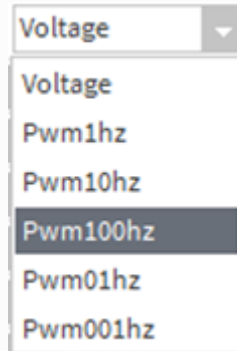
- Facets: determines how an input value will be displayed.
- Proxy Ext: the component's extension that handles the point's configuration and has the following slots:
  - Status: indicates a current status of the component;
    - **Ok**: the component is working properly;
    - **Disabled**: the component or its parent (device or network) is disabled (the Enabled slot is set to false);
    - **Fault**: indicates an incorrect configuration of the component;
    - **Down**: no response from the point;
  - Fault Cause: describes a cause of an error if there is a fault or down status;
    - **None**: no fault;
    - **Bad Parent**: component has been inserted in an incorrect place in the structure (the only correct place is the Device component or a subfolder of the Device component);
    - **Duplicated Component**: appears if a component with a given address already exists (prevents double representation of the input/output within an application);
    - **Invalid Type**: a type of component is not supported by the device;
    - **Parent disabled**: a parent (device or network) is disabled;
    - **Point down**: the point is unavailable.
  - Enabled: enables/disables the component;



- Poll Frequency: allows to select a poll frequency of the points, the available options are: fast, normal, slow;
- Output Number: allows to select an output number; if the point is added to the device, the component selects the first unused output number automatically;
- Max Output Number: shows the number of available outputs in the device;
- Analog Type: allows to select the mode, which the analog output operates in.

### Available Analog Modes

The following input types are available:



- 0-10 V: the analog output works as a voltage output in range of 0-10V;
- PWM1Hz: the analog output operates in PWM mode with a frequency of 1 Hz;
- PWM10Hz: the analog output operates in PWM mode with a frequency of 10 Hz;
- PWM100Hz: the analog output operates in PWM mode with a frequency of 100 Hz;
- PWM01Hz: the analog output operates in PWM mode with a frequency of 0,1 Hz.

- Linear Conversion: converts the Out slot value according to the formula  $y=ax+b$ , where  $x$  = value of the In slot with the highest priority other than null;  $a$  = the Scale slot;  $b$  = the Offset slot. Incorrect scaling of the results in the calculated value (exceeding the available range for the device, e.g., 0-10 V), results in indicating a different value on the input and on the Out slot. If the scaling is correct, the values are identical;
- Out: provides a real-time information about the current value of the input data together with the units selected in the Facets slot and the current state of the point. If the value of the Out slot is forced by one of the available component actions, the value is followed by the information about the executed action, e.g., {overridden}. If the component is working correctly, the status is considered normal, and the value appears with the default status {ok}.
- In1-In16: input slots; the value of the highest priority slot different from null is rewritten into the Out slot. The In1 has the highest priority, while the In16 has the lowest priority;
- Fallback: if the component has a null value, or is incorrect on all In1-In16 slots, the Out slot takes the value entered into this slot. The value of the Fallback slot can be set with the Set action.
- Override Expiration: the time after which the Override action expires.

The AnalogOutput component has the following actions:

- **Emergency Override:** overwrites the value of the component with the highest priority (In1); this action does not expire automatically—in order to disable it, enable the Emergency Auto action;

- **Emergency Auto:** restores the component to automatic operation; disables Emergency Override action;
- **Override:** overwrites the component value (on the In8 priority); the action is disabled after the time set in the Override Expiration slot;
- **Auto:** sets the point to automatic operation;
- **Set:** changes the value of the Fallback slot.

Additionally, the ProxyExt component’s extension has the following actions:

- **Force Write Config:** instantly saves point configurations to the device;
- **Force Read:** sends a query immediately, despite the settings in the Poll Frequency slot;
- **Force Write:** sends the overwrite command automatically despite the Poll Frequency settings.

Any change of the configuration slots such as Input Number, Analog Type, or Default Output results in sending this configuration to the device automatically.

## 9.8 DigitalOutput

The DigitalOutput component is designed to service local physical digital outputs.

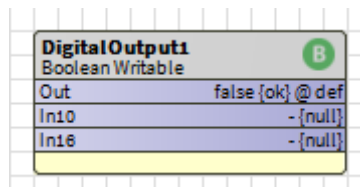


Figure 29. The DigitalOutput component

The component must be placed under LocalIODevice component.

The default value of the component is false.

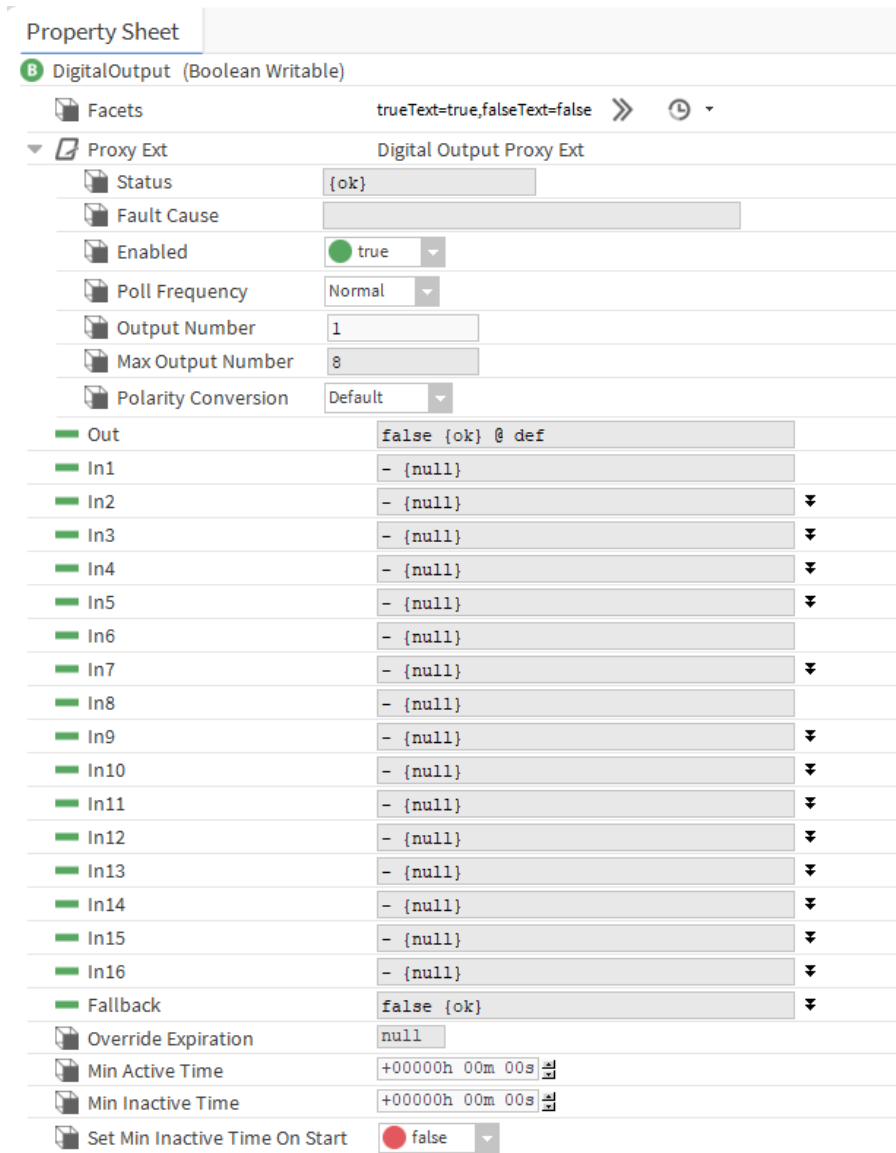


Figure 30. The DigitalOutput in the Property Sheet

The DigitalOutput component has the following slots:

- Facets: determines how an input value will be displayed.
- Proxy Ext: the component’s extension that handles the point's configuration and has the following slots:
  - Status: indicates a current status of the component;
    - **Ok**: the component is working properly;
    - **Disabled**: the component or its parent (device or network) is disabled (the Enabled slot is set to false);
    - **Fault**: indicates an incorrect configuration of the component;
    - **Down**: no response from the point;
  - Fault Cause: describes a cause of an error if there is a fault or down status;
    - **None**: no fault;
    - **Bad Parent**: component has been inserted in an incorrect place in the structure (the only correct place is the Device component or a subfolder of the Device component);

- **Duplicated Component:** appears if a component with a given address already exists (prevents double representation of the input/output within an application);
- **Invalid Type:** a type of component is not supported by the device;
- **Parent disabled:** a parent (device or network) is disabled;
- **Point down:** the point is unavailable.
- **Enabled:** enables/disables the component;
- **Poll Frequency:** allows to select a poll frequency of the points, the available options are: fast, normal, slow;
- **Output Number:** allows to select an output number; if the point is added to the device, the component selects the first unused output number automatically;
- **Max Output Number:** shows the number of available outputs in the device;
- **Polarity Conversion:** allows for the output to operate in a reversed polarity. The following options are available from a drop-down list:
  - **Direct:** the digital output works in a normally open mode (default);
  - **Reverse:** the digital output works in a normally closed mode.

### Warning!

Using a reverse polarity changes the NO operation of the digital output to NC only on the software side. The physical relays are normally open type and will update their state only when the station is running. Please be cautious when using a reversed polarity, as this can lead to later confusion when solving logic issues.

- **Out:** provides a real-time information about the current value of the input data, according to parameters set in the Facets slot, Polarity Conversion slot, and current state of the point. If the Out slot value was forced by one of the available component's actions, the value is followed by information about the executed action, e.g., {overridden}. If the component is working properly, the status is considered normal, and the value appears with the default status {ok}.
- **In1-In16:** input slots; the value of the highest priority slot different from null is rewritten into the Out slot. The In1 has the highest priority, while the In16 has the lowest priority;
- **Fallback:** if the component has a null value, or is incorrect on all In1-In16 slots, the Out slot takes the value entered into this slot. The value of the Fallback slot can be set with the Set action.
- **Override Expiration:** the time after which the Override action expires;
- **Min Active Time:** allows to set a timer to specify the minimum active time; typically, used is to prevent short cycling of equipment controlled by the point;
- **Min Inactive Time:** allows to set a timer to specify the minimum inactive time; typically, used is to prevent short cycling of equipment controlled by the point;
- **Set Min Inactive Time on Start:** if the slot value is set to true, the Min Inactive Time timer is enabled from the start of the station.

The DigitalOutput component has the following actions:

- **Emergency Override:** overwrites the value of the component with the highest priority (In1); this action does not expire automatically—in order to disable it, enable the Emergency Auto action;
- **Emergency Auto:** restores the component to automatic operation; disables Emergency Override action;

- **Override:** overwrites the component value (on the In8 priority); the action is disabled after the time set in the Override Expiration slot;
- **Auto:** sets the point to automatic operation;
- **Set:** changes the value of the Fallback slot.

Additionally, the ProxyExt component’s extension has the following actions:

- **Force Write Config:** instantly saves point configurations to the device;
- **Force Read:** sends a query immediately, despite the settings in the Poll Frequency slot;
- **Force Write:** sends the overwrite command automatically despite the values set in the Poll Frequency slot.

Any change of configuration slots, such as Input Number or Default Output results in sending this configuration to the device automatically.

## 9.9 RotarySwitch

The RotarySwitchS1 and RotarySwitchS2 components support physical rotary switches located under the top cover of the controller.

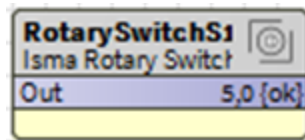


Figure 31. The RotarySwitch component

The component must be placed under the LocalIODevice component. Components RotarySwitchS1 and -S2 are not visible on the Isma Point Manager view (if the ISMA\_IO.wb is installed).

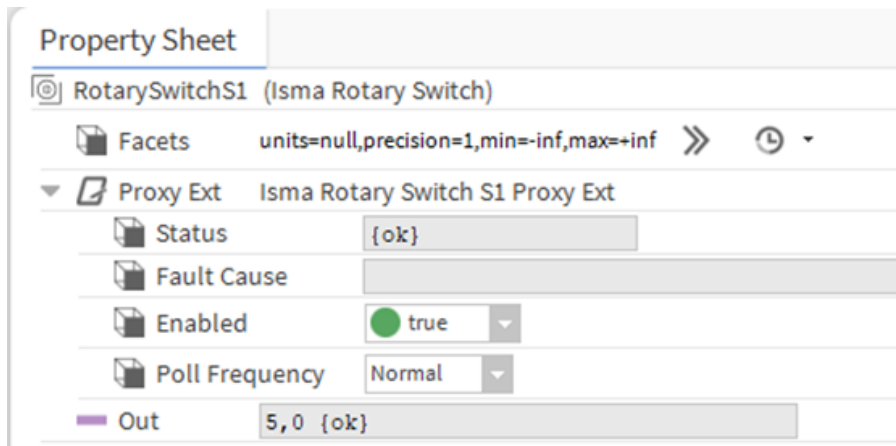


Figure 32. The RotarySwitch in the Property Sheet

The Rotary Switch component has the following slots:

- **Facets:** determines how an input value will be displayed.
- **Proxy Ext:** the component’s extension that handles the point's configuration and has the following slots:
  - **Status:** indicates a current status of the component;
    - **Ok:** the component is working properly;
    - **Disabled:** the component or its parent (device or network) is disabled (the Enabled slot is set to false);
    - **Fault:** indicates an incorrect configuration of the component;
    - **Down:** no response from the point;
  - **Fault Cause:** describes a cause of an error if there is a fault or down status;

- **None:** no fault;
- **Bad Parent:** component has been inserted in an incorrect place in the structure (the only correct place is the Device component or a subfolder of the Device component);
- **Duplicated Component:** appears if a component with the given address already exists (prevents double representation of the input/output within an application);
- **Invalid Type:** a type of component is not supported by the device;
- **Parent disabled:** a parent (device or network) is disabled;
- **Point down:** the point is unavailable.
- **Enabled:** enables/disables the component;
- **Poll Frequency:** allows to select a poll frequency of the points, the available options are: fast, normal, slow;
- **Out:** provides a real-time information about the current value set on the selected rotary switches S1/S2, in the range of 0 to 9, together with the units selected in the Facets slot and the current status of the point. If the component is working correctly, the status is considered normal and the value appears with the default status {ok}.

The ProxyExt component’s extension has the following actions:

- **Force Write Config:** instantly saves the component’s existing configuration to the device;
- **Force Read:** sends a query immediately, despite the settings in the Poll Frequency.

## 9.10 DIPSwitch

The DipSwitchS3 and DipSwitchS4 components support physical DIP switches located under the top cover of the controller.

DipSwitchS4	
Isma Dip Switch S4	
Out	- {fault,null}
Out1	false
Out2	false
Out3	false
Out4	false
Out5	false
Out6	false
Out7	false
Out8	false

Figure 33. The DIPSwitch component

The component must be placed under the Local IO Device component. Components Dip Switch S3 and S4 are not visible on the Isma Point Manager view (if the iSMA\_IO.wb is installed).

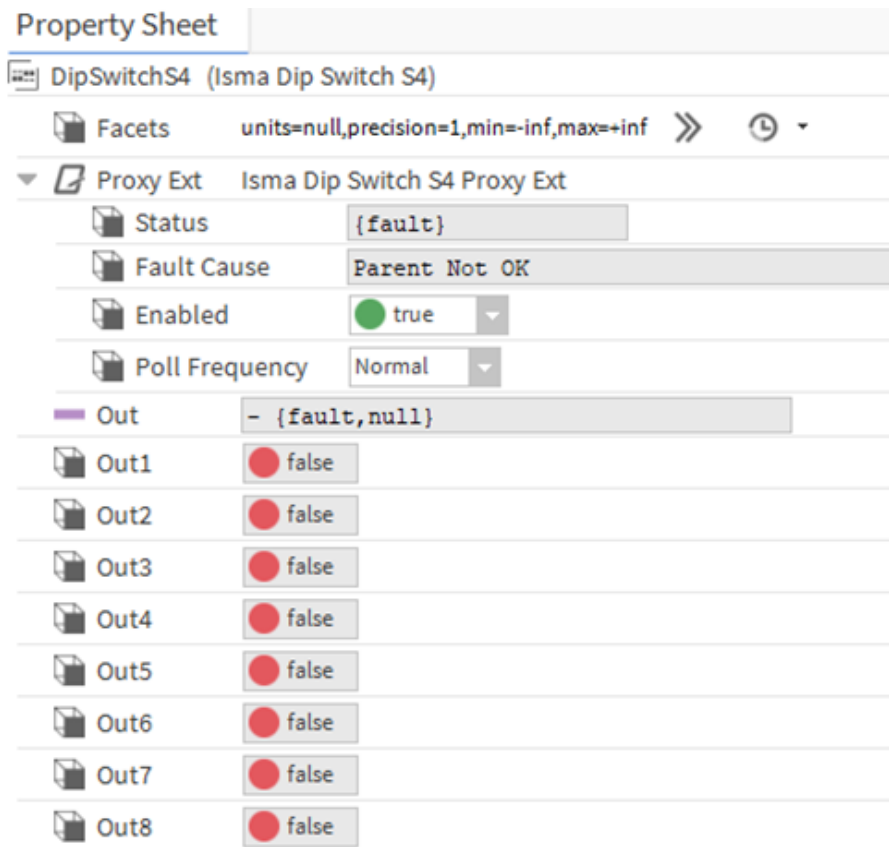


Figure 34. The DIPSwitch in the Property Sheet

The DIP Switch component has the following slots:

- Facets: determines how the input value will be displayed.
- Proxy Ext: the component’s extension that handles the point configuration and has the following slots:
  - Status: indicates the current status of the component;
    - **Ok**: the component is working properly;
    - **Disabled**: the component or its parent (device or network) is disabled (the Enabled slot is set to false);
    - **Fault**: indicates an incorrect configuration of the component;
    - **Down**: no response from the point;
  - Fault Cause: describes the cause of the error if there is a fault or down status;
    - **None**: no fault;
    - **Bad Parent**: component has been inserted in the incorrect place in the structure (the only correct place is the Device component or a subfolder of the Device component);
    - **Duplicated Component**: appears if a component with a given address already exists (prevents double representation of the input/output within an application);
    - **Invalid Type**: a type of component is not supported by the device;
    - **Parent disabled**: a parent (device or network) is disabled;
    - **Point down**: the point is unavailable.
  - Enabled: enables/disables the component;
  - Poll Frequency: allows to select a poll frequency of the points, the available options are: fast, normal, slow;
- Out: provides real-time information about the current value set on the selected DIP switches S3/S4. The value is represented as the sum of the values of the set switches

in binary code (switch 1 has a weight of  $2^0$ , switch 2 has a weight of  $2^1$ , etc.), together with the units selected in the Facets slot and the current status of the point. If the component is working correctly, the status is considered normal and the value appears with the default status {ok}.

- Out1-Out8 (for S3 up to Out6): provides real-time information about the current state set on the selected DIP switch S3/S4.

The ProxyExt component's extension has the following actions:

- **Force Write Config:** instantly saves the component's existing configuration to the device;
- **Force Read:** sends a query immediately, despite the settings in the Poll Frequency.