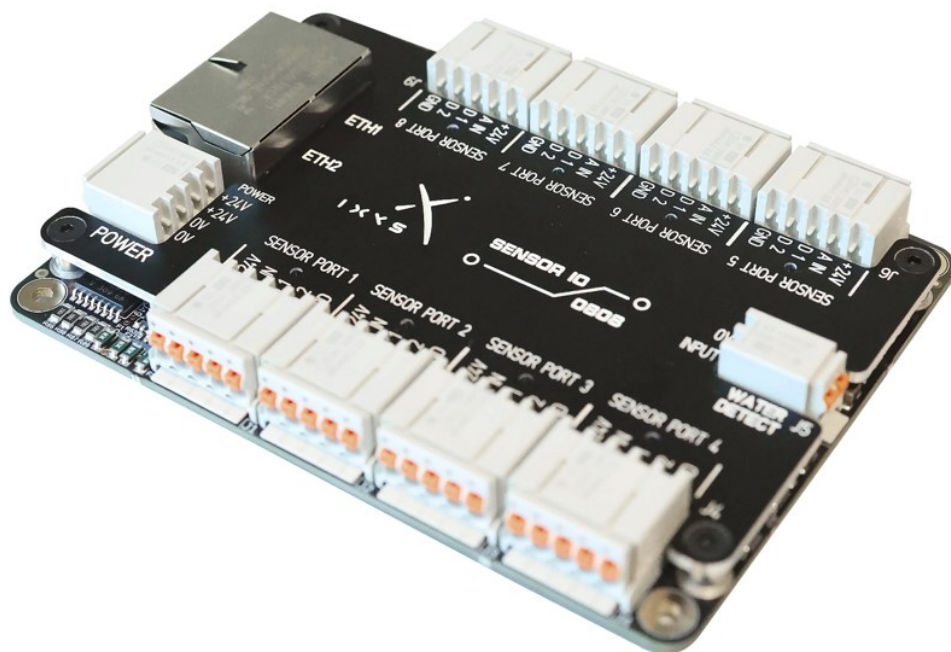


# USER MANUAL

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## SENSOR IO REVISION A



## REVISIONS

PUBLISHED	REVISION	NOTES	REVISED BY
15.06.2026	A	Issued for release	TRC



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# 1 INTRODUCTION

## 1.1 PURPOSE AND SCOPE

This document outlines and defines the installation, operation, and maintenance procedures for the Ixys Sensor IO PCB. The manual will contain all relevant data and methods to be able to use and maintain the device for its intended purpose.

The manual includes technical specifications, installation information, description of the various product features, as well as troubleshooting suggestions.

## 1.2 ABBREVIATIONS

ABBREVIATION	DESCRIPTION
ADC	Analog to Digital Converter
ESD	Electrostatic Discharge
IP	Internet Protocol
NPN	Negative-Positive-Negative / Sink
PCB	Printed Circuit Boards
PNP	Positive-Negative-Positive / Source
PPM	Pulse-Per-Minute
TCP	Transmission Control Protocol
UDP	User Datagram Protocol

## 1.3 SUPPLIER CONTACT INFORMATION

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Langmyra 11  
4344 Bryne  
Norway

+47 51 42 22 22

[post@ixys.no](mailto:post@ixys.no)

<https://ixys.no>

## 1.4 DOCUMENT REFERENCES

DOCUMENT NUMBER	DESCRIPTION
121273-IX-DAS-0001	Datasheet







## 2 HEALTH, SAFETY AND ENVIRONMENT

### 2.1 GENERAL

Safety Notes and General Precautions shall be presented to all personnel concerned prior to testing, operation, maintenance, and repair. The operations shall be performed by the responsible engineer/supervisor. The personnel using this equipment must have knowledge of this type of equipment and have familiarized themselves with the applicable procedures and manuals for this product.

### 2.2 SAFETY MESSAGE LEVELS

Safety message level	Indication
	<b>DANGER:</b> A hazardous situation which, if not avoided, will result in death or serious injury
	<b>WARNING:</b> A hazardous situation which, if not avoided, could result in death or serious injury
	<b>CAUTION:</b> A hazardous situation which, if not avoided, could result in minor or moderate injury or damage to equipment
	<b>Electrical Hazard:</b> The possibility of electrical risks if instructions are not followed in a proper manner
<b>Note:</b>	A potential situation which, if not avoided, could result in an undesirable result or state. A practice not related to personal injury



## 3 TECHNICAL INFORMATION AND DATA

### 3.1 TECHNICAL DESCRIPTION

Sensor IO is a printed circuit board with dual Ethernet ports and a built-in switch enabling daisy-chaining multiple PCBs. The board has 8 isolated ports, which each has an analog 4-20 mA input and two digital inputs. The digital inputs can be combined to read encoders or flow meters. Each port also provides a 24 V supply, to power sensors.

The PCB has a full-featured, user-friendly web-interface, which allows configuration of all features. There's also a live view of input values.

All inputs and outputs are available over Modbus, for usage from Ixys VJU Studio or other systems. The PCB supports Modbus over TCP and UDP over Ethernet.

The board has built-in monitoring of supply voltage and water detection.

### 3.2 TECHNICAL DATA

Manufacturer	Ixys AS
Ixys part number	121273
Description	PCB Sensor IO
Weight	~ 150 g
Dimensions	120 x 90 x 22 mm
Supply voltage	24 V DC (10-30)
Power consumption	< 3 W*
Network connectivity	10/100 Mbps

\*Power consumption when idle, only Ethernet communication active

### 3.3 WARRANTY CONDITIONS AND GUARANTEE

- Improper use of equipment where use is not reflected in what it was intended to.
- Where general maintenance is not performed, leading to defective parts or other types of defects.
- Incorrect handling or use of equipment.
- Packing not carried out in an ESD protective way.

### 3.4 ORDERING

Ixys Part Number	Description
121273	PCB Sensor IO



### 3.5 ACCESSORIES

Ixys Part Number	Description
114568	Connector – 2-way plug Wago 3.5 mm 2091-1122
112073	Connector – 4-way plug Wago 3.5 mm 2091-1124
117390	Connector – 5-way plug Wago 3.5 mm 2091-1125



## 4 HARDWARE DESCRIPTION

### 4.1 DRAWING

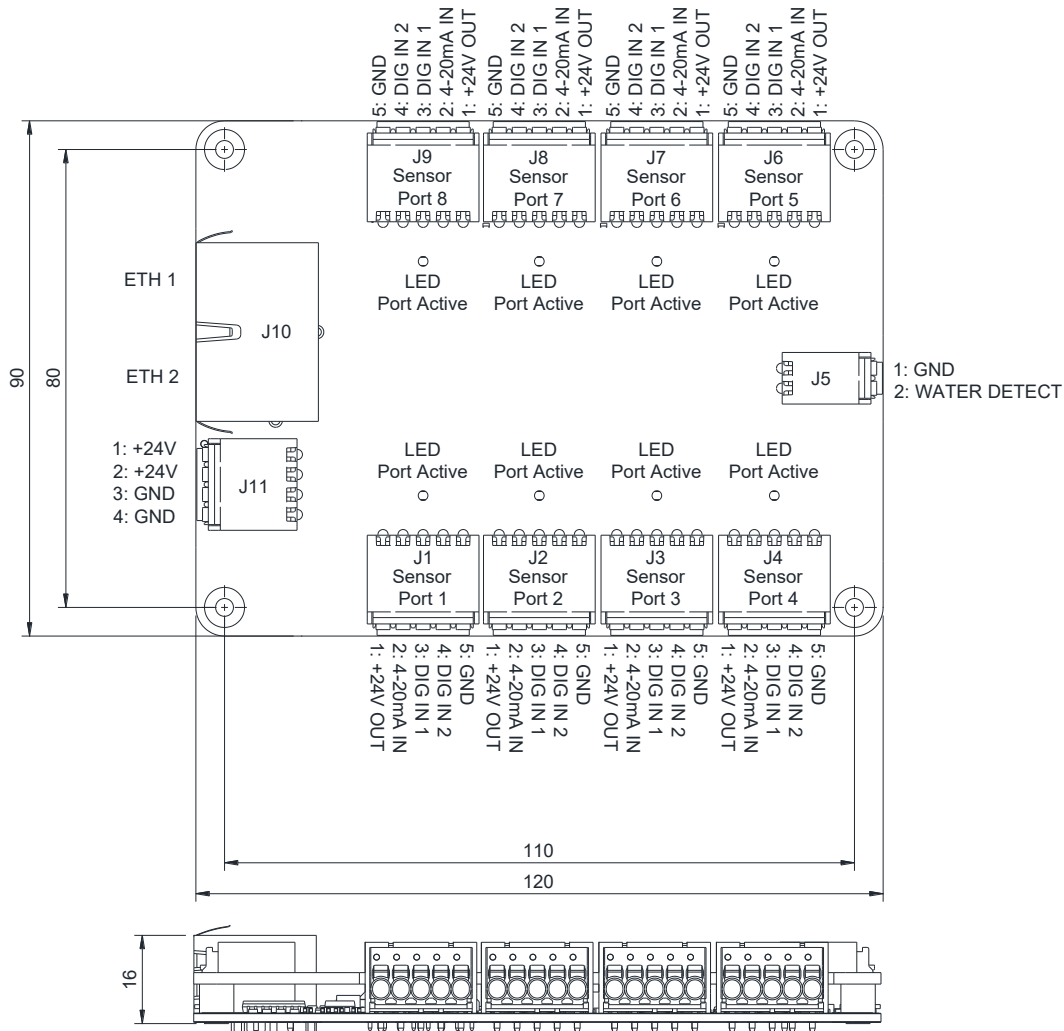


Figure 1: PCB diagram including dimensions and pinout

### 4.2 LEDS

The blue POWER LED will light up as soon as the board is powered correctly. A 1 Hz blinking orange activity LED marked ACT indicates that the PCB is running.

Each RJ45 has two LEDs. The green LED is a combined link/activity LED for each port. When it's lit, a link has been established, and blinking indicates activity. The yellow LED indicates port speed.

For each port there is a red LED that is lit when the port's supply output is enabled.



## 4.3 CONNECTIONS

The PCB should be powered by connecting supply voltage on J11.

J5 is usable for water detection. If pin 1 and pin 2 of this connector are shorted, the board will detect this and indicate it as described in section 6.2.

Each port has 5 pins: 24 V DC out, 4-20 mA input, digital in A, digital in B and GND.

4-20 mA sensors can be directly connected to each of the ports. If the sensor needs 24 V DC supply, that can be drawn from the 24 V DC output of the connectors, if desired. The 24 V DC pins are each protected with an auto-resetting 460 mA PTC fuse.

The digital inputs support both NPN and PNP inputs. The encoder counter will count rising edges of PNP inputs and falling edges of an NPN input.



## 5 FUNCTIONAL DESCRIPTION

### 5.1 GENERAL

The PCB has a water detect input, which can be used to indicate water intrusion, and supply voltage measurement. See section 6.2 for details on how to read out these values.

#### 5.1.1 WEB INTERFACE

All features of the PCB can be configured from a user-friendly web interface. The web interface is accessible by opening the device's IP address in any modern browser.

The About page shows the firmware version, serial number and hardware revision. It's also possible to perform a Factory reset to return all settings to default, and to reboot the PCB.

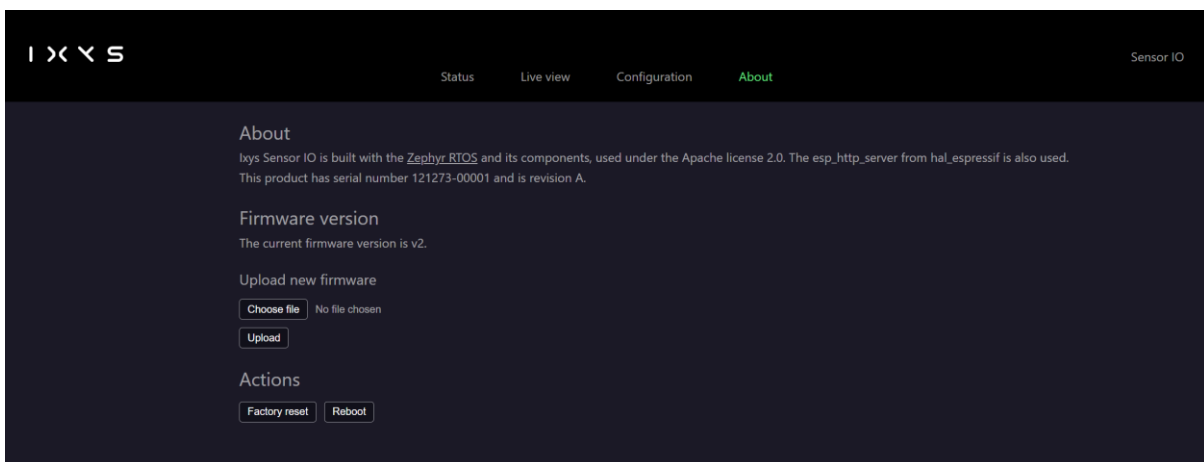


Figure 2: About page in the web application.

All configuration is available on the Configuration tab, including the ability to change the PCB's IP address.

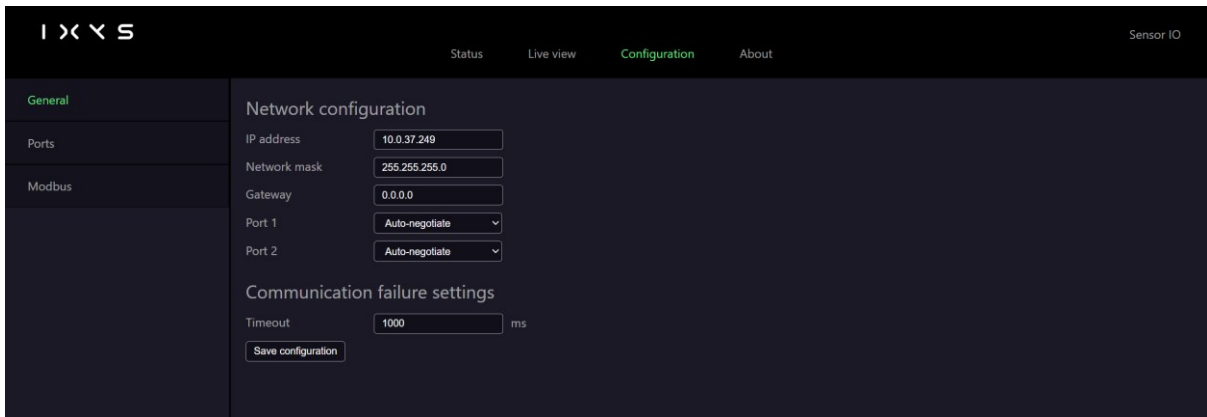


Figure 3: Basic configuration options including network settings are available on the General configuration page.

The Live view tab allows viewing the current sensor values and states.

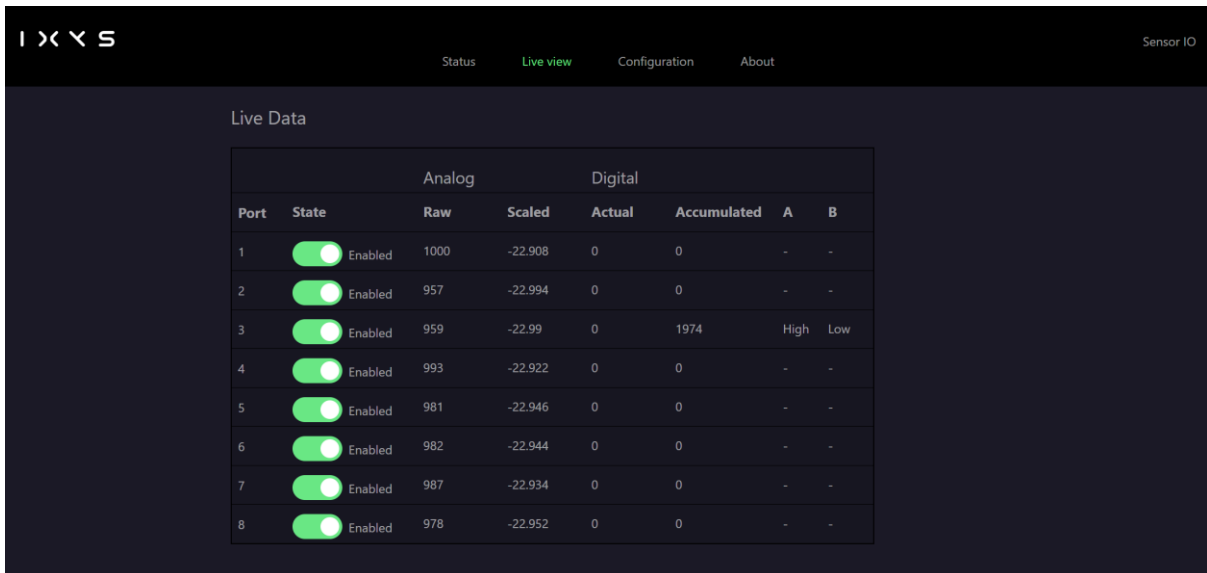


Figure 4: Live view of values in the web application.

The PCB state is available on the Status page, e.g. voltages and temperatures. This page also shows link state and data counters for the Ethernet ports.



The screenshot shows the 'Status' page of a web application. At the top, there is a navigation bar with the IXYS logo on the left and 'Sensor IO' on the right. The main content area is titled 'Status' and contains two tables. The first table lists system metrics: Total Uptime (0 days 0 hours 7 minutes 18 sec), Supply Voltage (23.9 V), Core Temperature (41.8 °C), Ambient Temperature (37.9 °C), and Water Alarm (Water not detected). The second table is a network port status table with columns for Port, State, Speed, Duplex, In, and Out.

Port	State	Speed	Duplex	In	Out
Port 1	Link	100 Mbps	Full duplex	16 kbps (480 kB)	12 kbps (581 kB)
Port 2	No link	-	-	0 bps (0 B)	0 bps (0 B)

Figure 5: Status page in web application.

## 5.1.2 NETWORK PORTS

The PCB has two Ethernet ports, which functions as an Ethernet switch. Other PCBs or network devices can therefore be daisy-chained if needed.

Each port is set up with auto-negotiation enabled by default, but port speed and duplex mode can be forced per port from the web interface, if required.

Sensor IO default IP is 10.0.37.249/24.

## 5.1.3 COMMUNICATION FAILURE

When used as part of a control system, it is usually expected that another device in the system will write desired output states to the PCB periodically. Should such writes not happen for a given period, this often indicates a system problem.

The board therefore monitors Modbus writes and can be configured to zero all outputs a certain time after the last write. This time period is called the Communication Failure timeout, and can be set from the web interface, or in a Modbus register.

By default, the board has its timeout set to 0, which means that all outputs will be left as-is when the Communication Failure timeout triggers. If the timeout is set to a non-zero value, all outputs will be set to 0 once the timeout triggers.

## 5.1.4 HEARTBEAT BROADCAST

Every 5 seconds, the device sends a UTF-8 encoded JSON object in a UDP packet to the broadcast IP 255.255.255.255 on port 65000. This message includes the device's IP address, firmware version, serial number, and allows easy identification.



Ixys VJU Studio software will use this to automatically identify the device, but it can also be found manually for instance with Wireshark, or by other applications.

### 5.1.5 MODBUS TCP/UDP

The PCB supports Modbus/TCP and Modbus/UDP over Ethernet.

The default Modbus Unit ID is 1. Registers that can be read or written to are described in section 6.2.

All readable registers can be read with Function Code Read Holding Registers and Read Input Registers. All registers are writable with both Write Single Register and Write Multiple Registers.

### 5.1.6 FIRMWARE UPGRADE

Firmware upgrades will be made available on an ongoing basis on [ixys.no](http://ixys.no). Upgrades are provided as a zip archive of an updater-application. The updater application will upgrade both the actual firmware and the web interface.

```
Sensor IO updater v2
-----
Make sure you're connected to the card's ethernet interface.
Enter the card's IP address, or press enter to use default [10.0.37.249].
|
```

Figure 6: Updater application

After an upload has been completed, the PCB should be kept powered for a couple of minutes to allow the upgrade to finalize.

## 5.2 PORT SUPPLY VOLTAGE

All ports on Sensor IO are galvanically isolated from the board's main supply, and from the other ports. If there is a ground fault on one of the ports' outputs or inputs, this fault will hence not affect any other part of the system when the port is disabled.

Each port has a separate, galvanically isolated fused power supply output. The fuses will trip at 460 mA and will auto-reset. Each output port can be turned individually on or off both from the web interface, or through a Modbus register.



By default, all ports are enabled when the PCB is powered. The default state for each port can be configured from the web interface, or through a Modbus register.

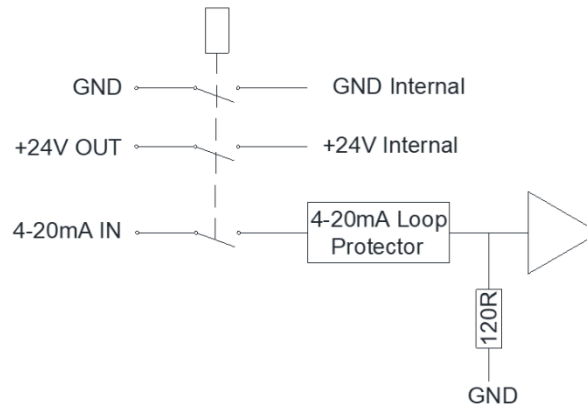


Figure 7: Power circuitry of each port.

## 5.3 ANALOG INPUTS

### 5.3.1 GENERAL

Each input channel can be used to read a 4-20 mA sensor. The sensor signal is terminated in a 120 Ohm resistor and measured using a 16-bit ADC with a 2.5 V reference.

$$\text{Value} = \frac{(A * 120 \Omega)}{2.5 V} * 65535$$

A 20 mA signal will give a reading of about 62900, while a 4 mA signal will give a reading of about 12600.

For each port, there is both a Raw value read from the ADC and a floating-point Scaled value available. The scaling values can be configured independently for each input.

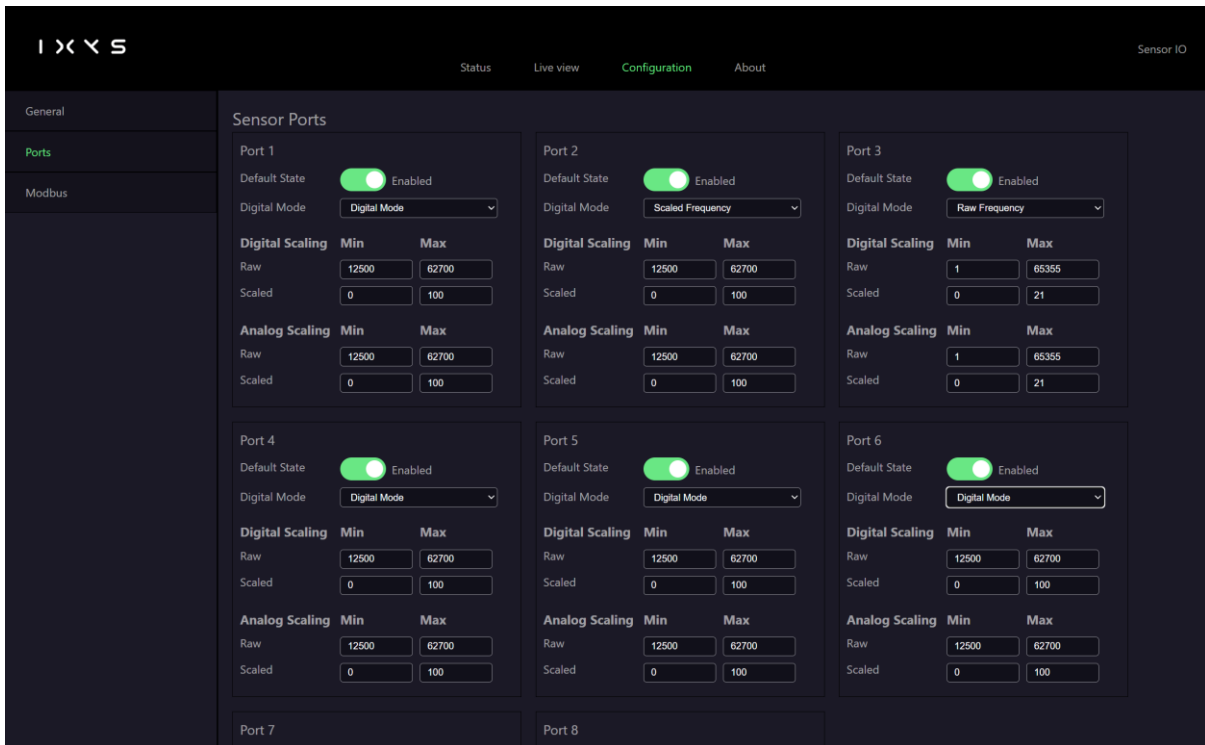


Figure 8: Port configuration page

## 5.4 DIGITAL INPUTS

Each port has two digital inputs, with circuitry to determine if the pin is held high, low, or is left floating. The two inputs can be combined to read an encoder or flow meter.

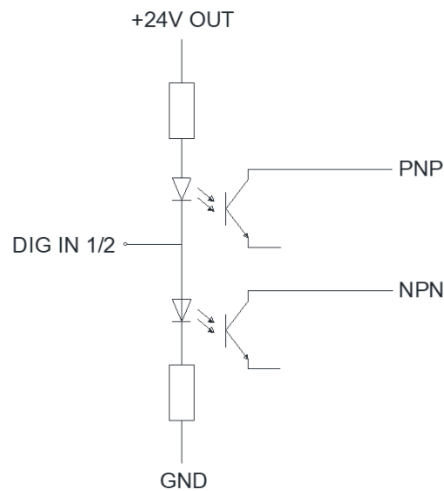


Figure 9: Digital input circuit.



### 5.4.1 DIGITAL MODES

While a port is enabled, the PCB will count edges on the digital inputs by sampling at 10 kHz. The counted edges are used to calculate both a pulses-per-minute value (PPM) and accumulate into a counter value.

There are 5 different counter modes available, as indicated in the table below.

**Note:** If a single output encoder is used, the corresponding counter will count only upwards if the encoder is connected to Input 1.



<b>ID</b>	<b>Name</b>	<b>Accumulated</b>	<b>Actual</b>	<b>Description</b>
0	Digital Mode	Accumulated counter	Electrical input level	
1	Frequency	Accumulated counter	PPM / Edge frequency	Accumulated is signed, frequency only positive.
2	Directional Frequency	Accumulated counter	PPM / Edge frequency	Accumulated and frequency are signed.
3	Scaled Frequency	Accumulated counter	PPM / Edge frequency	Accumulated is signed, frequency only positive. Actual value is scaled.
4	Scaled Directional Frequency	Accumulated counter	PPM / Edge frequency	Accumulated and frequency are signed. Actual value is scaled.



## 6 REGISTERS

### 6.1 DATA TYPES

The following table describes the data types used. For 32-bit values two Modbus registers are used, where the first is the most significant.

Name	Size	Value Range
INT16	2 bytes	-32,768 to 32,767
UINT16	2 bytes	0 to 65,535
INT32	4 bytes	-2,147,483,648 to 2,147,483,647
UINT32	4 bytes	0 to 4,294,967,295
REAL32	4 bytes	1.2E-38 to 3.4E+38

### 6.2 HEADER REGISTERS

Register 6 is stored in non-volatile memory when changed.

Address	Description	Default	Note	Data Type
0	PCB Type	51	Sensor IO PCB type ID	UINT16
1	Serial Number	N/A		UINT16
2	Firmware Version	N/A		UINT16
3	Status	N/A	Bit0 = Reserved Bit1 = Water Alarm	UINT16
4	Reserved	N/A		UINT16
5	Supply voltage	N/A	Unit = 0.1 V	UINT16
6	Timeout	0	Milliseconds without writes before Communication Failure is triggered. See section 5.1.2.	UINT16
7	Unit identifier	1	Modbus unit identifier	UINT16
8	Heartbeat	N/A	Increments by one each second and rollover at 65535	UINT16
9	Reserved	N/A		UINT16

### 6.3 INPUT REGISTERS

Address	Description	Note	Data Type
125	Port 1 Enabled State	1 = Enabled, 0 = Disabled (read only)	UINT16
126	Port 1 Analog Raw	Raw ADC value where 4 mA = 12600, 20 mA = 62900	UINT16



127	Port 1 Analog Scaled MSB	Analog input raw value scaled according to scale settings and presented as floating-point number.	REAL32
128	Port 1 Analog Scaled LSB		
129	Port 1 Digital Input State	Pull-up state of digital input 1 and 2. Bit 0 = Digital Input 1, Bit 1 = Digital Input 2. 1 = Input is high, 0 = input is low or floating.	UINT16
130	Port 1 Digital Input State Inverse	Pull-down state of digital input 1 and 2. Bit 0 = Digital Input 1, Bit 1 = Digital Input 2. 1 = Input is low, 0 = input is high or floating.	UINT16
131	Port 1 Digital Actual Value	Current actual value of the digital encoder. Depends on Digital Mode Setting.	UINT16
132-133	Port 1 Reserved		UINT16
134	Port 1 Digital Scaled MSB	Accumulated edge counter, as configured by the port's Digital Mode setting.	REAL32
135	Port 1 Digital Scaled LSB		
136-139	Port 1 Reserved		UINT16
140-244	Port 2-8	Same as registers 125-139 repeated for each port	

## 6.4 OUTPUT REGISTERS

Address	Description	Note	Data Type
250	Port 1 State	1 = Enabled, 0 = Disabled (Non-persistent)	UINT16
251-257	Port 2-8 State	Same as register 250 for ports 2 to 8	UINT16



## 6.5 SETTING REGISTERS

All setting registers are saved when written.

### 6.5.1 INPUT SETTINGS

Address	Description	Default	Note	Data Type
375	Port 1 Default Enabled State	1	Enabled state startup value. 1 = Enabled, 0 = Disabled.	UINT16
376	Port 1 Analog Raw Max	62700	Raw value corresponding to Scaled Max value	UINT16
377	Port 1 Analog Raw Min	12500	Raw value corresponding to Scaled Min value	UINT16
378	Port 1 Analog Scaled Max	100	A high reference for calibration of input scaling (typically sensor maximum)	INT16
379	Port 1 Analog Scaled Min	0	A low reference for calibration of input scaling (typically zero)	INT16
380	Port 1 Counter Mode	0	0 = Digital Mode 1 = Frequency 2 = Directional Frequency 3 = Scaled Frequency 4 = Scaled Directional Frequency See section 5.4.1 for details.	UINT16
381	Port 1 Digital Raw Max	100	Raw value corresponding to Scaled Min value	UINT16
382	Port 1 Digital Raw Min	0	Raw value corresponding to Scaled Max value	UINT16
383	Port 1 Digital Scaled Max	100	A low reference for calibration of input scaling (typically zero)	INT16
384	Port 1 Digital Scaled Min	0	A high reference for calibration of input scaling (typically sensor maximum)	INT16
385-389	Reserved			UINT16
390-494	Port 2-8	Same as registers 375 to 389 repeated for ports 2-8.		



## 7 TROUBLESHOOTING / FAULTFINDING

Symptom	Possible cause	Remedy
Power LED not lit	Not powered	<ul style="list-style-type: none"><li>• Verify power connections are according to specifications in section 3.2 and connected as in section 4.3</li></ul>
	Faulty PCB	<ul style="list-style-type: none"><li>• Contact Ixys support</li></ul>
No link LED	Linked device not powered	<ul style="list-style-type: none"><li>• Verify linked device is powered</li></ul>
	Faulty cabling	<ul style="list-style-type: none"><li>• Try different network cable</li><li>• Verify cable used with other equipment</li></ul>
Intermittent link LED	Poor cabling	<ul style="list-style-type: none"><li>• Try different network cable</li><li>• Verify cable used with other equipment</li></ul>
	Wrong configuration	<ul style="list-style-type: none"><li>• Verify that linked device is correctly powered</li><li>• Try using fixed speed and duplex on both devices</li></ul>
Not able to access web interface	Wrong IP address being used	<ul style="list-style-type: none"><li>• Use VJU Device Discovery or read broadcast messages to identify IP. See section 5.1.4 for details.</li></ul>
	Client device in wrong subnet	<ul style="list-style-type: none"><li>• Verify the client is in the same subnet as the PCB</li></ul>