

Radial Workhorse

Modular Processing & Summing System



With API's 500-series 'Lunchbox' format becoming ever more popular, it was almost inevitable that someone would try to improve on the standard...

HUGH ROBBOHNS

The 'Lunchbox' modular racking system, conceived and developed by API as the 500 series, is now a much-loved industry standard, and a wide range of manufacturers have produced countless compatible modules and frames. The latest addition is the 'Workhorse' rack and mixer from Radial, who have been producing 500-series compatible modules for some time.

While the Workhorse is fundamentally similar to all 500-series compatible rack frames, it's also radically different in some interesting and useful ways — as is often the case when Radial's engineers set pen to draughtsman's paper! It also has more versatile module connectivity and configurability than most other frames.

Overview

The Workhorse is a standard 3U-high rackmounting frame, designed to accommodate up to eight single-width 500-series modules, or a combination of single- and double-width modules. The frame is made of heavy-gauge steel (the empty rack frame weighs a solid 10kg) and painted in a tough, dark-blue finish.

A removable tray screwed inside the base of the unit helps to guide modules into line with the rear connectors. This tray is equipped with guide slots for both single (slots 1-4), and double-width modules (5-6 and 7-8). The latter can also accommodate single-width modules. Anyone who already owns a range of 500-series modules will know that they're not all constructed to the same frame

size tolerances. Radial are well aware of that, which is why the slot tray can be removed. It's a thoughtful feature, which allows slightly oversized modules to be installed without excessive force (or resorting to hand files!).

On the right-hand side of the frame, where most 500-series racks would house a power supply, the Workhorse instead features an eight-channel stereo analogue mixer, complete with integral monitoring facilities feeding two main outputs (main and monitor), as well as a pair of headphones outputs. The main





outputs are equipped with an insert point and Jensen output transformers, along with a master level control and on-off button. The twinned headphone outputs are taken from the same feed (but before the level control and on-off switching) and have their own level control and mono button. The headphone amplifier is a pretty meaty design that's capable of driving most headphones to painfully loud volumes.

The separate monitor output is derived before the insert point, but has its own on-off button and level control. There are also facilities to expand the built-in mixer by coupling its stereo bus to other Workhorses, or compatible units (the

Rupert Neve Designs Portico units, for example). These expansion facilities take the form of a pair of TRS sockets to accept an external stereo bus input, and two more sockets to provide the Workhorse's mix-bus outputs (essentially a fixed-level version of the monitor outputs).

Each of the eight mixer input channels is provided with an on-off button, an overload LED, a rotary level control and a pan control. If using Radial 500-series modules, their outputs are automatically passed directly to the corresponding mixer inputs. The mixer inputs are derived from pin 11 of each module connector, a terminal originally associated with remote gain-adjustment on appropriate modules. A rear-panel D-sub connector is also provided on the frame, and this is wired to access the same eight mixer inputs at unity gain.

Older 500-series modules that don't have output bussing via pin 11 can be linked into the Workhorse mixer externally by hooking up the relevant module outputs on the back of the frame to the corresponding D-sub input channels. Alternatively, the external mixer inputs can be used as a simple outboard analogue summing mixer — although if the rack is fitted with any Radial modules, any signals passing through them at the same time will also appear in the mixer. The mixer itself is a simple virtual-earth design using op-amps with 4k7 bus resistors.

The rear panel of the Workhorse is pretty busy. Each module slot has both female (input) and male (output) XLRs, each with a parallel-wired TRS socket to afford more connection versatility and duplicated outputs. All of the module inputs and outputs are also wired (in parallel again) to a pair of D-sub connectors, using the ubiquitous Tascam standard for eight-channel balanced

Radial Workhorse

PROS

- Extremely solid construction.
- Removable module slot tray to accommodate oversized modules.
- Built-in eight-channel mixer with good monitoring facilities.
- Handy 'Feed' switches for patch-free signal chaining.
- Accessible module stereo-link switches.
- Three-way I/O paralleling on XLR, TRS and D-sub.
- External mixer inputs and stereo-bus expansion I/O.

CONS

- Not all 500-series modules are designed to use the internal mix facilities.

SUMMARY

The Workhorse is a very thoughtfully engineered 500-series rack that builds constructively on the original API module interface format, adding an internal mix-bus path and an adaptable Omniport I/O socket to cater for a wide variety of applications.

analogue audio connections.

In addition, each module has an extra TRS socket, labelled 'Omniport' the function of which will depend on the module's facilities and requirements. This socket is wired to terminals 7 and 9 on the module connector, which was originally designed to accept a low-level input. Radial's intention is that it could be used as a key input for a gate module, an instrument input on a preamp, a direct output or insert point, or even a footswitch control socket. In most cases, though, it won't be needed to provide stereo linking between adjacent compressors or limiters: that function is already built into the frame, and is activated by slide switches provided on alternate modules, thereby allowing module 1 to be linked with

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The rear panel hosts a number of I/O options, including a D-sub input for the summing amp, and direct outputs from each module.

Radial's 500-series Modules

Seven of the eight modules currently made by Radial were supplied with the review unit, and are described below. We don't have space here to review them in depth, but all of Radial's 500-series modules are built with high-quality components and very rugged construction. They can all be used with any 500-series rack, but when loaded into the Workhorse, additional benefits become available to them in the form of module-specific I/O via the Omniport, and integral signal routing to the frame's stereo mixer.

The **JDX Reactor Speaker Simulator** (with a red face plate, £358.80 including VAT) is, as the name would imply, a guitar-amp interface and cabinet simulator that can be used to take the signal from a guitar (or guitar-pedal chain) directly or, preferably, via the amp. In the latter mode, the speaker output from the amplifier head is plugged into the front of the JDX module and passed via a second socket back to the speaker cabinet. A balanced line-level output is available on the module XLR on the back of the rack. The JDX circuitry is configured to capture the amp's output signal, taking into account the back-EMF (Electromotive Force) generated by the speaker as it responds, which helps to capture the true characteristic sound of a typical 4x12 cabinet. Push buttons are provided for ground lift and polarity inversion, and when working with bass guitars, another button increases the bass extension, to emulate

a 15-inch speaker cabinet. A variable low-pass filter stage takes care of string buzzes and amp hiss, while two recessed switches select between guitar and amplifier input modes, and switch between 100W and 300W power sensitivities. The JDX is backwards compatible with all 500-series racks, but when used with the Workhorse, it integrates properly with the internal mixer, and the Omniport socket provides a mic-level direct output.

The **Power Pre** (dark blue front panel, £598.80) is a high-quality mic preamplifier equipped with a 'vintage' broadcast output transformer made by the Hammond company (no, it's a Canadian transformer manufacturer, not the famous American organ company!), which is claimed to add warmth and deliver an "exceptionally smooth tone". The microphone input can be plugged into the front- or rear-panel XLRs and a recessed button provides phantom power. When used in a Workhorse rack, the Omniport socket provides a 150kΩ instrument input, which is selected automatically when a plug is inserted. A rotary gain control adjusts the gain of the complete 'AccuState' amplifier stage, from off through to +55dB, and is designed to optimise the signal-to-noise ratio at all gain settings. The specifications give an EIN figure of -122dBu at 55dB gain, which is very respectable. A horizontal, 10-segment LED bar-graph meter

indicates the output signal level, while three more push buttons provide polarity inversion, a 15dB pad, and a 100Hz high-pass filter. A three-way toggle switch is labelled **Breath**, **Linear** and **Punch**. The first provides a little more air EQ to brighten the sound slightly, while the last setting provides more lower-mid body and energy. The linear mode is, as the name suggests, the neutral setting. The **Power Pre** is also compatible with the Workhorse mixer.

The **EXTC Reamp** module (orange panel, £310.80) is essentially a guitar effects interface, designed to enable the connection of guitar pedal units into a pro-audio signal path. The unit unbalances the module's line-input signal from the rack, making it suitable in terms of levels and impedance for feeding an external guitar pedal, via a transformer (to avoid ground loops). It also accepts the return from a pedal (or a chain of pedals) which it balances, amplifies and feeds to the line output. The unbalanced send and return sockets are mounted on the module's front panel, and rotary level controls are provided to fine-tune the send and return levels. A rotary Blend control allows the source signal to be mixed against the guitar-pedal effects signal, while two push buttons provide a polarity inversion and allow the Omniport on the Workhorse frame to be used as a second effects loop, which is connected in series with, and after, the front-panel pedal loop. The XTC

» module 2, and module 3 with 4, and so on.

Another very useful feature, provided by more slide switches alongside each module's input XLR, is labelled 'Feed'. Operating the switch connects the balanced output of that module directly to the input of the module to its immediate right, making it very easy to link several

modules together without the need for a rat's nest of patch cables on the back of the frame. So a mic preamp in position 1 can be linked straight into an EQ module in position 2 and a compressor in position 3, effectively creating a full channel strip without any rear-panel patching.

The left-hand side of the rear panel

carries the I/O connectivity for the mixer and monitoring section, starting with a third D-sub socket (mentioned earlier) to accept external mixer channel inputs. These inputs are unbalanced, but the D-sub is still wired to the Tascam standard, with the cold side of each channel connected to ground. The main

and monitor outputs are both equipped with XLRs and paralleled TRS sockets, with two further TRS sockets providing unbalanced insert sockets for the main outputs. Four more TRS sockets provide the stereo mix-bus expansion inputs and outputs.

A pair of wire-linked 4mm binding posts allows the circuit and chassis grounds to be separated when necessary, and a five-pin XLR accepts three DC voltages from an

One of the features that makes the Workhorse very different from other 500-series racks is the eight-channel summing amp, the controls for which are located on the right-hand side of the front panel.



is also compatible with the Workhorse mixer.

The **PhazeQ** module (light blue panel, £358.80) is a phase-alignment tool intended to help blend the outputs from spaced microphones, or the DI'd signal from a guitar, with the output of a mic on the amp. A discrete phase-shifter circuit can be adjusted from 0-180 degrees via a rotary control or, at the push of a button, from 180-360 degrees. When used to realign one mic signal relative to another, adjusting the phase control alters which frequencies boost and which become attenuated. A variable low-pass filter is also provided, and this can be switched between ranges of 3-38kHz or 300-3800Hz. The phase-shift and filter stages can be bypassed individually, and a Blend control allows the input signal to be mixed with the processed signal. If used in the Workhorse rack, the Omniport socket provides an unprocessed output.

The **Shuttle Insert** (brown panel, price yet to be announced) is an effects insert and routing module that can be used to help integrate standard 500-series modules into the Workhorse frame without the need for extensive patching. The balanced input and output on the rack are connected to two insert send-return loops, each with its own bypass button. The top pair of sockets provide a balanced +4dBu interface, while the bottom pair provide an unbalanced -10dBV interface. When used within a Workhorse frame, a third unbalanced insert loop (with its

own bypass button) can be connected via the Omniport socket. The Shuttle module can also be used to route line-level inputs through to the Workhorse channel mixer, enabling the creation of artist cue-mixes, or latency-free overdubbing when used to handle the outputs from a DAW or tape recorder, for example.

The **Komit Comp** (green panel, £598.80) module is a versatile and easy-to-use compressor-limiter that combines a modern, super-clean, feed-forward VCA compressor stage with a vintage-style, diode-bridge clipping limiter. A three-position toggle switch selects between preset fast, medium and slow attack and decay time constants, while a rotary ratio control adjusts the compression slope from 1:1 up to 10:1 and simultaneously alters the knee from soft to hard. Although the compressor is very transparent, the limiter is a real old-school clipper. Depending on how hard it is driven and the position of the rotary Limiter switch, its character can be adjusted from very subtle vintage-style harmonic overload right up to extremely aggressive clipping. There is also a brickwall limit option, which bypasses the limiter section and switches the VCA compressor into a 20:1 limit mode. A Hammond broadcast output transformer is used again, while a rotary control provides up to 22dB of compressor make-up gain, and can be used to drive the limiter stage harder. A 10-segment

bar-graph meter is divided in two to show the gain reduction being applied on the left, and the output level on the right. A recessed button switches the threshold for +4 and -10dB nominal levels. Two adjacent modules can be stereo linked (using the rear-panel switch on the Workhorse frame) and a recessed button labelled Sync establishes a master-slave arrangement to match time constants. In a Workhorse rack, the Omniport socket is employed as a key input for frequency-dependent compression, de-essing and ducking.

The **X-Amp Reamp** module (yellow panel, £310.80) is designed to make it easy to route a pre-recorded signal — such as a DI'd guitar track — out to a guitar or bass amp, or effects processors. The rack's balanced line input is routed directly to the balanced output, and is also unbalanced and routed to two independently transformer-isolated, high-impedance, guitar-level outputs on the front panel. Each of these outputs is equipped with on-off and ground-lift buttons, and the second output can also have its polarity inverted. Independent level controls allow the volume from each output to be adjusted to optimise the amplifier drive. When used with the Workhorse rack, the Omniport socket provides a guitar-level input, allowing one guitar to feed two amps simultaneously. The X-Amp is also compatible with the Workhorse mixer.

external universal (SMPS) power supply unit, which can be run on 100-240V AC. The modules are powered from $\pm 16V$ DC rails for the audio, and +48VDC for phantom power. The maximum current available for the eight-frame modules is about 1200mA, which works out at an average of 150mA per module, or 300mA per double-width module. In most cases, this should be more than sufficient, but a few 500-series modules require more current than usual, and it might then be necessary to leave one or more module slots vacant, or select other modules with lower than usual current demands.

Conclusion

There are plenty of impressive 500-series modules on the market from a wide range of manufacturers, some of which are even

available as DIY kits. The price of these modules varies widely, but in general they are extremely cost effective because of the reduced metalwork and absent power supplies — which are the two elements that tend to be the costliest parts of most rackmount devices. Consequently, it makes a lot of sense to invest in 500-series modules, as they allow the user to acquire and expand a collection of preamps, equalisers, compressors and other signal-processing tools, with a range of tonal characters and facilities that best meet their precise needs, without breaking the bank.

Choosing the best and most appropriate modules might be a challenge in itself, of course, but deciding on a suitable rack to house them can be equally difficult. Some 500-series racks provide little other than a power supply and some I/O connectors. The Radial Workhorse is one of the most versatile and well-equipped racks I've tried, and exudes the typical Radial engineering detail and thoughtfulness.

The inclusion of a simple mixer allows a complete stereo recording package to be constructed within a single rack frame, while also permitting direct separate

recording of each channel output at the same time. It also facilitates the creation of artist monitor mixes while recording channels direct to a DAW. The Workhorse manual provides several illustrated examples of various applications, including re-amping setups, vocal tracking, stereo channel strips, live stereo mix recording with simultaneous tracking of individual channels, and many more.

This is a well-designed and well-engineered 500-series rack system, and Radial's development of the original API specification is modest but well conceived. In making all of the interface details open-source, Radial are hoping that other manufacturers will get on board and support their initiative by developing or updating their own modules to take advantage of the Omniport I/O and mix-bus facilities. If you are thinking of embarking down the 500-series road, the Workhorse rack has to feature very highly on the list of contenders for a system frame. ■■■

Alternatives

There are several 500-series host racks available from a range of manufacturers. Obviously, API themselves produce suitable racks, but there are also systems offered by the likes of **A-Designs** and **Purple Audio**, and **SPL's Rackpack 500** accepts 500-series modules as well as SPL's own. None of them, however, offers the additional mixing and monitoring facilities of the **Radial Workhorse**.

E Workhorse chassis £1798.80 including VAT.
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