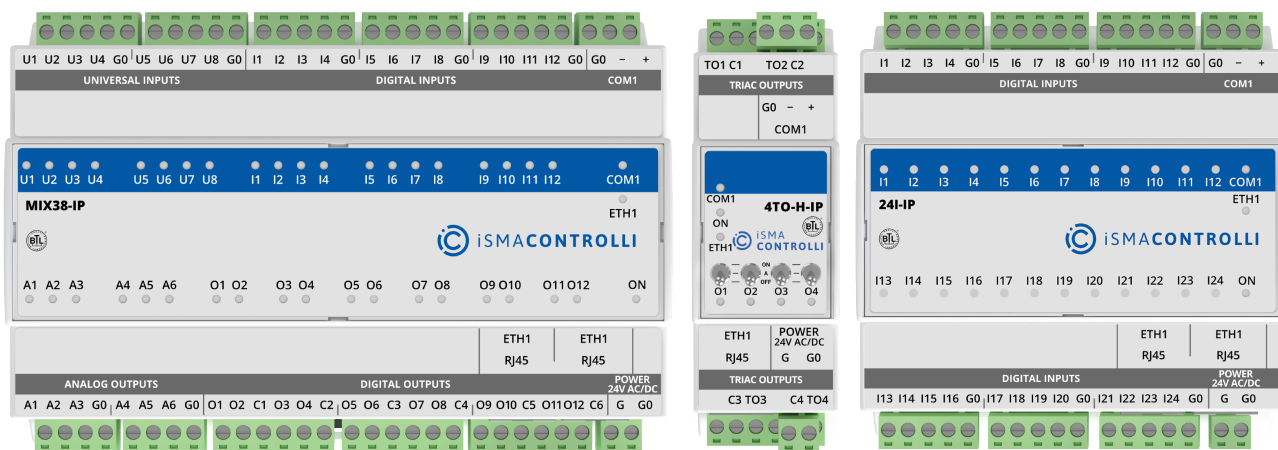


# Multiprotocol I/O Modules

User Manual

## Modbus



## Table of Contents

1	Introduction .....	6
1.1	Revision History.....	6
2	Safety Rules.....	9
2.1	Wiring.....	10
2.2	EN 60730-1 Power Supply Considerations .....	10
2.3	FCC Compliance Note.....	10
3	Technical Specification .....	12
3.1	Summary Table for All Modules.....	16
4	Hardware Specification .....	18
4.1	Dimensions .....	18
4.2	Power Supply Connection .....	21
4.3	LED Indicators .....	21
4.3.1	MIX Series Front Panels .....	21
4.3.2	MINI Series Front Panels.....	22
4.3.3	MAX Series Front Panels.....	24
4.4	RS485 Port .....	25
4.4.1	RS485 Communication Bus Connection.....	25
4.4.2	RS485 Network Termination.....	25
4.5	Setting Module Address in Modbus Network.....	25
4.6	Baud Rate .....	26
4.7	Protocol.....	26
4.7.1	Free Modbus TCP Sockets Counter .....	27
4.8	DHCP .....	27
4.9	Default Settings.....	27
4.9.1	Restoring Default Settings.....	28
5	Inputs and Outputs.....	30
5.1	Local I/O .....	30
5.2	Universal Inputs .....	31
5.2.1	Universal Input Voltage Connection .....	31
5.2.2	Universal Input Current Connection.....	31
5.2.3	Universal Input Resistance Connection .....	32
5.2.4	Universal Input Dry Contact Connection .....	32
5.3	Digital Inputs .....	32
5.3.1	Digital Input Counter .....	33
5.4	Analog Outputs .....	33

5.4.1	Analog Output Voltage Connection .....	33
5.4.2	Analog Output Relay Connection .....	34
5.4.3	Analog Output Actuator Connection .....	34
5.5	Digital Outputs .....	34
5.5.1	Digital Output Solenoid Valve Connection .....	35
5.5.2	Digital Output Resistive Load Connection .....	35
5.5.3	Digital Output Inductive Load Connection .....	36
5.6	Triac Outputs .....	36
6	Configuration Registers.....	37
6.1	Firmware Version and Module Type (30001).....	37
6.2	Module Address (30002) .....	38
6.3	Baud Rate and Protocol (30003).....	38
6.4	Counter of Received Messages (30004).....	39
6.5	Counter of Error Messages (30006).....	39
6.6	Counter of Sent Messages (30008).....	39
6.7	Up Time (30012) .....	39
6.8	Hardware Version (30130) .....	39
6.9	MAC Address (30131).....	39
6.10	Device Actions (40001).....	39
6.11	Baud Rate (40136).....	39
6.12	Stop Bits (40137) .....	40
6.13	Data Bits (40138) .....	40
6.14	Parity Bit (40139) .....	40
6.15	Response Delay Time (40140).....	41
6.16	Watchdog Time (40141).....	41
7	LocalIO Registers .....	42
7.1	Universal Input Registers.....	42
7.1.1	Status of Universal Inputs Working as Digital Inputs (30017).....	42
7.1.2	Universal Input Voltage (Current) Measure 1-8 (30071, 30073, 30075, 30077, 30079, 30081, 30083, 30085) .....	42
7.1.3	Universal Input Temperature Measurement 1-8 (30072, 30074, 30076, 30078, 30080, 30082, 30084, 30086) .....	42
7.1.4	Universal Input Resistance Measurement 1-8 (30103-30118) .....	42
7.1.5	Universal Input Configuration 1-8 (40151-40158).....	43
7.1.6	Filter Time Constant of the Universal Input 1-8 (40159-40166) .....	44
7.1.7	Resolution of the Universal Inputs (40167).....	44
7.2	Digital Input Registers.....	45

7.2.1	State of Digital Inputs (30016 for MINI/MIX/MAX Series, 30216 for MAX Series)....	45
7.2.2	Counter 1-12 (40023-40046 for MINI/MIX/MAX Series and 40223-40246 for MAX Series).....	45
7.2.3	Resetting the Counters (40022 for MINI/MIX/MAX Series and 40222 for MAX Series).....	45
7.3	Analog Output Registers.....	46
7.3.1	State of Analog Outputs Operating as Digital Outputs (40019).....	46
7.3.2	Value of Analog Output 1-6 (for MIX Series 40121-40126), 1-4 (for MINI Series 40121-40124), .....	47
7.3.3	Default State of the Analog Outputs (Digital) (40144) .....	47
7.3.4	Default State of Analog Outputs 1-6 (for MIX Series: 40145-40150), 1-4 (for MINI Series: 40145-40148).....	47
7.3.5	Configuration Mode of Analog Outputs 1-6 (for MIX Series: 40168-40173), 1-4 (for MINI Series: 40168-40171).....	47
7.3.6	Hand Control Status of Analog Outputs (30015).....	48
7.3.7	Hand Control Value of 1-4 Analog Outputs (for MINI Series: 30125-30128).....	48
7.4	Digital Output Registers.....	48
7.4.1	State of Digital Outputs (40018) .....	48
7.4.2	Default State of Digital Outputs (40143).....	49
7.4.3	Hand Control Status of Digital Outputs (for MINI/MIX/MAX Series: 30015, for MAX Series: 30215).....	50
7.5	Triac Output Registers.....	50
7.5.1	State of Triac Outputs (40018).....	50
7.5.2	Default State of Triac Outputs (40143) .....	51
7.5.3	Value of 1-4 Triac PWM Outputs (40121-40124).....	51
7.5.4	Default State of 1-4 Triac PWM Outputs (40145-40148).....	51
7.5.5	Configuration Mode of 1-4 Triac Outputs (40168-40171).....	51
7.5.6	Hand Control Status of the Triac Outputs (30015) .....	52
7.6	Special Application Modes .....	52
7.6.1	Special Application Modes for 4I4O-H, 4I4O-H-IP, 4U4O-H, and 4U4O-H-IP .....	52
7.6.2	Operation Mode Registers (40176, 40180, 40184, and 40188).....	54
7.6.3	Time Value Registers (40177,40181,40185,40189).....	57
7.6.4	Command Register (40020).....	57
7.6.5	Block Inputs Register (40021).....	58
7.6.6	Setpoint Registers (40178, 40182, 40186, 40190).....	58
7.6.7	Differential Registers (40179,40183,40187,40191).....	58
8	Web Configuration .....	59
8.1	Web Server Access.....	59
8.2	Device Page.....	59



8.3	Local I/O Status and Configuration .....	59
8.3.1	Universal Inputs .....	59
8.3.2	Digital Inputs .....	61
8.3.3	Digital Outputs .....	62
8.3.4	Analog Outputs .....	63
8.3.5	Special Application Modes .....	63
8.4	RS485 Configuration .....	64
8.5	IP Configuration .....	65
8.6	Device Management .....	68
8.7	Contact .....	69
9	List of Modbus Registers .....	70
10	List of Supported Temperature Sensors .....	83

# 1 Introduction

The MINI, MIX, and MAX series of multiprotocol I/O modules with RS485 and IP have been designed for building distributed control systems using MAC36, AAC20, or another controller. Each module is equipped with the most commonly used types of I/Os in building automation. Depending on the version, the modules are equipped with a mix of different types of I/O in one unit:

- MINI series: 4 or 8 inputs and outputs;
- MIX series: 18 or 38 inputs and outputs;
- MAX series: 24 or 12 inputs or outputs.

All I/O modules have BTL, and MINI/MIX series-UL, certificates. The modules with RS485 and IP are factory-equipped with the two most popular open communication protocols: Modbus (RTU, ASCII, TCP/IP) and BACnet (MS/TP, IP), which are selected using DIP switches. Rotary switches are used to set the module address, which facilitates and accelerates the process of commissioning the system. Built-in mini USB allows for the initial configuration of the unit without external power supply.

Built-in Modbus TCP/IP to Modbus ASCII/RTU gateway enables to connect additional modules/devices that communicate via Modbus RS485.

Thanks to supporting open communication standards, I/O modules can be installed in both new and completed installations, as part of existing BMS. These versatile devices will fit any BMS perfectly.

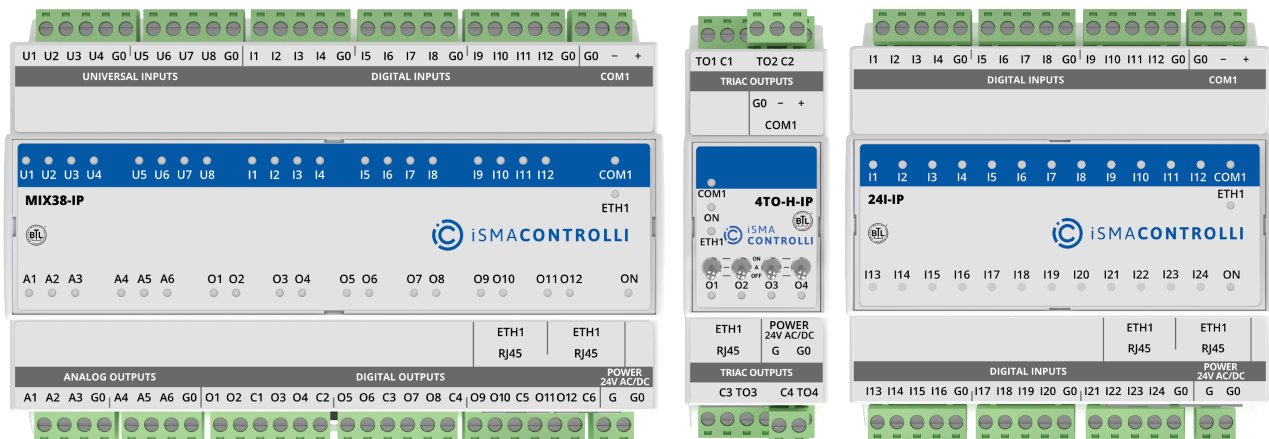


Figure 1. The MIX38-IP (MIX series), 4TO-H-IP (MINI series), and 24I-IP (MAX series) modules

This user manual outlines all information specific to using I/O modules in the Modbus protocol.

## 1.1 Revision History

Date	Rev.	Description
15 Mar 2024	1.11	<ul style="list-style-type: none"> <li>• Updated UI temperature input type information</li> </ul>
10 Nov 2023	1.10	<ul style="list-style-type: none"> <li>• DHCP functionality added (MINI/MIX modules)</li> <li>• Modbus TCP free sockets counter functionality added (MINI/MIX modules)</li> </ul>
15 Feb 2023	1.9	<ul style="list-style-type: none"> <li>• New title of the user manual for all series of modules (MINI/MIX/MAX) - Multiprotocol I/O Modules User Manual;</li> <li>• MAX series of I/O modules added</li> </ul>

Date	Rev.	Description
		<ul style="list-style-type: none"> <li>• DHCP functionality added (MAX modules)</li> <li>• Modbus TCP free sockets counter functionality added (MAX modules)</li> </ul>
25 May 2022	1.8	Rebranded
13 Oct 2020	1.7	<ul style="list-style-type: none"> <li>• Introduced an option to disable web server access by changing the HTTP port to 0;</li> <li>• Corrected summary table for all modules;</li> <li>• Updated information about biasing resistors in MIX modules;</li> <li>• General improvements and bugfixes.</li> </ul>
19 Feb 2020	1.6	<ul style="list-style-type: none"> <li>• New temperature sensors implemented in Celsius and Fahrenheit degrees</li> <li>• New Modbus function 0x17 Read/Write Multiple registers</li> <li>• New Modbus function 0x2B to read the VENDOR_NAME,MODEL_NAME, FW_VERSION, HOMEPAGE</li> <li>• Supporting Modbus address 0xFF for communication with the gateway (IP module)</li> <li>• Improved filtering on UI</li> <li>• Fixed one record in sensor 30k6A1 table –resistance 60713 to 80713 (5°C)</li> </ul>
5 Oct 2018	1.5	<ul style="list-style-type: none"> <li>• Corrections of typing errors in the text</li> <li>• Added imperial unit of measure</li> </ul>
7 Dec 2017	1.4	<ul style="list-style-type: none"> <li>• Firmware Version 6.0 released with BACnet certification</li> <li>• fixed out of service flags in AO, BO and TO</li> <li>• fixed overridden flags in AO, BO and TO</li> <li>• fixed bug with number of counters for Binary input object (now variable is 32 bit)</li> <li>• changed AO-1, BO-1, TO-1 HAND_STATUS Access to read-only</li> <li>• changed resistance table for 2.2K3A1 sensor</li> </ul>
16 May 2017	1.3	<ul style="list-style-type: none"> <li>• Hardware Version information on the main tab on the web page and in the Modbus register added</li> <li>• new action in Modbus register no 0 – enter the bootloader</li> <li>• RS485 biasing control added for MINI IP modules with hardware version &gt;= 2.0</li> <li>• www page: RS485 Biasing Resistors activating option (appears only in MINI modules with hardware &gt;= 2.0)</li> <li>• modules names on web page corrected (added -H for all modules with hand operation switches)</li> </ul>
3 Jan 2017	1.2	<ul style="list-style-type: none"> <li>• New HVAC functions: Heating and Cooling in 4U40, based on output thermostatic control with a setpoint and differential value setting;</li> <li>• New input mode for 4I40 added: Time Relay NC [ms], Time Relay NO and NC in seconds, Input Forwarding;</li> <li>• New input mode added for 4U40: Ordinary IO, Monostable Relay, Bistable Relay, Time Relay NO and NC [ms], Time Relay NO and NC in seconds, Input Forwarding, Heating, Cooling with corresponding BACnet objects and Modbus registers;</li> <li>• Output for resetting to default added after input mode change in 4U40 and 4I40;</li> </ul>

Date	Rev.	Description
		<ul style="list-style-type: none"> <li>• Improved BACnet COV Increment now can have values with the resolution of 0.1;</li> <li>• BACnet COV Increment access (read/write) through USB added;</li> <li>• Power LED added, flashing when the I/O watchdog is triggered;</li> <li>• I/O watchdog reset after read/write registers through USB modified;</li> <li>• Sensors added for detecting short circuit and disconnection, regardless of filter settings on universal inputs;</li> <li>• Fixed bug with Stop bits, it was always 1.</li> </ul>
1 Feb 2016	1.1	<ul style="list-style-type: none"> <li>• Information about the capacitive load relay added to the technical specifications.</li> <li>• Information about load Triac Outputs added to the technical specifications.</li> <li>• Description of the new MINI module 4x Triac Outputs: 4TO-H and 4TO-H-IP</li> <li>• MINI - 4I40-H and 4I40-H-IP Module built-in application: Change of logic in the Time relay mode. Now, the timer counts from the falling edge (it used to start counting from the rising edge).</li> <li>• New gateway functionality blocking Send Modbus Error.</li> <li>• Tables with PT1000 and NI1000 updated with more accurate data with new FW measuring resistance at these sensors with the accuracy of 0.1 Ω.</li> </ul>
28 Aug 2015	1.0	First edition

Table 1. Revision history

## 2 Safety Rules

- Improper wiring of the product can damage it and lead to other hazards. Make sure that the product has been correctly wired before turning the power on.
- Before wiring or removing/mounting the product, make sure to turn the power off. Failure to do so might cause an electric shock.
- Do not touch electrically charged parts such as power terminals. Doing so might cause an electric shock.
- Do not disassemble the product. Doing so might cause an electric shock or faulty operation.
- Use the product only within the operating ranges recommended in the specification (temperature, humidity, voltage, shock, mounting direction, atmosphere, etc.). Failure to do so might cause a fire or faulty operation.
- Firmly tighten the wires to the terminal. Failure to do so might cause a fire.
- Avoid installing the product in close proximity to high-power electrical devices and cables, inductive loads, and switching devices. Proximity of such objects may cause an uncontrolled interference, resulting in an instable operation of the product.
- Proper arrangement of the power and signal cabling affects the operation of the entire control system. Avoid laying the power and signal wiring in parallel cable trays. It can cause interferences in monitored and control signals.
- It is recommended to power controllers/modules with AC/DC power suppliers. They provide better and more stable insulation for devices compared to AC/AC transformer systems, which transmit disturbances and transient phenomena like surges and bursts to devices. They also isolate products from inductive phenomena from other transformers and loads.
- Power supply systems for the product should be protected by external devices limiting overvoltage and effects of lightning discharges.
- Avoid powering the product and its controlled/monitored devices, especially high power and inductive loads, from a single power source. Powering devices from a single power source causes a risk of introducing disturbances from the loads to the control devices.
- If an AC/AC transformer is used to supply control devices, it is strongly recommended to use a maximum 100 VA Class 2 transformer to avoid unwanted inductive effects, which are dangerous for devices.
- Long monitoring and control lines may cause loops in connection with the shared power supply, causing disturbances in the operation of devices, including external communication. It is recommended to use galvanic separators.
- To protect signal and communication lines against external electromagnetic interferences, use properly grounded shielded cables and ferrite beads.
- Switching the digital output relays of large (exceeding specification) inductive loads can cause interference pulses to the electronics installed inside the product. Therefore, it is recommended to use external relays/contactors, etc. to switch such loads. The use of controllers with triac outputs also limits similar overvoltage phenomena.
- Many cases of disturbances and overvoltage in control systems are generated by switched, inductive loads supplied by alternating mains voltage (AC 120/230 V). If they do not have appropriate built-in noise reduction circuits, it is recommended to use external circuits such as snubbers, varistors, or protection diodes to limit these effects.

## 2.1 Wiring

In most cases, I/O modules will be installed in an enclosure along with the other devices, which generate electromagnetic radiation. Relays, contactors, transformers, motor invertors, etc., are examples of such devices. Radiation can induce electrical noise into both power and signal lines, as well as direct radiation into the module. Whether or not the iSMA modules are immune to such effects, the interferences must be suppressed at their source if possible to ensure the proper functioning of the entire system. Appropriate grounding, shielding and other protective steps should be taken at the installation stage to prevent these effects. It is recommended to at least follow the rules below:

- Line power cables must be routed with spatial separation from signal and data transmission cables.
- Analog and digital signal cables should also be separated.
- It is recommended to use shielded cables for analog signals, cable shields should not be interrupted by intermediate terminals.
- The shielding should be earthed directly after the cable enters the cabinet.

It is recommended to install interference suppressors when switching inductive loads (e.g., coils of contactors, relays, solenoid valves). RC snubbers or varistors are suitable for AC voltage and freewheeling diodes for DC voltage loads. The suppressing elements must be connected as close to the coil as possible.

## 2.2 EN 60730-1 Power Supply Considerations

- Electrical safety in the building automation and control systems is essentially based on the use of extra-low voltage which is strictly separated from the mains voltage. This low voltage is either SELV or PELV according to EN 60730-1.
- Protection against electric shock is ensured by the following measures:
  - Limitation of voltage (low voltage AC/DC 24V supply, either SELV or PELV)
  - Protective-separation of the SELV-system from all circuits other than SELV and PELV
  - Simple-separation of the SELV-system from other SELV-systems, from PELV-systems and earth
- Field devices such as sensors, status contacts, and actuators connected to the low-voltage inputs and outputs of I/O modules must comply with the requirements for SELV or PELV. The interfaces of field devices and other systems must also satisfy SELV or PELV requirements.
- If the supply of SELV or PELV circuits is obtained from supply mains of higher voltages, it shall be provided by safety transformer or a converter designed for continuous operation to supply SELV or PELV circuits.

## 2.3 FCC Compliance Note

**Note:** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a

particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- reorient or relocate the receiving antenna;
- increase the separation between the equipment and receiver;
- connect the equipment into an outlet on a circuit different from that to which the receiver is connected;
- consult the dealer or an experienced radio/TV technician for help.

### 3 Technical Specification

Power supply	Voltage	24 V AC/DC $\pm$ 20%	
	Power consumption		
	Module type	At 24 V DC	At 24 V AC
	8I	0.4 W	0.6 VA
	8I-IP	1.4 W	2.1 VA
	8U	0.5 W	0.8 VA
	8U-IP	1.5 W	2.3 VA
	4I4O-H	1.2 W	1.8 VA
	4I4O-H-IP	2.2 W	3.3 VA
	4U4O-H	1.2 W	1.8 VA
	4U4O-H-IP	2.2 W	3.3 VA
	4U4A-H	2.2 W	3.3 VA
	4U4A-H-IP	3.2 W	4.8 VA
	4O-H	1.6 W	2.4 VA
	4O-H-IP	2.6 W	3.9 VA
	4TO-H	1.0 W	1.5 VA
	4TO-H-IP	2.0 W	3.0 VA
	MIX18	3.0 W	4.5 VA
	MIX18-IP	4.4 W	6.6 VA
	MIX38	5.0 W	7.5 VA
MIX38-IP	7.4 W	11.1 VA	
12O-H	3.4 W	9 VA	
12O-H-IP	4.5 W	11.7 VA	
24I	1 W	3.2 VA	
24I-IP	2.1 W	6.2 VA	
Universal Inputs	Temperature input	Measurement with attached RTDs (resistance temperature detectors) Accuracy $\pm$ 0.1°C For PT1000 and NI1000 sensors use 16-bit resolution	



	Voltage input	Voltage measurement in 0-10 V DC range Input impedance 100 kΩ Measurement accuracy ±0.1% Measurement resolution 3 mV at 12-bit and 1 mV at 16-bit	
	Current input	Current measurement in 0 - 20 mA range Required external resistor 200 Ω Measurement accuracy ±1.1% Measurement resolution 15 μA at 12-bit and 5 μA at 16-bit	
	Resistive input	Measurement of resistance in 0 to 1000 kΩ range Measurement resolution for 20 kΩ load 20 Ω at 12-bit and 1 Ω at 16-bit Measurement resolution for PT1000 and NI1000 0.1 Ω at 16-bit	
	Resistance measurement method	Voltage divider	
	Dry contact input	Output current ~1 mA	
	Measurement resolution	12-bit (default) or 16-bits	
	Processing time	10 ms/channel at 12-bits 140 ms/channel at 16-bits	
Digital Inputs	Type	Dry contact	
	Max. input frequency	100 Hz saved in EEPROM memory	
Analog Outputs	Voltage range	0-10 V DC	
	Max. load current	20 mA, total 60 mA load current for all outputs for MIX18, MIX18-IP, MIX38, MIX38-IP modules	
	Resolution	12-bit	
	Accuracy	± 0.5%	
Digital Outputs (relays)	Contact material	AgSnO <sub>2</sub>	
		UL compliant ratings	Maximum ratings
	Resistive load AC1	3 A at 24 V AC 3 A at 30 V DC	3 A at 230 V AC 3 A at 30 V DC
	Inductive load AC3	8 VA at 24 V AC 30 W at 30 V DC	75 VA at 230 V AC 30 W at 30 V DC
	Capacitive load		50 W at LED + PS 230 VAC 100 W at fluorescent lamps with electronic ballast

			75 W at CFL Compact fluorescent lamp
Digital Outputs (relays) 4O-H and 4O-H-IP	Contact material	AgSnO2	
		UL compliant ratings	Maximum ratings
	Resistive load AC1	8 A at 230 V AC 8 A at 30 V DC	8 A at 230 V AC 8 A at 30 V DC
	Inductive load AC3	37 VA at 230 V AC 90 W at 30 V DC	360 VA at 230 V AC 90 W at 30 V DC
	Capacitive load		180 W at CFL Compact fluorescent lamp 120 W at LED + PS 230 V AC 240 W at fluorescent lamps with electronic ballast
Digital Outputs (relays) 12O-H and 12O-H-IP	Contact material	AgSnO2	
	Resistive load AC1	3 A at 230 V AC 3 A at 30 V DC	
	Inductive load AC3	75 VA at 230 V AC 30 W at 30 V DC	
	Capacitive load	50 W at LED + PS 230 V AC 100 W at fluorescent lamps with electronic ballast 75 W at CFL Compact fluorescent lamp	
Triac Outputs	Continuous load per channel	0.5 A at 20 V AC up to max. 250 V AC	
	Peak load per channel	1.5 A at 20 V AC up to max. 250 V AC (30 s)	
	Gate Control	Zero crossing turn ON	
	Frequency Range	47 to 63 Hz	
	Snubber	Snubberless triac	
RS485 Interface	RS485	Up to 128 devices	
	Communication protocols	Modbus RTU, Modbus ASCII, or BACnet set by switch	
	Baud rate	From 2400 to 115200 set by switch	
	Address	0 to 99 set by switch	
Ethernet		MIX18-IP, MIX38-IP, 12O-H-IP, 24I-IP	
	Fast Ethernet	Switch mode (2 RJ45 ports)	

	Baud rate	10/100 Mb/s		
	8I-IP, 8U-IP, 4I4O-H-IP, 4U4O-H-IP, 4U4A-H-IP, 4O-H-IP, 4TO-H-IP			
	Fast Ethernet	IP interface		
	Baud rate	10/100 Mb/s		
USB	USB	Mini USB 2.0		
Ingress protection	IP	IP20		
Temperature	Storage	-40°C to +85°C (-40°F to 185°F)		
	Operating	-10°C to +50°C (14°F to 122°F)		
Humidity	Relative	5% to 95%		
Connectors	Type	Removable		
	Maximum cable size	2.5 mm <sup>2</sup> (18–12 AWG)		
	Maximum tightening torque	0.35 Nm		
Dimensions	MAX Series			
	Width	106.30 mm/4.19 in		
	Length	110.00 mm/4.33 in		
	Height	Without hand switches	With hand switches	
		62.00 mm/2.44 in	70.00 mm/2.76 in	
	MIX18, MIX18-IP			
	Width	87.80 mm/3.46 in		
	Length	110.00 mm/4.33 in		
	Height	62.00 mm/2.44 in		
	MIX38, MIX38-IP			
	Width	160.20 mm/6.31 in		
	Length	110.00 mm/4.33 in		
	Height	62.00 mm/2.44 in		
	MINI Series			

	Width	36.30 mm/1.43 in	
	Length	110.00 mm/4.30 in	
	Height	Without hand switches	With hand switches
		62.00 mm/2.44 in	68.70 mm/2.70 in

Table 2. Technical specification

### 3.1 Summary Table for All Modules

Module Type	UI	DI	AO	DO	TO	Modbus RTU/ASCII	Modbus TCP/IP	BACnet MS/TP	BACnet IP
4I4O-H		4		4		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
4I4O-H-IP		4		4			<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
4O-H				4 (NC/NO-8A)		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
4O-H-IP				4 (NC/NO-8A)			<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
4U4A-H	4		4			<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
4U4A-H-IP	4		4				<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
4U4O-H	4			4		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
4U4O-H-IP	4			4			<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
8I		8				<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
8I-IP		8					<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
8U	8					<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
8U-IP	8						<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
4TO-H					4	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
4TO-H-IP					4		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>

MIX18	5	5	4	4		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
MIX18-IP	5	5	4	4			<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
MIX38	8	12	6	12		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
MIX38-IP	8	12	6	12			<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
12O-H				12		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
12O-H-IP				12			<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
24I		24				<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
24I-IP		24					<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
						RS485 slave	Modbus gateway IP/ RS485 (works only as a master on RS485 network)	RS485 master slave	Modbus gateway IP/ RS485 (works only as a master on RS485 network)

Table 3. Summary table for all modules

## 4 Hardware Specification

### 4.1 Dimensions

MINI Series (Without Hand Switches)

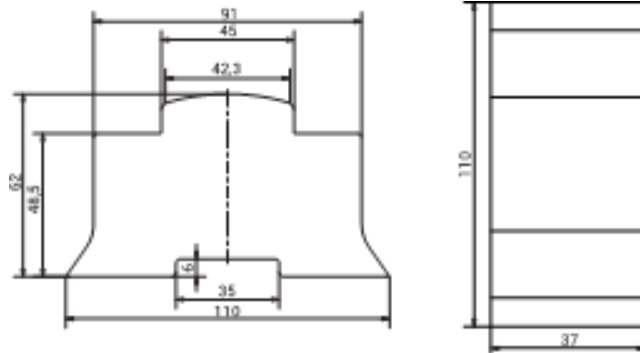


Figure 2. The MINI series dimensions (without hand switches)

MINI Series (With Hand Switches)

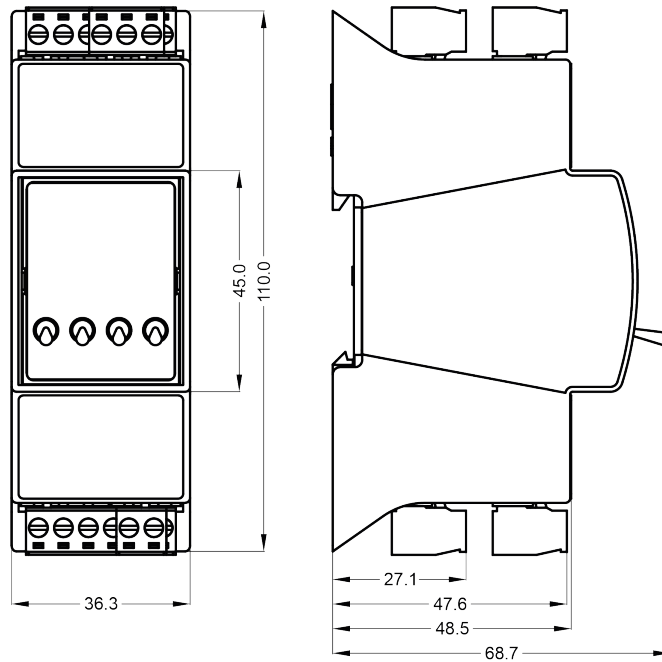


Figure 3. The MINI series dimensions (with hand switches)

### MIX18 Series

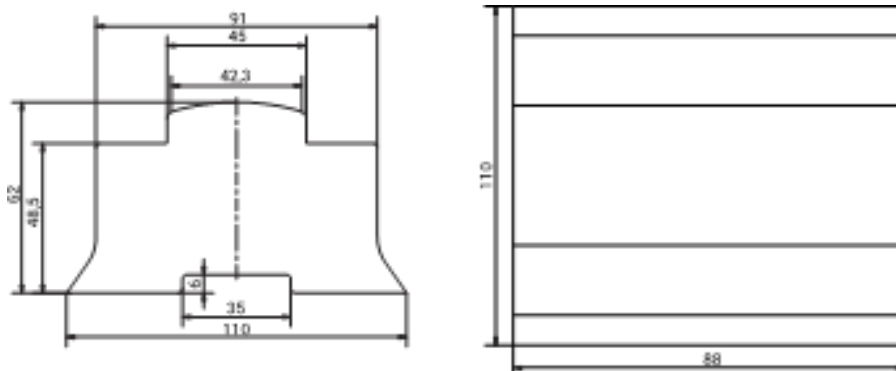


Figure 4. The MIX18 series dimensions

### MIX38 Series

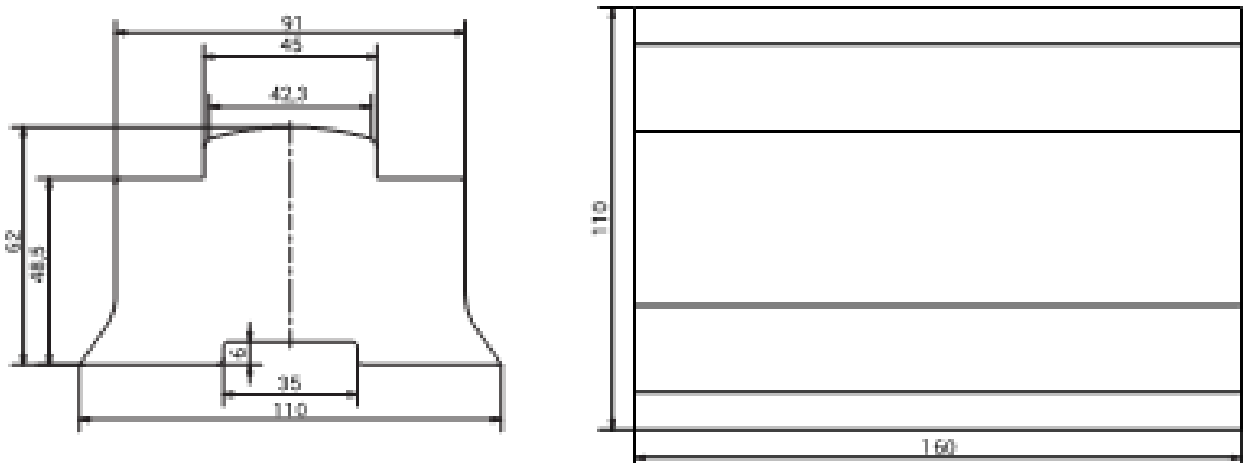


Figure 5. The MIX38 series dimensions

### MAX Series (Without Hand Switches)

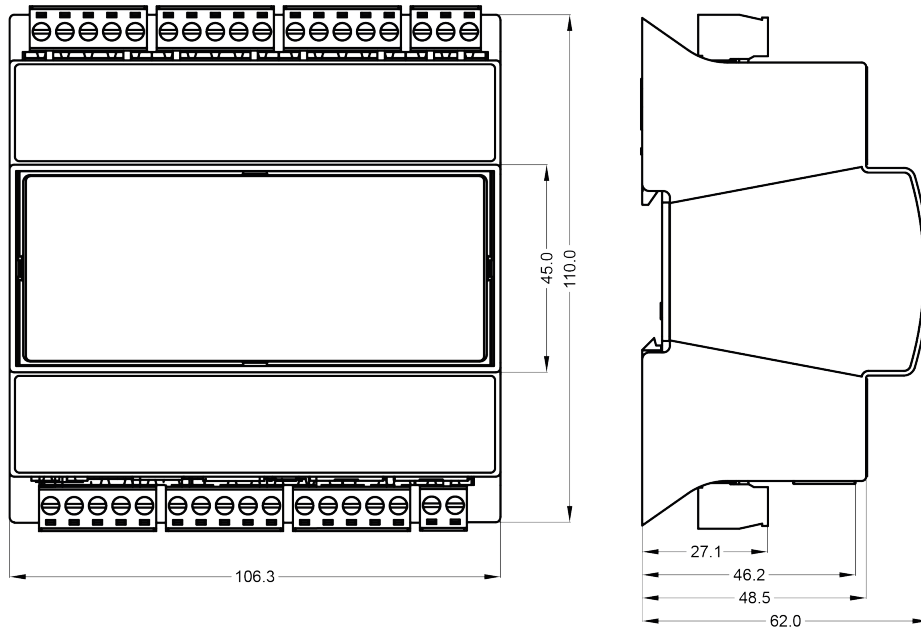


Figure 6. The MAX series dimensions (without hand switches)

### MAX Series (With Hand Switches)

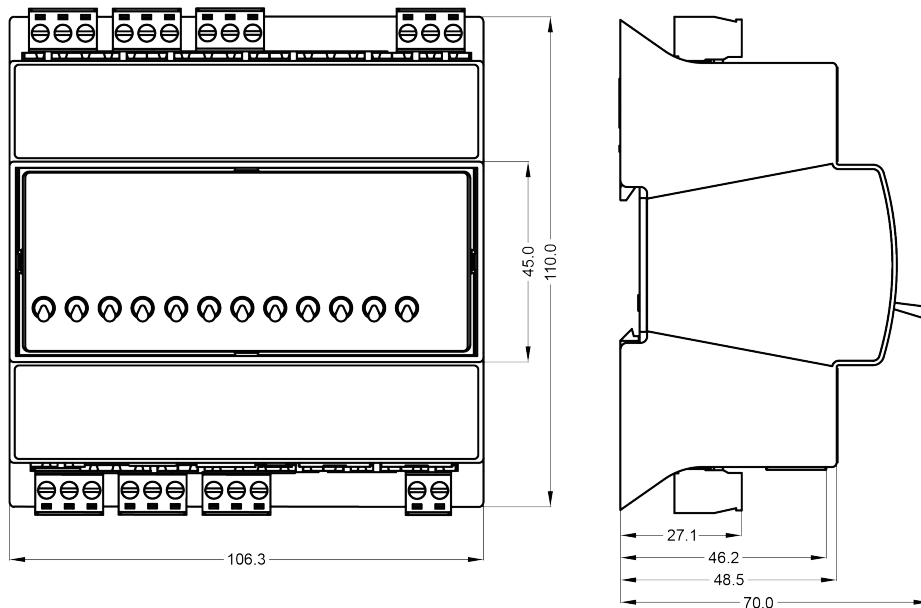


Figure 7. The MAX series dimensions (with hand switches)



## 4.2 Power Supply Connection

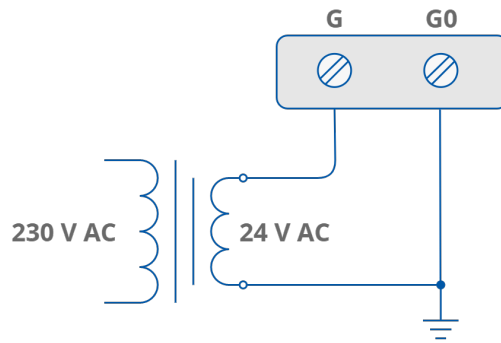


Figure 8. AC power supply connection

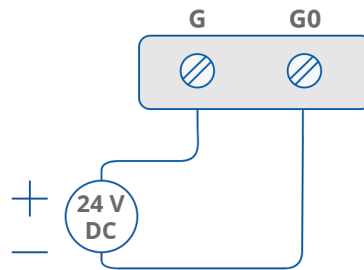


Figure 9. DC power supply connection

## 4.3 LED Indicators

### 4.3.1 MIX Series Front Panels

#### MIX18

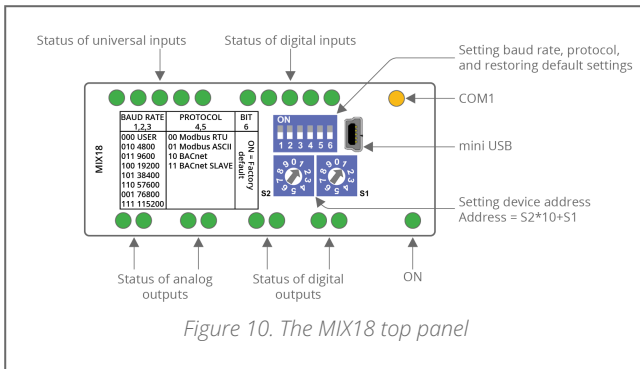


Figure 10. The MIX18 top panel

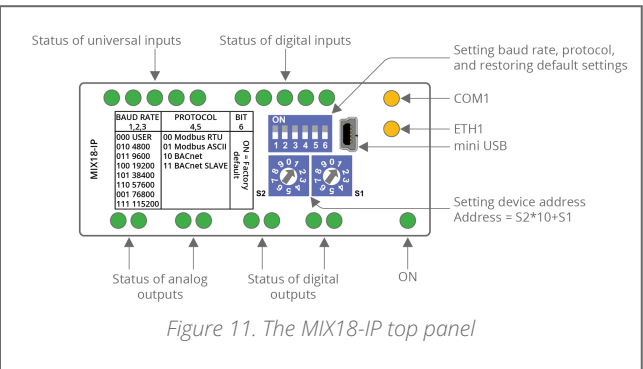


Figure 11. The MIX18-IP top panel

#### MIX38

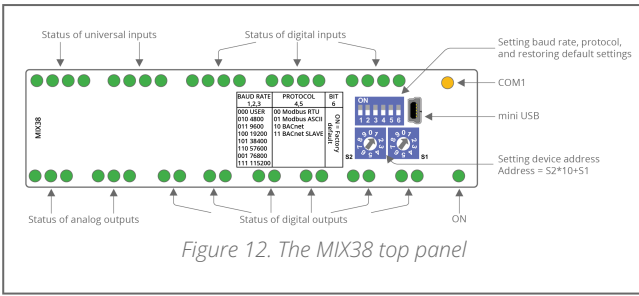


Figure 12. The MIX38 top panel

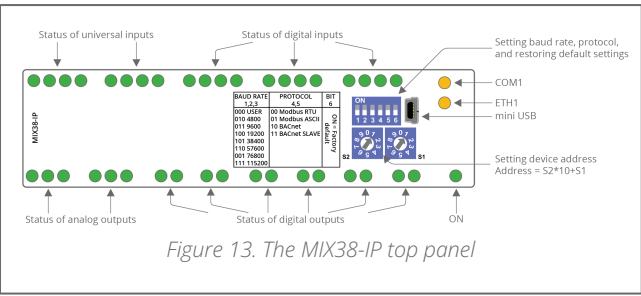


Figure 13. The MIX38-IP top panel

### 4.3.2 MINI Series Front Panels

#### MINI 8I and 8I-IP

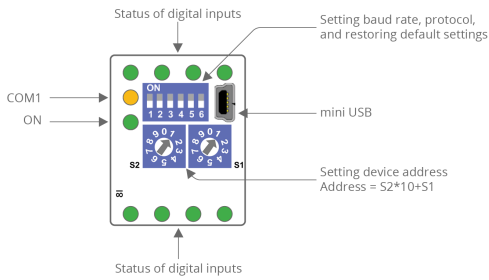


Figure 14. The 8I top panel

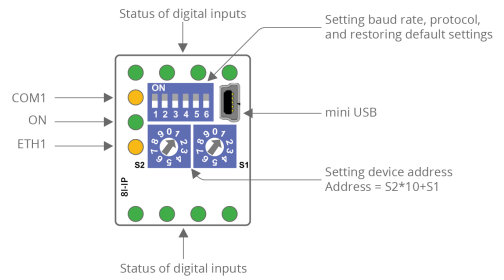


Figure 15. The 8I-IP top panel

## MINI 8U and 8U-IP

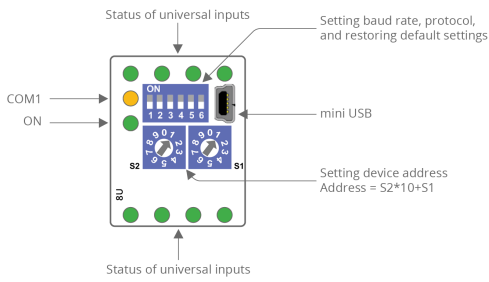


Figure 16. The 8U top panel

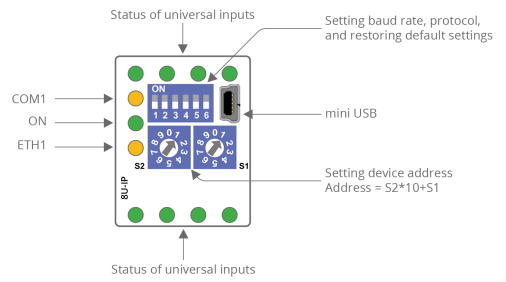


Figure 17. The 8U-IP top panel

## MINI 4I4O-H and 4I4O-H-IP

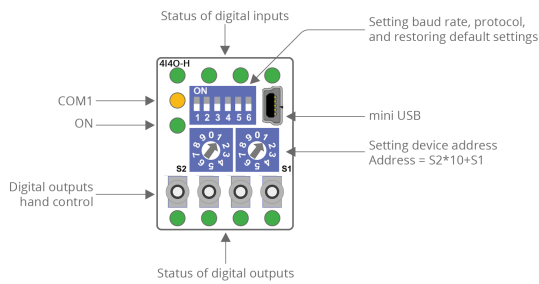


Figure 18. The 4I4O-H top panel

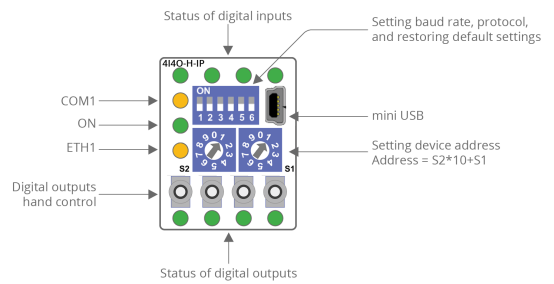


Figure 19. The 4I4O-H-IP top panel

## MINI 4U4O-H and 4U4O-H-IP

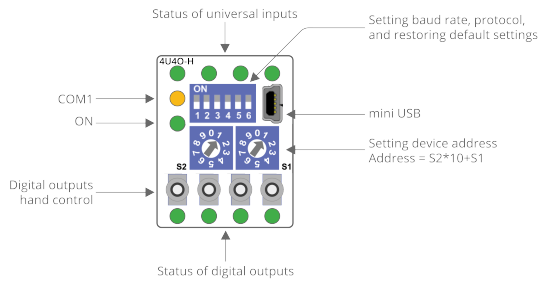


Figure 20. The 4U4O-H top panel

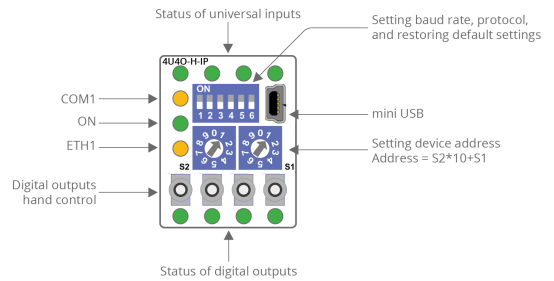


Figure 21. The 4U4O-H-IP top panel

## MINI 4U4A-H and 4U4A-H-IP

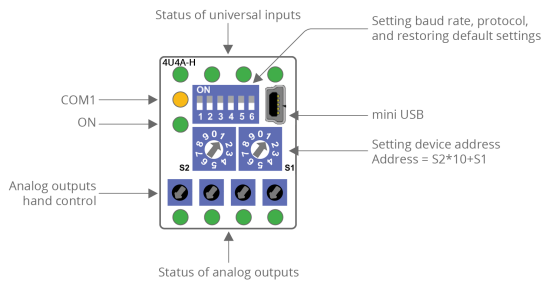


Figure 22. The 4U4A-H top panel

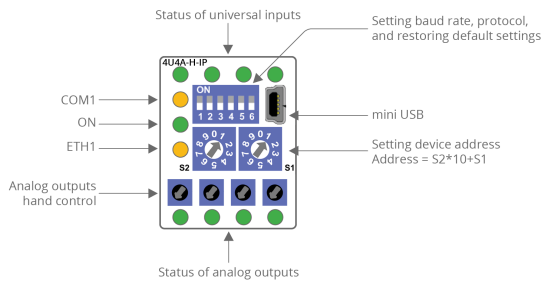


Figure 23. The 4U4A-H-IP top panel

## MINI 40-H and 40-H-IP

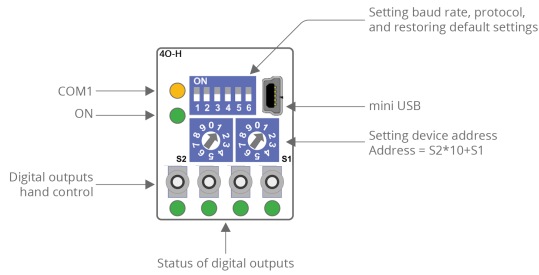


Figure 24. The 40-H top panel

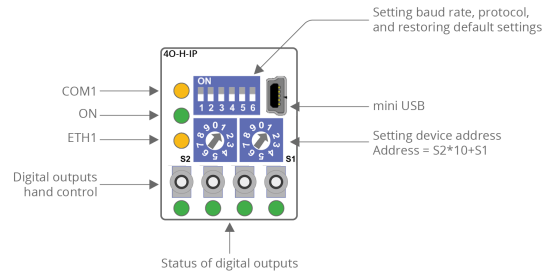


Figure 25. The 40-H-IP top panel

## MINI 4TO-H and 4TO-H-IP

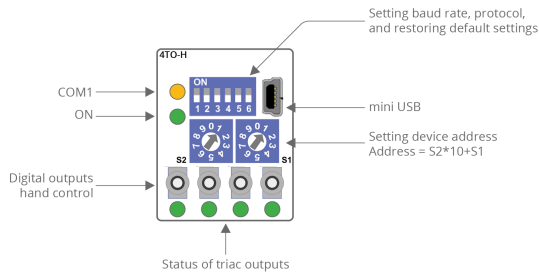


Figure 26. The 4TO-H top panel

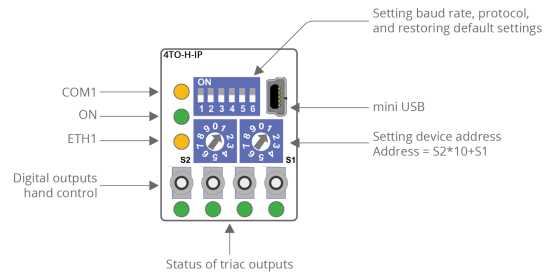


Figure 27. The 4TO-H-IP top panel

## 4.3.3 MAX Series Front Panels

### MAX 120-H and 120-H-IP

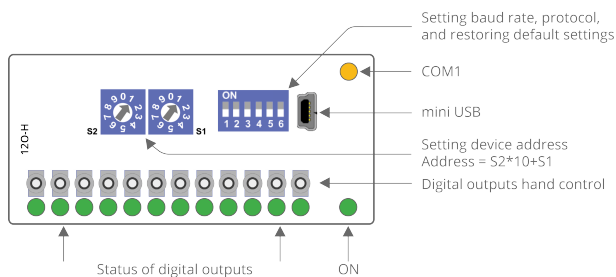


Figure 28. The 120-H top panel

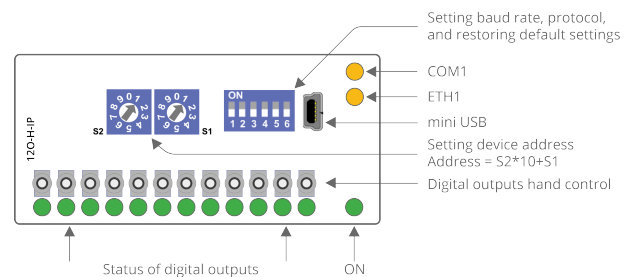


Figure 29. The 120-H-IP top panel

### MAX 24I and 24I-IP

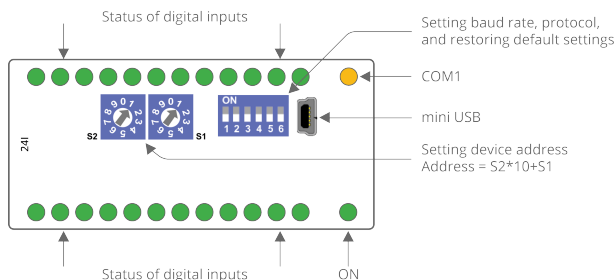


Figure 30. The 24I top panel

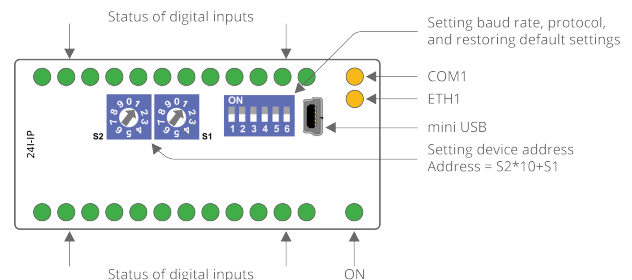


Figure 31. The 24I-IP top panel

- The power LED (ON) is on (green) if the module runs properly.
- The communication LED (COM1) is on (orange) for 20 ms after sending each message. If the module receives/sends a lot of messages, the LED can be lit continuously.

- The communication LED (ETH1) lights up (orange) in the transmit or receive state when sending/receiving each package through the Ethernet port. As long as the device sends/receives packages, the communication LED blinks continuously.
- LEDs indicating the status of the universal inputs (U1-Un) are lit when the resistance connected to the input is less than 5 kΩ (dry contact input is active).

**WARNING!**

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

- LEDs indicating the status of the digital inputs (I1-In) are lit when the input is active.
- LEDs indicating the status of the analog outputs (A1-An) are lit when the output voltage or PWM duty cycle is greater than 0.
- LEDs indicating the status of the digital outputs (O1-On) are lit when the output is enabled.
- LEDs indicating the status of the triac outputs (TO1-TO<sub>n</sub>) are lit when the output is enabled or PWM duty cycle is greater than 0.

## 4.4 RS485 Port

### 4.4.1 RS485 Communication Bus Connection

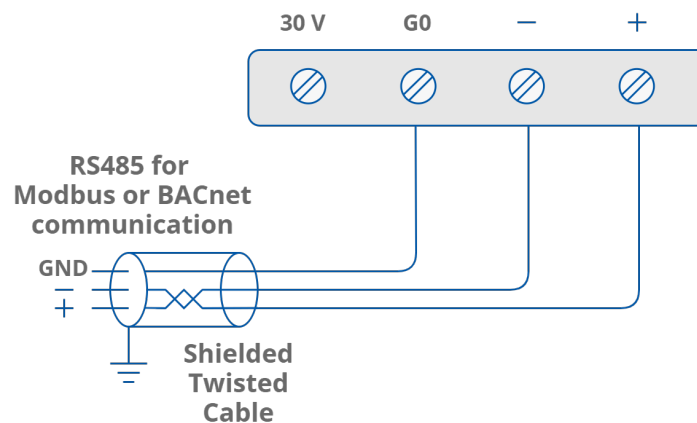


Figure 32. RS485 connection

### 4.4.2 RS485 Network Termination

Transmission line effects often present problems for data communication networks. These problems include reflections and signal attenuation.

To eliminate the presence of reflections of signal from the end of the cable, the cable must be terminated at both ends with a resistor across the line adequate to its characteristic impedance. Both ends must be terminated since the propagation is bidirectional. In case of an RS485 twisted pair cable this termination is typically 120 Ω.

## 4.5 Setting Module Address in Modbus Network

To determine the address on the Modbus network, the module is equipped with two rotary switches, S1 and S2, located on the top panel of the device.

It is possible to set the device address from 0 to 99.

The address is set with the following formula:

$$\text{Address} = S2 \cdot 10 + S1$$

where S1 and S2 are the values of the switches.

For example:

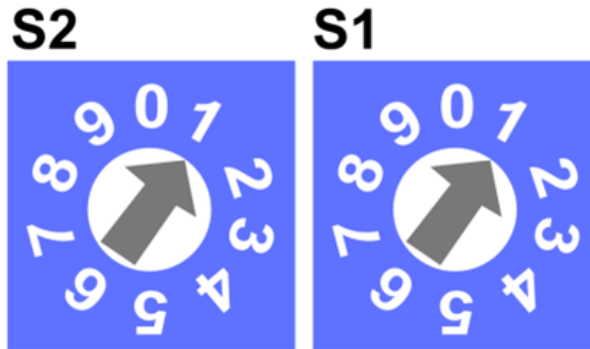


Figure 33. Setting the address in a Modbus network

Switches set as in the figure above will set the module address to 11.

## 4.6 Baud Rate

The transmission baud rate is set with the S3 switch (sections 1, 2, and 3) in accordance with the following table:

1	2	3	Baud Rate
Off (0)	Off (0)	Off (0)	Defined by the user in the register
Off (0)	Off (0)	On (1)	76800
Off (0)	On (1)	Off (0)	4800
Off (0)	On (1)	On (1)	9600
On (1)	Off (0)	Off (0)	19200
On (1)	Off (0)	On (1)	38400
On (1)	On (1)	Off (0)	57600
On (1)	On (1)	On (1)	115200

Table 4. Baud rate selection

## 4.7 Protocol

The protocol is selected with sections 4 and 5 of the S3 switch according to the table:

4	5	Protocol
Off (0)	Off (0)	Modbus RTU
Off (0)	On (1)	Modbus ASCII

4	5	Protocol
On (1)	Off (0)	BACnet master
On (1)	On (1)	BACnet slave

Table 5. Protocol selection

**WARNING!**

The BACnet slave mode does not support the discover function.

### 4.7.1 Free Modbus TCP Sockets Counter

**Note:**

The free Modbus TCP sockets counter is implemented from the 7.0 firmware.

The counter of free Modbus TCP sockets informs the user about the number of available Modbus TCP connections for the device.

The maximum number of TCP connections is 4.

The number of free Modbus TCP sockets can be reached in two ways:

- in the 292 Modbus register (read-only): the register shows values from 0 to 4, where 0 means no available connections, 4 means 4 available connections;
- in the [IP Configuration](#) tab in the web server.

### 4.8 DHCP

Unable to render include or excerpt-include. Could not retrieve page.

The DHCP functionality allows to turn on/off an automatic IP address setting from the available DHCP server. The DHCP functionality may be turned on/off in the web configurator for modules and iSMA Configurator.

Unable to render include or excerpt-include. Could not retrieve page.

### 4.9 Default Settings

In its out-of-the-box state, as well as after restoring the default values, the device has the following default register values:

Register Name	Default Value
COUNTER 1-12	0
COUNTER 12-24 (24I and 24I-IP)	0
USER BAUD RATE	7680 (76800 bps)
STOP BITS	1

DATA BITS	8
PARITY BITS	0
RESPONSE DELAY	0
WATCHDOG TIME	0 (disabled)
DEFAULT STATE OF DIGITAL OUTPUTS (1-12)	0
DEFAULT STATE OF THE ANALOG OUTPUTS (DIGITAL 1-6)	0
DEFAULT STATE OF THE ANALOG OUTPUTS (1-6)	0
UNIVERSAL INPUT CONFIGURATION (1-8)	3 (10K3A1 NTC (°C))
INPUT FILTER TIME CONSTANT (1-8)	2
UNIVERSAL INPUT RESOLUTION (1-8)	1 (12-bit)
ANALOG OUTPUT CONFIGURATION (1-6)	1 (voltage)
<b>Only for IP Modules</b>	
USERNAME	admin
PASSWORD	1000
IP ADDRESS	192.168.1.123
MASK	255.255.255.0
GATEWAY	192.168.1.1
DHCP	Disabled
HTTP PORT	80
MODBUS TCP PORT	502
MODBUS TCP TIMEOUT	60 s
RS485 TIMEOUT	500 ms
RS485 BIASING RESISTORS (MINI only)	DISABLED
SEND MODBUS ERRORS	ENABLED

Table 6. Default values

### 4.9.1 Restoring Default Settings

To restore the default configuration of all registers, follow the steps below:

- turn off the power supply;
- set section 6 of the S3 switch to on;



- turn on the power supply, the power LED will start blinking;
- switch section 6 of the S3 switch to off to restore the default settings. To cancel the reset, turn off the power, and switch section 6 of the S3 switch to the off position.

## 5 Inputs and Outputs

### 5.1 Local I/O

The multiprotocol I/O modules are equipped with local inputs and outputs (universal inputs, digital inputs, analog outputs, digital outputs, and triac outputs), and their quantities differ between the modules types, according to the table:

Module Type	UI	DI	AO	DO	TO
4I4O-H		4		4	
4I4O-H-IP		4		4	
4O-H				4 (NC/NO-8A)	
4O-H-IP				4 (NC/NO-8A)	
4U4A-H	4		4		
4U4A-H-IP	4		4		
4U4O-H	4			4	
4U4O-H-IP	4			4	
8I		8			
8I-IP		8			
8U	8				
8U-IP	8				
4TO-H					4
4TO-H-IP					4
MIX18	5	5	4	4	
MIX18-IP	5	5	4	4	
MIX38	8	12	6	12	
MIX38-IP	8	12	6	12	
12O-H				12	
12O-H-IP				12	
24I		24			
24I-IP		24			

Table 7. Inputs and outputs in multiprotocol I/O modules

## 5.2 Universal Inputs

Universal inputs support four types of input signals:

- voltage (0-10 V DC, input impedance 100 kΩ);
- current (0-20 mA);
- resistance and temperature measurement (10k thermistor, a full list of supported temperature sensors is available here: [List of Supported Temperature Sensors](#));
- dry contact (output current 1 mA).

Current measurement is realized by voltage measurement and 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.

### 5.2.1 Universal Input Voltage Connection

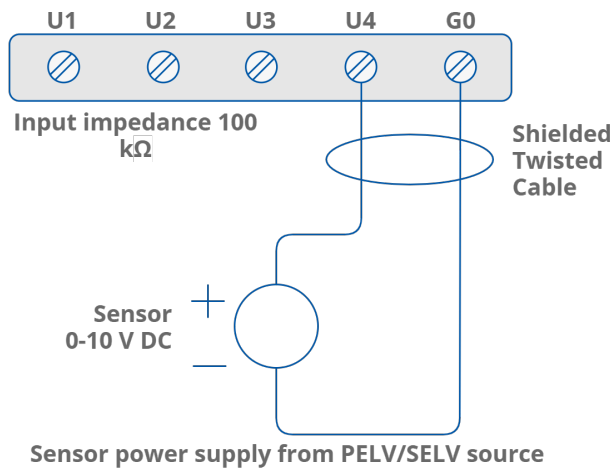


Figure 34. A universal input voltage connection

### 5.2.2 Universal Input Current Connection

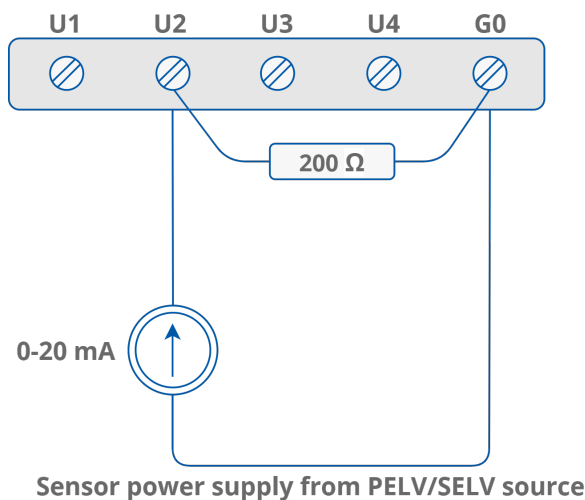


Figure 35. A universal input current connection

### 5.2.3 Universal Input Resistance Connection

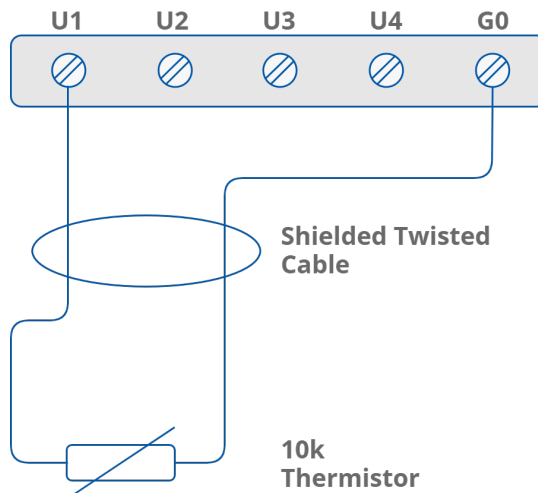


Figure 36. A universal input resistance connection

### 5.2.4 Universal Input Dry Contact Connection

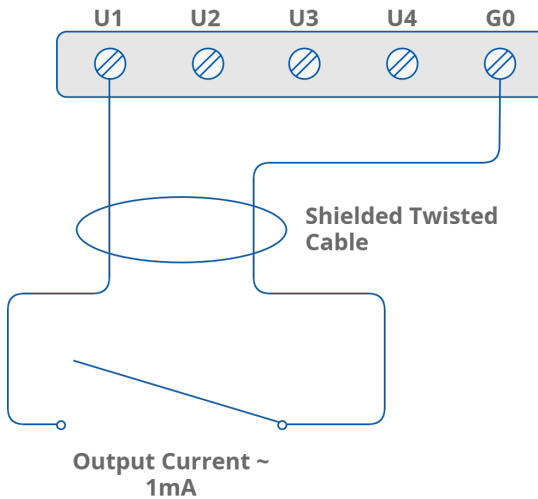


Figure 37. A universal input dry contact connection

## 5.3 Digital Inputs

Digital inputs operate as standard dry contact inputs and, additionally, as high speed pulse counters up to 100 Hz.

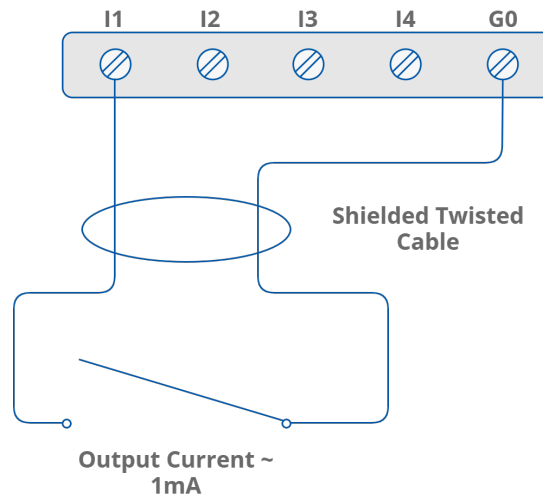


Figure 38. A digital input connection

### 5.3.1 Digital Input Counter

A digital input can work as a counter of dry contact pulses up to 100 Hz. The connection is identical as in case of the dry contact input.

## 5.4 Analog Outputs

Analog outputs provide a 0-10 V DC output with maximum load up to 20 mA. They support three types of output signals:

- voltage (0-10 V DC) with maximum load up to 20 mA;
- digital;
- Pulse Width Modulation (PWM) 0,01 Hz, 0,1 Hz, 1 Hz, 10 Hz, 100 Hz.

### 5.4.1 Analog Output Voltage Connection

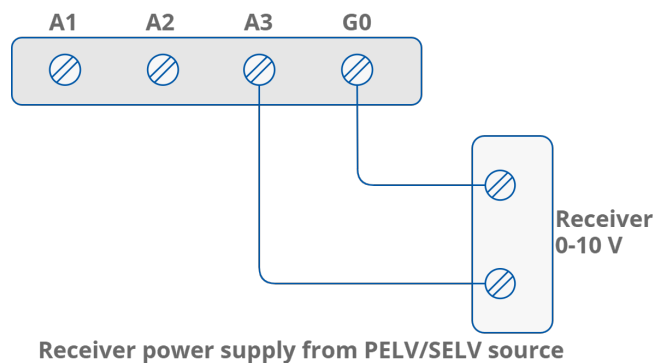


Figure 39. An analog output voltage connection

### 5.4.2 Analog Output Relay Connection

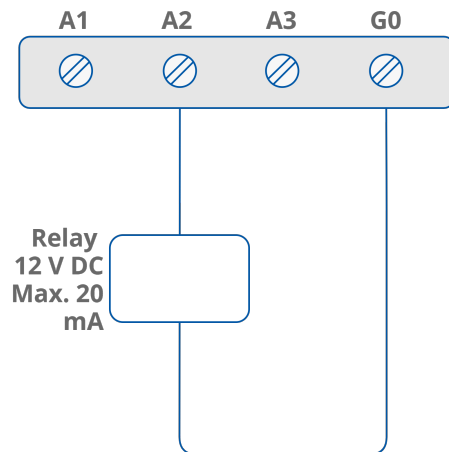


Figure 40. An analog output relay connection

### 5.4.3 Analog Output Actuator Connection

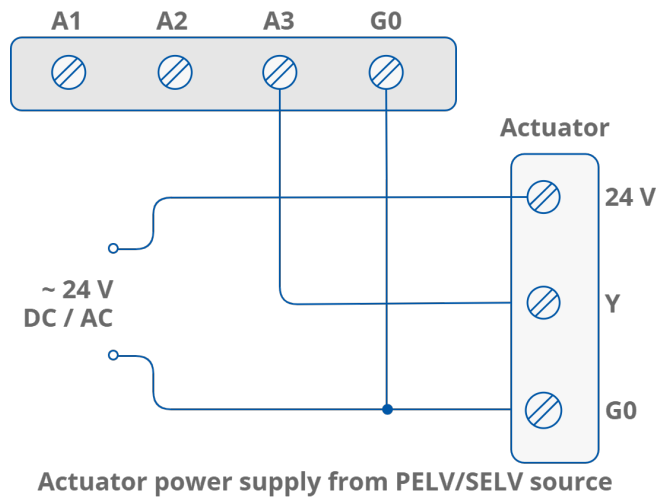


Figure 41. An analog output actuator connection

## 5.5 Digital Outputs

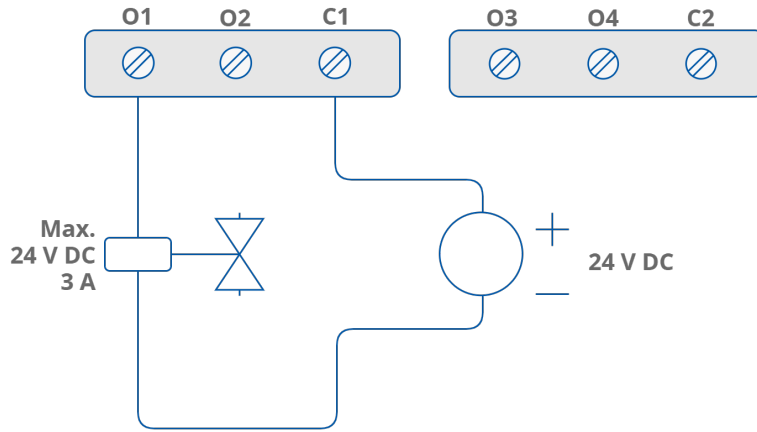
Digital outputs operate as relay outputs with maximum loads of:

		UL compliant ratings	Maximum ratings
Digital outputs (relays)	Resistive load (AC1)	3 A at 24 V AC 3 A at 30 V DC	3 A at 230 V AC 3 A at 30 V DC
	Inductive load (AC3)	8 VA at 24 V AC 30 W at 30 V DC	75 VA at 230 V AC 30 W at 30 V DC
40-H and 40-H-IP	Resistive load (AC1)	8 A at 230 V AC 8 A at 30 V DC	8 A at 230 V AC 8 A at 30 V DC

	Inductive load (AC3)	37 VA at 230 V AC 90 W at 30 V DC	360 VA at 230 V AC 90 W at 30 V DC
--	----------------------	--------------------------------------	---------------------------------------

Table 8. Resistive and inductive loads for digital outputs

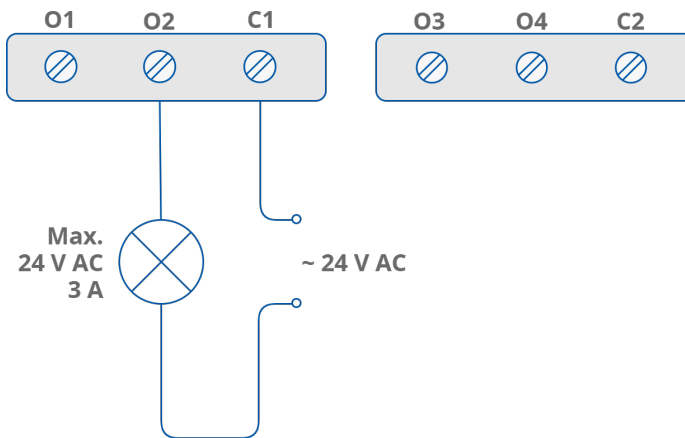
### 5.5.1 Digital Output Solenoid Valve Connection



Every CX terminal can be supplied by different PELV/SELV source

Figure 42. A digital output solenoid valve connection

### 5.5.2 Digital Output Resistive Load Connection



Every CX terminal can be supplied by different PELV/SELV source

Figure 43. A digital output resistive load connection

### 5.5.3 Digital Output Inductive Load Connection

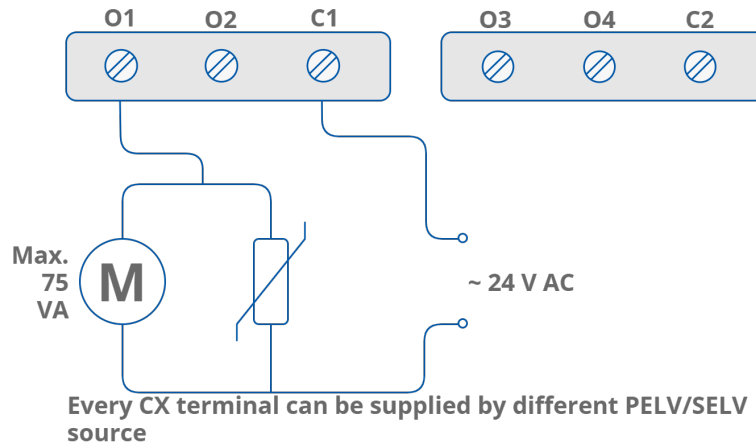


Figure 44. A digital output inductive load connection

### 5.6 Triac Outputs

Triac outputs work as typical binary outputs or in Pulse Width Modulation (PWM) mode: 0,01 Hz, 0,1 Hz, 1 Hz, 10 Hz.

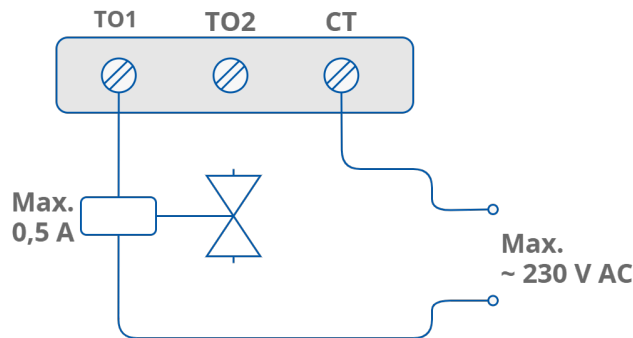


Figure 45. A triac output connection



## 6 Configuration Registers

### WARNING!

Changing the configuration parameters of the transmission will only take effect after restarting the unit or invoking the Reload Settings action (except for the registers the value of which is read from the switch).

### 6.1 Firmware Version and Module Type (30001)

In this register type and firmware version of the module are encoded.

A low byte contains information about the type of module in accordance with the table below:

Value	Type
81 <sub>10</sub> (0x51 <sub>16</sub> )	8I
91 <sub>10</sub> (0x5B <sub>16</sub> )	8I-IP
84 <sub>10</sub> (0x54 <sub>16</sub> )	8U
94 <sub>10</sub> (0x5E <sub>16</sub> )	8U-IP
83 <sub>10</sub> (0x53 <sub>16</sub> )	4I4O-H
93 <sub>10</sub> (0x5D <sub>16</sub> )	4I4O-H-IP
85 <sub>10</sub> (0x55 <sub>16</sub> )	4U4O-H
95 <sub>10</sub> (0x5F <sub>16</sub> )	4U4O-H-IP
86 <sub>10</sub> (0x56 <sub>16</sub> )	4U4A-H
96 <sub>10</sub> (0x60 <sub>16</sub> )	4U4A-H-IP
82 <sub>10</sub> (0x52 <sub>16</sub> )	4O-H
92 <sub>10</sub> (0x5C <sub>16</sub> )	4O-H-IP
87 <sub>10</sub> (0x57 <sub>16</sub> )	4TO-H
97 <sub>10</sub> (0x61 <sub>16</sub> )	4TO-H-IP
50 <sub>10</sub> (0x32 <sub>16</sub> )	MIX18
51 <sub>10</sub> (0x33 <sub>16</sub> )	MIX38
52 <sub>10</sub> (0x34 <sub>16</sub> )	MIX18-IP
53 <sub>10</sub> (0x35 <sub>16</sub> )	MIX38-IP

Value	Type
88 <sub>10</sub> (0x58 <sub>16</sub> )	12O-H
98 <sub>10</sub> (0x62 <sub>16</sub> )	12O-H-IP
89 <sub>10</sub> (0x59 <sub>16</sub> )	24I
99 <sub>10</sub> (0x63 <sub>16</sub> )	24I-IP

Table 9. Firmware version and module type

The high byte contains the module firmware version multiplied by 10.

For example:

In the 30001 register, number 12810<sub>10</sub> = 0x320A<sub>16</sub>, which means that it is module MIX18 (0x32) with firmware in version 1.0 (0x0A<sub>16</sub> = 10<sub>10</sub>).

## 6.2 Module Address (30002)

This register contains information about the address of the Modbus module. This address is set with switches S1 and S2 (see section [Setting Module Address](#)).

## 6.3 Baud Rate and Protocol (30003)

The register contains information about the baud rate and type of protocol in accordance with the table below. This register reflects the state of S3 switch.

Baud rate				Protocol		
Bit 0	Bit 1	Bit 2	Baud rate	Bit 3	Bit 4	Protocol
0	0	0	User defined	0	0	Modbus RTU
0	0	1	76800	0	1	Modbus ASCII
0	1	0	4800	1	0	BACnet Master
0	1	1	9600	1	1	BACnet Slave
1	0	0	19200			
1	0	1	38400			
1	1	0	57600			
1	1	1	115200			

Table 10. Baud rate and protocol

## 6.4 Counter of Received Messages (30004)

The 32-bit register with the number of valid Modbus messages received by the module, which was powered up last. The value is reset after the power cycle or after changing transmission parameters (speed, stop bits, parity, etc.).

## 6.5 Counter of Error Messages (30006)

The 32-bit register with the number of error Modbus messages received by the module, which was powered up last. The value is reset after the power cycle or after changing transmission parameters (speed, stop bits, parity, etc.).

## 6.6 Counter of Sent Messages (30008)

The 32-bit register with the number of Modbus messages sent by the module, which was powered up last. The value is reset after the power cycle or after changing transmission parameters (speed, stop bits, parity, etc.).

## 6.7 Up Time (30012)

This 32-bit register contains module counting time in seconds from the last powering up or module reset.

## 6.8 Hardware Version (30130)

This 16-bit register contains the module hardware version multiplied by 10.

## 6.9 MAC Address (30131)

This 48-bit register contains MAC address information of the module.

## 6.10 Device Actions (40001)

Setting the 40001 register, according to the table below, enables 1 of 4 available actions: module reset, reloading the settings, setting to default, and entering the bootloader.

Value	Action
511	Reset
767	Reload settings
1023	Set to default
1279	Enter bootloader

Table 11. Device actions

## 6.11 Baud Rate (40136)

If sections 1, 2, and 3 of the S3 switch are in off position, the baud rate is determined in accordance with this register. The baud rate is determined with the following formula:

Baud rate = register value • 10

## 6.12 Stop Bits (40137)

The number of stop bits is determined on the basis of this register in accordance with the following table:

Value	No. of Stop Bits
1 (default)	1
2	2
256	RS485 biasing*

Table 12. Stop bits

\* Bit No. 8 activates RS485 biasing resistors in order to pull-up the voltage on the RS485 bus. If the bit no. 8 is true (bit 8 = 1), RS485 biasing resistors are activated. The function is **only** available in **MINI IP I/O modules** with hardware version  $\geq 2.0$

The biasing resistors are useful in case the iSMA modules are connected with third-party devices with the same RS485 bus and communication errors appear on the network.

### WARNING!

Only a single device in the network can have biasing resistors activated!

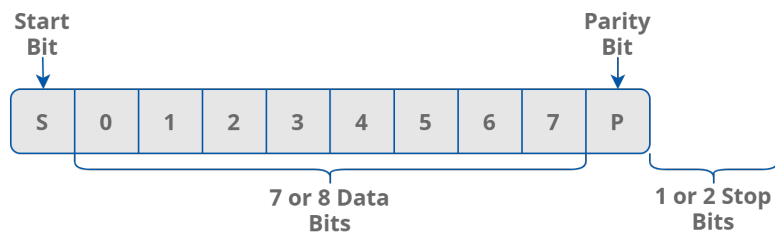


Figure 46. Modbus frame

## 6.13 Data Bits (40138)

The number of data bits transmitted in a single byte is determined according to the following table:

Value	No. of Data Bits
7	7
8 (default)	8

Table 13. Data bits

## 6.14 Parity Bit (40139)

Every byte of data being transferred may have additional protection in the form of a parity bit added before the stop bit (bits).

The method of calculating the parity bit is presented in the table below:

Register Value	Type of Parity Bit
0 (default)	None
1	Odd (number of all ones in a byte is odd)
2	Even (number of all ones in a byte is even)
3	Always 1
4	Always 0

Table 14. Parity bit

## 6.15 Response Delay Time (40140)

The value of this 16-bit register determines the number of milliseconds to wait before the unit answers the question. This time is used to extend the interval between the question and answer. The default value of 0 means no delay (the answer is sent once during the transmission of 3.5 character required by the protocol Modbus RTU).

## 6.16 Watchdog Time (40141)

This 16-bit register specifies the time (expressed in seconds) to watchdog reset. If the module does not receive any valid message within that time, all digital and analog outputs will be set to the default state.

This feature is useful in case of an interruption in data transmission, and if, for security reasons, output states must be set to the appropriate state in order to avoid endangering the safety of persons or the property.

The default value is 0 seconds, which means the watchdog function is disabled.

If the watchdog is triggered, the power LED blinks in the specified sequence (3 blinks with 20 Hz frequency and 1-second pause).

## 7 LocalIO Registers

The following sections describe the Modbus registers dedicated to inputs and outputs of the iSMA-B-MINI/MIX/MAX modules.

### 7.1 Universal Input Registers

#### 7.1.1 Status of Universal Inputs Working as Digital Inputs (30017)

This 16-bit register contains information about the status of digital inputs (dry contacts). If the input is shorted to the ground, the corresponding bit value is set to 1 in accordance with the following table:

No. of Bit in Register	No. of Universal Input
0	1
1	2
2	3
3	4
4	5
5	6
6	7
7	8

Table 15. UI register operating DI for MIX38 and MIX38-IP

#### 7.1.2 Universal Input Voltage (Current) Measure 1-8 (30071, 30073, 30075, 30077, 30079, 30081, 30083, 30085)

These 16-bit registers contain the results of measuring the voltage for each input. The result is expressed in millivolts.

The results of measuring the current for each input are stored in the same registers. In such case, the current value has to be calculated according to the equation:

$$I = \text{register value} / 200 \text{ [mA]}$$

#### 7.1.3 Universal Input Temperature Measurement 1-8 (30072, 30074, 30076, 30078, 30080, 30082, 30084, 30086)

In these 16-bit registers the result is expressed in Celsius degrees  $\cdot 10$ .

#### 7.1.4 Universal Input Resistance Measurement 1-8 (30103-30118)

In these 16-bit registers the result is expressed in  $\Omega$  or in  $0.1 \Omega$  units for PT1000 and NI1000 configuration. In the register with the lower number, it is the lower storage part of the result and the higher register storage part of the result.

### 7.1.5 Universal Input Configuration 1-8 (40151-40158)

These 16-bit registers are used to configure universal inputs in accordance with the following table:

Register Value	Description
0	Off resistance measurement (only measuring the voltage, dry contact off)
1 (default)	Temperature sensor 10K3A1 NTC B=3975K (°C)
2	Temperature sensor 10K4A1 NTC B=3695K (°C)
3	Temperature sensor 10K NTC B=3435K Carel (°C)
4	Temperature sensor 20K6A1 NTC B=4262K (°C)
5	Temperature sensor 2,2K3A1 NTC B=3975K (°C)
6	Temperature sensor 3K3A1 NTC B=3975K (°C)
7	Temperature sensor 30K6A1 NTC B=4262K (°C)
8	Temperature sensor SIE1 (°C)
9	Temperature sensor TAC1 (°C)
10	Temperature sensor SAT1 (°C)
16	Temperature sensor Pt1000 (°C)
17	Temperature sensor NI1000 (°C)
18	NI1000 21C (°C)
19	NI1000 LG (°C)
20 (default US version)	10K Type2 NTC B=3975K (°F)
21	10K Type3 NTC B=3695K (°F)
22	20K NTC B=4262K (°F)
23	3K NTC B=3975K (°F)
24	PT1000 (°F)
25	NI1000 32F (°F)
26	NI1000 70F (°F)
126	Resistance measurement
+128	Off voltage measurement

Register Value	Description
(set 7. bit of register)	

Table 16. UI configuration

### 7.1.6 Filter Time Constant of the Universal Input 1-8 (40159-40166)

These 16-bit registers contain a time constant low pass filter. The value is expressed in seconds. Valid values must be between 0 and 60 seconds. The default filter value is 2 seconds. Setting the value to 0 disables the filter.

In case of the UI shortcut or open-loop, the filter is reset and the UI value filtering is stopped.

### 7.1.7 Resolution of the Universal Inputs (40167)

This register is used to determine the bit resolution for each of the universal inputs.

Setting the bit to 0 sets the resolution of the converter to 12-bit. Setting the bit to 1 sets the resolution of the converter to 16-bit.

**WARNING!**

Setting 16-bit resolution increases the measurement time of one channel from 10 ms to 140 ms. The total time taken to measure all the channels increases from 50 ms to 700 ms.

Each input can be configured separately in accordance with the following table:

No. of Bit in Register	No. of Universal Input
0	1
1	2
2	3
3	4
4	5
5	6
6	7
7	8

Table 17. Universal inputs resolution for MIX38 and MIX38-IP



## 7.2 Digital Input Registers

### 7.2.1 State of Digital Inputs (30016 for MINI/MIX/MAX Series, 30216 for MAX Series)

This 16-bit registers contain the status of digital inputs. Short-circuit input to GND sets the corresponding bit in the register in accordance with the table below:

No. of Bit in the 30016 Register	No. of Digital Input
0	1
1	2
...	...
10	11
11	12
No. of Bit in the 30216 Register	No. of Digital Input
0	13
1	14
...	...
10	23
11	24

Table 18. Status of DI

### 7.2.2 Counter 1-12 (40023-40046 for MINI/MIX/MAX Series and 40223-40246 for MAX Series)

The modules have 32-bit counters, one for each digital input.

The register with a lower number contains a lower byte of the counter and in the register with a higher number is stored in the higher byte of the counter.

In order to change the value of the register, write any value (called 'preset') for pulse counting registers. In special cases, the counter can be reset by entering 0. Resetting the counter is also possible with the 40022 register and 40222 register for 24I and 24I-IP modules.

### 7.2.3 Resetting the Counters (40022 for MINI/MIX/MAX Series and 40222 for MAX Series)

Setting a true value of a particular bit of this 16-bit register results in resetting the corresponding counter (setting it to 0) in accordance with the following table:

No. of Bit in the 40222 Register	No. of Digital Input
0	1
1	2
...	...
10	11
11	12
No. of Bit in the 40222 Register	No. of Digital Input
0	13
1	14
...	...
10	23
11	24

Table 19. Resetting counters

### 7.3 Analog Output Registers

#### 7.3.1 State of Analog Outputs Operating as Digital Outputs (40019)

Setting a true value of a particular bit of this 16-bit register causes setting the maximum output voltage (10 V) on the corresponding output and setting the corresponding register with analog output value (40121-40126) to 0.

Bits of the register correspond to the following analog outputs.

No. of Bit in the Register	No. of Analog Output
0	1
1	2
2	3
3	4
4	5
5	6

Table 20. AO operating as DO for MIX38 and MIX38-IP

### 7.3.2 Value of Analog Output 1-6 (for MIX Series 40121-40126), 1-4 (for MINI Series 40121-40124),

These 16-bit registers contain the value of analog output voltage in mV.

### 7.3.3 Default State of the Analog Outputs (Digital) (40144)

Setting a true value of a particular bit of this 16-bits register sets the maximum voltage (10 V) on the corresponding analog output after turning the power on or resetting the watchdog.

Bits of the register correspond to the following analog outputs:

No. of Bit in the Register	No. of Analog Output
0	1
1	2
2	3
3	4
4	5
5	6

Table 21. Default state of AO operating as DO form MIX38 and MIX38-IP

### 7.3.4 Default State of Analog Outputs 1-6 (for MIX Series: 40145-40150), 1-4 (for MINI Series: 40145-40148)

These 16-bit registers contain the values of voltage in mV, which appear on the analog outputs after turning the power on or resetting the watchdog.

### 7.3.5 Configuration Mode of Analog Outputs 1-6 (for MIX Series: 40168-40173), 1-4 (for MINI Series: 40168-40171)

These 16-bit registers contain information about the mode of the analog outputs according to the following table:

Register Value	Description
0 (default)	Voltage output 0-10 V
1	PWM 1Hz
2	PWM 10Hz
3	PWM 100Hz
4	PWM 0.1Hz

Register Value	Description
5	PWM 0.01Hz

Table 22. AO type settings

### 7.3.6 Hand Control Status of Analog Outputs (30015)

This register is available only for modules with the manual control of analog outputs.

No. of Bit in Register	Description
0, 1	Hand status of outputs 1
2, 3	Hand status of outputs 2
4, 5	Hand status of outputs 3
6, 7	Hand status of outputs 4

Table 23. AO hand status bits

Value of the Hand Status	Status Description
0	AUTO
1	HAND CONTROL

Table 24. AO hand status value

The current value of the output in the hand mode determines registers from 30125 to 30128.

### 7.3.7 Hand Control Value of 1-4 Analog Outputs (for MINI Series: 30125-30128)

The registers contain a percentage value of the manual control for outputs from 1 to 4.

## 7.4 Digital Output Registers

### 7.4.1 State of Digital Outputs (40018)

This 16-bit register contains the state of digital outputs. Setting a particular bit in the register activates the corresponding digital output according to the following table:

No. of Bit in Register	No. of Digital Output
0	1
1	2
2	3
3	4

No. of Bit in Register	No. of Digital Output
4	5
5	6
6	7
7	8
8	9
9	10
10	11
11	12

Table 25. State of DO for MIX38 and MIX38-IP

### 7.4.2 Default State of Digital Outputs (40143)

This 16-bit register contains the default state of the digital output device after the start or watchdog reset. Register bits correspond to the digital outputs according to the following table:

No. of Bit in the Register	No. of Digital Output
0	1
1	2
2	3
3	4
4	5
5	6
6	7
7	8
8	9
9	10
10	11
11	12

Table 26. Default state of DO for MIX38 and MIX38-IP

### 7.4.3 Hand Control Status of Digital Outputs (for MINI/MIX/MAX Series: 30015, for MAX Series: 30215)

This register is available only for modules with the manual control of outputs.

No. of Bit in the 30015 Register	Description
0, 1	Hand status of output 1
2, 3	Hand status of output 2
4, 5	Hand status of output 3
6, 7	Hand status of output 4
No. of Bit in the 30215 Register	Description
0, 1	Hand status of output 5
2, 3	Hand status of output 6
4, 5	Hand status of output 7
6, 7	Hand status of output 8
8, 9	Hand status of output 9
10, 11	Hand status of output 10
12, 13	Hand status of output 11
14, 15	Hand status of output 12

Table 27. DO hand status bits

Value of Hand Status	Status Description
0	AUTO
2	HAND OUT = 0
3	HAND OUT = 1

Table 28. DO hand status value

## 7.5 Triac Output Registers

### 7.5.1 State of Triac Outputs (40018)

This 16-bit register contains the state of triac outputs in digital mode. Setting a particular bit in the register activates the corresponding triac output according to the following table:

No. of Bit in the Register	No. of Triac Output
0	1
1	2
2	3
3	4

Table 29. State of TO for 4TO-H and 4TO-H-IP

### 7.5.2 Default State of Triac Outputs (40143)

This 16-bit register contains the default state of the triac output device after the start or after resetting the watchdog.

The register bits correspond with triac outputs according to the following table:

No. of Bit in the Register	No. of Triac Output
0	1
1	2
2	3
3	4

Table 30. Default state for 4TO-H and 4TO-H-IP

### 7.5.3 Value of 1-4 Triac PWM Outputs (40121-40124)

These 16-bit registers contain the value of the duty that appears on the PWM output (expressed in percents). Output working mode is defined by the CONFIGURATION mode of the triac output.

### 7.5.4 Default State of 1-4 Triac PWM Outputs (40145-40148)

These 16-bit registers contain the value of the duty that appears on the triac output (expressed in percents) after turning the power on or resetting the watchdog.

### 7.5.5 Configuration Mode of 1-4 Triac Outputs (40168-40171)

These 16-bit registers contain information about the mode of triac outputs according to the following table:

Register Value	Description
0 (default)	Digital Output
1	PWM 1Hz
2	PWM 10Hz

Register Value	Description
3	Not supported
4	PWM 0.1 HZ
5	PWM 0.01Hz

Table 31. TO type settings

### 7.5.6 Hand Control Status of the Triac Outputs (30015)

This register is available only for modules with the manual control of outputs.

No. of Bit in the Register	Description
0,1	Hand status of outputs 1
2,3	Hand status of outputs 2
4,5	Hand status of outputs 3
6,7	Hand status of outputs 4

Table 32. TO hand status bits

Value of Hand Status	Status Description
0	AUTO
2	HAND OUT = 0
3	HAND OUT = 1

Table 33. TO hand status value

## 7.6 Special Application Modes

### 7.6.1 Special Application Modes for 4I4O-H, 4I4O-H-IP, 4U4O-H, and 4U4O-H-IP

The 4I4O-H, 4I4O-H-IP, 4U4O-H, 4U4O-H-IP modules have simple built-in applications, which can be used to control building devices. These applications control digital output states according to the signals from the digital input. The relation between inputs and outputs is shown in the table below, and it cannot be changed.

Digital Input	Digital Output
DI1	DO1
DI2	DO2
DI3	DO3



Digital Input	Digital Output
DI4	DO4

Table 34. Built-in application determining relations between inputs and outputs

The digital inputs in 4I4O-H, 4I4O-H-IP, 4U4O-H, 4U4O-H-IP modules can be set to work in different modes. There are dedicated registers for operation mode (40176, 40180, 40184, 40188), time parameters (40177, 40181, 40185, 40189), setpoints for heating/cooling modes (40178, 40182, 40186, 40190 4U4O-H, and 4U4O-H-IP only), and for differential value in heating/cooling modes (40179, 40183, 40187, 40191 4U4O-H and 4U4O-H-IP only).

Register	Description
40176	DI1 OPERATION MODE
40177	DI1 TIME VALUE
40178	DI1 SETPOINT (4U4O-H and 4U4O-H-IP only)
40179	DI1 DIFFERENTIAL (4U4O-H and 4U4O-H-IP only)
40180	DI2 OPERATION MODE
40181	DI2 TIME VALUE
40182	DI2 SETPOINT (4U4O-H and 4U4O-H-IP only)
40183	DI2 DIFFERENTIAL (4U4O-H and 4U4O-H-IP only)
40184	DI3 OPERATION MODE
40185	DI3 TIME VALUE
40186	DI3 SETPOINT (4U4O-H and 4U4O-H-IP only)
40187	DI3 DIFFERENTIAL (4U4O-H and 4U4O-H-IP only)
40188	DI4 OPERATION MODE
40189	DI4 TIME VALUE
40190	DI4 SETPOINT (4U4O-H and 4U4O-H-IP only)
40191	DI4 DIFFERENTIAL

Register	Description
	(4U40-H and 4U40-H-IP only)

Table 35. List of registers dedicated for special application mode

### 7.6.2 Operation Mode Registers (40176, 40180, 40184, and 40188)

This register contains information about the module working mode. Available modes and register values are listed in the table below:

Value	OPERATION MODE Register
0	Ordinary IO (def)
1	Monostable Relay
2	Bistable Relay
3	Time Relay NO [ms]
4	Time Relay NC [ms]
5	Time Relay NO [s]
6	Time Relay NC [s]
7	Input Forwarding
8	Heating (4U40-H and 4U40-H-IP only)
9	Cooling (4U40-H and 4U40-H-IP only)

Table 36. Special application modes

The operating mode can be changed by writing the right value in the Operation Mode register.

Special modes are initialized after 3 seconds from the power-up or restart of the module (the time value needed to stabilize the operation of the analog transmitter).

With each change of the input mode, the assigned output is set to default state and the timer used in time-based modes is reset. If the recently selected operating mode is running, the output is controlled according to the new mode activated.

#### Ordinary IO

In this mode, the module operates as a standard IO; the inputs and the outputs are in no relation with each other.

#### Monostable Relay

In this mode, both the rising and the falling edge of the digital input change the output state. The action of a monostable relay can be executed remotely by changing the state of

bit from false to true in the COMMAND register (40020). Outputs can be also overwritten with the DIGITAL OUTPUT register (40018), which allows remote control from BMS.

## Bistable Relay

In this mode, only the rising edge of the digital input changes the output state. The action of a bistable relay can be executed remotely by changing the state of bit from false to true in the COMMAND register (40020). Outputs can be also overwritten by the DIGITAL OUTPUT register (40018), which allows remote control from BMS.

## Time Relay NO [ms]

In this mode, if the output value is false, the rising edge of the digital input sets the output to a true value. Every falling edge of the digital input starts the counter from the beginning so that the output stays in a true value for the time defined in the TIME VALUE register (expressed in milliseconds), counting from the last falling edge of the digital input. The action of the time relay can be executed remotely by changing the state from false to true in the relevant COMMAND register (40020). The outputs can be also overwritten with the register of the DIGITAL OUTPUT module (40018), which allows for remote control from BMS.

## Time Relay NC [ms]

In this mode, if the output value is false, the falling edge of the digital input sets the output to a true value. Every rising edge of the digital input starts the counter from the beginning so that the output stays in true value for a time defined in the TIME VALUE register (expressed in milliseconds), counting from the last rising edge of the digital input. The action of time relay can be executed remotely by changing the state from false to true in the relevant COMMAND register (40020). Outputs can be also overwritten with the register of DIGITAL OUTPUT module (40018), which allows for remote control from BMS.

## Time Relay NO [s]

In this mode, if the output value is false, the rising edge of the digital input sets the output to a true value. Every falling edge on the digital input starts the counter from the beginning so that the output stays in true value for a time defined in TIME VALUE register (expressed in seconds), counting from the last falling edge of the digital input. The action of time relay can be executed remotely by changing the state from false to true in relevant COMMAND register (40020). Outputs can be also overwritten with the register of DIGITAL OUTPUT module (40018), which allows for remote control from BMS.

## Time Relay NC [s]

In this mode, if the output value is false, the falling edge of the digital input sets the output to a true value. Every rising edge on the digital input starts the counter from the beginning so that the output stays in true value for a time defined in the TIME VALUE register (expressed in seconds), counting from the last rising edge of the digital input. The action of time relay can be executed remotely by changing state from false to true in the relevant COMMAND register (40020). Outputs can be also overwritten with the register of DIGITAL OUTPUT module (40018), which allows for remote control from BMS.

## Input Forwarding

In this mode, any signal from the input is transferred directly to the assigned output without any modifications. The operation of the input forwarding mode can be stopped with the block input function.

## Heating Mode (4U40-H and 4U40-H-IP Only)

In this mode, the output is controlled like a typical thermostat, based on the Setpoint register and control value (input value) with differential parameter defined in the Differential register. The output signal works in 2 states, low and high.

If the control value is lower or equal with the difference between the Setpoint register and the Differential register, the output is in the low state.

If the control value is higher or equal with the sum of the Setpoint register and the Differential register, the output is in the high state.

Output in the high state:

Control value  $\geq$  Setpoint + Differential

Output in the low state:

Control value  $\leq$  Setpoint - Differential

The algorithm of the heating mode is shown in chart below.

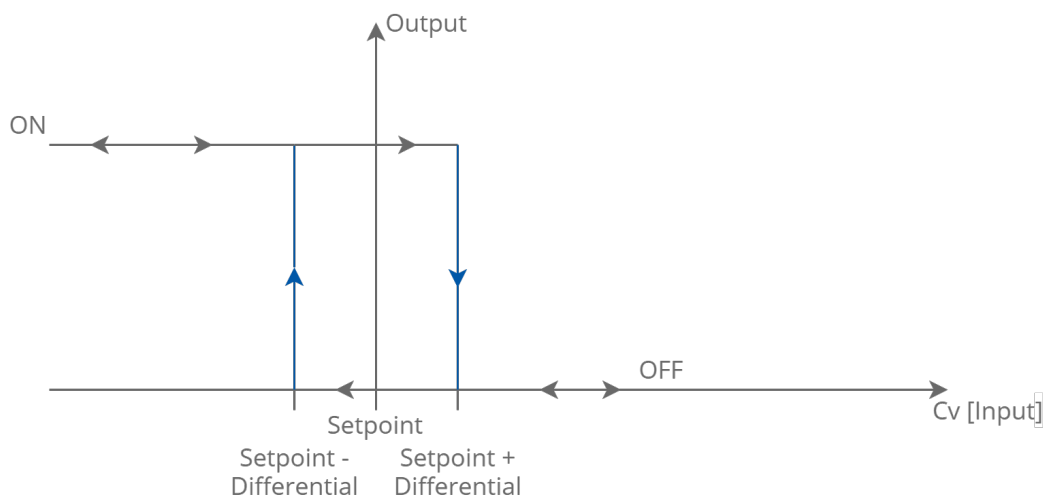


Figure 47. The heating mode algorithm

### WARNING!

In case when the temperature sensor fails (when it is disconnected or shortcut), the heating mode is not active and the output remains in the false state.

## Cooling Mode (4U40-H and 4U40-H-IP Only)

In this mode, the output is controlled like a typical thermostat on the basis of the Setpoint register and the control value (input signal) with the differential parameter defined in the Differential register.

The output signal works in 2 states, low and high.

If the control value is lower or equal with the difference between the Setpoint register and the Differential register, the output is in the low state.

If the control value is higher or equal with the sum of the Setpoint register and Differential register, the output is in the high state.

Output in the low state:

Control value  $\leq$  Setpoint - Differential

Output in the high state:

Control value  $\geq$  Setpoint + Differential

The algorithm of the cooling mode is shown in the chart below.

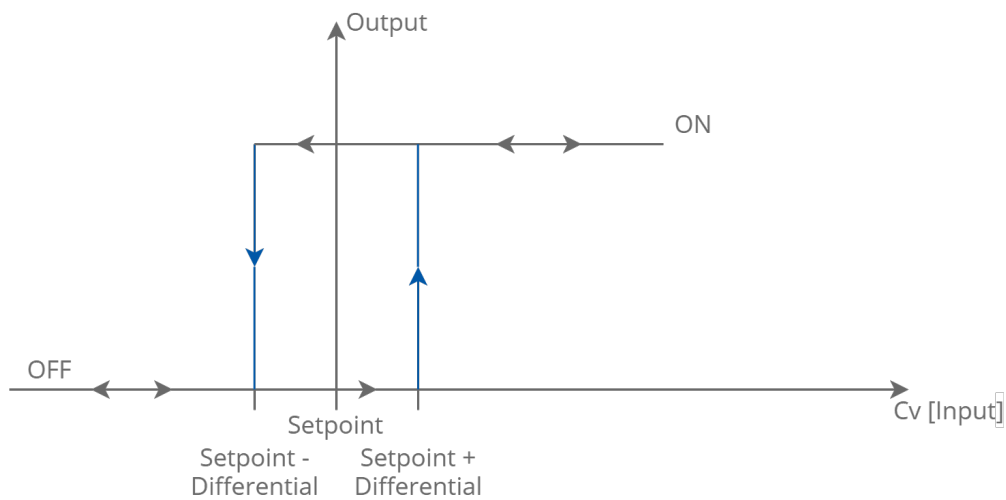


Figure 48. The cooling mode algorithm

**WARNING!**

In case when the temperature sensor fails (if it is disconnected or shortcut), the heating mode does not work and the output remains in the false state.

**7.6.3 Time Value Registers (40177,40181,40185,40189)**

The registers contain time values for TIME RELAY modes. The time unit depends on the selected mode [milliseconds] or [seconds].

**7.6.4 Command Register (40020)**

The module is equipped with a special register called COMMAND (40020). The Command register is used to remotely execute the action (simulate light switch/PIR). The action is executed by changing the state of the relevant bit (changing from false to true). All special application modes can be executed except for Input Forwarding, Heating, and Cooling modes.

No. of Bit in the Register (40020)	Command Input Number
0	1

No. of Bit in the Register (40020)	Command Input Number
1	2
2	3
3	4

Table 37. Command register for special application modes

### 7.6.5 Block Inputs Register (40021)

The Block Inputs register is used to block the physical input signals to take action in logic. By setting a true value on the relevant bit, the module blocks the input and no action will be executed. Setting false value restores normal operation. The block input function does not work when the heating/cooling input mode is set.

No. of Bit in the Register (40021)	Block Input Number
0	1
1	2
2	3
3	4

Table 38. Block input register

### 7.6.6 Setpoint Registers (40178, 40182, 40186, 40190)

The Setpoint registers contain values which are used in heating/cooling modes (4U4O-H and 4U4O-H-IP only) as the setpoints for heating/cooling control algorithm

The default Setpoint value is 21.

The register stores the setpoint multiplied by 10.

### 7.6.7 Differential Registers (40179,40183,40187,40191)

The Differential registers contain values, which are used in heating/cooling modes (4U4O-H and 4U4O-H-IP only) as the differential for heating/cooling control algorithm. Setpoint registers and Differential registers create deadband of the control values, which has no influence on the output.

Deadband = (Setpoint – Differential, Setpoint + Differential)

The default Differential value is 1.

The register stores the differential multiplied by 10.

## 8 Web Configuration

This section outlines all information specific to configuring IP modules in a web server.

**WARNING!**

Please note that web configuration features are available only for IP versions for the multiprotocol I/O modules.

### 8.1 Web Server Access

All IP version modules are equipped with a built-in web server, which allows for showing the status of the module and for changing the configuration.

To access the web server, open a browser, and enter the IP address of the module; the default address for a new module is **192.168.1.123**. Please use the following default credentials:

Username: **admin**

Password: **1000** (by default)

**Note:** The web server can be disabled by setting the HTTP port to 0. This option is available for firmware versions 6.5 and up.

### 8.2 Device Page

This page contains device technical information. Basic Information section includes information about the type of the module, its firmware version and uptime.



Device Information	
Basic Information	
Module Type	ISMA-B-24I-IP
Firmware Version	7.0.29
Bootloader Version	5.0.12
Hardware Version	1.0
Serial Number	2771180023
Uptime	0 days, 0 hours, 1 minutes, 55 seconds

Figure 49. The 24I-IP device page

### 8.3 Local I/O Status and Configuration

#### 8.3.1 Universal Inputs

This page allows for entering the configuration parameters and showing the actual value of the universal inputs. To open this page, please navigate to the Local I/O tab and choose Universal Inputs from the submenu.

iSMA-B MIX38-IP Universal Inputs										
Input	Type	Resolution	UI Flag	Disable Voltage Measure	L.P. Filter Constant	Resistance	Temperature	Voltage	BACnet COV Increment	
Universal Input 1	Temperature 10K3A1 NTC B=3975K (°C)	12 Bit	<input type="checkbox"/>	<input type="checkbox"/>	2	1000000 Ω	-3276.8 °C	0 mV	1.0	
Universal Input 2	Temperature 10K3A1 NTC B=3975K (°C)	12 Bit	<input type="checkbox"/>	<input type="checkbox"/>	2	1000000 Ω	-3276.8 °C	0 mV	1.0	
Universal Input 3	Temperature 10K3A1 NTC B=3975K (°C)	12 Bit	<input type="checkbox"/>	<input type="checkbox"/>	2	1000000 Ω	-3276.8 °C	0 mV	1.0	
Universal Input 4	Temperature 10K3A1 NTC B=3975K (°C)	12 Bit	<input type="checkbox"/>	<input type="checkbox"/>	2	1000000 Ω	-3276.8 °C	0 mV	1.0	
Universal Input 5	Temperature 10K3A1 NTC B=3975K (°C)	12 Bit	<input type="checkbox"/>	<input type="checkbox"/>	2	1000000 Ω	-3276.8 °C	0 mV	1.0	
Universal Input 6	Temperature 10K3A1 NTC B=3975K (°C)	12 Bit	<input type="checkbox"/>	<input type="checkbox"/>	2	1000000 Ω	-3276.8 °C	0 mV	1.0	
Universal Input 7	Temperature 10K3A1 NTC B=3975K (°C)	12 Bit	<input type="checkbox"/>	<input type="checkbox"/>	2	1000000 Ω	-3276.8 °C	0 mV	1.0	
Universal Input 8	Temperature 10K3A1 NTC B=3975K (°C)	12 Bit	<input type="checkbox"/>	<input type="checkbox"/>	2	1000000 Ω	-3276.8 °C	0 mV	1.0	

Figure 50. The 8U-IP Universal Inputs page

Input	Type
Universal Input 1	Temperature 10K3A1 NTC B=3975K (°C)
Universal Input 2	Disabled Resistance Measurement
Universal Input 3	Temperature 10K4A1 NTC B=3695K (°C)
Universal Input 4	Temperature 10K NTC B=3435K Carel (°C)
Universal Input 5	Temperature 20K6A1 NTC B=4262K (°C)
Universal Input 6	Temperature 2.2K3A1 NTC B=3975K (°C)
Universal Input 7	Temperature 3K3A1 NTC B=3975K (°C)
Universal Input 8	Temperature 30K6A1 NTC B=4262K (°C)
	Temperature SIE1 (°C)
	Temperature TAC1 (°C)
	Temperature SAT1 (°C)
	Temperature PT1000 (°C)
	Temperature NI1000 0C (°C)
	Temperature NI1000 21C (°C)
	Temperature NI1000 LG (°C)
	Temperature 10K Type2 NTC B=3975K (°F)
	Temperature 10K Type3 NTC B=3695K (°F)
	Temperature 20K NTC B=4262K (°F)
	Temperature 3K NTC B=3975K (°F)
	Temperature PT1000 (°F)

Figure 51. Types of sensors

The Universal Input table contains the following fields:

- **Sensor type** (read/write): allows for setting a different type of sensor;
- **Resolution** (read/write): resolution measurement 12-bit/16-bit (for PT1000 and NI1000 sensors, please use 16-bit resolution);
- **UI Flag** (read-only): the status of UI configured as dry contact input;
- **Disable Voltage Measurement** (read/write): disables voltage measuring resistance measurement only;
- **L.P. Filter Constant** (read/write): the value of the time constant for low pass filter in seconds. Valid values must be between 0 and 60 seconds (default 2s). Setting the 0 value disables the filter;
- **Resistance** (read-only): in the range from 0 to 1000k [Ω];
- **Temperature** (read-only): in Celsius with the accuracy of 1 degree [°C];
- **Voltage** (read-only): in millivolts [mV];
- **BACnet COV Increment** (read/write): change of state sending threshold value.



**WARNING!**

To save changes, please use the “Submit” button.

### Configuration of Special Application Modes

This page allows for entering the configuration parameters and showing the actual value of Special application modes. To open this page, please navigate to the Local I/O tab and choose a relevant page from the submenu.



Device Local I/O RS485 Configuration IP Configuration Device Management Contact Logout

**iSMA-B-4U40-H-IP Universal Inputs**

Input	Type	Resolution	UI Flag	Disable Voltage Measure	L.P. Filter Constant	Resistance	Temperature	Voltage	BACnet COV Increment
Universal Input 1	Temperature 10K3A1 NTC B=3975K (°C)	12 Bit	<input type="checkbox"/>	<input type="checkbox"/>	2	1000000 Ω	-3276.6 °C	0 mV	1.0
Universal Input 2	Temperature 10K3A1 NTC B=3975K (°C)	12 Bit	<input type="checkbox"/>	<input type="checkbox"/>	2	1000000 Ω	-3276.6 °C	0 mV	1.0
Universal Input 3	Temperature 10K3A1 NTC B=3975K (°C)	12 Bit	<input type="checkbox"/>	<input type="checkbox"/>	2	1000000 Ω	-3276.6 °C	0 mV	1.0
Universal Input 4	Temperature 10K3A1 NTC B=3975K (°C)	12 Bit	<input type="checkbox"/>	<input type="checkbox"/>	2	1000000 Ω	-3276.6 °C	0 mV	1.0

**Special Modes Configuration**

Input	Block Input	Input Mode	Command	Mode Time	Setpoint	Diff
Universal Input 1	<input type="checkbox"/>	Ordinary I/O	<input type="checkbox"/>	1000	21.0 °C	1.0 °C
Universal Input 2	<input type="checkbox"/>	Monostable Relay	<input type="checkbox"/>	1000	21.0 °C	1.0 °C
Universal Input 3	<input type="checkbox"/>	Bistable Relay	<input type="checkbox"/>	1000	21.0 °C	1.0 °C
Universal Input 4	<input type="checkbox"/>	Time Relay NO [ms]	<input type="checkbox"/>	1000	21.0 °C	1.0 °C
		Time Relay NC [ms]	<input type="checkbox"/>	1000	21.0 °C	1.0 °C
		Time Relay NO [s]	<input type="checkbox"/>	1000	21.0 °C	1.0 °C
		Time Relay NC [s]	<input type="checkbox"/>	1000	21.0 °C	1.0 °C
		Input Forwarding	<input type="checkbox"/>			
		Heating	<input type="checkbox"/>			
		Cooling	<input type="checkbox"/>			

Submit Refresh

Figure 52. The 4U40-IP special modes configuration

The Special Modes Configuration table contains the following fields:

- **Block Input** (read/write): allows for blocking a particular input (except for heating/cooling modes);
- **Input Mode** (read/write): allows for selecting the Special Application Mode for a particular input (Ordinary IO in default);
- **Command** (read/write): execution of the Special Application Modes (except for input forwarding, heating/cooling modes);
- **Mode Time** (read/write): time base for time relay application modes (the unit depends on the selected mode: [ms] or [s]);
- **Setpoint** (read/write, 4U40-H-IP only): setpoint value for heating/cooling modes. By default 21;
- **Diff** (read/write, 4U40-H-IP only): differential value for heating/cooling modes. By default 1.

### 8.3.2 Digital Inputs

This page allows for entering the configuration parameters and showing the actual value of the digital inputs. To open this page, please navigate to the Local I/O tab and choose Digital Inputs from the submenu.



Input	State	Reset Flag	Counter State	Counter State To Set
Digital Input 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 13	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 14	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 15	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 16	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 17	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 18	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 19	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 20	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 21	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 22	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 23	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
Digital Input 24	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="2"/>	<input type="text" value="2"/>

Figure 53. The 24I-IP Digital Inputs page

The Digital Input table contains the following fields:

- **State** (read-only): actual input state
- **Reset Flag** (read/write): reset of pulses value (leaving reset active will reset the value of the pulses);
- **Counter State** (read-only): the actual value of pulses saved in EEPROM;
- **Counter State To Set** (read/write): allows for setting the value of the counter.

**WARNING!**

To save changes, please use the “Submit” button.

### 8.3.3 Digital Outputs

This page allows for entering the configuration parameters and showing the actual value of the digital outputs. To open this page, please navigate to the Local I/O tab and choose the Digital Outputs from the submenu.



Output	State	Default State
Digital Output 1	<input type="checkbox"/>	<input type="checkbox"/>
Digital Output 2	<input type="checkbox"/>	<input type="checkbox"/>
Digital Output 3	<input type="checkbox"/>	<input type="checkbox"/>
Digital Output 4	<input type="checkbox"/>	<input type="checkbox"/>
Digital Output 5	<input type="checkbox"/>	<input type="checkbox"/>
Digital Output 6	<input type="checkbox"/>	<input type="checkbox"/>
Digital Output 7	<input type="checkbox"/>	<input type="checkbox"/>
Digital Output 8	<input type="checkbox"/>	<input type="checkbox"/>
Digital Output 9	<input type="checkbox"/>	<input type="checkbox"/>
Digital Output 10	<input type="checkbox"/>	<input type="checkbox"/>
Digital Output 11	<input type="checkbox"/>	<input type="checkbox"/>
Digital Output 12	<input type="checkbox"/>	<input type="checkbox"/>
Watchdog (s)	<input type="text" value="0"/>	

Figure 54. The MIX38-IP Digital Outputs page

The Digital Output table contains the following fields:

- **State** (read/write): the actual state of the digital output;

- **Default State** (read/write): the output state after power-up and watchdog operation;
- **Hand State Output** (read-only, MINI/MAX series only): manually override the status of the switch;
- **Watchdog** (read/write): device watchdog value in seconds.

**WARNING!**

To save changes, please use the “Submit” button.

### 8.3.4 Analog Outputs

This page allows for entering the configuration parameters and showing the actual value of the analog outputs. To open this page, please navigate to the Local I/O tab and choose the Analog Outputs from the submenu.



Output	Value	Type	Default Value	Digital Output	Default Digital Output	BACnet COV Increment
Analog Output 1	0 mV	Voltage 0-10V	0 mV	<input type="checkbox"/>	<input type="checkbox"/>	1.0
Analog Output 2	0 mV	Voltage 0-10V	0 mV	<input type="checkbox"/>	<input type="checkbox"/>	1.0
Analog Output 3	0 mV	Voltage 0-10V	0 mV	<input type="checkbox"/>	<input type="checkbox"/>	1.0
Analog Output 4	0 mV	Voltage 0-10V	0 mV	<input type="checkbox"/>	<input type="checkbox"/>	1.0
Analog Output 5	0 mV	Voltage 0-10V	0 mV	<input type="checkbox"/>	<input type="checkbox"/>	1.0
Analog Output 6	0 mV	Voltage 0-10V	0 mV	<input type="checkbox"/>	<input type="checkbox"/>	1.0
Watchdog (s)	0					

Submit Refresh

Figure 55. The 4U4A-H-IP Analog Outputs page

The Analog Outputs table contains the following fields:

- **Value** (read/write): the actual value of the analog output in millivolts [mV];
- **Type** (read/write): the analog output operating mode voltage/PWM;
- **Default Value** (read/write): default output value after the power-up and watchdog operation;
- **Digital Output** (read/write): the output status flag for the DO mode;
- **Default Digital Output** (read/write): the default output status for the DO mode;
- **Watchdog** (read/write): the device watchdog value in seconds;
- **Hand State Output** (read-only, MINI series only): manually overrides the status of the potentiometer;
- **BACnet COV Increment** (read/write): change of the state sending threshold value.

**WARNING!**

To save changes, please use the “Submit” button.

### 8.3.5 Special Application Modes

This page allows for entering the configuration parameters and showing the actual value of Special application modes. To open this page, please navigate to the Local I/O tab and choose a relevant inputs page from the submenu (universal or digital).



iSMA-B-4U40-H-IP Universal Inputs										
Input	Type	Resolution	UI Flag	Disable Voltage Measure	L.P. Filter Constant	Resistance	Temperature	Voltage	BACnet COV Increment	
Universal Input 1	Temperature 10K3A1 NTC B=3975K (°C)	12 Bit	<input type="checkbox"/>	<input type="checkbox"/>	2	1000000 Ω	-3276.8 °C	0 mV	1.0	
Universal Input 2	Temperature 10K3A1 NTC B=3975K (°C)	12 Bit	<input type="checkbox"/>	<input type="checkbox"/>	2	1000000 Ω	-3276.8 °C	0 mV	1.0	
Universal Input 3	Temperature 10K3A1 NTC B=3975K (°C)	12 Bit	<input type="checkbox"/>	<input type="checkbox"/>	2	1000000 Ω	-3276.8 °C	0 mV	1.0	
Universal Input 4	Temperature 10K3A1 NTC B=3975K (°C)	12 Bit	<input type="checkbox"/>	<input type="checkbox"/>	2	1000000 Ω	-3276.8 °C	0 mV	1.0	

Special Modes Configuration						
Input	Block Input	Input Mode	Command	Mode Time	Setpoint	Diff
Universal Input 1	<input type="checkbox"/>	Ordinary IO	<input type="checkbox"/>	1000	21.0 °C	1.0 °C
Universal Input 2	<input type="checkbox"/>	Ordinary IO	<input type="checkbox"/>	1000	21.0 °C	1.0 °C
Universal Input 3	<input type="checkbox"/>	Monostable Relay	<input type="checkbox"/>	1000	21.0 °C	1.0 °C
Universal Input 4	<input type="checkbox"/>	Bistable Relay	<input type="checkbox"/>	1000	21.0 °C	1.0 °C
		Time Relay NO [ms]	<input type="checkbox"/>	1000	21.0 °C	1.0 °C
		Time Relay NC [ms]	<input type="checkbox"/>	1000	21.0 °C	1.0 °C
		Time Relay NO [s]	<input type="checkbox"/>	1000	21.0 °C	1.0 °C
		Time Relay NC [s]	<input type="checkbox"/>	1000	21.0 °C	1.0 °C
		Input Forwarding	<input type="checkbox"/>			
		Heating	<input type="checkbox"/>			
		Cooling	<input type="checkbox"/>			

Figure 56. The 4U40-IP special modes configuration

The Special Modes Configuration table contains the following fields:

- **Block Input** (read/write): allows for blocking a particular input (except for heating/cooling modes);
- **Input Mode** (read/write): allows for selecting the Special Application Mode for a particular input (Ordinary IO in default);
- **Command** (read/write): execution of the Special Application Modes (except for input forwarding, heating/cooling modes);
- **Mode Time** (read/write): time base for time relay application modes (the unit depends on the selected mode: [ms] or [s]);
- **Setpoint** (read/write, 4U40-H-IP only): setpoint value for heating/cooling modes. By default 21;
- **Diff** (read/write, 4U40-H-IP only): differential value for heating/cooling modes. By default 1.

**WARNING!**

To save changes, please use the “Submit” button.

## 8.4 RS485 Configuration

This page allows to enter the configuration parameters and show the information of the controller’s RS485 port.



iSMA-B-24I-IP RS485 Configuration	
<b>Modbus Settings</b>	
Actual Baud Rate	115200
User Baud Rate	76800
Stop Bits	1 Bit
Data Bits	8 Bits
Parity Bits	None
<b>Statistics</b>	
Received Frames	0
Error Frames	0
Transmitted Frames	0
<input type="button" value="Submit"/> <input type="button" value="Refresh"/>	

Figure 57. The RS485 configuration page

This page allows for setting parameters such as:

- **Actual Baud Rate** (read-only): the RS485 baud rate within the range from 2400 to 115200;
- **User Baud Rate** (read/write): allows to set the baud rate by the user; the value overwrites the baud rate set on the DIP switch;
- **Stop Bits** (read/write): number of stop bits (1 or 2);
- **Data Bits** (read/write): number of data bits transmitted in a single byte (7 or 8);
- **Parity Bits** (read/write): transmission protection as a parity bit added before the stop bit (bits);
- **RS485 Biasing Resistors**: activation of the biasing resistors for MINI IP modules only, with a hardware version 2.0 and later; MIX and MAX series IP modules with hardware version 3.0 and up have a hardware switch for RS485 biasing under the bottom cover;
- **Received Frames** (read-only): number of received frames;
- **Transmitted Frames** (read-only): number of transmitted frames;
- **Error Frames** (read-only): number of error frames.

**WARNING!**

To save changes, please use the “Submit” button.

## 8.5 IP Configuration

This page allows for changing parameters of the Ethernet port, Modbus TCP, BACnet IP, and Foreign Device (for BACnet network).



iSMA-B-241-IP IP Configuration	
<b>Network Configuration</b>	
DHCP	Disabled ▾
Ip Address	192.168.34.209
Mask	255.255.254.0
Gateway	192.168.34.1
Http Port	80
Mac Address	80:34:28:38:33:5E
<b>Modbus Configuration</b>	
Protocol Type	Modbus RTU
Modbus TCP Port	502
Modbus Address	1
Modbus TCP Connection Timeout [s]	60
Free Modbus TCP Sockets	4 / 4
RS485 Timeout [ms]	500
Send Modbus Errors	<input checked="" type="checkbox"/>
<b>BACnet Configuration</b>	
BACnet ID	626001
BACnet UDP Port	47808
BBMD IP	
BBMD UDP Port	47808
BBMD Time To Live [s]	500
BACnet Register us as Foreign Device	<input type="checkbox"/> Send Request
<input type="button" value="Submit"/> <input type="button" value="Refresh"/> <input type="button" value="Reboot"/>	

Figure 58. The IP configuration page

This page allows for setting parameters such as:

- **DHCP** (read/write): enables address setting by the DHCP server; If enabled, the IP, Mask, and Gateway parameters become empty; it is required to insert own static values before clicking the Submit button;

**Note:**

The DHCP functionality has been implemented from the 7.0 firmware.

- **IP Address** (read/write): the IP address of the controller's Ethernet interface (if the DHCP slot is enabled, this slot shows the current IP address);
- **Mask** (read/write): the network mask (if the DHCP slot is enabled, this slot shows the current IP mask);
- **Gateway** (read/write): the network default gateway (if the DHCP slot is enabled, this slot shows the current gateway IP address);
- **Http Port** (read/write): the http port;
- **Mac Address** (read-only): the Ethernet interface MAC address;
- **Protocol Type** (read-only): the DIP switch protocol selection;
- **Modbus TCP Port** (read/write): the Modbus TCP port number, default 502;
- **Modbus Address** (read-only): the Modbus device address set by rotary switches;
- **Modbus TCP Communication Timeout** (read/write): the timeout value for TCP/IP messages;
- **Free Modbus TCP Sockets** (read-only): the number of available TCP connections;
- **RS485 Timeout** (read/write): the timeout value for Modbus RTU/ASCII messages;
- **Send Modbus Errors** (read/write), enable/disable sending Modbus error messages;
- **BACnet ID** (read/write): BACnet ID set by rotary switches, this value can be overridden by the user; once overridden by the user, changing rotary switches will not affect the BACnet ID;
- **BACnet UDP Port** (read/write): the BACnet IP port;
- **BBMD IP** (read/write): the IP address of the BACnet Broadcast Management Device (BBMD) server; the default value is blank (0.0.0.0);

**Note:** If the BBMD IP address is left to its default value (0.0.0.0), registering to the BBMD server is disabled. The default value of the BBMD IP address is displayed as an empty field in the IP Configuration web view.

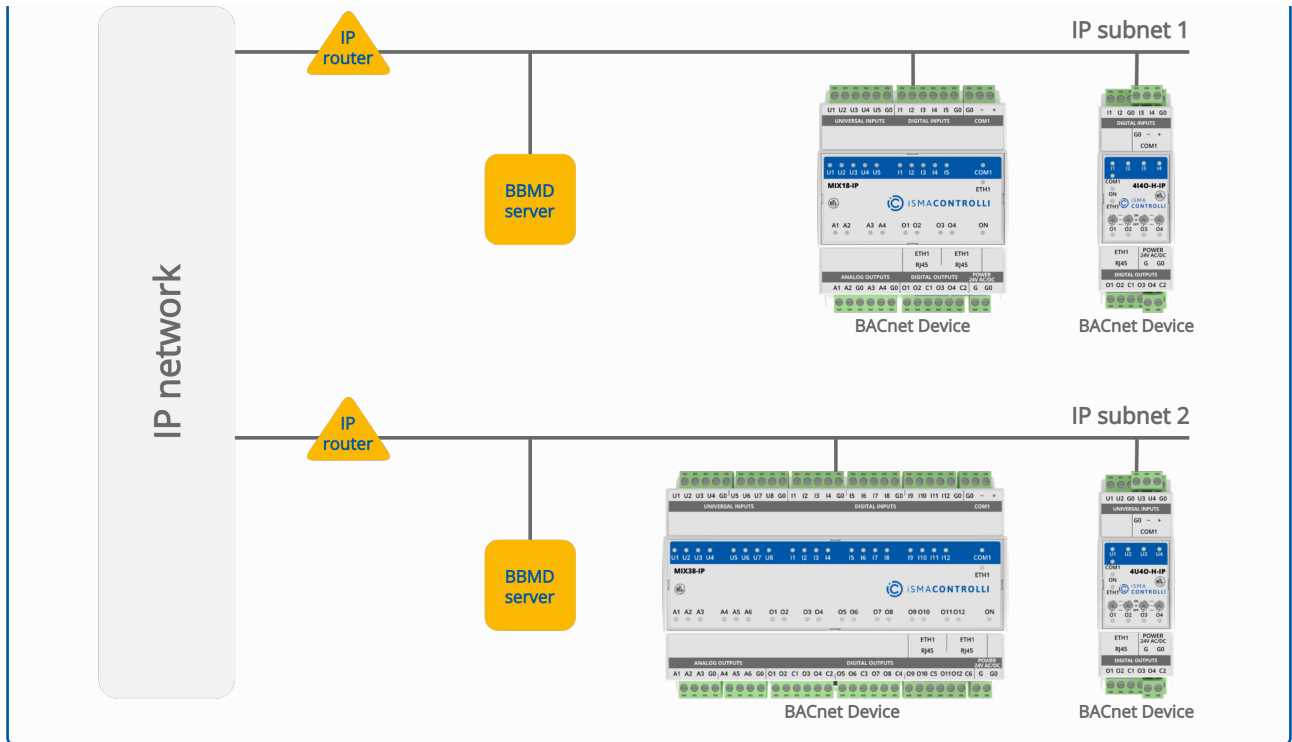
- **BBMD UDP Port** (read/write): the UDP port of the remote BBMD server; the default UDP port value is 47808;
- **BBMD Time To Live [s]** (read/write): the number of seconds, within which a foreign device must re-register with a BBMD; the default Time To Live value is 500;
- **BACnet Register us as Foreign Device** (request): multiprotocol I/O IP modules can register to receive broadcasts from devices on different subnets by sending a "BACnet Register us as Foreign Device request" to the BBMD that supports the foreign device registration.

### **WARNING!**

To save changes, please first click the "Submit" button, and then the "Reboot" button.

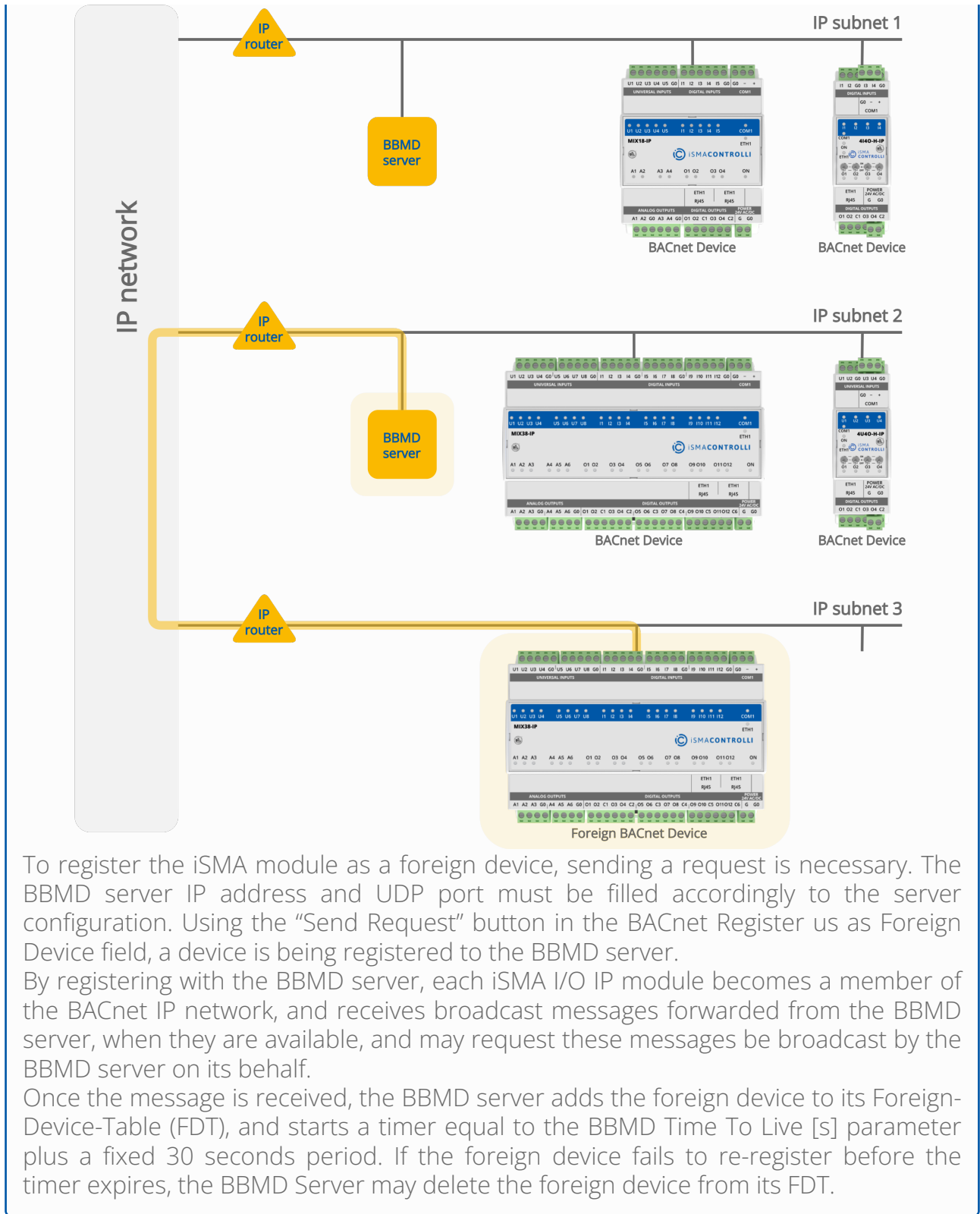
### **What is BBMD?**

The BACnet/IP Broadcast Management Device (BBMD) is a device added to the BACnet network, which broadcasts messages discovering devices on the network. The BBMD solution allows to overcome an issue of standard IP routers, which cannot forward BACnet messages for BACnet networks on multiple IP subnets (two or more). In such networks, each IP subnet, which is a part of a BACnet IP network with two or more subnets, needs a BBMD Server in order to communicate. If the BBMD Server has also been designated to register foreign devices like iSMA I/O IP modules, it shall include a Foreign Device Table (FDT).



### iSMA IP Module as Foreign Device

Each iSMA I/O IP module can be a foreign BACnet device. The foreign device is a BACnet device that has a different IP subnet address than those devices comprising the BACnet IP network, which the foreign device wants to join. The foreign device could be a full-time node on the foreign subnet or it could be a part-time participant. The foreign device mechanism is designed to enable communication with a BACnet IP network for BACnet devices, which present no economical sense to install, configure, or maintain a BBMD server for, or if there are no other BACnet nodes.



To register the iSMA module as a foreign device, sending a request is necessary. The BBMD server IP address and UDP port must be filled accordingly to the server configuration. Using the “Send Request” button in the BACnet Register us as Foreign Device field, a device is being registered to the BBMD server. By registering with the BBMD server, each iSMA I/O IP module becomes a member of the BACnet IP network, and receives broadcast messages forwarded from the BBMD server, when they are available, and may request these messages be broadcast by the BBMD server on its behalf. Once the message is received, the BBMD server adds the foreign device to its Foreign-Device-Table (FDT), and starts a timer equal to the BBMD Time To Live [s] parameter plus a fixed 30 seconds period. If the foreign device fails to re-register before the timer expires, the BBMD Server may delete the foreign device from its FDT.

### 8.6 Device Management

This page allows for changing the password and rebooting the device remotely.



Device	Local IO	RS485 Configuration	IP Configuration	Device Management	Contact	Logout
iSMA-B-241-IP Device Management						
Change password						
Current Device Password	<input type="text"/>					
New Device Password	<input type="text"/>					
Confirm New Device Password	<input type="text"/>					
						Submit
						Reboot
						Reboot

Figure 59. The Device Management page

The procedure of changing the device password:

- enter current device password in the Current Device Password field;
- enter the new device password in the New Device Password field;

**WARNING!**

Please note that the new password cannot contain special characters.

- enter the new device password again in the Confirm New Device Password field;
- to confirm the password change, please click the “Submit” button;
- please log out and log in again using the new password.

**WARNING!**

To reset the password to default, refer to “Restoring default settings”.

## 8.7 Contact

This page displays information about Manufacturer’s web page address and the e-mail address to technical support.

Device	Local IO	RS485 Configuration	IP Configuration	Device Management	Contact	Logout
Contact						
Contact						
Company	iSMA CONTROLLI S.p.A.					
Homepage	www.ismacontrolli.com					
Support	support@ismacontrolli.com					

Figure 60. Contact page view

## 9 List of Modbus Registers

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description
30001	0	0x00	VERSION AND MODULE TYPE	Read-only	
30002	1	0x01	MODULE ADDRESS (state of switch)	Read-only	
30003	2	0x02	BAUD RATE AND PROTOCOL (state of the switch)	Read-only	
30004	3	0x03	COUNTER OF RECEIVED FRAMES (32-bit)	Read-only	Default state is 0 Reset at the unit start and change of transmission parameters
30006	5	0x05	COUNTER OF FRAMES WITH ERROR (32-bit)	Read-only	Default state is 0 Reset at the unit start and change of transmission parameters
30008	7	0x07	COUNTER OF SENT FRAMES (32-bit)	Read-only	Default state is 0 Reset at the unit start and change of transmission parameters
30012	11	0x0B	UP TIME	Read-only	This 32-bit register contains module counting time in seconds from the last powering up or module reset
30015	14	0x0E	STATUS OF MANUAL OPERATION	Read-only	Status of manual operation of DO, TO, and AO for MINI series modules and DO1-4 of the 12O-H and 12O-H-IP modules
30215	214	0x0D6	STATUS OF MANUAL OPERATION	Read-only	Status of manual operation of DO5-12 of the 12O-H and 12O-H-IP modules
30016	15	0x0F	STATE OF DIGITAL INPUTS	Read-only	Status of digital inputs DI1-12
30216	215	0x0D7	STATE OF DIGITAL INPUTS	Read-only	Status of digital inputs DI13-24 in 24I and 24I-IP modules
30017	16	0x10	STATE OF UNIVERSAL INPUTS	Read-only	Status of universal inputs operating as digital inputs

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description
			WORKING AS DIGITAL INPUTS		
40001	0	0x00	DEVICE ACTIONS	Read/write	Allows for enabling 1 of 4 device actions
40018	17	0x11	STATE OF DIGITAL OUTPUTS	Read/write	State of digital outputs
40019	18	0x12	STATE OF ANALOG OUTPUTS WORKING AS DIGITAL OUTPUTS	Read/write	State of analog outputs operating as digital outputs
40020	19	0x13	DIGITAL INPUTS COMMAND REGISTER	Read/write	Digital inputs command register
40021	20	0x14	DIGITAL INPUTS BLOCKING	Read/write	Digital inputs blocking register
40022	21	0x15	COUNTER RESET	Read/write	Sets bit in register to reset the corresponding counter (digital inputs 1-12)
40023	22	0x16	COUNTER 1 LSB	Read/write Memory	32-bit counters for each of the digital input counting pulses
40024	23	0x17	COUNTER 1 MSB		
40025	24	0x18	COUNTER 2 LSB	Read/write Memory	
40026	25	0x19	COUNTER 2 MSB		
40027	26	0x1A	COUNTER 3 LSB	Read/write Memory	
40028	27	0x1B	COUNTER 3 MSB		
40029	28	0x1C	COUNTER 4 LSB	Read/write Memory	
40030	29	0x1D	COUNTER 4 MSB		
40031	30	0x1E	COUNTER 5 LSB	Read/write Memory	
40032	31	0x1F	COUNTER 5 MSB		
40033	32	0x20	COUNTER 6 LSB	Read/write Memory	
40034	33	0x21	COUNTER 6 MSB		
40035	34	0x22	COUNTER 7 LSB	Read/write Memory	
40036	35	0x23	COUNTER 7 MSB		

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description	
40037	36	0x24	COUNTER 8 LSB	Read/write Memory		
40038	37	0x25	COUNTER 8 MSB			
40039	38	0x26	COUNTER 9 LSB	Read/write Memory		
40040	39	0x27	COUNTER 9 MSB			
40041	40	0x28	COUNTER 10 LSB	Read/write Memory		
40042	41	0x29	COUNTER 10 MSB			
40043	42	0x2A	COUNTER 11 LSB	Read/write Memory		
40044	43	0x2B	COUNTER 11 MSB			
40045	44	0x2C	COUNTER 12 LSB	Read/write Memory		
40046	45	0x2D	COUNTER 12 MSB			
For 24I and 24I-IP only						
40222	221	0xDD	COUNTER RESET	Read/write		Sets bit in register to reset the corresponding counter (digital inputs 13-24)
40223	222	0xDE	COUNTER 13 LSB	Read/write Memory	32-bit counters for each of the digital input counting pulses	
40224	223	0xDF	COUNTER 13 MSB			
40225	224	0xE0	COUNTER 14 LSB	Read/write Memory		
40226	225	0xE1	COUNTER 14 MSB			
40227	226	0xE2	COUNTER 15 LSB	Read/write Memory		
40228	227	0xE3	COUNTER 15 MSB			
40229	228	0xE4	COUNTER 16 LSB	Read/write Memory		
40230	229	0xE5	COUNTER 16 MSB			
40231	230	0xE6	COUNTER 17 LSB	Read/write Memory		
40232	231	0xE7	COUNTER 17 MSB			
40233	232	0xE8	COUNTER 18 LSB	Read/write Memory		
40234	233	0xE9	COUNTER 18 MSB			
40235	234	0xEA	COUNTER 19 LSB	Read/write		

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description	
40236	235	0xEB	COUNTER 19 MSB	Memory		
40237	236	0xEC	COUNTER 20 LSB	Read/write Memory		
40238	237	0xED	COUNTER 20 MSB			
40239	238	0xEE	COUNTER 21 LSB	Read/write Memory		
40240	239	0xEF	COUNTER 21 MSB			
40241	240	0xF0	COUNTER 22 LSB	Read/write Memory		
40242	241	0xF1	COUNTER 22 MSB			
40243	242	0xF2	COUNTER 23 LSB	Read/write Memory		
40244	243	0xF3	COUNTER 23 MSB			
40245	244	0xF4	COUNTER 24 LSB	Read/write Memory		
40246	245	0xF5	COUNTER 24 MSB			
30071	70	0x46	UNIVERSAL INPUT VOLTAGE 1	Read-only		Voltage measurement value is expressed in mV Formula for the current measurements: where: U – register value, 200 – value of attached resistor Temperature is expressed in Celsius degrees * 10 For a result, divide the register value by 10: Selection of the type sensor is completed UNIVERSAL INPUT CONFIGURATION register from 40151 to 40158 for each input separately
30072	71	0x47	UNIVERSAL INPUT TEMPERATURE 1	Read-only		
30073	72	0x48	UNIVERSAL INPUT VOLTAGE 2	Read-only		
30074	73	0x49	UNIVERSAL INPUT TEMPERATURE 2	Read-only		
30075	74	0x4A	UNIVERSAL INPUT VOLTAGE 3	Read-only		
30076	75	0x4B	UNIVERSAL INPUT TEMPERATURE 3	Read-only		
30077	76	0x4C	UNIVERSAL INPUT VOLTAGE 4	Read-only		
30078	77	0x4D	UNIVERSAL INPUT TEMPERATURE 4	Read-only		
30079	78	0x4E	UNIVERSAL INPUT VOLTAGE 5	Read-only		
30080	79	0x4F	UNIVERSAL INPUT TEMPERATURE 5	Read-only		

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description
30081	80	0x50	UNIVERSAL INPUT VOLTAGE 6	Read-only	
30082	81	0x51	UNIVERSAL INPUT TEMPERATURE 6	Read-only	
30083	82	0x52	UNIVERSAL INPUT VOLTAGE 7	Read-only	
30084	83	0x53	UNIVERSAL INPUT TEMPERATURE 7	Read-only	
30085	84	0x54	UNIVERSAL INPUT VOLTAGE 8	Read-only	
30086	85	0x55	UNIVERSAL INPUT TEMPERATURE 8	Read-only	
30087	86	0x56	UNIVERSAL INPUT VOLTAGE 1	Read-only	
30088	87	0x57	UNIVERSAL INPUT VOLTAGE 2	Read-only	
30089	88	0x58	UNIVERSAL INPUT VOLTAGE 3	Read-only	
30090	89	0x59	UNIVERSAL INPUT VOLTAGE 4	Read-only	
30091	90	0x5A	UNIVERSAL INPUT VOLTAGE 5	Read-only	
30092	91	0x5B	UNIVERSAL INPUT VOLTAGE 6	Read-only	
30093	92	0x5C	UNIVERSAL INPUT VOLTAGE 7	Read-only	
30094	93	0x5D	UNIVERSAL INPUT VOLTAGE 8	Read-only	
30095	94	0x5E	UNIVERSAL INPUT TEMPERATURE 1	Read-only	
30096	95	0x5F	UNIVERSAL INPUT TEMPERATURE 2	Read-only	
30097	96	0x60	UNIVERSAL INPUT TEMPERATURE 3	Read-only	
30098	97	0x61	UNIVERSAL INPUT TEMPERATURE 4	Read-only	

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description
30099	98	0x62	UNIVERSAL INPUT TEMPERATURE 5	Read-only	
30100	99	0x63	UNIVERSAL INPUT TEMPERATURE 6	Read-only	
30101	100	0x64	UNIVERSAL INPUT TEMPERATURE 7	Read-only	
30102	101	0x65	UNIVERSAL INPUT TEMPERATURE 8	Read-only	
30103	102	0x66	RESISTIVE INPUT 1 LSB	Read-only	Resistance measurement result expressed in $\Omega$
30104	103	0x67	RESISTIVE INPUT 1 MSB	Read-only	
30105	104	0x68	RESISTIVE INPUT 2 LSB	Read-only	
30106	105	0x69	RESISTIVE INPUT 2 MSB	Read-only	
30107	106	0x6A	RESISTIVE INPUT 3 LSB	Read-only	
30108	107	0x6B	RESISTIVE INPUT 3 MSB	Read-only	
30109	108	0x6C	RESISTIVE INPUT 4 LSB	Read-only	
30110	109	0x6D	RESISTIVE INPUT 4 MSB	Read-only	
30111	110	0x6E	RESISTIVE INPUT 5 LSB	Read-only	
30112	111	0x6F	RESISTIVE INPUT 5 MSB	Read-only	
30113	112	0x70	RESISTIVE INPUT 6 LSB	Read-only	
30114	113	0x71	RESISTIVE INPUT 6 MSB	Read-only	
30115	114	0x72	RESISTIVE INPUT 7 LSB	Read-only	
30116	115	0x73	RESISTIVE INPUT 7 MSB	Read-only	

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description
30117	116	0x74	RESISTIVE INPUT 8 LSB	Read-only	
30118	117	0x75	RESISTIVE INPUT 8 MSB	Read-only	
40121	120	0x78	VALUE OF ANALOG OUTPUT 1	Read/write	Voltage at analog outputs expressed in mV within the range from 0 to 10000 mV
40122	121	0x79	VALUE OF ANALOG OUTPUT 2	Read/write	
40123	122	0x7A	VALUE OF ANALOG OUTPUT 3	Read/write	
40124	123	0x7B	VALUE OF ANALOG OUTPUT 4	Read/write	
40125	124	0x7C	VALUE OF ANALOG OUTPUT 5	Read/write	
40126	125	0x7D	VALUE OF ANALOG OUTPUT 6	Read/write	
30125	124	0x7C	HAND STATUS VALUE 1	Read-only	The current value of analog output in the hand mode for MINI with AO
30126	125	0x7D	HAND STATUS VALUE 2	Read-only	
30127	126	0x7E	HAND STATUS VALUE 3	Read-only	
30128	127	0x7F	HAND STATUS VALUE 4	Read-only	
30130	129	0x81	HARDWARE_VERSION	Read-only	The current hardware version of a device
30131	130	0x82	MAC_ADDRESS (48-bit)	Read-only	The MAC address of a device
40136	135	0x87	BAUD RATE	Read/write Memory	Transmission speed The value is considered only when sections 1, 2, and 3 of S3 switch are in the OFF position The default value is 7680 (76800 bps)
40137	136	0x88	STOP BITS	Read/write Memory	Supported values are 1 and 2 The default value is 1



Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description												
40138	137	0x89	DATA BITS	Read/write Memory	Supported values are 7 and 8 The default value is 8												
40139	138	0x8A	PARITY BIT	Read/write Memory	Parity Bit (40139) The default value is 0 (no parity) Allowed values: <table border="1" data-bbox="1114 555 1426 996"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0 (default)</td> <td>None</td> </tr> <tr> <td>1</td> <td>Odd</td> </tr> <tr> <td>2</td> <td>Even</td> </tr> <tr> <td>3</td> <td>Always 1</td> </tr> <tr> <td>4</td> <td>Always 0</td> </tr> </tbody> </table>	Value	Description	0 (default)	None	1	Odd	2	Even	3	Always 1	4	Always 0
Value	Description																
0 (default)	None																
1	Odd																
2	Even																
3	Always 1																
4	Always 0																
40140	139	0x8B	RESPONSE DELAY	Read/write Memory	Delay in ms before sending the response The default value is 0												
40141	140	0x8C	WATCHDOG TIME	Read/write Memory	Time in second before watchdog reset in case no transmission A value of 0 disables Watchdog The default value is 0 s												
40143	142	0x8E	DEFAULT STATE OF DIGITAL OUTPUTS	Read/write Memory	State of digital outputs assigned at the start of the module and watchdog reset The default value is 0												
40144	143	0x8F	DEFAULT STATE OF ANALOG OUTPUTS (DIGITAL)	Read/write Memory	State of analog outputs assigned at the start of the module and watchdog reset The default value is 0												
40145	144	0x90	DEFAULT STATE OF ANALOG OUTPUT 1	Read/write Memory	In the registers is stored value that appears at the analog output after power on or watchdog reset. The default value is 0												
40146	145	0x91	DEFAULT STATE OF ANALOG OUTPUT 2	Read/write Memory													
40147	146	0x92	DEFAULT STATE OF ANALOG OUTPUT 3	Read/write Memory													

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description																																	
40148	147	0x93	DEFAULT STATE OF ANALOG OUTPUT 4	Read/write Memory																																		
40149	148	0x94	DEFAULT STATE OF ANALOG OUTPUT 5	Read/write Memory																																		
40150	149	0x95	DEFAULT STATE OF ANALOG OUTPUT 6	Read/write Memory																																		
40151	150	0x96	UNIVERSAL INPUT CONFIGURATION 1	Read/write Memory	Configuration of universal input and type of temperature sensor The default value is 1																																	
40152	151	0x97	UNIVERSAL INPUT CONFIGURATION 2	Read/write Memory																																		
40153	152	0x98	UNIVERSAL INPUT CONFIGURATION 3	Read/write Memory																																		
40154	153	0x99	UNIVERSAL INPUT CONFIGURATION 4	Read/write Memory																																		
40155	154	0x9A	UNIVERSAL INPUT CONFIGURATION 5	Read/write Memory																																		
40156	155	0x9B	UNIVERSAL INPUT CONFIGURATION 6	Read/write Memory																																		
40157	156	0x9C	UNIVERSAL INPUT CONFIGURATION 7	Read/write Memory																																		
40158	157	0x9D	UNIVERSAL INPUT CONFIGURATION 8	Read/write Memory																																		
						<table border="1"> <thead> <tr> <th>Value</th> <th>Description / Sensor</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Resistance measurement off</td> </tr> <tr> <td>1</td> <td>10K3A1 NTC</td> </tr> <tr> <td>2</td> <td>10K4A1 NTC</td> </tr> <tr> <td>3</td> <td>10K NTC Carel</td> </tr> <tr> <td>4</td> <td>20K6A1 NTC</td> </tr> <tr> <td>5</td> <td>2,2K3A1 NTC B=3975K</td> </tr> <tr> <td>6</td> <td>3K3A1 NTC</td> </tr> <tr> <td>7</td> <td>30K6A1 NTC</td> </tr> <tr> <td>8</td> <td>SIE1</td> </tr> <tr> <td>9</td> <td>TAC1</td> </tr> <tr> <td>10</td> <td>SAT1</td> </tr> <tr> <td>16</td> <td>Pt1000</td> </tr> <tr> <td>17</td> <td>Ni1000</td> </tr> <tr> <td>126</td> <td>Resistance measurement</td> </tr> <tr> <td>+128</td> <td>Voltage measurement off</td> </tr> </tbody> </table>	Value	Description / Sensor	0	Resistance measurement off	1	10K3A1 NTC	2	10K4A1 NTC	3	10K NTC Carel	4	20K6A1 NTC	5	2,2K3A1 NTC B=3975K	6	3K3A1 NTC	7	30K6A1 NTC	8	SIE1	9	TAC1	10	SAT1	16	Pt1000	17	Ni1000	126	Resistance measurement	+128	Voltage measurement off
Value	Description / Sensor																																					
0	Resistance measurement off																																					
1	10K3A1 NTC																																					
2	10K4A1 NTC																																					
3	10K NTC Carel																																					
4	20K6A1 NTC																																					
5	2,2K3A1 NTC B=3975K																																					
6	3K3A1 NTC																																					
7	30K6A1 NTC																																					
8	SIE1																																					
9	TAC1																																					
10	SAT1																																					
16	Pt1000																																					
17	Ni1000																																					
126	Resistance measurement																																					
+128	Voltage measurement off																																					

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description
40159	158	0x9E	FILTER TIME CONSTANT OF THE UNIVERSAL INPUT 1	Read/write Memory	Filter time constant, expressed in seconds in the range from 0 to 60 seconds A value of 0 disables the filter The default value is 2 s
40160	159	0x9F	FILTER TIME CONSTANT OF THE UNIVERSAL INPUT 2	Read/write Memory	
40161	160	0xA0	FILTER TIME CONSTANT OF THE UNIVERSAL INPUT 3	Read/write Memory	
40162	161	0xA1	FILTER TIME CONSTANT OF THE UNIVERSAL INPUT 4	Read/write Memory	
40163	162	0xA2	FILTER TIME CONSTANT OF THE UNIVERSAL INPUT 5	Read/write Memory	
40164	163	0xA3	FILTER TIME CONSTANT OF THE UNIVERSAL INPUT 6	Read/write Memory	
40165	164	0xA4	FILTER TIME CONSTANT OF THE UNIVERSAL INPUT 7	Read/write Memory	
40166	165	0xA5	FILTER TIME CONSTANT OF THE UNIVERSAL INPUT 8	Read/write Memory	
40167	166	0xA6	RESOLUTION OF THE UNIVERSAL INPUTS	Read/write Memory	Resolution of the analog inputs. When a bit is set, the measurement at corresponding input is performed with 16-bit resolution. By default, all the measurements are performed with 12-bit resolution.

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description																				
40168	167	0xA7	ANALOG OUTPUT CONFIGURATION 1	Read/write Memory	Configures the mode of the analog output according to the following table: <table border="1" data-bbox="1114 414 1428 1014"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0 (default)</td> <td>Voltage output 0-10 V</td> </tr> <tr> <td>1</td> <td>PWM 1 Hz</td> </tr> <tr> <td>2</td> <td>PWM 10 Hz</td> </tr> <tr> <td>3</td> <td>PWM 100 Hz</td> </tr> <tr> <td>4</td> <td>PWM 0.1 Hz</td> </tr> <tr> <td>5</td> <td>PWM 0.01 Hz</td> </tr> </tbody> </table>	Value	Description	0 (default)	Voltage output 0-10 V	1	PWM 1 Hz	2	PWM 10 Hz	3	PWM 100 Hz	4	PWM 0.1 Hz	5	PWM 0.01 Hz						
Value	Description																								
0 (default)	Voltage output 0-10 V																								
1	PWM 1 Hz																								
2	PWM 10 Hz																								
3	PWM 100 Hz																								
4	PWM 0.1 Hz																								
5	PWM 0.01 Hz																								
40169	168	0xA8	ANALOG OUTPUT CONFIGURATION 2	Read/write Memory																					
40170	169	0xA9	ANALOG OUTPUT CONFIGURATION 3	Read/write Memory																					
40171	170	0xAA	ANALOG OUTPUT CONFIGURATION 4	Read/write Memory																					
40172	171	0xAB	ANALOG OUTPUT CONFIGURATION 5	Read/write Memory																					
40173	172	0xAC	ANALOG OUTPUT CONFIGURATION 6	Read/write Memory																					
40176	175	0xAF	DIGITAL INPUT 1 CONFIGURATION MODE	Read/write Memory	Digital input configuration mode table: <table border="1" data-bbox="1114 1115 1428 1993"> <thead> <tr> <th>Value</th> <th>OPERATING MODE</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Ordinary IO(def)</td> </tr> <tr> <td>1</td> <td>Monostable Relay</td> </tr> <tr> <td>2</td> <td>Bistable Relay</td> </tr> <tr> <td>3</td> <td>Time Relay NO [ms]</td> </tr> <tr> <td>4</td> <td>Time Relay NC [ms]</td> </tr> <tr> <td>5</td> <td>Time Relay NO [s]</td> </tr> <tr> <td>6</td> <td>Time Relay NC [s]</td> </tr> <tr> <td>7</td> <td>Input Forwarding</td> </tr> <tr> <td>8</td> <td>Heating</td> </tr> </tbody> </table>	Value	OPERATING MODE	0	Ordinary IO(def)	1	Monostable Relay	2	Bistable Relay	3	Time Relay NO [ms]	4	Time Relay NC [ms]	5	Time Relay NO [s]	6	Time Relay NC [s]	7	Input Forwarding	8	Heating
Value	OPERATING MODE																								
0	Ordinary IO(def)																								
1	Monostable Relay																								
2	Bistable Relay																								
3	Time Relay NO [ms]																								
4	Time Relay NC [ms]																								
5	Time Relay NO [s]																								
6	Time Relay NC [s]																								
7	Input Forwarding																								
8	Heating																								

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description	
40177	176	0xB0	DIGITAL INPUT 1 TIME VALUE	Read/write Memory	Value	OPERATING MODE
40178	177	0xB1	DIGITAL INPUT 1 SETPOINT	Read/write Memory		
40179	178	0xB2	DIGITAL INPUT 1 DIFFERENTIAL	Read/write Memory	9	Cooling (4U40-H and 4U40-H-IP only)
40180	179	0xB3	DIGITAL INPUT 2 CONFIGURATION MODE	Read/write Memory	DIGITAL INPUT TIME VALUE in [ms] or in [s] – depending on mode selection SETPOINT in °C multiplied by 10 Default value = 0 DIFFERENTIAL in °C multiplied by 10 Default value = 0	
40181	180	0xB4	DIGITAL INPUT 2 TIME VALUE	Read/write Memory		
40182	181	0xB5	DIGITAL INPUT 2 SETPOINT	Read/write Memory		
40183	182	0xB6	DIGITAL INPUT 2 DIFFERENTIAL	Read/write Memory		
40184	183	0xB7	DIGITAL INPUT 3 CONFIGURATION MODE	Read/write Memory		
40185	184	0xB8	DIGITAL INPUT 3 TIME VALUE	Read/write Memory		
40186	185	0xB9	DIGITAL INPUT 3 SETPOINT	Read/write Memory		
40187	186	0xBA	DIGITAL INPUT 3 DIFFERENTIAL	Read/write Memory		
40188	187	0xBB	DIGITAL INPUT 4 CONFIGURATION MODE	Read/write Memory		
40189	188	0xBC	DIGITAL INPUT 4 TIME VALUE	Read/write Memory		
40190	189	0xBD	DIGITAL INPUT 4 SETPOINT	Read/write Memory		
40191	190	0xBE	DIGITAL INPUT 4 DIFFERENTIAL	Read/write Memory		

Modbus Address	Decimal Address	Hex Address	Register Name	Access	Description
30293	292	0x124	COUNTER OF FREE MODBUS TCP SOCKETS	Read-only	Number of available Modbus TCP sockets

Table 39. List of Modbus registers

## 10 List of Supported Temperature Sensors

- 10K3A1
- 10K4A1
- 10K Carel
- 20K6A1
- 2.2K3A1
- 3K3A1
- 30K6A1
- SIE1
- TAC1
- SAT1
- PT1000
- NI1000
- NI1000 21C (°C)
- NI1000 LG (°C)
- 10K Type II NTC
- 10K Type III NTC
- 20K NTC
- 3K NTC
- NI1000 32F (°F)
- NI1000 70F (°F)
- PT1000 (°F)

No.	1
Sensor	<b>10K3A1</b>
$\beta$ coefficient	3975K
Manufacturers	Aquatrol, Cylon, Honeywell, Johnson, Satchwell, Seachange
°C	$\Omega$
-50	667828
-45	491749
-40	335671
-35	241840
-30	176683
-25	131251
-20	96974
-15	72895
-10	55298

No.	1
-5	42314
0	32650
5	25396
10	19904
15	15714
20	12494
25	10000
30	8056
35	6530
40	5325
45	4367
50	3601
55	2985
60	2487
65	2082
70	1751
75	1480
80	1256
85	1070
90	916
95	787
100	678
105	587
110	510
115	444
120	388



No.	1
125	340
No.	2
Sensor	<b>10K4A1</b>
$\beta$ coefficient	3695K
Manufacturers	Andover, Delta Controls, Siebe, York
$^{\circ}\text{C}$	$\Omega$
-50	441667
-45	330749
-40	239831
-35	181532
-30	135233
-25	105081
-20	78930
-15	61030
-10	47549
-5	37316
0	29490
5	23462
10	18787
15	15136
20	12268
25	10000
30	8197
35	6754
40	5594
45	4656

No.	2
50	3893
55	3271
60	2760
65	2339
70	1990
75	1700
80	1458
85	1255
90	1084
95	939
100	817
105	713
110	624
115	547
120	482
125	426
No.	3
Sensor	<b>10K Carel</b>
$\beta$ coefficient	3435K
$^{\circ}\text{C}$	$\Omega$
-50	329500
-45	247700
-40	188500
-35	144100
-30	111300
-25	86430

No.	3
-20	67770
-15	53410
-10	42470
-5	33900
0	27280
5	22050
10	17960
15	14690
20	12090
25	10000
30	8313
35	6940
40	5827
45	4912
50	4161
55	3536
60	3020
65	2588
70	2228
75	1924
80	1668
85	1451
90	1266
95	1108
100	973
105	857

No.	3
110	758
115	672
120	597
125	531
No.	4
Sensor	<b>20K6A1</b>
$\beta$ coefficient	4262K
$^{\circ}\text{C}$	$\Omega$
-40	806800
-35	574400
-30	413400
-25	300400
-20	220600
-15	163480
-10	122260
-5	92220
0	70140
5	53780
10	41540
15	32340
20	25340
25	20000
30	15886
35	12698
40	10212
45	8260

No.	4
50	6718
55	5494
60	4518
65	3732
70	3098
75	2586
80	2166
85	1823
90	1541
95	1308
100	1114
105	953
110	818
115	704
120	609
125	528
115	444
120	388
125	340
No.	5
Sensor	<b>2.2K3A1</b>
$\beta$ coefficient	3975K
Manufacturers	Ambiflex, Johnson
$^{\circ}\text{C}$	$\Omega$
-50	150395
-45	112994

No.	5
-40	75593
-35	57691
-30	39789
-25	30814
-20	21839
-15	16416
-10	12453
-5	9529
0	7353
5	5719
10	4482
15	3539
20	2814
25	2252
30	1814
35	1471
40	1199
45	983
50	810
55	672
60	560
65	468
70	394
75	333
80	282
85	241

No.	5
90	206
95	177
100	152
105	132
110	114
115	100
120	88
125	77
No.	6
Sensor	<b>3K3A1</b>
$\beta$ coefficient	3975K
Manufacturers	Alerton
$^{\circ}\text{C}$	$\Omega$
-50	200348
-45	150524
-40	100701
-35	76853
-30	53005
-25	41048
-20	29092
-15	21868
-10	16589
-5	12694
0	9795
5	7619
10	5971

No.	6
15	4714
20	3748
25	3000
30	2417
35	1959
40	1598
45	1310
50	1080
55	896
60	746
65	625
70	526
75	444
80	377
85	321
90	275
95	236
100	204
105	176
110	153
115	133
120	117
125	102



No.	7
Sensor	<b>30K6A1</b>
β coefficient	4262K
Manufacturers	Drayton
°C	Ω
-30	622911
-25	477393
-20	331876
-15	245785
-10	183697
-5	138502
0	105305
5	80713
10	62347
15	48511
20	38019
25	30000
30	23828
35	19046
40	15317
45	12390
50	10079
55	8243
60	6777
65	5600
70	4650
75	3879

No.	7
80	3251
85	2737
90	2313
95	1963
100	1672
105	1430
110	1228
115	1058
120	915
125	793
No.	8
Sensor	<b>SIE1</b>
Manufacturers	Barber Colman, Siebe
°C	Ω
-50	10732
-45	10624
-40	10517
-35	10344
-30	10172
-25	9913
-20	9654
-15	9320
-10	8933
-5	8496
0	8044
5	7489

No.	8
10	6938
15	6370
20	5798
25	5238
30	4696
35	4185
40	3707
45	3271
50	2875
55	2521
60	2206
65	1929
70	1685
75	1472
80	1287
85	1127
90	986
95	866
100	760
105	670
110	590
115	522
120	462
125	410

No.	9
Sensor	<b>TAC1</b>
β coefficient	3500K
Manufacturers	TAC
°C	Ω
-40	39024
-35	29358
-30	22284
-25	17073
-20	13192
-15	10276
-10	8068
-5	6382
0	5085
5	4078
10	3294
15	2676
20	2188
25	1800
30	1488
35	1237
40	1034
45	869
50	733
55	622
60	529
65	453

No.	9
70	389
75	335
80	290
85	252
90	220
95	192
100	169
105	149
110	131
115	116
120	103
125	92
No.	10
Sensor	<b>SAT1</b>
Manufacturers	Satchwell
°C	Ω
-50	9719
-45	9652
-40	9584
-35	9467
-30	9349
-25	9159
-20	8968
-15	8708
-10	8396
-5	8031

No.	10
0	7614
5	7150
10	6649
15	6121
20	5580
25	5039
30	4513
35	4012
40	3545
45	3117
50	2730
55	2386
60	2082
65	1816
70	1585
75	1385
80	1213
85	1064
90	937
95	828
100	734
105	654
110	585
115	525
120	474
125	429

No.	11
Sensor	<b>PT1000</b>
Manufacturers	Honeywell, Sauter, Serck, Siebe, Cylon
°C	$\Omega$
-50	803.1
-40	842.7
-30	882.2
-20	921.6
-10	960.9
0	1000.0
10	1039.0
20	1077.9
30	1116.7
40	1155.4
50	1194.0
60	1232.4
70	1270.8
80	1309.0
90	1347.1
100	1385.1
110	1422.9
120	1460.7
130	1498.3
140	1535.8
150	1573.3
160	1610.5
170	1647.7

No.	11
180	1684.8
190	1721.7
200	1758.6
210	1795.3
220	1831.9
230	1868.4
240	1904.7
250	1941.0
260	1977.1
270	2013.1
280	2049.0
290	2084.8
300	2120.5
310	2156.1
320	2191.5
330	2226.8
340	2262.1
350	2297.2
360	2332.1
370	2367.0
380	2401.8
390	2436.4
400	2470.9
No.	12
Sensor	<b>NI1000</b>
Manufacturers	Sauter



No.	12
°C	Ω
-50	742.6
-40	791.3
-30	841.5
-20	893.0
-10	945.8
0	1000.0
10	1055.5
20	1112.4
30	1170.6
40	1230.1
50	1291.1
60	1353.4
70	1417.2
80	1482.5
90	1549.4
100	1617.8
110	1687.9
120	1759.8
130	1833.4
140	1909.0
150	1986.6
No.	13
Sensor	<b>NI1000 21C (°C)</b>
Manufacturers	Distech
°C	Ω

No.	13
-40	699,3
-30	745,5
-20	792,8
-10	841,2
0	891,0
10	942,0
20	994,3
30	1047,8
40	1102,6
50	1158,5
60	1215,8
70	1274,3
80	1334,4
90	1407,8
100	1473,1
110	1524,0
No.	14
Sensor	<b>NI1000 LG (°C)</b>
Manufacturers	LG
°C	Ω
-50	790,9
-40	830,8
-30	871,7
-20	913,5
-10	956,2
0	1000,0

No.	14
10	1044,8
20	1090,7
30	1137,6
40	1185,7
50	1235,0
60	1285,4
70	1337,1
80	1390,1
90	1444,4
100	1500,0
110	1557,0
120	1615,4
130	1675,2
140	1736,5
150	1799,3
No.	15
Sensor	<b>10K Type II NTC</b>
$\beta$ coefficient	3975K
Manufacturers	Alerton
$^{\circ}\text{F}$	$\Omega$
-40	336095
-35	279921
-30	233942
-25	196184
-20	165062
-15	139324

No.	15
-10	117968
-5	100192
0	85346
5	72910
10	62464
15	53660
20	46222
25	39919
30	34563
35	30001
40	26104
45	22767
50	19903
55	17439
60	15313
65	13476
70	11884
75	10501
80	9298
85	8249
90	7333
95	6530
100	5826
105	5208
110	4663
115	4182

No.	15
120	3757
125	3381
130	3047
135	2751
140	2487
145	2252
150	2042
155	1855
160	1687
165	1536
170	1401
175	1279
180	1169
185	1070
190	981
195	901
200	827
205	761
210	701
215	646
220	597
225	551
230	510
235	472
240	438
245	406

No.	15
250	377
No.	16
Sensor	<b>10K Type III NTC</b>
$\beta$ coefficient	3695K
Manufacturers	Andower
$^{\circ}\text{F}$	$\Omega$
-40	239831
-35	203801
-30	173631
-25	148378
-20	127139
-15	109226
-10	94078
-5	81235
0	70317
5	61012
10	53063
15	46255
20	40411
25	35382
30	31046
35	27298
40	24051
45	21234
50	18782
55	16646

No.	16
60	14780
65	13148
70	11717
75	10459
80	9353
85	8378
90	7517
95	6755
100	6080
105	5481
110	4948
115	4474
120	4051
125	3673
130	3335
135	3032
140	2761
145	2517
150	2297
155	2100
160	1921
165	1760
170	1615
175	1453
180	1363
185	1255

No.	16
190	1156
195	1066
200	985
205	910
210	842
215	780
220	723
225	671
230	623
235	580
240	540
245	503
250	469
No.	17
Sensor	<b>20K NTC</b>
$\beta$ coefficient	4262K
Manufacturers	Honeywell
$^{\circ}\text{F}$	$\Omega$
-40	817605
-35	674624
-30	558679
-25	464299
-20	387186
-15	323956
-10	271927
-5	228972



No.	17
0	193390
5	163823
10	139177
15	118571
20	101293
25	86764
30	74511
35	64152
40	55369
45	47904
50	41543
55	36109
60	31457
65	27464
70	24029
75	21068
80	18509
85	16294
90	14372
95	12700
100	11244
105	9974
110	8862
115	7888
120	7034
125	6282

No.	17
130	5620
135	5036
140	4519
145	4062
150	3657
155	3297
160	2976
165	2691
170	2436
175	2209
180	2005
185	1823
190	1659
195	1512
200	1379
205	1260
210	1153
215	1055
220	967
225	888
230	816
235	750
240	691
245	637
250	588

No.	18
Sensor	<b>3K NTC</b>
$\beta$ coefficient	3975K
°F	$\Omega$
-40	100618
-35	83827
-30	70079
-25	58783
-20	49468
-15	41763
-10	35367
-5	30042
0	25593
5	21866
10	18735
15	16096
20	13865
25	11975
30	10369
35	9000
40	7831
45	6830
50	5971
55	5232
60	4594
65	4043
70	3565

No.	18
75	3150
80	2789
85	2475
90	2200
95	1959
100	1748
105	1562
110	1399
115	1254
120	1127
125	1014
130	914
135	825
140	746
145	676
150	613
155	556
160	506
165	461
170	420
175	384
180	351
185	321
190	294
195	270
200	248

No.	18
205	228
210	210
215	194
220	179
225	165
230	153
235	142
240	131
245	122
250	113
No.	19
Sensor	<b>NI1000 32F (°F)</b>
Manufacturers	Distech
°F	Ω
-40	791,3
-30	818,9
-20	847,1
-10	875,6
0	904,6
10	933,9
20	963,7
30	993,9
40	1024,5
50	1055,5
60	1086,9
70	1118,7

No.	19
80	1151,0
90	1183,6
100	1216,7
110	1250,2
120	1284,1
130	1318,5
140	1353,4
150	1388,5
160	1424,2
170	1460,3
180	1497,0
190	1534,1
200	1571,7
210	1609,8
220	1648,4
230	1687,9
240	1727,3
250	1767,6
No.	20
Sensor	<b>NI1000 70F (°F)</b>
Manufacturers	Distech
°F	Ω
-40	699,3
-30	724,8
-20	750,7
-10	776,9

No.	20
0	803,4
10	830,3
20	857,7
30	885,4
40	913,5
50	942,0
60	970,9
70	1000,2
80	1029,9
90	1059,9
100	1090,3
110	1121,1
120	1152,2
130	1183,8
140	1215,8
150	1248,1
160	1280,9
170	1314,2
180	1347,9
190	1382,0
200	1417,0
210	1452,0
220	1487,0
230	1524,0
240	1560,0
250	1597,0

No.	21
Sensor	<b>PT1000 (°F)</b>
Manufacturers	Distech
°F	Ω
-40	842,7
-30	864,7
-20	886,6
-10	908,5
0	930,3
10	952,2
20	973,9
30	995,7
40	1017,4
50	1039,0
60	1060,7
70	1082,2
80	1103,8
90	1125,3
100	1146,8
110	1168,3
120	1189,7
130	1211,1
140	1232,4
150	1253,7
160	1275,0
170	1296,2
180	1317,4



No.	21
190	1338,6
200	1359,7
210	1380,8
220	1401,8
230	1422,9
240	1443,8
250	1464,8