UP4 Preamplifier:

The UP4 is a four channel, one rack unit, remote controlled universal preamplifier. The second of our PUP family of units; the design used provides for the remote control of preamplifier function, while maintaining performance at the best achievable with any form of audio circuitry. Input and output levels of up to +28dBu are accepted, which together with an EIN figure of -133dBu defines an exemplary, universal input stage.

Siting preamplification at the nearest point to a signal source can reduce many forms of signal degradation that appear when driving cables directly with un-buffered low level signals. Many of which can also manifest if not using properly buffered discrete outputs at line levels, such as:
- radiated noise pickup
- microphonic cable noise
- capacitive and ringing effects
- slew rate degradation
- loss of high frequencies
- increased distortion

Features and Use:

The front panel has level indication for each channel; displaying -16dBu (signal present-green) and +24dBu (high level-red). Two data indicators also show: network connection (green) and data transfer (red). The remaining indicator shows power is present, while the 'set' switch is used either to reset or set one of 16 network addresses.

In use, each channel has 19 gain steps in 4dB increments, from -8dB to +64dB; together with phantom power on/off, mute, and phase reverse functions. Care has been exercised in all functions, particularly in the elimination of switching noise. For example, the use of an embedded micro controller has allowed for the introduction of muting during phantom power switching, protecting against damage to open studio monitors, or embarrassed engineers while powering down a microphone. The exemplary noise floor, distortion and overload performance result in absolute sound clarity, warmth and transient performance; while fast overload recovery and physically protected inputs provide for a hard circuit to abuse.

Specifications:

Parameter	Conditions	Figure
EIN	50 Ohm source, +64dB gain, referenced to +4dBu	133dBu
Frequency Response	between 10 and 100kHz	+/- 0.1dB
THD	100-20kHz,1kHz/0dBu signal @ 12dB Gain setting	0.0003%
THD	100-20kHz,1kHz/-64dBu signal @ 64dB Gain setting	0.02%
CMRR	at 0dB gain setting, 1kHz	-70dBu
CMRR	at +64dB gain setting, 1kHz	-80dBu
Input Headroom	All gain settings	+28 dBu
Output Headroom	All gain settings	+28 dBu
Crosstalk	Measured channel at +64 Gain, clip second channel	>-100dB
Input Impedance	Optimised at low/high gains. (Figures in Ohms)	6K8/1K6
Depth in Rack	1u form factor. Not including XLR connectors.	260mm
Power Consumption	(selectable for 100/115/230v).All channels driven.	40w

Remote Control:

Two options have been provided. Ethernet allows for control from devices such as Fairlight's Dream; or Apple and IBM computers (software is provided). Also, various PUP units can interface using an audio XLR data cable. This long range signal can be patched through normal audio tie lines, such as a multicore between a stage and mixing position.

Technical discussion:

PUP represents many years of development by Alan Smart. Noise, CMRR, Distortion, Headroom, Crosstalk, Dynamic Range are exemplary, and outperform all other tested units evaluated so far (Focusrite Blue, Massenburg); and also beating all published specs so far examined (Amek 9098, DACS, APHEX - though one DACS unit however has a better published CMRR spec at 1KHz).

The circuit is a unique variant of instrumentation amplifier topology, starting with the good CMRR performance typical of this format. All internal audio circuitry is fully balanced, maintaining symmetry from input to output, which helps further reject noise, crosstalk, and distortion products. Gain adjustment is achieved with only 5 relays, while offsets are nulled to typically 25microvolts by DC-servo circuits in all stages, resulting in the need for only one Polycarbonate capacitor in the audio path. No electrolytics are used.

Headroom at all points of the circuit is maintained to the power rails, at +28dBu, and at all gain settings. Many other designs suffer from degraded input headroom as a result of using a 'long tailed pair' configuration; while the output performance is variously compromised from op-amp-only; pseudo-balanced; or transformer circuits falling prey to real-world situations not fully defined or tested in the lab. For example the 'pseudo-balanced' opamp circuit favored by 80% of manufacturers induces around 9dB of noise as a result of the positive feedback employed. As this is a dynamic problem, it measures well without signal present, and only manifests when excited by low level signals, resulting in worse noise performance in use. Driving outputs from op-amps directly brings other drawbacks such as far higher distortion under load and long cables, instability, and degraded slew rate performance. Again, often problems that manifest in 'system' use, and so slip through the design stage, and don't show up on a specification sheet.

To optimize these output drive issues we have developed a discrete transistor output circuit, capable of driving into long cables and difficult loads, and switch-select between balanced or unbalanced configuration. (This circuit is also in use in the C2 and other products).

Discrete FET's are used for break-before-make switching of phase reverse and muting functions; and with balanced, proprietary drive circuitry, outperform the charge introduction, off isolation, and rds-on performance of the commonly used SSM2402 family of i.c. switches.

OP275 amplifiers are used for the audio signal path. These were chosen in listening tests for their sound and hybrid FET/Transistor inputs, together with their overall performance.

Large-geometry transistors bypass the first stage input transistors to provide an EIN figure of 133dB (see specifications). NPN or PNP input transistors can be fitted, so that should any advantageous new devices become available we have the best chance for their inclusion.

As a result of both remote control and the surface mounting of components, a compact physical layout has been possible. Cables to and from front panel controls become unnecessary, and pcb layout problems are reduced such as crosstalk, noise pickup and stability.