EcoStruxure Plant Data Expert – SE Modbus Tag Node

User Manual

08/2020

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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

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Table of Contents

Safety Information

Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

About the Book

At a Glance

Document Scope

The SE Modbus Tag node is an evolution of the SE Modbus Basic node. SE Modbus node V3.0.0 is a package of three nodes namely SE Modbus Read, SE Modbus Write and SE Modbus Tag node.

In addition to the SE Modbus Basic nodes, the two new features added in this version are:

- The SE Modbus Tag node can import tags that are exported from EcoStruxure Control Expert or any other PLC configuration software.
- Five additional data types are supported in this version:
  - UINT
  - UWORD
  - DINT
  - UDINT
  - DWORD

Henceforth, we will refer this package as SE Modbus nodes in the document.

This document describes:

- installation and uninstallation of SE Modbus nodes.
- configuration of the nodes.
- usage of the nodes.
- limitations.

Validity Note

This document has been updated with the release of SE Modbus nodes V3.0.0

Related Documents

Title of Documentation	Reference Number
EcoStruxure Plant Data Expert - SE Aveva Insight Node - User Manual	*EIO0000004102*
EcoStruxure Plant Data Expert - SE Machine Advisor - User Manual	*EIO0000004100*

You can download these technical publications and other technical information from our website at https://spiceportal.schneider-electric.com/web/industrial-automation-products-campus/ecostruxure-plant-data-expert. See launch book where all the marketing aspects are detailed on IAP Campus Portal.

Part I
Introduction

Chapter 1
Overview

What Is in This Chapter?

This chapter contains the following topics:

General Information

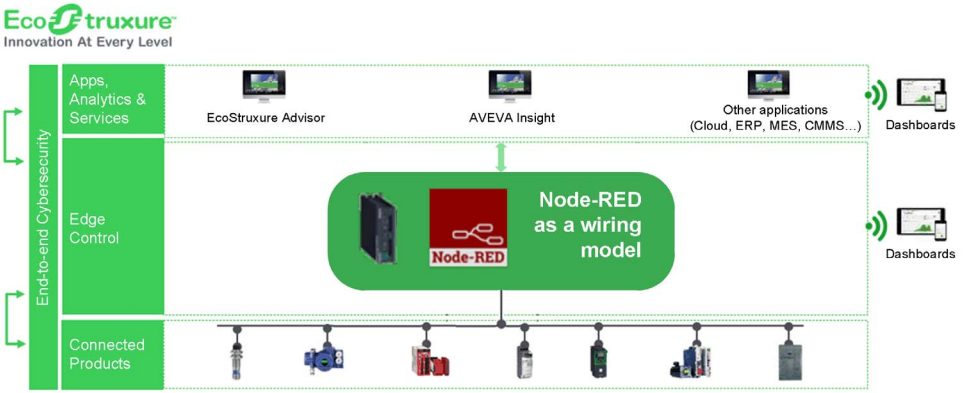
IIoT (Industrial Internet of Things)

IIoT is a network of intelligent computers, devices, and objects that collect and share huge amounts of data. IIoT is the use of Internet of Things (IoT) technologies in manufacturing. With Industrial Internet of Things (IIoT), the device itself will be seamlessly wired to the business systems.

Operational Technology (OT) is a category of hardware and software that monitors and controls the physical devices. Due to increasing trend towards convergence of IT (Information Technology) and OT (Operational Technology), the plant managers in charge of operational technology are more efficient being remote.

Node-RED in EcoStruxure layers

Node-RED is an IoT wiring tool to connect services through a user-friendly graphical interface. Schneider Electric has selected Node-RED as the technology to deliver basic connectivity through tested, validated and documented nodes.



Connected Products

Modbus is a non-proprietary communication protocol used for programmable controller networks that fall under application level, that is, level 7 of OSI Model. Originally designed for Modicon (Schneider Electric) PLCs, it has become widely used by many PLC manufacturers and industrial networks.

The aim is to transform standard brownfield asset into connected asset. In this case, the data is exchanged from the lowest layer of connected devices through the Edge layer further up to the Apps, Analytics and Services. Predictive maintenance, MES or CMMS are the typical apps integrated in this kind of solution.

Edge Control

Edge control provides connectivity for OT and IT systems and data processing right next to the machines. Instead of sending data to the cloud for processing and waiting for the analytical results, edge control devices push their data to the cloud, thus saving bandwidth and enabling increased responsiveness. Magelis iPC and Magelis Edge Box offer smart application design and engineering to leverage asset performance with end-to-end cybersecurity.

Schneider Electric provides nodes that are tested, validated, and supported to run with Node-RED on the Magelis iPC and Edge Box.

There are three main advantages of Schneider Electric nodes:
- **Scalability**: easy to add connected devices in a cyber-secure manner.
- **Time to market**: significant reduction in integration time to implement a case solution.
- **Expert support**: access to our strong L3 support team experts and the available technical documentation.

Apps, Analytics and Services

SE Modbus node is developed by Schneider to simplify the Node-RED flows for use cases that require connectivity with the cloud applications. The web page included with this node also provides the means to specify the data to be retrieved from the PLC and to define the polling rate. The data from the node data is collected and sent further to the web based applications through the connected publishing node.

Magelis Edge Box

The new Magelis Edge Box meets IIoT challenges at the Edge Control level by enabling secured communication from connected products on the shop floor to the required software and applications on the top floor. The Edge box plugs itself on top of your current application, there is no need to stop or modify your control application (including 3rd party control devices).

Magelis Edge Box types are commercialized, as detailed in the following table:

IOT Edge Box	Reference
Magelis HMIBSC	*Reference HMIBSCEA53D1L0T HMIBSC with ARM, Linux*
Magelis HMIBMI	*Reference HMIBMIEA5DD110L HMIBMI with Intel Atom*
Magelis HMIBMO	*Reference HMIBMOMA5DD1E01: HMIBMO with Intel Atom*

Magelis iPC

The Magelis iPC is a robust industrial device without a fan or even a hard drive, requiring no maintenance, and designed to run in the machine or plant field, even in harsh environments. New IIoT monitors for the Magelis iPC come tested, validated, and supported in two versions - agent and server.

Magelis iPC Box types are commercialized, as detailed in the following table:

IOT Edge Box	Reference
Magelis HMIBMP	*Reference HMIBMPHI74D4801 HMIBMP with 4 expansion slots, Intel Core I7*
Magelis HMIBMU	*Reference HMIBMUSI29D2801 HMIBMU with 2 expansion slots, Intel Celeron*

SE Modbus Nodes

Modbus

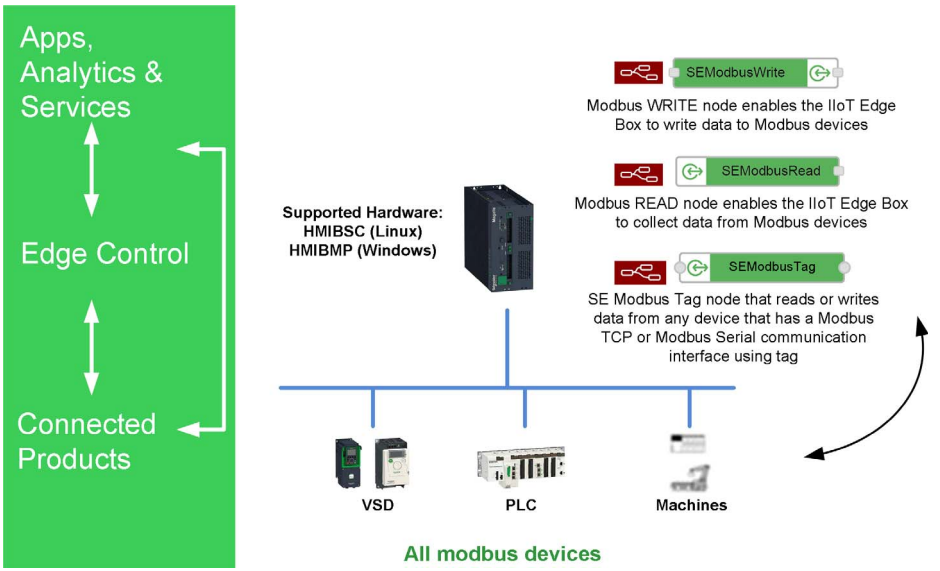
Modbus Protocol is a messaging structure developed by Modicon that provides a common language for devices and equipment to communicate with each other. Modbus is a standard, open and most widely-used network protocol in industrial automation. Modbus is used to establish master-slave / client-server communication between smart devices. Hundreds of vendors have been deployed on thousands of different devices to transfer discrete / analog I/O and to record data between control devices.

SE Modbus nodes is developed by the Schneider Electric. The SE Modbus nodes are connecting node that collects data from Modbus devices/PLCs and reads or writes data and sends it to publish nodes such as SE Aveva Insight, SE Machine Advisor, etc.

The output will be in CMS (Common Message Structure) format *(see page 140)* regardless of the input format. This CMS format makes Schneider node plug and play. The user does not have to configure intermediate nodes with Schneider nodes in a complete end-to-end Schneider data flow.

SE Modbus Nodes Integration in Ecostruxure™ Architecture

The following figure is an example of SE Modbus nodes in Ecostruxure™:



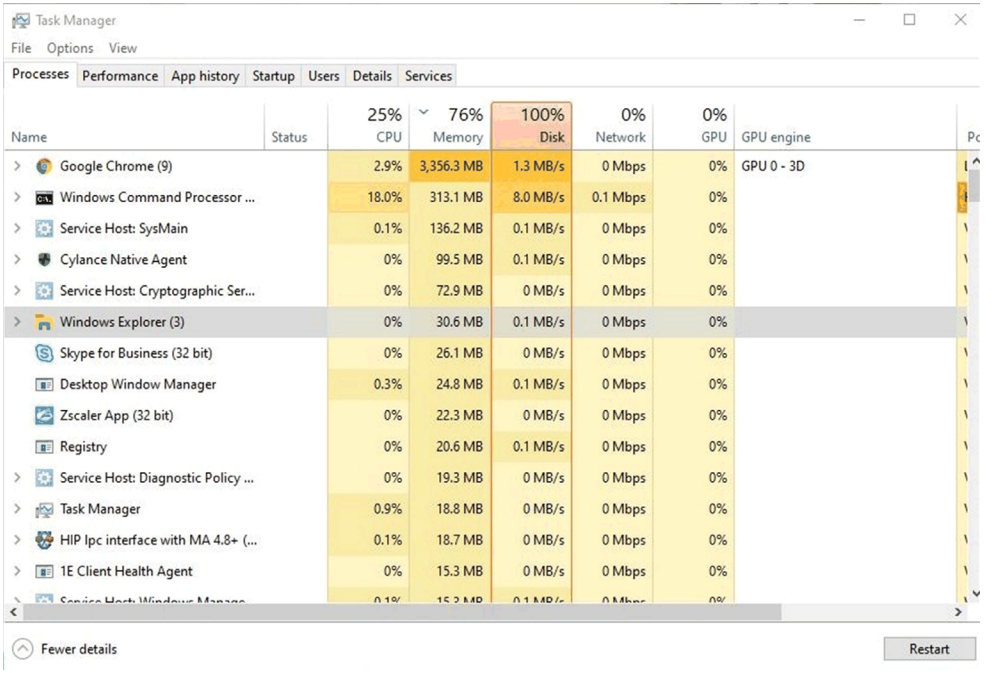
The SE Modbus nodes package consists of three nodes. They are as follows:

1. SE Modbus Read node: This node is used to read the data from modbus devices using modbus TCP or modbus Serial communication protocol.
2. SE Modbus Write node: This node is used to write the data to modbus devices using the modbus TCP or modbus serial communication protocol.
3. SE Modbus Tag node: This node can import tags that are exported from EcoStruxure Control Expert or any other PLC configuration software to perform a read/write operation

Best Practices for Node-RED

1. Running Node-RED as a service on Windows using NSSM *(see page 18)*.
2. Use Browsers Wisely
   When more web pages are accessed in the browser, Node-RED server may not be responsive to the program. Remove unused web pages in the browser to prevent this.
   If Node-RED application is not responsive, you will receive a page unresponsive message.
3. Stop Unused Services

Stop unused services that consume more memory displayed in **Task Manager**.



NOTE: Memory consumption can be observed by using **Task Manager**.

Limitations

SE Modbus nodes have the following limitations:

1. Node-RED application is supported in any browser with V8 engine or similar (for example: Google chrome V73.0, Firefox V66.0). For future support version, refer README file of node package at location <SE node folder>/README.md in your system.
   For example: se-node-red-modbus/README.md
2. Node-RED web page is only available in English, irrespective of the system language.
3. Modbus protocol limitations to read data from a modbus device are as follows:
   - **Read Coil Status**: 2000
   - **Read Input Status**: 2000
   - **Read Holding Registers**: 125
   - **Read Input Registers**: 125
4. Modbus protocol limitations to write data from a modbus device are as follows:
   - **Force Single Coil**: 1
   - **Preset Single Register**: 1
   - **Force Multiple Coils**: 1968
   - **Preset Multiple Registers**: 123
5. Node-RED Editor Debug window shows maximum 1000 register values only.

6. SE Modbus Tag node can import maximum of 2000 tags to be read.
7. When the user wants to do the offline installation, the internet should be disabled. It takes longer to install if the internet is enabled.
8. For optimum performance, in one Edge Box, consider deploying 4 SE Modbus Read nodes (with maximum 125 holding registers) along with publishing nodes. In this scenario, 4 SE Modbus Read nodes will enable overall 500 tags to be read.
9. For optimum performance, in one Edge Box, consider deploying 4 SE Modbus Tag nodes along with 500 tags configured per node.
10. SE Modbus node supports 8 data types which are **INT**, **UINT**, **WORD**, **REAL**, **DINT**, **UDINT**, **DWORD** and **BOOLEAN**. Other data types are not supported.
11. When you launch a Node-RED server, it takes time to get started, in order to avoid this refer to **Commissioning of Node-RED** procedure (steps 11...14) *(see page 51)*.

SE Modbus nodes have the following limitations for Windows platform:

1. Operating system anything less than Windows 10 is not supported.
2. SE Modbus nodes will not work on Node.js® unstable versions and 6.x.x, 8.x.x and 12.x.x versions
3. SE Modbus nodes will work on Node-RED 0.20.7 and Node.js® V10.15.3 versions only.

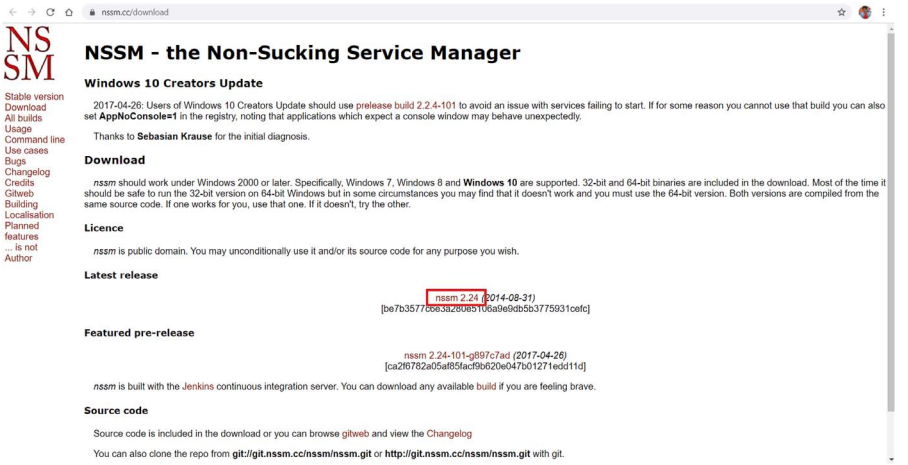
Installation of NSSM

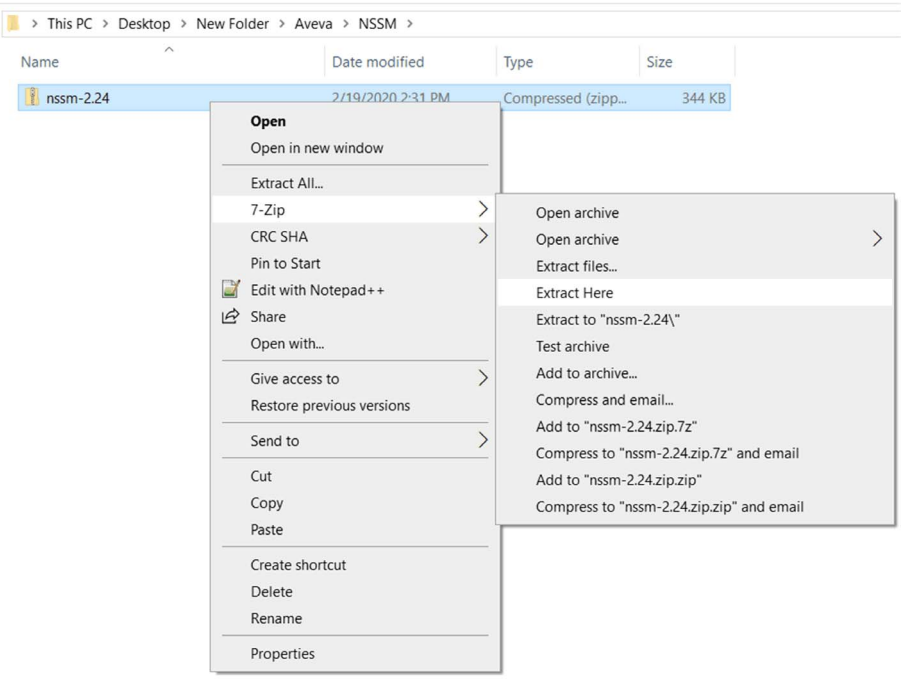
Running Node-RED as a service on Windows Using NSSM

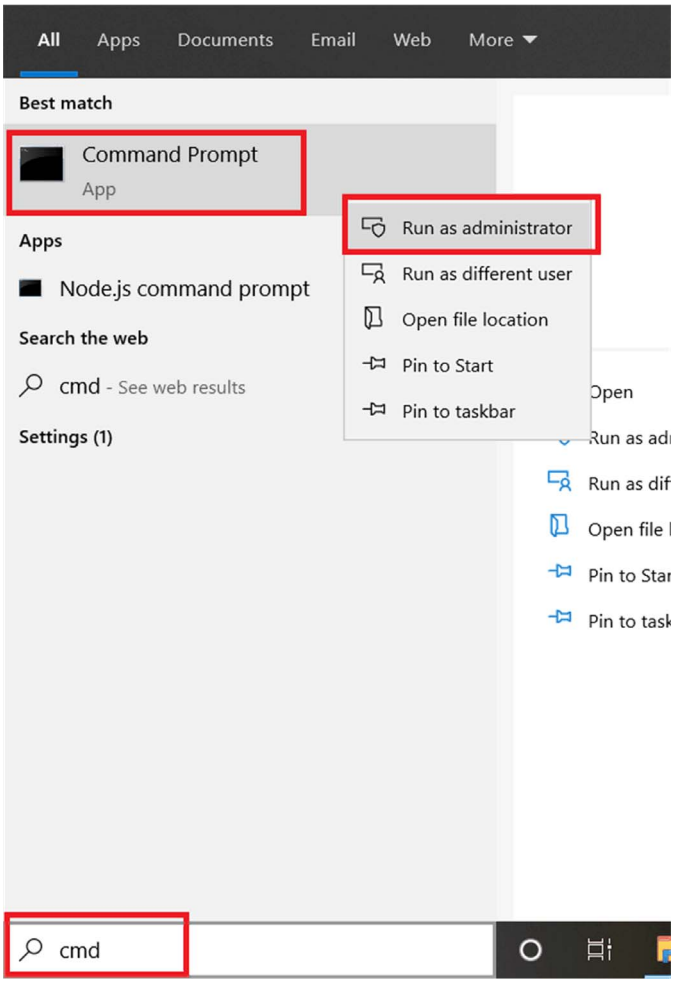
NOTE: Installation of NSSM is applicable for Windows platform only.

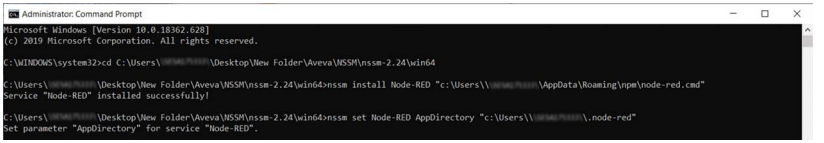
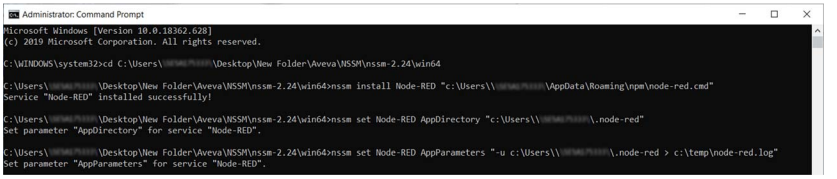
You need to install NSSM (Non-Sucking Service Manager) to open Node-RED server directly from the web page.

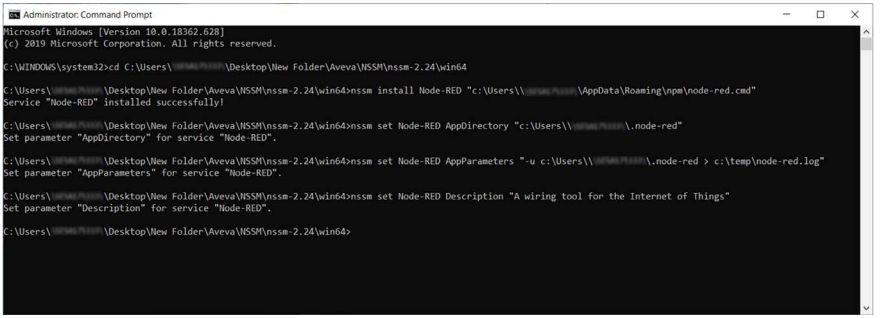
The following procedure shows the installation of NSSM:

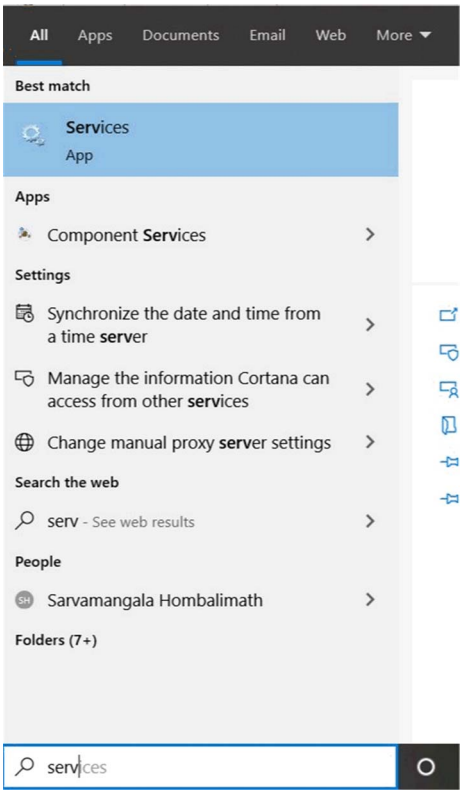
Step	Action
1	Download the `nssm-2.24.zip` file from the link given below: *https://nssm.cc/download* **NOTE:** Make sure unzip software is available in your device, if not available, download it from the given link: *https://www.7-zip.org/download.html*
2	Click **nssm 2.24** link. 

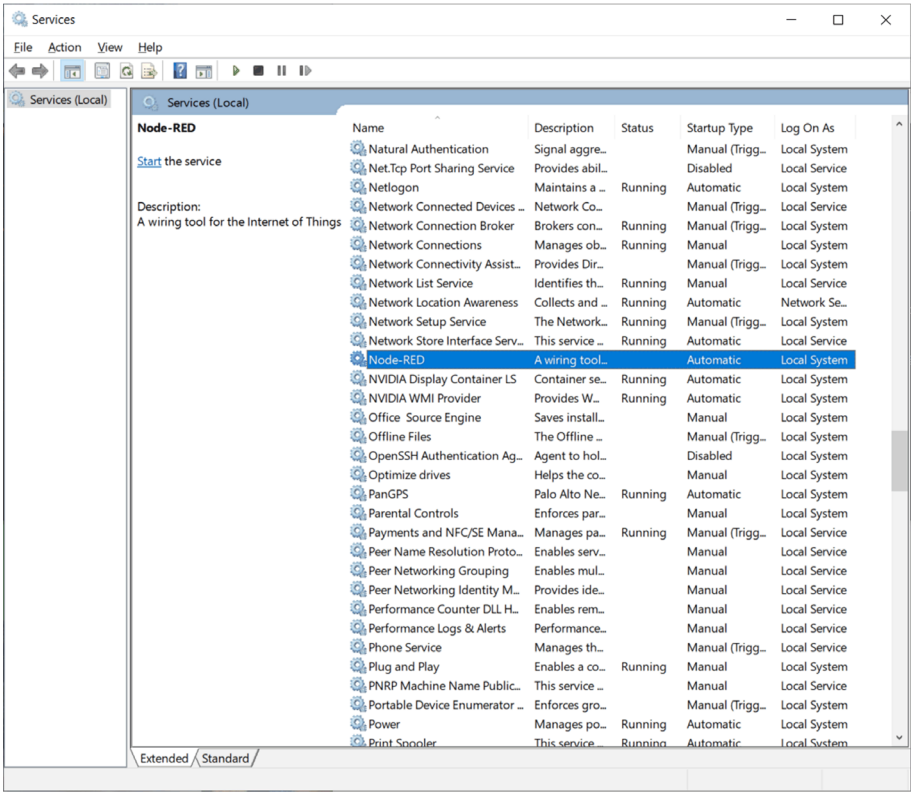
Step	Action
3	Right-click the downloaded `nssm-2.24.zip` file and select **7-Zip → Extract Here**.  **Result**: The selected file is unzipped.

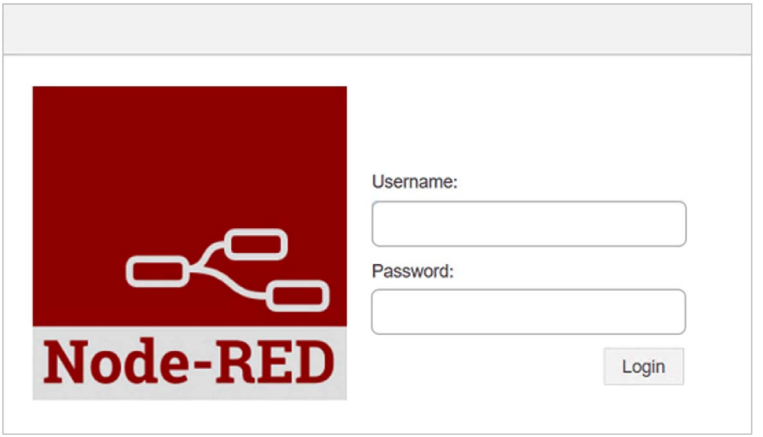
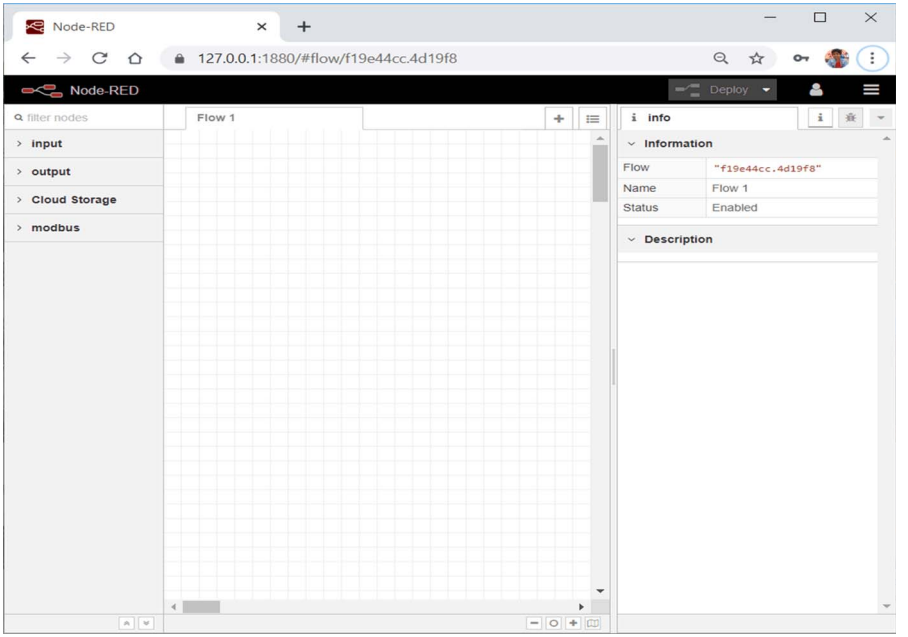
Step	Action
4	Type `cmd` in search bar and right-click **Command Prompt → Run as administrator**.  **Result**:Command Prompt opens.
5	Copy the location of the folder you downloaded. For example: `C:\Users\SESAXXXXXX\Desktop\New Folder\Aveva\NSSM\nssm-2.24\win64` **NOTE:** Use your device name in the text above instead of **SESAXXXXXX**.

Step	Action
6	Navigate to the location where NSSM is installed. Paste in the command prompt adding `cd`. For example: `cd C:\Users\SESAXXXXXX\Desktop\New Folder\Aveva\NSSM\nssm-2.24\win64`
7	Type `nssm install Node-RED "c:\Users\SESAXXXXXX\AppData\Roaming\npm\node-red.cmd"` and press **Enter**  **Result**: Service “Node-RED” installed successfully.
8	Type `nssm set Node-RED AppDirectory "c:\Users\SESAXXXXXX\.node-red"` and press **Enter**.  **Result**: Set parameter “AppDirectory” for service “Node-RED”.
9	Type `nssm set Node-RED AppParameters "-u c:\Users\SESAXXXXXX\.node-red > c:\temp\node-red.log"` and press **Enter**.  **Result**: Set parameter “AppParameters” for service “Node-RED”.

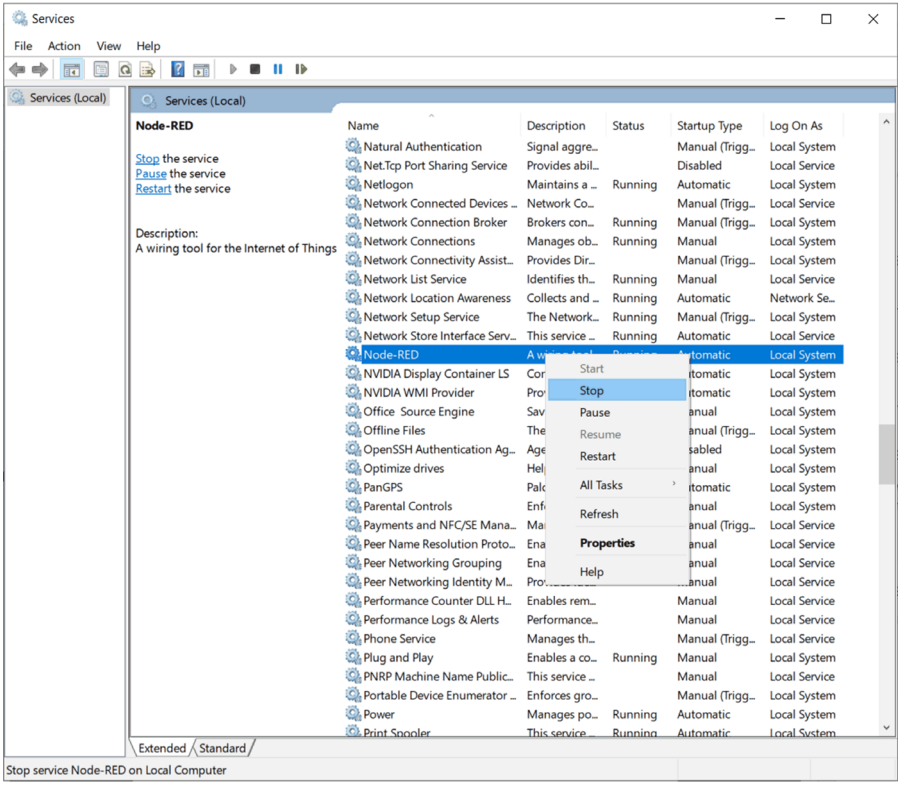
Step	Action
10	Type `nssm set Node-RED Description "A wiring tool for the Internet of Things"` and press **Enter**. **Result**: Set parameter “Description” for service “Node-RED”. 

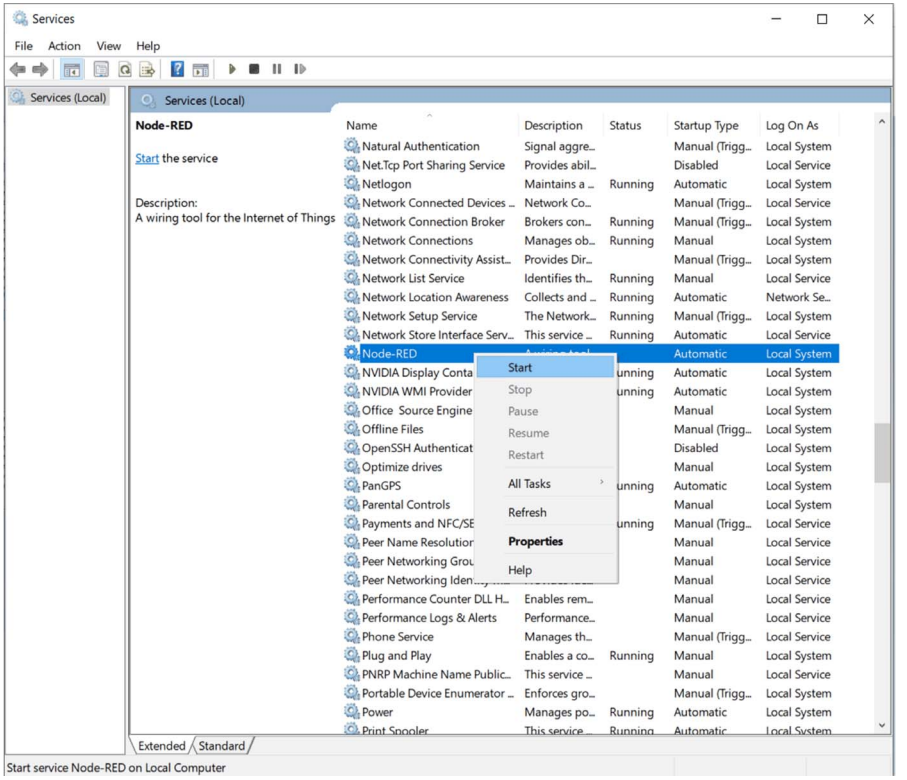
Step	Action
11	Type `Services` in search bar and click **Services**.  **Result**: Services window appears.

Step	Action
12	
13	Restart your computer.

Step	Action
14	Type the *https://127.0.0.1:1880/* in a supported browser. Type the **Username** and **Password** in related fields and click **Login**.  **Result**: Node-RED factory editor appears.
15	

Step	Action
16	When you install/uninstall any node in your system, **Stop** using Node-RED in **Services**.



Step	Action
17	Once installation/uninstallation process is completed in your system, **Start** Node-RED in **Services** to launch Node-RED application. 

To disable Node-RED as a service follow the steps given below:

- Navigate to NSSM folder in command prompt.
- Type `nssm remove <service-name> confirm` and press **Enter**.

Part II
Installation and Uninstallation - SE Modbus Nodes

What Is in This Part?

This part contains the following chapters:

Chapter 2
Prerequisites

System Requirements

Operating System

The SE Modbus nodes V3.0.0 are supported on the following operating systems:

- Microsoft Windows 10
  - Standard Image and IIoT One Image (RC7 and above)

  NOTE: Magelis HMIBMP - User has to install the Node.js, Node-RED and Python software in the **Magelis HMIBMP** box (Standard Image) manually.
- Linux Yocto - V1.00.010 and above
  - IIoT One Image (V1.00.010 and above)

  NOTE: Magelis HMIBSC - The required softwares like Node.js, Node-RED and Python are pre-installed in the **Magelis HMIBSC** box.

Hardware Requirements

NOTE: The SE Modbus nodes are supported in **Magelis HMIBMP** and **Magelis HMIBSC** only. Other **Magelis Edge Box** and **Magelis iPC** will be supported in future versions of the node.

IIoT Edge Box	PC hardware	Specification
Magelis HMIBMP	Processor	Reference HMIBMPHI74D4801 HMIBMP with 4 expansion slots, Intel Core I7
	RAM	8 GB
	Hard disk space	500 GB HDD
	Operating system	Microsoft Windows 10
Magelis HMIBSC	Processor	Reference HMIBSCEA53D1L0T HMIBSC with ARM
	Hard disk space	eMMC and TPM for hardware encryption
	Operating system	Linux Yocto

Software Requirements

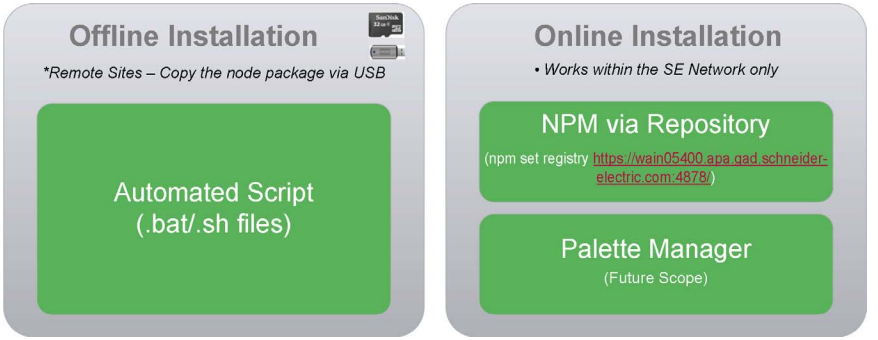
- Node.js V10.15.3 *(see page 35)*
- Node-RED server V0.20.7 *(see page 42)*
- Npm (Node package manager) V6.4.1

- Python V2.7 (online installation for Windows only) *(see page 44)*
- Supported browser: Node-RED application is supported in any browser with V8 engine or similar (for instance: Google chrome V73.0, Firefox V66.0)

NOTE: The software versions mentioned above support the SE Nodes installation. Other versions do not support it.

Accessing the SE Modbus nodes

You can perform the installation of nodes using any of the following different platforms:



You can perform the nodes installation on the platforms given below:

- Install the node - Windows Platform *(see page 33)*
- Install the node - Linux Platform *(see page 75)*

Chapter 3
Installation and Uninstallation of SE Modbus Nodes - Windows Platform

Overview

The installation and uninstallation of the SE Modbus nodes package will install and uninstall all three nodes (SE Modbus Read, SE Modbus Write and SE Modbus Tag) respectively.

What Is in This Chapter?

This chapter contains the following sections:

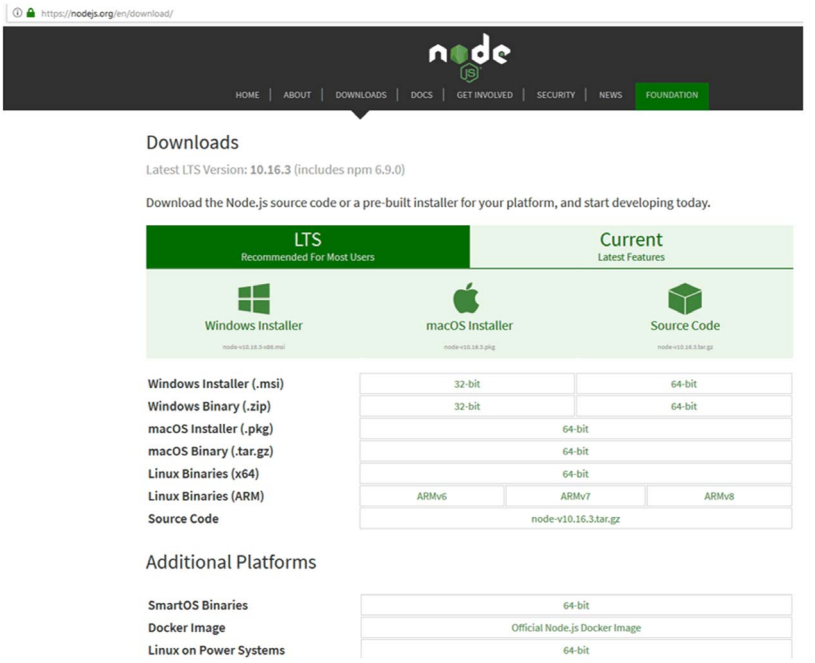
Section 3.1
Install SE Modbus Nodes - Windows Platform

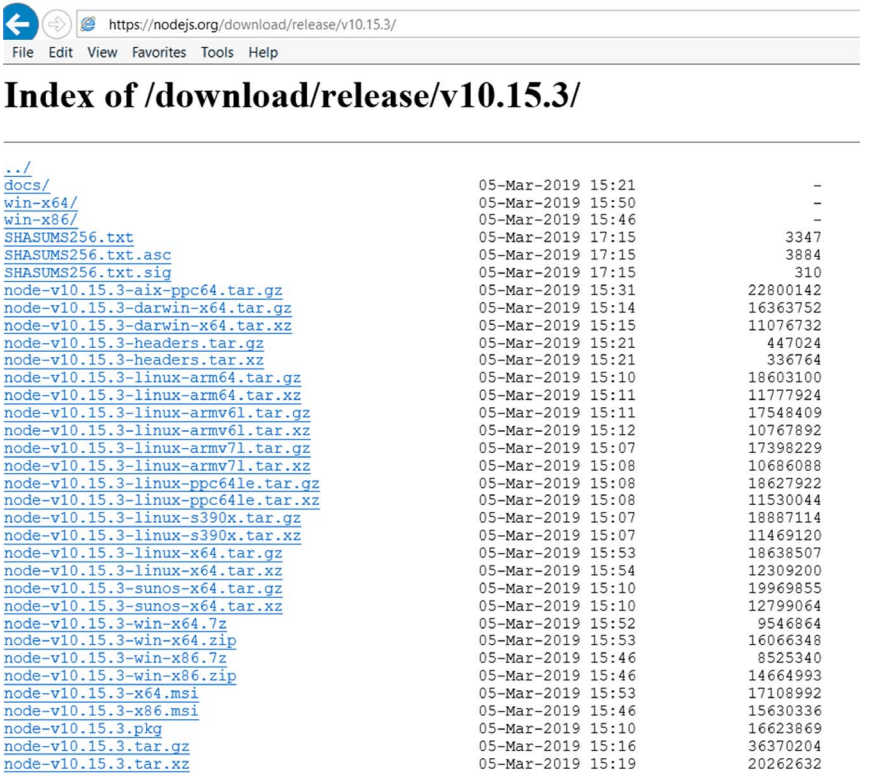
What Is in This Section?

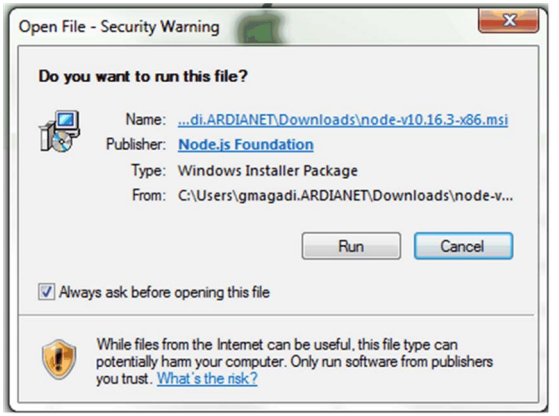
This section contains the following topics:

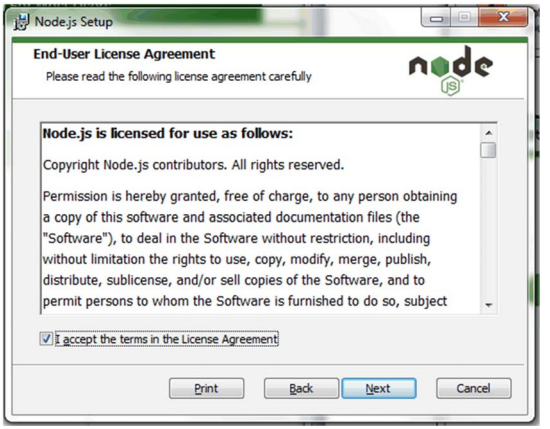
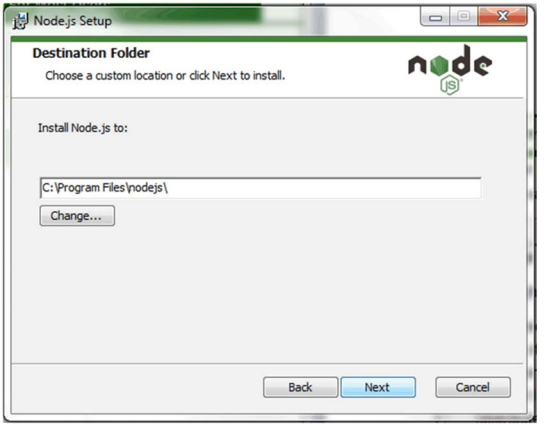
Installing Node.js

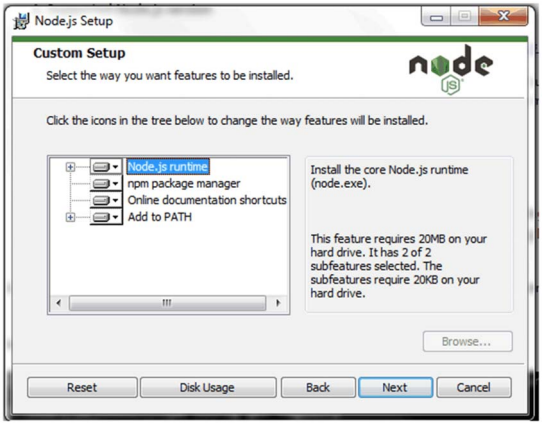
This table shows the installation procedure for Node.js:

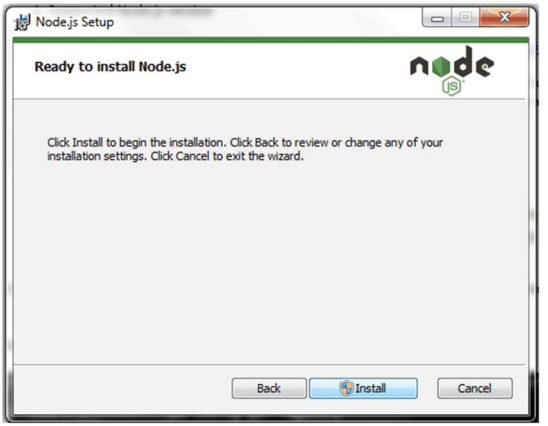
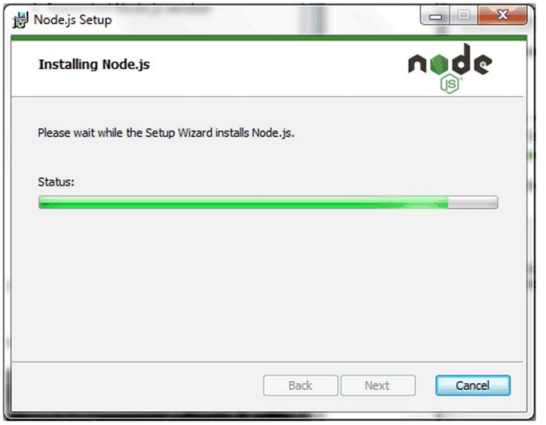
Step	Action
1	Open the Node.js® for Windows from the below link: *https://nodejs.org/en/download/* 

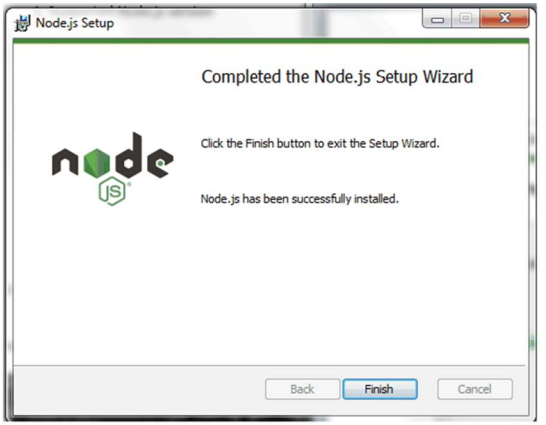
Step	Action
2	Use the `node-v10.15.3-x64.msi` version. Download the Node.js® from the link given below: *https://nodejs.org/download/release/v10.15.3/* 
3	Select `node-v10.15.3-x64.msi` for download.
4	Double-click the downloaded file to start the installation process. **Result**: **Open File** dialog box appears.

Step	Action
5	Click **Run**.  **Result**: Node.js Setup Wizard dialog box appears.
6	Click **Next**.  **Result**: **End–User License Agreement** dialog box appears.

Step	Action
7	Select **I accept the terms in the License Agreement** and click **Next**. 
8	Click **Next**. 

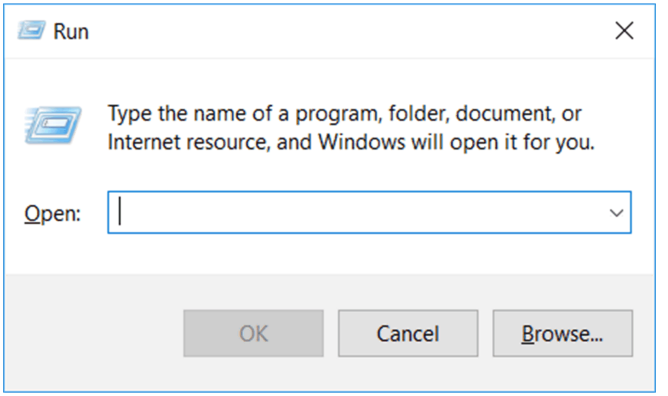
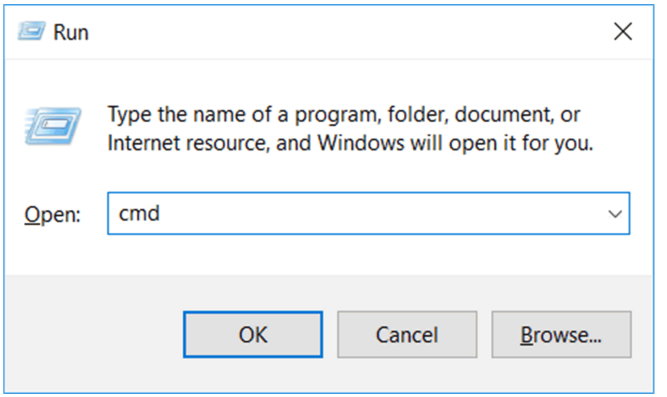
Step	Action
9	Click **Next**. 

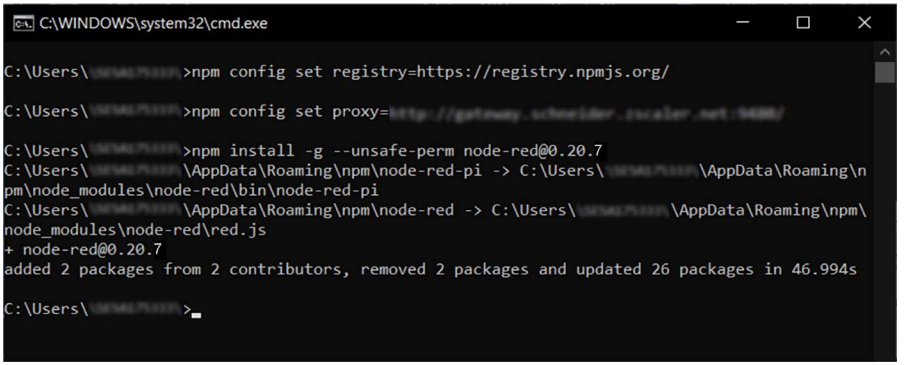
Step	Action
10	Click **Install**.  

Step	Action
11	Click **Finish**. 
12	Node.js installation is completed.

Installing Node-RED

This table shows the installation procedure for Node-RED:

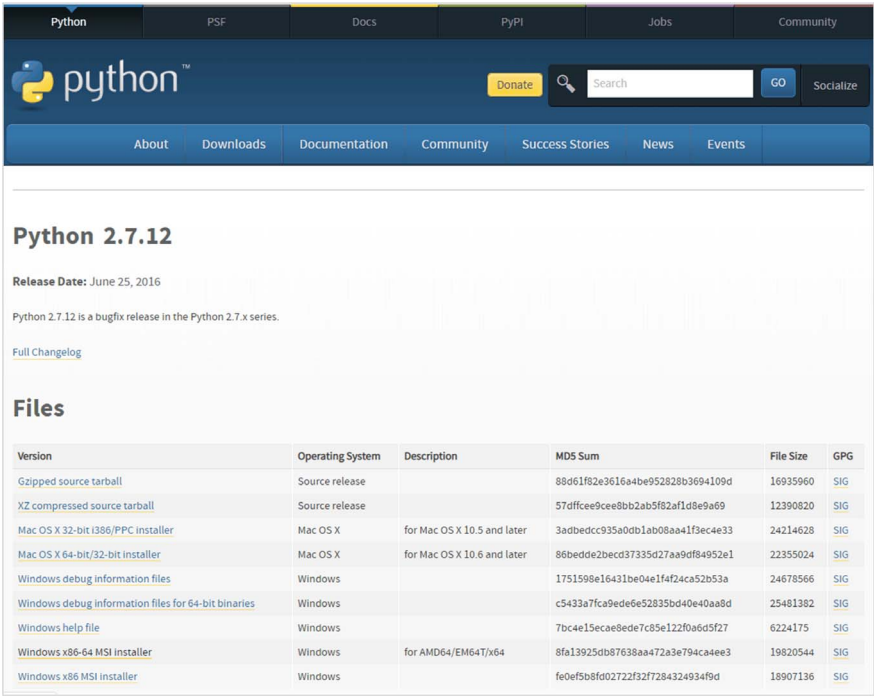
Step	Action
1	Click  and type **Run** in the search bar and press **Enter**. 
2	Type the `cmd` in the **Run** dialog box and press **OK**.  **Result**: Command prompt window appears.
3	With Schneider network connected, type the text given below in the command prompt and press **Enter**. `npm config set registry=https://registry.npmjs.org/`

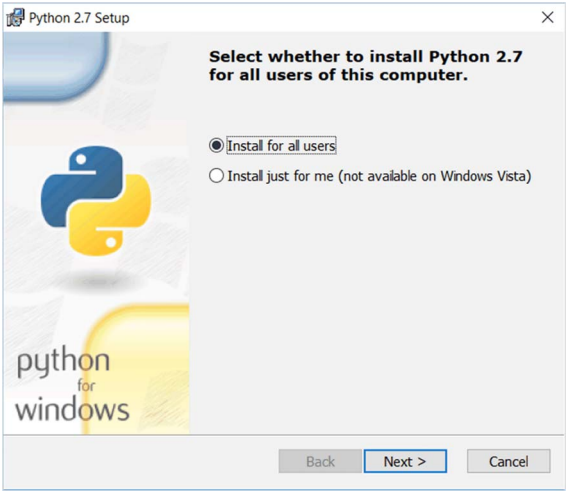
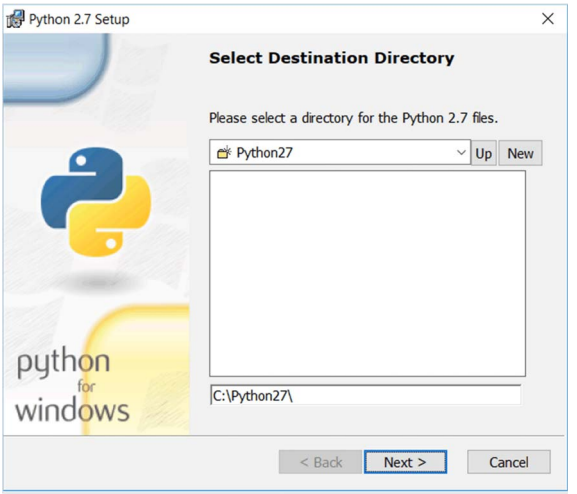
Step	Action
4	Type the valid proxy with respect to your organization or country (for instance, http://yourproxy:XXXX/) and press **Enter**. `npm config set proxy=http://yourproxy:XXXX/`
5	Type `npm install -g --unsafe-perm node-red@0.20.7` and press **Enter**. 
6	Node-RED application is installed.

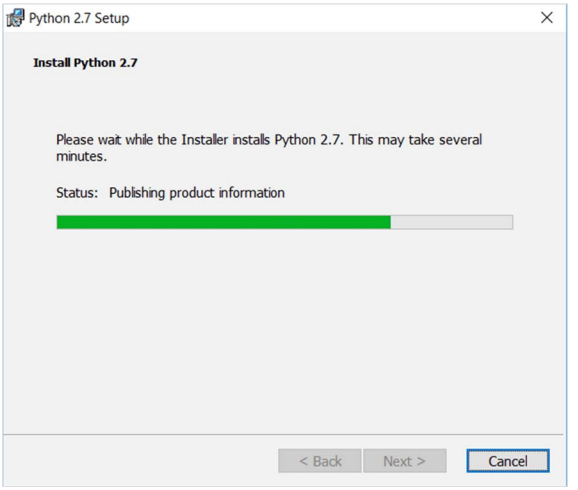
Installing Python

NOTE: Python installation is applicable only for online installation mode in Windows platform.

This table shows the installation procedure for Python:

Step	Action
1	Download `python 2.7.x` version from the link given below: *https://www.python.org/downloads/release/python-2712/*
2	Click the `Windows x86-64 MSI` to download the file. 
3	Downloaded file name: `python-2.7.12.amd64`.
4	Double-click the downloaded file to install python software.

Step	Action
5	Select **Install for all users** and click **Next** 
6	Click **Next** 

Step	Action
7	Click **Next**  

Step	Action
8	Click **Finish**  **Result**: Python installation is completed.

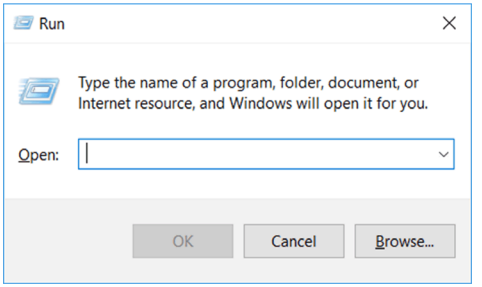
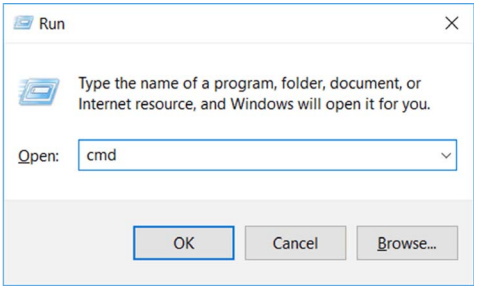
Commissioning of Node-RED server

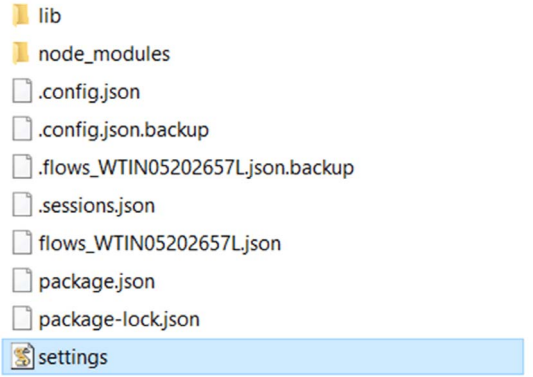
Overview

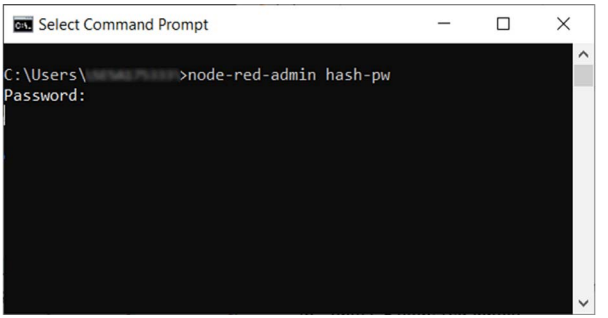
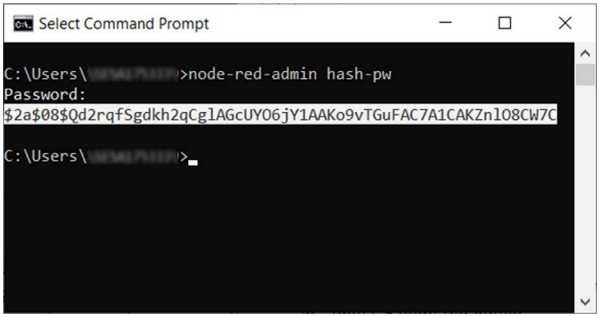
Before enabling login credentials you need to install the Node-RED software. It has to be a secured platform to be compliant with cybersecurity.

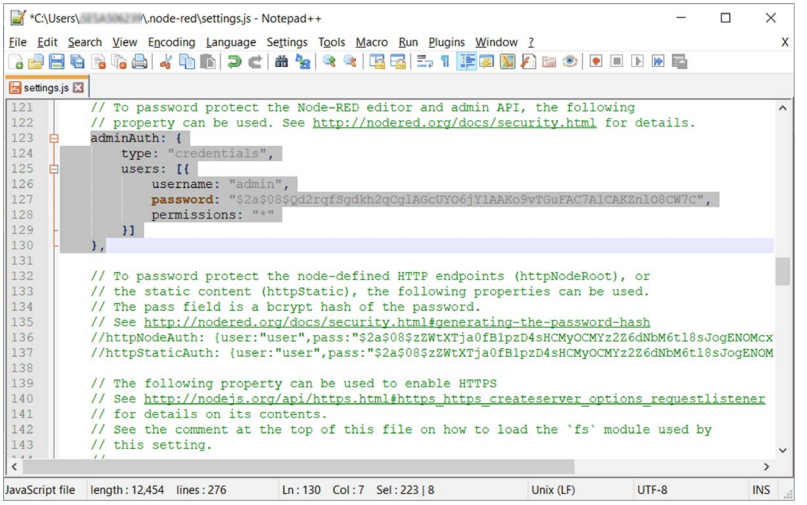
Securing Node-RED - Enable Login Credentials

The following steps explains the enabling of user authentication when accessing the Node-RED Editor.

Step	Action
1	Click  and type **Run** in the search bar and press **Enter**. 
2	Type the `cmd` in the run dialog box and click **OK**.  **Result**: Command prompt window appears.
3	Type `npm config set registry https://registry.npmjs.org` in the command prompt and press **Enter**.

Step	Action
4	Type `npm set proxy http://yourproxy:XXXX/` in the command prompt and press **Enter**. **NOTE:** Type the valid proxy with respect to your organization or country.
5	Type `node-red` in the command prompt and press **Enter**. **Result**: `.node-red` folder is created in `Local Disk (C:)/Users/SESAXXXXXX/`.
6	In .node-red folder open settings.js file in the Notepad++. **NOTE:** Download **Notepad++** software if not available in your windows system. 
7	Type `npm i -g node-red-admin` in the command prompt and press **Enter**.  **Result**: Node-RED admin is installed globally.

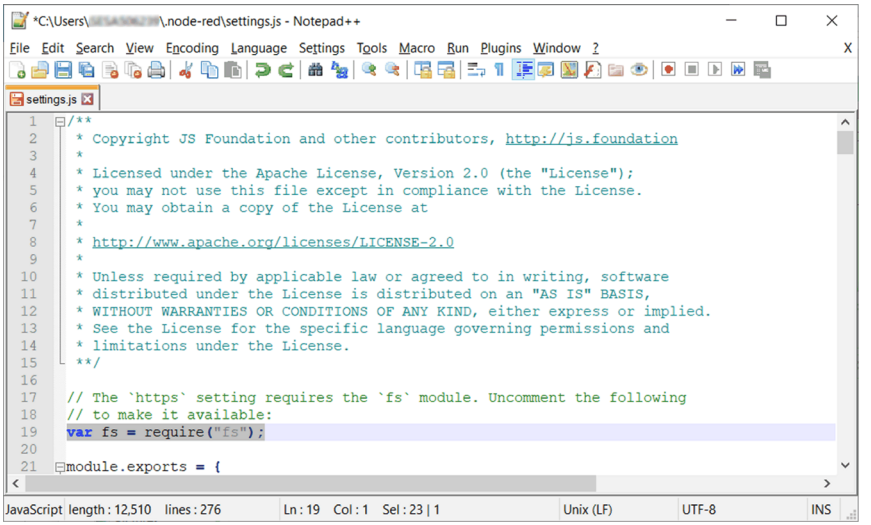
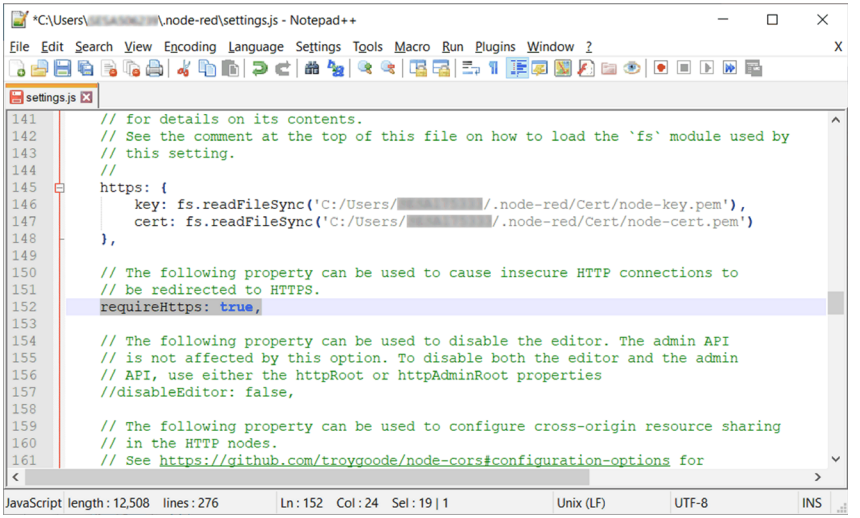
Step	Action
8	Type `node-red-admin hash-pw` in the command prompt and press **Enter**. 
9	Type the **Password** and press **Enter**.  **Result**: The password is encrypted.

Step	Action
10	Copy the encrypted text (password), search for `adminAuth` in settings.js file and paste encrypted text as password. Uncomment (remove //) `adminAuth` credential details. 

Securing Node-RED - Enabling SSL

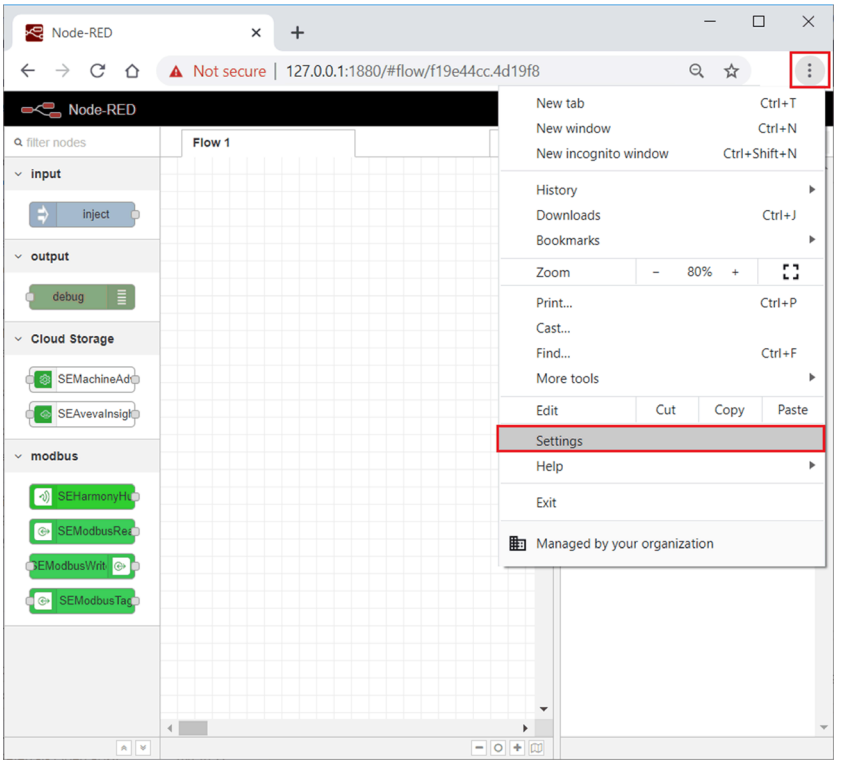
Follow the steps below to enable SSL (Secure Socket Layer) on Node-RED - Editor:

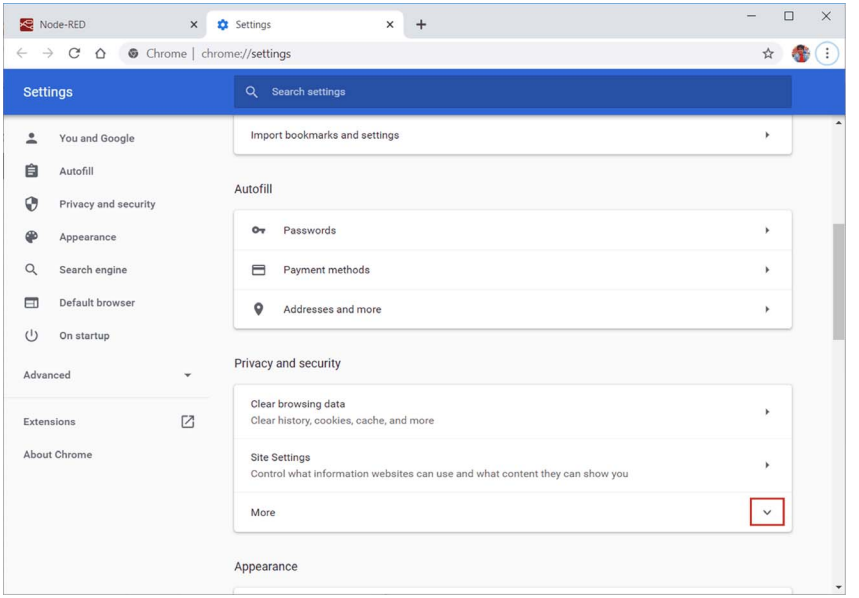
Step	Action
1	Create a new folder called **Cert** in .node-red folder. For instance, `C:/Users/SESAXXXXXX/.node-red`
2	Copy the SSL certificate files (for instance, node-key.pem and node-cert.pem) and paste them in the path given below: For instance, `C:/Users/SESAXXXXXX/.node-red/Cert`
3	Open **settings.js** file in **Notepad++**. The **settings.js** file will be located in the path given below: `C:/Users/SESAXXXXXX/.node-red/`

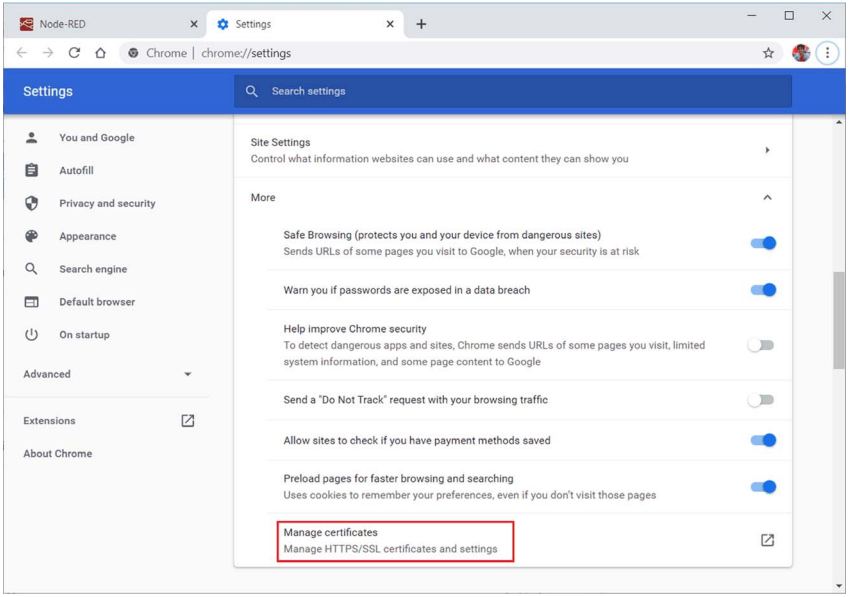
Step	Action
4	Search for the `var fs` and uncomment (remove //) the statement. 
5	Search for `https` in settings.js file and edit the key and cert files path and uncomment (remove //) `https` details. Search for the `requireHttps` and uncomment (remove //) the statement. 

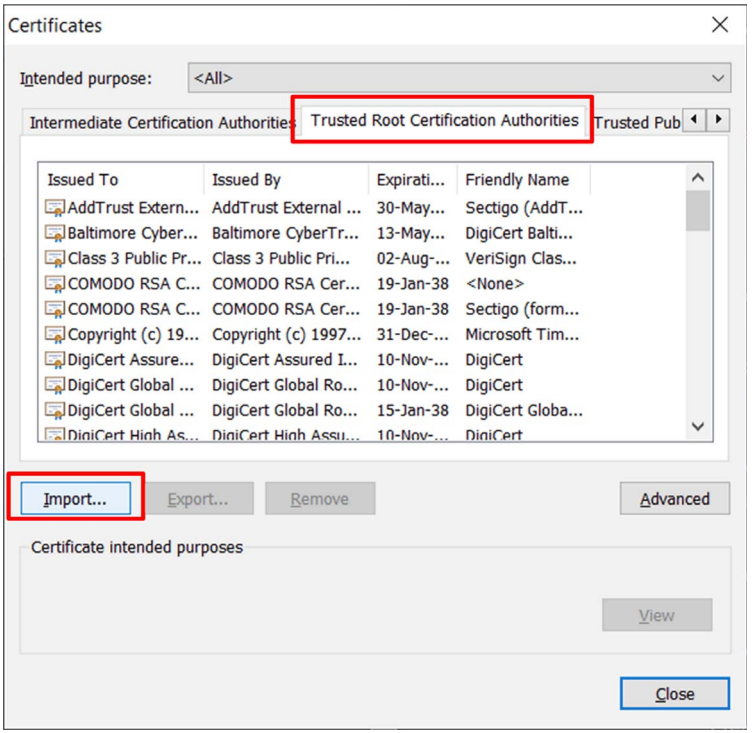
Step	Action
6	Save the **settings.js** file and close.
7	Restart the node-red server.

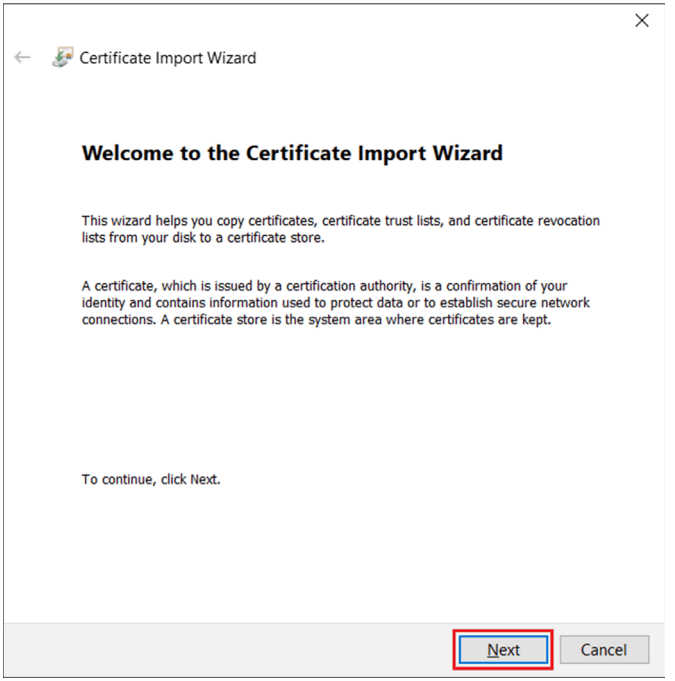
If your Node-RED server (*https://127.0.0.1.1880/*) is showing Not-secure then follow the steps given below to make the server secure:

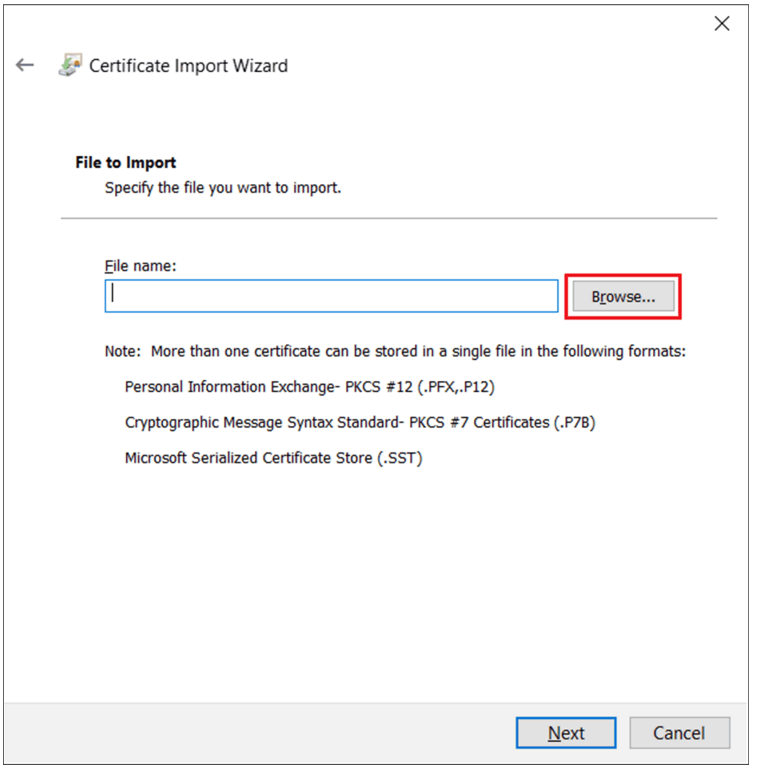
Step	Action
1	Open Node-RED application in a specified browser. Click **Kebab Menu** → **Settings** as shown in the image below.  **Result**: Settings window appears.

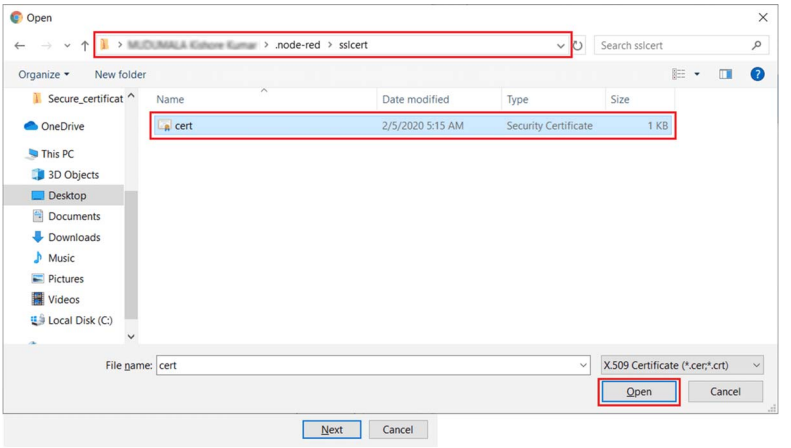
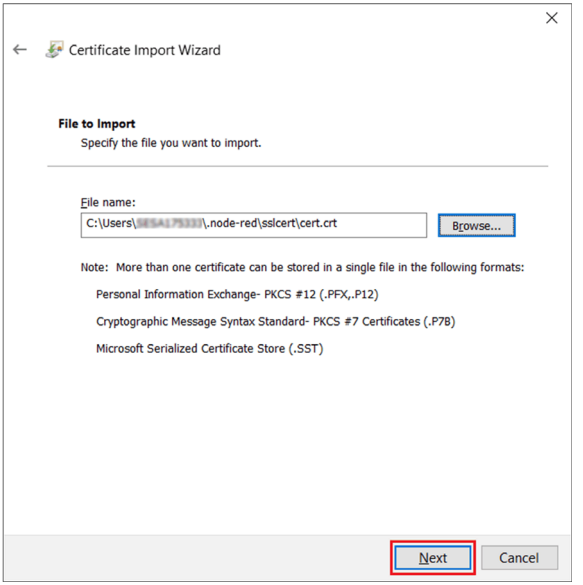
Step	Action
2	Click **More** drop-down. 

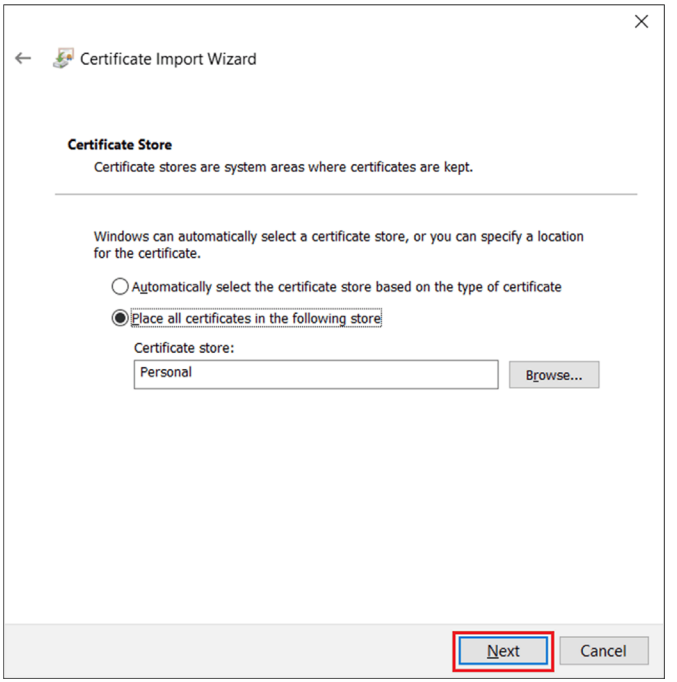
Step	Action
3	Click **Manage certificates**. 

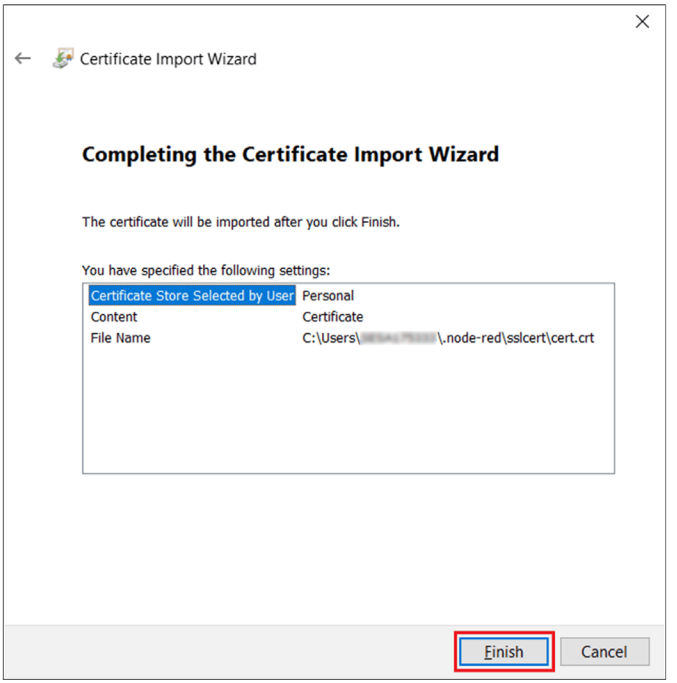
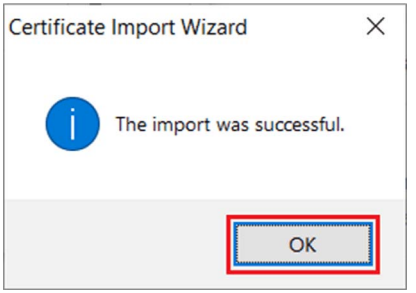
Step	Action
4	Click **Trusted Root Certification Authorities** and **Import...**. 

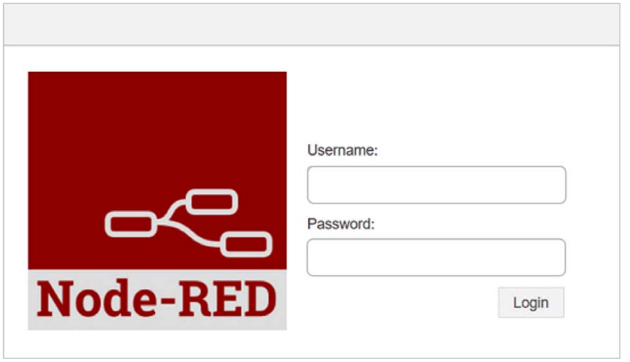
Step	Action
5	Click **Next**. 

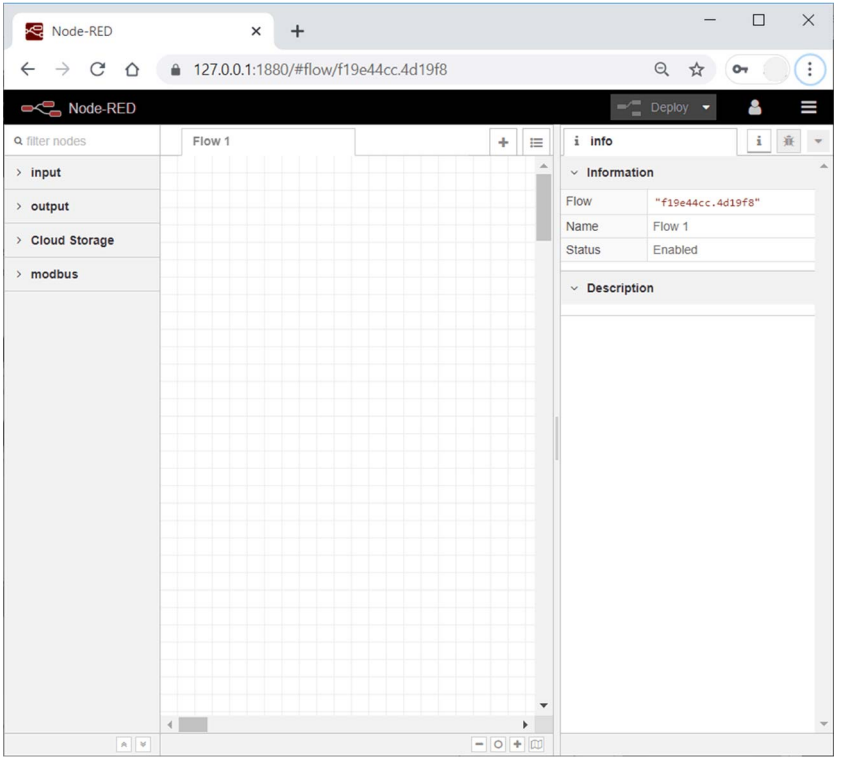
Step	Action
6	Click **Browse...**. 

Step	Action
7	Select the location of the certificates which are available in the .node-red folder. Select **cert** and click **Open**. For example, `C:/Users/SESAXXXXXX/.node-red/sslcert` 
8	Click **Next**. 

Step	Action
9	Click **Next**. 

Step	Action
10	Click **Finish**. 
11	Click **OK**. 
12	Reload the browser, and restart your computer if required.

Step	Action
13	Copy *https://127.0.0.1.1880/* and paste the link in a supported browser. Type the **Username** and **Password** in related fields and click **Login**. 

Step	Action
14	Secured Node-RED application is launched successfully. 

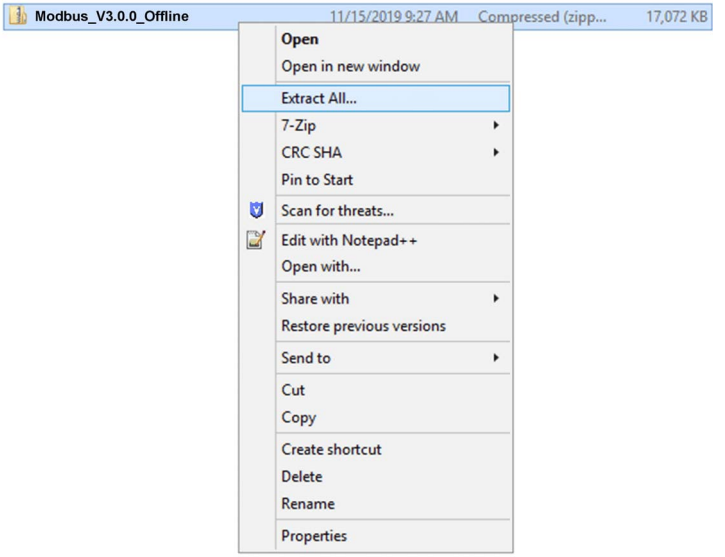
Installing SE Modbus Nodes - Offline Installation Mode

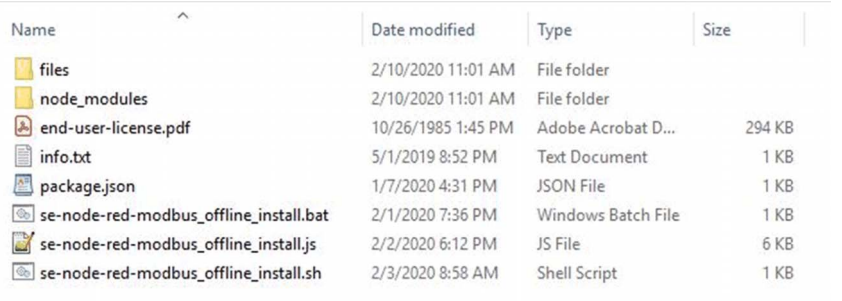
Overview

You should install the software below in your system before proceeding with the offline installation mode:

- Node.js *(see page 35)*
- Node-RED *(see page 42)*

Installing SE Modbus Nodes

Step	Action
1	Download the `Modbus_V3.0.0_Offline.zip` file from the link given below: *https://schneider-electric.box.com/s/xsmgvjhjo4km8jwlsn8qyprgb0gy8bv6* **NOTE:** Make sure that unzip software is available in your device, if not available, download it from the given link: *https://www.7-zip.org/download.html*
2	Right click on the downloaded `Modbus_V3.0.0_Offline.zip` file and select **Extract All...**  **Result**: The selected file is unzipped.

Step	Action
3	Open `Modbus_V3.0.0_Offline` folder. Right click on the `se-node-red-modbus_offline _install.bat` file and click **Open** for installing nodes.  **Result**: The below license document and statement appears: • EULA (End User Licensing Agreement) document. **NOTE:** The document will be opened in PDF format. Please go through the document and return to the command prompt to accept the terms and conditions. • `Please read the Terms & Conditions carefully. Do you agree to our Terms & Conditions? (yes/no):`
4	Type `yes` and press **Enter** to agree the terms and conditions and install SE Modbus nodes.  **Result**: SE Modbus nodes is successfully installed. **NOTE:** The node package is saved in the User folder (for example: `C:\Users\SESAxxxxxx\se-node-red-modbus`). **NOTE:** If you type `no`, the installation is cancelled.
5	To launch SE Modbus Nodes *(see page 127)*.

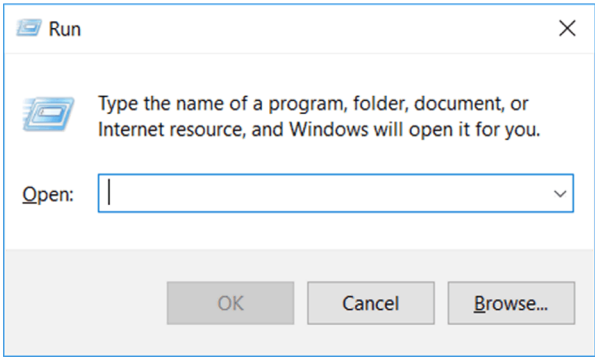
Installing SE Modbus Nodes - Online Installation Mode

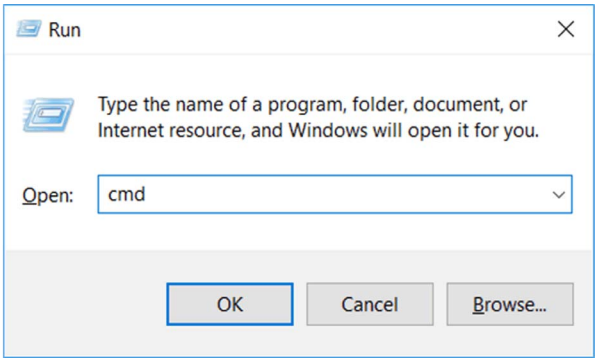
Overview

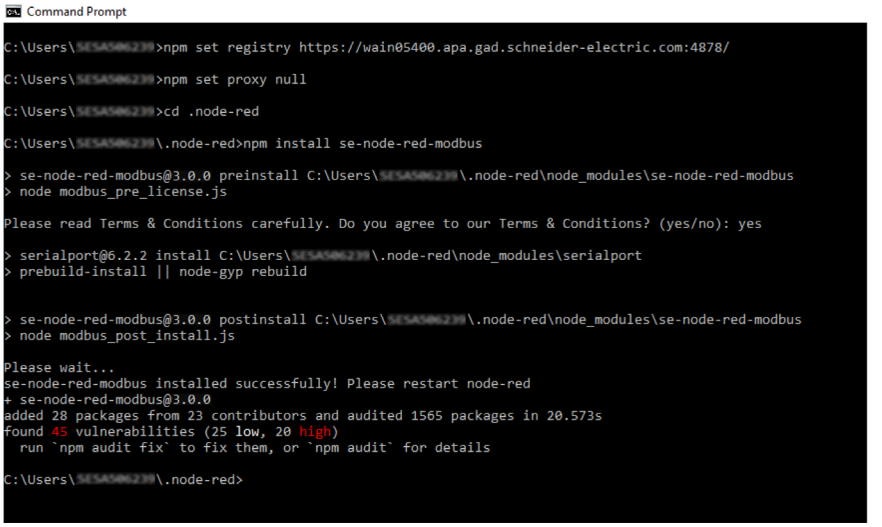
You should install the software below in your system before proceeding with the online installation mode.:

- Node.js *(see page 35)*
- Node-RED *(see page 42)*
- Python v2.7.x *(see page 44)*

Installing SE Modbus Nodes

Step	Action
1	Click  and type **Run** in the search bar and press **Enter** 

Step	Action
2	Type the `cmd` in the **Run** dialog box and click **OK**.  **Result**: Command prompt window appears.
3	Type the text given below in the command prompt and press **Enter**: `npm set registry https://wain05400.apa.gad.schneider-electric.com:4878/`
4	Type the text given below in the command prompt and press **Enter**: `npm set proxy null` **Note:** If set proxy null command is not working, remove proxy for respective types as follows: • `npm config rm proxy` • `npm config rm http-proxy` • `npm config rm https-proxy`
5	Type the below text in the command prompt and press **Enter**: `cd .node-red`
6	Type `npm install se-node-red-modbus` and press **Enter**. **Result**: The below license document and statement appears: • EULA (End User Licensing Agreement) document. **NOTE:** The document will be opened in PDF format. Please go through the document and return to the command prompt to accept the terms and conditions. • `Please read the Terms & Conditions carefully. Do you agree to our Terms & Conditions? (yes/no):`

Step	Action
7	Type `yes` and press **Enter** to agree the terms and conditions and install SE Modbus nodes.  **Result**: Installation is successfully completed. **NOTE:** If you type `no`, the installation is cancelled.
8	To launch SE Modbus Nodes *(see page 127)*.

NOTE: The online installation process sometimes does not work due to Schneider proxy issue. If you face the proxy issue, follow the offline installation process as a workaround *(see page 64)*.

Section 3.2
Uninstall SE Modbus Nodes - Windows Platform

What Is in This Section?

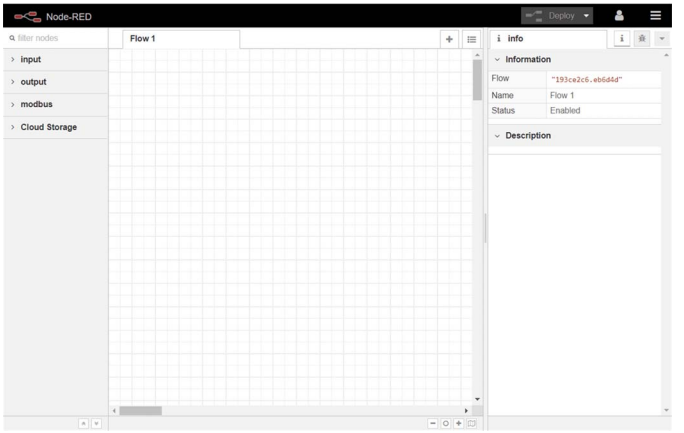
This section contains the following topics:

Uninstall SE Modbus Nodes - Offline Uninstallation Mode

NOTICE
LOSS OF DATA Backup the data before uninstalling SE Modbus nodes. **Failure to follow these instructions can result in equipment damage.**

This procedure explains how to uninstall SE Modbus nodes:

Step	Action
1	Delete the SE Modbus nodes from the flow.
2	Click **Deploy**  and **Logout** from the Node-RED application.
3	Close the Node-RED server running in the command prompt window.
4	Open users folder. For example: `C:\Users\SESAXXXXXX`
5	Double-click `se-node-red-modbus_uninstall.bat` file to uninstall the SE Modbus nodes. **Result**: SE Modbus nodes are uninstalled.

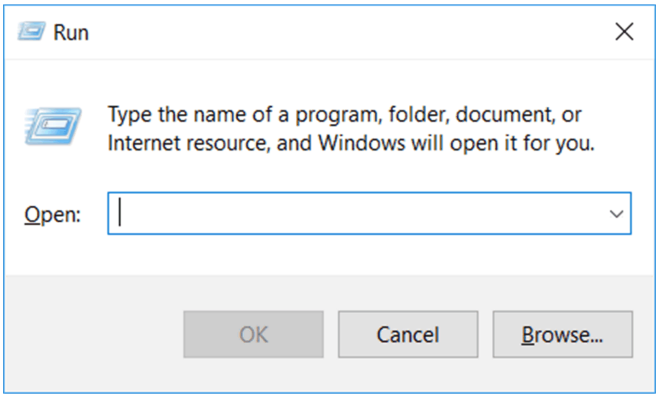
Step	Action
6	To restart the Node-RED server, follow the steps: **1.** Type `node-red` in the command prompt. **2.** Press **Enter**. **Result**: Node-RED server starts. **3.** Copy the IP address (*https://127.0.0.1:1880/*) in which the Node-RED server is running. **4.** Open a browser. **5.** Paste the IP address in the **URL** field in the browser. **6.** Press **Enter**. **7.** Type the **Username** and **Password** in related fields and click **Login**. **Result**: Node-RED factory window reappears. 

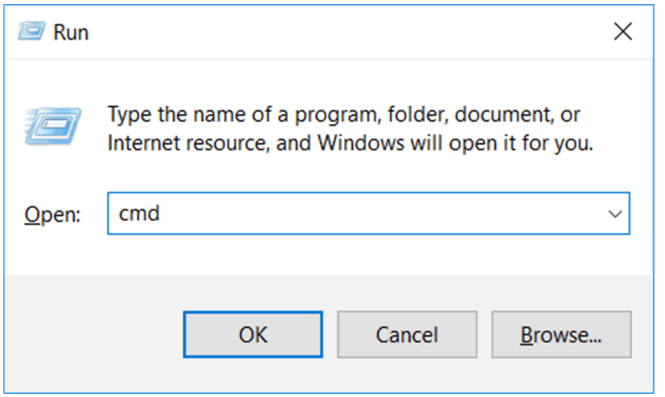
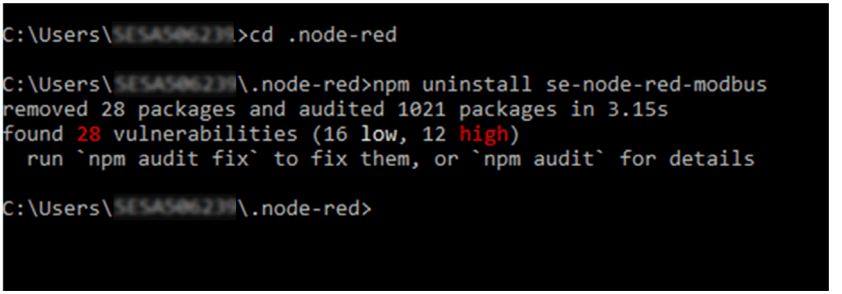
Uninstall SE Modbus Nodes - Online Uninstallation Mode

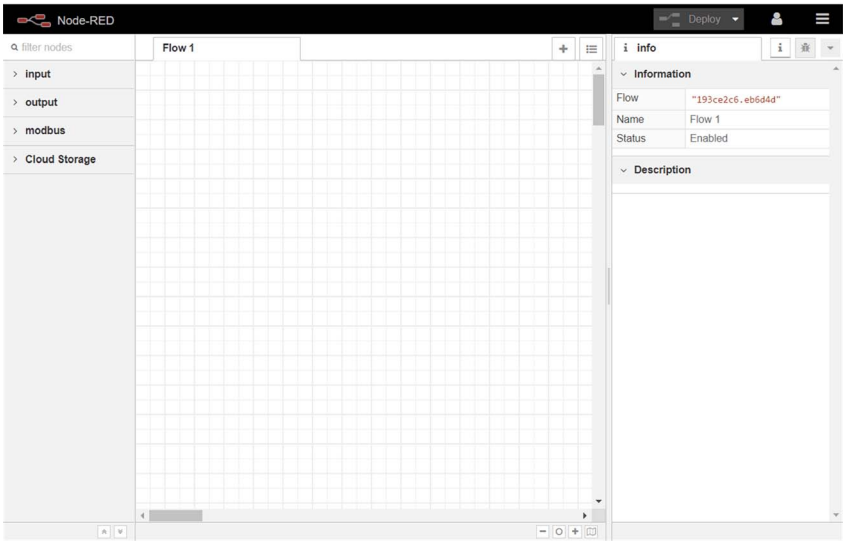
NOTE: You can uninstall the SE Modbus nodes using the command prompt.

NOTICE
LOSS OF DATA Backup the data before uninstalling SE Modbus nodes. **Failure to follow these instructions can result in equipment damage.**

This procedure explains how to uninstall the SE Modbus nodes:

Step	Action
1	Delete the SE Modbus nodes from the flow.
2	Click **Deploy**  and **Logout** from the Node-RED application.
3	Close the Node-RED server running in the command prompt window.
4	Click  and type **Run** in the search bar and press **Enter** 

Step	Action
5	Type the `cmd` in the **Run** dialog box and press **Enter**.  **Result**: Command prompt window appears.
6	Type *`cd .node-red`* and press **Enter**.
7	Type *`npm uninstall se-node-red-modbus`*.
8	Press **Enter** to uninstall the SE Modbus nodes.  **Result**: SE Modbus nodes are successfully uninstalled.

Step	Action
9	To restart the Node-RED server, follow the steps: **1.** Type `node-red` in the command prompt. **2.** Press **Enter**. **Result**: Node-RED server starts. **3.** Copy the IP address (*https://127.0.0.1:1880/*) in which the Node-RED server is running. **4.** Open a browser. **5.** Paste the IP address in the **URL** field in the browser. **6.** Press **Enter**. **7.** Type the **Username** and **Password** in related fields and click **Login**. **Result**: Node-RED factory window reappears. 

Chapter 4
Installation and Uninstallation of SE Modbus Nodes – Linux Platform

Overview

The installation and uninstallation of the SE Modbus nodes package will install and uninstall all three nodes (SE Modbus Read, SE Modbus Write and SE Modbus Tag) respectively.

What Is in This Chapter?

This chapter contains the following sections:

Section 4.1
Install SE Modbus Nodes - Linux Platform

What Is in This Section?

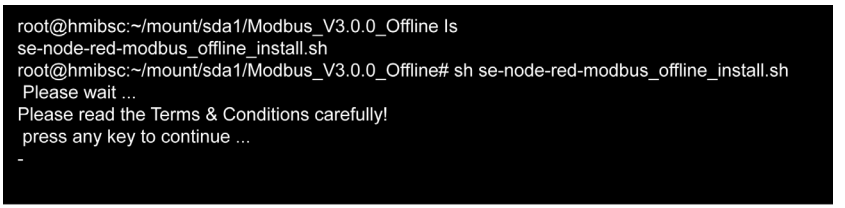
This section contains the following topics:

Installing SE Modbus Nodes - Offline Installation Mode

The Linux based Edge Boxes (for example, HMIBSC) have in-built Node-RED-as-a-Service. This means Node.js, Node-Red and Python are pre-installed in the OS image.

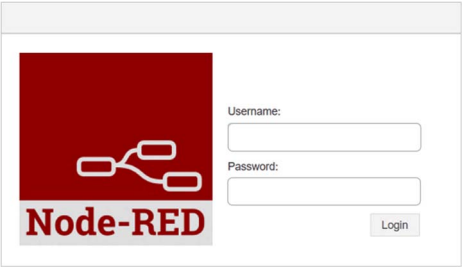
The SE Modbus nodes package is installed by the user from the portable disk.

The below procedure is applicable for the Edge Boxes running on Linux Yocto (for example, HMIBSC):

Step	Action
1	Download the `Modbus_V3.0.0_Offline.zip` file from the link given below: *https://schneider-electric.box.com/s/xsmgvjhjo4km8jwlsn8qyprgb0gy8bv6*
2	Extract the downloaded file `Modbus_V3.0.0_Offline.zip` and transfer the extracted folder (`Modbus_V3.0.0_Offline`) into a portable disk. Example: Pendrive.
3	Connect the portable device to IIoT Edge Box.
4	• Navigate to the directory of the portable device (for instance, `cd mount/media/<disk name>`) and press **Enter**. • Type `cd Modbus_V3.0.0_Offline` and press **Enter** to go to the directory where the offline files for SE Modbus nodes are placed.
5	Type `sh se-node-red-modbus_offline_install.sh` and press **Enter** to install the SE Modbus nodes. Press any key to read the Terms & Conditions.  **NOTE:** Press any key to continue until the result appears below. **Result**: `Do you agree to our Terms & Conditions? (yes/no):.`

Step	Action
6	Type `yes` and press **Enter** to agree the terms and conditions and install SE Modbus nodes. in both cases, for the sole and restricted purpose of exercising the concurrent use license right granted to You under said Corporate License within the limits set forth hereinabove. This Appendix forms an integral part of this EULA, and all terms and conditions of this EULA which are not expressly deviated under this Appendix, shall apply to You in accordance with the foregoing in addition to the terms and conditions set forth in this Appendix. As used herein and for the purposes of Corporate Licenses only, the following terms shall have the following meaning : -the term ■Group of Companies■ means any company or corporation: a)in which You directly or indirectly own or control the voting rights attached to more than 50% of the issued ordinary share capital. or (ii) control directly or indirectly the appointment of a majority of directors (or equivalent) of its board of directors (or equivalent body): or b)which directly or indirectly (i) owns or controls the voting rights attached to more than 50% of Your issued ordindry share capital, or (ii) controls the appointment of a majority of directors (or equivdlent) of Your board of directors (or equivalent body); or c)which is directly or indirectly owned or controlled by the same company or carporation as You in accordance with sub-case b) above. -the term ■Authorized Users■ means any end-users at the Sites who use the Software Product; -the term ■Sites■ means Your facility to which Schneider Electric Initially supplied the Software Product as well as all of Your facilities and the facilities of Your Group of Companies, irrespective whether said facilities are located within the same country or several countries. 22 Press any key to continue Do you agree to our Terms & Conditions? (yes/no): Please wait ... Successfully copied se-node-red-modbus files Running: cd /home/root/se-node-red-modbus && npm link Done: cd /home/root/se-node-red-modbus && npm link se-node-red-modbus installed successfully! Please restart node-red root@hmibsc:~/mount/sda1/Modbus_V3.0.0_Offline **Result**: se-node-red-modbus installed successfully. Please restart node-red by rebooting **Magelis HMIBSC** Edge box. **NOTE:** If you type `no`, the installation is cancelled.

Step	Action

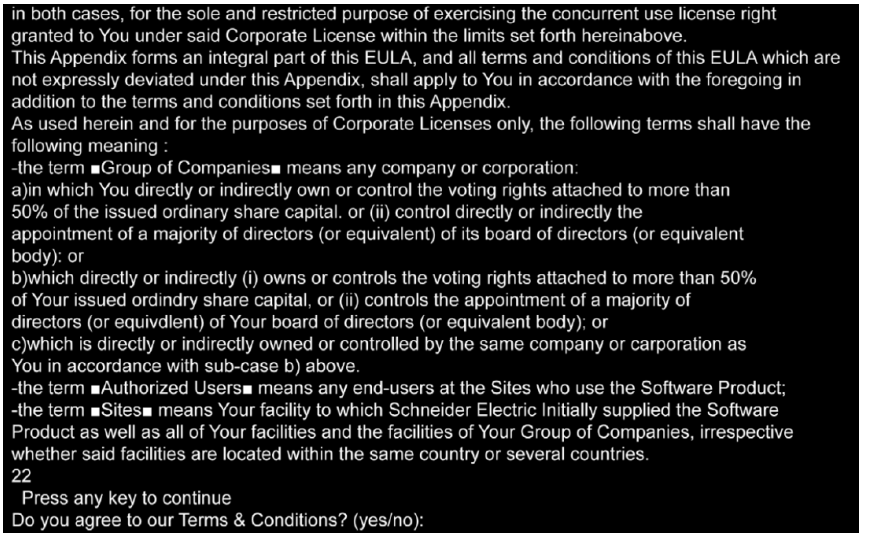
7	Open a browser from system (Laptop or Desktop) connected in same network as the Linux Edge box:
	• Go to https:\\<ip address>:1880
	NOTE: To know your IP address, type `ifconfig` in your Linux Edge box.
	`/home/root$ ifconfig`
	`eth0 Link encap:Ethernet HWaddr 74:FE:48:34:66:93`
	`inet addr:192.168.10.78 Bcast:192.168.255.255 Mask:255.255.0.0`
	`inet6 addr: 2405:204:551b:d6f7:76fe:48ff:fe34:6693%4804152/64 Scope:Global`
	`inet6 addr: fe80::76fe:48ff:fe34:6693%4804152/64 Scope:Link`
	`UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1`
	`RX packets:144095435 errors:79654 dropped:40320 overruns:0 frame:39334`
	`TX packets:145389576 errors:0 dropped:0 overruns:0 carrier:0`
	`collisions:0 txqueuelen:1000`
	`RX bytes:10131566838 (9.4 GiB) TX bytes:11357314537 (10.5 GiB)`
	`eth1 Link encap:Ethernet HWaddr 74:FE:48:34:66:94`
	`UP BROADCAST MULTICAST MTU:1500 Metric:1`
	`RX packets:0 errors:0 dropped:0 overruns:0 frame:0`
	`TX packets:0 errors:0 dropped:0 overruns:0 carrier:0`
	`collisions:0 txqueuelen:1000`
	`RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)`
	`lo Link encap:Local Loopback`
	`inet addr:127.0.0.1 Mask:255.0.0.0`
	`inet6 addr: ::1%4804152/128 Scope:Host`
	`UP LOOPBACK RUNNING MTU:65536 Metric:1`
	`RX packets:174 errors:0 dropped:0 overruns:0 frame:0`
	`TX packets:174 errors:0 dropped:0 overruns:0 carrier:0`
	`collisions:0 txqueuelen:1`
	`RX bytes:13456 (13.1 KiB) TX bytes:13456 (13.1 KiB)`
	`wlan0 Link encap:Ethernet HWaddr 02:00:16:B1:2F:02`
	`inet addr:192.168.225.250 Bcast:192.168.225.255 Mask:255.255.255.0`
	`inet6 addr: 2405:204:551b:d6f7:0:16ff:feb1:2f02%4804152/64 Scope:Global`
	`inet6 addr: fe80::16ff:feb1:2f02%4804152/64 Scope:Link`
	`UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1`
	`RX packets:21598 errors:0 dropped:0 overruns:0 frame:0`
	`TX packets:5230 errors:0 dropped:0 overruns:0 carrier:0`
	`collisions:0 txqueuelen:1000`
	`RX bytes:1019306 (995.4 KiB) TX bytes:434633 (424.4 KiB)`
	• Login window appears.
	Note: Use your Node-RED login credentials to operate Linux Edge box through your system.
	 
	NOTE: As the browser is not accessible in the Linux Edge box, you can connect to another system (Laptop or Desktop) using the Linux Edge box IP address.

Installing SE Modbus Nodes - Online Installation Mode

The Linux based Edge Boxes (for example, HMIBSC) have in-built Node-RED-as-a-Service. This means Node.js, Node-Red and python are pre-installed in the OS image.

To install SE Modbus nodes follow the steps given below:

Step	Action
1	Type the text given below in the terminal and press **Enter**: `npm set registry https://wain05400.apa.gad.schneider-electric.com:4878/`
2	Type the text given below in the terminal and press **Enter**: `npm set proxy null` **Note:** If set proxy null command is not working, remove proxy for respective types as follows: • `npm config rm proxy` • `npm config rm http-proxy` • `npm config rm https-proxy`
3	Type `npm install se-node-red-modbus` and press **Enter**. **NOTE:** Press any key to continue until the result appears. **Result**: `Do you agree to our Terms & Conditions? (yes/no):.`

Step	Action
4	Type `yes` and press **Enter** to agree the terms and conditions and install SE Modbus nodes.  in both cases, for the sole and restricted purpose of exercising the concurrent use license right granted to You under said Corporate License within the limits set forth hereinabove. This Appendix forms an integral part of this EULA, and all terms and conditions of this EULA which are not expressly deviated under this Appendix, shall apply to You in accordance with the foregoing in addition to the terms and conditions set forth in this Appendix. As used herein and for the purposes of Corporate Licenses only, the following terms shall have the following meaning : -the term ■Group of Companies■ means any company or corporation: a)in which You directly or indirectly own or control the voting rights attached to more than 50% of the issued ordinary share capital. or (ii) control directly or indirectly the appointment of a majority of directors (or equivalent) of its board of directors (or equivalent body): or b)which directly or indirectly (i) owns or controls the voting rights attached to more than 50% of Your issued ordindry share capital, or (ii) controls the appointment of a majority of directors (or equivdlent) of Your board of directors (or equivalent body); or c)which is directly or indirectly owned or controlled by the same company or carporation as You in accordance with sub-case b) above. -the term ■Authorized Users■ means any end-users at the Sites who use the Software Product; -the term ■Sites■ means Your facility to which Schneider Electric Initially supplied the Software Product as well as all of Your facilities and the facilities of Your Group of Companies, irrespective whether said facilities are located within the same country or several countries. 22 Press any key to continue Do you agree to our Terms & Conditions? (yes/no): **Result**: Installation is successfully completed. **NOTE:** If you type `no`, the installation is cancelled.
5	Restart Node-RED application by rebooting **Magelis HMIBSC** Edge box.

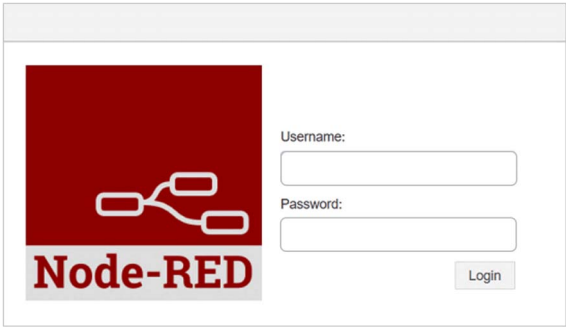
Step	Action
6	Open a browser from system (laptop or desktop) connected in same network as the Linux Edge box: • Go to https:\\<ip address>:1880 **NOTE:** To know your ip address, type `ifconfig` in your Linux edge box. • Login window appears. Use your Node-RED login credentials to operate Linux Edge box through your system (laptop or desktop). **NOTE:** As browser is not available in Linux edge box you can connect to another system (laptop or desktop) using the ip address of Linux Edge box.

```
/home/root$ ifconfig
eth0      Link encap:Ethernet  HWaddr 74:FE:48:34:66:93
          inet addr:192.168.10.78  Bcast:192.168.255.255  Mask:255.255.0.0
          inet6 addr: 2405:204:551b:d6f7:76fe:48ff:fe34:6693%4804152/64 Scope:Global
          inet6 addr: fe80::76fe:48ff:fe34:6693%4804152/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:144095435 errors:79654 dropped:40320 overruns:0 frame:39334
          TX packets:145389576 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:10131566838 (9.4 GiB)  TX bytes:11357314537 (10.5 GiB)

eth1      Link encap:Ethernet  HWaddr 74:FE:48:34:66:94
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1%4804152/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:174 errors:0 dropped:0 overruns:0 frame:0
          TX packets:174 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:13456 (13.1 KiB)  TX bytes:13456 (13.1 KiB)

wlan0     Link encap:Ethernet  HWaddr 02:00:16:B1:2F:02
          inet addr:192.168.225.250  Bcast:192.168.225.255  Mask:255.255.255.0
          inet6 addr: 2405:204:551b:d6f7:0:16ff:feb1:2f02%4804152/64 Scope:Global
          inet6 addr: fe80::16ff:feb1:2f02%4804152/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:21598 errors:0 dropped:0 overruns:0 frame:0
          TX packets:5230 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1019306 (995.4 KiB)  TX bytes:434633 (424.4 KiB)
```



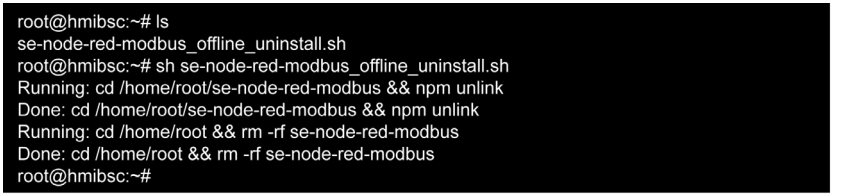
Section 4.2
Uninstall SE Modbus Nodes - Linux Platform

What Is in This Section?

This section contains the following topics:

Uninstalling SE Modbus Nodes - Offline Uninstallation Mode

The below procedure is applicable for the Edge Boxes running on Linux Yocto (for example, HMIBSC):

Step	Action
1	Type `ls` and press **Enter**. **Result**: Installed nodes appears.
2	Type `sh se-node-red-modbus_offline_uninstall.sh` and press **Enter** to uninstall the SE Modbus nodes.  root@hmibsc:~# ls se-node-red-modbus_offline_uninstall.sh root@hmibsc:~# sh se-node-red-modbus_offline_uninstall.sh Running: cd /home/root/se-node-red-modbus && npm unlink Done: cd /home/root/se-node-red-modbus && npm unlink Running: cd /home/root && rm -rf se-node-red-modbus Done: cd /home/root && rm -rf se-node-red-modbus root@hmibsc:~# **NOTE:** After uninstalllation, restart Node-RED by rebooting **Magelis HMIBSC** Edge box.

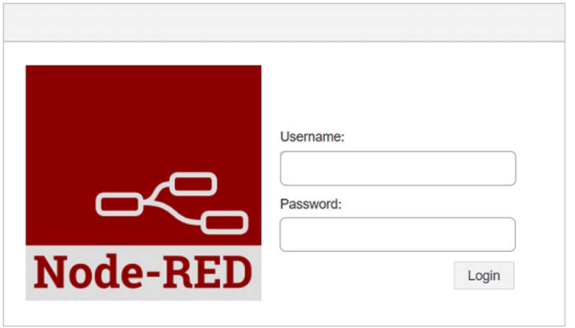
Step	Action
3	Open a browser from system (Laptop or Desktop) connected in same network as the Linux Edge box: • Go to https:\\<ip address>:1880 **NOTE:** To know your IP address, type `ifconfig` in your Linux Edge box. • Login window appears. **Note**: Use your Node-RED login credentials to operate Linux Edge box through your system. **NOTE:** As the browser is not accessible in the Linux Edge box, you can connect to another system (Laptop or Desktop) using the Linux Edge box IP address.

```
/home/root$ ifconfig
eth0      Link encap:Ethernet  HWaddr 74:FE:48:34:66:93
          inet addr:192.168.10.78  Bcast:192.168.255.255  Mask:255.255.0.0
          inet6 addr: 2405:204:551b:d6f7:76fe:48ff:fe34:6693%4804152/64 Scope:Global
          inet6 addr: fe80::76fe:48ff:fe34:6693%4804152/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:144095435 errors:79654 dropped:40320 overruns:0 frame:39334
          TX packets:145389576 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:10131566838 (9.4 GiB)  TX bytes:11357314537 (10.5 GiB)

eth1      Link encap:Ethernet  HWaddr 74:FE:48:34:66:94
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1%4804152/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:174 errors:0 dropped:0 overruns:0 frame:0
          TX packets:174 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:13456 (13.1 KiB)  TX bytes:13456 (13.1 KiB)

wlan0     Link encap:Ethernet  HWaddr 02:00:16:B1:2F:02
          inet addr:192.168.225.250  Bcast:192.168.225.255  Mask:255.255.255.0
          inet6 addr: 2405:204:551b:d6f7:0:16ff:feb1:2f02%4804152/64 Scope:Global
          inet6 addr: fe80::16ff:feb1:2f02%4804152/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:21598 errors:0 dropped:0 overruns:0 frame:0
          TX packets:5230 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1019306 (995.4 KiB)  TX bytes:434633 (424.4 KiB)
```



Uninstalling SE Modbus Nodes - Online Uninstallation Mode

This procedure explains how to uninstall the SE Modbus nodes:

Step	Action
1	From the browser where Node-RED server is running, delete the SE Modbus nodes from the flow.
2	Click **Deploy**  and **Logout** from the Node-RED application.
3	Go to **HMIBSC** terminal.
4	Type `npm uninstall se-node-red-modbus`.
5	Press **Enter** to uninstall the SE Modbus nodes. **Result**: SE Modbus nodes are successfully uninstalled.
6	Restart Node-RED application by rebooting **Magelis HMIBSC** Edge box.

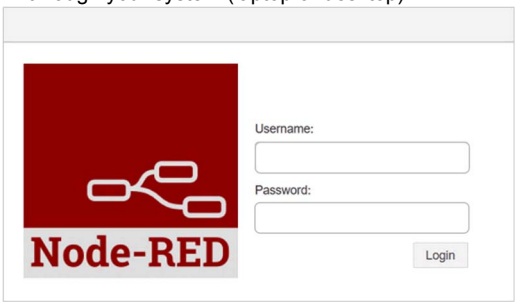
Step	Action
7	To check if your node is uninstalled follow the steps below ● Open a browser from system (laptop or desktop) connected in same network as the Linux Edge box: ❍ Go to https:\\<ip address>:1880 **NOTE:** To know your ip address, type `ifconfig` in your Linux edge box. ❍ Login window appears. Use your Node-RED login credentials to operate Linux Edge box through your system (laptop or desktop). **NOTE:** As browser is not available in Linux edge box you can connect to another system (laptop or desktop) using the ip address of Linux Edge box.

```
/home/root$ ifconfig
eth0      Link encap:Ethernet  HWaddr 74:FE:48:34:66:93
          inet addr:192.168.10.78  Bcast:192.168.255.255  Mask:255.255.0.0
          inet6 addr: 2405:204:551b:d6f7:76fe:48ff:fe34:6693%4804152/64 Scope:Global
          inet6 addr: fe80::76fe:48ff:fe34:6693%4804152/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:144095435 errors:79654 dropped:40320 overruns:0 frame:39334
          TX packets:145389576 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:10131566838 (9.4 GiB)  TX bytes:11357314537 (10.5 GiB)

eth1      Link encap:Ethernet  HWaddr 74:FE:48:34:66:94
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1%4804152/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:174 errors:0 dropped:0 overruns:0 frame:0
          TX packets:174 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:13456 (13.1 KiB)  TX bytes:13456 (13.1 KiB)

wlan0     Link encap:Ethernet  HWaddr 02:00:16:B1:2F:02
          inet addr:192.168.225.250  Bcast:192.168.225.255  Mask:255.255.255.0
          inet6 addr: 2405:204:551b:d6f7:0:16ff:feb1:2f02%4804152/64 Scope:Global
          inet6 addr: fe80::16ff:feb1:2f02%4804152/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:21598 errors:0 dropped:0 overruns:0 frame:0
          TX packets:5230 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1019306 (995.4 KiB)  TX bytes:434633 (424.4 KiB)
```



Part III
SE Modbus Nodes

Chapter 5
About SE Modbus Nodes

Overview

This chapter describes information about SE Modbus Read, SE Modbus Write and SE Modbus Tag nodes.

What Is in This Chapter?

This chapter contains the following sections:

Section 5.1
SE Modbus Read Node

What Is in This Section?

This section contains the following topics:

Introduction

Overview

SE Modbus Read node reads the data from modbus devices using modbus TCP or modbus Serial communication protocol. The node reads one or multiple register values at specified poll interval. The output of SE Modbus Read node is in CMS format.

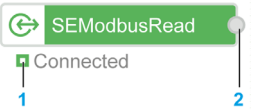
NOTE: Modbus Serial communication with HMIBSC Box cannot be established using modbus serial cable due to the unavailability of the driver in the Linux platform.

The additional data types supported in SE Modbus nodes V3.0.0 are as follows:

- UINT
- WORD
- DINT
- UDINT
- DWORD

Node Description

SE Modbus Read node consists of:

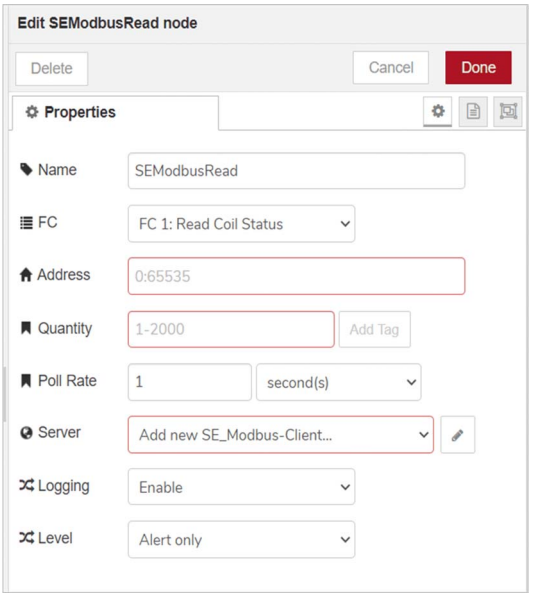


Item number	Item name	Description
1	Connection status	Indicates the following connection status: • **Connecting**: Node is connecting to any modbus device. • **Connected**: Node is connected to the device. • **Success**: Data from Modbus device read successfully. • **Error**: Indicates when the node detects an error. • **ConfigError**: Node is not configured properly.
2	Output	Generated CMS is passed as an output

Configuring SE Modbus Read Node

Configure SE Modbus Read node properties

Double-click SE Modbus Read node. The **Properties** screen of the node appears.

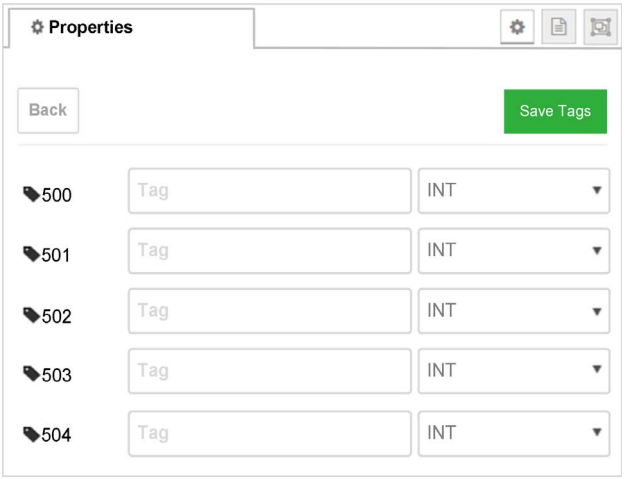


Parameters	Description
FC	Select the required function code from the list: • **FC 1**: **Read Coil Status** • **FC 2**: **Read Input Status** • **FC 3**: **Read Holding Registers** • **FC 4**: **Read Input Registers** **NOTE:** The **FC** (Function Code) defines the memory area to read the data.
Address	Type the address to be read. The address should be between 0...65535. For example: 125 **NOTE:** An address is a location where data is stored.
Quantity	Type the value to be read starting from the address configured in previous step. **NOTE:** The value for **FC 1** and **FC 2** should be between 1...2000. The value for **FC 3** and **FC 4** should be between 1...125.

Parameters	Description
Add Tag	Click to add the tag name and type (**INT**, **UINT**, **WORD**, **BOOLEAN**, **REAL**, **DINT**, **UDINT** and **DWORD**) for corresponding register. For more information *(see page 96)*.
Poll Rate	Select the frequency at which data has to be read.
Server	Click  icon to configure the parameters of the selected server (modbus device) types given below: ● **TCP** *(see page 96)* ● **Serial** *(see page 98)*
Logging	Logging is used to read the data. Select the **Enable** or **Disable** for logging the events. By default, **Enable** is selected. When Enabled, the log events are recorded in the log file. The log files will be saved in the path given below: `<Installed Node Directory>/nodes/log/` For instance the location will be: ● Offline installation ❍ `<User Directory>/se-node-red-modbus/nodes/log/` ● Online installation ❍ `<User Directory>/.node-red/node_modules/se-node-red-modbus/nodes/log/`
Level	Select the logging level from the list: ● **All Events** Error, info, debug messages are logged ● **Alerts Only** Error messages are logged **NOTE:** By default, **Alerts Only** is selected.

Add Tag Properties

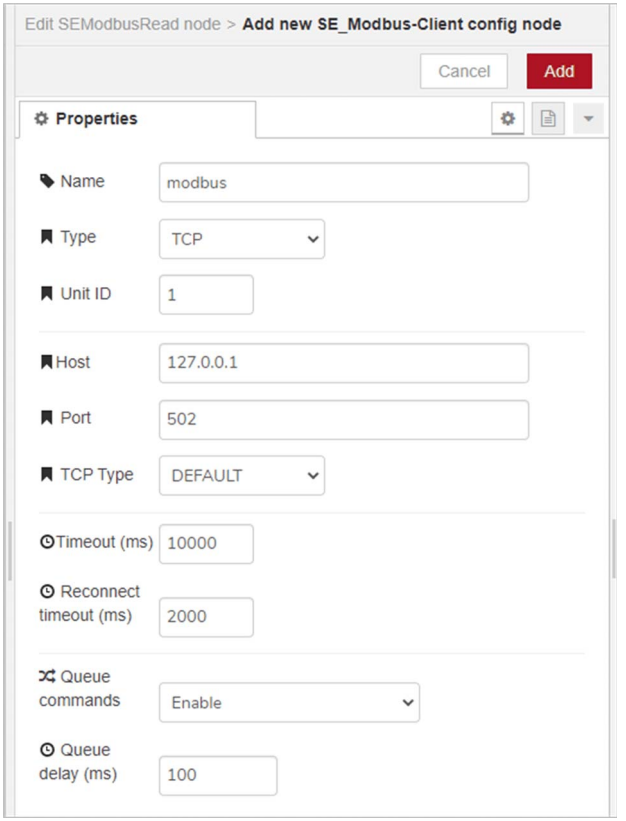
By clicking **Add Tag** option the window given below appears. Here you can add the details of the tags that you wish to read.



Parameters	Description
Tag field	Type the tag name.
Data type of tag	Select any one of the following data type: • **INT**: Its range is -32,768 to 32,767. • **UINT**: Its range is 0 to 65,535. • **WORD**: Its range is from 0 to 65,535. • **BOOLEAN**: true or false. • **REAL**: Its range is 3.4E±38 (7 digits) • **DINT**: Its range is from -2,147,483,648 to 2,147,483,647. • **UDINT**: Its range is from 0 to 4,294,967,295. • **DWORD**: Its range is from 0 to 4,294,967,295.
Save Tags	Click **Save Tags** to save the tags information.

TCP Properties

NOTE: TCP and Serial are mutually exclusive. If the user wants to connect to a Modbus TCP device, only then follow these steps.



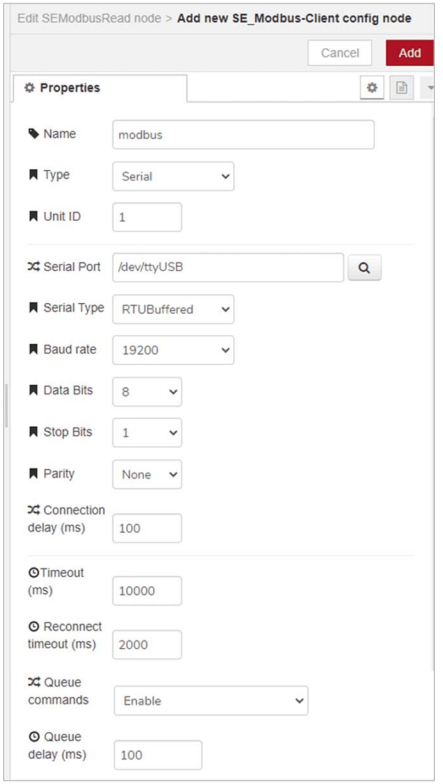
If the user wants to connect to a modbus **TCP** device, follow these steps:

Parameters	Description
Unit ID	Type the modbus device address of SE Modbus Read **Serial** and **TCP** (Optional) devices. **NOTE:** Unit ID is the device Id of serial device.
Host	Type the IP address Each host has a host number that, together with a network identity, forms its own unique IP address.
Port	Type the port number. The TCP port is a 16 bit number, 1... 65535, used to identify the services or processes being used in networking communications. Specific port numbers are often used for the purpose of identifying specific services. TCP port 502 is used by convention under the Modbus protocol.

Parameters	Description
TCP Type	Select the **TCP Type** from the drop-down list: • **Default** • **RTUBuffered** A remote terminal unit (RTU) is a microprocessor-controlled electronic device that interfaces objects in the physical world to a distributed control system or SCADA by transmitting telemetry data to a master system, and by using messages from the master supervisory system to control connected objects.
Timeout	When the idle **Timeout** is set, if there is no communication to the device for the specified period of time (in seconds), the connection will be closed. By default, the delay time is 10000 ms.
Reconnect timeout	Timeout controls how long transmitted data may remain unacknowledged before a connection is forcefully closed. Set the reconnect time out for reconnecting the node. By default, the reconnect time is 2000 ms.
Queue commands	Select the required option from the drop-down list: • **Enable**: This option stores incoming commands and sends them with delay. • **Disable**: This option turns off the queuing of commands. By default, the Queue commands is **Enable**.
Queue delay	Set the time interval to delay sending the commands from queue. By default, the queue delay is 100 ms.

Serial Properties

NOTE: TCP and Serial are mutually exclusive. If the user wants to connect to a Modbus Serial device, only then follow these steps.



If the user wants to connect to a modbus **Serial** device, follow these steps:

Parameters	Description
Unit ID	Type the modbus device address of SE Modbus Read **Serial** and **TCP** (Optional) devices. **NOTE:** Unit ID is the device Id of serial device.
Serial Port	Click Search icon and select `(/dev/tty.usbserial | COM[1...n])` from the drop down list.

Parameters	Description
Serial Type	Select the required option from the drop-down list: • **RTUBuffered** A remote terminal unit (RTU) is a microprocessor-controlled electronic device that interfaces objects in the physical world to a distributed control system or SCADA by transmitting telemetry data to a master system, and by using messages from the master supervisory system to control connected objects.
Baud rate	Select the suitable option from the drop-down list: • **115200** • **57600** • **38400** • **19200** • **9600** • **4800** • **2400** • **1200** • **300** • **110** • **75** **NOTE:** The Baud rate is the speed at which Modbus messages are sent (in bits / seconds). Based on the rate selected, the information is transferred in a communication channel.
Data Bits	Select the suitable option from the drop-down list: • **8** • **7** • **6** • **5** **NOTE:** Based on the bit selected, the information is transferred in a communication channel.
Stop Bits	Select the suitable option from the drop-down list: • **1** • **1.5** • **2**
Parity	Select the suitable parity bit from the drop-down list: • **None** • **Even** • **Odd** • **Mark** • **Space**

Parameters	Description
Connection delay	Type the delay time for sending data after reconnection. By default, the value is 100 ms.
Timeout	When the idle **Timeout** is set, if there is no communication to the device for the specified period of time (in seconds), the connection will be closed. By default, the delay time is 10000 ms.
Reconnect timeout	Timeout controls how long transmitted data may remain unacknowledged before a connection is forcefully closed. Set the reconnect time out for reconnecting the node. By default, the reconnect time is 2000 ms.
Queue commands	Select the required option from the drop-down list: • **Enable**: This option stores incoming commands and sends them with delay. • **Disable**: This option turns off the queuing of commands. By default, the Queue commands is **Enable**.
Queue delay	Set the time interval to delay sending the commands from queue. By default, the queue delay is 100 ms.

Section 5.2
SE Modbus Write Node

What Is in This Section?

This section contains the following topics:

Introduction

Overview

SE Modbus Write node writes the data to modbus devices using the modbus TCP or modbus serial communication protocol. The node writes into one or multiple register values in the device.

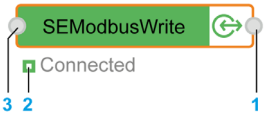
NOTE: Modbus Serial communication with HMIBSC Box cannot be established using modbus serial cable due to the unavailability of the driver in the Linux platform.

The additional data types supported in SE Modbus nodes V3.0.0 are as follows:

- UINT
- WORD
- DINT
- UDINT
- DWORD

Node Description

SE Modbus Write node consists of:

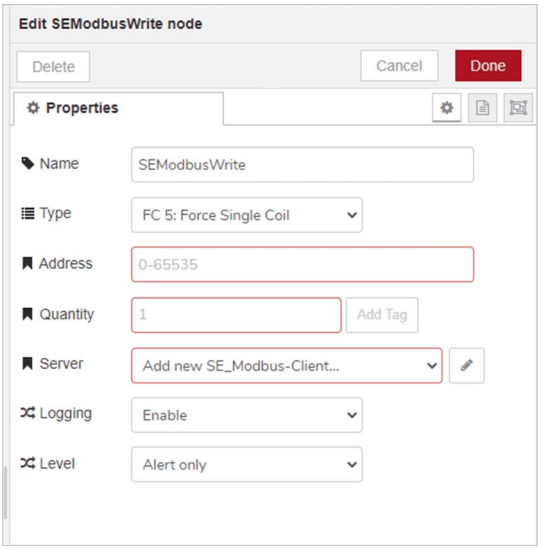


Item number	Item name	Description
1	Output	You can connect the output to any connection node or debug node.
2	Connection status	Indicates the following connection status: • **Connecting**: Node is connecting to any modbus device. • **Connected**: Node is connected to the device. • **Success**: Data to Modbus device written successfully. • **Error**: Indicates when the node detects an error. • **ConfigError**: Node is not configured properly.
3	Input	Inject data/values from inject node for the configured parameters.

Configuring SE Modbus Write Node

Configuring SE Modbus Write Node

Double-click SE Modbus Write node. The **Properties** screen of the node appears.



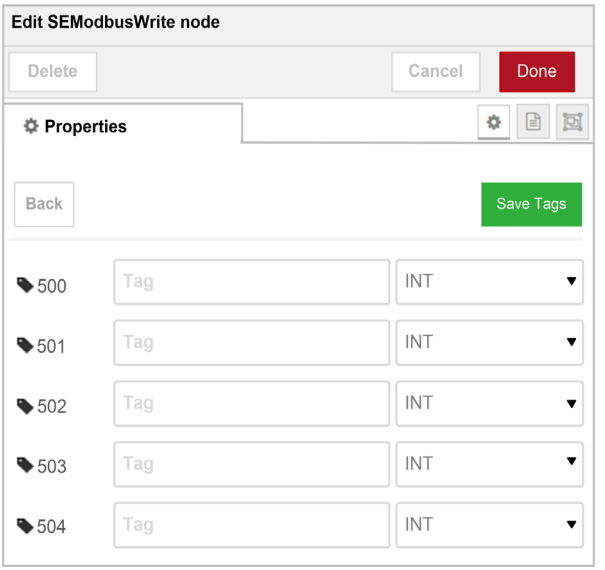
Parameters	Description
Type	Select the required function code from the drop-down list: • **FC 5**: **Force Single Coil** • **FC 6**: **Preset Single Register** • **FC 15**: **Force Multiple Coils** • **FC 16**: **Preset Multiple Registers** **NOTE:** The **FC** (Function Code) defines the memory area to write the data.
Address	Type the text in the address field that is to be written. The address has to be between 0...65535. **NOTE:** An address is a location where data is stored.
Quantity	Type the value in quality field that is to be written starting from the address configured in above step. The value for **FC 5** and **FC 6** should be 1 The value for **FC 15** should be between 1...1968 The value for **FC 16** should be between 1...123
Add Tag	Click to add the tag name and type (**INT**, **UINT**, **WORD**, **REAL**, **DINT**, **UDINT**, **DWORD**, and **BOOLEAN**) for corresponding register. For more information *(see page 105)*.

Parameters	Description
Server	Click  icon to configure the parameters of the selected server types given below: ● **TCP** ● **Serial**
Logging	Logging is used to write the data. Select the **Enable** or **Disable** for logging the events. By default, **Enable** is selected. When Enabled, the log events are recorded in the log file. The log files will be saved in the path given below: `<Installed Node Directory>/nodes/log/` For instance the location will be: ● Offline installation ❍ `<User Directory>/se-node-red-modbus/nodes/log/` ● Online installation ❍ `<User Directory>/.node-red/node_modules/se-node-red-modbus/nodes/log/`
Level	Select the logging level from the drop-down list: ● **All events** ● **Alerts only** **NOTE:** By default, **Alerts only** is selected.

Add Tag Properties

The node writes the variables into the device. Each variable has its own special register address. Users can add tags / variables to the add tag properties using the register address to monitor specific register address variables.

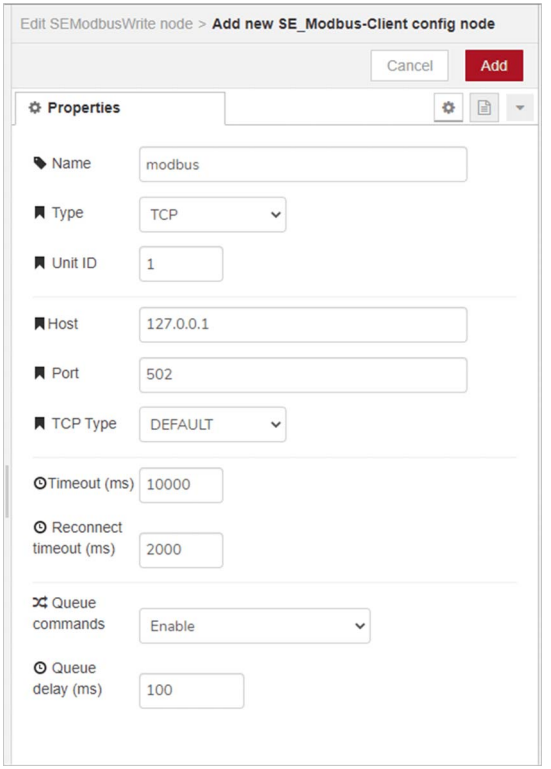
By clicking **Add Tag** option the window given below appears. Here you can add the details of the tags that you wish to write.



Parameters	Description
Tag field	Type the tag name.
Data type of tag	Select any one of the following data type: • **INT**: Its range is -32,768 to 32,767. • **UINT**: Its range is 0 to 65,535. • **WORD**: Its range is from 0 to 65,535. • **BOOLEAN**: true or false. • **REAL**: Its range is 3.4E±38 (7 digits) • **DINT**: Its range is from -2,147,483,648 to 2,147,483,647. • **UDINT**: Its range is from 0 to 4,294,967,295. • **DWORD**: Its range is from 0 to 4,294,967,295.
Save Tags	Click **Save Tags** to save the tags information.

TCP Properties

NOTE: TCP and Serial are mutually exclusive. If the user wants to connect to a Modbus TCP device, only then follow these steps.



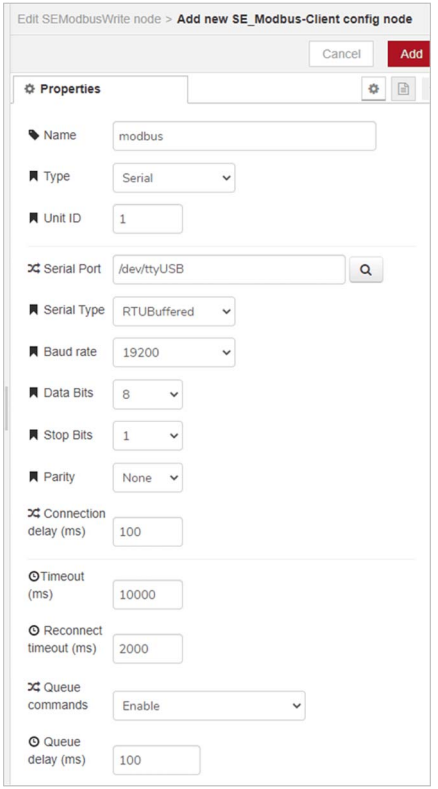
If the user wants to connect to a modbus **TCP** device, follow these steps:

Parameters	Description
Unit ID	Type the modbus device address of the **Serial** and **TCP** (Optional) devices. **NOTE:** Unit ID is the device Id of serial device.
Host	Type the IP address Each host has a host number that, together with a network identity, forms its own unique IP address.
Port	Type the port number. The TCP port is a 16 bit number, 1... 65535, used to identify the services or processes being used in networking communications. Specific port numbers are often used for the purpose of identifying specific services. TCP port 502 is used by convention under the Modbus protocol.

Parameters	Description
TCP Type	Select the **TCP Type** from the drop-down list: • **DEFAULT** • **RTUBuffered** A remote terminal unit (RTU) is a microprocessor-controlled electronic device that interfaces objects in the physical world to a distributed control system or SCADA by transmitting telemetry data to a master system, and by using messages from the master supervisory system to control connected objects.
Timeout (ms)	When the idle **Timeout** is set, if there is no communication to the device for the specified period of time (in seconds), the connection will be closed. By default, the delay time is 10000 ms.
Reconnect timeout (ms)	Timeout controls how long transmitted data may remain unacknowledged before a connection is forcefully closed. Set the reconnect time out for reconnecting the node. By default, the reconnect time is 2000 ms.
Queue commands	Select the required option from the drop-down list: • **Enable**: This option stores incoming commands and sends them with delay. • **Disable**: This option turns off the queuing of commands. By default, the Queue commands is **Enable**.
Queue delay (ms)	Set the time interval to delay sending the commands from queue. By default, the queue delay is 100 ms.

Serial Properties

NOTE: TCP and Serial are mutually exclusive. If the user wants to connect to a Modbus Serial device, only then follow these steps.



If the user wants to connect to a modbus **Serial** device, follow these steps:

Parameters	Description
Unit ID	Type the modbus device address of the **Serial** and **TCP** (Optional) devices. **NOTE:** Unit ID is the device Id of serial device.
Serial Port	Click Search icon and select `(/dev/tty.usbserial | COM[1...n])` from the drop down list.

Parameters	Description
Serial Type	Select the required option from the drop-down list: • **RTUBuffered** A remote terminal unit (RTU) is a microprocessor-controlled electronic device that interfaces objects in the physical world to a distributed control system or SCADA by transmitting telemetry data to a master system, and by using messages from the master supervisory system to control connected objects.
Baud rate	Select the suitable option from the drop-down list: • **115200** • **57600** • **38400** • **19200** • **9600** • **4800** • **2400** • **1200** • **300** • **110** • **75** **NOTE:** The Baud rate is the speed at which Modbus messages are sent (in bits / seconds). Based on the rate selected, the information is transferred in a communication channel.
Data Bits	Select the suitable option from the drop-down list: • **8** • **7** • **6** • **5** **NOTE:** Based on the bit selected, the information is transferred in a communication channel.
Stop Bits	Select the suitable option from the drop-down list: • **1** • **1.5** • **2**
Parity	Select the suitable parity bit from the drop-down list: • **None** • **Even** • **Odd** • **Mark** • **Space**

Parameters	Description
Connection delay	Type the delay time for sending data after reconnection. By default, the value is 100 ms.
Timeout (ms)	When the idle **Timeout** is set, if there is no communication to the device for the specified period of time (in seconds), the connection will be closed. By default, the delay time is 10000 ms.
Reconnect timeout (ms)	Timeout controls how long transmitted data may remain unacknowledged before a connection is forcefully closed. Set the reconnect time out for reconnecting the node. By default, the reconnect time is 2000 ms.
Queue commands	Select the required option from the drop-down list: • **Enable**: This option stores incoming commands and sends them with delay. • **Disable**: This option turns off the queuing of commands. By default, the Queue commands is **Enable**.
Queue delay (ms)	Set the time interval to delay sending the commands from queue. By default, the queue delay is 100 ms.

Section 5.3
SE Modbus Tag Node

What Is in This Section?

This section contains the following topics:

Introduction

Overview

SE Modbus Tag node is a connector node that reads or writes data from any device that has a Modbus TCP or Modbus Serial communication interface using tags.

SE Modbus Tag node can import tags that are exported from EcoStruxure Control Expert or any other PLC configuration software in the below formats:

- Unity XSY file
- XML file
- CSV file

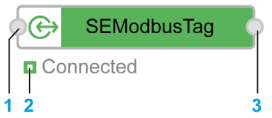
The output of SE Modbus Tag node is in CMS format *(see page 140)*.

The additional data types supported in SE Modbus nodes V3.0.0 are as follows:

- UINT
- WORD
- DINT
- UDINT
- DWORD

Node Description

SE Modbus Tag node consists of:

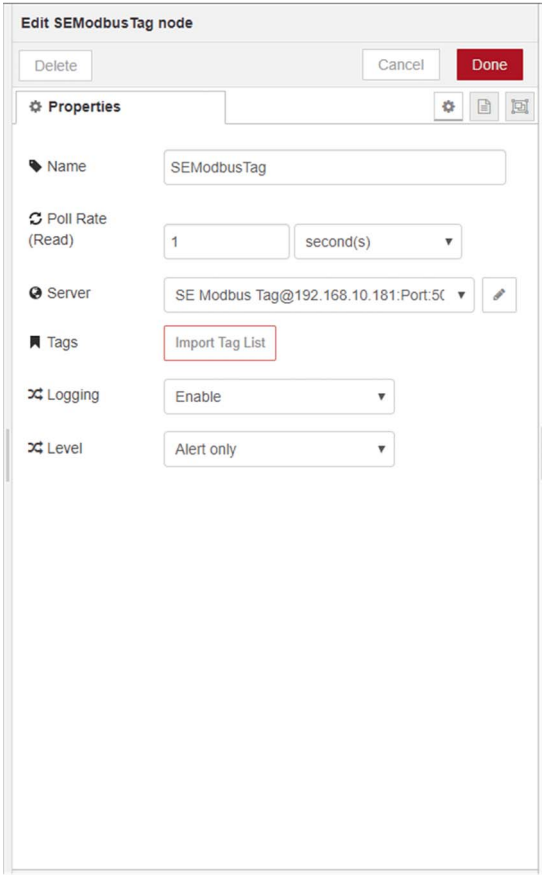


Item number	Item name	Description
1	Input	Inject data/values from inject node for the configured parameters.

Item number	Item name	Description
2	Connection status	Indicates the following connection status: • **Connecting**: Node is not connected to any modbus device. • **Connected**: Node is connected to the modbus device. • **Success**: Indicates only when READ or WRITE operation is successful for all records. **NOTE:** Node does not import more than 500 variables / tags from the tag file. When READ or WRITE operation i s successful for “n of X” records. Show the exact count of records read or written and the complete count in the file. For example: success 98 of 100 • **Disconnected**: Indicates when connection to device is disconnected. • **Error**: Indicates only when READ or WRITE is unsuccessful for all records.
3	Output	Generated CMS is passed as an output.

Configuring SE Modbus Tag Node

Double-click SE Modbus Tag node. The configuration screen of the node appears:



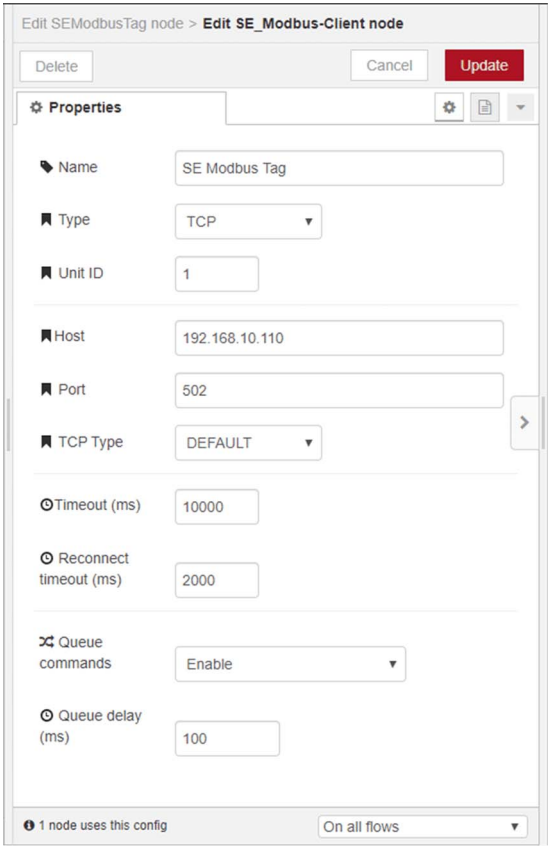
Parameters	Description
Name	Type the name to be displayed on the node.
Poll rate (Read)	Select the frequency at which data has to be read.

Parameters	Description
Server	Click icon to configure the parameters of the selected server type given below: • **TCP** *(see page 116)* • **Serial** *(see page 118)*
Tags	Refer to **Tags** table given below *(see page 121)*.
Logging	Select the **Enable** or **Disable** for logging the events. By default, **Enable** is selected. When Enabled, the log events are recorded in the log file. The log files will be saved in the path given below: `<Installed Node Directory>/nodes/log/` For instance the location will be: • Offline installation ❍ `<User Directory>/se-node-red-modbus/nodes/log/` • Online installation ❍ `<User Directory>/.node-red/node_modules/se-node-red-modbus/nodes/log/`
Level	Select the logging level from the list: • **All Events** Error, info, debug messages are logged • **Alerts Only** Error messages are logged **NOTE:** By default, **Alerts Only** is selected.

TCP Properties

NOTE: TCP and Serial are mutually exclusive. If the user wants to connect to a Modbus TCP device, only then follow these steps.

Server type: **TCP** properties



Server configuration for **TCP** connection:

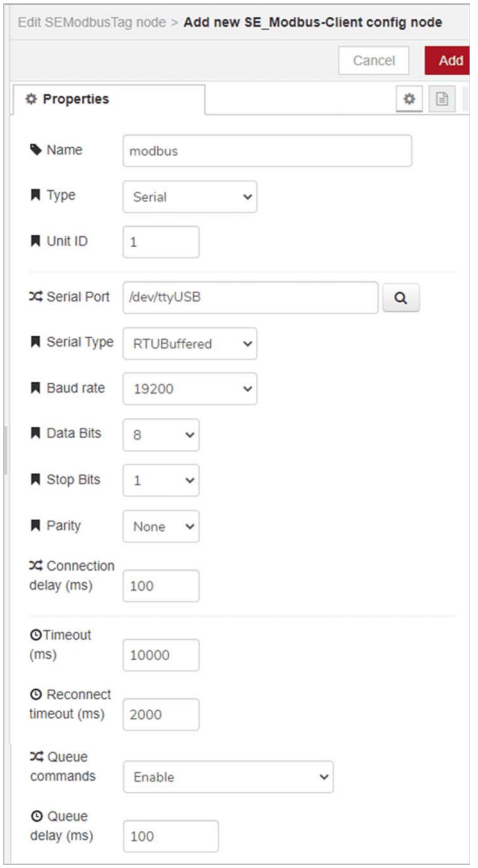
Parameters	Description
Unit ID	Type the modbus device address of the **Serial** and **TCP** (Optional) devices. **NOTE:** Unit ID is the device Id of serial device.
Host	Type the IP address Each host has a host number that, together with a network identity, forms its own unique IP address.
Port	Type the port number. The TCP port is a 16 bit number, 1... 65535, used to identify the services or processes being used in networking communications. Specific port numbers are often used for the purpose of identifying specific services. TCP port 502 is used by convention under the Modbus protocol.

Parameters	Description
TCP Type	Select the **TCP Type** from the drop-down list: • **Default** • **RTU-BUFFERD** A remote terminal unit (RTU) is a microprocessor-controlled electronic device that interfaces objects in the physical world to a distributed control system or SCADA by transmitting telemetry data to a master system, and by using messages from the master supervisory system to control connected objects.
Timeout (ms)	When the idle **Timeout** is set, if there is no communication to the device for the specified period of time (in seconds), the connection will be closed. By default, the delay time is 10000 ms.
Reconnect timeout (ms)	Timeout controls how long transmitted data may remain unacknowledged before a connection is forcefully closed. Set the reconnect time out for reconnecting the node. By default, the reconnect time is 2000 ms.
Queue commands	Select the required option from the drop-down list: • **Enable**: This option stores incoming commands and sends them with delay. • **Disable**: This option turns off the queuing of commands. By default, the Queue commands is **Enable**.
Queue delay (ms)	Set the time interval to delay sending the commands from queue. By default, the queue delay is 100 ms.

Serial Properties

NOTE: TCP and Serial are mutually exclusive. If the user wants to connect to a Modbus Serial device, only then follow these steps.

Server type: **Serial** properties:



Server configuration for **Serial** connection:

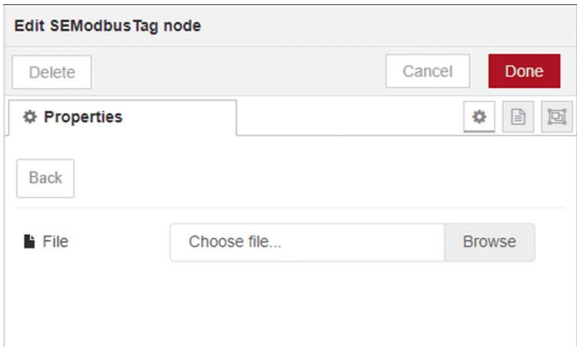
Parameters	Description
Unit ID	Type the modbus device address of the **Serial** and **TCP** (Optional) devices. **NOTE:** Unit ID is the device Id of serial device.
Serial Port	Serial port is a serial communication interface through which information transfers in or out sequentially one bit at a time. Click Search icon and select `/dev/ttyUSB`)

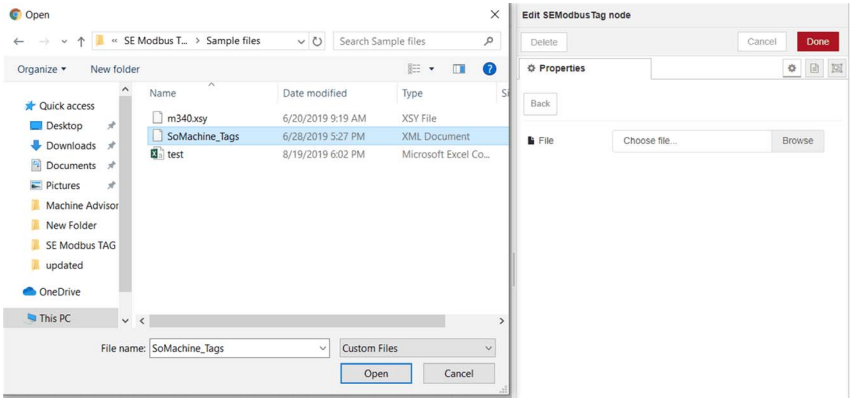
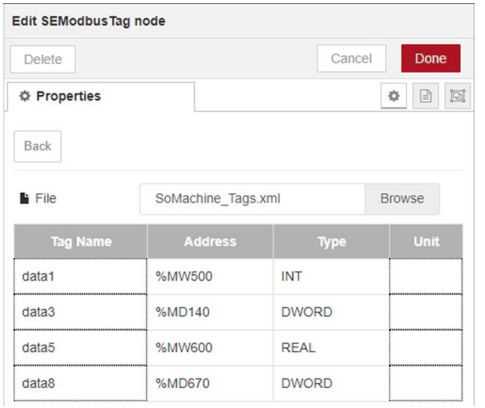
Parameters	Description
Serial Type	Serial communication is the process of sending data one bit at a time, sequentially, over a communication channel or computer bus. Select the required option from the drop-down list: • **RTU-BUFFERD**
Baud rate	Select the baud rate from the drop-down list: • **115200** • **57600** • **38400** • **19200** • **9600** • **4800** • **2400** • **1200** • **300** • **110** • **75** **NOTE:** The Baud rate is the speed at which Modbus messages are sent (in bits / seconds). Based on the rate selected, the information is transferred in a communication channel.
Data Bits	Select the suitable option from the drop-down list: • **8** • **7** • **6** • **5** **NOTE:** Based on the bit selected, the information is transferred in a communication channel.
Stop Bits	Select the suitable option from the drop-down list: • **1** • **1.5** • **2**
Parity	Select the suitable parity bit from the drop-down list: • **None** • **Even** • **Odd** • **Mark** • **Space**
Connection delay (ms)	Type the delay time for sending data after reconnection. By default, the value is 100 ms.

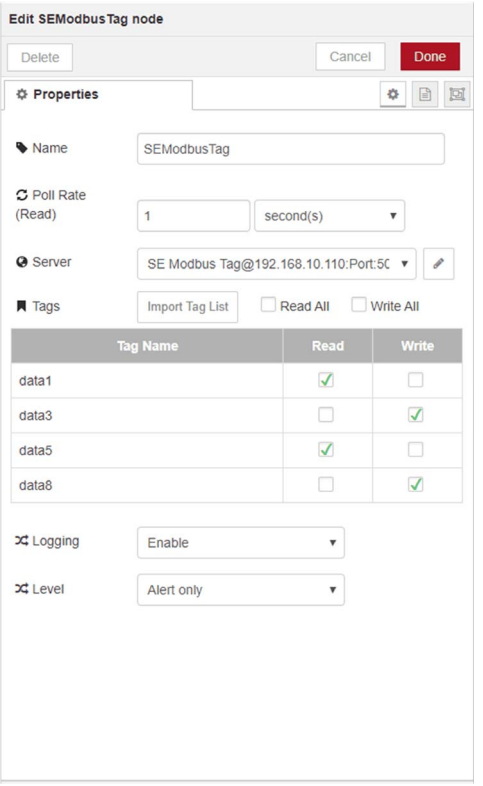
Parameters	Description
Timeout (ms)	When the idle Timeout is set, if there is no communication to the device for the specified period of time (in seconds), the connection will be closed. By default, the delay time is 10000 ms.
Reconnect-Timeout (ms)	Set the reconnect time out for reconnecting the node. By default, the reconnect time is 2000 ms.
Queue commands	Select the required option from the drop-down list: • **Enable**: This option stores incoming commands and sends them with delay. • **Disable**: This option turns off the queuing of commands. By default, the Queue commands is **Enable**.
Queue delay (ms)	Set the time interval to delay sending the commands from queue. By default, the queue delay is 100 ms.

Configure Tags

Configuration for **Tags** connection:

Step	Action
1	Click on the **Tags** field. **Result**: **Properties** window appears.
2	Click **Browse** tab. 

Step	Action
3	Select the supported input data file and click **Open**. **NOTE:** You can use XML, XSY and CSV format files for input.  **Result**: Input data appears under tags section as parameters.
4	Click **Back**. 

Step	Action
5	Select the data that you want to **Read** or **Write** in respective columns. 
6	Click **Done** and **Deploy**  to configure the node.

Part IV
Usage of SE Modbus Nodes

What Is in This Part?

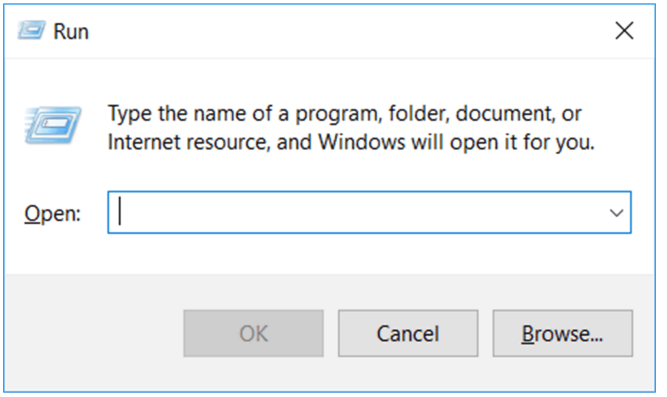
This part contains the following chapters:

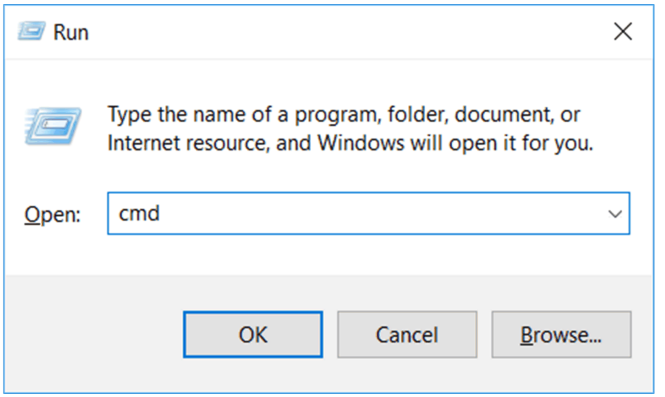
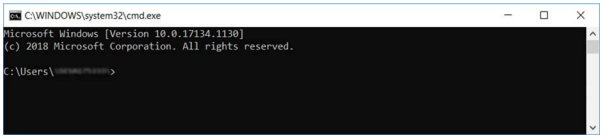
Chapter 6
Launching of SE Modbus Nodes

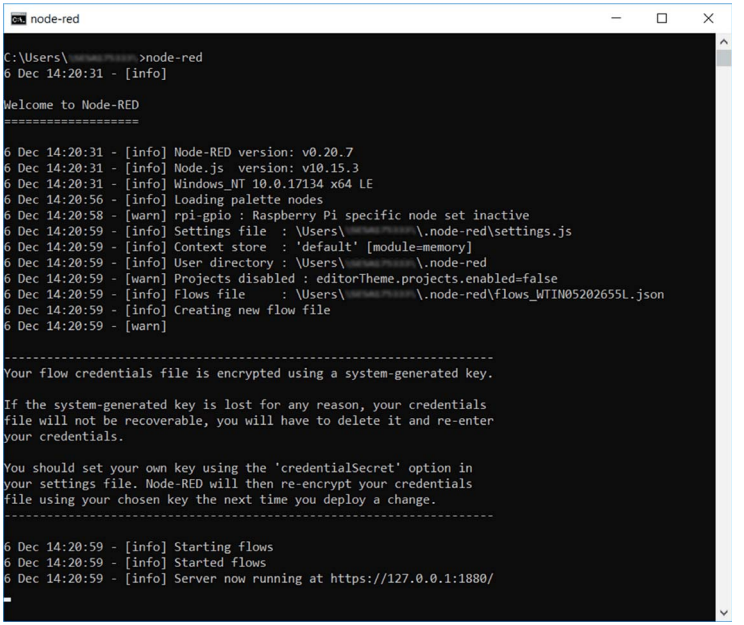
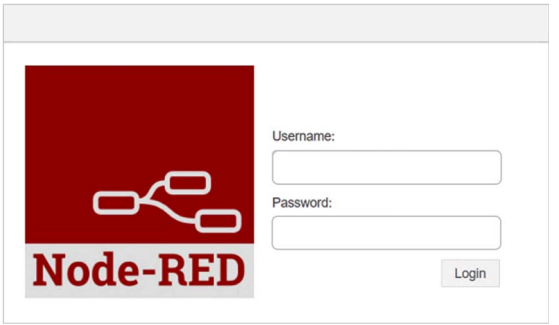
Launching Node-RED Server and SE Modbus Nodes

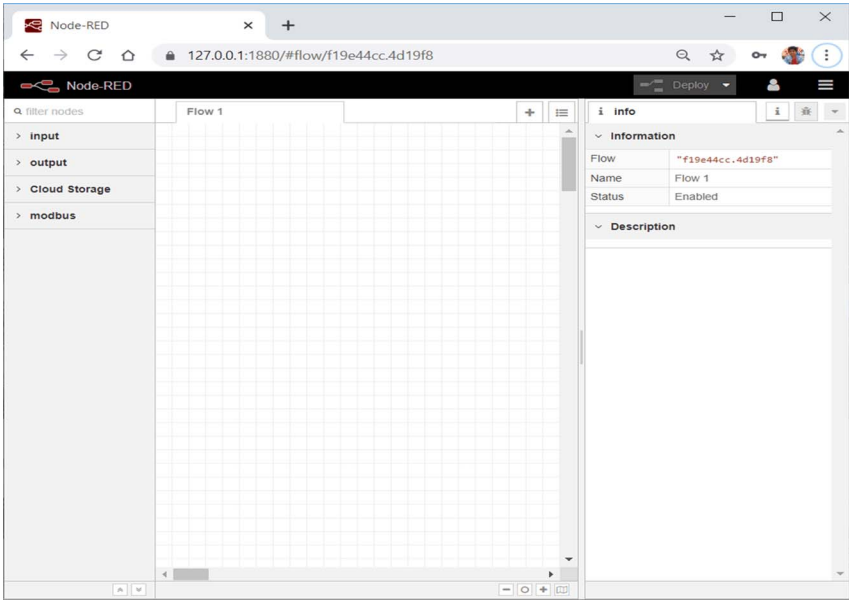
Node-RED

After Node-RED and SE Modbus nodes are installed, launch Node-RED server.

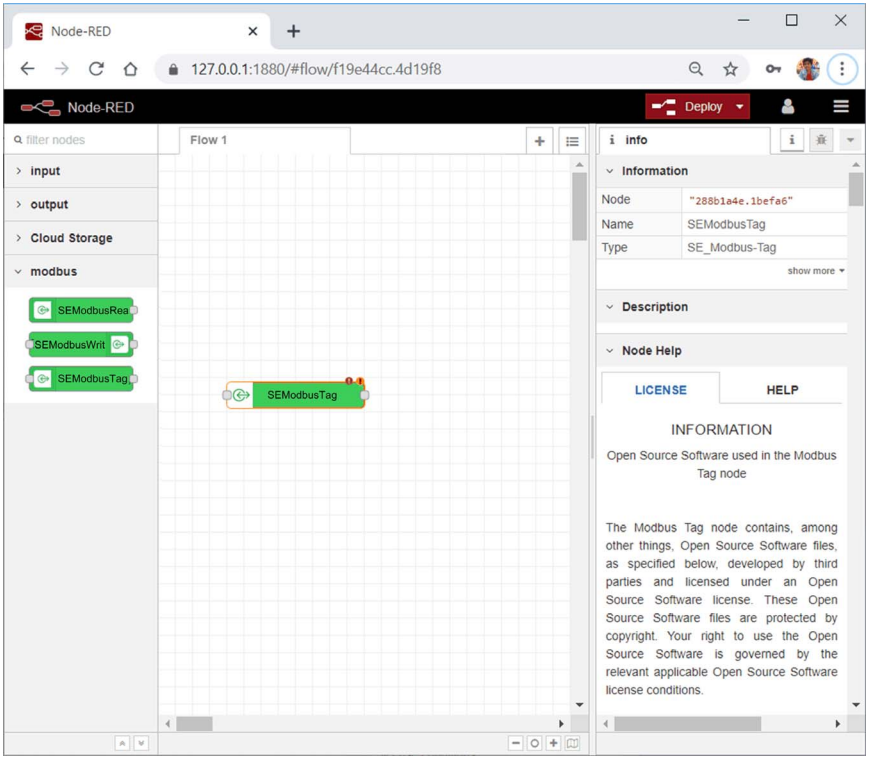
Step	Action
1	Click  and type **Run** in the search bar and press **Enter** 

Step	Action
2	Type the `cmd` in the **Run** dialog box and press **Enter**.  **Result**: Command prompt window appears.
3	Type *`node-red`* in the command prompt. and press **Enter** 

Step	Action
4	Node-RED server now running at *https://127.0.0.1:1880/*. 
5	Copy the **URL** in which Node-RED server is running (*https://127.0.0.1:1880/*)
6	Open the link in a supported browser. **Result**: **Login** page appears.
7	Type the **Username** and **Password** in respective fields and press **Login**.  **Result**: Node-RED page appears.

Step	Action
8	

SE Modbus Nodes

Step	Action
1	In Node-RED window, use the scroll bar to find SE Modbus nodes on the left side. **NOTE:** Alternatively, you can also search from the **Filter Nodes** search option available at the left side node palette area.  **Result**: In **modbus** category, SE Modbus nodes are available. **NOTE:** SE Modbus nodes license information is available in the **LICENSE** tab. Help manual for respective nodes are available in the **HELP** tab (right next to **LICENSE** tab).
2	Drag-and-drop required SE Modbus node on a flow page.

Chapter 7
SE Modbus Nodes Usage

What Is in This Chapter?

This chapter contains the following topics:

Usage of SE Modbus Nodes

Overview

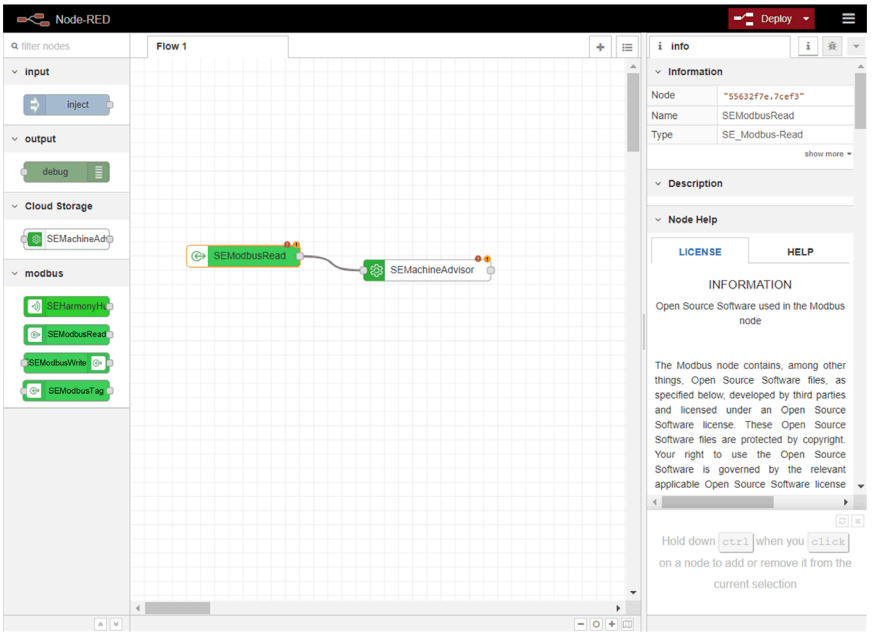
This chapter describes the usage of all SE Modbus nodes:

- SE Modbus Read node *(see page 134)*
- SE Modbus Write node *(see page 135)*
- SE Modbus Tag node *(see page 137)*

Usage of SE Modbus Read node

The user needs to connect to a modbus device, to collect the data to be read and send it to any publishing nodes (for example, SE Machine Advisor node).

The procedure for the use of SE Modbus Read node is given below:

Step	Action
1	Launch Node-RED server *(see page 127)*.
2	Launch SE Modbus Read node *(see page 131)* and SE Machine Advisor.
3	Connect the two nodes by joining the output of SE Modbus Read and input of SE Machine Advisor as shown below: 

Step	Action
4	Double-click SE Modbus Read node. **Result**: **Edit SEModbusRead node** opens.
5	Configure SE Modbus Read node *(see page 94)*. **Result**: SE Modbus Read reads the data from device and sends as an input to SE Machine Advisor node.
6	Double-click SE Machine Advisor node. **Result**: **Edit SEMachineAdvisor node** opens.
7	Configure SE Machine Advisor node.
8	Click **Done** and **Deploy**  to save the changes. **Result**: Nodes status changes to **Connected**. **Result**: The data is fetched at a frequency specified in the **Poll Rate** of SE Modbus Read. At the same frequency, data in the CMS format is sent as an input to SE Machine Advisor to push it to EcoStruxure Machine Advisor cloud.

Usage of SE Modbus Write node

The user needs an inject node to provide input data to the SE Modbus Write node. This enables the user to write the data into any modbus device configured. The user may need a debug node to view the node output.

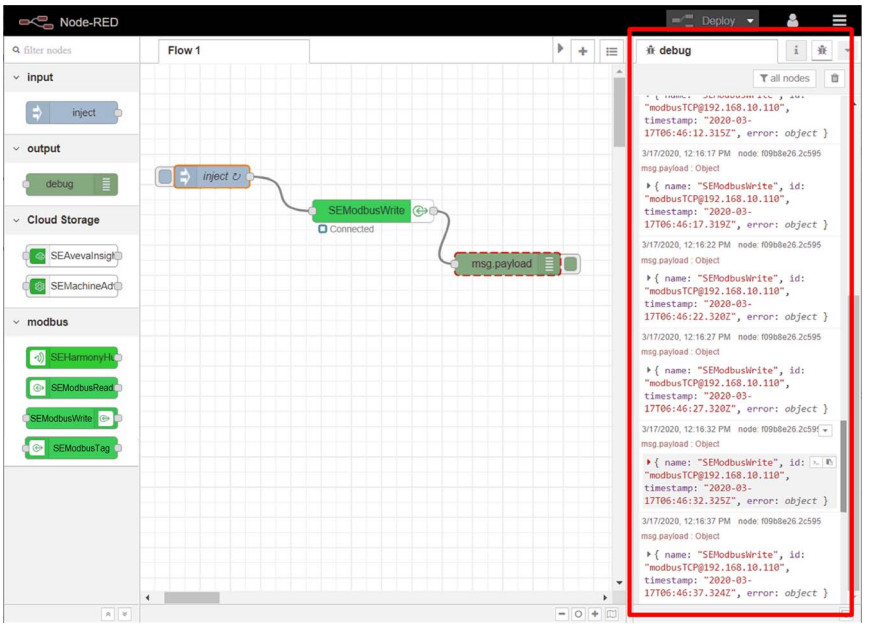
The procedure for SE Modbus Write node usage is given below:

Step	Action
1	Launch Node-RED server *(see page 127)*.
2	Drag and drop the inject and debug nodes from the palette.
3	Launch SE Modbus Write node *(see page 131)*.
4	Connect all the nodes in the flow.
5	Double-click inject node. **Result**: **Edit inject node** opens.

Step	Action

6	**Configuring the Inject Node**
	
	Select payload as JSON from the drop down and click .
	Example of payloads injected from the Inject node:
	Default payload (payload type - number)
	A number in case of single write register.
	`28`
	Input payload (payload type - JSON)
	A number array in case of multiple write registers.
	`[28, 48]`
	Click **Done**.
	Select the required option from the drop down to set the poll rate and click **Done**:
	● none
	● interval
	● interval between times
	● at a specific time

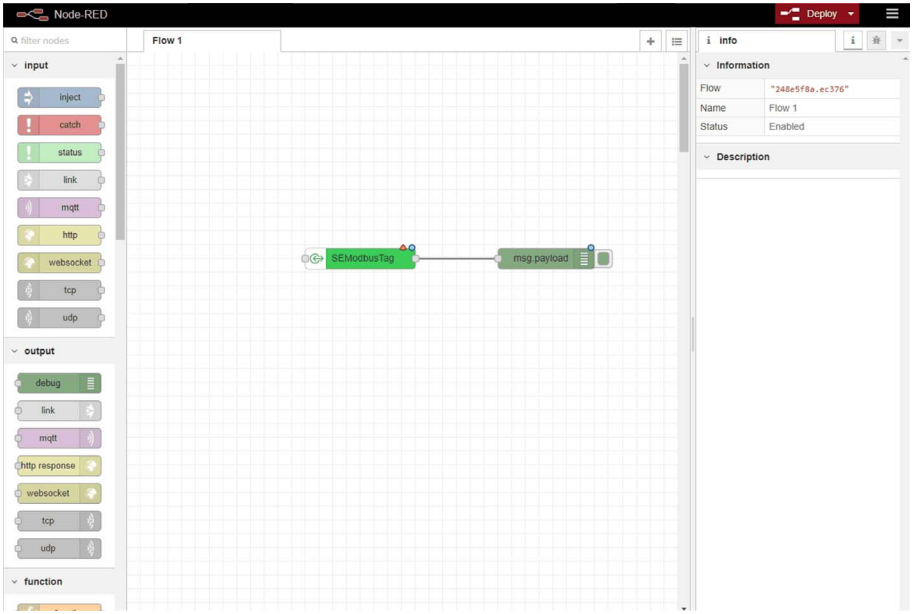
7	Double-click SE Modbus Write node. **Result**: **Edit SEModbusWrite node** opens.
8	Configure SE Modbus Write node *(see page 104)*.

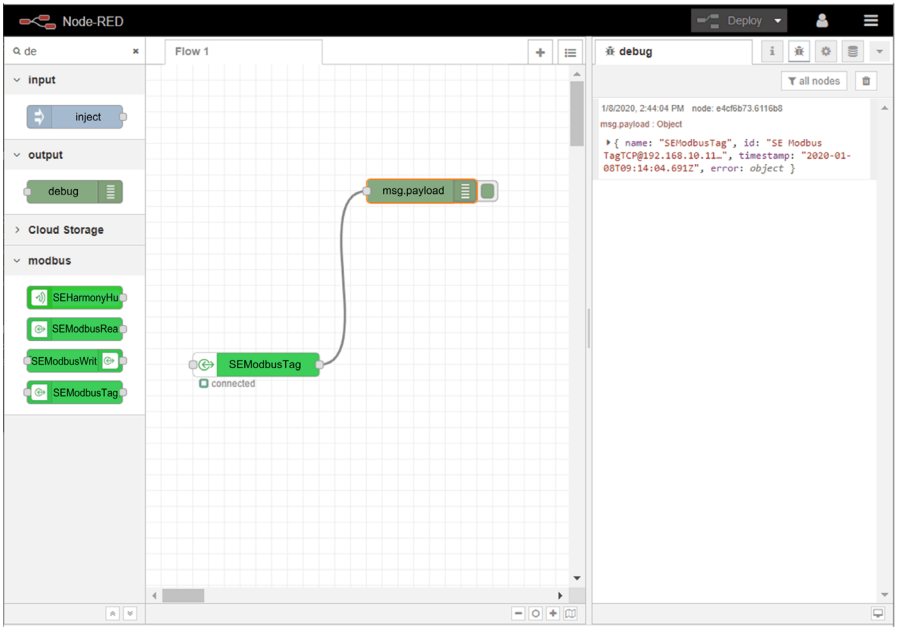
Step	Action
9	Click **Done** and **Deploy**  to save the changes.  **Result**: Node status changes to **Connected**. **Result**: The data obtained from the inject node will be written to the modbus device whenever the user clicks on the debug node (cyclical operations can be performed on the basis of the inject poll rate). `▸{name: "SEModbusWrite", id: "modbusTCP@192.168.10.110", timestamp: "2020-03-17T06:46:32.325Z", error: object}`

Usage of SE Modbus Tag Node

The procedure for the use of SE Modbus Tag node is given below:

Step	Action
1	Launch Node-RED server and SE Modbus Tag node *(see page 127)*.

Step	Action
2	Connect the two nodes by joining the output of SE Modbus Tag to input of debug node as shown below: 
3	Double-click SE Modbus Tag node. **Result**: **Edit SEModbusTag node** opens.
4	Configure SE Modbus Tag node *(see page 115)*.
5	Import tags from the input file uploaded (XML or XSY or CSV file format), select relevant tags and perform read or write operation *(see page 121)*.
6	Click **Done** and **Deploy**  to save the changes. **Result**: The status of SE Modbus Tag node is changed to **connected**.

Step	Action
7	Click **Debug** tab to check the output data of SE Modbus Tag node. 

Common Message Structure (CMS)

A Node-RED flow works by passing messages between nodes. All messages are confirmed in a common message format to simplify the navigation of the message content. The messages are simple JavaScript objects that can have any set of properties.

To avoid any intermediate function nodes, CMS is standard JSON format between a connecting node and a publishing node. JSON is a standard way for representing a JavaScript object as a string. It is commonly used by web APIs to return data.

The following graphic shows the CMS structure:

Field	Description
Name	Name of the node.
Id	Unique Identifier of the device.
Timestamp	The exact time at which the read or write operation is performed by the node.

Field	Description
Devices	Applicable for Harmony Hub sensor. All nested objects consists of one or many Device objects.
Data	Object at root level and as a composite inside devices object. It contains at least one property object.
Error	Detected error at the root level, not tied to any parameter. ● Scenario 1: Gateway disconnected. ● Scenario 2: Gateway timed out. ● Scenario 3: Modbus port not opened. ● Scenario 4: Gateway connected. Read Error encountered.
Property	If data object exists, then atleast one property (value) is mandatory. This mapped to the parameter details. It contains Error, Value, Unit, Type.
Error	Local detected error pertaining to the parameter. ● Scenario 1: No Radio (at a sensor level) ● Scenario 2: Parameter Read Error encountered. (for example: FF, FFFF, FFFFFFFF) ❍ Value: When mandatory, always in case of success. When optional, in case of detected error. ❍ Unit - optional field ❍ Type - optional field

The following graphics are an example of CMS data:

Example: One device connected directly through SE Modbus Tag node output:


```
{
    "name": "SEModbusTag",
    "id": "modbusTCP@127.0.0.1",
    "timestamp": "2020-03-23T06:33:45.231Z",
    "data": {
        "T_Ebool": {
            "value": false,
            "type": "EBOOL",
            "unit": ""
        },
        "T_Real": {
            "value": 0,
            "type": "REAL",
            "unit": "F"
        }
    }
}
```

Part V
IIoT and Cybersecurity

Chapter 8
IIoT and Cybersecurity

Cybersecurity

Overview

Because of the IIoT design, industrial and control systems are increasingly vulnerable to cyber-attacks for the following reasons:

- Magelis Edge Box and Magelis iPC are commercially available in the market.
- Publishing nodes can be remotely accessible.
- IIoT designs are a strategic location in the industrial processes that is of interest to hackers.

To secure the industrial installation, the following fundamental characteristics should be considered:

- Availability of the system to help ensure that the system remains operational
- Integrity of the data to maintain the integrity of information
- Confidentiality to avoid information disclosure

General Practices

To keep the system as secured as possible, secure the environment where the Box is installed.

Unauthorized persons may gain access to the Magelis iPC and Magelis Edge Box as well as to other devices on the network/fieldbus of the machine and connected networks via insufficiently secure access to the software and networks.

Before creating user login details, cross-check again if it is necessary to give access to others. Users may have one of two permissions (*-full access/read-only access). Admin login and password details must be secured.

To avoid unauthorized access to the Magelis iPC and Magelis Edge Box, you must have the:

- Operating system, libraries, runtime environments, etc. are installed and correctly configured.
- Patch management controls to ensure that all software is kept up-to-date.
- Configuration change management controls.
- Malicious code detection and prevention controls, for example:
  - Anti-virus signature and pattern updates are applied in a timely fashion.
  - Application whitelisting.
- Access control and permission management.
- Backup and restore functionality.
- Area where the Box is placed must be physically protected to keep the device as safe as possible.

- Authentication and authorization enabled for Node-RED environment.
- SSL enabled to secure Node-RED in Windows platform *(see page 48)*. By default, SSL is enabled to secure Node-RED in the HMIBSC boxes.

Cybersecurity Certification

Schneider Electric developed cybersecurity guidelines based on the following recommendations:

- ISA Secure.