

Information Note

Configuring FXO Answer and Disconnect Supervision



Configuring FXO ports on Vega Gateways to support Answer and Disconnect supervision

Introduction

In the days when analog telephony signalling was designed, telephones were used just to allow two people to talk to each other. You were alerted to a call being made to you by hearing the phone ring; the calling party knew that you had answered the call when they heard the ringback tone stop and you said 'hello'. At the end of the call you said 'goodbye' to one another before replacing the handsets.

Today, and especially with VoIP, there is need for electronic equipment to be connected to analog telephone lines.

Some systems have extended the analog signalling specification to provide an indication that a call has disconnected; others have extended the signalling specification further to indicate both that the call has disconnected and that the call has been answered.

Where this extended signalling is available, it is by far the best way to determine the call answer and call clear-down conditions.

Where this enhanced signalling is not available, equipment can be designed to 'listen' to the line and interpret the noises heard to try and determine answer and clear-down situations.

Why is answer and disconnect supervision needed?

Disconnect

Disconnect supervision is necessary in order to release resources at the end of a call. If a call was made through a telephony system and neither end supported disconnect supervision, then the telephony system could never clear down, releasing its resources ready for the next call, as it would not know whether the call was still in progress or had completed.

FXS ports detect clear-down based on the line current no longer flowing as the far end device goes 'on-hook'.

Digital systems send messages indicating call clear-down – these indicate the reason for the clear-down too.

FXO ports may have a signalling based clear-down, line current reversal or loop current disconnect, but in many situations there is no explicit (signalling based) clear-down indication.

Answer

Answer supervision is needed where billing records are needed. It is not good to charge callers for calls that fail to connect or for the time that the caller is listening to ringback tones – waiting for the called party to answer. Having an answer indication allows billing durations to start at the correct time.

FXS ports detect answer based on the line current starting to flow as the far end device goes 'off-hook'.

Digital systems send messages indicating call answer

FXO ports may have a signalling based answer, line current reversal, but in many situations there is no explicit (signalling based) answer indication.

Configuring FXO disconnect supervision

Only 1 form of disconnect supervision should be enabled at a time, either:

- Loop-Current-Disconnect detection,
- Line-Current-Reversal detection
- Tone-based disconnect supervision
- Silence detection disconnect

Configuring Loop-Current-Disconnect (aka Battery Stop) detection

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FXO parameters	
Loop Current Detect	<input type="checkbox"/>
Loop Current Time	300
Hook Flash Time (ms)	200
Early Line Seize	<input type="checkbox"/>
Early Line Seize Time	30
Early Line Seize Timeout (s)	30
Line Reversal Detect	<input type="checkbox"/>
Line Reversal Debounce Time (ms)	50
Force Disconnects	<input checked="" type="checkbox"/>
DTMF Hold-off Time (ms)	200
Line Reversal Sample Delay (ms)	50

The 'Loop Current Detect' tick box enables loop current detection

The 'Loop Current Time' value specifies the minimum duration that the line current is dropped to indicate a call clear-down.

Configuring Line-Current-Reversal (aka Battery Reversal) detection

With this signalling the line voltage polarity is reversed from its IDLE state to an IN-CALL state as the call is answered. The line voltage polarity is then returned to the IDLE state polarity when the call clears down.

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FXO parameters	
Loop Current Detect	<input type="checkbox"/>
Loop Current Time	300
Hook Flash Time (ms)	200
Early Line Seize	<input type="checkbox"/>
Early Line Seize Time	30
Early Line Seize Timeout (s)	30
Line Reversal Detect	<input type="checkbox"/>
Line Reversal Debounce Time (ms)	50
Force Disconnects	<input checked="" type="checkbox"/>
DTMF Hold-off Time (ms)	200
Line Reversal Sample Delay (ms)	50

The 'Line Reversal Detect' tick box enables line current reversal detection

The 'Line Reversal Debounce Time' value specifies the minimum time the line must be reversed for to note it as a reversal.

Configuring Tone-based disconnect supervision

Vega tone-based disconnect supervision is based around the Vega gateway detecting specific tones. Tones for detection are defined by a frequency range in which the tone should be looked for, and the minimum tone on and minimum tone off times that are expected for that tone.

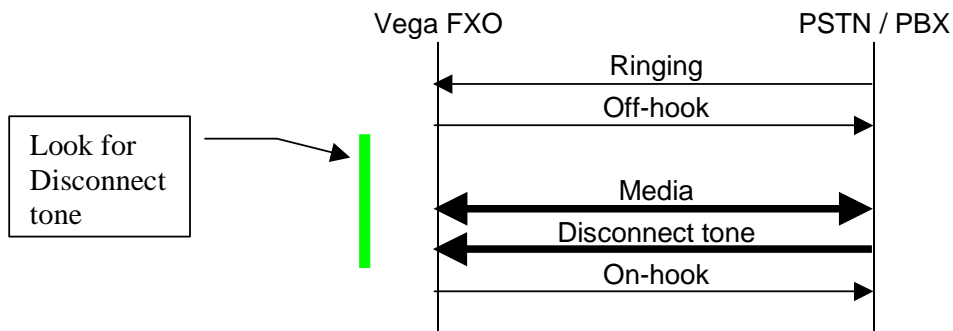
The tones that the Vega uses are:

- Ringback tone
- Busy tone
- Congestion tone
- Disconnect tone (often fast busy)

The operation of the tone-based clear-down is different depending upon whether the Vega FXO port is receiving the call or whether it is making the call.

Vega FXO port receiving the call from the telephony network

As soon as the Vega answers the call (by going off-hook) it will start looking for the Disconnect tone (only). If it is detected then the call is cleared. Detecting a tone means that at least a single cycle of the definition is seen; the on tone followed by the appropriate period of silence.



Vega FXO port making call to the telephony network

As soon as the call is made the Vega will start looking for Ringback, Busy and Congestion tones.

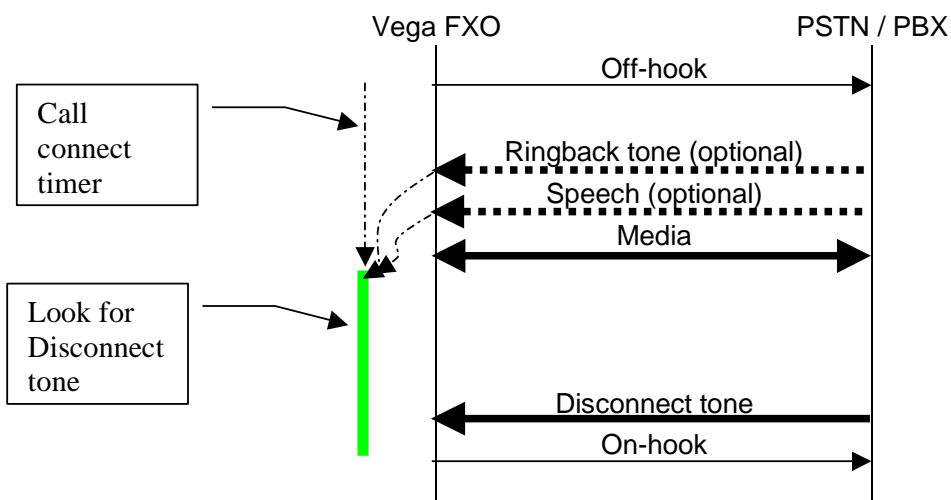
Disconnect tone is looked for once the first of the following events is found:

- Ringback tone has been detected
- A voice based answer condition is detected¹
- The call connect timer expires (default setting 30 seconds)

When Disconnect tone is detected, the call is cleared with clear-down cause code 16.

If voice-based answer supervision is also enabled then if Busy tone or Congestion tone is detected, then the call will be cleared with clear-down cause code 17.

¹ Line signaling based answer detect is not included in this list, because line signaling based answer supervision also provides line signaling based disconnect indication, so tone based detection would not be needed.



Configuring parameters for tone based disconnect supervision

Enable / Disable tone based cleardown detection

Tone based cleardown detection is enabled / disabled using the following configuration:

```
[_advanced.pots.fxo.1]
  tone_detect=1
```

Tone detection parameters

Tone detection parameter values are configured in 'tonedetect' profiles. As many 'tonedetect' profiles may be set up as desired, though for each tone, only 1 profile will be used at a time.

Busy and Disconnect tones are defined as a frequency range and a tone on and a tone off period. Some countries have Ringback and Congestion tones which have an on-off-on-off cadence, and thus two on and two off times are defineable. If only a single on-off cadence defines the tone then min_on_time2 and min_off_time2 should be set to zero.

```
[_advanced.tonedetect.busy.1]
  freq_max=650
  freq_min=300
  min_on_time=375
  min_off_time=375
[_advanced.tonedetect.cong.1]
  freq_max=650
  freq_min=300
  min_on_time1=400
  min_off_time1=350
  min_on_time2=225
  min_off_time2=525
[_advanced.tonedetect.disc.1]
  freq_max=650
  freq_min=300
  min_on_time=375
  min_off_time=375
[_advanced.tonedetect.ringback.1]
  freq_max=650
  freq_min=300
  min_on_time1=400
  min_off_time1=200
  min_on_time2=400
  min_off_time2=200
```

The tonedetect profile to be used for each tone / cadence detection is specified using:

```
[_advanced.pots.fxo.1]
  busy_tonedetect_profile=1
  cong_tonedetect_profile=1
  disc_tonedetect_profile=1
  ringback_tonedetect_profile=1
```

Call Connection Timer

The call connection timer² value is set using:

```
[_advanced.pots.fxo.1]
  call_connection_time=30
```

Choosing values for upper and lower frequency

In general the default range – a fairly broad frequency range – is a good frequency range to use. These only need to be altered if two tones have similar cadences and only differ from one another in the frequency of the tone. In this case set the min and max frequencies so that they include the frequency of the tone, but do not overlap the frequency range of the other tone.

Checking cadences

The cadences presented to the Vega can be checked by enabling the following debug on a telnet or serial command line interface:

- debug enable _pots i
- debug on
- set _advanced.tonedetect.busy.1.min_on_time=150
- set _advanced.tonedetect.busy.1.min_off_time=150
- set _advanced.pots.fxo.1.tone_detect=1
- save
- apply

Now make a call out through the FXO port

An example of calling to UK ring tone (3 cycles of approx 400ms on, 200ms off, 4000ms on, 2000ms off):

```
_POTS :Info : 0327755: 327755:POTS :POTSCall_Alloc[00000000] (f10015f6): : (potscallcb.c;156)
_POTS :Info : 0336120: 08365:POTS :POTSCall_Alloc[00000000] (f10015f7): : (potscallcb.c;156)
_POTS :Info : 0336947: 00827:POTS :POTSMC_SetToneDetectionState: Tone state set to
POTSMC_OUTGOING_WAITING_RINGBACK : (potsmc.c;861)
_POTS :Info : 0336947: 00000:POTS :POTSMC_CPToneDetect low_freq=300 high_freq=650 min_on_time=150
: (potsmc.c;988)
_POTS :Info : 0337830: 00883:POTS :POTSMC_ToneDetected: On time=440 Off time=130 : (potsmc.c;1397)
_POTS :Info : 0340235: 02405:POTS :POTSMC_ToneDetected: On time=470 Off time=1930 : (potsmc.c;1397)
_POTS :Info : 0340235: 00000:POTS :potsmc_outgoing_waiting_ringback: CONGESTION tone received
: (potsmc.c;1175)
_POTS :Info : 0340825: 00590:POTS :POTSMC_ToneDetected: On time=460 Off time=130 : (potsmc.c;1397)
_POTS :Info : 0340825: 00000:POTS :potsmc_cong_tone_received: CONGESTION tone received : (potsmc.c;1325)
_POTS :Info : 0343230: 02405:POTS :POTSMC_ToneDetected: On time=470 Off time=1930 : (potsmc.c;1397)
```

² The expiry of the call connection timer allows the Vega to start looking for the disconnect tone, if neither ringback tone has been detected, nor the voice based answer condition has been detected already.

```

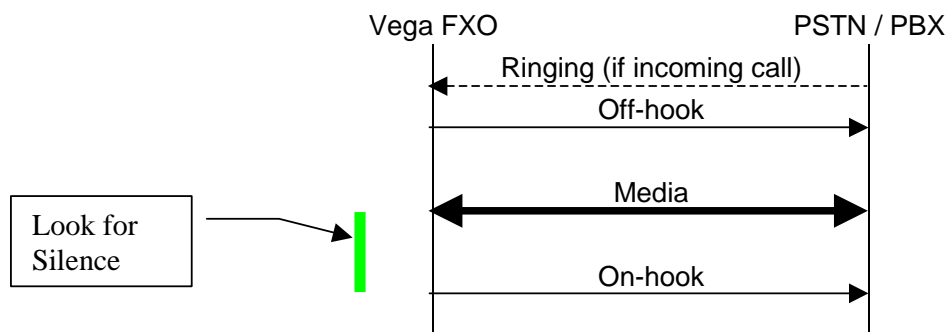
_POTS :Info : 0343232: 00002:POTS :potsmc_cong_tone_received: CONGESTION tone received : (potsmc.c;1325)
_POTS :Info : 0343830: 00598:POTS :POTSMC_ToneDetected: On time=460 Off time=140 : (potsmc.c;1397)
_POTS :Info : 0343832: 00002:POTS :potsmc_cong_tone_received: CONGESTION tone received : (potsmc.c;1325)
_POTS :Info : 0346230: 02398:POTS :POTSMC_ToneDetected: On time=460 Off time=1930 : (potsmc.c;1397)
_POTS :Info : 0346832: 00002:POTS :potsmc_cong_tone_received: CONGESTION tone received : (potsmc.c;1325)
_POTS :Info : 0352437: 05605:POTS :POTSCall_Dealloc[f10001b4] (f10015f6): : (potscallcb.c;165)
_POTS :Info : 0352442: 00005:POTS :POTSMC_SetToneDetectionState: Tone state set to notone_state : (potsmc.c;878)
_POTS :Info : 0352445: 00003:POTS :POTSCall_Dealloc[f10001b4] (f10015f7): : (potscallcb.c;165)

```

Configuring Silence detection cleardown

After the voice path has been established between the called and calling parties the Vega gateway checks whether the level of the audio on the line is above or below a threshold. If it remains below a threshold for more than a specified length of time the Vega will clear the call.

Be careful in setting the value for the silence time – remember that people listening to the other party may well not speak for significant lengths of time. It is recommended that a time > 1 minute is used.



Configuring parameters for silence detection cleardown

Enable / Disable silence detection cleardown

Silence detection cleardown is enabled / disabled, the silence detection duration and power level are defined using the following configuration:

```

[_advanced.pots.fxo.1]
    voice_detect_power_threshold=-60
    voice_lost_disc_time=0

```

If `voice_lost_disc_time=0` then silence detection cleardown is disabled; if it is `>0` then this is the silence detection duration.

Configuring FXO answer supervision

Only 1 form of answer supervision should be enabled at a time, either:

- Line-Current-Reversal detection
- Voice-based answer supervision

Configuring Line-Current-Reversal (aka Battery Reversal) detection

[POTS](#) > [Advanced](#) > [FXO](#) > 1

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Early Line Seize Timeout (s)	30
Line Reversal Detect	<input type="checkbox"/>
Line Reversal Debounce Time (ms)	50
Force Disconnects	<input checked="" type="checkbox"/>
DTMF Hold-off Time (ms)	200
Line Reversal Sample Delay (ms)	50

The 'Line Reversal Detect' tick box enables line current reversal detection

The 'Line Reversal Debounce Time' value specifies the minimum time the line must be reversed in order for it to be detected as a valid reversal.

Configuring Voice-based answer supervision

Voice based Answer supervision is only required for an FXO port making a call to the telephony network. (When a call is being received on the FXO port, it is the Vega that initiates the answer by going off-hook).

If voice based answer detection is enabled, the Vega defines the call to be answered if, after going off-hook:

- No progress tones are being detected
- The power level on the line rises above a certain level for a specified length of time (after the last ring tone cadence was detected)

If Busy or Congestion tones are detected then the call is disconnected with clear-down cause code 17.

Configuring parameters for voice based answer supervision

Enable / Disable voice based answer detection

Voice based answer detection is enabled / disabled, and the voice detect duration and power level are defined using the following configuration:

```
[_advanced.pots.fxo.1]
voice_detect=1
voice_detect_min_time=800
voice_detect_power_threshold=-60
```


Tone detection parameters

The configuration parameters that define the tones:

```
[_advanced.tonedetect.busy.1]
...
[_advanced.tonedetect.cong.1]
...
[_advanced.tonedetect.disc.1]
...
[_advanced.tonedetect.ringback.1]
...
```

and the parameters that define the tonedetect profiles to be used:

```
[_advanced.pots.fxo.1]
  busy_tonedetect_profile=1
  cong_tonedetect_profile=1
  disc_tonedetect_profile=1
  ringback_tonedetect_profile=1
```

need to be appropriately configured, as defined in the tone based disconnect supervision section above.

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