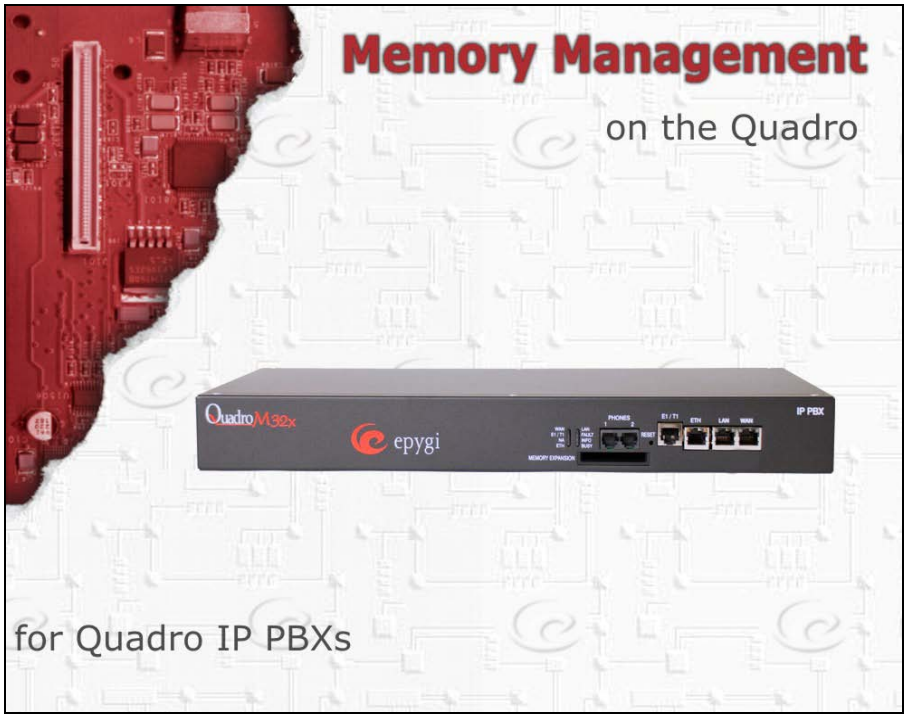
Memory Management on the Quadro



Revision: 2.9

Abstract: **This document provides information on memory management of Quadro IP PBXs.**

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Document Revision History

Revision	Date	Description	Applicable to SW	Applicable to models
1.0	25-Dec-06	Initial release	4.0.x	IP PBXs
2.0	12-Oct-07	Updated for SW 4.1.x Info on memory sizes of Quadro IP PBXs with new hardware added Values in table 1 and 2 corrected	4.1.x	IP PBXs
2.1	05-Dec-07	Edits	4.1.x	IP PBXs
2.2	19-Oct-09	Quadro6L and Quadro4Li integrated	5.1.x	IP PBXs
2.3	04-Nov-09	Memory sizes are updated for SW 5.1.x. QuadroM32x product integrated	5.1.x	IP PBXs
2.4	02-Sep-11	QuadroM8L/26x/12Li/26xi and QX1000 integrated	5.2.x	IP PBXs
2.5	21-Nov-11	Added Call Recording memory storage	5.2.x	IP PBXs
2.6	19-Jan-12	QuadroM memory size is updated	5.2.x	IP PBXs
2.7	15-Mar-12	Quadro4L integrated	5.3.x	IP PBXs
2.8	26-Mar-12	Quadro2x2 integrated	5.3.x	IP PBXs
2.9	21-Nov-12	Quadro4Li memory size is updated	5.3.x	IP PBXs

1 Introduction

This document provides information on memory size and memory allocation of Quadro IP PBXs. It specifically describes the total storage space available on the Quadro IP PBX models and the default distribution of storage among extensions on these models. A scheme is provided to estimate an amount of space required for storing custom system messages of a given duration.

2 Assumptions

The following assumptions are made in this document:

- SW 5.2.x or higher is running on the Quadro IP PBX.
- No language pack is installed on the Quadro. The use of a language pack reduces the total space by about 2-5 MB depending on the language.

Please Note: Memory size on QX1000 is the same, regardless of whether a Language Pack is installed.

Except for Section 7, other sections will additionally assume that no USB flash drive and/or Compact Flash are installed on the Quadro.

3 User Available Memory Sizes on Quadro IP PBXs

The user available memory size of a Quadro IP PBX varies depending on the Quadro model, hardware and software versions. The hardware version of a Quadro is found on the label attached to the unit.

Table 1 lists the available memory size (without LP uploaded) on basic models of a Quadro IP PBX with different hardware versions.

Table 1 Available Memory Sizes

IP PBX Model	Hardware version	Available Memory Size in Megabytes (MB)
Quadro2x	SASY-MICRO-0101-0002 SASY-MICRO-0101-0101 SASY-MICRO-0102-xxxx SASY-MICRO-0103-xxxx	37.5 MB
	SASY-MICRO-0100-0000 SASY-MICRO-0101-0000 SASY-MICRO-0101-0001 SASY-MICRO-0101-0100	7 MB
Quadro4x/ Quadro16x	SASY-SOHO-0103-xxxx	37 MB
	SASY-SOHO-0100-xxxx SASY-SOHO-0101-xxxx SASY-SOHO-0102-xxxx	6.5 MB
Quadro6L **Quadro4Li**	Any model	34 MB
QuadroM32x/8L/26x/12Li/26xi	Any model	30.5 MB
QX1000	Any model	71018 MB
Quadro4L/2x2	Any model	100 MB

The user available memory size of a Quadro IP PBX can be viewed on the **System→Status→*Memory Status*** page (see Figure 1). The size displayed on this page is expressed in time units and is calculated using a specific codec selected on the **Telephony→*Voice Mail Common Settings*** page (see Figure 2).

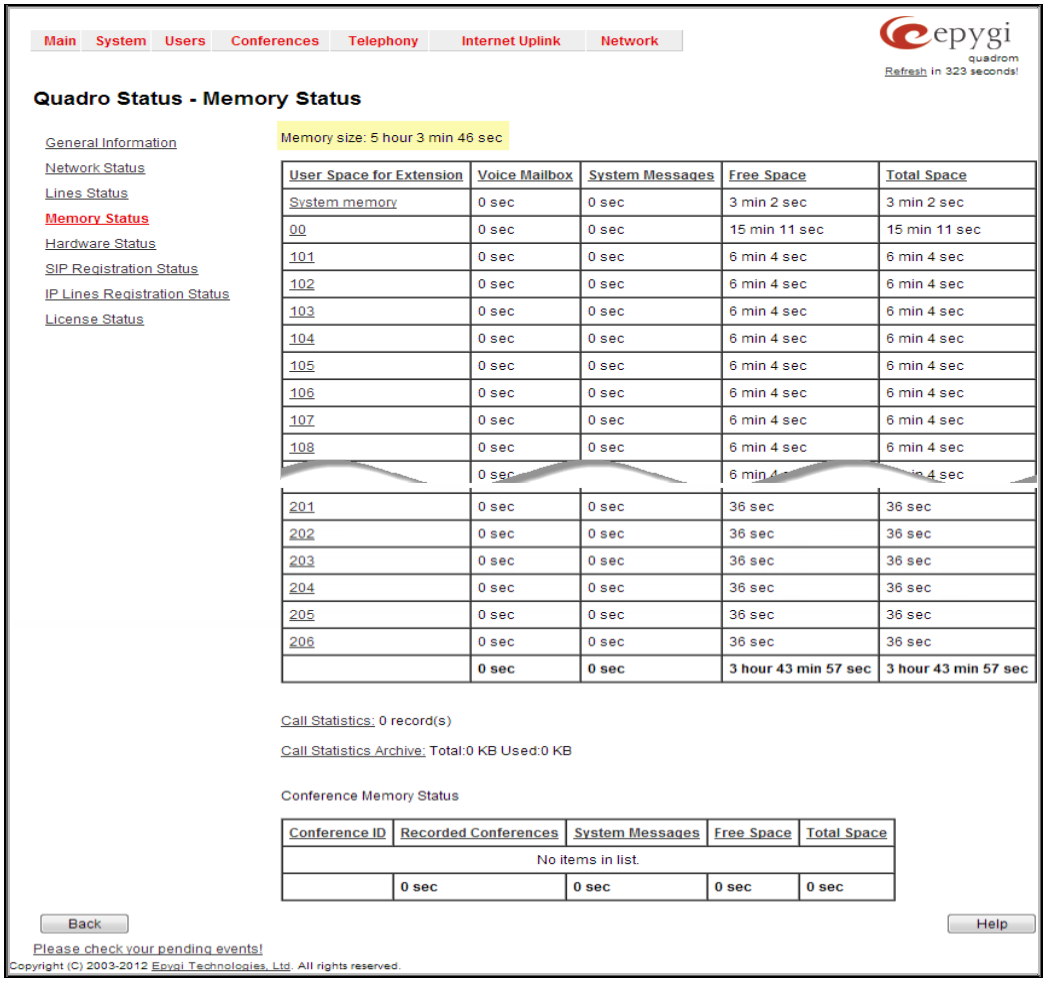

Figure 1 Viewing the Memory Status

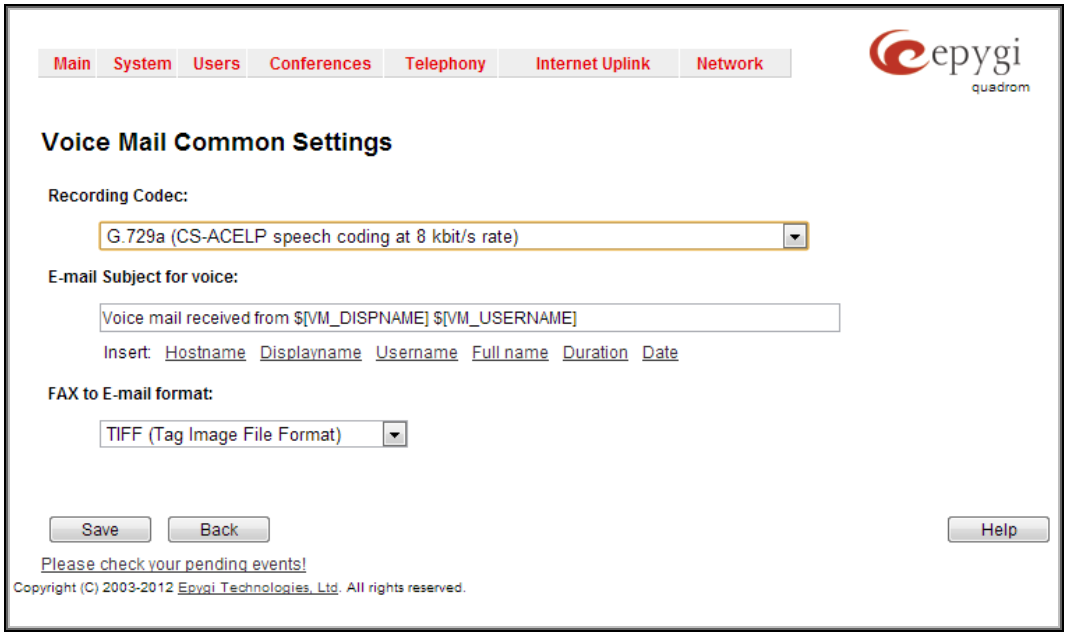

Figure 2 Selecting the voice mail recording codec

Table 2 summarizes the memory sizes on basic Quadro IP PBX models expressed in time units for different recording codecs. Note that codecs providing a higher rate of compression increase the storage size in terms of time.

Table 2 Memory sizes in time units for different recording codecs

Quadro Model / Recording Codec	Quadro2x		Quadro4x / Quadro16x		Quadro6L	Quadro4Li	QuadroM 32x	QuadroM8L /26x/12Li/ 26xi	QX1000	Quadro4L/ Quadro2x2
	SASY-MICRO- 0101-0001/ 0100-0000/ 0101-0000/ 0101-0100	**SASY-MICRO-** 0101-0002/ 0101-0101/ 0102-xxxx/ 0103-xxxx	**SASY-SOHO--** 0100-xxxx/ 0101-xxxx/ 0102-xxxx	**SASY-SOHO-** 0103-xxxx	**Any model**	**Any model**	**Any model**	**Any model**	**Any model**	**Any model**
G.711u	15 min	1 hr 20 min	13 min	1 hr 18 min	1 hr 12 min	1 hr 18 min	1 hr 2 min	1 hr 3 min	107 day 17 hr 34 min	3 hour 31 min
G.711a	15 min	1 hr 20 min	13 min	1 hr 18 min	1 hr 12 min	1 hr 18 min	1 hr 2 min	1 hr 3 min	107 day 17 hr 34 min	3 hour 31 min
G.726-16	1 hr	5 hr 20 min	55 min	5 hr 15 min	4 hr 50 min	5 hr 11 min	4 hr 10 min	4 hr 13 min	430 day 22 hr 15 min	14 hour 6 min
G.726-24	40 min	3 hr 30 min	36 min	3 hr 30 min	3 hr 12 min	3 hr 27 min	2 hr 46 min	2 hr 49 min	287 day 6 hr 50 min	9 hour 24 min
G.726-32	30 min	2 hr 40 min	27 min	2 hr 38 min	2 hr 25 min	2 hr 35 min	2 hr 3 min	2 hr 6 min	215 day 11 hr 7 min	7 hour 3 min
G.726-40	24 min	2 hr 8 min	22 min	2 hr 6 min	1 hr 56 min	2 hr 4 min	1 hr 40 min	1 hr 41 min	172 day 8 hr 54 min	5 hour 38 min
G.729a	2 hr	10 hr 40 min	1 hr 50 min	10 hr 30 min	9 hr 40 min	10 hr 21 min	8 hr 19 min	8 hr 26 min	861 day 20 hr 29 min	1 day 4 hour 13 min
iLBC	1 hr 12 min	6 hr 24 min	1 hr 6 min	6 hr 20 min	5 hr 48 min	6 hr 13 min	5 hr 59 min	5 hr 4 min	517 day 2 hr 42 min	16 hour 55 min

4 Memory Allocation on a Quadro IP PBX

By default, the Quadro IP PBX assigns a certain default percentage of the total memory to all extensions: user extensions and auto attendants. For user extensions, this is shared memory to be used for storing the user's voice mails and custom voice messages.

Table 3 lists the default distribution of the total memory among user extensions and the default auto attendant on basic models of a Quadro IP PBX. The **System memory** is used for storing universal extension recordings (see Section 6.4).

Table 3 Default distribution of memory on basic models of Quadro IP PBXs

Quadro Model	Memory size as a percentage of the total memory			
	Extension		Attendant	System memory
	Onboard	IP line		
Quadro2x	5%		1%	1%
Quadro4x	1%		1%	1%
Quadro16x	2%	1%	1%	1%
Quadro 6L	-	5%	5%	1%
Quadro4Li	-	4%	3%	1%
QuadroM32x/8L/26x/12Li/26xi	5%	0.4%	5%	1%
QX1000	-	0.08%	0.08%	0.08%
Quadro4L/2x2	5%	5%	1%	1%

The administrator can manually modify the default memory size allocated for an extension. This is done from the **Users→Extensions Management→*Edit Entry*** page (see Figure 3). The maximum value in the **Percentage of System Memory** drop-down list on this page equals the maximum free space currently available on the Quadro IP PBX.

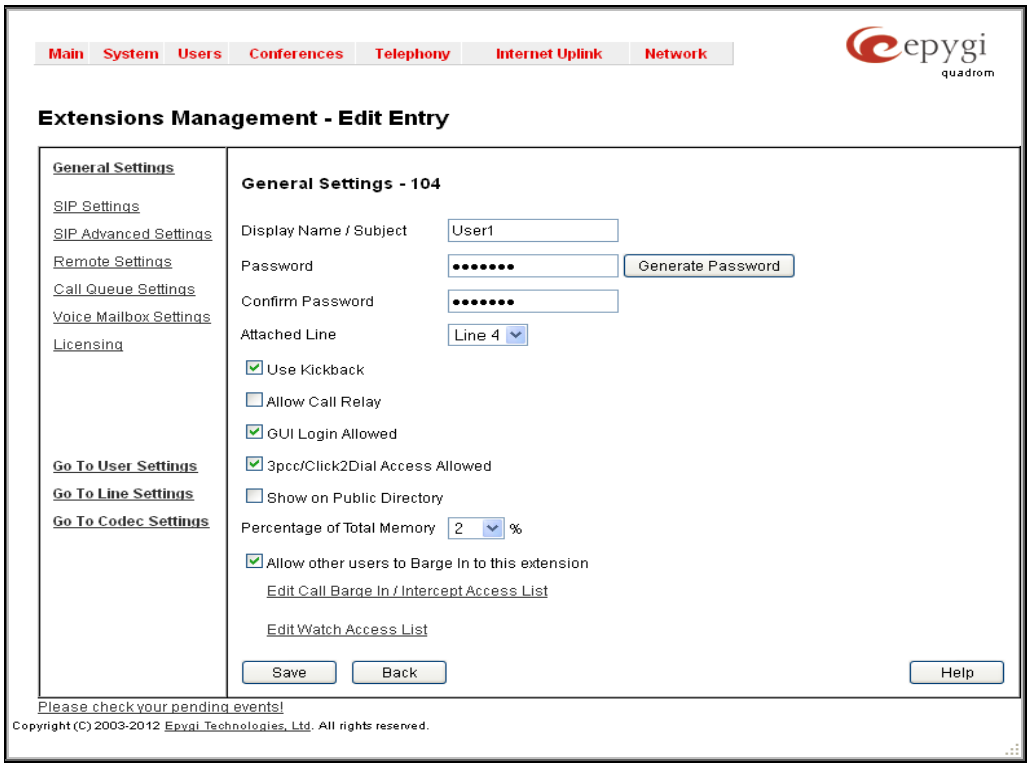

Figure 3 Modifying the default memory size

The memory size in time units corresponding to the assigned percentage can also be viewed on the **System→Status→*Memory Status*** page (see Figure 1, the **Total Space** parameter for an extension).

Please Note: The memory size displayed on the **Memory Status** page is calculated according to the selected voice mail recording codec (see Figure 2), which is set to G.729a by default. Custom system messages are recorded using the PCMU (G.711u) codec (see Section 6.2). Therefore, to estimate the duration corresponding to an assigned percentage of memory using the PCMU codec, first change the recording codec to PCMU.

5 Call Recording memory storage on Quadro IP PBXs

The **Call Recording** service is a licensable feature and available for the following IP PBX models: 4x/16x/32x/8L/26x/26xi/12Li and QX1000. To be able to record calls a recording box extension(s) should be created in the extensions management first. Create a recording box extension in the extensions management page and assign a memory size as it is shown in the Figure 5.

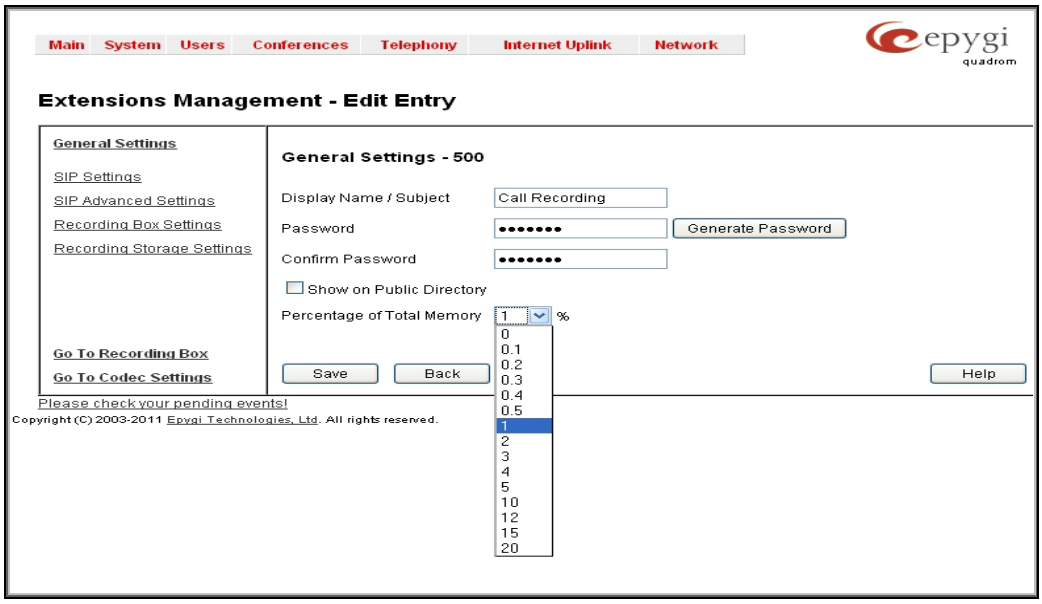

Figure 4 Extensions Management page

The call recording is done using PCMU (G.711) codec. Therefore, change the recording codec to PCMU to estimate the duration for the recording box extension memory.

The call recording memory size in time units corresponding to the assigned percentage can be viewed on the **System→Status→*Memory Status*** page (see Figure 1, the **Total Space** parameter for the recording box extension).

The available memory for the call recording can also be viewed in the recording box pages (see Figure 6).

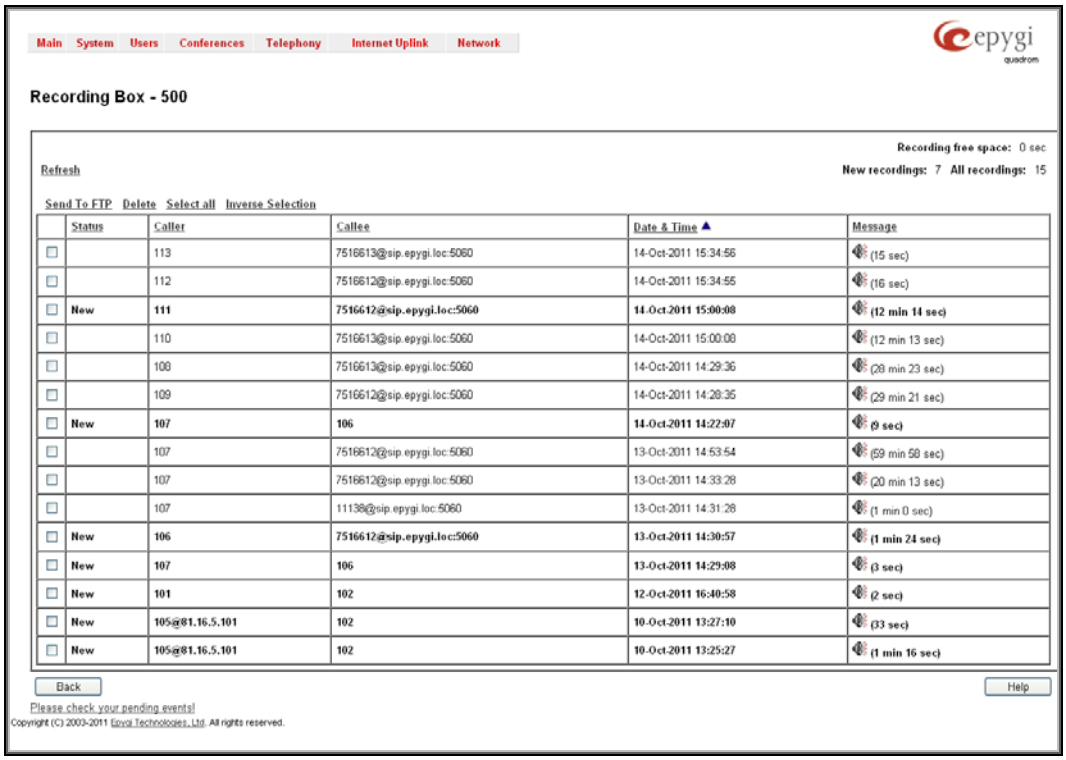

Figure 5 Recording Box page

6 Custom System Messages

The complete list of system messages that can be changed to a user-defined (custom) message is provided in Table 4.

The Voice Mail Greeting, Incoming Blocking, Outgoing Blocking, Out of Office messages, Extension User's Name, Find Me/Follow Me Welcome Message, Attendant Welcome Message and Recurring Attendant Prompt can be recorded directly from the phone handset or uploaded from the Quadro web management. The Hold Music, Call Queue Welcome, Call Queue and New Voice Message Notification messages, Attendant Ringing Announcement, Menu Welcome message, Menu Recurring message, Options Announcement, Upload VXML Scenario Voice Messages, Upload new recording announcement message, Customize queue scenario Messages, Conference Welcome Message and Conference Hold Music can be uploaded from the web management only. To ensure an acceptable quality, it is recommended to upload previously recorded voice messages, rather than recording them from the handset. For more information about uploading custom voice messages, please refer to the Quadro IP PBX manuals and online help.

Table 4 The list of custom voice messages

Messages	Description
Voice Mail Greeting	Played to callers that reach the extension's VM.
Incoming Blocking Message	Played to callers that call from numbers blocked for particular extension.
Outgoing Blocking Message	Played to the extension user when they dial a number that has been blocked for particular extension.
Extension User's Name	Played in the Extensions Directory.
Out of Office Message	Played to callers that call an extension with the Out of Office feature enabled.
Hold Music	Played to parties on hold.
Call Queue Welcome Message	Played to callers joining the extension's call queue.
Call Queue Message	Played to callers in the queue.
New Voice Message Notification	Informs about the receipt of a new voice mail message.
Auto Attendant	
Attendant Welcome Message	Played to callers the default Auto Attendant welcome message.
Recurring Attendant Prompt	Played to callers the default Auto Attendant message.
Attendant Ringing Announcement	Played to callers instead of ring-back tones when making calls through default Auto Attendant.

Customized Attendant Scenario	
Menu Welcome message	Played to callers joined to Auto Attendant with customized scenario.
Menu Recurring message	Played to callers in Auto Attendant with customized scenario.
Options Announcement	The announcement of options 0-9, #, *, “Any input other than in the list above”, “No input” and “Incorrect number handling”. Played to callers when they use the corresponding option.
VXML Scenario	
Upload VXML Scenario Voice Messages	Played to callers the voice messages used in scenario file.
Recording Box	
Upload new recording announcement message	Played to callers a new recording announcement message.
ACD	
Customize queue scenario Messages	Played to callers the messages of ACD customized queue scenario.
Conference (available only for QuadroM32x/8L/26x/12Li/26xi and QX1000)	
Conference Welcome Message	Played to callers joined to Conference.
Conference Hold Music	Played to conference participant when he is alone in the Conference.
Find Me/Follow Me	
Upload New Welcome Message	Played to callers a new Find Me/Follow Me message.

6.1 Limitation on Message Durations

All the custom voice messages, except the hold music, are limited to 5 minutes in duration. The duration of the hold music is limited to the maximum space available for an extension.

Please Note: There is a general limitation when uploading custom voice messages. The maximum size of an uploaded file is limited to 7.5 MB.

6.2 Requirements on the Format

All custom voice messages on a Quadro IP PBX must comply with the following requirements to be accepted by the Quadro:

- **File format** - The name of the file format varies depending on the tool used for recording a message. In Cool Edit Pro or Adobe Audition, for example, the required format is called *A/mu Law Wave.* In Windows Sound Recorder it is called *CCITT* (see the next paragraph below).
- **Sample Rate** – 8000
- **Resolution** – 16 bit
- **Channels** – mono

The following instructions describe how to record a custom system message using Windows Sound Recorder:

1. Go to Start→Programs→Accessories→Entertainment→Sound Recorder.
2. Use a microphone or headset to record a message or open an existing recording to change it to the required format.
3. Once recording is complete, click on File→Save As.
4. Use the **Change** button below **Save as type** to change the **Format** to *CCITT A-Law*, and the attributes to *8,000 Hz; 8/16 Bit; Mono*.
5. Save the file locally on your PC to upload it later to the Quadro.

6.3 Computing the Required Percentage of Space

To estimate the percentage of total space required for storing custom system messages of a given duration (for example, 3 minutes), follow these steps:

1. Multiply the desired duration expressed in minutes by 480 KB. This is the space required to store a one-minute recording using the PCMU codec:

   3 x 480 KB = 1,440 KB ~1.4 MB.

2. Calculate what percentage of the total memory the required space takes. For example, on the Quadro16x with hardware version SASY-SOHO-0103-xxxx, the required percentage for a 3-minute custom system message will be the following:

   (1.4 MB/ 38 MB) x 100 % ~ 4 %.

If the user also needs additional space for voice mail, compute the required percentage in the following way:

3. Divide the desired duration for voice mail by the total space on the Quadro expressed in minutes and multiply the result by 100. For example, on the Quadro16x, the required percentage for a 4-minute voice mailbox will be computed as follows (assuming that the G.729 is used as the recording codec):

   (4 / 600) x 100% ~ 1 %

Therefore, to allow the user to store a 3-minute custom system message and a 4-minute voice mailbox, the administrator should assign at least 5% of the total space to the extension. If this value is not listed in the **Percentage of System Memory** drop-down list, the administrator should free some space on the system, for example, by reducing the storage allocated for other extensions.

Table 5 summarizes the memory sizes in MB and the corresponding percentage of the total memory required to store custom hold music of 1 to 12 min durations on the Quadro16x.

Table 5 Memory Size for recorded Hold music

Duration of custom hold music in minutes	Approximate memory size in MB	Approximate percentage of memory on Quadro16x
1	0.5 MB	2 %
2	1 MB	3 %
3	1.5 MB	4 %
4	2 MB	6 %
5	2.5 MB	7 %
6	3 MB	8 %
7	3.5 MB	10 %
8	4 MB	11 %
9	4.5 MB	12 %
10	5 MB	14 %
11	5.5 MB	15 %
12	6 MB	16 %

6.4 Universal Extension Recordings

Universal extension recordings are intended to replace the default system messages for all extensions on the Quadro IP PBX. Once uploaded, they are used on all extensions unless the extension user uploads/records their own custom system message(s).

The list of default system messages, and thus the universal extension recordings, coincides with the list given in Table 4.

To replace any default system message with a universal extension recording, follow these steps:

1. Open the **Users→*Extensions Management*** page.
2. Click on the **Upload Universal Extension Recordings** link (see Figure 7).
3. On the **Upload Universal Extension Recordings** page, click the appropriate **Upload** link to replace the corresponding default system message (see Figure 8).

The **Percentage of System Memory** setting on this page indicates the total space allocated for storing the above-listed messages.

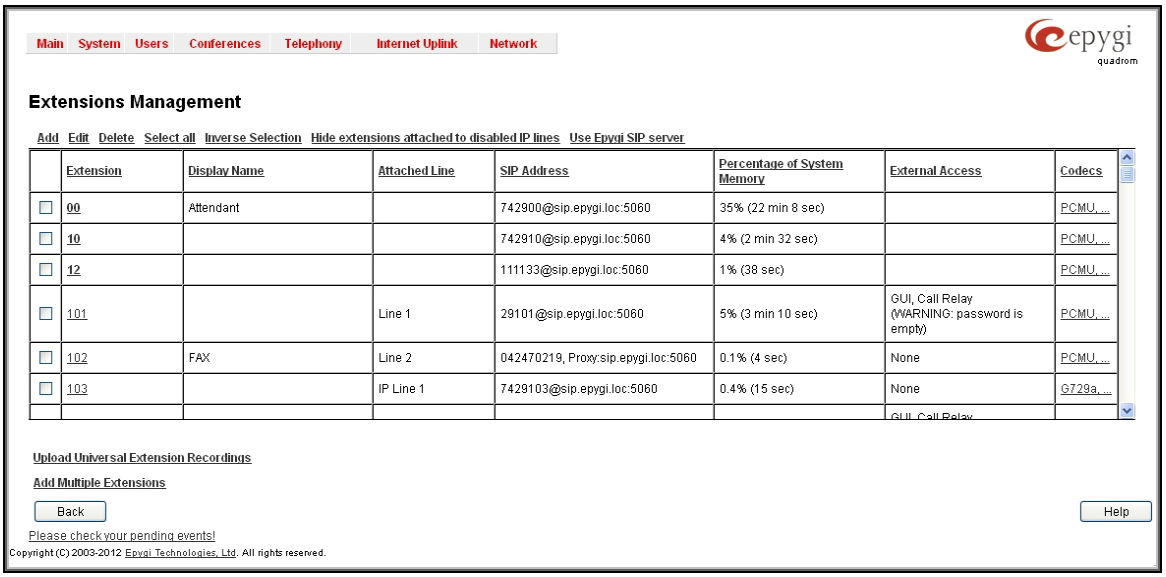

Figure 6 Opening the Upload Universal Extension Recordings page

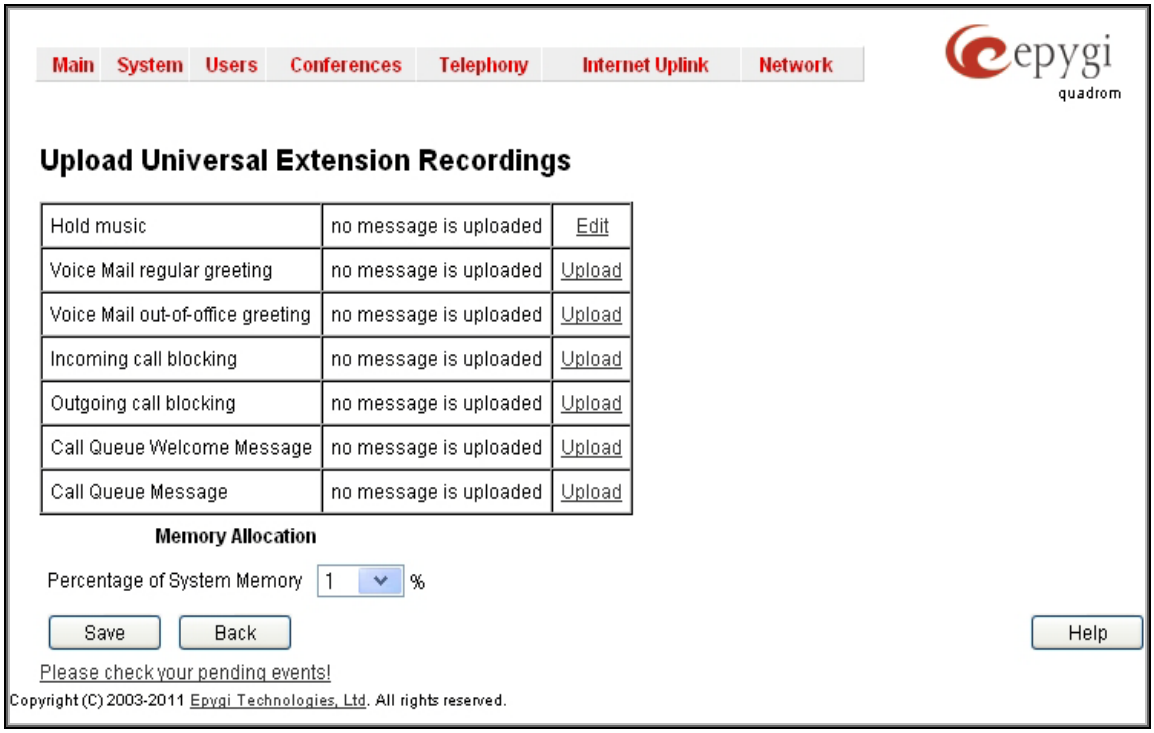

Figure 7 Uploading universal extension recordings

7 Increasing Quadro's Memory with a USB Flash Drive and Compact Flash Memory Cards

The **USB memory Flash Drives** are used to expand the memory capacity of the Quadro4x/16x.

By default, all voice data on the Quadro is stored on the system embedded memory. The voice data includes universal extension recordings, custom system messages used on auto attendants and extensions as well as the voice mails of extensions. If the size of the embedded memory is insufficient to hold the needed amount of voice data, the administrator may install a USB Flash drive and configure the Quadro to use it.

The following step-by-step instructions describe how to install a USB Flash drive on a Quadro:

1. Insert the USB Flash drive into the USB port on the rear panel of the Quadro.
2. Open the **Telephony→*Voice Mail Common Settings*** page and select the **External USB Flash** checkbox (see Figure 2).
3. Click on **Save**.
4. Click on "**yes**" when asked for the USB Flash drive formatting.

As a result of formatting, the Quadro will do the following:

1. Erase all data on the drive and create the file structure of the Quadro extensions on it.
2. Copy all voice data from the embedded memory to the drive.

The first step, formatting the drive without copying the voice data, can also be executed by pressing the **Clear USB Flash** button.

Once a USB Flash drive is formatted, the Quadro will automatically mount the drive each time it is plugged in again with no request for formatting.

To switch over to the embedded memory again, first un-mount the drive and then unplug it. Removing the drive without un-mounting it first may result in corrupting the voice data stored on the USB Flash drive. To un-mount the drive, select the **Embedded Memory Storage** on the **Voice Mail Common Settings** page and click on **Save**. Once the Quadro starts using the embedded memory again, it will restore the voice data available at the time the USB Flash drive was installed.

The **Compact Flash memory Cards** are used to expand the memory capacity of the QuadroM32x/8L/26x/12Li/26xi.

Please Note: Always power down the device before inserting (the same when removing) the Compact Flash card.

The following step-by-step instructions describe how to install a Compact Flash card on a Quadro:

1. Insert the Compact Flash card into the Memory Expansion slot (via upside down) of the rear panel of the Quadro.
2. Quadro will automatically recognize the card with no request for formatting.

As a result, go to the **System→Status→*Hardware Status*** page to ensure that Compact Flash is mounted.

The **System→Status→*Memory Status*** page now shows the available memory size with Compact Flash card.

8 References

Following documents for the corresponding software release:

- Manual II – Administrator's Guide.
- Epygi Supported USB and Compact Flash Drives

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