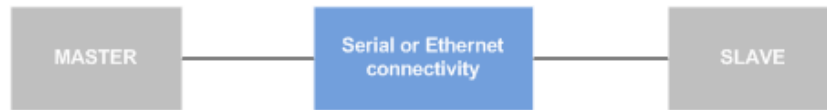


# Modbus

Modbus is a communications protocol originally published by Modicon (now Schneider Electric) in 1979 for use with its programmable logic controllers (PLCs). Simple and robust, it has since become a de facto standard communication protocol, and it is now a commonly available means of connecting industrial electronic devices.



## Info about protocol

### Address:

- **IP address** - every device in Ethernet have physical address (only for Ethernet)
- **Station address** - every slave (client) device have a logical address.
- **Function** - function type
- **Address** - information object address.

## Telegram Structure

### Modbus RTU

#### Request

Name	Bytes	Function
Station	0	Station address
Function	1	Function code
Address Hi	2	Starting address
Address Lo	3	
Quantity Hi	4	Quantity
Quantity Lo	5	
CRC	6	CRC check

#### Response

Name	Bytes	Function
Station	0	Station address
Function	1	Function code
Bytes	2	Data bytes
Data	3...	Data
CRC	Depending of data	CRC check

### Modbus RTU/ASCII

#### Request

Name	Char	Function
------	------	----------

Start	0	: 0x3A
Station	1	Station address
Function	2	Function code
Address Hi	3	Starting address
Address Lo	4	
Quantity Hi	5	Quantity
Quantity Lo	6	
LRC	7	LRC check
End	8	ASCII values of 0x0D & 0x0A
End	9	

## Response

Name	Char	Function
Start	0	: 0x3A
Station	1	Station address
Function	2	Function code
Bytes	3	Data bytes
Data	4...	Data
LRC	Depending of data	LRC check
End	Depending of data	ASCII values of 0x0D & 0x0A

## Modbus TCP

### Request

Name	Bytes	Function
Transaction Identifier	0	For synchronization
Transaction Identifier	1	
Protocol Identifier	2	Zero for Modbus/TCP
Protocol Identifier	3	
Length	4	Number of remaining bytes in this frame
Length	5	
Station	6	Station address
Function	7	Function code
Address Hi	8	Starting address
Address Lo	9	
Quantity Hi	10	Quantity
Quantity Lo	11	

### Response

Name	Bytes	Function
------	-------	----------

Transaction Identifier	0	For synchronization
Transaction Identifier	1	
Protocol Identifier	2	Zero for Modbus/TCP
Protocol Identifier	3	
Length	4	Number of remaining bytes in this frame
Length	5	
Station	6	Station address
Function	7	Function code
Bytes	8	Data bytes
Data	9...	Data

## Functions

Standard MODBUS functions

Dec	Description	Direction	Support
1	Read Coils	Monitor	Yes
2	Read Discrete Inputs	Monitor	Yes
3	Read Holding Registers	Monitor	Yes
4	Read Input Registers	Monitor	Yes
5	Write Single Coil	Control	Yes
6	Write Single Register	Control	Yes
7	Read Exception Status	Monitor	No
8	Diagnostic	Monitor	No
11	Get Com Event Counter	Monitor	No
12	Get Com Event Log	Monitor	No
15	Write Multiple Coils	Control	Yes
16	Write Multiple Registers	Control	Yes
17	Report Slave ID	Monitor	No
20	Read File Record	Monitor	No
21	Write File Record	Control	No
22	Mask Write Register	Control	No
23	Read/Write Multiple Registers	Both	No
24	Read FIFO Queue	Monitor	No
43	Read Device Identification	Monitor	No
43	Encapsulated Interface Transport	Monitor	No

## Settings

MASTER			
<div>Address</div> <div>Slave address: <input type="text" value="1"/></div> <div>Timeouts</div> <div>ScanRate(ms): <input type="text" value="1000"/></div>		Modbus TCP	Modbus Serial (ASCII included)
	Slave address	Address of the device which data is read from	Address of the device which data is read from
	Scan Rate(ms)	Interval between requests to data	Interval between requests to data
SLAVE			
<div>Address</div> <div> <div>Select all</div> <div>Clear all</div> <div> <input checked="" type="checkbox"/> 1  <input type="checkbox"/> 2  <input type="checkbox"/> 3  <input type="checkbox"/> 4 </div> </div>	Address	Select addresses of slaves to simulate	Select addresses of slaves to simulate
<div>Value</div> <div>Default value: <input type="text" value="0"/></div>	Value	Default value which slaves will return from all registers.	Default value which slaves will return from all registers.

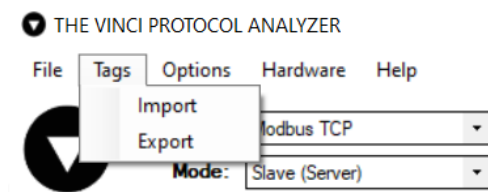
 Default values are overridden by created Tags.

# Functions

## Tags

This function allows user to created named points. After points created, user can send it manually or set reply checkbox to automatic reply.

- To export Tags to csv file: **Tags -> Export -> Save file dialog appear**
- To import Tags from csv file: **Tags -> Import -> Open file dialog appear**



## Creating Tag

In Modbus protocol tags are mostly used for Slaves to simulate specific data registers, although they can be used in Master to write data to slave registers or format received data from Slave devices.

There are two ways of creating tags:

1. Add button in the tag menu.

The image shows a window titled 'Tags'. At the top is a text input field labeled 'Name'. Below this field are three buttons stacked vertically: 'Add', 'Edit', and 'Delete'. A black arrow points from the left towards the 'Add' button.

2. Left mouse button double click value in statistic tab.

## Slave

If the simulation mode is **Slave** a modbus tag creation window should look like this and have these parameters.

- **Name** - user-friendly tag name.
- **Type** - the function to be used. *This means that if The Vinci software gets a request with the 03 function type and there is a tag created with that type and it matches the slave address and data address The Vinci software will respond to the request with the value that is set as the tag value.*
- **Slave** - Slave address of tag.
- **Address** - Address of slave register.
- **Format** - Format to store or read data in.
- **Value** - Value of the register.

The image shows a 'Tag' creation window. It has a title bar with a close button. The window contains the following fields and controls:
 

- Name:** A text input field.
- Type:** A dropdown menu with 'Read Holding Registers (3)' selected.
- Slave:** A text input field with the value '1'.
- Address:** A text input field with the value '1'.
- Format:** A dropdown menu with 'Signed' selected.
- Value:** A text input field with the value '0'.
- Buttons:** 'Save' and 'Cancel' buttons at the bottom.

## Master

If the simulation mode is **Master** a modbus tag creation window should look like the one shown below and have these parameters.

In this case since this is the **Master** tag creation window it has two additional buttons that give the master the ability

to write data to the Slave device. For the selected type the buttons are **Write 5** and **Write 15** correlating to the modbus types.

In **Master** applications tags are mostly used to format data read from Slaves since data reading from devices is done using **Jobs**.

**i** For types 1 and 2 the buttons will be **Write 5** and **Write 15**.

**i** For types 3 and 4 the buttons will be **Write 6** and **Write 16**

- **Name** - user-friendly tag name.
- **Type** - the type of data.
- **Slave** - Slave address of tag.
- **Address** - Address of slave register.
- **Format** - Format to store or read data in.
- **Value** - Value of the register.

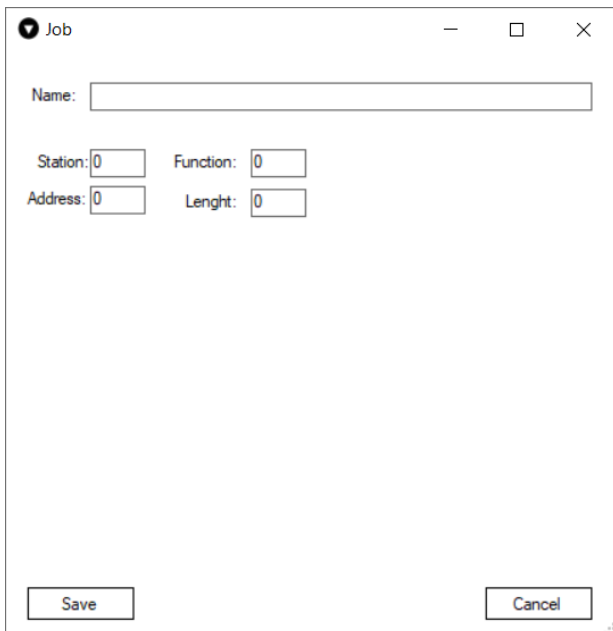
The screenshot shows a 'Tag' configuration window. It includes a 'Name' input field, a 'Type' dropdown menu currently set to 'Read Coil Status (1)', and input fields for 'Slave' and 'Address', both set to '1'. There is an unchecked checkbox for 'Value'. Below these are two buttons labeled 'Write 5' and 'Write 15'. At the bottom are 'Save' and 'Cancel' buttons.

## Jobs

Jobs are only available in **Master** simulations. What jobs are meant for is reading data from the Modbus slave device. They can send requests for big chunks of data in a single request. Then the data that slave responds with can be formatted using tags.

Job has these parameters:

- **Name** - user-friendly job name.
- **Station** - Modbus **Slave address** to read data from.
- **Function** - the function to be used to read data.
- **Address** - slave address to begin reading data from.
- **Length** - how many bytes will be read.



A dialog box titled "Job" with a standard Windows window frame (minimize, maximize, close buttons). It contains the following fields:

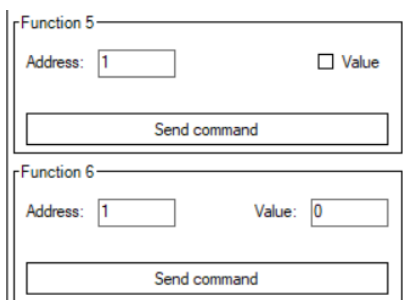
- Name:** A text input field.
- Station:** A numeric input field with the value "0".
- Function:** A numeric input field with the value "0".
- Address:** A numeric input field with the value "0".
- Lenght:** A numeric input field with the value "0".

At the bottom, there are two buttons: "Save" on the left and "Cancel" on the right.

## Command

Commands are only available in **Master** simulations. Commands are used to send data to **Slave** devices. They serve the same purpose as **Write 5** and **Write 6** buttons in tags.

Although, commands will send data to the **Slave address** configured in the **Settings** tab whereas tags will send the data to the **Slave address** configured in the tag configuration.



Two stacked panels for configuring Modbus commands:

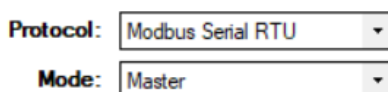
- Function 5:**
  - Address:** Input field with value "1".
  - ☐ **Value** checkbox.
  - Send command** button.
- Function 6:**
  - Address:** Input field with value "1".
  - Value:** Input field with value "0".
  - Send command** button.

**⚠** When using commands make sure to enter the desired Slave Address in the settings tab.

## Setup

To setup an Modbus simulation it is fairly straightforward.

1. Select Modbus and the mode.

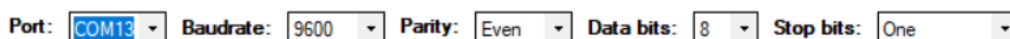


Configuration for Modbus protocol and mode:

- Protocol:** Dropdown menu showing "Modbus Serial RTU".
- Mode:** Dropdown menu showing "Master".

**i** There are three different Modbus modes: **Modbus TCP**, **Modbus Serial RTU**, **Modbus Serial ASCII**.

2. Select Serial Port settings according to your device specification.



Serial port configuration fields:

- Port:** Dropdown menu showing "COM13".
- Baudrate:** Dropdown menu showing "9600".
- Parity:** Dropdown menu showing "Even".
- Data bits:** Dropdown menu showing "8".
- Stop bits:** Dropdown menu showing "One".

- 2.1 If **Modbus TCP** is used then the **IP** address and **Port** will have to be selected.

IP:

Port:

3. Select settings in the settings tab according to your device, preference and selected mode.

Address

Slave address:

Timeouts

ScanRate(ms):

4. Press the green **START** button and the simulation should start. If everything was done correctly The Vinci software should establish communication with the Modbus device which you can monitor in the console tab.

Protocol:

Mode:



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