

Matrikon Industrial UA Modbus Gateway Configuration Guide

This document is designed to describe how to configure the Matrikon Industrial UA Modbus Gateway to connect to MODBUS devices.

Getting Started

Before you can begin, please perform the following tasks, and/or install the following tools/software on a computer with Ethernet access to the gateway device:

1. Consult the Quick Installation Guide and the Initial Setup Guide to connect the power, communications, and to configure the device for your network.
2. Copy the configuration tool software on the provided USB key to a desktop or laptop computer. The software may also be run directly off of the USB key.

Configuration Overview

The Matrikon Industrial UA Gateway for MODBUS uses 3 files to configure the UA Services on the device for communication with the MODBUS slave devices used. All of the configuration files are stored as Comma-Separated-Values (CSV) formatted files and can be created and edited using a text editor or a spreadsheet program such as Microsoft Excel.

1. `ports.csv`: This file configures the connections used to talk to MODBUS slave devices.
2. `acl.csv`: This file defines user credentials (user name/password) for OPC UA user tokens for access control.
3. `tags.csv`: This file defines the UA tag names and browse structure for the server. Tags are linked to a port in the `ports.csv` file, the protocol specific address information, and users with access permissions.

These configuration files are transmitted to the Matrikon Industrial UA Gateway For MODBUS using the UA Protocol and standard OPC UA Specification based file-transfer mechanisms. The configuration tool provided on the USB Key is a UA client to transmit these files to the device.

This guide assumes that the hardware has been wired and the initial configuration process has been completed so that the Matrikon Industrial UA Gateway for MODBUS is available for communications using the OPC UA Protocol.

Sample configuration files are provided on the USB key.

Ports Configuration

Ports are how the device describes connection points to talk to MODBUS devices. Ports are either one of the two serial ports on the bottom of the device, or a TCP client connection to either a serial-ethernet terminal server or a Modbus TCP server. The `ports.csv` file configures the name of each port, the type (serial or TCP), what protocol is to be used on that port, and any additional options required to configure the port.

CSV Columns:

Port Name, Port Type, Port Options, Protocol Name, Protocol Options

Port Name:

The name of the port. This is used by the `tags.csv` file to identify which port a tag can be accessed on. Serial ports must use COM1 and COM2. TCP connections may use any short string (16 characters or less).

Port Type:

'S' for serial, 'T' for TCP/IP

Port Options:

This format of this field depends on the port type.

For Serial ('S') ports, it must set the serial standard, baud rate, data bits, parity, number of stop bits, flow control:

```
RS232 115200 8 N 1 RTSCTS
```

```
RS422 19200 8 E 1 NONE
```

```
RS485_2WIRE 38400 8 O 2 XONXOFF
```

```
RS485_4WIRE 19200 8 N 1 NONE
```

RS232, RS485_2WIRE, RS485_4WIRE, and RS422 are supported for the serial standard. The wiring for the serial port must match the setting configured. All standard baud rates are supported from 50 – 230400. (E)ven, (O)dd, or (N)one parity can be supported. 5, 6, 7, or 8 data bits per byte, and 1 or 2 stop bits. The flow control settings can be NONE, RTSCTS, or XONXOFF – RTSCTS is only supported on RS232 connections when wired correctly.

Additional options can be added following the basic serial configuration options:

```
RS232 19200 8 E 1 NONE TIMEOUT=1500 KEYDOWN=30 KEYUP=30 MINDELAY=10
```

The KEYDOWN and KEYUP options only apply to RS232 connections and are intended for connections to serial radio modems. KEYDOWN is the number of milliseconds before starting a transmission that the server will assert the RTS line in order to give the radio time to warm up. The RTS line is held asserted until KEYUP milliseconds after the end of the last byte transmitted. These control lines need to be wired to control the Push-To-Talk (PTT) line on the radio modem. By default, KEYDOWN and KEYUP are set to 0 milliseconds. Setting either option also implies that NONE flow control will be used – the flow control option will be ignored. CTS will be ignored, and RTS will be activated KEYDOWN milliseconds before transmission, and will be held active until KEYUP milliseconds after the end of the transmission.

The TIMEOUT option is the number of milliseconds the device will wait for a response after sending a command. If no response is received before the timeout expires, the server will mark the items as bad quality and continue trying to read other items. TIMEOUT applies to all serial standards.

The MINDELAY option sets the minimum delay between sending and receiving Modbus messages, in milliseconds. By default, the minimum delay is set to 0 ms, and messages will be sent as quickly as possible. For some devices, adding a small delay (5-20ms recommended) between messages is necessary to ensure that the Modbus device is able to respond to all requests.

For TCP ('T') ports, the hostname or IP address and port must be set. Additional options such as the timeout can be added. E.g.:

```
192.168.3.1:502
```

```
Hostname.somecompany.com:10000 TIMEOUT=2500
```

The only option available for TCP ports is TIMEOUT, and it functions in the same way as the serial configuration.

Protocol:

At this time only 'MODBUS' is supported. Future versions of the UA Gateway may support other protocols.

Protocol Options:

The MODBUS protocol has 3 variations; Select one of:

```
RTU
```

```
ASCII
```

```
TCP
```

Additional options can be added following the protocol option. For all of the Modbus protocol variations, one option is supported:

```
RTU MAXITEMS=64
```

The MAXITEMS option limits the number of items requested in a single command when reading from the MODBUS hardware. If no MAXITEMS option is used, the default maximum is set to 32. MAXITEMS can be set in the range of 1 to 255, and does not override protocol limitations on packet size.

Any of the Modbus protocol types can be used on a TCP port to allow for use of a serial-to-Ethernet convertor. RTU and ASCII options are allows for serial ports.

Example ports.csv:

TCP0,T,192.168.3.1:502	TIMEOUT=900,MODBUS,TCP	MAXITEMS=16
COM1,S,RS232 115200 8 N 1 NONE	KEYUP=400 KEYDOWN=300,MODBUS,RTU	
COM2,S,RS232 9600 8 N 1 NONE	TIMEOUT=1200 KEYUP=500 KEYDOWN=400,MODBUS,RTU	MAXITEMS=64

Access Control List – acl.csv

The access control list defines what usernames and passwords can be used to access the device. Up to 14 users may be added to the device. One special user exists on the device automatically: the admin users, which uses the same password as the root account on the device set up during initial configuration.

acl.csv has 4 columns:

user name, token type, plaintext token, encoded token

Username:

The username part of the UA credentials token.

Token Type:

(P)assword or (C)ertificate. Only 'P' (password) tokens are currently supported.

Plaintext token:

For password tokens, this is the password of the user, in plain text. When read by the server, the password will be hashed, and the file on the device will be re-written to store the hash. For certificate tokens, the thumbprint of the user certificate that identifies this user.

Encoded Token:

For a certificate token, this field is not used. For a password token, this field will contain then cryptographic hash of the password. The UA Gateway will convert plaintext passwords into encoded passwords and re-save the file with only the encoded passwords when the file is read.

Example acl.csv (plain text passwords):

```
operator,P,operator,
field_service,P,field_service,
user,P,user,
```

Tags – tags.csv

The tags file lists each MODBUS register or value that can be accessed through this device. Each tag is bound to a particular port by this file, and the modbus data type, unit number, register address, options, name and path on the UA server, and the users with access to read, write, and view the tag.

Tag Fields (Modbus protocol):

Port, tagFolder.name, modbus unit id, modbus register type, modbus register address, modbus tag options, users with read access, users with write access, users with view access

Port:

The name of the port configured in the ports.acl file for this tag.

tagFolder.name:

The path and name of the tag. Periods ('.') separate folder names from the tag name. Multiple layers of folder names can be used. Everything after the last period is the tag name.

Modbus Unit ID:

0-255, the unit number that the tag is found on.

Modbus Register Type:

- 1: Coils (Boolean, Read/Write)
- 2: Status Flags (Boolean, Read only)
- 3: Holding Registers(16bit signed int (by default), Read/Write)
- 4: Analog Inputs (16 bit signed int by default, Read only)

Modbus Register Address:

1-65535. Some Modbus software groups the register type and address into a single number, e.g. 400005. For the UA Gateway, that would have to be entered as register type 4, register number 5.

Modbus Register Options:

For Modbus, only the type 3 (holding registers) and type 4 (analog inputs) have options available. All other tag types should leave this blank. For the holding registers and analog inputs, one or more of the following options can be added:

Option Letter	Name	Can be combined with:	Description
<none>	n/a	n/a	By default, analog inputs and holding registers are treated as 16 bit signed integers.
F	Float	SRT	Implies 'W' – wide. Takes the register number and the register that follows that, and treats the resulting 2 words (4 bytes) as an IEEE 957 single precision floating point number. The UA Client will see this item as an OPC UA Float value.
U	Unsigned	WSRT	Treat the value as an unsigned 16 bit integer. When combined with 'W', treat the value as an unsigned 32 bit integer.
W	Wide	SRT	Assembles the register at the requested address with the register one address higher, and assembles the value as a 32 bit signed integer (or a 32 bit unsigned integer when combined with 'U') i.e. if the selected register had the bytes 12 and the next register had the bytes 34, the resulting 4 byte value would be 1234.
S	Word Swap	WFU	Only applies when the 'W' or 'F' options are selected. Swaps the order of the two selected registers before converting it to the final value. i.e. if the selected register had the bytes 12 and the next register had the bytes 34, the resulting 4 byte value would be 3412.
R	Byte and Word swap	WFU	Only applies when the 'W' or 'F' options are selected. Swaps the order of the two selected registers, and the order of the bytes inside the registers before converting it to the final value. i.e. if the selected register had the bytes 12 and the next register had the bytes 34, the resulting 4 byte value would be 4321.
T	Byte Swap	WFU	Swaps the order the bytes inside the register(s) before converting it to the final value. i.e., for a 'W' – wide or 'F' float tag where the first register has the bytes 12 and the next register has the bytes 34, the resulting 4 byte value would be 2143. For a non-wide tag, where the bytes in the selected register are 12, the resulting value will be 21.

User Permissions:

Each tag has three user permissions that must be assigned. User names from the ACL file are used here, along with a couple special names:

ALL – all users, including anonymous.

ANON – The anonymous user.

ALL_NON_ANON – all users, not including anonymous users.

The administrative user with the initial configuration password always has read/write and view access to all tags. A blank entry in one of the permissions fields indicates no access of that type except by the administrative user.

Users with Read access:

A list of user names separated by spaces that are allowed to read the tag.

Users with Write access:

A list of user names separated by spaces that are allowed to write the tag.

Users with View access:

A list of user names separated by spaces that are allowed to view the tag when browsing the UA server.

Example Tags File:

```
COM1,COM1.Coils.1,1,1,1,,operator field_service user,operator field_service,ALL_NON_ANON
COM1,COM1.Coils.2,1,1,2,,operator field_service user,operator field_service,ALL_NON_ANON
COM2,COM2.Flags.3,1,2,3,,operator field_service user,operator field_service,ALL_NON_ANON
COM2,COM2.Flags.4,1,2,4,,operator field_service user,operator field_service,ALL_NON_ANON
COM2,COM2.Flags.5,1,2,5,,operator field_service user,operator field_service,ALL_NON_ANON
COM2,COM2.Flags.6,1,2,6,,operator field_service user,operator field_service,ALL_NON_ANON
COM2,COM2.Flags.7,1,2,7,,operator field_service user,operator field_service,ALL_NON_ANON
COM2,COM2.Flags.8,1,2,8,,operator field_service user,operator field_service,ALL_NON_ANON
COM2,COM2.AnalogInput.1,1,4,1,,operator field_service user,operator field_service,ALL_NON_ANON
COM2,COM2.AnalogInput.2,1,4,2,,operator field_service user,operator field_service,ALL_NON_ANON
COM2,COM2.AnalogInput.3,1,4,3,,operator field_service user,operator field_service,ALL_NON_ANON
TCP0,TCP0.HoldingReg.2U,1,3,2,U,field_service,field_service,field_service
TCP0,TCP0.HoldingReg.3U,1,3,3,U,field_service,field_service,field_service
TCP0,TCP0.HoldingReg.4U,1,3,4,U,field_service,field_service,field_service
TCP0,TCP0.HoldingReg.5,1,3,5,,field_service,field_service,field_service
TCP0,TCP0.HoldingReg.6,1,3,6,,field_service,field_service,field_service
TCP0,TCP0.HoldingReg.7,1,3,7,,field_service,field_service,field_service
TCP0,TCP0.HoldingReg.8,1,3,8,,field_service,field_service,field_service
```

Once you have prepared the configuration files, the Configuration tool can be used to upload these files to the device.

Transferring the Configuration Files

A command line tool is provided to transfer the configuration files to the device. The command line tool requires Microsoft Windows to run. The tool can be used in batch scripts to help automate configuration deployment to multiple devices.

Required Information

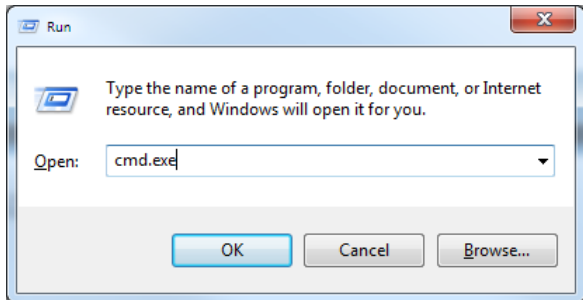
In order to transfer configuration files to the device, you will need:

- The IP address or hostname of the device.
- The administration (root) password of the device. The initial configuration process requires you to set this password, and that must have been completed before files can be transferred.
- The configuration files to send to the device.

Command Line Tool usage

Open the windows command prompt from the start menu:

- Click on the start menu
- Choose 'Run'
- Enter 'cmd.exe'
- Click on 'ok' or press the enter key



Change the current drive and directory to the location of the tool (assuming the USB key has been identified as g:)

Execute the upload command to send the files to the device (replace <ipaddress> with the address configured for your device, replace <cfgspath> with the path to the configurations files that have been prepared).

```
ConfigureUAGatewayConsole [ipaddress] upload /tags:[cfgspath]\tags.csv
                        /ports:[cfgspath]\ports.csv /acl:[cfgspath]\acl.csv
```

The configuration tool will prompt you for a password: you need to supply the password created for the administration (root) account during initial configuration, and press enter. The device identification (hostname, user supplied ID string) will be displayed. Upon successfully uploading the file, the Matrikon Industrial UA Gateway for MODBUS will close all UA connections and restart to activate the new configuration.

```
G:\>cd "UA Configuration Tool-Console"
G:\UA Configuration Tool-Console>ConfigureUAGatewayConsole.exe 192.168.3.127 upl
oad /tags:xtags.csv /acl:xacl.csv /ports:xports.csv
Password: ****
Destination Server Information
  IP Address      : 192.168.3.127
  Custom ID       : UA Modbus server 1
  Host Name       : UAGateway
  Manufacture Name: MatrikonOPC
  Software Version: 1.0.0
Operation Result:
File xtags.csv upload successfully!
File xacl.csv upload successfully!
File xports.csv upload successfully!
Warning: Trigered new Configuration and Server will restart!
G:\UA Configuration Tool-Console>_
```

The configuration tool may also be used to download the configuration files from the device, using the command 'download' instead of upload.

Detailed Command Line Options:

```
ConfigureUAGatewayConsole [IP Address] [Operation Type] [/tags:Tags File] [/ports:Ports File]
[/acl:Acl File] [/log:Log file] [/config:Config File] [/password:Password]
```

Parameter Description:

IP Address	Destination IP address. Mandatory.
Operation Type	upload - send files to the device or download - retrieve current files from device. Mandatory.
Tags File	Tags file that will be uploaded or downloaded. Optional.
Ports File	Ports file that will be uploaded or downloaded. Optional.
Acl File	Acl file that will be uploaded or downloaded. Optional.
Log File	Log file that will be downloaded from the device. Optional, download only. This option is normally used to gather information when requested for support.
Config File	Config file that will be downloaded from the device. Optional, download only. This option is normally used to gather information when requested for support.
Password	Administrative/Root User password. Optional. If the password is not supplied on the command line, the program will prompt for the password. This option is intended for use in deployment scripts for multiple devices. Note that if the password is stored in a batch file, that file must be protected to prevent unauthorized persons from gaining access to the device.

Example:

```
ConfigureUAGatewayConsole.exe 192.168.13.169 download /tags:mytags.csv /ports:myports.csv /acl:myacl.csv
/password:root
```


Contacting Support

The MatrikonOPC Customer Services department (**MatrikonOPC Support**) is available 24 hours a day, seven days a week.

Contact MatrikonOPC Support using the information below, or send an email to support@matrikonopc.com.

For Monday to Friday **daytime support** requests, contact MatrikonOPC Support using the regional phone numbers provided in the table below.

Region	Office Hours	Contact Information
North America UTC/GMT -7 hours (MST)	8:00am-5:00pm	+1-877-672-4255
South America UTC/GMT -3 hours (BRT)	9:00am-5:00pm	+55 (11) 3475-1846
Europe /Africa UTC/GMT +1 hours (CET)	9:00am-5:00pm	+49-221-969-77-10 (Request OPC Support)
Australia/Asia UTC/GMT +10 hours (AEST)	9:00am-5:00pm	+61-2-4908-2198 (Request OPC Support)

For **after-hours support** in all regions, please use the following number. There is no extra charge from Matrikon for calling the after-hours support number.

Region	Contact Information
All	+1-780-231-9480