FlipFactory® Measuring & Adjusting ITU-R BS.1770 Loudness



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Synopsis

The combination of TrafficManager and FlipFactory provides capability to measure and adjust audio loudness using techniques described in the ITU-R BS.1770 Standard. The ITU-R BS.1770 algorithm is a methodology for assessing the loudness of an audio signal with between one and five channels.

The ITU-R BS.1770 Measurement and Adjustment option is a licensed feature of FlipFactory which may be purchased and downloaded by registered FlipFactory users from our Web site at *www.telestream.net.*

Note: The FlipFactory implementation of the loudness measurement algorithm makes no distinction between speech and other types of audio content. The algorithm will only work correctly on audio with a sample rate of 48 KHz.

The FlipFactory implementation of measuring and adjusting loudness requires a two-factory workflow. The first factory measures loudness, the second factory adjusts it.

In the first factory, FlipFactory measures the average loudness over the entire length of the input file by using an *Audio Analysis* Process/Analysis tool, then duplicates the input file for use by the second factory which makes loudness adjustments.

In the second factory, FlipFactory applies gain correction (via *Forward Notification* from the first factory) adjusting the loudness to meet a specified target. Gain correction is applied equally across all channels in the audio file and is constant over its entire length.



Creating a Loudness Adjustment Workflow

Note: This example assumes you know how to create and configure factories in FlipFactory and how to submit jobs. Review the FlipFactory User's Guide for details.

The loudness adjustment workflow in FlipFactory involves two factories: one to do analysis, the other to make adjustments.

Creating the Analysis Factory

To create the analysis factory to determine the loudness measurement in LKFS, following these steps:

1. Create a new factory and name it *analyze_loudness*. Add a local monitor folder for placing input media files to be processed for loudness adjustment by FlipFactory. (Alternatively, you can submit jobs manually):

Manage Factories					
📍 🗂 ITULoudmess 🚺	Spottraffic Catch Server	Vortex Network Folder	Vyvx Catch Server		
🕈 🗂 Factories	SAN Folder	SeaChange BML	SeaChange BMS/BM	IC	SmartJog Gateway
🕈 🛄 analyze_loudness	Pathfire Pa	thfire Ad Exchange	Pipeline EDL	Reu	ters Network Folder
Y Monitors	Omneon Server On	nneon Server (FTP) C	n The Spot Media	P2 Local Folde	P2 Network Folder
- V Local Folder	MediaStream Mijo	Network Folder	Network Folder (Sami	oa) Net	twork Folder + Metadata
←	Liquid Network Folder	Local Folder Local	Folder + Auxiliary	Local Folder +	Metadata Media DVX
🗠 🔚 Notifications	GV Profile PDR/XP/MAN	Harris LXF WANS	treamer Hula M	(Hyper	Launch Receive Server
	Eclipse Monitor Ema	il/ClipMail Extreme Re	ach FastChannel	FTP Folder	FTPS Folder GV K2
	CBS Serial Automation	Centaur Server (ClipMail Folder Data	base DG S	Systems DubList/ISCI
0000	Adstream Server	Akamai/StreamOS	Autodesk Stone	Avid	Avid Playback Service
	Add				

2. To add the Audio Analysis Process/Analysis tool, click *Process/Analyze*, select *Audio Analysis*, and check *Enabled*:



3. Click Audio Analysis to configure Audio Level Analysis. Check Use ITU-R BS.1770 Loudness Measurement and (optionally) check Specify Channels For Analysis to specify a different channel mapping from the default setting:

💦 FlipFactory Manage		
FlipFactory Manage	Audio Level Analysis Response Time 200 50 1000 Create waveform display Create waveform display Use ITU-R BS.1770 Loudness Measurement V Use ITU-R BS.1770 Loudness Measurement Specify Channels For Analysis	Click Audio Analysis Check Use ITU-R BS.1770 Loudness Measurement
	Use ITU-R BS.1770 Loudness Measurement Specify Channels For Analysis Specify Channels For Analysis Left Channel [18] Center Channel [18] Left Surround Channel [18] Kight Surround Channel [18] S	Loudness Measurement Check Specify Channel For Analysis

The loudness measurement algorithm assigns different weights to each audio channel (left, right, center, etc.). If *Specify Channels For Analysis* is unchecked, the default channel mapping is used as specified in the SMPTE 370m standard. (Channel 1 = Left, 2 = Right, 3 = Center, 4 = LFE, 5 = Left Surround, 6 = Right surround). The ITU-R BS.1770 algorithm does not include the Low Frequency Effects (LFE) channel in calculating its loudness measurement.

4. To add the Analysis product, right-click *Products* and select *New Product*, then select *Analysis* from the list of products:



5. Click *Codecs* and select *Analysis* as the Video Codec:



6. Click Analysis and check Audio Analysis Only and Video Analysis Only:

R FlipFactory Manage		
Manage Factories		Click Analysis
	Analysis Audio Analysis Only Audio Analysis Only Audio Analysis Only Video Analysis Only Video Analysis Only Video Analysis Only	Check Audio Analysis Only

 Right-click *Products* and select *New Product*, then select *Duplicate Original* from the list of products. This product performs a file copy of the original file and saves it in FlipFactory's default store:



8. Right-click on *Factories* and select *New Factory*. Name the new factory *adjust_loudness*. (This is the second factory that will perform the loudness adjustment. It is created here so that *Notification* can be assigned to it):



9. In the analyze_loudness factory, click on Notifications, select the Forward tab, and click Add:



 Click on Forward. From the Account Username pull-down menu select the account username that contains the adjust_loudness factory. then select adjust_loudness from the Factory pulldown menu list:



Creating the Adjustment Factory

Now that the loudness of your media has been measured by the *analysis* factory, this value is used to adjust loudness in the media file forwarded to the adjustment factory via the FlipFactory *Notification* process. To create the *adjustment* factory, follow these steps:

1. In the *adjust_loudness* factory, right-click *Products* and select *New Product*, then select *VOD Transport Stream* from the list of products:

FlipFactory Manage			Right-click Products and
	1 Product		 select New Product
Patories adjustjoudness adjustjoudness Monitors Process/Analyze Products WOD Transport Stream Motifications analyze_loudness	Omneon Server Ouantel Quartel QuickTime Streaming Sony MAV70 Vortex	PacketVideo MPEG4 QuickTime SeaChange Format VOD Transport Stream WAVE Audio	Select VOD Transport Stream

Note: This example uses the **VOD Transport Stream** product, though any product with audio output can be used.

2. Click *Codecs* and select a video codec to be used. Click *Filters*, select *Audio Filters* tab, then check *Enabled*:



- 3. Click Audio Level to display Audio Level configuration:
 - Adjust Master Gain. If the value selected not zero, it is converted to LKFS and added to the loudness value selected in Target Loudness. If ITU is checked, Master Gain is ignored.
 - Check Enable Auto Correction to adjust loudness using the ITU-R BS.1770 LKFS value passed in from the analysis factory
 - Check Adjust Loudness and set Target Loudness to set the absolute level of loudness (in LKFS values)
 - Check Adjust Target Loudness To Restrict Peak Level and set Desired Peak Level if required.



FlipFactory calculates the gain correction required to achieve the desired target loudness by subtracting the incoming LKFS value from the target loudness value and master gain value.

For example, the clip processed in the analysis factory is determined to have a loudness value of -25 LKFS. This loudness value is passed to the adjustment factory as a metadata label along with the original input media you submitted. In the second factory, you set the target loudness value to -20 LKFS. FlipFactory subtracts the loudness value from the target value to obtain the adjustment: +5 LKFS. During audio encoding, +5 LKFS is applied to the audio, and the media is encoded to produce your desired output file.

Testing Your Loudness Adjustment Workflow

Now that you have created two FlipFactory factories to analyze and adjust the audio loudness in your input media file, the result should be tested to ensure success:

- 1. In FlipFactory, open the *Job Status* window to monitor factory progress.
- 2. Place the media file to be audio-adjusted into the monitored folder:



3. Wait for both factories to finish processing and the Job Status window to display "Complete":

	<mark>ob</mark> Status					
1 9	66 ○	-				
Source	Factory	Receiv	red 🔻	Subject	Status	Priority
-						
	'ITULoudmess''					
All jobs for ' Source	'ITULoudmess'' Factory	Server	Received	Subject	Status	3
All jobs for ' Source .ocal Folder	'ITULoudmess'' Factory adjust_loudness	Server w-carlj	Received Fri Dec 18 15:25:	Subject HDTESTFILE2603.mxf	Status	3

Wait for both factories to display *Complete*

4. Examine the destination folder to verify that a new media file has been created, then play the file to ensure that the that audio loudness adjustment is correct:

눧 adju	stmentDe	st				
File E	dit View	Favorites	Tools	Help		27
🕞 Ba	ck - Θ) - 🎓	🔎 Se	earch	6 Folders	»
Address	dress 🗁 C:\loudness\adjustmentDest 🛛 🔽 🕞 Go					Go
Name	*			Size	Туре	
📥 HDTE:	STFILE2603.	mpg	135,67	з кв	VLC media file (.mpg) –
<			_			>

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