



40W PoE+ + Integrated Power Amplifier Configuration Guide

NQ-GA40P3



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Configuring the Nyquist Integrated Power Amplifier

The NQ-GA40P3 is a plenum-rated Nyquist 40W integrated power amplifier that works as a page zone extender to facilitate voice access to a single zone of one-way paging over the Nyquist network.

It also works in background music applications, leveraging the exhaustive audio management and distribution capabilities of Bogen's Nyquist platform.

The NQ-GA40P3 appliance uses the latest in Class D amplifier technology and provides unparalleled sonic quality, exceptional reliability, and reduced power consumption to permit standalone PoE++ operation over the local network.

The Nyquist server or System Controller can automatically discover and configure the NQ-GA40P3, but you can also manage the device, and manually configure some settings, through the appliance's web-based user interface (web UI). It can also operate in Stand-alone mode, allowing it to be used without a Nyquist server.

A two-second press of the appliance's **Reset** button reboots the device. If you press the **Reset** button for 10 seconds, the appliance returns to the factory default configuration settings. Returning to the default configuration settings does not change the appliance's firmware.

The following sections describe the process for manual configuration. For information about using Nyquist's automatic configuration process, refer to the appropriate *Nyquist System Administrator Guide*.

Note: Do not use third-party browser extensions with the Nyquist user interface.

To access the appliance's Web-based user interface (UI):

- 1 Before accessing the web UI for the first time, the Bogen Certification Authority (CA) digital certificate must be installed on the client. This certificate can be downloaded from any Nyquist appliance and enables your browser to recognize the Nyquist web application as a trusted site.

For details on how to download and install the certificate to your client computers, see "*Bogen Digital Certification Authority*" on page 40.

- 2 Access the appliance's web UI by doing one of the following:
 - a) On your web browser, enter the IP address for the appliance as the URL.
 - b) From the Nyquist server's web UI navigation bar, select **Stations**, select **Stations Status** or **Appliance Status**, navigate to the device that you want to configure, and then select the **Link** icon.
 - c) From the Nyquist server's **Appliance Discovery Wizard**, select the **Link** icon for the device that you want to configure.

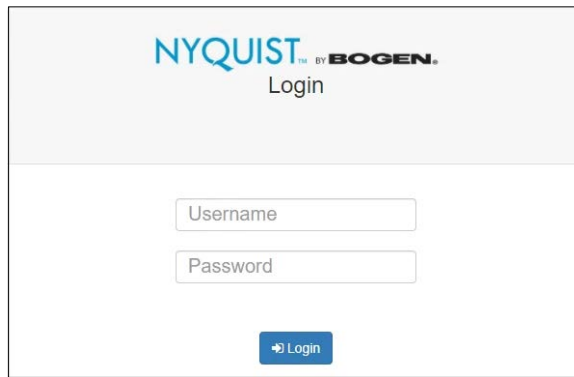


Figure 1. Nyquist Appliance Login

- 3 At the Nyquist appliance's Login page, enter username and password, then press enter or click on the **Login** button.

The default username is `admin`; the default password is `bogen`.

Note: After a successful login, a warning will be displayed if the default password is still in use. We strongly encourage changing the default password as soon as possible.

When you have logged in successfully, you will be presented with the dashboard for the appliance.

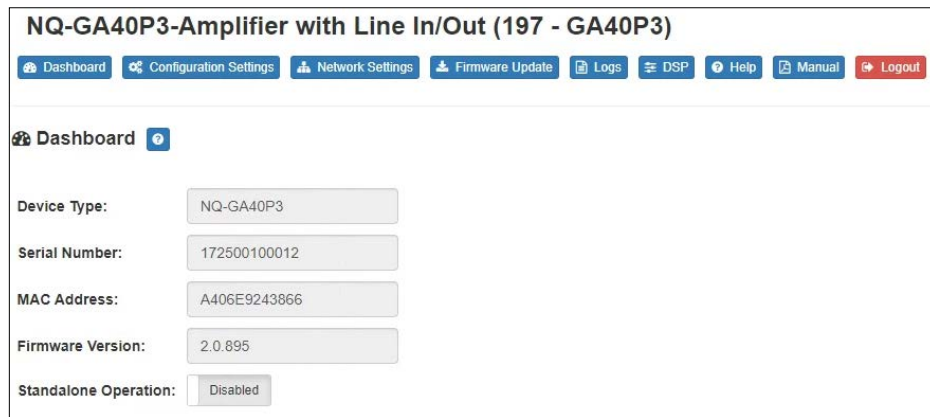


Figure 2. NQ-GA40P3 Dashboard

Using the Dashboard

The dashboard displays the following fields:

Table 1. Appliance Dashboard Fields

Device Type	Identifies the model of this device.
Serial Number	Identifies the serial number for the device.
MAC Address	Identifies the Media Access Control (MAC) address, which is a unique identifier assigned to network interfaces for communications on the physical network segment.
Firmware Version	Identifies the firmware version installed on the device.
Standalone Operation	Enables or disables Standalone mode.

The following buttons are available at the top of all pages in the application.

Table 2. Appliance Dashboard Buttons

Dashboard	Displays the dashboard.
Configuration Settings	Accesses the Configuration Settings page where you can view and set various options. If Standalone Operation is not enabled, you can also receive configuration settings from a Nyquist server.
Network Settings	Accesses the Network Settings page where you can view and set network settings, such as the static IP address.
Firmware Update	Accesses the Firmware Update page where you can view the current Nyquist version, update firmware to a new version, restore the configuration to factory defaults, and reboot the appliance.
Logs	Accesses log files, which record either events or messages that occur when software runs and are used when troubleshooting the appliance.
DSP	Accesses the DSP page where you can view and set parameters for Digital Signal Processing (DSP).
Help	Accesses the appliance's online help.
Manual	Displays this appliance's configuration guide.
Logout	Logs out of the appliance's web UI.

Standalone Operation

This device can also run in Standalone Operation mode, where it will not interact with a Nyquist server (e.g., E7000 or C4000). This means the device will not:

- Fetch device configuration from Nyquist server
- Register with Nyquist server (via SIP)
- Store backup information to Nyquist server
- Allow access to Nyquist server-based NTP

Standalone Operation allows this device to be used without a Nyquist server as a generic SIP endpoint when integrated with a 3rd-party VoIP telephone system or other SIP server-based solutions, such as a unified communications (UC) platform. In a non-SIP environment, these devices are capable of receiving audio through one or more prioritized multicast channels.

Important: Appliances maintain a distinct web username and password for Standalone Operation. It may be helpful to record this standalone-mode username and password or set them to the default or well-known values before switching to non-standalone mode. This username and password will be needed to log in when and if the appliance is subsequently returned to standalone mode. The standalone-mode username and password will be set to the default values if the appliance is reset to the factory default configuration.

Updating Firmware

When you select **Firmware Update** from the appliance's web UI, the Firmware Update page appears. From this page you can determine which Nyquist firmware version the appliance is using and if an update is available. You can also load a firmware release, install the loaded firmware, restore the configuration to factory defaults, and reboot the appliance.

Note: A Nyquist appliance connected to the Nyquist network receives a configuration file from the Nyquist server that includes the latest firmware available from the server. If the firmware is different from the one installed on the appliance, an automatic firmware update occurs unless the **Firmware** parameter for the station is left blank. Refer to the *Nyquist System Administrator Guide* for more information.



Note: Some buttons only appear on this page when applicable.

Figure 3. Firmware Update Page

To use the Firmware Update page:

- 1 On the appliance web UI's main page, select **Firmware Update** to view or update the firmware version.
 - If the device is in Standalone mode, the **Check for Updates** button will be shown. Selecting it checks the Bogen website for the latest firmware version available. If a version newer than the one currently installed is found, it is downloaded to the appliance and the **Update Firmware** button will be shown.
 - If you already have a firmware file you would like to install to the appliance, select **Upload Firmware** to upload the firmware file from your computer to the appliance. A popup screen appears that allows you to select the file that you want to upload. You can navigate to the file's location. After you select the file, select **Upload**.

The page displays the uploaded firmware version ("New Nyquist Version") and an **Update Firmware** button appears. Select this button if you want to update the appliance's firmware to the uploaded version.
 - If you want to return your appliance to its original factory configuration, select **Restore Factory Settings**.
 - Select **Reboot Appliance** to restart your appliance.

Table 3. Firmware Update settings

Current Nyquist Version	Shows the version of the appliance's currently installed firmware.
New Nyquist Version	Shows the version of the firmware that has been loaded, though not installed, onto the appliance.
Update Firmware	Available only when a new firmware version has been loaded onto the appliance (as specified in New Nyquist Version). Installs the loaded firmware. A reboot may be required after installation.
Upload Firmware	Prompts the user to specify a firmware file, which will then be loaded (though not installed) onto the appliance. <i>Note:</i> To obtain the firmware file for a specific version, please contact Bogen Technical Support.
Check for Updates	Available only when the appliance is configured for Standalone mode. Checks the Bogen website for the latest firmware version available and, if it finds a version newer than what is currently installed, downloads it to the appliance. <i>Note:</i> Ensure your Nyquist appliance has network access to bogen-ssu.bogen.com, port 22.
Restore Factory Settings	Returns the appliance to its original factory configuration. <i>Note:</i> This does not install the original appliance firmware. The firmware will not be changed.
Reboot Appliance	Restarts the appliance.

Network Settings Tab Parameters

Network settings can be configured dynamically by the Nyquist server or manually by using the appliance's web UI.

To manually configure network settings:

- 1 On the appliance web UI's main page, select **Network Settings**.

- 2 Select your desired network settings.
- 3 Select **Save**.

 **Network Settings** 

 Network Traffic Capture

IP Address:

192.168.90.18

Netmask:

255.255.255.0

Gateway:

192.168.90.1

VLAN ID:

VLAN Priority:

0 - Best Effort ▾

NTP Server:

192.168.90.10

TFTP Server:

192.168.90.10

TFTP Server from DHCP:

Yes ▾

DHCP Enabled:

Yes ▾

Reboot Appliance:

No ▾

 Save

Figure 4. Network Settings

 **Network Settings** 

IP Address:

192.168.90.18

Netmask:

255.255.255.0

Gateway:

192.168.90.1

DNS:

192.168.90.1

VLAN ID:

VLAN Priority:

0 - Best Effort ▾

NTP Server:

192.168.90.10

DHCP Enabled:

Yes ▾

Reboot Appliance:

No ▾

 Save

Figure 5. Network Settings (Standalone)

Network settings are described in the following table:

Table 4. Network Settings

Network Traffic Capture	Captures network traffic on this appliance and saves it to a PCAP file that can be downloaded to the user's computer. For details, see <i>Network Traffic Capture</i> in the Nyquist System Administrator Guide.
IP Address	Identifies the IP address assigned to the appliance.
Netmask	Identifies the subnetwork subdivision of an IP network.
Gateway	Identifies the address, or route, for the default gateway.
DNS	Identifies one or more space-delimited DNS server IP addresses. <i>Note:</i> If DHCP option 6 (DNS) is provided by a DHCP server, the DHCP-provided DNS configuration and this field will be ignored. <i>Note:</i> This field is only available when Standalone Operation is enabled.
VLAN ID	Identifies the Virtual Local Area Network (VLAN) for this appliance. Values range from 0 to 4094.
VLAN Priority	Identifies the priority of the network traffic on the VLAN. Priority can range from 0 through 7.
NTP Server	Identifies the IP address or the domain name of the Network Time Protocol (NTP) Server. <i>Note:</i> This field is only editable when Standalone Operation is enabled.

Table 4. Network Settings (Continued)

TFTP Server	Identifies the host name or IP address of the Trivial File Transfer Protocol (TFTP) server. The specified TFTP server can be used to automatically set this device's Configuration settings via the Get Configuration from Server button. If TFTP Server from DHCP (see below) is set to "Yes", this value will be auto-configured via DHCP option 66, assuming the DHCP server has been configured to provide option 66. For details, see the documentation for your DHCP server. <i>Note:</i> A TFTP server runs on the Nyquist server on port 69 (the standard TFTP port) and the optional Nyquist DHCP service automatically provides this TFTP address via option 66. <i>Note:</i> If this value is unspecified, the TFTP Server from DHCP will automatically be set to "Yes", this field will become read-only, and DHCP will be used to configure this setting. To change this value, the TFTP Server from DHCP setting must be set to No, which makes the field editable. <i>Note:</i> This setting is not available when Standalone Operation is enabled.
TFTP Server from DHCP	Yes means the device will use the DHCP option 66 value to retrieve an address for the TFTP Server from DHCP. No means the device will ignore the DHCP option 66 value and use the manually configured value of the TFTP Server (see above). <i>Note:</i> This setting is not available when Standalone Operation is enabled.
DHCP Enabled	Indicates if the device is enabled to use DHCP to retrieve its IP configuration.
Reboot Appliance	Indicates that this appliance should reboot when the Save button is clicked.

Configuration Settings Tab Parameters

The way to configure this Nyquist appliance is to obtain configuration settings from the Nyquist server by selecting **Get Configuration From Server**.

To view or modify the Nyquist appliance configuration:

- 1 On the appliance Web UI's main page, select **Configuration Settings**.
- 2 View the settings as described in Table 5 on page 12 for normal configuration, or modify the settings as described in "Standalone Operation Configuration Settings" on page 13 for Standalone Operation configuration.
- 3 If changes were made (Standalone Operation only), click the **Save Configuration Settings** and/or **Save Multicast Addresses** buttons to save your changes.

Configuration Settings

Get Configuration From Server

Web Username: admin

	IP Address	Port Number	Cut Level	Station List
Emergency-All-Call:	239.0.2.1	62001	-16	1
All-Call:	239.0.2.2	62002	-17	1
Audio Distribution:	239.0.2.3	62003	-28	1
Multicast 1:	239.0.2.10	62010	-21	1

Nyquist Control Password

Save Password

Device Stations

Port Number	Port Type	Account Id	Local Port	Username
1	Paging-Audio Amp	slp:197@172.31.19.203	5060	197

Figure 6. Appliance Configuration Settings

The following table describes the Configuration Settings tab settings when Standalone Operation is *not* enabled for this device:

Table 5. Configuration Settings (Standalone disabled)

Web Username	Provide a web username for this appliance.
Emergency-All-Call	Identifies the IP address, port number, cut level (volume), and station list used for emergency all-call pages.
All-Call	Identifies the IP address, port number, cut level (volume), and station list used for all-call pages.
Audio Distribution	Identifies the IP address, port number, cut level (volume), and station list used for audio distribution.
Multicast #	Identifies the IP address, port number, cut level (volume), and station list used for the multicast audio stream of a specific zone. If this device belongs to more than one zone, then multiple Multicast # entries will be displayed.
Nyquist Control Password	Specifies a password used to secure Nyquist control messages between this device and the Nyquist controller. This value must match the password specified on the Nyquist controller to support certain Nyquist features, such as sound masking, amp protection mode, and station check-in. The specified password must be exactly 20 characters long and include uppercase, lowercase, and numeric characters. <i>Note:</i> This password cannot be set unless the Web Password has been changed from the default value.

The **Configuration Settings** tab also displays the following information for each **Device Station** attached to the amplifier:

Port Number	Shows the port number of the appliance.
Port Type	Shows the station type to which the port connects.
Account ID	Shows the SIP account (IP address) associated with the device preceded by the extension of the device associated with this port.
Local Port	Shows the port used for SIP.
Username	Shows the username or extension for the station associated with the port.

Standalone Operation Configuration Settings

Configuring this device consists of specifying one or more of the following:

- The SIP server addresses, ports, and SIP extensions at which to register for incoming SIP calls.
- The input multicast (Receive) addresses (and ports) from which the device will receive encoded signals, which will then be converted to analog and played to both line output and speaker output.

To receive networked audio, configure one or more Multicast Addresses (Receive) entries with the multicast addresses, ports, and codecs from which to receive the encoded streams. Specify the cut level for the signal sent to the output channel, which encompasses both the line and speaker outputs.

Configuration Settings

Device Type:

NQ-GA40P3-Amplifier with Line In/Out

Device Name:

NQ-GA40P3

Web Username:

admin

Web Password:

Web Confirm Password:

Time Zone:

Select a time zone

Prioritize Line Input:

No

Output Power (Watts):

1/2

Enable SIP Calls:

Yes

SIP Server Address:

SIP Network Port:

SIP Codecs:

G722 ulaw alaw

SIP Extension:

SIP Username:

SIP Password:

Cut Level: -6 dB

Save Configuration Settings

Multicast Addresses (Receive)

Sorting:

Disabled

	Multicast IP Address	Multicast Port Number	Codec	Channels	Cut Level (dB)	Description
+	239.1.1.1	6000	G711 u-law	1	-20	Empty

Note: The following codecs are supported for multicast: G711 u-law, G711 a-law, G722, and OPUS.

Save Multicast Addresses (Receive)

Figure 7. Appliance Configuration Settings (Standalone enabled)

The following table describes the **Configuration Settings** tab settings when Standalone Operation is enabled for this device:

Table 6. Configuration Settings (Standalone enabled)

Device Type	Displays the type of this device.
Device Name	Provides a name for this device.
Web Username	Specifies a web username for this appliance.
Web Password	Specifies a web password for logging into the appliance.
Web Confirm Password	Re-enter the password used to log into the appliance.

Table 6. Configuration Settings (Standalone enabled)

Time Zone	Specifies the time zone in which the device resides.
Prioritize Line Input	If a channel simultaneously receives input signals from both a network input and a line input, "Yes" means line input is used, "No" means network input is used. Yes or No
Output Power (Watts)	Specifies the output power for the amplifier in Watts. Valid values are: ½, 1, 2, 4, 8, 16, and 32.
Enable SIP Calls	Enables this device to receive one-way SIP calls, wherein only the caller can be heard (such as announcements). If enabled, a number of SIP-related configuration settings are displayed.
SIP Server Address^a	Specifies the IP address of the SIP Registration Server with which the device will register.
SIP Network Port^a	Specifies the IP port on which to communicate with the SIP Registration Server (typically 5060).
SIP Codecs^a	Displays a read-only list of codecs allowed on SIP sessions.
SIP Extension^a	Specifies the SIP extension for this device. The extension, along with the IP address, is used to specify the URI used to place a SIP call to this extension: <pre>sip:<extension>@<local_ip_address></pre>
SIP Username^a	Specifies the SIP user name used to register the device with the SIP server.
SIP Password^a	Specifies the SIP registration password used to register the device with the SIP server.
Cut Level^a	Cut level for intercom calls. This can be a value from -42 to 0 dB.

a. Available only when Enable SIP Calls has a value of Yes.

The following parameters appear for each Multicast Address configured for this device.

Multicast IP Address	Specifies the multicast IP address on which to receive audio streams.
Multicast Port Number	Specifies the multicast port on which to receive audio streams.
Codec	Specifies the codec to be used when decoding audio. Select one of the following values: • G711 u-law • Intercom call quality • A narrowband audio codec that provides toll-quality audio at 64 kbps. The u-law version is primarily used in North America and Japan. • G711 a-law • Intercom call quality • A narrowband audio codec that provides toll-quality audio at 64 kbps. The a-law version is primarily used in most countries outside of North America and Japan. • G722 • Tone and paging quality • A wideband audio codec operating at 48, 56, and 64 kbps. • OPUS • Music quality • An audio codec format designed for speech and general audio, supporting low latency, constant and variable bitrate encoding (6 to 510 kbps), and five sampling rates (from 8 to 48 kHz).
Channels	Channel(s) on which the audio streams will be output. This is a single-channel device, so the only available selection is "1".

Tip: Fine tuning of levels per output channel can be adjusted using DSP settings.

Cut Level (dB)

Specifies the cut level for the audio stream.

This can be a value from –70 to 0 dB.

The default value is –20 dB.

Note: To modify, click on the value, adjust the slider on the popup using the cursor keys or mouse, and click the check box button.

Tip: To fine tune the cut level per channel, adjust the gain settings on the DSP Router.

Description

User-specified description of this multicast address.

This setting can contain a maximum of 30 characters and should not contain any of the following: [] {} <> , | :

Note: A maximum of 24 multicast entries is supported.

Multicast Addresses should be ordered by priority, highest priority first. If multiple streams are active on the same channel simultaneously, the one with the highest priority will be played. Set the **Sorting** switch to Enabled and drag entries using the 4-way arrow symbols to drag entries up and down to rearrange the priorities.

Accessing Log Files

A log file records events and messages that occur when software runs, to be used when troubleshooting the appliance. From the appliance's web-based UI, log files can be viewed directly or exported via download to your PC, Mac, or Android device, where they can be copied to removable media or attached to an email for technical support.

To view a log file:

- 1 On the appliance Web UI's main page, select **Logs**.
- 2 From the drop-down menu, select the log that you want to view.
Multiple versions and zipped copies of a log may be available.

- 3 To export the file, select **Export**.
The log file will be downloaded to your browser.

View Logs

sw_versions.log

/var/log/sw_versions.log

Export

Debian 8.6 - Linux kernel version:
4.9.0-rc7-bone3 #5 Fri Dec 2 09:26:11 EST 2016 armv7l GNU/Linux

Software Components:

Log Settings

Logging Level: ERROR

Logging Categories

Log Registration: No

Log Intercom: No

Log Check-In: No

Log Multicast: No

Log PTT: No

Log Sound Masking: No

Save

Status Reporting Settings

Enable Status Reporting: No

Network IP Address:

Network Port: 0

Status Reporting Categories

Intercom: No

Paging: No

Save

Figure 8. Logs

Available logs are described in the following table.

Table 7. Logs

Log	Description
ampws.log	Contains information about protection status and logs protection events with temperature information at the time of event.
auth.log	Contains system authorization information, including user logins and authentication methods that were used.
daemon.log	Contains information logged by the various background daemons that run on the system.
debug	Contains errors and debug information.
dmesg	Contains information about hardware, device driver initialization, and kernel module messages that take place during system startup.
dpkg.log	Contains information that is logged when a package is installed or removed using dpkg command.
kern.log	Contains information logged by the kernel and recent login information for all users.
messages	Contains messages generated by Nyquist.
sw_versions.log	Contains the names and version numbers of key software components used by the Nyquist appliance.
syslog	Contains list of errors that occur when the server is running and server start and stop records
user.log	Contains information about all user level logs.

Log Settings

Log Settings provides the ability to specify the level of detail to be logged at run time (in the *syslog* and *daemon.log* files) for each of several categories.

Note: These settings do not filter the display of events that have already occurred; they indicate which subsequent events will be logged.

Table 8. Log Settings

Logging Level	Indicates the level of detail to be logged at runtime. Valid values are: NONE: No Nyquist logging will be performed. ERROR: Only error conditions will be logged. These are conditions that prevent the appliance from operating correctly. WARNING: Warning and error conditions will be logged. INFO: All information will be logged, including informational, warning, and error conditions. The default value is ERROR.
Logging Categories	Indicates which event categories will be logged for this device. Any number of categories can be enabled. By default, all categories are disabled.
Log Registration	Log detailed information related to station registration.
Log Intercom	Log detailed information related to intercom calls to and from the appliance, as well as talkback parameters.
Log Check-In	Log detailed information related to station check-ins.
Log Multicast	Log detailed information related to incoming multicast pages or audio distribution.
Log PTT	Log detailed information related to Push-to-Talk features.
Log Sound Masking	Log detailed information related to amplifier sound masking, such as spectrum preset applied, slow and fast ramping, and scheduled ramping.

Status Reporting Settings

The **Status Reporting Settings** section provides the ability to configure network-based status reporting for this device.

When an event of any of the specified **Status Reporting Categories** occurs, a JSON packet will be sent to the specified IP address and UDP port containing the event infor-

mation. The JSON will be formatted in the following format (the fields are described in *Table 9, "Status Event JSON elements," on page 21*):

```
{"device":"<string>","port":<int>,"event":"<string>","state":"<string>"}
```

Table 9. Status Event JSON elements

JSON key	Value Description
device	MAC address of the reporting station, with hexadecimal bytes separated by colons (:).
port	The port on the Nyquist appliance to which the reporting station is connected. Valid integer values range from 1 (for most appliances) to 24.
event	The type of event that occurred. Valid values are: • INTERCOM • PAGE
state	The status of the event. Valid values are: • PENDING • IN_PROGRESS • TERMINATED

To configure the Status Reporting for this appliance, set **Enable Status Reporting** to **Yes**, configure the **Network IP Address** and **Network Port** (a UDP port) to which status

events will be sent, and specify which **Status Reporting Categories** to send, as described in *Table 10*.

Table 10. Status Reporting Settings

Enable Status Reporting	Enables network-based status reporting whenever a call changes state on a given port. PENDING: Call setup in progress, but not yet connected. IN_PROGRESS: Call or page established. TERMINATED: Call or page ended. This setting is disabled by default.
Network IP Address	The network IP address to which status messages will be sent.
Network Port	The network UDP port to which status messages will be sent.
Status Reporting Categories	Status event types to be sent to the event logging server.
Intercom	Report intercom-related events.
Paging	Report paging-related events.

Setting DSP Parameters

When you select **DSP** from the appliances web UI, the DSP page appears.

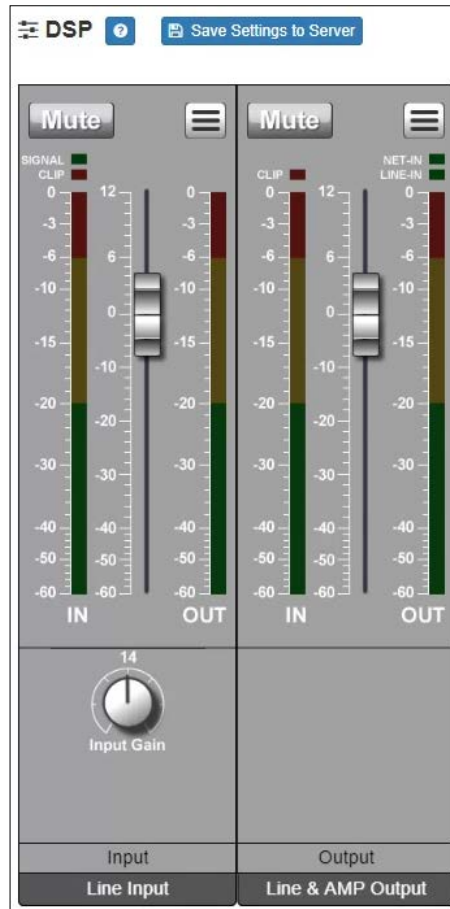


Figure 9. DSP Page

From this page, you can adjust settings in the DSP. The appliance uses traditional processors (for example, Compressor, Limiter) for audio signals in the digital domain.

The DSP page shows **Mute** and level selections for the input and output channels and allows you to adjust the channel input gain level.

Selecting the **Menu** button displays other parameters. DSP parameters and the **Mute** and level controls are described in the following table.

Table 11. DSP Page

Save Settings to Server	Backs up the DSP settings to the server. If this device is later replaced or reset to factory defaults, these DSP settings can be restored when the new device is “swapped” for the old on the Nyquist server. <i>Note:</i> This button appears on each DSP feature page.
Mute	Silences the audio.
DSP Features button 	Presents a menu of DSP features that can be applied to the corresponding channel.
Channel Fader	Adjusts the channel volume level in 1-dB increments.
Signal LED	Illuminates when a signal is present.
Clip LED	Illuminates when a signal has exceeded the maximum threshold, indicating that the signal is “clipping.” <i>Note:</i> When Sound Masking is enabled, Clip LED is illuminated.
NET-IN LED	Illuminates when a signal is being received from the Network stream input. <i>Note:</i> When Sound Masking is enabled, NET-IN LED is illuminated.
LINE-IN LED	Illuminates when a signal is being received from the analog Line input.
IN VU meter (Line Input)	Indicates the strength of the analog input signal.
OUT VU meter (Line Input)	Indicates the strength of the output from the analog signal.
IN VU meter (Line & AMP Output)	Indicates the strength of the network input signal.
OUT VU meter (Line & AMP Output)	Indicates the strength of the channel output signal for both Line Output and Speaker Output.
Input Gain	Adjusts the strength of the analog line input signal.

The DSP features that can be applied to a channel, accessible through the DSP Features menu, are described in the following table.

Table 12. DSP Features

Compressor	Lessens the dynamic range between the loudest and quietest parts of an audio signal.
High/Low Pass	Sets the band of frequencies that will pass through the high pass and low pass filters and selects the type of filter that is used.
Limiter	Prevents a signal from exceeding an adjustable maximum level.
Outputs	Allows you to enable speaker or line outputs and to adjust the volume level for each output.
Parametric EQ	Uses a center/primary frequency to allow tailoring of the frequency content of an audio signal.
Settings	Allows you to provide names and colors for the input channel.
Signal Present	Illuminates green when audio is present in the channel input.
Reset button 	Present on almost all DSP screens other than the main mixer, this button will reset the DSP settings to the displayed feature's default setting.

Setting the Channel Level

The channel level control is a *channel fader*, which is adjusted in 1-dB increments and controls the output level for the channel. The channel levels can range from -60 to +12 dB. If you place the mouse over the fader, the numerical value of the level appears.

Adjusting Volume Levels

The channel fader control can be used to adjust the channel's output level in 1-dB increments between -60 and +12 dB. The overall adjusted output level of the channel signal can be viewed on the **OUT** VU meter, marked in 2-dB increments between -60 and 0 dB.

Tip: For best results, adjust input signal levels until you have a strong signal (i.e., within the green and yellow areas on the meter), then adjust the final output levels using the DSP Outputs controls.

To adjust the channel volume level:

- 1 On the appliance Web UI's main page, select **DSP**.
- 2 Use the channel's fader to adjust the volume level.

Knob Adjustments

Many DSP controls use knobs to adjust one or more settings. The value of a knob can be adjusted in one of two ways:

- 1 Click the knob control, hold the mouse button down, and drag the mouse up or down to increase or decrease the value.
- 2 Double-click the knob, type a value into the resulting popup, and click the Save button.

Signal Indicators

Each input channel has signal indicators and two vertical volume unit (VU) meters, labeled "IN" and "OUT".

The green input signal LED(s) automatically illuminates when a signal is being received.

The red **Clip** LED automatically illuminates when the signal is clipping (i.e., exceeding a predefined threshold). Clipping can result in distortion and, for output signals, can even damage speakers. Note that the specific level and duration that a signal must reach in order to trigger the input signal LED can be configured via the **Signal Present** settings.

The "IN" VU meter indicates the strength of the channel's input signal (after gain adjustments), while the "OUT" VU meter indicates the strength of the channel's output signal. The VU meter not only illuminates green, yellow, or red (depending on the signal level), but also has a scale ranging from -60 to 0 dB to indicate the actual signal level.

Muting a Channel

You can mute a channel to cut off an audio signal and stop the input signal from being sent to the output channel. Note the input signal will still be visible on the IN meter, but the OUT meter will show that nothing is being forwarded to the output channel.

To mute a channel:

- 1 On the appliance Web UI's main page, select **DSP**.
- 2 Click the **Mute** button for the channel that you want to silence.

The **Mute** button will illuminate red. You can click the **Mute** button again to unmute the channel.

Compressor

A compressor reduces the dynamic range of a signal. This effect is perceived as quieting loud sounds and boosting quiet sounds.



Figure 10. Compressor Settings

To adjust the compressor settings for a channel:

- 1 On the appliance Web UI's main page, select **DSP**.
- 2 Select the **Menu** button for the channel.
- 3 From the drop-down menu, select **Compressor**.
- 4 Make desired adjustments using the controls described in Table 13, "Compressor Settings," on page 28.

Note: If you want to return to the factory settings, select the **Reset** icon that appears in the right corner.

- 5 Select **Enable** to apply the settings to the selected channel.

Table 13. Compressor Settings

Enable	Enables or disables the compressor DSP effect for this channel.
Threshold	Sets the threshold level, which is the point where the signal activates the compressor circuit. The range is -135 to +21 dB.
Attack	Sets how quickly or slowly compression will be applied to the signal once the audio signal goes above the threshold level. It specifies the length of time over which the compression ratio will gradually increase from no compression to full compression. The range is 1 to 500 ms.
Hold	Sets how long compression will be applied after the signal has fallen below the threshold. The range is 1 to 500 ms.
Decay	Sets how quickly or slowly compression will be removed from the signal after the signal has dropped below the threshold <i>and</i> the Hold interval has expired. It specifies the length of time over which the compression ratio will gradually decrease from full compression to no compression. The range is 0 to 2000 ms.
Knee	Sets how far below the threshold compression will begin to be <i>gradually</i> applied to the signal. A very low value, known as a <i>hard knee</i>, immediately applies full compression once the threshold is reached. A high value, known as a <i>soft knee</i>, will gradually start applying compression before the signal reaches the threshold, not reaching the full effect until the threshold is reached, thereby "rounding off" the compression effect. Increasing the knee level decreases the obvious transition from the uncompressed to the compressed sound. The range is 1 to 100 dB.

Table 13. Compressor Settings

Ratio	Sets the compression ratio to be applied to the signal. For example, if the ratio is set for 6 (6:1), the input signal must increase by 6 dB for the output level to increase by 1 dB. The range is 1 to 100.
Input meter	Shows the strength of the input signal.
Output meter	Shows the strength of the output signal, providing a visual indicator of the effect of the compressor on the output signal.
Comp LED	Illuminates when compression is being applied to the signal.

High/Low Pass

High-pass filters allow signals that are higher than the specified frequency and attenuate signals that are lower. Low-pass filters allow signals that are lower than the specified frequency and attenuate signals that are higher. When combined, they are known as a *band-pass filter*. Band-pass filters can be used to tailor the frequency response of a microphone exclusively for vocals, which can be very useful in a noisy environment to filter out the higher and lower frequencies that could mask the human vocal range during announcements.

You can specify the range of frequencies that will pass through the high-pass and low-pass filters and select the type of filter that is used through the channel's **High/Low Pass** drop-down menu option.



Figure 11. High/Low Pass Parameters

To adjust the high/low pass parameters for a channel:

- 1 On the appliance Web UI's main page, select **DSP**.
- 2 Select the **Menu** button for the channel.
- 3 From the drop-down menu, select **High/Low Pass**.

Note: If you want to return to the factory settings, select the **Reset** icon that appears in the right corner.

- 4 Set the parameters described in the following table:

Table 14. High/Low Pass Parameters

High-Pass (Low Cut)

This feature helps eliminate low-frequency noise (signals of 100 Hz and below, such as background rumble from ventilation systems, etc.) and is used primarily with microphone-level input. It is particularly effective when handheld microphones are used.

Enable Enables or disables the High-Pass filter.

Table 14. High/Low Pass Parameters (Continued)

Frequency	Set the cutoff frequency. You can adjust the frequency by moving the knob (click and move up or down) or by double-clicking the knob and typing the frequency. When typing the frequency, only numeric values from 20 Hz to 20,000 Hz can be entered. The high-pass filter attenuates content below this frequency and lets frequencies above this cutoff frequency pass through the filter.
Type	Available filter types are: • Linkwitz-Riley (12, 24, 36, and 48 dB per octave) • Butterworth (6, 12, 18, 24, 30, 36, 42, and 48 dB per octave) • Bessel (12, 18, and 24 dB per octave) <i>Note:</i> The term "dB per octave" describes how steeply frequencies below the selected cutoff frequency are attenuated. For example, if the cutoff frequency is 100 Hz and the filter type specifies 12 dB per octave, a 50-Hz signal (i.e., one octave lower) will be attenuated by 12 dB and a 25-Hz signal (i.e., two octaves lower) will be attenuated by an additional 12 dB.
Low-Pass (High Cut)	
This feature helps eliminate high-frequency noise (signals of 8000 Hz and above) such as background hiss and sibilance (excessive "S" in vocals, etc.) and is used primarily with microphone-level input. It is particularly effective when handheld microphones are used.	
Enable	Enables or disables the Low-Pass filter.

Table 14. High/Low Pass Parameters (Continued)

Frequency	Set the cutoff frequency. You can adjust the frequencies by moving the knob (click and move up or down) or by double-clicking the knob and typing the frequency. When typing the frequency, only numeric values from 20 Hz to 20,000 Hz can be entered. The low-pass filter attenuates content above this frequency and lets frequencies below this cutoff frequency pass through the filter.
Type	Available filter types are: • Linkwitz-Riley (12, 24, 36, and 48 dB per octave) • Butterworth (6, 12, 18, 24, 30, 36, 42, and 48 dB per octave) • Bessel (12, 18, and 24 dB per octave) <i>Note:</i> The term “dB per octave” describes how steeply frequencies above the selected cutoff frequency are attenuated. For example, if the cutoff frequency is 8,000 Hz and the filter type specifies 12 dB per octave, a 16,000-Hz signal (i.e., one octave higher) will be attenuated by 12 dB and a 32,000-Hz signal (i.e., two octaves higher) will be attenuated by an additional 12 dB.

Limiter

A limiter is a compressor with a high slope (i.e., attack) that is used to prevent a signal from exceeding a set decibel level. Limiters are used as safeguards against signal clipping.

Limiter parameters are set per channel.



Figure 12. Limiter Settings

To adjust the limiter settings for a channel:

- 1 On the appliance Web UI's main page, select **DSP**.
- 2 Select the **Menu** button for the channel or select the **Menu** button for the **Output**.
- 3 From the drop-down menu, select **Limiter**.

Note: If you want to return to the factory settings, select the **Reset** icon that appears in the right corner.

- 4 Adjust the following settings as needed:

Table 15. Limiter Settings

Threshold	Sets the signal level at which the limiter is triggered. Any signal exceeding this threshold will be compressed to this level. The range is -24 to +24 dB.
Decay	Sets the rate for turn off of the limiter after the signal is below the threshold. Decay range is 5 to 2300 milliseconds.
RMSTC (Root Mean Square Time Constant)	Sets how fast the limiter reacts to a signal that has exceeded the threshold. RMSTC range is 50 to 10000 dB/sec.

Adjusting Outputs

Selecting **Outputs** allows you to enable and adjust the volume levels for speaker and line outputs.

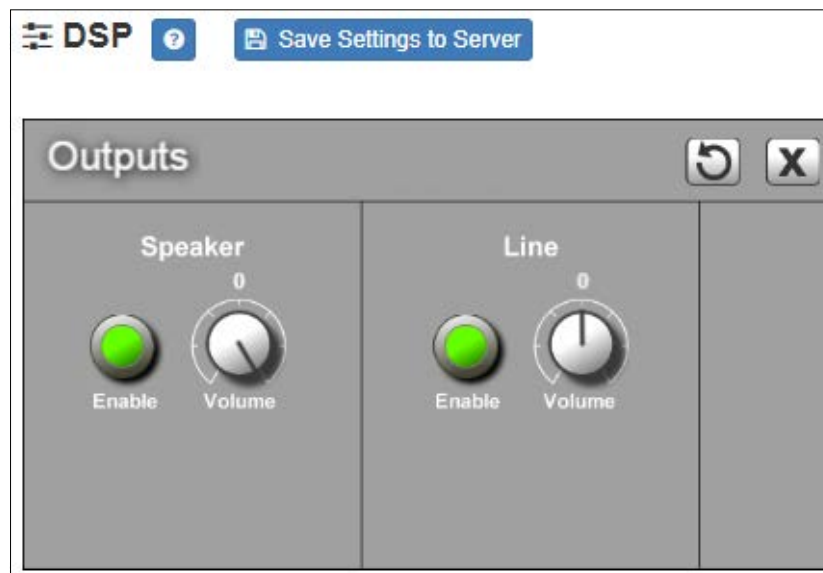


Figure 13. Outputs

To adjust outputs for speaker or line:

- 1 On the appliance Web UI's main page, select **DSP**.

- 2 Select the **Menu** button.
- 3 From the drop-down menu, select **Outputs**.
- 4 To enable outputs for a speaker or line, select **Enable** for the corresponding output.
- 5 Make desired Volume adjustments by adjusting the knob. Volume levels range from 0 to 15 dB for the Speaker Output and -15 to +15 dB for the Line Output.

Parametric EQ

A parametric equalizer is a multi-band variable equalizer that allows control of frequency amplitude (boost/cut), center frequency, and frequency bandwidth, or Q.

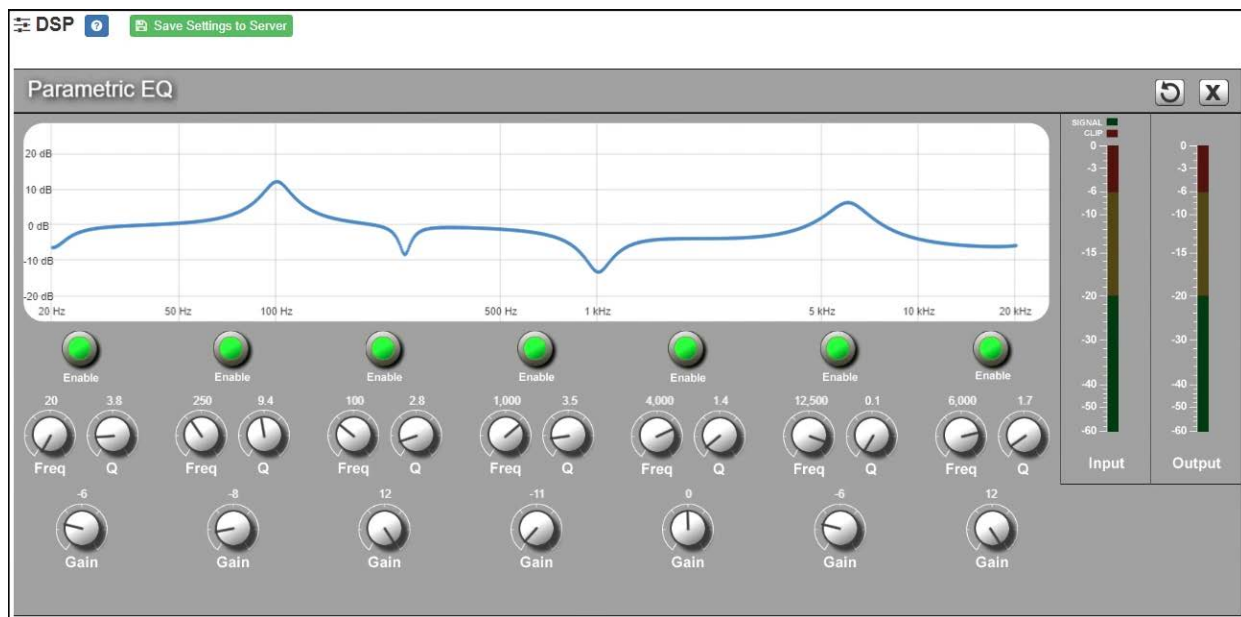


Figure 14. Parametric Equalizer Settings

The parametric equalizer settings for your device allows you to adjust the Q and gain for seven separate frequencies, which then become plot points on the screen's graph.

To adjust the parametric equalizer settings for a channel:

- 1 On the appliance Web UI's main page, select **DSP**.
- 2 Select the **Menu** button for the channel.
- 3 From the drop-down menu, select **Parametric EQ**.

Note: If you want to return to the factory settings, select the **Reset** icon that appears in the right corner.

- 4 Adjust frequencies as desired, ensuring the **Enable** LEDs are green for each selected frequency. You can adjust the frequencies by moving the **Freq** knob or by double-clicking the knob and typing the frequency. When typing the frequency, only numeric values from 20 to 20,000 can be entered.
- 5 Make desired **Q** adjustments by adjusting knob (or double-clicking and typing the desired adjustment). Q can be from 0.1 to 20 and sets how wide to either side of the selected frequency the adjacent frequencies are affected.

Q is the Quality or Quality Factor, which refers to the bandwidth of one band of a parametric equalizer. Q is calculated by dividing the center frequency in Hz by the width of the boost or cut zone, +3 dB or -3 dB above or below 0 dB.

- 6 For each frequency, use the **Gain** knob or double-click the knob and type the gain to either boost (turn up) or cut (turn down).

Gain knobs can be moved between +12 or -12 dB. By default, each knob is set at 0 dB, which means that no frequencies are being boosted or cut.

- 7 Select **Save Settings to Server**.

Settings

You can set select a name and a color for the input channel.

The screenshot shows a web interface for configuring DSP settings. At the top, there's a header with 'DSP' and a 'Save Settings to Server' button. Below this is a 'Settings' window with a title bar containing a refresh icon and a close icon. The window has two sections: 'Input' and 'Output'. Each section has a 'Name' text input field and a 'Color' dropdown menu. The 'Input' section has 'Input' in the name field and 'Grey' in the color dropdown. The 'Output' section has 'Output' in the name field and 'Grey' in the color dropdown. A green 'Save' button is located in the bottom right corner of the settings window.

Figure 15. Settings Parameters

To adjust the settings for the channel:

- 1 On the appliance Web UI's main page, select **DSP**.
- 2 Select the **Menu** button for the channel.
- 3 From the drop-down menu, select **Settings**.
- 4 Type the name that you want to display for the channel.
- 5 Select a color that will be used to highlight the channel.

Note: If you want to return to the factory settings, select the **Reset** icon that appears in the right corner.

- 6 Select **Save**.

Signal Present

You can configure the threshold level that a signal must reach before the signal LED is lit, as well as how long the LED will remain lit. You can configure this for each channel.



Figure 16. Signal Present Parameters

To adjust the Signal Present settings for a channel:

- 1 On the appliance Web UI's main page, select **DSP**.
- 2 Select the **Menu** button for the channel.
- 3 From the drop-down menu, select **Signal Present**.

Note: If you want to return to the factory settings, select the **Reset** icon that appears in the right corner.

- 4 Adjust the following settings as needed.

Table 16. Signal Present Parameters

Threshold	Sets the minimum level the signal must reach before the signal LED is illuminated. Threshold range is -144 to +24 dB.
Hold	Sets the minimum number of milliseconds that the signal LED will remain illuminated. Hold range is 2 to 200 milliseconds.

Appendix A: Bogen Digital Certification Authority

When a client (e.g., a web browser) connects to the Bogen device's web application, the device's digital certificate is sent to the client to authenticate the identity of the device's web application. The client uses the Bogen Certification Authority (CA) certificate to authenticate the device's digital certificate, which verifies that the client is connecting to a valid server. If the Bogen CA certificate is not installed on the client, the browser will display a warning that it was unable to authenticate the server, displaying a red *Not secure* warning immediately to the left of the browser's address bar (or a similar warning, depending on the browser) after it attempts to access the Bogen device.

The following sections provide instructions for downloading and installing the Bogen CA in various environments.

Tip: The Bogen CA can be downloaded using the cURL command instead of via the browser. If you prefer that method, issue the following command in lieu of step 1 of the subsequent installation instructions:

```
curl.exe --insecure https://<device>/ssl/bogenCA.crt > bogenCA.crt
```

Tip: Some browsers do not recognize newly installed CAs until after the browser has restarted. Browse to <chrome://restart> in a Chromium-based browser or <edge://restart> in the Edge browser to restart all open browser windows.

Installing Certification Authority on Windows System

To download and install the Certification Authority on a Windows device:

- 1 From your Chrome or Edge browser, type `http://<device>/ssl/bogenCA.crt` in the address bar, where `<device>` is the Nyquist device's IP address or DNS name (for example, `http://192.168.1.0/ssl/bogenCA.crt`).
- 2 Select the downloaded file and select **Open**.
- 3 Select Open when prompted with "Do you want to open this file?"
- 4 Select the **Install Certificate...** button. The Certificate Import Wizard starts.
- 5 Select **Current User**, and then select **Next**.

Note: To allow *all* users on this Windows client to access the Nyquist device, select **Local Machine** instead of **Current User**. You may be prompted for administrator credentials.

- 6 Select "Place all certificates in the following store", then select **Browse**.
- 7 Select **Trusted Root Certification Authorities**, and then select **OK**.
- 8 Select **Next**.

9 Select **Finish**.

10 Restart the browser and log in to the device's web application.

Install Certificate Authority using PowerShell (optional)

You can optionally download and install the Certification Authority using a PowerShell command prompt or script, which involves fewer steps.

To download the certificate to a CRT file, execute the following PowerShell command, replacing <device> with the IP address or DNS name of the Nyquist device:

```
Invoke-WebRequest -Uri http://<device>/ssl/bogenCA.crt -OutFile $env:TEMP\bogenCA.crt
```

To optionally validate the certificate before importing it, execute the following command:

```
[Security.Cryptography.X509Certificates.X509Certificate2]::new(  
"$env:TEMP\bogenCA.crt").GetCertHashString() -eq '0A8248F69D970F8DD855D0E0592972DA64B1A845'
```

If the command returns True, the certificate is valid.

To install the CA certificate into the CurrentUser certificate store, which only applies to the current user, execute the following command:

```
Import-Certificate -CertStoreLocation cert:\CurrentUser\Root -FilePath $env:TEMP\bogenCA.crt
```

To install the certificate for all users on this machine, which requires administrator privileges to execute, execute the following command:

```
Import-Certificate -CertStoreLocation cert:\LocalMachine\Root -FilePath $env:TEMP\bogenCA.crt
```

Note: These commands can be executed remotely using PowerShell Remoting, which may be helpful if the certificate needs to be installed on multiple client machines.

Installing Certification Authority on Mac System

To download and install the Certification Authority on a Mac:

- 1 From your Safari browser, type `http://<device>/ssl/bogenCA.crt` in the address bar, where <device> is the Nyquist system device's IP address or DNS name (for example, `http://192.168.1.0/ssl/bogenCA.crt`).
- 2 Save the downloaded `bogenCA.crt` file to the desktop.
- 3 Double-click the certificate file on the desktop.
The Keychain Access App opens.
- 4 Double-click the certificate to reveal the trust settings.
- 5 Change the top trust setting to **Always Trust**.
- 6 Close the Trust Setting window and enter the computer administrative password to save.
- 7 Restart the browser and log in to the Nyquist web application.

Installing Certification Authority on an Android Device

Note: The Android device WiFi must be connected to the same network as the Nyquist Server.

To download and install the Certification Authority on an Android device:

- 1 From your Chrome or Edge browser, type `http://<device>/ssl/bogenCA.crt` in the address bar, where `<device>` is the Nyquist device's IP address or DNS name (for example, `http://192.168.1.0/ssl/bogenCA.crt`).
- 2 If prompted, verify your identity (e.g., enter your PIN or fingerprint).
- 3 Type a certificate name (e.g., "Bogen CA"), specify "VPN and apps" under "Used for", and select **OK** to install the certificate.

Installing Certification Authority on an iOS Device

Note: The iOS device WiFi must be connected to the same network as the Nyquist Server.

To download and install the Certification Authority on an iPhone Operating System (iOS) device:

- 1 From your Safari browser, type `http://<device>/ssl/bogenCA.crt` in the address bar, where `<device>` is the Nyquist device's IP address (for example, `http://192.168.1.0/ssl/bogenCA.crt`).
- 2 Select **Go**.
- 3 Select **Allow** when prompted to allow the download.
- 4 Select **Close** after the notification that a profile was downloaded.
- 5 Select **Settings > General > VPN & Device Management**.
- 6 Select the **Bogen CA** certificate under **DOWNLOADED PROFILE**.
- 7 Select **Install**.
- 8 If prompted, enter your passcode.
- 9 On the **Warning** page, select **Install**.
- 10 Select **Done**.
- 11 Select **Settings > General > About > Certificate Trust Settings**.
- 12 Under **ENABLE FULL TRUST FOR ROOT CERTIFICATES**, enable the switch next to **Bogen CA**.

Viewing the Certificate

The following steps outline how to view and verify the TLS/SSL certificate that was provided by the Nyquist device.

Important: The user interfaces for browsers change not infrequently, so the exact details may vary from what is described in the following instructions. Some security packages can also affect the information available, such as antivirus software that injects its own CA certificate in lieu of the website's actual certificate, which has the effect of hiding the actual certificate from the user.

- 1 Browse to the Bogen device's web application in your browser (using Safari on iOS, Chrome or Edge on all other platforms).
- 2 Select the lock icon on the address bar of the browser (to the left of the URL).
- 3 Display the CA certificate by following one of the following steps:
 - a) On the Chrome or Edge browser, select **Connection is secure**, then select either **Certificate is valid**, the certificate icon, or **Certificate information** to display the Certificate Viewer dialog. Select the Details tab, then Bogen CA in the Certificate Hierarchy section.
 - b) On the Safari browser *[MacOS or iOS only]*, select **Show Certificate** in the window that appears.
 - c) As an alternative on Android devices, select the Android system's **Settings > Biometrics and security > Other security settings > View security certificates**, select the **USER** tab, and select the Bogen certificate.
- 4 Verify that the Bogen CA certificate is selected and not the server certificate (the server certificate's name will be an IP address). To verify that the certificate is valid, verify that the displayed fingerprint values match the following:

SHA-1: 0A 82 48 F6 9D 97 0F 8D D8 55 D0 E0 59 29 72 DA 64 B1 A8 45

SHA-256: 6B D0 D5 8D C8 F7 E8 03 9E A3 F1 52 32 1D 9C 5C 58 8B 4E FA DF 03 43 64 34 C2 6C 63 C5 4A AC 46