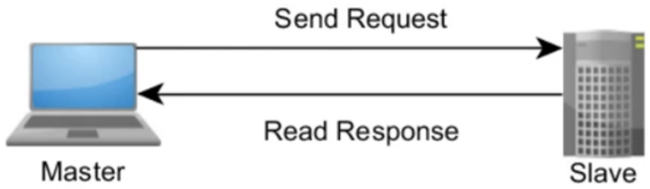
Tutorial:
connecting a Modbus RTU sensor using MOXA UPort 1130



Introduction

- What is Modbus?
- Modbus message

The address of the slave	commonly referred to as Unit ID or Device ID
The command	What kind of action is performed (read / write)
The data itself	
Check sum	Used to check the integrity of the data (errors during transmission or storage)

Introduction

- Modbus message

Request

Function code → what kind of action to perform

Data bytes → additional information for the slave

Example: Function code 03 - for reading holding registers and respond with contents

Data field → telling the slave which register to read, the length and check sum

Response

The function code is echoed

Data bytes → the data collected by the slave

Two transmission modes: **ASCII** and **RTU**

Introduction

Start	Address	Function	Data	Check sum	End
3.5 char times	8 bit	8 bit	N * 8 bit	16 bit	3.5 char times

Individual devices assigned in the range of 1…247

What function to perform

2 8-bit bytes

Introduction

- Implementations of the protocol

RS-232	RS-422	RS-485
• Point-to-point method of communication • Cable length : 15m max • Full duplex mode • Three-wire connection: **trnasmit data (TX), receive data (RX) and ground (GND)**	• Differential signaling • Communication over long distances • Allow for multidrop • Four-wire connection and half duplex	• Communication over long distances • multidrop capability ◦ Two-wire; half duplex ◦ Four-wire; full duplex • Data wires (wires that transmit the data, in exact opposite polarity)

Connecting a Modbus sensor to MOXA

Equipment used

MOXA UPort 1130

MINI DB9F-to-TB

Power meter without display - POM100

Računalnik

Connecting a Modbus sensor to MOXA

MOXA UPort 1130

Use:

- USB-to-Serial converter
- Used for connecting different serial devices in the field
- UPort 1130 provides one RS-422/RS-485 port

How to install the needed drivers:

- Go to the www.moxa.com website;
- Choose the correct device (UPort 1130)
- Find the correct driver for your operating system and choose the latest version
- We download the driver, in our case for the Windows OS and the latest version.

NAME	TYPE	CHECKSUM	VERSION	OPERATING SYSTEM	RELEASE DATE
Driver for UPort 1100 Series (Windows 11 and Windows Server 2022, WHQL certified) 2.9 MB	Driver	SHA-512	v4.2	- Windows 11 - Windows Server 2022	Apr 02, 2024 Release notes
Software Package for UPort 1100 Series (UPort Configuration Tool for macOS) 4.7 MB	Software Package	SHA-512	v1.0	- macOS 11 - macOS 12 - macOS 13 Show More	Mar 07, 2024 Release notes
PComm Lite Suite - Serial Communication Tool for Windows 3.5 MB	Utility	SHA-512	v1.7	- Windows - Windows 10 - Windows 11 Show More	Jun 19, 2023 Release notes
Driver for UPort 1100 Series (Linux Kernel 6.x) 250.4 KB	Driver	SHA-512	v6.0	- Linux Kernel 6.x	Mar 28, 2023 Release notes
ViewCom Utility 3.3 MB	Utility	SHA-512	v2.0	- Windows 10 - Windows 11 - Windows 7 Show More	May 30, 2022 Release notes

Connecting a Modbus sensor to MOXA

Sensor used in tutorial : **Power meter with NO display**

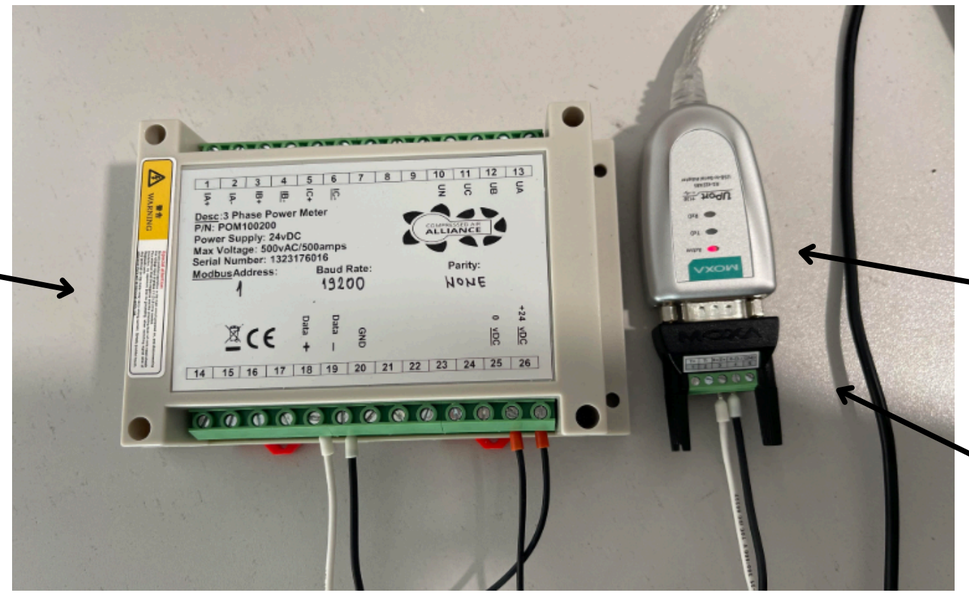
Manufacturer: Compressed Air Alliance

Model: POM100

- Wiring the sensor to the MOXA UPort1130 device using the DB9 connector

Power meter
(with terminals used:

- **Data + → pin3**
- **Data - → pin4**
- **+24VDC → +24VDC**
- **0VDC → 0VDC)**



MOXA UPort1130

(MINI DB9F-to-TB)
DB9 connector to terminal block

Connecting a Modbus sensor to MOXA

- Once the sensor is wired, the Modbus parameters need to be set

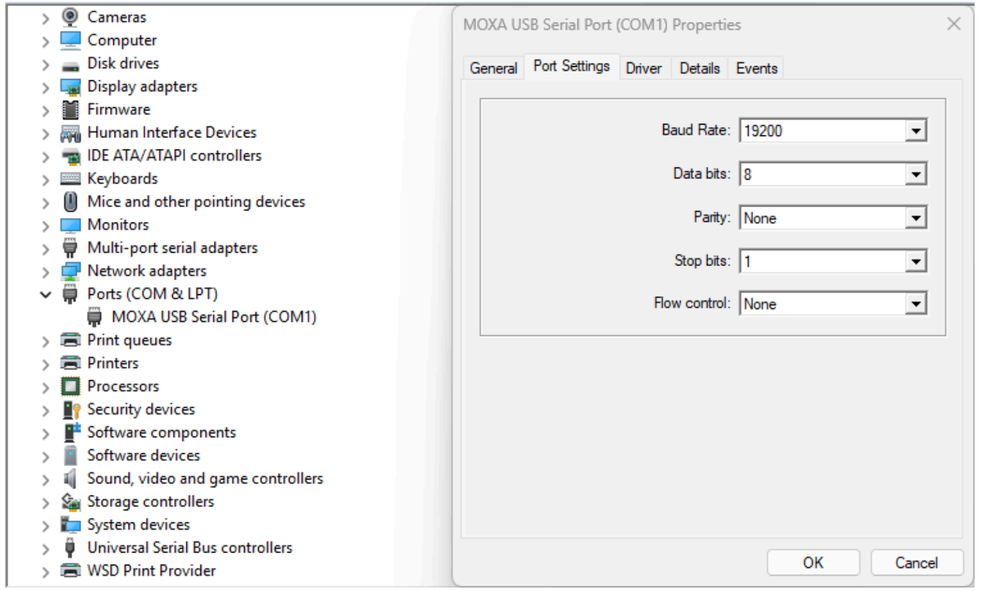
Baud rate	rate at which data is transferred
Data bits	how many bits are transferred
Parity	whether a data integrity is included
Stop bits	allow time between reception and processing of current byte and preparation for the next one

Connecting a Modbus sensor to MOXA

The default Modbus parameters settings on the sensor are found in the signal list.

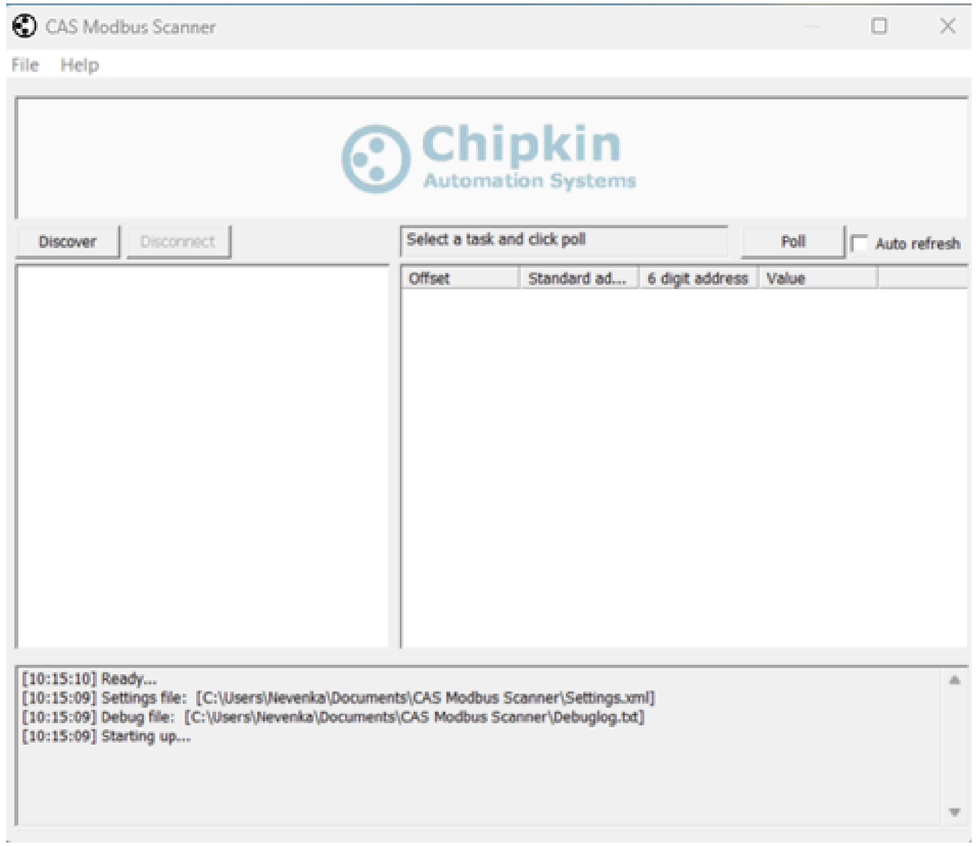
Parameters	Available Values	Default Value
Baud rate	1200 Baud 2400 Baud 4800 Baud 9600 Baud 19200 Baud 38400 Baud 57600 Baud	19200 Baud
Data bits	8	8
Parity	Odd Even None	None
Stop bits	1	1
Address	1–247	1

Setting the correct parameters on the computer (after you have inserted the USB adaptor)

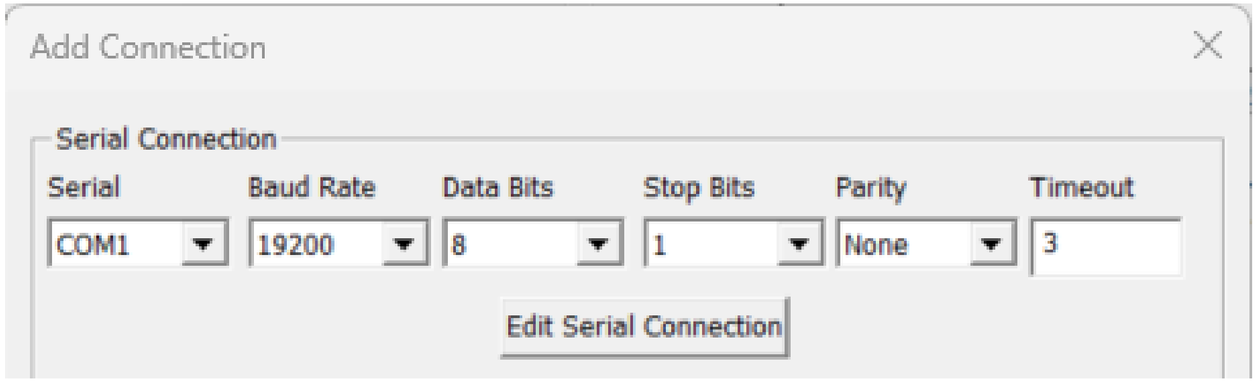


Interpretation of the signal list and polling data

- Download appropriate software for reading data from Modbus sensor
- CAS Modbus Scanner used
- Introduction on CAS Modbus Scanner

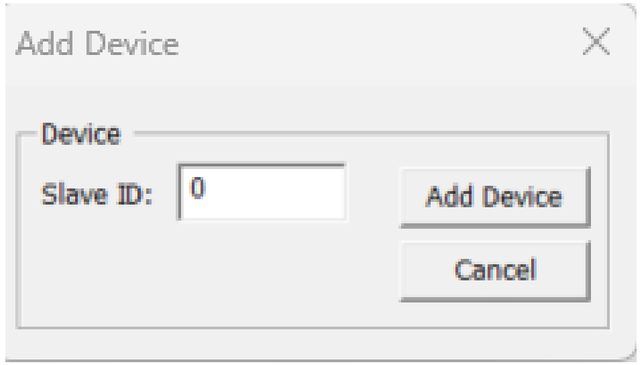


1. Add the sensor (right click on the left part of the screen, in the white box under "*Discover*" and "*Disconnect*" and click **Add connection**)
2. A window for the Modbus parameters will open:



Interpretation of the signal list and polling data

- We edit tne connection by choosing the correct parameters and click **Edit connection**
- Once the connection is added, right click on the connection and choose the **Add device** option



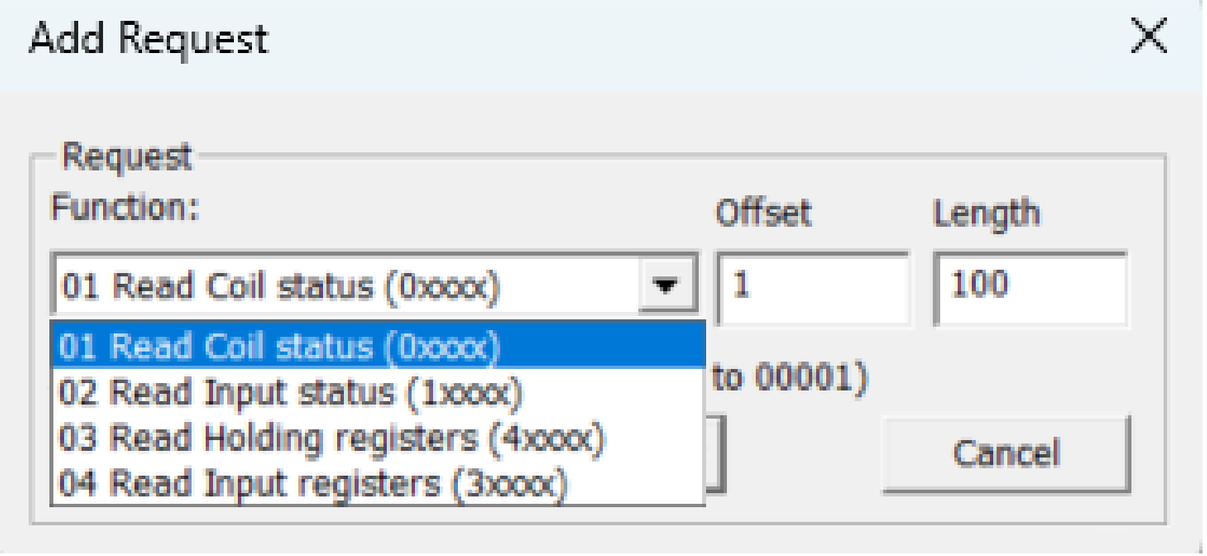
In this window the Device ID is written.
To confirm click **Add device.**

To create a task, right click on *Device.* There are two options **Add task** and **Add write task.**

- **Add task** → creates requests only for reading
- **Add write task** → creates tasks for writing.

Interpretation of the signal list and polling data

Adding requests



1. Choose the function code (usually given in the signal list)
2. **Offset :** write the register address given in the signal list. (sometimes you have to take into account the *zero vs. one based numbering*)
3. **Length :** describes the length of the request.

Interpretation of the signal list and polling data

Data

Offset	Standard add...	6 digit address	Hex	char	uint16	int16	uint32	int32	float32 (LSW-MSW)	float32 (MSW-LSW)
81	40081	400081	0x0001	☐	1	1				
82	40082	400082	0x0004	☐	4	4	262145	262145	0.000000	0.000000
83	40083	400083	0x0002		2	2	incomplete	incomplete	incomplete	incomplete

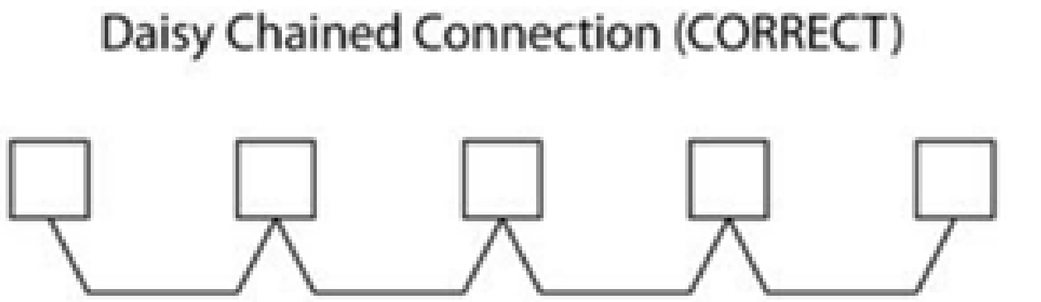
Example: One request with the length of 3 starting with the register 81

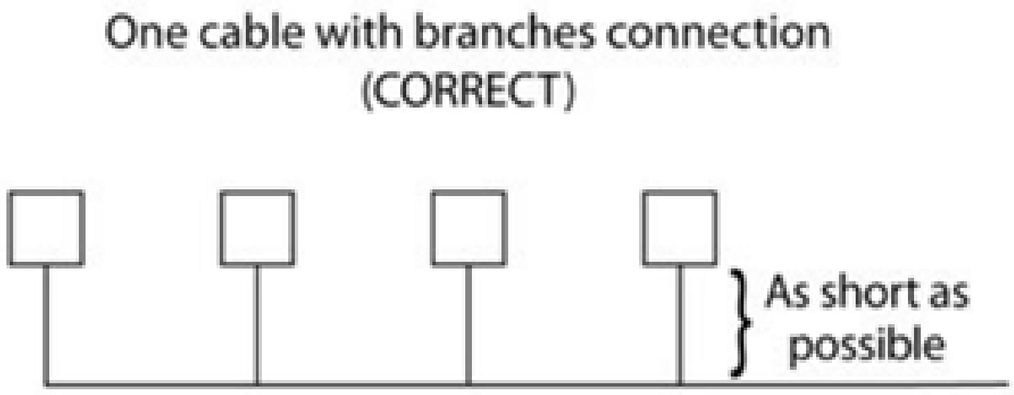
- We check the values according to the signal list (they have to match)

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Address	80	R/WC	1	UInt16	-	1 to 247
Baud Rate	81	R/WC	1	UInt16	-	0 = 1200 1 = 2400 2 = 4800 3 = 9600 4 = 19200

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
						5 = 38400 6 = 57600
Parity	82	R/WC	1	UInt16	-	0 = ODD 1 = EVEN 2 = None

Daisy chaining

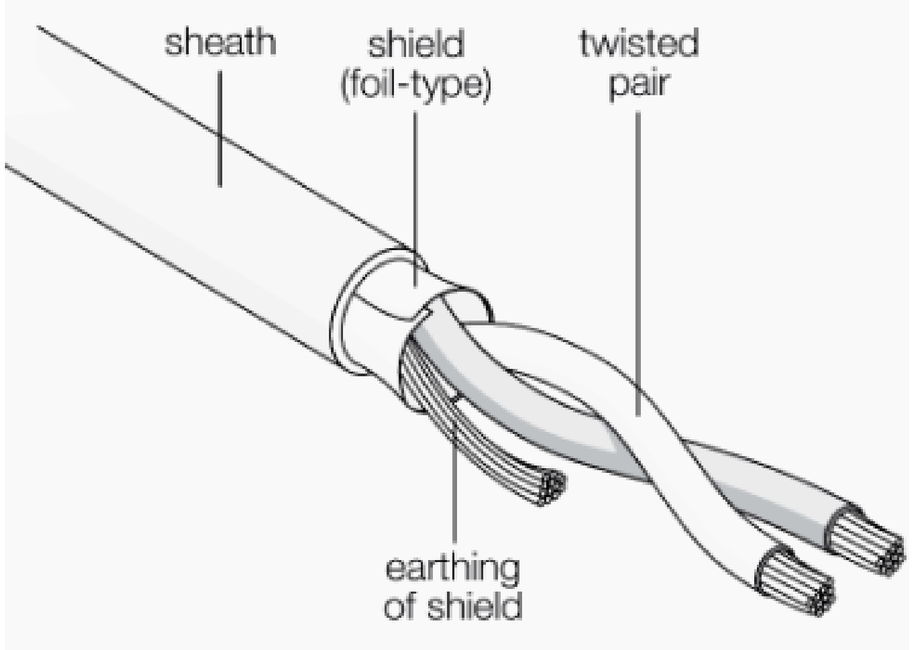




- Best way to connect devices in a Modbus communication
- Termination - the last device in the chain must be terminated with a 120 Ohm resistor

- **Not recommended**, but can be used if the cable is as short as possible

Daisy chaining



Important notes:

- We have to **ground** the signal
- Use **shielded** and **twisted pair cable**
- Do not run Modbus wires in the same conduit as main because of interference

Troubleshoot

If there are problems with the data transmission it is likely:

1. A grounding problem (data is transmitted by electricity so it needs a return path to function)
2. Wiring problem (usually swapping the **Data+** and **Data-** wires solves the problem)
3. Incorrect shielding (each shield must be grounded on one side only)