Reversible Beverage System

DXE-RBSA-1P

DXE-RBSA-1P-INS Rev 3a
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>3</td>
</tr>
<tr>
<td>Features</td>
<td>3</td>
</tr>
<tr>
<td>Specifications</td>
<td>3</td>
</tr>
<tr>
<td>Typical Reverse Beverage System Layout</td>
<td>4</td>
</tr>
<tr>
<td>Additional Parts Required</td>
<td>5</td>
</tr>
<tr>
<td>Hardware</td>
<td>5</td>
</tr>
<tr>
<td>Ground Rods</td>
<td>5</td>
</tr>
<tr>
<td>Feedline</td>
<td>5</td>
</tr>
<tr>
<td>Antenna Wire</td>
<td>6</td>
</tr>
<tr>
<td>Power Supply</td>
<td>6</td>
</tr>
<tr>
<td>Installation</td>
<td>6</td>
</tr>
<tr>
<td>Site Selection</td>
<td>6</td>
</tr>
<tr>
<td>Proximity to Transmitting Antennas</td>
<td>7</td>
</tr>
<tr>
<td>Lightning Protection</td>
<td>7</td>
</tr>
<tr>
<td>Adding #26 Wire - Figure 2</td>
<td>7</td>
</tr>
<tr>
<td>Grounding</td>
<td>7</td>
</tr>
<tr>
<td>Antenna</td>
<td>8</td>
</tr>
<tr>
<td>Antenna Performance Chart - Table 1</td>
<td>8</td>
</tr>
<tr>
<td>Feedline</td>
<td>9</td>
</tr>
<tr>
<td>75 Ohm Termination - Figure 3</td>
<td>9</td>
</tr>
<tr>
<td>Mounting</td>
<td>9</td>
</tr>
<tr>
<td>Feed point and Reflection Units</td>
<td>9</td>
</tr>
<tr>
<td>Antenna Ladder Line</td>
<td>9</td>
</tr>
<tr>
<td>450 Ohm Ladder Line Insulated Support</td>
<td>10</td>
</tr>
<tr>
<td>Connections</td>
<td>10</td>
</tr>
<tr>
<td>Antenna</td>
<td>10</td>
</tr>
<tr>
<td>Polarity of Feedline - Figure 5</td>
<td>10</td>
</tr>
<tr>
<td>Feedline</td>
<td>11</td>
</tr>
<tr>
<td>Reversible Beverage System - Figure 6</td>
<td>11</td>
</tr>
<tr>
<td>Operation and Configuration</td>
<td>12</td>
</tr>
<tr>
<td>Control Voltage</td>
<td>12</td>
</tr>
<tr>
<td>Basic Troubleshooting</td>
<td>12</td>
</tr>
<tr>
<td>Additional Applications</td>
<td>14</td>
</tr>
<tr>
<td>Directional Beverage Layout - 4 Directions</td>
<td>14</td>
</tr>
<tr>
<td>Directional Beverage Layout</td>
<td>15</td>
</tr>
<tr>
<td>Port Selection Control Voltage Matrix</td>
<td>15</td>
</tr>
<tr>
<td>Detailed System Troubleshooting</td>
<td>15</td>
</tr>
<tr>
<td>Optional Items</td>
<td>20</td>
</tr>
<tr>
<td>Technical Support and Warranty</td>
<td>24</td>
</tr>
</tbody>
</table>
Introduction

The DXE-RBSA-1P allows two Beverage antennas receiving in opposing directions to share the same space. With the DXE-RBSA-1P, you can build a 2-wire reversible Beverage antenna system with superior signal-to-noise ratio, most useful on the 40, 80 and 160m bands. The W8JI design consists of a DXE-RBSA-1FP Feed Point System and a DXE-RBS-1RT Reflection Transformer. You can operate and even confirm the F/R ratio of this antenna at any time from the operating position.

This system is immune to strong signal overload and core saturation common in multi-transmitter contesting environments, and is used by winning contest stations and low-band DXers.

The DXE-RBSA-1P has two 75Ω antenna ports that use type F connectors. This allows the use of DX Engineering DXE-F6-CTL/1000 high quality, low loss F-6 flooded coaxial cable as the feedline.

The standard configuration of the DXE-RBSA-1P uses the AWAY port for receiving and directional control. The TOWARD port is terminated (termination included).

Applying negative 10 to 18 Vdc (or AC) to the feedline reverses the direction of reception. For simultaneous reception from opposing directions, feed lines from both ports can be connected to separate receivers. Having both feed lines available at the operating position also allows the use of a noise canceling device.

While the DXE-RBSA-1P is optimized to use DXE-LL-450-5C/-1K high quality multi-strand copper 16 gage 450Ω ladder line for the antenna element, the system will work with any 300-600Ω two-wire line.

The DXE-RBSA-1P chassis is custom made from stainless steel and has a special UV resistant cover with an integral RF Shield coating applied to the inside surfaces.

Features:
- Broad operating range, 0.2 to 30 MHz
- Fully isolated grounds used to prevent common-mode noise and unwanted signals
- Wide foil traces and air gaps for increased lightning protection
- 75Ω design enables the use of high quality, low cost RG-6 coaxial feedline
- RF Shielded Weatherproof Housing - unique protection

Specifications
- Operating Range: 0.2 to 30 MHz
- Reversing voltage (Required for remote direction switching):
  - 9 to 12 Vac or negative 10 to 15 Vdc at 80 mA max.
- Antenna Impedance: 450Ω nominal (accepts 300Ω to 600Ω balanced line)
- Feedline Impedance: 50Ω to 75Ω (75Ω recommended)
Figure 1 depicts a typical DXE-RBSA-1P system layout. A DX Engineering DXE-FVC-1 is used to provide the switching voltage on the feedline required for the DXE-RBSA-1P system to reverse directions.
Additional Parts Required But Not Supplied

Hardware
Supports and insulators for mounting the DXE-RBSA-1FP Feed Point unit, the DXE-RBS-1RT reflection transformer and the antenna wire.

For the antenna run, non-conductive supports are best, however metal tubing can be used if the antenna line is kept a couple of inches away from the metal supports using non-conductive spacers. This prevents any degradation of system performance due to mutual coupling. DX Engineering offers a very convenient insulator (See Figure 4) for securing the 450Ω ladder line to wood supports. They also lock the line in place. Part number DXE-LL-INS includes 25 insulators.

The use of a non-conductive mounting configuration for the DXE-RBSA-1FP and DXE-RBS-1RT is also highly recommended. Use pressure treated posts or perhaps a handy tree. If mounting these units on conductive supports (i.e., a metal fence post or pipe) keep the feedline a couple of inches away from the support using non-conductive spacers as well. If a pipe is used to mount the DXE-RBSA-1FP Feed Point unit, use a Stainless Steel V-Clamp, part number DXE-SSVC-2P, that accepts pipe sizes from 1/2” to 2”. The DXE-RBS-1RT reflection unit is flanged for mounting and requires two wood or metal screws.

Ground Rods
A minimum of two, 5 foot by 3/4 inch OD or larger copper ground rods and clamps are required. One rod is needed for each end of the antenna. In poor soil, adding an additional ground rod to each end may improve performance. As an alternative, 3/4 inch OD copper water pipe works well.

Feedline
Use 75Ω coaxial cable with F-type coaxial cable connectors from the feed point unit to the operating position. We recommend using a high quality 75Ω “flooded” RG-6 type coax such as DX Engineering DXE-F6-SPL. Flooded style cables have the distinct advantage of automatically sealing small accidental cuts or lacerations of the jacket. Flooding also prevents shield contamination and the coaxial cable can be direct-buried. This coaxial cable is available with F-Connectors installed and in any desired custom length from DX Engineering.

Preparing flooded F-6 cable for connectors not difficult with the correct tools. DX Engineering offers an inexpensive stripping tool, part number DXE-CPT-659, that strips the F-6 coaxial cable in one operation and the tool includes an extra cutting cartridge.

It is essential that the feedline connections are of high quality and weather resistant. The feedline is used not only for the received signal, but also carries the voltage used for directional control. For this reason, we recommend the use of Snap-N-Seal type F connectors. DX Engineering part number DXE-SNS6-25 contains 25 Snap-N-Seal connectors.

The Snap-N-Seal connectors cannot be installed with normal crimping tools or pliers. An installation tool like the DXE-SNS-CT1, available from DX Engineering, and is essential for proper F type Snap-N-Seal connector installation.
Antenna Wire
Antenna wire is a suitable length of balanced ladder or open wire line with impedance between 300 and 600Ω. See Table 1 for suggested lengths. The line that most closely approximates 450Ω impedance is #18 gauge. Ladder line constructed of #16 gauge wire, with standard 1-inch spacing, has about 420Ω impedance, but is considerably stronger, can use fewer supports and is less likely to break during weather events. DX Engineering offers the #16 gauge ladder-line, part number DXE-LL450 in both 500 and 1000 foot spools.

Power Supply
Applying 9 to 12 Vac or negative 10 to 15 Vdc at 80 mA to the coaxial feedline will cause the antenna to reverse receiving direction. The DX Engineering DXE-FVC-1 Feedline Voltage Coupler which includes the required 12 Vac wall transformer can be used.

If using a Bias Tee, since a negative voltage is required for direction change, do not use a DC source that is used for other station equipment; a separate wall transformer is recommended. The source should be current limited or fused for no more than 1 amp. The DX Engineering DXE-PSW-12D1A AC Adapter, 12Vdc 1000 mA Wall Transformer may be used, with the appropriate fusing and polarity reversal handled before connection to a bias tee.

Installation
Site Selection
Like any antenna, the DXE-RBSA-1P will couple to everything around it. This system should be located more than a wavelength from other large metallic structures, such as towers or noise sources like power lines, electric fence wires and neighbors’ houses in order to achieve peak performance. Most installations involve compromise of some sort, so do the best you can.

The DXE-RBSA-1P antenna is versatile in that you can make reasonable height changes, drape it over tree branches (insulated balanced line only!), and deviate its path from a straight line by about 10 degrees without significantly degrading performance. Avoid placing the antenna near transmitting antennas, power lines, large metal fences, or over buried cables. Install the balanced line 5 to 8 feet above the ground. It is not necessary to strictly follow the contour of the land because small hills, ravines and ditches generally will not affect the performance of the antenna.

While the impedance of the antenna is affected by its height above ground, the effect on performance is minimal. A perfectly level (with respect to the ground) antenna looks better but is not absolutely necessary!

Contrary to popular belief, a gradual slope of the antenna as it approaches its feed and termination points does not improve performance. Simply bring the ends down to the termination and feed boxes at any convenient angle, even if it is perfectly vertical. In the worst case the vertical portion will be only a few feet. Signal reception in the few feet of wire comprising the vertical ends is insignificant when compared to the signal reception from the entire length of the antenna. Unless the antenna is more than 0.05-wavelength high, the vertical ends will not compromise antenna performance.
**Proximity to Transmitting Antennas**
This system will not be damaged by a transmitted signal as long as it is more than 1/2-wavelength from the transmitting antenna, and the power is not more than 1500 watts.

**Do not** transmit directly into this antenna with more than 10 watts.

**Lightning Protection**
This system features small air gaps and wide foil trace areas, as well as entrance gaps at all terminal feed-throughs. The gaps act as safe, short paths for lightning. The **DXE-RBSA-1P** is normally immune to nearby lightning, although a direct strike might cause significant damage.

**Grounding**
The antenna GROUND terminals on both the feed and reflection units are intentionally insulated from the metal enclosure and whatever the enclosure is mounted to. This isolation prevents the feedline from becoming an unintentional ground path and introducing unwanted signals and noise into the antenna system via a common feedline and antenna ground.

The shields of both the AWAY and TOWARD coaxial feedline connectors are common to the **DXE-RBSA-1FP** enclosure. Do not connect the **DXE-RBSA-1FP** enclosure to the ground terminal, since that would connect the feedline shields to the antenna ground and possibly increase noise or reduce the front-to-back ratio. If you want to ground the metal housing, it should be grounded to its own separate ground rod. That rod should be two to five feet from the nearest antenna ground.

Connect the ground terminal only to earth ground using at least one copper ground rod. Use a large diameter ground rod when possible. We recommend using 3/4 inch OD or larger rigid copper water pipe if possible, although conventional copper coated steel rods will also work. Avoid small diameter ground rods. A good ground system improves performance and enhances lightning survivability.
In poor conductivity soils, better performance may be realized with multiple ground rods spaced a few feet apart. Remember that increasing ground rod depth beyond five feet rarely improves RF grounding because skin effect in the soil prevents current from flowing deep in the soil.

Follow national and local wiring codes for grounding where cables enter a building.

**Antenna**

You will need at least 3/8-wavelength of a nominal 450Ω balanced ladder line for the antenna. Ideally, the entire antenna run should be of the same type balanced line such as **DXE-LL450-1K** 450Ω Ladder Line. Mixing two similar appearing, but different impedance lines can compromise system performance.

The performance difference between the various 450Ω lines is generally negligible, especially for lengths near a multiple of 240 feet (73.1 meters) on the 160 Meter band, a multiple of 120 feet (36.5 meters) on the 80 meter band, or a multiple of 60 feet (18.2 meters) on the 40 Meter band. It is possible to use home-made parallel line, although close spacing should be used.

The following combinations are examples of relative performance for various antenna lengths. The antenna can be any length between 3/8-wavelength through multiple wavelengths. The **DXE-RBSA-1P** performance is excellent even when it is not cut to the ideal length.

<table>
<thead>
<tr>
<th>Antenna Length</th>
<th>160 Meters</th>
<th>80 Meters</th>
<th>40 Meters</th>
<th>20 Meters</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 feet (36.5 meters)</td>
<td>Too short</td>
<td>Marginal</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>240 feet (73.1 meters)</td>
<td>Marginal</td>
<td>Good</td>
<td>Best</td>
<td>Good</td>
</tr>
<tr>
<td>360 feet (109.7 meters)</td>
<td>Fair</td>
<td>Best</td>
<td>Best</td>
<td>Good</td>
</tr>
<tr>
<td>480 feet (146.3 meters)</td>
<td>Good</td>
<td>Best</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>600 feet (182.9 meters)</td>
<td>Better</td>
<td>Good</td>
<td>Good</td>
<td>Good to Marginal</td>
</tr>
<tr>
<td>720 feet (219.4 meters)</td>
<td>Best</td>
<td>Good</td>
<td>Good</td>
<td>Marginal</td>
</tr>
</tbody>
</table>

**Table 1 - Antenna Performance Chart**

The **DXE-RBSA-1P** is forgiving in many installation parameters. Nevertheless, attention to detail will yield better performance.
Feedline
75Ω coaxial feedline from the DXE-RBSA-1FP to the control voltage coupler and station is strongly preferred, but any impedance from 50 to 75Ω unbalanced is acceptable. We recommend using a high quality 75Ω “flooded” RG-6 type coax such as DX Engineering part number DXE-F6-SPL. Bury this feedline a few inches deep for 10 feet or more approaching the DXE-BS-1FP. Grounding the feedline shield to a separate ground rod near the feedpoint may also be done, but is not necessary. Use a 5-foot ground rod, but not the same ground rod used for the ground terminal on the DXE-RBSA-1FP. These two ground rods should be spaced a minimum of three to four feet apart.

If you use a single feedline, be sure the unused port is terminated with the supplied termination as shown in Figure 3. Failure to terminate the unused port will significantly reduce the antenna system's front-to-back ratio.

Mounting

Feed Point and Reflection Units
The DXE-RBSA-1FP feed point and DXE-RBS-1RT reflection units can be mounted on trees, pressure treated lumber, or landscaping timbers. Pressure treated wood posts or landscaping timbers are a convenient way to mount the units and also support and attach the ends of the antenna wire. When setting end-posts, a power auger or post-hole digger works well. Line the hole with copper flashing which will become part or all of the feed point (and termination) ground connection. If you choose to use a metal pipe for mounting, use a DXE-SSVC-2P V-Clamp or other suitable hardware. Note: UMI-81343 Never-Seez or DXE-NSBT8 Anti-Seize should be used on all clamps, bolts and stainless steel threaded hardware to prevent galling and to ensure proper tightening. Do not use the metal mounting pipe for the antenna ground. Use a separate ground rod placed at least two or more feet away from the base of the metal pipe. The DXE-RBSA-1FP and the DXE-RBS-1RT cases do not require grounding.

You may orient the feed point unit so the connectors labeled AWAY and TOWARD are at the bottom and the antenna connections are at the top, but it is better if all connectors face downward. Never mount this unit with the connectors facing up. The far-end reflection unit is normally mounted with the two antenna terminals toward the top.

Antenna Ladder Line
The only requirement for the antenna wire support is it must hold the antenna up, and it cannot connect the antenna to ground. A metal pole with a small PVC stub for an insulator is every bit as good as a full non-metallic pole. Trees make good supports, especially if you use electric-fence insulators for use with wooden posts.
The support shown in Figure 4 can be nailed or screwed to either wood or plastic. The window in the ladder line fits over the support and then a plastic pin locks it in place, while allowing it to float horizontally. These DXE-LL-INS supports are available from DX Engineering, in packages of 25 insulators. The ladder line used for the RBS system may require more supports than a single wire Beverage because of the limited tension you can apply to the wire, mainly due to the size of the window in the line. The ladder line need not be perfectly parallel to the ground along its length, and a half twist every 20 to 30 feet in the line will help maintain balance in the antenna.

Figure 4: 450Ω Ladder Line Insulated Support

Connections

Antenna
The antenna ladder-line is connected between the feed point and reflection units observing the polarity between the units. The + side of the ladder line on the feed point unit is connected to the + side of the reflection unit, refer to Figure 5. Since you may be twisting the ladder line multiple times along its length, correct polarity should be verified using a meter. An incorrect connection will result in poor front-to-back ratio or sensitivity.

Figure 5

Note: The antenna connection wing nuts on the units should be hand tightened only, do not use any sort of pliers or other tool as this places excessive force on the terminals.
Feedline
The factory-set configuration uses a single feedline, connected to the AWAY port, which is used for the receive signal and to supply the reversing voltage to the DXE-RBSA-1P.

The TOWARD port is terminated using the supplied terminating connector. With no reversing voltage applied, the DXE-RBSA-1P is responsive to signals coming from the far-end (AWAY) direction as depicted in Figure 6. This is consistent with the receiving direction of a conventional Beverage.

The default receiving direction can be changed to the opposite direction (TOWARD) by moving the terminating connector from the TOWARD port to the AWAY port and connecting the feedline to the TOWARD port. Now the DXE-RBSA-1P is sensitive to signals coming from the feed point end or TOWARD direction with no reversing voltage applied. An internal jumper must also be changed to allow the reversing voltage to be sent through the TOWARD port. Failure to change this internal jumper will result in no directional reversing. Jumper selection is further discussed in the next section.

Feedlines for both the AWAY and TOWARD ports can also be run back to the operating position. This would allow receiving both directions simultaneously (requires two receivers) or the use of a phasing unit for pattern modification or a noise attenuation device. No reversing voltage or jumper changes are needed when using two feedlines.

Figure 6
Operation and Configuration

By default, with no reversing voltage applied, the **DXE-RBSA-1P** is responsive to signals coming from the far-end (AWAY) direction as depicted in Figure 6. When the reversing voltage (−12 Vdc or 12 Vac) is continuously applied, the **DXE-RBSA-1P** reverses direction. It now responds to signals coming from the general direction of the feedpoint end (TOWARD) of the antenna. The TOWARD port must be terminated using the supplied termination connector to ensure maximum front-to-back and signal-to-noise ratio.

The default or un-switched receiving direction can be reversed by moving the feedline to the TOWARDS port, moving the terminator to the AWAY port and by changing the internal header jumper in the **DXE-RBSA-1P** feed point unit to the TOWARDS side. This jumper determines which port is used to supply the directional control voltage. This header jumper is set at the factory to the AWAY port.

To access the jumper, remove 6 screws from the **DXE-RBSA-1FP** unit and pull the cover out of its housing. The jumper is located directly underneath the AWAY and TOWARD ports on the circuit board. To change directional control to the TOWARD port, pull the small black jumper block straight out, move it to the 2 pins closest to the TOWARD label on the circuit board. Always be sure the jumper is installed with the notched end of the jumper block away from the circuit board. Changing jumper position to the TOWARD port side is necessary only when the coaxial cable supplying reversing voltage is moved to the TOWARD port. Be sure to terminate the unused port with the supplied terminating connector.

Control Voltage

A negative 10 to 15 DC or AC voltage (AC contains negative voltage) must be continuously applied to reverse the antenna receiving direction. The DX Engineering **DXE-FVC-1** Feedline Voltage Coupler which includes an AC wall transformer, couples this voltage to the coax feedline going to the **DXE-RBSA-1FP**.

Alternatively, a separate wall transformer may be used as the voltage source. Do not use a DC source that is used for other station equipment; a separate wall transformer is recommended. The source should be current limited or fused for no more than 1 amp such as the DX Engineering **DXE-PSW-12D1A** AC Adapter, 12Vdc 1000 mA Wall Transformer.

Basic Troubleshooting

The completed **DXE-RBSA-1P** Beverage should exhibit a 1:1 SWR with 75Ω SWR meter, or around 1.5:1 or slightly more with a 50Ω meter or antenna analyzer. Most of the antenna analyzers available are 50Ω.

If you experience poor sensitivity, check the feedline connections, the polarity of the antenna ladder line may be crossed, the antenna ground system may not be sufficient or may be improperly connected (Refer to Figure 5). Do not ground the cases of the units to the antenna ground. The
Beverage length may also be marginal for the band, see Table 1 for suggested lengths. Make sure the unused port is terminated.

If the **DXE-RBSA-1P** directivity seems poor, ensure the jumper setting for directional control is on the proper port. The jumper determines which port is used for directional control and should coincide with the port used for the feedline. The **DXE-RBSA-1P** requires a nominal –12 Vdc or AC at the feed point unit to reverse direction. The sensitivity may also be marginal, see above.

The optional DX Engineering **DXE-RPA-1** preamp may be used to provide up to 16 dB of gain to the received signal if needed. Generally, if the **DXE-RBSA-1P** produces enough signal to be heard above the noise floor of the receiver, then the signal to noise ratio of the system will not be improved with a preamp, it will just be louder. With the **DXE-RBSA-1P** system, the **DXE-RPA-1** must be installed at the operating position.

Additional detailed system troubleshooting is described at the end of this manual.
Additional Applications

Use two DXE-RBSA-1P Reversible Beverage Systems, along with a DX Engineering DXE-RLS-2, 2-port receiving antenna switch, to build a four direction Beverage system using a single feedline. See Figure 7. One or more DXE-RLS-2’s can be used to expand larger Beverage arrays and share the feedline back to the operating position.

Figure 7 - Directional Beverage Layout - 4 Directions
Directional Beverage Layout

1. Single feed line from each DXE-RBSA-1FP to the DXE-RLS-2 and from the DXE-RLS-2 to the receiver. The jumper in the DXE-RLS-2 must be reset for voltage pass through.

2. Uses voltage on the feedline to switch the DXE-RLS-2 and the DXE-RBSA-1FP's.

3. DXE-RLS-2 switches when +12 Vdc is applied to feedline.

4. Port Selection Matrix:

<table>
<thead>
<tr>
<th>Voltage Applied to Feedline</th>
<th>Selected Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Vdc</td>
<td>Beverage A, Away</td>
</tr>
<tr>
<td>-12 Vdc</td>
<td>Beverage A, Toward</td>
</tr>
<tr>
<td>+12 Vdc</td>
<td>Beverage B, Away</td>
</tr>
<tr>
<td>12 Vac</td>
<td>Beverage B, Toward</td>
</tr>
</tbody>
</table>

Table 2 - Port Selection Control Voltage

5. The required DXE-FVC-1 applies the correct voltage to the feedline for a four direction system. Controlling directions can be done with the DXE-CC-8A Control Console or a simple ground closure arrangement using a 4-position rotary or other switch, with the internal jumper reset in the DXE-FVC-1.

6. The DXE-FVC-1, DXE-CC-8A and DXE-RPA-1 pre-amp are normally located near the receiver. The DXE-RLS-2 is normally located close to the DXE-RBSA-1FP units as is the DXE-RFCC-1 Feedline Choke to minimize the required feedline.

Detailed Reversible Beverage System Troubleshooting

There are several possible causes for a malfunction of a Reversible Beverage System (RBS), but testing the system is not difficult and can be completed in an hour or so. Separate circuits for directional switching and RF are combined onto a single feedline, even in a four-direction double Reversible Beverage System. Antenna directional switching can each be affected by a variety of cabling, connection, and or component problems. All of the descriptions and references to RBS below reference the new RBSA units which have only appearance changes that do not affect performance.

The following are the most common causes of Reversible Beverage System malfunction:

A) Broken and/or shorted conductors due to animal or weather related damage or other damage, including chewed, punctured, stretched and broken ladder line conductors and feedline conductors.
B) Regressed center conductors in the feedlines causing disengagement from the female center capture pin of the F connector. This can happen in antenna or main feedline connections. Many times a compression F connector that seemed to have a long enough center conductor when it was originally made has regressed to the point that it is not long enough to make connection. A properly installed F connector should have the center conductor protruding 1/4 inch beyond the shell when viewed from the side. Check all F connectors!

C) Shorted or opened conductors caused by water migration into a feedline.

D) **Improper switching is often caused by the use of a +12 Vdc (DC) wall transformer or power supply connected to the Feedline Voltage Coupler model FVC-1.** The FVC-1 and the Reversible Beverage System requires 12 Vac (AC) to be connected to the FVC-1 power input for proper directional operation of the system.

E) A burned out **RBS-1FP Feed Point unit or RBS-1RT Reflection Transformer** or a damaged **RLS-2 Two Port Switch** used in a double Reversible Beverage, due to lightning pulse is possible, or due to high power RF overload, which is less likely. High transmit power radiated from a transmit antenna into a Beverage system that is installed within one-quarter wavelength can cause component damage. Transmit and receive antennas should be separated by one-half wavelength or more to prevent overload, induced broad band noise, and Beverage antenna pattern degradation or distortion. As shown in the **RBS manual**, a very small gauge wire in series with the end of each antenna wire can offer some measure of lighting protection to the components of the system.

F) The **FVC-1** green 5-pin connector screw connections can inadvertently be tightened onto the insulation of control conductors and not the wire, causing non-switching results. If these screw connections are over tightened, the conductor can be nicked which can cause a later break.

```
Over 90% of all Reversible Beverage System malfunctions have been caused by the above system problems.

A thorough inspection and subsequent testing of the **FVC-1** control cable, the RF feedlines, the antenna ladder line, and their respective connections, will usually uncover the cause of most RBS troubles.

A damaged **FVC-1** unit, due to lightning, has been reported only a couple of times and is extremely unlikely.
```

Now you are well informed about the areas and components that need to be checked in a Reversible Beverage System. Additional troubleshooting as described below will most likely uncover the cause of a problem.
System Troubleshooting Procedure

1) Depending upon the switching method used for the Feedline Voltage Controller model FVC-1, make sure the jumper inside the unit is set to respond to your method of switching, BCD voltage or 1-of-4 ground switching. By default, the FVC-1 is set for BCD voltage control with the jumper JMP1 connecting to the two pins below EXT. **If you are using your own 4 position grounding switch for FVC-1 control, JMP1 inside the FVC-1 must be reset to jumper setting INT.**

Additional information on the connections to the FVC-1 unit is available in this manual.

Only when a DX Engineering CC-8 or CC-8A Switch Control Console unit or other BCD voltage control is used, the JMP1 jumper must be set to EXT. Also check that the connections from the BCD voltage source and the FVC-1 control. From the CC-8 or CC-8A to the FVC-1, connections correspond to A to NEG, B to POS, and G to G. When rotating the switch from position 1, 2, 3, and 4, or 5, 6, 7 and 8, if all LEDs light normally, measure BCD output voltages. Normally, +12 to 18 Vdc is output on the rear panel green 5-pin connector pins reference to ground pin G. Voltage measured may be as high as +18 Vdc unloaded. If the CC-8 or CC-8A has only a couple LEDs lit with the control cable disconnected, then it may have sustained lightning pulse damage and will need to be repaired or replaced. A new CC-8A is available separately from DX Engineering.

After checking the FVC-1 control switching, continue troubleshooting the RBS with the entire system connected normally.

2) With the main Reversible Beverage System feedline connected to the FVC-1, test the voltages between the OUT terminal and the ground G terminal of the FVC-1, while switching through the four positions. The sequence that should be measured is 0 V, -12 Vdc, +12 Vdc, and 12 Vac. The voltage will read on a multi-meter at about 6 to 7 V because they are half-wave rectified, pulsating dc. These are the same voltages that are being sent out onto the feedline. Only -12 Vdc is used to switch a single RBS.

If the voltages measured are not normal with the feedline line connected, then disconnect the feedline and retest. If voltages are still incorrect, there is a problem with FVC-1 power supply (must be 12 Vac, NOT 12 Vdc), jumpering (see #1 above), or switching control (wrong or bad connection). Correct FVC-1 operation as discussed above.

If voltages were wrong with the feedline connected but are now okay with the feedline disconnected from the FVC-1, this indicates:

- a) A short circuit in the feedline,
- b) A bad RLS-2 in a four-direction double RBS,
- c) Or a short or an open in a feedline or a section of the RBS, which includes the RBS-1FP Feedpoint Unit, a break or a short in the ladder line Beverage antenna wire, or a short or open in the RBS-1RT Reflection Transformer.
The first direction of reception is with no voltage sent on the feedline. The default direction of reception (jumper selected inside the RBS-1FP Feedpoint Unit and feedline connection dependent) is Away from the unit.

On a single RBS, switching to position 2, the FVC-1 sends the -12 Vdc required to switch the relay in the RBS-1FP Feedpoint Unit from the Away to the Toward receiving direction. On a double RBS, the RLS-2 does not respond, stays on N/C port, for 0 V first direction or -12 Vdc second direction, and passes the -12 Vdc which switches the first RBS-1FP Feedpoint Unit from Away to Toward for the second receiving direction.

When the third switch position is selected, the FVC-1 sends +12 Vdc and the RLS-2 switches to the N/O port, connecting the second RBS-1FP Feedpoint Unit, which does not respond to the +12 Vdc, so it receives its default Away direction.

On the fourth position, the FVC-1 sends 12 Vac, which the RLS-2 responds to it as +12 Vdc, passes the AC voltage to the second RBS Feedpoint Unit, which responds as if it were -12 Vdc, and switches from Away to Toward for the fourth direction of reception.

5) Determine if the main feedline line is intact by resistance testing for shorts with the far end of the feedline disconnected from the RBS-1FP unit in a single system, or disconnected from the RLS-2 unit in a double system. Test additional feedlines of the double system before reconnecting the voltage source.

6) Next test the voltages sent by the FVC-1 on the main feedline and through the RLS-2 on a double system. Remember that voltages measured will not appear as full 12 V, since half-wave rectification produces a pulsating DC, which reads about 6 to 8 Vdc on a multi-meter. The AC voltage may vary from 6 to 12 volts.

Replace or repair feedlines and connectors that show shorts or loss of proper voltages as discussed above.

7) If all voltages tested at the ends of disconnected feedlines appear as expected, but full system functionality is not restored, then carefully inspect and test each conductor of the ladder line with battery power.

Many cases of malfunction have been traced to breaks in one or both conductors of the ladder line, or shorts across both conductors of the ladder line, caused by hidden damage.

A simple short may not be easily detected by measuring resistance at the feedpoint end. A complete inspection and comprehensive measurements of the antenna ladder line should be done. Undetected intermittent breaks and shorts in antenna ladder line have caused a few hams to believe problems existed in their RBS-1FP or RBS-1RT. When their units were sent in, they actually tested good. Later, it was discovered that there was an intermittent problem with the antenna ladder line.
8) If all Beverage antenna ladder line conductors have been thoroughly tested, reconnect them to the **RBS-1FP** and **RBS-1RT**. If functionality has not been restored, a problem inside one of these units is possible. If a double system is being used, substitution of Feedpoint and Reflection Transformer Units from a known good system may help determine which piece is bad, by a process of elimination. Service for an **RBS** unit, as well as a replacement unit, is available from DX Engineering.

**Proper Reversible Beverage System operation depends upon proper installation, correct grounding and lightning precautions, and correct voltage switching.**

Use a steady, non-fading ground wave signal from a low to medium power daytime AM Broadcast station that is over 10 miles away, on a frequency high in the band, or a constant signal source on 160 or 80 meters, well away from the array, to test that the Reversible Beverage System is receiving at proper levels and is offering expected directivity. Do not use sky-wave AM broadcast or night signals for tests. Strong sky-wave signals arriving at high angles of propagation may overpower the Reversible Beverage System directivity that is very apparent on low angle DX signals. When installed and operating correctly, the Reversible Beverage System can enhance forward low and medium angle signals, and reject rearward and high angle signals, to create signal-to-noise results that can far exceed transmit antennas, for greatly improved weak signal DX operations.

At this point, any problem in your Reversible Beverage System should have been identified.

If you need additional assistance, feel free to call or write DX Engineering technical support. Detailed descriptions of system function, connections and troubleshooting is best handled by telephone, Monday through Friday, 8:30 am to 4:30 pm Eastern Time, at 330-572-3200. Or you can email to: dxengineering@dxengineering.com.
Optional Items

DXE-LL450-1K - Ladder Line, 450 ohm - 1000 ft. Spool - DXE-LL450-1K
DXE-LL450-5C - Ladder Line, 450 ohm - 500 ft. Spool - DXE-LL450-5C

Transmit-quality 450 ohm ladder line for your antenna project when the feedpoint impedance is close to 400 Ohms. It is also ideally suited for use with our Reversible Beverage Antenna, the RBS-1P. This quality line is constructed of 16 gauge conductors that are formed by 19 strands of 29 gauge copper-clad steel wire which provides the strength to hold up for long runs between supports. Actual impedance is nominally 400 Ohms with a nominal velocity factor of 91%.

- 1000' or 500' Spools
- Conductor AWG (strand): 16 (19/29)
- Nominal Impedance: 400 Ohms
- Velocity factor of 91%

DXE-LL-INS - 450 ohm Ladder Line Supports (25 per pack)
Top grade, UV stabilized, polyethylene ladder line supports designed for Beverage antennas that use 450 ohm line as the antenna wire, like the DXE-RBSA-1P.

- 25 Per Pack
- Easy to install
- Molded Pin Holds Wire or Ladder Line Tightly – Simply pull the pin to release.
- Fits Standard Wood Posts
- Heavy Duty Flange Holds insulator to Post
- Top Grade, UV Stabilized Polyethylene Prevents Arcing and Provides Long Life
- 5 Year Warranty

DXE-F6-CTL - 75Ω F-6 Style Direct Bury Coax, Per Foot
DXE-F6-10000 - 75Ω F-6 Style Direct Bury Coax, 1,000 Foot Spool

Hi Quality CATV, 75Ω F6 type "Flooded" Coax

Sold by the foot without connectors, specify length when ordering. Also available in a 1000 ft. Spool. Custom assemblies with connectors are also available - call DX Engineering for details.

Center Conductor: 18 AWG Copper-Clad Steel, Nominal Diameter: 0.040 in., Dielectric: Gas Expanded Polyethylene, Nominal Diameter Over Dielectric: 0.180 in. Shield: 1st Shield: Aluminum-Polypropylene-Aluminum, Laminated Tape with overlap Bonded to the Dielectric, Nominal Diameter Over Tape: 0.187 in. 2nd Shield: 34 AWG Aluminum Braid Wire, 60% Coverage. Jacket: PE (Flooded for Underground), Nominal Diameter Over Jacket: 0.272 in., Nominal Jacket Thickness: 0.030 in. Electrical Properties: Impedance: 75.0 +/- 3.0 Ohms, Velocity of Propagation: 85.0% Nominal. We recommend the use of Snap-N-Seal connectors to ensure a high quality and weather resistant feedline connection. The proper tool must be used to install these connectors.

DXE-UT-KITF
This cost-saving kit provides a handsome, convenient carrying case complete with the DX Engineering F-6 coaxial cable prep tools and accessories. It features a rugged, lockable enclosure fitted with a precut foam insert with a home for each tool. The DXE-UT-KITF kit provides the case complete with the following:

- DXE-CPT-659- Stripping Tool for RG-59/F-6 size cable w/extra blades
- DXE-SNS6-25 - Snap-N-Seal Watertight F Connectors - qty. 25 pcs
- DXE-SNS-CT1 - SNS Connector Compression Tool
- CNL-911 - Coaxial Cable Shears
- DXE-CIT-1 - F Connector Tightening Tool

DXE-CPT-659
Prepares CATV F-6, RG-6 and RG-59 coax cable for the installation of an "F" type connector

- One-step cutting motion
- Precision cut
- No nicks or scratches to conductor
- Includes 1 replacement blade

DXE-CPT-659RB - Replacement Blades for DXE-CPT-659 Coax Cable Stripper, Package of 2
Replacement Blades for a DXE-CPT-659 Coax Cable Stripper, Package of 2
DXE-SNS6-25 - Watertight Coax Connector, Snap-N-Seal for CATV F-6 Cable, 25 pieces
Snap-N-Seal is an environmentally sealed CATV F coax connector system for harsh environments. The connectors have a unique, 360 degree radial compression system that offers the signal leakage protection required for high performance receive systems.

- Quad sealed system prevents moisture from migrating into the connection
- 360 degree radial compression provides superior RF integrity (~95dB typical, 60% bonded foil cable)
- Easy cable preparation
- Connector to cable retention of 40 lbs minimum
- Superb impedance match to 1 GHz
- Manufactured of high quality 360 brass, cadmium plated with iridescent clear chromate coating for maximum corrosion resistance
- UV-resistant plastic and O-rings provide a reliable environmentally sealed connector

An installation tool, such as the DXE-SNS-CT1, is required to install the connectors. Normal crimping tools or pliers will not work.

DXE-SNS-CT1 - Compression Tool for Snap-N-Seal 75Ω Coax Connectors
Ratchet compression tool for installing Snap-N-Seal 75Ω Coax connectors. Ordinary pliers will not install these connectors properly.

DXE-CT1 F Connector Tightening Tool
The CIT-1 installs and removes F connectors in high density and hard to reach locations, and is the only tool that works with bent coax. Only finger force is required. Provides enough leverage to achieve a 30 in/lb tightening force by hand. Helps insure proper connections thereby reducing the potential of loose connector related problems. Patent #6,817,272.

DXE-SSVC-2P - Stainless Steel V-Clamp for steel pipe, 2 inch V-bolt
This V-Clamp is made in one size that fits Steel tubing or pipe from 1 to 2" O.D. as used in antenna construction. The supplied V-bolt is long enough to attach tubing to thick plates and is made with anti-corrosive properties. The special Stainless Steel saddle has serrated teeth will clamp to the pipe securely by biting into the surface. For this reason, it is not recommended for softer aluminum tubing or pipe. Ideal for fastening a radial plate or antenna mounting to a steel pipe.

- Used to clamp 1 to 2" (O.D.) steel tubing or pipe
- Designed for attachments that don't require resistance to torque
- V-bolt and saddle made from high-strength 18-8 stainless steel
  The use of an anti-seize compound is HIGHLY recommended to achieve proper torque and prevent galling.

DXE-FVC-1 - Feedpoint Voltage Coupler
The FVC-1 provides an interface for standard control switches, such as the DXE-CC-8A or your own arrangement to voltage-multiplexed antenna systems. This interface system will provide the voltages required to remotely select up to four antennas (or four directions) through receiving or low power transmitting feedlines. It provides fuse-protected 0V, +12 Vdc, -12 Vdc, and 12 Vac output voltages through a panel mounted feedline connector. These voltages can be used to provide four-direction switching of an antenna array either through the feedline or on a single wire supplemental control line. Control is done using a standard 1 of 4, BCD or switch closure interface (internal jumper selectable).

The FVC-1 is recommended for use with the RBS-1 Reversible Beverage Antenna System and the RLS-2 Transfer Switch. The CC-8A Control Console can provide the 1 of 4 and BCD input used by the FVC-1 or you can use your own switch.

The FVC-1 also has two LED indicators, red and green, which indicate the presence and polarity of the output control voltage being used. They are directional indicators that can be read at a convenient distance and can aid in troubleshooting.

- Safe, external 12V heavy duty power pack.
- Metal Housing – superior shielding, rugged, and easy mounting
- Convenient installation– mounts anywhere in your shack
- Rugged Control Connector – reliable solder-less connections
- Internal thermal reset fuse- full protection against accidental shorts
- Flexible logic input- BCD or standard one-of-four, high or low actuated
- Operation indicators- bright red and green LED indicators can be seen at a distance
DXE-RPA-1 - Receiver Preamplifier, 0.3-35 MHz
This is the best HF low noise amplifier available. The RPA-1 is optimized for 0.3-35 MHz operating range. The push-pull amplifier design and robust components enable it to withstand high signal levels and operate when you need it most. The dynamic range of the RPA-1 is better than most receivers. The RPA-1 is suitable for indoor or outdoor installation, with the option of being powered through the coaxial feed. The metal housing provides shielding and improved lifespan. The unit uses RCA type phono jack and CATV F connector for the input and output connections, and has a relay that automatically bypasses the amplifier when dc power is removed.

Benefits:
- Push-pull operation eliminates harmonic distortion
- High quiescent current increases ability to handle strong signals without distortion or overload
- Meticulous craftsmanship and durable components provide superior dynamic range
- RCA type phono jack and type F connector ease installation
- Simplified switching - automatic bypass eliminates gain when dc power is off
- 10-18 Vdc power using power connector or through the coax
- 10-18 Vdc through coax enables remote operation at antenna

DXE-RFCC-1 - Receive Feedline Current Choke, 50 to 75Ω 300 kHz to 30 MHz
If you wish to reduce signal pick up and improve reception, a Receive Feedline Current Choke is recommended. Adding a DX Engineering Receive Feedline Current Choke at the point where the feedline exits the area of the antenna will substantially reduce unwanted reception without the need for improved station grounding.

The advantages of using an RFCC:
- Prevents unwanted RFI reception by eliminating feedline current
- Reduces noise or unwanted signals picked-up by the feedline
- Overcome a less than optimal ground system

The DX Engineering RFCC-1 receive feedline common-mode choke is the most effective solution to common-mode noise or unwanted signal ingress available to date. The DX Engineering RFCC-1 provides thousands of ohms isolation between the input and output coaxial shield connections while passing desired signals, including dc or low frequency ac control signals. The RFCC-1 has extremely high isolation impedance which effectively blocks common-mode noise or unwanted signals, even in the presence of very poor grounding. Low noise receive antennas are traditionally located away from electrical wiring and other noise sources. Unfortunately, noise and other unwanted signals have a direct path to your low-noise antenna through the feedline shield connections between the station equipment and antenna. Unwanted signals can also energize the outside of the feedline shield, and this undesired signal energy can be conducted directly to the receiving antenna. This can reduce antenna directivity. Unless you have a perfect zero-resistance RF ground at the antenna, some of the common-mode noise or unwanted signals from the feedline shield will make it into the antenna. The RFCC-1 is effective from 300 kHz to 30 MHz. It comes with standard CATV type “F” female connectors, although it can be used in any 50 to 75Ω receiving system. The RFCC-1 is a passive device, therefore requires no power to operate.

DXE-CC-8A Control Console, 8 Position
The CC-8A Control Console is a flexible, 8-position controller used to control the DX Engineering RR8 series antenna switches, the RFS-2P Receive Four Square controller or any product that uses a 12 or 24 Vdc 1-of-8 or BCD control format. The attractive metal housing is powder-coated and features an ON/OFF switch, ergonomic selector knob and eight front-panel LED’s, with adjustable brightness, to indicate switch position. The rear panel external plug allows the control cable to be easily unplugged during weather events or if the shack needs to be rearranged. We suggest unplugging the CC-8A control leads when severe weather is expected. The use of a lightning protector on the control lines, such as the PolyPhaser PPC-IS-RCT, available from DX Engineering, is prudent as well. Shielded CAT-5 type cable can be used for the control cable. (8 conductors plus ground). DXE-CW9S is a top quality 9-conductor stranded, shielded cable for best results. For most applications requiring 12 Vdc switching, your existing transceiver power supply or the accessory DXE-PSW-12D1A can be used.

Features:
- Switching positions: 8
- Input voltage: 12/24 Vdc, user supplied
- Output voltage: 12/24 Vdc dependent on user-supplied dc input power source.
- Protection: Dual internal automatic reset fuses
- Output format: 3-bit BCD or standard 1-of-8
- Dimensions: 8 x 5 x 2.75” (203.2 x 127 x 69.85 mm) (W x D x H)
DXE-RLS-2 - Two Port Receive Antenna Switch
The DX Engineering 2-Port Receiving Antenna Switch RLS-2 is designed to allow selection of one of two output ports (generally connected to different receiving antennas) from one feedline. Transfer activates with application of a +10-15 Vdc or 9-12 Vac control voltage through the feedline.

Features
- Metal housing for superior shielding and long life
- High quality components
- Reliable F-type connectors
- Operating range from 300 kHz to 30 MHz with 75Ω systems
- Jumper-selectable, control voltage pass-thru to the selected port

When used with two DX Engineering RBS-1 Reversible Beverage Systems, the RLS-2 will allow selection of four directions using a single main feedline. Install one or more RLS-2's to expand larger Beverage arrays and share the feedline back to the operating position. The DX Engineering FVC-1 Voltage Coupler can be used to supply the control voltages through the feedline to control 4-direction switching of an receiving array (using two RLS-2's) or selection of four different receiving antennas.

DXE-PSW-12D1A  AC Adapter 12 Volt DC 1000 mA Wall Transformer
110 Vac 60 Hz input - 12 Vdc, 1 Amp, Fused output. A standard 2.1 mm plug connection for 12 Vdc.

Outer connection is GROUND  +  Center Pin is input for +12 VDC.

COM-CW3 Cable, 3 Conductor
A high quality, PVC jacketed 3-wire control cable, COM-CW3 consists of 3 #20 AWG conductors. It may be used in a multitude of control cable applications, such as remote switching and antenna rotators.

Sold by the foot - order the length you need.

DXE-CW9S - Shielded Control Wire, 9 Conductor, stranded, per foot
DXE-CW9S is a high quality shielded outdoor cable. It features 9 #24 AWG stranded conductors with aluminum foil shielding plus a #24 stranded tinned copper drain wire. This gives you 8 switch positions plus common ground - plus the separate shield. It has a gray PVC jacket. This cable is ideal for DX Engineering Remote Antenna Switches and Four Square arrays, and should be considered for any low-current custom remote switching application you have - such as receiving antenna arrays. Order by the foot in the length you require. Price shown is per foot. A nice feature is the "rip cord", which allows for easy stripping of the heavy jacket without worry about nicking or accidentally cutting the conductors.

DXE-CW9 - Shielded Control Wire, 9 Conductor, per foot
DXE-CW9-1K is a high quality shielded outdoor FTP (Foil Twisted Pair) CAT 5e cable. It features 4 Twisted pairs of 24 AWG solid wire with Al foil shielding plus a solid tinned copper drain wire - providing a total of 9 conductors for DC switching applications. It has a polyethylene jacket and is rated for direct burial. This cable is ideal for DX Engineering Remote Antenna Switches and Four Square arrays, and should be considered for any low-current custom remote switching application you have - such as receiving antenna arrays. Order by the foot in the length you require. A nice feature is the "rip cord", which allows for easy stripping of the heavy jacket without worry about nicking or accidentally cutting the conductors. Excellent for use in all outdoor applications of switching, networking, data transfer and phone lines. As a data transfer line, it supports 10/100/1000Mbps.

DXE-CW9-1K - Shielded Control Wire, 9 conductor, 1000 ft reel
DXE-CW9-1K is a 1000 foot box of high quality shielded outdoor FTP (Foil Twisted Pair) CAT 5e cable. It features 4 Twisted pairs of 24 AWG solid wire with Al foil shielding plus a solid tinned copper drain wire - providing a total of 9 conductors for DC switching applications. It has a polyethylene jacket and is rated for direct burial. This cable is ideal for DX Engineering Remote Antenna Switches and Four Square arrays, and should be considered for any low-current custom remote switching application you have - such as receiving antenna arrays. A nice feature is the "rip cord", which allows for easy stripping of the heavy jacket without worry about nicking or accidentally cutting the conductors. Excellent for use in all outdoor applications of switching, networking, data transfer and phone lines. As a data transfer line, it supports 10/100/1000Mbps.
Technical Support

If you have questions about this product, or if you experience difficulties during the installation, contact DX Engineering at (330) 572-3200. You can also e-mail us at:

DXEngineering@DXEngineering.com

For best service, please take a few minutes to review this manual before you call.

Warranty

All products manufactured by DX Engineering are warranted to be free from defects in material and workmanship for a period of one (1) year from date of shipment. DX Engineering’s sole obligation under these warranties shall be to issue credit, repair or replace any item or part thereof which is proved to be other than as warranted; no allowance shall be made for any labor charges of Buyer for replacement of parts, adjustment or repairs, or any other work, unless such charges are authorized in advance by DX Engineering. If DX Engineering’s products are claimed to be defective in material or workmanship, DX Engineering shall, upon prompt notice thereof, issue shipping instructions for return to DX Engineering (transportation-charges prepaid by Buyer). Every such claim for breach of these warranties shall be deemed to be waived by Buyer unless made in writing. The above warranties shall not extend to any products or parts thereof which have been subjected to any misuse or neglect, damaged by accident, rendered defective by reason of improper installation, damaged from severe weather including floods, or abnormal environmental conditions such as prolonged exposure to corrosives or power surges, or by the performance of repairs or alterations outside of our plant, and shall not apply to any goods or parts thereof furnished by Buyer or acquired from others at Buyer’s specifications. In addition, DX Engineering’s warranties do not extend to other equipment and parts manufactured by others except to the extent of the original manufacturer’s warranty to DX Engineering. The obligations under the foregoing warranties are limited to the precise terms thereof. These warranties provide exclusive remedies, expressly in lieu of all other remedies including claims for special or consequential damages. SELLER NEITHER MAKES NOR ASSUMES ANY OTHER WARRANTY WHATSOEVER, WHETHER EXPRESS, STATUTORY, OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS, AND NO PERSON IS AUTHORIZED TO ASSUME FOR DX ENGINEERING ANY OBLIGATION OR LIABILITY NOT STRICTLY IN ACCORDANCE WITH THE FOREGOING.

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