FlipFactory®

MEASURING & ADJUSTING ITU-R BS.1770 LOUDNESS

This App Note applies to FlipFactory versions 7.0 & later

Part No. 74-0151-02

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.

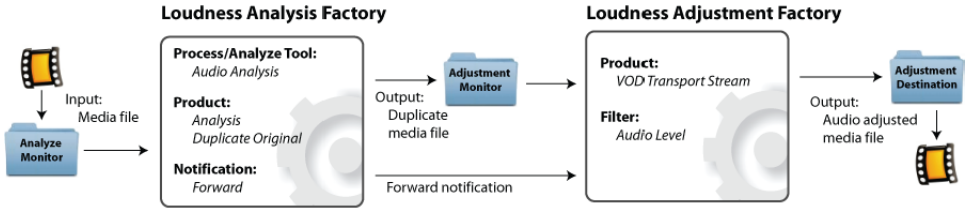
The ITU-R BS.1770 Measurement and Adjustment option is a licensed feature of FlipFactory which may be purchased and downloaded by registered FlipFactory users from our Web site at *www.telestream.net.*

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

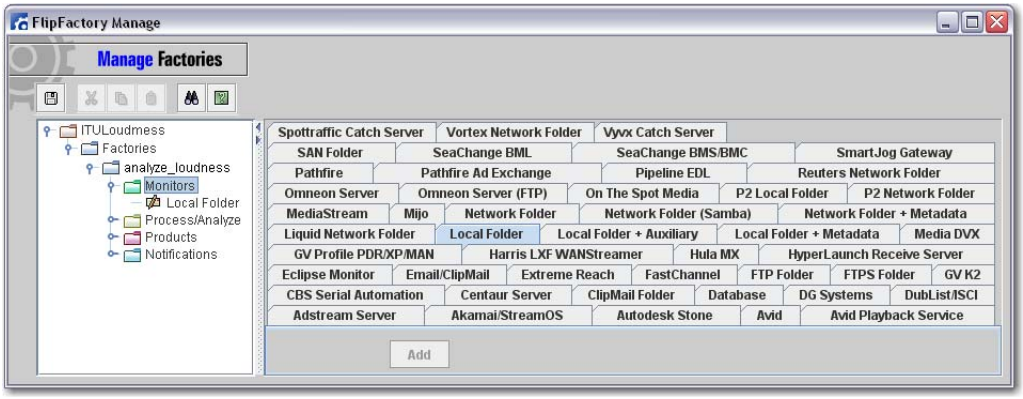
Note: *This example assumes you know how to create and configure factories in FlipFactory and how to submit jobs. Review the FlipFactory User's Guide for details.*

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

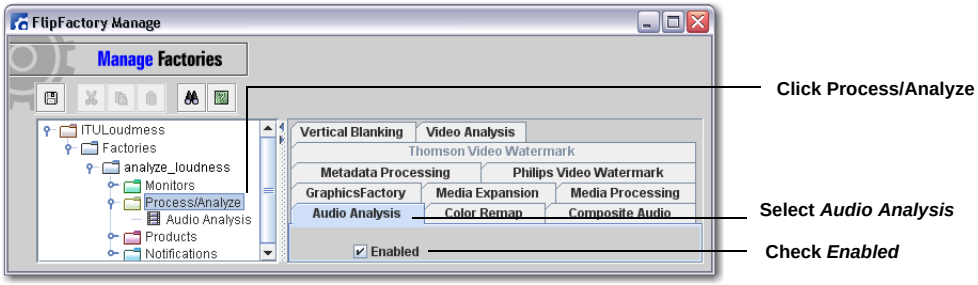
Creating the Analysis Factory

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

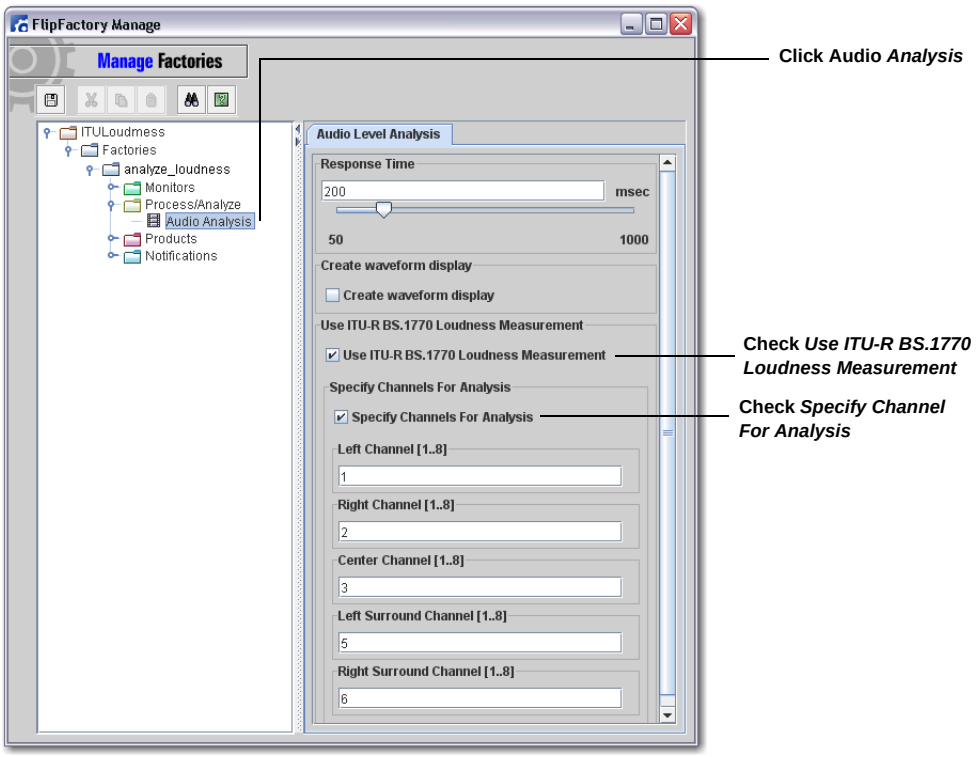
1. Create a new factory and name it *analyze_loudness.* Add a local monitor folder for placing input media files to be processed for loudness adjustment by FlipFactory. (Alternatively, you can submit jobs manually):



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

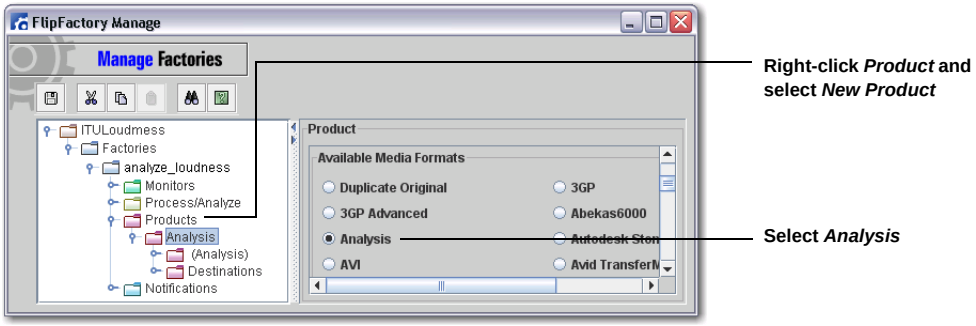


3. Click *Audio Analysis* to configure *Audio Level Analysis.* Check *Use ITU-R BS.1770 Loudness Measurement* and (optionally) check *Specify Channels For Analysis* to specify a different channel mapping from the default setting:

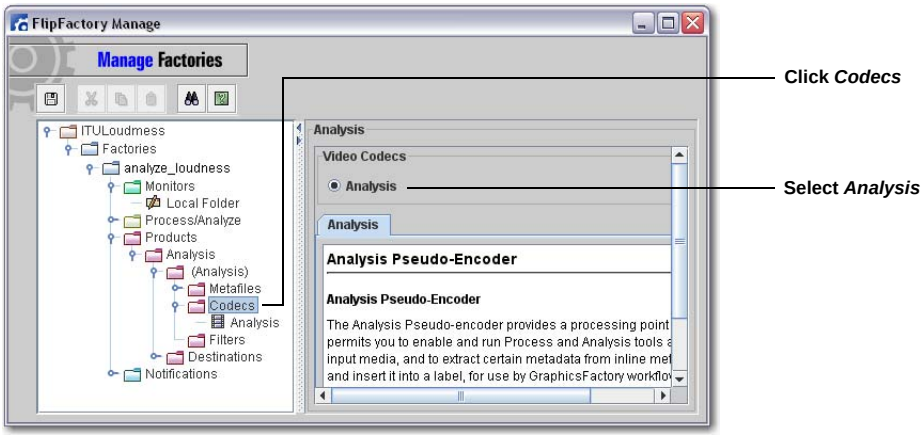


The loudness measurement algorithm assigns different weights to each audio channel (left, right, center, etc.). If *Specify Channels For Analysis* is unchecked, the default channel mapping is used as specified in the SMPTE 370m standard. (Channel 1 = Left, 2 = Right, 3 = Center, 4 = LFE, 5 = Left Surround,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

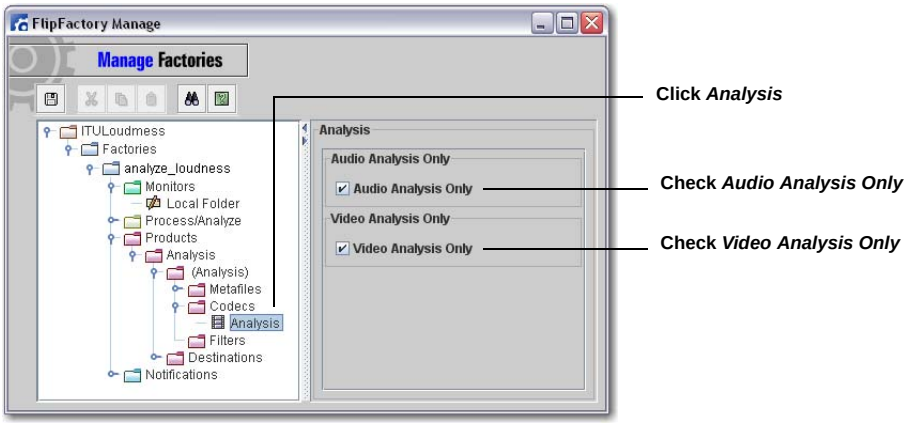
4. To add the Analysis product, right-click *Products* and select *New Product*, then select *Analysis* from the list of products:



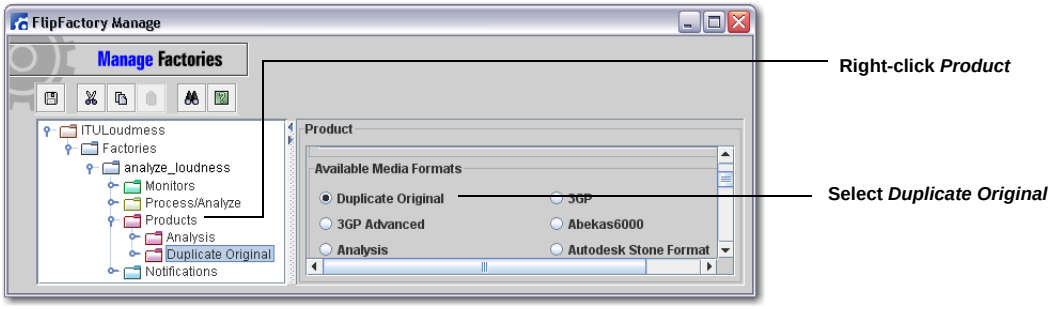
5. Click *Codecs* and select *Analysis* as the Video Codec:



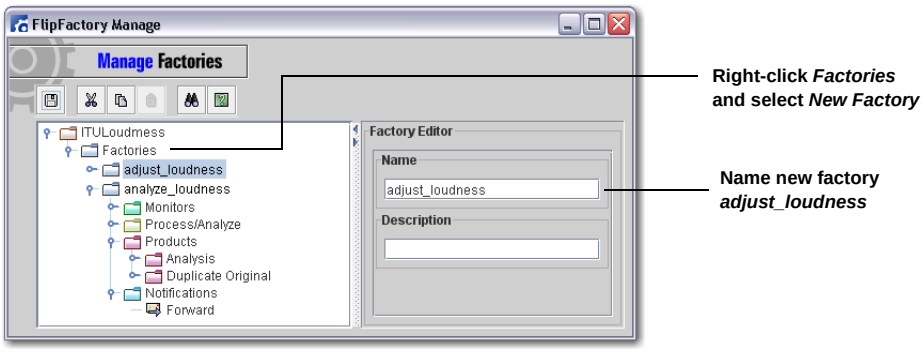
6. Click *Analysis* and check *Audio Analysis Only* and *Video Analysis Only*:



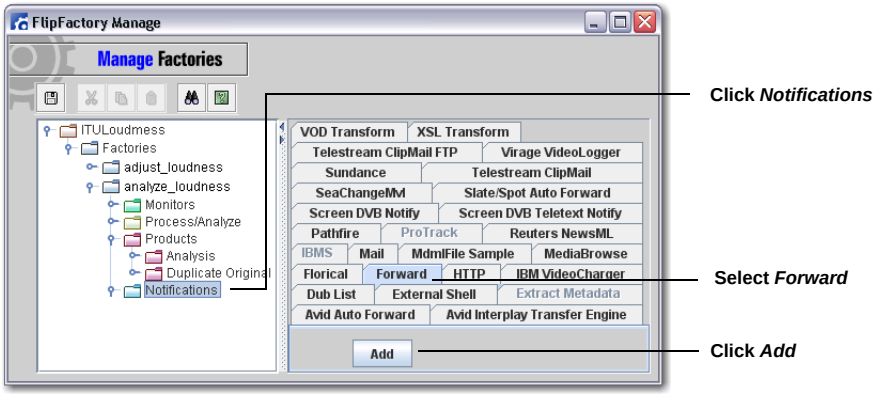
7. Right-click *Products* and select *New Product*, then select *Duplicate Original* from the list of products. This product performs a file copy of the original file and saves it in FlipFactory's default store:



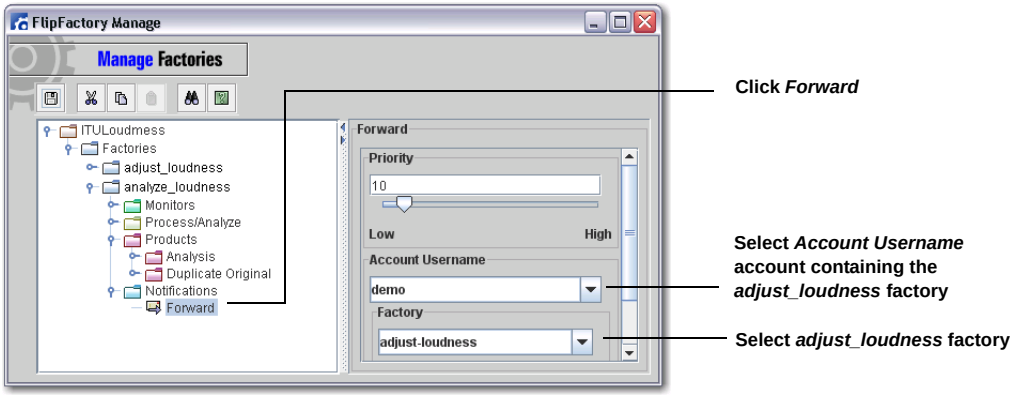
8. Right-click on *Factories* and select *New Factory.* Name the new factory *adjust_loudness.* (This is the second factory that will perform the loudness adjustment. It is created here so that *Notification* can be assigned to it):



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



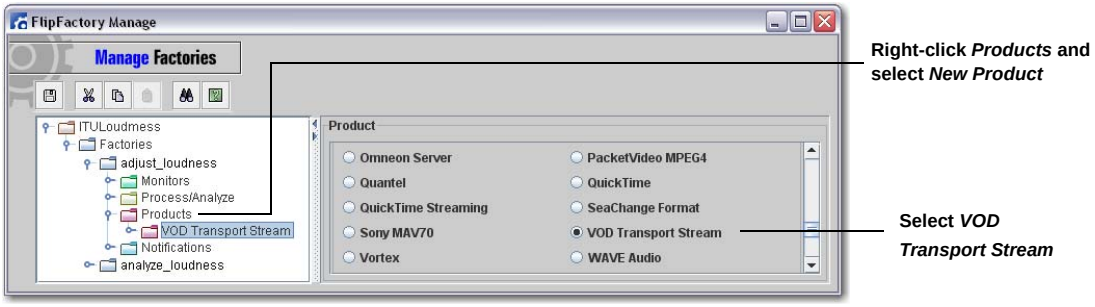
10. Click on *Forward*. From the *Account Username* pull-down menu select the account username that contains the *adjust_loudness* factory. then select *adjust_loudness* from the *Factory* pull-down menu list:



Creating the Adjustment Factory

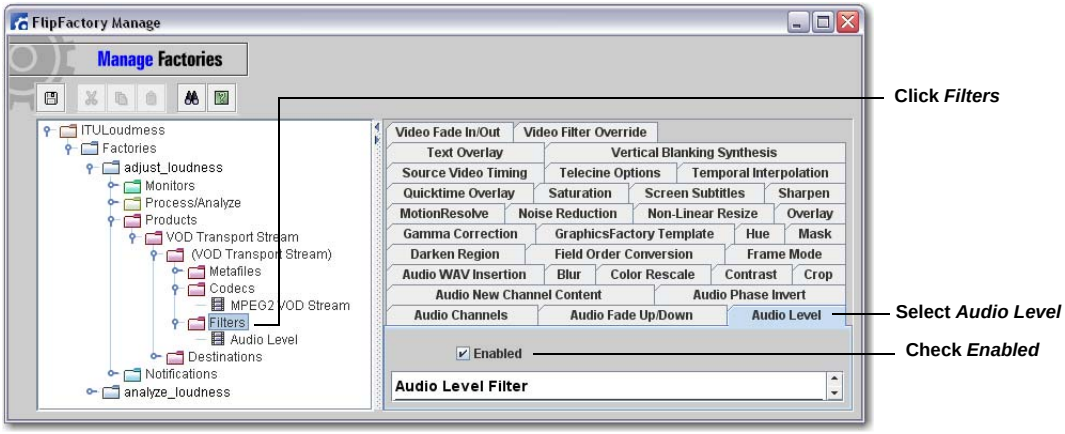
Now that the loudness of your media has been measured by the *analysis* factory, this value is used to adjust loudness in the media file forwarded to the adjustment factory via the FlipFactory *Notification* process. To create the *adjustment* factory, follow these steps:

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

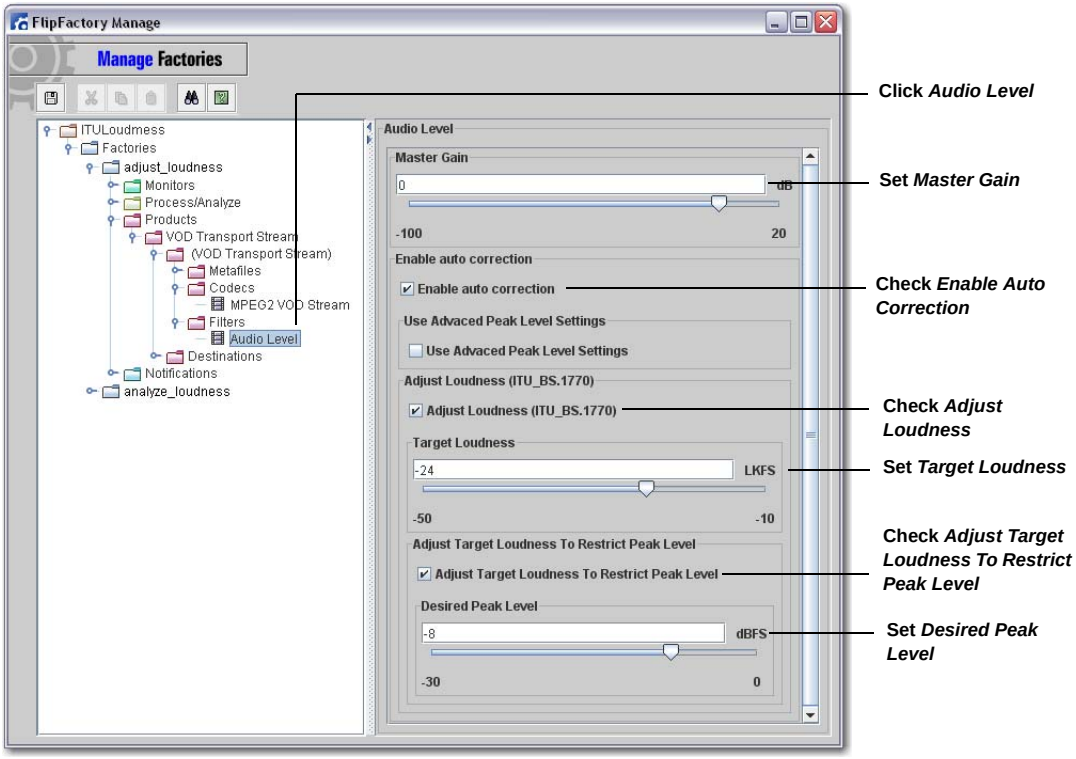


Note: *This example uses the **VOD Transport Stream** product, though any product with audio output can be used.*

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.



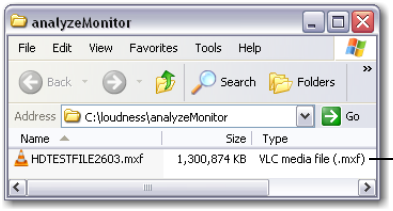
FlipFactory calculates the gain correction required to achieve the desired target loudness by subtracting the incoming LKFS value from the target loudness value and master gain value.

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.

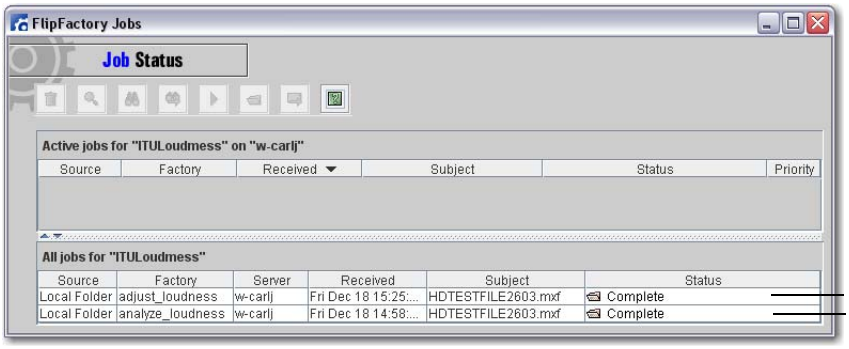
Testing Your Loudness Adjustment Workflow

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:

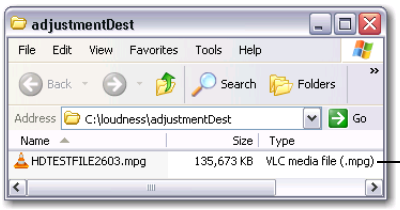
1. In FlipFactory, open the *Job Status* window to monitor factory progress.
2. Place the media file to be audio-adjusted into the monitored folder:



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



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:



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