

SPICA SERVO SUBWOOFER

OWNERS MANUAL

The Installation procedures given in this manual MUST
be followed for the SERVO to perform properly.

<u>CONTENTS</u>	<u>PAGE</u>
Introduction	2
Checking system polarity	2
Changing the SERVO's polarity	3
Passive interface setup	4
Making the connection	6
Placement	7
Setting levels	9
Some fine points	10
Technical specifications	12
Warranty	12

INTRODUCTION

Your new SPICA SERVO subwoofer is designed to extend the low frequency performance of the SPICA TC-50 speaker system. Its computer-optimized crossover network, servo error correction circuit, specially designed 8" woofer, and internal 70 watt power amplifier all contribute to give a dramatic improvement in your system's clarity and definition, while allowing higher sound pressure levels to be obtained. And it does all of this without degrading the superior stereo imaging that the TC-50 is famous for. We are confident that you will be more than pleased with this addition to your system.

An important consideration in the design of the SERVO was to make it flexible enough to be used with whatever receiver or power amplifier you might be using for your TC-50s, while retaining the sonic purity that your system already has. To accomplish this, a simple passive filter is used in the portion of the crossover network that feeds the TC-50s. This part of the setup procedure represents a minor inconvenience for you, the end user. Although the procedure is a somewhat technical one, we have made every effort to present it as simply as possible. Please read and follow the instructions carefully.

Some of the 'tools' you will need are:

- > CASSETTE PLAYER (for setting levels)
- > MEASURING TAPE (for physical placement)
- > SOLDERING IRON (for capacitor installation)

For setting the relative level of the subwoofer with greater accuracy, a method is provided that requires the use of an AC VOLTMETER. If you do not have a soldering iron, your SPICA dealer will be able to assist you in installing the capacitors into the passive box.

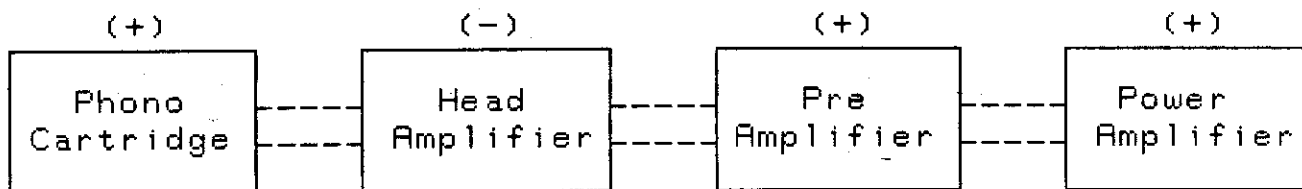
We mentioned above that the SERVO does not degrade the stereo imaging abilities of the TC-50. Another way of saying this is that the SERVO is a phase-coherent addition to the TC-50. This is quite a distinction from all of the 'generic' subwoofers available which, by their very nature, can only give 'generic' results. If by chance you are using the SERVO with satellite speakers other than the TC-50, we have no way of predicting how successfully the SERVO will match up with them, and the setup procedures given in this manual may not be applicable to your system.

We would like to acknowledge the fine folks at PS AUDIO for the design of the internal 70 watt power amplifier and the servo circuit.

CHECKING SYSTEM POLARITY

Suppose you were standing in front of a mirror that turned everything reflected in it upside down. All the features of the image would be there, but they would be inverted. This is a visual analogy of what is called POLARITY. The audio industry has not established any polarity standards, so some pieces of equipment invert the signal as it passes through them, and others do not. In order to determine the polarity of your system, you must find out which pieces in your system invert the signal, and which ones do not. This information is often given in the owner's manual of each piece. If it is not, contact your dealer or the manufacturer to find this out now.

FIGURE 1 SYSTEM POLARITY



To assist in the polarity-hunt, a sketch of your system in the form of a 'block diagram' will help immensely. FIGURE 1 shows such a diagram of a typical system. Draw up a similar diagram for your system, including everything from the source device (phono cartridge, tape player, etc.) to the speaker outputs of your receiver or power amplifier. If you have a receiver, the MAIN OUT jacks on the back panel are functionally the same as the 'Pre Amplifier' in FIGURE 1.

The (-) or (+) above each block refers to the inverting or noninverting status of each piece, where (-) signifies the inverting condition. Do the same on your diagram, noting the polarity of each piece above it. Now give each (+) a value of 0 and each (-) a value of 1. Add up all the values from the SOURCE device to the PREAMPLIFIER(MAIN OUT). If the number you get is an EVEN number or ZERO, no change in the SERVO is required. If it adds up to an ODD number, you must follow the procedure given below to change the polarity of the SERVOs woofer.

Now, check the polarity of the amplifier being used with the TC-50. Add its value (0 or 1) to the previous total. If this new total is EVEN or ZERO, the (+) terminal of the amplifier powering the TC-50s should be connected to the red input of the TC-50s, as is normal. If it is ODD, you should reverse the connections to each TC-50 at its input terminals.

CHANGING THE SERVOs POLARITY

WARNING : UNDER NO CONDITIONS SHOULD THE SERVOs POWER CORD BE PLUGGED INTO AN AC OUTLET WHILE THIS OPERATION IS BEING PERFORMED. The damage that results is not covered under warranty, and personal injury is possible.

If you have determined above that the SERVO's polarity needs to be reversed, you will need a SOLDERING IRON and a PHILLIPS SCREWDRIVER to change it. Place the SERVO on a table or bench, and proceed as follows:

- 1> MAKE SURE the SERVO's power cord is DISCONNECTED.
- 2> Remove the grill frame from the front of the enclosure by tugging firmly on it at the bottom of the enclosure.
- 3> Using a PHILLIPS SCREWDRIVER, remove all eight of the screws that secure the woofer onto the enclosure.
- 4> Free the woofer, and set it face-down in front of its mounting hole.
- 5> Make note of which color wire is connected to which terminal on the woofer. From the factory, the GREEN wire is connected to the woofer terminal marked with a RED DOT near it.
- 6> Unsolder both wires and resolder each of them to the terminal that was previously connected to the other color.
- 7> Replace the woofer into its mounting hole, lining up the screw holes in its frame with the holes in the enclosure.

- 8> Screw each screw in part way, making sure the woofer is seated evenly all around, then tighten them up in a cross-wise fashion. DO NOT overtighten them, or the holes will strip. They should be firmly snug.
- 9> Replace the grill frame onto the enclosure, pushing around the perimeter to engage the Velcro fasteners.
- 10> VOILA !!

PASSIVE INTERFACE SETUP

To interface properly with the SERVO, the signal sent to the amplifier that is driving the TC-50s must be 'high pass filtered' at the correct frequency. This is accomplished by installing the proper value of capacitor into the PASSIVE INTERFACE box. The value of this capacitor is determined by the input impedance of the power amp you are using. If you are using a receiver to power the TC-50s, it must have Preamp Out/ Main Amp In jacks on the rear panel. If yours does not, you should contact your dealer to make the appropriate modifications to your unit.

Find out the input impedance of your amplifier unit. This information is normally given in the owner's manual; if it is not, your dealer can find it out for you.

Locate the impedance value on the vertical axis of the chart in FIGURE 2 on the next page. Using a straight edge placed parallel to the bottom of the chart at the point located, mark the point where it crosses the curved plotted line. Now drop this point straight down to the bottom of the chart and mark it. Find the value of the nearest major division (the ones that are labelled), and count the number of small tick marks between this major division and your mark. If your mark is to the left of this division, ADD .001 to the number at the major division for each tick mark you counted; if is to the right, SUBTRACT .001 for each tick mark. The total you get is the capacitance in microfarads you will need to install into the PASSIVE INTERFACE box.

If your unit has an input impedance outside the range of the chart, you will have to calculate the value or ask your dealer to do it for you. The formula is:

$$\frac{1808.92}{\text{Input Impedance}} = \text{Capacitor value (in microfarads)}$$

$$R \times C \times 88 = C \text{ IN FARADS}$$

Hz

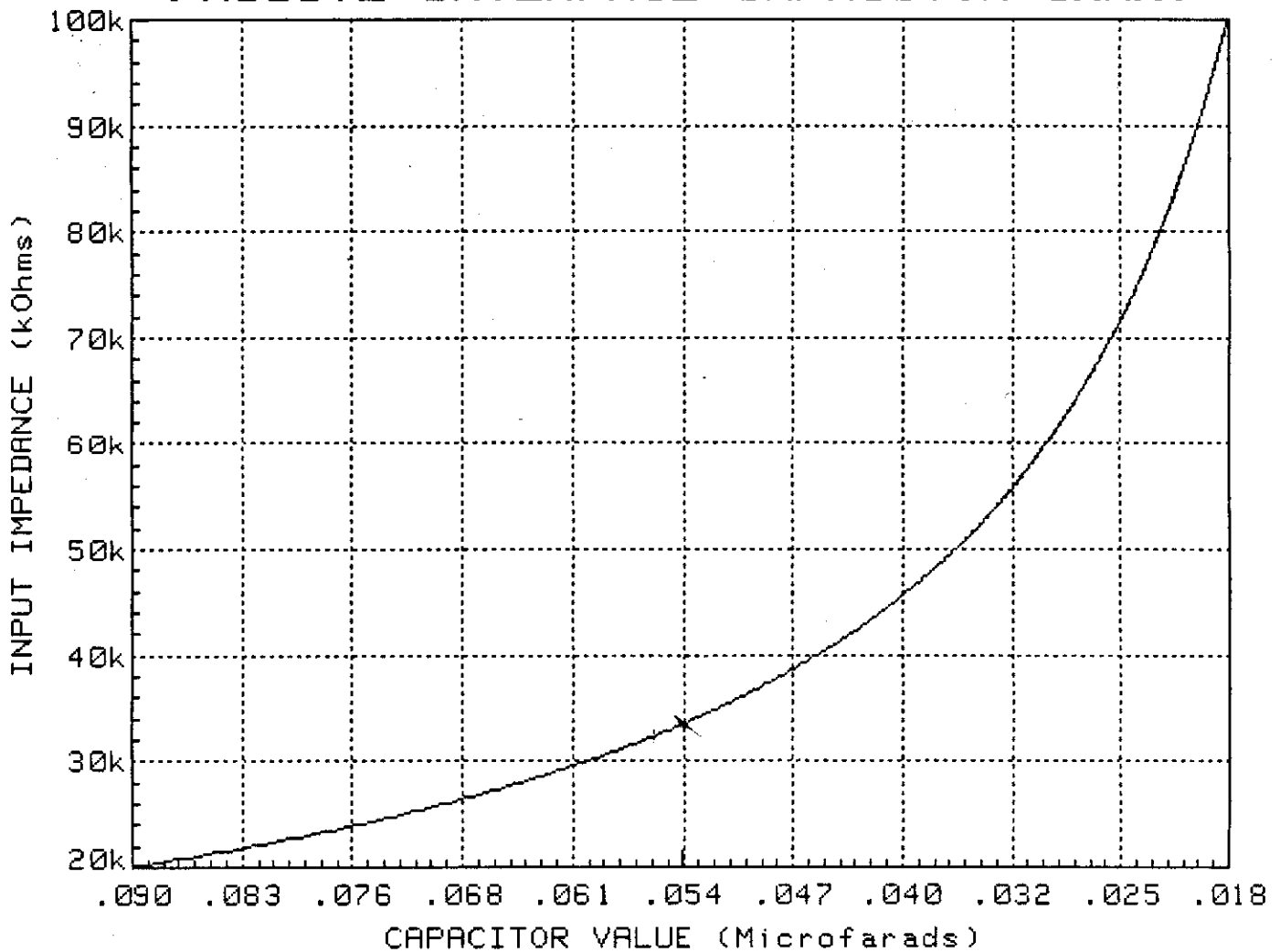
CAPACITOR SELECTION

Some of the values necessary are not 'standard values', so they must be obtained by combinations of parts. We have provided a selection of capacitors with the PASSIVE INTERFACE that will satisfy the required values.

Open up the PASSIVE INTERFACE box and take a look at the parts in it. There are three sets of larger value capacitors (yellow color), and four values of smaller ones (silver color). The large parts have values of .018, .039, and .056. If the value you need is within + .001 of one of these, just grab a pair of them and proceed on to the 'Capacitor Installation' section.

Every one else gets a little lesson on the inconsistent ways in which the values of the smaller parts are marked on them. Some manufacturers mark these parts in microfarads, and others in picofarads. ".01" microfarads is "10000" picofarads. Likewise, ".005" microfarads is "5000" picofarads. So, while we are discussing values in microfarads, be aware of this difference in the way these parts may be marked. To convert picos to micros, place a couple of zeroes in front of the picofarad value, and then place a decimal point six digits to the left, starting at the right end of the number, and there you have it.

PASSIVE INTERFACE CAPACITOR CHART



Okay! A calculator will come in handy now. From the three larger parts, select the value that is less than the value you need. Subtract it from the total. Then find the nearest value that is less than or equal to this remainder. Do this until you are within .002 of the value you need. The nearer the better, but this accuracy is sufficient. If your amp's input impedance is 60K Ohms or greater, get within .001 of the target value.

CAPACITOR INSTALLATION

Its time to fire up your soldering iron. You will find a length of solder in the PASSIVE INTERFACE box; it's good stuff, so use it. If you needed more than one capacitor to get your target value, hold the smaller parts length-wise along the larger part, and GENTLY wrap the lead of each smaller part a couple of turns around that of the larger at each end. The leads of the small silver parts are a little fragile, so don't tug on them too hard. You will do this twice, once for each channel. Do yourself a favor, and double check your work before you solder. You should have two capacitor clusters with identical parts in each.

Solder the capacitors together, working as swiftly as possible so as not to damage the parts. Cut the leads of the smaller parts off, leaving the leads of the larger part extending on either end.

Before installing the parts into the PASSIVE INTERFACE box, take a look at FIGURE 3, which shows the correct orientation of the parts and their connection inside the box. The installation procedure will be described for one capacitor, and should be repeated for the other as well.

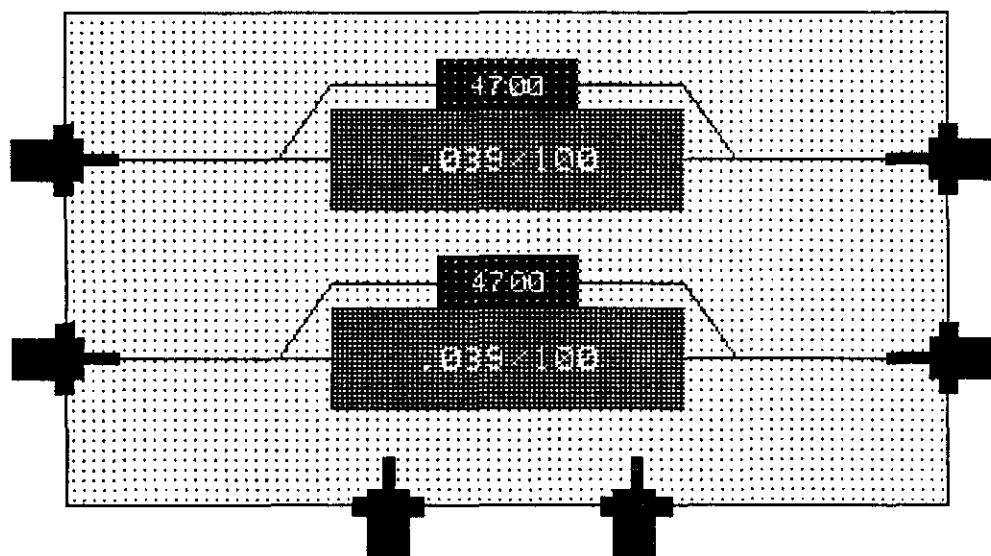


FIGURE 3 CAPACITOR INSTALLATION

Place the box so that the insides are exposed. Cut the leads of the capacitor so that the total length from end to end is just shy of the long dimension of the box. Bend one end of the leads to form a small hook. Hook the lead through the small hole in the CENTER POST of one of the phono jacks at the long end of the box, and the other end through the center post of the phono jack directly opposite it. Do not cross the leads of the two parts; if they touch each other, you will convert your wonderful stereo into a monaural system, although it is not likely to do any damage.

Crimp the leads loosely onto the posts, and solder them. Now put the top onto the box, securing it with the screws provided, and you're done!

MAKING THE CONNECTION

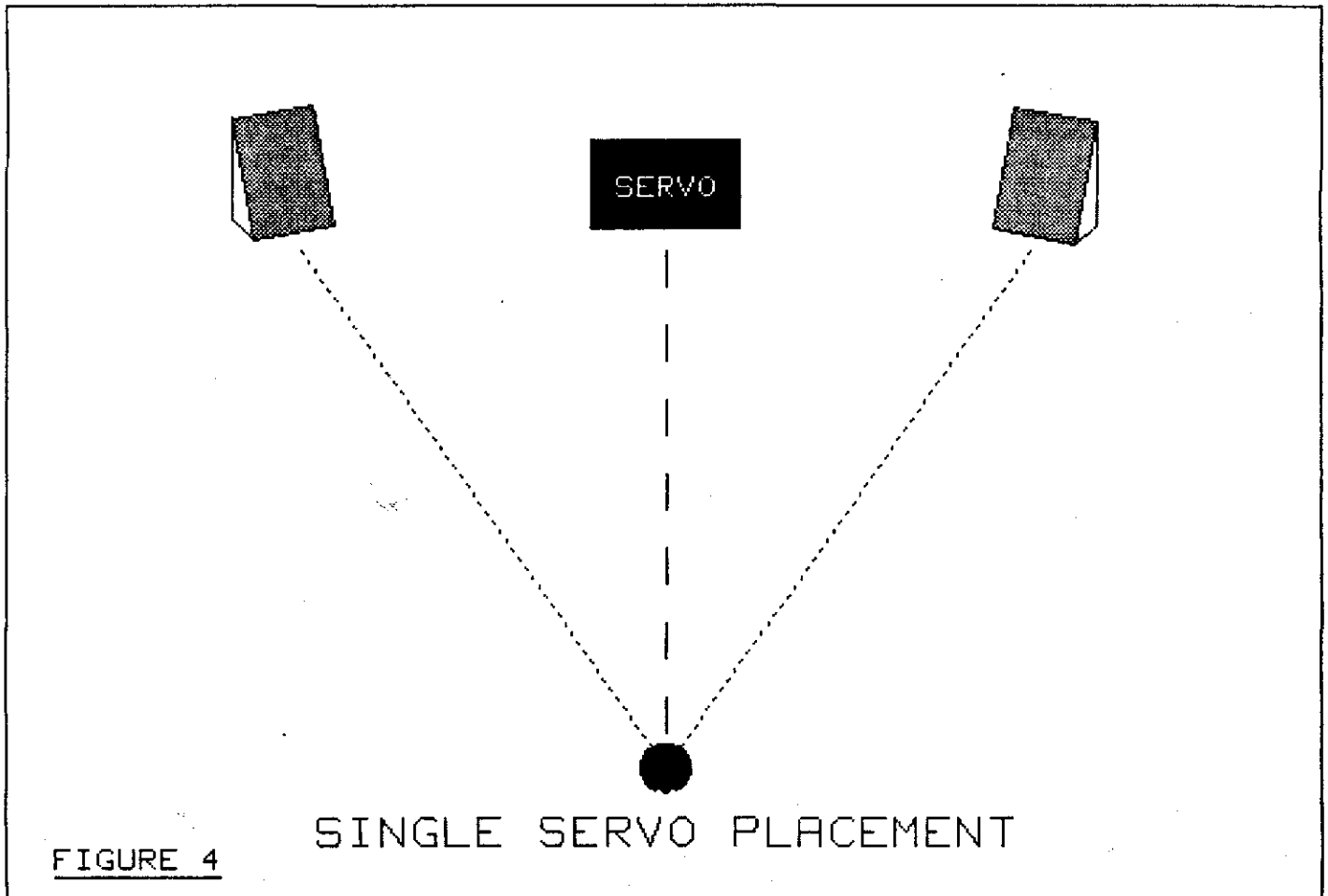
Place the completed PASSIVE INTERFACE behind your other components. Turn all of the components in your system OFF. With patchcords, connect the output of your preamplifier to the jacks marked "IN" on the PASSIVE INTERFACE, making sure, as always, to keep your 'lefts' and 'rights' consistent (if you don't know your left from your right, your SPICA dealer is qualified to help you). Connect the jacks marked "SATELLITE OUT" to the input of the power amplifier that is driving the TC-50s. Connect a long set of patchcords to the jacks marked "SERVO OUT", and let them be for the moment.

PLACEMENT

In phase-coherent systems (as in life in general), TIMING IS OF THE ESSENCE. In order that the timing relationships of the SERVO and the TC-50s be correct, it is necessary that the distance from the SERVO to your listening position be greater than the distance from the TC-50s to your listening position by a certain amount. If this is not done, all of the other system parameters will be thrown out of whack. Also, where you place the SERVO(s) depends on whether you are using one or two of them in your system. Fortunately, this is a very simple procedure. All you need is a MEASURING TAPE, and possibly a helper.

FOR SINGLE SERVO SYSTEMS:

As shown in FIGURE 4, the SERVO should be placed in between the TC-50s. Placing it anywhere else in your room will result in reduced accuracy, because the SERVO must be placed at a fixed distance offset from each TC-50. And since one SERVO is serving this function for two TC-50s, placing it in between the TC-50s is the only way this condition can be satisfied.



FOR DUAL SERVO SYSTEMS:

As shown in FIGURE 5, the SERVOS should be placed as closely as possible to each TC-50. Having them on the outside is slightly preferable, but the inside is fine. For optimum performance, you may want to consider using the stands which have been specifically designed for the TC-50 when used with dual SERVOS. They are made by Chicago Speaker Stand. These stands mount on top of the SERVO enclosure, placing the TC-50 at the correct distance offset, and can accommodate a range of listening heights through their tilt adjustment. Ask your dealer for more information.

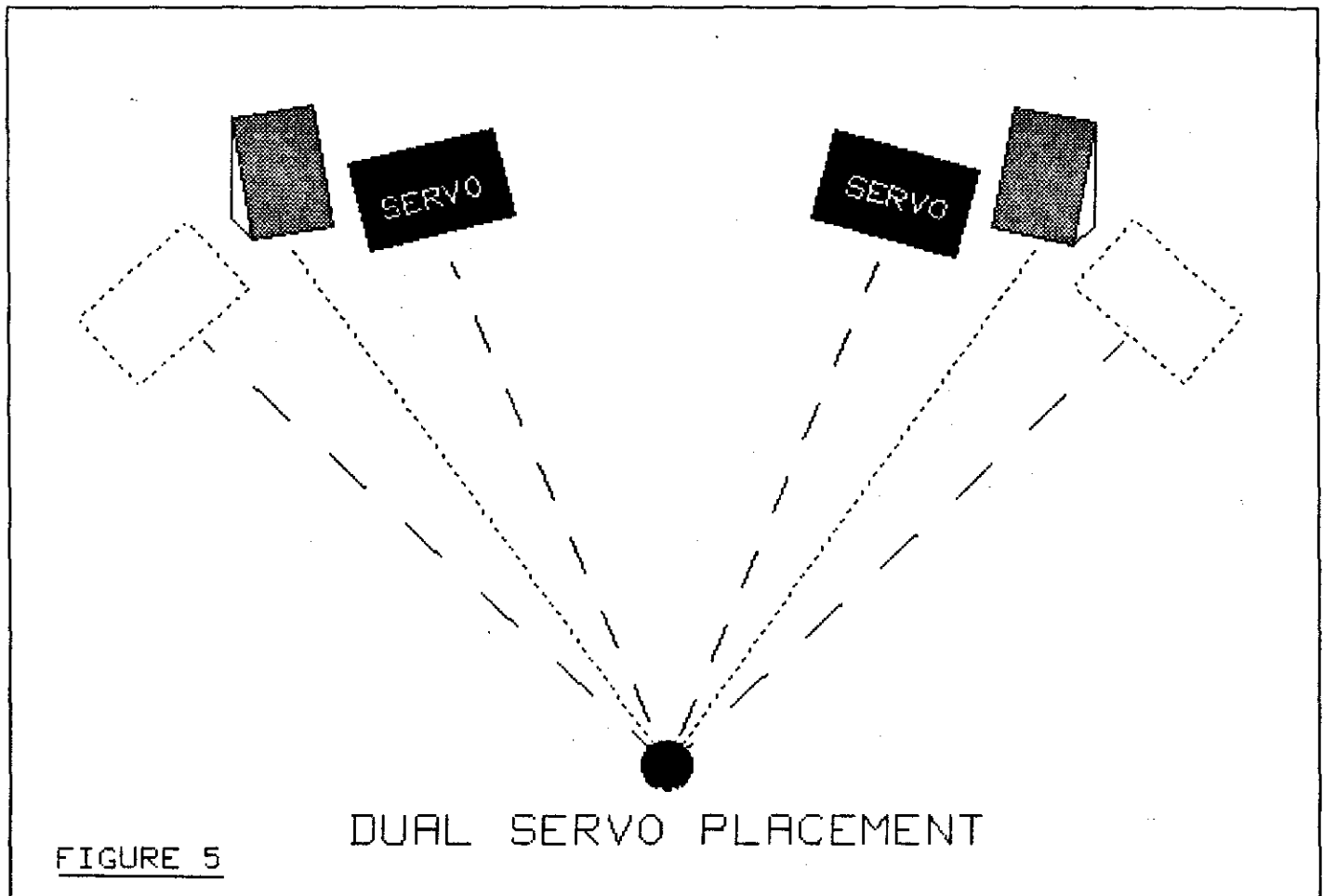


FIGURE 5

DUAL SERVO PLACEMENT

ALL SYSTEMS:

- 1> Put a small piece of masking tape on the couch or chair you listen in, at a point near where your head is located when you are seated.
- 2> Use your measuring tape to find the distance from this point to the BOTTOM FRONT EDGE of one of the TC-50s, and write it down.
- 3> Now measure the distance to the other TC-50 from the same point, and move it backward or forward until the two distances are identical.
- 4> Place the SERVO(s) in the location described above, at a distance that is 4.5 inches GREATER than the TC-50s, as measured from the same point to the BOTTOM FRONT EDGE of the SERVO(s).

- 5> Plug the patch cords from the PASSIVE INTERFACE into the SERVO(s). If you are using one SERVO, it makes no difference which cord is plugged into which jack. If you are using two, check to make sure your lefts and rights are consistent with the rest of the system, but don't use the furnished shorting plug until we find out later whether you need to or not.
- 6> Plug the power cord of the SERVO(s) into an AC outlet. DON'T turn it on just yet.

SETTING LEVELS

It is not uncommon these days for people (even non-hobbyist types) to have an AC Voltmeter around the house, or at least to have a friend that does. If you do, here's an opportunity to put it to good use.

On the back panel of the SERVO is a level control. It is used to set the loudness of the SERVO to the proper level. There is sufficient gain (12 dB) in this control to match the sensitivity of almost any amplifier you may be using to drive the TC-50s. There is also enough gain here so that if the control has inadvertently been 'cranked up', some damage could be done to the amplifier or woofer in the SERVO. Turn the control to its fully counter-clockwise position.

We are providing two methods of setting levels; one is strictly subjective, the other is empirical. If you have access to a voltmeter, we strongly suggest you use the empirical method; why guess if you don't have to? Both methods require the use of a CASSETTE PLAYER; the quality of the unit is not important.

The level setting procedure takes advantage of the following fact: AT ONE FREQUENCY, THE ACOUSTIC OUTPUT OF THE SERVO AND THE TC-50 ARE THE SAME. We have furnished a cassette that has five minutes of this frequency recorded on each side of it. If you are going to follow the SUBJECTIVE METHOD, a friendly assistant would be helpful.

BOTH METHODS:

- 1> Connect a cassette player to the appropriate inputs of your system.
- 2> Turn the level control on your preamp or receiver all the way down.
- 3> Set your Bass and Treble controls to their center (off) positions. They should remain off for the entire setup procedure.
- 4> Turn all of the components in your system ON, except the SERVO(s).
- 5> Place the SERVO SETUP cassette into your player.

SUBJECTIVE METHOD:

This method requires a little bit of explanation before we jump right into it. You will be listening to the tone recorded on the SERVO SETUP tape, first played through the TC-50s alone, then through the SERVO(s) alone. You therefore need some way of disabling the output to the TC-50s when listening to the tone through the SERVO. To accomplish this;

- > If you have a separate power amplifier for the TC-50s, all you have to do is turn that unit off.
- > If you have a receiver or integrated amplifier that has speaker switching, all you have to do is switch the speaker selector to off or to the other output.
- > If you have none of these, you must turn the receiver off (without changing the level control on it), disconnect the patch cords from the Passive Interface Box to the receiver main input, then turn the unit back on.

Whichever is appropriate for your case, it is referred to in the instructions that follow as "disabling the TC-50s".

If you are using a DUAL SERVO setup, the instructions given should be repeated for each side. Use your balance control to get the tone output from the side that the setup is being done for. During the setup, if you should find that

the SERVO level control is turned all the way down and is still too loud, then insert a shorting plug into the unused input, and start the level procedure again. This will give an additional 6 dB of attenuation.

If you are using a SINGLE SERVO setup, place your balance control in the center position. Do not change it during the setup procedure.

- 5> Start the cassette running, and set the level to a comfortable one, using your preamp/receiver's level control. Do not change the setting of this control during the setup procedure.
- 6> Disable the SERVO by turning its power switch to OFF.
- 7> From your listening location, listen to the loudness of the tone that comes through the TC-50s alone.
- 8> Disable the TC-50s, and turn the SERVO power switch to ON.
- 9> Listen to the loudness of the tone from the SERVO alone, and adjust the SERVO level control until it is the same as it was from the TC-50s. If there is any doubt, set the SERVO level on the low side.
- 10> Repeat steps 6 through 9 until you are satisfied that the levels from the TC-50s and the SERVO are the same.
- 11> For dual SERVO setups, turn your balance control to the opposite side, and start at step 6 again.
- 12> Skip to the section on 'Some Fine Points'.

EMPIRICAL METHOD:

This is the easiest and most accurate method. Making sure not to move the SERVO from its optimum location, remove the grill frame from the SERVO. Above the woofer, to the left, flush with the face of the enclosure, are two exposed Test Points. Before we proceed, a word of caution is in order. These Test Points are connected DIRECTLY to the power amplifier, and are also part of the SERVO's 'comparator'. If they are accidentally shorted together, connected to an AC ground, or if any voltages are applied to these test points, you stand a good chance of 'blowing up' the power amplifier in the SERVO. Before measuring the voltages at these Test Points:

- > YOUR VOLTMETER MUST BE SET TO MEASURE AC VOLTS. If it is set on the Resistance mode, it will insert a reference voltage into the SERVO circuit, and most assuredly will cause some damage.
- > YOUR VOLTMETER MUST NOT BE CONNECTED TO AN AC OUTLET, but should be operating on its internal batteries. If EITHER test point is connected to an AC GROUND, the SERVO will go up in smoke before your very eyes.

If you have a SINGLE SERVO system, turn your balance control all the way to one side or the other, and start at step 6.

- 5> Set the balance control on your preamp/receiver to its center position.
- 6> Turn the SERVO(s) power switch on.
- 7> Start the cassette running, and set the level to a comfortable one, using your preamp/receiver's level control. Do not change the setting of this control during the setup procedure.
- 8> Measure the voltage at the input terminals of the TC-50, and write it down.
- 9> MULTIPLY this figure times .7.
- 10> Hook the voltmeter to the Test Points on the SERVO.
- 11> Adjust the SERVO level control until the voltage measures the same as the figure obtained in Step 9.
- 12> For DUAL SERVO systems, repeat Steps 8 through 11 for the other channel.
- 13> Replace the grill frame onto the enclosure, pushing around the perimeter of it to engage the Velcro.
- 14> Th-th-that's all, folks!

SOME FINE POINTS

Before going on further with this, take some time now and listen to some music through your new system. Listen to a variety of material, and notice how different the character of the low frequency part of the music is as you go from one recording to another. Then come back, and we'll go through some fine points regarding the setup.

If you're pleased as punch with your system, and can't imagine that it could be any better, then you're all done and you need not concern yourself with this section on fine tuning your system. If you'd like to extract the last ounce of accuracy out of it, and you don't mind a little 'tech talk', then read on.

There are two factors that can affect the absolute accuracy of the setup procedure you've just completed. The first factor is a combination of a) the distances from the SERVO and your listening position to the various surfaces in your room, and b) the 'liveness' or 'deadness' of the floor immediately in front of the SERVO, which can be 'tuned' by fine changes in the placement of the SERVO. The second factor is variations in the sensitivities of the drivers in both the TC-50 and the SERVO, which can be 'tuned' by adjustments to the SERVO level control. This is what we call OPTIMIZING, a procedure that is a very meaningful one for us here at SPICA. It is distinguished from IDEALIZING in that it takes into consideration the immutable 'undesirable' conditions as well as the desirable ones in any circumstance.

The very walls in your room are one such undesirable condition, in that they restrict the free expansion of the sound pressure wave, and create resonances and cancellations at frequencies that are related to the distances between these surfaces. This is actually a very complex subject, but the long and short of it is that your listening position may be placed in a location where there is a strong 'buildup' or cancellation of acoustical energy, and this may be happening right in the frequency range where the SERVO and the TC-50s are trying to combine their contributions to the overall sound. If the distance from the SERVO to the wall behind it is identical to the distance from your listening position to the wall behind it, you are most likely listening in one such problem area. The solution is to make these distances unequal by relocating your listening position or the TC-50s and the SERVO together. After making any changes to the position, remember to go through the procedures on placement again, to ensure that the relative distances are correct.

Now lets take a look at the effects of the reflective character of the floor in your room. The SERVO is specifically intended to be placed on the floor, or 'floor coupled', as we call it. At low frequencies, this placement effectively eliminates the floor from being one of the early reflective sources that we mentioned above. At higher frequencies, this becomes increasingly less true, so that the absorbtive character of the floor immediately in front of the SERVO effects the smoothness of the SERVO's output at higher frequencies, which in turn has a subtle (or not-so-subtle, depending on your attentiveness) effect on the audible result. We recommend that a rug be placed under or immediately in front of the SERVO.

Mark the current position of the front of the SERVO on your floor with a small piece of masking tape. From your collection, choose some recorded material that has either very coherent depth in it, or very percussive low frequency information. Choose a 30 second long passage that 'grabs you', and listen to it with the system set up the way it is now. Listen in particular to the quality of the impact of low frequency transients, to the 'focus' of the instruments that seem to come from further back in the soundstage, and to the general sense of warmth of the overall sound. Now experiment with moving the SERVO back a little bit from the original position, listening to the same passage after every move.

There will be a place where the three above qualities will come together dramatically. If you have gone more than an inch or so away from the original position, you have gone too far, and you might want to choose a different selection of program material.

To correct for the variations in the sensitivities of the various drivers in the system, you can make minute adjustments to the SERVO level control, using the same criteria as given above. Be sure to mark your original position before you start, so that you can return to it for comparisons.

Some words of caution are in order here. If you do make adjustments to the SERVO level control, keep the following in mind:

- > We Americans, as a culture, tend to be 'bass freaks' with our sound systems, so there is going to be a tendency to want to keep 'cranking it up' in order to achieve that indistinct 'sameness' in bass quality that we have all grown up with.
- > You will find that continually increasing the SERVOS loudness above the proper level actually lessens the perceived bass! Things start to cancel each other rather than working together.
- > DO NOT use the SERVO level control as a bass tone control. Use your preamps bass control to compensate for bass-deficient recordings.
- > The SERVO has a built in 'rumble filter'. We have purposely set it at the extremely low frequency of 4 Hertz. If you are:
 - a) playing a record that is badly warped,
 - b) playing your system VERY loud,
 - c) boosting the bass with your bass tone control,then you should consider engaging the rumble filter on your preamp/receiver if it has one. Otherwise, you should leave it off.
- > Avoid the use of the LOUDNESS button on your receiver.

TECHNICAL SPECIFICATIONS

System type	: Sealed box
Woofer Enclosure Volume	: 1.25 cu. ft.
System Resonance / Q	: 31 Hz, Total Q .5
Low Frequency Extension	: -3dB @ 25 Hz
Woofer	: 8" diameter with 1" peak-to-peak excursion
Hipass Crossover	: Passive 1st Order, -3dB @ 88 Hz
Lopass Crossover	: Electronic with computer-derived slope
Input Impedance	: 110k Ohms open, 20k Ohms one input shorted
Polarity	: Inverting, for use with non-inverting TC-50s
Level Control	: Continuously variable within a 12dB range
Power Amplifier	: Solid state 70 watts RMS minimum
Size in inches(cm)	: 17.5(44.5)W X 14.5(36.8)H X 15.875(40.3)D
Weight in lbs(kg)	: 40(18.25)

WARRANTY

To the original purchaser, SPICA warrants the SERVO to be free from mechanical defects for five(5) years and electronic defects for one(1) year from the date of purchase, when purchased from an authorized SPICA dealer. Your sales receipt is your proof of purchase. This warranty excludes damage caused by user abuse, carelessness, and modifications other than those covered in the owners manual. SPICA reserves the right to make final determination of warranty coverage. SPICA makes no other warranties, either expressed or implied.