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# VPVision Mobile

User manual

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# VPVision Mobile

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Van Putten Instruments BV  
Marlotlaan 1G  
2614 GV Delft  
The Netherlands

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# 1 Warning - Read this first

	Read and understand user manuals of all equipment involved before commencing installation or use.
	<b>Compressed air can be dangerous!</b> Please familiarize yourself with the forces under pressurized conditions. Respect the local guidelines and regulations for working with pressurized equipment.
	All electrical installations to be carried out by authorized electrical installation engineers only.
	<b>WARNING:</b> 100...250 VAC mains cables are present in the housing. Do not touch the cables and the power supply when mains is applied. Keep the housing closed during normal operation. Check the cable glands on water tightness.
	<b>Do not overestimate the results. VPIstruments does not take any responsibility for the correctness of measurement results under field conditions.</b> The practical measurement uncertainty of a flow meter in the field may vary, depending on how well it is installed, due to the nature of gas flow. The piping table provides guidelines on how to optimize the field accuracy. Our products are not intended to be used as a single means to determine compressor capacity.
	<b>Avoid heat.</b> Make sure that the ambient temperature does not exceed the limits. Overheating might cause temporary shutdown or permanent failure of the hardware.
	<b>Do not open the device.</b> Our instruments are assembled with high precision. Opening this device is dangerous and may destroy the instrument. Warranty is voided when you open the instrument.
	<b>Feedback leads to product improvement.</b> Please share your experience with us, as we are continuously improving our products in our commitment to quality, reliability and ease of use. Let us know via <a href="mailto:sales@vpinstruments.com">sales@vpinstruments.com</a> !

## 2 Introduction

Congratulations! **You purchased the easiest to use and fastest compressed air measurement tool in the world.** With the VPVision Mobile, you can monitor all your energy utilities simultaneously in the field.

VPVision Mobile offers an all in one solution for audits by using the VPVision M hardware combined with multiple connectivity options in a mobile package. VPVision is a web based energy monitoring system, primarily developed to monitor all energy flows in a plant. It monitors your entire compressed air system from supply to demand side. Thanks to the standardized hardware and the modular software architecture, VPVision is scalable and adaptable.

### About this manual

We have written this manual to help you to get the VPVision Mobile system up and running in no time. Basic IT and network knowledge is required combined with a basic understanding of flow measurement principles and hardware installation.

### Sensors

VPVision Mobile supports all VPInstruments sensors, and other Modbus RTU or 4..20 mA based sensor types. For some Modbus sensors, we offer pre installed drivers for quick and easy installation. If the pre installed Modbus sensor driver is not available, please contact VPInstruments.

### Software options:

VPVision has several software options. See our website for details, as VPVision is continuously evolving.

### Language options:

VPVision is available in international English only.

Check the packaging box for any inconsistencies. Should there be any shipping damage, notify the local carrier. At the same time a report should be submitted to Van Putten Instruments BV, Marlotlaan 1G, 2614 GV DELFT, The Netherlands.

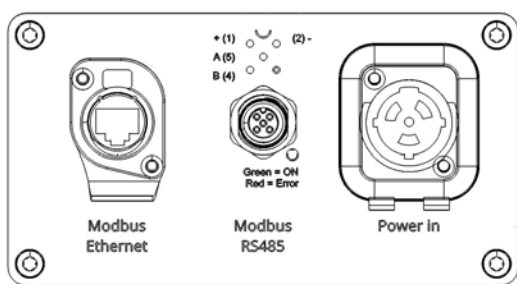
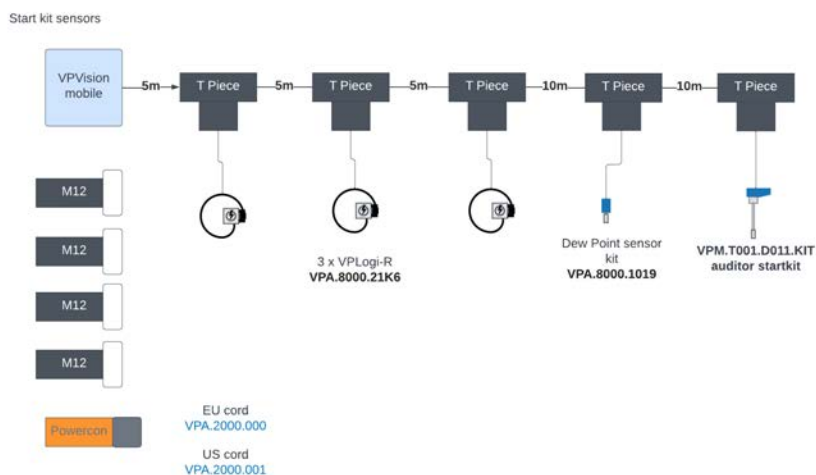
For technical questions or support inquiries, please contact us by email at [support@vpinstruments.com](mailto:support@vpinstruments.com).

Older software features may not be covered by the contents of this user manual. Please contact us for a subscription program, which includes software updates!

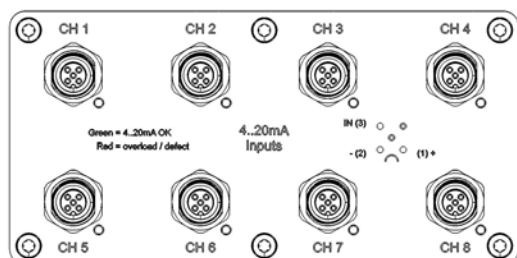
## 3 Product Overview

### 3.1 VPVision Mobile Case

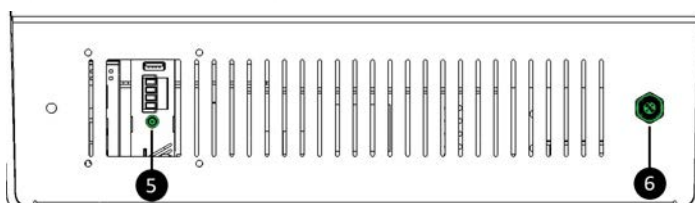
The VPVision Mobile case is the Platform which houses the VPVision Software and offers a wide variety of connectivity options. The case is designed to offer all the functionality of a permanent monitoring system in a portable package. A typical setup for the VPVision Mobile case is to connect it with Multiple sensors (Power/Dew point/Mass Flow) via Modbus TCP, Modbus RS485 or use the 4..20 mA analog inputs with M12 connectors. Next to the standard connectors for measurement the VPVision Mobile case offers the option to connect an external wireless antenna or a secondary battery.



1. Ethernet
2. Modbus RS485 (Green = OK, Red = Modbus or power error, Green blinking = communicating)
3. Power in: Neutrik NAC3MPX-TOP, 90-263VAC 47-63Hz



1. 8x 4..20mA analog inputs



1. External antenna connection: VPRouter
2. External battery connection: TE Connectivity T4130012021-000, 24V

## 4 Quick start in 9 steps

### Step 1. Unpack the VPVision Mobile

Unpack the box and check if all items are there and in good shape.

### Step 2. Install the VPVision Mobile case

Find a suitable location to install the VPVision Mobile case, preferably flat and dry, away from large machines and crowded paths. Connect the unit to a power source (110-250 VAC).

### Step 3. Configure your Modbus devices

Every Modbus device needs configuration. Depending on your type of device, different settings are required. Assign a unique Modbus address to each individual sensor, so they can be found within the Modbus network.

Third party Modbus devices can be added upon request and by consultant of VPInstruments.

### Step 4. Install the sensors

Ask your certified (electrical) installation subcontractor to install the sensors, and connect it to the Modbus network. Install analog sensors and make a list of analog input channels on your configuration sheet. See also the [documentation example](#).

### Step 5. Configure inputs

Configure the input channels in the backend of VPVision. You can add the sensors via [the web interface](#). Use your configuration sheet as a reference for the channel names, sensor locations, sensor ranges, diameter settings, etc.

### Step 6. Configure widgets

Once the channels are in place, you can start to [configure the widgets](#). Several types are available to visualize all the data.

Widgets and sections can be named in a preferred language.

### Step 7. Configure pages

Once the channels and widgets are in place, you can start to [configure the pages](#). Assign the widgets to the pages, one page can hold multiple widgets.

### Step 8. Configure your reports

Configure your reports using the [page reports](#).

### Step 9. Use VPVision and save!

Now it is time to lean back, relax and monitor your entire system. Let us know how much you did save! We will reward every white paper or savings success story with a nice gift.



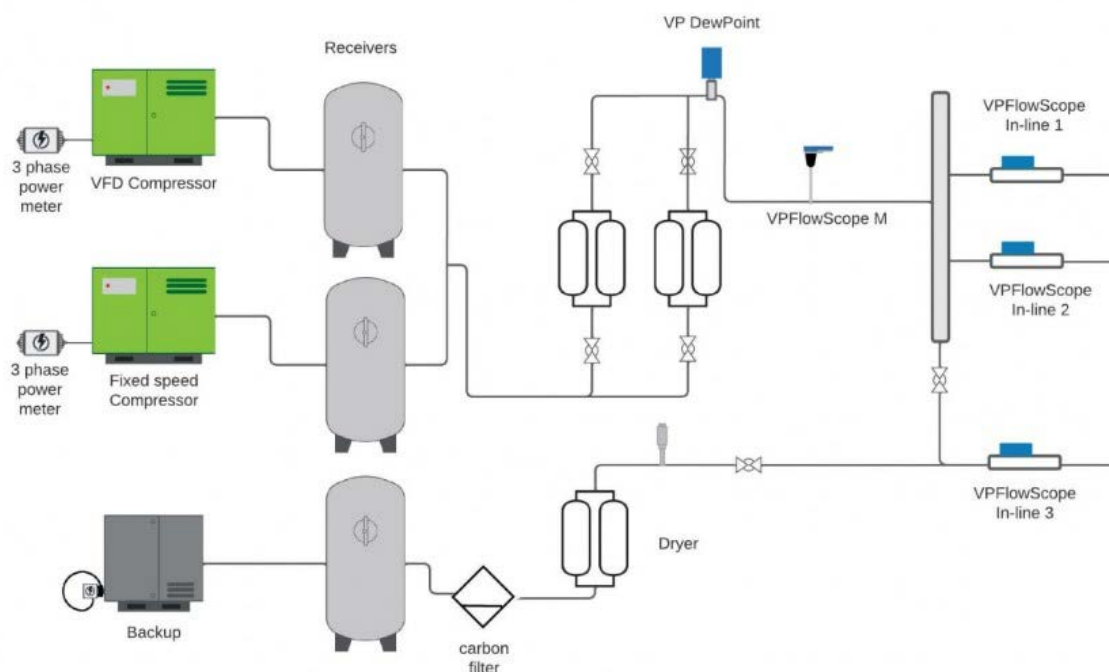
## 5 Preparation



Preparation is the key to smooth installation. A lot of things can be prepared before the actual installation or even the purchase of the complete system.

### 5.1 P&ID

An overview of the installation will help you to determine where to install the sensors. Inspect all locations and make sure that all environmental specifications for the sensors are met.



### 5.2 Contact IT department

#### 5.2.1 General access

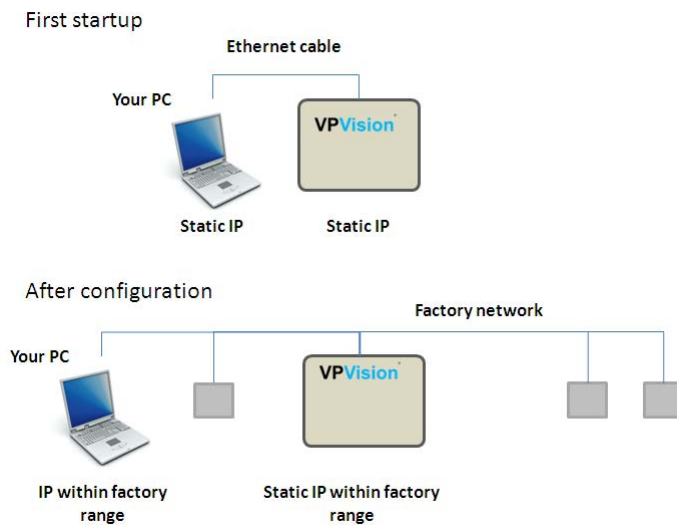
VPVision is a web based monitoring system. An Ethernet connection to the VPVision unit is required to view the system from your computer. The IT department can provide you with IP address(es) and physical connection to the factory Ethernet network.

##### Define your network

- IP addresses must be unique
- Gateway must be defined
- Subnet mask must be defined
- DNS must be defined
- Relay host needs to be defined in order to send mail
- When using existing network structure: Get your address range: Check with client IT dept

##### General convention on IP numbers

To make it more easy to find a device, we will use the following guidelines to assign IP addresses to devices in the network. In existing networks, this might not be possible due to limitation.



### Ethernet address example

The default address for LAN port: See the configuration leaflet, which comes with your VPVision system.

### Example network configuration:

- 10.0.0.1 VPVision-M
- 10.0.0.2 Analog inputs, building 1
- 10.0.0.254 Gateway

## 5.2.2 Connect via Ethernet

VPVision can communicate with Modbus and analog sensors via Ethernet. In most factories, Ethernet is available throughout the complete plant.

## 5.2.3 Access remotely



Make sure that your IT department provides VPN access to the network for remote support.

You can view the VPVision system on any computer, tablet or smartphone as long as the VPVision has access to the Internet. External access to the VPVision system is possible with the VPRouter via the VPInstruments cloud environment. Please contact your IT department in an early stage to prevent any delays. See [VPN connection](#) for more information.

## 5.3 Create wiring diagram

A wiring diagram will help you to determine what parts to use.

### Inputs

Modbus devices need to be daisy-chained with a maximum of 8 devices in one chain.

Analog sensors need to be wired to the available ports separately. Up to 8 sensors can be connected to VPVision Mobile.

**Acessories**

Part	Description
VPA.5000.000	5-pin M12 MALE connector (connector with screw terminal)
VPA.5000.010	Cable 10m/32.8ft. with 5 pin M12 on one side
VPA.5000.060	Modbus T Splitter
VPA.5000.061	Modbus RS485 bus termination connector
VPA.5000.062	Modbus cable 10 m with 5 pin M12 on both sides
VPA.5000.105	Modbus cable 5 m with 5 pin M12 on both sides
VPA.5000.063	Modbus cable 1 m with 5 pin M12 on both sides
VPA.5000.160	RS485 network cable set; combination of VPA.5000.060, VPA.5000.062, VPA.5000.063

**5.4 Sensor configuration**

The sensors require configuration before they can be connected to VPVision. Read the sensor's manual for more information.

**Modbus devices**

A Modbus device needs to have a unique hardware address in it's daisy chain. Every Modbus sensor in the same daisy chain requires this unique Modbus address. But every Modbus sensor in the same daisy chain also requires equal communication settings like baud rate, parity and stop bits for this daisy chain.

**Analog devices**

Analog sensor values will need to be converted in to real measurement values. This is done by zero and span where zero matches 4mA and span matches 20mA. These numbers can be calculated during the preparation and will be entered in to VPVision during configuration.

## 6 Hardware installation



**Warning:** Installation involves connection to mains. Installation of field cables requires indepth knowledge and skills. Therefore all steps that involve electrical installation should be carried out by certified installation professionals.



Make sure that the ambient temperature does not exceed the limits of the VPVision (max 40 deg C | 104 F). Higher ambient temperature requires suitcase cooling.



Check if the earth wire (field ground) is free of interference and potential dangerous high voltage. Make sure the circuit breaker is in off position. Then install the L, N and Earth wire. The L, N and Earth may have a different color, depending on your local legislation and directives for medium voltage systems.

### 6.1 VPVision-M

The VPVision is mounted in a PVC explorer case including:

- AC IN: Two Phase Mains input 100..240 VAC.
- LAN: An Ethernet port for connection to your network. Address can be pre-configured.
- The VPVision-M computer.
- 8 Ch analog input converter
- VPRouter

**NOTE:** Be aware that VPVision-M must be able to communicate with all the connected sensors and nothing is blocking this communication (firewalls, switches).

### 6.2 PC connection

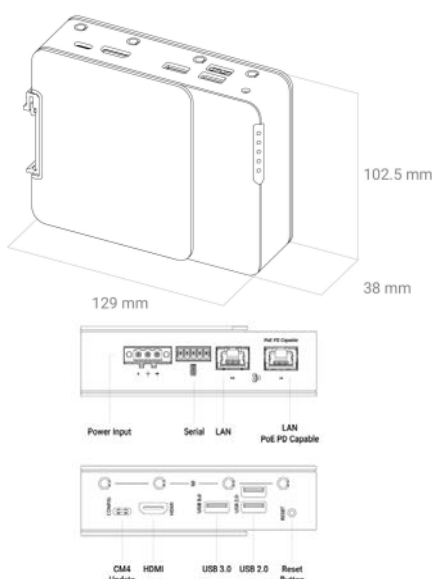


You need to set your computer's IP address to a static ip address when connecting your computer to the VPVision. The address should be within the same IP range as the VPVision. See the configuration sheet which comes with your VPVision to find the default configuration.

To connect your PC or Laptop, use the ethernet port.

Connect an Ethernet cable between laptop (PC) and the VPVision-M LAN. The Laptop should have a static IP address within the same range as the VPVision-M. If you don't know how to set a statis IP adress on your laptop, please contact your IT department. Make sure the IP address is not the same as the VPVision-M.

Open your webbrowser, type in the IP address of the VPVision-M and you should see the startup screen. Now you can configure the system ([see Configuration backend](#)).



## 6.3 RS485 connection



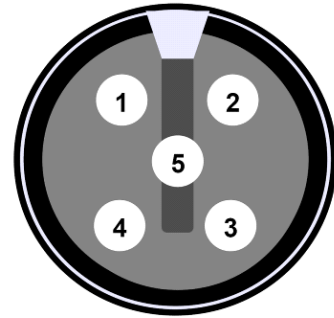
Installing a RS485 network require specific knowledge. Not following the specifications strictly might result in in-correct communications and equipment damage. Please leave installation up to professional contractors. Make sure that they read this chapter carefully and follow up all RS485 guidelines.

### RS485 connection terminal

The VPI Vision M features 1 pre-wired RS485 interface. It contains the following pins:

Pin	Signal	Wire color
1	Power + (24VDC)	Brown
2	Power -	White
3		
4	Modbus B/+	Black
5	Modbus A/-	Grey

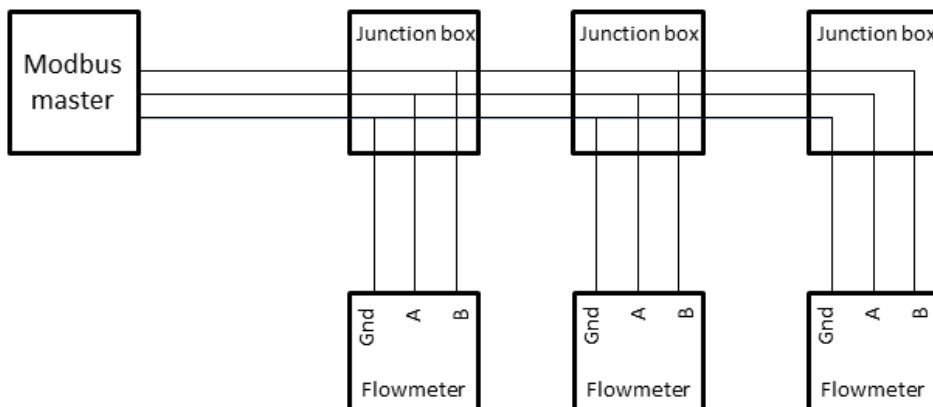
\* Wire colors apply to VPI Instruments cables



M12 5-pin female connector

### RS485 wiring

RS485 is a differential balanced line over twisted pair. It can span relatively large distances up to 1200 meter | 4000 feet. The wires should be connected as a point-to-point configuration, or also called daisy chain. Do not install as star or ring network! The trunk line goes from the master to all devices making a drop down to each device. The cable length from the trunk line to the Modbus device needs to be as small as possible. Junction boxes are used to make the T junction.



Shielded twisted pair should be used. For Modbus field cabling only use the [recommended cables](#) sized and shielded in line with the specific situation in your plant. Connection of a third wire between the master and slave should be done to limit the common mode voltage that can be impressed on the slaves inputs.

### Bus power

The VPFlowScope probe can be powered via the same trunk line. 2 separate wires are used for power + and power -. Take in account that long wires with multiple slaves will cause voltage drops. The minimum supply voltage is 12VDC measured at the last VPFlowScope probe in the daisy chain.

### Termination resistor

Termination resistors reduce electrical noise sensitivity. They need to be added to the installation when cable distances become longer than 10 meter. The value of each termination resistor should be equal to the cable characteristic impedance (typically, 120 ohms for twisted pairs).

There can only be one termination resistor at the very end of the trunk line. The VPInstruments junction box features a jumper that can be used to enable a 120 Ohm resistor. When using the VPInstruments Modbus Junction boxes make sure that the 120 Ohm resistor is only enabled in the last Modbus Junction box in the daisy chain.

### Biasing

When there is no data activity on an RS485 network, the communications lines are "floating" and, thus susceptible to external noise or interference. Receivers on a RS485 network have built in hysteresis (200mV differential required to insure known state). To insure that a receiver stays in an inactive state, when no data signal is present, bias resistors are required. Bias resistors are a pull-up resistor on Modbus B and a pull-down resistor on the Modbus A line. The value of the bias resistor depends on the number of devices and the supply voltage. The table below shows which resistor values can be used for different voltage in a chain with 1 to 8 VPFlowScope probes.

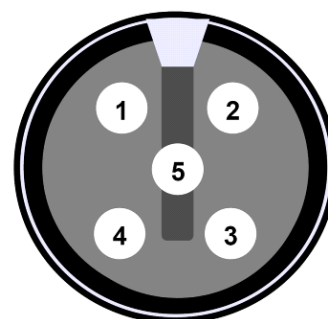
Supply voltage	Bias pull up	Bias pull down
12 V	5 K	1 K
24 V	10 K	1 K

## 6.4 Analog input connection

Analog sensors can be connected to VPVision Mobile. We have chosen for 4..20 mA as default interface. If needed, you can change the I/O converter to 0..10 Volt.

Pin	Signal	Wire color
1	Power + (24VDC)	Brown
2	Power -	White
3	4-20 mA input	Blue
4		
5		

\* Wire colors apply to VPInstruments cables



M12 5-pin female connector

### I/O converter description

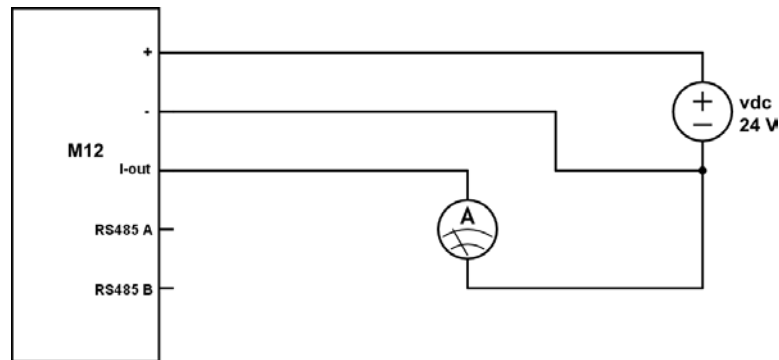
This converter contains 8 inputs. Internally, you can find dip switches which affect the analog input configuration. It can be set to 4..20 mA (default) or 0..10 Volt.

### 4..20 mA

An advantage of a current loop is that the accuracy of the signal is not affected by voltage drop over the line. Even if there is significant electrical resistance in the line, the current loop VPVision Mobile will maintain the proper current, up to its maximum voltage capability. The live-zero represented by 4mA allows the receiving instrument to detect some failures of the loop. An analog current loop can be converted to a voltage input with an external third party precision resistor.

### Cabling

3 wires are required to create a current loop. It is advised to use a shielded cable to prevent electrical noise to affect the signal.



## 6.5 VRouter (VPN connection)

For safe remote access to the VPVision-M without interfering with the client's network, a VRouter is available. In this way it is always possible to access the VPVision-M from a distance and it enables remote support and updates. The VPVision does not send out or retrieve any data to the internet. As long as port 80 is blocked, the VPVision is not visible from outside the premises. For remote viewing, port 80 or another (mapped) port can be added to access the web server from remote.

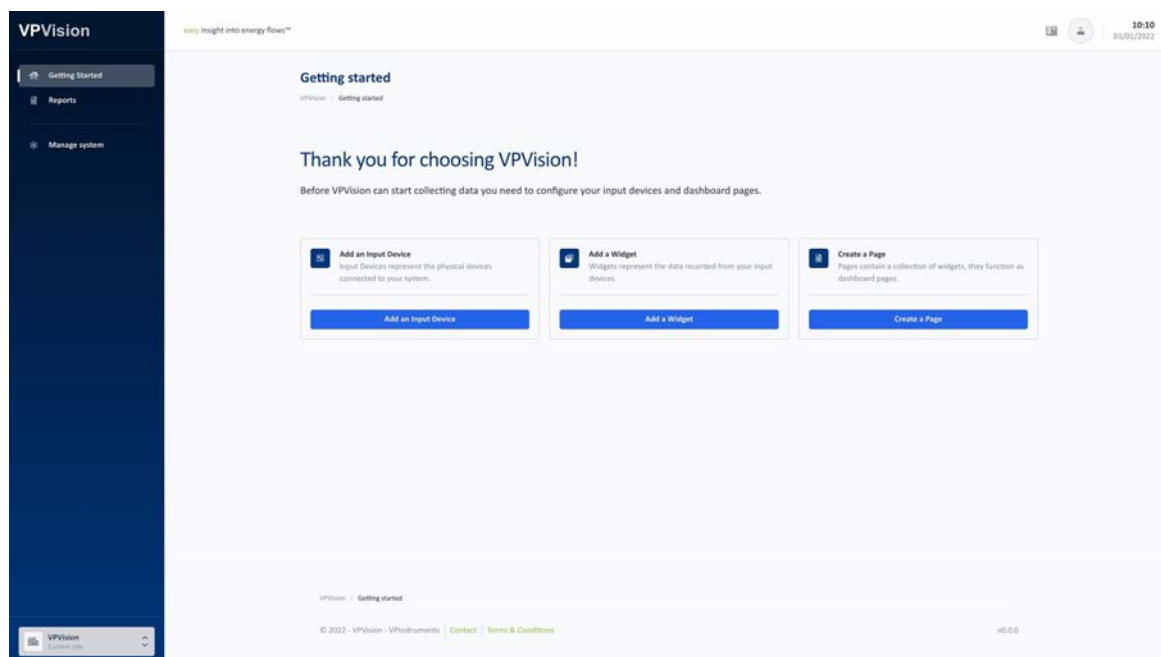
A cellular internet connection via the VRouter can be used if it is not possible to create a wired connection.

**NOTE:** Preferably use the VPN connection in the VRouter cloud environment for the best connection to your VPVision system.

## 6.6 Power supplies

The base unit features a UPS 4 Amp (100 Watt) power supply, which delivers power to the VPVision-M, up to 8 Modubs devices and 8 analog 4...20 mA loop powered sensors.

## 7 Getting started with VPVision



### 7.1 Terminology

<i>Pages</i>	Pages contain a collection of <i>widgets</i> , they function as dashboard pages.
<i>Widgets</i>	Widgets represent the data recorded from your <i>input devices</i> .
<i>Input devices</i>	Input devices are the physical devices connected to your system.
<i>Reports</i>	Reports are generated from Pages as a PDF file and can be configured to be periodically generated and sent through mail.
<i>Alarms</i>	Alarms are configured to monitor the state of an input device. Alarms can be configured to trigger a notification when a certain threshold has been reached.

### 7.2 Accessing the site settings

By pressing 'Manage system' or 'Sign-in', you can access the VPVision backend. On smaller screens the sidebar might be hidden, you will need to click the menu button in the top bar to open the sidebar in this case.

Once authenticated you can access various sections used to manage your system. These sections will be listed in the main menu.

In order to return to your VPVision frontend simply press 'Back to system' at the top of the menu.

### 7.3 Authentication

The VPVision backend requires user authentication. By default the system is provisioned with an administrator user. You can use this user to start configuring your system.

The credentials for the administrator user are:

**Username:** *admin*

**Password:** *visionair*

It is **STRONGLY** recommended to change the default password for the administrator user after first authentication.



You can quickly access the current user settings by pressing the user icon in the top bar, and navigating to the “Personal settings” page. The user icon will only be shown when you are signed in.

## 7.4 User management

VPVision has support for multiple users accounts. There are 2 user roles available, the default ‘user’ and ‘admin’ role.

- Users with the ‘user’ role have limited access to the application and can only manage input devices, pages and other related resources.
- Administrators have access to additional system settings, network management and user management.

You can access the user management by navigating to the ‘User’ section within the VPPVision backend.

## 7.5 Managing devices

Devices are critical for recording data and completely configuring your system. They represent the physical devices attached to your system.

Devices can be added in the ‘Devices’ section within the VPPVision backend. They need to be enabled to start recording data.

### Virtual Inputs

In addition to various physical device types, VPPVision also includes a virtual input. The virtual input can be used to combine multiple devices into one output or completely transform the incoming data by applying a formula.

Once a virtual input has been added you will be tasked to configure a formula before enabling the device.

This is done by pressing the ‘Update formula’ button on the device details screen.

For more information about composing formulas please refer to ‘The Formula Editor’ section in the appendix.

## 7.6 Managing widgets

Widgets represent the data recorded from one or multiple input devices. Additionally VPPVision ships with various widgets, like the P&ID widget, used to visualize your environment and can help you in navigating between pages within VPPVision.

Widgets can be added in the ‘Widgets’ section within the VPPVision backend.

### Custom formulas for KPI widgets

Out of the box the KPI widget comes with various predefined calculations. These calculations represent a formula.

VPPVision enables you to use your own custom formula within the KPI widget. Custom formula KPIs can be added by selecting the ‘Custom formula’ calculation whilst configuring a KPI widget.

Once a KPI has been added with the ‘Custom formula’ calculation you will be tasked to configure a formula. This is done by clicking the ‘Update Formula’ button on the widget details screen. This button is only shown for widgets with a custom formula. For more information about composing formulas please refer to ‘The Formula Editor’ section in the appendix.

### Managing KPI Calculation types

It is possible the ‘Custom Formula’ or other KPI calculation types are not yet enabled on your system.

To enable various KPI calculation types simply navigate to the 'KPI Types' section within the VPVision backend.

## 7.7 Managing pages

Pages are your primary source of data visualization. Pages can contain one or multiple widgets, of any kind, and can be subdivided into multiple windows. Windows are essentially a category within the page.

Pages can be added in the 'Pages' section within the VPVision backend.

After adding a page and enabling it, either from the 'Pages' section or directly whilst adding a new page, the page will be shown in the main menu.

## 7.8 Managing Reports and Alarms

Reports are available for each page, with an option at the top of every page to configure its reports.

Alarms can be configured independently from the rest of the system and are not required to start recording data. An active device is required to configure the alarm.

Alarms can be added in the 'Alarms' section respectively within the VPVision backend.

For scheduled reporting and automated alarm notifications you need to configure an 'SMTP outgoing email server'.

Without an SMTP server reports can be manually downloaded from the 'Reports' page found in the main menu.

Active alarms will be shown in the alarm type widget, this widget needs to be added to your system before you can add it to a page.

## 7.9 VPInstruments Cloud environment

With the VPRouter connection it is possible to remotely access the VPVision-M software via [cloud.vpinstruments.com](https://cloud.vpinstruments.com).

After signing in with your personal credentials you choose Connect for establishing the VPN connection.

In case there is no VPN available on your local machine, first install the VPN client.

Browse to 10.0.0.1 in a new tab and you will access the VPVision-M software.



## 7.10 Advanced configurations

As an administrator you can configure various global settings including various regional and reporting settings.

These settings can be found in the 'Settings' section within the VPVision backend.

### 7.10.1 System

The system settings can be used to rename the system, use an on-screen keyboard, enable data retention, delete data, or perform a factory reset.

### 7.10.2 Language & Region

These settings can be easily customized to align with preferences, including timezone, date/time format, decimal separator, thousand separator, and currency.

### 7.10.3 Reporting

Reporting settings allow for the customization of display and calculation preferences for widgets and page reports, including options for formatting, start of the week, number rounding, paper size, and the reporting header.

Electricity cost in Euro per kWh, can also be adjusted. Operating hours are applied to constrained KPI calculations.

### 7.10.4 Users

It is possible to add more users accounts.

There are 2 user roles available, the default 'user' and 'admin' role.

- Users with the 'user' role have limited access to the application and can only manage input devices, pages and other related resources.
- Administrators have access to additional system settings, network management and user management.

### 7.10.5 Network

The 'Network' section is available on the 'Settings' section within the VPVision backend. It provides an overview of all active network interfaces.

You may alter the network settings of these interfaces when your site requires it. By default LAN 2 is configured to be used with the VRouter and is used to apply system updates. We do not recommend changing this interface.

If your site does not use the VRouter, or you need an additional network interface, the settings for this interface can be changed.

### 7.10.6 Mail Server

The 'Mail Server' section within the VPVision backend contains the configuration options for an outgoing SMTP email server.

The SMTP server is disabled by default, if you want to receive scheduled reports or automated alarm notifications it needs to be enabled. Enabling the SMTP server requires an active SMTP capable email server or service.

#### Configuring Gmail as an outgoing SMTP server

Gmail can be used as an outgoing SMTP server for VPVision. This either requires a personal Google account or a Google Workspace account.

When you use Two Factor Authentication with your Google account you will need to generate an Application password within your Google account before you can authenticate with the outgoing SMTP server.

Depending on your Google Workspace policies you might be required to change additional Google Workspace settings before you can use your Google Workspace account for outgoing SMTP traffic.

Hostname	smtp.gmail.com
Port	587
Encryption	TLS
Enable Authentication	Yes
Username	Your Google accounts email address
Password	Your Google accounts password or the Application password for VPVision
Sender E-mail Address	Anything you would like as the from address, default no-reply@vpvision.local
Sender Name	Anything you would like as the from name, default VPVision

### 7.10.7 Audit Mode

Audit Mode operates alongside VPVision's standard functions, providing real-time data recorded at 1-second intervals, which can be exported to CSV.

Data retention is reviewed every Monday, and any data exceeding the retention period will be automatically deleted. The retention periods are based on UTC.

Please be aware that longer retention periods can result in excessive amounts of raw real-time data. VPVision will automatically stop recording when the storage threshold has been reached.

### 7.10.8 CSV Publishing

CSV Publishing works alongside VPVision's Audit Mode, allowing the data acquisition system to continuously write real-time data at 1-second intervals for all included devices to CSV files.

By default, this setting is disabled and must be enabled to start exporting second data. Devices and specific channels can be selected for inclusion by toggling them on or off.

Configuration options include the decimal separator, value separator, and line separator.

### 7.10.9 SQL connection

With the SQL Connection you can create read-only users to access the recorded data on your system using the SQL protocol. Once a SQL user is added VPVision will expose a PostgreSQL connection on port 5432 by default.

This section within the VPVision backend contains an overview of all available database tables and the SQL Connection user management.

You will need a PostgreSQL compatible connector to connect with the SQL Connection.

### 7.10.10 License

Your system comes pre-installed with your VPVision license, if you receive a new license you need to upload the new license through the license page.

The license page can be found in the 'Settings' section within the VPVision backend.

On the license page you will find all license details of your currently active license including your device's serial number, hardware revision and available channels.

## 8 Specification



**Please always check the label of your product for the specifications.**

Specifications are subject to change as we are continuously improving our products.  
Please contact us to obtain the latest specification sheet.

### Mechanical

Case	PVC Explorer Case
Size	48 x 42 x 22 cm   19 x 16.5 x 8.6 inch
Weight	7 kg   15.4 pounds
Ambient temperature max	40 deg C   104 F
Ambient temperature min	-10 deg C   32 F

### Electrical

Power input	110-250 VAC
Component power	24 VDC
Fuses	3.15 A for analog inputs, 3.15 A for Modbus sensors

### Electronics

Computer	Industrial fanless mini PC
Storage	256 GB Solid State Drive
COM ports	1x RS485
Ethernet ports	1x RJ45

### Inputs and outputs

Modbus terminal	1x ( <i>upto 8 Modbus sensors</i> )
Analog inputs	8x
Analog inputs modes	0..10V   4..20mA

### Data storage

Database	SQL
Data retrieval frequency	1 second
Data storage interval	Standard Mode: 1 minute Audit Mode: 1 second

## 9 Appendix

### 9.1 Cables for VPVision



All electrical installations to be carried out by authorized electrical installation engineers only.

#### Ethernet

For Ethernet, Cat5e cable with 4 twisted pairs must be used. For some applications, a higher quality cable might be needed. In case of any doubt, It is best to consult the site on their existing cables to make sure that the VPVision cables match the prescribed standards. The cable should match the power budget of all connected sensors. Long cables will result in increased cable resistance, which might cause issues when not properly addressed.

#### RS485 Modbus

For RS485 networks, cable with 2 shielded twisted pairs must be used. One pair will be used to power the connected sensors. The other pair will be used for Modbus data transfer. The quality of this cable depends on the length of the total Modbus chain and the number of sensor attached. Your local contractor can help you calculate the coper wire thickness. Make sure the shield is connected to the power supply side only.

#### Analog sensors

For 4..20 mA based sensors, a single or double twisted pair cable can be used. The same cable as for Modbus can be used to connect these sensors.

### 9.2 The Formula Editor

The formula editor enables you to compose custom formulas for virtual input devices and KPI widgets based on the custom formula calculation.

Please refer to 6.5 and 6.6 respectively on how to create these instances.

#### Formula Elements

Formulas are composed using formula elements. These are grouped into 3 categories: Inputs, Operators and Endpoints.

- Inputs refer to sensors or a group of sensors, also referred to as input devices.
- Operators are actions that should be performed on input elements.
- Endpoints indicate the end result of the formula.

#### Connecting elements

Once a formula element has been added to the editor a dot will be shown next to it. For operators this will be one or two dots to the left and one to the right of the element, endpoints will have a single dot to the left and inputs will have a single dot to the right.

These dots represent the input, to the left, and output to the right. To connect an element's output to the input of the next element simply click and drag the output dot and drag the resulting arrow to the input dot of the next element. Once an element has successfully been connected the arrow will remain between these elements. Click the arrow to remove this connection.

#### Grouped Sensors

Grouped sensors are only available to custom formula KPI widgets and consist of all input devices added to the KPI widget during creation. Input devices for custom formula KPI widgets are optional, once they're added the 'Summarized' and 'Averaged' input formula elements will be available in the formula editor.

- Summarized grouped inputs consist of all input devices from the same measurand type and 'sum' the data of all applicable devices.
- Averaged grouped inputs consist of all input devices from the same measurand type and average the summed data of all applicable devices. I.e. when 3 devices of the same measurand type are added the sum will be divided by 3.

### **Sensors, Variables and Cost Input elements**

Comparable to grouped sensors the sensor input element represents a single input and allows you to select the desired channel and desired starting unit.

Variable input elements are a fixed variable, for example a multiplier or divider. The cost input element is only available to KPI widgets using the custom formula calculation from the cost KPI type.

The cost element represents the electricity cost configured whilst creating a KPI widget. This element is comparable to the variable element.

### **Operators**

Operators apply a certain action to the input data. Most operators allow up to 2 input streams and result in one output. Operator inputs are not limited to input elements and can be combined with the output of a previous operator.

VPVision ships with 5 operator types:

	Sigma	addition operator without the 2 inputs max input limit. You can link as many inputs as you like resulting in a single output.
+	Addition	limited to 2 inputs resulting in a single output.
-	Subtraction	limited to 2 inputs resulting in a single output.
x	Multiplication	limited to 2 inputs resulting in a single output.
÷	Division	limited to 2 inputs resulting in a single output.

It's important to note that the order of operations is determined by the order of connected inputs.

### Endpoints

The endpoint element represents the resulting output of the formula. For virtual inputs this can result in a data conversion when the input data is not using the same unit as the endpoint dictates. This isn't applicable to KPI widgets where the endpoint simply represents a description of your resulting output.

The endpoint, the unit description for virtual inputs or the description you've entered for KPI widgets will be shown in widgets where these instances are used. This is most notable for the KPI widget as the description will be directly displayed within the widget.



## 9.3 Troubleshooting

### 9.3.1 Problems and solutions

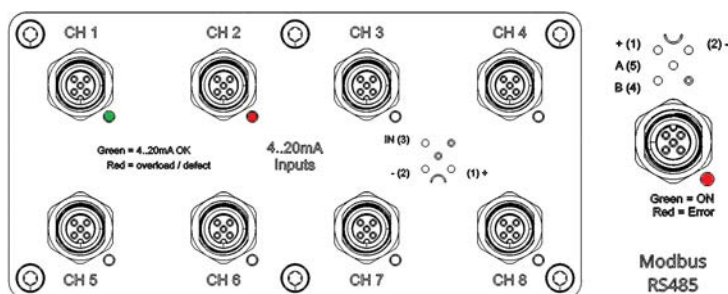
This section will address common problems and their resolution.

Issue	Symptom	Cause	Resolution
Cannot find VPVision in my network		IP conflict, IP address out of range	Re-connect to LAN 1 with a direct Ethernet connection.
VPVision page is not updating	All widgets are static	Connection problems with remote IO, network off line, switch off line	Restart DAQ process via the configuration backend.
Communication problem	No data on screen	Modbus address or port not properly assigned, Modbus conflict,	
	Red LED	Wrong wiring, communication error	Swap RX and TX (A and B) wire and see if this resolves. Disconnect all but one Modbus device to isolate the problem. Check device settings like baud rate, parity, stop bits
Analog input configuration	VPVision shows 0 as measurement value	The analog module has been reset or the configuration is lost	Log in to the analog module internal web server, enable user defined Modbus addresses and set all read out parameters to be located in the holding registers
Wrong kW measurement	Wrong kW in display	The VPLog-i is just an Ampere meter... make sure that the voltage and power factor is as correct as possible	If not good enough--> invest in a real kW meter with Modbus

### 9.3.2 Communication issues

#### RS485 Modbus or Analog related issues

- Green: VPVision Data Acquisition is active.
- Red: Communication Error



#### Ethernet issues

Ethernet issues can be localized by pinging the individual components of the system. Each Ethernet device has a unique IP address. The addresses can be pinged and when they respond, you know that the device is reachable. An unreachable device will result in a request time out.

## 9.4 Documentation example

Proper documentation is key to long term success. Therefore we added an example (empty) documentation sheet here. You can use it as a guideline for documentation of your VPVision configuration.

### IP address list

No	Name	IP address
1	VPVision-M	10.0.0.1
2	Analog converter	10.0.0.2
3		
4		
5		

### Device list

Use the list below to write down your configuration. Store this list for future reference

No	Name	Modbus address	Com port	Comment
1	Packaging dept.	9	3	Pipe diameter = 80.2 mm
2				
3				
4				
5				
6				
7				
8				

### Analog Channel configuration - Remote analog IO module

Use the list below to write down your configuration. Store this list for future reference

No	Name	Min (4mA)	Max (20mA)	input number	Converter IP address
1	Dewpoint	-40	+10	1	192.168.1.250
2					
3					
4					
5					
6					
7					
8					

## Notes

## Notes

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**VPInstruments**

Van Putten Instruments BV  
Marlotlaan 1G  
2614 GV Delft  
The Netherlands  
[info@vpinstruments.com](mailto:info@vpinstruments.com)  
[www.vpinstruments.com](http://www.vpinstruments.com)

MAN-VP-VM-EN-2500

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