OPC UA

OPC Specification

Open Process Connectivity (OPC) is a technology standard used to exchange information between hardware and software through specialized drivers. Information is exchanged between items such as programmable logic controllers (PLCs), gauges, and databases. OPC is published and maintained by the OPC Foundation, an organization comprised of hundreds of member companies that strives to ensure interoperability on the plant floor and beyond.

The original OPC specifications used Microsoft Distributed Component Object Model (DCOM) technology to provide a uniform way for industrial applications to share data. There were several separate specifications that provided functions such as Data Access (OPC-DA), Alarms and Events (A&E), and Historical data (HDA).

DCOM always proved difficult to work with, and by 2004 it was clear that a more modern solution was needed. Therefore, a new specification was developed that used common networking principles (like TCP/IP) instead of DCOM, was platform independent, and combined the various separate specifications into one: Open Process Connectivity Unified Architecture (OPC UA).

On this page ...

OPC UA

OPC UA is the leading industrial standard for platform and vendor-neutral data access. Connecting any PLC device to Ignition is easy with OPC UA. Device connections are done over the Ethernet for those devices that have an Ignition device driver. The OPC UA Module makes Ignition act as an OPC UA server, serving data collected by its built in drivers to other Ignition modules, as well as to third-party OPC UA clients.

OPC UA is the latest revision of the OPC specification, which offers platform and vendor neutral transfer and use of industrial data. The specification plays a crucial role in Ignition, and is the primary data access specification used in the Gateway. Ignition supports connections to any number of OPC UA servers created by any manufacturer, provided that they are compliant to the specification. The data is then used to drive all aspects of the system. Creating connections to OPC UA servers is described below in Connecting with OPC UA.

Distributed Systems with OPC UA

OPC UA breaks down boundaries and enables free data flow. Using standard TCP/IP instead of legacy DCOM, OPC UA makes it easy to securely transfer data between networks and though firewalls. All OPC UA connections are based on the same technology, which means that a connection to your local machine is not entirely different than a connection to a machine that's far away. This enables the creation of a highly distributed system, and in combination with other features of Ignition can lead to more connected enterprises.

For example, imagine a corporate network with an office in the center, and remote processes connected through a VPN, which would pass through a variety of connections. Each remote site could have an Ignition installation running only an OPC UA module that would report data back to a central facility and record it in a database. The overall system cost would be very low. The data could be managed centrally in a single location, and then made available to all interested parties through the Vision module or any application that could access the database.

Servers and Clients

When discussing OPC (as the specifications are often called collectively), it is common to hear about OPC **servers** and OPC **clients**. An OPC server is a piece of software that implements the OPC interface and provides data. An OPC client is an application which connects to an OPC server and uses the specification to retrieve and work with data.

The Ignition platform inherently offers OPC UA client functionality. Even with no modules installed, the Gateway can connect to any compliant OPC UA server and work with data. With the addition of the OPC UA module, Ignition becomes an OPC server as well, hosting device drivers that read and publish data.

The OPC COM module is available to provide client access to older, DCOM based, OPC-DA servers.

Technology

The OPC UA specification offers a wide range of flexibility in choosing technologies, from the transport mechanism, to the way data is encoded, to the encryption used to secure the data. Ignition supports the UA/TCP transport with the UA/Binary encoding scheme for maximum performance.

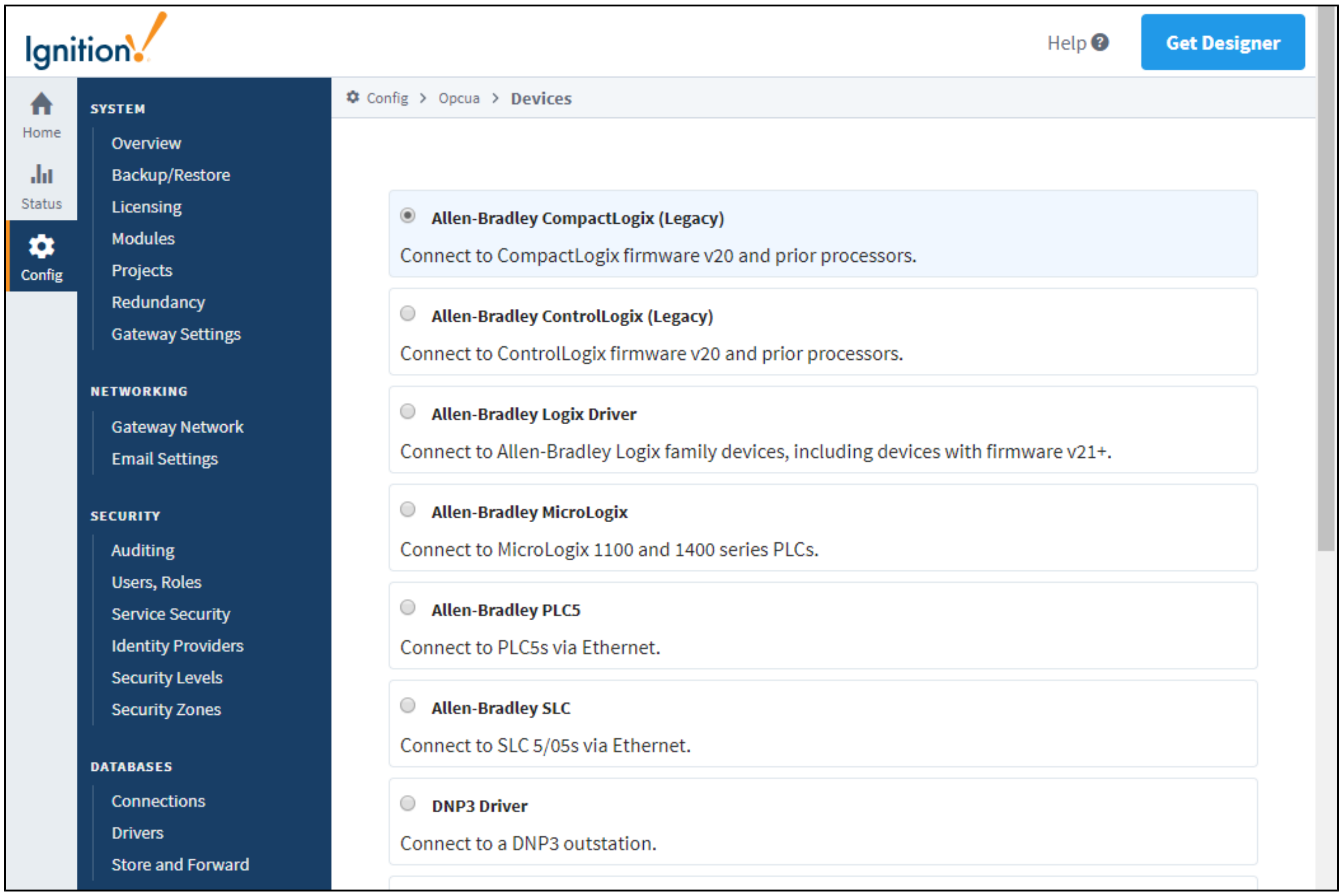
Additionally, Ignition supports all of the common encryption schemes. This means that Ignition connects to OPC UA servers (and allows connections from clients) over TCP/IP using encryption, and sends data by first encoding it into an efficient format defined by the OPC UA specification. This is in contrast to other schemes outlined in the specification, which can use web services and XML encoding that are not as efficient.

Connecting with OPC UA

Connecting to a Device

With the Ignition OPC UA module and and device drivers installed, connecting to a device is simple. To quickly get connected to one of your devices, go to the **Config** tab of the Ignition Gateway and scroll down to **OPC UA > Device Connections**. The Device page will appear showing all of your installed devices.

To add a new device, click on **Create New Device...**. Ignition has several device drivers available, and the Device Type list is populated based on what Driver modules you have installed. Select the type of device connection you want and fill in the details for you device connection. See the device types below for more information on connecting to your specific device type:



[✓ **Allen-Bradley CompactLogix (Legacy)**]
Connect to CompactLogix firmware v20 and prior processors.

Allen-Bradley ControlLogix (Legacy)
Connect to ControlLogix firmware v20 and prior processors.

Allen-Bradley Logix Driver
Connect to Allen-Bradley Logix family devices, including devices with firmware v21+.

Allen-Bradley MicroLogix
Connect to MicroLogix 1100 and 1400 series PLCs.

Allen-Bradley PLC5
Connect to PLC5s via Ethernet.

Allen-Bradley SLC
Connect to SLC 5/05s via Ethernet.

DNP3 Driver
Connect to a DNP3 outstation.

Connecting to a Server

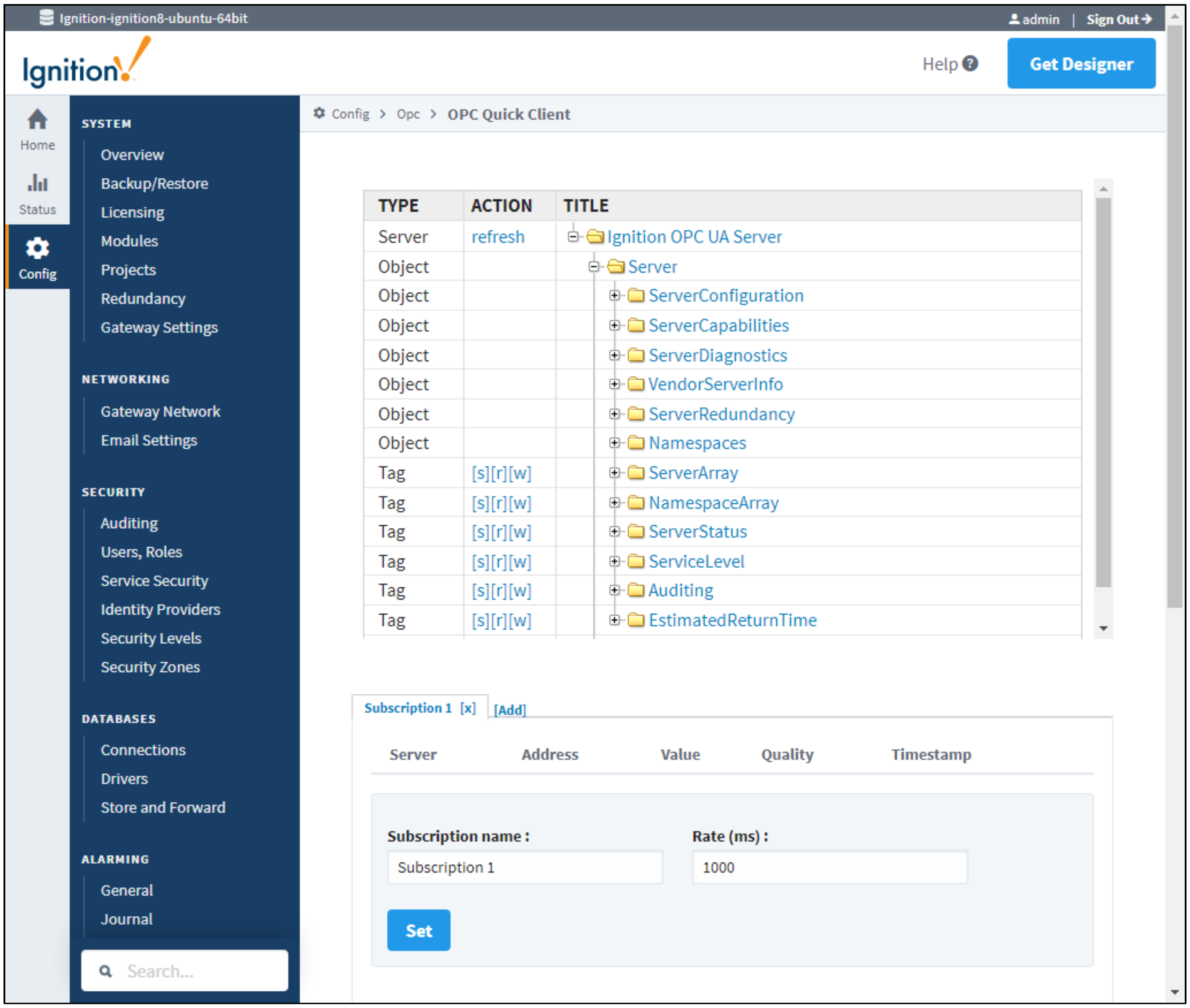
If you don't see the type of device you want, then you can always connect with another OPC UA or OPC DA server.

- Third Party OPC Servers
- OPC COM

OPC Quick Client

After you connect to a device, you can access the **OPC Quick Client** page on the Gateway by following **Config** > **OPC Client** > **OPC Quick Client**. It allows for quick, simple testing of any devices connected to the server. You can browse the OPC UA Server by expanding the tree nodes, and read from or write to OPC tags by clicking on the **[r]** and **[w]** links next to the tags.

Clicking on the **[s]** link will create a subscription and show live value changes in the Subscriptions area at the bottom of the screen. Use the **Set** button to confirm any changes made in the **Subscription name** and **Rate (ms)** fields.



TYPE	ACTION	TITLE
Server	refresh	Ignition OPC UA Server
Object		Server
Object		ServerConfiguration
Object		ServerCapabilities
Object		ServerDiagnostics
Object		VendorServerInfo
Object		ServerRedundancy
Object		Namespaces
Tag	[s][r][w]	ServerArray
Tag	[s][r][w]	NamespaceArray
Tag	[s][r][w]	ServerStatus
Tag	[s][r][w]	ServiceLevel
Tag	[s][r][w]	Auditing
Tag	[s][r][w]	EstimatedReturnTime

Subscription name :	Rate (ms) :
Subscription 1	1000

How Do I Get Data from My PLC?

Getting data from your PLC into Ignition is a two step process:

1. Add a device, see OPC UA#Connecting to a Device.
2. Add some tags, see Creating Tags.

It requires you to touch both the Ignition Gateway and the Ignition Designer. There are also some limitations as to what kind of devices you can connect to Ignition and these are explained throughout the user manual, however, included below is an overview of what you can expect when it comes to compatibility.

Brief Summary of Device Connection in Ignition

- Ignition can only connect directly to devices over Ethernet.
- Ignition can only connect directly to devices for which there is an Ignition device driver. Visit the OPC UA Drivers page for an overview of supported devices and drivers.
- Ignition can connect to third party OPC servers via OPC UA or OPC-DA (using the OPC-COM module) for devices that do not have a supported driver.

Adding a Device to Ignition

Ignition Supported OPC UA Device

Most commonly you will be adding a device that is supported by one of the built-in device drivers. The first step is connecting your device to Ignition. This is done through the Ignition Gateway Config tab under the OPC UA > Device Connections page.

1. **Click Create new Device...**
2. Select the driver for the device you wish to add. Click **Next**.
3. When adding a device you will notice that there are some common settings that are shared by all devices. You can find an explanation of these settings on the individual page for each OPC UA Driver.
4. Specify any of the required device specific settings for the device (for example, hostname, etc.)
5. Check the status of your device to see if it is connected.

As long as all the device information you entered was correct you should see your device in a connected state. The only exception to this is if you chose to add a Siemens or Modbus device. Since these devices don't support the browsing of Tags, you will have to create and address some Tags in the Ignition Designer before the device will stop cycling from a connected to disconnected state.

If you need to address your Tags for your Siemens or Modbus device, you'll want to read about adding Tags in the Ignition Designer as well as how addressing works for the different protocols. You will have to first add a Tag in the Ignition Designer and then edit the OPC Item Path of the Tag using the appropriate addressing scheme.

Adding Connection to Third Party OPC Server Via OPC UA

If your device does not have an Ignition driver, you can use a third party OPC server to connect to your device and then have Ignition connect to the server as a client. If the OPC server offers support for OPC UA, you can add a new OPC UA server connection in the Ignition Gateway. For more information, see the OPC UA Client Connection Settings page. Additionally, the Connecting to Kepware OPC UA is useful when connecting to Kepserver.

Adding Connection to Third Party OPC Server Via OPC COM

When attempting to connect Ignition to an OPC COM server, the OPC COM module must be installed. More information about configuring OPC COM connections can be found on the OPC COM page.

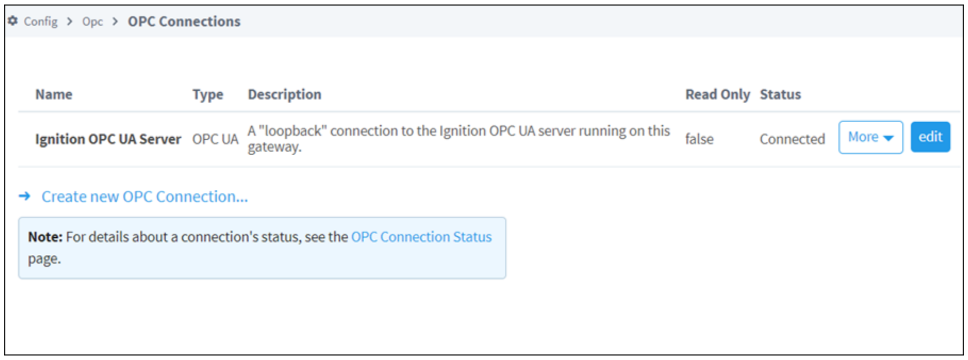
OPC UA Client Connection Settings

Configuring an OPC Client Connection

An OPC UA connection is used to communicate with an OPC UA compliant server, such as the one the OPC UA Module provides.
The following steps walk through connecting Ignition (as an OPC UA client) to a OPC UA server.

On this page ...

1. On the Config tab of the Gateway Webpage, go to **OPC Client > OPC Connections**. The OPC Server Connections page is displayed.
2. Click on the **Create new OPC Connection**.



Config > Opc > OPC Connections

Name	Type	Description	Read Only	Status
Ignition OPC UA Server	OPC UA	A "loopback" connection to the Ignition OPC UA server running on this gateway.	false	Connected

Note: For details about a connection's status, see the OPC Connection Status page.

3. Select **OPC UA** from the list and click **Next**. The Server Discovery page appears.
4. Enter an OPC UA endpoint URL for the OPC UA server Ignition should connect to. The format should be as follows:

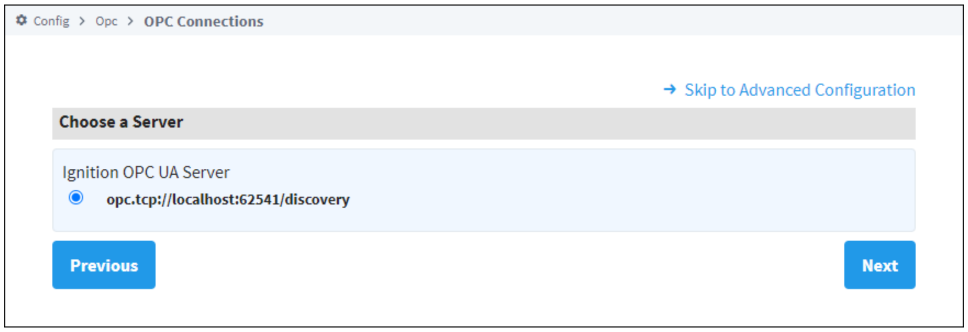
```
opc.tcp://IpAddress:Port
```

Instead of an IP address, a host name can be used:

```
opc.tcp://myServer:12345
```

Note: An Advanced Configuration link was added to this flow, allowing you to manually configure connection settings. This is useful in cases where a server doesn't allow anonymous endpoint access, but provides separate discovery endpoints.

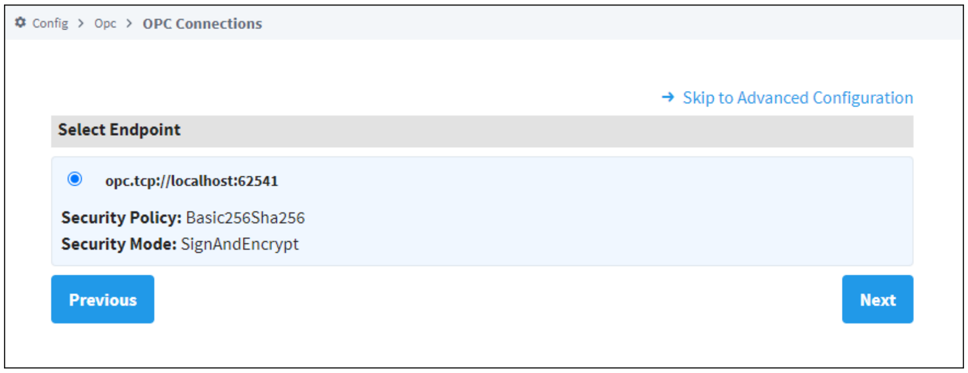
5. Click **Next**.
6. Choose a server, then click **Next**.



Config > Opc > OPC Connections

Ignition OPC UA Server
● opc.tcp://localhost:62541/discovery

7. Choose an endpoint, then click **Next**.

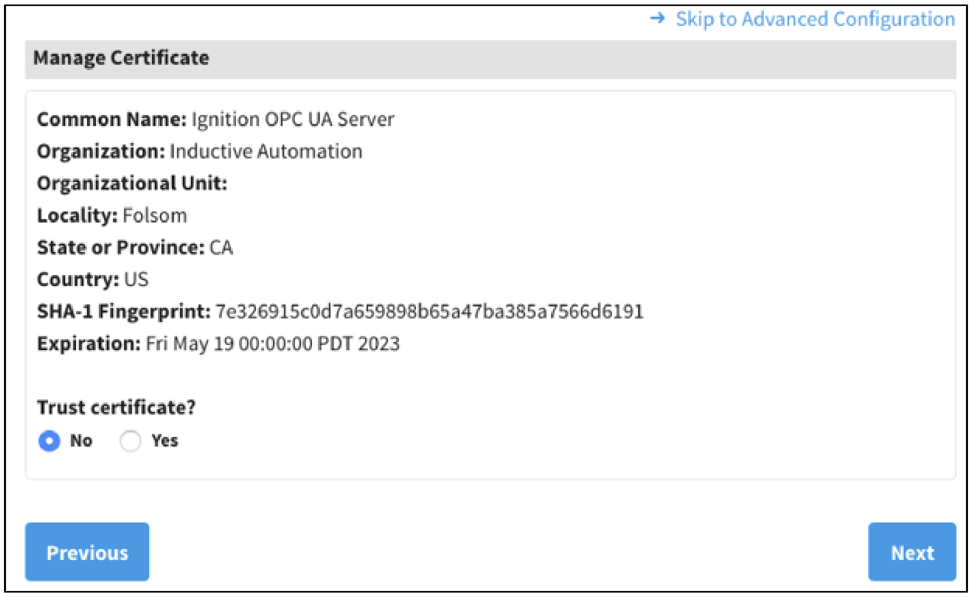

Config > Opc > OPC Connections
→ Skip to Advanced Configuration
Previous
Next

Select Endpoint

[✓ opc.tcp://localhost:62541]

Security Policy: Basic256Sha256
Security Mode: SignAndEncrypt

8. A Manage Certificate window will open if you haven't previously trusted a certificate. If the certificate that the Endpoint sends you to is already in Ignition's trust store, this step is skipped. Trust the Certificate and click **Next**.

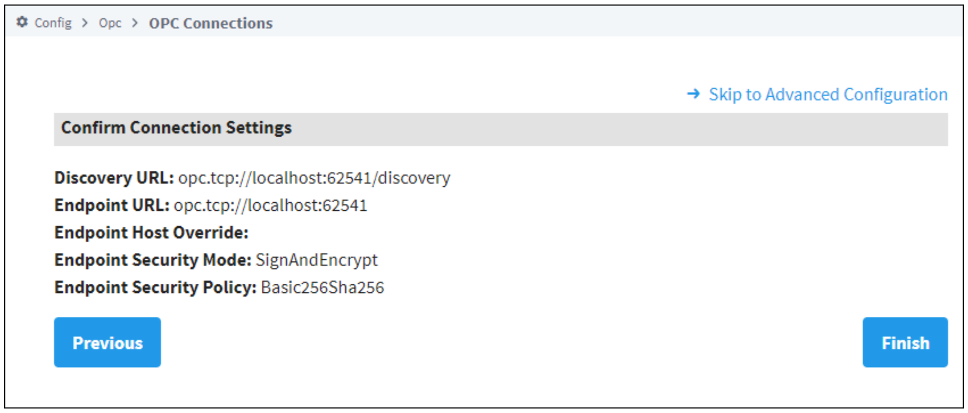


Manage Certificate

Common Name: Ignition OPC UA Server
Organization: Inductive Automation
Organizational Unit:
Locality: Folsom
State or Province: CA
Country: US
SHA-1 Fingerprint: 7e326915c0d7a659898b65a47ba385a7566d6191
Expiration: Fri May 19 00:00:00 PDT 2023

Trust certificate?
[✓ No] Yes

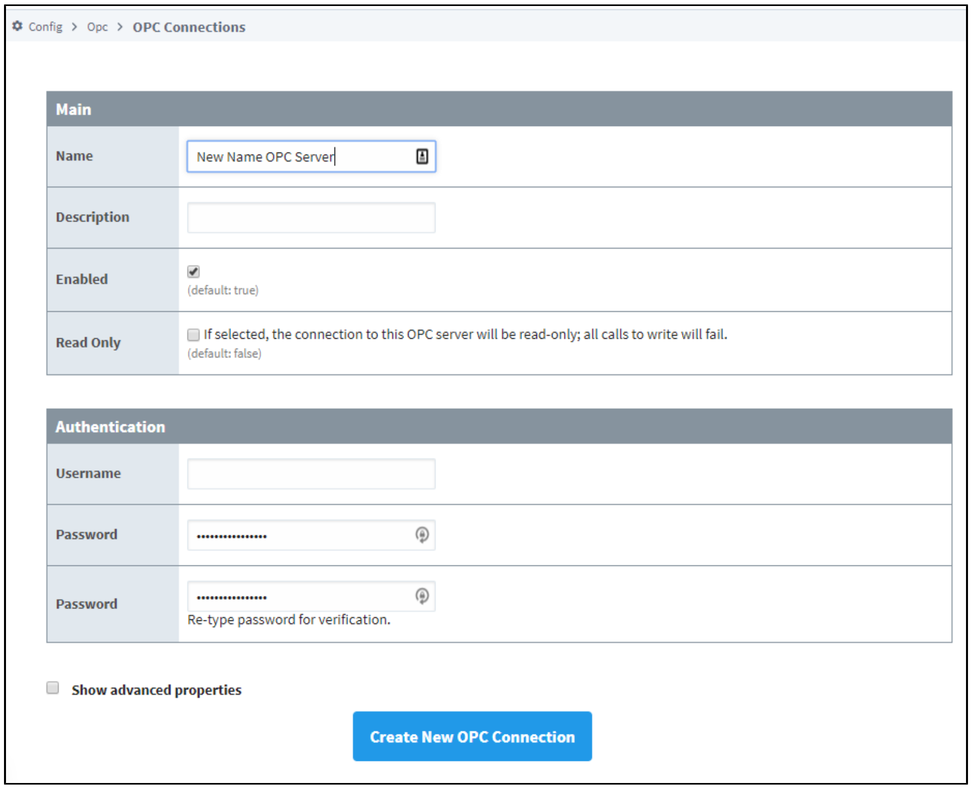
9. If you entered a discovery URL in step 4, you also have an option to enter another URL if the host is unreachable.
10. Select a Security Policy and Message Security configuration to use when connecting to the endpoint, then click **Finish**. The policies that appear here are determined by the server.
11. A confirmation page is displayed. Click **Finish**.


Config > Opc > OPC Connections
→ Skip to Advanced Configuration
Previous
Finish

Confirm Connection Settings

Discovery URL: opc.tcp://localhost:62541/discovery
Endpoint URL: opc.tcp://localhost:62541
Endpoint Host Override:
Endpoint Security Mode: SignAndEncrypt
Endpoint Security Policy: Basic256Sha256

12. On the **New OPC UA Connection Settings** page, give the connection a name. Some OPC UA servers may require a username and password, but this is not always the case. Check with the OPC UA server's documentation for more details. Credentials for Ignition's OPC UA server can be found on the Ignition's OPC UA Server page.


Config > Opc > OPC Connections

Main

Name	New Name OPC Server
Description	
Enabled	✓ (default: true)
Read Only	If selected, the connection to this OPC server will be read-only; all calls to write will fail. (default: false)

Authentication

Username	
Password	••••••••••••••••
Password	•••••••••••••••• Re-type password for verification.

Show advanced properties

13. Once credentials have been entered, click the **Create New OPC Connection** button.

Ignition is now connected to the OPC UA server.

OPC UA Client Connection Settings

The following table describes all the available properties.

Main	
Name	A name used to identify this connection.
Description	Short description of this connection.
Enabled	Disable the connection to the OPC server.
Read-only	Puts the connection into read-only mode. All writes sent to this server will fail.
Authentication	
Username	A username the connection will use when authenticating with the UA server.
Password Fields	The password to use when authenticating with the UA server.
Advanced	
Host Override	When specified, if the endpoint address returned by the OPC server has a different IP address or hostname than the discovered endpoint, the overridden value will be used. Expects just an IP address or hostname, for example: 192.168.1.10
Connect Timeout	The timeout, in milliseconds, when opening a socket connection to a remote host. Default is 5,000.
Acknowledge Timeout	The timeout, in milliseconds, to wait for an Acknowledge message in response to the client's Hello message. Default is 5,000.

Request Timeout	Maximum amount of time, in milliseconds, to wait for the response to a request. Default is 60,000.
Session Tim eout	Requested session timeout value, in milliseconds. Default is 120,000.
Max Per Operation	Specify the maximum number of nodes to read, write, subscribe, or unsubscribe to in any given UA server request. Default is 8,192.
Max References Per Node	Configures the number of references per node. A "node" in this case is any item inside of a UA server, so items like tags and folders would qualify as a node, while a References is simply a reference to another node. This setting is useful in situations where the address space is completely flat, so a large number of adjacent nodes could potentially run into a maximum message size. In these cases increasing the value of this property can be useful. However, most systems will not need to change this setting. Defaults to 8,192 references.
Max Pending Publish Requests	The number of concurrent Publish Requests allowed to be pending at any given time. Default is 2.
Max Notifications Per Publish	The maximum number of notifications per publish. Default is 65,535.
Max Message Size	The maximum allowable size of an OPC UA application layer message. Default is 33,554,432.
Max Array Length	The maximum allowable size for arrays. Default is 2,147,483,647.
Max String Length	The maximum allowable size for strings. Default is 2,147,483,647.
Type Dictionary Fragment Size	The fragment size to request when reading the server's type dictionary. Default is 8,192.
Keep-Alive Failures Allowed	Number of consecutive failures allowed before disconnecting. Setting this to <= 0 means consecutive failures will not cause a disconnect. Default is 1.
Keep-Alive Interval	Interval, in milliseconds, between keep-alive requests.
Keep-Alive Timeout	Max duration, in milliseconds, to wait for a response to a keep-alive request. Default is 10,000.
Browser Origin	The Node that browsing should originate from. Options are OBJECTS_FOLDER or ROOT_FOLDER. Most OPC UA Servers use OBJECTS_FOLDER, but some non-standard servers may require ROOT_FOLDER to browse correctly. Ignition's OPC UA Servers uses OBJECTS_FOLDER.
Failover	
Failover Enabled	Enable failover on the connection, allowing the UA client to switch to a backup server in the event the primary server is unavailable.
Failover Threshold	The number of retry attempts before the failover connection is used. The default is 3.
Failover Discovery URL	The discovery URL for the backup server's OPC UA server. Expects the following format: `opc.tcp://hostname:port`
Failover Endpoint URL	The endpoint of the failover server. Example: `opc.tcp://192.168.1.0:62541`
Failover Host Override	When specified, if the endpoint address returned by the failover OPC server has a different IP address or hostname than the discovered endpoint, the overridden value will be used. Expects just an IP address or hostname. Example: 192.168.1.10

Security	
Certificate Validation Enabled	The following feature is new in Ignition version **8.1.0** Click here to check out the other new features Enables validation of server certificates. This is required by the OPC UA specification, but it may be disabled for troubleshooting or temporarily connecting to servers with invalid or untrusted certificates. Default is true. **Caution:** Disabling certificate validation compromises the security of the connection.
KeyStore Alias	The alias of the certificate and private key stored in the client KeyStore.
Password Fields	The password to use when authenticating with the UA server.

Failover Versus Backup Properties

The Failover properties should be used when a single Ignition Gateway needs to connect to a pair of redundant OPC UA servers. The failover OPC UA server will be used in the event the primary OPC server goes down. To enable failover, set the **Failover Enabled** property to true, and specify the **Failover Endpoint**. The **Failover Threshold** can be adjusted if desired.

Note: Failover events are "sticky." That means once control has moved to a backup OPC UA server, it stays there until that server fails.

Related Topics ...

- Ignition's OPC UA Server
- Tag Browser

Ignition's OPC UA Server

Ignition's OPC UA server, provided by the OPC UA module, allows an ignition installation to utilize Ignition's various device driver modules. In addition, with the module installed, OPC UA clients can connect to Ignition's UA server, exposing any connected devices to 3rd party systems.

Settings for the server can be found under the **Config** section of the Gateway Webpage. On the sidebar, locate **OPC UA > Server Settings**.

Default Credentials

Ignition's OPC UA server does not initially support anonymous access, but can be configured to do so (see the settings table below). Authenticated connection require the following credentials:

Username	opcuauser
Password	password

New installations of Ignition will automatically create the user above, allowing the Gateway to initially connect as a UA client to its own UA server.

Connecting with UA Discovery

Ignition's OPC UA server is initially, and intentionally, difficult to discover on new installations. To aid with discovery attempts, a separate unsecured endpoint is available, allowing UA clients a means of finding the server. When attempting to discover the server, the endpoint URL should include "/discovery" at the end:

```
opc.tcp://192.168.2.134:62541/discovery
```

OPC UA Server Settings

Note: Changes made to any of the following OPC UA Server settings requires a restart (of either the Gateway or the OPC UA module) before the changes will take effect.

The table below represents settings on Ignition's OPC UA server. They'll only become available if the OPC UA Module is installed on the Gateway.

Setting	Description	Default value
Endpoint Configuration		
Bind Port	The port the UA server will bind to.	`62,541`
Bind Addresses	The address the server will bind to. If you want to expose the OPC UA server to external sources, you need to use 0.0.0.0 or the IP address of the computer.	`localhost`

Endpoint Addresses	A comma separated list of endpoint addresses that the UA server can be reached at. It is important that this is set to addresses that can be reached by any UA clients attempting to connect to the server.
	
	When entering addresses into this property, they can be just an IP address or hostname:
	
	`10.10.10.100`
	
	Alternatively, angled brackets can be used. When applied to an address, the server attempts to find the hostname, or resolve the value to as many addresses or hostnames as it can find.
	
	`<10.10.10.100>`
		`<hostname>, <localhost>`

Security Policies	A comma separated list of acceptable security policies. Available policies are: • `None` • `Basic256Sha256` • `Aes128_Sha256_RsaOaep` • `Aes256_Sha256_RsaPss` In addition, the following deprecated policies are available, but not recommended: • `Basic128Rsa15 (deprecated)` • `Basic256 (deprecated)`	`Basic256Sha256`
Authentication		
Anonymous Access Allowed	Specifies if UA clients are allowed to connect to this server anonymously. While false, client connections are required to authenticate with the server.	`false`
User Source	Which user source contains the initial user for authenticated access. Credentials for the initial user can be found above.	Attempts to use the 'opcua-module' user sources
Advanced		
Expose Tag Providers	When enabled, Ignition Tag Providers will be exposed through the UA server, allowing third-party UA clients to access tags in the provider.	`false`
Max Session Count	The following feature is new in Ignition version **8.1.17** Click here to check out the other new features The maximum number of client connections to the UA server.	`100`
Redundancy		
Backup Bind Addresses	The local addresses that the UA server will attempt to bind to while the backup server in a redundant pair .	`localhost`
Backup Endpoint Addresses	The endpoint addresses that the UA server can be reached at while the server is configured as the backup in a redundant pair . The notation on this property is similar to the **Endpoint Addresses** property above, in that angled brackets can be used with each hostname and IP address.	`<hostname>, <localhost>`
Read-only When Inactive Node	When enabled, this server switches to a read-only state while its Gateway is the inactive node in a redundant pair.	`false`
Master Application URI	The following feature is new in Ignition version **8.1.10** Click here to check out the other new features Application URI that a redundant backup will advertise in its address space as belonging to the server on the redundant master. When enabling OPC UA redundancy, enter the master gateway's URI here. URIs will generally look like the following: `urn:inductiveautomation:ignition:opcua:server:########-####-####-####-############` **Note:** An OPC UA server's URI can be found by reading the **Ignition OPC UA Server > Server > ServerArray** tag. In addition, the URI is reported in the gateway's wrapper log file on startup.	*blank*

Backup Appli cation URI	The following feature is new in Ignition version **8.1.10** Click here to check out the other new features Application URI that a redundant master will advertise in its address space as belonging to the server on the redundant backup. When enabling OPC UA redundancy, enter the backup gateway's URI here.	*blank*

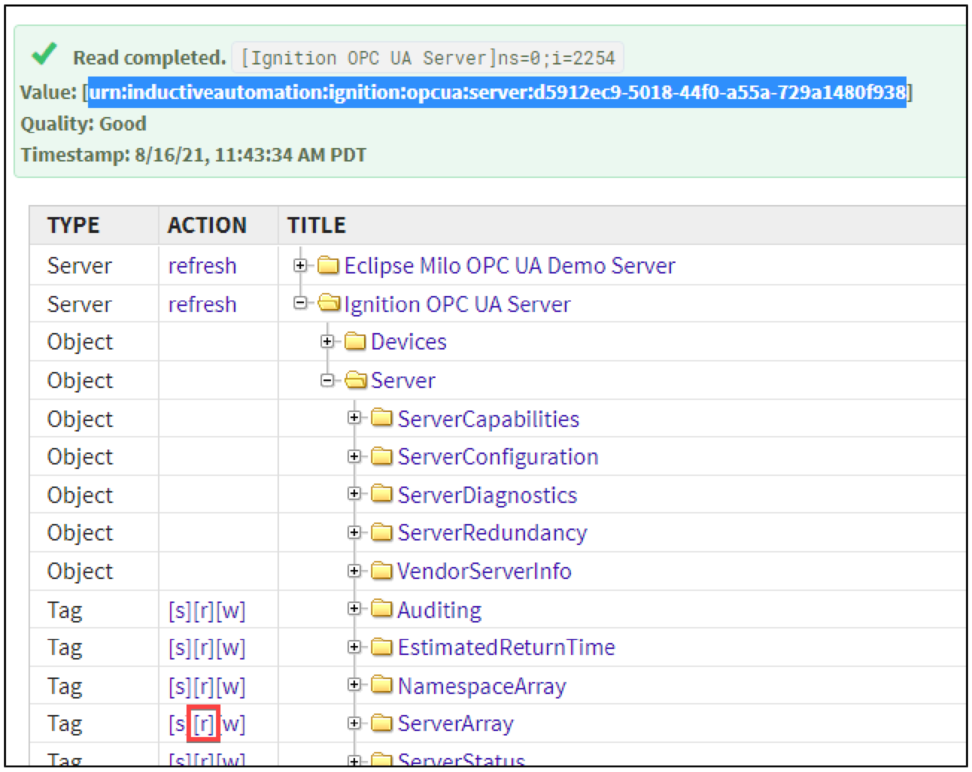
OPC UA Client Redundancy

The following feature is new in Ignition version **8.1.10**
Click here to check out the other new features

Ignition's OPC UA server supports non-transparent redundancy. This allows third-party OPC UA clients to connect to the active node in a pair of redundant gateways. If the master gateway goes down, then the OPC UA client would be able to switch to the backup gateway, following the active node as the system changes.

The steps below demonstrate how to configure OPC UA redundancy.

1. Start by having gateway redundancy configured between two Ignition Gateways.
2. Next we need to find URIs for the OPC UA servers on each node. These can be browsed from a quick client. On the Master gateway, navigate to **Config > OPC Client > OPC Quick Client**.
3. In the quick client, browse down to the **Ignition OPC UA Server > Server**.
4. We'll need to **read** (not subscribe) to the ServerArray. Press the **[r]** link next to **ServerArray**. This will make the server's URI appear in a panel above the tree. Copy the URI, but omit the square brackets.



Read completed. [Ignition OPC UA Server]ns=0;i=2254
Value: [urn:inductiveautomation:ignition:opcua:server:d5912ec9-5018-44f0-a55a-729a1480f938]
Quality: Good
Timestamp: 8/16/21, 11:43:34 AM PDT

TYPE	ACTION	TITLE
Server	refresh	Eclipse Milo OPC UA Demo Server
Server	refresh	Ignition OPC UA Server
Object		Devices
Object		Server
Object		ServerCapabilities
Object		ServerConfiguration
Object		ServerDiagnostics
Object		ServerRedundancy
Object		VendorServerInfo
Tag	[s][r][w]	Auditing
Tag	[s][r][w]	EstimatedReturnTime
Tag	[s][r][w]	NamespaceArray
Tag	[s][r][w]	ServerArray
Tag	[s][r][w]	ServerStatus

5. This is the master's URI. Temporarily store the URI, as we'll need to pass it into a setting later.
6. Next, switch over to the Backup gateway. Repeat steps 2-5 to obtain the backup gateway's URI.
7. With both URIs, switch back to the Master gateway.
8. Navigate to **Config > OPC UA > Server Settings**.
9. For the **Master Application URI setting**, enter the master's URI.
10. For the **Backup Application URI setting**, enter the backup's URI.
11. Press **Save Changes**.

From this point on, third-party OPC UA clients can connect to the active node's OPC UA server, and will fail over when the active node switches. While OPC UA redundancy is enabled, the Ignition **OPC UA Server > Server > ServiceLevel** tag can be used to denote which server is running as the master.

Service Level Value	Description
255	The OPC Server is on the master gateway, and the master is the active node. Note that this value is also used in cases where redundancy is not enabled.
254	The OPC Server is on the backup gateway, and the backup is the active node.
1	The OPC Server is the inactive node. Meaning the other node is currently active.

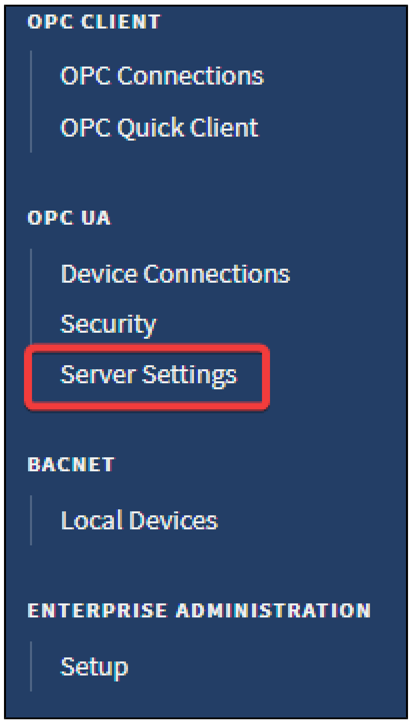
Note: It is possible for both nodes to be active, where the master shows a value of 255 and the backup simultaneously shows a value of 254. This generally happens in cases where the two nodes are unable to communicate with each other. For example, when a network disconnect occurs between the two gateways, or if the gateway network connection between the two is pending approval.

Troubleshooting a Faulted Connection to Ignition's OPC UA Server

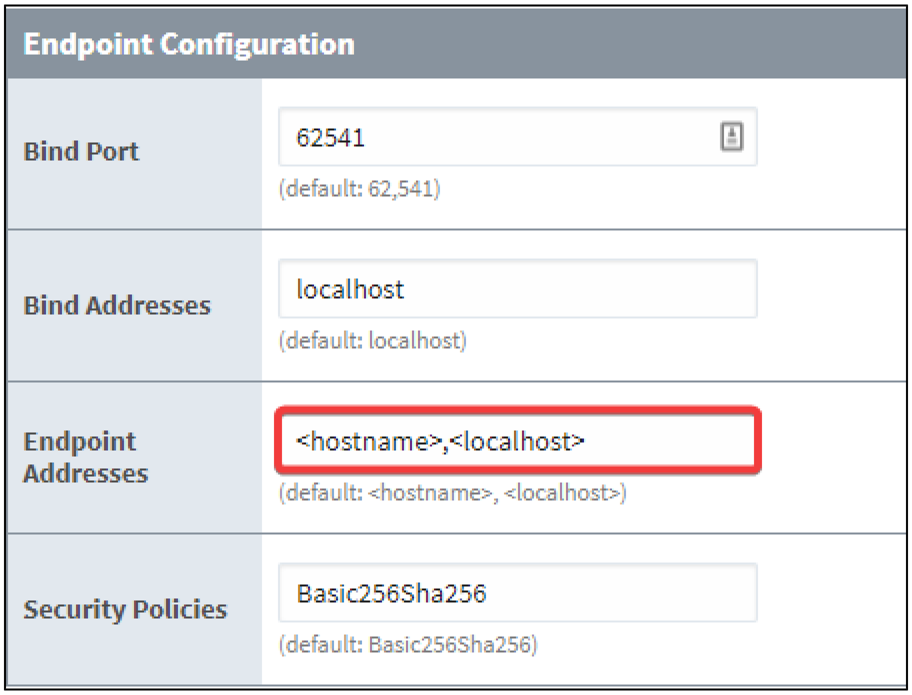
You may occasionally run into issues with Ignition's OPC UA Server connection. In these situations, there are a few things you can check to diagnose your issue.

To troubleshoot your connection to Ignition's OPC UA Server, follow the steps below:

1. Go to the Server Settings page for Ignition's OPC UA Server. This page is located on the Gateway webpage **Config > OPC UA > Server Settings**.



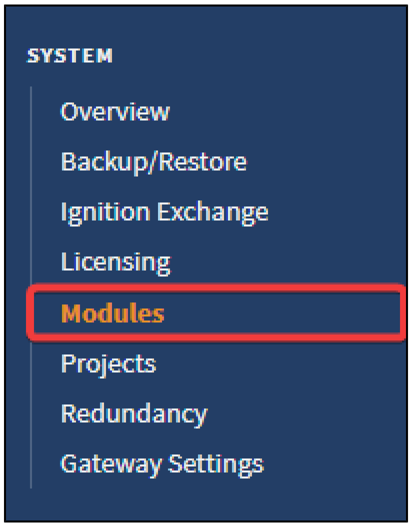
2. Check your Endpoint Addresses setting. The default value for this setting is `<hostname>,<localhost>`. The IP address of the internal OPC UA Server, which can be found on the Status page of your Gateway, can also be appended.

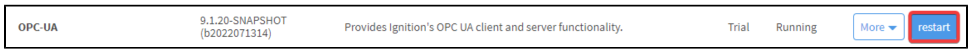


Endpoint Configuration

Bind Port	62541 (default: 62,541)
Bind Addresses	localhost (default: localhost)
Endpoint Addresses	<hostname>,<localhost> (default: <hostname>, <localhost>)
Security Policies	Basic256Sha256 (default: Basic256Sha256)

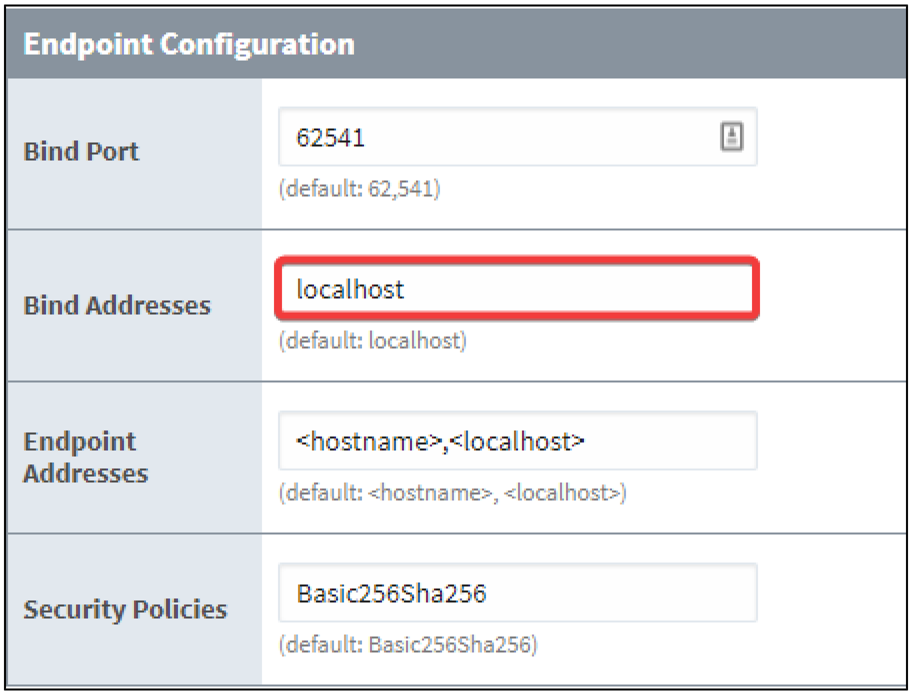
3. Restart the "OPC-UA" module. After making changes to your settings, restarting your module may help flush out any residual information. You can restart the module by going to your Gateway webpage **Config > System > Module**, locating OPC-UA and selecting **restart.**





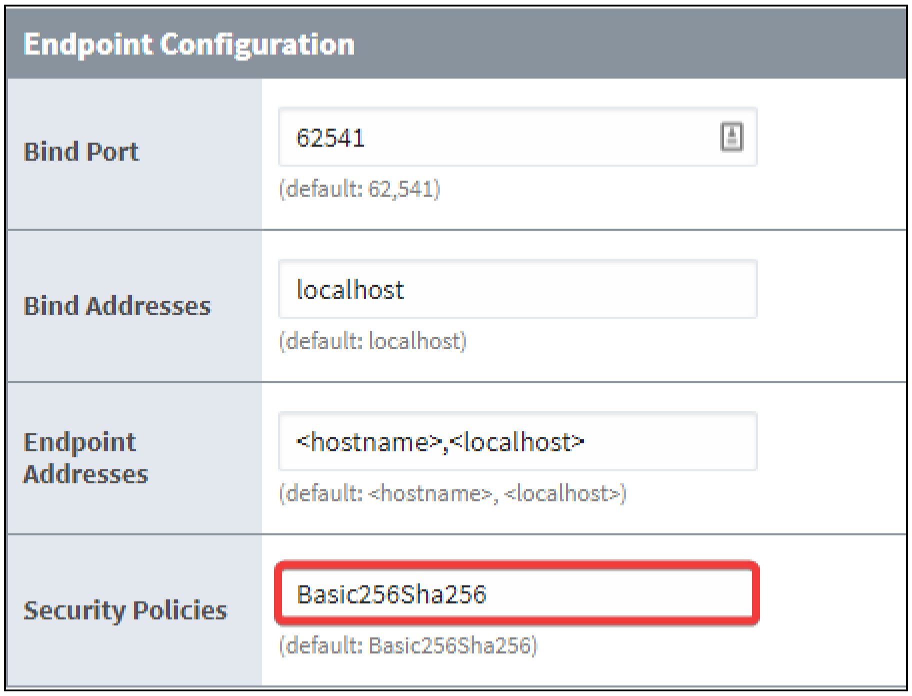
OPC-UA	9.1.20-SNAPSHOT (b2022071314)	Provides Ignition's OPC UA client and server functionality.	Trial	Running	More	restart

4. Check your Bind Addresses. The default value for this setting is `localhost`. If you want to expose the OPC UA Server to external clients, you can use a value like 0.0.0.0 or the IP address of the computer.



Endpoint Configuration	
Bind Port	62541 (default: 62,541)
Bind Addresses	localhost (default: localhost)
Endpoint Addresses	<hostname>,<localhost> (default: <hostname>, <localhost>)
Security Policies	Basic256Sha256 (default: Basic256Sha256)

5. Check your Security Policies. Possible values for this setting are listed in the table under OPC UA Server Settings.

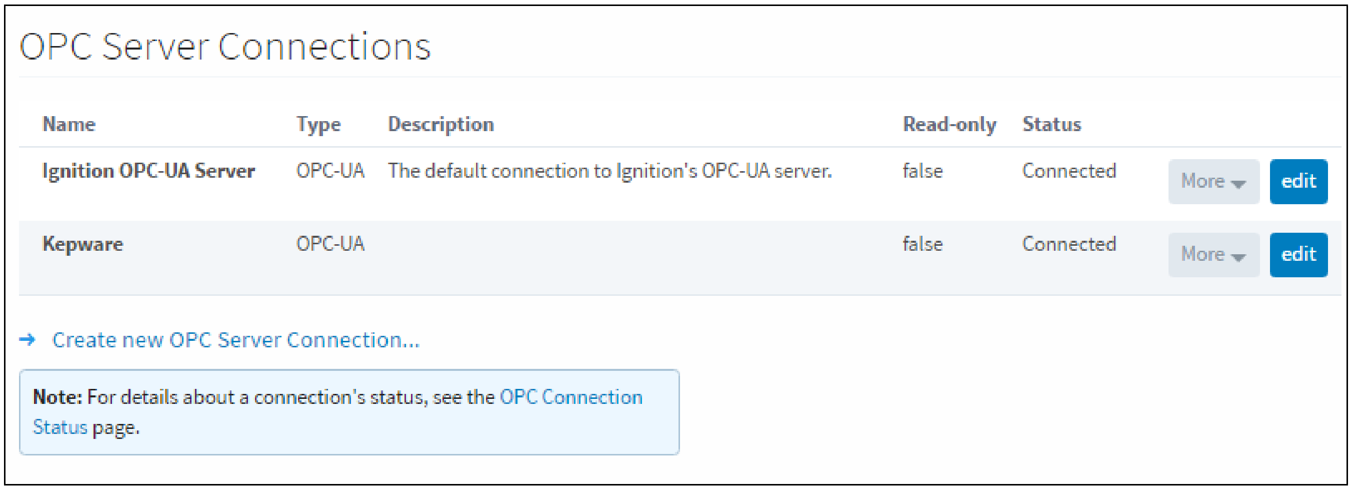


Endpoint Configuration	
Bind Port	62541 (default: 62,541)
Bind Addresses	localhost (default: localhost)
Endpoint Addresses	<hostname>,<localhost> (default: <hostname>, <localhost>)
Security Policies	Basic256Sha256 (default: Basic256Sha256)

If you continue running into problems after following these troubleshooting steps, contact the Support department.

Third Party OPC Servers

Ignition has a built-in OPC UA server that includes all of the drivers in this section, but if your devices aren't listed here, there is another way to connect to them. Ignition can quickly and easily connect to third party OPC servers via OPC UA or OPC DA (using the OPC COM module) for devices that do not have a supported driver. This opens up the possibilities to connect Ignition to any device with servers like Kepware, Matricon, etc. With over 100 driver suites each, you are sure to be able to connect anything to Ignition.



OPC Server Connections

Name	Type	Description	Read-only	Status		
Ignition OPC-UA Server	OPC-UA	The default connection to Ignition's OPC-UA server.	false	Connected	More	edit
Kepware	OPC-UA		false	Connected	More	edit

Create new OPC Server Connection...

Note: For details about a connection's status, see the OPC Connection Status page.

OPC UA

OPC UA is the new Unified Architecture for connecting to OPC devices. Probably the best feature of this new standard is that it can be used on any OS, it is not tied to Microsoft like its predecessor is. Many companies make an OPC UA server, and between them grant access to hundreds of driver suites, giving you access to thousands of available devices through Ethernet, serial, and other types of communication. If Ignition doesn't have it already, you can still get your data in.

Connecting to an OPC-UA server is simple (locally or remote), but because of the increased security, you need access to both the OPC server and Ignition to complete the setup. For step-by-step instructions to connect to a Kepware OPC server, see Connecting to Kepware OPC UA. All other OPC UA servers will have extremely similar connection steps.

Note: While Ignition can connect to third-party OPC UA servers, these servers must include support for at least OPC UA 1.03 datatype dictionaries in order to read structured values.

OPC COM (DA)

OPC COM (often called OPC-DA) has been the way to connect to OPC devices for many years, but the world has since out-grown it with the creation of OPC-UA. It relies on the .NET framework and because of this is restricted to Microsoft operating systems. There is no way to install an OPC COM server on Mac or Linux. There are many still in use today so it cannot be abandoned completely yet, but Ignition has an OPC COM module to connect to them.

OPC COM servers are notoriously difficult to connect to, especially if you want to connect to one on a remote server. If you need to do so, using Ignition's OPC COM Tunneller Module is highly preferred over setting up a Remote COM connection.

In This Section ...

Connecting to Kepware OPC UA

OPC UA makes connecting to third party OPC servers quick and easy without all the headaches associated with COM. This is a detailed step-by-step guide to connecting to KEPServerEX from Ignition using OPC UA.

On this page ...

INDUCTIVE UNIVERSITY

Connecting to Kepware OPC-UA

Watch the Video

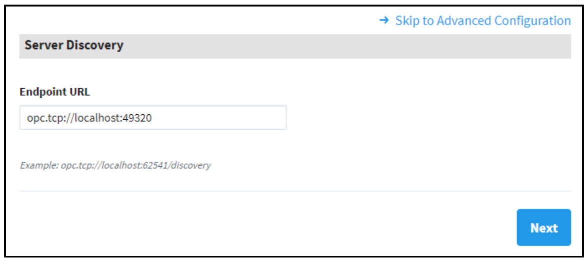
Connect to KEPServerEX from Ignition using OPC UA

1. In the **Config** section of the Gateway, go to **OPC Client > OPC Connections**. The OPC Connections page is displayed showing the OPC UA servers your Ignition is connected to.
2. Click on **Create new OPC Connection…**.
3. Choose **OPC UA** as the connection type, and click **Next**.

4. On the Server Discovery page,enter the endpoint of the OPC UA server Ignition should connect to. For example:

Sample Format	Localhost Example, Default Port	Remote Example, Custom Port
`opc.tcp://IpAddress:Port`	`opc.tcp://localhost:49320`	`opc.tcp://10.1.1.10:4444`

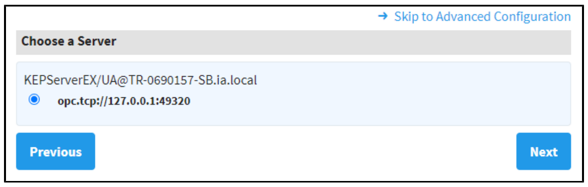
Click the **Next** button to continue.



Endpoint URL: opc.tcp://localhost:49320

Example: opc.tcp://localhost:62541/discovery

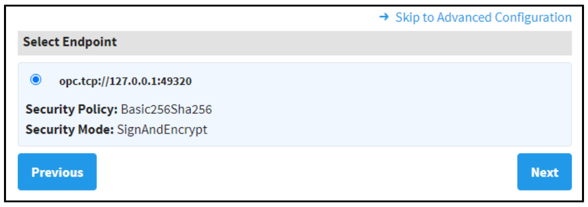
5. Select the Server you want and click **Next**.



KEPServerEX/UA@TR-0690157-SB.ia.local

● opc.tcp://127.0.0.1:49320

6. A list of available Endpoints with Security Policies and Security Modes options appears.



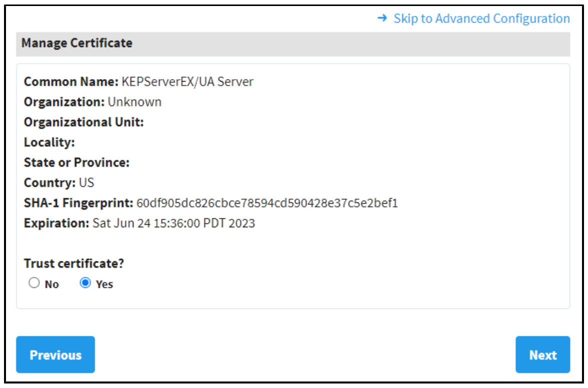
● opc.tcp://127.0.0.1:49320

Security Policy: Basic256Sha256

Security Mode: SignAndEncrypt

Once an endpoint configuration has been selected, click the **Next** button.

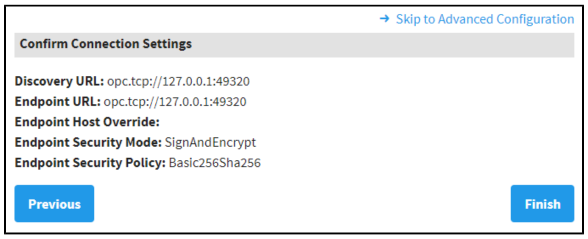
7. On the Manage Certificate page select **Yes** for **Trust Certificate?** and click Next.



Common Name: KEPServerEX/UA Server
Organization: Unknown
Organizational Unit:
Locality:
State or Province:
Country: US
SHA-1 Fingerprint: 60df905dc826cbce78594cd590428e37c5e2bef1
Expiration: Sat Jun 24 15:36:00 PDT 2023

Trust certificate?
No [✓ Yes]

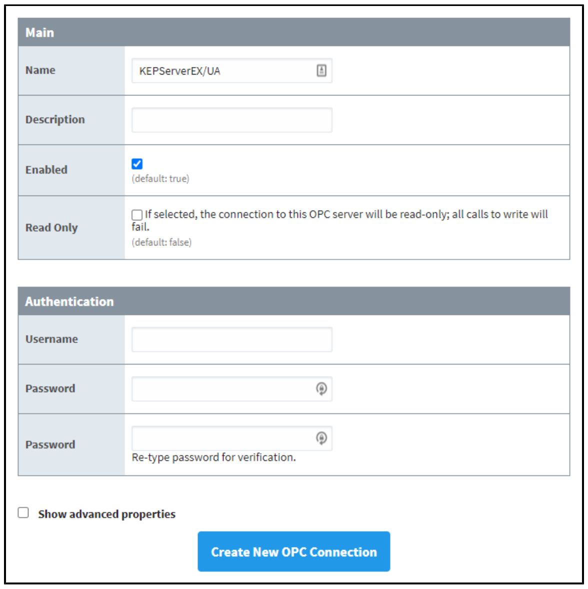
8. Confirm your settings and click **Finish**.



Discovery URL: opc.tcp://127.0.0.1:49320
Endpoint URL: opc.tcp://127.0.0.1:49320
Endpoint Host Override:
Endpoint Security Mode: SignAndEncrypt
Endpoint Security Policy: Basic256Sha256

9. This takes you to the new OPC Connection screen. Fill in the **Username** and **Password** if your KEPServer connection requires it.

   Most current installations of KEPServer require a login and will not connect without one. See the No Anonymous Token Policy Found section below.



Main	
Name	KEPServerEX/UA
Description	
Enabled	✓ (default: true)
Read Only	☐ If selected, the connection to this OPC server will be read-only; all calls to write will fail. (default: false)

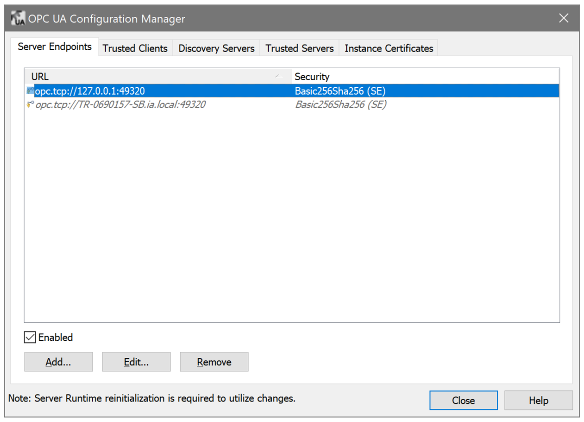
Authentication	
Username	
Password	
Password	Re-type password for verification.

☐ Show advanced properties

10. Click **Create New OPC Connection**.

11. The connection will appear as **Faulted**. This is expected because KEPServerEX is denying access to the Ignition OPC UA Client. The next step is to have KEPServerEX trust the Ignition O PC UA Client.

12. On the computer that KEPServer is installed on, right-click on the **KEPServerEX** icon on the desktop KEPServerEx is installed on, and from the menu select **OPC UA Configuration**. The **O PC UA Configuration Manager** will appear.



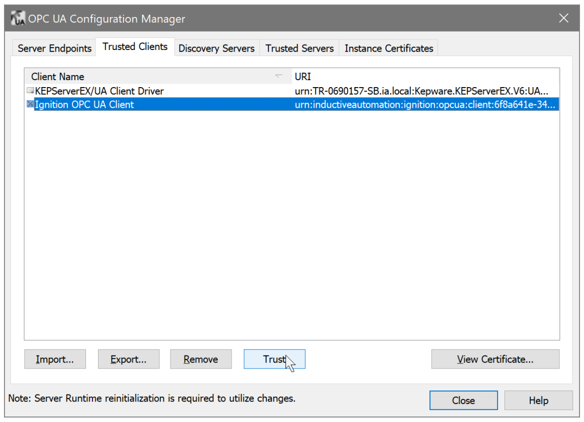
OPC UA Configuration Manager

URL	Security
opc.tcp://127.0.0.1:49320	Basic256Sha256 (SE)
opc.tcp://TR-0690157-SB.ia.local:49320	Basic256Sha256 (SE)

☑ Enabled

Note: Server Runtime reinitialization is required to utilize changes.

13. On the OPC UA Configuration Manager window, go to the **Trusted Clients** tab.
14. Click on **Ignition OPC UA Client**, click the **Trust** button, and click **Close**. Now the OPC Server Connections page shows the Status of Kepware to be Connected.



OPC UA Configuration Manager

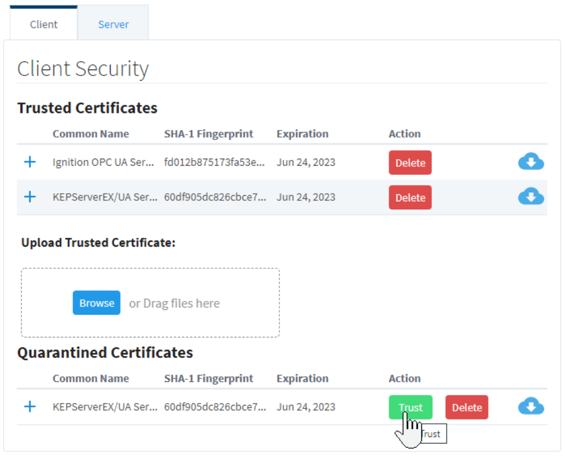
Client Name	URI
KEPServerEX/UA Client Driver	urn:TR-0690157-SB.ia.local:Kepware.KEPServerEX.V6:UA...
Ignition OPC UA Client	urn:inductiveautomation:ignition:opcua:client:6f8a641e-34...

Note: Server Runtime reinitialization is required to utilize changes.

15. Again, right-click on the **KEPServerEX** icon on the desktop KEPServerEx is installed on, and from the menu select **Reinitialize**.

16. Go back to the Ignition Gateway Webpage. In the **Config** section, go to the **OPC UA > Security** page.

17. Under the Client Security tab, you will find your new connection listed as Quarantined. Click on the **Trust** button on the far right.



Client Security

Trusted Certificates

	Common Name	SHA-1 Fingerprint	Expiration	Action	
+	Ignition OPC UA Ser...	fd012b875173fa53e...	Jun 24, 2023	Delete	
+	KEPServerEX/UA Ser...	60df905dc826cbce7...	Jun 24, 2023	Delete	

Upload Trusted Certificate:

Quarantined Certificates

	Common Name	SHA-1 Fingerprint	Expiration	Action		
+	KEPServerEX/UA Ser...	60df905dc826cbce7...	Jun 24, 2023	Trust	Delete	

18. Go back to the **Config** section of the Gateway, to OPC Connections > Servers. The Status of your KEPServer connection should be **Connected**.

19. To test your tag connections, go to the OPC Connections > Quick Client in the Configure section of the Gateway. Expand the **KEPServer** object until you find tags.

Troubleshooting

If **Status** does not read **Connected**, click the **edit** link next to the server connection, scroll down to the bottom of the connection configuration page, and click **Save**. If **Status** is still reading something other than **Connected**, click the **OPC Connection Status** link at the bottom of the **OPC Server Co nnections** page and see if there are any useful messages to help troubleshoot the issue. Also, ensure your firewall is not blocking traffic on the port that KEPServerEX is using to communicate.

Failover

The failover Kepware OPC UA server works the same as the OPC UA server with the exception that you need to have two copies of Kepware set up, preferably on different servers. The failover Kepware OPC UA server will be used in the event the primary Kepware server goes down. To enable failover, check the box to **Show advanced properties** in the New OPC UA Connection Settings, set the **Failover Enabled** property to **'true,'** and specify the **Failover Endpoint**.

The **Backup** properties should be used when a pair of redundant Ignition Gateways are trying to look at the same Kepware OPC UA server. Both the **Backup Discovery URL** and **Backup Endpoint URL** properties need to be configured.

For additional information on Failover, refer to OPC UA Client Connection Settings.

No Anonymous Token Policy Found

When connecting to KepServer, some versions may not allow anonymous connections by default. This typically means you need to specify user credentials for Ignition to use in the OPC UA server connection. Alternatively, individual Kepware Projects can allow anonymous login. For more information, look into allowing "anonymous login" in KepServer's OPC UA Configuration Manager documentation.

Other UA Servers

While the above example is specific to KEPServerEX, the same concepts apply to connecting to any other third party OPC server that accepts OPC UA client connections. The only difference may be in the way that the certificates are accepted on the server.

The Ignition OPC UA server sends the client certificate to the third party OPC server when it tries to make the connection, however if the OPC server is not designed to expect these certificates then there may not be a straight forward way to accept them. In these cases, you can manually download a client ticket from Ignition and supply it to the OPC server in the appropriate manner.

Download a Client Certificate Manually

1. Go to **Config** section in the Gateway Webpage.
2. Select **OPC UA > Certificate** from the left side of the page. The Manage Certificates page is displayed.
3. In the **This Gateway** tab, click the download link under **Ignition OPC UA Client**, and save the certificate somewhere to disk. This certificate is then supplied to your third-party OPC server in a way specific to that server. For more information, check the respective server's documentation.

Related Topics ...

- OPC COM

OPC COM

Connecting to OPC Classic (COM)

Note: Classic OPC is based on COM, which is a technology in Microsoft Windows. Therefore, the information in this section only applies to Ignition Gateways installed on Windows. For other operating systems, OPC UA must be used.

The OPC-COM module provides the ability to connect to OPC servers that only communicate using the older COM based OPC-DA standard. If you have an OPC server that is not capable of accepting OPC UA connections and you need to talk to a PLC for which Ignition has no supported driver, you'll have to use the OPC-COM module to make your device data available in Ignition. Connections to OPC servers will be held open while the Ignition Gateway is running. All subscriptions to the server will use the same connection.

This section provides a brief walk-through of how to set-up a new Local or Remote OPC-DA server connection using the COM module. Due to the complications that Windows DCOM security settings can cause, this set-up guide is followed by the Troubleshooting OPC-COM Connections section that deals with an overview of how to deal with a faulted server connection due to DCOM security settings as well as other possibilities.

Install OPC Core Components

1. Register at www.opcfoundation.org.
   The OPC-COM module relies on a .dll package provided by the OPC Foundation (www.opcfoundation.org) called the OPC Core Components. You can download the OPC Core Components Redistributable from the OPC Foundation's website under the downloads section. Registration with the OPC Foundation is required before you can download the package, but the registration process is free and painless.

2. Download appropriate OPC Core Components Redistributable package.
   There are two packages to choose from, the 32-bit (x86) and the 64-bit (x64), make sure you get the correct one for the version of Java and Ignition you are running. 64-bit Java and Ignition needs the 64-bit Core Components package and likewise 32-bit installations needs the 32-bit package. You may have to look around a bit for the redistributable. At last update of this page (2019), the download was listed under Resources Samples and Tools classic.

3. Install Core Components on Ignition server.
   It should be noted that if you are going to connect to an OPC server on a remote machine, you must also install the appropriate version of the Core Components on that server as well. The version type, 64-bit or 32-bit, does not need to be the same across the two servers. Just be sure to install the version that is appropriate for the OPC Server and Windows architecture.

4. (Remote) Install Core Components on remote machine running the OPC-DA server.
   Once you have the correct package downloaded you can extract the contents of the .zip file and then run the installer. With the core components installed you can now proceed to setting up your OPC-DA server connection in Ignition.

Connecting to OPC-DA Server

With the OPC Core Components now installed the next step is creating/configuring a new OPC-DA server connection.

Install OPC-DA Server Connection

1. Go to the Ignition Gateway Config section (http://localhost:8088/main/web/config).

2. Go to OPC Connections > Servers and then select **Create new OPC Server Connection...**.

3. Choose the **OPC-DA COM Connection** and then select whether you want to make a Localconnection or if the OPC server resides on a Remote machine. For the most part, setting up a local or remote connection to an OPC-DA server is the same. There are only a couple of differences for a remote connection that will be highlighted along the way.

   Local - Selecting a local connection takes you to a screen that contains a list of the available and running OPC servers located on the local machine.
   Remote - For a remote connection you first have to specify the host name or IP address of the machine the the OPC server resides on and then (as of Ignition 7.4) you are redirected to the available servers list.

4. Select the OPC server that you wish to connect to from the list. In the case where your server is not listed, see the **OPC server is not listed...** the Troubleshooting OPC-COM Connection section.

   Unique Remote Connection Settings - Remote connections have a few unique settings that you can specify. You can get to these settings by selecting the **Show advanced properties** check box. As of Ignition 7.4 these should all be set for you (except for the CLSID which should no longer be necessary but is still available for you to set if you wish).
   Remote Server - Specifies that the server is remote and that a DCOM connection will be used.
   Host Machine - The computer name or IP address of the machine on which the remote server is running.
   CLSID - This is no longer required as of Ignition 7.4, but it is still made available for you. It can be used in place of the ProgId because the ProgId is really just used to lookup the CLSID in the registry. This id can be found in the registry of the machine hosting the server under:

HKEY_CLASSES_ROOT\OPCServerName\CLSID

5. All of the settings for the server connection are rather straight forward and each property has a description of its functionality. Most of these settings should be fine when left at their default values. The only setting that could possibly give you some trouble is the ProgId. If you selected your OPC server from the list on the **Choose OPC-DA Server** page, this will be filled in for you. However, if for whatever reason your server wasn't listed and you choose the **Other Server** option, you will have to know the ProgId for your server and specify it here. The ProgId is used to look up the CLSID of the OPC Server in the Windows Registry and without this a connection cannot be made.

6. When you are finished fine tuning these settings click **Create new OPC Server Connection**. You will be redirected to the OPC Server Connections page and your new server connection should be listed. The status of your connection will read Connected if Ignition was able to successfully connect to the third-party OPC server.

Connection Is Faulted

In the case where your connection status is reporting Faulted, the troubleshooting process begins. As previously stated, configuring the DCOM settings on your machine can be a headache. The Troubleshooting OPC-COM Connections section next is an attempt to ease the process of determining why your connection is faulted and how to go about fixing the issue. If after exhausting the options presented to you, you are still having issues getting you server connection up, give our Inductive Automation tech support line a call and one of our representatives will be happy to assist you.

Troubleshooting OPC-COM Connections

This section provides you with a list of common OPC-COM connection problems with their possible solutions. It would be impossible to give an exhaustive list of everything that can go wrong but this should give you a good start on the troubleshooting process. If you do not see your problem listed and your connection status is faulted, try following the steps outlined in the Ignition Server DCOM Settings and OPC Server DCOM Settings sections.

Common Problems

OPC Server Is not Listed in Choose OPC-DA Server List when First Creating a Connection

There are some cases in which an OPC Server that is installed will not show up in the generated list. This list is generated by the OPC Server Enumerator which is part of the OPC Core Components, so when a server you have installed on the machine does not appear in this list it is likely due to the OPC Core Components not being installed correctly.

Try reinstalling the Core Components and going through the process of creating a new server connection in Ignition again. If the server still does not appear and you have the ProgId (or the CLSID for a remote connection) for the OPC server, you can just select the **Other Server** option and then click **Next**. In this situation you will have to enter the ProgId manually on the **New OPC-DA Server** page.

With all the correct information about the OPC server we can sometimes still make a valid connection to the OPC Server even when it is not detected automatically. This however is rare. Most of the time when the server is not detected, any connection attempts Ignition makes will fail.

Connection Status Is Connected but Data Quality Is Bad or the Connection Goes Faulted after Trying to Read Tag Data

Usually this occurs when the DCOM settings for the machine on which Ignition is running are not correctly configured. DCOM connections go in both directions. Ignition must be able to send requests to the OPC server and the OPC server must also be able to callback to Ignition. If the DCOM settings on the Ignition server are not configured correctly those callbacks will fail and the server connection that initially had a status of “Connected” will either fault or all the Tags that you have configured will come back with bad quality.

This is a problem that can affect both local and remote server connections.

Follow the steps outlined in the “Ignition Server DCOM Settings” section to ensure that you have correctly configured the DCOM security settings on the Ignition server machine.

Ignition Launches Second Instance of an Already Running OPC Server and Is Unable to See Any Data

It is important to note that Ignition runs as a service under the Windows System account. This can cause some issues with OPC servers that are meant to run interactively, meaning they run under the user account that is currently logged on. When Ignition attempts to make a connection to the OPC server, it will attempt to find an instance running under the same account and if it doesn't find one it will launch its own instance under the System account. Even if there are other instances running, Ignition will choose the one that was launched under the System account for its connection.

Many OPC servers maintain an instance running under the interactive user account that has been configured by the user and maintains all of the device connection information. When Ignition launches a new instance, this configuration information is lacking and none of the desired data can be seen or accessed. To get around this problem, you must specify in the DCOM settings for the OPC server that it always identify itself with the interactive user. Essentially this will force Ignition to use the currently running instance of the OPC server.

Set the OPC Server to Run as Interactive User

1. The DCOM settings are found in the Component Services manager. Right-click the entry for your OPC server under the DCOM Config folder and select properties from the popup menu.

2. Select the Identity tab. Select the option that reads **The interactive user**, and click **OK**.

3. Close out of component services and kill any extra instances of the OPC server you see running in the Task Manager.
4. Go edit and save the OPC server connection in the Ignition Gateway.

Faulted Status with E_CLASSNOTREG Error Reported on OPC Connections Status Page

This is almost always caused by the OPC Core Components not being installed correctly. Download and install the correct version(s) for your system (s) from the OPC Foundation (www.opcfoundation.org). Remember, if you are making a remote connection you must install these components on both the Ignition server as well as the machine on which the OPC server is running.

DCOM Settings

Ignition Server DCOM Settings

Follow these steps to open up the DCOM security settings on the machine that is running Ignition:

1. Open the **Windows Component Services**, located in the Administrative Tools section of the Control Panel.
2. Browse down through the Component Services tree until you see My Computer, right-click and select **Properties**.
3. We want to focus on the COM Security tab. There are two sections, **Access Permissions and Launch** and **Activation Permissions**. Each section has an Edit Limits... and Edit Defaults... button. You must add the ANONYMOUS and Everyone accounts under each of the four areas making sure that the **Allow** option is checked for each of the permission settings. If you skip adding both of these to either the limits or defaults areas under either of the two sections there is a good chance your connection will not be successful.
4. You can also try setting the Default Authentication Level to **None** and the Default Impersonation Level to **Identify** on the Default Properties tab. This isn't always necessary but it can sometimes help.

OPC Server DCOM Settings

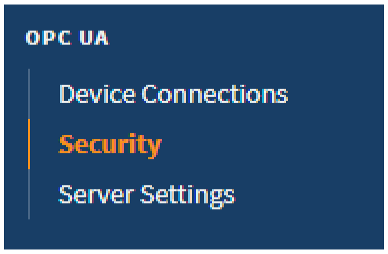
Follow these steps to open up the DCOM security settings on the machine that is running the OPC server:

1. Open up **Windows Component Services**, located in the Administrative Tools section of the Control Panel.
2. Browse down through the Component Services tree until get to the **DCOM Config** folder.
3. Locate the entry for your OPC server that you wish to make a connection to, right-click and select properties.
4. Click the **Security** tab and you will see three sections: Launch and Activation Permissions, Access Permissions, and Configuration Permissions. There are two options to choose from for each section. If you already added the ANONYMOUS and Everyone accounts to the COM Security section from the **Ignition Server DCOM Settings** section then you can go ahead and just select the **Use Default** option for each of the three areas. The second option is to edit each of the groups that have **Customize** selected. You will have to add both the **ANONY MOUS** and **Everyone** accounts with all privileges.
5. Now select the **Identity** tab. You will notice that you can choose which account you want to run the OPC server under. Select the **Interactive User** option. This ensures that if Ignition launches an instance of the OPC server, it will run under whichever user is currently logged into the system.

OPC UA Security

On the OPC UA security page you can manage OPC UA certificates for the client and server. Trusted certificates can be imported and quarantined certificates can be marked as trusted.

The OPC UA pages in located under the Gateway's **Config** section, under **OPC UA**:



On this page ...

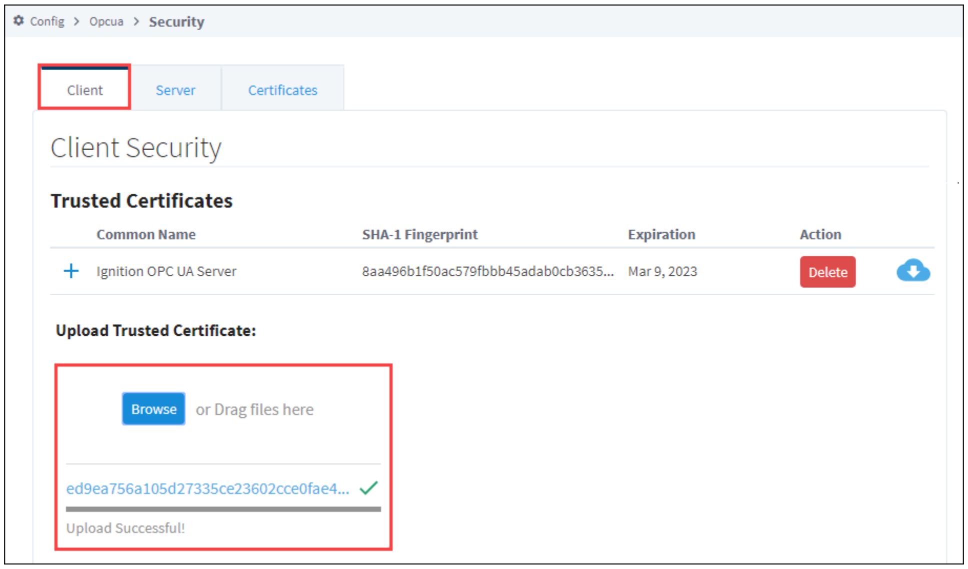
Client and Server Tabs

Both the Client and Server tabs allow you to view OPC UA security certificates. The **Client** tab contains certificates the gateway uses when acting as a OPC UA client, while the **Server** tab contains certificates the gateway uses when acting as an OPC UA server. Both tabs have the same options in regards to managing certificates.

Upload a Trusted Certificate

The steps for uploading trusted certificates are the same whether you're on the Client tab or the Server tab. To upload a trusted Certificate, do the following.

1. On the Gateway Webpage, select **OPC UA > Security**.
2. Click the **Client** tab or **Server** tab, depending on the what certificate you're uploading.
3. Click the **Browse** button.
4. Navigate to the location of of certificate on your system and click **Open**. (Alternatively, you can drag the certificate file onto the page where it says "Drag files here.")
5. If the upload was successful, you'll see the name of the certificate and the message "Upload Successful!" The certificate will appear in the Trusted Certificates list.



Common Name	SHA-1 Fingerprint	Expiration	Action
Ignition OPC UA Server	8aa496b1f50ac579fbbb45adab0cb3635...	Mar 9, 2023	Delete

ed9ea756a105d27335ce23602cce0fae4...

Upload Successful!

Download a Trusted Certificate

To download a trusted certificate, do the following.

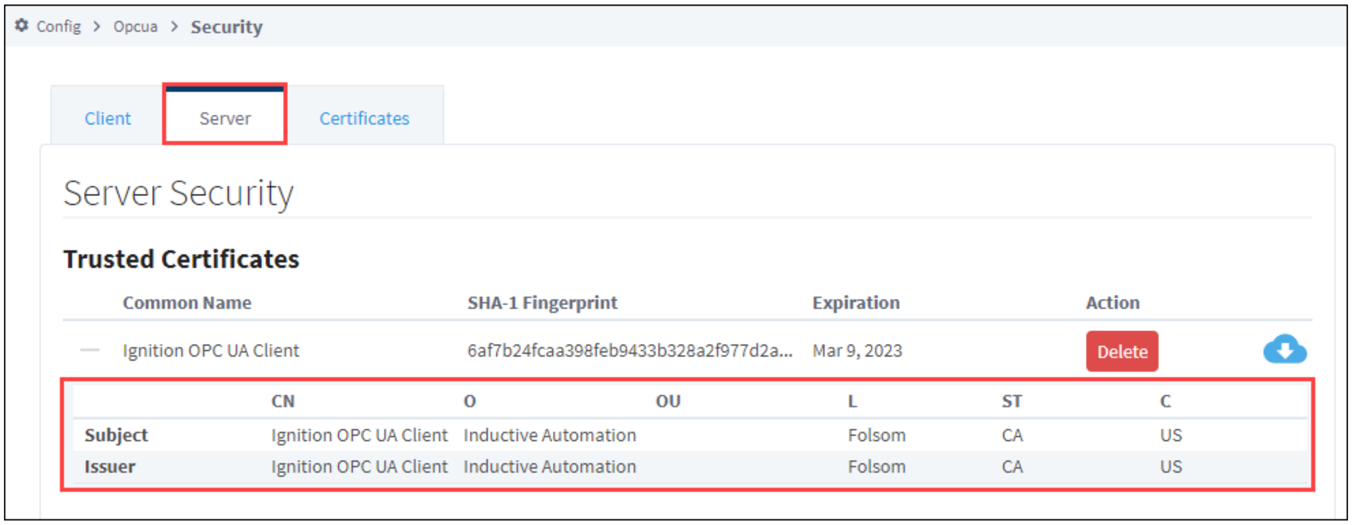
1. Next to the certificate name, click the **Download** icon.
2. The certificate is downloaded to your system by your web browser.

Delete a Trusted Certificate

To delete a trusted certificate, do the following.

1. Next to the certificate name, click the **Delete** action button.
2. The certificate is deleted.

To view more information about a trusted certificate, click the **More Info** + icon.



Server Security

Trusted Certificates

	Common Name	SHA-1 Fingerprint	Expiration	Action
—	Ignition OPC UA Client	6af7b24fcaa398feb9433b328a2f977d2a...	Mar 9, 2023	Delete

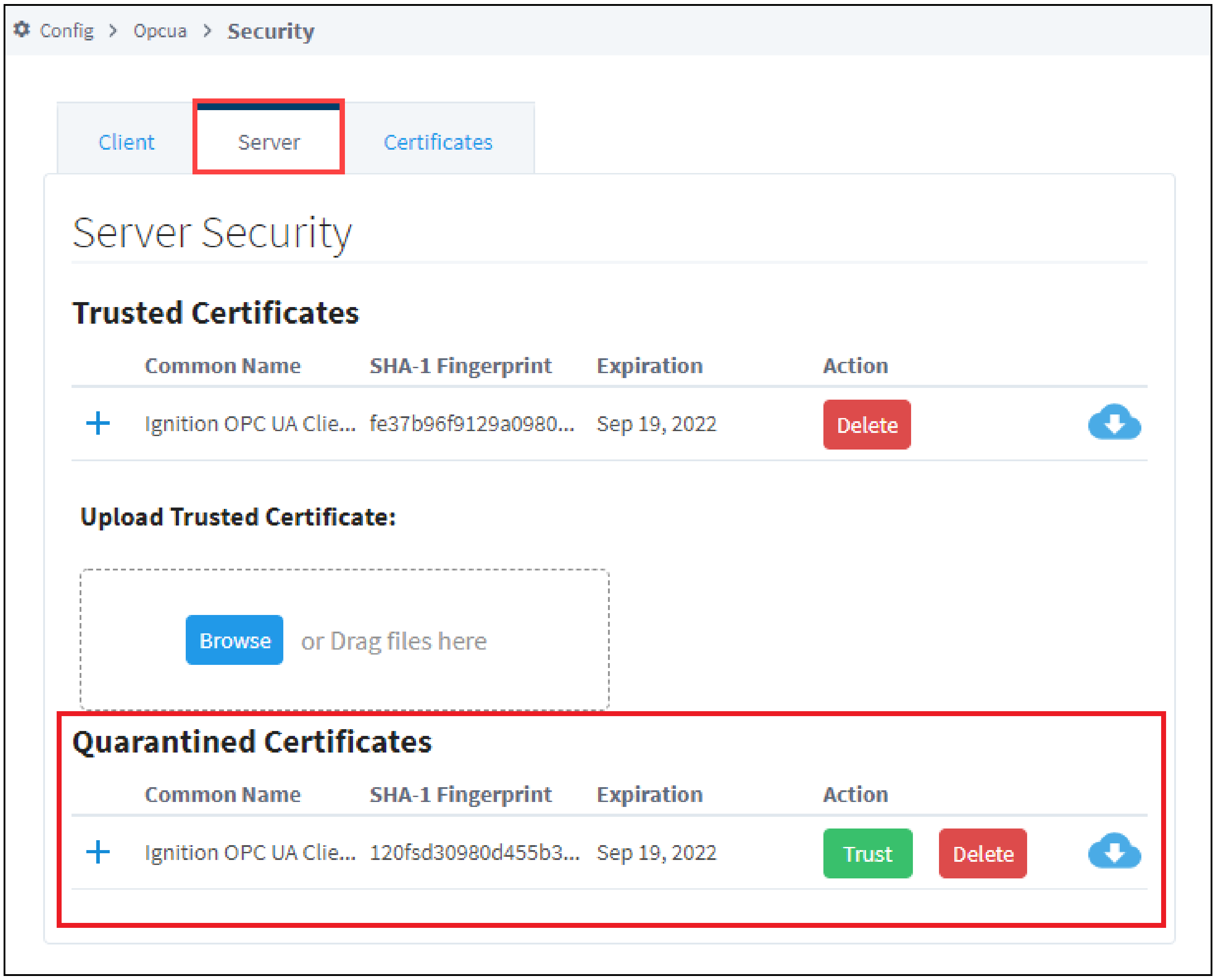
	CN	O	OU	L	ST	C
Subject	Ignition OPC UA Client	Inductive Automation		Folsom	CA	US
Issuer	Ignition OPC UA Client	Inductive Automation		Folsom	CA	US

OPC UA Security Page Details

Trusted Certificates	
Common Name	Name of the certificate.
SHA-1 Fingerprint	The SHA-1 (Secure Hash Algorithm 1) fingerprint is the unique identifier of the certificate.
Expiration	Date the certificate will expire.
Additional Information	
CN	Common Name
O	Organization, usually the legal incorporated name of a company.
OU	Organizational Unit
L	Locality (Town or City)
ST	State
C	Country, the two-letter ISO code for the country where the organization is located.

Quarantined Certificates

If you import a certificate that is not trusted, it will appear on the Quarantined Certificates list. From here you can view the details by clicking the **More Info** + icon, **Trust** the certificate, or **Delete** it.



Server Security

Trusted Certificates

	Common Name	SHA-1 Fingerprint	Expiration	Action
+	Ignition OPC UA Clie...	fe37b96f9129a0980...	Sep 19, 2022	Delete

Upload Trusted Certificate:

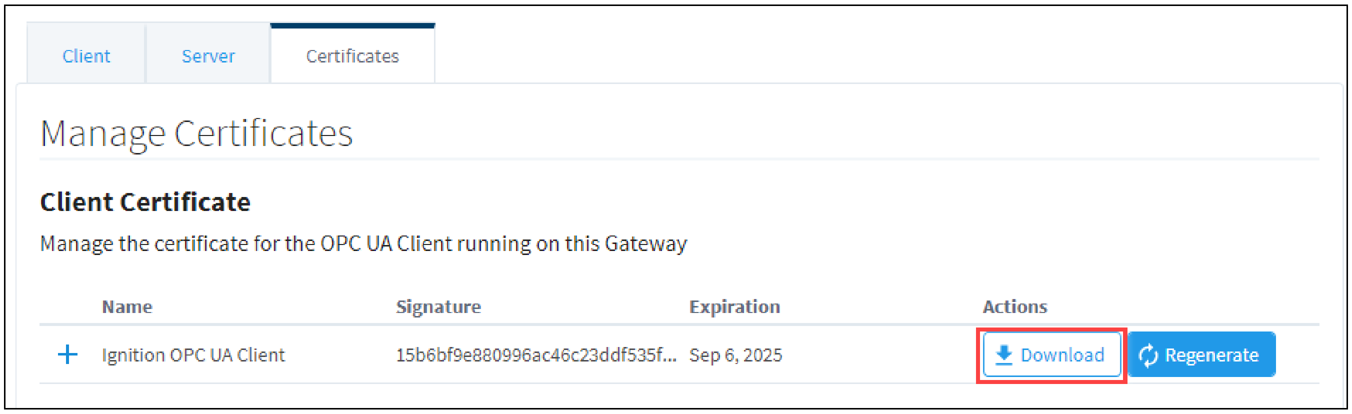
Quarantined Certificates

	Common Name	SHA-1 Fingerprint	Expiration	Action
+	Ignition OPC UA Clie...	120fsd30980d455b3...	Sep 19, 2022	Trust Delete

Certificates Tab

The following feature is new in Ignition version **8.1.0**
Click here to check out the other new features

The Certificates tab shows the trusted certificates for the OPC UA client and server on the gateway. From this tab the certificates can be examined by clicking the **More Info** + icon. The certificates can be downloaded by clicking the **Download** button. This will perform the same action as downloading a certificate from the **Client** tab as described above.



Manage Certificates

Client Certificate

Manage the certificate for the OPC UA Client running on this Gateway

	Name	Signature	Expiration	Actions
+	Ignition OPC UA Client	15b6bf9e880996ac46c23ddf535f...	Sep 6, 2025	Download Regenerate

Clicking the **Regenerate** button for each certificate will create a new certificate.

Regenerate Current Certificates

All certificates have a definitive live span. For example, the default life span for an Ignition-generated OPC UA certificate is three years. Any OPC UA connection, even the default loopback connection to Ignition's own server, will stop working if the certificate expires or is invalid.

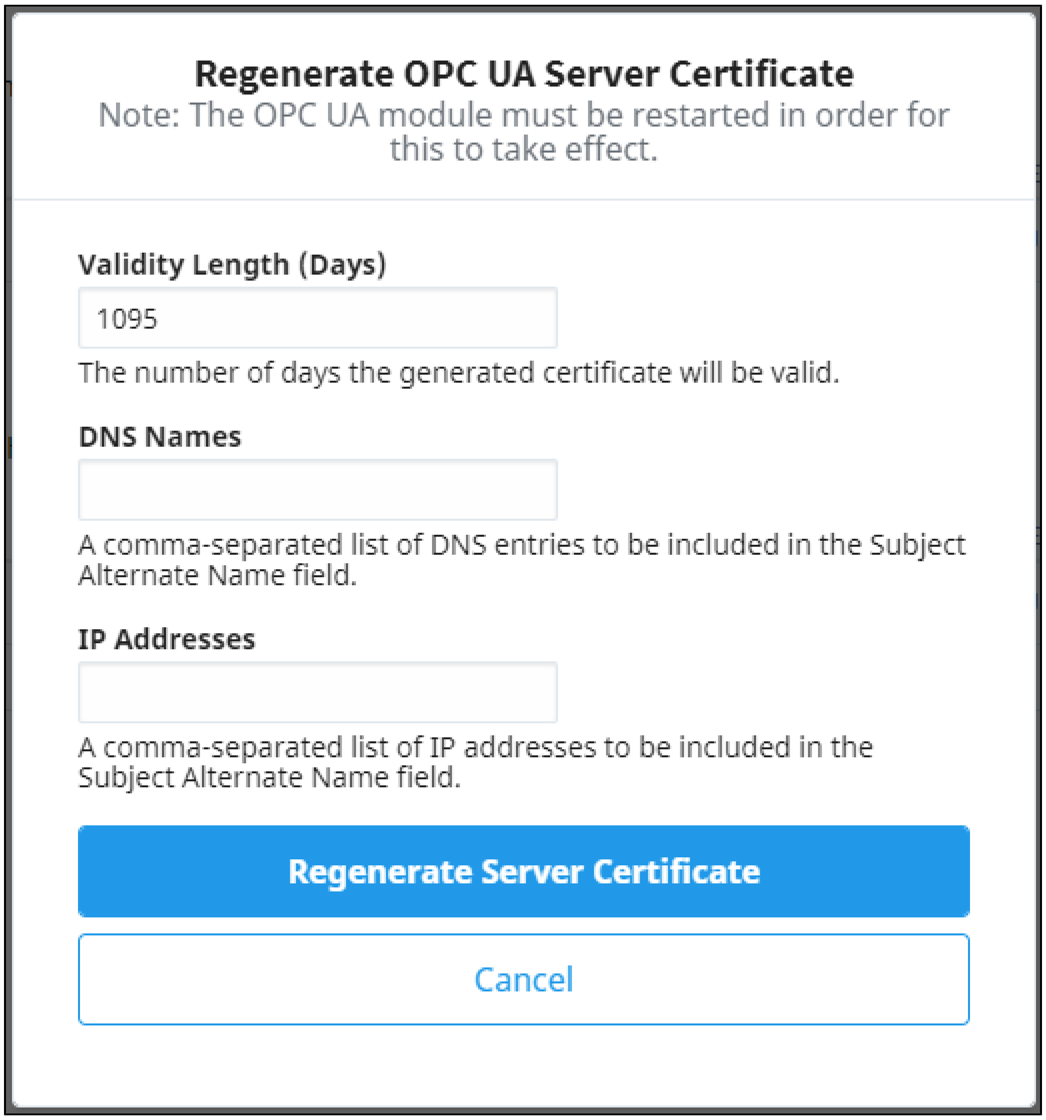
Regenerating the certificates creates a new certificate with an expiration date set for three years later. If your private key is somehow compromised, regenerating a Client or Server certificate also ensures that the private key will no longer work with the Ignition Gateway.

Newly regenerated certificates are automatically trusted by the Gateway issuing them.

Note that regenerating a server certificate will require that the OPC UA module is restarted.

The following feature is new in Ignition version **8.1.8**
Click here to check out the other new features

Regenerating a client certificate will allow you to specify the duration of the new certificate. In addition, regenerating a server certificate will allow you to specify the duration as well as the DNS names and IP addresses to be included in the Subject Alternate Name (SAN) fields.



Regenerate OPC UA Server Certificate
Note: The OPC UA module must be restarted in order for this to take effect.

Validity Length (Days)
1095
The number of days the generated certificate will be valid.

DNS Names

A comma-separated list of DNS entries to be included in the Subject Alternate Name field.

IP Addresses

A comma-separated list of IP addresses to be included in the Subject Alternate Name field.

OPC UA Drivers

Ignition has a few drivers in the form of modules that allow you to connect to specific types of devices over OPC UA. Each module provides the ability to connect to different types of devices.

On this page ...

Device Diagnostic Tags

All drivers include built-in diagnostic tags that can be used to monitor the health of the device connection. Some of these metrics can also be found on the Device Connections Status page on the Gateway.

Root Diagnostic Tags

Tag	Description
Connected	A Boolean representing the connection between the device and the OPC UA server. Replaced the legacy "isConnected" tag, which was functionally the same.
Hostname	The hostname of the device, as configured in the device configuration on the Gateway.
Name	The name of the device, as configured in the device configuration on the Gateway.
Port	Represents the port used to communicate with the device.
State	A string representing the state of the device configuration. Example: "Connected", "Disconnected".
Status	A string representing the status of the device configuration. Generally provides more granular information than the **State** tag.

Sampling Tags

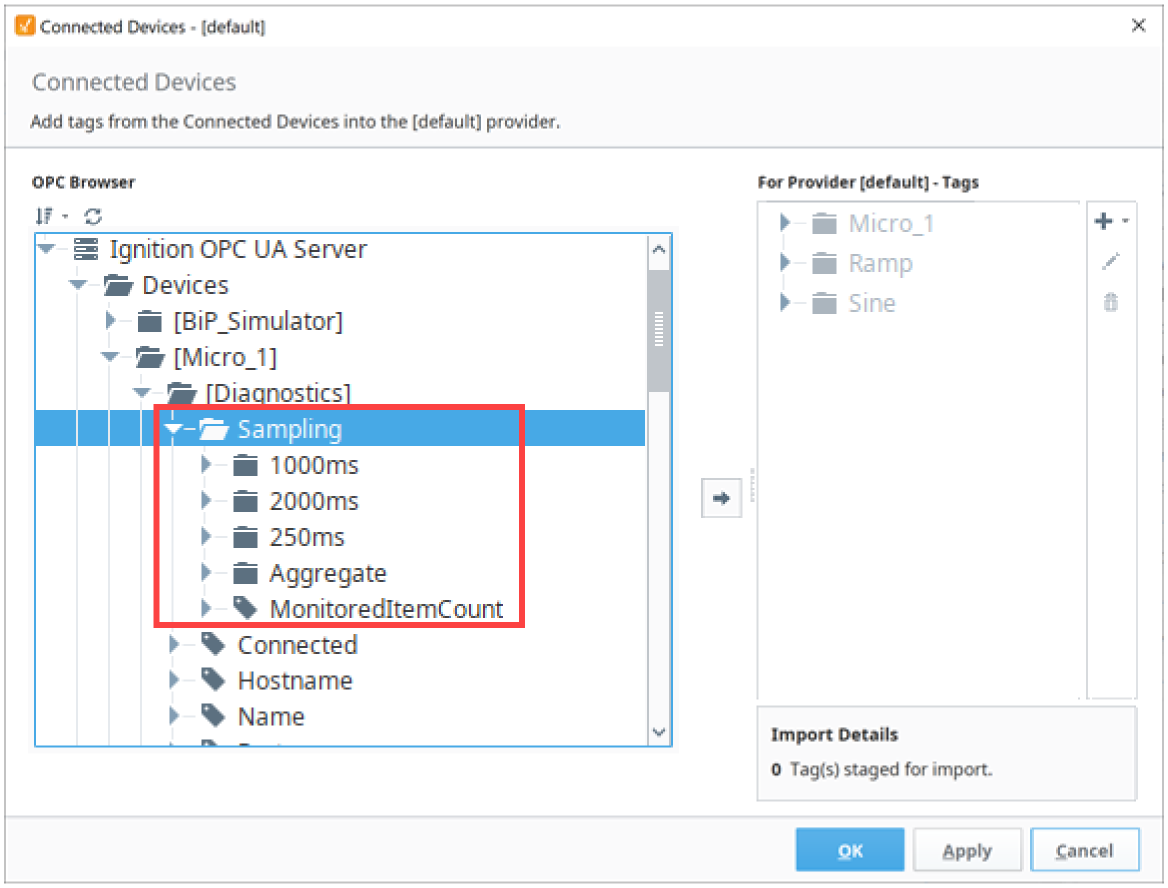
The following feature is new in Ignition version **8.1.6**
Click here to check out the other new features

The **Sampling** folder contains metrics of the device connection's throughput. Each device contains an **Aggregate** folder, which represents overall performance of the device connection. The Aggregate folder is always present when browsing device connections that make use of one of Ignition's drivers.

Additional **Sampling Group Folders** are provided based on active subscriptions, and are grouped by sample rate. These folders contain tags that represent throughput of subscription items at set rates. For example, in the image of the Connected Devices window below we see several folders next to Aggregate: *250ms*, *1000ms*, and *2000ms* **.** These folders exist because items in the device are being subscribed to at the rates specified.

This means there is at least one item in Micro_1 that is being subscribed to at a rate of 250ms. Thus, the driver has metrics for items that are being subscribed at that rate. Because there is a 1000ms folder, we know there is at least one item being subscribed at a 1000ms rate, and so on. Thus, every additional sampling folder signifies a different sampling group, and exists because something is being subscribed to at that rate.

Note: Subscriptions are most commonly created by Tag Groups, but can be created by other means. For example, Transaction Groups that utilize OPC Items, or the Gateway's Quick Client page.


Connected Devices - [default]

Connected Devices

Add tags from the Connected Devices into the [default] provider.

OPC Browser

- Ignition OPC UA Server
  - Devices
    - [BiP_Simulator]
    - [Micro_1]
      - [Diagnostics]
        - Sampling
          - 1000ms
          - 2000ms
          - 250ms
          - Aggregate
          - MonitoredItemCount
        - Connected
        - Hostname
        - Name

For Provider [default] - Tags

- Micro_1
- Ramp
- Sine

Import Details

0 Tag(s) staged for import.

The following feature is new in Ignition version **8.1.10**
Click here to check out the other new features

As of 8.1.10 each device contains a **MonitoredItemCount** tag, which represents the total number of items subscribed to on the gateway. Note that this count includes device diagnostic tags.

Requests

When Ignition's drivers attempt to read values from a device, it does so with a grouping process. Updates for individual items are grouped up into **requests**. A request is a grouping of tags/items that need to be read at the same time. The number of items in a single request differs per driver, based mostly off of the protocol being used. Some drivers may have additional configurations options that impact how requests are grouped. Since requests have a fixed number of items to monitor, it's fairly common that there are more pending reads than can fit into a single request. As a result, multiple requests are often used to read values from the same device for the same sampling rate.

All requests are placed into a request queue and wait to execute. The **Sampling Group Diagnostic Tags** represent how well the device is able to respond to requests.

Sample Group Diagnostic Tags

The table below describes the various diagnostic tags under the Aggregate and Sampling Group folders. Note that the structure for each type of folder is the same, save for several tags that are not available under the Aggregate folder; those exceptions are noted in the description column.

Tags in the **Aggregates** folder summarize all requests across all groups, whereas Tags in sampling group folders represent metrics for that sample group. All metrics are based off the *start* of their group, unless specified otherwise. In the case of Aggregates, they're based off the last initialization of the device connection configuration on the host Ignition Gateway.

Tag	Description	Available in Aggregate Folder?
ActualSamplingInterval	Represents the actual interval the sample group was able to last execute at, in milliseconds.	No
ActualThroughput	A count representing the actual number of requests that were able to execute during the last sample interval.	Yes
IdealSamplingInterval	The ideal sample interval for the sample group in milliseconds. Generally, this will simply be the configured sample interval.	No

IdealThroughput	A count representing the ideal number of requests handled over a 1000ms period. Calculated with the following equation: `RequestCount * 1000 / SamplingInterval`	Yes
OverloadFactor	Represents how well the device is able to keep up with requests at the sample rate. Overload is calculated with the formula: `100 * (QueueDuration / ActualSamplingInterval)` If overload exceeds 100%, then requests are being sampled at a slower than ideal rate.	No
QueueDuration	Represents the average amount of time a request has spent in the request queue.	No
RequestCount	The number of requests within the sampling group.	Yes

Execution Timer Tags

The Tags in the table below represent how long the request process takes. Execution times are recorded in the following manner:

1. A timer starts
2. The request is sent off to the device
3. A response from the device is received by the OPC server
4. The timer stops

Note that all of the following tags are available in both sample group folders, as well as the Aggregates folder. Like the Sample Group Diagnostics all metrics are based of the *start* of their group, unless specified otherwise. In the case of Aggregates, they're based off the last initialization of the device configuration.

Tag(s)	Description
NthPercentile	N% of requests were able to execute at a number of milliseconds equal to or faster than the value on the tag. Example: If 75thPercentile shows a value of 50, then 75% of all requests were able to complete within 50 or fewer milliseconds.
Count	Represents the number of requests processed since the start of the sample group.
Max	The longest duration an execution took in the sampling group since the start of sampling. Reported in milliseconds.
Mean	The average duration for all executions in the sampling group since the start of sampling. Reported in milliseconds.
Min	The smallest duration an execution took to complete since the start of sampling. Reported in milliseconds.
MeanRate	An average of throughput, since the start of the sampling group. The MeanRate tag in the Aggregates folder represents an average since the last startup of the device connection.
OneMinuteRate	A rolling average of throughput over the last minute.
FiveMinuteRate	A rolling average of throughput over the last five minutes.

Allen-Bradley Ethernet

Connecting to Allen-Bradley Devices

Ignition contains drivers for several Allen-Bradley devices. These drivers can connect directly through the Gateway to devices that support Ethernet communications and to devices that have access to an Ethernet card such as an ENBT or EN2T. The device drivers in the Allen-Bradley Ethernet Module are:

- **Logix** ControlLogix and CompactLogix firmware v20.19+
- **ControlLogix** firmware v20.18 and prior
- **CompactLogix** firmware v20.18 and prior
- **PLC-5**
- **MicroLogix** 1100, 1200, 1400, 1500
- **SLC** 5/05

Note: The Allen-Bradley Ethernet drivers, excluding the Logix driver, only support firmware versions 16 and up. Older firmware versions may work, but are unsupported. If your device does not meet these requirements, another OPC Server can be used to connect to them.

Caution: Direct connections to RSLinx Emulate 5000 are not supported, and may not work properly.

Verifying Device Connectivity

Device connectivity can be verified in the following places:

- In the **Config** page of the Gateway under **OPC UA > Device Connections**
- In the **Status** page of the Gateway under **Overview >** click the **Devices** box
- In the **Status** page of the Gateway under **Connections > Devices**
- In the **Status** page of the Gateway under **Connections > OPC Connections**

Allen-Bradley Connection Paths Explained

All of the Allen-Bradley drivers have a **Connection Path** property that is used when the device uses a special Ethernet card (instead of having an Ethernet connection built in) or if you are using another device to act as a bridge. That is, connections to ControlLogix, CompactLogix, PLC-5, MicroLogix and SLC Allen-Bradley processors bridged through a ControlLogix Gateway require a connection path. The connection path is unique to your setup and is dependent on what modules the connection is being routed through. With there being nearly an endless number of ways to route your connection from device to device it is impossible to give an example of every possible connection path, but in general there is a pattern to how the connection path is specified.

The following is a basic outline for figuring out your connection path. For more specific information on individual device types, see the individual connection pages.

Follow the Path

A connection path is exactly what it sounds like. It is a path that when followed will lead a processor residing in a numbered slot of a chassis somewhere on site. You merely have to follow the path and build the connection path as you go. The first connection point between Ignition and the device is a ControlLogix Ethernet module such as an ENET, ENBT or EN2T module. The slot number of this module doesn't matter and there is no need to specify it in the connection path. The first entry in any connection path will be a 1, which specifies moving to the back plane. You then specify the slot of the module you wish to move to, followed by the port or channel of that module that you wish to exit through. Finally you specify the address of your entry point to the next module and the process starts all over again. This process may sound complicated at first but after some practice it will get easier.

Connection Path Steps

1. Move to the backplane.
2. Specify the slot number of the module you are moving to.
3. Specify the exit port or channel.
4. Specify address of entry point (DH+ Station Number / ControlNet Address / IP Address of Ethernet module).
5. Move to the backplane.
6. Specify processor slot number or the slot number of the module you wish to exit through.

Connection Path Entries for Different Module Types

How you specify your exit point from a module differs depending on which module type you are using. You can only move in two directions once you are "in" a module: out to the backplane or out through the module port/channel. Ethernet modules have Ethernet ports and an IP address; ControlNet modules have ControlNet Ports and ControlNet addresses; DHRIO modules have channels and station numbers. Below is a list of different kinds of modules and what numbers you specify in the connection path when you are exiting or entering those modules. When in a module, an entry of 1 will always take you to the backplane.

ENET, ENBT, and EN2T:
Exiting
  1 = Backplane
  2 = Ethernet Port
Entering
  IP Address

CNB:
Exiting
  1 = Backplane
  2 = ControlNet Port
Entering
  ControlNet Address

DHRIO
Exiting
  1 = Backplane
  2 = DH+ Channel A
  3 = DH+ Channel B
Entering
  DH+ Station Number (an octal value between 0-77)

You use these numbers to specify how to move out of the module, then you specify where you are moving to by either specifying the DH+ station number, ControlNet address, or the IP address of another Ethernet module. Your connection path will always be an even number of entries due to the fact that you always move in two steps: out of a module and then in to another module. So if your connection path ends up with an odd number of entries you have missed a step somewhere and you'll have to go back and trace the path again.

In This Section ...

Connecting to CompactLogix

Note: This driver is made for CompactLogix firmware up to version 20.18.

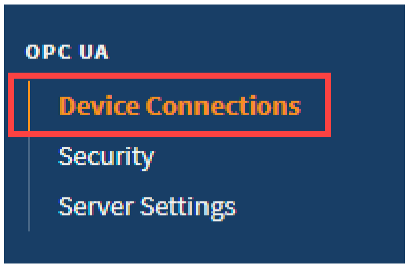
INDUCTIVE UNIVERSITY

Connecting to Legacy CompactLogix

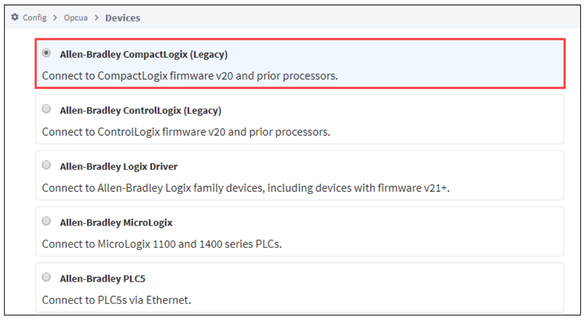
Watch the Video

Connect to an Allen-Bradley CompactLogix Device

1. Go to the **Config** section of the Gateway Webpage.
2. Scroll down and select **OPC UA > Device Connections**.



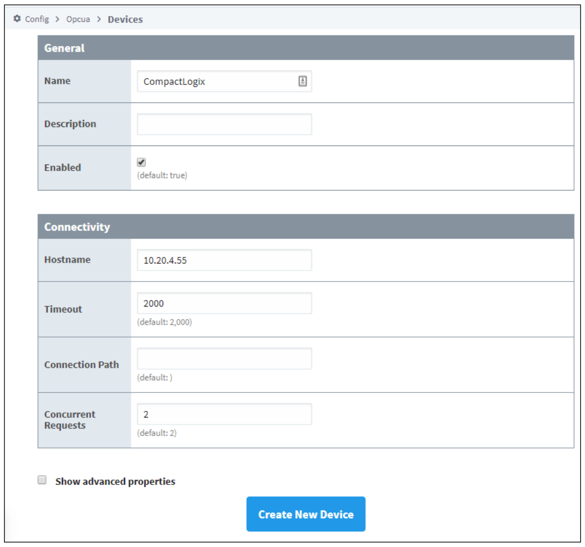
3. On the **Devices** page, find the blue arrow and click on **Create new Device**.
4. Select **Legacy Allen-Bradley CompactLogix**, and click **Next**.



Config > Opcua > Devices

- ● Allen-Bradley CompactLogix (Legacy) — Connect to CompactLogix firmware v20 and prior processors.
- ○ Allen-Bradley ControlLogix (Legacy) — Connect to ControlLogix firmware v20 and prior processors.
- ○ Allen-Bradley Logix Driver — Connect to Allen-Bradley Logix family devices, including devices with firmware v21+.
- ○ Allen-Bradley MicroLogix — Connect to MicroLogix 1100 and 1400 series PLCs.
- ○ Allen-Bradley PLC5 — Connect to PLC5s via Ethernet.

5. On the **New Device** page, leave all the default values and type in the following fields:
   Name: **CompactLogix**
   Hostname: type the **IP address** for the PLC, for example 10.20.4.55.



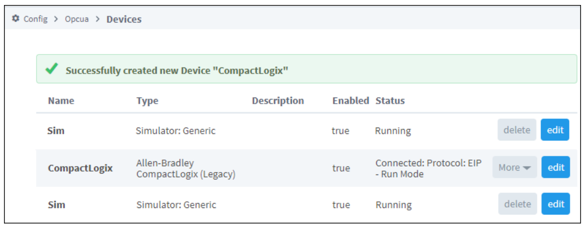
Config > Opcua > Devices

General	
Name	CompactLogix
Description	
Enabled	✓ (default: true)

Connectivity	
Hostname	10.20.4.55
Timeout	2000 (default: 2,000)
Connection Path	(default:)
Concurrent Requests	2 (default: 2)

☐ Show advanced properties

6. Click **Create New Device**.
   The **Devices** page is displayed showing the **CompactLogix** device is added to Ignition. The **Status** will show as Disconnected and then Connected.



Successfully created new Device "CompactLogix"

Name	Type	Description	Enabled	Status	
Sim	Simulator: Generic		true	Running	delete edit
CompactLogix	Allen-Bradley CompactLogix (Legacy)		true	Connected: Protocol: EIP - Run Mode	More edit
Sim	Simulator: Generic		true	Running	delete edit

7. To see all the Tags, go to **OPC Client > Quick Client** in the **Config** section. On the **OPC Quick Client** page, expand the **CompactLogix** folder and in the **Global** folder you can see all the tags.

Device Connection Settings

The general settings are common to all Allen Bradley devices. The connectivity and advanced settings are device dependent.

General	
Name	The user-defined name for this Device. The Device Name must be alphanumeric.
Description	The user-defined description for the device. This is only used as a note to differentiate between devices.
Enable Device	Only devices that are enabled appear in **Connections > Devices** of the **Status** page of the Gateway and thus have their tags available for use. Default is true.

Connectivity	
Hostname	This is the IP Address of the Ethernet module to route through to connect a CompactLogix processor.
Local Address	The following feature is new in Ignition version **8.1.8** Click here to check out the other new features The local address to connect from when establishing a TCP connection. If left blank, then the driver will simply pick an available address.
Timeout	The timeout settings refer to the communication between the device driver and the OPC-UA server and usually can be left at their default values.
Connection Path	The Connection Path value is used to define the route to connect to the processor. The Connection Path format contains 4 numbers separated by commas. The first number is always 1 and tells the Ethernet module to route through the backplane. The rest of the numbers vary by device type, for a more in depth explanation of connection paths, see Allen Bradley Connection Paths Explained section.
Concurrent Requests	The number of requests that Ignition will try to send to the device at the same time. Increasing this number can sometimes help with your request throughput, however increasing this too much can overwhelm the device and hurt communications with the device.

Advanced	
Disable Automatic Browse	Disables the automatic browse setting. Default is false.
Show String Arrays	Disables the Show String Arrays setting. Default is false.
Status Request Poll Rate	Controls the poll rate for status requests, in milliseconds. Default is 1,000.

Related Topics ...

- Connecting to MicroLogix

Connecting to ControlLogix

Note: This driver is made for ControlLogix firmware up to version 20.18.

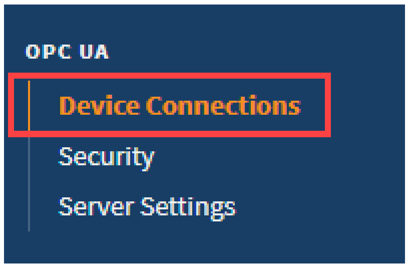
INDUCTIVE UNIVERSITY

Connecting to Legacy ControlLogix

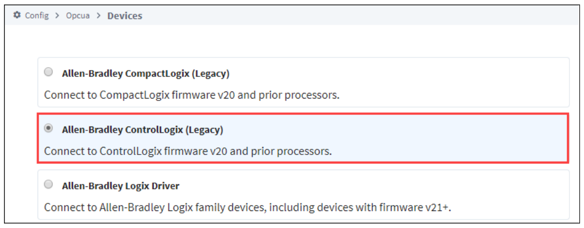
Watch the Video

Connect to an Allen-Bradley ControlLogix Device

1. Go to the **Config** section of the Gateway Webpage.
2. Scroll down and select **OPC UA > Device Connections**.



3. On the **Devices** page, find the blue arrow and click on **Create new Device**.
4. Select **Legacy Allen-Bradley ControlLogix**, and click **Next**.

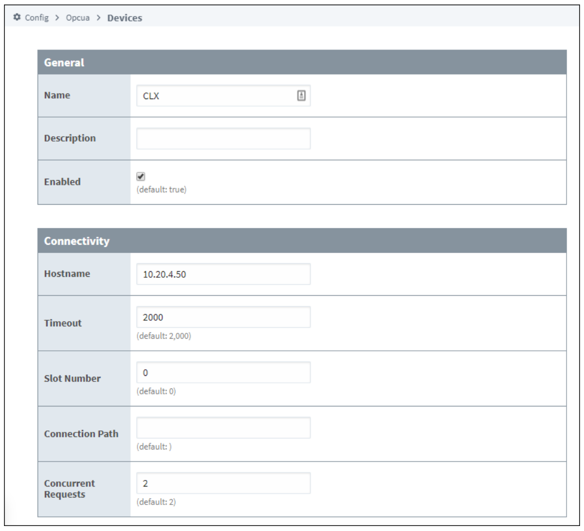


Allen-Bradley CompactLogix (Legacy)
Connect to CompactLogix firmware v20 and prior processors.

[✓ Allen-Bradley ControlLogix (Legacy)]
Connect to ControlLogix firmware v20 and prior processors.

Allen-Bradley Logix Driver
Connect to Allen-Bradley Logix family devices, including devices with firmware v21+.

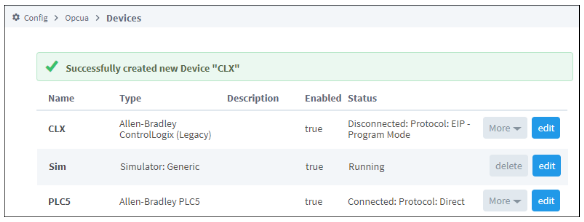
5. On the **Devices** page, leave all the default values and type in the following fields:
   Name: **CLX**
   Hostname: Enter the **IP address** for the PLC, for example 10.20.4.50.



General	
Name	CLX
Description	
Enabled	✓ (default: true)

Connectivity	
Hostname	10.20.4.50
Timeout	2000 (default: 2,000)
Slot Number	0 (default: 0)
Connection Path	(default:)
Concurrent Requests	2 (default: 2)

6. Click **Create New Device**.
   The **Devices** page is displayed showing the **ControlLogix** device is added to Ignition. The **Status** will show as Disconnected and then Connected.



Successfully created new Device "CLX"

Name	Type	Description	Enabled	Status
CLX	Allen-Bradley ControlLogix (Legacy)		true	Disconnected: Protocol: EIP - Program Mode
Sim	Simulator: Generic		true	Running
PLC5	Allen-Bradley PLC5		true	Connected: Protocol: Direct

7. To see all the Tags, go to **OPC Client > Quick Client** in the **Config** section. On the **OPC Quick Client** page, expand the **ControlLogix** folder and in the **Global** folder you can see all the tags.

Device Connection Settings

The **General** settings are common to all Allen Bradley devices, and the **Connectivity** settings are device dependent.

General	
Name	The user-defined name for this Device. The name chosen will show up in **OPC Item Paths** and under **OPC-UA Server > Devices** of the **Configure** page of the Gateway. The Device Name must be alphanumeric.
Description	The user-defined description for the device. This is only used as a note to differentiate between devices.
Enable Device	Only devices that are enabled appear in **Connections > Devices** of the **Status** page of the Gateway and thus have their tags available for use.

Connectivity	
Hostname	This is the IP Address of the ControlLogix Ethernet module (1756-ENET) to route through to connect a ControlLogix processor. EthernetIP protocol on TCP port 44818 (0xAF12) is used to communicate to ControlLogix processors.
Local Address	The following feature is new in Ignition version **8.1.8** Click here to check out the other new features The local address to connect from when establishing a TCP connection. If left blank, then the driver will simply pick an available address.
Timeout	After sending a request to the ControlLogix processor, the Communication Timeout setting is the amount of time in msec to wait for a response before treating it as a failure.
Slot Number	The Slot Number value is the zero based ControlLogix chassis slot number of the ControlLogix processor to connect to.
Connection Path	The Connection Path value is used to define the route of the PLC-5 processor to connect to. Currently routing through the ControlLogix Ethernet Communication Interface Module (1756-ENET) to the ControlLogix Data Highway Plus-Remote I/O Communication Interface Module (1756-DHRIO) and on to a PLC-5 processor of the DH+ network is supported.
Concurrent Requests	The number of requests that Ignition will try to send to the device at the same time. Increasing this number can sometimes help with your request throughput, however increasing this too much can overwhelm the device and hurt your communications with the device.

Advanced	
Disable Automatic Browse	Disables the automatic browse setting. (Default is false.)
Show String Arrays	Disables the Show String Arrays setting. (Default is false.)
Status Request Poll Rate	Controls the poll rate for status requests, in milliseconds. (Default is 1,000.)

Supported Connection Methods

ControlLogix 5500 connected through 1756-ENET/A or 1756-ENET/B.

Related Topics ...

- Connecting to CompactLogix

Connecting to Logix

Note: This driver is optimized for Logix family devices with firmware version 21+, but supports earlier firmware versions with significantly reduced performance.

On this page ...

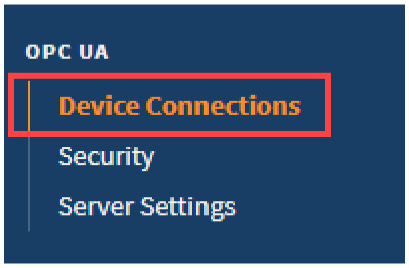
INDUCTIVE UNIVERSITY

Connecting to ControlLogix v21

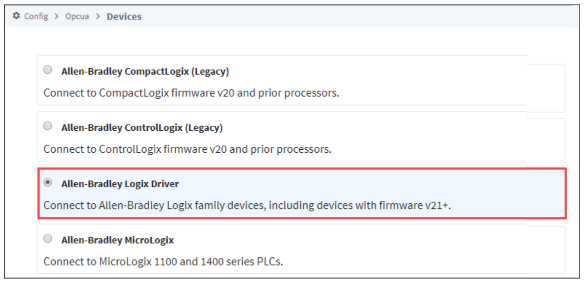
Watch the Video

Connect to an Allen-Bradley Logix Device

1. Go to the **Config** section of the Gateway Webpage.
2. Scroll down and select **OPC UA > Device Connections**.



3. On the **Devices** page, find the blue arrow and click on **Create new Device**.
4. Select **Allen-Bradley Logix Driver**, and click **Next**.



Config > Opcua > Devices

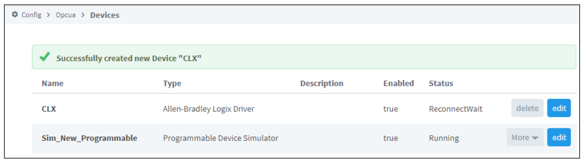
- ○ **Allen-Bradley CompactLogix (Legacy)**
  Connect to CompactLogix firmware v20 and prior processors.
- ○ **Allen-Bradley ControlLogix (Legacy)**
  Connect to ControlLogix firmware v20 and prior processors.
- ● **Allen-Bradley Logix Driver**
  Connect to Allen-Bradley Logix family devices, including devices with firmware v21+.
- ○ **Allen-Bradley MicroLogix**
  Connect to MicroLogix 1100 and 1400 series PLCs.

5. Fill in the following fields:

   Name: **CLX**
   Hostname: type the **IP address** for the PLC, for example 10.20.1.54.

   Leave the default values in the remaining fields.

6. Click **Create New Device**.
7. The **Devices** page is displayed showing the **ControlLogix** device is added to Ignition. The **Status** will show as Disconnected and then Connected.



Config > Opcua > Devices

✓ Successfully created new Device "CLX"

Name	Type	Description	Enabled	Status	
CLX	Allen-Bradley Logix Driver		true	ReconnectWait	delete edit
Sim_New_Programmable	Programmable Device Simulator		true	Running	More edit

8. To see all the Tags, go to **OPC Client > Quick Client** in the **Config** section. On the **OPC Quick Client** page, expand the **CompactLogix** folder and in the **Global** folder you can see all the tags.

Driver Implementation

One noteworthy implementation of the Logix driver is how boolean arrays are handled. Boolean arrays items are browsed as members of a 32-bit DWORD. Thus, a BOOL[64] in the PLC is implemented as DWORD[2] in the driver.

Below is a table representing how members of a boolean array items are mapped in the PLC, compared to the Logix driver's implementation.

PLC Mapping	Driver Implementation
`boolTag[0]`	`boolTag[0].0`
`boolTag[31]`	`boolTag[0].31`
`boolTag[32]`	`boolTag[1].0`
`boolTag[63]`	`boolTag[1].31`

The following feature is new in Ignition version **8.1.28**
Click here to check out the other new features

The Logix driver also supports the following datatypes:

- DT (Date/Time)
- LDT (Date/Time [ns])
- LTIME (LTime [ns])
- TIME (Decimal)
- TIME32 (Time32 [us])

Device Connection Settings

The General settings are common to all Allen Bradley devices, and the Connectivity settings are device dependent.

General	
Name	The user-defined name for this Device. The name chosen will show up in **OPC Item Paths** and under **OPC-UA Server > Devices** of the **Configure** page of the Gateway. The Device Name must be alphanumeric.
Description	The user-defined description for the device. This is only used as a note to differentiate between devices.
Enable Device	Only devices that are enabled appear in **Connections > Devices** of the **Status** page of the Gateway and thus have their tags available for use.

Connectivity	
Hostname	This is the IP Address of the ControlLogix Ethernet module (1756-ENET) to route through to connect a ControlLogix processor. EthernetIP protocol on TCP port 44818 (0xAF12) is used to communicate to ControlLogix processors.
Port	Port to connect to the remote device.
Local Address	The following feature is new in Ignition version **8.1.8** Click here to check out the other new features The local address to connect from when establishing a TCP connection. If left blank, then the driver will simply pick an available address.
Timeout	After sending a request to the ControlLogix processor, the Communication Timeout setting is the amount of time in msec to wait for a response before treating it as a failure.
Max Concurrent Requests	The number of requests that Ignition will try to send to the device at the same time. Increasing this number can sometimes help with your request throughput, however increasing this too much can overwhelm the device and hurt your communications with the device.
Slot Number	The Slot Number value is the zero based ControlLogix chassis slot number of the ControlLogix processor to connect to.

Advanced	
Automatic Rebrowse	Monitor for tag additions and UDT changes and automatically initiate a re-browse when detected. If this is disabled tags will only be browsed when connecting and reconnecting. (Default is true.)

Identity Request Frequency	The following feature is new in Ignition version **8.1.3** Click here to check out the other new features Frequency, in milliseconds, that the request to read CIP Identity Object attributes occurs at. (Default is 5,000.)
CIP Connection Size	The CIP connection size to use during Forward Open requests. (Default is 500.)
CIP Connection Timeout	The following feature is new in Ignition version **8.1.10** Click here to check out the other new features Target timeout, in milliseconds, for CIP connections and RPI. (Default is 16,000)

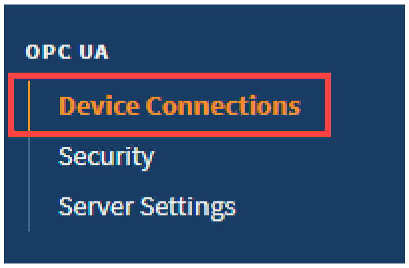
Related Topics ...

- Connecting to ControlLogix

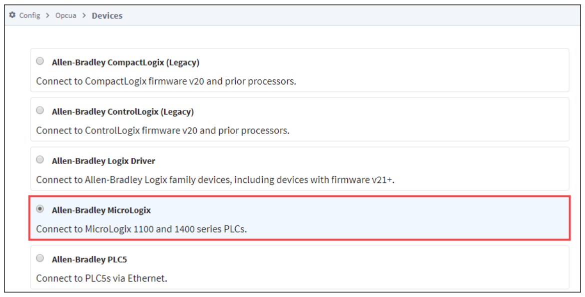
Connecting to MicroLogix

Connect to a Device

1. Go to the **Config** section of the Gateway Webpage.
2. Scroll down and select **OPC UA > Device Connections**.

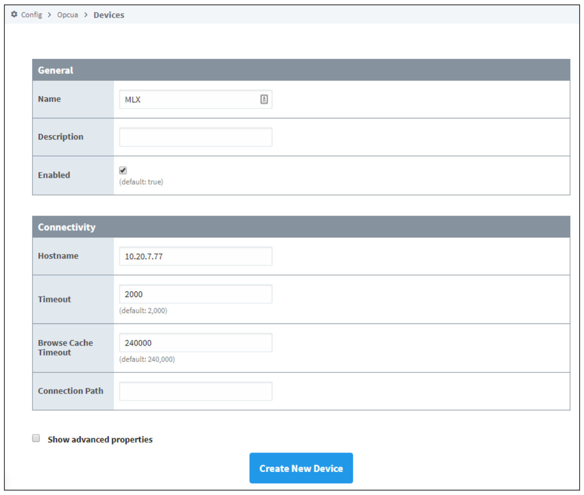


3. On the **Devices** page, find the blue arrow and click on **Create new Device**.
4. Select **Allen-Bradley MicroLogix**, and click **Next**.


Config > Opcua > Devices

- Allen-Bradley CompactLogix (Legacy)
  Connect to CompactLogix firmware v20 and prior processors.
- Allen-Bradley ControlLogix (Legacy)
  Connect to ControlLogix firmware v20 and prior processors.
- Allen-Bradley Logix Driver
  Connect to Allen-Bradley Logix family devices, including devices with firmware v21+.
- [✓ Allen-Bradley MicroLogix]
  Connect to MicroLogix 1100 and 1400 series PLCs.
- Allen-Bradley PLC5
  Connect to PLC5s via Ethernet.

5. On the **New Device** page, leave all the default values and type in the following fields:
   Name: **MLX**
   Hostname: Enter **IP address** for the PLC, for example 10.20.7.77

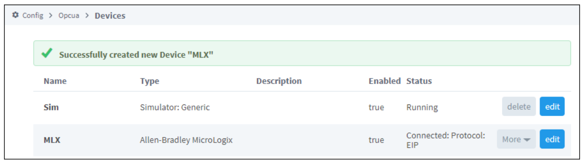

Config > Opcua > Devices

General	
Name	MLX
Description	
Enabled	✓ (default: true)

Connectivity	
Hostname	10.20.7.77
Timeout	2000 (default: 2,000)
Browse Cache Timeout	240000 (default: 240,000)
Connection Path	

Show advanced properties

6. Click **Create New Device**.
7. The **Devices** page is displayed showing the **MicroLogix** device is added to Ignition. The **Status** will show as Disconnected and then Connected.


Config > Opcua > Devices

✓ Successfully created new Device "MLX"

Name	Type	Description	Enabled	Status	
Sim	Simulator: Generic		true	Running	delete edit
MLX	Allen-Bradley MicroLogix		true	Connected: Protocol: EIP	More edit

On this page ...

INDUCTIVE UNIVERSITY

Connecting to MicroLogix

Watch the Video

8. To see all the Tags, go to **OPC Client > Quick Client** in the **Config** section. On the **OPC Quick Client** page expand the **MicroLogix** folder which contains all the folders with the individual Tags.

Device Connection Settings

The **General** settings are common to all Allen-Bradley devices, and the **Connectivity** settings are device dependent.

General	
Name	The user-defined name for this Device. The name chosen will show up in **OPC Item Paths** and under **OPC-UA Server > Devices** of the **Configure** page of the Gateway. The Device Name must be alphanumeric.
Description	The user-defined description for the device. This is only used as a note to differentiate between devices.
Enable Device	Only devices that are enabled appear in **Connections > Devices** of the **Status** page of the Gateway and thus have their tags available for use.

Connectivity	
Hostname	The Hostname value is the IP Address of the MicroLogix 1100 processor, MicroLogix 1400 processor or 1761-NET-ENI Ethernet interface. EthernetIP protocol on TCP port 44818 (0xAF12) is used to communicate to the listed devices.
Local Address	The following feature is new in Ignition version **8.1.8** Click here to check out the other new features The local address to connect from when establishing a TCP connection. If left blank, then the driver will simply pick an available address.
Communication Timeout	After sending a request to the MicroLogix processor, the Communication Timeout setting is the amount of time in msec to wait for a response before treating it as a failure.
Browse Cache Timeout	When the data table layout is read from the MicroLogix processor, the Browse Cache Timeout value is the amount of time in msec to cache the results.

Advanced	
Disable Processor Browse	Disables the processor browse setting. (Default is false.)
Zero TNS Connection	Disables the Zero TNS connection setting. (Default is false.)

Supported MicroLogix Connection Methods

- MicroLogix 1100 and 1400 direct
- MicroLogix 1100 and 1400 connected through 1761-NET-ENI
- MicroLogix 1100/1400 connected through Spectrum Controls WebPort 500

Caution:

MicroLogix 1200 and 1500 are not fully supported. Browsing is not available on these devices, so the 'Disable Processor Browse' advanced property will need to be set to True on the device connection.

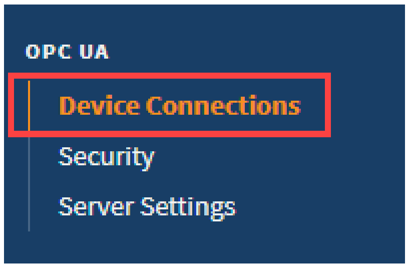
Additionally, the MicroLogix driver can not access Input Parameters.

Note: Some Micrologix devices may get stuck in a 'Browse Pending' status. In this case setting the connection path property to 1,0 should resolve the issue.

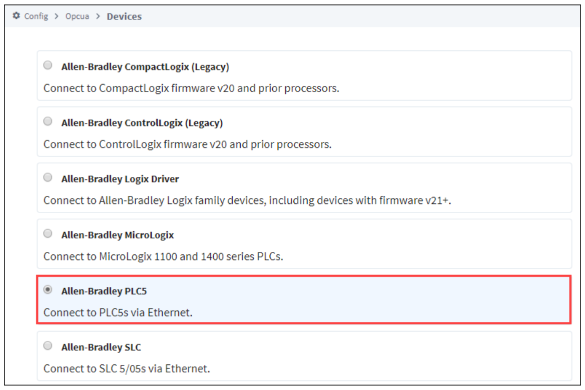
Connecting to PLC5

Connect to a Device

1. Go to the **Config** section of the Gateway Webpage.
2. Scroll down and select **OPC UA > Device Connections**.



3. On the **Devices** page, click on **Create new Device**.
4. Select **Allen-Bradley PLC5**, and click **Next**.

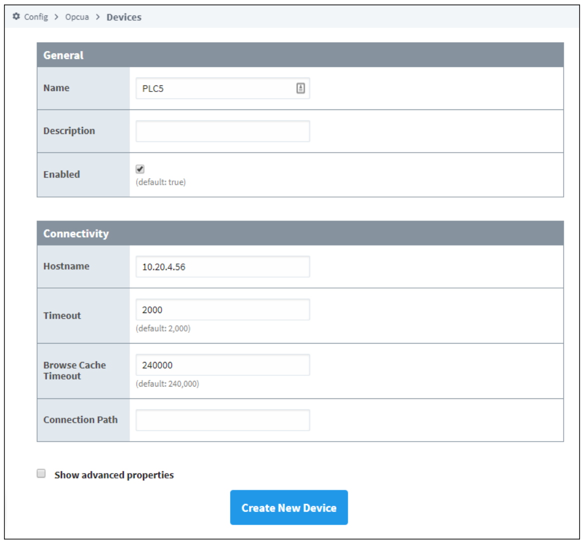


Config > Opcua > Devices

- ○ Allen-Bradley CompactLogix (Legacy)
  Connect to CompactLogix firmware v20 and prior processors.
- ○ Allen-Bradley ControlLogix (Legacy)
  Connect to ControlLogix firmware v20 and prior processors.
- ○ Allen-Bradley Logix Driver
  Connect to Allen-Bradley Logix family devices, including devices with firmware v21+.
- ○ Allen-Bradley MicroLogix
  Connect to MicroLogix 1100 and 1400 series PLCs.
- ● Allen-Bradley PLC5
  Connect to PLC5s via Ethernet.
- ○ Allen-Bradley SLC
  Connect to SLC 5/05s via Ethernet.

5. Fill in the following fields:
   Name: **PLC5**
   Hostname: type the **IP address** for the PLC, for example 10.20.4.56.

   Leave the default values for the remaining fields.



Config > Opcua > Devices

General	
Name	PLC5
Description	
Enabled	✓ (default: true)

Connectivity	
Hostname	10.20.4.56
Timeout	2000 (default: 2,000)
Browse Cache Timeout	240000 (default: 240,000)
Connection Path	

☐ Show advanced properties

Create New Device

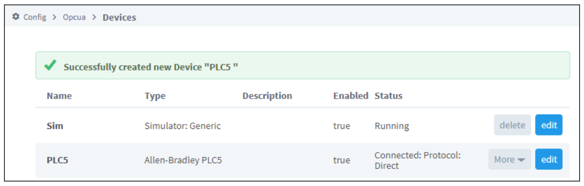
6. Click **Create New Device**.
7. The **Devices** page is displayed showing the **PLC5** device is added to Ignition. The **Status** will show as Disconnected and then Connected.

On this page ...

INDUCTIVE UNIVERSITY

Connecting to PLC5

Watch the Video



Successfully created new Device "PLC5 "

Name	Type	Description	Enabled	Status
Sim	Simulator: Generic		true	Running
PLC5	Allen-Bradley PLC5		true	Connected: Protocol: Direct

8. To see all the Tags, go to **OPC Client > Quick Client** in the **Config** section. On the **OPC Quick Client** page, expand the **PLC5** folder and in the **Global** folder you can see all the tags.

Device Connection Settings

The **General** settings are common to all Allen Bradley devices, and the **Connectivity** settings are device dependent.

General	
Name	The user-defined name for this Device. The name chosen will show up in **OPC Item Paths** and under **OPC-UA Server > Devices** of the **Configure** page of the Gateway. The Device Name must be alphanumeric.
Description	The user-defined description for the device. This is only used as a note to differentiate between devices.
Enable Device	Only devices that are enabled appear in **Connections > Devices** of the **Status** page of the Gateway and thus have their tags available for use.

Connectivity	
Hostname	The Hostname value is the IP Address of the PLC-5 processor. The protocol that the PLC-5 processor supports is automatically detected. It will use either CSP protocol on port 2222 (0x8AE) or EthernetIP protocol on port 44818 (0xAF12).
Local Address	The following feature is new in Ignition version **8.1.8** Click here to check out the other new features The local address to connect from when establishing a TCP connection. If left blank, then the driver will simply pick an available address.
Communication Timeout	After sending a request to the PLC-5 processor, the Communication Timeout setting is the amount of time in milliseconds to wait for a response before treating it as a failure.
Browse Cache Timeout	When the data table layout is read from the PLC-5 processor, the Browse Cache Timeout value is the amount of time in milliseconds to cache the results.
Connection Path	The Connection Path value is used to define the route of the PLC-5 processor to connect to. Currently routing through the ControlLogix Ethernet Communication Interface Module (1756-ENET) to the ControlLogix Data Highway Plus-Remote I/O Communication Interface Module (1756-DHRIO) and on to a PLC-5 processor of the DH+ network is supported.

Advanced	
Disable Processor Browse	Disables the processor browse setting. (Default is false.)
Zero TNS Connection	Disables the Zero TNS connection setting. (Default is false.)

More Information On Connection Path

The Connection Path format contains 4 numbers separated by commas. The first number is always 1 and tells the 1756-ENET module to route through the backplane. The second number is the slot number of the 1756-DHRIO module of the DH+ network the PLC-5 processor is connected to.

The third number is the channel of the 1756-DHRIO module that the PLC-5 processor is connected to. Use 2 for channel A and 3 for channel B. The final and fourth number is the DH+ node number. This number is in octal and is the same as configured in the PLC-5 processor. See the **ControlLogix Ethernet Communication interface Module** User Manual for more information.

Connection Path Format: 1,<1756-DHRIO slot number>,<1756-DHRIO channel>,<DH+ node number>

The valid range for the 1756-DHRIO slot number is between 0 and 16 but depends on the chassis size. The 1756-DHRIO channel is either 2 for channel A or 3 for channel B. The DH+ node number range is from 00 to 77 octal.

Supported PLC-5 Connection Methods

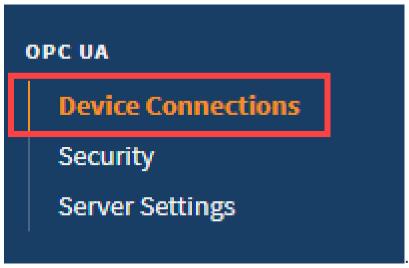
PLC-5 L/20E, L/40E, L/80E direct
All PLC-5 processors connected through DH+ via the 1756-DHRIO module.

Note: ASCII data types from a PLC5 are not supported by the Allen-Bradley PLC5 driver.

Connecting to SLC

Connect to an Allen-Bradley SLC Device

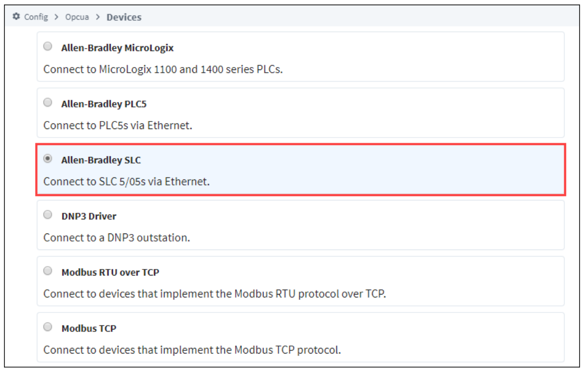
1. Go to the **Config** section of the Gateway Webpage.
2. Scroll down and select **OPC UA > Device Connections**.



.

3. On the **Devices** page, click on **Create new Device**.
4. Select **Allen-Bradley SLC**, and click **Next**.

Note: These PLCs do not have a native Ethernet connection, therefore another device like a Net ENI or an ENBT must be used for the connection.



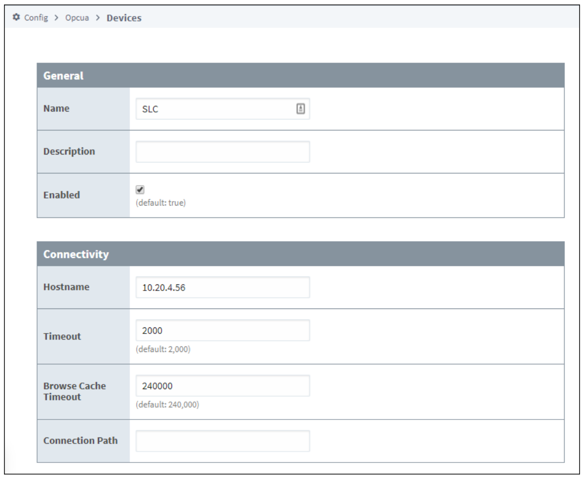
Config > Opcua > Devices

- Allen-Bradley MicroLogix
  Connect to MicroLogix 1100 and 1400 series PLCs.
- Allen-Bradley PLC5
  Connect to PLC5s via Ethernet.
- [✓ Allen-Bradley SLC]
  Connect to SLC 5/05s via Ethernet.
- DNP3 Driver
  Connect to a DNP3 outstation.
- Modbus RTU over TCP
  Connect to devices that implement the Modbus RTU protocol over TCP.
- Modbus TCP
  Connect to devices that implement the Modbus TCP protocol.

5. Fill in the following fields:

   Name: **SLC**
   Hostname: **IP address** for the PLC, for example 10.20.4.56.

   Leave the default values in the remaining fields.



Config > Opcua > Devices

General	
Name	SLC
Description	
Enabled	✓ (default: true)
Connectivity	
Hostname	10.20.4.56
Timeout	2000 (default: 2,000)
Browse Cache Timeout	240000 (default: 240,000)
Connection Path	

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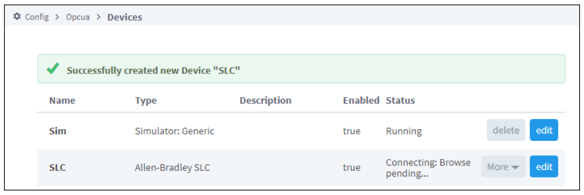
INDUCTIVE UNIVERSITY

Connecting to SLC

Watch the Video

6. Click **Create New Device**.
   The **Devices** page is displayed showing the **SLC** device is added to Ignition. The **Status** will show as Disconnected and then Connected.



Config > Opcua > Devices

Successfully created new Device "SLC"

Name	Type	Description	Enabled	Status	
Sim	Simulator: Generic		true	Running	delete edit
SLC	Allen-Bradley SLC		true	Connecting: Browse pending...	More edit

7. To see all the Tags, go to **OPC Client > Quick Client** in the **Config** section. On the **OPC Quick Client** page, expand the **SLC** folder and in the **Global** folder you can see all the tags.

Device Connection Settings

The general settings are common to all Allen Bradley devices, and the connectivity and advanced settings are device dependent.

General	
Name	The user-defined name for this Device. The name chosen will show up in **OPC Item Paths** and under **OPC-UA Server > Devices** of the **Configure** page of the Gateway. The Device Name must be alphanumeric.
Description	The user-defined description for the device. This is only used as a note to differentiate between devices.
Enable Device	Only devices that are enabled appear in **Connections > Devices** of the **Status** page of the Gateway and thus have their tags available for use.

Connectivity	
Hostname	The Hostname value is the IP Address of the SLC processor. The protocol that the SLC processor supports is automatically detected. It will use either CSP protocol on port 2222 (0x8AE) or EthernetIP protocol on port 44818 (0xAF12).
Local Address	The following feature is new in Ignition version **8.1.8** Click here to check out the other new features The local address to connect from when establishing a TCP connection. If left blank, then the driver will simply pick an available address.
Communication Timeout	After sending a request to the SLC processor, the Communication Timeout setting is the amount of time in milliseconds to wait for a response before treating it as a failure.
Browse Cache Timeout	When the data table layout is read from the SLC processor, the Browse Cache Timeout value is the amount of time in milliseconds to cache the results.
Connection Path	The Connection Path value is used to define the route of the SLC processor to connect to. Currently routing through the ControlLogix Ethernet Communication Interface Module (1756-ENET)to the ControlLogix Data Highway Plus-Remote I/O Communication Interface Module (1756-DHRIO) and on to a SLC processor of the DH+ network is supported.

Advanced Options	
Disable Processor Browse	Disables the processor browse setting. (Default is false.)
Zero TNS Connection	Disables the Zero TNS connection setting. (Default is false.)

More Information On Connection Path

The Connection Path format contains 4 numbers separated by commas. The first number is always 1 and tells the 1756-ENET module to route through the backplane. The second number is the slot number of the 1756-DHRIO module of the DH+ network the SLC processor is connected to. The third number is the channel of the 1756-DHRIO module that the SLC processor is connected to. Use 2 for channel A and 3 for channel B. The final and fourth number is the DH+ node number. This number is in octal and is the same as configured in the SLC processor. See the ControlLogix Ethernet Communication interface Module User Manual for more information.

Connection Path Format: 1,<1756-DHRIO slot number>,<1756-DHRIO channel>,<DH+ node number>

The valid range for the 1756-DHRIO slot number is between 0 and 16 but depends on the chassis size. The 1756-DHRIO channel is either 2 for channel A or 3 for channel B. The DH+ node number range is from 00 to 77 octal.

Supported SLC Connection Methods

SLC505 direct
SLC505, SLC504, SLC503 connected through 1761-NET-ENI
SLC504 connected through 1756-DHRIO
SLC505, SLC504, SLC503 connected through Spectrum Controls WebPort 500

Allen-Bradley Connection Paths

Connections to ControlLogix, CompactLogix, PLC-5, MicroLogix and SLC Allen-Bradley processors through a ControlLogix Gateway require a connection path. The connection path is unique to your setup and is dependent on what modules the connection is being routed through. However, each connection path follows a basic set of rules outlined below.

On this page ...

Follow the Path

A connection path is a path that when followed leads from the ControlLogix gateway to a processor residing in a numbered slot of a chassis somewhere on site. You only have to build the connection path as you go.

Setting Up the Device Connection

The first connection point between Ignition and the device is a ControlLogix Ethernet module such as an ENET, ENBT, or EN2T module. This means that the while the driver type used is the same type as the PLC you want to connect to, the hostname actually needs to point to the ControlLogix Gateway. The connection path is then followed to go out of the ControlLogix Gateway and into the PLC you are connecting to.

You need to have 6 numbers/entries to specify the connection path. The way you find each number is described in the following table:

1st Number	Is 1 and means move to the back plane
2nd Number	Is the slot number of the module you want to move to
3rd Number	Is the exit port or channel of that module that you want to exit through
4th Number	Is the address of entry point to the next module (DH+ Station Number / ControlNet Address / IP Address of ethernet module)
5th Number	Is 1 and means move to the back plane (from this 5th Number, it starts repeating as the 1 st Number)
6th Number	Is the processor slot number OR the slot number of the module you want to move to

The process of coming up with these numbers may sound complicated at first but after some practice it gets easier.

Examples

Below there are a few examples that go over the differences with using specific modules to route the connection. Note that typically, the end result PLC does not matter. So while the example may show connecting to a PLC5 through ControlNet, the the PLC5 could easily be swapped out with another PLC, and the connection path would remain the same. The big change when using different end result PLCs is what device driver to use for the connection.

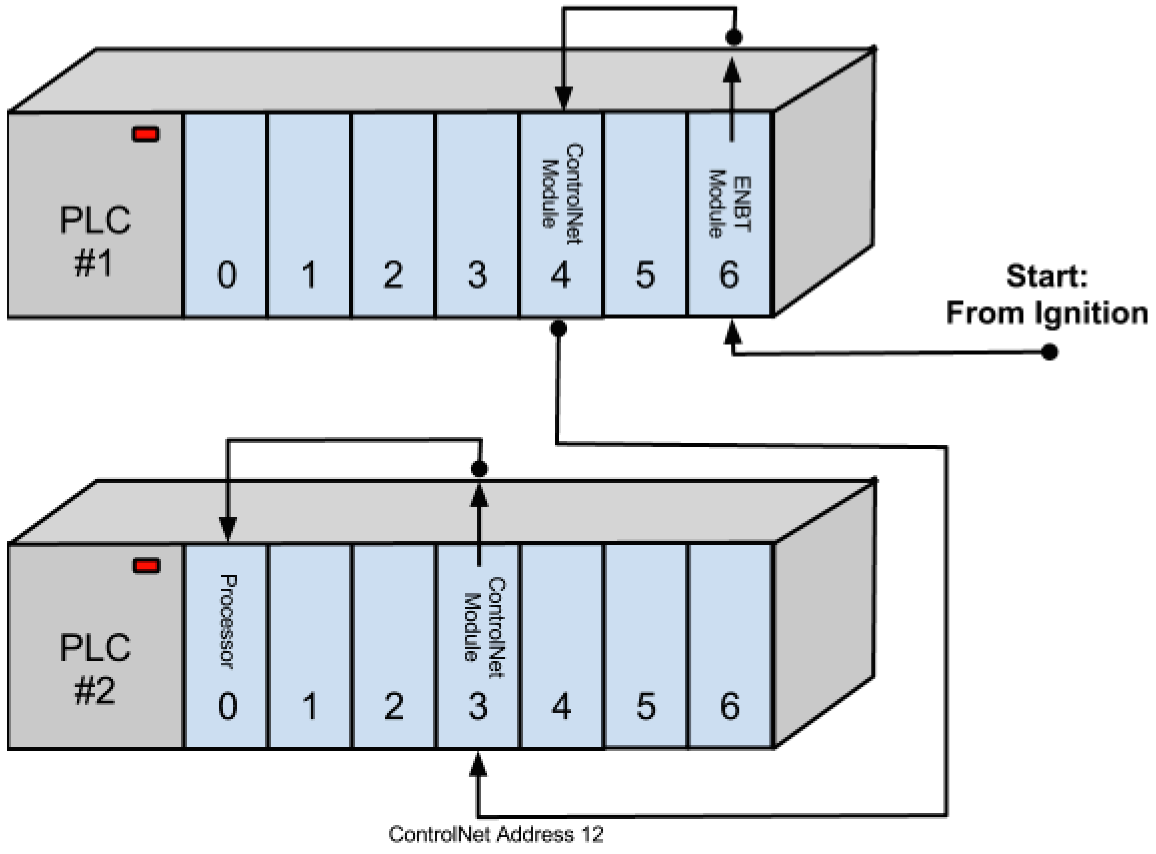
Note: Understanding how the Connection Paths are built listed above is important to understand the specifics of using different modules in the examples below.

Connecting to a PLC through ControlNet

The example below connects to a PLC5 using ControlNet that has a **connection path** of **1,4,2,12,1,0** going from **PLC 1** to **PLC 2**. The device driver is the Allen-Bradley PLC5, and the hostname is the IP address of the ControlLogix Gateway (PLC #1).

1	Move out of ENBT Module to the backplane
4	Move to ControlNet Module in Slot 4

2	Move out ControlNet Port
12	Move in ControlNet Module at ControlNet Address 12
1	Move out of ControlNet to the backplane
0	Move to the Processor in Slot 0



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ControlNet Example

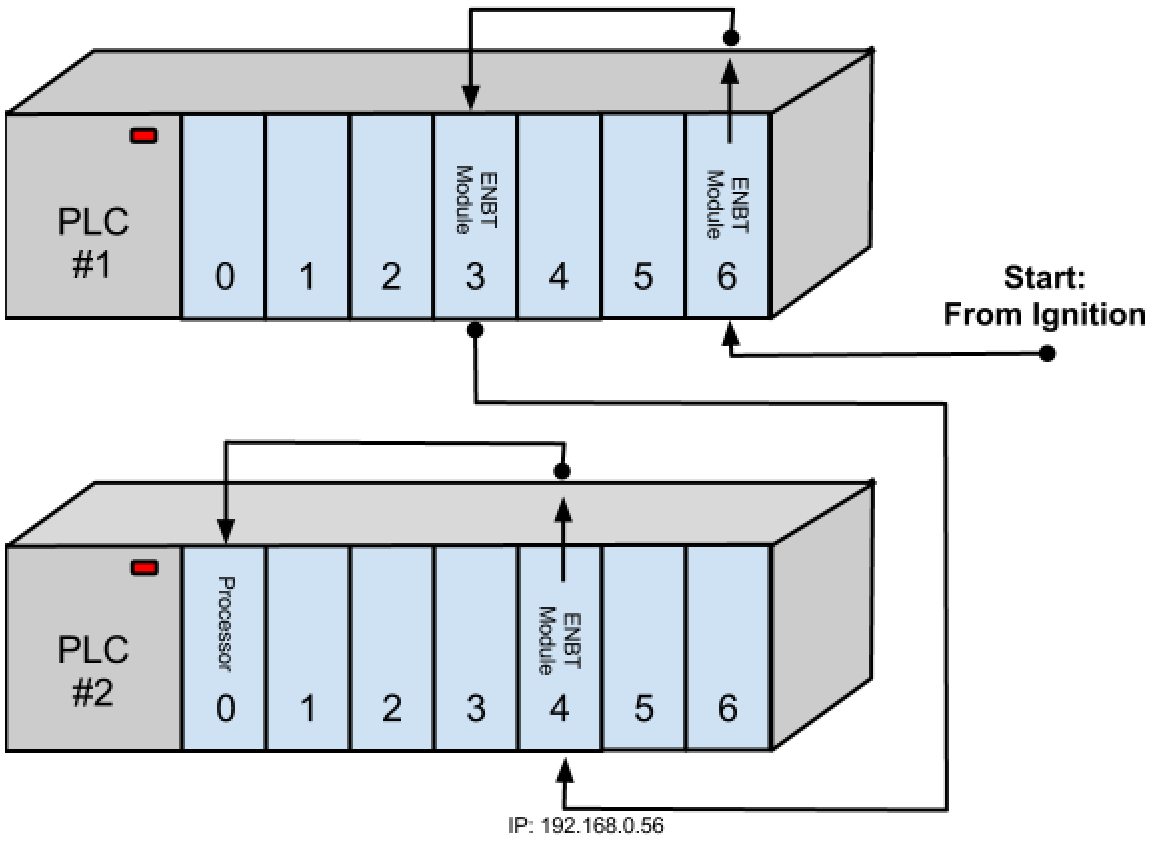
Watch the Video

Connecting to a PLC using ENBT

The example below connects to a ControlLogix using ENBT that has a **connection path** of **1,3,2,192.168.0.56,1,0** going from **PLC 1** to **PLC 2**. The device driver is the Allen-Bradley ControlLogix, and the hostname is the IP address of the ControlLogix Gateway (PLC #1).

1	Move out of ENBT Module to the backplane
3	Move to ENBT Module in Slot 3
2	Move out the Ethernet Port

192.168.0.56	Move in EBNT Module at IP Address 192.168.0.56
1	Move out of EBNT to the backplane
0	Move to the Processor in Slot 0



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An ENBT Example

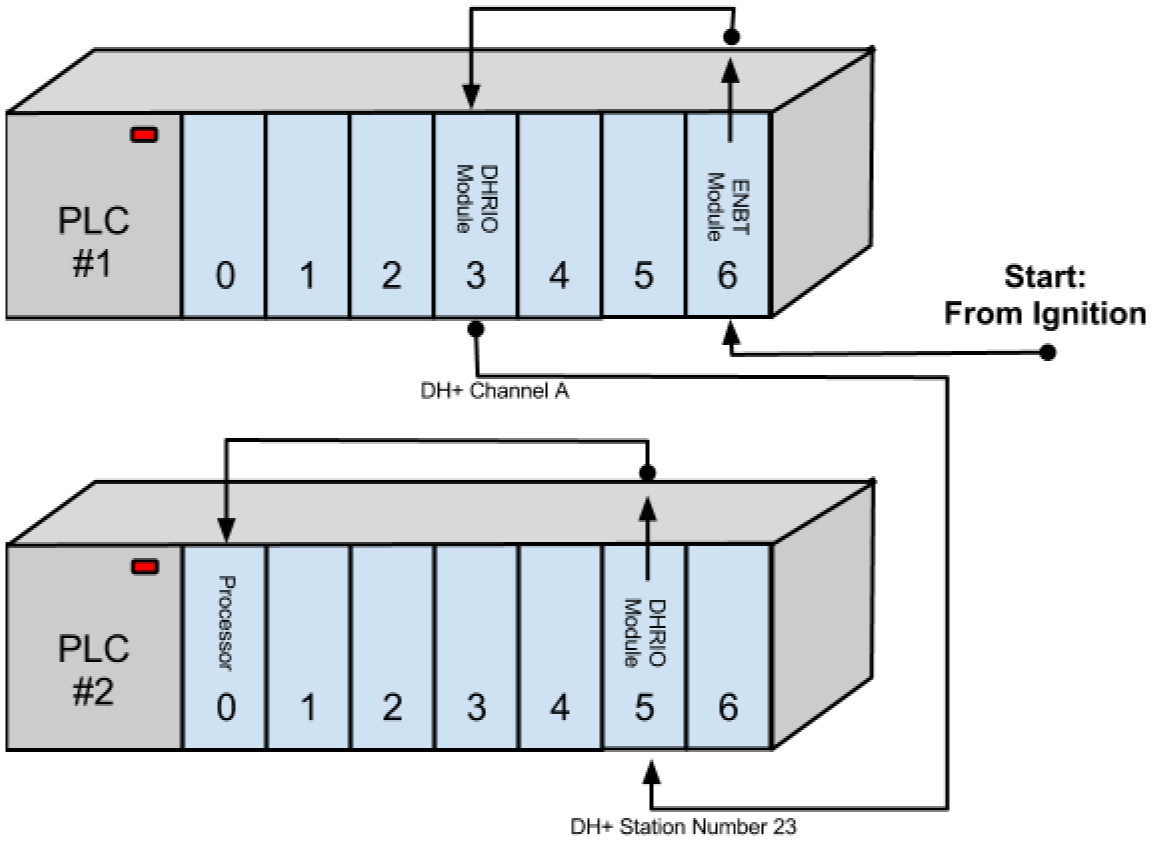
Watch the Video

Connecting to a ControlLogix using Data Highway Plus (DH+)

The example below connects to a ControlLogix using Data Highway Plus that has a **connection path** of **1,3,2,23,1,0** going from **PLC 1** to **PLC 2**. The device driver is the Allen-Bradley ControlLogix, and the hostname is the IP address of the ControlLogix Gateway (PLC #1).

1	Move out of ENBT Module to the backplane
3	Move to DHRIO Module in Slot 3
2	Move out DH+ Channel A
23	Move in DH+ Station Number 23
1	Move out of DHRIO Module to the backplane

0	Move to the Processor in Slot 0



Connecting to multiple SLCs using Data Highway Plus (DH+)

The example below connects to 3 different SLC using Data Highway Plus. Each SLC connection would have their own device connection, each with a unique connection path.

The connection paths are:

- **SLC X 1,3,2,21**
- **SLC Y 1,3,3,40**
- **SLC Z 1,3,3,41**

The device driver is the device you want to connect to (in this case, Allen-Bradley SLC), and the hostname is the IP address of the ControlLogix Gateway (PLC #1).

SLC X

1	Move out of ENBT Module to the backplane
3	Move to DHRIO Module in Slot 3
2	Move out DH+ Channel A
21	Move in DH+ Station Number 23

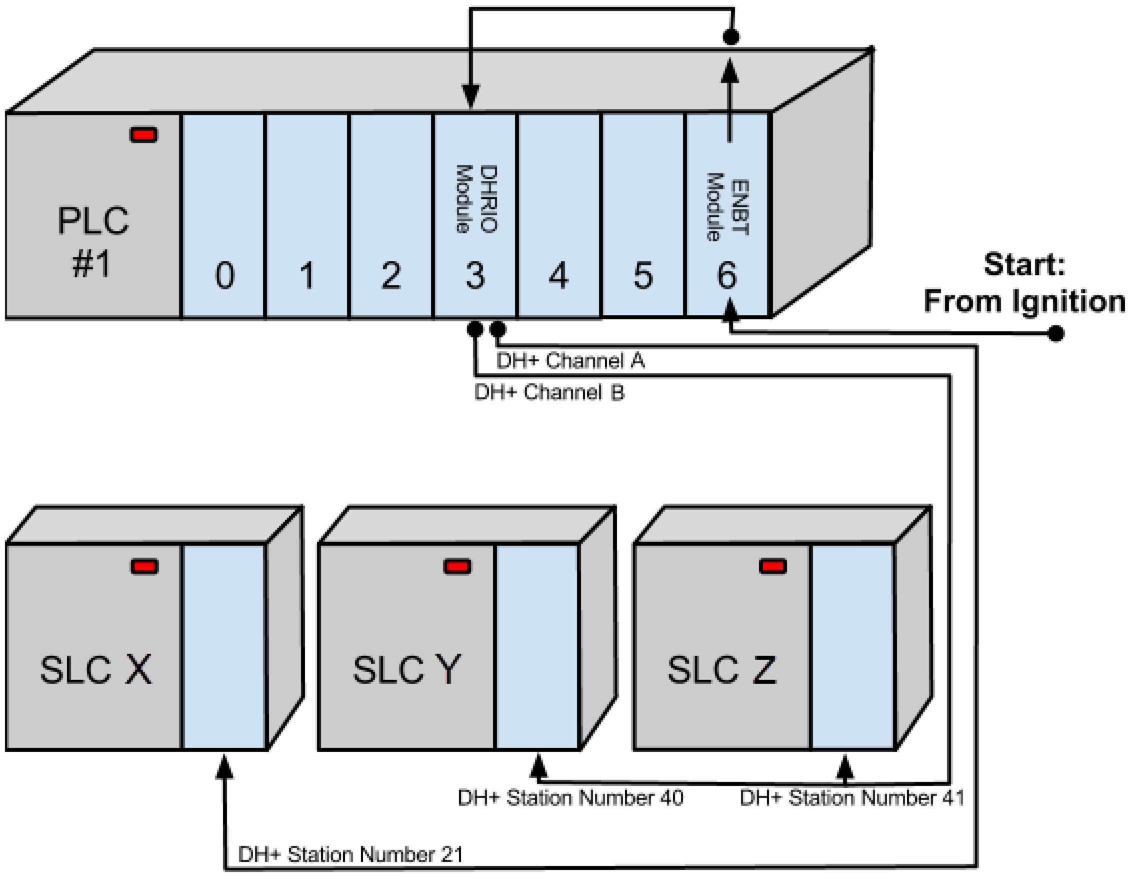
SLC Y

1	Move out of ENBT Module to the backplane
3	Move to DHRIO Module in Slot 3

3	Move out DH+ Channel B
40	Move in DH+ Station Number 40

SLC Z

1	Move out of ENBT Module to the backplane
3	Move to DHRIO Module in Slot 3
3	Move out DH+ Channel B
41	Move in DH+ Station Number 41



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A DH+ Example

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Modbus

Modbus Devices

Unlike some of the other drivers (like Allen Bradley, Siemens) Modbus is a standard and not specific to a brand of device. Modbus is a protocol used for connecting to many types of devices. This is a huge benefit, but can lead to a lot of confusion because different device manufacturers may design their devices differently, and the documentation for the different manufacturers varies wildly in quality and availability. The main idea behind the Modbus standard is that you should have a regular pattern for tags inside the device, and use the same connection methods.

Our generic Modbus driver allows the Ignition OPC-UA server to communicate with any device that supports the Modbus TCP protocol or the RTU over TCP protocol. Because of this, the Modbus driver can connect directly to any devices that support Ethernet communications, even if they use the older RTU standard. If you're not sure which connection type to use, it's probably not RTU. However, it's not difficult to just try both and see which works.

Connecting to a Device

The Connecting to Modbus Device section contains step-by-step instructions on how to connect to a Modbus device. It is important to only add one Modbus device connection to Ignition for each IP address, regardless of how many devices are using that IP address. When communicating to multiple Modbus devices on the same IP address where each has a unique unit ID, either include the unit ID in the Modbus specific address or set it in the address mapping for the device.

It's easy to get connected to a Modbus device, but figuring out the addressing can be time consuming. Even with poor (or missing) device documentation, it's just a little bit of trial and error to get your addressing set.

Modbus Addresses

Getting access to your Modbus tags can be confusing because of all the different options available in the device connection. For example, you could have 0/1 based addressing or reversed word order that isn't clearly documented in the device instructions. It's helpful to manually create a few Tags in Ignition and change your connection settings until your values are correct.

One important setting to note is the **Max Holding Registers Per Request**. This setting can cause all of your test tags to go to bad quality when only one is bad. Change this setting (under the Advanced properties) to 1 while you are testing, and set it back when you are done. If you leave it at 1, this will cause a huge strain on your system after you have added hundreds or thousands of tags from your device.

Manually Addressing

Manually creating Tags in Ignition is pretty easy. If you want to look at Holding Register 1 (a common address in Modbus), the OPC Item Path is "[devicename]HR1". It's that simple! Try setting up HR0, HR1, and HR2 while you are testing to help figure out your connection settings.

Address Mapping

Creating an Address Map in Ignition for your device allows you to drag and drop tags just like any of the browseable device connections (like an Allen Bradley ControlLogix). You can even import and export your maps to make it quick and easy to set up many devices. Once you have your mapping set up, just drag your Tags into Ignition and start designing. Make sure to test a few tag values when you get the Address Mapping set up. Modbus devices cannot verify that your mapping is correct, it just creates a list of tags for you.

In This Section ...

Connecting to Modbus Device

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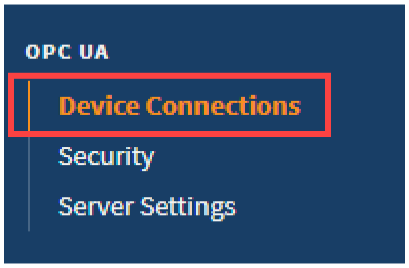
Connecting to Modbus Device

Watch the Video

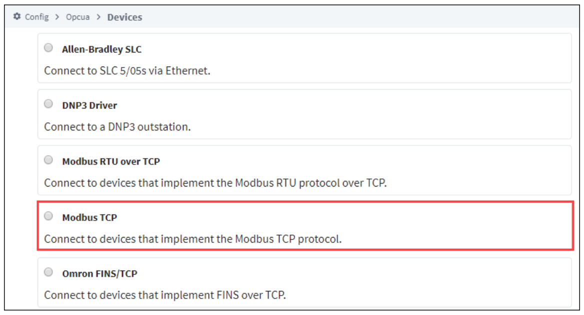
1. Go to the **Config** section of the Gateway Webpage.
2. Scroll down and select **OPC UA > Device Connections**.



3. On the **Devices** page, find the blue arrow and click on **Create new Device.** There are two modules to choose from
   -
     - **Modbus RTU over TCP**
       Which connects to devices that implement the Modbus RTU protocol over TCP.
     - **Modbus TCP**
       Which connects to devices that implement the Modbus TCP protocol.
     - **Modbus RTU** (only available if the **Serial Support Gateway** module is installed)
       Connects to a device via Modbus RTU over serial

   This feature was changed in Ignition version **8.1.20**:
   Starting in version 8.1.20, the Modbus RTU driver no longer requires the Serial Support Gateway module to function.

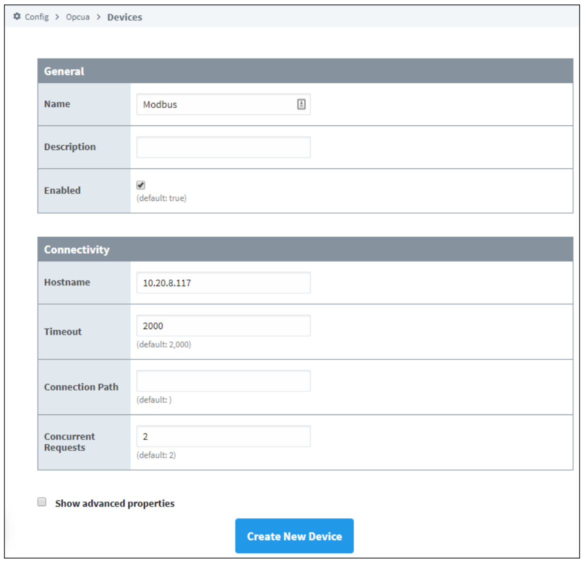
4. In this example we'll select **Modbus TCP**, and click **Next**.



Config > Opcua > Devices

- Allen-Bradley SLC
  Connect to SLC 5/05s via Ethernet.
- DNP3 Driver
  Connect to a DNP3 outstation.
- Modbus RTU over TCP
  Connect to devices that implement the Modbus RTU protocol over TCP.
- Modbus TCP
  Connect to devices that implement the Modbus TCP protocol.
- Omron FINS/TCP
  Connect to devices that implement FINS over TCP.

5. On the **New Device** page, leave all the default values and type in the following fields:
   Name: **Modbus**
   Hostname: type the **IP address**, for example 10.20.8.117.



Config > Opcua > Devices

General

Name	Modbus
Description	
Enabled	✓ (default: true)

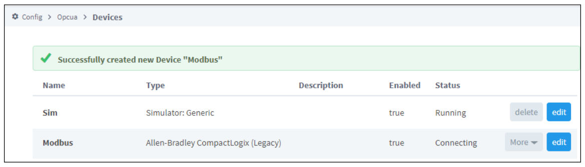
Connectivity

Hostname	10.20.8.117
Timeout	2000 (default: 2,000)
Connection Path	(default:)
Concurrent Requests	2 (default: 2)

Show advanced properties

6. You can check the box for **Show advanced properties** to see the additional settings, or you can keep all the defaults.

7. Click **Create New Device**.
   The **Devices** page is displayed showing the **Modbus** device is successfully created and added to Ignition. The **Status** will show as Disconnected and then Connected.



Config > Opcua > Devices

Successfully created new Device "Modbus"

Name	Type	Description	Enabled	Status	
Sim	Simulator: Generic		true	Running	delete edit
Modbus	Allen-Bradley CompactLogix (Legacy)		true	Connecting	More edit

Unlike other PLCs, Modbus devices do not support browsing, therefore you can not browse the Tags by going to the **OPC Connections > Quick Client** in the **Configure** section of the Gateway. To see and browse the Tags, you need to create the Tags as described in the Modbus Addressing section.

Modbus Drivers using Ethernet

The generic Modbus driver allows the Ignition OPC-UA server to communicate with any device that supports Modbus TCP protocol. The Modbus driver can connect directly to devices that support Ethernet communications. It can also connect to Modbus devices through a Gateway.

It is important to only add one Modbus device in the Ignition Device List per IP address. When communicating to multiple Modbus devices through a Gateway each with a unique unit ID, either include the unit ID in the Modbus specific address or set it in the address mapping for the device.

Supported Functions Codes

The Modbus driver supports the functions codes listed below. In some cases, a device may not allow certain function codes. To remedy this, advanced properties on the device connection can restrict or force specific functions codes. See the **Driver Properties** table on this page for more details.

Function Name	Code	Hex
Read Discrete Inputs	02	0x02
Read Coils	01	0x01
Write Single Coil	05	0x05
Write Multiple Coils	15	0x0F
Read Input Register	04	0x04
Read Holding Register	03	0x03
Write Single Register	06	0x06
Write Multiple registers	16	0x10

Mask Write	22	0x16

Device Connection Settings

General	
Name	The user-defined name for this Device. The name chosen will show up in **OPC Item Paths** and under **OPC-UA Server > Devices** of the **Configure** page of the Gateway. The Device Name must be alphanumeric.
Description	The user-defined description for the device. This is only used as a note to differentiate between devices.
Enable Device	Only devices that are enabled appear in **Connections > Devices** of the **Status** page of the Gateway and thus have their Tags available for use.

Connectivity (Modbus RTU over TCP and Modbus TCP connections)	
Hostname	Is the IP Address of the Modbus device.
Port	Is the port to use when connecting to a Modbus device. The Modbus TCP port specified in the Modbus specification is 502, but it can be changed to a different port.
Local Address	The following feature is new in Ignition version **8.1.8** Click here to check out the other new features The local address to connect from when establishing a TCP connection. If left blank, then the driver will simply pick an available address.
Communication Timeout	Is the amount of time in milliseconds to wait for a response before treating it as a failure, after sending a request to the Modbus device. **Note:** When working with a Modbus RTU over TCP connection, each "device" would be an individual Modbus device on the Modbus network.

Connectivity (Modbus RTU connections)	
Serial Port	The name of the Serial Port (i.e COM1).
Bit Rate	The bit rate for the connection.
Data Bits	Data bits for the connection.
Parity	Parity configuration for the connection.
Stop Bits	Determines the stop bits for the connection.
Handshake	Determines the handshake for the connection.
Communication Timeout	Determines the maximum amount of time the connection will wait for a response.
RS-485 Mode	The following feature is new in Ignition version **8.1.25** Click here to check out the other new features Enables RS-485 mode when checked for a device using RS-485 instead of RS-232. RS-232 mode is the default mode.

Advanced	
Concurrent Requests	The following feature is new in Ignition version **8.1.0** Click here to check out the other new features

	The number of requests that Ignition will try to send to the device at the same time. Increasing this number can sometimes help with your request throughput, however increasing this too much can overwhelm the device and negatively impact communciations with the device.
Max Holding Registers per Request	The maximum number of Holding Registers the device can handle. Because some Modbus devices cannot handle the default of requesting 125 Holding Registers in one request, to accommodate this limitation you can change this setting.
Max Input Registers per Request	The maximum number of Input Registers the device can handle. Because some Modbus devices cannot handle the default of requesting 125 Input Registers in one request, to accommodate this limitation you can change this setting.
Max Coils per Request	The maximum number of Coils the device can handle. Because some Modbus devices cannot handle the default of requesting 2000 Coils in one request, to accommodate this limitation you can change this setting.
Max Discrete Inputs per Request	The maximum number of Discrete Inputs the device can handle. Because some Modbus devices cannot handle the default of requesting 2000 Discrete Inputs in one request, to accommodate this limitation you can change this setting.
Reverse Word Order	When reading and writing 32bit values from/to a Modbus device, the high word comes before the low word. By checking this option, the low word comes before the high word. The Modbus specification does not include a section for reading and writing 32bit values and as a result device manufacturers have implemented both methods.
Zero-based Addressing	When this option is checked, the address range for each area starts at 0. If unchecked, the range starts at 1. The Modbus specification states that Modbus addresses are to be zero based. Meaning Modbus addresses start at 0 instead of 1. To read a value from Modbus address 1024, 1023 is sent to the device. When connecting to devices that do not adhere to zero based addressing, make sure this option is not selected.
Span Gaps	When this option is checked, it spans address gaps when optimizing requests, reducing the number of requests but increasing the amount of data requested at once. If unchecked, it does not span the address gaps.
Allow Write Multiple Registers Request	Enable or disable Modbus function code 0x10, Write Multiple Registers. Some devices may not support this function code. **Caution:** Disabling this option will break the ability to write 32-bit and String values correctly to registers.
Force Multiple Register Writes	Force the use of Modbus function code 0x10, Write Multiple Registers, on write requests.
Allow Write Multiple Coils Request	Enable or disable Modbus function code 0x0F, Write Multiple Coils. Some devices may not support this function code.
Allow Read Multiple Registers Request	If disabled all registers will be read in individual read requests. Disable with caution.
Allow Read Multiple Coils	If disabled all coils will be read in individual read requests. Disable with caution.
Allow Read Multiple Discrete Inputs	If disabled all discrete inputs will be read in individual read requests. Disable with caution. **Note:** Function code 0x02 is always used to read Discrete Inputs, regardless what this property is set to.
Reconnect After Consecutive Tries	Force a reconnect after 3 consecutive timeouts. Default is true.
Max Retry Count	Maximum number of times to retry a read request after receiving a response containing an allowable Exception Code (GatewayPathUnavailable, GatewayTargetDeviceFailToRespond, SlaveDeviceBusy, or SlaveDeviceFailure). Default is 1.

String Handling

Reverse String Byte Ord er	When reading and writing string values from/to a Modbus device, the low byte comes before the high byte. By checking this option the high byte comes before the low byte. If reading a string value from a device should read ABCD but BADC appears in Ignition, then check this option.
Right Justify Strings	Strings stored in a Modbus device may contain leading spaces or trailing spaces. This can produce unwanted results so that Modbus driver removes spaces or zeros when reading string values. By default, left justify string handling is used when reading and writing strings. When you check this option, right justify string handling is used.
Read Raw Strings	Whether or not to read the entire length of a string, ignoring any null bytes encountered.

Related Topics ...

- Modbus Addressing

Modbus Addressing

Manually Addressing a Modbus Device

Modbus doesn't support tag browsing, this means you cannot view the Tags in the Connected Devices window in the Designer or from the OPC Connections > Quick Client in the Config section of the Gateway.

There are two ways you can create Tags so that you can browse them:

1. By manually specifying each address
   This is done from the Designer by entering Modbus Specific Addresses into the OPC Item Path of an OPC Tag. See below for detailed information.

2. By specifying the address mapping
   This is done from the Gateway, see the Modbus Address Mapping section.

On this page ...

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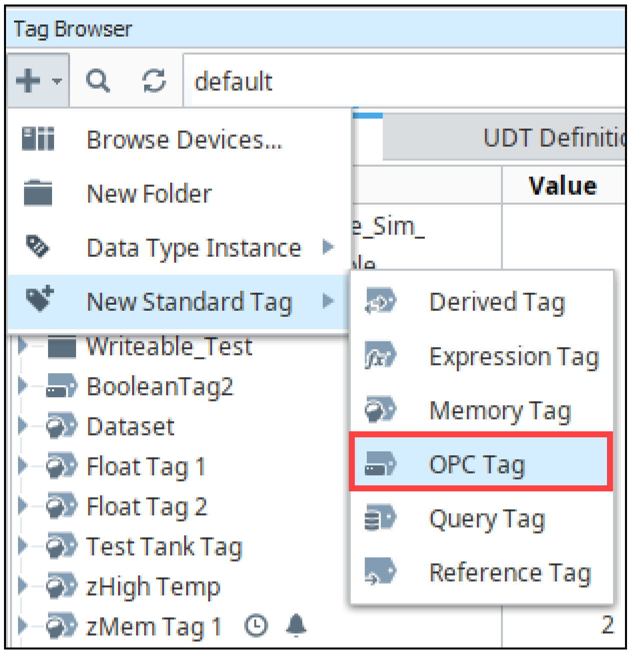
About Modbus Addressing

Watch the Video

Manually Specify Each Address

You can enter Modbus specific addresses into the OPC Item Path of an OPC Tag by using the following designators along with the Modbus address:

1. In the **Tag Browser**, click the **Add** ✚ icon.
2. Select **New Standard Tag** then **OPC Tag**.



3. In the **Tag Editor** window, as an example, you can set the following values:
   Name: **Temp**
   Data Type: **Integer**

OPC Server: Choose **Ignition OPC UA Server** from the dropdown
OPC Item Path: **[Modbus]HR1**. The **Modbus** device name goes in the square brackets. Next you give the address to PLC which in this case is the **HR** designator plus **1** as the Modbus address. The Modbus Specific Addressing section below, explains how your can construct these addresses.

4. Click **OK**.
Now you can see the Temp tag in the Tag Browser.

Modbus Specific Addressing

Per the Modbus protocol specification, the following four basic types of addresses can be read from a device:

- Holding Registers (read/write 16 bit words)
- Input Registers (read only 16 bit words)
- Coils (read/write bits)
- Discrete Inputs (read only bits associated with device input points)

Manually Create an Address for a Single Tag

To manually enter Modbus Specific Addresses into the **OPC Item Path** of the **Tag Editor** window, use one of the following designators plus the Modbus address:

Note: Other OPC servers represent each type by starting the OPC address with a number, for example, 4 for holding registers.

Designator	Description
HR	for 16 bit signed Holding Register (HR1, equivalent to 40001 in other applications)
IR	for 16 bit signed Input Register (IR1, equivalent to 30001)
C	for Coil (C1, equivalent to 00001)
DI	for Discrete Input (DI1, equivalent to 10001)

For example, to use these designators with the Modbus address you would enter **HR1** in the OPC Item Path of an OPC Tag in the Tag Editor window, which is the **HR** designator plus the Modbus address **1**.

Because some devices that support Modbus protocol store data in **BCD format**, there are two additional designators. These designators convert the data from BCD format to decimal when reading data from the device and convert data from decimal to BCD when writing to the device.

Designator	Description
HRBCD	for Holding Register with BCD conversion.
HRBCD_32	for 2 consecutive Holding Registers with BCD conversion.
IRBCD	for Input Register with BCD conversion.
IRBCD_32	for 2 consecutive Input Registers with BCD conversion.

To accommodate other data encoding commonly used by Modbus supported devices, the following designators are available for Modbus specific addressing:

Description	Holding Register Designator	Input Register Designator
Float/Double		
2 consecutive Registers with Float conversion.	HRF	IRF
4 consecutive Registers with Double conversion.	HRD	IRD
Integer		
Holding Registers with 16 bit unsigned integer conversion.	HRUS	IRUS
2 consecutive Registers with 32 bit integer conversion.	HRI	IRI

2 consecutive Registers with 32 bit unsigned integer conversion.	HRUI	IRUI
4 consecutive Registers with 64 bit integer conversion.	HRI_64	IRI_64
4 consecutive Registers with 64 bit unsigned integer conversion.	HRUI_64	IRUI_64

To read or write string values from/to a Modbus device, the following designation is available for Modbus specific addressing:

Designator	Description
HRS	read or write consecutive Holding Registers as a string value.

Note: There are two characters for each word and the order of which character comes first is controlled by the Reverse String Byte Order device setting as described in the Connecting to Modbus Device section. Because two characters are stored in a word, the string length must be an even number of characters.

```
HRS FORMAT: HRS<Modbus address>:<length>
```

Examples	Description
`[DL240]HR1024`	Read 16bit integer value from Holding Register 1024.
`[DL240]HRBCD1024`	Read BCD value from Holding Register 1024.
`[DL240]IR512`	Read 16bit integer value from Input Register 512.
`[DL240]C3072`	Read bit value from Coil 3072.
`[DL240]IR0`	Read 16bit integer value from Input Register 0.
`[DL240]HRS1024:20`	Read 20 character string value starting at Holding Register 1024.

Unit ID
You can also specify the Modbus unit ID by pre-pending it to the Modbus address. For example, to access Modbus unit ID 3 and read HR1024, the full OPC path is as follows:

```
[DL240]3.HR1024
```

Bit-Level Addressing

For bit-level addressing, you just append a period and the bit number you want to read and write to a bit. Your Modbus device must support the `Mask Write` command (your device documentation should specify if it does).

To read or write to a specific bit within a holding register, simply append the location of the bit as demonstrated in these examples:

[DL240]HR1024.0 will read and write to the first bit of the holding register.

[DL240]HR1024.10 will read and write to the 11th bit of the holding register.

Related Topics ...

- Modbus Address Mapping

Modbus Address Mapping

Because it can be tedious to manually enter OPC Tag information one-by-one, the driver offers an address mapping feature. This feature allows entering blocks of common addresses and the driver will create the individual addresses and display them in the Connected Devices window.

Another benefit of address mapping is that the addresses inside a device can have a different numbering scheme than the Modbus address. The Direct Automation DL240 is a perfect example of this. Address V2000, capable of holding a 16 bit integer, is Modbus Holding Register 1024. In addition, the DL240 addressing is in octal meaning there are no 8 or 9s. The sequence of addresses are: V2000, V2001, V2002, V2003, V2004, V2005, V2006, V2007, V2010, V2011.... V3777.

On this page ...

About Modbus Address Mapping

Watch the Video

Address Mapping Properties

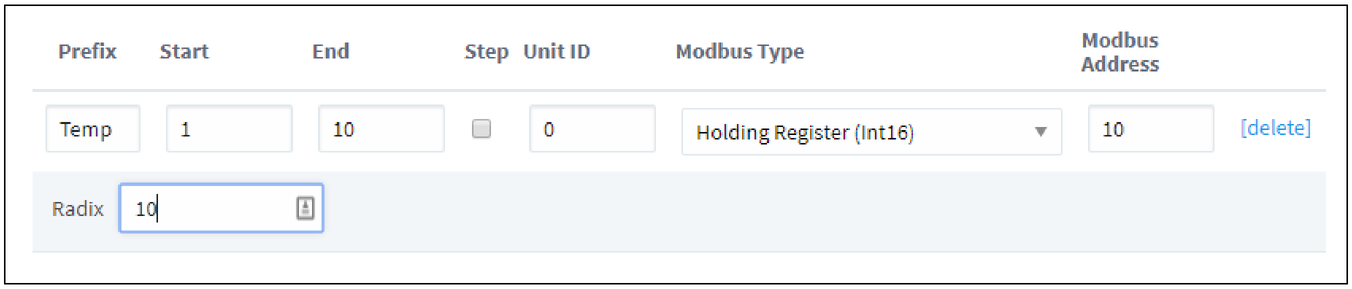
Name	Description
Prefix	A prefix applied to each mapped address as they appear in the Connected Devices window. Must compose of letters, numbers, and underscore characters. The following values are reserved, and may not be used: **HR**, **IR**, **C**, or **DI**
Start and End	Numerical values will be assigned to each mapped addresses. These properties determine the range of the numerical assignments. Follows the Prefix. The difference between these two values determines how many mapped addresses will be created.
Step	When enabled, adjacent addresses will be combined. This is commonly used to combine two words (16-bit addresses) into a double word (32-bit addresses). Please see the Floating Point or 32-bit Address Mapping for more details.
Radix	The base number of unique digits for modbus addresses. Determines what format addresses in the device are incremented and labeled (HR0, HR1,...HR9, HR10, HR11). Common values are 10 (decimal system) or 16 (hexadecimal).
Unit ID	The Unit Id for the device to use. When several Modbus devices are connected to a single IP address, the step determines which device the mapping should be applied against. A value of 0 means the first device, and should be used when only a single Modbus device is connected. See Address Mapping Multiple Devices for more details.
Modbus Type	The table each mapped address should run against, as well as the type and size of each address.
Modbus Address	The address in the device that mapping will begin at. Since the Modbus Type property denotes which table the address will run against, the value here does not need to start with the entity number. Thus, when attempting to start a mapping at the 100th Holding Register, the value on this property would be 100 (assuming one-based addressing), not 40100; the Modbus Type property determines what the leading number is.

Simple Mapping Demonstration

Temperature readings are being stored in 10 16-bit addresses: 40,010 - 40,019. There is a single Modbus device at the IP address (unit ID 0), and the addresses are decimal. The mapped addresses should appear in the Connected Devices window as "Temp1", "Temp2", and so-on. The following configuration would be used:

Prefix: Temp
Start: 1
End: 10
Step: False
Unit ID: 0
Modbus Type: Holding Register (Int16)
Modbus Address: 10

Note: Address 40,010 (HR10) uses Modbus Address 10 as a starting point and not 40,010. The leading 4 is automatically entered for you when you select Holding Register from the dropdown. The same is true for all other types of Tags: Inputs are 30,000, Discrete are 10,000, etc.



Prefix	Start	End	Step	Unit ID	Modbus Type	Modbus Address	
Temp	1	10	☐	0	Holding Register (Int16)	10	[delete]

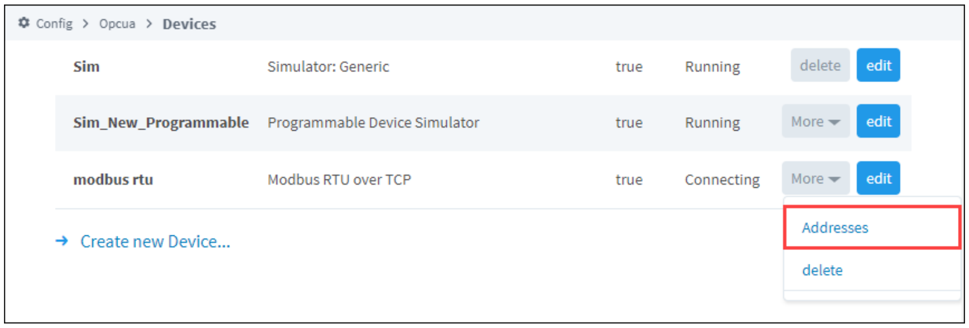
Radix 10

The above configuration results in the items Temp1 through Temp10 appearing in the Connected Devices window

Note: We are using Unit ID 0 in the demonstration above, but your Unit ID can vary depending on the Modbus device you are using.

Specify the Address Mapping

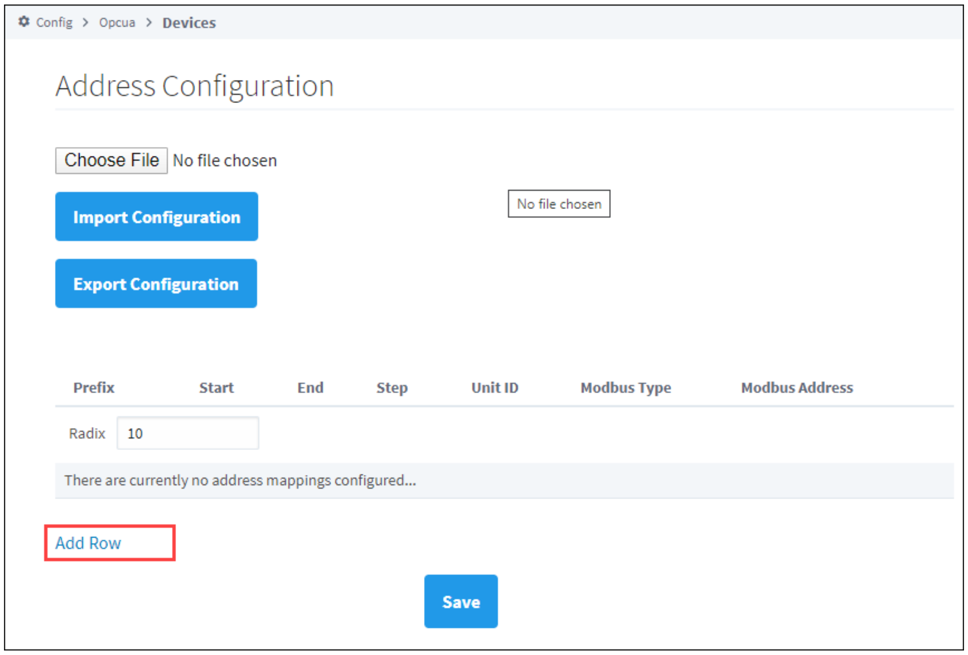
1. Go to the **Config** section of the Gateway Webpage.
2. Scroll down to **OPC-UA > Device Connection.**
3. Click on the **More** button and select **Addresses** to the right of your Modbus device.



Config > Opcua > Devices

Sim	Simulator: Generic	true	Running	delete edit
Sim_New_Programmable	Programmable Device Simulator	true	Running	More edit
modbus rtu	Modbus RTU over TCP	true	Connecting	More edit

4. Click on **Add Row**.



Config > Opcua > Devices

Address Configuration

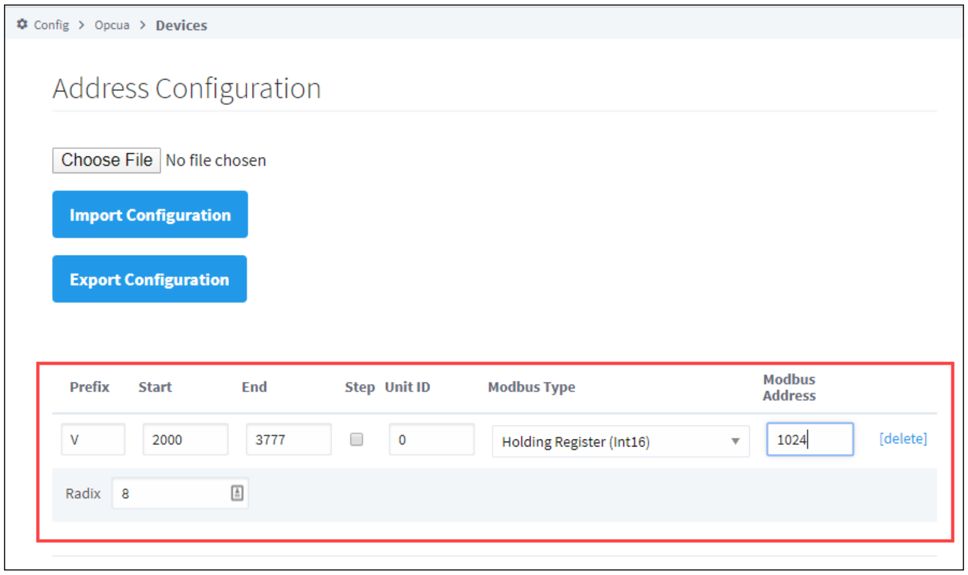
Prefix	Start	End	Step	Unit ID	Modbus Type	Modbus Address

Radix 10

There are currently no address mappings configured...

5. Enter the mapping as follows:
Prefix: **V**

Start: **2000**
End: **3777**
Modbus Type: **Holding Register (Int16)**
Modbus Address: **1024**
Radix: **8** (8 causes the addresses to be in octal, also known as base 8)



Prefix	Start	End	Step	Unit ID	Modbus Type	Modbus Address
V	2000	3777	☐	0	Holding Register (Int16)	1024

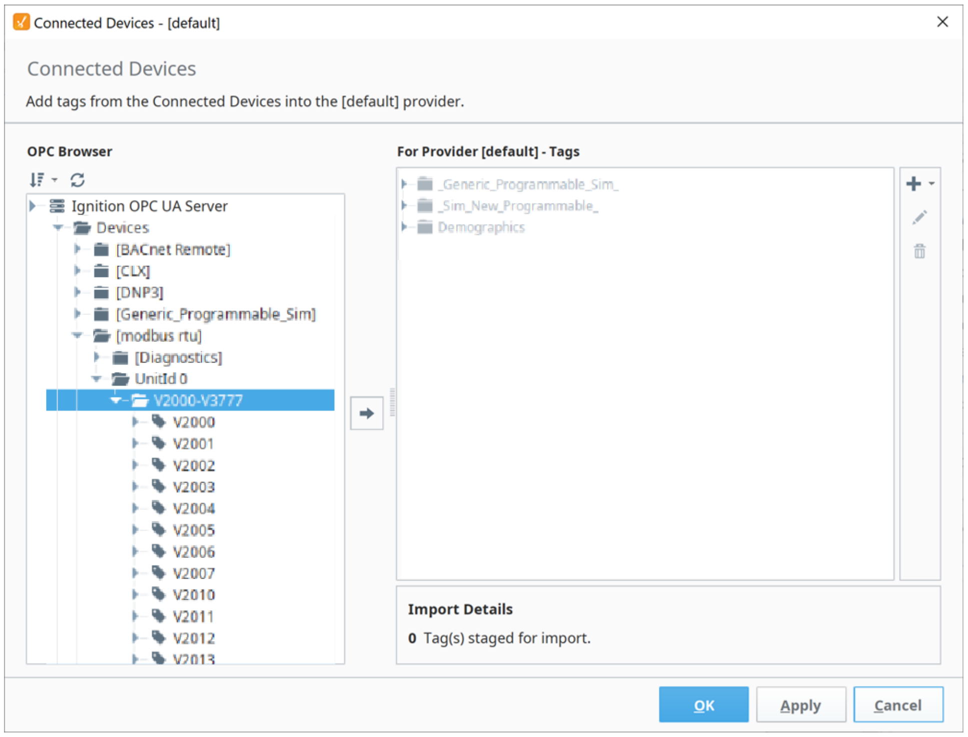
Radix: 8

These settings map the **Modbus address range V2000 to V3777** in octal to **Modbus Holding Register addresses 1024 to 2048**.

Note: The mappings for string data types cannot be entered. Strings can only be read or written using Modbus Specific Addressing.

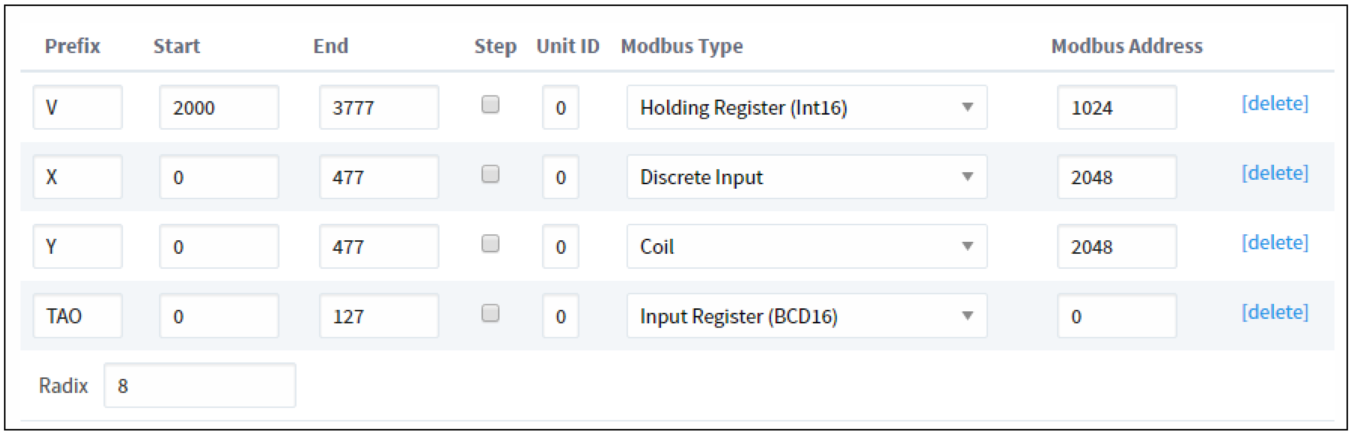
6. Click **Save**.
7. Go to the Connected Devices window in Designer or the OPC Connections > Quick Client (on Gateway), and open the **Modbus** folder.

   You can now see all the Modbus addresses from V2000 to V3777 in octal.



Here is an example of mapping for all of the Modbus DL240 addressing.

Prefix	Start	End	Unit ID	Modbus Type	Modbus Address
V	2000	3777	0	Holding Register (Int16)	1024
X	2000	477	0	Discrete Input	2028
Y	0	477	0	Coil	2048
TAO	0	127	0	Input Register (BCD16)	0



Prefix	Start	End	Step	Unit ID	Modbus Type	Modbus Address	
V	2000	3777	☐	0	Holding Register (Int16)	1024	[delete]
X	0	477	☐	0	Discrete Input	2048	[delete]
Y	0	477	☐	0	Coil	2048	[delete]
TAO	0	127	☐	0	Input Register (BCD16)	0	[delete]

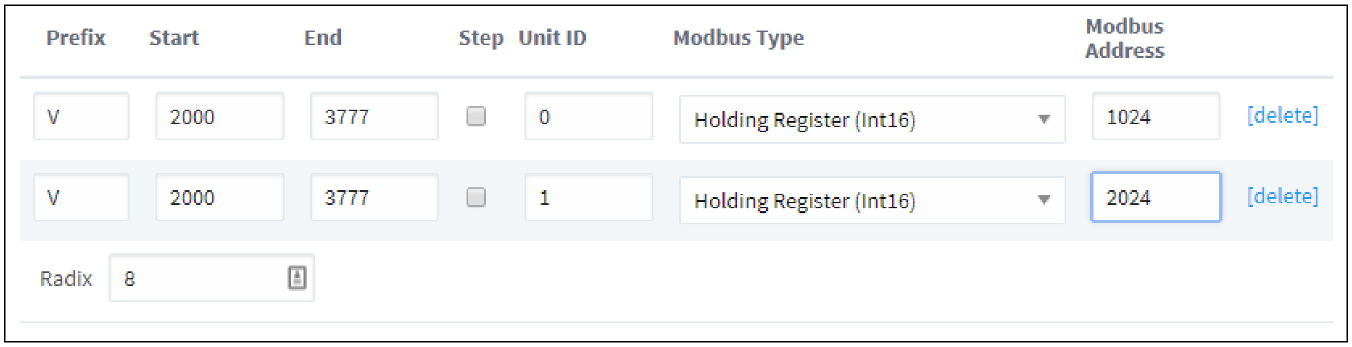
Radix 8

Address Mapping Multiple Devices

It is not recommended to communicate to multiple Modbus devices through a Modbus Gateway where Gateway has the same address. Therefore, do not add multiple Modbus devices with the same IP address.

Only add one Modbus device to the Ignition OPC UA Server device list for Gateway and specify the different unit IDs in the address mapping. The unit ID is specified for each entry in the address mapping for the Modbus device. Notice in the example below, the Prefix, Start, End, Modbus Type and Modbus Address can be the same for two entries provided that the Unit IDs are different.

Prefix	Start	End	Unit ID	Modbus Type	Modbus Address
V	2000	3777	0	Holding Register (Int16)	1024
V	2000	3777	1	Holding Register (Int16)	2024



Prefix	Start	End	Step	Unit ID	Modbus Type	Modbus Address	
V	2000	3777	☐	0	Holding Register (Int16)	1024	[delete]
V	2000	3777	☐	1	Holding Register (Int16)	2024	[delete]

Radix 8

Now when browsing the Modbus device, the unit ID will show as a folder and the OPC Tag path includes the unit ID. This only happens when more than one unit ID is specified in the address mapping otherwise the unit ID is eliminated.

Floating Point or 32-bit Address Mapping

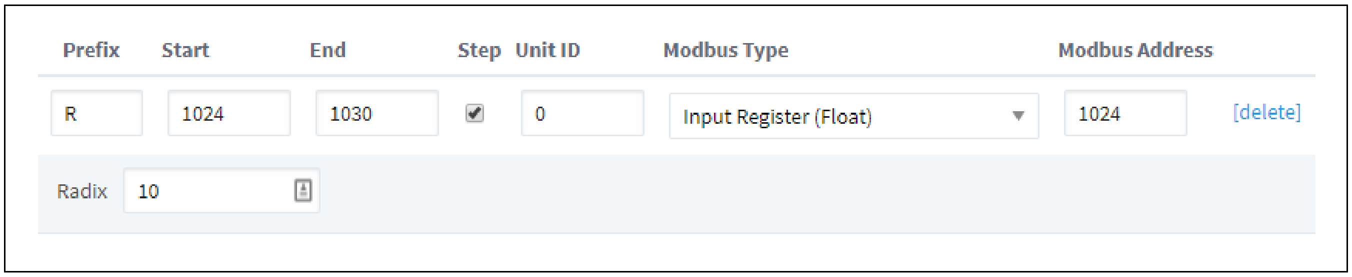
Modbus only supports reading and writing to memory types of bits and 16-bit words. This is not very useful when reading from or writing to float point or 32-bit integers.

To work around this problem, the Modbus driver is designed to read two consecutive 16-bit words and encode it into the desired data type.

Mapping Float Point Addresses

The Modbus address mapping below shows how to map float point addresses starting at 1024 and ending at 1030. With the box in the **Step** column checked, the addresses on the Ignition side will index by 2. In this case, R1024, R1026, R1028 and R1030 will be created.

Because **Modbus Type of Holding Register (Float)** is selected, the driver will read two consecutive 16-bit words and convert it to a floating point value. It also indexs the Modbus Address by 2 for each entry. In this case, R1024 reads from Modbus addresses 1024 and 1025 and converts them into a floating point value. When writing, the reverse of converting a floating point value into two 16-bits words is done before sending them to the device.



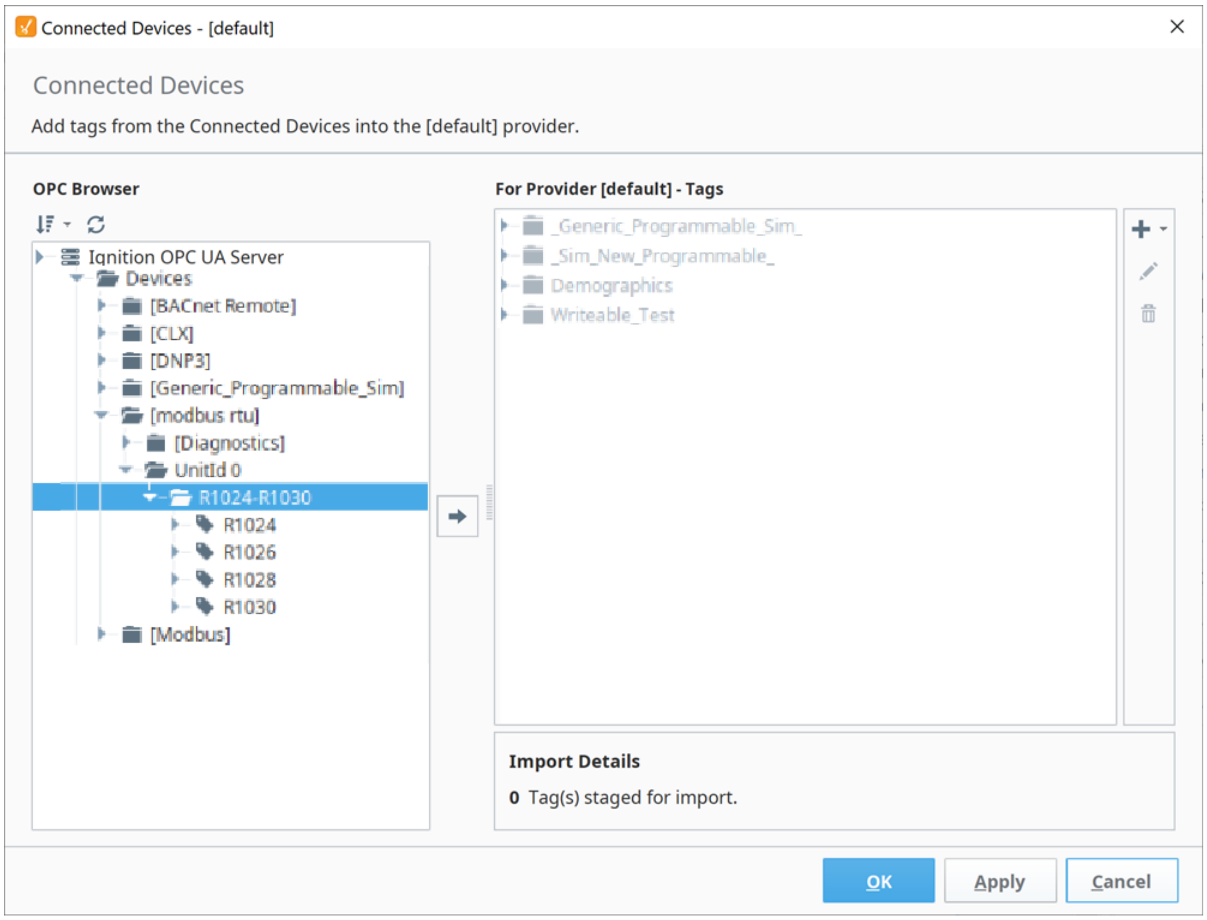
Prefix	Start	End	Step	Unit ID	Modbus Type	Modbus Address	
R	1024	1030	✓	0	Input Register (Float)	1024	[delete]

Radix 10

The following window shows what is displayed in the Connected Devices window. Notice that the numbering is indexed by two and that it matches the Modbus address. With some devices, this allows the addresses displaying in the Connected Devices window to match the addresses in the device.

OPC Browser

- Ignition OPC UA Server
  - Devices
    - [modbus rtu]
      - Unitid 0
        - R1024-R1030
          - R1024
          - R1026
          - R1028
          - R1030


Connected Devices - [default]

Connected Devices

Add tags from the Connected Devices into the [default] provider.

OPC Browser

- Ignition OPC UA Server
  - Devices
    - [BACnet Remote]
    - [CLX]
    - [DNP3]
    - [Generic_Programmable_Sim]
    - [modbus rtu]
      - [Diagnostics]
      - UnitId 0
        - R1024-R1030
          - R1024
          - R1026
          - R1028
          - R1030
    - [Modbus]

For Provider [default] - Tags

- _Generic_Programmable_Sim_
- _Sim_New_Programmable_
- Demographics
- Writeable_Test

Import Details

0 Tag(s) staged for import.

Import / Export Address Mapping

The mapping configuration can be exported to a comma separated values (CSV) file. The CSV file can later be imported in other Ignition installations or similar devices.You can find a few examples of CSV files on our website. To see the examples, go to:

https://inductiveautomation.com/downloads/extra-material

Scroll down to **Modbus Templates** and double-click on the template files to see an example of the CSV file.

Siemens

The Siemens drivers in Ignition support basic connections to S7 devices. Ignition connects to these PLCs via TCP/IP using the S7 protocol. Similar to Modbus and some Allen Bradley connections, the Siemens S7 devices do not support Tag browsing. You can create S7 Tags manually in Ignition, or use Ignition's Tag import/export to create all of your Tags quickly in Excel or another spreadsheet program. Currently, Ignition has drivers for the following Siemens PLCs:

- S7-300
- S7-400
- S7-1200
- S7-1500

On this page ...

Considerations for 1200 and 1500 Devices

The following considerations and configurations changes must be made when using the S7-1200 and S7-1500 drivers:

1. Only global DBs can be accessed.
2. The optimized block access must be turned off.
3. The access level must be "full" and the "connection mechanism" must allow GET/PUT.
4. Reading and writing is not supported for timer (TM) and counter (CT) areas.

Connect to a Siemens Device

Connecting to S7 Devices

Watch the Video

1. Go to the **Config** section of the Gateway Webpage.
2. Scroll down and select **OPC UA > Device Connections**.
3. On the Devices page, click on **Create new Device**.
4. On the Add Device Step 1: Choose Type page, select **Siemens S7-1200**, and click **Next**.
5. There are four modules to choose from
   - **Siemens S7-1500**
     Which connects to Siemens S7-1500 PLCs over Ethernet.
   - **Siemens S7-1200**
     Which connects to Siemens S7-1200 PLCs over Ethernet.
   - **Siemens S7-300**
     Which connects to Siemens S7-300 PLCs over Ethernet.
   - **Siemens S7-400**
     Which connects to Siemens S7-400 PLCs over Ethernet.
6. On the New Device page, leave all the default values and type in the following fields:
   Name: **S71200**
   Hostname: type the **IP address**, for example 10.20.4.71
7. You can check the box for **Show advanced properties?** to see the additional settings, but you can keep all the defaults.
8. Click **Create New Device**.
   The Devices page is displayed showing the Siemens device is successfully created and added to Ignition. The Status will show as Disconnected and then Connected.

Siemens devices do not support browsing, therefore you can not browse the Tags by going to the **OPC Connections > Quick Client** in the **Configure** section of the Gateway. To see and browse the Tags, you need to create the Tags manually as described in the Configuring Siemens Addressing section.

Configuring Siemens Addressing

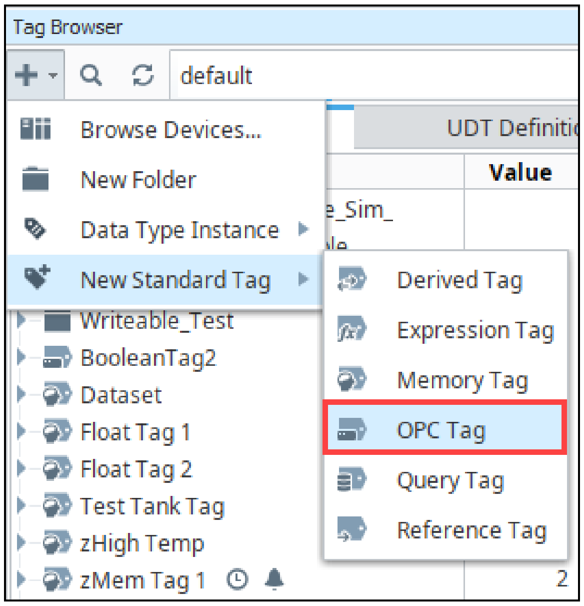
About Siemens Addressing

Watch the Video

The S7 protocol does not support Tag browsing. Therefore, you must configure all Tags in the Designer. This can be done either manually, as needed, or by importing bulk using the Tags CSV import functionality.

To Manually Specify Each Address

1. From the Designer, in the Tag Browser, click the **Add** ✚ icon.
2. Select **New Standard Tag**, then **OPC Tag**.



3. In the Tag Editor window, as an example, you can set the following values:
   Name: **Tag**
   Data Type: **Int4**
   OPC Server: choose **Ignition OPC-UA Server** with the edit button on the right.
   OPC Item Path: **[S71200]IW0**, the **S71200** device name goes in the square brackets then you give the address to PLC which in this example is **IW0** (Word at Offset 0 in the Inputs area). The Address Syntax section explains how you can construct these addresses.
4. Click **OK**.
   Now you can see the Temp Tag in the Tag Browser.

Address Syntax

You need a device name plus a Tag address to create a Tag. The device name is a known, but the Tag address needs to be configured. Once you have both the device name and Tag address you enter them in the in the **OPC Item Path** field of the **Tag Editor** window using the **[device_name]address** format, where **device_name** is the name of the device and **address** is the configured Tag address which is described here.

Tag addresses are made up of three different components: Area, Data Type and Offset.

	Area Syntax	
DataBlocks	DBn	
Inputs	I	
Outputs	Q	
Flags	M	
Timers	T	
Counters	C	
	Data Type Syntax	**Signedness**
Bit	X	N/A
Byte	B	Unsigned
Ch	C	Signed

ar		
Word	W	Unsigned
Int	I	Signed
DWord	D	Unsigned
DInt	DI	Signed
Real	REAL	Signed
String	STRING or STRING.LEN	N/A
Date_And_Time	The following feature is new in Ignition version **8.1.29** Click here to check out the other new features DT **Note:** Due to limitations on Siemens devices, this data type is only supported on the following devices: • S7-300 • S7-400 • S7-1500	N/A
LInt	The following feature is new in Ignition version **8.1.29** Click here to check out the other new features LI **Note:** Due to limitations on Siemens devices, this data type is only supported on the following device: • S7-1500	Signed
LReal	The following feature is new in Ignition version **8.1.29** Click here to check out the other new features LREAL **Note:** Due to limitations on Siemens devices, this data type is only supported on the following devices: • S7-1200 • S7-1500	Signed

To form an address, you combine syntax for the desired Area and Data Type with an Offset into that area.

Examples	

Area+Data Type+Offset	
IB0	Byte at Offset 0 in the Inputs area
IW0	Word at Offset 0 in the Inputs area
DB500,DI8	DInt at Offset 8 in DataBlock 500
ISTRING24.50	A String of length 50 starting at offset 24 in the Inputs area
IX20.3	Bit 3 of the Byte at Offset 20 in the Inputs area
T0	Timer at offset 0 (No data type is specified for timers)
C0	Counter at offset 0 (No data type is specified for counters)

Offsets

It is important to note that offsets are absolute. **IW0** and **IW1** share a byte. To get two consecutive, non-overlapping words you need to address **IW0** and **IW2**.

Bits

Bits are addressed by using the Bit data type (X) and appending `.bit` to the end, where bit is in the range [0-7]. When addressing a bit at a given offset, that offset is always treated as a byte.

Strings

Strings are assumed to be in the S7 string format and have a max length of 210.

Timers

Timers are scaled up to a DWord and converted from S5 time format so they can represent the time in milliseconds without requiring any multipliers. When you write to a timer it is automatically converted from milliseconds into S5 time format for you. A data type is not specified when accessing timers.

Counters

Counters in the PLC are stored in BCD. The driver automatically converts to/from BCD for you and exposes any counter Tags as UInt16 values. A data type is not specified when accessing counters.

Device Settings

General	
Name	The name of the device connection
Description	A description for the device connection. The description will appear on the Devices page on the Gateway.
Enabled	Whether or not the connection is active. Disabling this setting terminates communication with the device.
Connectivity	
Hostname	The hostname or IP address of the device.
Local Address	The following feature is new in Ignition version **8.1.8** Click here to check out the other new features The local address to connect from when establishing a TCP connection. If left blank, then the driver will simply pick an available address.
Timeout	The request timeout, specified in milliseconds. The default is 2,000.
Advanced	
Port	The port to use when connecting to the device. The default is 102.
PDU Size	Number of bytes to fit into PDU block of a single packet. Increasing this number can improve request throughput only if the

	processor supports a higher PDU Size. Varies from 240 and up to 960 depending on the device. The default is 240.
Rack Number	The number of the rack that the device is positioned in. The default is 0.
CPU Slot Number	The slot number assigned to the CPU. The default is 2.
Reconnect After Consecutive Timeouts	After several consecutive timeouts, the device connection will attempt to reconnect to the device. Default is true.

UDP and TCP Driver

Ignition's UDP and TCP drivers allows Ignition to communicate to various devices like barcode scanners, and scales. These are not catch-all drivers that will talk to any PLC that communicates over TCP, but rather very basic drivers that will communicate over TCP or UDP. The drivers are configured to connect to one or more ports on a given IP address and bring in any data there (ASCII characters, etc) as a value of a Tag. Both drivers can act as strictly passive listeners: meaning they do not write back or make any requests to the device. This is very powerful for the devices that are designed to function in this way (like barcode scanners) because the device just needs to constantly update data on a port for this driver to work.

The TCP driver has the option of writing back to the device. When configured for Writeback, a Tag is exposed in Ignition's OPC server that will handle writing: any writes made to the Tag are sent to the device.

On this page ...

Structure in the Address Space

A device using the UDP or TCP driver appears in the **Devices** folder of the OPC-UA server with the name it was configured to use. Browsing the device will yield one folder per port configured to listen on. Browsing the port folder will yield one variable node containing the entire message received as well as an additional variable node per field configured. A device configured with a field count of four would have five nodes total: one for the message and four for the fields.

Connecting to a Device

Instead of connecting to a device directly, this driver will connect to a port (often on the host computer or a computer connected directly to the device), and that device will be configured to post data to that same host/port. Rules are configured that dictate how the incoming data is interpreted. You can configure multiple ports for each device connection.

Connecting to TCP Device

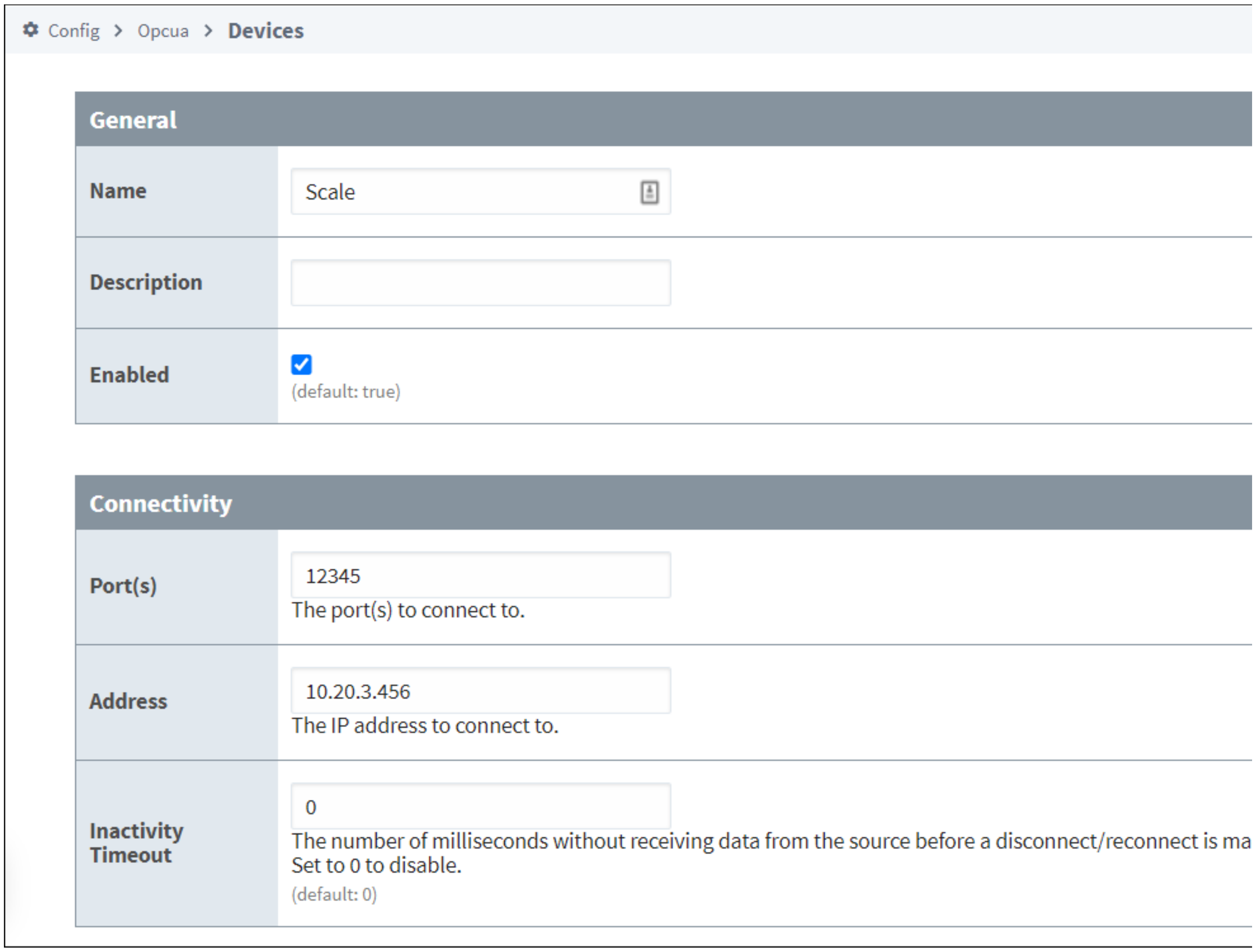
Watch the Video

Connect to a Barcode Scanner or Scale

You can connect to a barcode scanner or scale by using Ignition's UDP and TCP driver.

1. Go to the Config section of the Gateway Webpage.
2. Scroll down and select **OPC UA > Device Connections**.
3. On the Devices page, click on **Create new Device**.
4. On the Add Device Step 1: Choose Type page, scroll all the way down and select **TCP Driver**, and click **Next**.
5. On the New Device page, leave all the default values and type in the following fields.

    - Name: The name you specify here will appear under the **Devices** folder on the Quick Client page in the Gateway.
    - Port(s): **12345**, as an example
    - Address: type the **IP address**, for example 10.20.3.456


Config > Opcua > Devices

General

Name	Scale
Description	
Enabled	✓ (default: true)

Connectivity

Port(s)	12345 The port(s) to connect to.
Address	10.20.3.456 The IP address to connect to.
Inactivity Timeout	0 The number of milliseconds without receiving data from the source before a disconnect/reconnect is ma Set to 0 to disable. (default: 0)

6. You can check the box for **Show advanced properties?** to see the additional settings, but you can keep all the defaults.

7. Click **Create New Device**. The Devices page is displayed showing the Scale device is successfully created and added to Ignition. The **Stat us** will show as **1/1 Connected**.

8. Go to the **OPC Connections > Quick Client** in the Config section of the Gateway Webpage.

9. Under the **Devices>[Scale]>12345** folder you will see the Last Receive Time and the Message folders. Next to each Tag, under the **Action** column, you will see `[s][r][w]`.

10. Click on `[s]`, which means Subscription. You will be able to see the Value of the Tag displayed on this OPC Quick Client page.

Device Properties

The properties on the **New Device** page of the Gateway for the TCP and UDP devices are as follows:

General	
Name	Name of the device using this driver. This name will appear in the Devices folder when browsing the OPC-UA server.
Enables	When selected, the device is enabled. When not selected, disabled devices will not make a connection attempt.
Connectivity	
Port(s)	On the UDP driver, this is the port(s) to listen on. On the TCP driver, this is the port(s) to connect to. Separate multiple ports with a comma.
Address	On the UDP driver, this is the IP address to listen to. On the TCP driver, this is the IP address to connect to.
Local Address	

	The following feature is new in Ignition version **8.1.8** Click here to check out the other new features The local address to connect from when establishing a TCP connection. If left blank, then the driver will simply pick an available address.
Connect Timeout	The following feature is new in Ignition version **8.1.17** Click here to check out the other new features The timeout, in milliseconds, when opening a socket connection to a remote host. Set to 0 to disable.
Inactivity Timeout	The number of milliseconds without receiving data from the source before a disconnect/reconnect is made. Set to 0 to disable.
Message	
Message Delimiter Type	Sets the method used to determine how much or what data length constitutes a full **message**. **Packet Based:** Assumes that whatever arrives in one packet, regardless if length or content, is the message. **Character Based:** Content is appended to a message buffer until the given character or set of characters arrives, at which point the contents of the buffer are considered the message. **Fixed Size** Content is appended to a message buffer until some fixed number of bytes is received, at which point the contents of the buffer are considered the message.
Message Delimiter	If the message delimiter type is **Character Based**, this will be the character or set of characters used to identify a message. If the type is **Fixed Size**, this will be the size used to identify a message. If using Character Based, see Message Delimiters below.
Field Count	The number of fields within a message must be fixed. This property dictates how many fields will be present in each message. When the number of fields received does not match the designated count, all nodes will receive quality BAD_CONFIG_ERROR.
Field Delimiter	This is the character(s) that are used as field delimiters. For example, the message **a|b|c|d** with a field delimiter of "**|**" would be split into four fields: **a**, **b**, **c**, and **d**. The field count would have to be set at 4.

Both drivers have unique Advanced Properties

TCP Driver	
Write Timeout	The following feature is new in Ignition version **8.1.24** Click here to check out the other new features Duration, in milliseconds, to wait for writes to complete before returning. The default time is 5 seconds.
Writeback Enabled	Enable writeback capabilities for the device.
Writeback Message Delimiter	The delimiter expected by the device signaling the end of an incoming message. See Message Delimiters below.
UDP Driver	
Message Buffer Size	The size of the message buffer in bytes.
Multicast	If the connection should be enabled for multicast.

Tag Polling Speed
Tag values update no faster than the scan class a Tag is assigned to. If additional messages are received over TCP or UDP at a faster rate, the Tag will not show these additional values. Generally it is recommended to use these drivers with updates that come through at a 1 second rate or slower. The absolute maximum rate for the TCP driver is 25ms, although most systems cannot reliably execute this quickly. The UDP driver does not have a maximum rate, but a practical maximum rate will depend on hardware, and likely will be significantly slower than 25ms as well. Most "fast" scan rates fall in the 100ms-200ms range.

Message Delimiters

A couple of properties allow you to specify a message delimiter. Some devices may be expecting a control character of some sort, such as a carriage return. The table below lists characters that you can enter into a message delimiter property to signify certain control characters.

Characters	Description
\t	tab
\b	backspace
\n	newline
\r	carriage return
\f	form feed

UDP and TCP Device Tags

When configured, both drivers have explicit sets of Tags they use to communicate. The Tags are listed below.

TCP Tags

Name	Description
Last Receive Time	A datetime representing when the last message was received.
Message	A string interpretation of the last received message.
MessageBytes	The following feature is new in Ignition version **8.1.2** Click here to check out the other new features A binary representation of the last received message.
Writable	Only available when the TCP device connection has **Writeback Enabled**. Writing to this Tag from Ignition will send a write request to the device. The content will be sent as a string.
WritableBytes	The following feature is new in Ignition version **8.1.2** Click here to check out the other new features Only available when the TCP device connection has **Writeback Enabled**. Writing to this Tag from Ignition will send a write request to the device. The content will be sent as binary data.

UDP Tags

Name	Description
Last Receive Time	A datetime representing the when the last message we received.
Message	A string interpretation of the last received message.
MessageBytes	The following feature is new in Ignition version **8.1.2** Click here to check out the other new features A binary representation of the last received message.

DNP3

DNP3 is a protocol used commonly in utilities like water and electric companies. It is commonly used to connect to one master station (device) that is then connected to several other devices. This creates a web of devices without taxing the network too much. DNP3 is similar to the Modbus protocol in that it is more device agnostic, but it's newer, more robust, and because of that, more complex. You can use it to connect to many modern devices, check your documentation to see whether your device supports DNP3.

Note: The DNP3 driver does not support DNP3 Secure Authentication.

On this page ...

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Connecting to DNP3 Devices

Watch the Video

DNP3 Drivers

Ignition supports two DNP3 drivers:

- DNP3 Driver
- Legacy DNP3 Driver

Drivers installed prior to 8.1.35 are now referred to as the Legacy DNP3 driver. In Ignition versions 8.1.35 and above, the DNP3 driver will be automatically selected on new Ignition installations with the Legacy DNP3 driver now available as an optional choice. The Legacy DNP3 driver will still function the same as before, but will no longer receive continued support.

Scripting Functions

To avoid namespace conflicts, scripting functions for the DNP3 driver are under the **system.dnp** prefix, while the Legacy DNP3 driver scripting functions will remain unchanged and under the **system.dnp3** prefix.

Supported Operating Systems

Both the DNP3 and Legacy DNP3 drivers are compatible with the following operating systems:

- Windows x64
- Linux x64
- Linux arm32
- Linux arm64

Note: The native libraries used by both the DNP3 and Legacy DNP3 drivers are not currently supported on macOS.

Upgrade from the Legacy DNP3 Driver to DNP3 Driver

Those wishing to upgrade from the Legacy DNP3 driver may do so manually.

1. Delete or rename the Legacy DNP3 device.
2. Create a new device under the original name of the Legacy DNP3 device.
3. Fix tag references as necessary.

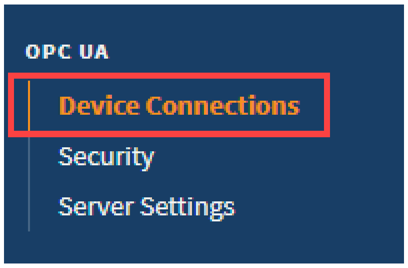
Note: It’s important to pay attention to the new settings that are available and understand that the DNP3 driver operates quite differently than the Legacy DNP3 driver.

Connecting to a Device

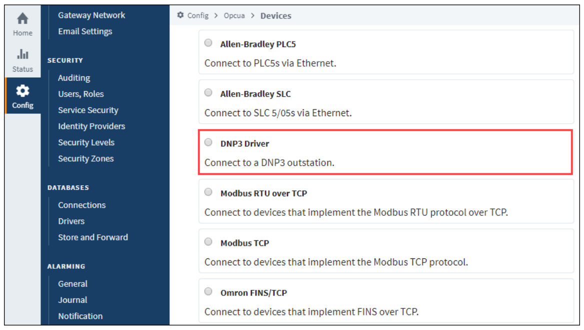
Ignition's DNP3 driver can connect directly to any devices that support Ethernet communication through the master station. It is important to make a new device connection for each of the outstations (remote devices), setting the source and destination addresses for each in Ignition's device connection.

1. Go to the **Config** section of the Gateway Webpage.

2. Scroll down and select **OPC UA > Device Connections**.



3. On the **Devices** page, find the blue arrow and click on **Create new Device**.
4. On the **Add Device Step 1: Choose Type** page, select **DNP3 Driver**, and click **Next**.



Allen-Bradley PLC5
Connect to PLC5s via Ethernet.

Allen-Bradley SLC
Connect to SLC 5/05s via Ethernet.

DNP3 Driver
Connect to a DNP3 outstation.

Modbus RTU over TCP
Connect to devices that implement the Modbus RTU protocol over TCP.

Modbus TCP
Connect to devices that implement the Modbus TCP protocol.

Omron FINS/TCP
Connect to devices that implement FINS over TCP.

5. On the **New Device** page, leave all the default values and type in the following fields:

   Name: **DNP3**
   Hostname: Enter IP address or hostname of the device.

6. You can check the box for **Show advanced properties?** to see the additional settings, but you can keep all the defaults.

7. Click **Create New Device**.
   The **Devices** page is displayed showing the **DNP3** device is successfully created and added to Ignition. The **Status** will show as Disconnected and then Connected or Idle, depending on the status of the device.

Connection Settings

General	
Name	The name of this DNP3 device connection.
Description	Device connection description (optional). Can be used to provide any useful information / comments about this connection.
Enabled	If True (checked), the connection is enabled; if False (unchecked), the connection is disabled.
Main	
Hostname	The IP Address of the device.
Port	The port to use when connecting to a DNP3 device. The default port is 20000.
Local Address	The following feature is new in Ignition version **8.1.8** Click here to check out the other new features The local address to connect from when establishing a TCP connection. If left blank, then the driver will simply pick an available address.
Source Address	The address of the master station, default is 3.
Destination Address	The address of the outstation, default is 4.

Integrity Poll Interval	The interval at which to perform an integrity poll, in millis, default is 3,600,000.
Direct Operate Enabled	When true, the Direct-Operate function code is used on a write, otherwise Select-Operate is used, default is true.
Unsolicited Messages Enabled	When true, the outstation may send unsolicited messages for Class 1, 2, and 3 data, default is false.
Advanced	
Message Fragment Size	The maximum size of a message fragment in the application layer, default is 249.
Message Timeout	The amount of time to wait for a message response from the outstation, default is 5,000.
Retries	The number of retries on a message timeout, default is 0.
Time Synchronization Enabled	The following feature is new in Ignition version **8.1.17** Click here to check out the other new features When true, automatically synchronizes the gateway time to the outstation when requested, default is true.
Link Layer Confirmation	When true, a link layer confirmation will be required from the outstation when sending messages, default is false
Default Outstation Conformance level	The default DNP3 Application Layer level subset to use when communicating with the outstation.
Default Value Types	
Analog Input Points	The default value type to use when reading an analog input point. default is INTEGER
Analog Input Frozen Points	The default value type to use when reading a frozen analog input point. default is INTEGER
Analog Output Points	The default value type to use when reading/writing an analog output point. defaultis INTEGER
Counter Points	The default value type to use when reading a counter point. default is INTEGER
Counter Frozen Points	The default value type to use when reading a frozen counter point. default is INTEGER
Binary Input Points	The default value type to use when reading a binary input point. default is WITH_FLAGS
Double-Bit Binary Input Points	The default value type to use when reading a double-bit binary input point. default is WITH_FLAGS
Binary Output Points	The default value type to use when reading a binary output point. default is WITH_FLAGS

Notes

- **Source Address and Destination Address**: These addresses are assigned to the computers and should be the same across all settings, because of this the settings in Ignition and the settings in the device are the opposite of each other. For example, if the device is configured with an address of 4 and Ignition has an address of 3:
  - the settings in Ignition should have the Source Address set to 3 and the Destination Address set to 4.
  - the settings in the Device should have the Source Address set to 4 and the Destination Address set to 3.
- **Unsolicited messages enabled** property: setting this property to True (checking the box) allows the outstation to send unsolicited messages to Ignition. This means that Ignition will connect to the outstation, but not request any data from it. Ignition waits for the outstation to send data.   Not all devices support this option; those that do need to be configured to use it. Please refer to your device's documentation for more information.

Internal Indicators

Each response received from a connected outstation will contain an Internal Indication (IIN) bit field. This field indicates certain states or error conditions in the outstation. IINs are mapped to read-only points, indicating the following:

- Broadcast message received (**Broadcast**)
- Additional Class 1, 2, or 3 event data is available (**Class 1 Events, Class 2 Events, Class 3 Events**)
- Time synchronization required in the outstation (**Need Time**)
- Some output points are in local mode (**Local Control**)
- An abnormal condition exists (**Device Trouble**)
- The outstation device has restarted (**Device Restart**)
- Function code not implemented (**No Func Code Support**)
- Object Unknown (**Object Unknown**)
- Request parameter error (**Parameter Error**)
- Outstation event buffer overflow (**Event Buffer Overflow**)
- An operation is already executing (**Already Executing**)
- Configuration corrupt (**Config Corrupt**)

Terminology

- **Unsolicited Response**: An Application Layer message from an outstation to a master for which no explicit request was received. The request is implied by the act of a master enabling unsolicited reporting of various points within an outstation.
- **Integrity Poll**: Requests all event data, followed by the static data of all points assigned to one of the four classes (static Class 0 or event Class 1, 2, or 3).
- **DNP3TIME**: Universal Coordinated Time (UTC) time expressed as the number of milliseconds since the start of January 1, 1970. The effective date for using the UTC time base is January 1, 2008. Prior to this, DNP3 did not require a specific time reference.

Buffered Events

Buffered events can be enabled by setting the Queue Size property on the corresponding Tag Group to a number greater than 1. See Queue Size on the Tag Groups page for more information. The Queue Size property value represents the number of buffer events that will be handled by the driver. The queue always keeps the most recent events, dropping older events. For example, if Queue Size is set to 20, and 30 value changes occur on the device while disconnected, then the 10 oldest events would be ignored by the driver.

After recovering from a disconnect, the driver will playback missed events from the driver, and update the value on the corresponding Ignition Tags by cycling through each event quickly, from oldest event in the buffer to the most recent. This value change will trigger value changes in certain systems. Specifically:

- Alarms events (recent events as well as alarm journal records)
- Tag History records (when the History **Sample Mode** is set to "On Change")
- Tag Events Scripts

Once finished cycling through the buffered values, the Tag will resume showing the live value.

Support of this Feature

This Buffered Events feature can only be used by devices that support Sequence of Events (SoE), and have the option enabled for points Ignition is subscribed to. Note that the data type for SoE may differ from the data type that is received by normal subscription. This is generally due to a configuration on the Default Variation property in the device.

Browsing DNP3 Points

When the driver (master) connects to a device (outstation), an integrity poll is performed. Any DNP3 objects returned in the response that fall under the Point Type categories listed in the table on the right are mapped to the OPC server with the appropriate index. (For example, g40v1i2 corresponds to an AnalogOutput point, variation 1, index 2.)

To see the points mapped, you can go to the Designer, and open the Connected Devices window.

About DNP3 Addressing

Watch the Video

Point Types

Type Name	Group	Supported Variations	
SingleBitBinaryInput	1	1 - Packed format	2 - With flags
DoubleBitBinaryInput	3	1 - Packed format	2 - With flags
BinaryOutput	10	1 - Packed format	2 - With flags
Counter	20	1 - 32-bit with flags	5 - 32-bit
		2 - 16-bit with flags	6 - 16-bit
FrozenCounter	21	1 - 32-bit with flags	6 - 16-bit with flags and time
		2 - 16-bit with flags	9 - 32-bit
		5 - 32-bit with flags and time	10 - 16-bit
AnalogInput	30	1 - 32-bit with flags	4 - 16-bit
		2 - 16-bit with flags	5 - Float with flags
		3 - 32-bit	6 - Double with flags
FrozenAnalogInput	31	1 - 32-bit with flags	5 - 32-bit
		2 - 16-bit with flags	6 - 16-bit
		3 - 32-bit with time of freeze	7 - Float with flags

		4 - 16-bit with time of freeze	8 - Double with flags
AnalogOutput	40	1 - 32-bit with flags 2 - 16-bit with flags	3 - Float with flags 4 - Double with flags
OctetString	110	0 - 255	

In This Section ...

DNP3 Driver

The DNP3 driver uses the **DNP3** protocol for event-based polling, unsolicited messaging, and explicit reads to acquire data. For the previous driver, see **Legacy DNP3 Driver**.

Note: The DNP3 driver does not support DNP3 Secure Authentication.

On this page ...

Data Acquisition

The DNP3 driver offers three distinct methods for acquiring data: event-based polling, unsolicited messaging, and explicit reads.

Event-Based Polling

This method serves as the primary approach to data acquisition for the DNP3 driver, but is not present in the Legacy DNP3 driver.

Within the DNP3 driver settings, each of the event classes (1, 2, and 3) can be configured with polling intervals. At these intervals, the driver polls each class for all events that have occurred since the previous class poll. If applicable, multiple events per point are preserved and processed in a sequential manner. OPC UA clients configured with MonitoredItems set to a sampling interval of 0, indicating an interest in report-by-exception or event-based changes, will receive the complete sequence of events for each point. The sampling interval requested by the client does not affect the class polling intervals.

Unsolicited Messaging

Unsolicited messaging, also available in the Legacy DNP3 driver, shares similarities with event-based polling in its event-driven approach to data processing. However, instead of explicitly polling each class at configured intervals, the outstation reports events only when changes occur within the outstation. The client's sampling interval does not influence the outstation, but does affect OPC UA MonitoredItem and Subscription behavior. OPC UA clients with MonitoredItems set to a sampling interval of 0 will receive the entire reported sequence of events for each point. This can be configured for each class. It's important to note that not all outstations support unsolicited messaging.

Explicit Reads

Explicit reads, the primary method used in the Legacy DNP3 driver, represent the method where points are explicitly read using the DNP3 Read function code, providing only the static or current value of each point at each poll. Events are neither read nor processed in this method of data acquisition. Explicit reads are employed when data points are addressed using the group/variation/index (gvi) syntax. For MonitoredItems, points are polled at the sampling interval requested by the client, using the DNP3 Read function. The Legacy DNP3 driver's behavior can be approximated by using gvi addressed tags.

Connecting to a Device

Ignition's DNP3 driver can connect directly to any devices that support Ethernet communication through the master station. It is important to make a new device connection for each of the outstations (remote devices), setting the source and destination addresses for each in Ignition's device connection.

1. Go to the **Config** section of the Gateway Webpage.
2. Scroll down and select **OPC UA > Device Connections**.
3. On the **Devices** page, find the blue arrow and click on **Create new Device**.
4. On the **Add Device Step 1: Choose Type** page, select **DNP3 Driver**, and click **Next**.
5. On the **New Device** page, leave all the default values and type in the following fields:

   Name: **DNP3**
   Hostname: Enter IP address or hostname of the device.

6. Click **Create New Device**.
   The **Devices** page is displayed showing the **DNP3** device is successfully created and added to Ignition. The **Status** will show as Disconnected and then Connected or Idle, depending on the status of the device.

Connection Settings

General	
Name	The name of this DNP3 device connection.
Description	Device connection description (optional). Can be used to provide any useful information or comments about this connection.
Enabled	If True (checked), the connection is enabled; if False (unchecked), the connection is disabled.
Connectivity	
Hostname	The hostname or IP address component of the outstation endpoint.
Port	The port component of the outstation endpoint. Default is 20000.
Source Address	The local (master) DNP3 data link address. Default is 3.
Destination Address	The remote (outstation) DNP3 data link address. Default is 4.
Response Timeout (ms)	The response timeout duration. Default is 5,000.
Keep Alive Timeout (ms)	The inactivity interval that will trigger a link-layer keep-alive message. Default is 3,600,000.
Data Acquisition	
Integrity Poll Period (ms)	The period at which to issue an integrity (Class 1/2/3/0) poll; disabled if 0. Default is 3,600,000.
Class 1 Poll Period (ms)	The period at which to issue a poll for Class 1 events; disabled if 0. Default is 10,000.
Class 2 Poll Period (ms)	The period at which to issue a poll for Class 2 events; disabled if 0. Default is 10,000.
Class 3 Poll Period (ms)	The period at which to issue a poll for Class 3 events; disabled if 0. Default is 10,000.
Unsolicited Event Classes	The event classes describing which data classes are enabled or disabled for unsolicited messaging. Leave blank if unsolicited messaging is not to be used. Default is blank.

Advanced Properties

Analog Operation	
Command Mode	The command mode to use when issuing commands for analog outputs; DIRECT_OPERATE or SELECT_BEFORE_OPERATE. Default is DIRECT_OPERATE.
Read After Operate	Whether an explicit read should be issued after operating analog outputs. Useful when an outstation does not support generating analog output events or assigning them to a class. Default is false.
Binary Operation	
Command Mode	The command mode to use when issuing commands for binary outputs; DIRECT_OPERATE or SELECT_BEFORE_OPERATE. Default is DIRECT_OPERATE.
Read After Operate	Whether an explicit read should be issued after operating binary outputs. Useful when an outstation does not support generating binary output events or assigning them to a class. Default is false.
Trip Close Code	The trip close code to use when issuing commands for binary outputs; NUL, CLOSE, or TRIP. Default is NUL.
Op Type	The operation type to use when issuing commands for binary outputs; LATCH or PULSE. Default is LATCH.
Count	The count to use when issuing commands for binary outputs. Default is 1.

On Time (ms)	The on-time to use when issuing commands for binary outputs. Default is 0.
Off Time (ms)	The off-time to use when issuing commands for binary outputs. Default is 0.
Logging	
Application Layer Debug Logging	Whether to enable debug logging for the DNP3 application layer. Default is false.
Physical Layer Debug Logging	Whether to enable debug logging for the DNP3 physical layer. Default is false.

Sequence of Events

Sequence of events can be preserved using both event-based polling and unsolicited messaging. It’s recommended to use a dedicated Tag Group with the following non-default settings:

- **OPC UA Queue Size**: This should be increased to the maximum anticipated number of queued events for the configured polling durations or anticipated communication outages. The amount of memory available to Ignition is likely to far exceed that of any outstation, and many of them will have small fixed-size buffers. The exact size will depend on the outstation implementation and must be derived from available technical documentation.
- **OPC UA Sampling Interval**: This setting should be set to 0. In OPC UA, a Sampling Interval of 0 means the server may use event-based reporting for a MonitoredItem, rather than sample-based. This must be enabled to allow multiple events that occur closer together in time than a non-zero sampling interval allows to be reported to the client while maintaining OPC UA compliant behavior in the server.

Legacy DNP3 Driver

The Legacy DNP3 driver, known as the DNP3 Driver prior to **8.1.35**, uses the **DNP3** protocol for explicit reads and unsolicited messaging to acquire data. The Legacy DNP3 driver will no longer be receiving continued support, updates, or fixes. For the newest driver, see **DNP3 Driver**.

Note: The Legacy DNP3 driver does not support DNP3 Secure Authentication.

On this page ...

Data Acquisition Methods

The Legacy DNP3 driver offers two methods for acquiring data: explicit reads and unsolicited messaging.

Explicit Reads

This method serves as the primary approach to data acquisition for the Legacy DNP3 driver.

The DNP3 Read function code is employed to directly access data points. During each polling operation, only the static or current value of each data point is obtainable, and event data is neither retrieved nor processed. This data acquisition method is specifically intended for scenarios where data points are designated using the group/variation/index (gvi) syntax.

Unsolicited Messaging

Unsolicited messaging shares similarities with event-based polling in its event-driven approach to data processing. However, instead of explicitly polling each class at configured intervals, the outstation reports events only when changes occur within the outstation. The client's sampling interval does not influence the outstation, but does affect OPC UA MonitoredItem and Subscription behavior. OPC UA clients with MonitoredItems set to a sampling interval of 0 will receive the entire reported sequence of events for each point. It's important to note that not all outstations support unsolicited messaging.

Connecting to a Device

Ignition's Legacy DNP3 driver can connect directly to any devices that support Ethernet communication through the master station. It is important to make a new device connection for each of the outstations (remote devices), setting the source and destination addresses for each in Ignition's device connection.

1. Go to the **Config** section of the Gateway Webpage.
2. Scroll down and select **OPC UA > Device Connections**.
3. On the **Devices** page, find the blue arrow and click on **Create new Device**.
4. On the **Add Device Step 1: Choose Type** page, select **Legacy DNP3 Driver**, and click **Next**.
5. On the **New Device** page, leave all the default values and type in the following fields:

   Name: **Legacy DNP3**
   Hostname: Enter IP address or hostname of the device.

6. Click **Create New Device**.
   The **Devices** page is displayed showing the **Legacy DNP3** device is successfully created and added to Ignition. The **Status** will show as Disconnected and then Connected or Idle, depending on the status of the device.

Connection Settings

General	
Name	The name of this DNP3 device connection.
Description	Device connection description (optional). Can be used to provide any useful information / comments about this connection.

Enabled	If True (checked), the connection is enabled; if False (unchecked), the connection is disabled.
Main	
Hostname	The IP Address of the device.
Port	The port to use when connecting to a DNP3 device. The default port is 20000.
Local Address	The following feature is new in Ignition version **8.1.8** Click here to check out the other new features The local address to connect from when establishing a TCP connection. If left blank, then the driver will simply pick an available address.
Source Address	The address of the master station, default is 3. These addresses are assigned to the computers and should be the same across all settings. For example, if the device is configured with an address of 4 and Ignition has an address of 3: • Ignition settings: Source Address is 3 and Destination Address is 4. • Device settings: Source Address is 4 and Destination Address is 3.
Destination Address	The address of the outstation, default is 4. These addresses are assigned to the computers and should be the same across all settings. For example, if the device is configured with an address of 4 and Ignition has an address of 3: • Ignition settings: Source Address is 3 and Destination Address is 4. • Device settings: Source Address is 4 and Destination Address is 3.
Integrity Poll Interval	The interval at which to perform an integrity poll, in milliseconds, default is 3,600,000.
Direct Operate Enabled	When true, the Direct-Operate function code is used on a write, otherwise Select-Operate is used, default is true.
Unsolicited Messages Enabled	When true, the outstation may send unsolicited messages for Class 1, 2, and 3 data, default is false. Ignition will connect to the outstation, but not request any data from it. Ignition waits for the outstation to send data. Not all devices support this option; those that do need to be configured to use it. Please refer to your device's documentation for more information.
Advanced	
Message Fragment Size	The maximum size of a message fragment in the application layer, default is 249.
Message Timeout	The amount of time to wait for a message response from the outstation, default is 5,000.
Retries	The number of retries on a message timeout, default is 0.
Time Synchronization Enabled	The following feature is new in Ignition version **8.1.17** Click here to check out the other new features When true, automatically synchronizes the gateway time to the outstation when requested, default is true.
Link Layer Confirmation	When true, a link layer confirmation will be required from the outstation when sending messages, default is false.
Default Outstation Conformance Level	The default DNP3 Application Layer level subset to use when communicating with the outstation.
Default Value Types	
Analog Input Points	The default value type to use when reading an analog input point. Default is INTEGER.
Analog Input Frozen Points	The default value type to use when reading a frozen analog input point. Default is INTEGER.
Analog Output Points	The default value type to use when reading/writing an analog output point. Default is INTEGER.

Counter Points	The default value type to use when reading a counter point. Default is INTEGER.
Counter Frozen Points	The default value type to use when reading a frozen counter point. Default is INTEGER.
Binary Input Points	The default value type to use when reading a binary input point. Default is WITH_FLAGS.
Double-Bit Binary Input Points	The default value type to use when reading a double-bit binary input point. Default is WITH_FLAGS.
Binary Output Points	The default value type to use when reading a binary output point. default is WITH_FLAGS.

Aliased Points

Aliased points allow the user to assign meaningful names and descriptions to DNP3 points. They are also useful for addressing any points that were not returned by the initial integrity-poll on connection.

Point Address	The group, variation, and index that fully describe a point. A full address consists of all three parts: • Group – An integer prefixed with **g**. For example, **g40** • Variation – An integer prefixed with **v**. For example, **v2** • Index – An integer prefixed with **i**. For example, **i5** Example: **g30v1i20**
Browse Path	A "/" separated folder hierarchy in which to create the aliased point. Example: **Facility1/Voltage**
Description	A user-defined description of the point mapping.

Note: Tags that have been created based on these aliases may need to have their OPC Item Path adjusted if the Point Address from the _Aliased Points_ configuration is modified.

Browsing DNP3 Points

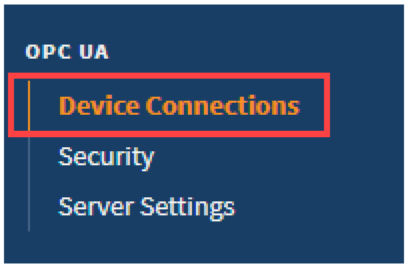
When the driver (master) connects to a device (outstation), an integrity poll is performed. Any DNP3 points returned in the response are mapped to the OPC server with the appropriate index. For example, g40v1i2 corresponds to an AnalogOutput point, variation 1, index 2. For a list of available points, see Point Types.

To see mapped points, go to the Designer and open the Connected Devices window.

Omron NJ Driver

Connect Ignition to an Omron NJ Device

1. Go to the **Config** section of the **Gateway** Webpage.
2. Scroll down and select **OPC UA > Device Connections**.



3. On the **Devices** page, click on **Create new Device**.
4. Select **Omron NJ Driver**, and click **Next**.
5. On the **New Device** page, leave all the default values and type in the following fields:

   Name: **Omron**
   Hostname: type the IP address, for example 74.125.224.72
   Check the box for **Show advanced properties?** to see the additional settings, but you can keep all the defaults.

6. Click **Create New Device**.
   The **Devices** page is displayed showing the **Omron** device is successfully created and added to Ignition.

7. On the **Devices** page, click the Tags link next to the newly created device.
   The **Manage Tags** page is displayed, allowing you to configure which variables in the device will show up as Tags in Ignition.

On this page ...

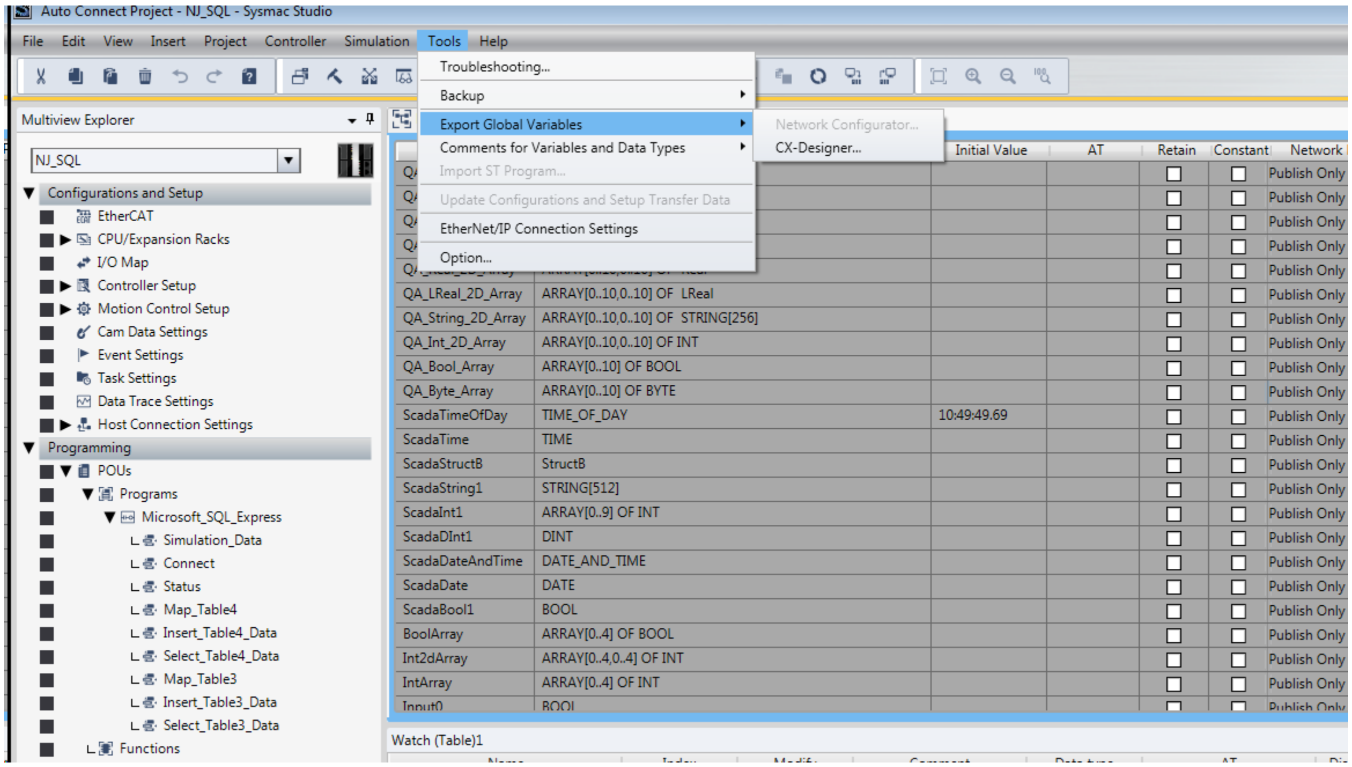
Device Settings

General	
Name	Device name.
Description	Description of the device connection.
Enabled	Default is set to true.
Main	
Hostname	The hostname or IP address of the device.
Local Address	The following feature is new in Ignition version **8.1.8** Click here to check out the other new features The local address to connect from when establishing a TCP connection. If left blank, then the driver will simply pick an available address.
Timeout	The request timeout, specified in milliseconds. The default is 2,000.
Concurrency	The number of concurrently issued requests allowed. There is a 1:1 correlation between concurrency and the number of CIP connections used. The default is 2.
Advanced	
Connection Size	The CIP connection size to use. The default (and maximum) is 1,994 bytes.
Date/Time Offset	

	The following feature is new in Ignition version **8.1.1** Click here to check out the other new features Offset in hours for Date/Time values. Default is 0. The driver needs an advanced setting for an offset to be applied when reading or writing date/time values. This feature was changed in Ignition version **8.1.37**: This property has changed to allow a configurable range of -24 to +24, from the previous configurable range of -12 to +14.
Slot Number	The slot number in the backplane in which the CPU is located. The default is 0.

Exporting from the Device

To export variables from Sysmac Studio, navigate to the global variables and select **Tools > Export Global Variables > CX-Designer.**

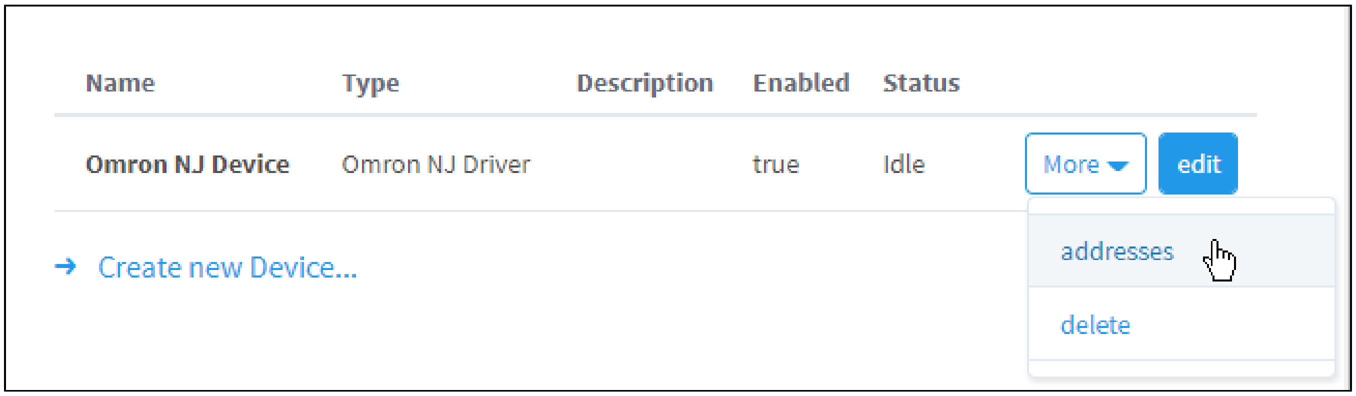


		Initial Value	AT	Retain	Constant	Network
QA_LReal_2D_Array	ARRAY[0..10,0..10] OF LReal			☐	☐	Publish Only
QA_String_2D_Array	ARRAY[0..10,0..10] OF STRING[256]			☐	☐	Publish Only
QA_Int_2D_Array	ARRAY[0..10,0..10] OF INT			☐	☐	Publish Only
QA_Bool_Array	ARRAY[0..10] OF BOOL			☐	☐	Publish Only
QA_Byte_Array	ARRAY[0..10] OF BYTE			☐	☐	Publish Only
ScadaTimeOfDay	TIME_OF_DAY	10:49:49.69		☐	☐	Publish Only
ScadaTime	TIME			☐	☐	Publish Only
ScadaStructB	StructB			☐	☐	Publish Only
ScadaString1	STRING[512]			☐	☐	Publish Only
ScadaInt1	ARRAY[0..9] OF INT			☐	☐	Publish Only
ScadaDInt1	DINT			☐	☐	Publish Only
ScadaDateAndTime	DATE_AND_TIME			☐	☐	Publish Only
ScadaDate	DATE			☐	☐	Publish Only
ScadaBool1	BOOL			☐	☐	Publish Only
BoolArray	ARRAY[0..4] OF BOOL			☐	☐	Publish Only
Int2dArray	ARRAY[0..4,0..4] OF INT			☐	☐	Publish Only
IntArray	ARRAY[0..4] OF INT			☐	☐	Publish Only

The variables will be saved to the clipboard in tab-separated format. You can now paste the contents into an empty text file for use with importing into the Ignition Gateway.

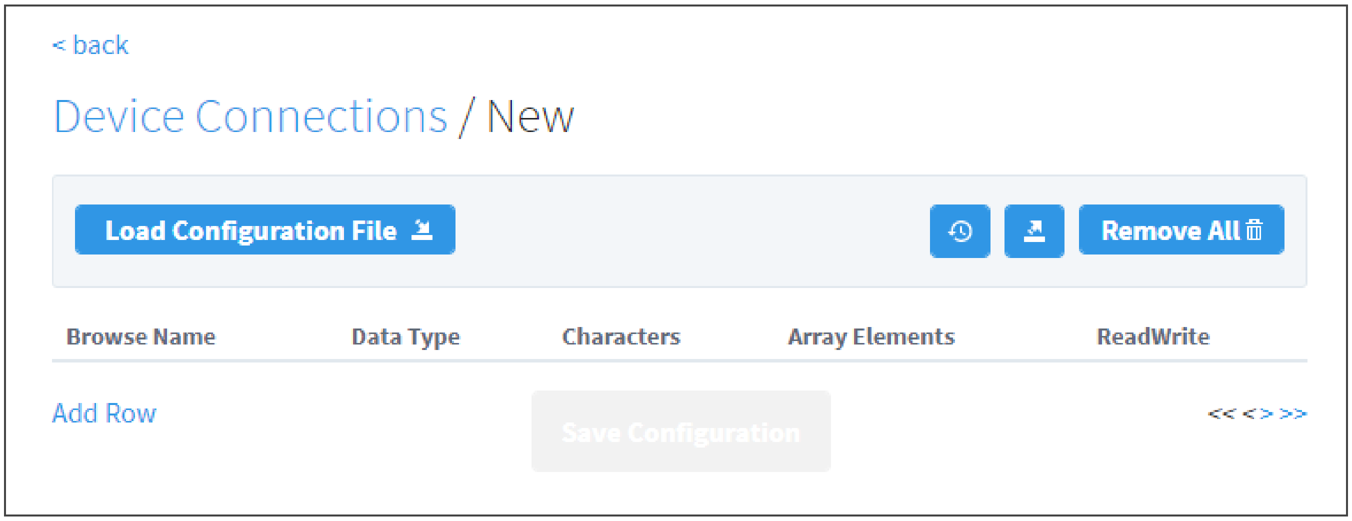
Managing Tags

In order to browse Tags in the Designer, you must first create a mapping for the device in the Gateway. The **Manage Tags** page can be accessed by navigating to the Omron device and clicking the **addresses** link.



Importing Tags

Once on the **Manage Tags** page, you can manually enter the Tags, or import them from a tab-separated file. When importing, first choose a file, then click the **Load Configuration File** button to append Tags to the table.



Once you save any changes made to the Tag mapping, you can view the Tags in the Connected Devices window of the Designer.

Addressing

In the **Tags** table of the **Manage Tags** page, we have four columns of configuration per Tag:

- **Browse Name** - The corresponding address of the variable found in the Omron device. Struct members are separated with periods.
- **Datatype** - The datatype of the variable found in the Omron device.
- **Chars** - The maximum number of characters that a String Tag will contain.
- **Elements** - Denotes whether the Tag is considered a scalar or array. See below for more detail on specifying the number of elements to read from the device.
- **R/W** - Specifies read / write access permissions on the Tag.

Support for the following data types is included:

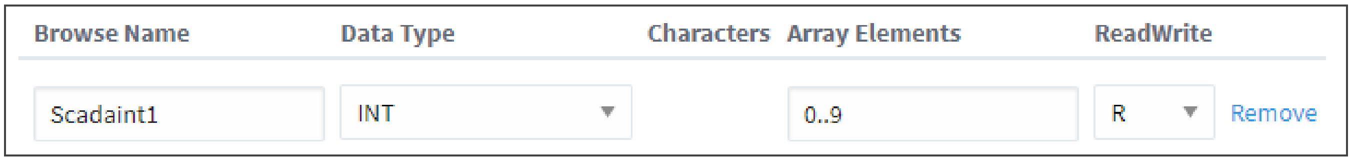
- TIME_NSEC
- DATE_NSEC
- TIME_OF_DAY_NSEC
- DATE_AND_TIME_NSEC

Scalars

Leaving the **Elements** column blank will result in a scalar Tag. When reading from the device, only one element will be requested.

Arrays

Specify the number of elements in an array in the form of **0..N**. The initial index 0 is always included, so an array mapped with 0..9 elements is a 10 element array.



Browse Name	Data Type	Characters	Array Elements	ReadWrite	
Scadaint1	INT		0..9	R	Remove

Optional Format

Array elements may also be specified with a single integer representing the last offset. For example, an integer value of **5** is equivalent to **0..5**.

The number range specified in the Elements field can deviate from the range specified in the device's program. Thus, if an array was configured with a range of 0 - 4, but the mapping on the Ignition Gateway is set to 3 - 7, then the resulting items would be offset as follows:

PLC Program	Tag in Ignition
0	BoolArray_3_
1	BoolArray_4_
2	BoolArray_5_
3	BoolArray_6_
4	BoolArray_7_

This is because the driver always assumes that the lowest configured element on the mapping page matches up with the lowest element in the PLC program. As seen above, this can cause some confusion if the mapping on the Ignition Gateway is configured with a different range.

For this reason, it is **highly recommended** to configure the Elements field on the Ignition Gateway to match the range used in the PLC program.

Note, that this also applies to **Multidimensional Arrays**.

Multidimensional Arrays

Multidimensional arrays are specified in the same way as arrays with each group of indices separated by a comma. For example, entering 0..3,0..3 into the **Array Elements** field specifies two groups of indices.

Strings

The number of characters for String variables is specified in the **Chars** field. String arrays are mapped using both the **Chars** and **Elements** fields.

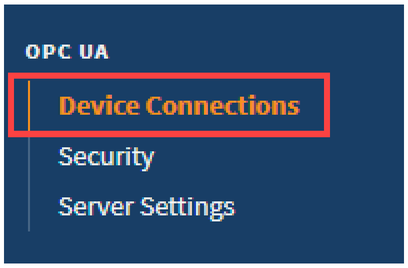
Omron FINS Driver

Ignition supports Omron FINS devices. This driver supports both UDP and TCP transport protocols.

On this page ...

Connect Ignition to an Omron FINS Device via TCP

1. Go to the **Config** section of the **Gateway** Webpage.
2. Scroll down and select **OPC UA > Device Connections**.



3. On the **Devices** page, click on **Create new Device**.
4. Select **Omron FINS/TCP**, and click **Next**.
5. Fill in the following fields:

   Name: **FINS TCP**
   Hostname: Enter the **IP address**, for example 74.125.224.72

   Leave the default values in the remaining fields.

6. Click **Create New Device**.

The **Devices** page is displayed showing the **FINS TCP** device is successfully created and added to Ignition.

Connect Ignition to an Omron FINS Device via UDP

1. Go to the **Config** section of the **Gateway** Webpage.
2. Scroll down and select **OPC UA > Device Connections**.
3. On the **Devices** page, click on **Create new Device**.
4. Select **Omron FINS/UDP**, and click **Next**.
5. Fill in the following fields:

   Name: **FINS UDP**
   Bind Address: Enter the **IP address** of your Gateway, for example 74.125.225.10
   Remote Address: Enter the **IP address** of your Omron FINS device, for example 74.125.224.72

6. Under FINS Settings set the following:

   FINS Source Node: The last octet of your IP address, for example 10 using the bind address above.
   FINS Destination Network: The address number of your FINS device typically configured in the routing table for your device. The valid range is 0-128.
   FINS Destination Node: The node number of your FINS device. This is typically the last octet of the IP address of the device, for example 72 in the example above.
   Fins Destination Unit: The unit number of your FINS device.

7. Click **Create New Device**.

The **Devices** page is displayed showing the **FINS UDP** device is successfully created and added to Ignition.

Device Settings

General	
Name	Device name.
Description	Device description.

Enabled	Default is set to true.

Connectivity		
Hostname	The hostname or IP address of the device.	TCP Only
Port	The port your Omron device is listening on. The default is 9600.	TCP Only
Local Address	Address of network adapter to connect from.	TCP Only
Bind Address	The hostname or IP address of the Gateway.	UDP Only
Bind Port	The port you wish to create a UDP connection on for the Gateway. The default is 9600.	UDP Only
Remote Address	The hostname or IP address of the device.	UDP Only
Remote Port	The port your Omron device is listening on. The default is 9600.	UDP Only
Timeout	The request timeout, specified in milliseconds. The default is 2,000.	UDP & TCP

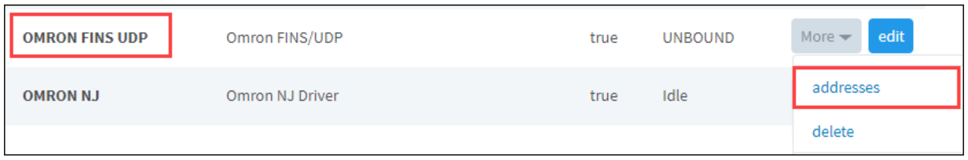
FINS Settings		
FINS Source Network	The address number of the source network (the Ignition Gateway).	Valid value is an integer between 0 and 127. The default setting is 0.
FINS Source Node	The number of the source node (the Ignition Gateway), typically the last octet of the IP address.	Valid value in an integer between 0 and 254. The default setting is 0.
FINS Source Unit	The unit number of the source device (the Ignition Gateway).	Valid value is an integer between 0 and 255. The default setting is 0
FINS Destination Network	The address number of the destination network (the FINS device).	Valid value is an integer between 0 and 127. The default setting is 0.
FINS Destination Node	The number of the destination node (the FINS device), typically the last octet of the IP address and set via dials on the front of the device.	Valid value in an integer between 0 and 254. The default setting is 0.
Fins Destination Unit	The unit number of the destination device (the FINS device).	Valid value is an integer between 0 and 255. The default setting is 0

Request Optimization	
Concurrent Requests	The number of requests that Ignition will try to send to the device at the same time. Increasing this number can sometimes help with your request throughput, however increasing this too much can overwhelm the device and hurt communications with the device.
Max Request Size	The maximum size of a request in bytes.
Max Gap Size	The maximum address “gap” to span when optimizing requests to contiguous address locations.
Write Priority Ratio	The number of write requests to execute for every read request, when an abundance of both are queued for execution.

Import Addresses

There is a user interface in the Gateway to create import addresses. After import, you'll be able to browse the Tags in the Designer.

1. Go to the **Config** section of the **Gateway** Webpage.
2. Scroll down and select **OPC UA > Device Connections**.
3. On the **Devices** page, scroll to the **OMRON FINS** device. Click the **More** dropdown and choose **addresses**.



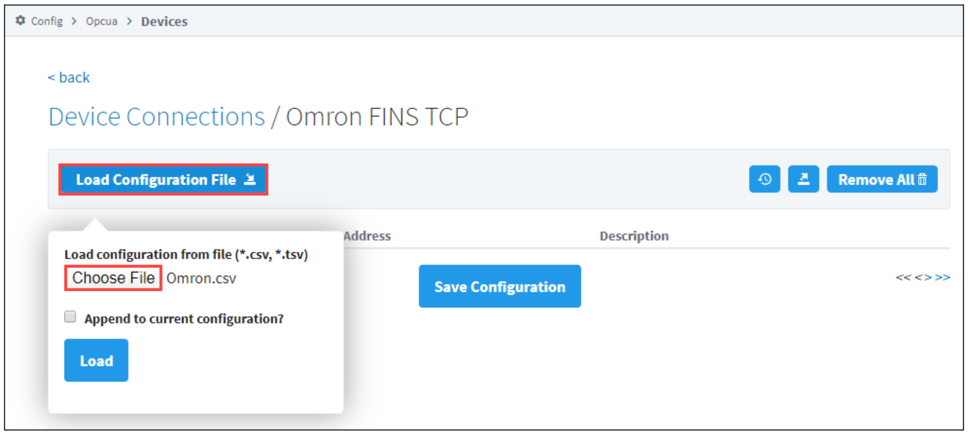
OMRON FINS UDP	Omron FINS/UDP	true	UNBOUND	More edit
OMRON NJ	Omron NJ Driver	true	Idle	

4. On the next page, load the addresses from a CSV, TSV, or XML file. Click the **Load Configuration** button and choose a file.

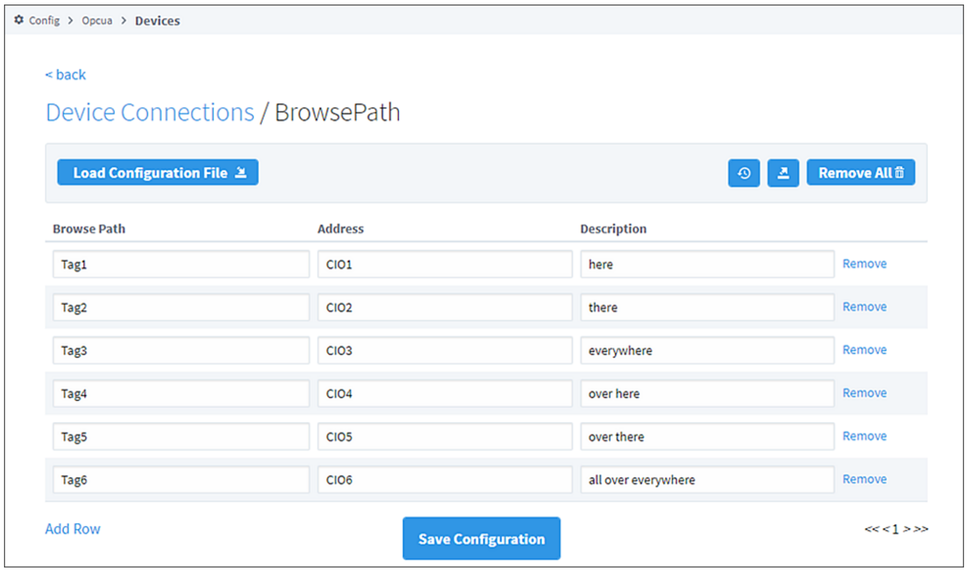
The following feature is new in Ignition version **8.1.2**
Click here to check out the other new features

Release 8.1.2 added support for XML configuration files.

5. Click **Load**.



You'll see the values load onto the screen.



Browse Path	Address	Description	
Tag1	CIO1	here	Remove
Tag2	CIO2	there	Remove
Tag3	CIO3	everywhere	Remove
Tag4	CIO4	over here	Remove
Tag5	CIO5	over there	Remove
Tag6	CIO6	all over everywhere	Remove

6. Click **Save Configuration**.
7. Once you save any changes made to the Tag mapping, you can view the Tags in the Connected Devices window of the Designer.

Addressing

You also have the option to manually address tags via an Ignition OPC tag in the Ignition Designer. See Ignition OPC UA Server Node Configuration for more information.

Data Areas

Area	Ignition Code	Omron Symbol Code	Native Size
CIO Area	CIO		Int16/UInt16
Work Area	WR or W	W	Int16/UInt16
Holding Bit Area	HR or H	H	Int16/UInt16
Auxiliary Bit Area	AR or A	A	Int16/UInt16
Timer Area	TIM or T	T	Int16/UInt16 or Bool
Counter Area	CNT or C	C	Int16/UInt16 or Bool
Index Register Area	IR	IR	Int32/UInt32
Data Register Area	DR	DR	Int16/UInt16
DM area	DM or D	D	Int16/UInt16
EM area	EM or Exx	E	Int16/UInt16

EM Area

Use `EM` for the current bank, or `Exx` for bank xx, where xx is 2 hex digits. Valid banks are E00 through E18 (25 total).

Data Types

Bit	Bool	Int16
Int32	Int64	UInt16
UInt32	Float	Double
String	BCD16	BCD32

Data Type Modifiers

Modifier	Order
@BE	Big Endian Byte Order (default when not specified)
@LE	Little Endian Byte Order
@HL	High-Low Word Order
@LH	Low-High Word Order (default when not specified)

Examples

Syntax Example

Note: Items in curly brackets {} are optional.

Below is an example OPC Item path, representing how to manually specify an address in the device.

```
ns=1;s=[DeviceName]Area{<DataType>}Offset{.Bit}
```

When typing Addresses in using the Device's Address page on the gateway, the syntax looks like the following:

```
Area{<DataType>}Offset{.Bit}
```

More Examples

Item Path (OPC UA NodeId)	FINS Request
`CIO0`	An Int16 at offset 0 in CIO area.
`CIO<Int32>1`	An Int32 at offset 1 in CIO area.
`CIO<Int64>3.0`	Bit 0 of an Int64 at offset 3 in CIO area.
`CIO<Int64@HL>3`	An Int64 at offset 3 in CIO area in High-Low word order.
`TIM0`	Present Value (16-bit) of Timer at offset 0.
`TIM<Bool>0`	Completion Status (Bool) of Timer at offset 0.
`CNT0`	Present Value (16-bit) of Counter at offset 0.
`CNT<Bool>0`	Completion Status (Bool) of Counter at offset 0.
`DR0`	An Int32 at offset 0 in DR area (32-bit by default).
`DR<Int64>0`	An Int64 at offset in DR area.
`CIO<Int16[3]>0`	An Int16 array of size 3 at offset 0 in CIO area.
`CIO<Int16[3]>0[1]`	Element 1 of an Int16 array of size 3 at offset 0 in CIO area.
`CIO<String10>0`	String of up to length 10 (string length in bytes) at offset 0 in CIO area.
`E001000`	An Int16 from EM bank 0 at offset 1000.
`E00<Int16>1000`	Also an Int16 from EM bank 0 at offset 1000, but with the an explicit DataType to make the address look less confusing.

Ignition OPC UA Server Node Configuration

You can also create OPC Nodes in Ignition’s OPC UA server manually via a CSV file on the Ignition Gateway itself with the following settings:

File Name: `tags.csv`
File Location:`$ignitionHome/data/opcua/devices/$deviceName`
File Format: Comma separated value file with the following columns:

- Browse Path
- Address
- Description

Example File

```
Tag1, CIO0, "First tag"
Foo/Tag2, CIO1, "Second tag, in a folder"
Foo/Bar/Tag3, CIO2, "In a couple of folders"
```

Use quotes on the description when it contains a comma (or whenever you like).

When adding or making changes to this file, a restart of the device is necessary for the changes to be picked up. This is done by editing the device and clicking **Save.**

Programmable Device Simulator

The Programmable Device Simulator allows you to add simulator devices that act as if they are connected to a real device. It allows users to read and write Tags without any network or PLC connection.

The Programmable Device Simulator provides functionality that allows you to create your own simulator program with outputs you define. Users are able to create Tags that can be used in their own development process, thus providing the flexibility to simulate devices with a Tag structure they are building for their project. There are a number of built-in functions that will result in unique Tag outputs rather than static values. We also provide the ability to set specific values at different points of the program should the functions not provide exactly what you need.

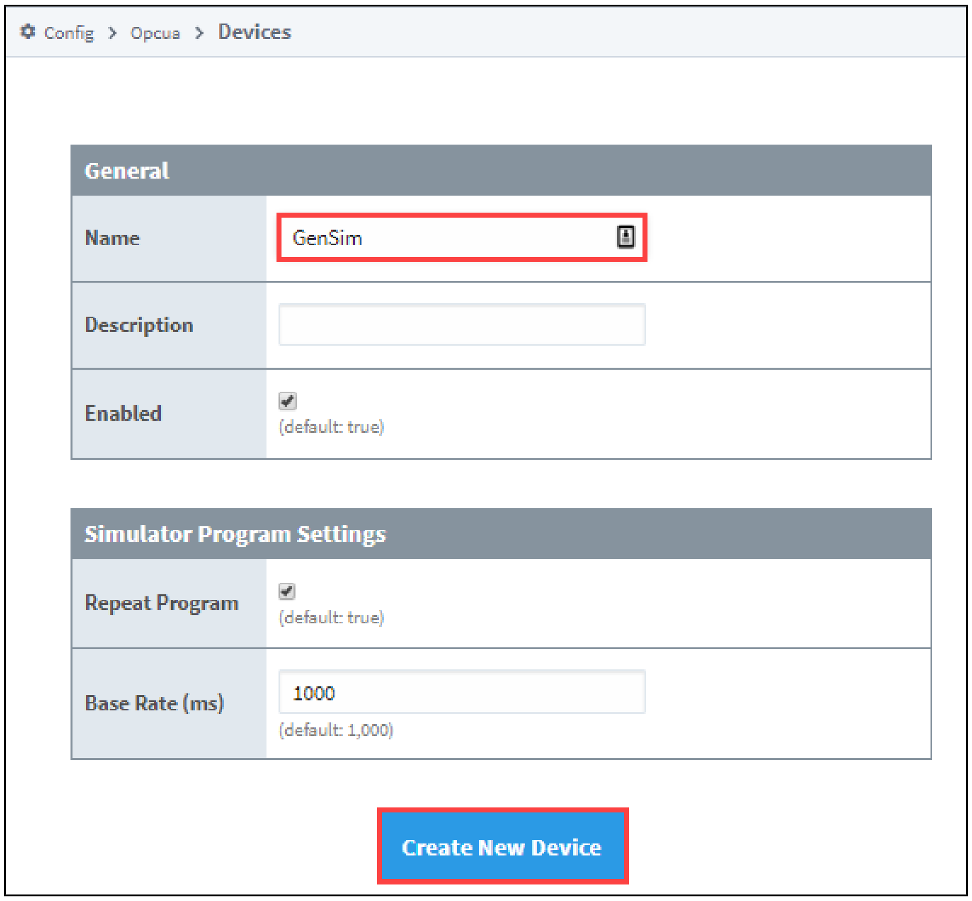
Note: The Programmable Device Simulator replaced the previous built-in simulators in earlier versions of Ignition, and combined the Dairy Demo, Generic and SLC simulator device connections into a single driver. Click here for the previous simulator documentation.

On this page ...

Connecting to a Programmable Device Simulator

Connecting to a Programmable Device Simulator and loading the programs are simple and will give you some values that change on their own. These simulator devices can be used for realtime values, history and alarms.

1. From the Gateway webpage, go to the **Config** section.
2. Scroll down and select **OPC UA > Device Connections**.
3. Click on **Create new Device...**.
4. Select **Programmable Device Simulator,** and click **Next**.
5. Give the device a name (i.e., GenSim), and click **Create New Device** button.



Config > Opcua > Devices

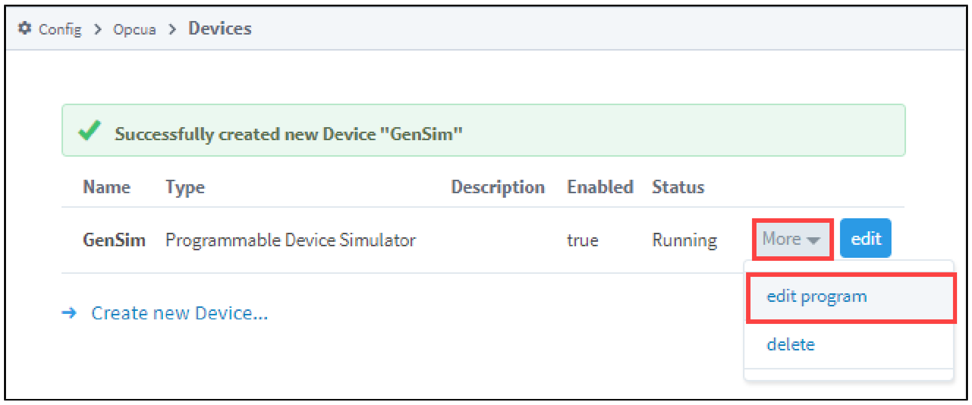
General

Name	GenSim
Description	
Enabled	✓ (default: true)

Simulator Program Settings

Repeat Program	✓ (default: true)
Base Rate (ms)	1000 (default: 1,000)

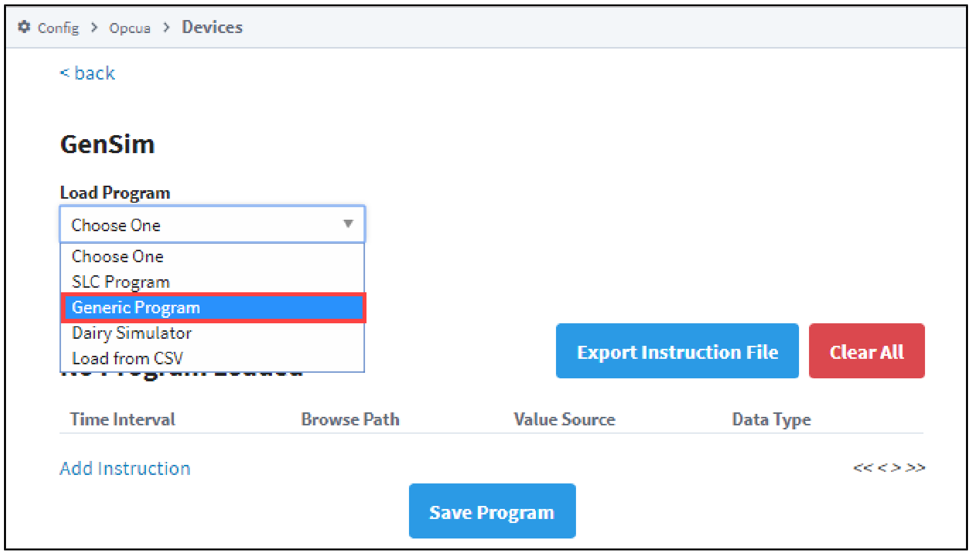
6. The window will refresh and you'll see your device was successfully created with a status of "Running". Now you can set the program for the simulator by clicking **More > edit program**.


Config > Opcua > Devices

Successfully created new Device "GenSim"

Name	Type	Description	Enabled	Status
GenSim	Programmable Device Simulator		true	Running

7. Create a program by either clicking the Add Instruction link to add a new line of instruction to the program, or loading a predefined program from the **Load Program** dropdown (i.e., Generic Program) and clicking the **Load Simulator Program** button.

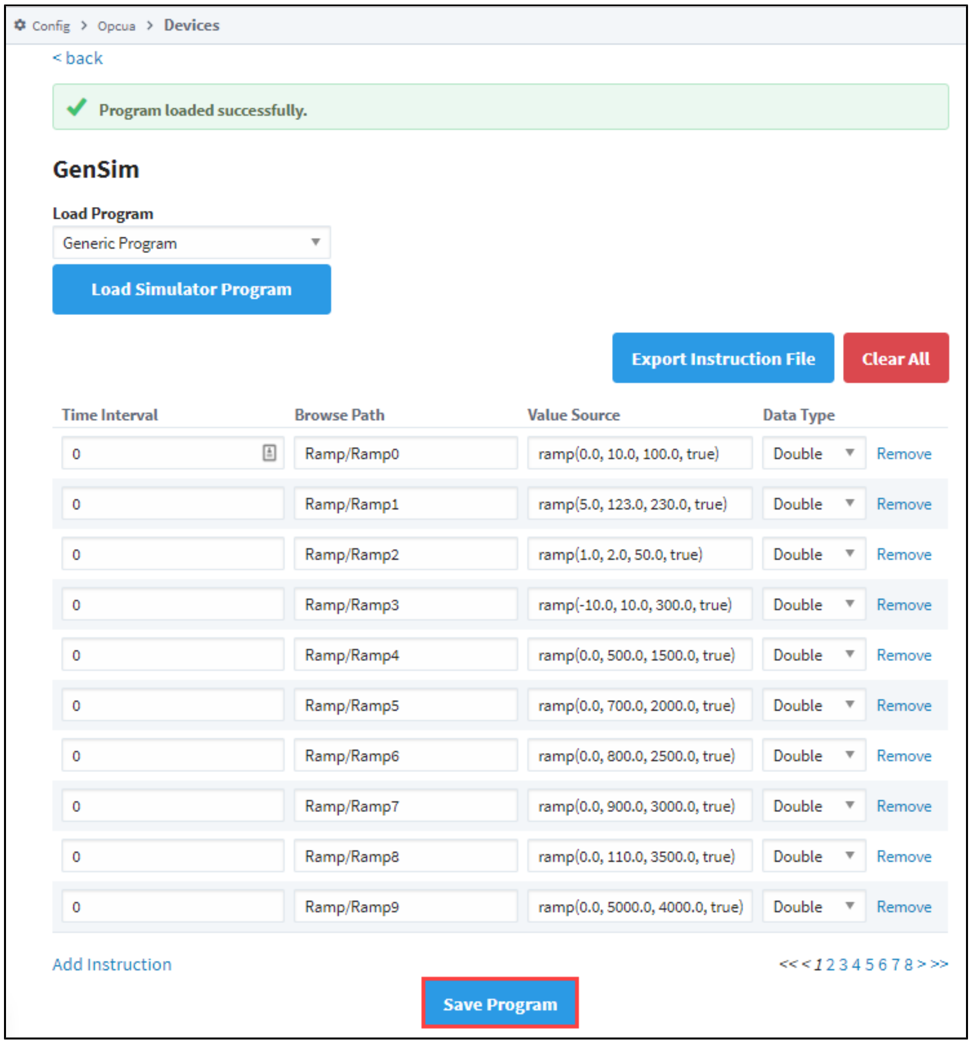

Config > Opcua > Devices

GenSim

Load Program

Time Interval	Browse Path	Value Source	Data Type

8. Once you have some instructions, click the **Save Program** button. These instructions determine what Tags get made, and what their values are.


Config > Opcua > Devices

< back

✓ Program loaded successfully.

GenSim

Load Program

Generic Program

Load Simulator Program

Export Instruction File | Clear All

Time Interval	Browse Path	Value Source	Data Type	
0	Ramp/Ramp0	ramp(0.0, 10.0, 100.0, true)	Double	Remove
0	Ramp/Ramp1	ramp(5.0, 123.0, 230.0, true)	Double	Remove
0	Ramp/Ramp2	ramp(1.0, 2.0, 50.0, true)	Double	Remove
0	Ramp/Ramp3	ramp(-10.0, 10.0, 300.0, true)	Double	Remove
0	Ramp/Ramp4	ramp(0.0, 500.0, 1500.0, true)	Double	Remove
0	Ramp/Ramp5	ramp(0.0, 700.0, 2000.0, true)	Double	Remove
0	Ramp/Ramp6	ramp(0.0, 800.0, 2500.0, true)	Double	Remove
0	Ramp/Ramp7	ramp(0.0, 900.0, 3000.0, true)	Double	Remove
0	Ramp/Ramp8	ramp(0.0, 110.0, 3500.0, true)	Double	Remove
0	Ramp/Ramp9	ramp(0.0, 5000.0, 4000.0, true)	Double	Remove

Add Instruction

<< < 1 2 3 4 5 6 7 8 > >>

Save Program

Simulator Settings

Setting	Description
Repeat Program	If True, the program will repeat indefinitely, meaning that once the last defined Time Interval has been reached, the program will start over again at Time Interval 0.
Base Rate (ms)	The number of milliseconds determining how quickly the program should move between each Time Interval. The initial duration of the Base Rate is defined in the Program Device Simulator settings should you need this value to persist after restarts.

Program Instructions

The simulator gets its values from a Program made up of various instructions. The program runs through the instructions in order and executes. Each Program Device Simulator contains only one program. Each instruction has a Time Interval and Tag path. If there is more than one Time Interval for a Tag, it will step through those values in order. You can alternatively have a single time Interval and a function in the Value Source field.

Term	Description
Time Interval	Represents a “step” or point in time for the program. A program will start at interval 0, and set the Value Source on the Tag. The program will wait for a number of milliseconds (determined by the Base Rate, defined below) before moving to the new Time Interval.
Browse Path	The full path to the Tag you want to create in the simulator. Forward slashes are used to specify folders, as well as act as a delimiter for additional folders in the path.
Value Source	Determines how the value for the node at the Browse Path is generated. Either a static value or a function will be used to generate the value.

Data Type	The Data Type for a node. Valid types are: • boolean • int16 • uint16 • int32 • uint32 • int64 • float • double • string • datetime • uint64 (Not all values fully supported by Ignition at this time)

Value Source Functions

Users are allowed to define a 'function' for the value source. This is not a Python or Expression function. Rather, the value in the cell is a string that looks like a function definition; eg., foo(x,x,x). The driver will attempt to parse the string, and then derive a value based on the function. Valid functions are in the following table.

Function	Descriptions
sine(min, max, period, repeat)	Sine wave. The value moves between the min value and max value, and back to the min. The total duration of this wave is based on the period parameter. If no parameters are specified, then the function should produce a wave that starts at 0, reaches an upper bound of 100, and returns to 0. This series should occur over the default period ((10 * Base Rate) * 1000 ms = 10,000 ms).
cosine(min, max, period, repeat)	Cosine wave.
square(min, max, period, repeat)	Square wave.
triangle(min, max, period, repeat)	Triangle wave.
ramp(min, max, period, repeat)	Ramp signals starts from the min value going up to max value based on the period parameter. When the value reaches its upper limit, it is reset to the min value.
realistic (setPoint, proportion, integral, derivative, repeat)	A realistic number generator driven by a PID system.
random(min, max, repeat)	Random values starting at the min value and working up to the max value.
list(value1, value2, etc..., valueN, repeat)	Accepts any number of parameters and walks through each value in this list.
qv(value, qualityCode)	Sets a value and quality code. Allows users to simulate a value with bad quality.
readonly(value)	Sets a static value for read only purpose.

Each of the functions above expects certain parameters.

Parameter	Description	Default Value
min	Minimum value for the function.	0
max	Maximum value for the function.	100
period	Represents a period of time as a number of Time Intervals. The default value of 10 represents "10 Time Intervals."	10
setPoint	The setpoint of the PID Control Loop. Also known as the desired position	100
proportion	The proportional value of the PID Control Loop.	1.2

integral	The integral value of the PID Control Loop.	0.06
derivative	The derivative value of the PID Control Loop.	0.25
qualityCode	Allows users to set the quality on a Tag (assuming the function used contains a quality code parameter). Valid values are: Good, Bad, Uncertain.	Good
repeat	Does the function repeat for each time slice of the program, or does it report a single value when the instruction is run. The default value of true will ensure that a function will continue to run as long as the program itself is running. A value of false will only update a value when it reaches the specified Time Interval in the program.	true

Example Instruction Files

Simple Function Example

TimeInterval	BrowsePath	ValueSource	DataType
0	TagA	sine(0,100,10,true)	Double

The table above shows us function usage with parameters. Because the example is using default values, it is functionally equivalent to the following:

TimeInteval	BrowsePath	ValueSource	DataType
0	TagA	sine()	Double

Running this program should yield the following results (assuming repeat is enabled):

1. A Tag at root named “TagA” will be created.
2. Since only a single Time Interval was defined, the program ends quickly. The delta time between the start of the program and the end should be around one Base Rate interval.
3. The simulator will use a internal clock to ensure that the value reported is representative of the actual period for the function requested and if history is enabled, a full wave would be graphed.

Advanced Program Example

TimeInterval	BrowsePath	ValueSource	DataType
0	TagA	sine()	Double
0	myFolder/TagB	0	Int32
3	myFolder/TagB	4	Int32
4	another_folder/TagC	100	Int32
20	TagA	ramp()	Double
30	myFolder/TagB	55	Int32

The program above should yield the following results:

1. TagA is initialized with the Sine function.
2. TagB (which is located under **myFolder** in the simulator’s structure) is initialized with a value of 0.
3. TagC isn’t defined at the start, but that doesn’t matter; the program creates a TagC initially because it will exist in the device. If this is the first time the program ran, then TagC started with a value of 0. If it is the second time through, it maintains the value at the end of the program until it reaches an interval where something changes.
4. Time Interval 1. The program doesn’t state that any changes should be made, so we’re done evaluating this Time Interval.
5. Time Interval 2. Again, nothing to do here, so we wait another Base Rate duration.
6. Time Interval 3, the value on TagB to 4.
7. Time Interval 4. The value of TagC changes to 100. If this program has executed at least once before, then TagC could already have a value of 100, since this is the only entry in the program that changes the value on Tag C. However, it is possible that the user (or something else, such as a binding or script) wrote another value to this Tag. At this point, our program is setting the value back to 100
8. Time Interval 20, TagA switches to the Ramp function. This whole time it has been using the Sine function to generate some moving numbers, but now we’re telling it to use the Ramp function, which change the value (starting with the minimum value for the function) and uses a different method to determine its value.

9. Time Interval 30. The value of TagB changes to 55.
10. We’re now at the end of the program. If Repeat was enabled, we’ll move back to Time Interval 0 and start the whole process over again. If not, then the program ends for all Tags.

Preloaded Programs

The Programmable Device Simulator comes with preloaded programs for Generic, Dairy and SLC simulators, as well as the ability to load from a CSV.

When loading any of the default programs (Generic, Dairy, or SLC), the item paths on the tags generated will contain a **_Meta:** prefix. This prefix exists for legacy purposes to ensure that users who replace simulators created in 7.x with the new programmable simulator will not have to recreate tags.

However, this also means that if you later export these tags as a CSV, the **_Meta:** prefix is removed since it is not clearly shown in the browse path. This means that once you are done adding or removing tags in the exported CSV and want to import again, the old tags may no longer work. To fix the old tags, you can either recreate the OPC tags or manually add **_Meta:** before the value set in the Browse Path column.

Example Browse Path

```
ns=1;s=[Testing]_Meta:Writeable/Agitator1Mode
```

Generic Simulator Program

The Generic Simulator Program provides a variety of Tags that offer different data types and value generation styles. For example, there are ramps, sine waves, and random values. Additionally, there is a set of static writable Tags whose values will persist while the device is running.

Dairy Simulator Program

The Dairy Simulator Program has a ControlLogix like structure with Compressor, Tank, Motor Tags and more. The folders are split into an Overview and Refrigeration section with Tags multiple levels deep that mimic a UDT in a ControlLogix device.

SLC Simulator

The SLC Simulator Program creates a simple device whose address structure mimics a basic SLC structure. These Tags are readable and writeable.

Load From CSV

The Load from CSV option allows you to select a CSV file to load a predefined program from. The CSV file must have four columns in a specific order (Time Interval, Browse Path, Value Source, Data Type), with each row representing a different instruction in the program.

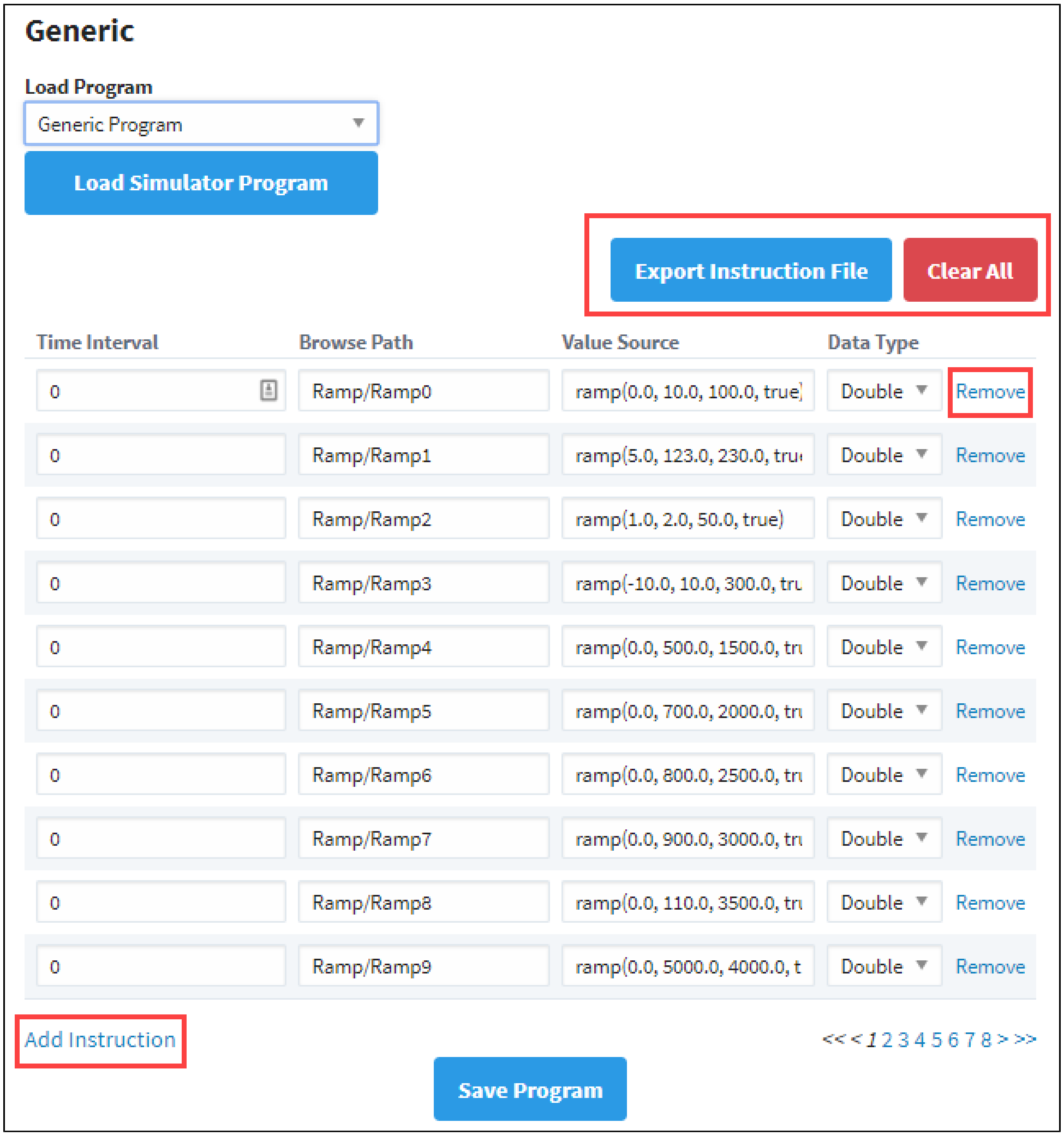
Meta Tags

Each Programmable Device Simulator will have Meta Tags that allow users to interact with the program from the Designer/Session/Client. All Tags will be listed under the parent folder **[Controls]** within the device. Altered Meta Tag values do not persist after restart.

Term	Description
Base Rate	The number of milliseconds determining how quickly the program should move between each Time Interval. The initial duration of the Base Rate is defined in the Program Device Simulator settings should you need this value to persist after restarts.
Pause	Setting this Tag to 'True' will stop the program at its current Time Interval. Setting it back to 'False' will cause the program to resume from that point.
Program Counter	A count that tracks the Time Interval of the currently running program. This counter continues to increment for the duration of the program and resets when a program repeats.
Repeat	If True, the program will repeat indefinitely, meaning that once the last defined Time Interval has been reached, the program will start over again at Time Interval 0.
Reset	If True, the program is immediately reset to Time Interval 0 and the value will immediately change back to' False.'

Export Instruction File

The ability to create custom instructions in the driver was added providing an opportunity to create a custom simulator device. You have the option of exporting the instruction file to a CSV formatted file and loading it once it's modified. You also have the ability to add and remove individual instructions. **Clear All** removes all instructions in the program.



Generic

Load Program

Generic Program

Time Interval	Browse Path	Value Source	Data Type	
0	Ramp/Ramp0	ramp(0.0, 10.0, 100.0, true)	Double	Remove
0	Ramp/Ramp1	ramp(5.0, 123.0, 230.0, tru	Double	Remove
0	Ramp/Ramp2	ramp(1.0, 2.0, 50.0, true)	Double	Remove
0	Ramp/Ramp3	ramp(-10.0, 10.0, 300.0, tru	Double	Remove
0	Ramp/Ramp4	ramp(0.0, 500.0, 1500.0, tru	Double	Remove
0	Ramp/Ramp5	ramp(0.0, 700.0, 2000.0, tru	Double	Remove
0	Ramp/Ramp6	ramp(0.0, 800.0, 2500.0, tru	Double	Remove
0	Ramp/Ramp7	ramp(0.0, 900.0, 3000.0, tru	Double	Remove
0	Ramp/Ramp8	ramp(0.0, 110.0, 3500.0, tru	Double	Remove
0	Ramp/Ramp9	ramp(0.0, 5000.0, 4000.0, t	Double	Remove

BACnet

BACnet

Ignition provides a driver for BACnet (a data communication protocol for building automation and control networks). The first step before setting up devices and using the driver is to download the module. Go to the Ignition downloads page then refer to Installing or Upgrading a Module.

The driver implements BACnet/IP over UDP. Any access to devices on other network media types (Ethernet (ISO-8802-3), MSTP, ARCNET, etc…) must be done through a gateway/router device.

On this page ...

Setup Process

The process for setting up BACnet differs from other drivers in that you have to first set up a local device. After that you can configure a remote device.

1. Set up a local device.
2. Set up a remote device.

Creating Tags

The BACnet driver offers browsing support, making Tag creation as easy as dragging-and-dropping from the Tag Browser. However understanding how the OPC Item Path is read by the driver can be useful. Using the example below, there are three important parts of the item path we can identify.

```
ns=1;s=[MyRemoteDevice]AnalogInput100.Present_Value
```

- [MyRemoteDevice] is the Remote Device Name
- AnalogInput is the Object Type
- 100 is the Object Identifier

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BACnet Addressing

Watch the Video

Remote Device Name

The name of the Remote Device, as known by the OPC server.

Object Type

The BACnet object type. Currently supported types are:

- Device
- AnalogInput
- AnalogOutput
- AnalogValue
- LargeAnalogValue
- BinaryInput
- BinaryOutput
- BinaryValue
- MultiStateInput
- MultiStateOutput
- MultiStateValue

The following feature is new in Ignition version **8.1.17**
Click here to check out the other new features

Ignition now supports Elapsed_Active_Time and Time_Of_Active_Time_Reset properties on BinaryInput, BinaryOutput, and BinaryValue objects. These tag types contain an ElapsedActiveTime folder with the following properties:

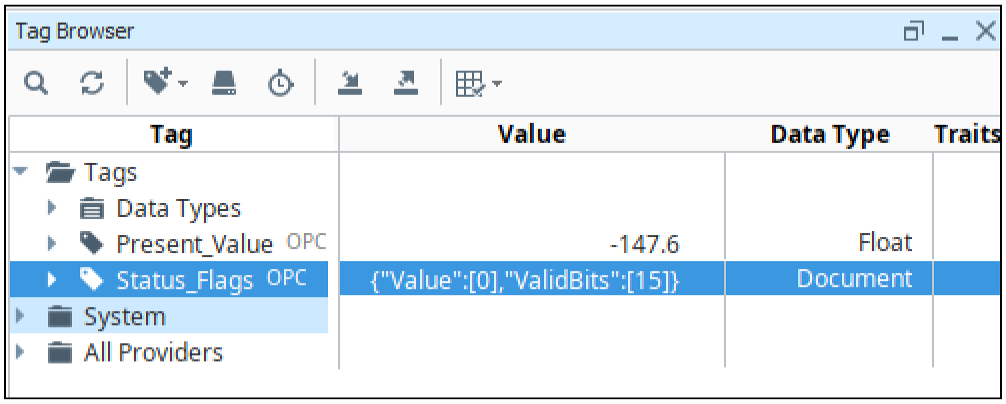
Name	Type	Read/Write
Elapsed_Active_Time	Long	Writable
Time_Of_Active_Time_Reset	Document	Read Only

Object Identifier

The numerical identifier of the object.

Status_Flags and Document Tags

The Status_Flags Tags on each object are turn a JSON document, which requires parsing before you can see the values on the flags.



Tag	Value	Data Type	Traits
Tags			
Data Types			
Present_Value OPC	-147.6	Float	
Status_Flags OPC	{"Value":[0],"ValidBits":[15]}	Document	
System			
All Providers			

While the individual flags can be accessed by manually creating Tags for each flag, in some cases you may want to handle the parsing with an expression instead of creating separate OPC Tags. This can easily be done with the jsonGet and getBit functions. Assuming an Expression Tag was created in the same directory as a Status_Flags Tag, we could use the following expression to extract the first bit of Status_Flags (which represents In_Alarm):

```
getBit(jsonGet({[.]Status_Flags}, 'Value[0]'), 0)
```

The following feature is new in Ignition version **8.1.4**
Click here to check out the other new features

Writing BACnet Null Values

As of release 8.1.4, you can write a `None` value (via Python) to a Tag that's subscribing to an address in a BACnet device.

Writing to Unsupported Objects

The following feature is new in Ignition version **8.1.18**
Click here to check out the other new features

Scripting functions (system.bacnet.readRaw and system.bacnet.writeRaw) now allow users to read from or write to any BACnet object or property. Because the functions accept and return types used by the underlying BACnet4j library instead of translating to OPC UA and into types supported by tags, these functions provide access to objects not explicitly supported by the BACnet driver.

Caution: Please use caution when interacting directly with any BACnet device, as writing to an object may have unintended consequences and could result in data loss.

BACnet Local Device

Before you can start communicating with a remote device you must first configure a local device, representing Ignition's presence as a BACnet device on a network.

Local Devices are configured by specifying a local bind address, port, broadcast address, BACnet network, and BACnet device number. A Local Device can communicate with many remote devices as long as they are reachable on the same IP network.

On this page ...

Device Configuration Strategies

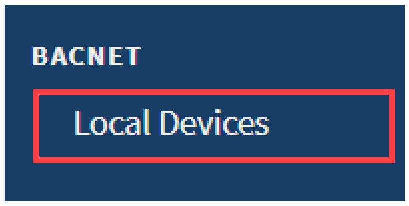
One strategy for configuring local devices is to configure one per network adapter that will be used for communication between the Ignition Gateway and remote BACnet devices.

The local device bind address is configured by default to a wildcard address of 0.0.0.0. This wildcard address is required to receive broadcast packets from any of the remote devices you intend to communicate with. We've found that some devices will only respond to the BACnet Who-Is request with an I-Am that is sent to a broadcast address regardless of whether the original Who-Is was sent unicast or broadcast.

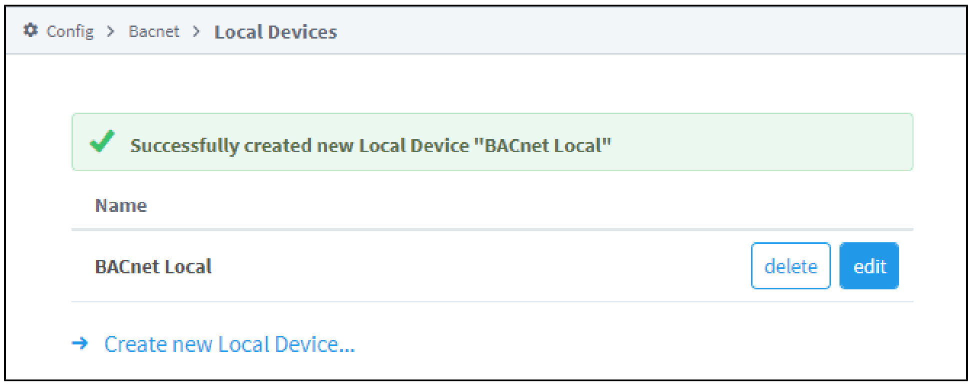
Another situation where you may need multiple local devices is when registration as foreign device with a BACnet Broadcast Management Device (BB MD) is necessary to bridge traffic between networks. Each Local device instance can only be registered with one BBMD.

Configure a Local BACnet Device

1. Go to the **Config** section of the **Gateway** Webpage.
2. Scroll down and select **BACnet > Local Devices**.



3. On the **Devices** page, click on **Create new Device**.
4. Select **BACnet/IP**, and click **Next**.
5. Fill in the following fields:
   - Name: **BACnet Local**
   - Bind Address: Enter the **IP address** or leave the wildcard 0.0.0.0 default address.
   - Bind Port: Enter **local port** or leave default of 47,808.
   - Broadcast Address: Enter the **IP address**, for example 10.10.###.##
6. Leave the default values in the remaining fields.
7. Click **Create New Local Device**. You'll see the message "Successfully created new Local Device "BACnet Local."



Successfully created new Local Device "BACnet Local"

Name	
BACnet Local	delete edit

Now you can configure a driver for the remote device.

Device Settings

General Properties

Local Device Setting	**Description**
Name	Device name.
Bind Address	This feature was changed in Ignition version **8.1.31**: The local IP address to bind to. The default wildcard binding address is 0.0.0.0, which will process broadcast traffic for the given bind port over all interfaces.
Bind Port	This is the port the Device you are setting up will listen on. The local port to bind to. Default is 47,808.
Broadcast Address	A network address shared by other BACnet devices to send and receive UDP data.
Network Prefix Length	Default is 24.
Device Number	Default is 1,000.
Network Number	Default is 1.
Foreign Device Registration Enabled	If true, register as a foreign device with the configured BBMD (BACnet Broadcast Management Device). Default is false.
BBMD Address	Address of the BACnet Broadcast Management Device (BBMD) to register with. If you're planning on having this Local Device configuration work in conjunctions with a Remote Device via BBMD, then the address here should be the address of the BBMD on the same subnet as the Remote Device.
BBMD Port	Port the BACnet Broadcast Management Device to register with is listening on. Default is 47,808.

Advanced Properties

Ignition Redundancy Setting	**Description**
Backup Device Number	The following feature is new in Ignition version **8.1.29** Click here to check out the other new features Device number used by the local device on the Ignition redundant backup. Should differ from the device number used on the Ignition redundant primary. Default is 1,001.

BACnet Remote Device

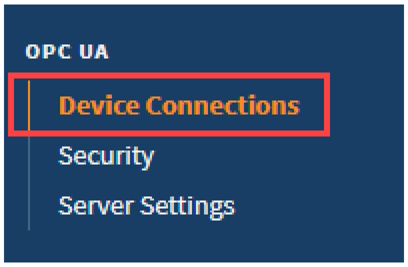
Once a local device has been configured a remote BACnet device can be added. You must know the IP address and device number of the remote device to configure a connection.

UDP is a connectionless protocol so a device is considered connected or initialized once Ignition has sent a Who-Is, received an I-Am, and then interrogated the remote device for some basic properties, including its object list and the supported properties of each object.

The object and properties are cached and subsequent connection attempts will only re-read them if the Database_Revision property changes. You can invalidate the browse data under the "More" menu for a given device (Config > OPC UA > Device Connections) on the devices page in the Ignition Gateway.

Connect to a Remote BACnet Device

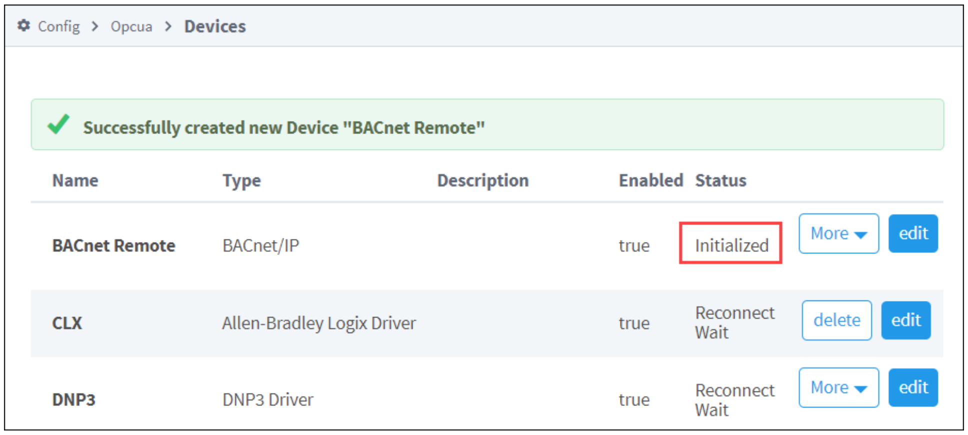
1. Go to the Config section of the Gateway Webpage.
2. Scroll down and select **OPC UA > Device Connections**.



3. On the Devices page, click on **Create new Device**.
4. Select **BACnet/IP**, and click **Next.**
5. Select the local device from the dropdown. If no local devices are shown, you'll need to set one up first. See BACnet Local Device.
6. Fill in the following fields:

   Name: **BACnet Remote**
   Hostname: Enter the **IP address**, for example 10.10.###.##
   Remote Device Number: The instance number of the remote device you're setting up.

7. Leave the default values in the remaining fields.
8. Click **Create New Device**.
9. The Devices page is displayed showing the **BACnet/IP** device is successfully created and added to Ignition.



Successfully created new Device "BACnet Remote"

Name	Type	Description	Enabled	Status	
BACnet Remote	BACnet/IP		true	Initialized	More edit
CLX	Allen-Bradley Logix Driver		true	Reconnect Wait	delete edit
DNP3	DNP3 Driver		true	Reconnect Wait	More edit

Device Settings

General	
Name	Device name.

Description	Device description.
Enabled	Default is set to true.

Other	
Local Device	The name of the local BACnet device instance that will be used when communicating with the remote device. If no local devices are shown, you'll need to set one up first. See BACnet Local Device.
Remote Address	The hostname or IP address of the remote device.
Remote Port	The port that the remote device is listening on. Default is 47,808.
Remote Device Number	The instance number of the remote device you're setting up. Default is 1.
Write Priority	The priority to use when writing to commandable properties. Default is 8.
COV Enabled	If true a Change of Value (COV) subscription is used for properties that support it. If false all properties are polled. Default is true. **Note:** COV subscriptions are only applied to Present_Value and Status_Flags.
COV Heartbeat Interval	Interval, in seconds, between reading the System_Status property of the Device object as a heartbeat. If three consecutive attempts fail, all COV items will be marked with uncertain quality. Default is 5.
COV Subscription Lifetime	Lifetime, in seconds, of COV subscriptions. Use 0 for indefinite. When non-zero COV subscriptions are renewed at a rate of 75% of the lifetime. Default is 900.
COV Subscription Retry Interval	The following feature is new in Ignition version **8.1.33** Click here to check out the other new features Interval, in seconds, to attempt recreating COV subscriptions that previously failed to be created or renewed. Use 0 to have failed subscription items remain polled. Default is 120.
Confirmed Notifications Enabled	If true COV subscriptions use confirmed notifications. If false COV subscriptions use unconfirmed notifications. Default is false.
Discovery Timeout	The following feature is new in Ignition version **8.1.4** Click here to check out the other new features Duration, in seconds, to wait for the remote device discovery process to complete. Default is 5.

IEC 61850 Driver

The following feature is new in Ignition version **8.1.25**
Click here to check out the other new features

On this page ...

IEC 61850 is a protocol used for power systems that need to send control signals to different types of intelligent electronic devices (IEDs) defined in a substation. It is similar to the structure of the DNP3 protocol where a single station host can become a bridge to a web of other devices without taxing the network too much. For a more in-depth overview of IEC61850 standards and considerations, refer to the Understanding IEC61850 Knowledge Base article.

The Ignition driver acts as a 61850 Manufacturing Message Standard (MMS) Client. The IEC 61850 driver does NOT support Generic Object Oriented System Event (GOOSE) or Sampled Values (SV) protocols. Check your documentation to see whether your device supports IEC 61850.

Note:

The IEC 61850 driver only works on Windows and Linux (x64 distributions). ARM chips and macOS platforms are not currently supported.

In addition, the driver requires a modern version of the Visual C++ Redistributable. Read our technical advisory for more details: https://support.inductiveautomation.com/hc/en-us/articles/13897307938829

Connecting to a Device

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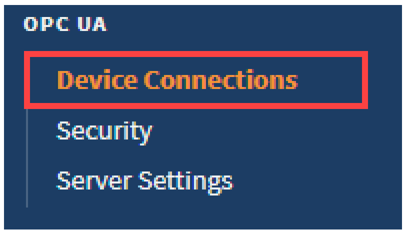
Connecting To IEC 61850 Devices

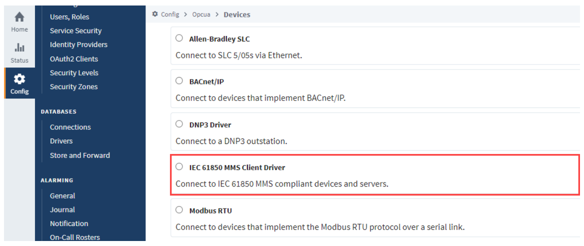
Watch the Video

Ignition's IEC 61850 driver can connect directly to any devices that support Ethernet communication through a substation host. It is important to make a new device connection for each of the substation device's IEDs, since only one can be selected per connection.

1. Go to the **Config** section of the Gateway Webpage.
2. Scroll down and select **OPC UA > Device Connections**.



3. Click on **Create new Device**.
4. Scroll down to select the **IEC 61850 MMS Client Driver** and click **Next** at the bottom of the page.



Allen-Bradley SLC
Connect to SLC 5/05s via Ethernet.

BACnet/IP
Connect to devices that implement BACnet/IP.

DNP3 Driver
Connect to a DNP3 outstation.

IEC 61850 MMS Client Driver
Connect to IEC 61850 MMS compliant devices and servers.

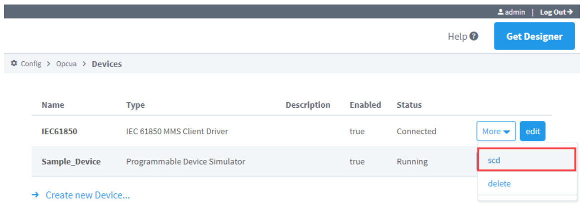
Modbus RTU
Connect to devices that implement the Modbus RTU protocol over a serial link.

5. Enter a desired name into the **Name** field. In this example, we will be entering **IEC61850**.
6. Enter the IP address or hostname of the device you are connecting to in the **Hostname** field. All other default settings can be left as is.
7. Click **Create New Device**. The **OPC UA** > **Devices Connections** page now lists the IEC 61850 MMS Client Driver. The **Status** column will show Connected or Idle, depending on the status of the device.
8. On the connected driver, IEC61850 in this example, and click **More > scd**.

Note:

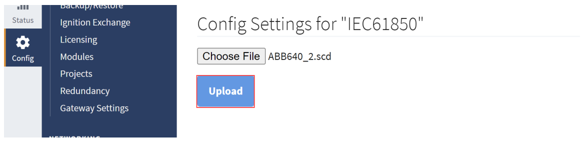
Substation Configuration Description (SCD) files grant user control of transfer device descriptions and communication parameters. This file format is the only accepted System Configuration Language (SCL) file type. It is generally recommended to use an SCD file if you intend to limit the request size and visibility of access points during OPC browsing. This will effe ctively reduce the load against the substation device. Without an SCD file, any device connection restart will request all defined Logical Nodes from your defined IED for OPC browsing, which can become network-traffic heavy.

However, because of how Ignition treats device attributes we recommend **always** using an SCD file, as it may not be possible to resolve associated quality or timestamp values without it.



Name	Type	Description	Enabled	Status
IEC61850	IEC 61850 MMS Client Driver		true	Connected
Sample_Device	Programmable Device Simulator		true	Running

9. Click **Choose File**.
10. Locate your SCD file and select it for upload.
11. Click **Upload**.

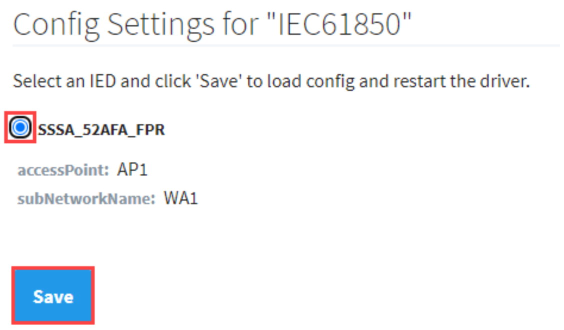


Config Settings for "IEC61850"

Choose File ABB640_2.scd

12. Select the IED you want to request for reports.

Note: Returning to step 9, the selected IED will now display in the IED Name field and the accessPoint information will now display in the Access Point Name field for the SCL File Settings section of the advanced properties.



Config Settings for "IEC61850"

Select an IED and click 'Save' to load config and restart the driver.

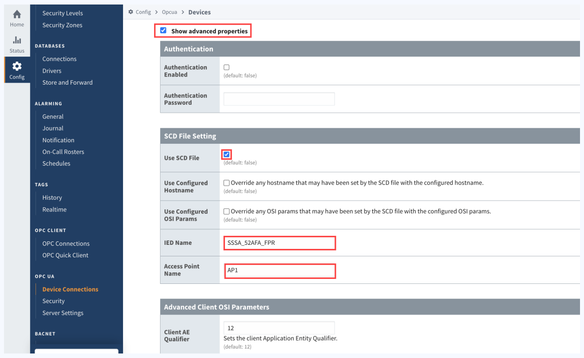
SSSA_52AFA_FPR

accessPoint: AP1

subNetworkName: WA1

13. Click **Save**.

Note: The advanced properties will now show the saved SCD file settings. Checking the **Show advanced properties** box on the **Device** > **edit** page will display the settings. Use SCD File will be checked, and IED Name and Access Point Name will match the selected upload config settings. You can use these settings to verify correct configuration or further tweak your SCD file.



☑ Show advanced properties

Authentication

Authentication Enabled	☐ (default: false)
Authentication Password	

SCD File Setting

Use SCD File	☑ (default: false)
Use Configured Hostname	☐ Override any hostname that may have been set by the SCD file with the configured hostname. (default: false)
Use Configured OSI Params	☐ Override any OSI params that may have been set by the SCD file with the configured OSI params. (default: false)
IED Name	SSSA_52AFA_FPR
Access Point Name	AP1

Advanced Client OSI Parameters

Client AE Qualifier	12 Sets the client Application Entity Qualifier. (default: 12)

Use the OPC Quick Client to Confirm Report Statuses

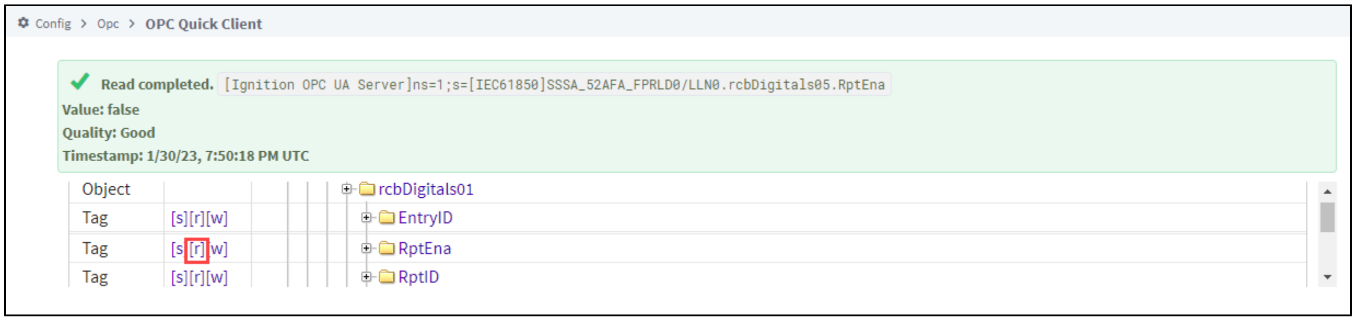
Once you've established a device connection, you'll likely be looking to enable a report so it may be helpful to check the device data before opening your Designer. The OPC Quick Client can be a useful tool for checking report statuses or for troubleshooting purposes. Navigate to **OPC Client > OPC Quick Client** to access the Ignition OPC UA Server folder and locate your IED under the Devices folder. The configured device data is stored in three main folders:

- Model: The Model folder contains logical nodes that can be directly polled for information.
- Reports: The Reports folder includes all the available reports and attributes available for subscription.

  Note: Subscribing to any reporting control block attribute will trigger Ignition to attempt to enable the associated report via the RptEna attribute. If enabling of a report cannot be achieved you will see quality like Bad_OutOfService: The source of the data is not operational.

- Diagnostics: The Diagnostics folder containd subfolders that can help identify the status of certain aspects of the configured devices.

If you are unsure of your report subscription status, you can use the Read link **[r]** for the **RptEna** tag within the related Reports folder to confirm if the report is available before you try to enable it. If the value returns as True, that report is already enabled elsewhere and unavailable for use.



Read completed. [Ignition OPC UA Server]ns=1;s=[IEC61850]SSSA_52AFA_FPRLD0/LLN0.rcbDigitals05.RptEna
Value: false
Quality: Good
Timestamp: 1/30/23, 7:50:18 PM UTC

Few events in the IEC 61850 standard allow for writes to occur, and no write actions should be attempted on the Quick Client page. See Device Operations below for recommended practices to write back to an IED.

Device Properties

General	
Name	The name of this IEC61850 device connection.
Description	Device connection description (optional). Can be used to provide any useful information / comments about this connection.
Enabled	If True (checked), the connection is enabled; if False (unchecked), the connection is disabled.
Main	
Hostname	The IP Address of the device.
Port	The port to use when connecting to an IEC61850 device, default is 102.
Request Timeout	Determines the maximum amount of time a request to the device will wait for a response, default is 2000.

Advanced Properties

Authentication	
Authentication Enabled	Determines if a password will be provided for authenticating requests to the device, default is false.
Authentication Password	The password used to authenticate requests to the device, default is an empty string.

SCD File Setting	
Use SCD File	Determines if a SCD file upload will be used when requesting from the device. The default value is false.
Use Configured Hostname	Override any hostname that may have been set by the SCD file with the configured hostname, default is false.
Use Configured OSI Params	Override any OSI params that may have been set by the SCD file with the configured OSI params, default is false.
IED Name	If Use SCD File is enabled, this field will be populated automatically with the selected IED name during the SCD File Upload.
Access Point Name	If Use SCD File is enabled, this field will be populated automatically with the selected IED access point information during the SCD File Upload.
Advanced Client OSI Parameters	
Client AE Qualifier	Sets the client Application Entity Qualifier, default is 12.
Client AP Title	Sets the client Application Process Title, default is 1,1,1,999,1.
Client Presentation-Selector	Sets the client Presentation-Selector (P-SEL), default is 00000001.
Client Session-Selector	Sets the client Session-Selector (S-SEL), default is 0001.
Client Transport-Selector	Sets the client Transport-Selector (T-SEL). It is optionally transmitted in the OSI Transport Layer connection request (CR), default is 0001.
Advanced Server OSI Parameters	
Server AE Qualifier	Sets the server Application Entity Qualifier, default is 12.
Server AP Title	Sets the server Application Process Title, default is 1,1,1,999,1.
Server Presentation-Selector	Sets the server Presentation-Selector (P-SEL), default is 00000001.
Server Session-Selector	Sets the server Session-Selector (S-SEL), default is 0001.
Server Transport-Selector	Sets the server Transport-Selector (T-SEL). It is optionally transmitted in the OSI Transport Layer connection request (CR), default is 0001.
Misc. Advanced Settings	
Use Report Timestamp	Determines if the timestamp from the report will be used instead of the timestamp associated with each reported value.

Reports

Reports can exchange monitoring information, power metering, power quality, and fault event analysis, among other data from IED servers to clients. D evice data and reports are sent to the client based on user-defined device configuration through report control blocks (RCBs) and SCL files. The IEC 61850 driver supports Unbuffered/Buffered Report Control Blocks (URCB/BRCB). Remember, an RCB can only be enabled by a single device connection to the IED. This is because an RCB is blocked once a client has registered to receive a report by enabling it. Therefore, if the report is in use elsewhere, an attempted overlap could prevent connections from occurring. You will need to replicate the report on your IED if you want multiple Ignition Gateways to access the same report or leverage a Remote Tag Provider.

- **Buffered Reports**: Reports are buffered by the IED in case a connection to the client is interrupted so that report data is still available to the client when the connection resumes.
- **Unbuffered Reports**: Information is not stored during a connection loss, so any data that may have been sent during the lost connection time is not available. Reporting begins again after the connection has resumed.

If you are using a buffered report, be aware the config.idb file will be frequently updated with the last report_id received. This could cause the auto-backup to trigger every 2 minutes when Ignition sees a change to the config.idb file. Changes to the auto-backup settings are encouraged to prevent threads pausing until the DB finishes being backed up. Changes can be made by modifying either of the following properties in the data/gateway.xml file.

- The first modification option is to change the value in minutes for how often the auto-backup is triggered based on when Ignition checks for changes. The current value as shown is 2 minutes.

```
<entry key="localdb.autobackup.delay">2</entry>
```

This feature was changed in Ignition version **8.1.27**:

The auto-backup default time has been changed from 2 minutes to 60 minutes. This update eliminates the need to modify the auto-backup trigger time.

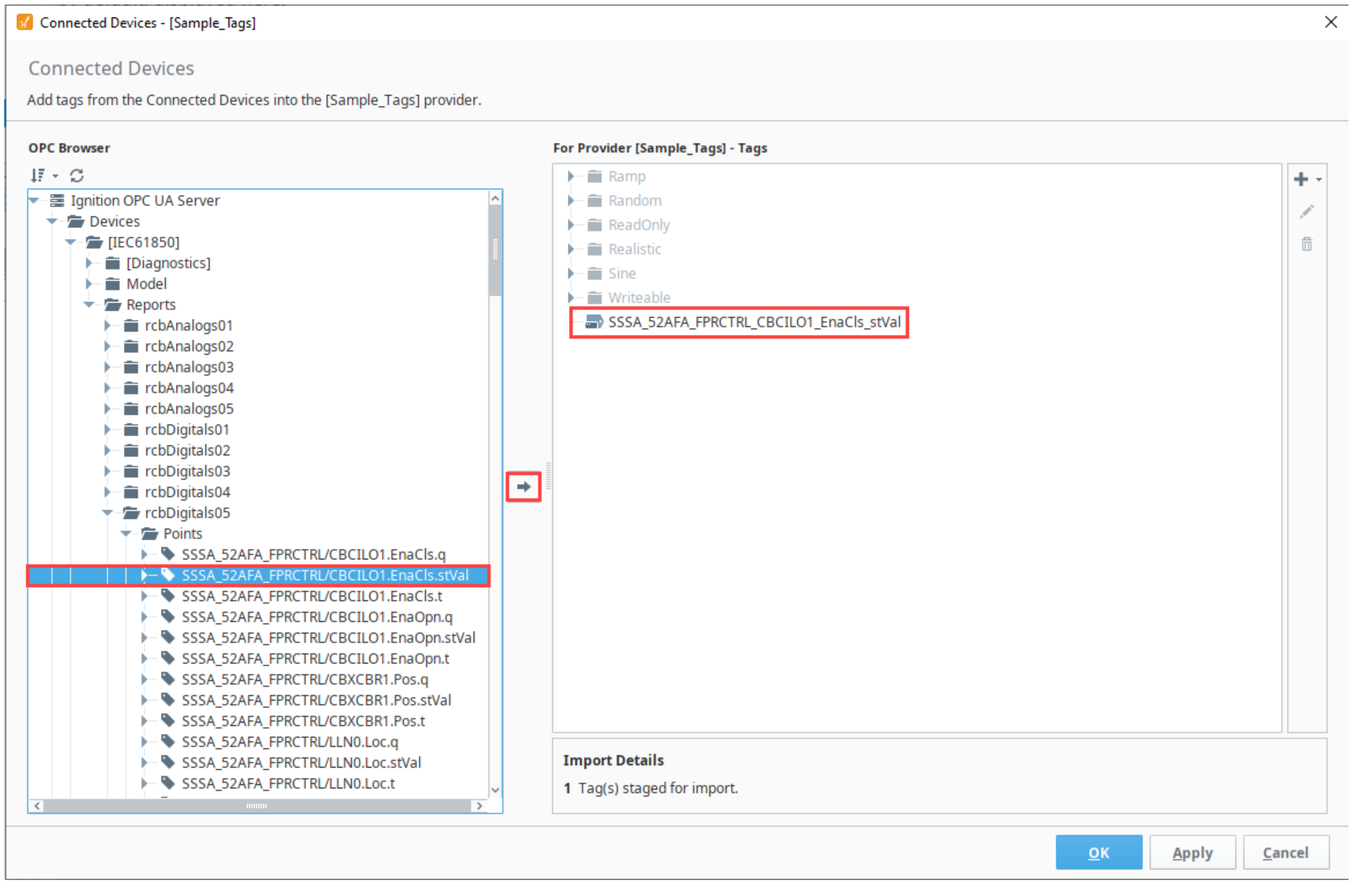
- The following method is not recommended, but you can also change the true value to false, which will turn off this feature entirely if desired.

```
<entry key="context.startup.useautobackups">true</entry>
```

Use the Tag Browser to Enable a Report

Adding a report folder in your Designer immediately enables a report and allows you to see related attributes in the Tag Browser. This process is done in the same manner as creating a tag.

As you navigate to your desired Logical Node and Points folder, you'll notice a different format than what you might expect from a typical tag in the Tag Browser where all attributes are contained in a single tag. Attributes are listed as separate tags with their own qualified values (e.g. value, quality, and timestamps). This is because the Ignition needs to map the 61850 specification to the OPC UA model that requires an associated value, quality, and timestamp. Ignition will attempt to retrieve the q and t attributes that correspond with reported value attributes if they are available. Be sure to only add a single folder from the Points folder to your Tag Browser to avoid any issues that can occur from enabling multiple reports.



Connected Devices - [Sample_Tags]

Connected Devices

Add tags from the Connected Devices into the [Sample_Tags] provider.

OPC Browser

- Ignition OPC UA Server
  - Devices
    - [IEC61850]
      - [Diagnostics]
      - Model
      - Reports
        - rcbAnalogs01
        - rcbAnalogs02
        - rcbAnalogs03
        - rcbAnalogs04
        - rcbAnalogs05
        - rcbDigitals01
        - rcbDigitals02
        - rcbDigitals03
        - rcbDigitals04
        - rcbDigitals05
          - Points
            - SSSA_52AFA_FPRCTRL/CBCILO1.EnaCls.q
            - SSSA_52AFA_FPRCTRL/CBCILO1.EnaCls.stVal
            - SSSA_52AFA_FPRCTRL/CBCILO1.EnaCls.t
            - SSSA_52AFA_FPRCTRL/CBCILO1.EnaOpn.q
            - SSSA_52AFA_FPRCTRL/CBCILO1.EnaOpn.stVal
            - SSSA_52AFA_FPRCTRL/CBCILO1.EnaOpn.t
            - SSSA_52AFA_FPRCTRL/CBXCBR1.Pos.q
            - SSSA_52AFA_FPRCTRL/CBXCBR1.Pos.stVal
            - SSSA_52AFA_FPRCTRL/CBXCBR1.Pos.t
            - SSSA_52AFA_FPRCTRL/LLN0.Loc.q
            - SSSA_52AFA_FPRCTRL/LLN0.Loc.stVal
            - SSSA_52AFA_FPRCTRL/LLN0.Loc.t

For Provider [Sample_Tags] - Tags

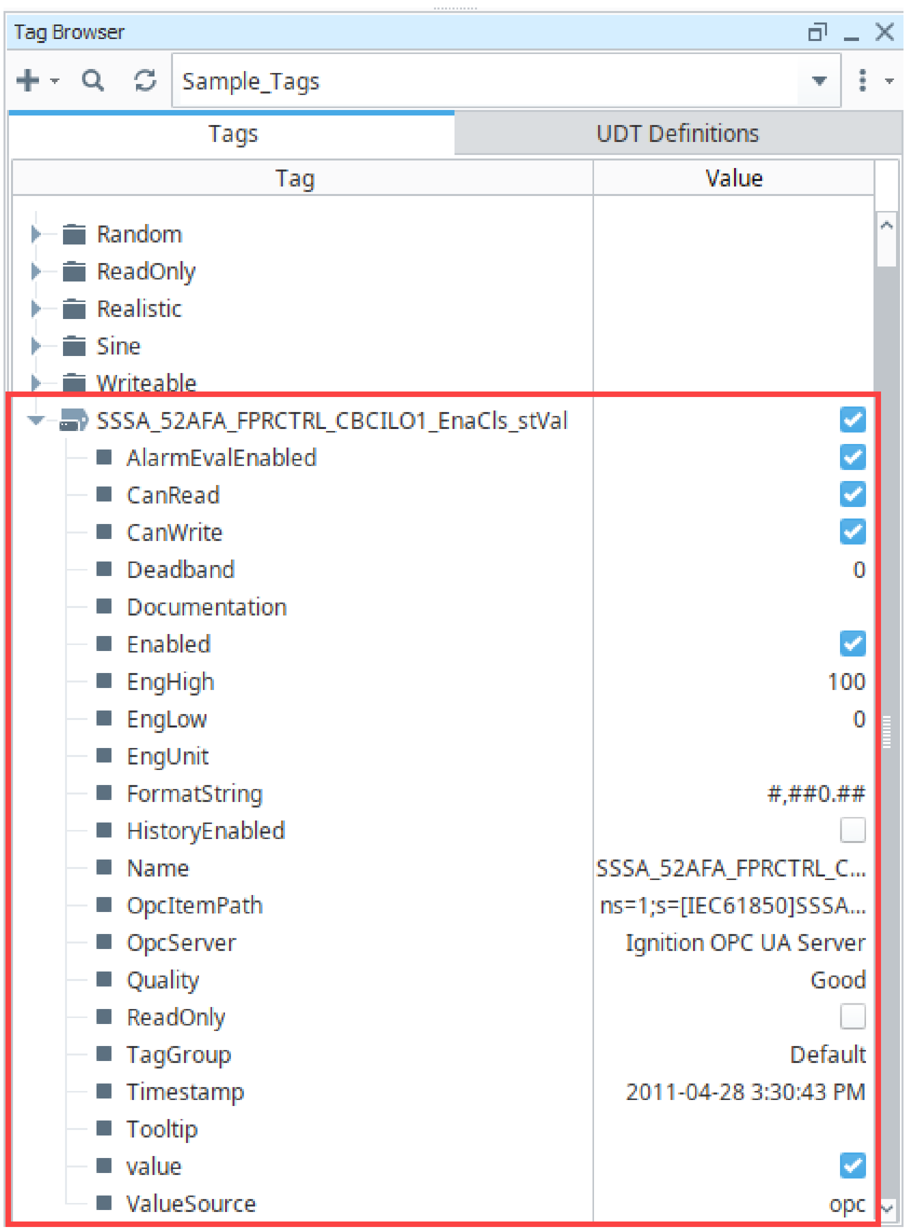
- Ramp
- Random
- ReadOnly
- Realistic
- Sine
- Writeable
- SSSA_52AFA_FPRCTRL_CBCILO1_EnaCls_stVal

Import Details

1 Tag(s) staged for import.

Report Attributes

Once a specific attribute tag has been added in the Connected Devices window, you'll see your enabled report data in the Tag Browser. You can further curate this data by deleting unwanted data from the browser display.



Tag	Value
Random	
ReadOnly	
Realistic	
Sine	
Writeable	
SSSA_52AFA_FPRCTRL_CBCILO1_EnaCls_stVal	✓
AlarmEvalEnabled	✓
CanRead	✓
CanWrite	✓
Deadband	0
Documentation	
Enabled	✓
EngHigh	100
EngLow	0
EngUnit	
FormatString	#,##0.##
HistoryEnabled	☐
Name	SSSA_52AFA_FPRCTRL_C...
OpcItemPath	ns=1;s=[IEC61850]SSSA...
OpcServer	Ignition OPC UA Server
Quality	Good
ReadOnly	☐
TagGroup	Default
Timestamp	2011-04-28 3:30:43 PM
Tooltip	
value	✓
ValueSource	opc

IEC 61850 Hierarchical Data Model

Additionally, the OPC item path that Ignition uses can be isolated to identify individual attribute data because paths are built with an hierarchical data model. The data included in the path identifies the IED, logical device, logical node, data object, and attribute information. The example attribute we've been using in this section is shown below.

```
[SSSA_52AFA_FPR]LD0/LLN0.rcbDigitals05$SSSA_52AFA_FPRCTRL/CBCILO1.EnaCls.stVal
```

- IED: SSSA_52AFA_FPR
- Logical Device: LD0/LLN0
- Logical Node: rcbDigitals05$SSSA_52AFA_FPRCTRL/CBCILO1
- Data Object: EnaCls
- Attribute: stVal

Disable a Report

Deleting all Points from the Tag Browser in your Designer and/or deleting all report point subscriptions from the OPC Quick Client page will disable a report. You can confirm a report is successfully disabled by using the read from link **[r]** for the corresponding **RptEna** tag on the OPC Quick Client page.

Additionally, if a device is disabled while a subscription is still active, the subscription status code will show `Uncertain_LastUsableValue` instead of the `good` value.

Device Operations

The IEC 61850 driver supports certain system functions to control operations and perform file services. These functions can be used to discover object data, test or maintain desired statuses, and modify device files. Check out the system.iec61850 page for complete function information.

Using IEC 61850 Scripting Functions

Watch the Video

Control Functions

The supported IEC 61850 system control functions are getControlParams, Select, Operate, and Cancel. The getControlParams function returns a list of report control names and their attributes contained in the configured IEC 61850 device. Having a function to collect this data in the moment is useful for many instances, including to provide the required params keys for the Select, Operate, and Cancel functions if they are otherwise unknown.

The type of control model (ctlModel) defines how to use the Select (if applicable) and Operate control functions to write to the connected 61850 device when possible. A Status-only type means you cannot perform any operation actions. Direct types allow an immediate change to an access point using the Operate function only. Select before Operate (SBO) types require use of the Select function to confirm a chosen access point before the Operate function will run. Control model types are represented by the following values:

- 0: Status-only
- 1: Direct-with-normal -security
- 2: SBO-with-normal-security
- 3: Direct-with-enhanced-security
- 4: SBO-with-enhanced-security

The Cancel function will clear a selection of an SBO type control if an operate command is not desired to be executed on the selected control.

File Functions

The supported IEC 61850 system file functions are listFile, readFile, and writeFile. These functions allow users to obtain a list of files present on configured devices, and transfer IED files between remote IED servers and local paths. Note that local paths for file functions are local to the Gateway. For example, if these functions get used on a Perspective page, the file will be downloaded to the Gateway, not the client where the browser is running.

Mitsubishi TCP Driver

The following feature is new in Ignition version **8.1.28**
Click here to check out the other new features

The Mitsubishi TCP driver provides a user interface in the Gateway where you can create, import, or export addresses when connected to devices that support the MELSEC protocol. After setup, configured tags will be browsable in the OPC Browser of the Designer with read/write access. Supported Hardware Series include:

- iQ-R
- iQ-F (FX5U)
- Q
- L
- The following feature is new in Ignition version **8.1.31**
  Click here to check out the other new features

  F

On this page ...

Connecting to Mitsubishi Devices

Watch the Video

Connecting to a Mitsubishi Device

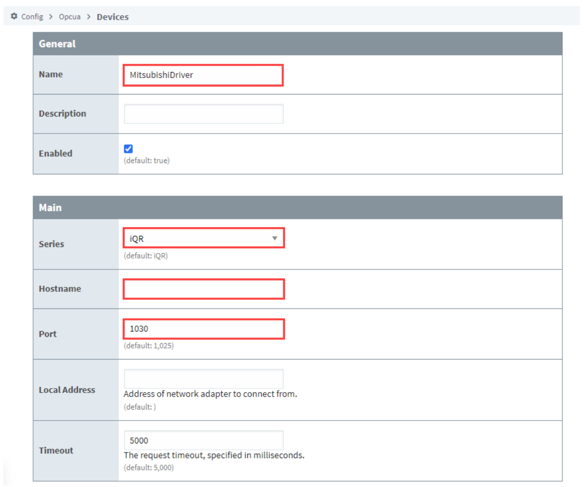
Before you can connect your Mitsubishi device to this driver, your GX Works software settings must meet certain requirements. Configuring GX Works will also provide information needed during the driver connection process, such as Hostname and Port.

To connect a Mitsubishi Device:

1. Navigate to **Config** > **OPC UA** > **Device Connections** on the Gateway Webpage.
2. On the Devices page, click on **Create new Device**.
3. Select **Mitsubishi TCP**, and click **Next**.
4. Fill in the Name field. Entering a description is optional.
5. Select the MELSEC series you will be connecting to using the dropdown. Options include iQR, iQF, Q, and L.

   Be sure to select the correct device type when connecting to avoid causing an error condition on the device.

6. Enter the device hostname in the Hostname field.
7. Enter the device port in the Port field.



Config > Opcua > **Devices**

General	
Name	MitsubishiDriver
Description	
Enabled	✓ (default: true)

Main	
Series	iQR (default: iQR)
Hostname	
Port	1030 (default: 1,025)
Local Address	Address of network adapter to connect from. (default:)
Timeout	5000 The request timeout, specified in milliseconds. (default: 5,000)

8. Enter the local address of the network adapter to connect from. This is necessary if you have multiple network cards and you need to specify the particular network card that has PLC access.
9. Leave the default values in the remaining fields.
10. Click **Create New Device**.

The Devices page now displays the Mitsubishi TCP device is successfully connected.

Device Settings

General	Description
Name	Device name
Description	Device description
Enabled	If true, attempt connection to the device, default is true
Main	**Description**
Series	The series of the Mitsubishi device. Default is iQR
Hostname	The IP Address of the device
Port	The port the device is listening on
Local Address	Address of network adapter to connect from
Timeout	The request timeout, specified in milliseconds with a valid range from 0 to 16383750. Default is 5000
Request Optimization	**Description**
Max Gap Size	The maximum address “gap” to span when optimizing requests to contiguous address locations. Increasing the max gap size will reduce the number requests but increase the amount of data requested. Default is 0.
Write Priority Ratio	The number of write requests to execute for every read request when an abundance of both types are queued up for execution. Default is 5.

Adding Addresses

You can add addresses through a few different options on the Gateway or in the Designer.

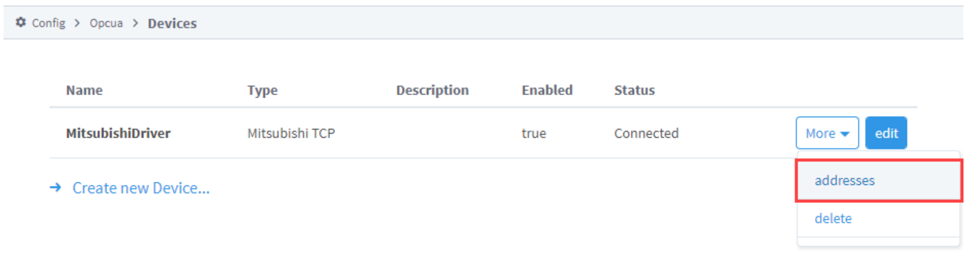
Addressing on the Gateway

The Mitsubishi addresses page on the Gateway allows entering Browse Path and Address information individually, importing user-created CSV files containing a list of addresses, and importing a GX Works CSV file. Even if you are planning to import multiple addresses using a CSV file, it’s recommended to first enter a single tag address to test if your connection is working as expected. The addresses page has three areas of information:

- Browse Path: This represents the browse path for the OPC UA client.
- Address: This is the device, offset, and additional specifications to find desired values.
- Description: This is an optional field to help in identifying displayed values.

To access the addresses page:

1. Navigate to the **Config** > **OPC UA** > **Device Connections**.
2. Click the **More** dropdown and choose **addresses** on your Mitsubishi device.



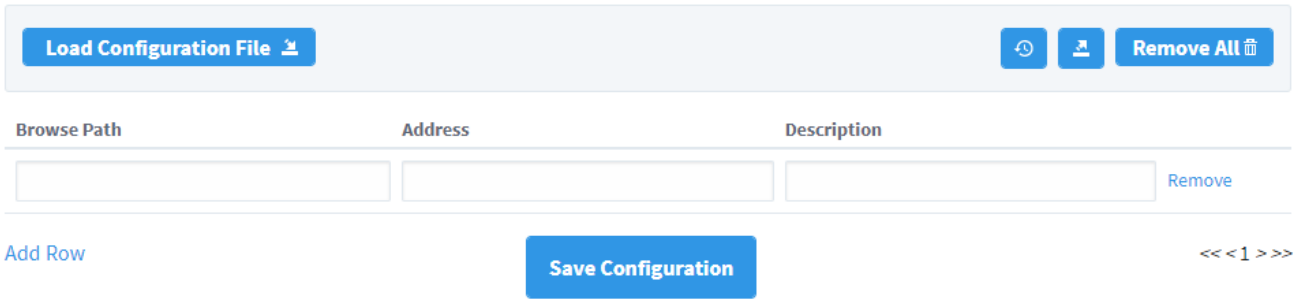
Name	Type	Description	Enabled	Status
MitsubishiDriver	Mitsubishi TCP		true	Connected

Adding Individual Address Rows

To manually enter addresses:

1. Click **Add Row** to populate rows for address information.
2. Enter Browse Path field and Address field information. Enter Description information as desired.
   Note: All components are case-insensitive.
3. Continue adding rows and address information until you’ve added all the addresses you want to be available as tags.

4. Click **Save Configuration** when you are finished.



Importing and Exporting

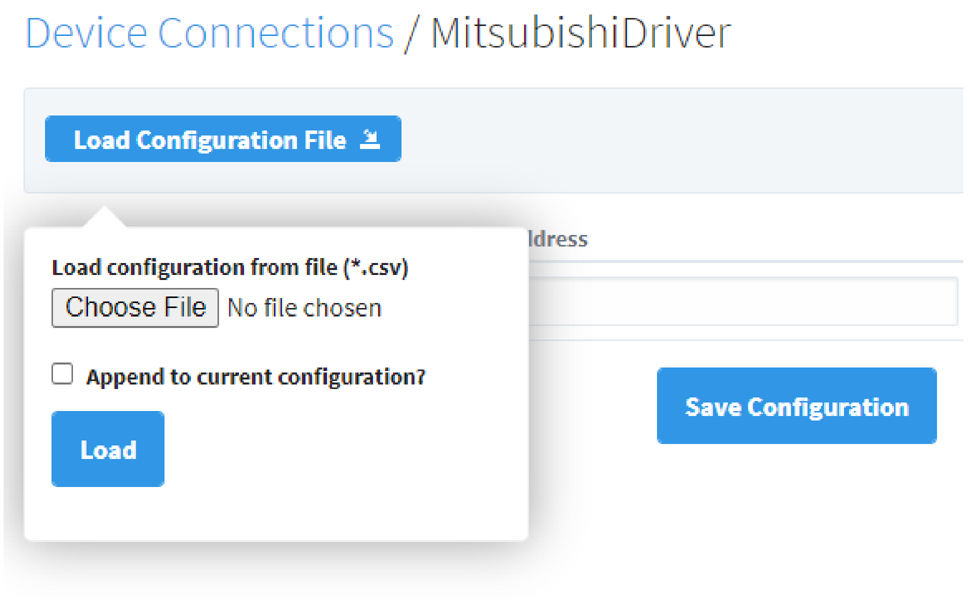
To import a CSV file:

1. Select **Load Configuration File** on the device address page.
2. Select **Choose File**.
3. Locate the CSV file you want to upload and select it to open.

> ⚠ Make sure a comma separates column information, and if your Description column includes commas, use quotes to prevent misinterpretations when uploading.

4. Select the **Append to current configuration** box if you already have addresses listed and you want to add on to them. Leave unchecked if you want to replace existing rows.
5. Click **Load**.

> ⚠ If an existing address shares a tag name with an address imported by the CSV file, it will be replaced with the imported address.


Device Connections / MitsubishiDriver
Load Configuration File
Load configuration from file (*.csv)
Choose File
No file chosen
Append to current configuration?
Load
ldress
Save Configuration

6. Click **Save Configuration**.

To export the address list from the Gateway page, simply use the Export Configuration icon to download.

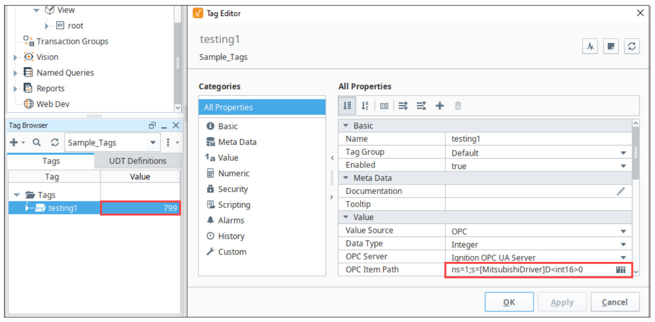
Addressing in the Designer

You also have the option to address tags via an Ignition OPC tag in the Ignition Designer. See Ignition OPC UA Server Node Configuration for more information. As opposed to adding addresses on the Gateway, the device needs to be specified here.

Example syntax, where optional components are included in curly brackets

```
ns=1;s=[DeviceName]Area{<DataType{[array]}>}Offset{.Bit}
```

Regardless of if the address path was entered on the Gateway and added as a tag, or entered directly in the Designer, you can continue to edit the item path in the Tag Editor if needed. The example below shows how changing the OPC Item Path data type from int16 to int32 instantly changes the tag value from 799 to 3,670,815.



Tag Editor

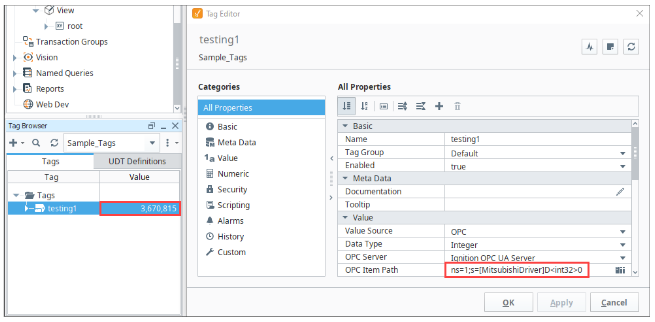
testing1

Sample_Tags

Tag	Value
testing1	799

All Properties

Name	testing1
Tag Group	Default
Enabled	true
Value Source	OPC
Data Type	Integer
OPC Server	Ignition OPC UA Server
OPC Item Path	ns=1;s=[MitsubishiDriver]D<int16>0



Tag Editor

testing1

Sample_Tags

Tag	Value
testing1	3,670,815

All Properties

Name	testing1
Tag Group	Default
Enabled	true
Value Source	OPC
Data Type	Integer
OPC Server	Ignition OPC UA Server
OPC Item Path	ns=1;s=[MitsubishiDriver]D<int32>0

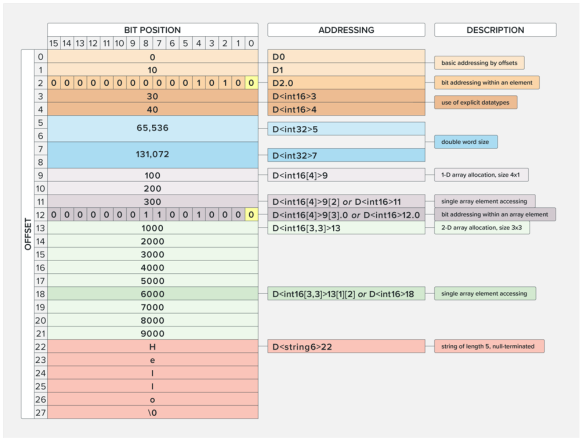
Determining Addresses

The Mitsubishi driver requires Area and Offset address components, but also allows many optional specifications. It’s important to know where the optional components must be placed in your address to properly connect. The example syntax below shows how optional data type (including modifiers) and array specifiers are listed before the Offset specification, and the optional array element index and bit index must be listed after the Offset specification.

Example syntax, where optional components are included in curly brackets

```
Area{<DataType{[array]}>}Offset{.Bit}
```

The image below demonstrates how different address specifications correspond with a Mitsubishi data register. The Description column functions the same way as it does on the Mitsubishi Driver addresses page to detail where the address is looking for data. The following syntax sections on this page provide an in-depth breakdown on how to find and enter addresses similar to the ones shown in these examples.



INDUCTIVE UNIVERSITY

Mitsubishi Addressing

Watch the Video

INDUCTIVE UNIVERSITY

Mitsubishi Address Mapping

Watch the Video

Areas

Note: On this page, and for the Mitsubishi driver, the term Area refers to the accessible Device Items. See the Area table below for potential device names and their related keywords and types.

The following table shows the MELSEC-Q/L, iQ-F and iQ-R series devices, keywords, and native types recognized by the driver. Extended Data Registers and Extended Link Registers are currently not supported.

Device Name		Keyword	Type
Special relay		SM	Bit
Special register		SD	Word
Input		X	Bit
Output		Y	Bit
Internal relay		M	Bit
Latch relay		L	Bit
Annunciator		F	Bit
Edge relay		V	Bit
Link relay		B	Bit
Step relay		S	Bit
Data register		D	Word
Link register		W	Word
Timer	Contact	TS	Bit
	Coil	TC	Bit
	Current value	TN	Word
Long timer*	Contact	LTS	Bit
	Coil	LTC	Bit
	Current value	LTN	Double word
Retentive timer	Contact	STS	Bit
	Coil	STC	Bit
	Current value	STN	Word
Long retentive timer*	Contact	LSTS	Bit
	Coil	LSTC	Bit
	Current value	LSTN	Double word
Counter	Contact	CS	Bit
	Coil	CC	Bit
	Current value	CN	Word
Long counter*	Contact	LCS	Bit
	Coil	LCC	Bit
	Current value	LCN	Double word
Link special relay		SB	Bit
Link special register		SW	Word
Direct access input		DX	Bit
Direct access output		DY	Bit
Index register	Index register	Z	Word
	Long index register*	LZ	Double word
File register	Block switching method	R	Word
	Serial number access method*	ZR	Word
Refresh data register*		RD	Word

*Not available for Q/L series

The following table shows the MELSEC-F series devices, keywords, and native types recognized by the driver.

The following feature is new in Ignition version **8.1.31**
Click here to check out the other new features

Device Name		Keyword	Type
Input		X	Bit
Output		Y	Bit
Internal relay		M	Bit
Step relay		S	Bit
Data register		D	Word
Timer	Contact	TS	Bit
	Current value	TN	Word
Counter	Contact	CS	Bit
	Current value	CN	Offsets 0-199 : Word Offsets 200-255: Double Word
File register	Block switching method	R	Word

Offsets

A simple example of reading a bit would be D0.0, which reads the bit0 of int16 at offset 0. You can also read bits within array elements that represent scalar values following the same addressing format. To read the bit 0 of element 0 of an array of length 4 at offset 0 would be D<int16[4]>0[0].0

Depending on the PLC series and bit area combination, offsets must be specified in octal, hex, or decimal. The following table lists the combinations that have a specification other than decimal.

	iQ-R	iQ-F	Q	L	F
X	Hex	Octal	Hex	Hex	Octal
DX	Hex	N/A	Hex	Hex	N/A
Y	Hex	Octal	Hex	Hex	Octal
DY	Hex	N/A	Hex	Hex	N/A
B	Hex	Hex	Hex	Hex	N/A
SB	Hex	Hex	Hex	Hex	N/A
W	Hex	Hex	Hex	Hex	N/A
SW	Hex	Hex	Hex	Hex	N/A

Note: Note that leading zeroes and lowercase hex characters are accepted. For example XF would be read the same as X0f.

Optional Data Types

The Mitsubishi driver supports reading/writing data types larger than the area’s native type by combining bytes from adjacent offsets into a single value. For example, each Data Register (D) point is natively a word (16-bit), but reading D<int32>0 requests bytes for D0 and D1 and combining the bytes into a signed 32-bit value.

The Mitsubishi driver does not support reading/writing data types smaller than the area’s native type. For example, each Long Index Register (LZ) point is a double word (32-bit) which means LZ<int16>0 and LZ<uint16>0 cannot be specified.

Some areas in particular cannot be combined and specific data types corresponding to its native type must be specified:

- Any area having a native type of Bit
- Any area having to do with Current value, such as:
    - TN
    - LTN
    - STN
    - LSTN

- CN
- LCN

Note:

When specifying a string data type, the length of the string must also be specified on the address. For example, D<string10>0 requests a string of up to 10 characters at offset 0 in the data register device.

If the length of the string is less than the address string length, it will be padded with null characters. For example, writing “hello” to D<string10> is equivalent to writing “hello\0\0\0\0\0” where “\0” are null characters.
If the length of the string is more than the address string length, it will be truncated to the address string length. For example, writing “hello world!” to D<string10> is equivalent to writing “hello worl”.

The string length will be automatically rounded up to the nearest even value. This is because two characters are stored inside a word. For example, D<string9>0 will be treated as D<string10>0.

The following data types are recognized by the driver:

- Bool
- Int16
- Int32
- Int64
- UInt16
- UInt32
- UInt64
- Float
- Double
- This feature was changed in Ignition version **8.1.31**:

  String (to use for ASCII characters)

- The following feature is new in Ignition version **8.1.31**
  Click here to check out the other new features

  Wstring (to use for Unicode characters)

If the data type is omitted, a default data type will be used depending on the area’s native type:

Area Native Type	Default Data Type
Bit	bool
Word	int16
Double word	int32

The following optional data type modifiers are recognized by the driver:

Attribute	Order
@BE	Big Endian Byte Order
@LE	Little Endian Byte Order (default when not specified)
@HL	High-Low Word Order (default when not specified)
@LH	Low-High Word Order

Optional Arrays

Arrays are a concept created within the driver representing contiguous blocks of memory starting from an offset. For example, instead of reading D<int16>0 through D<int16>8, you can create an array of the same values. The number of elements in an array are determined by multiplying the array dimensions. So reading D<int16[3, 3]>0 is a length of 3x3 where the start offset is 0 and the last offset is 8.

Similarly, reading an element within an array is equivalent to reading a single address. For example, you can see in the table below that reading D<int16[3, 3]>0[1][2] is equivalent to reading D<int16>5.

D[0][0] = D<int16>0	D[0][1] = D<int16>1	D[0][2] = D<int16>2
D[1][0] = D<int16>3	D[1][1] = D<int16>4	**D[1][2] = D<int16>5**
D[2][0] = D<int16>6	D[2][1] = D<int16>7	D[2][2] = D<int16>8

Large arrays should be used with caution. If an array read/write request is too large to fit into a single request, it will be broken up into multiple non-atomic sequential requests. Splitting requests when writing can result in the first send of the write requests creating new values and the remaining write requests failing. Similarly, if read requests are sent separately the resulting array may contain stale points.

Determining if an array is too large to be sent at the same time depends on how the array is optimized. Optimization refers to the process of minimizing the number of requests sent to the PLC by batching together device points with the goal to fit as many points as possible into a single request before splitting it off into multiple requests. Request optimization happens automatically when points are read or written to at the same time.

Optional Bit Index

Bit indexing can be specified on any integer data type to retrieve a boolean value at a bit position. Addresses with a bit index are read-only and any attempts to write to them will result in a Bad_NotSupported error due to the MELSEC protocol.

A bit index cannot be specified for the following:

- Non-integer data types (bool, float, double, and string)
- Non-scalar addresses (arrays)

GX Works Configuration

GX Works is the programming software designed for Mitsubishi PLCs. Before you can use the Mitsubishi driver, some configurations need to be made in GX Works when connecting to MELSEC-Q/L, iQ-F and iQ-R series devices with the Mitsubishi driver. These instructions are written for GX Works3. GX Works2 has slightly different settings but should in general resemble the following setting requirements.

1. Under the navigation tab, locate Parameter > CPU > Module Parameter > Basic Settings > Own Node Settings.
2. Set **Enable/Disable Online Change** to Enable All (SLMP).
3. Set **Communication Data Code** to Binary.
4. Navigate to External Device Configuration > Detailed Setting to add an SLMP Connection Module to the Ethernet Configuration with Protocol set to TCP.
5. Make sure to also identify the IP Address and Port No. These settings are what will be used for the Mitsubishi TCP driver Hostname and Port connection fields.
6. Write all changes to the PLC (Online > Write to PLC) and initiate a power cycle.

Configuring Device Points

Some areas or offsets within an area may not be accessible by default unless additional memory is allocated.

1. Navigate to Parameter > CPU > CPU Parameter > Memory Device Setting > Device/Label Memory Area Setting > Detailed Setting.
2. Change Points to desired size. The point allocation from all areas must not exceed the Total Device size.
3. Click Apply.
4. Write to the PLC (Online > Write to PLC) and initiate a power cycle.

Using GX Works3 to Troubleshoot

If you have access to GX Works3, you can use the Device/Buffer Memory Batch Monitor feature to test or troubleshoot your connection. This can be found under Online > Monitor > Device/Buffer Memory Batch Monitor. Type in the device keyword with an offset and hit enter to begin monitoring values.

GX Works also has an Ethernet Diagnostics tool which is useful for determining the status of the connection as well as other information like IP Address, Port No, and Latest Error Code. To access this tool, navigate to Diagnostics > Ethernet Diagnostics.

FX Configurator

FX Configurator is the required software for initial PLC setup when connecting to MELSEC-F series devices. Once you have created an FX3U model GXDeveloper project, complete the following configuration to begin making device connections.

1. Click Tools from the menu bar to select FX Special Function Utility > FX Configurator-EN.
2. Enter the minimum required FX3U-ENET configuration information.

3. Open the Operational Settings under Ethernet Module Settings and set the settings to the following:
    - Communication Data Code: Binary code.
    - Initial Timing: Always wait for OPEN.
    - Input Format: DEC.
    - Send Frame Setting: Ethernet(V2.0).
    - TCP Existence Confirmation Setting: Use the KeepAlive.
4. Select End when finished.

You can now add connections by selecting Open Settings back in the FX Configurator-EN window. These connections must set the Protocol to **TCP** and Fixed Buffer Communication Procedure to **Procedure Exist(MC)**. Recommendations for the remaining settings are as follows:

- Open System: Unpassive
- Fixed Buffer: Send
- Pairing Open: Disable
- Existence Confirmation: Confirm