MP-532

FM / FMHD+ /AM / AMHD+ / HD+
Digital Multi-Processor

Preliminary Guide

FEBRUARY 2021

Revision Ø

Wheatstone Audio Processing
Designed and manufactured in the USA by Wheatstone Corporation
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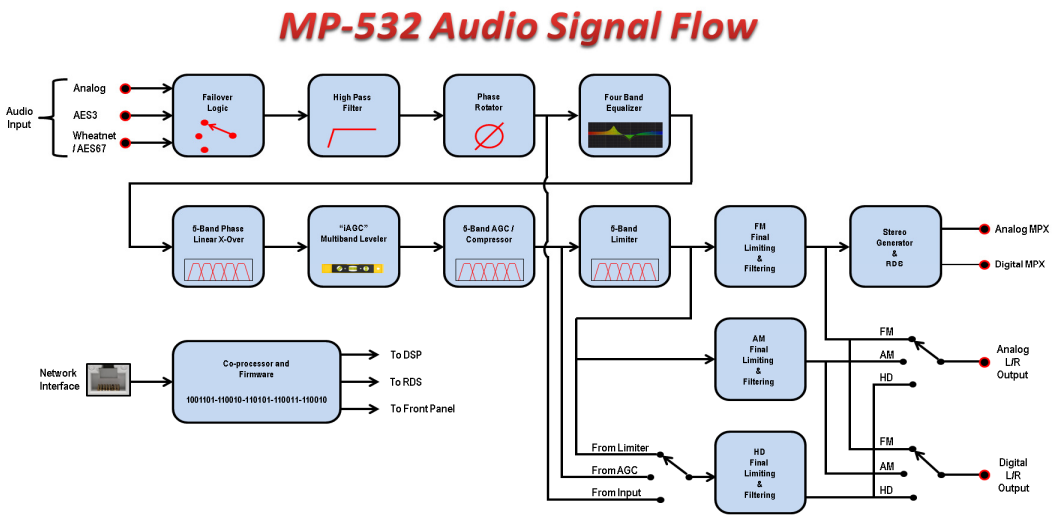
MP-532 Audio Signal Flow Overview



The signal flow diagram above shows that all processing up to and including the five-band limiter can be common to the MP-532's three different styles of final processing, if desired:

- FM pre-emphasis and distortion-cancelled clipping with FM stereo generator and RDS;
- AM pre-emphasis and distortion-cancelled clipping with adjustable asymmetrical modulation and transmitter tilt and HF equalization;
- A specially designed HD+ final limiter with automatic loudness control that is also perfect for streaming.

The MP-532's FM and AM modes are mutually exclusive; however the HD+ mode is always available for any potential application.

Input audio may be from conventional balanced left/right analog, AES3 digital, or our popular WheatnetIP network audio protocol. Selectable automatic audio failover is provided for the analog and digital inputs, enabling a backup audio source to be put on the air if the primary audio source fails.

The MP-532's output audio is available in several formats:

- Analog left/right;
- AES3 digital;
- Analog stereo multiplex, also known as MPX or Composite;
- Baseband192, sometimes also known as Digital MPX or MPX over AES;
- WheatnetIP, Wheatstone's network audio transport.

SPECIAL NOTE:

Audio processing up to and including the multiband limiters is common to <u>all</u> processing modes.

MP-532 Front Panel Overview

The MP-532 is equipped with LED-based front panel metering for audio input and output levels as well as for dynamic gain reduction which may be occurring in the multiband AGC, multiband limiters, and/or final limiting.

Front panel meter columns from left to right and labeled as follows:

INPUT — Left/Right input levels in dBFS. 0dBFS, or full scale, is the point at which the digital domain is out of bits and audio will become badly distorted.

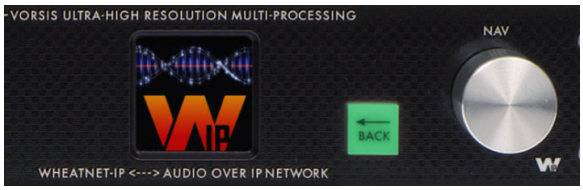
AGC — There are six AGC-related meters; the first column is the iAGC, or Intelligent AGC, with the next five meters showing the amount of gain reduction for each band of the five-band AGC. The number under each column represents the associated band number.

LIMITER — There are six Limiter-related meters; the first five show the amount of gain reduction occurring in each band of the five-band limiter. The number under each column represents the associated band number. The meter labeled FINAL shows the Final Limiting for whichever MP-532 processor mode is currently in use.

OUTPUT — The meter columns labeled L/A and R/B show the left/right output levels when the MP-532 is in FM mode and the TX1 and TX2 analog output levels when the MP-532 is in AM mode.

The column labeled FM shows the MPX output level *from the stereo generator* when the MP-532 is in FM mode, and the positive modulation in percent when in AM mode, importantly noting that the actual AM% reading will be highly dependent upon the setting of the AM mode's "AM Symmetry" control.

NOTE: Just as it is for the Input metering, the Output metering is also scaled in dBFS, or digital full scale. However, because the output metering is *after* all peak processing it is internally prevented from reaching 0dBFS so the appearance of full scale on any output meter *does not* indicate an 'out of bits' situation like it does for the Input metering.



Located to the right of the metering columns are an OLED display, a push button, and an encoder jog wheel with its own push switch.

The OLED display and controls allow basic operation and setup to be accomplished from the front panel.

The listening level supplied at the front panel headphone jack, located at the far left side of the front panel, is also adjusted using the menu and jog wheel.

MP-532 Front Panel Navigation

- HEADPHONE [HDPN]
  - Input
  - Analog Input
  - Digital Input
  - Processed Output
- PRESETS
  - Preset List
- INPUT
  - Source
    - Analog
    - Digital — AES
    - Digital — WNIP
    - Analog Gain
    - Digital Gain
- PRE-EMPH [PreEmp]
  - Flat
  - 50uS
  - 75uS
- SOUND
  - Texture
    - Drive — Edit -5 to +5
    - Density — Edit -5 to +5
    - Loudness — Edit -5 to +5
    - Save Preset [Save Pst] — Edit Name (8 char max)
  - Eq
    - Low EQ — Edit -5 to +5
    - Warm EQ — Edit -5 to +5
    - High EQ — Edit -5 to +5
    - Save Preset [Save Pst] — Edit Name (8 char max)
- OUTPUTS
  - TX-1 Out [Tx1 Lvl] — Edit TX-1 Level dB
  - TX-2 Out [Tx2 Lvl] — Edit TX-2 Level dB
  - Pilot Inj — Edit Pilot Inj %
  - Dig Out — Edit Digital Level dBFS
  - 192 Out — Edit MPX192 Level
- NETWORK
  - IP Address [IP Addr] — Edit IP Address
  - Subnet Mask [Sub Msk] — Edit Subnet Mask
  - Gateway — Edit Gateway
  - MAC Address [MAC Addr] — (scroll down to view)
- VERSION
  - SW: xx.xx.xx
  - HW: xx.xx.xx
  - DSP: xx.xx.xx
  - WS1 xxxx
  - WS2 xxxx
- ACCESS
  - Lock
  - Unlock
  - Change PW? [Chg PW]
    - N
    - Y
      - Old PW:
      - New PW:
      - Save
- EXIT

Also available on the front panel is the network setup which is important for setup if the MP-532 is to be connected to a network and controlled remotely using the PC-based GUI application.

Scroll the front panel menu with the jog wheel to locate the Network item, and then press the jog wheel to select the Network item. In this dialog the hardware IP address, subnet mask, and gateway may be configured.

IMPORTANT:
Please ensure that the network configuration being set up on the front panel matches the network address range for which the MP-532 will be connected!

As an example for how the menu navigation works, scroll down the menu items to find the IP Address entry and press the jog wheel. Now, each press of the jog wheel will select a different octet of the four octets of the IP address. While a particular octet is selected, turning the jog wheel will increment and decrement the values of the selected octet. When the correct value for an octet is found, press the jog wheel to select it and go on to the next octet. Once there, turn the jog wheel to select the correct value, and so on. The same procedure is used to modify the remaining subnet mask and gateway addresses. Once finished, power cycle the MP-532 and after it boots up its network settings will be what was just entered.

Functionally, the front panel and its menu are limited to basic setup such as the network configuration, input audio source selection, output level adjustments, and basic processing tuning, all things addressed during initial setup.

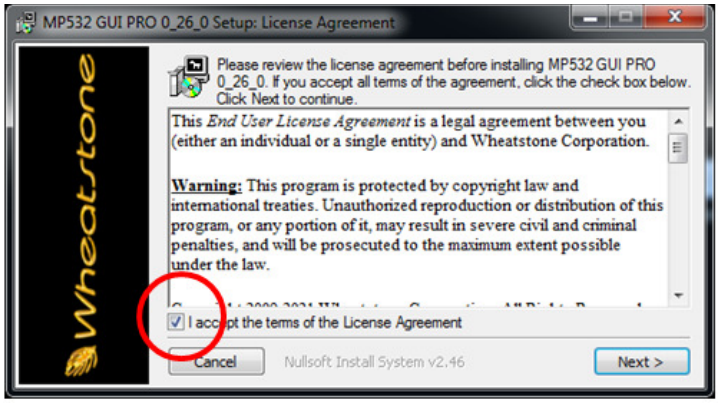
For deeper and complete access to every control the MP-532 offers we strongly recommend using the software GUI application which is perfect for routinely controlling and adjusting the MP-532 and also allowing it to be remotely controlled from anywhere in the world.

Installing the MP-532 GUI Application Software

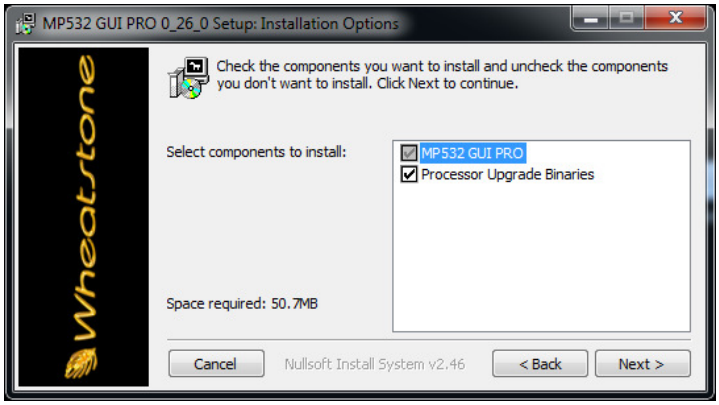
From here forward we will be discussing the features and operation of the PC-based software GUI application, starting first with GUI installation on the host PC which is then followed by configuring the GUI to communicate with the MP-532 hardware.

On the USB thumb drive along with this Quick Start Guide is the file for installing the GUI application.

First locate the file called “MP532_RemoteApp_x_xx_x.exe where the x’s show the version of GUI software to be installed. Double clicking the exe file will start the installation. Once the installation starts, a popup dialog will ask to accept the terms of the license agreement.

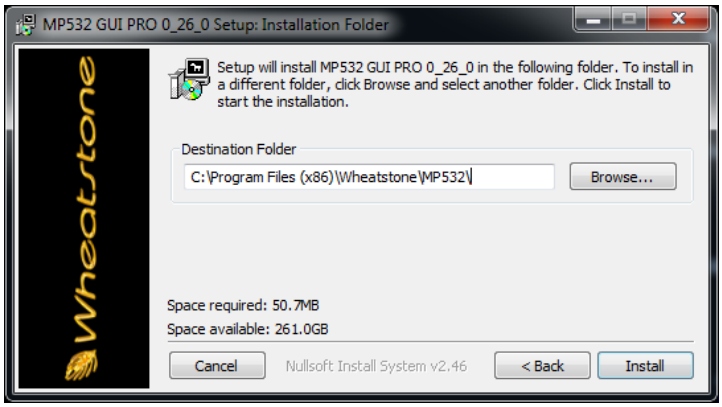


Click the “I Accept…” box checked in the image at left and then click Next to continue the installation.



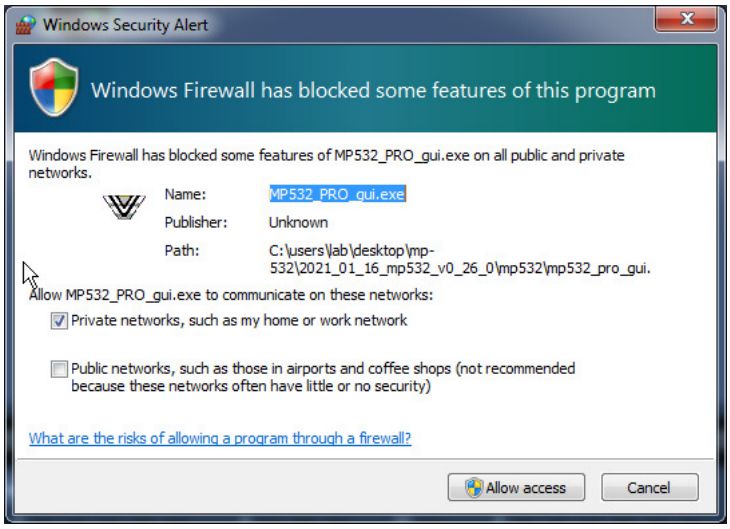
The next popup allows you to select the components to be installed. Both items will be checked and installed by default.

We recommend leaving the settings as they are, and continue the installation by clicking the Next button.



On most PC’s the default GUI App installation location will be in the location shown in the image at left, though the application may be installed in any location desired.

Once the installation has finished the GUI application may be started by navigating to the Windows All Programs dialog, scrolling to locate the Wheatstone entry, opening that, and clicking on the entry for the MP532 Remote App. During opening of the GUI application Windows may pop up the message below.



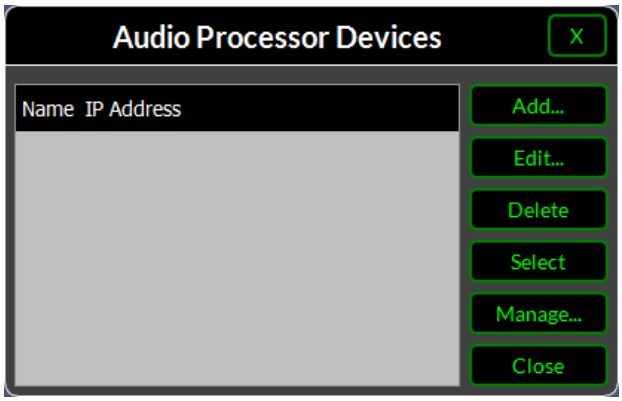
Normally the MP532 GUI application will need access through the Windows Firewall in order to communicate with the MP-532 hardware over the connected network.

On the dialog at left we've allowed the GUI application to communicate on a Private network. This choice is checked by default.

Press the Allow access button to continue GUI application startup or press Cancel to not start the GUI application.

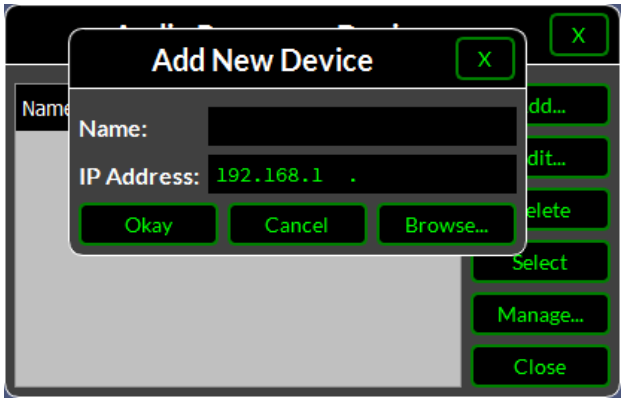
When the GUI application starts up the following screen will appear. This is the SYSTEM page of the interface and where hardware status, software versions, security, and operating mode choices are located. Next we will configure the GUI application to communicate with the MP-532 hardware.

To configure the GUI application to communicate with the MP-532 over a network, click on the Devices button circled in the image below.

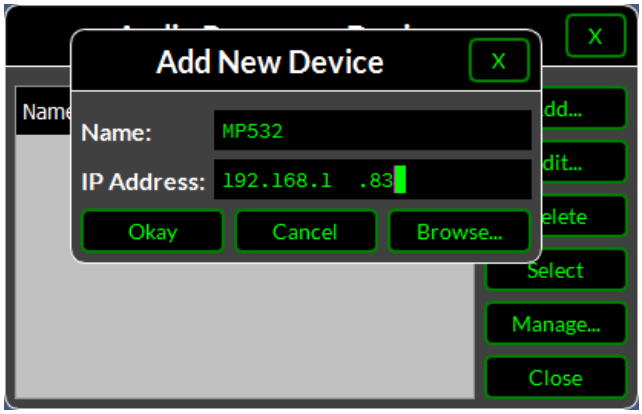


When the button is clicked, a new dialog will pop up called Audio Processor Devices.

Clicking the Add… button will open the next dialog.



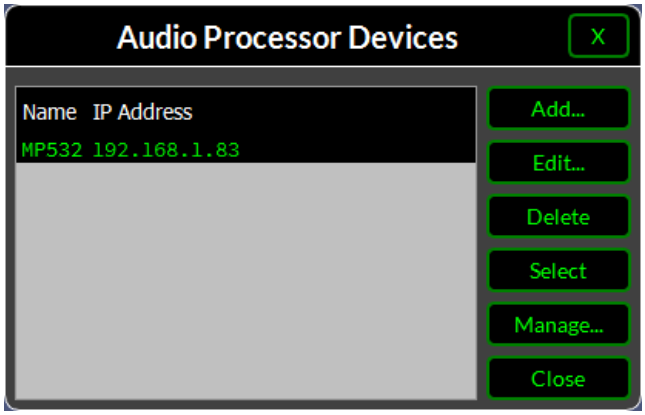
In the Name: box we can give the MP-532 a unique device name that will be displayed in the GUI application when it's connected and online to the MP-532.



In the dialog at left we've given the new device the name MP532 and told the device configuration dialog that this MP-532 can be found at the IP address 192.168.1.83.

Once your MP-532 device information has been entered, click to Okay button to create the new device.

NOTE: It is unwise to use leading zeros in IP addresses!!



Now that the new MP-532 device has been created, it must be 'selected' before the GUI can use and connected to the MP-532 with the information entered.

Highlight the new device and then click the Select button to make it the active device for the GUI application. Next, click the Close button to close the Devices menu and return back to the System screen of the GUI application.

Operating the MP-532 and its Graphical User Interface (GUI)

After closing the Devices dialog we're ready to connect to the MP-532 over the network and begin setting things up for on-air. Click the button shown circled at the top of the next image. The Status text should change to Online, the Device Name should be showing, and the currently running preset should be displayed, here shown as Quick Start_FM.

Also shown above is that the MP-532 is connected to an audio source and that it is operating in its FM Mode as indicated by the Processor Mode knob at lower right circled in red.

Additional information is also present on the System screen such as the unit's internal temperature, the versions of software and firmware that it is running, and how its Network Configuration is configured. These items are found within the dashed boxes in the above image.

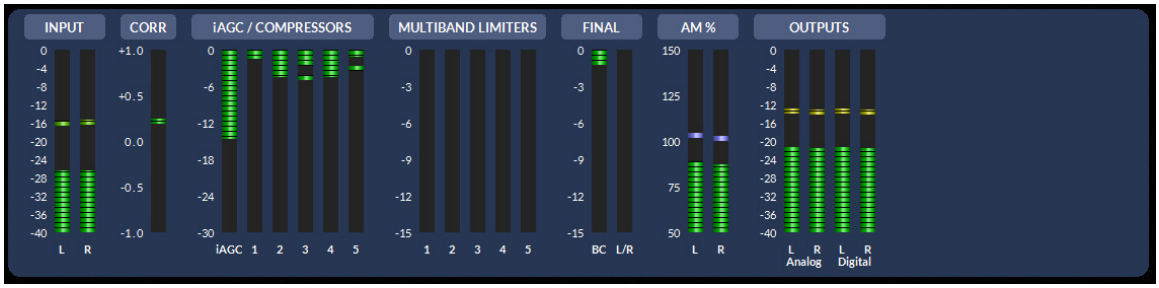
The System screen also hosts the options for setting up:

- Hardware and remote GUI security;
- System Time (also equipped with Network Time Protocol, or NTP);
- Headphone audio source and headphone volume;
- Which audio outputs the HD+ signal path utilizes;
- Whether Input or Output settings follow preset takes.

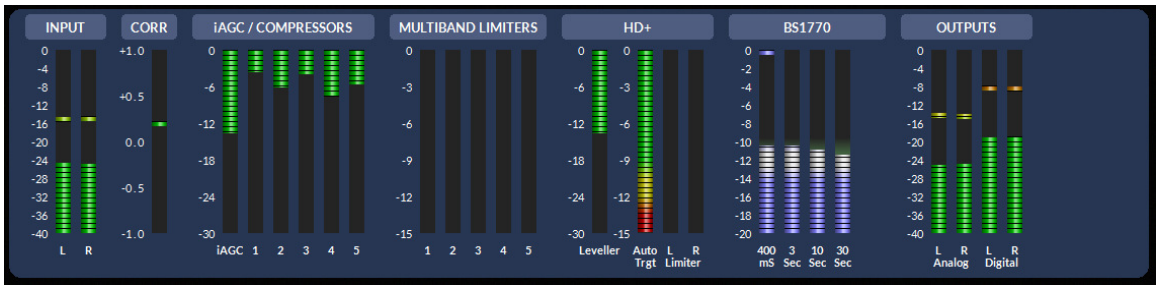
Along the bottom of GUI are a series of bargraph meters to indicate various types of activity related to the audio processing. The metering being shown is related to the selected processing mode and the meters will change when modes are changed to reflect the activity for that mode.

The FM mode metering is shown below.

The AM mode metering is shown next.



And, finally, the metering for when the HD+ mode is selected.



Each MP-532 operating mode's metering will be described in turn, starting with FM.

Keep in mind that from left to right, the metering is common for <u>all</u> modes up through the Multiband Limiter. Those to the right beyond the Multiband Limiter meters are dedicated to the current operating mode of the MP-532.

FM Mode Metering

INPUT – Shows the Left Channel and Right Channel audio input level regardless of which audio input source is in use.

Normal operating levels should have the INPUT meters frequently peaking near -12dBFS but never more than about -4dBFS on frequent occasions. Wheatstone's audio level meters are calibrated in decibels Full Scale digital which makes 0dBFS mean the digital domain is "out of digital bits". Severe distortion will be the result.

CORR – This meter shows left/right channel correlation, indicating the relative phasing between the two stereo channels. Fully mono material will cause the meter to stay near +1.0. Normal stereo material will cause the meter reading to stay between 0.00 and 1.0. An inadvertent phase error between left and right channels, such as a polarity error, will cause the meter to read between 0.0 and -1.0.

iAGC / COMPRESSORS – Note that the gain reduction meters are read down from the top.

iAGC – Indicates the amount of gain reduction occurring within the five band iAGC section, the meter showing the maximum of a single band. Normal indications will have the meter running somewhere between -6dB and -18dB depending on program content. This meter will always be a solid bar.

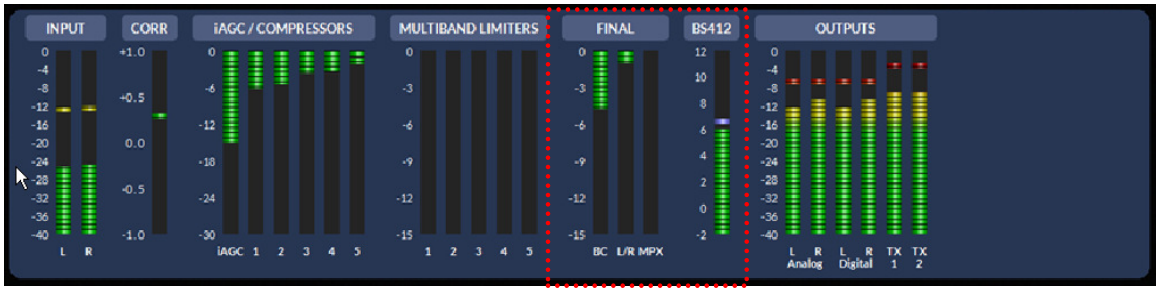
1, 2, 3, 4, 5 – Indicates the gain reduction of each individual band within the Multiband AGC and Compressor stage. The meters have two parts; a solid bar represents the current value of faster compression, and a single bar which indicates the current value of gain reduction being applied by the slower AGC. The bands can be quite active (or not) depending on the program content being processed and the preset in use.

MULTIBAND LIMITERS

1, 2, 3, 4, 5 – These meters show the instantaneous amount of peak limiting in each of the five limiter bands. Depending on program content and the preset in use the meters might be very active, or perhaps not showing any visible gain reduction at all. This is behavior normal.

FINAL – These meters show the amount of final peak limiting and/or clipping and will be different for each of the MP-532 operating modes.

FM Final Metering



The FM mode-related Final meters are shown inside the dashed box in the above image:

BC – This meter indicates the activity of the MP-532's Bass Management System. As with the LIMITER meters, the BC meter may not show much activity on one type of program material, and then on the next song frequently hit -15dB full scale. This too is normal. There are several closely-related bass managers working behind the scenes and the BC meter indicates the greatest of the activity occurring in any one of the bass managers.

L/R – This meter shows the activity of the MP-532's final FM clipper. A fair amount of activity is normal for most program material, is no cause for concern, and is due to FM pre-emphasis being applied prior to the final clipper and distortion cancelling algorithms.

Unlike other products we are aware of our metering shows the true amount of control being applied to the pre-emphasized audio rather than a scaled down version intended to 'ease concern' about the amount of processing actually required to control FM pre-emphasis in a competitive broadcast environment.

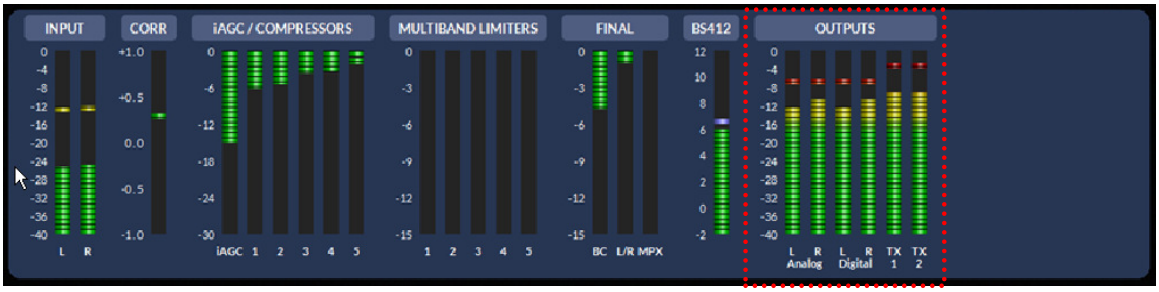
Example: If the clipping threshold at 400Hz is 0dB (extremely gentle processing!) FM pre-emphasis will cause audio at 15 kHz to be 'into the clipper' by 17dB, more than -15dB full scale!

MPX – This meter shows the amount of MPX processing (composite clipping) occurring. On the majority of Factory Presets the MPX meter will be showing very little activity. The capabilities of the MP-532's final FM clipper make the use of composite clipping optional for most formats.

BS412 – This meter shows the amount of multiplex (MPX) power being generated by the current preset and program content. More aggressive presets and/or user settings will generate varying amounts of MPX power and can often be higher than the MPX power generated by Factory Presets.

NOTE: Certain countries in Europe impose a MPX Power maximum on FM broadcast stations in order to help reduce adjacent channel interference. In such countries the FM channel spacing is only 100 kHz as opposed the US and other country's 200 kHz channel spacing. This makes the management of MPX power a mandatory method to help reduce interference to FM stations operating on such narrow FM channel spacing.

FM Output Metering



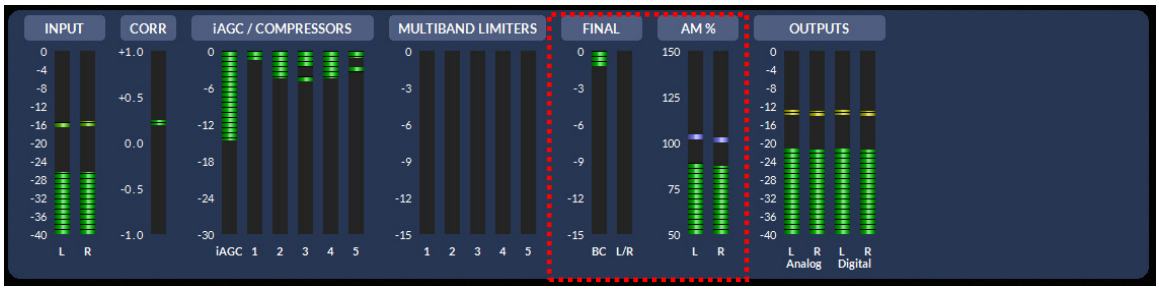
NOTE: All metering is calibrated in dFBS, or decibels Full Scale (digital).

L/R Analog – These meters indicate the output levels present at input to the analog output digital-to-analog converter which then feeds the left/right analog outputs on the rear panel of the MP-532. A full scale setting of the Analog Output level control will result in a +22dBu audio level (balanced) at the rear panel XLR connectors into a bridging load.

L/R Digital – These meters show the actual output levels in dBFS present at the AES3 digital output on the rear panel of the MP-532.

TX1/TX2 – These meters show the input levels to the MPX path digital to analog converters which then feed via buffer amplifiers, followed by the BNC outputs on the rear panel. The MPX outputs are capable of more than 10V P-P into a bridging load.

AM Mode Final Metering



The AM mode-related Final meters are shown inside the dashed box in the above image.

BC – This meter indicates the activity of the MP-532's Bass Management System. As with the LIMITER meters, the BC meter may not show much activity on one type of program material, and then on the next song frequently hit -15dB full scale. This too is normal. There are several closely-related bass managers working behind the scenes and the BC meter indicates the greatest of the activity occurring in any one of the bass managers.

L/R – This meter shows the activity of the MP-532's final AM clipper. A fair amount of activity is normal for most program material, is no cause for concern, and is due to AM pre-emphasis being applied prior to the final clipper and distortion cancelling algorithms.

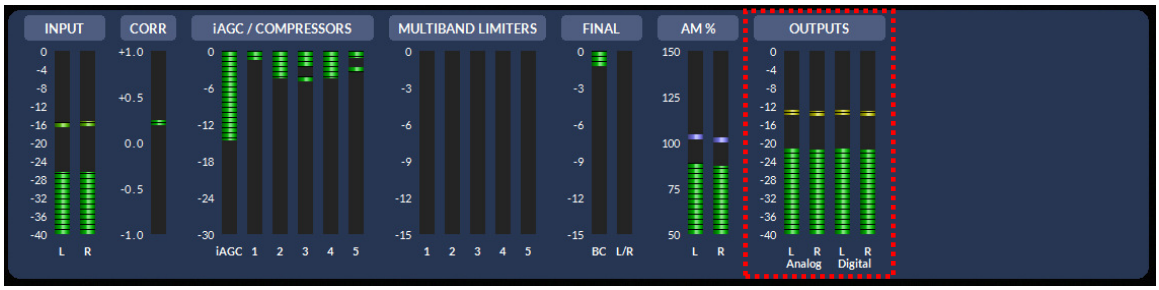
Unlike other products we are aware of our metering shows the true amount of control being applied to the pre-emphasized audio rather than a scaled down version intended to 'ease concern' about the amount of processing actually required to control AM pre-emphasis in a competitive broadcast environment. Example: Due to AM pre-emphasis, if the clipping threshold at 400Hz is 0dB (extremely gentle processing!!), audio at 10 kHz will be 'into the clipper by 13dB', almost full scale!

AM% - These meters show the relative modulation based on the setting of the AM Symmetry control in the AM mode's "AM" GUI page.

If the AM Symmetry choice is <u>not</u> checked the L/R meters indicate the *negative going* value of modulation that should occur when the MP-532 is connected to an AM transmitter and the modulation has been set. Under this condition the audio outputs will be symmetrical, i.e., no positive peaks above 100%.

When the AM page's AM Symmetry choice <u>is</u> checked, the L/R meters will show the *positive going* value of modulation that should be occurring on a transmitter with linear and sufficient positive modulation headroom. Under this condition the audio outputs will be asymmetrical, i.e., positive peaks will be above 100% as set by the Positive Modulation control in the GUI's AM page.

AM Mode Output Metering



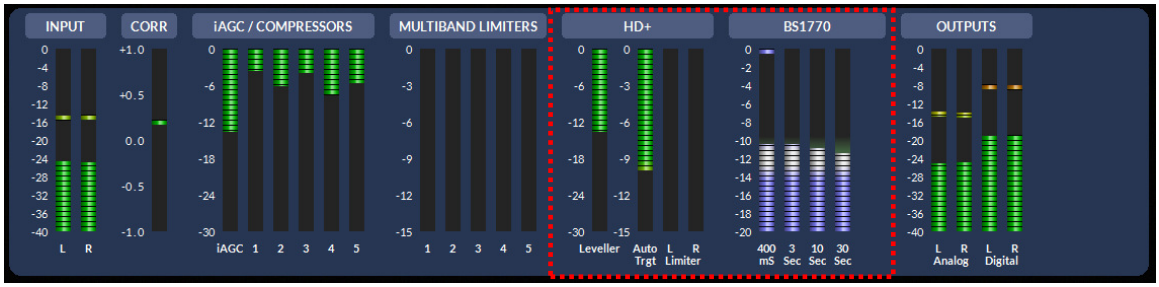
The AM Mode Output metering is shown inside the dotted box in the above image.

L/R Analog – These meters show the digital input levels applied to the digital to analog converters prior to the analog output buffer amplifiers. The output level controls in the GUI labeled Level A and Level B feed the Left and Right meters, respectively, as well as the Left and Right analog outputs on the rear panel of the MP-532. The analog outputs will commonly be used to feed older AM transmitters lacking digital AES3 inputs.

The analog outputs are capable of driving +22dBu into a bridging load. Most AM transmitters equipped with analog inputs will achieve 100% negative modulation with a +10dBu input level which leaves 12dB of headroom above 100% modulation.

L/R Digital – These meters show the levels in the digital domain for the A/L and B/R outputs of the AM mode's final processing. Like others, the meters are calibrated in dBFS. Most AM transmitters we are aware of and equipped with AES3 digital inputs will achieve 100% negative modulation with a peak input level of -6dBFS.

HD Mode Final and BS.1770 Metering



The HD+ mode-related Final and BS.1770 meters are shown inside the dashed box in the above image.

Leveller – This meter indicates the amount of gain reduction occurring within the HD+ mode's slow, gain-riding leveler which serves to even out levels applied later to the final lookahead limiter.

Auto Trgt – This meter shows the amount of gain reduction required in order for the BS.1770 Loudness Controller to achieve the target value set by the user.

L/R Limiter – These meters indicate the amount of gain reduction, in dB, occurring in the HD+ peak limiter.

BS1770 400ms – This meter indicates the 'loudness' of the HD+ processing section over the past 400 milliseconds.

BS1770 3 Sec – This meter indicates the 'loudness' of the HD+ processing section over the past 3 seconds.

BS1770 10 Sec – This meter indicates the 'loudness' of the HD+ processing section over the past 10 seconds.

BS1770 30 Sec – This meter indicates the 'loudness' of the HD+ processing section over the past 30 seconds.

All loudness measurements are made according to the International Telecommunications Union (ITU) BS.1770-4 standard adopted on October 14, 2015.

HD+ Output Metering

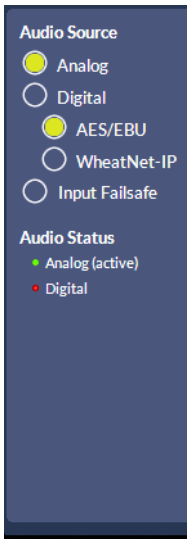
NOTE: All metering is calibrated in dFBS, or decibels Full Scale (digital).

L/R Analog – These meters indicate the output levels present at input to the analog output digital-to-analog converter which then feeds the left/right analog outputs on the rear panel of the MP-532. A full scale setting of the Analog Output level control will result in a +22dBu audio level (balanced) at the rear panel XLR connectors into a bridging load.

L/R Digital – These meters show the actual output levels in dBFS present at the AES3 digital output on the rear panel of the MP-532.

Main GUI – INPUT Screen

Above is the INPUT screen of the GUI when it has been selected to be in view. In order to explain the various controls within the Input screen we'll break it down below and explain each subset.



Audio input sources may be analog left/right. AES3 digital, or WheatnetIP as selected by clicking on its associated dot.

When the dot is filled the selection is active.

When the Input Failsafe dot is filled the automatic failover from analog to digital, or digital to analog source is armed. If the primary source is digital, the backup source is analog, and the digital source fails, the MP-532 will switch the input over to the analog source where it will remain unless or until the digital source returns.

Analog fail is via silence sense on BOTH channels for 30 seconds with an audio trigger level of -42dBFS.

Digital fail is via silence sense on BOTH channels for 30 seconds with an audio trigger level of -42dBFS. If digital fails due to invalid digital data the failover will be immediate.

Audio input levels to the processing may be adjusted by using the Analog Gain for the analog input and/or the Digital Gain for the AES3 digital input.

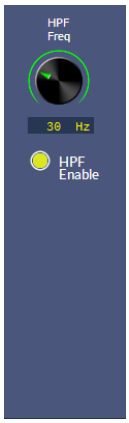
The adjustment range of both controls is +/-12dB and should be adjusted that with normal programming applied to the MP-532 audio input, the Input Level meters on the front panel or remote GUI are peaking around -12dBFS with very occasional peaks permitted up to -4dBFS.

The Input Level meters true peak reading and are calibrated in dBFS (decibels Full Scale digital). If the meters are indicating above -4dBFS – or trying to go higher – the input, in the digital domain, will be out of headroom and serious distortion will result.

Shown at left is the Left/Right channel balance control. Extenuating circumstances may require small adjustments to maintain center channel mono during voice, but such instances should be rare.

The Left/Right Mode allows the MP-532 to be driven with a stereo source (normal) or from a left only or right only input. When the left or right only choices are invoked, audio from one input channel feeds BOTH left and right channels of the internal processing. The mono position is useful for AM when the STL delivers stereo audio to the transmitter site and no other means exists to mix the audio down to mono.

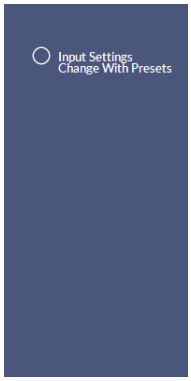
The Phase Rotator, located at the bottom, selects whether or not the phase rotator is invoked. Phase rotators are used to realign the sometimes asymmetrical waveforms of speech to make better use of processing capabilities and can result in a reduction of distortion during period of raw voice. Leaving the Phase Rotator in its enabled state (dot filled) is recommended for all program formats.



The HPF (High Pass Filter) Freq control is next and represents the control for the filter that removes inaudible subsonic sounds from the audio prior to processing. Removing such low frequency material prior to processing makes the processing cleaner, the bass better defined, and typically results in reduced processing-related distortion.

We recommend the High Pass Filter to be switched in and set to the following for the MP-532's different modes:

FM Mode:	30 Hz
AM Mode:	60 Hz
HD+ Mode:	30 Hz



The MP-532 has the ability to modify the settings in the Input screen of the GUI through the use of presets. When the Input Settings Change With Presets dot is not filled, the option is OFF.

If the **Input Settings Change With Presets** dot is filled, when a preset is recalled, whatever Input setting existed when that preset was last saved WILL BE RECALLED. It is important to keep this 'feature' in mind if using it is not intended.

One use example for the feature: what if you'd like to not use, for whatever reason, the Input screen's automatic failover feature but want to change input audio sources on the fly some another way? Enter the Input Settings Change With Presets feature!

To use this feature you would create and then save two versions of the same preset. One would be saved with Analog as the input source and one would be saved with Digital as the input source, and both would have the Input Settings Change With Presets feature enabled when the presets were saved.

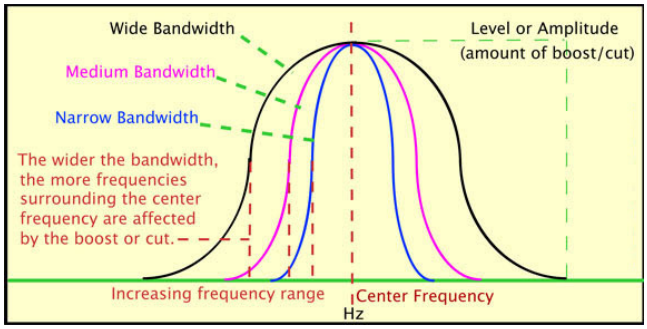
Now you can switch input sources merely by changing presets! And you can change these preset manually, via the MP-532's onboard real-time scheduler, or via its rear panel GPIO interface.

Main GUI – EQ Screen

There are four equalizer sections available in the main program signal flow, and functionally it is located prior to the multiband AGC which follows.

The first and fourth equalizer sections operate in shelving mode and in terms of their effect, operate much like the familiar bass and treble controls of consumer audio gear.

The second and third equalizer sections operate in 'parametric' mode, which means that not only are boost and cut available, but so too are the center frequency upon which the boost or cut will take place, as well as the width of the band of frequencies also affected by boost or cut. The latter is controlled by the knobs labeled Bandwidth and calibrated in octaves. The relationship between Bandwidth and Q is represented by the following graphics.

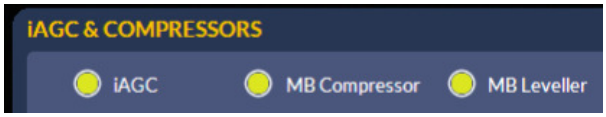


BW (Octaves)	Q
2.0	0.667
1.0	1.414
2/3 (0.66666)	2.145
1/2 (0.50000)	2.871
1/3 (0.33333)	4.318
1/6 (0.16666)	8.651
1/10 (0.10000)	14.242
1/30 (0.03000)	43.280

The equalizer may be adjusted turning the knobs present on the GUI, or by dragging the equalizer response curves around with the mouse in order to create the desired effect.

Main GUI – AGC Screen

iAGC, Compressor and Leveler In/Out



Across the upper left of the GUI's AGC page are three circles representing the Enable/Disable buttons for the **iAGC**, **Compressor** and **Leveler**. When clicked by the mouse to make them filled in yellow the processing section they represent is enabled. Conversely, when clicked to undo the yellow fill, the section is disabled.

iAGC The **iAGC**, or Intelligent Automatic Gain Control, is a windowed multiband gain controller operating directly on incoming audio, post Equalizer and prior to the MB (multiband) Compressor and MB (multiband) Leveler. The AGC Drive, mentioned later, does not affect the operation of this processing stage.

MB Compressor The (multiband) **MB Compressor** does the job of 'filling in' the lower level passages that, due to its much slower reaction time, can't bring up without sounding unnatural. The compressor does this by operating faster, within certain limits, one of which is that the compressor can never add more gain at any instant than the AGC.

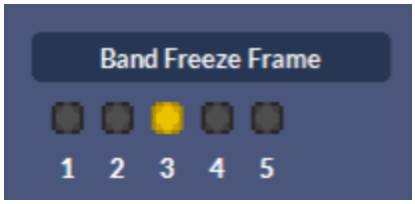
MB Leveler The (multiband) **MB Leveler** does just what its name implies; it 'levels out' the variation in incoming audio levels in order to build a polished and more cohesive final sound.

AGC Drive Sets the amount of 'work' that the multiband section does in order to generate a consistent output level. Higher settings 'push' the AGC section harder while lower settings relax it.

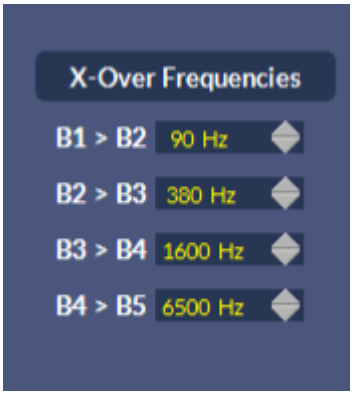
Gate Mode The **Gate Mode** control sets how the AGC silence gate works. In the **Hold** mode, as soon as the audio input level into a band falls below the currently set Gate Threshold, the gain of the band freezes. In the **Ooze** mode, when the above condition is achieved, instead of the band gain holding at its current level, it will slowly release towards 0dB, increasing the gain.

Gate Delay The **Gate Delay** control sets how long the audio level sensor within the gating circuit *waits* before applying the setting chosen by the Gate Mode control. Higher settings of **Gate Delay** are useful for talk formats by helping to keep the voice audio levels higher and more even.

Gate Thresh(threshold) The Gate Threshold control sets the audio level at which the circuit determines that the detected audio level is at the point where it should apply Gate Mode Hold or Ooze, once the presently set Gate Delay time expires.

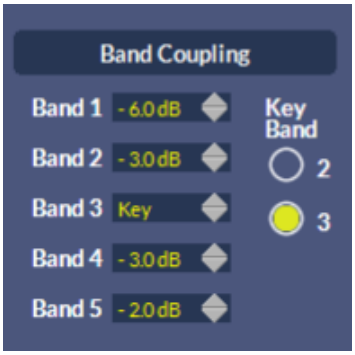


Whenever a band is it in Gated mode the Freeze, or Gate indicator for that band will illuminate within the **Band Freeze Frame** window.



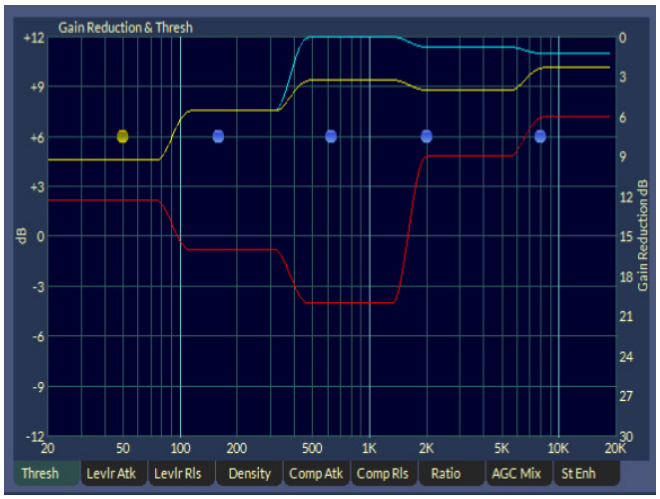
X-Over Frequencies There are four controls located in this area of the GUI which are used for setting the desired crossover frequencies for the five AGC bands. The settings shown are suitable for a wide variety of program material but may be adjusted to taste and format needs.

There are no really 'wrong' settings, though setting the controls so that a band's bandwidth becomes very narrow can sound odd, perhaps even undesirable.



Band Coupling The Band Coupling controls set how much a band's gain reduction can different from the adjacent band. Larger numbers allow greater independence, while smaller numbers cause the band gains to track more closely to each other.

The band used for Reference is called the *Key Band*, and can be set to be either Band 2 or Band 3. The Band 2 setting is usually better for music while the Band 3 mode is usually better for voice formats.



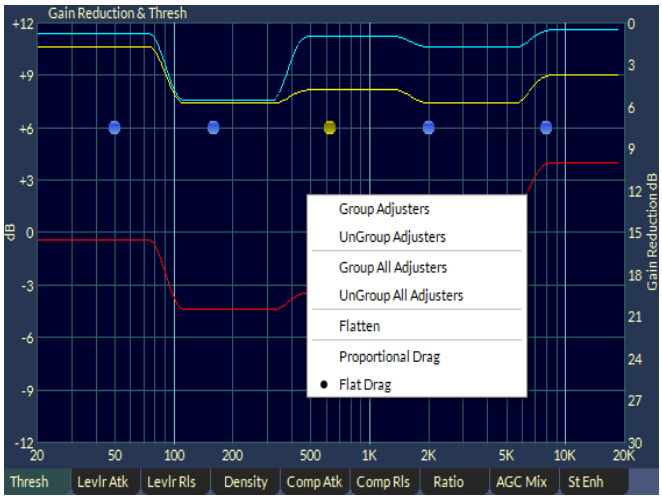
There is a large graphical area at the upper right in the GUI's AGC screen which shows multiple pieces of information related to the multiband AGC.

iAGC Gain Reduction is shown by the red wiggly lines.

Compressor Gain Reduction is shown by the light blue wiggly lines.

AGC Gain Reduction is shown by the yellow wiggly lines. All gain reduction displays use the scale along the right side

Along the bottom of the graphical area are nine tabs with each tab being the key into the per-band adjustments related to the tab name. Each band is represented by a blue dot and when it is double clicked to turn the dot orange, becomes the adjuster for that band.



Right clicking over the graphical will open up the menu for the various ways to make adjustments to the individual band parameters, noting that the graph scale will change when the active tabs are changed in order to match the type of parameters then available for adjustment.

The individual 'band dots' may be adjusted together, individually, or in a proportional sense depending on how the right click pop up navigation menu has been configured.

Main GUI – Limiter Screen

The GUI's Limiter Screen is shown above, noting that it is similar in appearance to the AGC screen, but with a different set of user controls.

Enable, Yes/No sets whether or not the multiband limiter is enabled and in circuit. When the limiter is not enabled it is completely out of the signal path.

Drive sets the amount of multiband AGC output signal being sent into the limiters. Lower settings will make the audio sound more relaxed. Higher settings will make the audio more dense, but not necessarily louder once the limiter drive has reached a certain point.

Knee the Knee control sets the steepness of limiting action. When the Knee control is set to Hard, limiting does not occur until the actual limiting threshold is achieved, upon which limiting achieves a high ratio.

When the Knee control is set to Soft, limiting begins a few dB below the set threshold and then gradually begins hard limiting once the threshold is reached. The Soft Knee mode sounds softer or more spongy because limiting isn't quite abrupt as it is in the Hard mode.

The **Vox Ducking** section (Vox for Voice) assures that when voice content is being aired, the Main Clipper Drive is backed out slightly to reduce clipper distortion on voice.

The **Enable** control set whether or not Vox Duck is active.

The **Sense** control sets at what point the vox detector believes the program content is voice. Lower settings will cause the sense circuit to trip earlier while higher settings cause the detector to be less sensitive.

The **Duck** control sets how much Main Clipper Drive is reduced during live voice content. Usually settings between 1dB and 3dB are appropriate.

The **Bass Clipper** does just what it says – it prevents very low frequency content from getting into the main clipper and causing distortion. In fact, the Bass Clipper's job is to clip bass just enough to prevent the main clipper from seeing it.

But the Bass Clipper has a sound, and that sound can be customized to suit the station's needs and format.

Higher settings of the **Drive** control make the bass clipper work harder on low frequency content. Very high settings can add bass sustain and additional low frequency harmonics that can make bass sound bigger on smaller speakers.

The **Threshold** control set how high clipped bass is allowed to go and still stay below the main clipper threshold. The Drive and Threshold controls are best adjusted by ear, although we recommend not setting the Threshold control higher than about -2dB to prevent bass IM distortion in the main clipper.

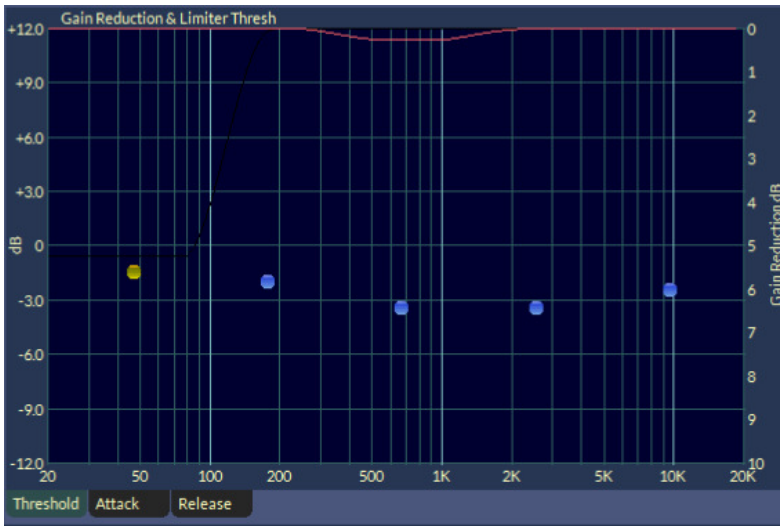
Next is the **Main Clipper**, the final arbiter for the maximum peak level which will exit this section of processing. The Main Clipper is also where many stations will go to add additional competitive loudness. The MP-532's Main Clipper is fairly forgiving, though as with all clippers, at some point there is no more free lunch and things will become badly distorted, and fast.

The **Pre-Emphasis** control sets the appropriate amount of FM high frequency boost according to the particular country where the MP-532 is being operated.

Note that we have seen some US-based stations operating with 50uS instead of 75uS pre-emphasis, especially if their format is targeted more towards a female audience.

The 50uS setting affords about 3dB less high frequency clipping which might improve long term listening, noting at the same time that multiband AGC and limiter technology which operates on the audio prior to pre-emphasis being added makes the difference between 50uS and 75uS very small indeed, but still potentially useful nonetheless.

Multiband Limiter Graphical Area



Like the Multiband AGC, the Multiband Limiter has its own graphical screen, only here there is much less going on or to show.

The red wiggly line represents the gain reduction occurring at any instant.

There are three tabs across the bottom of the graph to allow navigation to the Threshold, Attack and Release parameters for each band.

Just like the multiband AGC's graphical area, right clicking on the Multiband Limiter graph will pop up an options menu showing the different options for manipulating the blue dots for each limiter band. Remember that each dot represents a single band (left to right and 1 through 5) and as different tabs are selected, that band's dot adjusts the parameter selected by the tab Threshold, Attack or Release tabs below the graphic.

MAIN GUI – MPX and OUTPUT SCREEN

After all FM left/right processing has been completed, the signal next moves to the stereo generator which then constructs the multiplex composite signal. There are three separate tabs for the MPX and Output page, Process & SCA, Outputs, and Delay and Test, containing the controls associated with each specific part of the processing.

The **Composite Clipper Drive** control adds clipping in the multiplex domain, if desired while maintaining good distortion and spectrum control. Most users will rarely advance this control beyond about +2.0dB.

The **MPX Mode** switch changes the stereo generator between stereo and mono mode. In mono mode the stereo pilot is automatically turned off.

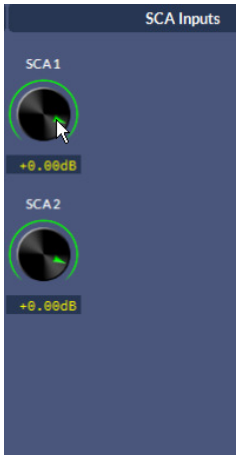
The **Multipath Limiter** control adjusts the amount of L-R difference signal management which in some installations has reduced the effects of perceived multipath. The Multipath Limiter continuously analyzes the ratio between the L+R (mono) signal and the L-R (stereo) signal and maintains that ratio at the set percentage. It is rare to need this control set as low as 20% - most users find it useful when set between 50% and 70%.

The **Pilot Injection** control adjusts the amount of 19 kHz stereo pilot signal – the signal that tells FM receivers that the station is broadcasting in stereo.

The **Pilot Phase** control makes small adjustments to the relative phase between the 19 kHz stereo pilot and the 38 kHz subcarrier that carries the L-R (stereo) part of the program content. Normally this control will be set to +0.0 unless equipment is available to make an actual measurement of the 19 kHz/38 kHz phase relationship.

BS412 Enable turns on and off an algorithm which is only used in certain countries in Europe as mandated by broadcast regulations. The control should remain in the "No" position in countries not required to conform to BS.412 regulations – turning it on will immediately cause a loudness decrease of 5dB or more.

BS412 Offset allows BS.412 users to make BS.412 limiter threshold adjustments to better complement their station's source material. This control has no effect when the BS412 Enable control is in the NO position.



The MP-532 is equipped with two subcarrier inputs suitable for RDS, RBDS or other types of subcarriers. These inputs are both digitized at a 192 kHz sample rate and then added to the stereo multiplex signal in the digital domain.

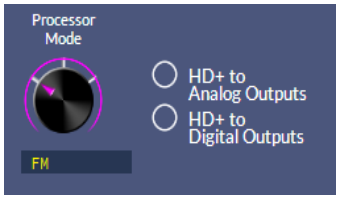
The controls labels **SCA 1** and **SCA 2** serve as level adjustments for matching the output subcarrier generator to the desired deviation of the main FM carrier.

The second tab of the MPX&OUTPUT GUI page hosts the level controls for the various types of output signals.

Analog Level adjusts the output signal at the MP-532 rear panel Analog left/right outputs.

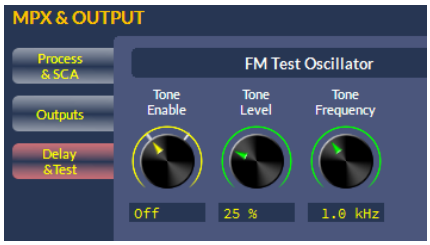
Analog HD Delay selects whether or not analog left/right outputs are before the Diversity Delay or after it. The "In" position means the analog outputs are after the delay and not before it.

The **Analog De-Emphasis** control selects whether to apply de-emphasis to the analog outputs if the analog outputs are coming from the FM processing system (see below). If pre-emphasis is not on, the De-Emphasis control has no effect.



The MP-532 analog and digital outputs may be used for FM, AM or the HD+ Mode so there must be a way to assign those signals to the appropriate outputs.

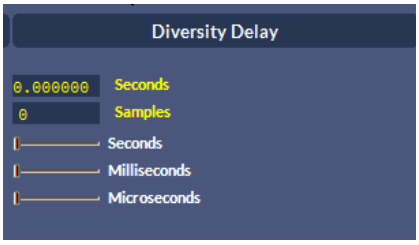
In the image at left are shown choices available on the GUI's SYSTEM page for reassigning the Analog or Digital outputs to the HD+ signal path.



Normally the analog and digital left/right outputs would follow the FM or AM mode, as selected by the **Processor Mode** switch unless overruled by the HD+ choices.

The third tab of the MPX&OUTPUT GUI page provides access to a **Test Oscillator** whose **Tone Level** and **Tone Frequency** may be varied as desired.

Note that if the **Tone Oscillator** is switched on, the test tone will replace any program content previously on the air.



The MP-532 is also equipped with FM/AM **Diversity Delay** for use in the FM/HD or AM/HD transmission systems.

Coarse adjustments may be made while holding down the keyboard **SHIFT** key while scrolling settings with a mouse wheel. Alternately, fine adjustments may be made in the same way but by holding down the keyboard's **ALT** key instead.

MAIN GUI – RDS SCREEN

The MP-532 is equipped with a full-featured RDS/RBDS generator which may be set up for static messages only such as station call letters or slogan, or may be configured for fully automatic message updating by receiving data from the station's playout system over the network. The RDS/RBDS generator is complex and we have therefore created a separate manual for its usage and setup which is part of this manual as an appendix.

MAIN GUI – SYSTEM SCREEN

The MP-532 GUI's SYSTEM page, especially when connected to the MP-532 hardware, displays a lot of useful information that can help with troubleshooting. For instance, on a tech support call we would want to know the version of firmware and such currently on the hardware and the upper left corner of the System page shows all of that and more, including the network address of the computer that's currently running the GUI.

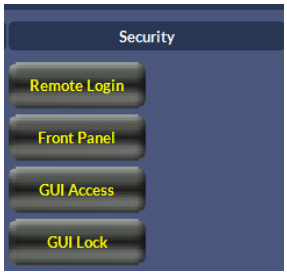
Likewise, the Status area of the System Page shows the MP-532's network configuration including, importantly, the internal temperature of the processor's hardware. The temperature displays in green as long as the internal temperature is 49.9C or below, and at 50.0C the display turns red to let you know it's getting hot in there and maybe needs a little more breathing room in the rack!

Also important are the options for choosing whether presets are allowed to change Input and Output settings when they are taken. Normally these options are not active and you may freely take presets *without* the Input audio source and Output Levels changing. However, it may be *desired* to change the Input Source or Output Levels by taking a preset with those new settings, so that capability has been provided.

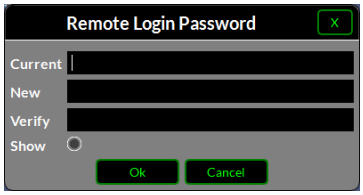
One example of how this feature might be used is to have one preset saved with the Digital Input selected as the audio source, and have a *copy* of that preset saved, but with the Analog Input source selected instead. Now with the Input Settings Change with Presets option enabled, taking those presets will change just the MP-532 Input audio source and nothing else.

And, speaking from experience, it's advisable to name those presets for what they do!

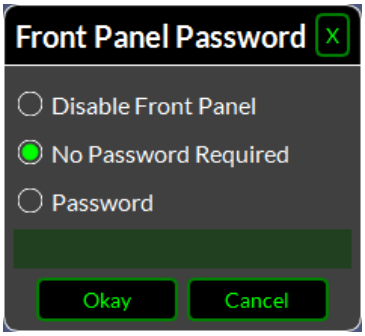
MP-532 Security



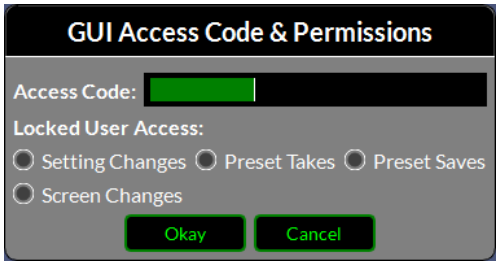
Several methods have been provided on the MP-532 software GUI's SYSTEM page for 'locking down' the processor and /or its GUI software.



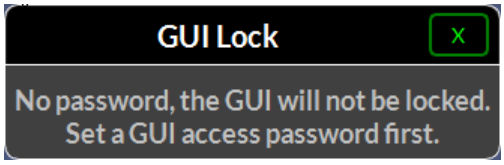
Remote Login:
Enables password protection for logging into the MP-532 remotely using the GUI software.



Front Panel Password:
Allows the MP-532 front panel to be password protected, if desired.

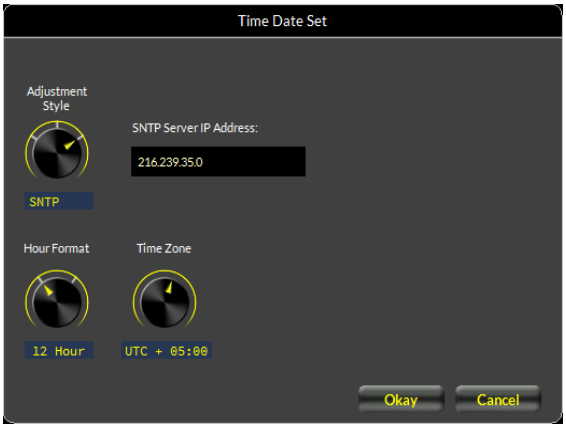


GUI Access:
Permits the software GUI to have special permissions, such as disallowing actions that might compromise the station's on-air sound. For instance, the programming department might be given access to taking presets, but be prevented from making changes to the station's modulation level.



GUI Lock:
Works in conjunction with the GUI Access dialog to lock access to the GUI once an Access Code has been assigned. In the image at left, no Access Code has been assigned so locking the GUI is prevented.

SYSTEM PAGE – MISCELLANEOUS



Clicking on **Set Time** opens the dialog where MP-532 "time" may be set by several methods.

At left the MP-532 is configured to receive time from Google's NTP Server at 216.234.35.0.

The MP-532 may also synchronize to the current time of the GUI PC or free run after being manually set.

Headphone Source:
The source feeding the headphones plugged into the MP-532 front panel headphone jack can be selected with the Headphone Source selector. The available sources are:

Input: Listens to whatever source is selected by the Input Selector switch on the Input page of the GUI.

Analog Input: Listens to the Analog Input even if the Digital Input is the actual program source. Useful for checking that a backup audio source is available without actually switching it to air.

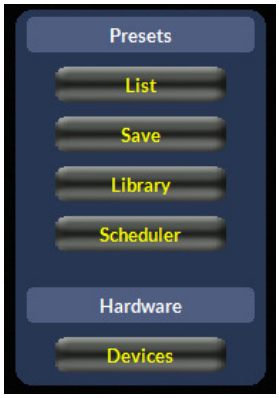
Digital Input: Listens to the Digital Input even if the Analog Input is the actual program source. Useful for checking that a backup audio source is available without actually switching it to air.

Process Out: Listens to the final output of the processing, regardless of which Input Source is being used.

Headphone Level: Sets the volume for the headphone output.

Processor Mode: The MP-532 is equipped with two primary operating modes, both with the capability of also adding processing for HD (called HD+ here). The default mode as shipped from the factory is FM, however a full-featured AM mode may be selected at any time by changing the setting of the Processor Mode switch to "AM". There is no need to download a different firmware image and reboot – there is plenty of on-board memory to hold the operating modes for both FM and AM, and its sidekick, HD+.

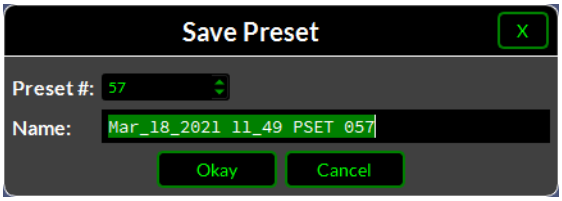
The analog and/or digital outputs may be selectively reassigned to the HD+ processing at a click of the mouse on the HD+ to Analog Outputs or HD+ to Digital Outputs option. Or, both analog and digital outputs can be connected to the HD+ output which might be the case where FM mode is using the two composite BNC outputs.



In the lower right corner of the PC GUI are buttons for different aspects of preset management.

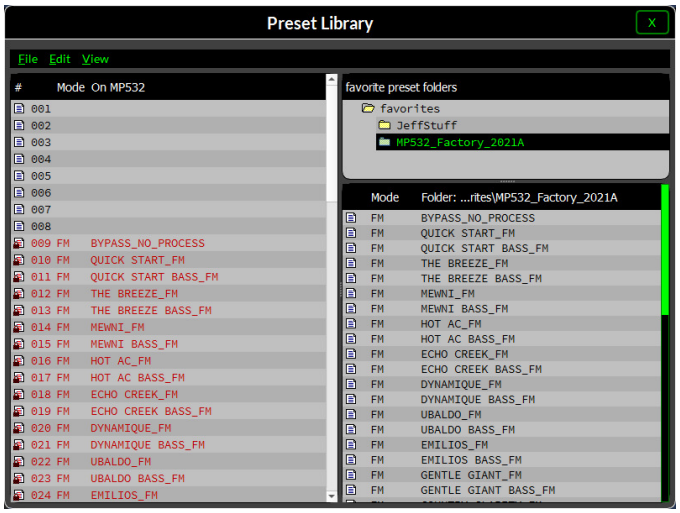
The List button opens the dialog shown below showing the list of presetws currently loaded on the MP-532 hardware.

Taking a preset can be accomplished by double clicking on the preset name you wish to put on the air or right clicking on the preset name and selecting the Take option.



If changes are made to the currently running preset and you wish to save the changes, clicking on the Save button will open the dialog at left.

The Preset# is the slot number the preset is about to be saved in, and the desired preset Name can be entered here as well.



Clicking the Library button opens the two-paned dialog shown at left. The significance of the two panes is very important:

The LEFT pane shows the presets currently loaded on the MP-532 hardware itself.

The RIGHT pane shows the folders and presets currently available on the host PC that is running the GUI interface.

Presets may be freely moved back and forth between the two panes using the familiar Windows drag operation, noting that presets being moved TO the MP-532 FROM the PC must be moved into an available empty preset slot on the MP-532 hardware.

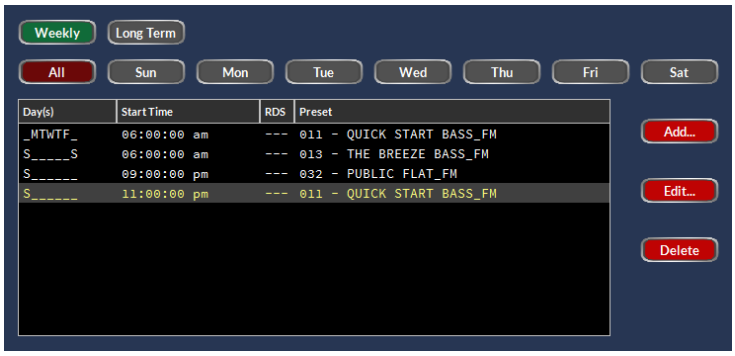
The Favorites folder in the right pane's upper portion is created when the MP-532 GUI is installed and it is a write protected folder – presets cannot be moved directly into that folder from the hardware. Instead, a new folder is created under Favorites. There is no limit to the number of subfolders which may be hosted by the Favorites folder.

Presets shown in the right pane of the Library dialog will be stored in the following location on Windows PC's running any version of Microsoft Windows above Windows XP Service Pack 3:

C:\Users\(currently logged on user)\Documents\Wheatstone\mp532\presets\favorites

Presets in the left pane of the dialog that are shown in Red text are Factory locked and may not be deleted or overwritten.

User locked presets will be shown in Blue text. Presets may be user-locked by right clicking on the preset and selecting the Lock Preset option from the dialog. Unlocking a user-locked preset is via a right click, Unlock Preset choice.



The MP-532 is equipped with a automatic preset scheduler that can be set up to automagically change presets on any specified date or time.

The default schedule is Weekly, however there is also a Long Term schedule function that can be set up to activate any preset days, weeks or months later.

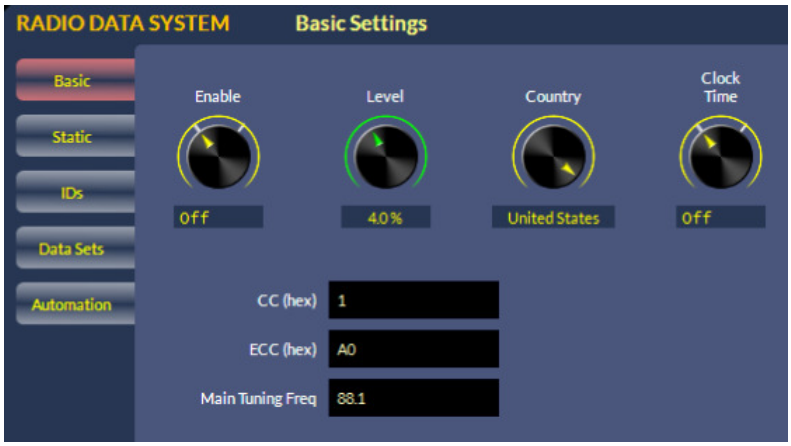
The scheduler can, at the user's discretion, also change parameters associated with the built-in RDS/RBDS generator on any date, time or other pre-saved schedule by recalling any one of 16 pre-defined Data Sets as part of a preset recall. In fact, a Preset Recall via the scheduler isn't absolutely necessary because the schedule can be set up to only change RDS parameters without changing the preset currently on the air.

This option is available at the time a scheduled event is created or at any time in the future by using the Scheduler's Edit button to modify how a particular schedule should behave.

RDS Functions

Radio Data System is an international standard protocol which allows the broadcaster to embed text and other metadata into the FM signal. FM radios receiving this signal can decode that metadata and display it as text or act upon it in other ways. The RDS standard is documented in IEC-62106 (2009). The North American variant, RBDS, is documented in NRSC-4-B (2011). MP-532 is compliant with both standards.

Basic Settings



RDS must be configured first before it is enabled and it is quick and easy to do.

- Select the RDS screen and go to the Basic Settings panel. Do not enable RDS yet. Leave the level setting at 4%.
- Dial in your Country Code (CC). If your country is not listed, choose the Manual Entry setting and enter the value in the CC field.
- Enter your Extended Country Code (ECC). A complete list of Country Codes and Extended Country Codes is provided at the end of this chapter.
- Enter your station's broadcast frequency.
- Enable Clock Time (CT) messages if you have an internet connection to an NTP server.

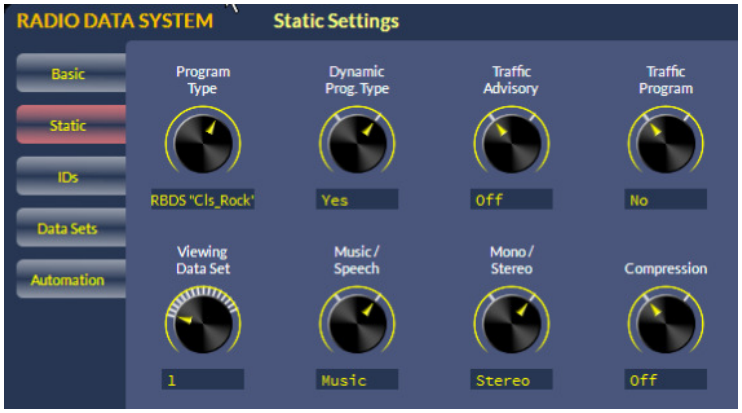
A Word about Data Sets

The Basic Settings we have just configured apply to all RDS messaging. The remaining information that RDS can carry is arranged in Data Sets, of which there are a maximum of 128, and of which only one is active at any given time. You do not have to use all 128 Data Sets, but you will use at least one. Data Sets are one way of changing the public "face" – the metadata messaging – of your station from hour to hour, day to day, or week to week.

When setting parameters in the Static Settings and ID Settings panels, pay attention to the fact that the change you are making applies only to one Data Set, which is the one selected by the "Viewing Data Set" knob in each of these two panels.

Data Sets may be switched dynamically during a broadcast, in order to switch the IDs and messaging encoded in the RDS stream. Several ways to do this are discussed later in this chapter.

Static Settings

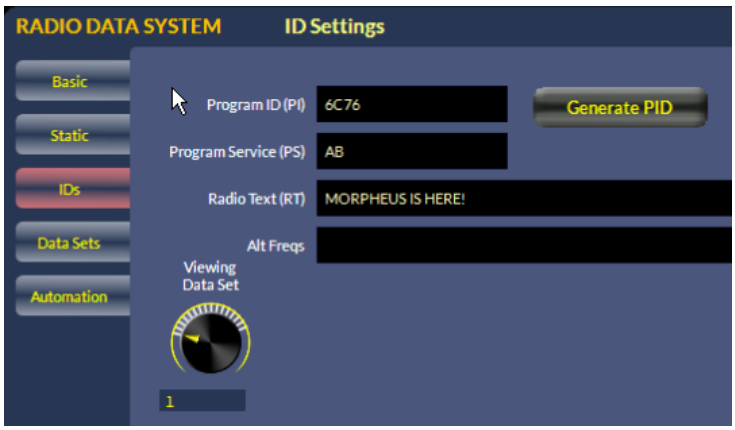


As the name suggests, the Static Settings do not, as a general rule, change very often, so you might think of them as "default settings" which describe the majority of your station's programming.

- Program Type (PTY) is a subject category like "talk", "news," or "sports". Note that the knob values are divided into two sets. The RBDS categories in the second half of the knob settings are appropriate for stations in North America, while the RDS categories in the first half of the settings should be used in the rest of the world.
- Dynamic Program Type Indicator (PTYI) is a flag that tells the receiver whether your Program Type will change periodically, or remain fixed.
- Traffic Advisory (TA) is a flag which indicates that your station is currently broadcasting motor vehicle traffic information, e.g. accidents, congestion, road closures, recommended detours, etc.
- Traffic Program (TP) is a flag which indicates that your station does normally carry traffic reports (although not necessarily at the moment).
- Music/Speech (MS) is a flag which indicates the predominant type of programming your station broadcasts.

Two settings are largely deprecated in current RDS practice (and ignored by most receivers), but they are provided for backwards compatibility. Mono/Stereo is a flag which indicates whether your program is broadcast in mono or stereo. Compression is a flag which indicates whether your signal is compressed.

ID Settings



- Program ID (PI) is a crucial part of your station's RDS messaging and you should take care to set it correctly.

- The Generate PI Code dialog, which is opened by pressing the "Generate PID" button, can help in this regard.

- In North America, the PI code is generated from the station's call sign (3 or 4 letters).

- In the rest of the world, PI codes are assigned by regional broadcast authorities, but they may also be formulated from a combination of the Country Code, a Regional Coverage code, and a Reference Number. LPFM stations use a PI code generated from the Country Code and a flag indicating whether or not your program is broadcast on alternate frequencies. In any case, your PI code should be unique, and should not overlap with any other transmitters in your geographical location.

- Program Service (PS) is an 8-character text string (including spaces) which identifies your station. Examples might be "103.5 FM," "The Jet," or "Radio 1." Most receivers display this text prominently.

- Radio Text (RT) is a 64-character text string (including spaces) which can carry any message you desire. It is up to the receiver how or even if to display this message – when it is shown, it is often displayed in a smaller font than the PS message, and it is often scrolled by the receiver inside a "window" of less width than the entire message can fit.

- Alternate Frequencies (AF) is a space-separated list of frequencies which carry the same program as your main tuning frequency. The AF list is used by more sophisticated receivers to automatically switch to an alternate frequency when you are listening to the radio in a vehicle which is moving out of the reception area of the station you are currently listening to.

When setting all of these parameters, carefully note which Data Set you are altering.

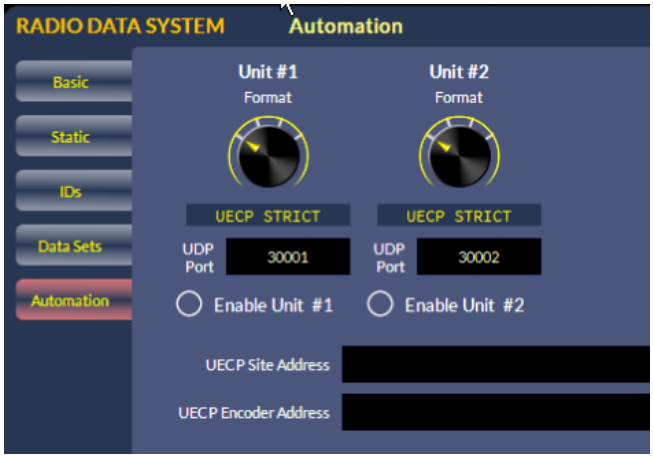
At this point the RDS encoder has the minimal amount of information it needs, and you could go back to the Basic Settings page and enable it.

Data Sets, Again

The Data Sets panel displays a summary of all the settings in each of your data sets. You may copy values from one Data Set to another, save all Data Sets to a file, restore all Data Sets from a file, and activate a Data Set. There are 128 Data Sets available and you must use at least one.

The columns display, left to right, the Program ID (normally this should be the same for ALL Data Sets), Program Type, Dynamic Program Type Indicator, Traffic Announcement, Traffic Program, Music/Speech, Stereo/Mono, Compression, Alternate Frequencies, Program Service Name and Radio Text.

Automation



Now we come to the fun stuff!

You *could* set all of the values discussed above, for one Data Set, and just let that run: never changing your message, never displaying artist and title info for your listeners, never texting clues for a call-in contest to your audience.

Alternatively, you *could* try to do all of that in real-time by opening the MP-532 GUI, going to the RDS screen, and typing away.

That would work, but you'd be very busy.

Or you can automate! There are three ways to do this: with UECP messages (transmitted via UDP), with plain text messages (transmitted via UDP), and with the Scheduler. These methods may be used independently or simultaneously, in any combination.

The Automation Settings panel displays controls for two "Units" which receive messages on the selected UDP port. There are four different message formats which may be received; two are UECP, and two are plain text.

Universal Encoder Communication Protocol

UECP (often pronounced "you-sep") is described by the RDS Forum Technical Specification SPB 490 (2010). In the strict interpretation of the protocol, each message is bounded by special start and stop bits, there is a CRC word, and a requirement that certain byte patterns in the message be escaped. It's very technical, and that's why we call it **UECP Strict**.

A Unit which receives a Strict message has to "unpack" it – it has to strip off the start and stop bits, check and remove the CRC, and translate the escape characters. The message in this form we call **UECP Unpacked**, and this is the format that many automation systems transmit.

Incoming UECP messages have a four-tiered addressing scheme. The top level is the UECP Site Address, which is a number in the range 1-1023. A Site corresponds to a transmitter location or a broadcast facility. The next level is the UECP Encoder Address, which is a number in the range 1-63, and which differentiates multiple Encoders at one Site. Next is the Data Set Number (DSN), a number in the range 1-253 (corresponding to the 253 Data Sets available for storing metadata). Finally there is the Program Service Number (PSN), which is a number in the range 1-255.

In an incoming UECP message, each of these addresses may be set to the special value 0. In the Site Address, it means "all sites." In the Encoder Address, it means "all encoders." In the DSN field, it means "current data set." The PSN field is an exception: it *must* be set to 0 or the MP-532 will ignore the message.

In the Automation Settings panel, set your UECP Site Address if you have one, or set it to 0 if not. Likewise with the UECP Encoder Address.

The MP-532 implements the following UECP commands:

01	PI	Set Program ID code
02	PS	Set Program Service Name
03	TA/TP	Set Traffic Advisory/Program flags
04	DI/PTYI	Set values for Dynamic PTY, Stereo/Mono and Compressed flags
05	MS	Set Music/Speech flag
06	PIN	Set Program Item Number, the start time of the current program
07	PTY	Set Program Type code
13	AF	Set Alternate Frequencies
1C	DataSetSelect	Set current Data Set
3E	PTYN	Set Program Type Name, an 8-character string which extends PTY
24	FreeFormat	Transmit arbitrary RDS message using raw data blocks passed in
25	IH	Transmit In-House RDS message
2B	EWS	Transmit Emergency Warning System message
30	TMC	Transmit Traffic Message Channel ODA message
40	ODA Configure	Transmit ODA configuration message, transmit short ODA
42	ODA FreeFormat	Transmit free format ODA message
46	ODA Data	Transmit ODA message

Plain Text

Plain text messages received by the MP-532 may be routed to either PS (Program Service) or RT (Radio Text), depending on the Unit's Format setting. These messages affect only the current data set, and neither value is saved (for example, if you switch to a different Data Set after receiving these message, then their values are lost). A PS text string longer than eight characters will be displayed in chunk-wise scrolling fashion. An RT string longer than 64 characters is truncated. Both PS and RT text strings are displayed verbatim.

The Scheduler

The Scheduler can be used to activate different RDS Data Sets at pre-determined times, either weekly/daily/hourly or as a one-shot event on a particular date. Scheduled events may include processing changes as well as RDS Data Set changes.

RDS Level

The RDS Level control is found on the **RDS Basic** page of the GUI and should normally be set at around 4% of total modulation. Make sure you have a modulation monitor capable of reading the RDS subcarrier injection level in order to set this accurately.

RDS Country Codes and Extended Country Codes

European Broadcasting Area

Country / Area	ISO Code	Country Code	Extended CC
Albania	ALB	9	E0
Algeria	ALG	2	E0
Andorra	AND	3	E0
Armenia	AM	A	E4
Austria	AUT	A	E0
Azerbaijan	AZ	B	E3
Azores [Portugal]	AZR	8	E0
Belgium	BEL	6	E0
Belarus	BLR	F	E3
Bosnia-Herzegovina	BIH	F	E4
Bulgaria	BUL	8	E1
Canaries [Spain]	CNR	E	E0
Croatia	HRV	C	E3
Cyprus	CYP	2	E1
Czech Republic	CZE	2	E2
Denmark	DNK	9	E1
Egypt	EG	F	E0
Estonia	EE	2	E4
Faroe Islands [Denmark]	DK	9	E1
Finland	FI	6	E1
France	FR	F	E1
Germany	DE	D or 1	E0
Georgia	GE	C	E4
Gibraltar [United Kingdom]	GI	A	E1
Greece	GR	1	E1
Hungary	HU	B	E0
Iceland	IS	A	E2
Iraq	IQ	B	E1
Ireland	IE	2	E3
Israel	IL	4	E0
Italy	IT	5	E0
Jordan	JO	5	E1
Kazakhstan	KZ	D	E3
Kyrgyzstan	KG	3	E4
Latvia	LV	9	E3
Lebanon	LB	A	E3
Libya	LY	D	E1
Liechtenstein	LI	9	E2
Lithuania	LT	C	E2
Luxembourg	LU	7	E1
Macedonia	MK	4	E3
Madeira [Portugal]	PT	8	E2
Malta	MT	C	E0
Morocco	MA	1	E2
Moldova	MD	1	E4
Monaco	MC	B	E2

Netherlands	NL	8	E3
Norway	NO	F	E2
Palestine	PS	8	E0
Poland	PL	3	E2
Portugal	PT	8	E4
Romania	RO	E	E1
Russian Federation	RU	7	E0
San Marino	SM	3	E1
Slovakia	SK	5	E2
Slovenia	SI	9	E4
Spain	ES	E	E2
Sweden	SE	E	E3
Switzerland	CH	4	E1
Syrian Arab Republic	SY	6	E2
Tajikistan	TJ	5	E3
Turkmenistan	TM	E	E4
Tunisia	TN	7	E2
Turkey	TR	3	E3
Ukraine	UA	6	E4
United Kingdom	GB	C	E1
Uzbekistan	UZ	B	E4
Vatican	VA	4	E2
(Yugoslavia)	YU	6	E3

African Broadcasting Area

Country / Area	ISO Code	Country Code	Extended CC
Ascension Island	??	A	D1
Cabinda	??	4	D3
Angola	AO	6	D0
Algeria	DZ	2	E0
Burundi	BI	9	D1
Benin	BJ	E	D0
Burkina Faso	BF	B	D0
Botswana	BW	B	D1
Cameroon	CM	1	D0
Canary Islands [Spain]	ES	E	E0
Central African Republic	CF	2	D0
Chad	TD	9	D2
Congo	CG	C	D0
Comoros	KM	C	D1
Cape Verde	CV	6	D1
Cote d'Ivoire	CI	C	D2
Djibouti	DJ	3	D0
Egypt	EG	F	E0
Ethiopia	ET	E	D1
Gabon	GA	8	D0
Ghana	GH	3	D1
Gambia	GM	8	D1
Guinea-Bissau	GW	A	D2
Equatorial Guinea	GQ	7	D0

Republic of Guinea	GN	9	D0
Kenya	KE	6	D2
Liberia	LR	2	D1
Libya	LY	D	E1
Lesotho	LS	6	D3
Mauritius	MU	A	D3
Madagascar	MG	4	D0
Mali	ML	5	D0
Mozambique	MZ	3	D2
Morocco	MA	1	E2
Mauritania	MR	4	D1
Malawi	MW	F	D0
Niger	NE	8	D2
Nigeria	NG	F	D1
Namibia	NA	1	D1
Rwanda	RW	5	D3
Sao Tome & Principe	ST	5	D1
Seychelles	SC	8	D3
Senegal	SN	7	D1
Sierra Leone	SL	1	D2
Somalia	SO	7	D2
South Africa	ZA	A	D0
Sudan	SD	C	D3
Swaziland	SZ	5	D2
Togo	TG	D	D0
Tunisia	TN	7	E2
Tanzania	TZ	D	D1
Uganda	UG	4	D2
Western Sahara	EH	3	D3
Zaire	ZR	B	D2
Zambia	ZM	E	D2
Zanzibar	??	D	D2
Zimbabwe	ZW	2	D2

ITU Region 2

Country / Area	ISO Code	Country Code	Extended CC
Anguilla	AI	1	A2
Antigua and Barbuda	AG	2	A2
Argentina	AR	A	A2
Aruba	AW	3	A4
Bahamas	BS	F	A2
Barbados	BB	5	A2
Belize	BZ	6	A2
Bermuda	BM	C	A2
Bolivia	BO	1	A3
Brazil	BR	B	A2
Canada	CA	C	A1
Cayman Islands	KY	7	A2
Chile	CL	C	A3
Colombia	CO	2	A3

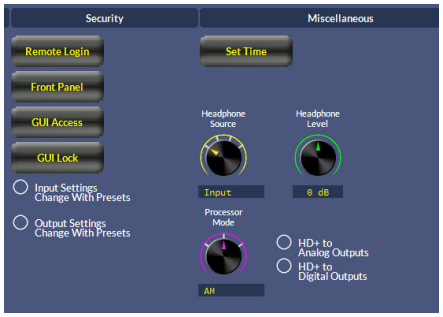
Costa Rica	CR	8	A2
Cuba	CU	9	A2
Dominica	DM	A	A3
Dominican Republic	DO	B	A3
Ecuador	EC	3	A2
El Salvador	SV	C	A4
Falkland Islands	FK	4	A2
Greenland	GL	F	A1
Grenada	GD	D	A3
Guadeloupe	GP	E	A2
Guatemala	GT	1	A4
Guiana	GF	5	A3
Guyana	GY	F	A3
Haiti	HT	D	A4
Honduras	HN	2	A4
Jamaica	JM	3	A3
Martinique	MQ	4	A3
Mexico	MX	F	A4
Montserrat	MS	5	A4
Netherlands Antilles	AN	D	A2
Nicaragua	NI	7	A3
Panama	PA	9	A3
Paraguay	PY	6	A3
Peru	PE	7	A4
Puerto Rico	PR	8	A3
Saint Kitts	KN	A	A4
Saint Lucia	LC	B	A4
St Pierre and Miquelon	PM	F	A6
Saint Vincent	VC	C	A5
Suriname	SR	8	A4
Trinidad and Tobago	TT	6	A4
Turks and Caicos Islands	TC	E	A3
United States of America	US	1..9,A,B,D,E	A0
Uruguay	UY	9	A4
Venezuela	VE	E	A4
Virgin Islands [British]	VG	F	A5
Virgin Islands [USA]	VI	F	A5

ITU Region 3

Country / Area	ISO Code	Country Code	Extended CC
Afghanistan	AF	A	F0
Saudi Arabia	SA	9	F0
Australia	AU		
Australia - Capital Territory		1	F0
Australia - New South Wales		2	F0
Australia - Victoria		3	F0
Australia - Queensland		4	F0
Australia - South Australia		5	F0
Australia - Western Australia		6	F0
Australia - Tasmania		7	F0

Australia - Northern Territory		8	F0
Bangladesh	BD	3	F1
Bahrain	BH	E	F0
Myanmar [Burma]	MM	B	F0
Brunei Darussalam	BN	B	F1
Bhutan	BT	2	F1
Cambodia	KH	3	F2
China	CN	C	F0
Sri Lanka	LK	C	F1
Fiji	FJ	5	F1
Hong Kong	HK	F	F1
India	IN	5	F2
Indonesia	ID	C	F2
Iran	IR	8	F0
Iraq	IQ	B	E1
Japan	JP	9	F2
Kiribati	KI	1	F1
Korea [South]	KR	E	F1
Korea [North]	KP	D	F0
Kuwait	KW	1	F2
Laos	LA	1	F3
Macau	MO	6	F2
Malaysia	MY	F	F0
Maldives	MV	B	F2
Micronesia	FM	E	F3
Mongolia	MN	F	F3
Nepal	NP	E	F2
Nauru	NR	7	F1
New Zealand	NZ	9	F1
Oman	OM	6	F1
Pakistan	PK	4	F1
Philippines	PH	8	F2
Papua New Guinea	PG	9	F3
Qatar	QA	2	F2
Solomon Islands	SB	A	F1
Western Samoa	WS	4	F2
Singapore	SG	A	F2
Taiwan	TW	D	F1
Thailand	TH	2	F3
Tonga	TO	3	F3
UAE	AE	D	F2
Vietnam	VN	7	F2
Vanuatu	VU	F	F2
Yemen	YE	B	F3

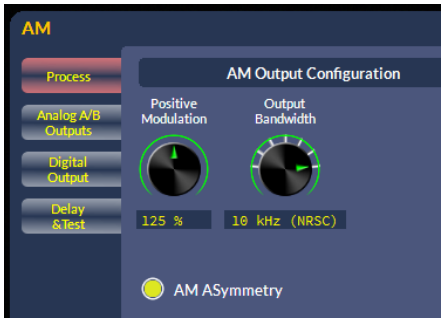
AM Mode Functions



Entering the MP-532's AM mode is accomplished by navigating to the GUI's SYSTEM screen and changing the Processor Mode switch to the AM position.

Once this is done a new AM option becomes visible at the top of the GUI, and clicking that button will open a new screen with all of the AM mode-specific controls.

AM Process



At left is the AM "Process" screen where the Positive Modulation, Output Bandwidth and AM Symmetry options are located.

Positive Modulation is adjustable from 100% to 150% and modulation will be asymmetrical only when the AM Symmetry button is highlighted (by clicking it).

The Output Bandwidth control sets the highest audio frequency to be transmitted to prevent adjacent channel interference. There are seven filter options available: Full (20kHz), 4.5kHz, 5.0kHz, 6.0kHz (CCIR), 7.5kHz, 9.0kHz, 10kHz (NRSC).

Analog A/B Outputs

The Analog A/B Outputs GUI screen hosts the adjustments associated with the analog AM outputs. Each output has its own level control and transmitter equalization. Transmitter Equalization may be used to optimize the modulation performance of transmitter/antenna combinations.

The Polarity Invert switch affects both outputs.

The A/B outputs may be operated as completely separate outputs, fed perhaps to a main and backup transmitter. Alternately the outputs may be operated in M/S mode for stereo AM transmitters accepting separate mono sum and stereo difference inputs.

See Appendix A for the use of the AM Mode's LF Tilt EQ and HF Corr EQ functions.

AM Digital Outputs

The MP-532's AM mode is also equipped with AES3 digital outputs. Note that both A and B outputs are carried on a common signal pair and the transmitter must be able to select audio from either channel A (AES left) or channel B (AES right).

Like the Analog outputs there is a Polarity Invert mode which flips the phase of *both* A and B outputs.

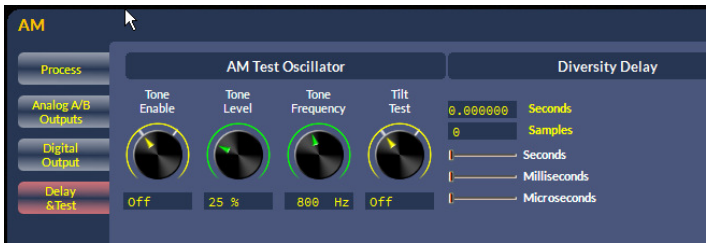
There is also an MS Mode switch which when activated in combination with the Left/Right Mode switch in the GUI's INPUT screen converts the output into a stereo Sum/Difference signal for use in AM Stereo situations.

The HD Delay In/Out switch allows the AM Digital output to be before or after the Diversity Delay (see Delay and Test mentioned later).

De-emphasis may be applied to the digital output with will be the complement of any pre-emphasis applied earlier in the GUI's Limiters screen.

The Digital Output Sample Rate may be either 44.1 kHz or 48 kHz as selected by the Sample Rate control. Other sample rates are not supported.

AM Delay and Test



To aid in setting modulation or transmitter equalization (if necessary) the AM Test Oscillator can output a choice of tone frequencies and levels. There is also a Tilt Test utilizing frequencies below 1kHz for checking the low frequency performance of less modern transmitters.

IMPORTANT NOTE:

When Tilt Test is set to On, the MP-532 creates a symmetrically clipped sine wave at 50% of the original sine wave amplitude, 6dB lower in peak level than when Tilt Test is Off.

To prevent possible damage to older transmitter's modulator components, the clipped tone's level – now with characteristics more like a square wave – is decreased by 6dB to 50%. This reduction is especially important when utilizing tone frequencies below approximately 300Hz.

AM Diversity Delay

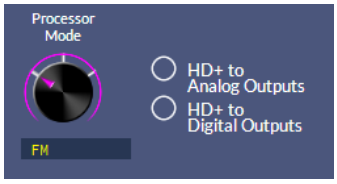
For AM/HD applications the MP-532 is equipped with up to ten seconds of delay for the analog side of the audio processing chain. The delay may be adjusted in whole Seconds, Milliseconds, or Microseconds/Samples. The Seconds and Samples displays show the total applied delay in seconds and fractions thereof, as well as in digital samples.

Using combinations of the mouse (or mouse wheel) and the keyboard CTRL, ALT and SHIFT keys the settings may be adjusted in different increments:

Settings	Mouse Only	Mouse + Shift	Mouse + Ctrl	Mouse + Alt
Seconds	1 Second	1 Second	1 Second	1 Second
Milliseconds	Medium	Coarse	Fine	Medium
Microseconds (Samples)	Medium	Coarse	No Changes	Medium

HD Functions

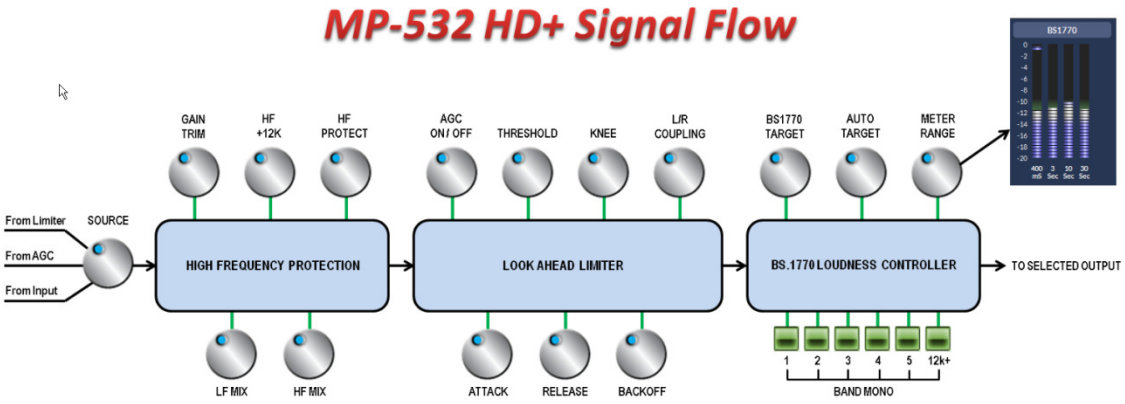
The MP-532 is equipped with a sophisticated “HD+” processing section which is suitable not only for processing the primary, secondary and tertiary HD channels prior to transmission, but also for processing web streams prior to the associated codec.



In the SYSTEM page of the GUI is a Mode Switch to select which processing is applied to the Analog and Digital outputs UNLESS the HD+ path is directed to use one or both of those outputs, at which point the HD+ processing is steered to that/those output(s). The Output choice must be made *prior* to entering HD+ mode – that choice is not available once in HD+ mode.

Once the HD+ mode is entered a comprehensive HD+ control screen will appear in the GUI.

Referring to the MP-532 HD+ signal flow shown below, note that the INPUT to the HD+ processing can be from the unprocessed MP-532 input source, from the output of the multiband AGC, or from the output of the multiband limiter with "final" limiting applied by the HD+ processing itself.



The HD+ processing begins with a high frequency protection algorithm which has been designed to increase the perceived sound quality of low bitrate codecs. Processing is accomplished in a 'split-band' fashion with carefully selected, optimized and non-adjustable crossover frequencies. The controls for this section are as follows:

Source: Determines which signal is feeding the input to the HD+ processing; the unprocessed input to the MP-532, the output of its multiband AGC, or the output of its multiband limiter. The specific application will determine which input source is applicable.

Gain Trim: The Gain Trim control allows adjustments to the amount of drive signal to the HD+ processing 'back end' and is necessary in order to accommodate situations where the HD+ section might be driven by the unprocessed input to the MP-532. When driven by the multiband AGC or multiband limiters the Gain Trim will normally be at or near its zero dB setting. The Trim control may also be used to push the BS1770 Auto-Target harder to hit a specific loudness target when the program material isn't loud enough or dense enough to do it on its own.

HF 12k+: This control has three positions, Off, Protect, and On.

Off: signal frequencies above 12 kHz are filtered out. This mode of operation can be beneficial for *very* low bitrate codecs.

Protect: high frequencies above 12 kHz are constrained to a certain maximum level in dB as determined by the control labeled HF Protect Level – an alternate mode of protecting very low bitrate codecs from attempting to encode high frequencies which can drastically enhance the perceived quality of such streams.

On: Audio frequencies at and above 12 kHz are passed unaffected.

HF Protect Level: Sets the maximum >12 kHz peak level in dB below the peak level of midrange energy in order to prevent *very* low bitrate codecs from encoding such information. Higher settings allow more high frequency energy to pass while lower and lower settings increasingly constrain such energy.

LF Mix and HF Mix: Mentioned previously, the high frequency controller operates in two frequency bands and the LF and HF Mix controls permit custom adjustments to the overall spectral balance.

Lookahead Limiter Threshold: Permits the HD+ final limiter limit threshold to be adjusted downward from 0dBFS. Normally the control will be set at a fraction of a dB below 0dBFS, such as -0.5 or so and when set in this manner, audio peaks will never reach or (try to) exceed digital full scale (out of bits).

Lookahead Limiter Knee: Permits the sound and limiting behavior of the lookahead limiter to be modified.

Knee = Hard: Limiting is abrupt and will only occur if the peak level reaches the lookahead limiter's Threshold setting. Limiting is less audible in this mode.

Knee = Soft: Limiting gradually begins about 3dB below the Threshold and as the peaks get closer to the setting of the Threshold control, limiting becomes tighter and more absolute. The soft mode is useful if the action of limiting is desired to be more audible, i.e., for effect.

L/R Coupling: Sets the tightness of inter-channel gain, or high tightly the left and right channels follow each other during limiting. In the "0" position the gain reduction occurring in one channel is immediately applied to the other. In the -12dB position the two channels operate more as independent individuals. As the control is moved from 0dB towards -12dB there is an ever increasing independence between channels.

AGC: Should be in the On position used when the HD+ Signal chain is receiving its input from the MP-532 INPUT rather than AGC or Limiter in order to achieve a consistent input level to the HD+ final processing and loudness controller. May be in the On or Off position when the MP-532 HD+ section is receiving its audio from the multiband AGC or limiter, depending of course on the specific application.

Attack: Sets the attack time of the AGC mentioned above with lower settings causing the AGC to correct volume increases faster.

Release: Sets the release time of the AGC or how fast it brings the gain back up after it has been reduced due to the Attack time setting. Lower settings are faster and higher settings are slower.

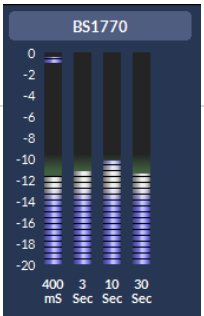
AGC Backoff: There is a short term compressor embedded within the AGC which helps fill in short gaps of low level signals. As the AGC Backoff control is advanced towards more positive numbers, the effect of this hidden compressor become more apparent. When the AGC Backoff control is set to the 0dB position, there is virtually no short term level correction contributions from the hidden compressor.

BS1770 Target: The MP-532 has a very effective loudness controller built in and the BS1770 Target control sets the desired loudness level to be present at the output of the HD+ signal processing. The control has a range of -8 to -25 LUFS.

Auto Target: When Auto Target is On the loudness controller automatically maintains the target loudness set by the BS1770 Target control. When Auto Target is off automatic loudness control is disabled.

As mentioned previously, if the MP-532 HD+ processing has been set to receive its signal from the Input (see Source, previous page) then it may be necessary to engage the HD+ section's AGC by turning it on. This will ensure that the BS1770 Loudness Controller can, in its Auto Target mode, maintain the set loudness level as program content varies.

Meter Range: Sets the scaling for the BS1770 metering shown here.



BS1770 dBLU: Selecting this choice causes the large digital meter to display the current medium term loudness value over the preceding ten seconds.

Long Term Avg: Selecting this choice causes the large digital meter to display the Long Term Average (LTA) over the preceding 120 minutes. There are three associated buttons for this mode;

Reset: Clears the LTA timer and its measurement.

Pause: Causes the measurement to freeze at its current value and stop accumulating data.

Run: Starts a new measurement and then indicates how many minutes the data has been accumulating and averaged.

When the first minute has been reached, the display will update to show the accumulated data averaged over the last minute. Data will continue to be averaged and the amount of time accumulated for the displayed average is shown under the meter as “Over Last x Minutes”.

When 120 minutes has been reached, the oldest data is discarded and is replaced by data gathered over the displayed time period, i.e., earlier data is dropped in favor of new in moving average fashion.

Mono: There are six Mono buttons located directly above the digital loudness meter, one for each processing band plus one for just the energy above 12 kHz. Making very low and very high frequency program content mono can allow some codecs to have higher *perceived* audio quality by not forcing them to encode stereo difference information at the frequency extremes, and this is especially true for the effectiveness of the Band 1, Band 2 and 12k+ buttons.