USING A MULTI-DOMAIN SSL CERTIFICATE WITH A 3-SERIES PROCESSOR

RESIDENTIAL APPLICATION

Crestron Electronics, Inc.

REVISION HISTORY

Version	Date	Comments	Author
1.1	8/22/2018	Updated to reflect new information.	AS

TABLE OF CONTENTS

1 INTRODUCTION

This guide will provide step-by-step instructions for installing a multi-site SSL certificate in a Crestron 3-Series control system. Specific domain registrars were selected to reduce confusion and provide the exact steps needed. The following registrars were selected for this guide:

- gandi.net

The purpose of using a multi-domain certificate in a residence is to provide support for multiple encrypted connections to more than one hostname, but utilize a single SSL certificate.

I.E. With a registered domain of "JohnsHome.com", multiple subdomains can be secured: "AVInside.JohnsHome.com", "AVOutside.JohnsHome.com", "Security.JohnsHome.com", "CameraDVR.JohnsHome.com", etc.

Since the Crestron App supports multiple connection configurations, one subdomain can be used for inside the residence and another for outside.

The following are requirements with this guide:

1. Control system must use a static IP address (can be a reserved DHCP address).
2. Domain(s) must be registered with a public DNS provider. (I.E. gandi.net)
3. 3-Series control system must be running firmware 1.010.0060 and above.

The control system must be registered with the MyCrestron DNS service.

2 CONTROL SYSTEM ETHERNET CONFIGURATION

If the home router supports DHCP Address Reservation, it is highly recommended that it be used and that the control system Ethernet configuration be set to DHCP.

Note: Since the public domain registrar will be used to resolve the fully qualified hostname of the control system, the "Domain Name" field cannot contain the registered domain. Use anything other than the domain registered with the public registrar or simply leave it blank.

If the home router does not support DHCP Reservation, manually configure the Ethernet port of the control system and set a static IP address. Do not forget to configure the DNS server(s).

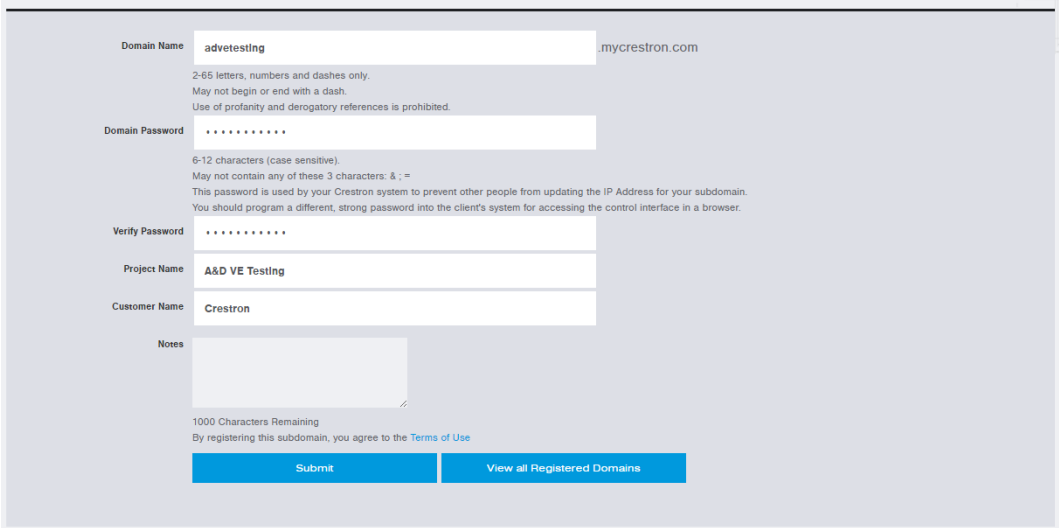
In either case, note the IP address of the control system. For the purpose of this guide, the IP address of the control system is 192.168.1.35 and this was set in the DHCP Address Reservation list of the home router.

3 REGISTER CONTROL SYSTEM WITH MYCRESTRON DNS

The control system needs to be registered with the MyCrestron DNS service. This service will be used to resolve the public facing home router to a DNS name that can be used with the SSL certificate.

1. Before configuring the control system, log into the Crestron website and register a domain for the control system here: http://www.crestron.com/resources/design-install-tools/my-crestron-dynamic-dns-ddns.

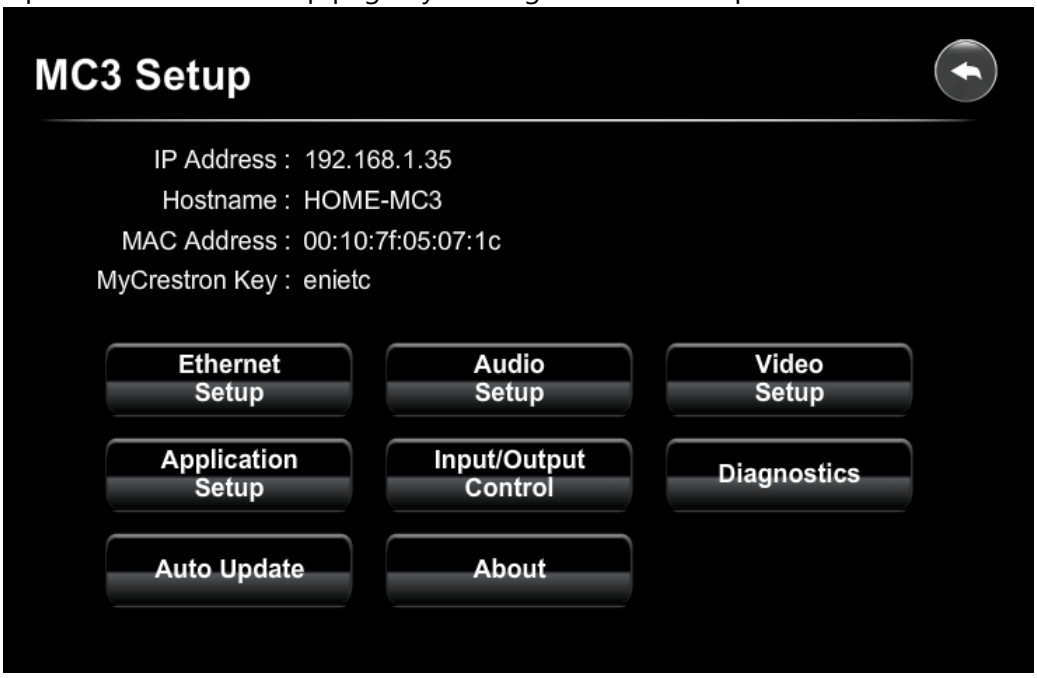
   For the purpose of this guide, the following information was registered:



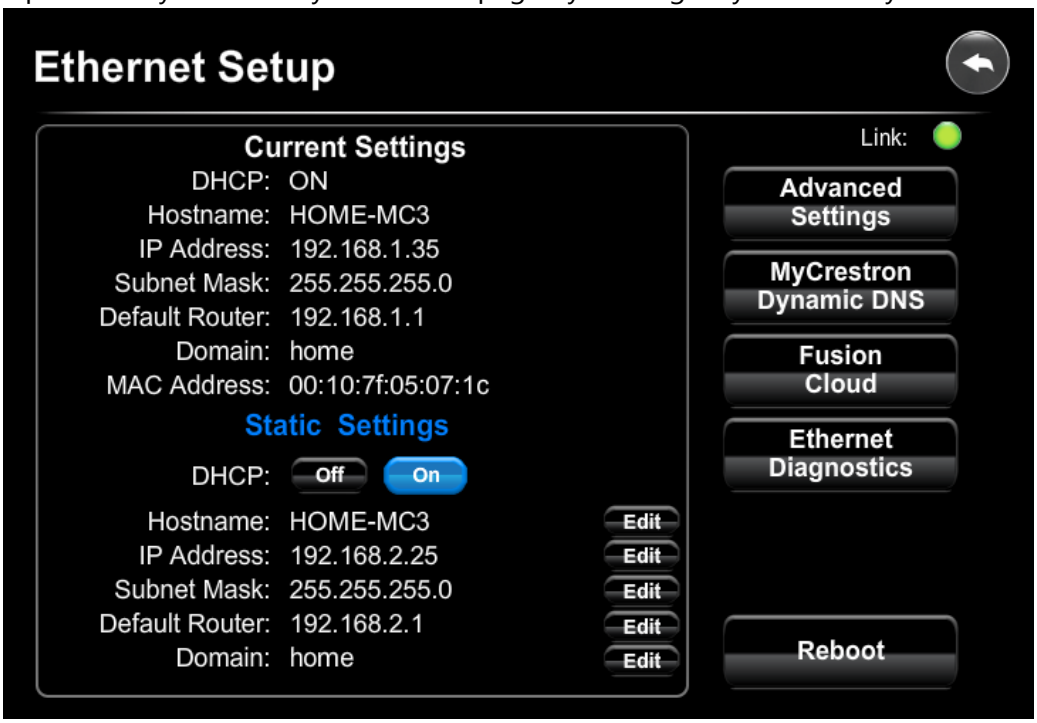
   Make sure the password used for registration is noted, as it will be required in the control system registration page.

2. After a domain is registered at the Crestron website, use a web browser and open the control system configuration interface using http://<control_system_ip>/setup. Click "Setup".

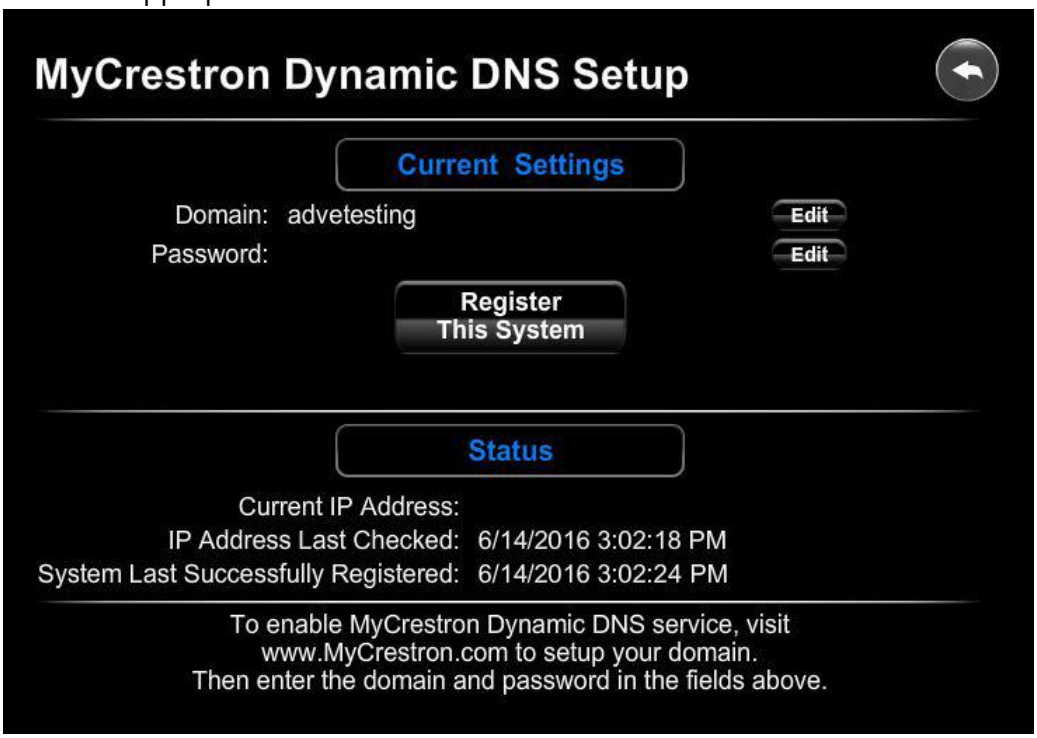
3. Open the Ethernet Setup page by clicking "Ethernet Setup".



4. Open the MyCrestron Dynamic DNS page by clicking “MyCrestron Dynamic DNS”.



5. Enter the appropriate data.



- Edit the domain and enter the registered MyCrestron domain (from Step 1).
- Edit the password and enter the password used for registration (from Step 1).
- Click “Register This System”.

4 USING GANDI.NET

This section will provide detailed instructions using gandi.net as the domain registrar, as well as the SSL certificate provider.

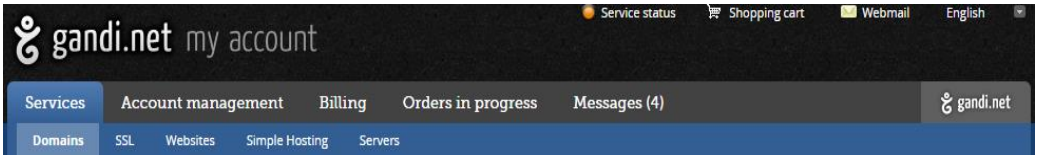
4.1 REGISTER THE DOMAIN

Using the domain search page: https://www.gandi.net/domain find an available domain and register it. During the registration process, an account will be created.

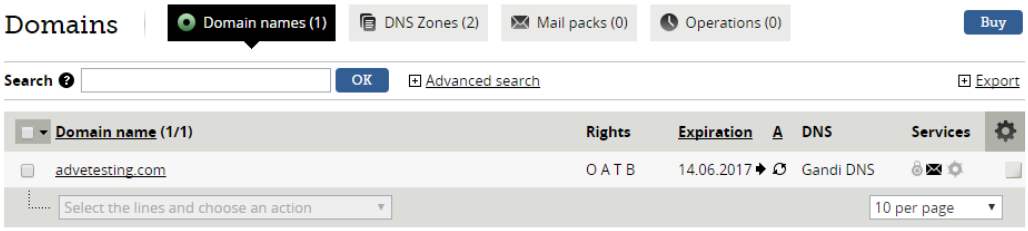
For the purpose of this guide, "advetesting.com" was registered.

4.2 CREATE SUBDOMAIN RECORDS

1. In the "Services" tab of the main menu, select "Domains".

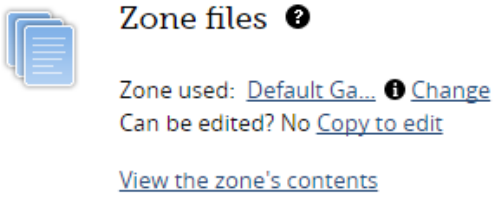


2. The newly registered domain should appear in the interface. Click the domain to edit it.

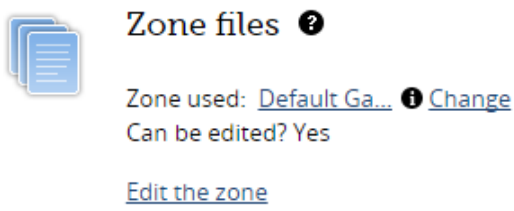


3. To add a new subdomain, the zone file must be edited. However, a zone file that is currently in use cannot be edited. A copy of an "in-use" zone file must be made first.

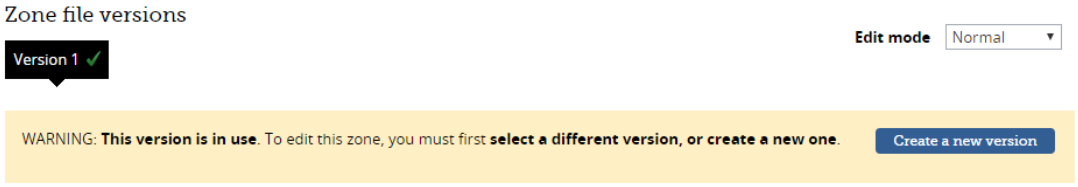
4. If this is the first time editing the zone file, the interface will provide a link to create a copy. Click the "Copy to edit" link.



5. Once a copy is made, the zone file can be edited. Click the “Edit the zone” link.

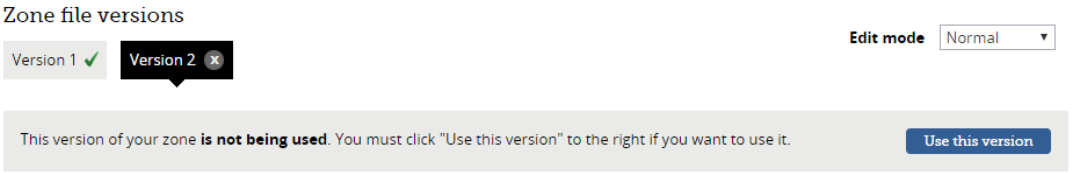


6. If this was the first copy made, it will have already been put “in-use”. A notice will be displayed in the interface.



Click “Create a new version”.

7. The new version of the zone file can now be edited. The interface will provide a message stating that this version of the zone file is not “in-use”.



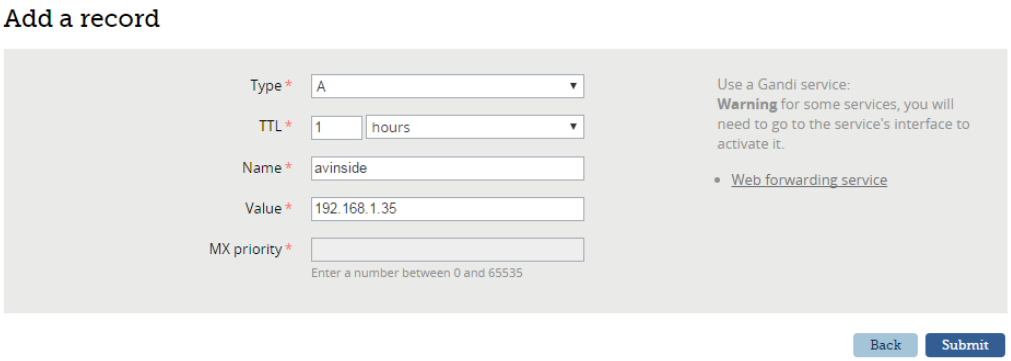
DO NOT click “Use this version” until all subdomain records have been added.

8. First, a subdomain record needs to be created that will be used for connections inside the residence. Click the “Add” button to create a new record. Leave the “Type” as “A” and set the “TTL” to “1 hour”. Enter the desired name for the subdomain in the “Name” field. Do not include the registered domain value in this field. It will automatically be appended in the actual server.

   I.E. If “myinsideconnection” is entered in the field, and the registered domain is “cooldomain.com”, the full subdomain will be “myinsideconnection.cooldomain.com”.

   Enter the inside IP address of the control system into the “Value” field.

For our example domain (advetesting.com), it was decided to use “avinside” for the internal connection. This means the entire subdomain will be “avinside.advetesting.com”. Since the interal IP address of the control system is 192.168.1.35, that was entered into the “Value” field. The following values were entered in the dialog:



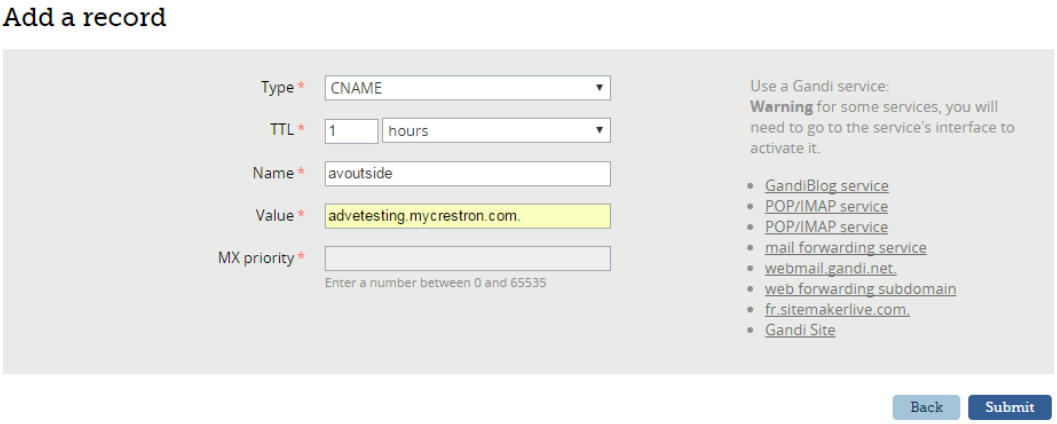
9. Next, a subdomain record needs to be created that will be used for connections outside the residence. Click the “Add” button to create a new record. This time, set the “Type” as “CNAME” and set the “TTL” to “1 hour”. Enter the desired name for the subdomain in the “Name” field. As with Step 8, do not include the registered domain value in this field. It will automatically be appended in the actual server.

   I.E. If “myoutsideconnection” is entered in the field, and the registered domain is “cooldomain.com”, the full subdomain will be “myoutsideconnection.cooldomain.com”.

   Enter the full MyCrestron registered domain into the “Value” field.

   I.E. If “johnshome” was registered with MyCrestron, the full name that should be entered is “johnshome.mycrestron.com”.

   For our example domain (advetesting.com), it was decided to use “avoutside” for the external connection. This means the entire subdomain will be “avoutside.advetesting.com”. From earlier in this guide, the MyCrestron value for our example domain was “advetesting” making the field value “advetesting.mycrestron.com”. The following values were entered in the dialog:



10. Now that the subdomain records have been created in the zone file, the file needs to be set "in-use".

Click "Use this version".

11. It will take some time for these records to become live. Please verify that the DNS records are "live" before continuing with this guide.

    The records can be verified by using a simple PING command in a DOS prompt.

    For our example domain (advetesting.com), using the subdomains that were just created, the following pings were issued:

    - "ping avinside.advetesting.com"

      This ping will only return a valid result if it is issued from inside the residence. If it is issued outside the residence, the request will timeout, but the registered IP address should be shown in the first line:

      This at least validates that the subdomain is using the correct IP address.

    - "ping avoutside.advetesting.com"

      This ping should return the IP address of the home router, registered by the control system using the MyCrestron DNS.

4.3 CREATE CERTIFICATE SIGNING REQUEST (CSR)

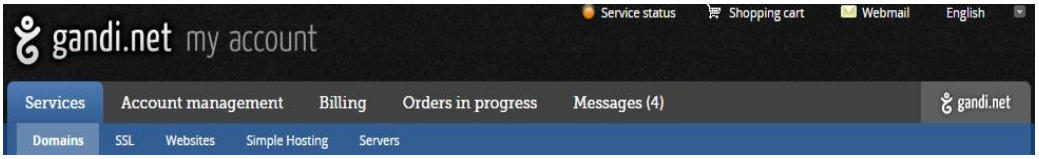
Follow the directions in **Section 5 - Creating a Certificate Signing Request (CSR)**.

4.4 CREATE SSL CERTIFICATE

Once the CSR has been generated, an SSL certificate can now be created.

1. Log back into gandi.net.

2. In the "Services" tab of the main menu, select "Domains".

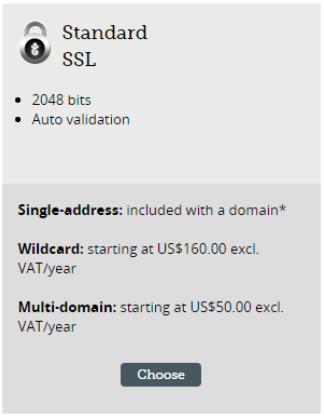


3. Click the padlock  icon (in the "Services" column) to add an SSL certificate to the domain.

4. Click the 

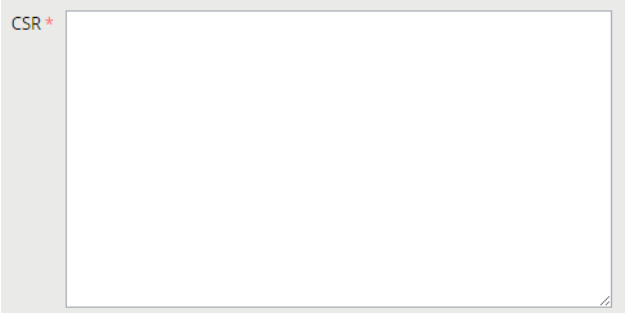
button.

5. Select the "Standard SSL" certificate.

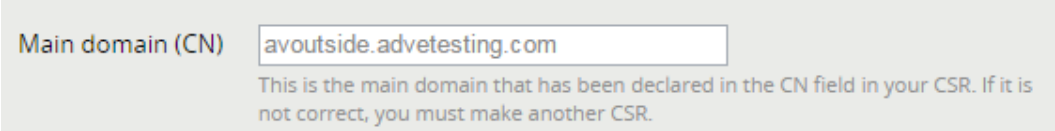


6. Select "Multi-Domain".

7. Using a text editor (like Notepad++), open the CSR file generated in **Section 4.3 - Create Certificate Signing Request (CSR)** and paste the contents, including the "BEGIN" and "END" tags, into the CSR data field.

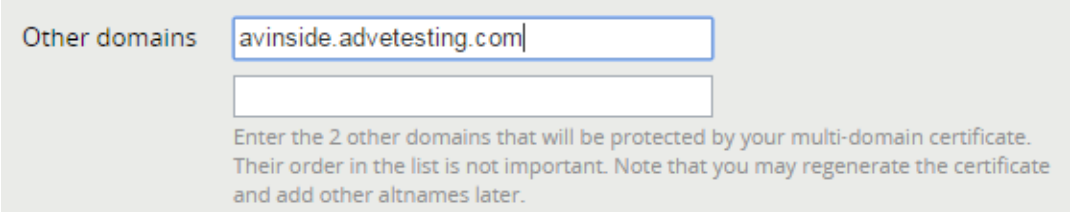


8. The CSR main domain will be shown in the "Main domain (CN)" field. For our example domain (advetesting.com), we created the CSR using the subdomain "avoutside.advetesting.com". The field displayed this:

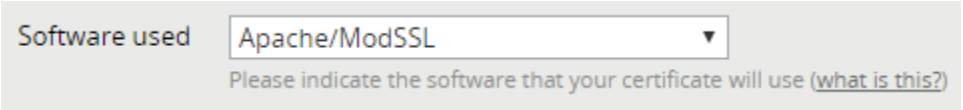


This correctly matches the registered subdomain.

9. Next, enter the inside subdomain that was registered earlier. For our example domain (advetesting.com), the inside subdomain is "avinside.advetesting.com".



10. Leave the "Software used" value set to "Apache/ModSSL".

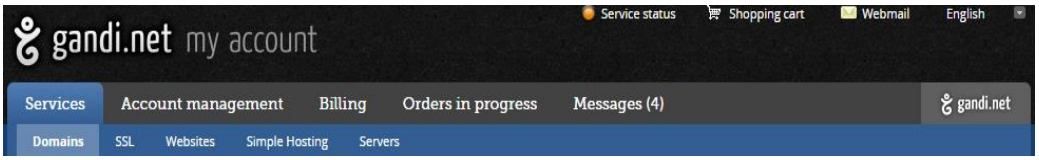


11. Finalize the purchase of the certificate.

12. Once payment is approved, an email will be provided with a link to complete the SSL certificate validation process. **DO NOT click the link**. By default, the validation rights to the domain uses a DNS record to validate each subdomain. Since gandi.net provides 5 free email addresses with the domain purchase, it is actually easier to use Gandi mail to validate the subdomains.

13. Log back into gandi.net.

14. In the “Services” tab of the main menu, select “Domains”.



15. Click the email  icon (in the “Services” column) to activate the Gandi mail services.

16. Create a new mailbox called “admin”.

17. Activate the mail service by clicking the activate link.

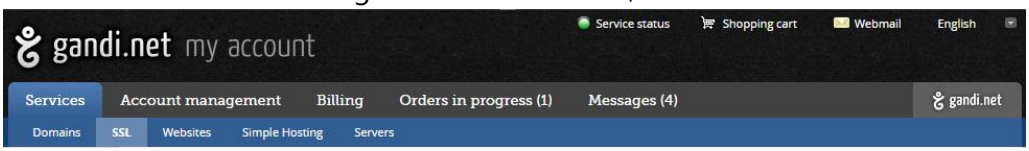
Gandi Mail service: not activated activate

18. Open Gandi Webmail by clicking the access link.

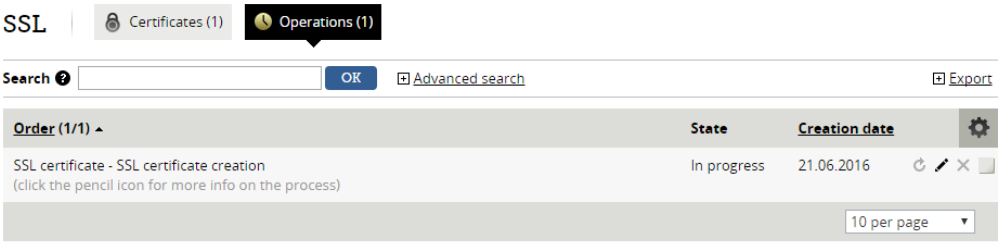
Gandi Webmail: Access

19. Log into the admin mailbox created in Step 16 and leave the interface open.

20. In the “Services” tab of the gandi.net main menu, select “SSL”.

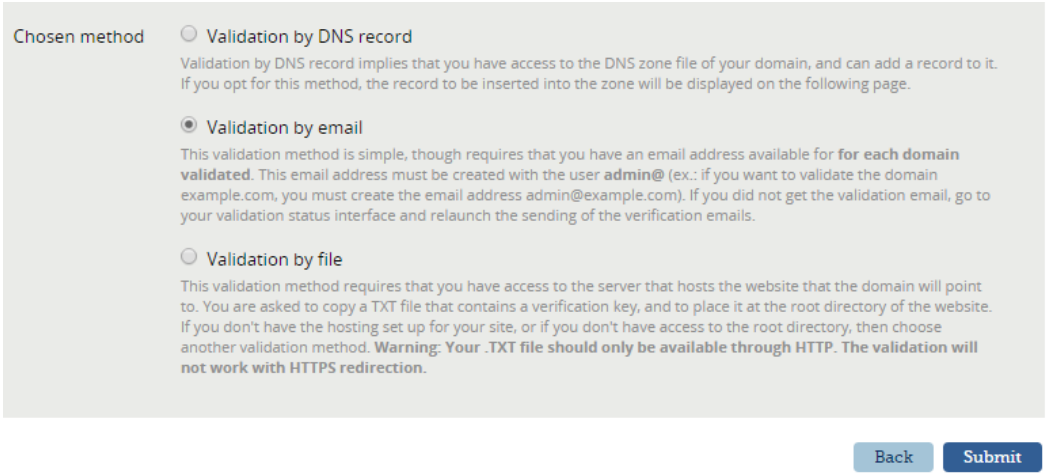


21. Selection “Operations” and then select the pencil  icon.



22. Click the 

button to open the validation configuration dialog. Change the method to "Validation by email".



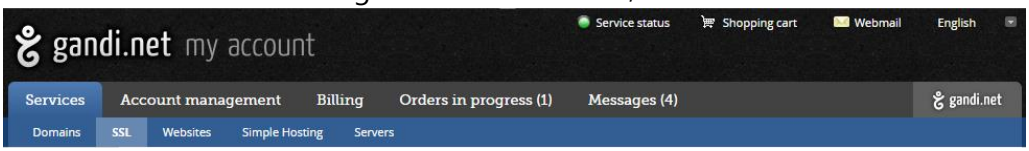
23. Two emails will now be sent to the "admin@" mailbox created in Step 16. Follow the instructions to validate the subdomains.

4.5 DOWNLOAD THE SSL CERTIFICATE

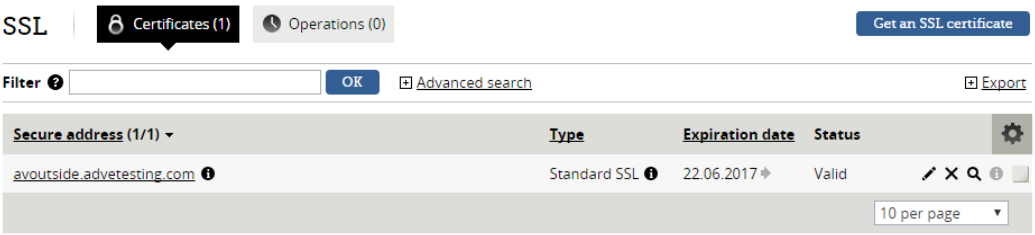
Once the SSL certificate has been issued, it can be downloaded from your account.

1. Log back into gandi.net.

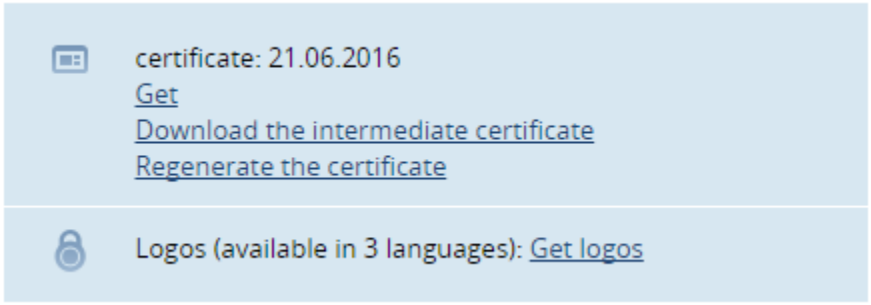
2. In the "Services" tab of the gandi.net main menu, select "SSL".



3. The subdomain that just received an SSL certificate should be shown in the list. For our example domain (advetesting.com), the certificate for the subdomain "avoutside.advetesting.com" was in the list. Click the actual subdomain name.



4. Download both the actual SSL certificate, as well as the intermediate certificate. Click "Get" for the SSL certificate. Click "Download the intermediate certificate" for the intermediate.



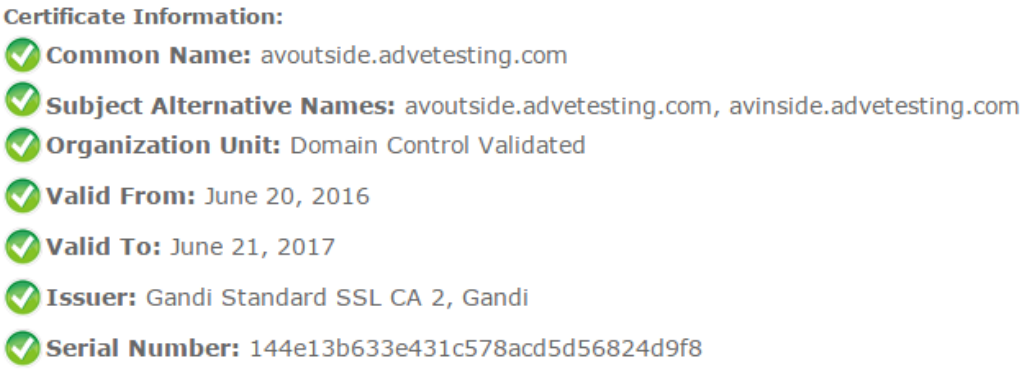
   Note: If either of the certificates do not download as files, but display raw data in the browser window, simply select all the data and paste it into a text document (Notepad++ works well for this). Save each file separately with a .cer file extension. Note the filenames to distinguish the SSL from the Intermediate certificate.

5. To validate the contents of both the SSL and Intermediate certificates, use one of the free online services.

   I.E. https://www.sslshopper.com/certificate-decoder.html.

   Simply paste the contents of the .cer/.crt files into the decoding window. For the SSL certificate, verify that both registered subdomains are reflected.

   For our example domain (advetesting.com), this is what was decoded:



   This reflects that both of the subdomains are supported with this certificate.

6. See **Section 6 – Uploading Certificates to the Control System** for instructions on how to upload the certificates.

5 CREATING A CERTIFICATE SIGNING REQUEST (CSR)

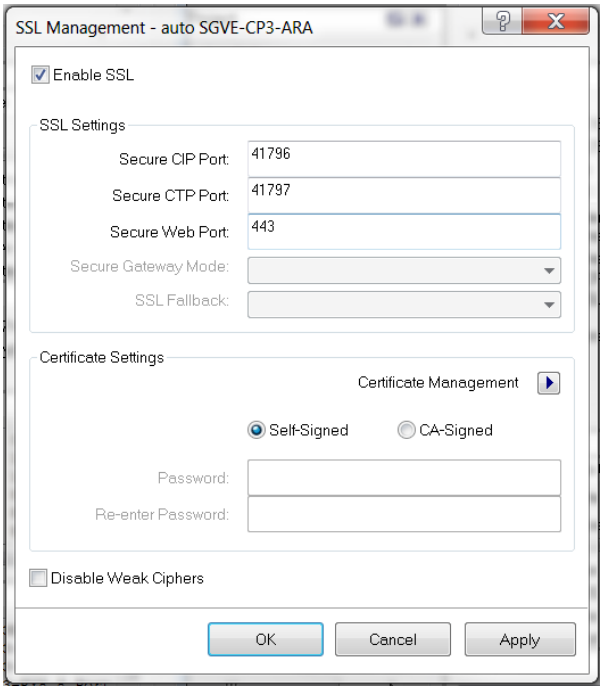
A certificate signing request must be created before an SSL certificate can be issued.

Note: Once the CSR is generated and submitted to the certificate provider, DO NOT generate another CSR. At the moment the CSR is generated using the control system, a private key file (.pvk) is created. This file is unique to the CSR.

1. Using Toolbox -> System Info, connect to the control system.

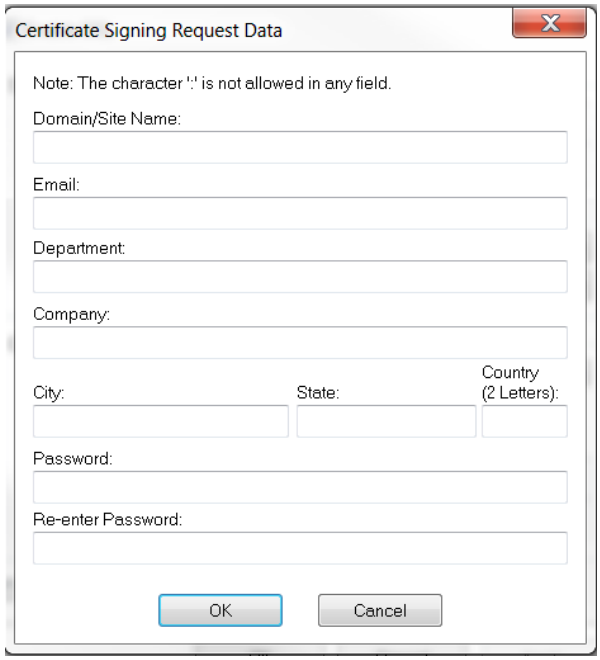
2. Select Functions -> SSL Management.

3. Check "Enable SSL". Leave the "Certificate Settings" type as "Self-Signed". Click next to "Certificate Management" and select Generate Certificate Request.

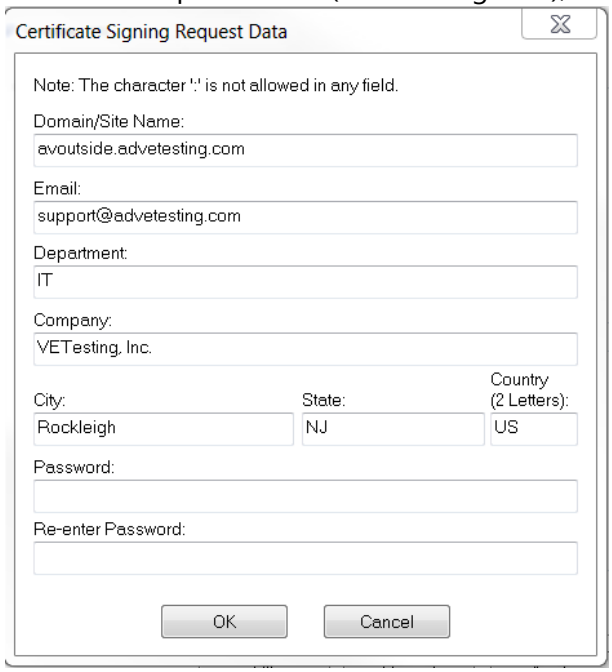


4. Fill in all of the fields, making sure the domain is entered correctly. Since our SSL certificate is a multi-domain type, either of the subdomains can be entered into the "Domain/Site Name" field.

   Note: A password is required to generate the CSR and PVK files. **DO NOT forget the password as it is required before you install the SSL certificate**.



For our example domain (advetesting.com), the following data was entered:



5. Save the .csr file to an accessible directory on a PC.
6. You can verify the contents of the CSR using an online verification tool.

   I.E. https://www.sslshopper.com/csr-decoder.html.

   Simply copy the contents of the CSR file into the decoding window.

   For our example domain (advetesting.com) CSR, the following was revealed:

7. It is highly advisable to store a copy of the .pvk file in a directory on a local PC. Using Toolbox -> File Manager, browse to the "Sys" folder and export a copy of the "srv_key.pvk" file. This will allow the SSL certificate to be installed again, should the control system need to be replaced.

8. If the SSL certificate is going to be created at a later date or if the creation is going to take some time, the "Enable SSL" checkbox can be cleared so the control system can operate without SSL until the certificate is ready.

6 UPLOADING CERTIFICATES TO THE CONTROL SYSTEM

Once the SSL certificate has been issued, two files need to be uploaded to the control system. The first is the Root Certificate and the second is the actual SSL Certificate.

The SSL certificate supplier should have provided an intermediate certificate. This will be used as the RootCA certificate in the control system.

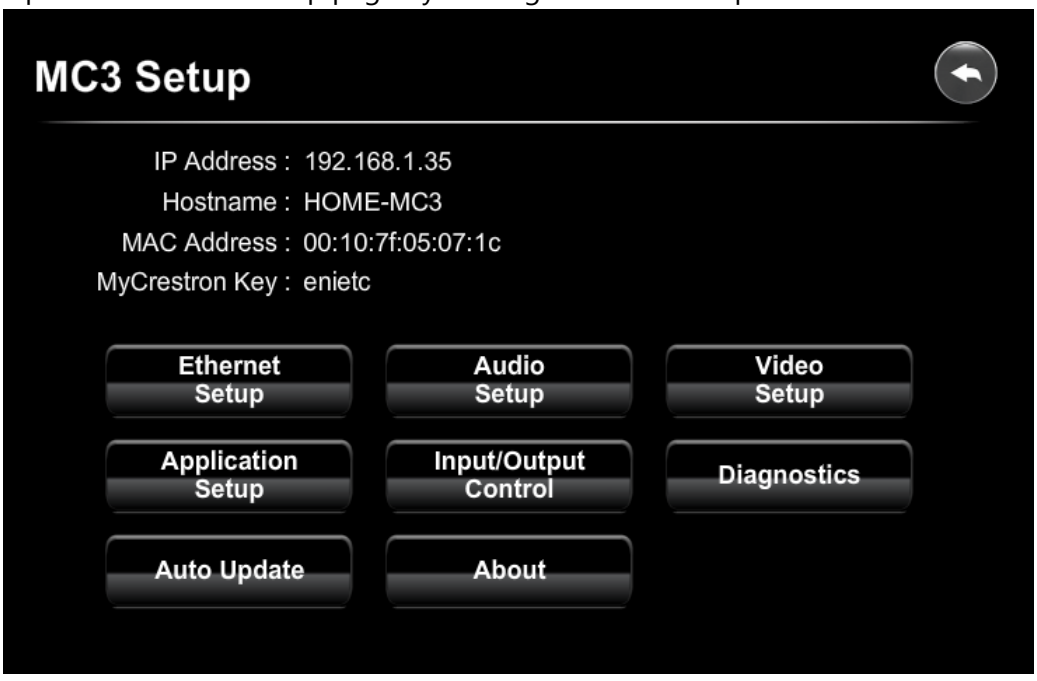
If either of the files do not have a .cer extension, simply copy the files and rename the extension to .cer.

1. Using Toolbox -> System Info, connect to the control system.
2. Select Functions -> SSL Management.
3. Check the "Enable SSL" box if it is unchecked.
4. Select "CA-Signed" if it is not selected.
5. Click  and select Upload Root Certificate.
6. Select the Root Certificate file.
7. Click  and select Upload Signed Certificate.
8. Select the SSL Certificate file.
9. Enter the password used to generate the CSR/PVK before clicking "Apply".

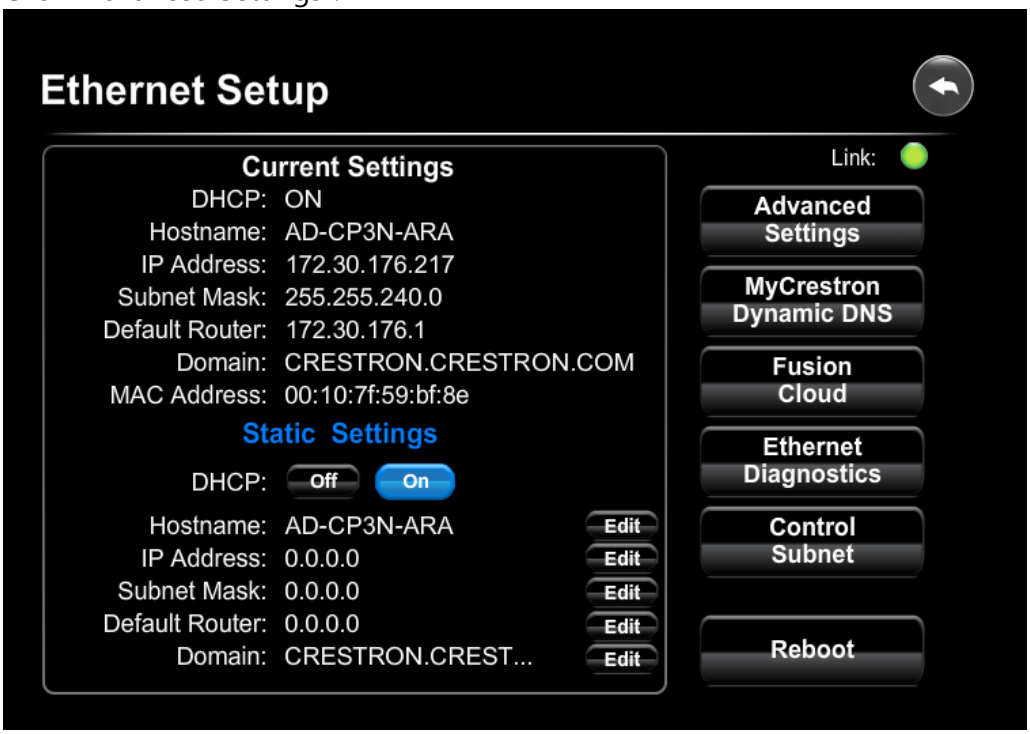
7 ENABLE SSL CERTIFICATE AND ENCRYPTED COMMUNICATION FOR WEB XPANEL

1. Use a web browser and open the control system configuration interface using http://<control_system_ip>/setup. Click "Setup".

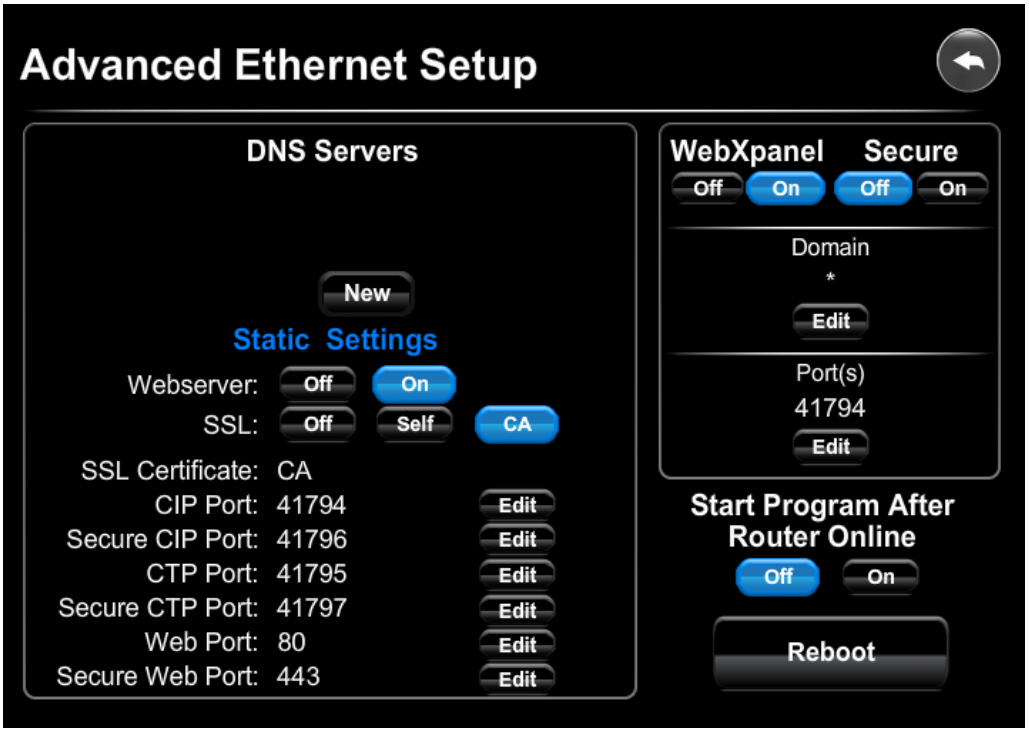
2. Open the Ethernet Setup page by clicking "Ethernet Setup".



3. Click “Advanced Settings”.



4. Click SSL “CA”.



5. Click “Reboot” to reboot the control system.

6. After the reboot, the control system should now require https to access the web server. The domain name configured for the inside address in **Section: Create Subdomain Records – Step 8** is what should be used.

   Use https://<myinside_domain_name>/setup to open the setup page.

7. Repeat Steps 2 – 3 and click Secure "On". This will enable secure CIP communication (CIPS) for Web Xpanel.

   Important: This step only secures the Web Xpanel data communication and also allows a secure Crestron App connection. The original CIP port (41794) is still active and available. To secure the entire control system, please review Crestron's Secure Deployment Guide, Answer ID 5571.

8. Click "Reboot" to reboot the control system.

8 CONFIGURE PORTS IN ROUTER FIREWALL

In order to securely access a control system from outside the residence, multiple ports need to be opened/forwarded to the control system processor. Please refer to the actual router manual to determine how to forward ports.

The following are ports that need to be forwarded and what they are used for:

Port	Type	Use
41796	TCP	SSL -> Xpanel Exe, Xpanel Web, Crestron App
41797	TCP	SSL -> Toolbox
443	TCP	SSL -> Xpanel Web, Crestron App
843	TCP	Non-SSL, SSL -> Xpanel Web

Note: Since 443 is a standard web ports, some residential routers do not allow these to be forwarded. Also, those ports may already be in-use by the router remote management web interface. In either case, use a different external port, but forward it to 443 on the control system.

I.E. Forward Port 9443 to Port 443 on the control system IP address. Then, to make a secure web page request from outside the residence, the URL is:
HTTPS://<external_subdomain_registered>:9443/<myPage.html>

See Section 10 - Xpanel Web for specific information about using an Xpanel Web project inside and outside the residence.

For our example domain (advetesting.com) tests, we configured the following port forwarding rules:

External Port 41796 -> Port 41796 on 192.168.1.35
External Port 41797 -> Port 41797 on 192.168.1.35
External Port 9443 -> Port 443 on 192.168.1.35
External Port 843 -> Port 843 on 192.168.1.35

9 BASIC SSL TESTING

9.1 INTERNAL NETWORK

A simple web test using the internal (inside residence) network, can be used to verify that the SSL certificate is working correctly.

1. Upload a .jpg image to the HTML folder.
2. Open a web browser and enter HTTPS://<internal_subdomain_registered>/<image.jpg>

   For our example domain (advetesting.com), we created a DNS record for the subdomain "avinside" with an IP address of 192.168.1.35. An image "spam.jpg" was uploaded to the HTML folder of the control system. Our test URL while connected to the internal network is: HTTPS://avinside.advetesting.com/spam.jpg.

   After the image loads in the browser, you can verify the SSL certificate.

   I.E. In Chrome, simply right-click the green padlock 

and select "Details", then "View certificate". For our example domain (advetesting.com), this is what shown:

9.2 EXTERNAL NETWORK

Once the internal test has been completed above, an external test can be done to verify the subdomain registered for use outside the residence is working correctly.

1. Assuming the .jpg image previously placed in the HTML folder of the control system is still there.

2. Open a web browser and enter HTTPS://<external_subdomain_registered>/<image.jpg>

   For our example domain (advetesting.com), we created a DNS record for the subdomain "avoutside" with a CNAME reference to our control system MyCrestron hostname. An image "spam.jpg" was uploaded to the HTML folder of the control system. Our test URL while connected to a network outside the residence is: HTTPS://avoutside.advetesting.com/spam.jpg.

10 CRESTRON APP

Now that everything has been configured and verified, the internal and external subdomains can be used in the connection details of the Crestron App.

Open the Crestron App and edit/create a new connection. Scroll to the bottom of the dialog and slide "Enable SSL" to ON.

Configure the Address 1 connection:

1. Set the "Host name or IP Address" field to the subdomain registered for the internal connection.

   For our example domain (advetesting.com), the internal subdomain is "avinside.advetesting.com".

2. The "HTTP Port" and "CIP" fields should be pre-filled with the correct values of 443 and 41796 respectively, since SSL was enabled in the app.

Configure the Address 2 connection:

1. Slide the "Enabled" to ON.

2. Set the "Host name or IP Address" field to the subdomain registered for the external connection.

For our example domain (advetesting.com), the external subdomain is "avoutside.advetesting.com".

3. Set the "HTTP Port" field to the correct value based on the router port configuration set in **Section 7 - Configure Ports in Router Firewall**.

   For our example domain (advetesting.com), we configured our router with external port 9443 to forward to 443. So in this field, 9443 was entered.

11 XPANEL WEB

Now that everything has been configured and verified, the internal and external subdomains can be used to open an Xpanel Web project.

11.1 CONNECTION PROPERTIES

The connection properties of the project need to be modified before it can be used with SSL.

1. Open the project using VTPRO.
2. Select the top node of the project to reveal the project properties.
3. Expand the "Connection Settings" node.
4. Set the "Port" to 41796.
5. Check the "Enable SSL" checkbox.

Note: If the "Enable SSL" checkbox is missing from the properties dialog, that parameter will need to be appended to the browser URL as "?enablessl=1". See below for more details.

11.2 CORE3 XPANEL WEB

Before opening the Xpanel Web project, the control system core3 web server needs to be configured for SSL.

1. Using Toolbox -> Text Console, connect to the control system.
2. At the prompt, type "core3xpanelweb" to display the current web server configuration.
3. To configure the server for secure connections, type "core3xpanelweb on * 41796 secure_on".

11.3 INTERNAL NETWORK

The registered subdomain for the internal network can be used to open the Xpanel Web project.

Enable SSL Set at Design Time

URL: HTTPS://<internal_subdomain_registered>/core3xpanel.html

For our example domain (advetesting.com), the URL is HTTPS://avinside.advetesting.com/core3xpanel.html

Enable SSL NOT Set at Design Time

URL: HTTPS://<internal_subdomain_registered>/core3xpanel.html?enablessl=1

For our example domain (advetesting.com), the URL is HTTPS://avinside.advetesting.com/core3xpanel.html?enablessl=1

11.4 EXTERNAL NETWORK

The registered subdomain for the external network can be used to open the Xpanel Web project. Unlike the internal network though, the secure web port needs to be specified in the URL, if 443 had to be remapped in **Section 7 - Configure Ports in Router Firewall**.

Enable SSL Set at Design Time / 443 Not Remapped

URL: HTTPS://<external_subdomain_registered>/core3xpanel.html

For our example domain (advetesting.com), the URL is: HTTPS://avoutside.advetesting.com/core3xpanel.html

Enable SSL Set at Design Time / 443 Is Remapped

URL: HTTPS://<external_subdomain_registered>:external_port/core3xpanel.html

For our example domain (advetesting.com), 443 was remapped to 9443. So the URL is: HTTPS://avoutside.advetesting.com:9443/core3xpanel.html

Enable SSL Not Set at Design Time / 443 Not Remapped

URL: HTTPS://<external_subdomain_registered>/core3xpanel.html?enablessl=1

For our example domain (advetesting.com), the URL is: HTTPS://avoutside.advetesting.com/core3xpanel.html?enablessl=1

Enable SSL Set at Design Time / 443 Is Remapped

URL: HTTPS://<external_subdomain_registered>:external_port/core3xpanel.html?enablessl=1

For our example domain (advetesting.com), 443 was remapped to 9443. So the URL is: HTTPS://avoutside.advetesting.com:9443/core3xpanel.html?enablessl=1

12 APPENDIX

12.1 DOMAIN REGISTRAR

The following is a list of domain registrars and common services/pricing

Name	Domain Cost (per Year)	SSL Certificate	Notes
gandi.com	$15.50 (.com)	$50 (Multi-Domain)	Account comes with free email.
namecheap.com	$11 (.com)	$30 (Multi-Domain)	