

## VoIP Settings & Configuration

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### A. VoIP Overview

RTI devices with VoIP (Voice over IP) support currently support peer-to-peer communication with other RTI devices and 3rd party devices that support the SIP protocol. Audio is supported via either G.711-ALaw or G.711-Ulaw codecs.

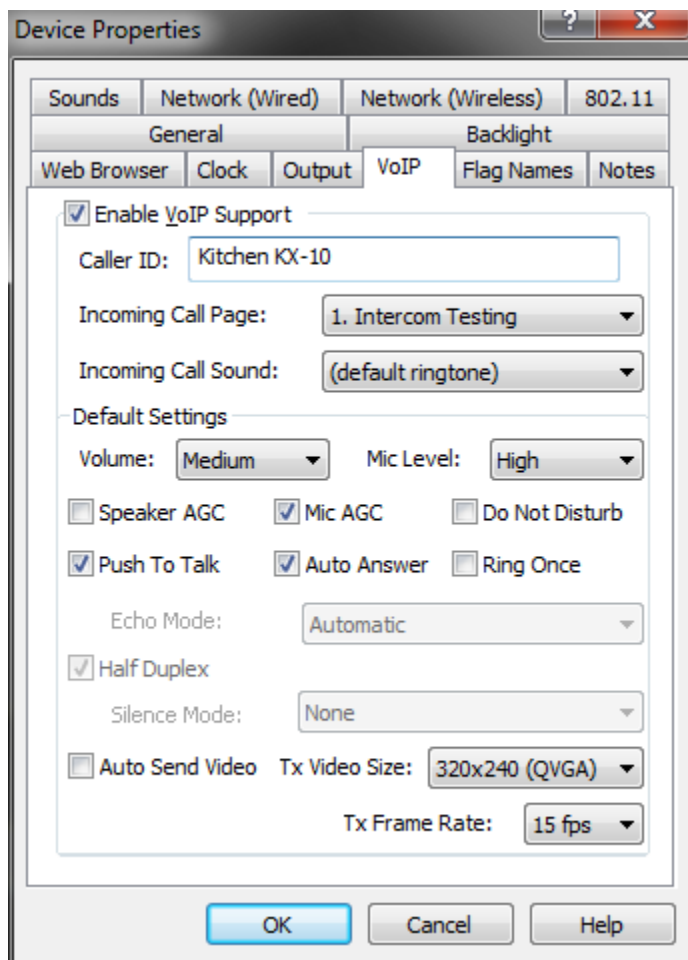
Bi-directional video streaming is supported via the H.264 codec. Currently, only the H.264 baseline profile is supported.

### B. Device Setup

The device is configured via the VoIP tab of the devices Device Properties dialog in Integration Designer.

#### Settings:

- Enable VoIP Support – toggle on to enable VoIP
- Incoming Call Page – the page to change to when receiving a call
- Incoming Call Sound – the sound to play when receiving a call
- Volume – the call volume
- Mic Level – the microphone level
- Speaker AGC – automatic gain control – adjusts gain to help amplify low-level audio
- Mic AGC – automatic gain control – adjusts mic gain to help amplify low-level audio
- Do Not Disturb – indicates whether or not the device will accept incoming calls
- Push To Talk – indicates whether or not to enable the push-to-talk feature
- Auto Answer – indicates whether or not the device should automatically answer an incoming call
- Ring Once – toggle on to ring once before auto answering
- Echo Mode – sets the current echo suppression mode (see below)
- Half Duplex – indicates whether or not to enable half-duplex mode (see below)
- Silence Mode – sets the current silence suppression mode (see below)
- Auto Send Video – automatically send video when the call is instantiated. Leave unchecked if the device won't be sending video as part of the VoIP call
- Tx Video Size – the size of the outgoing video frames
- Tx Frame Rate – the frame rate of the outgoing video



### C. Control Objects

The following control object commands are available via the Intercom control object:

- Video: Incoming Video – defines the area to place incoming video. Parameters are:
  - Rx Frame Size – indicates to the other party the preferred size for video frames
  - Display Mode – indicates whether to center or stretch the incoming video
- AGC Mic: Disable – disable Automatic Gain Control for outgoing audio
- AGC Mic: Enable – enable Automatic Gain Control for outgoing audio
- AGC Mic: Toggle – toggle state of Automatic Gain Control for outgoing audio
- AGC Speaker: Disable – disable Automatic Gain Control for incoming audio
- AGC Speaker: Enable – enable Automatic Gain Control for incoming audio
- AGC Speaker: Toggle – toggle state of Automatic Gain Control for incoming audio
- Call: Answer – answer an incoming call
- Call: Hang Up – hang up the current call
- Call: Reject – reject an incoming call
- Dial: Extension – the extension of the device to call. This is only valid when using a SIP Server (see the SIP Server Registration section below)
- Dial: IP Address – dial the device with the given IP address
- Dial: RTI Device – dial the given RTI device
- Echo: Set Mode – set the echo suppression mode (None, Automatic or Fixed)
- Echo: Threshold Down – adjust the echo suppression threshold down (Fixed mode only)
- Echo: Threshold Set – adjust the echo suppression threshold to the given value (Fixed mode only)
- Echo: Threshold Up – adjust the fixed echo suppression threshold up (Fixed mode only)
- Half-Duplex: Disable
- Half-Duplex: Enable
- Half-Duplex: Toggle
- Mic: Level Down – adjust the microphone level down
- Mic: Level Set – adjust the microphone level to the given value
- Mic: Level Up – adjust the microphone level up
- Mic: Toggle Mute – toggles microphone mute
- Push to Talk: Disable – disable the push to talk feature
- Push to Talk: Enable – enable the push to talk feature
- Push to Talk: Talk – Push and hold to talk (enables the Mic, cuts the speakers)
- Push to Talk: Toggle – toggle the push to talk feature
- Send DTMF – sends DTMF characters to the other party
- Settings: Toggle Auto Answer – toggle the auto answer state
- Settings: Toggle Auto Answer Ring Once – toggle auto answer ring one state
- Settings: Toggle Do Not Disturb – toggle the do not disturb state
- Silence: Set Mode – set the silence suppression mode (None, Automatic or Fixed)

- Silence: Threshold Down – adjust the silence suppression threshold down (Fixed mode only)
- Silence: Threshold Set – adjust the silence suppression threshold to the given value (Fixed mode only)
- Silence: Threshold Up – adjust the silence suppression threshold up (Fixed mode only)
- Video: Auto Tx Video: Disable - disable setting indicating whether or not to send outgoing video when the call is initiated
- Video: Auto Tx Video: Enable - enable setting indicating whether or not to send outgoing video when the call is initiated
- Video: Auto Tx Video: Toggle - toggle setting indicating whether or not to send outgoing video when the call is initiated
- Video: Set Tx Frame Rate – adjust the outgoing video frame rate
- Video: Set Tx Frame Size – adjust outgoing video frame size
- Video: Tx Video: Disable – disable outgoing video
- Video: Tx Video: Enable – enable outgoing video
- Video: Tx Video: Toggle – toggle outgoing video
- Volume: Down – adjust the call volume down
- Volume: Set – adjust the call volume to the given value
- Volume: Up – adjust the call volume up

### D. Internal Variables

The following internal variables are available for the intercom:

- Auto Answer Enabled – indicates whether or not auto-answer is enabled
- Auto Answer Ring Once Enabled – indicates whether or not auto-answer ring once is enabled
- Caller – a string containing the identification of the other party
- Call Duration – the Duration of the current call
- Call In Progress – indicates whether or not a call is in Progress
- DND Enabled – indicates whether or not “do not disturb” is enabled
- Echo Suppress Half-Duplex – indicates whether or not half-duplex is enabled
- Incoming call – indicates whether or not a call is incoming
- Mic Level – the current microphone level
- Volume – the current call volume level
- Mute Enabled – indicates whether or not the current call is muted
- On Hook – indicates whether or not the device is currently on hook (opposite of Call In Progress)
- Mic Suppressed – indicates whether or not the microphone is currently suppressed because of echo suppression
- Push To Talk Enabled – indicates whether or not push-to-talk is enabled
- AGC-Speaker enabled – indicates whether or not AGC is enabled for the speaker

- AGC-Mic enabled – indicates whether or not AGC is enabled for the microphone
- Echo Suppress Threshold Hit – true indicates that the incoming audio level is above the echo threshold resulting in the microphone being disabled.
- Echo Suppress Threshold – the echo suppression threshold
- Echo Suppress Mode – current echo suppression mode (None, Automatic or Fixed)
- Echo Suppress Enabled – indicates whether or not echo suppression is enabled (Automatic or Fixed)
- Silence Suppress Threshold Hit – true indicates that the outgoing audio level is below the silence threshold resulting in the microphone being disabled.
- Silence Suppress Threshold – the silence suppression threshold
- Silence Suppress Mode – the current silence suppression mode (None, Automatic or Fixed)
- Silence Suppress Enabled – indicates whether or not silence suppression is enabled (Automatic or Fixed)
- Rx Level – the current incoming audio level
- Tx Level – the current outgoing audio level
- Rx Video Enabled – true indicates that Rx video is being received and displayed
- Tx Video Enabled – true indicates that Tx video is being sent
- Tx Auto Send Enabled – true indicates that video will be sent automatically when a call is instantiated
- Rx Video Actual Frame Width – the actual width of frames being received from the other party during a call, as negotiated with the other party on call setup
- Rx Video Actual Frame Height – the actual height of frames being received from the other party during a call, as negotiated with the other party on call setup
- Rx Video Actual Frame Rate – the actual frame rate of frames received from the other party
- Tx Video Max Frame Width – the currently set outgoing video frame width
- Tx Video Max Frame Height – the currently set outgoing video frame height
- Tx Video Max Frame Rate – the currently set outgoing video frame rate
- Tx Video Actual Frame Width – the actual width of frames being sent to the other party during a call, as negotiated with the other party on call setup
- Tx Video Actual Frame Height – the actual height of frames being sent to the other party during a call, as negotiated with the other party on call setup
- Tx Video Actual Frame Rate – the actual frame rate of frames being sent to the other party

### E. Setting up Calls

Calls are made directly from the RTI device to another party without using a SIP server, so the IP address of the other party has to be known when placing the call. There are two Control Objects to setup calls:

- Dial: IP Address – used to call 3rd party SIP devices via IP address
- Dial: RTI Device – used to dial an RTI device in the current system. Choose the device from the available devices

### F. Receiving Calls

When a call is incoming, a few things happen:

- The page is changed to the page indicated by the Incoming Call Page setting on the VoIP Tab
- A ring tone sounds as indicated by the Incoming Call Sound on the VoIP Tab
- The Caller system variable is updated to show the caller id of the calling party

The following Control Objects can be used when there's an incoming call:

- Call: Answer – answers the incoming call
- Call: Reject – rejects the incoming call

The following settings impact the incoming call behavior:

- Settings: Toggle Auto Answer – the device will automatically answer the incoming call if enabled. This setting can be useful for monitoring situations, such as a baby's room.
- Settings: Toggle Auto Answer Ring Once – if enabled, a single ring tone will play before the answer is automatically answered

### G. Echo and Silence Suppression

Echo is caused by the microphone picking up audio from the speaker and sending it back to the sender. To help prevent echo, two types of suppression are possible:

#### **Echo Suppression**

Echo suppression works by disabling the microphone when the incoming audio is above a certain threshold. This setting prevents the microphone from picking up the incoming audio and sending it back to the sender.

### Silence Suppression

Silence suppression works by disabling the microphone when the outgoing audio is below a certain threshold. This setting prevents low-level or background noise from sending to the other party. The low-level noise can cause low-level echo that escalates in volume depending on the mic and volume levels.

### Modes

For both echo and silence suppression, there are two modes available:

- Fixed: The threshold value is set manually. The value is set in Integration Designer or on the device itself.
- Automatic: Calculates the threshold based on averages over time.

## H. Audio Levels

The following system variables are useful for configuring echo suppression on site:

- RX Level
- TX Level

The RX value shows the audio level of the incoming audio stream – the audio coming from the other party. This setting is the level used to compare against the echo threshold when echo suppression is enabled.

When the RX level is above the echo threshold, the microphone on the local device is muted to prevent echo.

The TX value shows the audio level of the outgoing audio stream – the audio coming from this party. This value is the level used to compare against the silence threshold when silence suppression is enabled. The microphone stream is silenced when the TX value is below the silence threshold so that the other party will hear nothing.

## I. Half Duplex

When enabled, half-duplex only allows audio to travel in one direction at a time. Half Duplex works in conjunction with echo suppression. The speaker is enabled when the RX level is above the echo threshold and muted microphone. The speaker is muted when the RX level falls below the echo threshold, and the microphone is enabled.

The Mic Suppressed system variable can be very helpful because it shows the user when the microphone is muted because of echo suppression. It prevents the user from attempting to talk when the microphone is being muted and helps 'train' the user to wait until the other party is done talking before attempting to talk.

### J. Push to Talk

Push to talk is available as an option if the environment is causing excess echo that isn't handled well by the echo suppression. When push to talk is enabled, the device will send or receive audio, but never both simultaneously. When the Talk button is pressed, the speaker is disabled, and the microphone is enabled. The speaker is enabled when the Talk button is released and the microphone is disabled.

When Push to Talk is enabled, echo and silence suppression is disabled, and all related parameters are irrelevant.

### K. Talk Button Override

The Talk button can be useful even when Push to Talk is disabled. When pressed, the Talk button always silences the speaker and opens the Mic, regardless of any echo or silence suppression. It can be useful when noise comes from the other party that causes the echo suppression logic to silence the Mic too frequently. Pushing the Talk button will override this and allow the user to talk regardless.

### L. Video

Bi-directional video streaming is supported as part of the call via the H.264 codec. Currently, only the baseline profile of H.264 is supported:

#### Incoming (Rx) Video

Incoming video is configured via the VoIP "Video: Incoming Video" control object command. The parameters to the object are:

- Rx Frame Size – this is the size of the frame being streamed from the other party. Note this may not be the size of the local video image. The video image can be stretched locally and different from the size of the image received from the other party. This parameter is useful to reduce network congestion and decode time at the cost of image quality.
- Display Mode
  - Centered – centers the video frame in the area identified by the incoming video control object
  - Stretched – stretches the video to fit the area identified by the incoming video control object.

#### Outgoing (Tx) Video

Outgoing video parameters can be configured via the VoIP tab of the Device Properties dialog. Leave the "Auto Send Video" toggle unchecked if the device displays incoming video only. The frame rate and resolution can also be adjusted here.



### Note on Performance

When the incoming or outgoing video is choppy or seems to fall behind, it's an indication that the device has difficulty keeping up with the encoding of outgoing video or the decoding of incoming video. The best solution to the problem is to reduce the resolution and/or frame rate of the outgoing and incoming video until performance improves. When streaming from a 3rd party device, if possible, consider adjusting its video parameters, such as frame rate, resolution, and bit rate, to improve performance.

## M. SIP Server Registration

SIP Server Registration allows RTI devices to register with a SIP server, calling them via username rather than directly via IP address. The SIP server registrar tracks registered devices and binds the devices to IP addresses when calls are made. The Dial: Extension control object is used to call a device via the SIP server using the device's username (extension).

### Settings:

- SIP Registrar toggle – indicates whether or not to register the device with the SIP server registrar
  - Address – the IP address of the SIP server registrar
  - Port – the port used by the SIP server registrar
  - Time to Live – how often to refresh the registration
- Authentication – used by SIP Registrar and/or SIP Proxy for authentication
  - Username
  - Password
- SIP Proxy – in some cases, the SIP proxy used for outgoing calls may be separate from the SIP registrar. In this case, you'll want to enable SIP Proxy and indicate the proxy IP address and port. Typically, the SIP proxy is the same as the registrar, and it's unnecessary to enable this toggle.
  - Address – the IP address of the SIP proxy
  - Port – port used by the SIP proxy

The screenshot shows the 'Device Properties' dialog box with the 'VoIP-SIP' tab selected. The 'SIP Registrar' checkbox is checked. The 'Address' field is set to '10.0.1.68', the 'Port' is '5060', and 'Time to Live' is '300 seconds'. Under 'Authentication', the 'Username' is '135' and the 'Password' is 'rti135'. The 'SIP Proxy' checkbox is unchecked, with 'Address' set to '10.0.1.68' and 'Port' set to '5060'. Buttons for 'OK', 'Cancel', and 'Help' are at the bottom.