



CS-400™

OPERATING GUIDE

GENERAL DESCRIPTION

The field proven CS-400™ has been designed for commercial duty amplification where performance, reliability and long life are foremost requirements. Over the years, Peavey has continually refined the circuitry of the CS-400™ using the latest advances in circuit design technique and semiconductors. In this reliable high performance unit, we have combined the latest in high slew rate integrated circuits in the front end with the most rugged high-speed power transistors available in the output. The electronic sophistication and the unique modular packaging, together with a completely prefabricated wiring harness, constitute a system featuring performance, reliability and simplicity.

The CS-400™ utilizes a total of sixteen power transistors mounted on massive fan-cooled heatsinks. The CS-400's™ thermal system minimizes stress on each output device by distributing the total load over a large number of output devices and the automatic two-speed forced air cooling system insures low operating temperatures in any given environment to assure long, trouble-free operation.

This potent package now features Peavey's DDT (Distortion Detection Technique) compression circuitry that electronically senses the onset of clipping and engages a specially designed circuit which virtually eliminates the possibility of driving the amplifier into distortion. Our many years of field experience has proven that the main cause of speaker/driver failure is generally due to a system's power amplifier being overdriven, thus supplying clipped wave form (square waves) to the speaker system. A square wave is generally very destructive to speaker systems for many reasons, one being its extremely high D.C. content which greatly increases the average power delivered to the speaker, as well as the steep wave fronts and high harmonic content of these signals. Our DDT compression circuit may be disengaged if desired by the push/pull switch which is the integral part of the level control for each channel.

The CS-400™ features a unique patch system for each channel enabling the use of various plug-in accessories such as balanced input transformers and electronic crossovers. Professional design, specifications and "in-process" quality checks combine to produce an amplifier with honest performance at a reasonable price; but we don't stop here. We realize that even the most conservatively designed power amplifier will occasionally fail. Such occurrences are indeed unfortunate, but the real loss is usually discovered later when it becomes apparent that the amplifier failure has destroyed the speaker system. The Peavey CS-400™ has a built-in protection circuit in each channel to avoid this problem. A triac, the device commonly used in light dimmers, is employed in an "electronic crowbar" circuit connected across the speaker terminals of each channel. Under normal signal conditions, including full power output down to 20 Hz, this circuit remains inoperative. However, with the advent of abnormal D.C. voltages on the output terminals, the triac fires thereby placing a short circuit "electronic crowbar" across these terminals. This effectively shunts any D.C. voltage harmless to ground rather than to the speaker system. This circuit is an electronic insurance policy. It's there to protect the speakers when they need it the most.

As a home hi-fi amplifier, the Peavey CS-400™ is an unmatched stereo power amp. However, a word of warning should be given concerning the choice of the speaker system used. A true 200 watts per channel can easily destroy many home loudspeaker systems.

The operation of the CS-400™ is essentially straightforward and will present no difficulties in most applications. Our exclusive DDT compression circuitry enables the total system to enjoy freedom from most of the commonly encountered headroom problems with power amplifiers. The convenience of the rear patch panel, combined with the optional low cost plug-in accessories, give the CS-400™ unmatched versatility. The CS-400™ continues to be one of the most competitive professional power amplifiers on the market on a dollar-per-watt/performance basis. Professional specifications, components, the latest semiconductors and contemporary design make the CS-400™ the obvious choice for demanding commercial/professional applications. Comparison of performance, features, construction, techniques, and quality of components with any of its competition will illustrate the excellence of this professional amplifier.

WARNING
TO PREVENT ELECTRICAL SHOCK OR FIRE HAZARD, DO NOT EXPOSE THIS APPLIANCE
TO RAIN OR MOISTURE. BEFORE USING THIS APPLIANCE, READ BACK COVER FOR
FURTHER WARNINGS.

INSTALLATION AND CONNECTION

The Peavey CS-400™ Commercial Series power amplifier is designed for durability in commercial installations and delivers the quality of performance required in studio and home applications. The CS-400™ is a dual channel power amplifier with each channel capable of delivering more than 200 watts RMS into a 4-ohm load. The amplifier is of the standard 19" rack mount configuration and is cooled by an automatic two-speed internal fan.

Industrial and Commercial Installation

For commercial and other installations where sustained high power operation is required, the amplifiers should be mounted in a standard 19" rack with one standard rack space (1 3/4") between each amplifier in the stack. It should be noted that the fan pulls air in from one side and exhausts the hot air through the opposite side and top cover. It is for this reason that one rack space must be left between the units. Adequate air supply must be provided for the amplifiers when rack mounted. The internal fan must have a source of air that is not preheated by other equipment. The fan may be operated at high speed continuously to provide better cooling situations at all times. If fan cooling is inadequate due to preheated air or reduction of air flow, an internal thermal breaker may cause temporary shutdown of the amplifier. This is indicated by the front panel high temperature lamp (4). As a general rule, the cooler electronic equipment is operated, the longer its useful service life. You have invested in the finest equipment that money can buy and a little care will insure long and reliable operation.

Studio and Home Installation

In most low to medium power applications, the power amplifier can be mounted in almost any configuration. It is desirable that, if at all possible, the power amplifier be located at the top of an equipment stack. This will prevent possible drift or overheating of sensitive equipment from the hot air rising from the power amp. As a general rule, most home requirements will never cause the fan to switch to the high speed mode. Inadvertent short circuit or sustained high power usage, however, will cause high speed fan operation and could cause thermal shutdown.

Input Connections

All input connections are made at the rear panel jacks. The two jacks marked "Channel Inputs" (11) are wired in parallel for ease of connecting several amplifiers. Shielded cable must be used to minimize hum and noise pickup. The nominal input impedance is 50K Ohms. This impedance represents a bridging load to professional equipment and is compatible with the load requirements of home stereo devices. The CS-400™ has an input sensitivity of 1 volt RMS for rated output with the front panel level set at "10" allowing complete compatibility in home applications. This sensitivity decreases at lower level settings. It is generally wise to operate the level control at "7" or greater.

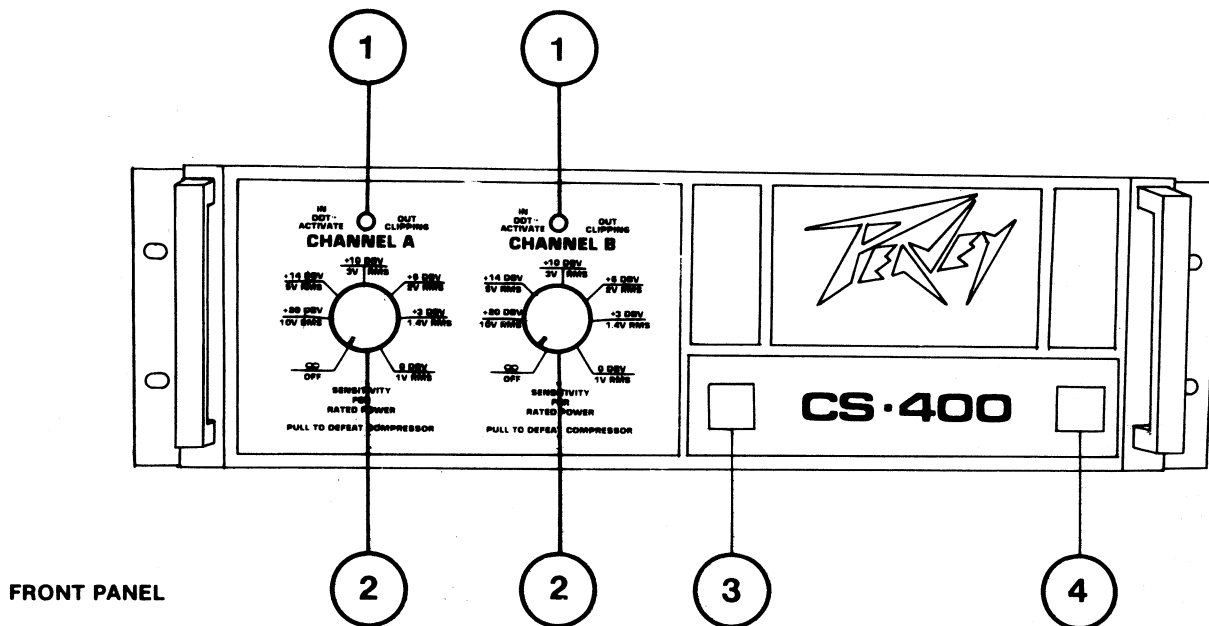
Output Connections

Two types of output connections are provided on the rear of the power amplifier modules. Two standard 1/4" phone jacks (12) and one set of binding posts (13) are available from each channel. Due to the high currents (greater than 10 amps) at full output, it is recommended that No. 16 or larger wire be used whenever possible. Smaller wire sizes will waste power and yield less than optimum results at the speaker.

It is also suggested that in commercial and other non-portable applications, the binding posts (13) be used instead of the 1/4" phone plugs. The binding posts are an industry standard and mating banana plugs are available from most electronic distributors. As with all electronic equipment, proper phasing of the outputs is important. A little time spent in correctly identifying the wiring could save a lot of problems in the field.

OPERATION

The CS-400™ Commercial Series power amplifier is designed for maximum ease and flexibility of operation. When the unit is installed and connected as described in the previous sections, operation is simply turning on the main switch and turning up the front panel level controls for the desired output level or until the front panel overload LED shows that the amplifier is clipping or compressing.



FRONT PANEL

DDT® COMPRESSION

The CS-400™ is a compact and powerful amplifier that features a new type of dynamic compression. This compression system enables the user to maximize the performance of the amplifier/speaker combination. We have determined through much research that the compression circuitry should prevent the power amp from running out of headroom (clipping) and should be as simple to operate as possible to avoid undue complication for the user. The compression system is activated by our exclusive "Distortion Detection Technique" circuit (DDT®) that senses conditions which might overload and activates compression when clipping is imminent. In other words, compression takes place whenever signal conditions exist which prevent the amplifier from faithfully reproducing the input signal. The threshold is the clipping level itself and no specific threshold control is provided. This technique effectively utilizes every precious watt available from the power amp. Because of the dynamics of music and vocals, it is quite common to activate the compression circuitry virtually constantly during a performance since this is what it is designed to do, i.e., to maximize the dynamics available from the amplifier within its power output capabilities regardless of power supply/line voltage variations and load impedance selection.

CLIPPING/COMPRESSION LED INDICATOR

The clipping/compression LED (light emitting diode) indicator (1), with the compressor operational, indicates when compression takes place. As long as gain reduction is occurring, the LED will continue to light thereby giving a valuable indication of this unique compression function. When the compressor is defeated by pulling out the level control on the associated channel (2), the LED now indicates a condition called "clipping." This condition is simply the failure of the amplifier to faithfully reproduce the input signal. Clipping can be caused by low line voltage, shorted speaker cables, or simply overdriving the amplifier with too much signal. In any event, the LED will light when this occurs and it has a short memory circuit built in to give the soundman a positive indication. The LED indicator will light during every clipping situation, thereby providing a valuable tool to help prevent severe distortion of the CS-400™. This type of indicator is more valuable than a conventional VU meter because a VU meter tends to ignore occasional peaks and only responds to relatively long term signals.

INPUT SENSITIVITY CONTROLS

The CS-400™ has the level controls for each channel labeled in a more functional manner replacing the conventional 0 to 10 segmented circle with the actual input sensitivity ratings of the amp for various settings of this control. In the past, this control has often confused even the most experienced audio technician as to its purpose and usage. This new change will help to explain its function, the need for these controls and the significance of the sensitivity rating.

The input sensitivity rating of a power amplifier is the RMS voltage level required at the input to produce full power into the rated load at the output. **This voltage then becomes the level at which the associated mixer must operate in order to produce the rated full power output.** Operation at levels above this rating will cause the power amplifier to clip (produce distortion) unless the associated amplifier has a compressor or limiter to minimize this distortion. Such a system called "DDT®" (U.S. Patent #4,318,053) is available on all Peavey power amplifiers and the advantages should be obvious...without it the sound engineer must "ride gain" on the mixer in order to prevent the mixer from producing an output signal level above the input sensitivity rating of the power amplifier which would cause distortion.

Traditionally the input sensitivity rating of a power amplifier receives low "billing" on a typical specification sheet. Usually the power output levels into various loads and the distortion numbers are first, followed by various other "interesting" specs, such as damping factor, slew rate, transient intermodulation distortion, and others. Then, in the fine print, one might find the input sensitivity rating...then again, one might not. **This rating, however, must be known to have performance visibility at the mixer.** Further, the rated sensitivity is only correct if the power amplifier level control is set at the **full clockwise or maximum setting.** Any other setting increases the value. With a numbered circle from 0 to 10, this new higher value is not indicated. The sensitivity ratings of the CS-400™ (and CS-800™) is to make the sensitivity rating known and to allow it to be adjusted accurately to higher values if necessary. You will notice that the sensitivity ratings are specified in both RMS voltage levels (usually given in power amp spec sheets) and the equivalent dBV values (usually listed in typical mixer specs). The dBV values are more useful since most contemporary mixers employ LED arrays, calibrated in sensitivity rating in dBV, indicating mixer output levels. Knowing the power amplifier sensitivity rating in dBV will allow the mixer operator to know the status of his power amplifiers (whether they are clipping or not) by noting which LED on the mixer is "peaking". Obviously the LED labeled the same or closest to the sensitivity rating will indicate full power output of the system. **Operation below that point will indicate how much so called "power amplifier headroom" is left. Operation above that point will cause clipping (or compression if the Peavey DDT™ system is in use).** Perhaps an example will be helpful here. Referring to the CS-400™ faceplate you will notice that with the amplifier "sensitivity for rated power" control set full clockwise, the rating is 1.0V RMS or 0 dBV. The critical LED on the driving mixer then is the one labeled 0 dBV. It will correlate with the power amplifier clipping/compression LED in that, whenever the 0 dBV LED on the mixer flashes on peaks, **the LED on the power amplifier will also flash indicating full power output is achieved.** If the CS-400™ control were adjusted to a higher value, then this new value would become the new correlation point on the associated mixer. This, then, is the main reason for knowing the value of the power amplifier sensitivity.

There is a very simple "rule" regarding the setting of the sensitivity (or level) control on a power amplifier. The "rule" is:

"UNLESS THERE IS A SPECIFIC REASON NOT TO, THE SENSITIVITY CONTROL ON ANY POWER AMPLIFIER SHOULD BE SET TO THE FULL CLOCKWISE POSITION, RESULTING IN THE MINIMUM VALUE OF SENSITIVITY RATING."

The exceptions to the full clockwise "rule" involve large systems where it is often necessary to employ several power amplifiers supplying the same signal to multiple speaker systems to achieve the necessary sound pressure levels or audience coverage. If the various amplifiers have different sensitivity ratings, it is necessary to adjust them to all have the same value so they all reach full power at the same time. A typical example is using a CS-400™ and a CS-800™ on the same mixer signal output. The CS-400™ is rated at 0 dBV, while the CS-800™ is rated at +3 dBV (the CS-800™ has 3 dB more power thus requiring 3 dB more signal input). To achieve simultaneous full power operation, the CS-400™ should be adjusted to +3 dBV. Notice the CS-800™ must be set full clockwise. The resulting system will have 15 dB of compression capability. Several competitive power amplifiers on the market have sensitivity ratings of +6 dBV (2V RMS). If these are employed in multiple systems, obviously, the more sensitive power amps must be adjusted accordingly.

In order to achieve the necessary sound pressure levels required in the typical "rock'n roll" concerts for the sound system, the use of bi-amped and tri-amped systems has become very popular and necessary. In this case, a crossover system must be employed between the mixer output and the various power amplifier systems in order to achieve 2 or 3-way operation with the associated loudspeaker components. Often these crossover systems provide adjustments for the crossover frequencies but have no level adjustments on the various outputs to compensate for differences in efficiency ratings of the various loudspeaker components. In this case, the sensitivity control can be adjusted upward on the particular amp the amount necessary to "pad" the associated speaker component in order to achieve a "flat" system. Naturally for optimum compression performance, the "unpadded" power amplifier should be set full clockwise.

Here at Peavey, we have chosen a unique plug-in crossover system, used in conjunction with our so-called "crossover islands" on the CS-400™ and CS-800™, to achieve bi-amped and tri-amped systems easily and at a low cost to the user. For each of our "bi-ampable" speaker systems we offer a matching crossover "can" which is specifically designed for that speaker system and contains all the necessary "padding and equalization" to achieve a "maximally flat" system. In this case, again, the sensitivity controls on the associated power amplifiers must be set at the full clockwise setting to achieve optimum performance. We also offer general purpose crossovers for competitive speaker enclosures which do not contain padding or equalization (referred to as "flat" crossovers) and, in this case, the power amplifier sensitivity controls or some other means must be employed to accomplish the necessary padding requirements.

One final point on setting power amplifier sensitivity controls...often, especially in small clubs, churches, and studio applications, the full power output capability of the power amplifier is not needed, or at the very most, there is no requirement for large amounts of compression capability due to the relatively low signal levels involved. Simultaneously these applications usually require a very low noise system. In this case it is possible to reduce the overall system noise at the expense of compression capability by increasing the power amplifier sensitivity accordingly. In other words, if instead of a sensitivity rating of 0 dBV on the Peavey CS-400™, we adjusted it to a rating of +10 dBV, overall system noise would be improved by 10 dB with the resulting compression capability of 8 dB. In other words, this can be one good reason for increasing the power amplifier sensitivity rating. Remember, however, once this is done, the mixer operator cannot re-establish full compression performance sitting at the mixer. If he wants it back, he has to do it at the power amplifier.

"ON/OFF" SWITCH/PILOT LAMP

The front panel of the CS-400™ contains a conventional type "ON/OFF" switch (3) with an internal pilot lamp. When the amplifier is plugged into a suitable power source, activating this switch should light the pilot indicator lamp. Failure of the pilot lamp to come on may indicate the line fuse has blown or the power source is faulty.

FAN SPEED SWITCH/HIGH TEMP. INDICATOR

The fan speed switch (4) determines the speed of the internal cooling fan with the internal lamp indicating over-temperature shutdown conditions. For most applications, low speed operation will provide adequate cooling. However, for sustained high powered applications, manual selection of high speed operation is recommended to provide maximum cooling, thereby minimizing the possibility of any shutdown of power due to over temperature conditions. The CS-400™ contains an internal thermal sensor that automatically raises the fan speed to high if low speed was selected when conditions exist which require additional cooling. Even at high speed operation, however, overloads into very low impedances and inadvertent short circuits could result in very high temperature conditions and the amplifier's thermal overload circuit may activate. This will be obvious with the pilot lamp off and the high temperature indicator on. The cooling fan will remain on as long as the unit is plugged in. After the unit has cooled down sufficiently, the amplifier will automatically cycle back on again. If high ambient temperature conditions exist, such as in a closed area,

