Integration Objects'

OPC DA Access for Modbus Devices

OPC Server for Modbus

Version 3.0 Rev.0

QUICK USER GUIDE

Integration Objects' OPC Server for Modbus Quick User's Guide Version 3.0 Rev.0
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ABOUT THIS USER GUIDE

This guide is a quick step by step guide on how to install and use the OPC Server for Modbus.

INSTALLATION PRE-REQUISITES

In order to properly run the OPC Server for Modbus, install these software components on the target system:

- The OPC core components 3.00 which consist of all shared OPC modules including the DCOM proxy/stub libraries, the OPC Server Enumerator, .NET wrappers, etc.
  You can deploy the OPC core components during the installation by checking the option "Install OPC Core Components" or after installation by using the setup available in the installation folder of the OPC Server for Modbus.
- .NET Framework 4.8 or higher.

INSTALLING THE OPC SERVER FOR MODBUS

To install the OPC Server for Modbus, run the installation executable using an administrator account and the wizard will take you through the different installation steps.

To start the OPC Server for Modbus, you need to follow the below steps:

1. Go to **Start => Programs => Integration Objects => OPC Server for Modbus => OPC Server for Modbus**
2. Start the OPC Server for Modbus.

ADDING A NEW DEVICE

To add a new device, right click on the Address Space node, select **New Device** as illustrated below.



Figure 1: Add a New Device

Then, the following dialog screen will appear as shown below:

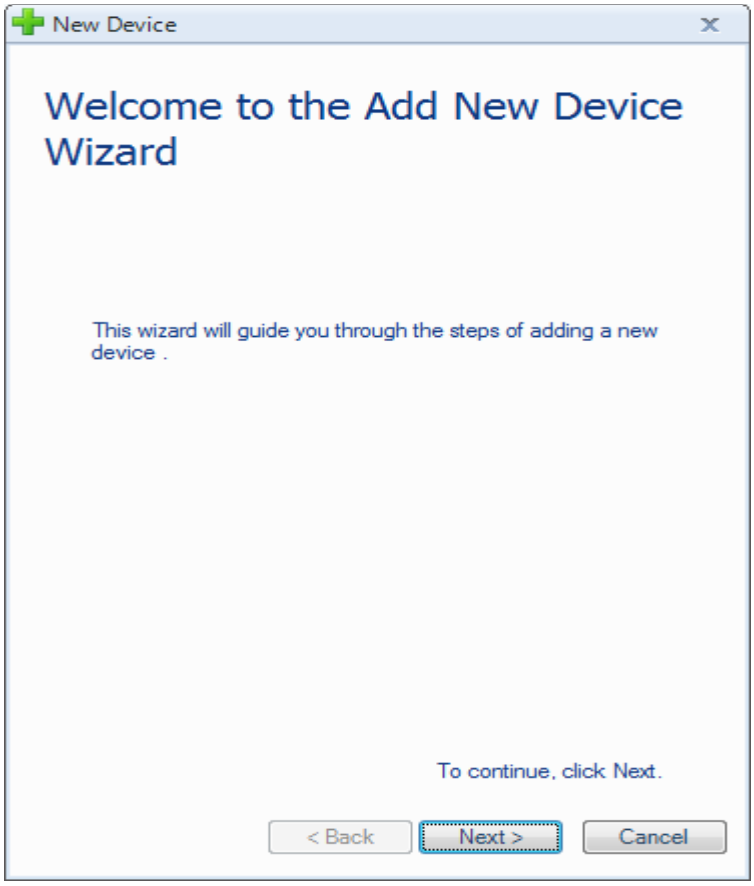


Figure 2: Add New Device Wizard

- Step 1: Connection Parameters

  Click the **Next** button. The following window will be displayed:

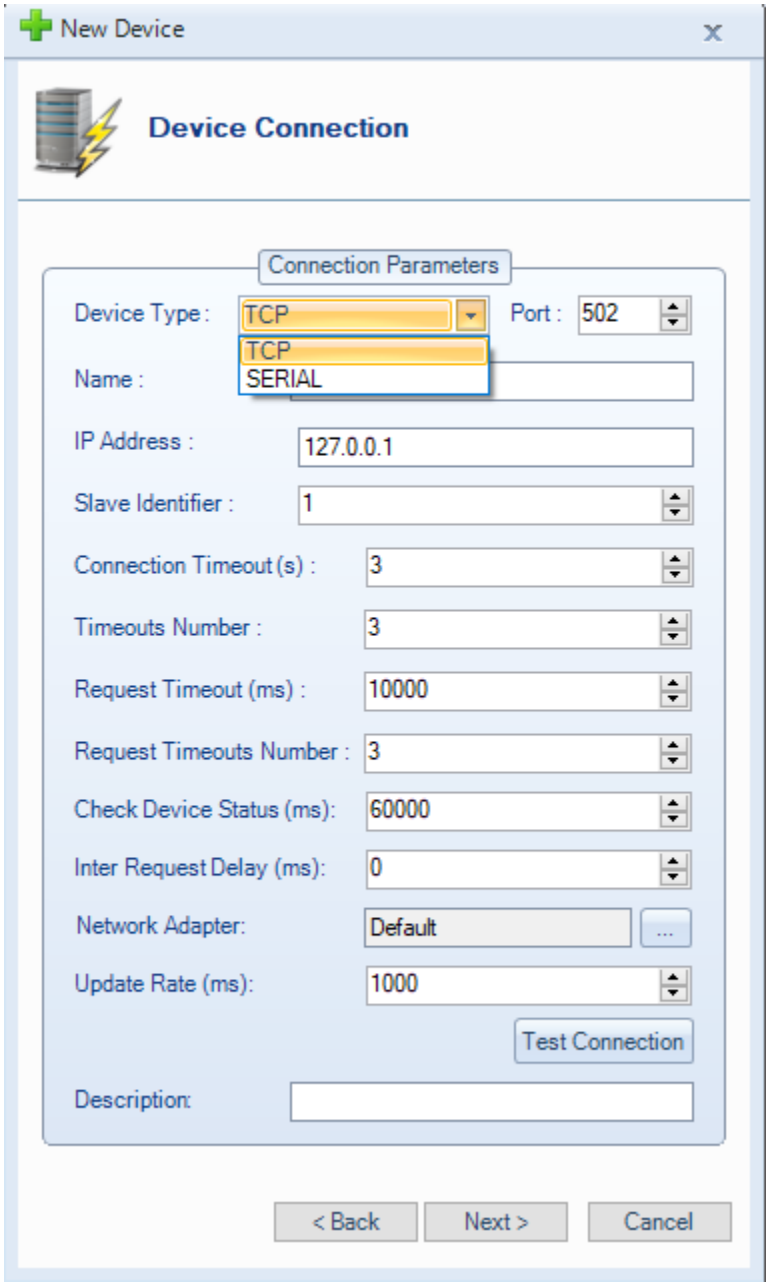


Figure 3: Select Device Connection Configuration

Depending on the selected features during the installation, you can configure the communication with the following Modbus devices types:

- TCP/IP Modbus Device
- Serial Modbus Device

You will then configure the port with reference to the selected type.

- For the Modbus TCP/IP protocol, enter the listening TCP port reserved for the Modbus device communications. The default value is 502.

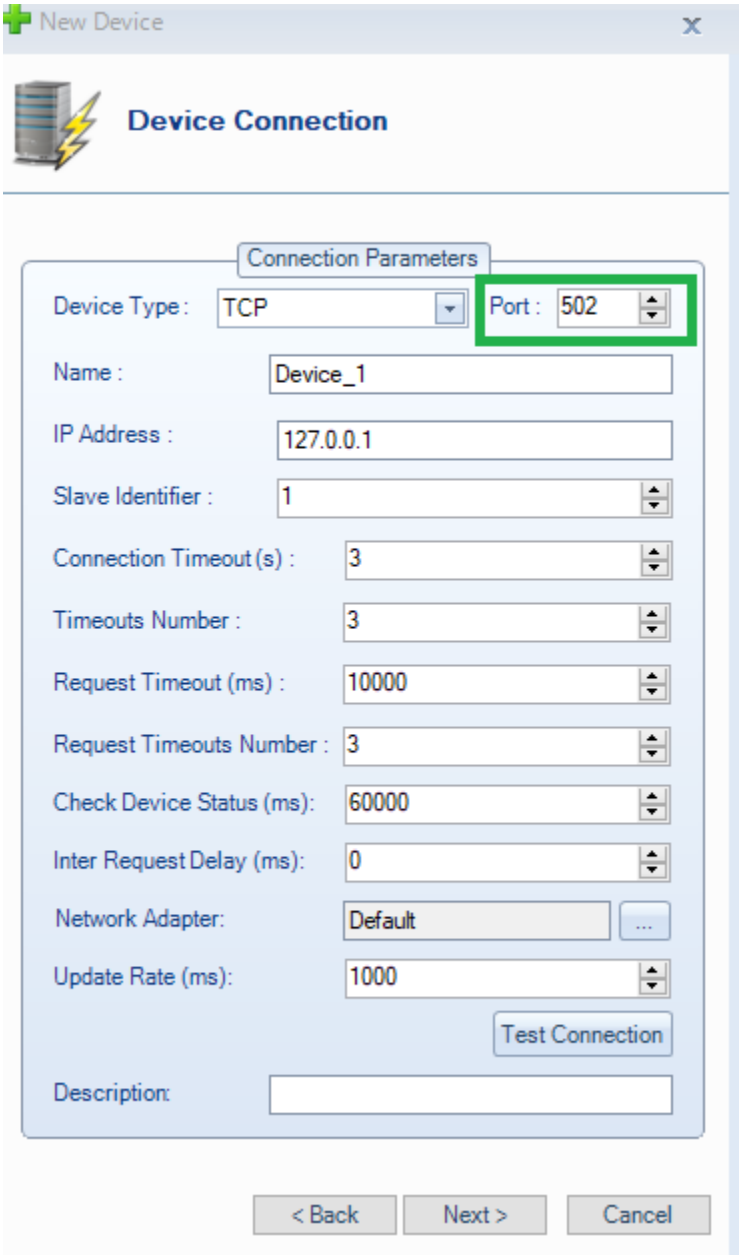


Figure 4: Select the TCP/IP Listening Modbus Port

For the Modbus serial protocol, click on the **Port Settings** button as shown below:

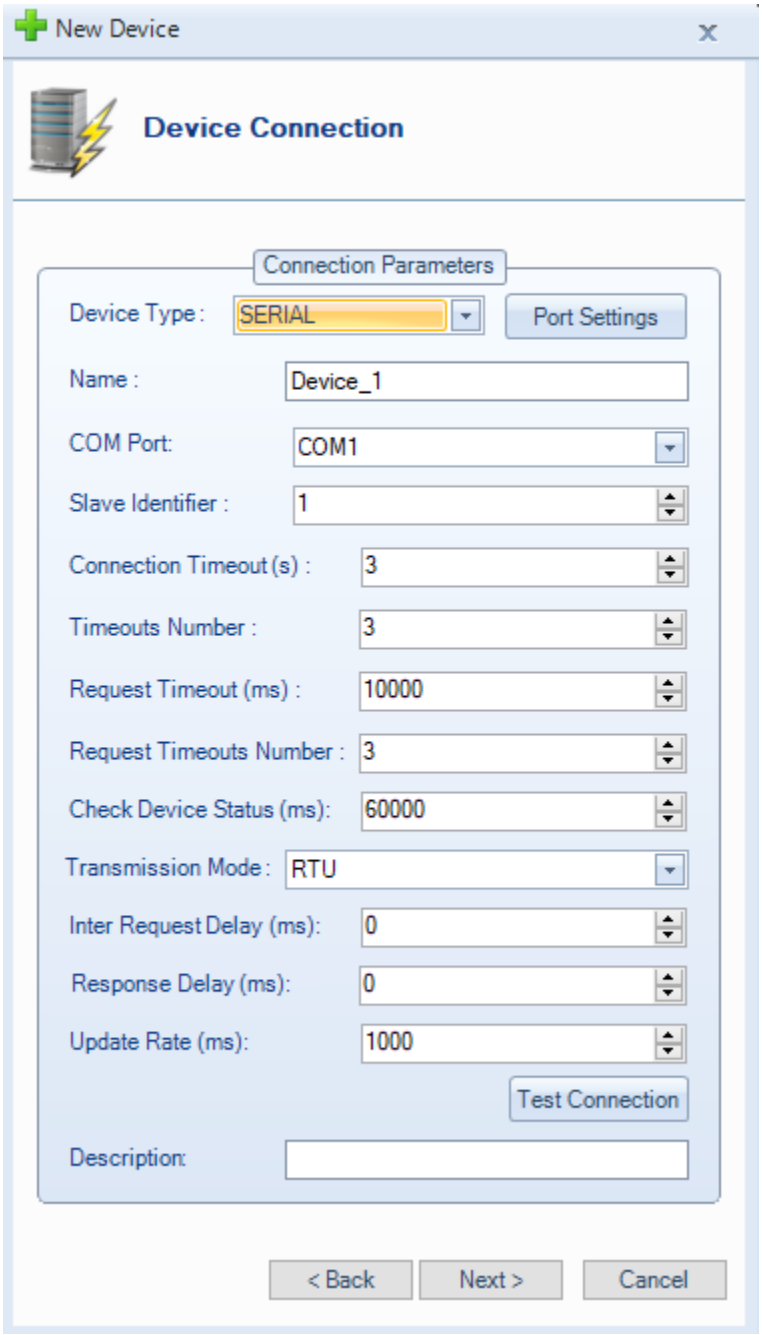


Figure 5: Select the Serial COM Modbus Port

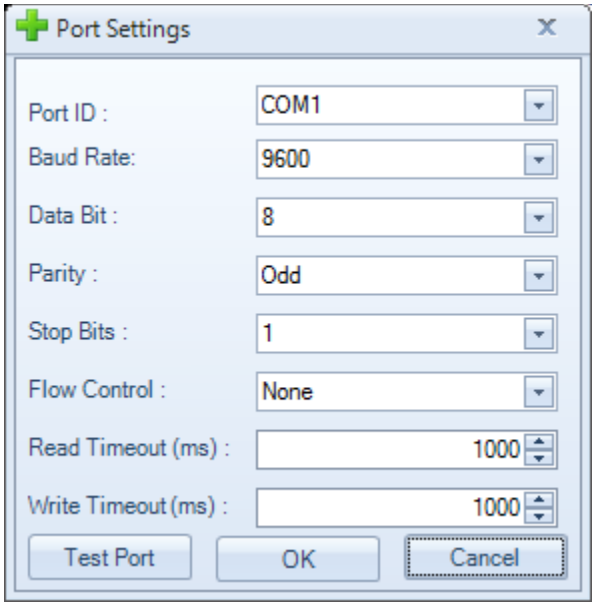


Figure 6: Select the COM Port Settings

The table below summarizes the parameters to configure the serial COM port:

Parameter	Description
Port ID	The port ID
Baud Rate	The baud rate to be used to configure the com port
Data Bits	The number of data bits per data word
Parity	The type of parity for the data
Stop Bits	The number of stop bits per data word
Flow Control	Defines how the RTS and DTR control lines are used
Read Timeout	The read timeout
Write Timeout	The write timeout

Table 1: COM Port Settings Parameters

After choosing the device type, enter the connection parameters.

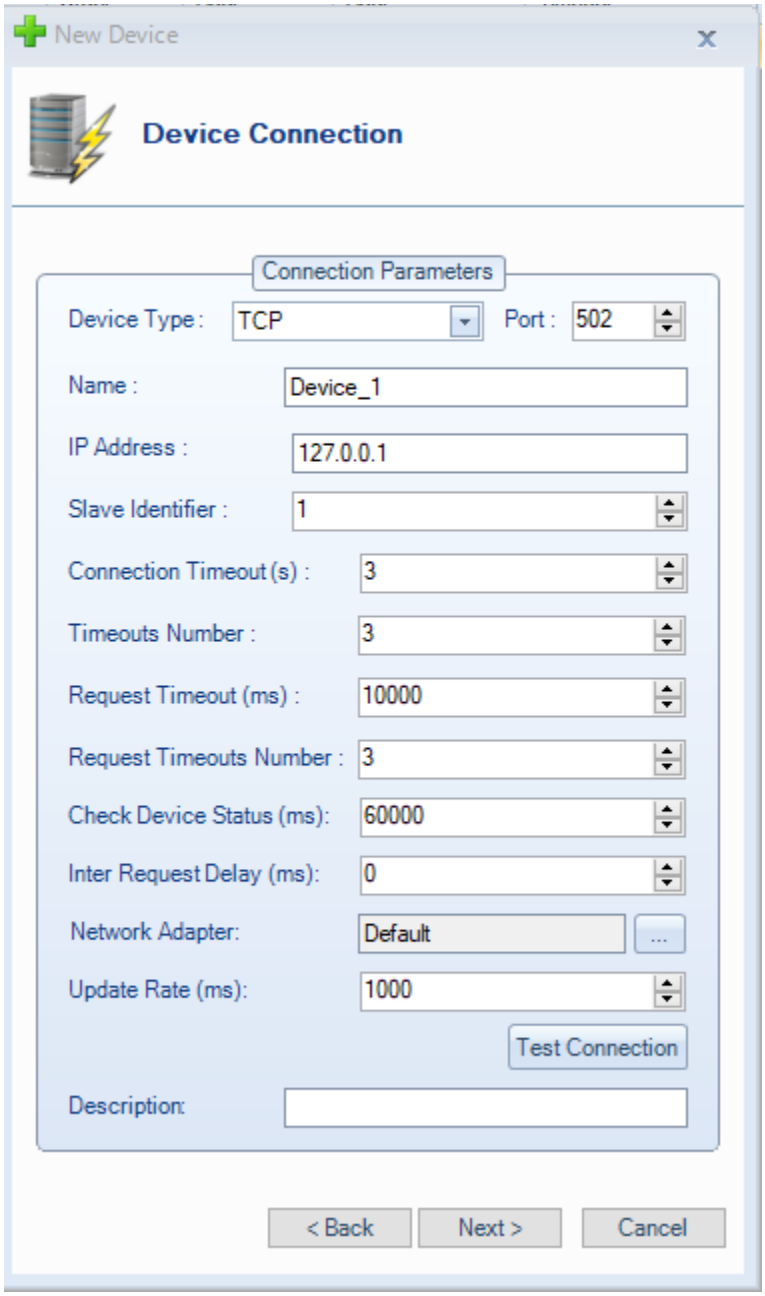


Figure 7: Select the TCP/IP Device Connection Parameters

Parameter	Description
Name	The device name
IP Address	The Modbus device IP address

Slave Identifier	The Identifier of the slave device
Connection Timeout	The waiting period, in seconds, for an unresponsive server
Timeout Number	The allowed timeouts number when the server does not respond
Request Timeout	The amount of time, in milliseconds, that the OPC Server will wait before setting the OPC Tag quality to bad
Request Timeouts Number	The allowed request timeouts number before starting the reconnection procedure to the device
Inter Request Delay	Specifies the amount of time, in milliseconds, between two read requests
Check Device Status	The period, in milliseconds, at which the OPC Server checks the device connection status (50 to 60 000 ms, default 60 000 ms)
Network Adapter	The local network adapter used to connect to the device. Click the "..." button to select one of the machine's adapters. "Default" lets Windows choose the route to the device
Update Rate	The period, in milliseconds, at which the OPC Server polls the device (50 to 60 000 ms, default 1 000 ms)
Description	A free-text description of the device
Dynamic Block Resize	When checked, if the device answers a block request with an Illegal Data Address exception, the OPC Server splits the block into two smaller blocks so that the valid addresses keep being read

Table 2: TCP/IP Device Connection Parameters

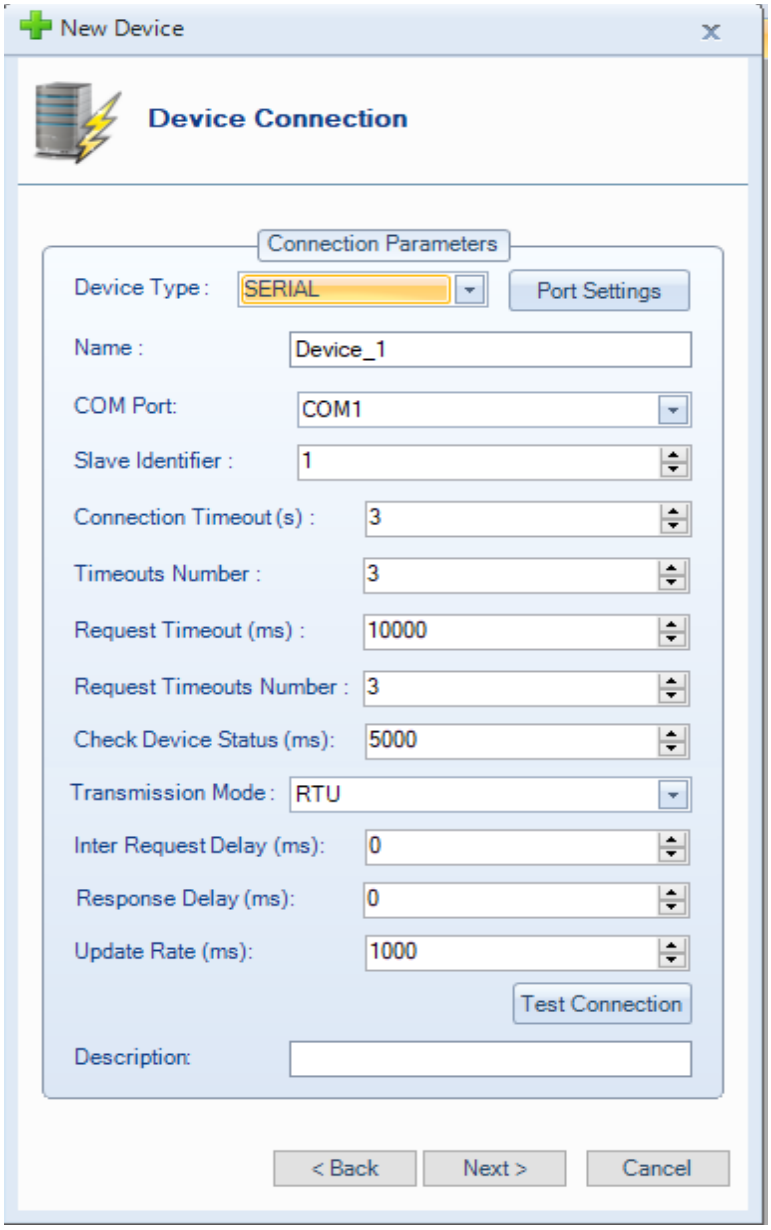


Figure 8: Select the Serial Device Connection Parameters

Parameter	Description
Name	The device name
COM Port	The serial communication port

Slave Identifier	The Identifier of the slave device
Connection Timeout	The waiting period, in seconds, for an unresponsive server
Timeout Number	The allowed timeouts number when the server does not respond
Request Timeout	The amount of time, in milliseconds, that the OPC Server will wait before setting the OPC Tag quality to bad
Request Timeouts Number	The allowed request timeouts number before starting the reconnection procedure to the device
Check Device Status	The period, in milliseconds, at which the OPC Server checks the device connection status (50 to 60 000 ms, default 60 000 ms)
Transmission Mode	The transmission mode. It can be either the RTU mode or the ASCII mode
Inter Request Delay	Specifies the amount of time, in milliseconds, between two read requests
Response Delay	Specifies the amount of time, in milliseconds, to wait for a response from the target device. This delay may be useful in case of devices with slow performance
Update Rate	The period, in milliseconds, at which the OPC Server polls the device (50 to 60 000 ms, default 1 000 ms)
Description	A free-text description of the device
Dynamic Block Resize	When checked, if the device answers a block request with an Illegal Data Address exception, the OPC Server splits the block into two smaller blocks so that the valid addresses keep being read

Table 3: Serial Device Connection Parameters

You can test the availability of the Modbus Device by clicking on the **Test Connection** button. If the Modbus device is available, a message box will be displayed:

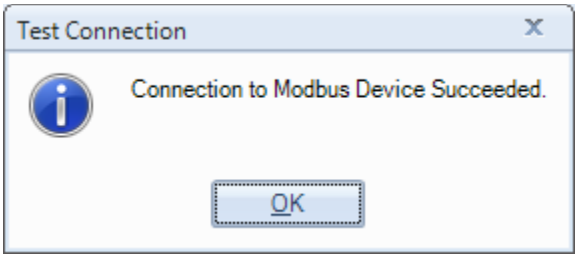


Figure 9: Test Connection with Modbus Device

Step 2: Data Access and Swapping Mode Configuration

Once the device connection parameters are configured, click the Next button and the following window will be displayed.

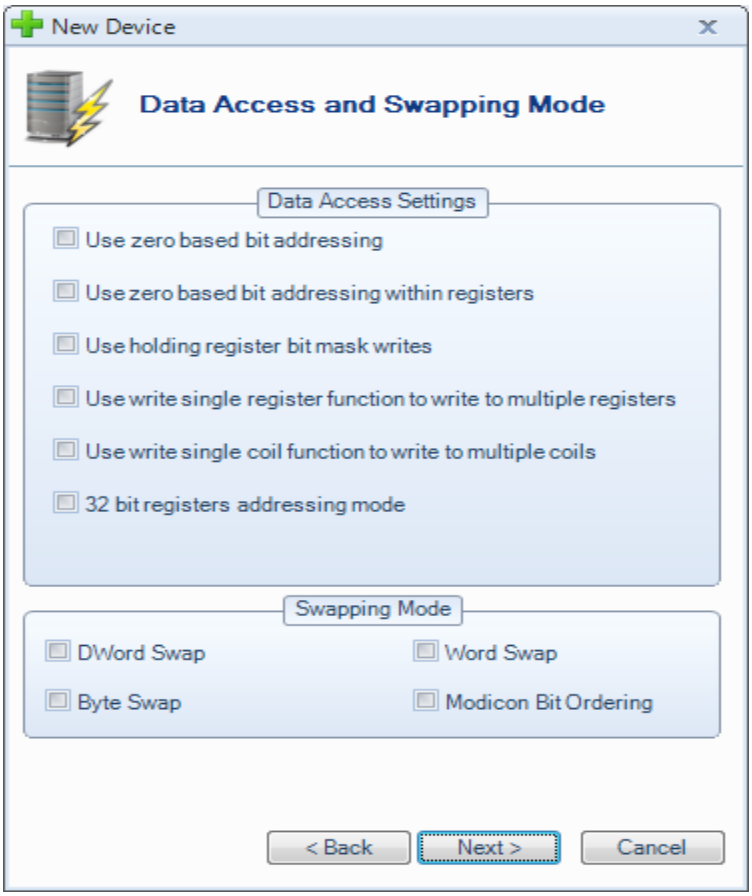


Figure 10: Select Device Data Access & Swapping Mode Parameters

The data access parameters are described in the below table:

Parameter	Description
Use zero based bit addressing	• False (unchecked):The Modbus device address numbering starts at 1 which makes the starting address sent in the Modbus frames request will have one subtracted. • True (checked): The Modbus device address numbering starts at 0 and the starting address included in the Modbus frame request will remain the same.
Use zero based bit addressing within registers	This option is used with bits within registers referenced as Boolean • False (unchecked): The first bit within register begins at one • True (checked): The first bit within register begins at zero
Use holding register bit mask writes	This option is used to write in a bit within register using the boolean datatype with holding registers. • False (unchecked): The OPC Server will use a read /Write operation to update the bit of interest. • True (checked): The OPC Server will use function 22 to update the bit of interest.
Use write single register function to write to multiple registers	This option is related to 32 bits and 64 bits OPC tags. • False (unchecked): The OPC Server will use the function 16 to write to multiple registers. • True (checked): The OPC Server will use function 06 to write into multiple registers.
Use write single coil function to write to multiple coils	• False (unchecked): The OPC Server will use the function 15 to write to multiple coils. • True (checked): The OPC Server will use function 05 to write into multiple registers.
Enable synchronous communication	• When unchecked, it means that the asynchronous communication will be used read/write data from/to Modbus device

	• When checked, it means that the synchronous communication will be used read/write data from/to Modbus device

Table 4: Device Data Access Parameters

You can also select the swapping mode with reference to the below description:

Parameter	Description
DWord Swap	• False (unchecked): Higher dword is sent/received first for double values. • True (checked): Lower dword is sent/received first for double values.
Word Swap	• False (unchecked): Higher word is sent/received first for long, unsigned long or float values. • True (checked): Lower word is sent/received first for long, unsigned long or float values.
Byte Swap	• False (unchecked): Higher byte is sent/received first for integer, unsigned integer, long, unsigned long or float values. • True (checked): Lower byte is sent/received first for integer, unsigned integer, long, unsigned long or float values.
Modicon Bit Ordering	• False (unchecked): Higher bit is sent/received first for Boolean, integer, unsigned integer, long, unsigned long or float values. • True (checked): Lower bit is sent/received first for Boolean, integer, unsigned integer, long, unsigned long or float values.

Table 5: Device Swapping Mode Parameters

Step 3: Auto-demotion, Block Sizes and Error Handling

After configuring the device data access and swapping mode, click the **Next** button and the following window will be displayed.

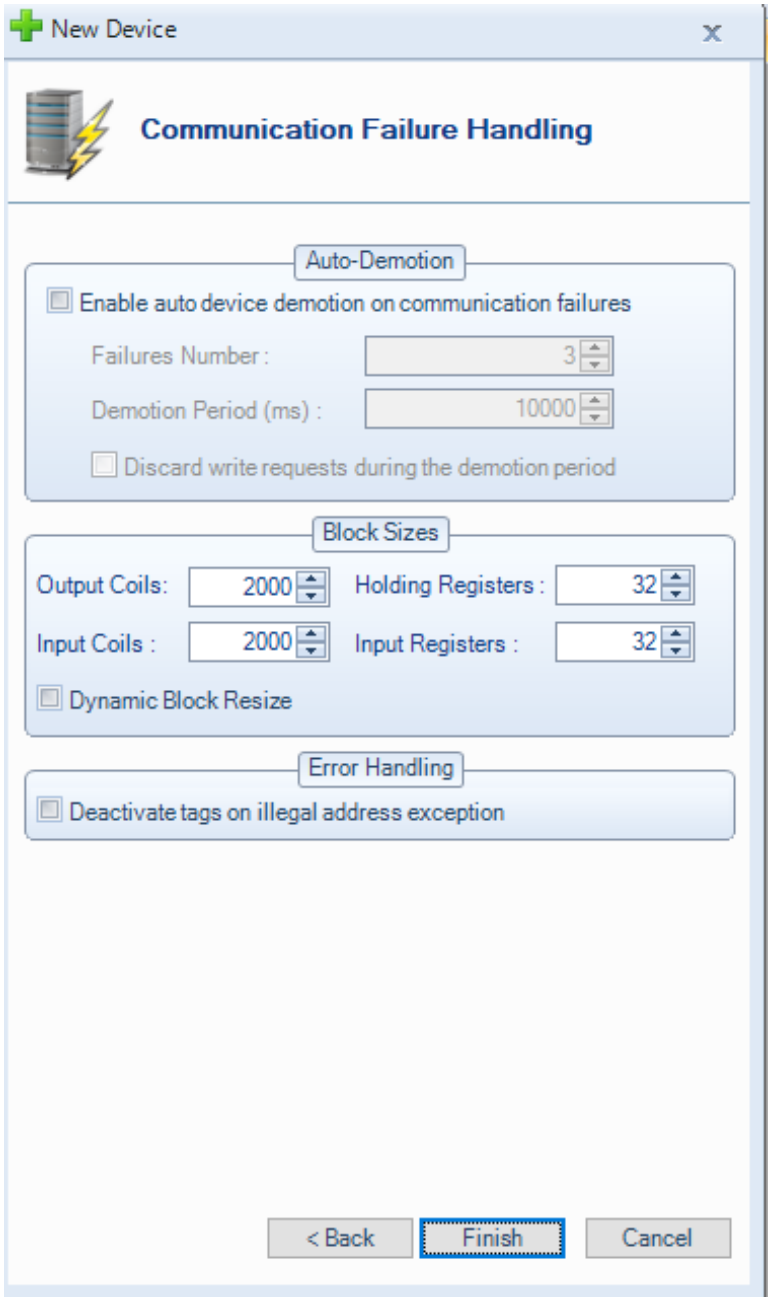


Figure 11: Select Communication Failure Handling Parameters

In addition to the connection parameters, the communication failure is also handled using the Auto-Demotion, the block sizes and the error handling parameters.

Below are the descriptions of each option:

Parameter	Description
Enable auto device demotion on communication failures	When checked, This option allows to demote a device for a specific period of time when communication failures reaches an already configured limited number.
Failures Number	The number of successive failures before demoting the device
Demotion Period	During this period ,no read request will be sent to the device
Discard write requests during the demotion period	When checked, no write request will be sent to the device during the demotion period

Table 6: Auto-Demotion Parameters

Parameter	Description
Output Coils	Specifies the number of output coils in the Modbus frame requests
Input Coils	Specifies the number of input coils in the Modbus frame requests
Input Registers	Specifies the number of output registers in the Modbus frame requests
Holding Registers	Specifies the number of input registers in the Modbus frame requests

Table 7: Device Block Sizes Parameters



After updating the block size properties, you need to restart the service so the changes take effects.

Parameter	Description
Deactivate tags on illegal address exception	• False (unchecked): When illegal data address error is occurred with a block addresses. The OPC Server remains sending read requests to the Modbus device • True (checked): When illegal data address error is occurred with a block addresses. The OPC Server stops sending read requests to the Modbus device

Table 8: Device Error Handling Parameters

Step 4: Finish Adding New Device

Click the **Finish** button and the device will be then added to tree view.

ADDING A NEW GROUP

You can add groups under the device node in order to build hierarchal organization of the server address space. A group belongs to a device and contains one or more OPC tags. It can also contain other sub-groups.

Right click on the device node and then select the **New Group** option from the displayed menu.

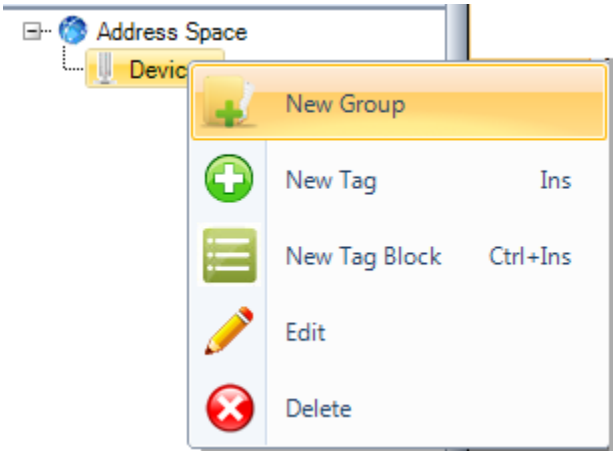


Figure 12: New Group

Then, the New Group dialog box will be displayed as illustrated below. You can have to specify the group name.

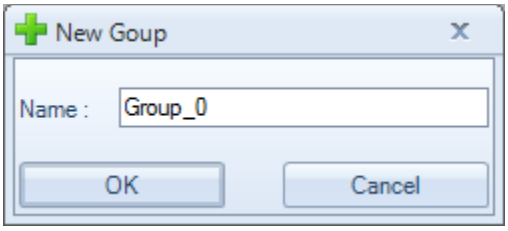


Figure 13: New Group Dialog Box

ADDING TAG PER BLOCK

You can add simultaneously multiple tags having the same location type and access right but different addresses. Right click on the group or device node and then select the **Add Tag Block** option.

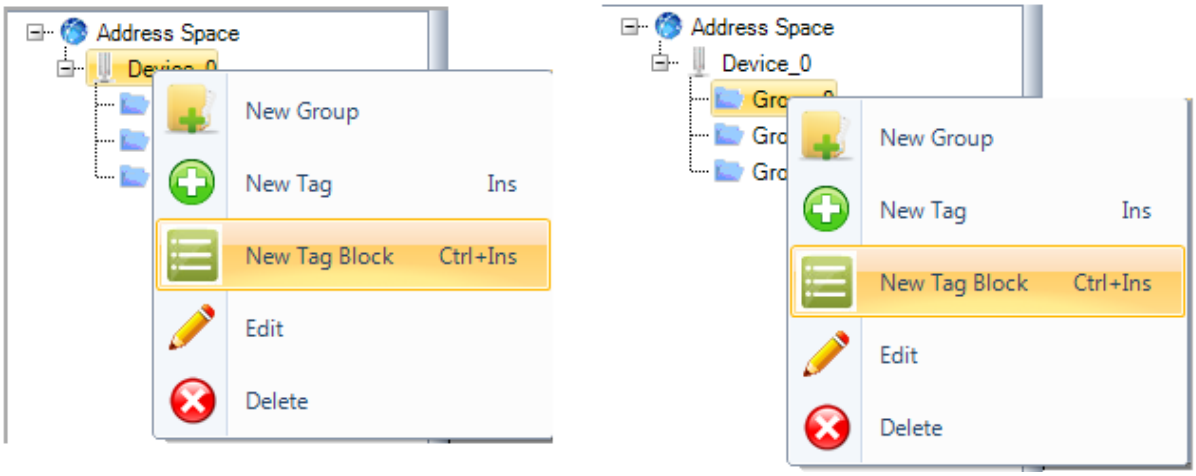


Figure 14: New Tag Block

The New Tag Block dialog box will be displayed as following:

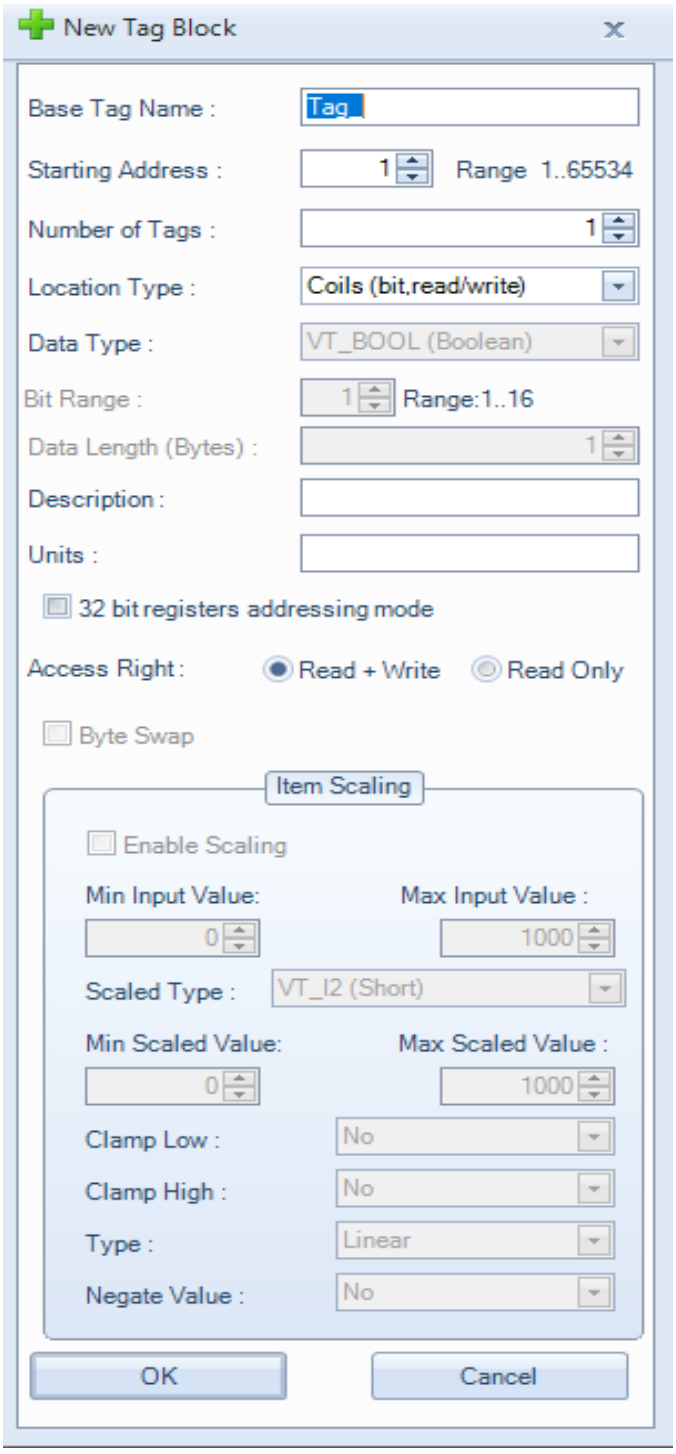


Figure 15: New Tag Block Dialog Box

Parameter	Description
Base Tag Name	The pattern used to generate the name of the tags
Location Type	The Modbus address type, which can be : • Coils • Discrete Inputs • Holding Registers • Input Registers ***Refer to the Location Type table for more details.***
Starting Address	The address of the first tag. Its value should be between 1 and 65534.
Number of Tags	The number of the tags to be added
Data Type	The type of data, which can be: • VT_I2: Variable type is 2-byte signed integer • VT_I4: Variable type is 4-byte signed integer • VT_R4: Variable type is 4-byte real • VT_UI2: Variable type is an unsigned integer • VT_UI4: Variable type is an unsigned long • VT_BSTR: Variable type is binary string • VT_BOOL: Variable type is Boolean
Data Length	The bytes number of the selected data type
Access Right	The data access right, which can be read only or read/write
Byte Swap	• False (unchecked): Higher byte is sent/received first for string values. • True (checked): Lower byte is sent/received first for string values.
Description	A free-text description of the tags
Units	The engineering units of the tags (for example °C or bar), exposed to OPC clients as the "Item EU Units" item property
32 bit registers addressing mode	When checked, the device holds a 32-bit or 64-bit value in one 32-bit register. When unchecked, the value spans two 16-bit registers

Table 9: Tag Block Properties

The Item Scaling section of the New Tag Block dialog box converts the raw value read from the Modbus device into an engineering value before it is sent to OPC clients. Scaling is available for numeric data types only; it is disabled for VT_BOOL and VT_BSTR tags. The value is first scaled, then clamped, then negated, as configured below. When an OPC client writes to a scaled tag, the OPC Server applies the inverse conversion, so the raw value written to the device is the one that would be read back as the written value.

Parameter	Description
Enable Scaling	When checked, the tag value is scaled using the parameters below. When unchecked, the raw value is reported unchanged and the other scaling parameters are disabled.
Min Input Value	The lowest raw value expected from the device. It is mapped to Min Scaled Value.
Max Input Value	The highest raw value expected from the device. It is mapped to Max Scaled Value.
Min Scaled Value	The engineering value that corresponds to Min Input Value.
Max Scaled Value	The engineering value that corresponds to Max Input Value.
Scaled Type	The data type of the scaled value exposed to OPC clients: VT_I2, VT_I4, VT_R4, VT_R8, VT_UI2 or VT_UI4.
Type	The scaling formula. **Linear:** Scaled = (Raw − Min Input) × (Max Scaled − Min Scaled) / (Max Input − Min Input) + Min Scaled. **Square Root:** Scaled = √((Raw − Min Input) / (Max Input − Min Input)) × (Max Scaled − Min Scaled) + Min Scaled. A raw value below Min Input Value gives Min Scaled Value.
Clamp Low	Yes: a scaled value below Min Scaled Value is reported as Min Scaled Value. No: the value is not limited.
Clamp High	Yes: a scaled value above Max Scaled Value is reported as Max Scaled Value. No: the value is not limited.

Negate Value	Yes: the sign of the scaled value is inverted before it is sent to OPC clients. No: the value is sent as is.

Table 10: Item Scaling Parameters

SAVING THE CONFIGURATION

You can save your configuration using the **Save As** or **Save** button available in the file menu. The Save File As dialog box is then displayed to choose the path where the configuration will be saved.

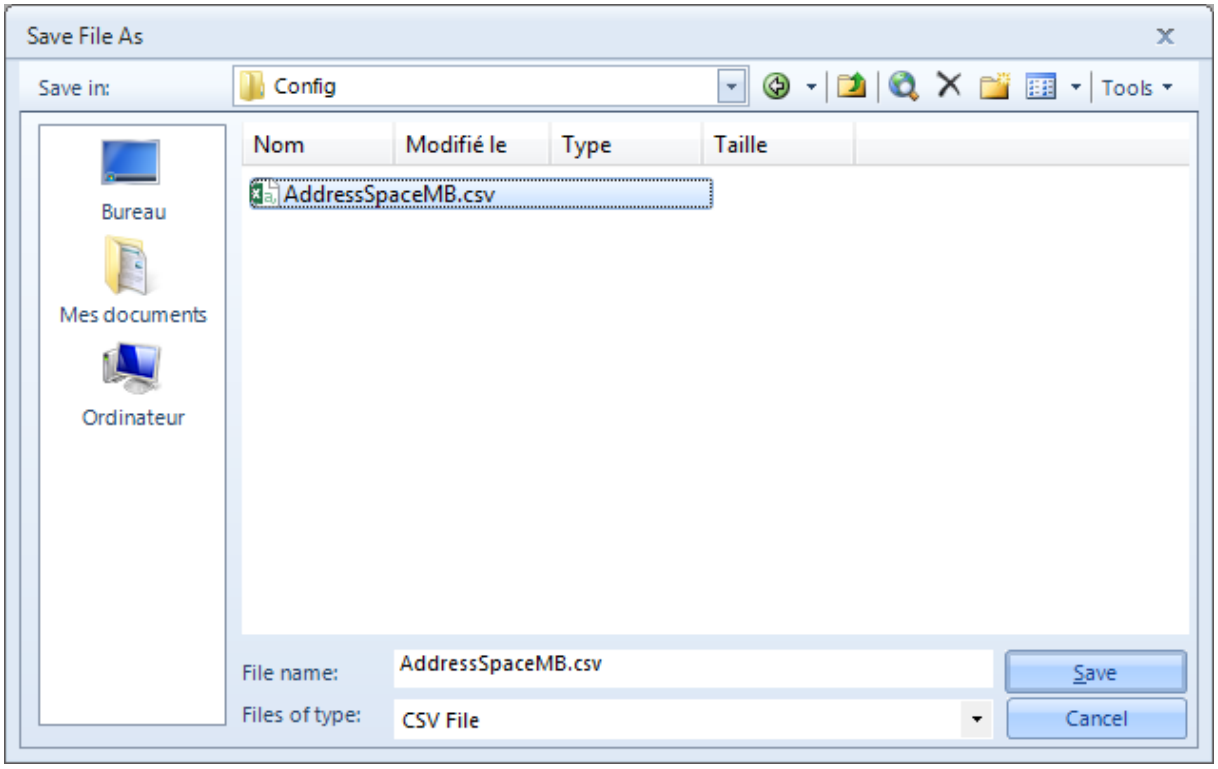


Figure 16: Save File As Dialog Box

The configuration will be then saved in CSV file format. The configuration is divided into three sections;

- COM port
- Devices
- Tags

The table below describes the fields of the COM port configuration section.

	Field	Description
1	**Port ID**	The port ID

2	**Baud Rate**	The baud rate to be used to configure the com port
3	**Data Bits**	The number of data bits per data word
4	**Parity**	The type of parity for the data
5	**Stop Bits**	The number of stop bits per data word
6	**Flow Control**	Defines how the RTS and DTR control lines are used
7	**Read Timeout**	The read timeout
8	**Write Timeout**	The write timeout

Table 11: COM Port Configuration Section Format

The table below describes the fields of the devices configuration section.

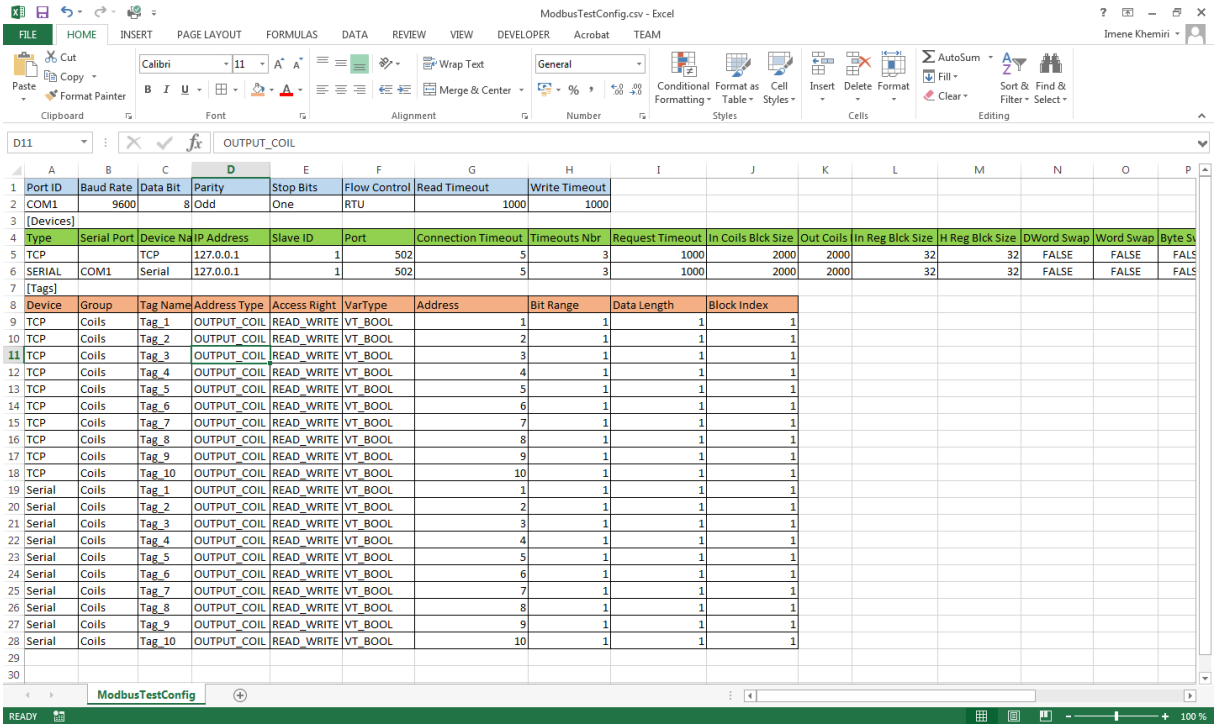
	Field	Description
1	**Type**	The device type (SERIAL/TCP)
2	**Serial Port**	The serial com port ID
3	**Device Name**	The device name
4	**IP Address**	The Modbus device IP address
5	**Slave ID**	The Identifier of the slave device
6	**Port**	The listening TCP port reserved for the Modbus device communications. The default value is 502.
7	**Connection Timeout**	The waiting period, in seconds, for an unresponsive server
8	**Timeouts Nbr**	The allowed timeouts number when the server does not respond
9	**Request Timeout**	The amount of time, in milliseconds, that the OPC Server will wait before setting the OPC Tag quality to bad.
10	**In Coils Blck Size**	Specifies the number of input coils in the Modbus frame requests
11	**Out Coils Blck Size**	Specifies the number of output coils in the Modbus frame requests
12	**In Reg Blck Size**	Specifies the number of input registers in the Modbus frame requests

13	**H Reg Blck Size**	Specifies the number of output registers in the Modbus frame requests
14	**DWord Swap**	• False (unchecked): Higher dword is sent/received first for double values. • True (checked): Lower dword is sent/received first for double values.
15	**Word Swap**	• False (unchecked): Higher word is sent/received first for long, unsigned long or float values. • True (checked): Lower word is sent/received first for long, unsigned long or float values.
16	**Byte Swap**	• False (unchecked): Higher byte is sent/received first for integer, unsigned integer, long, unsigned long or float values. • True (checked): Lower byte is sent/received first for integer, unsigned integer, long, unsigned long or float values.
17	**Bit Order**	• False (unchecked): Higher bit is sent/received first for Boolean, integer, unsigned integer, long, unsigned long or float values. • True (checked): Lower bit is sent/received first for Boolean, integer, unsigned integer, long, unsigned long or float values.
18	**Base Address**	• False (unchecked): The Modbus device address numbering starts at 1 which makes the starting address sent in the Modbus frames request will have one subtracted. • True (checked): The Modbus device address numbering starts at 0 and the starting address included in the Modbus frame request will remain the same.
19	**Reg Base Address**	This option is used with bits within registers referenced as Boolean • False (unchecked): The first bit within register begins at one • True (checked): The first bit within register begins at zero
20	**H Reg Bit Mask**	This option is used to write in a bit within register using the Boolean data type with holding registers. • False (unchecked): The OPC Server will use a read /Write operation to update the bit of interest. • True (checked): The OPC Server will use function 22 to update the bit of interest.
21	**Only Single Reg Write**	This option is related to 32 bits and 64 bits OPC tags. • False (unchecked): The OPC Server will use the function 16 to write to multiple registers. • True (checked): The OPC Server will use function 06 to write into multiple registers.

22	**Only Single Coil Write**	• False (unchecked): The OPC Server will use the function 15 to write to multiple coils. • True (checked): The OPC Server will use function 05 to write into multiple registers.
23	**Auto Demotion**	When checked, This option allows to demote a device for a specific period of time when communication failures reaches an already configured limited number.
24	**Failures Nbr**	The number of successive failures before demoting the device
25	**Demotion Period**	During this period ,no read request will be sent to the device
26	**Discard Write**	When checked, no write request will be sent to the device during the demotion period
27	**Deactivate Tags**	• False (unchecked): When illegal data address error is occurred with a block addresses. The OPC Server remains sending read requests to the Modbus device • True (checked): When illegal data address error is occurred with a block addresses. The OPC Server stops sending read requests to the Modbus device
28	**Tr Mode**	The transmission mode (RTU/ASCII)
29	**Synchronous Enabled**	• When unchecked, it means that the asynchronous communication will be used read/write data from/to Modbus device • When checked, it means that the synchronous communication will be used read/write data from/to Modbus device
30	**Request Timeout Nbr**	The allowed request timeouts number before starting the reconnection procedure to the device
31	**Inter-Frame**	The amount of time, in milliseconds, between two read requests (Inter Request Delay)
32	**Response Delay**	Serial devices only. The amount of time, in milliseconds, to wait for a response from the target device
33	**Check Device Status Period**	The period, in milliseconds, at which the device connection status is checked (50 to 60 000)
34	**Dynamic Block Resize**	True: a block that returns an Illegal Data Address exception is split into two smaller blocks. False: the block is not split
35	**Network Adapter**	TCP devices only. The IP address of the local network adapter used to reach the device, or "Default" to let Windows choose the route. Empty for serial devices

36	**Update Rate**	The device polling period, in milliseconds (50 to 60 000, default 1 000)
37	**Device Description**	A free-text description of the device

Table 12: Devices Configuration Section Format



Port ID	Baud Rate	Data Bit	Parity	Stop Bits	Flow Control	Read Timeout	Write Timeout
COM1	9600	8	Odd	One	RTU	1000	1000

[Devices]

Type	Serial Port	Device Na	IP Address	Slave ID	Port	Connection Timeout	Timeouts Nbr	Request Timeout	In Coils Blck Size	Out Coils	In Reg Blck Size	H Reg Blck Size	DWord Swap	Word Swap	Byte Su
TCP		TCP	127.0.0.1	1	502	5	3	1000	2000	2000	32	32	FALSE	FALSE	FALS
SERIAL	COM1	Serial	127.0.0.1	1	502	5	3	1000	2000	2000	32	32	FALSE	FALSE	FALS

[Tags]

Device	Group	Tag Name	Address Type	Access Right	VarType	Address	Bit Range	Data Length	Block Index
TCP	Coils	Tag_1	OUTPUT_COIL	READ_WRITE	VT_BOOL	1	1	1	1
TCP	Coils	Tag_2	OUTPUT_COIL	READ_WRITE	VT_BOOL	2	1	1	1
TCP	Coils	Tag_3	OUTPUT_COIL	READ_WRITE	VT_BOOL	3	1	1	1
TCP	Coils	Tag_4	OUTPUT_COIL	READ_WRITE	VT_BOOL	4	1	1	1
TCP	Coils	Tag_5	OUTPUT_COIL	READ_WRITE	VT_BOOL	5	1	1	1
TCP	Coils	Tag_6	OUTPUT_COIL	READ_WRITE	VT_BOOL	6	1	1	1
TCP	Coils	Tag_7	OUTPUT_COIL	READ_WRITE	VT_BOOL	7	1	1	1
TCP	Coils	Tag_8	OUTPUT_COIL	READ_WRITE	VT_BOOL	8	1	1	1
TCP	Coils	Tag_9	OUTPUT_COIL	READ_WRITE	VT_BOOL	9	1	1	1
TCP	Coils	Tag_10	OUTPUT_COIL	READ_WRITE	VT_BOOL	10	1	1	1
Serial	Coils	Tag_1	OUTPUT_COIL	READ_WRITE	VT_BOOL	1	1	1	1
Serial	Coils	Tag_2	OUTPUT_COIL	READ_WRITE	VT_BOOL	2	1	1	1
Serial	Coils	Tag_3	OUTPUT_COIL	READ_WRITE	VT_BOOL	3	1	1	1
Serial	Coils	Tag_4	OUTPUT_COIL	READ_WRITE	VT_BOOL	4	1	1	1
Serial	Coils	Tag_5	OUTPUT_COIL	READ_WRITE	VT_BOOL	5	1	1	1
Serial	Coils	Tag_6	OUTPUT_COIL	READ_WRITE	VT_BOOL	6	1	1	1
Serial	Coils	Tag_7	OUTPUT_COIL	READ_WRITE	VT_BOOL	7	1	1	1
Serial	Coils	Tag_8	OUTPUT_COIL	READ_WRITE	VT_BOOL	8	1	1	1
Serial	Coils	Tag_9	OUTPUT_COIL	READ_WRITE	VT_BOOL	9	1	1	1
Serial	Coils	Tag_10	OUTPUT_COIL	READ_WRITE	VT_BOOL	10	1	1	1

Figure 17: Configuration File Example

SETTING THE DEFAULT CONFIGURATION

After saving your configuration, you need to set the default configuration, which will be loaded automatically at the OPC Server for Modbus Service start-up. To define a default configuration, click the Define button available in the Settings Menu.

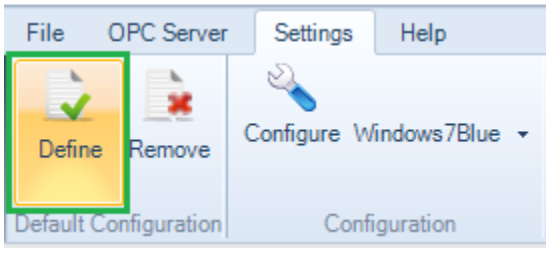


Figure 18: Set Default Configuration

STARTING THE OPC SERVER FOR MODBUS SERVICE

After setting the default configuration, select the OPC Server menu and click on the start button menu to start the Integration Objects' OPC Server for Modbus service.

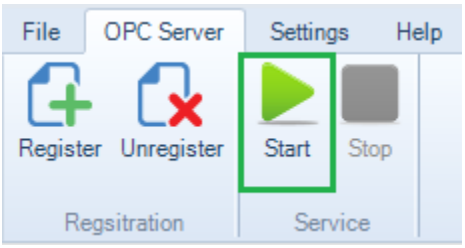


Figure 19: Start the OPC Server for Modbus Service

CONNECTING TO THE OPC SERVER FOR MODBUS

Once the OPC Server is configured, the next step will be the connection to the OPC Server and reading/writing data. To do so, you only need to:
Launch your OPC DA Client as administrator.

1. Enter the IP address of the machine where the OPC Server is installed
2. Connect to the OPC Server with the following ProgID: IntegrationObjects.OPC.ModBus.1"
3. Add a group and select the items to be read

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