WAVES

KRAMER MPX MASTER TAPE

USER GUIDE

WAVES

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Chapter 1 – Introduction

1.1 Welcome

Thank you for choosing Waves! In order to get the most out of your Waves processor, please take the time to read through this manual.

In conjunction, we also suggest that you become familiar with www.wavesupport.net. There you will find an extensive **Answer Base**, the latest **Tech Specs**, detailed **Installation** guides, new **Software Updates**, and current information on **Authorization** and **Registration**.

By signing up at www.wavesupport.net, you will receive personalized information on your registered products, reminders when updates are available, and information on your authorization status.

1.2 Product Overview

Developed in association with producer/engineer Eddie Kramer *(Jimi Hendrix, Led Zeppelin),* the MPX Master Tape plugin is modeled on a rare machine consisting of an Ampex 350 ¼" transport and 351 electronics. The 350 was used by Eddie Kramer during the late '60s at London's Olympic Studios to record some of rock's most classic tracks, by artists including Jimi Hendrix, Rolling Stones, Led Zeppelin, and Traffic. Typically, the Ampex 350 was the final link in his recording chain, used to record the output of the Helios console (modeled in the Kramer HLS Channel plugin), with dynamics processing by the PYE compressor (modeled in the Kramer PIE Compressor plugin.)

With adjustable tape speed, bias, flux, wow & flutter, and modeled noise, the MPX provides comprehensive control over the contours of your sound. To top it off, we've added a flexible slap & feedback delay section.

Accurately modeling the character and sound of the Ampex 350/351 proved quite challenging, from the acquisition of well-maintained components, generously provided by Eric Schilling *(Shakira, Gloria Estefan, Natalie Cole, Elton John)*, down to finding the

correct magnetic tape, in addition to modeling the mechanical and magnetic modulations and colorations that give these rare machines their own unique sound. Special thanks go out to Bob Ohlsson *(Stevie Wonder, Marvin Gaye, Diana Ross)* and especially John Haeny *(Bonnie Raitt, Weather Report, Jackson Browne, Linda Ronstadt, Jim Morrison, Tom Jones)* who provided invaluable assistance in the development of the MPX plugin. You can read in greater detail about the modeling process in the White Paper which is included as an appendix to this manual.

1.3 Concepts and Terminology

The following are a few of the terms and concepts that you will encounter while using the MPX Master Tape plugin. You can read more about them in the White Paper at the end of this manual.

Tape Speed

The MPX offers two tape speeds: Low (7.5 inches per second or “ips”) and High (15 ips). Low speed offers better low frequency response with some high frequency loss, while high speed offers a more full range signal with slightly less low end.

Input and Reproduce

When recording to tape, two monitoring modes are available. Input monitoring lets you hear the signal as it reaches the recording head, including tube and mic-pre saturation. Repro monitoring lets you hear the output of the repro head just like normal tape playback, meaning that tape speed, bias, flux, wow & flutter, and noise, in addition to tube and mic-pre saturation, all affect the monitored output.

Bias

Bias is an ultrasonic signal which is added to the recording in order to reduce limitations of the magnetic medium. Bias calibration was a regular part of the tape machine calibration routine and, while the manufacturers had their declared recommendations for specific machines, many engineers felt that adding more gain to the bias signal gave them better sound. For this reason, the MPX Master Tape plugin offers both nominal bias as well as overbias, which represents 3dB over the recommendation, a setting

which became popular with many users.

Flux

Flux is the term used for the level of magnetic radiation emitted from the record head on to the tape, commonly referred to as *operating level*. Measured in nano Webers per Meter – nWb/m, flux is essentially a gain factor reflecting a higher level passed onto the record head. While older tapes were designed to handle lower flux levels, modern tapes could withstand much higher flux before distorting, resulting in relatively lower noise.

Noise

The MPX plugin features modeled noise which is a combination of the tape hiss generated by analog tape recording, overlaid by the thermal valve noise of the Ampex 351 input and output electronics.

Wow & Flutter

The term *wow & flutter* refers to modulations and fluctuations in speed and gain caused by physical friction of the mechanical parts of the tape machine and the tape itself. While the original machines were designed to minimize wow and flutter, they nonetheless have become part of the sound we associate with analog tape. Increasing the Wow & Flutter control makes for a rougher, more “worn” sound.

VU Meter

The MPX features a modeled analog VU meter, where 0 dBVU = 1.23Volts RMS = +4 dBu at 1 kHz. Using a 700 Hz tone at -18 dBFS, input and output levels are equal. The default VU meter calibration is -18 dBFS = 0 dBVU, which we found to be optimal for achieving the desired sound when the meter action hovers around 0 dBVU. For hot digital signals peaking close to 0 dBFS, this will require lowering your Record Level proportionately to achieve “proper” tape sound. When running hot signals, the needle may stick to the right side (≥ +3 dBVU). If you are achieving the desired sound, but would like to see some meter action, you can calibrate the meter to your desired

headroom, and the VU meter will offset its metering so that 0 VU will correspond to the selected headroom value.

Delay

While the original Ampex 350/351 didn’t feature dedicated delay functions, many engineers utilized the machines for slap/feedback echo effects. The MPX plugin offers delay times from 1ms to 500 ms, with settings for 7.5 ips (266 ms) and 15 ips (133 ms), emulating the natural slap heard when monitoring the incoming and reproduced signals at the indicated speeds.

1.4 Components

The Kramer MPX Master Tape consists of two components:

- Kramer MPX Mono
- Kramer MPX Stereo

Kramer MPX Mono

Kramer MPX Stereo

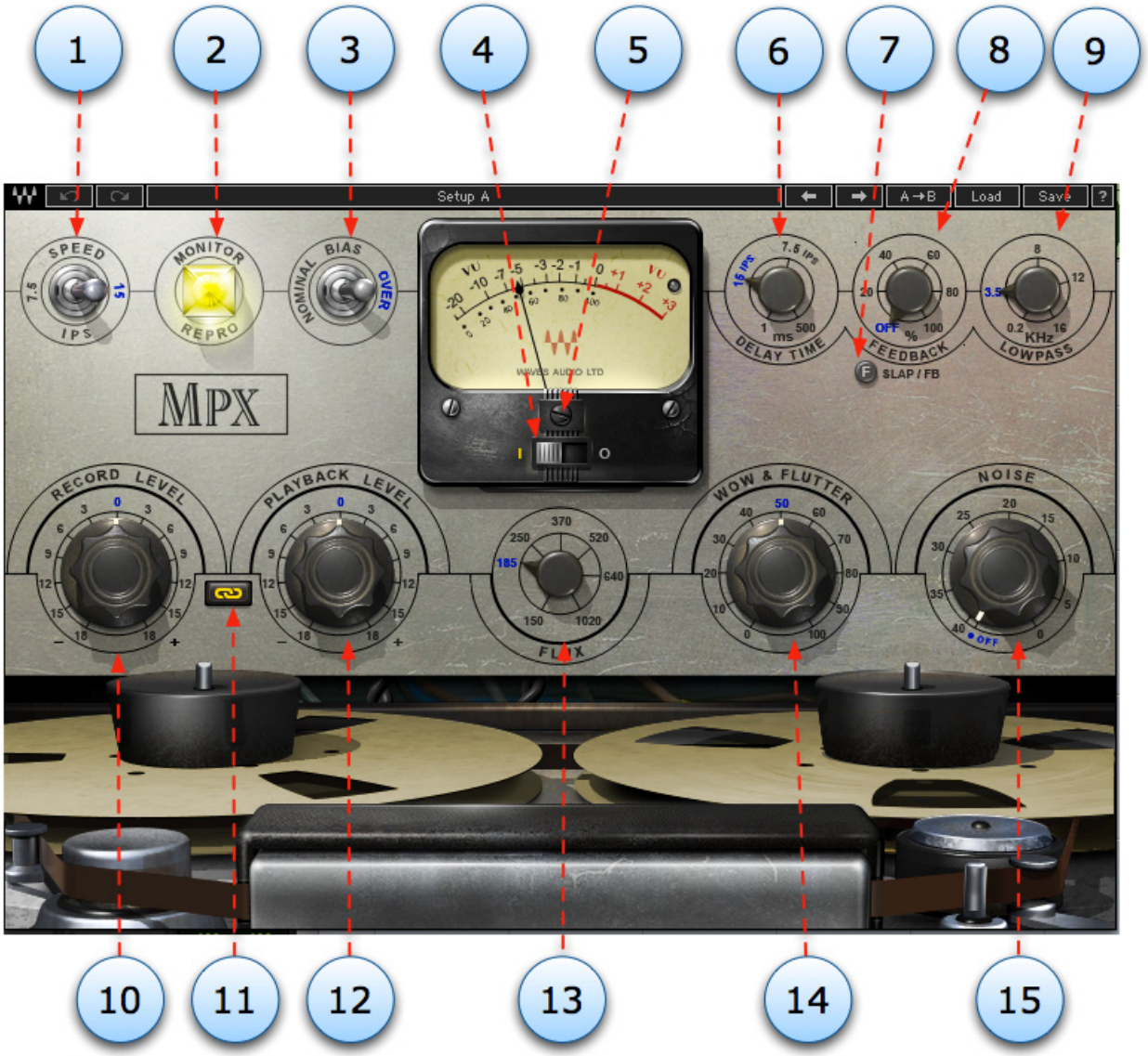
Chapter 2 – Quick Start Guide

- Insert the Kramer MPX on a track, group, or master.
- Go to the loudest passage in your song and, using the Record Level control, adjust the input until the meter displays -5 dBVU to 0 dBVU.
- If the track has important high frequency content (e.g., acoustic guitars, vocals, hi-hats, strings), use the 15 ips to better preserve high frequencies.
- If the track has a lot of low frequency information (e.g., bass, kick drum, tuba), use the 7.5 ips to better preserve low frequencies.
- Adjust the Flux control to increase or decrease amount of distortion.
- If needed, unlink the Record Level and Playback level and adjust levels individually.

Please note: Since input levels have a significant impact on the sound of the plugin, we recommend experimenting in order to find your optimal settings.

Chapter 3 – Interface and Controls

3.1 Interface



3.2 Controls

SPEED selects the simulated tape speed.
Range: 7.5 ips, 15 ips
Default: 15 ips

When switching between the two speeds, the noise and frequency response will change accordingly; at 15 ips, high frequency response is increased and noise is one octave higher than at 7.5 ips.

MONITOR selects the monitoring mode.

Range: Repro, Input
Default: Repro

Repro mode monitors input stage, tape stage and output stage; Input mode monitors only the input tube stage of the 351, before it goes to tape, prior to the pre-emphasis and de-emphasis filters.

BIAS controls the level of the ultrasonic bias signal.

Range: Nominal, Over
Default: Over

VU METER displays input or output level, depending on your selection.

Range: -20 dBVU – +3 dBVU

VU CALIBRATION controls the VU meter headroom calibration. It is represented by the small screw-head below the VU meter display and does not have a visible label. For most users, the default headroom setting of 18 dB should be the best choice. (On the Stereo component, use the screw located on the left to calibrate both meters.)

Range: -24 dBFS – -8 dBFS
Default: -18 dBFS

DELAY TIME controls the time of the tape delay effect, with settings for 7.5 ips (266 milliseconds) and 15 ips (133 ms).

Range: 1 ms – 500 ms (continuous)
Default: 133 ms (15 ips)

DELAY TYPE toggles between delay modes.

Range: Slap, Feedback
Default: Feedback

DELAY LEVEL controls the amount of the delayed output signal.

Range: Off – 100
Default: Off

LOWPASS controls the LP cutoff frequency on the delay path.

Range: 200 Hz – 16 kHz
Default: 3.5 kHz

RECORD LEVEL controls the input level.

Range: +/- 18 dB
Default: 0 dB

LINK I/O links Record and Playback Levels controls. The link relationship is inversely proportional, i.e., an increase in Record Level results in a decrease in Playback level, and vice versa.

Range: Linked/Unlinked
Default: Linked

PLAYBACK LEVEL controls the total signal output level.

Range: +/- 18 dB
Default: 0 dB

FLUX controls the level of simulated magnetic radiation emitted from the record head.

Range: 150 nWb/m – 1020 nWb/m
Default: 185 nWb/m (Ampex 0 dB)

WOW & FLUTTER controls the modulations and fluctuations of speed and gain.

Range: 0 – 100
Default: 50 (as modeled from the original)

NOISE controls the level of added modeled noise including noise modulations and signal additive noise.

Range: Off / -40 dB to 0 (0 as modeled from the original)
Default: Off

Chapter 4 – The WaveSystem

4.1 The WaveSystem Toolbar

All Waves plugins feature the WaveSystem toolbar which takes care of most administrative functions you will encounter while working with your Waves software. The features of the WaveSystem toolbar are the same on practically all Waves plugins, so familiarity with its features will be helpful whichever plugin you are using.

Toolbar Functions

	Opens the plugin About box
Undo	Undoes the last 32 actions
Redo	Redoes the last 32 undone actions
Setup A/B	Toggles between two presets, useful for comparison of parameter settings
L/R Arrows	Move to the previous or next preset
Copy A→B	Copies the current settings to the second preset register
Load	Recalls presets from file
Save	Saves presets in the Waves file formats
?	Opens the PDF manual for the plugin you are using

4.2 Preset Handling

Preset Types

Factory Presets are permanent presets in the Load menu. Factory presets cannot be overwritten or deleted. When applicable, different component plugins may have different factory presets.

User Presets are your favorite settings of the plugin saved as a preset in the Load menu, under ‘User Presets’. User Presets can be overwritten and deleted.

Setup Files may contain more than one preset. For example, a single file can contain all the presets for a session. When you open a Setup File, all its setups become part of your Load pop-up menu for fast access. This can be particularly useful with multiple instances of a plugin in a single session. By saving all the settings you create into a single Setup File, they can all be quickly available for every instance of that plugin.

Loading Presets and Setups

Click on the Load button to see the Load pop-up menu. The menu is divided into four sections. If a section is not currently available it will not appear in the Load pop-up menu.

Open Preset File…	Select to open any setup or preset file, whether from the Library or your own creations.
'Filename.xps':	Displays any currently loaded Setup File and its presets.
Factory Presets:	Displays the default Factory Presets.
User Presets:	Displays any loaded User Presets.

Saving Presets and Setups

Click on the Save button to see the Save pop-up menu. Four options are available. If an option is not currently available it will be grayed out and inaccessible.

Save to New File…	Select this to start a new Setup file. There are two prompts - first for the setup filename, then for the preset name. You must provide a name for both the setup file and the preset. Click OK (ENTER) to complete the save. It is a good idea to create a folder in which to save several setup files for a project.
Save 'File Name' – "Preset Name"	Overwrites the settings of the loaded preset (whether a User Preset or a preset from a Setup File) with the current settings. If a Setup File is currently loaded, the name of the Setup File is displayed followed by the name of the preset itself. If a User Preset is loaded, its name is displayed.
Save to 'File Name' As…	Saves the current settings as a new preset into the Setup file that is open (if one is not open, the option is grayed out). You will be prompted to give the preset a name.
Put into Preset Menu As…	Save the current settings into a User Preset that will always be in your Load menu (until deleted). You will be prompted to give this preset a name. User Presets are stored in the plugin's preference file.

Please note: Special characters (such as: !, @, #, %, ^, etc.) are not supported in preset names.

Deleting Presets

You may delete User Presets and presets within a Setup File. Factory Presets and Setup Library files cannot be deleted or overwritten.

1. Hold the Command (Mac)/Control (PC) key down.
2. Click-and-hold the Load button to see the pop-up menu.
3. While still holding the Command/Control key, select the preset or setup to delete.
4. A confirmation box will appear, allowing you to cancel or 'OK' the deletion.

A/B Comparison and Copying

The Setup A/Setup B button may be clicked to compare two settings. If you load a preset in the Setup B position, this will not affect the preset loaded into the Setup A position, and vice-versa.

If you want to slightly modify the settings in Setup A, you can copy them to Setup B by clicking on the Copy to B button, then alter Setup A and compare with the original Setup B.

The name of the current setup will be shown in the title bar (on platforms which support it), and will switch as you change from Setup A to Setup B.

Note: an asterisk will be added to the preset name when a change is made to the preset.

4.3 Interface Controls

Controls can be in one of three states:

- **Not Selected** where the control is not the target of any user entry
- **Selected** where the control is the target of mouse control entry only
- **Selected and Active** where the control is the target for both mouse and keyboard entry

Toggle Buttons

Toggle buttons display the state of a control, and allow switching between two or more states. **Single-click** to change the control's state. Some toggle buttons have a text display which updates with the current setting, and others (bypass, solo, or monitoring toggles) illuminate when the control is active.

Some plugins have **link buttons** between a pair of toggle buttons, allowing click-and-drag adjustment while retaining the offset between the controls.

Value Window Buttons

Value windows display the value of a control and allow **click-and-drag** adjustment, or **direct control via the keyboard**.

- **Using the mouse**, click-and-drag on the value window to adjust. Some value windows support left/right, some up/down (as you hover over a button, arrows will appear to let you know which direction of movement that button supports). You may also use your mouse-wheel to adjust parameter values.
- **Using the arrow keys**, click once with mouse to select the button, and then use up/down – left/right (depending on the direction supported by that button) to move in the smallest incremental steps across the button's range (holding down the arrow keys will move faster through the range).
- **Using key entry**, double click on the button to open the value window, and directly enter the value from your keyboard. If you enter an out of range number, the button stays selected but remains at the current setting. (System beeps if system sounds are on.)

Some plugins have **link buttons** between a pair of value windows, allowing click-and-drag adjustment while retaining the offset between the controls.

Sliders

Click or scroll the mouse-wheel on the slider itself or anywhere within the sliders track. The numerical value of the slider settings is displayed in a hover window above the slider path.

Hover Box

Hovering boxes will appear and display the control value when hovering with the mouse over the control.

Multiple Control Selection

One of the most powerful features of the WaveSystem is the ability to select and adjust multiple controls simultaneously. Using the mouse, drag-select the desired group of buttons or graphic controls by clicking and holding at a point outside the controls, and forming a rectangle that includes the controls you wish to adjust. Alternatively, press and hold Shift while clicking the mouse on any control you wish to link. This method is useful when you want to select two or more controls that are not adjacent to one another.

TAB Functions

TAB moves the 'selected' status to the next control, with shift-TAB moving in the reverse direction.

Additionally, the Mac has an option-TAB function for ‘down’ movement and shift-option-TAB for ‘up’ movement where applicable.

If you have several Value Window Buttons selected, TAB functions will take you through the selected controls only.

Hitting Esc or Return will return the 'focus' to the DAW application.

4.4 Waves Preferences (Pro Tools only)

When launching Pro Tools, hold Shift to view the Waves plugin Preferences window. The following options are available:

- Don't use AudioSuite plugins
- Don’t use RTAS plugins
- Rescan all plugins
- HUI control surface support (low resolution)
- Enable single-click text entry

Chapter 5 – Appendix

KRAMER MPX WHITE PAPER

Original document by Mike Fradis, Waves Product Manger
Rewritten and expanded by John Haeny
Edited by Michael Costa
Bias definition by Michael White

Introduction

When Waves started a hardware modeling project with Eddie Kramer, it was always their intention to create a model of the original recording chain from Olympic Studios in London that Eddie used on his great recordings of Led Zeppelin, The Rolling Stones and Jimi Hendrix. The model of the Helios Console Channel was challenging, resulting in the Waves Kramer HLS Channel. Next was the modeling of the famous PYE compressor which was released as Waves Kramer PIE Compressor.

Missing from the 'golden' chain was the Ampex valve analogue tape machine used for these recordings. Waves acquired what they believed was the right machine and set about modeling, knowing it would be difficult based on what was already on the market. As it turned out, the task was much more daunting than anticipated and Waves' first attempt, the initial Kramer MPX, was withdrawn shortly after being introduced into testing. It turned out that this third piece of the Kramer Olympic chain was going to be the hardest.

Waves discovered *(along with the guidance of some of their Beta team)* that they were missing a number of things, each one extremely complicated by itself, and in total representing a huge challenge. Thanks to the guidance of Bob Ohlsson and John Haeny, Waves was ultimately directed to the Ampex 350 transport with Ampex 351 valve electronics. With Bob's help, one of these rare beasts was found in Florida owned by Eric Schilling. Eric kindly agreed to let Waves do some preliminary testing to ensure that this machine was producing the sound that both Bob and John had missed in their first effort.

To clarify what appears to be a contradiction regarding the Ampex 350/351 Tape Machine being an American product, it should be made clear that at the time Eddie Kramer was working at Olympic Studios in London, it was Ampex 350/351 tape machines that Olympic and their clients were using as master recorders.

The Ampex 351 Valve tape machine was the mainstay of the recording industry *(particularly in America)* and was used for literally thousands of hit albums and singles over more than two decades of recording. For example in 1954, a recording studio equipped with an early Ampex reel to reel tape machine recorded the historic first single of an unknown truck driver named Elvis Presley, "That's All Right" at Sun Studios in Memphis. The Ampex 351 was also the backbone of the earliest days of multi-track recording. The first of the Ampex 8-track recorders was custom built for and sold to Les Paul for $10,000 in 1957 and was installed in his home recording studio. It became known as the "Octopus." Ampex 8 track serial number 3 was sold to Atlantic Records at Tom Dowd's insistence in early 1958. Atlantic Records was the first record company to use a multi-track recorder in their studio on a regular basis. Just pause for a moment and contemplate

all the great recordings that came out of that Atlantic Records recording studio. If they ever were to induct a tape recorder into the Rock and Roll Hall of Fame, it would be the Ampex 351!

With the modeling project still sounding reasonably workable, it turned out that the recording pre-emphasis curve, tape speed, tape emulsion, tape thickness, flux or level recorded on the tape *(more later),* and the bias settings all greatly impacted the final result. So again, with Bob and John's help, endless discussions and tests were made regarding tape types and alignment techniques until what Waves were going to model was finally settled. Over time and with much experimentation, they made sample recordings that both Bob and John agreed had established a solid baseline from which to proceed. It would be these initial samples of the test recordings that would be used for detailed comparison to ensure that each model was performing accurately.

Once again Eric Schilling came to the rescue and agreed to do the massive testing and modeling runs required to model the two primary tape speeds, a number of tape emulsions plus variations in flux and bias settings as well as approaches to alignment techniques.

With the modeling files in hand, Waves began the excessively complex task of creating models, not only of the variety of analogue tape recordings, but the variety of bias, flux levels *(tape saturation)* and speed settings. When Waves began evolving early stage Alpha plugs, they required painstaking subjective analysis by comparison to the original samples recorded on the original tape machine and then through feedback to the development and engineering team, the models were honed. As they could only develop for one platform at a time, Waves chose to do their initial development for the Macintosh, at which time Bob took a back seat and John Haeny made it a full-time job by becoming a co-developer of this product.

WHAT WAS MODELLED AND HOW DOES THAT AFFECT THE GUI AND THE OPERATION OF MPX?

Tape Type

Waves modeled 3M Scotch 206/207 tape as it was considered an almost an ideal match for this machine. There were other earlier tape types that were exceedingly popular as well - for example, 3M Scotch 201/202/203 was used extensively by Motown, but sadly it was no longer available in a sufficient and durable enough quantity for this project. Of the 3M Scotch 206 *(a 1.5 millimeter base)* and the 207 *(a 1.0 millimeter base),* 207 was selected because the slightly thinner base, although perhaps subject to greater print-through *(clearly not an issue for a tape modeled plugin),* provided a more intimate recording and playback head contact *(called tape wrap)* and thus produced a more extended high frequency response. Fortunately John Haeny had a sufficient supply of virgin 3M Scotch 207 stock for the purpose so off the shipment flew from Australia to Florida.

Tape Speed

The 350 transport has 2 speeds. 15ips *(inches per second),* and 7.5ips. 15ips was the default professional standard providing the best high frequency response and the lowest noise. 15ips has a gentle roll off at around 16kHz. 7.5ips was the minimum reasonable professional quality speed for studios and there was also a fair amount of equipment for the home that operated at 7.5ips. 7.5ips has quite a high frequency loss with a roll-off starting at around 8KHz, but 7.5ips managed to preserve low frequencies better than 15ips with a slightly more 'solid' bottom end and

therefore was widely used in rock recordings in the 60's and 70's. *(This has to do with the relationship of the wavelength of the signal and the width of the head gap. The slower the tape speed, the easier for a 'given' head gap to record and read the lower, or longer, wavelengths.)*

When switching between the 2 speeds you should expect to get a very much improved high frequency response with 15ips when compared to 7.5ips but perhaps a somewhat less tight low end. Note that 15ips will also provide less THD *(Total Harmonic Distortion)* than 7.5ips. There is also a shift in the frequency of the noise by an octave between 7.5ips and 15ips, with the noise at 15ips sounding an octave higher than 7.5ips. The significance of this difference has always been argued, with some preferring the noise signature of 7.5ips and others preferring the noise signature of 15ips. As time progressed and 30ips became popular, many used 30ips because as the noise shifted upwards yet another octave from 15ips, it moved further away from the fundamental musical frequencies and thus became less obtrusive. Experiment and form your own opinions on the issue of speed vs. noise vs. frequency response.

Pre-Emphasis Curves

At the time of the 351's popularity, there were a number of pre-emphasis curves in use worldwide. Because of the inherent limitations in analogue tape recording, these curves generally applied high frequency pre-emphasis equalization during recording and then applied the reverse curve upon playback. The net result of this was to maintain high frequency response while reducing tape noise.

The most popular curve in Europe at this time was CCIR. In America the curve was NAB. Ampex also had their own short-lived curve known as Ampex Master Equalization (AME). The machine at Olympic, as best we can determine, was a NAB machine although Ampex would provide CCIR machines on special order. Additionally, NAB was the curve used for the vast majority of the American pop recordings done on this machine. The NAB curve provided the most accurate sonic signature of this legendary machine, so NAB was the pre-emphasis curve chosen by Waves for the Kramer MPX tape model.

Bias

> *Defined: Bias is a high frequency signal, typically between 40 KHz and 150 KHz, applied to the record head along with the audio signal when an audio track is placed into record. The bias current solves a critical problem when recording to analog tape. When the amplitude of an audio signal passes through the zero voltage crossing, the magnetic field created by the record head is not strong enough to polarize the magnetic oxide particles on the tape. Thus, a distortion of the original audio signal is introduced. To minimize this distortion, the bias current is applied to break down this resistance to polarization. The audio signal can then be recorded more accurately without the effects of low level distortion. The amount of bias current applied is critical to the frequency response and distortion characteristics of an analog recording.*

Waves modeled and have provided you with two bias settings. "Normal Bias" *(this is the Ampex recommendation for bias adjustment, straight out of the original Operator's Manual for the 351*). "Normal Bias" was recommended in the first years of production by Ampex to try and reach the best recording levels with the minimum amount of distortion and the maximum frequency response. This setting produced a fairly low noise level *(noise is around 60dB lower than the peak signal),* and around 2 to 3dB of high frequency loss with a moderate amount of high frequency distortion.

During the 60's, after a number of years of working with these tapes, many professional studio engineers and technicians discovered that by over biasing *(increasing the amplitude of bias signal)* by only a small amount, they could improve the high frequency response and at the same time lower the noise level. This was called "Over Bias" and each tape type, studio, recording engineer and technician had their own way of calibrating the bias to achieve their preferred sonic qualities.

For MPX we modeled the -3dB over bias, which was agreed by most engineers to be the point where you got the best high frequency response, least amount of distortion and best signal to noise ratio on 3M Scotch 207 tape. *(Actually -.7dB at 700hz for 15ips but set at -3dB at 15KHz for accuracy. You adjusted nominal bias to accomplish the peak level of the signal and then continued beyond the peak until the level began dropping by the desired amount, therefore the term 'over bias'. The bias adjustment for 7.5 was done one octave lower at 350hz or 7,500hz and at -20dB to avoid excessive high frequency saturation.)* When you switch from "Normal Bias" to "Over Bias" mode, you should expect to hear a bit less noise, clearer high frequencies *(reduced distortion)*, and a bit more overall dynamic range *(clarity, once again the result of less overall THD)*.

Flux

> *Defined: The power emitted by the head responsible for transferring program information onto tape is measured as a quantity of lines of flux or fluxivity once on the tape. This is measured in NanoWebers per meter (commonly abbreviated as nWb/m). When picking an operating level for tape (flux), the general rule is that the higher the operating level, the further away you are from the noise floor but the closer you are to the point of distortion*

Flux is the amount of density of magnetic particles on the tape per meter *(nWb/m)*, the higher the flux level - the higher the recording level on the tape. In order to reach higher recording levels you need to have tapes that can manage a higher flux level *(many modern tapes can reach very high recording levels with minimum distortion with the added benefit of reduced noise or 'tape hiss')*.

Ampex initially set a standard recoding level that they called "Ampex 0" *(or Ampex Standard Operating Level)* for recordings made on their machines in 1950. This recording level was at a flux level of 185 nWb/m. All early alignment tapes were Ampex 0 or 185 nWb/m signals and were the standard for all recording. As tapes were developed to handle greater and greater flux *(or higher recording)* levels, the industry continued to rate tape flux levels based on the original Ampex Standard Operating Level. For example a tape that was designed to record signals at 250nWb/m was said to be recording at +3dB *(over Ampex 0 of 185nWb/m)*. As point of reference, since the Flux Control on Kramer MPX is calibrated in nWb/m, here is a quick reference guide for comparison *(Source Quantegy)*:

-2dB = 150 nWb/m
0dB = 185 nWb/m *(Ampex Standard Operating Level)*
+3dB = 250 nWb/m
+5dB = 320 nWb/m
+6dB = 370 nWb/m
+9dB = 520 nWb/m

Science aside, early on many engineers discovered that by pushing or abusing the recording levels on tapes, it created some very musical and frequently desirable side-effects, especially in Rock and Roll recording. Tape has a very unique way of going into saturation or overload, whereas digital is basically 'go or no-go' with over modulation producing clipping. As the levels are raised on analogue tape, a number of things increase simultaneously and fairly gradually: Third Harmonic Distortion *(THD)*, Inter-modulation Distortion *(IM)*, Modulation Distortion, a mix of other aberrations of distortion, many of which are still not fully understood, and ultimately when pushed hard enough, tape has a tendency to 'saturate' which is a form of compression, unique to analogue tape. Many engineers, even when digital was available, still preferred to record certain instruments on analogue tape *(especially Rock and Roll drums)* pushing the levels on the tape well beyond their ideal operating conditions to gain this saturation or compression.

Modeling this behavior of changing sonic behavior across a wide range of flux levels was perhaps one of Waves' biggest challenges. Ultimately they were able to create a continuous flux control that ranges from -2dB below the standard Ampex zero well into unknown territories, invaluable for a wide variety of special effects.

Since 3M Scotch 207 was rated at between 185 nWb/m or 250 nWb/m *(opinions vary about the 'ideal' level for Scotch 207, Waves have chosen the more conservative level of 185 nWb/m for the MPX default, although they modeled a wide range of flux levels to be able to accurately create the variable flux control)*), you will find that this plug will be especially sensitive to settings above the recommended level of the tape sampled. When reaching higher flux levels you will notice that the low frequencies and very high frequencies become more and more distorted as the noise level goes down. Additionally there is another layer of distortion since these increased operating levels also stress the valve input and output stages, giving you the bonus of an additional level of overall "tube distortion."

Kramer MPX is the first tape modeling plugin that has actually managed to create a continuously variable flux control, letting the user sonically understand the changes between different recording levels. Add to this that this is also being done on a fully valve electronics tape machine and you truly have a one of a kind plugin - unique in the industry.

As an added feature, using MPX in the input only mode allows you to add the sound of the input and output valve electronics, minus the sound of analogue tape recording. Increasing the record level as you reduce the playback level *(to maintain unity gain)* increases the valve saturation of the input and output amplifiers, independent of the flux control *(which only effects tape saturation).* These controls can be used either in conjunction with the sound of the tape saturation, or without the tape saturation to create just the sound of the Ampex valve amplifiers operating across their entire range of saturation.

Because of the independence of the flux control and the record level and playback level controls, you have full control over both the tape saturation and the valve saturation while maintaining the level of the MPX track in your mix *(using the 'Link' function for the record and playback controls).*

To simplify the MPX Flux control just think of it as a 'tape drive' or 'saturation control'. As you increase the flux level on the tape the output of the MPX plug stays constant at unity gain unless you choose to adjust the output gain control.

Noise

Although the Noise control on the MPX is defaulted to off, it is strongly suggested that you take a listen to it. If this can be said, you may find it to be some of the sweetest noise you will ever hear since it is a combination of the tape hiss generated by analogue tape recording, overlaid by the thermal valve noise of the Ampex 351 input and output electronics.

Wow

> *Defined: Wow and flutter in analogue tape recordings results from the turning speed inaccuracies (FM), and flutter effect (AM) caused from changes in the physical alignment of the tape on the actual recording head, coupled with the 'slip and slide' of the tape going through the transport mechanism and a variety of mechanical 'frictions.'*

In a perfect world, there would not have been wow and flutter. Many 'in the day' considered wow and flutter the same as surface noise on a vinyl disc - just something negative one had to live with since that was the 'state of the art.' But like noise, there are many that will feel that any model is not complete without all the flaws as well. For that reason Waves have provided you a manual wow control on the GUI of MPX. It is defaulted to the wow and flutter modeled on the sample machine. You can increase it for a somewhat more enhanced effect *(although it would have never been too obvious [unless your machine was broken] as it was always a subtlety of the analogue tape process),* or if you choose, you can move to a more idealized world and turn the wow off. Having or not having wow and flutter and/or noise has nothing to do with the primary advantages of the analogue tape recording sonics, so use them or not at your own discretion. You will always have the advantages of the 'Ampex Tape Sound' with or without them.

Something Extra

To sweeten the Kramer MPX package, Waves also added a variable delay control *(0ms-500ms)* that routes the tape playback of the plugin back to the input of the MPX. This creates a very basic feedback tape delay effect across the entire signal *(the direct signal is always included in the mix).* A low pass *(LP)* filter was added to the delayed feedback path to allow you to filter out any unwanted high frequencies. This delay/feedback feature is intended to be very basic. It does not offer a wide control section, but is believed to contribute additional value to the MPX plugin. Used carefully, this function has the capacity to create some very lovely tape delay sounds. It also needs to be pointed out that the delay is only affected by the Delay Time control in the delay section. It is NOT affected by the running speed of the transport. If you need to ask why Waves included this bonus function, the answer is quite simple. because they could!

WHAT TO EXPECT FROM THE MPX

Default Set-Up

The default set-up of the MPX, without any adjustments, will provide identical results to having made your recording on 3M Scotch 207 at 15ips using a NAB pre-emphasis curve with an over-bias of -3dB at 15KHz and at a recording flux level of 185 nWb/m. This will yield the sound of the basic industry set-up for this machine at the height of its era. The only item remaining for you to decide will be whether or not to have tape and valve amplifier noise, and if so, exactly to what degree.

Of course you also have other options with regard to bias, wow, speed and most dramatically, a continuously variable flux control starting at the ultra conservative setting of -2dB below the classic Ampex Zero all the way to some rather massive, heretofore unattainable in a plugin, extreme analogue tape saturation effects.

Meter Transfer Switch

On the face of the meter you will find a meter transfer switch that transfers the meter from reading the input to the MPX plug or the output of the MPX plug. This is purely a meter transfer switch and has no effect on the monitored sound.

Mode Switch or Input/Reproduce

In place of the classic record light you will find an illuminated yellow or amber lamp. The label above it will be in the default mode of Repro, which means the output of the MPX is after the model of recording on tape. In the Input mode you will only be hearing the sound of the valve input and output electronic stages *(or directly through the machine without any tape running).* This is not a pure bypass and this sound is, in and of itself, valuable for many applications. Other than the audio monitor transfer and the light being on for Reproduce and off for Input, when in Reproduce the transport reels will also be turning to insure you that you are hearing the result of recording on analogue tape.
Should you choose not to have the reels turning, simply clicking on them will turn their motion off.

What Should You Expect to Hear

The sound of analogue magnetic tape recording may be new or un-familiar to some born in the digital age. The goal of the design of all analogue tape recorders was the same - to provide a transparent, colorless method of media storage. The Ampex 351 recorder was quite successful in its day, at accomplishing this goal. But because of the state of the art at the time of its development, it still had a wide variety of limitations: Tape saturation, tape noise, harmonic distortion, modulation distortion, phase shift and limitations in frequency response to name but a few.

Although many think that analogue tape will improve the sonic quality of their signal, by today's standards and measurements it does quite the opposite. Measured by modern technology it lowers the overall resolution of a signal. In fact the signal to noise ratio of an analogue tape recording is not good by today's standards. It fails to accurately reproduce both high and low frequencies. Its THD measurements are not good by current standards *(more then 1% THD*) and yet listeners still find its sound pleasing.

So just why is this sound so desirable? Well for a number of reasons, but firstly, contrary to measurements and the theoretical loss of high frequency response, because of the non-linearity of the NAB pre-emphasis curve, coupled with the third harmonic distortion created by the analogue recording process, the ultimate subjective result is a slight increase in the quantity and clarity of the higher frequencies.

Even as digital recording has come of age, and with hindsight 20/20, what many considered to be a limitation of analogue tape recording, has in fact become desirable. Digital has been criticized by many as being clinical and cold sounding, while analogue technology has been touted as

sounding warm, clear and musical. Therein lies the big difference in what you should hear in the MPX plug. Granted if you want to play with the settings *(and please feel free to do so)* you can create some very dramatic tape effects of saturation, noise, etc. But by using the MPX with its default setting, it will provide you with an extremely accurate model of, not only analogue tape recording, but of analogue tape recording on what many considered to be the premier valve analogue tape recorder - the Ampex 350 transport coupled with the Ampex 351 valve record and reproduce electronics.

A description of the sound of the Kramer MPX is that it is best 'felt' as a warm, sweet and clear musical sound. Start there as your basis and then experiment with the controls to discover all the additional sonic qualities available to you and choose those that best suit your tastes and your style of music.

In Practical Application

It is not possible to create a model with this level of detail and flexibility and at the same time keep its resource demands low. Running MPX does require a fair amount of system resources as you might expect. If you want to use MPX on individual tracks, please do so, as there are no 'rules' in our art form. But MPX may perform best on sub-mixes of drums and percussion, strings, guitars, vocals and anything that requires analogue 'warmth and clarity.' Also, don't forget what MPX could contribute to digitally sampled instruments and digital synthesizers. Many will find that across an entire mix and especially in mastering, MPX may prove to be invaluable. MPX is the result of almost two years of failures and triumphs and contains the heart and soul of many contributors. Waves' sincerest hope is that you will enjoy MPX and that it will become an invaluable component in your sonic toolkit.

Kramer MPX used in conjunction with the Kramer HLS and the Kramer PIE finally completes the magic of the original Kramer Olympic Studio Recording Chain.