VALLEY 817 COMANDER
OWNER'S MANUAL

TABLE OF CONTENTS

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INTRODUCTION

　　　Thank you for purchasing the Valley Comander. We are
certain that it will give you years of trouble-free operation
and service. Valley products are manufactured to the highest
standards, using quality components and materials in
Nashville, Tennessee, the country music capital of the world.
This proximity to one of the greatest recording centers in
the United States gives us that "hands- on" product
formulation and testing that very few manufacturers can
boast. Valley International, Inc. is known for manufacturing
outstanding signal processing devices since 1969.
　　　If you have any questions regarding application or
operation of the Comander or any other Valley product, please
feel free to call us at any time at 615/383-4737 and ask for
our Customer Service Department.

DESCRIPTION

The Comander is a modular compressor / expander designed to enhance instruments, vocals, and mixes.

The compressor control section of the Comander features continuously variable threshold, attack (integration) time, ratio, and release time. An expander control section having fixed attack time and slope is integrated into the Comander in such a manner that the expander threshold and release controls are coupled with those of the compressor. As a result, the expander reduces noise which may be accentuated by the compression process without audible "turn on" or noticeable transition between compression and expansion.

The Comander uses Linear Integration Detection, a patented circuit which compensates for loudness as perceived by the the human ear, so that the compressed signal maintains the correct musical relationships among waveforms with varying degrees of complexity. Linear Integration, along with proprietary Anticipatory Release Computation and Peak Reversion Correction, virtually eliminates objectionable processing artifacts such as pumping and breathing, and enables the Comander to deliver a processed signal having a warm, open sound, without the strained and flattened characteristics imparted by most other compressors.

The Comander is designed for a variety of applications to fit the needs of recording engineers, broadcasters, musicians, or commercial installers.

Turn to the following pages to determine how to hook it up and make it work for you.

FRONT PANEL CONTROLS
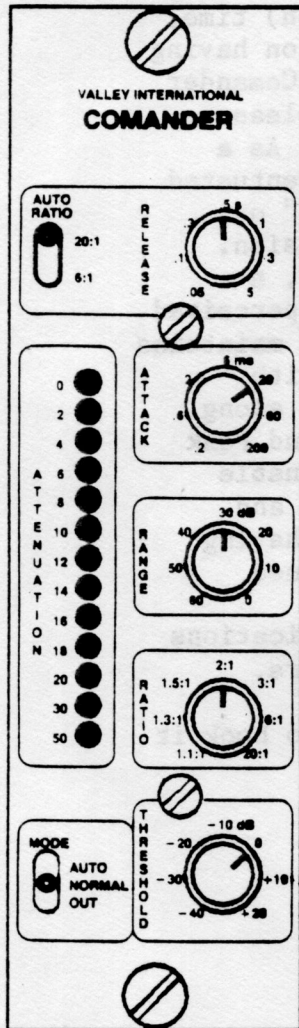
RELEASE time (.05 to 5 s/20 dB) determines the rate at which the processor recovers to quiescent gain after dynamic gain reduction ceases.

AUTO RATIO switch (20:1/6:1) selects compression ratio when the MODE switch is in the AUTO position.

ATTACK time (.2 to 200 ms) determines the integration time constant of the Linear Integration Detector over a 1000:1 range. At the .2 ms setting, the Comander behaves much as does a peak limiter, with the noteable exception that the Peak Reversion Correction circuitry coupled to the ATTACK time control compensates for low frequency threshold errors present in other fast-averaging and fast-rms detection schemes. As the control is adjusted to the 200 ms setting, the device becomes less sensitive to waveforms having high crest factors or high degrees of complexity.

RANGE (0 to 60 dB) varies the maximum attenuation which may be performed by the expander control section from 0 dB (expander out) to 60 dB.

RATIO (1.1:1 to 20:1) establishes the compression ratio.

THRESHOLD (-40 to +20 dB) sets the point above which gain reduction will begin, and, in conjunction with the ratio control, establishes the quiescent gain required to maintain the Comander's rotation point at 0 dB (0 dB input = 0 dB output)

MODE switch (AUTO/NORMAL/OUT) determines the source of control for the attack and release time settings and the ratio setting.

With the device in the AUTO mode, the operator may obtain
more or less compression by simply adjusting the threshold
control.
ATTENUATION (0 to 50 dB) LED flying dot display indicates the
amount of dynamic gain reduction taking place when the device
is in the signal chain. Since the display does not show gain
added to maintain a 0 dB rotation point, the amount of gain
reduction corresponds to the amount of compression. As a
convenience to the operator, the display is active even when
the unit is switched to the OUT mode, so that the device may
be adjusted for the desired amount of compression before
actually processing the signal.

CONNECTIONS

Everyone has connections in the audio business. Knowing how to use them is the key to success. Why should it be any different with signal processing equipment?

The Comander is housed and powered by the Valley PR-2 or PR-10 powered equipment racks, or may be specially ordered to fit the now obsolete TR-804/805 or TR-806 powered racks. The Valley powered equipment racks are connected by means of rear-panel barrier strips.

The Comander is electronically balanced in and out and easily interfaces with any source and its destination. The input and output sections of the Comander may be connected either to balanced lines, such as those found in professional studio and sound reinforcement equipment, or to unbalanced lines such as those on semi-pro equipment. The circuitry in the Comander automatically compensates for the differences in these two line types.

Refer to the following figures when connecting the Comander to other equipment.
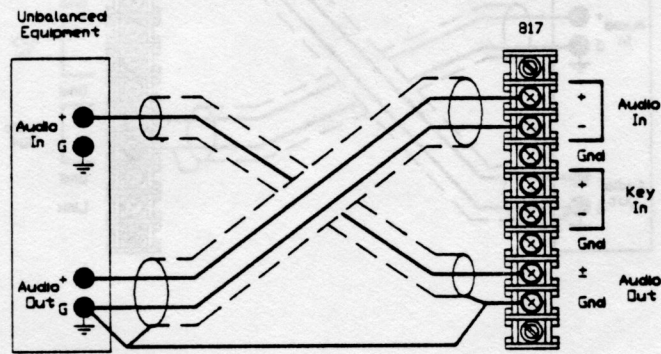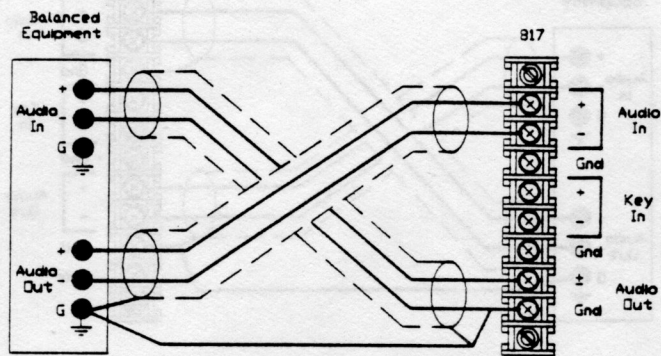
VALLEY 817 COMANDER
OWNER'S MANUAL

817 COMANDER IN PR-2 AND PR-10

PAGE 7
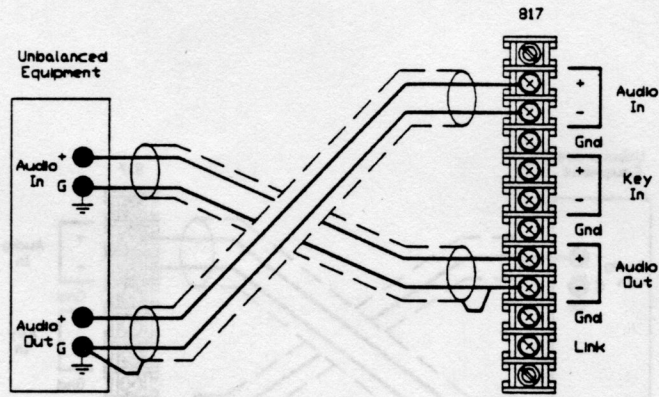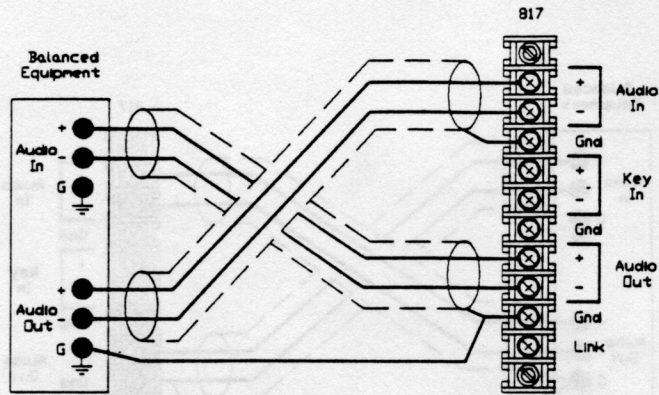
VALLEY 817 COMANDER
OWNER'S MANUAL

817 COMANDER IN TR-804 AND TR-806

OPERATIONS

AN INTRODUCTION TO DYNAMICS PROCESSING

Dynamics processing is defined as manipulation of the levels of complex sounds relative to some arbitrary point in such a manner as to alter the dynamic range of the sounds continuously and in real time. The most familiar of these processes are LIMITING, COMPRESSION, and EXPANSION.

LIMITING is the process of reducing the gain of a signal chain in the presence of an input whose level exceeds a preset reference, or THRESHOLD. Limiting may be accomplished at any RATIO, defined as the amount of input level increase (in decibels) above the threshold required to cause a 1 dB increase in the output level. For example, if a 2 dB increase in input causes a 1 dB increase in output, the ratio is 2:1. Most limiting is performed at higher ratios of 4:1 to 60:1, and some confusion exists concerning below which ratio a limiter ceases to limit and functions as a compressor; in fact, a limiter does not add gain to the signal chain when the input signal falls below the threshold, as does a compressor. A typical limiter transfer curve (ratio = 60:1) is shown in figure 1.
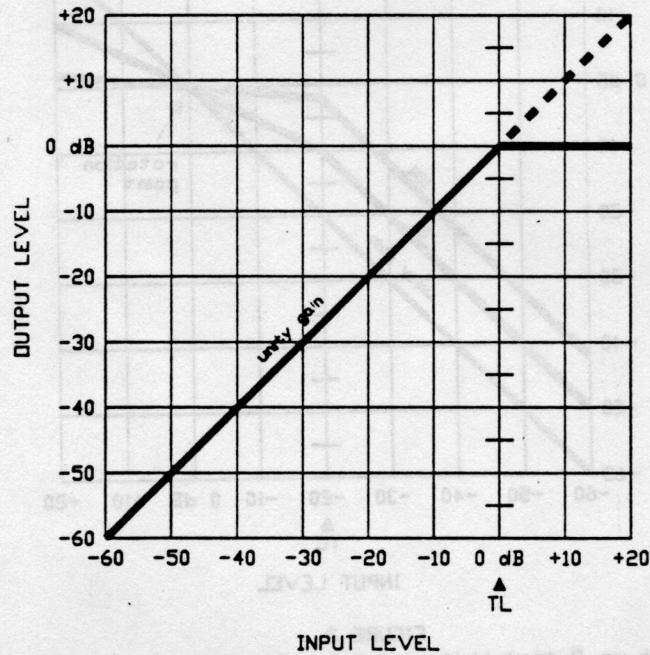

FIGURE 1
Input vs. Output Voltage Levels of a Continuous
Tone Signal Through a Limiter with Threshold @ 0 dB

COMPRESSION is a method of reducing the dynamic range of a
signal by adding gain to the signal chain in the presence of
input signals below a given threshold, and decreasing the
gain in the presence of input signals above the threshold.
The degree to which the gain is altered above the threshold
is determined by the compression RATIO, as is the amount of
gain added to signals below the threshold. Notice that a
compressor exhibits a well-defined ROTATION POINT, at which
the signal chain exhibits unity gain and through which all
possible transfer curves will pass. Figure 2 illustrates a
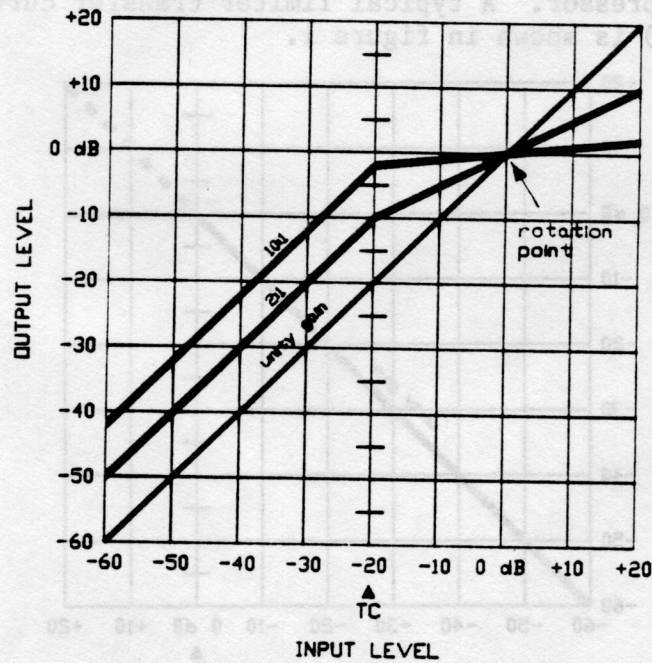typical set of compressor transfer curves.

FIGURE 2
Input vs. Output Voltage Levels of a Continuous Tone
Signal Through a Compressor with Threshold @ -20 dB

EXPANSION is a method of increasing the dynamic range of a
signal by increasing the gain of the signal chain in response
to an increase in signal level relative to a set threshold.
In direct expansion schemes, the threshold is set at a
relatively low value, theoretically corresponding to a point
just above the noise floor. Finite restrictions on signal
headroom make the direct expansion process somewhat difficult
to use in critical applications, as the signal chain gain
must vary in such a manner as not to overload the internal
circuitry during loud passages. A more practical method of
expanding signal dynamic range is DOWNWARD EXPANSION,
sometimes referred to as "soft noise gating".
In this type of expansion, the signal chain exhibits unity
gain for input signals exceeding the threshold, and decreases
its gain as the signal falls below threshold. The amount of
decrease in signal output which results from a 1 dB decrease
in signal input is determined by the expansion SLOPE. In an
expander with a characteristic slope of 1:2, a 1 dB drop in
input level below threshold results in a 2 dB drop in output
level. Expansion at high slopes is called "gating", and is
widely used for the suppression of unwanted noise in modern
recording studios, while expansion at lower slopes is
frequently used as a means of achieving dynamic noise
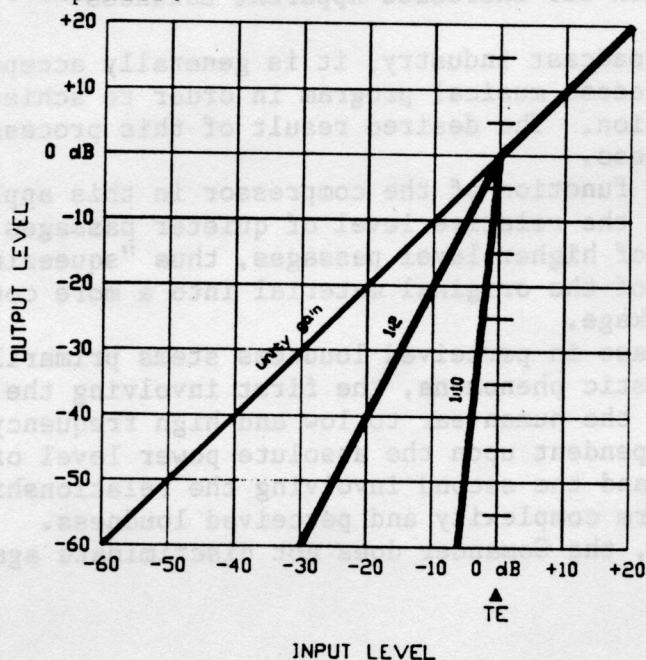reduction. Figure 3 illustrates the transfer characteristics
of a downward expander.

FIGURE 3
Input vs. Output Voltage Levels of a Continuous Tone
Signal Through an Expander with Threshold @ 0 dB

THEORY OF OPERATION

The Comander incorporates both a variable parameter compressor and an interactive expander in its control circuitry. Both sections operate a common voltage controlled amplifier (VCA). By allowing the compressor threshold and release time controls to affect the expander threshold and release time, the expander is adjusted to best perform as a noise reduction device to compensate for the increased level of the noise floor caused by the compression process. The expander range control is adjusted to provide the needed amount of attenuation when the expander is active, or is turned to the 0 position, fully clockwise, in order to remove the expander from the signal chain.

The rotation point of the compressor is 0 dB re.775 Vrms and is maintained by a computer which senses both the threshold control and the ratio control settings. When the compressor threshold control is set above 0 dB, the 817 operates as a limiter with variable ratio. When the threshold is turned below 0 dB, the compressor begins to add gain in order to maintain the rotation point.

APPLICATIONS

1) Compression for Increased Apparent Loudness

In the broadcast industry, it is generally accepted practice to process musical program in order to achieve denser modulation. The desired result of this process is enhanced loudness.

The basic function of the compressor in this application is to increase the relative level of quieter passages and to decrease that of higher level passages, thus "squeezing" the dynamic range of the original material into a more confined and denser package.

The increase in perceived loudness stems primarily from two psychoacoustic phenomena, the first involving the varying sensitivity of the human ear to low and high frequency information dependent upon the absolute power level of the sound source, and the second involving the relationship between waveform complexity and perceived loudness.

By design, the Comander does not discriminate against

low frequency information or complex waveforms. As a result,
it can provide a dramatic increase in loudness without
introducing objectionable amounts of dynamic distortion or
other processing artifacts.

When setting up the Comander for this application, use
the following control adjustments as a starting point.

RELEASE   .5
ATTACK   20
RANGE   20
RATIO   2:1
THRESHOLD   -20

The use of shorter release times and/or higher ratios will
cause an increase in the loudness at the expense of increased
dynamic distortion. The operator must determine by listening
where the optimum compromise between loudness and distortion
occurs, keeping in mind that the increased waveform
complexity provided by the introduction of dynamic distortion
may cause one program selection to sound "hot", while the
next selection may sound merely distorted. In any case, it
is common practice to adjust the threshold to provide an
average of 10 to 20 dB of compression. In most situations,
compression of more than 20 dB adds no more loudness.

2)   Wide Range Automatic Gain Control

When switching among different program sources with
varying or unpredictable audio levels, for example, from
sattelite to cart to land line, it is often necessary to
adjust the gain of the signal chain in order to prevent
overmodulation or to maintain an acceptably high audio level.
By using the Comander as a wide range AGC, the operator can
control audio levels over a range greater than 50 dB without
appreciably degrading the audio quality.

When using the Comander in this application, start with
these control settings.

RELEASE   5
ATTACK   2 or less
RANGE   40
RATIO   20:1
THRESHOLD   -20

When the unit is adjusted in this manner it will cause any

input between -20 dB and +24 dB to exit at a nominal level of
0 dB. Greater range is available if the threshold is
adjusted to the -40 position, but care must be taken that the
expander, whose threshold tracks that of the compressor down
to -20 dB, does not begin to chop up the signal when the
input falls below -20. If this should occur, and the
Comander is normally required to process signals with levels
less than -20 dB, the operator may wish to readjust the
expander threshold trim to a lower value. This is done by
locating the trimmer directly behind the front panel
THRESHOLD control, and using a miniature screwdriver or
alignment tool to turn the trimmer counterclockwise.

It is advisable to set the THRESHOLD control no lower
than the lowest anticipated nominal line level, thus if AGC
is required for signals only above 0 dB, set THRESHOLD at 0.
When using short attack times, the operator should note that
the Peak Reversion Correction feature of the Commander will
cause a level discrepancy of 10 - 15 dB on pure low frequency
tones such as a 25 Hz pilot signal. The 25 Hz tone in this
example would exit the device at a higher level relative to
the threshold setting than would a normal program. Use of
longer attack times helps, but provides little control of
transient peaks.

3)   Compression of Vocals or Instruments While Recording

For general use in the recording studio or production
room, the Comander can provide accurate control of program
dynamics without the introduction of audible coloration, or
it can used for effects such as altering drum sounds and
sustaining the sounds of guitar or other plucked instruments.
The addition of the expander to the signal chain allows
suppression of track leakage and room sounds.
When compressing for control, use the following settings
as a starting point.

RELEASE   .5
ATTACK   200 or less as required to control transients
RANGE   20 or less, as required
RATIO   1.5:1 or more, as required
THRESHOLD   0 or less, as required
When compressing for dynamic control, such parameters as

ratio and threshold are determined by monitoring the output
signal with meters and by listening, and adjusting for the
desired result. Expander range is usually determined soley
on the basis of listening for the desired effect.

Compression for effect requires the operator to be
conversant in the dynamics of the instrument he wishses to
process and the affect of the various controls upon them.
One example would be compression to exaggerate the percussive
impact of a kick drum, in which a relatively long attack time
would be used in conjunction with a high ratio. The
compressor would then be followed by additional gain in the
signal chain so that the initial impact of the drum would
cause a pronounced voltage excursion in the signal chain
followed by a controlled decay. In any case, the use of a
dynamics processor for the creation of special effects
requires only a vivd imagination and willingness to
experiment.

4)   Microphone Signal Processing

The demands of on-air processing are basic: the on-air
personality wants to sound bigger, better, and louder than
those other guys, and the PD wants an easily identifiable,
solid quality imparted to the signal. The methods used to
attain these goals are as varied as are the personalities of
those who use them, but compression of the dynamic range of
the air personality's voice is found in nearly every one of
them.

To compress a microphone signal, the operator must feed
the Comander from the output of the microphone preamplifier
at line level (OdB or higher), and return to a line level
point in the signal chain from the Comander output. Use the
following chart to perform the initial setup.

```
RELEASE     .1 to .5
ATTACK       2 to 20, less if transient control required
RANGE       15 to 30, depending on ambience desired
RATIO      6:1 to 20:1
THRESHOLD  -10 to -30 as required
```
The operator should note that the expander threshold tracks
the compressor THRESHOLD control down to approximately
-20 dB, so that extraneous room noises may be sufficiently

high in level to turn the expander on, causing perforation,
which is random rush-up of the noise floor. If this is a
problem, and if the Comander is normally to be used to
process the signal from a microphone in a live environment
containing room noise, the operator should raise the relative
threshold of the expander by adjusting the expander threshold
trimmer control. Locate the trimmer directly behind the
front panel THRESHOLD control,and use a miniature screwdriver
or alignment tool to increase the expander threshold by
turning the trimmer clockwise.

VALLEY 817 COMANDER
OWNER'S MANUAL

SPECIFICATIONS

Input	GUARANTEED	TYPICAL	UNITS
Input Impedance, bal:	100	---	kohm
Input Impedance, unbal:	50	---	kohm
Maximum Input Level @ 1 kHz, balanced:	+24	+25	dB
Maximum Input Level @ 1 kHz, unbalanced:	+24	+25	dB
Range of Input Levels for 0 dB Output:	-36 to +24 nom.		dB
Input CMRR(60 Hz to 15 kHz, ref. input):	>30	40	dB

Output

	GUARANTEED	TYPICAL	UNITS
Output Source Impedance, balanced:	50	---	ohm
Output Source Impedance, unbalanced:	25	---	ohm
Maximum Output Level into 600 ohm, bal:	+24	+25	dBm
Maximum Output Level into 600 ohm, unbal:	+21	+21.5	dBm
Static 1 kHz THD @ 0 dB in, Unity Gain:	.03	.01	%
Static IMD per SMPTE @ 0 dB in, Unity Gain:	.04	.012	%

Output Noise and Hum, Rsource=600 ohm, Rload =600 ohm:	GUARANTEED	TYPICAL	UNITS
	-83	-85	dB

NOTE: 0 dB refers to 0.775 Vrms;
All noise measurements made with rms-responding meters in a
20 kHz noise bandwidth; THD measurements made with 3rd order
low-pass filter having -3 dB point @ 30 kHz.

Electrical

Power Supply Requirements: +15 Vdc @ 100 mAdc

Mechanical

The 817 module is designed to be housed in either of the
Valley 800 powered rack enclosures, and occupies one 1.5" x
5.24" (38mm x 133mm) module space.

WARRANTY

VALLEY INTERNATIONAL, INC. warrants its products to be free
from defects in materials and workmanship for a period of one
year after the date of purchase. Should a VALLEY
INTERNATIONAL product fail to operate normally within the one
year warranty period, return the product, freight prepaid to
VALLEY INTERNATIONAL, INC.
2817 Erica Place
Nashville, TN 37204
Include a statement describing the nature of the failure.
If examination of the product reveals that the product has
failed under normal use, VALLEY INTERNATIONAL will repair or
replace the product at its sole discretion, and return it
freight prepaid. Repairs to damaged or out of warranty
equipment will be charged to the customer at an hourly rate.
This warranty is the sole warranty of VALLEY INTERNATIONAL
and is expressed in lieu of any other warranty, whether
implied or statutory.
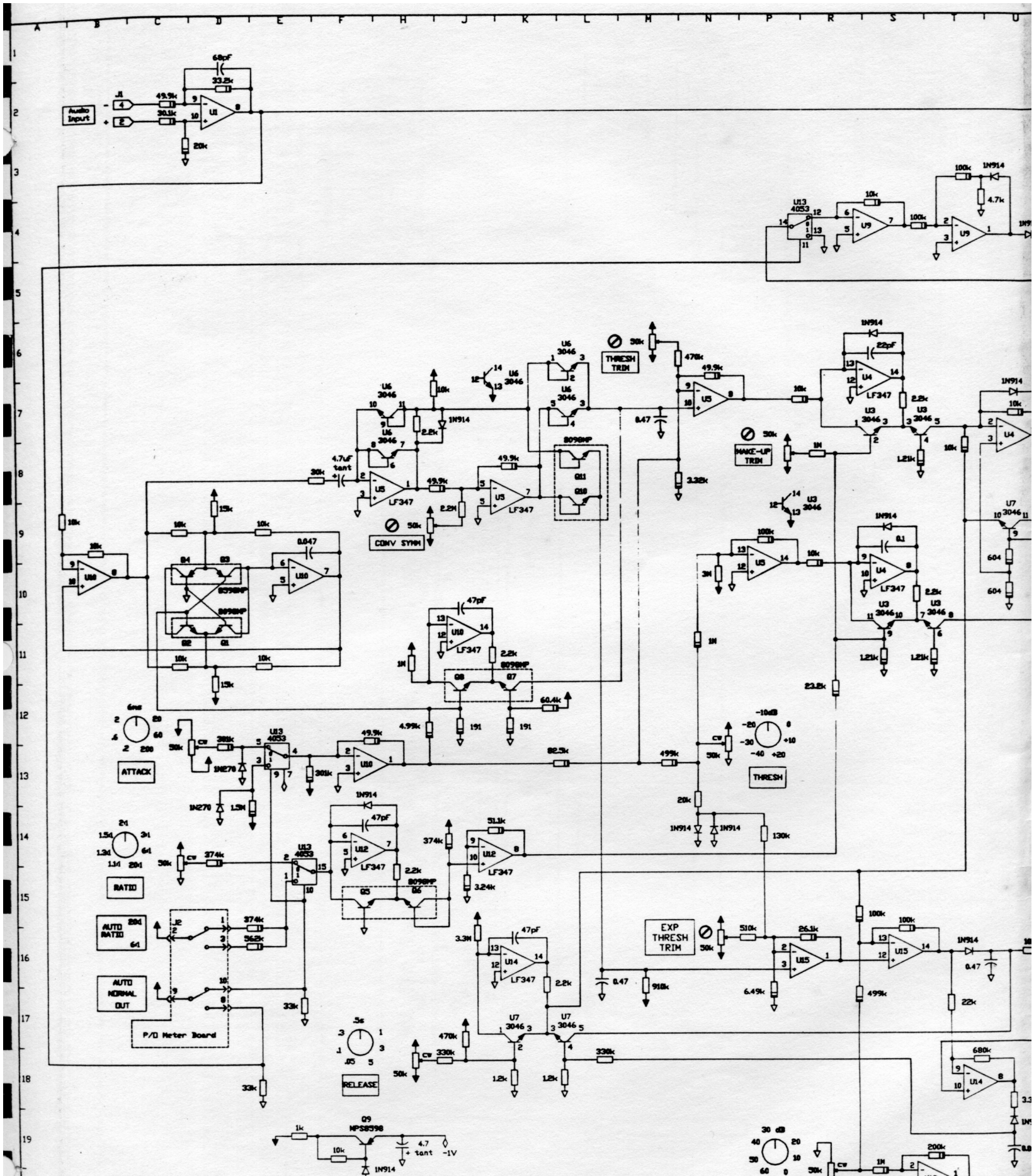
Electronic schematic
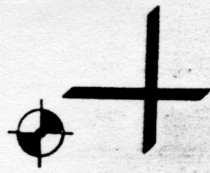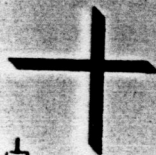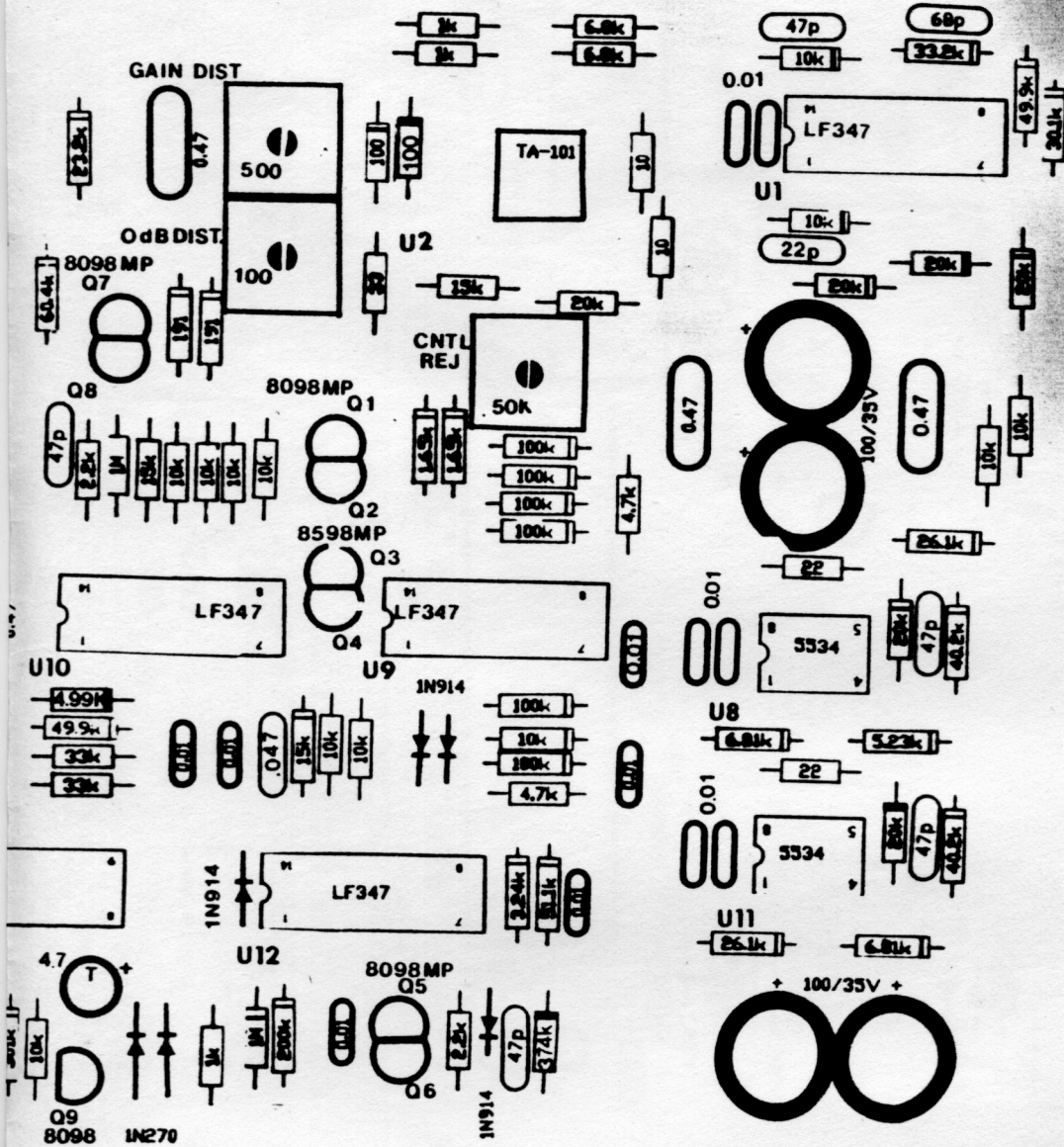Schematic layer
Labels layer
Special notes
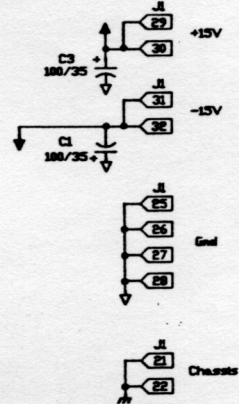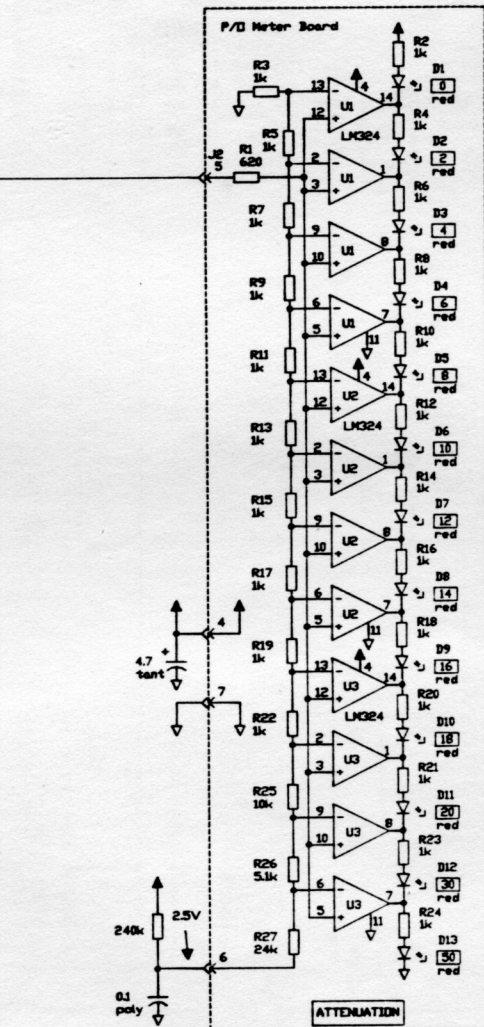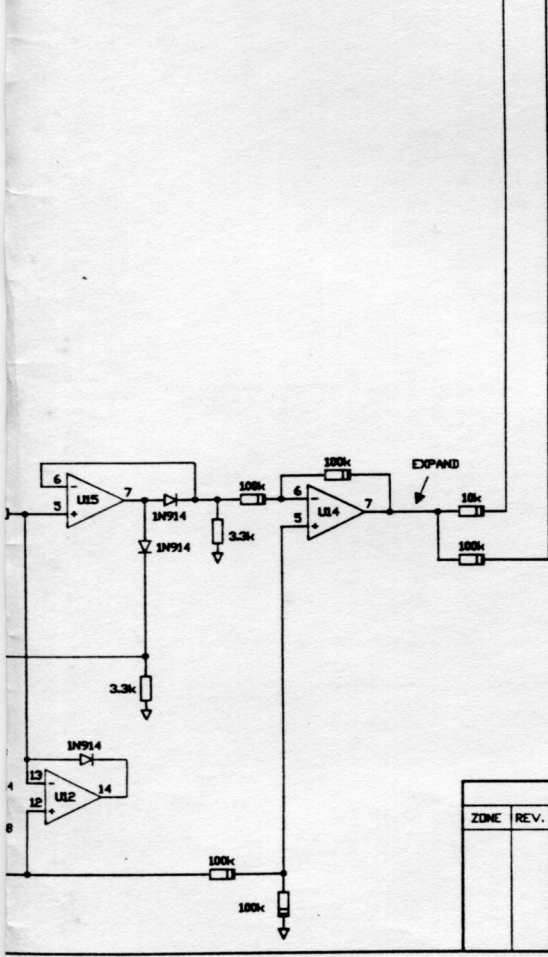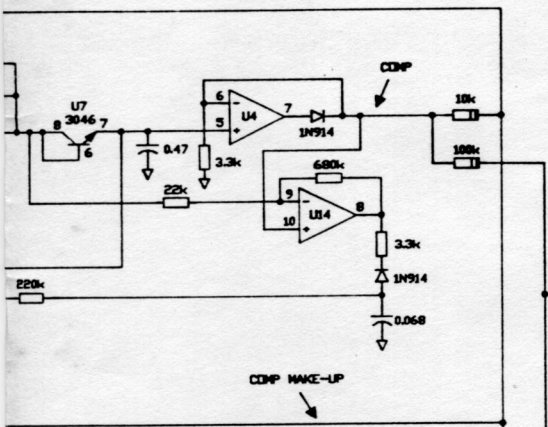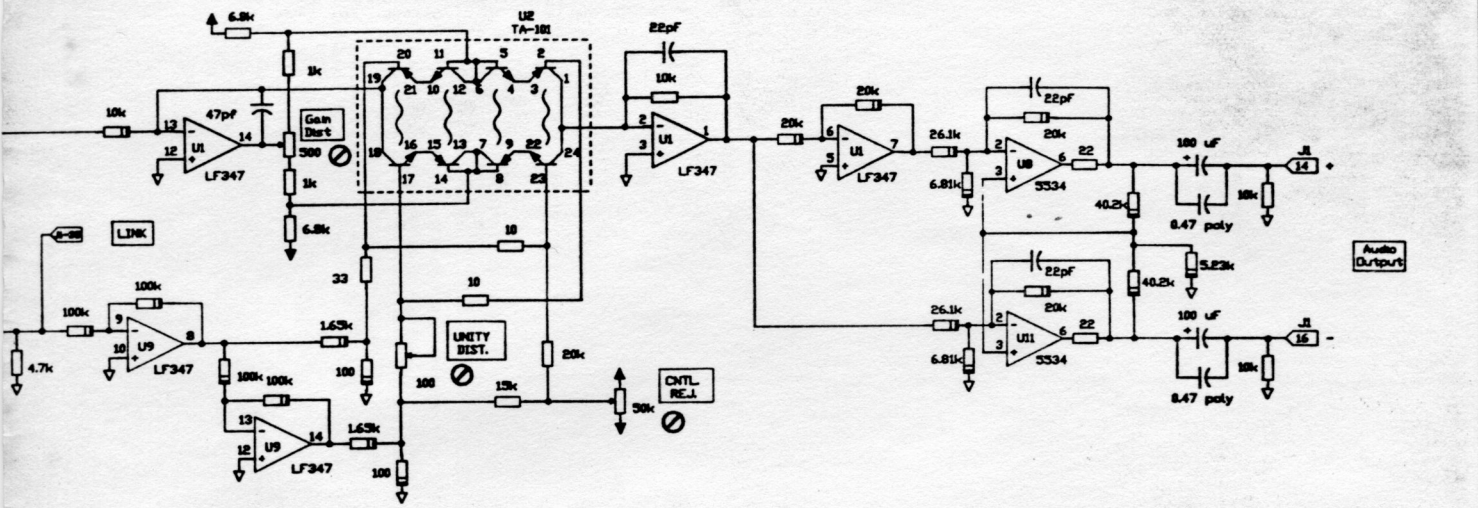
Notes:
Resistance values in ohms unless specified
Capacitance values in uf unless specified
— 1% metal film resistor
— 5% carbon film resistor
+15 V Power
-15 V Power
-1 V Power
Signal ground
Safety ground

RELEASE

ATTACK

RANGE

RATIO

THRESHOLD

U6 3046

8098MP Q11 Q10

SCREEN
VALLEY INT'L
COMMANDER 817
PART NO. 1891/D
MADE IN U.S.A.

4.7

U5 LF347

U15 LF347

THRESH
EXP. 50K

1N914

1N914

1N914 1N914 3.3k

20k 51.0k

30k

50K MAKE-UP 22pF 1N914

50K THRESH

50K CONV
SYMM

LF347 U4

U3 3046

604

J2

3046 U7

4.7 Poly

240k

LF347 U14

4053 U13

100k

0.47

Gnd

+15V

-15V

1N270

GAIN DIST

OdB DIST.

8098 MP
Q7

Q8

8098MP
Q1

Q2

8598MP
Q3

Q4

U10

U9

1N914

U12

1N914

4.7

Q9
8098

1N270

8098MP
Q5

Q6

1N914

500

100

U2

TA-101

CNTL REJ

50k

LF347

LF347

LF347

47p   68p

10k   33.2k

0.01

LF347

U1

10k

22p

U8

5534

0.01

5534

U11

100/35V

100/35V

1k   6.8k
1k   6.8k

0.47

22.1k

100   100

10

10

100

50

15k   20k

0.47

0.01

149k 149k

100k
100k
100k
100k

4.7k

22.1k
1M
10k
10k
10k
10k

47p

49.9k
30.1k

20k

20k

10k

10k

10k

26.1k

22

22.1k
47p
44.2k

6.81k   5.23k

22

26.1k
47p
44.2k

26.1k   6.81k

4.99K
49.9k
33k
33k

1M
1M

0.47

15k
10k
10k

100k
10k
100k
4.7k

10k

1N914

3.24k
8.1k
1M

10k

1M
200k

1M

2.2k
47p
374k

2/27/87 REV C - CORRECTIONS AFTER PROTOTYPE
PER PROTO