

How to Create and Use Self-Signed SSL Certificates

Network security is critical to ensure data authentication, integrity, and confidentiality in today's digital age, where sensitive information is transmitted over the Internet. HTTPS (Secure HTTP) uses encryption for secure communication over a computer network. HTTPS is encrypted using Transport Layer Security (TLS), formerly Secure Sockets Layer (SSL). The protocol is still referred to as HTTP over SSL, commonly shown as **https://** in the browser address bar.

SSL/TLS relies on the use of keys and digital certificates. Keys occur in pairs (public/private) and are used for encryption/decryption. A public key is used for encryption, while the private key is used for decryption. Digital certificates are used to prove the ownership and authenticity to ensure that only authorized devices



communicate with each other. Certificates are typically issued and managed by a trusted third-party company, called a Certificate Authority (CA). Getting an SSL certificate installed for a website by a well-known CA that is trusted by all devices and browsers, such as DigiCert, Comodo, GoDaddy, Let's Encrypt, can provide access to the website seamlessly over the public Internet. These trusted CAs only provide certificates to websites which have a public IP address. They won't do this for devices on an internal network with private IP addresses.

As most of our customers use our devices on internal networks, they can create a self-signed certificate. If you don't have an IT, you can generate a self-signed certificate that will make our device trusted by your browser.

Self-signed digital certificates are created by signing the certificate with the owner's private key. They are created, issued, and signed by the company or developer who is responsible for the website/software being signed. Unlike certificates issued by a trusted CA, no external party verifies a self-signed certificate. Self-signed certificates are fast, free, and easy to issue. They are appropriate for development/testing environments, internal network websites and providing secure webpages for devices. Most devices will use a self-signed certificate because of the associated cost of getting a certificate from a well-known CA that is trusted by all browsers.

If you don't have OpenSSL on your Windows's PC, you can utilize Windows Package Manager, WinGet, a free and opensource package manager designed by Microsoft that allows users to discover, install, upgrade, remove, and configure applications on Windows 10, Windows 11, and Windows Server 2025 computers.

If you are accessing the HTTPS device from a different PC, a Security Warning message will appear. You must download the self-signed certificate and install it to your local machine's trusted certificate store.

This document explains how to add OpenSSL for Windows using WinGet and create a self-signed certificate, how to install this self-signed certificate on the device, and how to download and install the self-signed certificate on different Windows machines. Instructions are provided for commonly used browsers—Google Chrome O, Microsoft Edge O and Mozilla Firefox .

I. Install OpenSSL on Windows 10/11 Computers Using WinGet

If you don't have OpenSSL on your Windows 10 or Windows 11 computer, you can utilize WinGet command line tool to install and configure the OpenSSL application. This free and open-source tool is the client interface to the Windows Package Manager service that enables users to discover, install, upgrade, remove and configure applications on Windows 10, Windows 11, and Windows Server 2025 computers.

- 1. Install WinGet.
 - Refer to: <u>https://learn.microsoft.com/en-us/windows/package-manager/winget/#install-winget</u>
- 2. Search for current version of OpenSSL by running the following command:
 - C:\>winget search OpenSSL

Command Prompt	× + ~			
C:\>winget search ope Name	enssl Id	Version	Match	Source
FireDaemon OpenSSL 3 OpenSSL 3.3.1 OpenSSL Light 3.3.1	FireDaemon.OpenSSL ShiningLight.OpenSSL.Dev ShiningLight.OpenSSL.Light	3.4.0 3.3.2 3.3.2	Tag: openssl	winget winget winget
c.\				

3. Using Winget, install OpenSSL using the full name in quotes. (Install your current version, if different than the example below.)

Example: C:\>winget install "OpenSSL 3.3.1"

C:\>winget install "OpenSSL 3.3.1"
Found OpenSSL 3.3.1 [ShiningLight.OpenSSL.Dev] Version 3.3.2
This application is licensed to you by its owner.
Microsoft is not responsible for, nor does it grant any licenses to, third-party packages.
This package requires the following dependencies:
- Packages
Microsoft.VCRedist.2015+.x64
Downloading https://slproweb.com/download/Win640penSSL-3_3_2.msi
216 MB / 216 MB
Successfully verified installer hash
Starting package install
Successfully installed

- 4. To confirm OpenSSL is correctly installed and can be located, close the current terminal window, and open a new command prompt.
- 5. Run the following command: C:\>**OpenSSL version –a**

NOTE: If you get an error and OpenSSL isn't installed correctly on your local machine's PATH, navigate to Settings >System >About > Advanced System Settings > Environment Variables. Then, under System variables:

- a. Click **Path** and then click **Edit**.
- b. Click **New** and paste the file path of the "openssl.exe" file. (The common path is "C:/Program Files/OpenSSL-Win64/bin")
- c. Click **OK** to apply changes.

II. Generate Self-signed Certificate for Your Device IP

1. Create a text file containing the following minimal information and name it openssl.cnf [req]

[ICQ]		
default_bits	= 4096	
default_md	= sha256	
prompt string_mask distinguished_name x509_extensions	= no = default = req_dn = x509_ext	
[req_dn] countryName stateOrProvinceName organizationName commonName	 US IL Contemporary Controls BASrouterSX 	ludata tha common Name
[x509_ext] subjectKeyldentifier authorityKeyldentifier keyUsage extendedKeyUsage subjectAltName	 hash keyid:always critical, digitalSignature, keyEncipherment serverAuth IP:10.0.13.71 	to your device name and subjectAltName to your device IP address (BASgatewaySX and 10.0.13.71, in this example).

 In the .cnf file, change the commonName/ subjectAltName to reflect the name and IP address of the device (BASgatewaySX and 10.0.13.71, in this example.)

NOTE: For a device that contains more than one IP: Add IP:xxx.xxx.xxx, IP:xxx.xxx, etc. , in the subjectAltName field.

opens	sl.cnf 🗵	
1	[req]	
2	default_bits	= 4096
3	default_md	= sha256
4	prompt	= no
5	string_mask	<pre>= default</pre>
6	distinguished_name	= req_dn
7	x509_extensions	= x509_ext
8		
9	[req_dn]	
10	countryName	= US
11	stateOrProvinceName	= IL
12	organizationName	= Contemporary Controls
13	commonName	= <mark>BASgatewaySX</mark>
14		
15	[x509_ext]	
16	subjectKeyIdentifier	= hash
17	authorityKeyIdentifi	ler = keyid:always
18	keyUsage	= critical, digitalSignature, keyEncipherment
19	extendedKeyUsage	= serverAuth
20	subjectAltName	= IP: 10.0.13.71
21		

- 3. Save the generated **openssl.cnf** file to the working directory from the command line.
- Run the following command to build selfsigned.key and selfsigned.pem files:
 C:\>openssl req -x509 -new -nodes -days 3650 -keyout selfsigned.key -out selfsigned.pem -config openssl. cnf

(Adjust the days in the above command to change the certificate validity period.)

C:\>openssl req -x509 -new -nodes -days 3660 -keyout selfsigned.key -out selfsigned.pem -config openssl.cnf
+++++++
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+++++++++
++++++++++++++
· + +
+++++++++++
+++++++++++++++++
+++++++++
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+++++++++++
+++++++++++
+.++++++++++
C:\>

 Run the following command to generate a Security Certificate: C:\>OpenSSL x509 -in selfsigned.pem -out selfsigned.crt

C:\>openssl x509 -in selfsigned.pem -out selfsigned.crt C:\>

III. Upload Certificate to the Device using the Certificate Upload Feature

1. From the device webpage Upload menu tab, select Upload Certificate.



- 2. Select **Private Key** from the Choose Certificate drop-down menu and click **Save**.
- From the Certificate Upload section, click the Browse button and select the recently generated selfsigned.key file.
- 4. Click Upload.
- 5. Select **Private Certificate** from the Choose Certificate drop-down and click **Save**.
- 6. From the Certificate Upload section, click **Browse** and select the **selfsigned.pem** file.
- 7. Click Upload.
- 8. Click Update Certificates and Reboot.
- 9. Close out all open tabs of the unit and wait for it to reboot.

Certificate			
Choose Certificate: Private Key			
			\square
	l l	Save	Cancel
Certificate Upload			
Upload Certificate to Gateway Select File:	Browse selfsigned.key		
	C	lpload	Cancel
Certificate			
Choose Certificate: Private Certificate V			
	I	Save	Cancel
Certificate			
Choose Certificate: Private Certificate V			
	(Save	Cancel

Upload Certificate to Gat	eway Select File:	Browse selfsig	ned.pem
			Upload
1. 0. + 0			

IV. Install Certificate .crt Format to Trusted Root CA Folder

- Right-click the selfsigned.crt file, select Install Certificate from the drop-down menu.
 NOTE: The selfsigned.key, .pem, and .crt files should all be located in the current working directory.
- 2. From the Certificate Import Wizard, select **Local Machine**. Then, click **Next**.

	selfsigned.crt	Open
	selfsigned.key	Install Certificate
÷ 🌮	Certificate Import Wizard	
	Welcome to the Certificate	Import Wizard
	This wizard helps you copy certificates, cer lists from your disk to a certificate store.	tificate trust lists, and certificate revocation
	A certificate, which is issued by a certificat and contains information used to protect d connections. A certificate store is the syste	ion authority, is a confirmation of your identity ata or to establish secure network em area where certificates are kept.
	Store Location	
	Current User Iocal Machine	
	To continue, dick Next.	
		Sext Canc
÷ 🐉	Certificate Import Wizard	
← <i>₽</i>	Certificate Import Wizard	
← <i>₹</i>	Certificate Import Wizard rtificate Store Certificate stores are system areas when	e certificates are kept.
← <i>₽</i> ₽ (Ce	Certificate Import Wizard rtificate Store Certificate stores are system areas when Windows can automatically select a certif the certificate.	e certificates are kept.
← <i>₽</i>	Certificate Import Wizard ertificate Store Certificate stores are system areas when Windows can automatically select a certifi the certificate. Automatically select the certificate	e certificates are kept. icate store, or you can specify a location for store based on the type of certificate

3. Select **Place all certificates in the following store**, then click **Browse...**

 From the Select Certificate Store pop-up, select Trusted Root Certificate Authorities, and then click OK.



5. Click Next.

	\times
🗧 🛃 Certificate Import Wizard	
Certificate Store	
Certificate stores are system areas where certificates are kept.	
Windows can automatically select a certificate store, or you can specify a location the certificate.	for
Automatically select the certificate store based on the type of certificate	
Place all certificates in the following store	
Certificate store:	
Trusted Root Certification Authorities Browse	
Next	Cancel

6. Click Finish.

÷ 🦻	Certificate Import Wizard		×
	Completing the Certifi	cate Import Wizard	
	The certificate will be imported after	r you dick Finish.	
	You have specified the following set	tings:	
	Certificate Store Selected by User Content	Trusted Root Certification Authorities Certificate	
		Finish Cancel	
Certifi	cate Import Wizard	×	
i	The import was success	sful.	
		K	

- If successful, a pop-up window should read, "The import was successful." Click, **OK**.
- 8. Clear your cache, then open the unit's IP address in a web browser and confirm the connection is secure.



V. Accessing the Device From Additional PCs

If you are accessing the device from a different PC, you must download the self-signed certificate and install it to your local machine's trusted certificate store. The self-signed certificate can be downloaded via the browser. Instructions are provided for commonly used browsers—Google Chrome (), Microsoft Edge () and Mozilla Firefox ().

Download Certificates Using Google Chrome 🣀

- 1. Launch the device webpage in Google Chrome 🧔.
 - a. Enter the **IP address** for the Contemporary Controls device (10.0.13.71 in this example.)
 - b. From the Warning screen:
 - Click Advanced.
 - Click Proceed to [IP address] (unsafe). IP is 10.0.13.71 in this example.



 The device webpage will launch.
 NOTE: For GSA-compliant devices, a GSA WARNING will appear.

Click I Agree to continue.



- 3. Download certificate to your local computer in .crt format.
 - a. Click **Not secure** in the URL and select **Certificate details** from the drop-down menu.



b. Select the **Details** tab and click **Export** to save the certificate locally on the computer.

Certificate Viewer: BASrouterSX	
General Details	
Certificate Hierarchy	
BASrouterSX	
Certificate Fields	
Version	
Serial Number	
Certificate Signature Algorithm	
Issuer	
- Validity	
Not Before	
Field Value	
	Expor

c. Name the certificate, then click **Save**.

CONTEMPORARY		×
	Certificate Hierarchy	
Save As	×	
$\leftarrow \rightarrow \checkmark \uparrow \clubsuit$ This PC \rightarrow	Downloads マ (ひ) Search Downloads ク	
File name: TestCERT.crt		
Save as type: Base64-encod	ed ASCII, single certificate (*.pem;*.crt) v	



- d. Select the certificate in the Downloads folder. Right-click, then select **Install Certificate** from the drop-down menu.
- 4. Follow the instructions described in Section IV: Install Certificate .crt Format to Trusted Root CA folder



Download Certificates Using Microsoft Edge C.

- 1. Launch the device webpage and advance through the Security Warning.
 - a. Enter the **IP address** for the Contemporary Controls device, (10.0.13.71 in this example.)
 - b. From the Warning screen:
 - Click Advanced.
 - Click Continue to [IP address] (unsafe).



2. The device webpage will launch.

NOTE: For GSA-compliant devices, a GSA WARNING will appear.

Click I Agree to continue.





- 3. Download certificate to your local computer in .crt format.
 - a. Click **Not secure** in the URL and select **Your connection to this site isn't secure** from the drop-down menu.



- b. Click the **certificate** icon.
- 4. Follow the instructions described in Section IV: Install Certificate .crt Format to Trusted Root CA folder.



Download Certificates in Mozilla Firefox 🕹

- 1. Launch the device webpage and advance through the Security Warning.
 - a. Enter the **IP address** for the Contemporary Controls device, (10.0.13.71 in this example.)
 - b. From the Warning screen:
 - Click Advanced.
 - Click Accept the Risk and Continue.



The device webpage will launch.
 NOTE: For GSA-compliant devices, a GSA

WARNING will appear.

Click **I Agree** to continue.



- 3. Download certificate to your local computer in .crt format.
 - a. Click the **Security Warning** icon in the URL and select **Connection not secure** from the drop-down menu.
 - b. Select More Information.





c. Click View Certificate.

d. Click the **PEM cert** link to download the "pem" file.

⊌ Firefox about:certificate?cert=MIIGKTCCBBGgAwIBAg 50% 🏠						
Certificate						
		*				
Subject	Name					
Country		US				
State/Province		Illinois				
Locality		Downers Grove				
Organization		RAD				
Common Name		*				
Email Address		info@ccontrols.com				
Issuer	Name					
Co	untry	US				
State/Pro	vince	Illinois				
Lo	cality	Downers Grove				
Organiz	ation	Contemporary Controls				
Organizational Unit		R&D				
Common	Name	•				
Email Ac	idress	inte@ccontrols.com				
v	alidity					
Not B	efore	Thu, 12 May 2022 00:10:51 GMT				
Not	After	Wed, 19 May 2032 00:10:51 GMT				
Subject Alt N	lames					
DNS	Name	*.pcbook.com				
DNS Name		*.pcbook.org				
IP Ac	idress	0.0.0				
Public Key	y Info					
Algo	rithm	RSA				
Ke	y Size	4096				
Exponent		65537				
Mo	dulus	BC:EE:0D:77:CE:96:CE:21:11:9A:9A:B8:25:47:2C:E0:E7:4D:6F:CB:9F:0	9:52:87:			
Miscellar	neous					
Coviet Mar	mhor	39-55-D9-15-DD-5D-55-90-00-00-55-54-45-93-44-03-55-44-04-44				
Signature Algorithm		SHA-256 with RSA Encryption				
Ve	Version					
Dow	nload	PEM (cart) PEM (chain)				
Finger	prints					
	0.055	0275-45-24-25-09-15-09-15-40-55-55-40-55-00-40-55-00-00-55-00	10.000			
SH	SH 0-1	02.7E.M3.34(33:35,13:06)13:44(73:55)13(54)05(A2)(C)08(08)01(5C)24 00-45(72)17(0)5(52:93:95)13(54)20(07:42)15(77:73)25(57:65)45(45)	02.00.0			
	ane"i	VERTICE NEWTOOLONG 2/04/26/07/06/15/27/14/25/27/25/25/43				

e. From your Downloads folder, rename the pem file to **pem.crt**

← → ✓ ↑ 🕹 > This PC > Downloads					
🚔 Documents	^	Name			
🕂 Downloads		V Today (1)			
👌 Music		To a set			
Pictures		E _R) pem.crt			
📑 Videos					
🏪 Windows (C:)	¥				

f. Select the certificate. Right-click, then select **Install Certificate** from the drop-down menu.



- g. Click **Open** on the pop-up screen to allow installation.
- 4. Follow the instructions described in <u>Section IV:</u> <u>Install Certificate .crt Format to Trusted Root CA</u> <u>folder</u>.



VI. Appendix: IP Resetting on your Device

Your self-signed certificate can be overwritten if you reset the device on a PC that has a previously established self-signed certificate.

For example, say the device's self-signed certificate is Installed at IP 10.0.13.71 and trusted by your PC via the Trusted Root CA folder. When you reset your device (by pressing the device's reset button), the device returns to the default IP (e.g., 192.168.92.16), and your new self-signed certificate at IP 10.0.13.71 is not recognized.

Clear your cache and device's webpage will be accessible, and follow the instructions described in <u>Section IV: Install</u> <u>Certificate .crt Format to Trusted Root CA folder</u>.



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