

# Owner's Manual

**UF-2  
Universal  
Filter**



\*TD-004031-00\*  
Rev. A

# UF-2 UNIVERSAL FILTER

## I. DESCRIPTION

The UF-2 is a Mini-Slot accessory dual-channel universal filter for use with QSC amplifiers using the Level 1 or Level 2 Open Input Architecture, such as the EX and MXa Series. Depending on how you set and select the resistor networks and programming jumpers and switches, you can configure the UF-2 to be a subsonic or ultrasonic filter, a bandpass filter, or an active crossover.

Using the UF-2 as a crossover is ideal for rental sound systems, since it virtually eliminates the possibility of unauthorized tampering with crossover settings or incorrect crossover output connections, and the loudspeaker damage that may result from such user errors.

The UF-2, as does any other Mini-Slot accessory, mounts to an input module (the standard input module, or any of the Open Input Architecture accessory modules that directly replaces the standard input module) with a 10-pin header and a 12-pin header that solder to the corresponding holes on the input module. The installation process involves soldering, so only qualified technical persons should attempt to install the UF-2 to the input module; ideally, you should enlist QSC's Customer Service Department or an authorized service center to perform the task. The installation section of this manual offers more information about installing the UF-2.

## II. FEATURES

The UF-2 allows independent filtering of the two audio channels. You can select high-pass, low-pass, or bandpass filtering, as well as the frequencies of the filtering.

Either channel's circuitry contains electronically balanced input circuitry and bypassable low-pass and high-pass circuitry. Each filter circuit has a four-pole (24 dB/octave) Linkwitz-Riley alignment and a "x10" range switch. Figure 1 shows a block diagram of the UF-2.

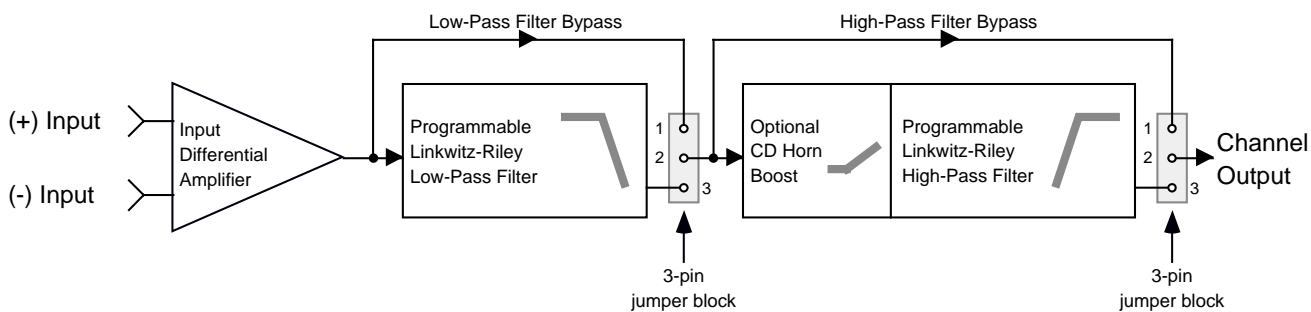


Figure 1—Block diagram of UF-2 (1 of 2 channels shown)

### III. PROGRAMMING THE UF-2

The UF-2 circuit board has four switches, six 3-pin headers, and four SIP resistor network sockets (see Figure 2). All these are used for programming the module. The circuitry for the two channels is identical, so the switches, headers, and sockets are divided between them: those designated by a three-digit number starting in a “1” (switches S101 and S102; headers J101, J102, and J103; and SIP resistor network sockets RN102 and RN104) are for Channel 1, while those with a three-digit number starting in a “2” are for Channel 2. The following instructions will use an “x” in place of the first digit, except where a specific channel reference is necessary.

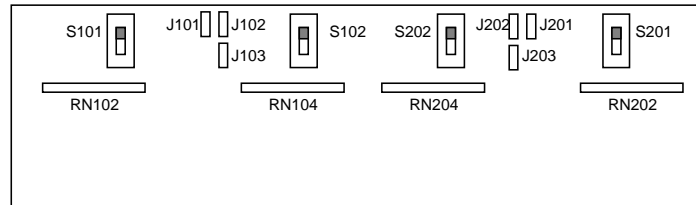


Figure 2—UF-2 Circuit board switch, jumper and resistor network locations

#### Notes on Stereo, Bridged, or Parallel Operation

The input board or accessory on which the UF-2 is installed has provisions—switches or headers—for setting the operating mode of the amplifier, i.e., stereo, parallel-mono, or bridged-mono. In the signal flow, the Mini-Slot accessory is located somewhere after these switches or headers, so you must configure both channels of the UF-2 accordingly, regardless of the operating mode selected. Usually you would use identical settings on both channels in stereo or parallel mode, depending on the application. If the amplifier is in bridged mode, bypass Ch. 2 of the UF-2 and use the Ch.1 input and processing only.

#### Bypassing the Filtering

To completely bypass the filtering circuitry of a channel, set the jumpers on both Jx01 and Jx02 across pins 1 and 2, which are the upper two pins on their headers (see Figure 3). Note: If you neglect to place jumpers on either header, no signal will pass on that channel.

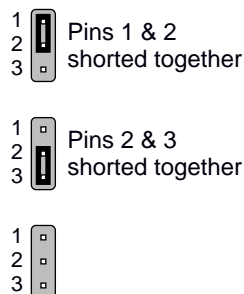


Figure 3—Jumper positions

#### Programming the Low-Pass Filter

To use the low-pass filter, set the jumper on Jx01 across pins 2 and 3, which are the lower two pins on their header. If, however, you do not wish to use the low-pass filter and want to bypass it instead, set the jumper across pins 1 and 2.

To set the corner frequency (at which the output is 6 dB down) of the low-pass filter, choose the appropriate value and switch setting for RNx02 and Sx01, respectively. (Sx01 is a “x10” range switch. In its upper position, the frequency range is x10, in the lower it is x1.) Use the table below to select the right combination.

Sx01 = x1	Sx01 = x10	RNx02
80 Hz	800 Hz	120K
100 Hz	1000 Hz	82K
120 Hz	1200 Hz	68K
160 Hz	1600 Hz	56K
200 Hz	2000 Hz	47K
250 Hz	2500 Hz	33K
500 Hz	5000 Hz	18K
800 Hz	8000 Hz	12K
1600 Hz	16000 Hz	5.6K
2000 Hz	20000 Hz	4.7K

If there is a resistor network already installed in the socket, carefully pull it straight out. Insert the pins of the new resistor network into the socket holes and carefully press the network into the socket. Be careful to avoid bending the pins of the resistor network. Orientation of the resistor network is unimportant, as long as all eight pins are well seated in the socket.

### Programming the High-Pass Filter and CD Horn Equalization

To use either the high-pass filter or the constant-directivity horn equalization, or both, set the jumper on Jx02 across pins 2 and 3, which are the lower two pins on their header. If, however, you do not wish to use either one and want to bypass them instead, set the jumper across pins 1 and 2.




To set the corner frequency (at which the output is 6 dB down) of the high-pass filter, choose the appropriate value and switch setting for RNx04 and Sx02, respectively. (Sx02 is a “x10” range switch. In its upper position, the frequency range is x10, in the lower it is x1.) Use the table below to select the right combination.

Sx02 = x1	Sx02 = x10	RNx04
20 Hz	200 Hz	120K
30 Hz	300 Hz	82K
40 Hz	400 Hz	56K
50 Hz	500 Hz	47K
80 Hz	800 Hz	27K
100 Hz	1000 Hz	22K
120 Hz	1200 Hz	20K
150 Hz	1500 Hz	15K
200 Hz	2000 Hz	12K
400 Hz	4000 Hz	5.6K
500 Hz	5000 Hz	4.7K
800 Hz	8000 Hz	2.7K

If there is a resistor network already installed in the socket, carefully pull it straight out. Insert the pins of the new resistor network into the socket holes and carefully press the network into the socket. Be careful to avoid bending the pins of the resistor network. Orientation of the resistor network is unimportant, as long as all eight pins are well seated in the socket.

In addition to enabling the high-pass filter at Jx02, if you opt for CD horn equalization you must place a jumper at Jx03 as well. The UF-2 offers two equalization curves for CD horn correction: one with +6 dB of boost at 20 kHz (place the jumper across pins 1 and 2 of Jx03), and one with +10 dB of boost at 20 kHz (place the jumper across pins 2 and 3). If you do not place a jumper in one position or the other, the CD horn equalization circuit will be inactive.

The table below is a summary of jumper settings for the UF-2.

Function		Header	Pins 1 & 2	Pins 2 & 3	None
					
Channel 1:	Bypass low-pass	J101	X		
	Enable low-pass	J101		X	
	Bypass high-pass	J102	X		
	Enable high-pass	J102		X	
	Disable CD horn boost	J103			X
	CD horn boost, +6 dB @ 20 kHz	J103	X		
	CD horn boost, +10 dB @ 20 kHz	J103		X	
Channel 2:	Bypass low-pass	J201	X		
	Enable low-pass	J201		X	
	Bypass high-pass	J202	X		
	Enable high-pass	J202		X	
	Disable CD horn boost	J203			X
	CD horn boost, +6 dB @ 20 kHz	J203	X		
	CD horn boost, +10 dB @ 20 kHz	J203		X	

## IV. TYPICAL APPLICATIONS

### Subsonic Filter

Subsonic filters are commonly used in sound installations to filter out rumbles and other inaudible or unwanted low frequency signals and to protect speaker drivers. Vented speaker enclosures in particular often exhibit a phenomenon in which the acoustical damping on the driver(s) drops at extremely low frequencies below their own resonant frequency. In a situation like this, a subsonic filter will help to prevent damage from over-excursion of the speaker cone.

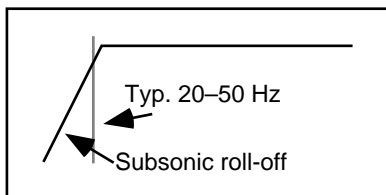


Figure 4—UF-2 as a subsonic filter

Program settings:

1. Set the jumper on Jx01 to bypass the low-pass filter (across pins 1 and 2).
2. Set the jumper on Jx02 to enable the high-pass filter (across pins 2 and 3).
3. No jumper on Jx03.
4. Insert a resistor network in RNx04 that is appropriate to the desired roll-off frequency—typically 20, 30, 40, or 50 Hz.

## Ultrasonic Filter

An ultrasonic filter is useful for minimizing RF interference, oscillations, leakage or aliasing from digital devices, and other signals that are too high in pitch to hear but may wreak havoc in an amplifier system.

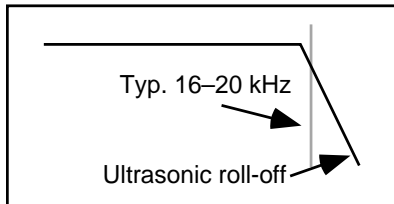


Figure 5—UF-2 as an ultrasonic filter

Program settings:

1. Set the jumper on Jx01 to enable the low-pass filter (across pins 2 and 3).
2. Set the jumper on Jx02 to bypass the high-pass filter (across pins 1 and 2).
3. Insert a resistor network in RNx02 that is appropriate to the desired roll-off frequency—typically 16 or 20 kHz.

## Bandpass Filter

A bandpass filter may be useful if the speaker system driven by the amplifier has a limited bandwidth. Minimizing the out-of-the-passband energy may result in reduced distortion and better intelligibility.

Program settings:

1. Set the jumper on Jx01 to enable the low-pass filter (across pins 2 and 3).
2. Set the jumper on Jx02 to enable the high-pass filter (across pins 2 and 3).
3. No jumper on Jx03.
4. Insert a resistor network in RNx04 that corresponds to the lower limit of the desired frequency passband.
5. Insert a resistor network in RNx02 that corresponds to the upper limit of the desired frequency passband. This frequency must be higher than the one selected for the previous step.

## CD Horn Equalization Filter

A constant-directivity horn requires a 6 dB per octave high-frequency boost from about 3.5 kHz to provide a flat frequency response. On the UF2 you must use the CD horn equalization in conjunction with the high-pass filter.

Program settings:

1. Set the jumper on Jx01 to bypass the low-pass filter (across pins 1 and 2).
2. Set the jumper on Jx02 to enable the high-pass filter (across pins 2 and 3).
3. Set the jumper on Jx03 to select the EQ curve you desire: across pins 1 and 2 for +6 dB at 20 kHz, or across pins 2 and 3 for +10 dB at 20 kHz.
4. Insert a resistor network in RNx04 that corresponds to the desired low-frequency roll-off.

### Subsonic Filter with CD Horn EQ

Use settings 1, 2, and 4 from the Subsonic Filter, and setting 3 from the CD Horn Equalization Filter. This would be suitable only if the loudspeaker system uses passive crossovers.

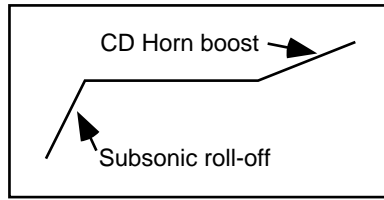


Figure 6—UF-2 as a subsonic filter with CD horn EQ

### Subsonic and Ultrasonic Filter

Use settings 2, 3, and 4 from the Subsonic Filter along with 2 and 3 from the Ultrasonic filter.

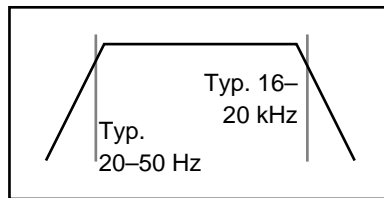


Figure 7—UF-2 as a subsonic and ultrasonic filter

### 2-Way Active Crossover

This configuration routes the frequencies below a particular frequency to amplifier Channel 1, which shall drive the low-frequency speakers, and the frequencies above to Channel 2, which shall drive the high-frequency speakers. Using the UF-2 as a crossover requires that you drive both amplifier inputs with the same full-band signal.

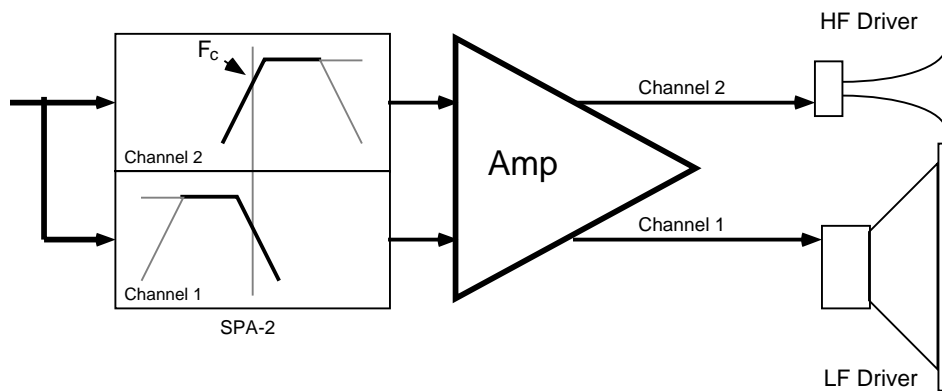


Figure 8—UF-2 as a 2-way active crossover

Program settings:

1. On the input module, set the amplifier mode to parallel. Alternately, you could use a Y-cable to provide the same signal to both channel inputs.

Steps 2 through 5 configure Channel 1.

2. Jumper J101 to enable Channel 1's low-pass filter (across pins 2 and 3).
3. No jumper on J103.
4. Insert a resistor network into RN102 that is appropriate to the desired crossover frequency.
5. If you need subsonic filtering, set a jumper on J102 to enable Channel 1's high-pass filter (across pins 2 and 3) and insert a resistor network into RN104 that corresponds to the roll-off frequency you desire. If you do not want subsonic filtering, set J102 to bypass the high-pass filter (across pins 1 and 2).

Steps 6 through 9 configure Channel 2.

6. Set J202 to enable Channel 2's high-pass filter.
7. Insert a resistor network into RN204 that is appropriate to the crossover frequency you set in #4.
8. If you need equalization for a constant-directivity horn, set a jumper on J203 for the amount of boost you need. If you do not want CD horn equalization, do not place any jumper on J203.
9. If you need ultrasonic filtering, set a jumper on J201 to enable Channel 2's low-pass filter (across pins 2 and 3) and insert a resistor network into RN202 that corresponds to the desired roll-off frequency. If you do not want any ultrasonic filtering, set the jumper on J201 to bypass the low-pass filter (across pins 1 and 2).

## Multi-way Crossover System

The UF-2 allows you to set up 3- and even 4-way systems. Of course, this also requires that you use more than one amplifier and more than one UF-2. The other basic requirement of using the UF-2 as a crossover is that you must feed each amplifier with the same full-range signal and use the UF-2 to filter the signals in the individual channels.

Figure 8 depicts an example of a 4-way system. Because of the multitude of possible system configurations, the fundamentals of the technique used in the example will be explained below, with a few specifics. **The actual crossover frequencies you should use will depend on your speaker system.**



## Subwoofer

The subwoofer subsystem in the example is driven by a bridged amplifier. Channel 1 of the UF-2 in this amplifier is set with the high-pass filter at 20 Hz (for subsonic filtering) and the low-pass at 150 Hz, which is the crossover point to the woofers. Channel 2 of the UF-2 is bypassed.

## Woofer

The woofers are driven by an amplifier operating in the parallel mode. Both channels of its UF-2 are set with the high-pass filter at 150 Hz (the crossover point from the subwoofers) and the low-pass filter at 1 kHz.

## Midrange and High Frequencies

The remaining speakers are driven by the same amplifier: the mids by channel 1, and the highs by channel 2. The settings for channel 1 of the UF-2 are: high-pass at 1 kHz (the crossover from the woofers) and low-pass at 5 kHz (the crossover point to the high-frequency drivers).

Channel 2 of the UF-2 is set for high-pass at 5 kHz. For ultrasonic protection, the low-pass is set at 20 kHz.

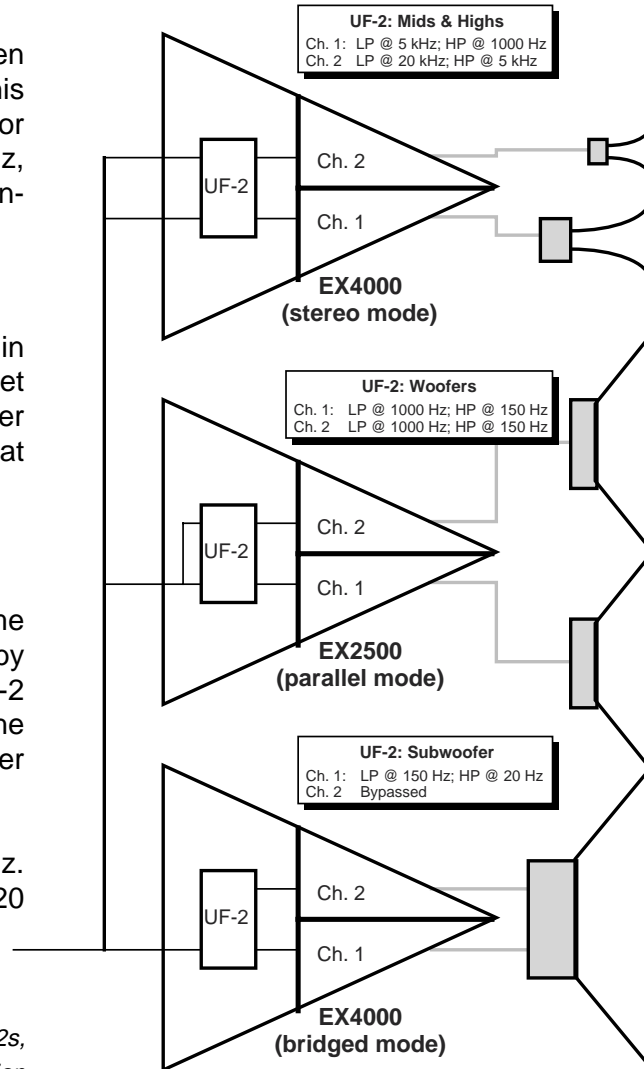


Figure 9—Multiple amplifiers with UF-2s, set up for 4-way crossover operation

## V. INSTALLATION

Installing the UF-2 requires PC board soldering skills, so only qualified service technicians should attempt it. Any authorized QSC service center—or, for an additional installation fee, the QSC factory service center—can perform the installation.

The UF-2 installs on the amplifier input PC board of any QSC EX Series amplifier. Some older EX amplifiers may require an upgrade to the current input board. Contact the QSC Service Department for details on compatibility with older EX amplifiers.

When installed, the UF-2 settings and adjustments are not externally adjustable; this can prevent tampering by unauthorized users.

Tools and materials you will need:

- Soldering iron
- Desoldering iron or other suitable desoldering equipment
- Phillips screwdriver
- Wire cutters
- Rosin-core solder

Do not use desoldering braid because it may damage the Mini-Slot socket solder pads on the input board, and it also might not adequately remove solder.

The UF-2 contains active components which can be damaged by electrostatic discharge (ESD). Be sure to practice standard ESD precautions and always ground yourself and your workstation before handling exposed circuit cards.

**CAUTION: Preparing the input board for installation of the UF-2 involves removing solder from feed-through holes on a two-sided circuit card. Excessive heat can easily damage the solder pads you will be working on. Proper equipment and experience with desoldering delicate PC board circuitry is essential to successfully perform the following procedure. Please contact the QSC Customer Service Department if you feel you might not be qualified to perform the installation yourself. One last warning: damage caused by an improper installation will void the warranty.**

Before you start any work, turn off the amplifier power switch and disconnect the AC power cord from the AC source. Disconnect all cables from the amplifier's input panel.

Position the amplifier so the rear of the chassis is facing you. The input panel is located on the left side of the rear panel. See Figure 10.

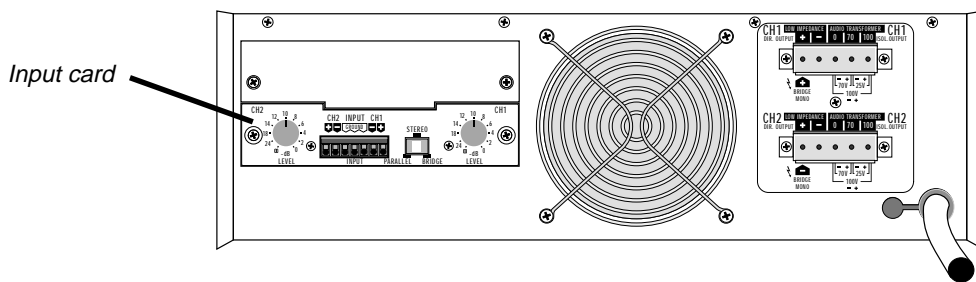


Figure 10

Begin the installation by locating and removing the screws securing both the upper blank and lower input panels to the rear side of the chassis (two screws on each mini panel). See Figure 10. The upper blank panel will simply drop off when its screws are removed.

Gently pull the lower input panel out from the amplifier. Once it is removed, you will notice a ribbon cable connecting the input PC board to the amplifier. Disengage the locking wing clamps on the ribbon header and carefully remove the ribbon head from the socket on the board. Now the input panel assembly is completely free from the amplifier. See Figure 11.

Next, desolder and remove the wire jumper pairs W305/W306 and W405/W406 (W303/W304 and W403/W404 on MXa Series amplifiers). Under where the jumpers were are two rows of solder pad holes, one with 10 holes and another with 12. These are the Mini-Slot "sockets." See Figure 11.



Figure 11

Continue preparing the PC board by removing solder from all 22 in-line socket holes. Once this is done, you are ready to install the UF-2.

With the input panel facing you and the component side of the UF-2 board facing away from you, carefully insert the header pins of the UF-2 fully into the socket holes. Turn the assembly over and solder the UF-2 in place. Make sure all the header pins are well soldered. Visually inspect for cold solder joints and verify that you have sufficient clearance to re-install the ribbon connector on the top side of the assembly. Finish by trimming the UF-2 header pins as required.

Reconnect the ribbon cable to the input board connector. Press the locking clamp wings of the connector closed. You will feel them snap onto place.

If you need to make any adjustments to the UF-2 settings or if you need to record them, do so now, because the UF-2 will be inaccessible once the input panel is re-installed into the amplifier chassis.

Carefully reposition the input board/UF-2 assembly into the amplifier chassis and secure it by fastening the two mounting screws. Make sure the screws are tightened snugly, but do not over-torque them. Re-install the upper blank panel.

Installation of the UF-2 is now complete, and the amplifier is now ready to be re-installed into the system.

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## **VI. WARRANTY AND DISCLAIMERS**

### **Disclaimer**

QSC Audio Products, Inc. is not liable for any damage to speakers, amplifiers, or any other equipment that is caused by negligence or improper installation and/or use of the UF-2.

### **Product Warranty**

QSC Audio Products, Inc. guarantees the UF-2 to be free from defective material and/or workmanship for a period of three years from date of sale, and will replace defective parts and repair malfunctioning products under this warranty when the defect occurs under normal installation and use—provided the unit is returned to our factory via prepaid transportation with proof of purchase (sales receipt). This warranty provides that examination of the returned product must disclose, in our judgment, a manufacturing defect. This warranty does not extend to any product which has been subject to misuse, neglect, accident, improper installation, or where the date code has been removed or defaced.

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## **VII. TECHNICAL ASSISTANCE & SERVICE**

Servicing your unit requires a trained technician capable of performing the type of service you need. There are no user serviceable components inside your unit and the danger of electric shock exists. Additionally, some of the components in your unit has QSC specific parts that require QSC replacements. Comprehensive service manuals for some models are available at QSC.

### **Technical Assistance**

If you suspect that your UF-2 is defective, check your system configuration and UF-2 settings to determine the origin of the problem. In many cases, incorrect audio interfacing, poor cabling, or other system level impairments are the cause of problems in audio systems. For technical assistance beyond the information given in this manual, QSC Technical Services may be contacted.

## Factory Service

In the event that your UF-2 does need factory service, you may reach QSC Technical Services for return instructions. A Return Authorization (RA) number must be obtained from QSC Technical Services. QSC may not account for products that are returned without a Return Authorization number.

### ***Product Return Guidelines***

1. Pack the product well for protection during shipment. QSC will provide the factory packaging free of charge upon request.
2. Include a copy of the sales receipt, your name, return address, phone number, and defect description with your return correspondence.
3. Call QSC Technical Services for a Return Authorization number.
4. Mark the Return Authorization number on the outside of the packaging.
5. Ship the product prepaid to QSC Audio Products. We recommend United Parcel Service (UPS).

#### **QSC Technical Services**

1675 MacArthur Blvd  
Costa Mesa, CA 92626

Telephone: (800) 772-2834  
(714) 957-7150  
(714) 754-6175

Fax: (714) 754-6173

Bulletin Board: (714) 668-7567

## Qualified Service Centers

QSC maintains a service center network for your convenience. If you choose to return your product to a local service center, you may call QSC Technical Services for a referral. Accessories, input modules and other peripheral QSC products must be returned to the factory for service.

## International Servicing

For QSC products that are purchased outside of the United States, service must be referred to the distributor or dealer from where the product was purchased. There are numerous service centers in many countries. The service centers in your country may be located by your dealer, distributor, or by contacting QSC Technical Services.

