EAS INDUSTRIES

Service Manual
EASI - 2000

1256 North Church Street Suite A-1
Moorestown, NJ 08057
Phone: 856-222-4788 Fax: 856-222-0188
Toll Free: 800-267-4275
E-Mail: easindustries@worldnet.att.net
www.easindustries.com

08/00

General Description

Installation

System Tuning

Transmitter

Receiver

Troubleshooting

General Technical Description

The EASI Article Surveillance System uses a swept radio frequency (RF) signal to detect resonant circuit tags. The system is designed to be compatible with all 8.2MHz, 9.5 MHz, and 10.0 MHz resonant RF tags. A single aisle system consists of a low voltage power supply, one receiver antenna, and one transmitter antenna. Power requirements of the standard system are 110 volt Vac/60 Hz. Power supplies with other input voltages are available upon request.

How the System Works

The transmitting circuit board continuously generates and broadcasts through its' antenna a low power electronic signal to the receiving antenna(s) where it is processed by the receiver circuit board(s). As a tagged item passes through the zone or detection field between the transmitter and receiver, the resonant circuit in the tag creates a small distortion in the signal. Digital and analog circuits within the receiver circuit board confirm the authenticity of this signal and create an audible alarm indicating that a tagged item has been moved through the zone.

In normal shoplifting prevention situations, the tag is removed or deactivated either manually or electronically at the point of sale when a valid purchase is made.

EASI Detection System Specification

The following is an outline of the overall system and its components:

System Technology

RF (Radio Frequency)

System/Antennas

KB-1

Size:	Height:	60 Inches - 152.4 cm
	Width:	11.25 Inches - 28.6 cm
	Depth:	1.25 Inches - 3.2 cm
Weight:	35 lbs. -	15.9 kg per system
	17.5 lbs -	7.9 per antenna
Color:	Gray	
	White/Almond	
	Black	

KB-2

Size:	Height:	60 Inches - 152.4 cm
	Width:	14 Inches - 35.6 cm
	Depth:	1 Inch - 2.54 cm
Weight:	21 lbs. -	9.6 kg per system
	10.5 lbs -	4.8 per antenna
Color:	Chrome with Black Circuit Board Covers	

Antenna Separation

Spacing between antennas can create aisle widths up to 6 feet (1.83m) depending on tags or labels used.

Optional Baseplates (Users Installed Systems)

Single Aisle System Baseplate - (36 inches - 91.5 cm)

Size:	20 inches X 40 inches - 50.8 cm X 101.6 cm
Weight:	39 lbs. - 17.7 kg
Color:	Black, ribbed rubber

Single Aisle System Baseplate - (48 inches - 122 cm)

Size:	20 inches X 51.5 inches - 50.8 cm X 130.8 cm
Weight:	53 lbs. - 24.0 kg
Color:	Black, ribbed rubber

Dual or Wide Aisle System Baseplate - (72 inches - 183 cm)

Size:	20 inches X 75.5 inches - 50.8 cm X 191.8 cm
Weight:	63 lbs. - 28.6 kg
Color:	Black, ribbed rubber

Power Supply

Standard 100/120/220 Vac 1.1A 50/60 Hz

Note 1: Type of supply must be designated
Note 2: Individual power supplies can be used for each antenna

Tags and Labels

EASI EAS systems are compatible with virtually all types of RF tags and labels (e.g. hard tags, custom flex tags, and flap tags).

Pre-Installation Guidelines

The EASI system operates using resonant frequencies. Mechanical and electrical devices or metal objects too close to the antennas can occasionally induce a spurious resonance or noise, causing a system malfunction. For this reason, the EASI system should be installed in an area as free as **reasonably possible** of these items.

Important: In order for the system to operate effectively it is recommended that the following guidelines be observed. Adhering to as many of the suggestions listed below and taking a few precautions now will help create a trouble free and effective environment for proper tag detection.

If in any doubt about the environment be sure to test the system in the intended location before the permanent installation.

- Try to avoid installing any electrical wiring within 3 feet (91.4cm) and parallel to the system antennas (e.g. vertical power poles from counter to ceiling, from floor to ceiling).

- Avoid having tagged merchandise with 3 feet (91.4cm) of the system.

- When **possible** the antennas should **not** be installed closer than 2 feet (61cm) to any mechanical or electrical devices (e.g. soda machines, vending machines, ice cream machines, computers, neon lights, telephones) and their associated wiring.

- When possible the antennas should not be installed closer than **2 feet** (16cm) to any metal object, such as windows, display fixtures, shelving, columns, and metal railings.

- The system must be installed at least **2 feet** (61cm) from the exit door. This will greatly reduce the possibility of resonances caused by moving metal door frames and door security systems. If the doors swing inward, the door arc must not come closer than **1 foot** (30.5cm) to the antennas. The doors should not swing between the antennas (refer to system placement diagrams).

- High voltage AC power cables or electrical conduit should **never** be run near the antennas or underneath the base plate (e.g. incoming electrical wiring for system, extension cords, etc.). The systems **low voltage AC power cables** must be run either along the floor or from under the system. This wiring should **not** be run into the ceiling parallel to the antennas (e.g. in the door or window framing) and then to the system antennas, as this is likely to cause noise and resonance problems. If power is available only from the ceiling, the low voltage AC power cable must be run from the ceiling to the floor at least **2 feet** (61cm) from all points of the antennas.

Helpful Hints

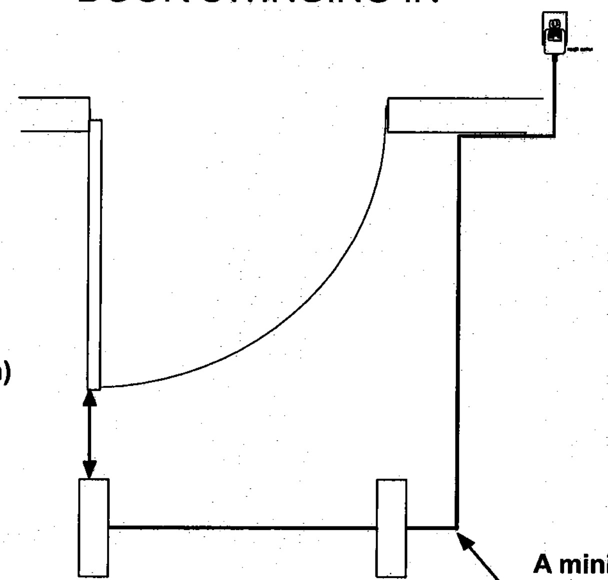
- Some locations experience the problem of children climbing on the antennas. It is possible to eliminate this problem by covering the antennas with non-metallic/non-conductive materials.

- During the holidays problems can be caused by the hanging of decorative lights or garland on or in close proximity to the system. These items should not be hung on or placed near the system.

Important Note:
The user is cautioned that changes or modifications to this system not expressly approved by EASI could void the user's FCC authority to operate this equipment.

System Placement Diagram
Single-Aisle System

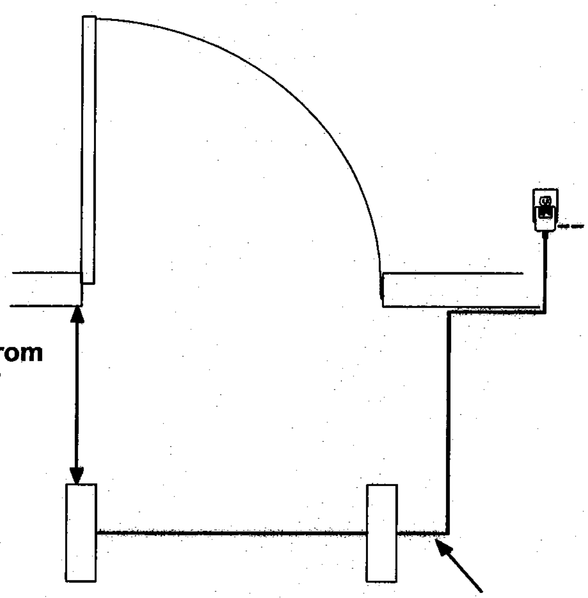
DOOR SWINGING IN



A minimum of 12" (30.5cm) from door frame to front edge of the systems baseplate.

A minimum of 6" (15.25cm) before turning 90 degrees.

DOOR SWINGING OUT

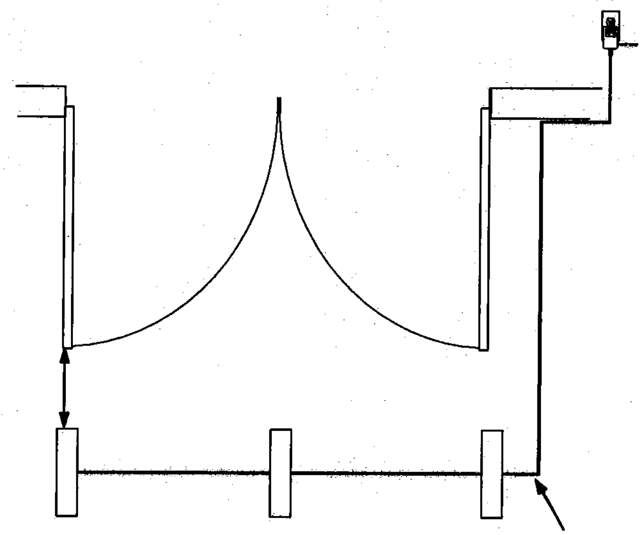


A minimum of 24" (61cm) from door frame to front edge of the systems baseplate.

A minimum of 6" (15.25cm) before turning 90 degrees.

System Placement Diagram
Dual-Aisle System

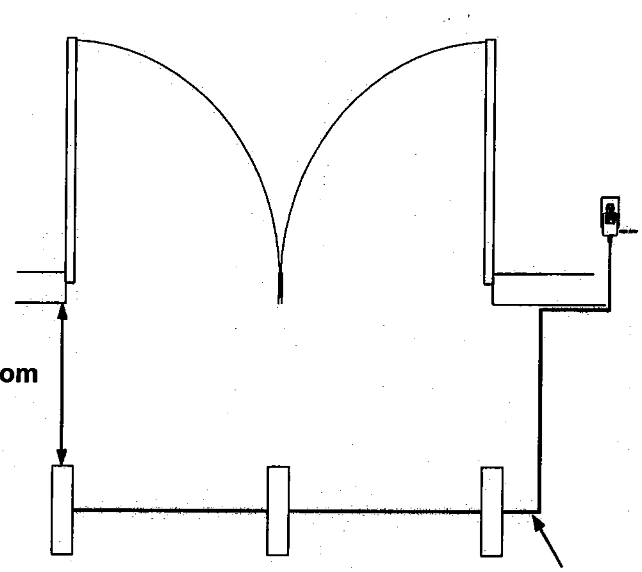
DOORS SWINGING IN



A minimum of 12" (30.5cm) from door frame to front edge of the systems baseplate.

A minimum of 6" (15.25cm) before turning 90 degrees.

DOOR SWINGING OUT



A minimum of 24" (61cm) from door frame to front edge of the systems baseplate.

A minimum of 6" (15.25cm) before turning 90 degrees.

Floor Mount Installations

Please read the pre-installation guidelines thoroughly before proceeding with the following.

The antennas should be installed first. If the system is a single aisle, there will be one transmitting antenna and one receiving antenna. If the system is a dual aisle, there will be one transmitting antenna (in the middle) and two receiving antennas (one on each side). A three aisle system consists of two transmitting antennas and two receiving antennas in alternating sequence.

Step 1

Remove the screws from the circuit board covers at the bottom of the antennas then pull up and out. Place antennas in an upright position on the floor in the approximate position where they are to be installed. This should be done carefully as the antennas have very narrow bases and could easily fall over. As indicated previously, the antennas should be positioned at least 2 feet (30.5cm) or more from the doorway and should not interfere with traffic flow. Maximum distance between antennas (i.e., aisle width) is 66 inches (168cm) center to center. The center to center aisle width is determined by the type of detection label being used. Use the following table for the recommended aisle widths for label type.

Label Type	Recommended Aisle Width
1.5" x 1.5" Soft Label	36" (91.4cm)
2" x 2" Soft Label	48" (122cm)
1 5/8" Small Round Hard Label	48" (122cm)
Large Hard Label	66" (168cm)
Flap Label	36" (91.4cm)

Step 2

Measure the distance center to center of each antenna and make sure that the aisle width is appropriate for the installation site and the size of the detection tag (reference the above table). Square up each antenna with each other and to the aisle path.

Important: Before drilling holes for bolting the antennas to the floor, the installer should check with the person in charge to be absolutely sure the positioning of the system is acceptable.

Step 3

Mark the floor through the two outside holes in the base of each antenna (center hole is for wires coming into the antenna circuit board). After marking the hole positions, move the antennas out of the way.

Important: If the system is to be installed on carpet, holes approximately 1 inch square must be cut in the carpet before holes are drilled. Drilling without cutting the carpet may cause damage to the carpet. Mark hole position on the carpet before cutting.

Step 4

Drill the antenna mounting holes using a heavy rotary hammer. Drill the holes the size and depth appropriate for the anchors being used and the type of floor being installed on. If the system is being installed on a wooden floor we recommend the use of lag bolts to anchor the system.

Step 5

Clean out holes, install anchors in place (remember to compensate for the width of the baseplate) and bolt antennas in place loosely (this will allow the cables to be placed under the base of antenna).

Multiple System Installations

Note: This section addresses installations with no more than three transmitters installed in the same location. For installations that require more that three transmitters in the same location you should contact the EASI service department for assistance.

The EASI transmitter operates essentially like a small radio station. Therefore if you install a transmitter in close proximity to another transmitter operating at the same center frequency, certain steps must be taken to eliminate the potential interference between them.

There are two methods that can be used to eliminate the interference. The decision as to which method to use is mostly based on the distance between the transmitters. If the transmitters are greater that 20 feet (60.9m) apart it is possible to offset the modulation rate of the systems to lessen the interference between transmitters. If the transmitters are less than 20 feet (6.09m) apart then it will be necessary to master/slave the transmitters.

Note: Of the two methods, offsetting the modulation frequency is the easiest to do. Regardless of the distance between transmitters you may wish to try this method before attempting the master/slave method.

Offsetting Modulation Frequency

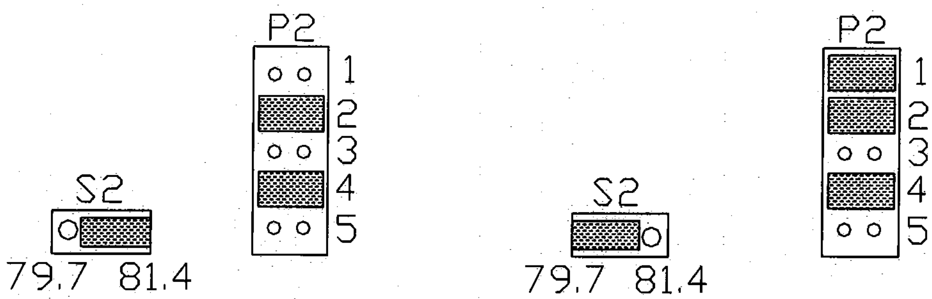
The EASI transmitter sweeps the tuned frequency range at a specified rate. This rate is normally set to 81.4 Hz at the factory. If the distance between transmitters is greater than 20 feet (6.09m) success has been achieved by changing the modulation sweep rate on one of the systems to 79.7 Hz. The following diagram shows the location of the **transmitter (TX)** and **receiver (RX)** jumpers and the positions they will be in when set matching modulation frequencies.

Note: If you change the modulation sweep rate on the transmitter you must also change the associated receiver(s) modulation frequency to match the transmitter (this must be done to all receiver(s) paired with the transmitter).

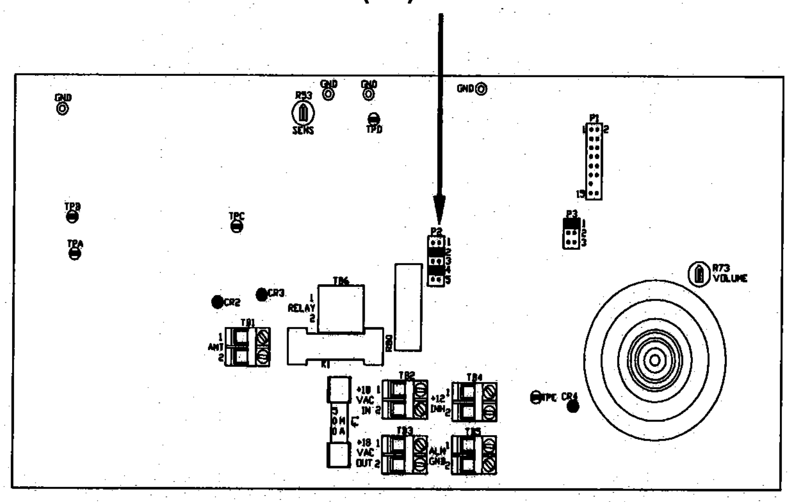
Offsetting Modulation Frequency Jumper Settings

81.4 Hz (NORMAL)
TX **RX**

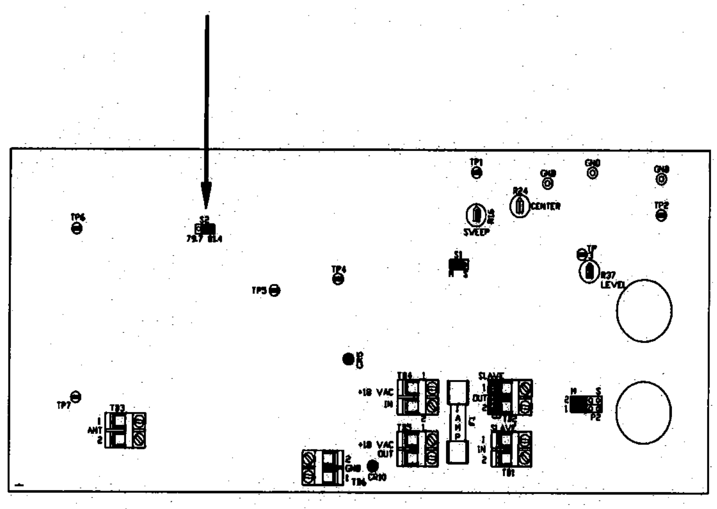
79.7 Hz (OFFSET)
TX **RX**



RECEIVER (RX) P2



TRANSMITTER (TX) S2



Master/Slave Method

Once that it has been determined that it is necessary to wire the systems as master and slaves you must select the transmitter that would best serve as the master. It will be necessary to leave one of the transmitters in the master mode and change all other transmitters to the slave mode. It will then be necessary to wire all of the remaining transmitters together.

When the following steps are completed the master transmitters will provide the RF and sweep frequency for all slaved transmitters. The slaved transmitters will only act as amplifiers for the RF signal generated by the master and will be synchronized with the master transmitter.

Master/Salve Jumper Settings

All transmitters are shipped from the factory configured in the master mode. To reconfigure to the slave mode you must move the jumpers at location S1 and P2 on the transmitter from the master (M) side of the jumper black to slave (S) side of the jumper block (see detail in Master/Slave diagram #1).

Note: The above changes are to be made only to the transmitter(s) designated as slave(s).

When two or more systems are designated for installation at the same site they may be shipped from the factory with offset modulation frequencies. All of the transmitters and receivers must have their modulation frequencies set to the modulation frequency of the **master** transmitter. (Reference **offsetting modulation frequency** section of this manual.)

Master/Slave Wiring

Connect the master transmitter to the slave transmitter following the **master/slave diagram #1**. Be sure to have wires connected to the proper terminal blocks with the correct polarity (see detail in master/slave diagram #1). EASI recommends using a 22 AWG., shielded, 2 pair/twisted wire (see list below for the recommended cable manufacturers and their corresponding part numbers).

Manhattan #4473
Alpha #2466
Belden #8723

Note: The last slaved transmitter on the slaved wire must have a 51 OHM resistor installed in position TB2 (see detail in master/salve diagram #1).

Low Voltage AC Power Wiring
(Reference Diagrams #1, #2, #3, and #4)

The low voltage AC power supply is normally installed no farther than 10 running feet (3.05m) from the antenna. If the distance is greater than 10 feet (30.5m) use 18 gauge wire to increase the length of the low voltage AC power supply wire. Refer to the Cable Placement Diagram #1 for the general placement of low voltage AC or slave wiring. All wires entering an antenna should be 90 degrees (at a right angle) to the antenna base and enter as close as possible to the center of the antenna base. In all cases the cables from the transmitter antenna must exit at 90 degrees to the antenna and travel at least 6 inches (15.25cm) before turning. If the installation will not allow the power supply wire to make a 6 inch (15.25cm) straight run into the transmitter, install the receiver antenna on the side closest to the power supply and the transmitter antenna on the other side.

To connect the low voltage AC power wires to the system, refer to the applicable Power Wiring Diagrams #2, #3 or #4. Use the following table to select to correct wiring diagram.

System Configuration	Diagram #
Single Aisle no Lights	2
Single Aisle with Lights	3
Dual Aisle no lights	4
Dual Aisle with Lights	4

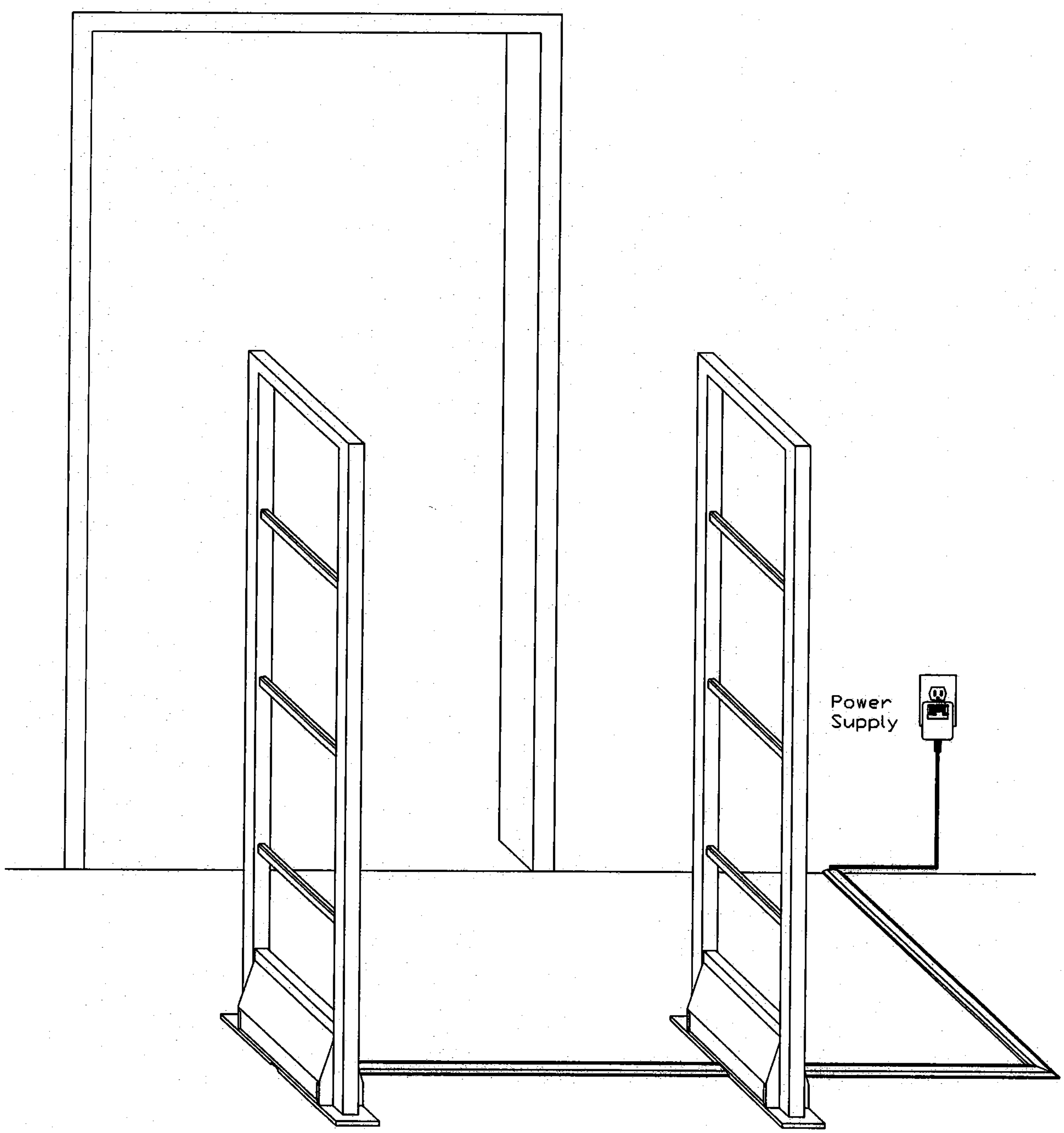
Powering Transmitter First

If the low voltage AC power is brought in on the transmitter side, connect the red wire to transmitter TB4 terminal 1 and connect the black wire to transmitter TB4 terminal 2. Connect the red wire of the interconnect pair (Belden 9740) to the transmitter TB5 terminal 1. Connect the black wire of the interconnect pair to the receiver TB2 terminal 1. Then connect the black wire of the interconnect pair to the receiver TB2 terminal 2.

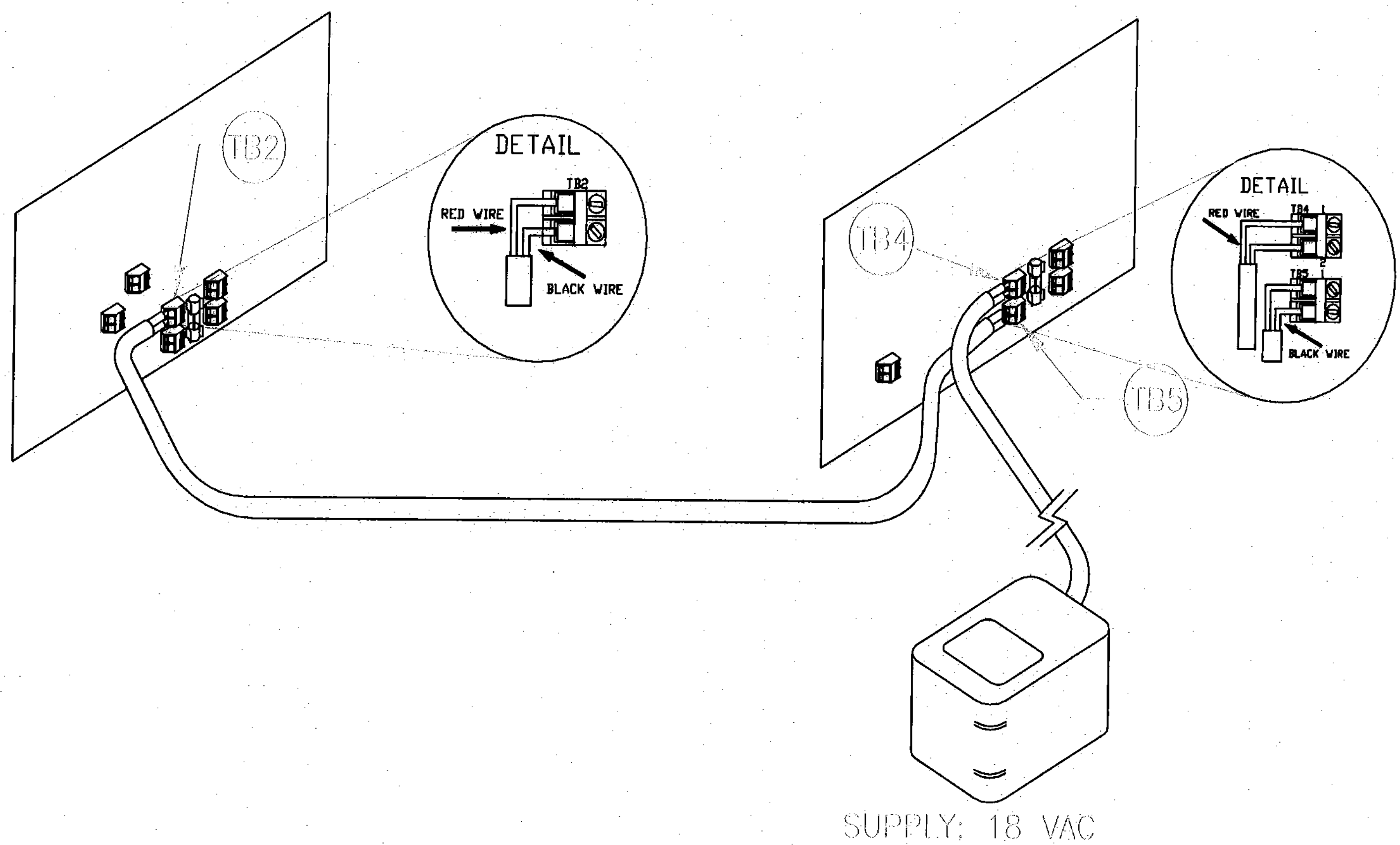
Power Receiver First

If the low voltage AC power is brought in on the receiver side, connect the red wire to receiver TB2 terminal 1 and connect the black wire to the receiver TB2 terminal 2. Connect the red wire of the interconnect pair (Belden 9740) to the receiver TB3 terminal 2. On the transmitter connect the red wire of the interconnect pair to the transmitter TB4 terminal 1. Then connect the black wire of the interconnect pair to the transmitter TB4 terminal 2.

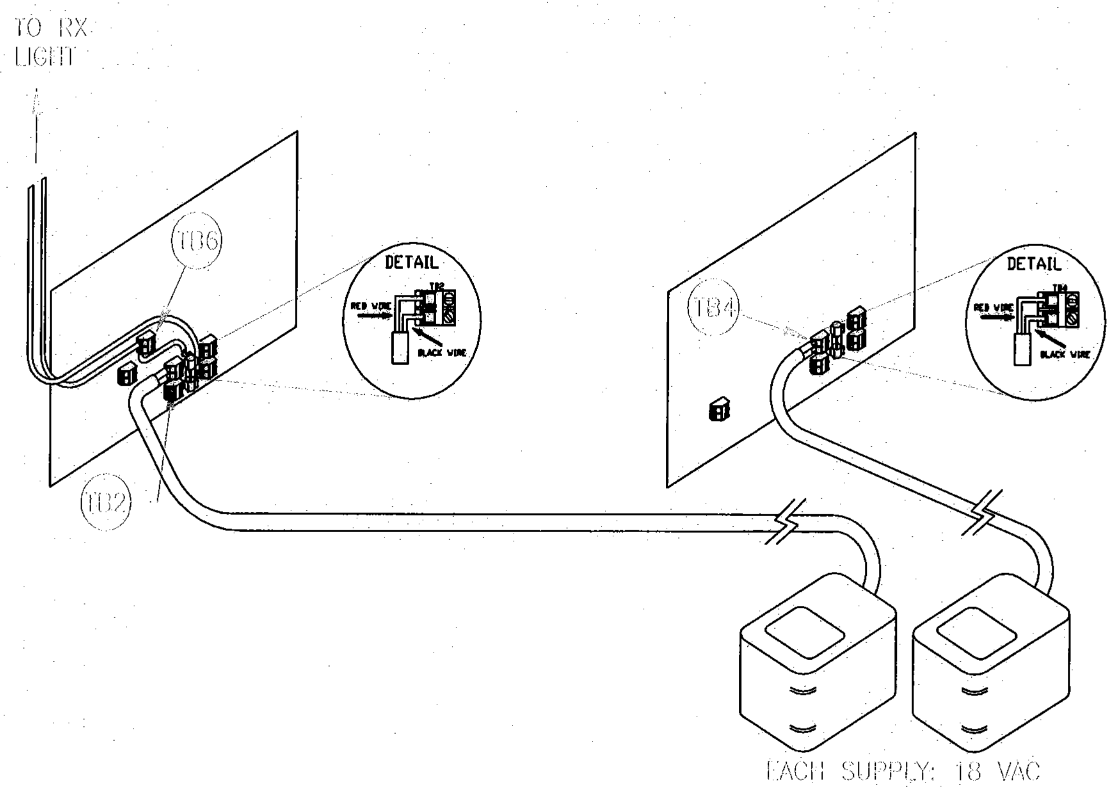
Low Voltage AC Wiring Diagram #1



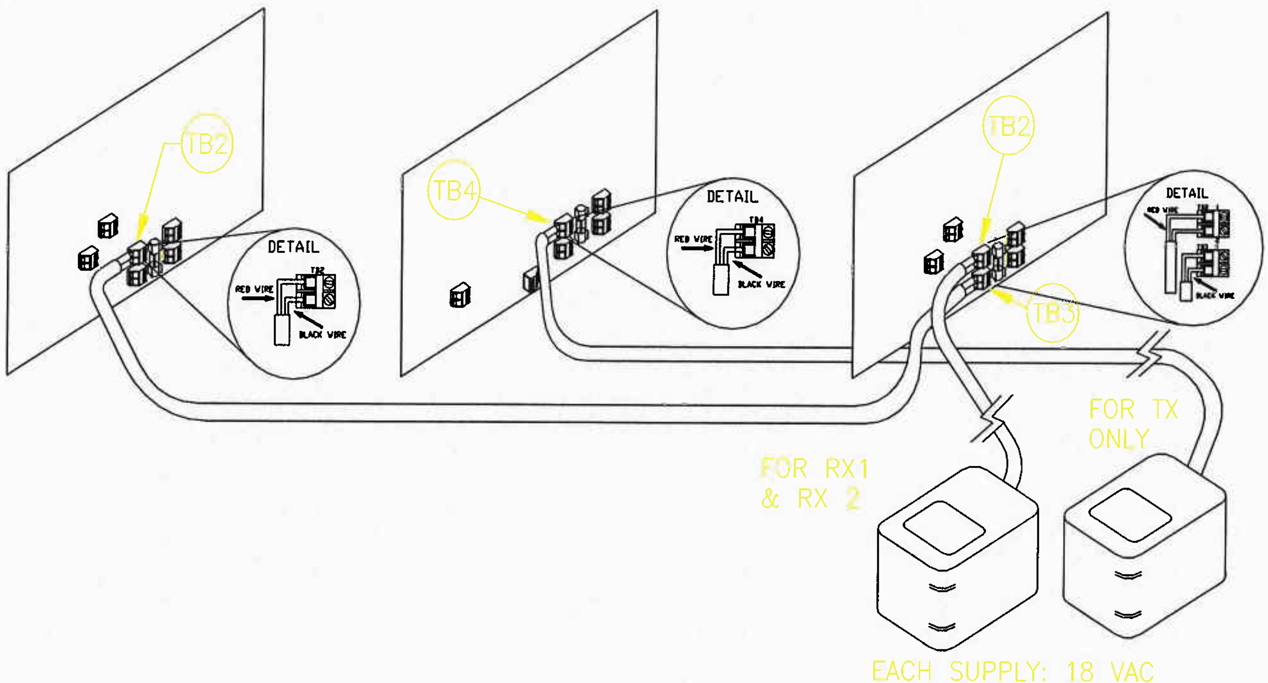
Low Voltage Power Wiring Diagram #2



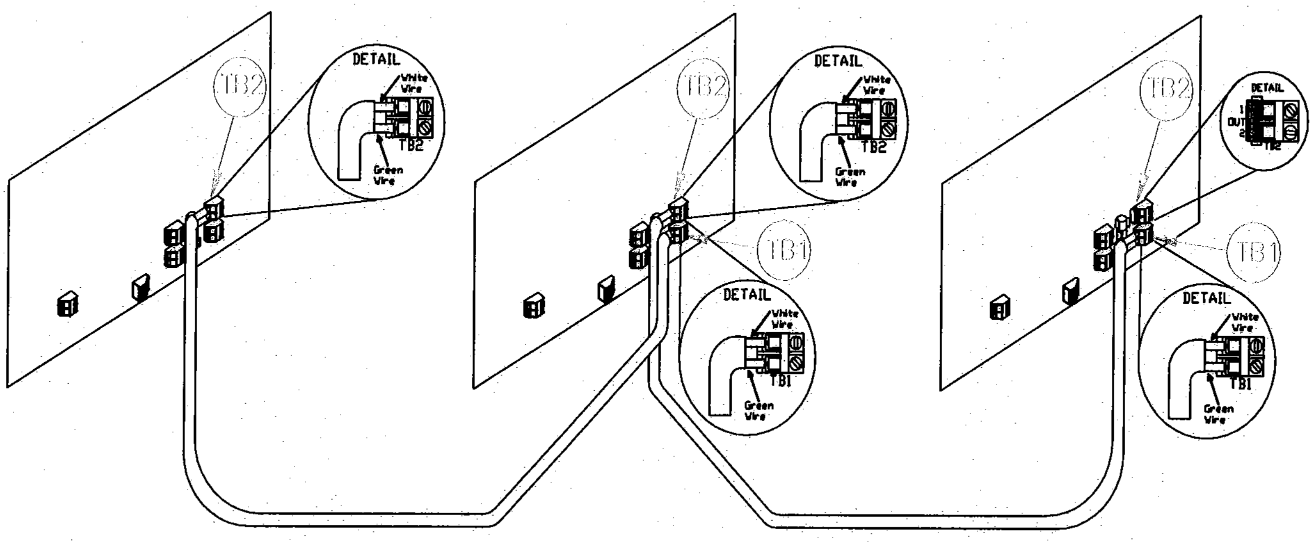
Low Voltage AC Power Wiring Diagram #3



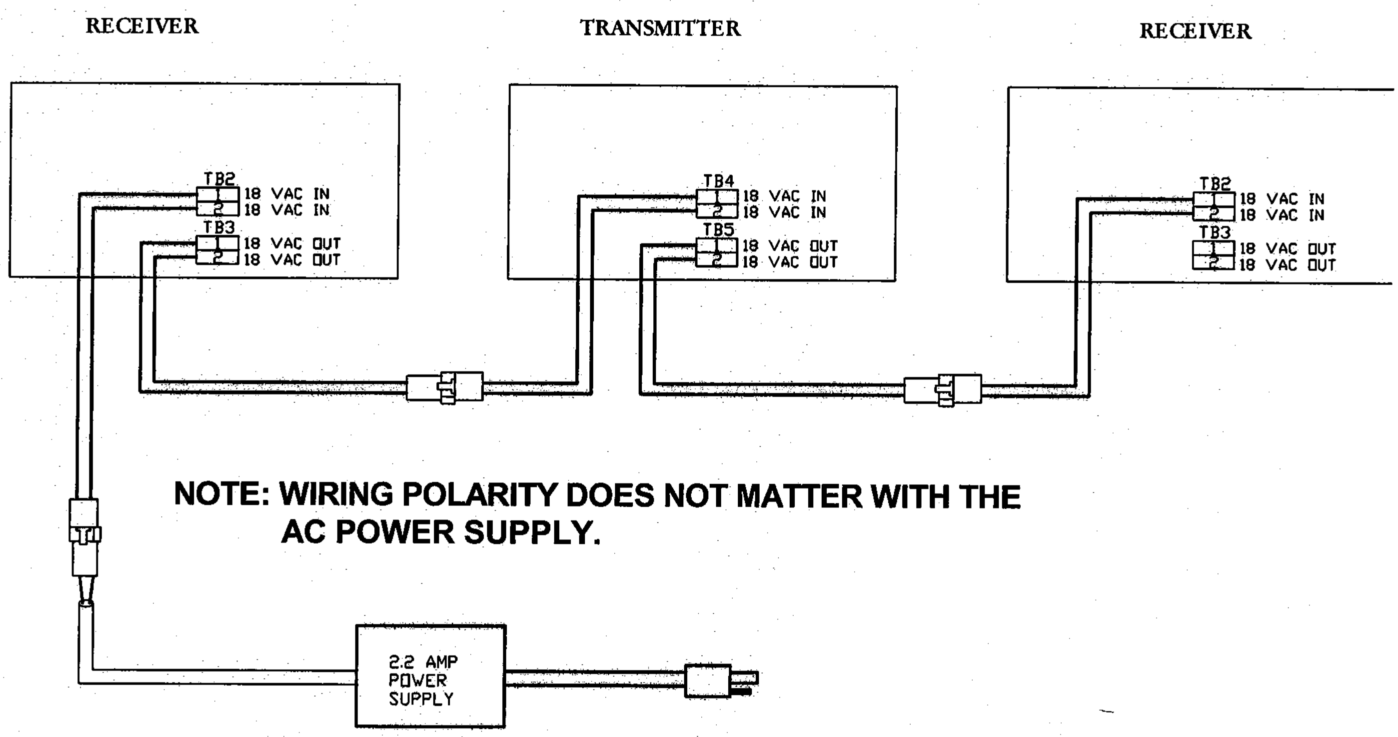
Low Voltage AC Wiring Diagram #2



Master/Slave Wiring Diagram #1



Dual Aisle Wiring Diagram
2.2 AMP Power Supply



Baseplate Installations

In some locations it may be desirable or required to install the EASI system on a portable baseplate. This baseplate is made of bent steel and is covered in a rubber mat. This provides a firm mounting surface at a preset aisle width that also eliminates the need to drill holes in the customers floor.

The portable baseplates are available from EASI in 3 foot (91.4cm), 4 foot (122cm), and 6 foot (182cm) widths. The correct width of the baseplate is determined by the type of detection label being used. Refer to the "detection tag" section of this manual for the proper widths.

The following steps are for the assembly of the EASI system to a baseplate.

Single-Aisle System

(Reference Baseplate Installation Diagram #1 & #2)

1) Remove the two antennas and the baseplate from their packaging.
2) Remove the four antenna mounting bolts and the power supply from the box.
3) Place the baseplate on the floor tilted on one edge. Slide the interconnect cables located at the bottom of each of the antennas through the holes in the base. Using the antenna mounting bolts, hand-tighten the antennas to the base.

Note: A single aisle system without lights will have one antenna with 2 wires. This antenna should be mounted on the side of the baseplate nearest the power supply.

4) Connect the two gray interconnect cables underneath the base together.

Note: The ends of the interconnects are keyed and can only be plugged together one way.

5) Before tightening all mounting bolts, make sure that none of the wires are being pinched under the bases of the antennas.
6) Attach the provided wire clips between the channels on the bottom of the moveable base and place the gray interconnect wires into the clips.

Important: During manufacturing, an oil is applied to the metal baseplate and must be cleaned with a solvent before adhering the wire clips.

7) Connect the power supply cable to the 1 foot black power cable attached to the antenna.
8) Stand the system upright and plug the systems power supply into the required voltage source.

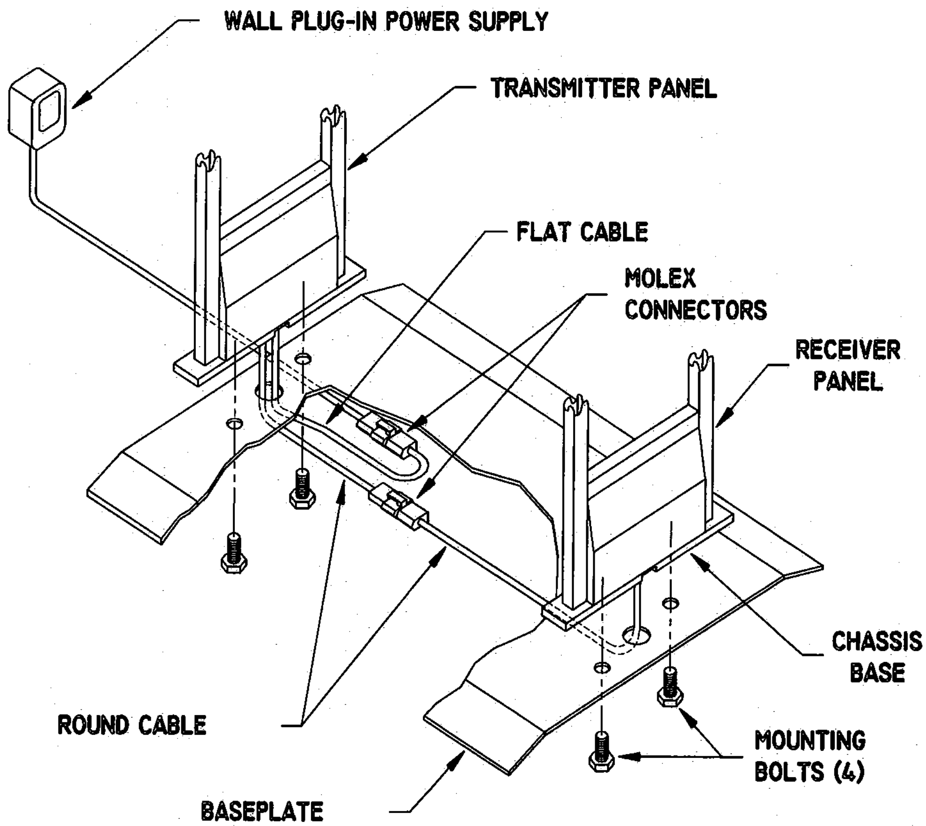
Dual-Aisle System
(Reference Baseplate Installation Diagram #3 & #4)

The dual aisle system is assembled the same as a single system except for the following:

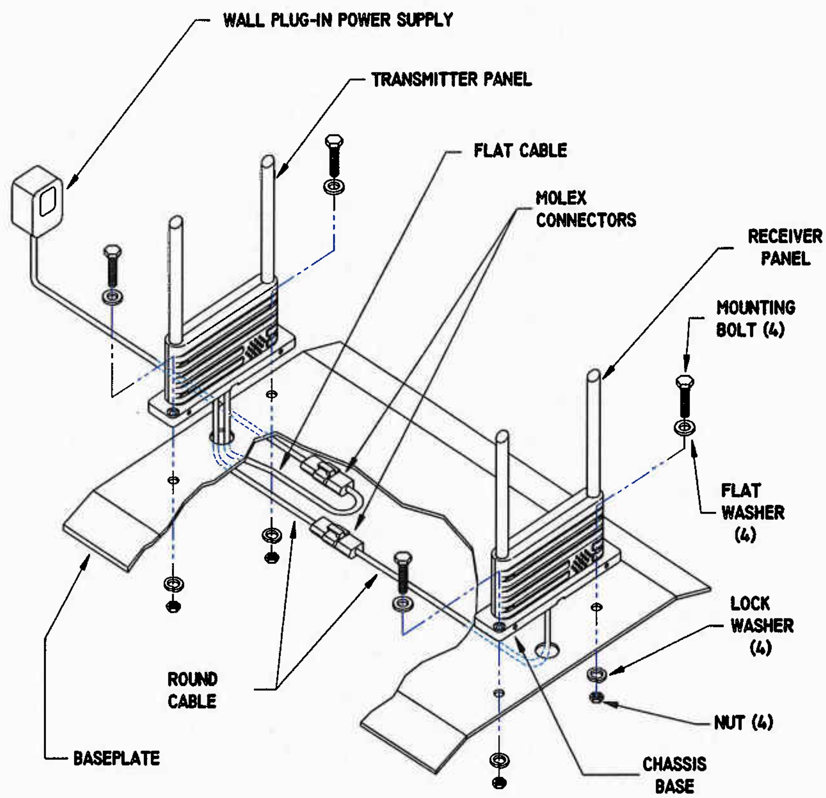
A dual-aisle system consists of a transmitter and two receivers. The antennas are marked at the factory by a label attached to the antennas specifying the transmitting antenna. **The transmitter antenna must be mounted in the center position.**

Note: All system tuning instructions and operational guidelines are the same for a baseplate mounted system and a floor mounted system.

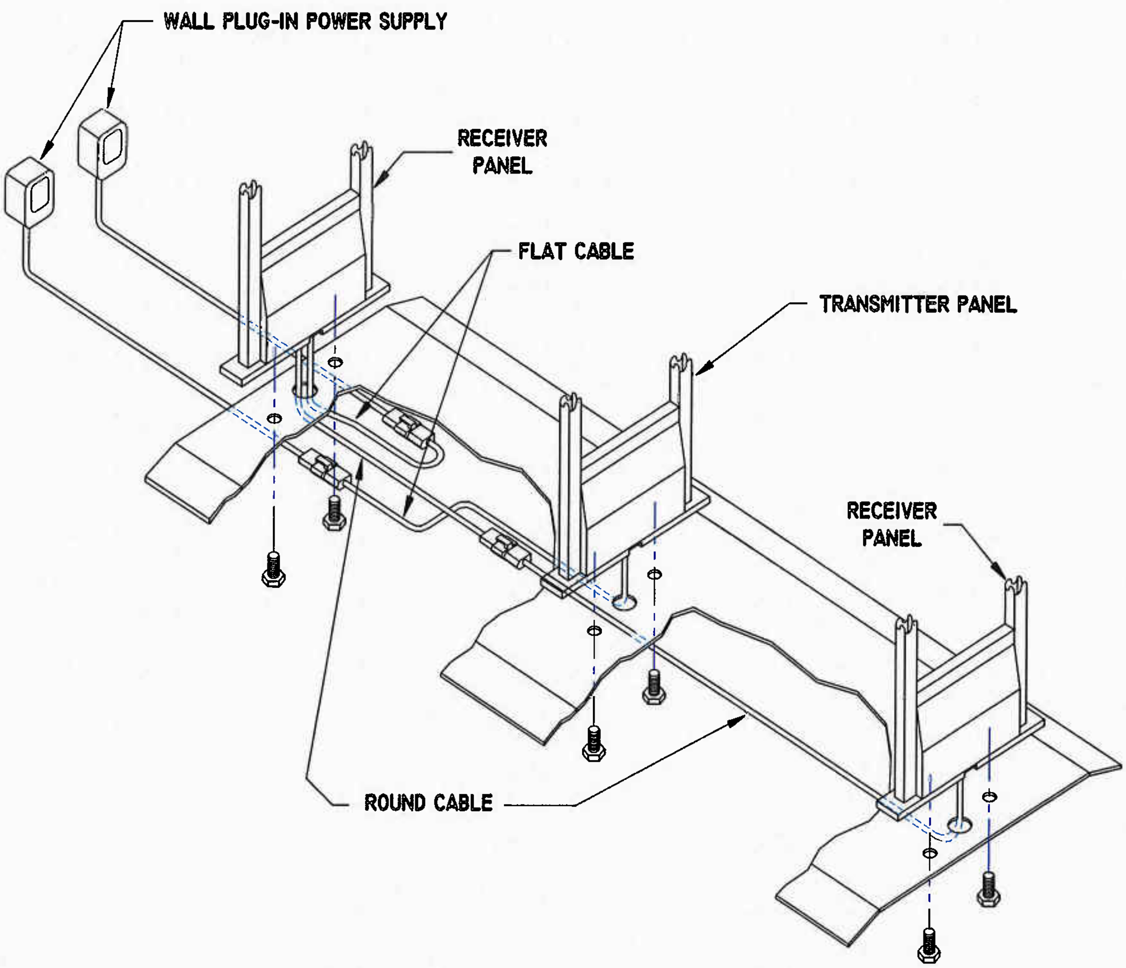
Basepalte Installation
Diagram #1



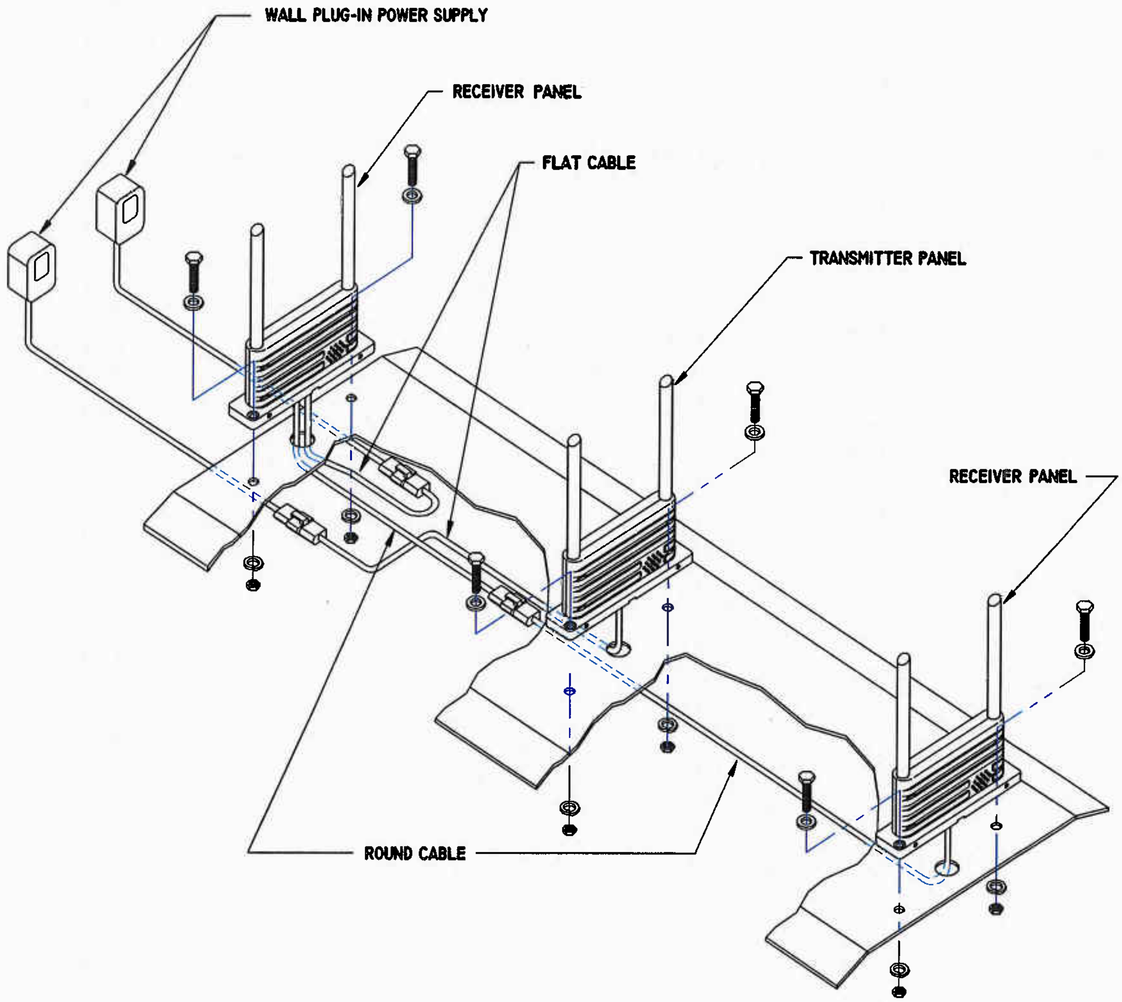
Basepalte Installation
Diagram #2



Basepalte Installation Diagram #3



Basepalte Installation Diagram #4



System Tuning

Note: All adjustments on the EASI circuit board have screwdriver slots with arrows on one end. The position of these arrows are referenced to a clock (e.g. 10 o'clock, 11 o'clock, etc) . All EASI adjustments are clockwise (right) to increase and counterclockwise (left) to decrease.

Set-up and Testing the System

The majority of settings and adjustments on the transmitter and receiver circuit boards are preset at the factory. A typical single aisle installation usually only requires adjustment on the receiver of the Sensitivity (R53) and Volume (R73) and adjustment on the transmitter of the Level (R37). Additional settings and adjustments are covered individually as required.

Typical System Adjustments

Visually check for the following settings:

Transmitter

36in (91.4cm)	Aisle widths - R37 (level) - Arrow at 12 o'clock position	
48in (122cm)	Aisle widths - R37 (level) - Arrow at 1 o'clock position	
66in (168cm)	Aisle widths - R37 (level) - Arrow at 2 o'clock position	
8.2 MHz	Tag Frequency	R16 (sweep) - Arrow at 11 o'clock position R24 (center) - Arrow at 10 o'clock position
9.5 MHz	Tag Frequency	R16 (sweep) - Arrow at 11 o'clock position R24 (center) - Arrow at 11 - 11:30 o'clock position
10 MHz	Tag Frequency	R16 (sweep) - Arrow at 1 o'clock position R24 (center) - Arrow at 12 o'clock position

S1 Jumper ON left position for master
S2 Jumper ON right position for 81.4 Hz
P2 Both jumpers ON "M" position for master

Receiver

36in (91.4cm)	Aisle widths - R53 (sens) - Arrow at 11 o'clock position
48in (122cm)	Aisle widths - R37 (sens) - Arrow between 10 and 11 o'clock position
66in (168cm)	Aisle widths - R37 (sens) - Arrow at 10 o'clock position
(R73) Volume	Arrow at 12 o'clock position
P2	Jumpers ON positions 2 & 4 (81.4 Hz/soft tag/Med. Fast tag reaction) Jumpers ON positions 3 & 4 (81.4 Hz/soft tag/Med. Fast tag reaction)
P3	Jumper ON position 1 (fast beep) Jumper ON position 2 (slow beep)

Note: The sweep setting at P2 (position 1) on the receiver board must match the sweep setting at S2 on the transmitter board. If the sweep settings are incorrectly matched, the system will not detect the presence of security tags (labels).

Alarm Time Adjustment

The alarm sound is factory preset for last 2 seconds (fast beep). For some installations where store personnel may not be near the exit, it may be desirable to increase the length of the alarm. This alarm time can be changed to 4 seconds by moving the jumper to receiver P3 position 2 (slow beep).

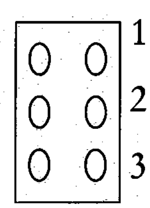
Alarm Rate Adjustment

In some installations, particularly in multiple aisle installations it may be desirable to change the alarm rate to differentiate alarm sounds between aisles. The system is factory preset to provide a Fast Beep sound. This can be changed to a Slow Beep by removing the jumper from receiver P3 position 1.

P3 Jumper Settings

1 is Off = Slow Beep
1 is On = Fast Beep
2 is Off = 2 second Alarm Time
2 is On = 4 second Alarm Time
3 is Not used

P3



Reaction Level

It is possible to effect the reaction level (overall sensitivity) of the receiver by changing the jumpers on receiver P2. The four (4) possible settings are listed below.

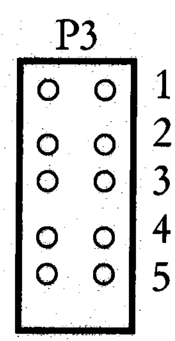
Setting	Pos. 4	Pos. 5	
#0 (slowest)	Off	Off	Slowest tag reaction level (Lowest phantom alarm potential)
#1	Off	On	Medium/Slow tag reaction level
#2	On	Off	Medium/Fast tag reaction level
#3	On	On	Fastest tag reaction level but increased phantom alarm potential (not recommended for aisle widths above 3 feet).

KB Receiver
P2 Jumper Settings

Modulation Frequency
1 is Off = 81.4 Hz
1 is On = 79.7 Hz

Key
On = Jumper "on" position
Off = Jumper "off" position

Tag Type
2 is Off & 3 is Off = Hard Tag
2 is Off & 3 is On = Hard tag & 2" X 2" Tag
2 is On & 3 is Off = 2" X 2" & 1.5" X 1.5" Tag
2 is On & 3 is On = 1.5" X 1.5" Tag



Reaction Level
4 is Off & 5 is Off = Slow
4 is Off & 5 is On = Medium Slow
4 is On & 5 is Off = Medium Fast
4 is On & 5 is On = Fast

KB Transmitter
Detailed Technical Description

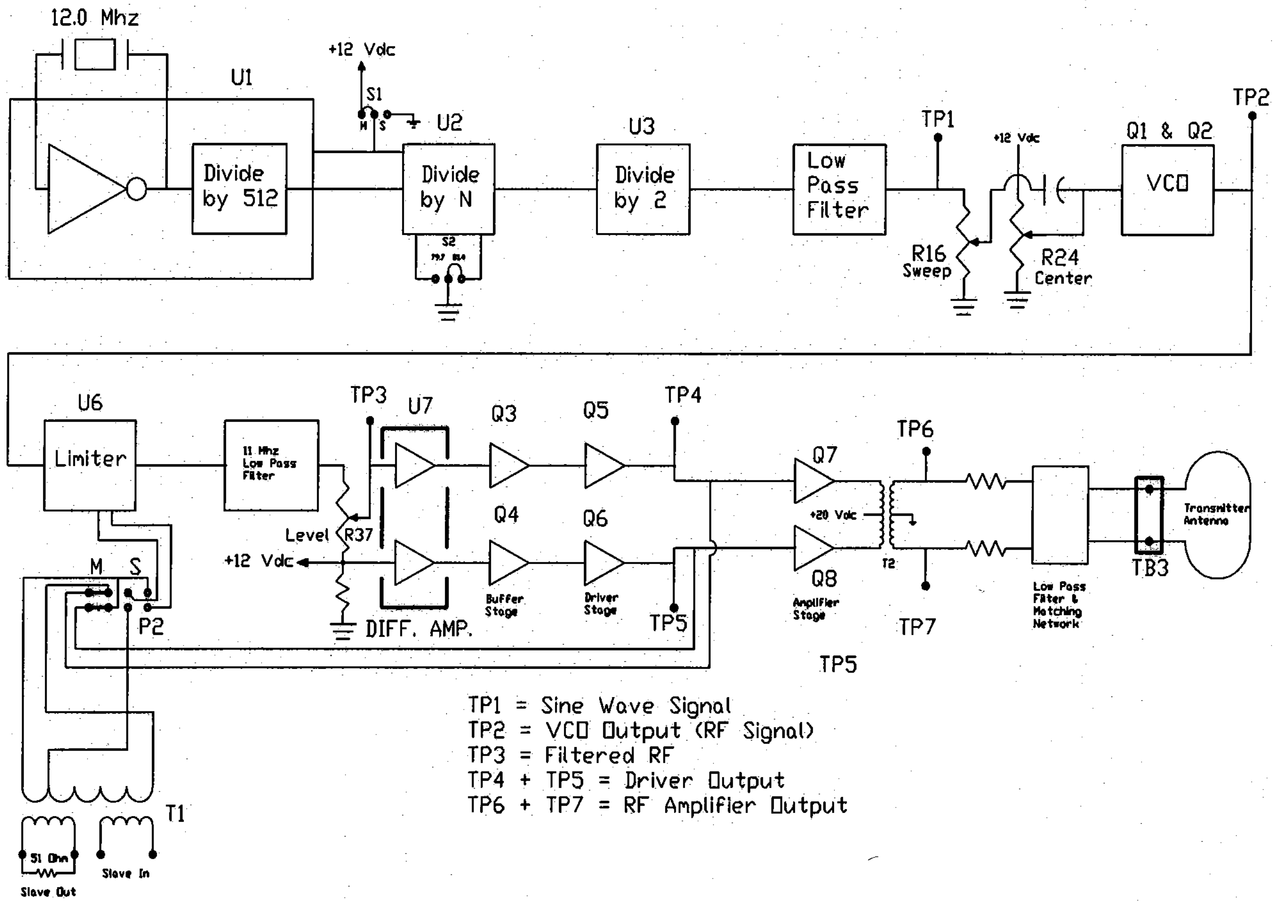
Refer to the KB Transmitter block diagram for detailed technical description.

The transmitter sweep frequency is derived from a 12 MHz clock at U1 (Divider and Oscillator). U1 provides active elements of the 12 MHz oscillator, in addition it divides the clock frequency by a fixed division ration of 512. The 23.4375 KHz square wave output of U1 is further divided by the programmable counter (U2). U2 is nominally set to divide by 144 to obtain a frequency of 162.7604 Hz or field programmed to divide by 147 to obtain a frequency of 159.4387 Hz. The jumper positioning at S2 sets the sweep rate of the transmitter. The output of U2 is an asymmetric square wave at twice the desired frequency. U3 (flip-flop) divides this signal by 2 to obtain a symmetrical square wave at the desired frequency (81.38 or 79.7194 Hz). An active 100 Hz low passes filter using dual op-amp (U4) filters the square wave to produce a sine wave sweep signal. Transistors Q1 and Q2 are the active elements of the voltage controlled oscillator circuitry (VCO) which generates the transmitter radio frequency (RF) signal source. The control voltage input of the VCO is DC coupled to potentiometer R24 which sets the VCO center frequency (8.2 MHz, 9.5 MHz, or 10.0 MHz). The VCO control voltage input is also AC coupled to the wiper arm R16. Potentiometer R16 controls the sweep signal amplitude to the VCO and hence the sweep range of the transmitter. The RF output signal from the VCO is amplified and limited by U6 (amplifier). The limited square wave output of U6 is filtered by an 11 MHz passive low-pass filter and applied to the level control potentiometer R37. The wiper of R37 is applied to U7 (video amplifier) which serves as an RF amplifier and signal phase-splitter. The output signals from U7 (two 180 degree differential signals) are fed to the bases of transistors Q3 and Q4 which act as buffers to the next stage of circuitry (drive stage). The outputs of Q3 and Q4 are fed to the bases of transistors Q5 and Q6. These transistors are connected in a class AB (push-pull) configuration and serve as current drivers for the final RF amplifier stage . The emitter outputs of Q5 and Q6 are capacitor coupled to the bases of Q7 and Q8. Transistors Q7 and Q8 are also connected in a class AB configuration and provide the final stage amplification of the RF signal before matching and filtering occur. The outputs of Q7 and Q8 and connected to primary side of transformer T2. The secondary side of T2 is connected to a matching network consisting of a resistive load (R57-R68), and a passive low-pass filter. The transmitter's antenna is connected to the matching network by a terminal connector block (TB3) and connector block (TB3) and completes the matching network "load" for the transmitters final RF output.

The transmitter can operate in a "Master" or "Slave" mode. In the "Master" mode, a small RF signal is tapped from the driver stage (Q5 and Q6) and is available at jumper select P2 on the transmitter board. When the mini-jumpers at P2 are placed in the "Master" mode, the RF signal path to T1 is completed. The RF signal I now present at TB2 on the transmitter board can be transferred to another transmitter (in the "Slave" mode) by the use of a twisted shield pair of wires. Jumper select S1 (in the "Master" mode) connects the 12 volt DC power source to the sweep frequency generation circuitry (U1-U5) and VCO circuitry (Q1 and Q2).

When the transmitter is in the "Slave" mode, it accepts a small RF signal (at TB1) from another transmitter. The jumper select P2 is set for "Slave" mode. This connects the primary side of T1 to the limiter U6. The RF signal is then limited, filtered, and amplified by the transmitter remaining output stages. In the "Slave" mode, the sweep frequency generation circuitry (U1-U5) and VCO (Q1 and Q2) are disabled at jumper select S2.

Transmitter Block Diagram

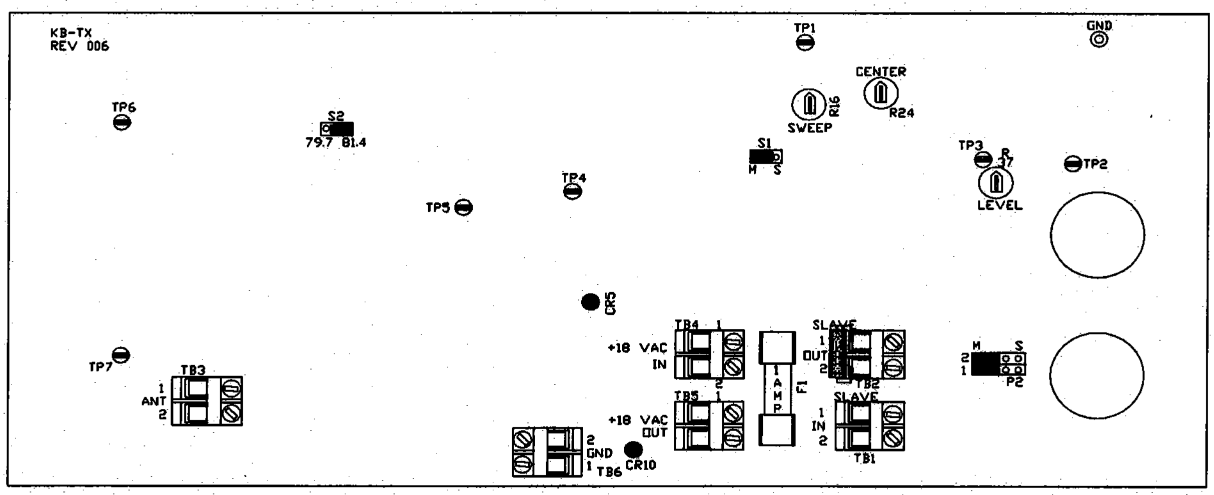


TP1 = Sine Wave Signal
TP2 = VCO Output (RF Signal)
TP3 = Filtered RF
TP4 + TP5 = Driver Output
TP6 + TP7 = RF Amplifier Output

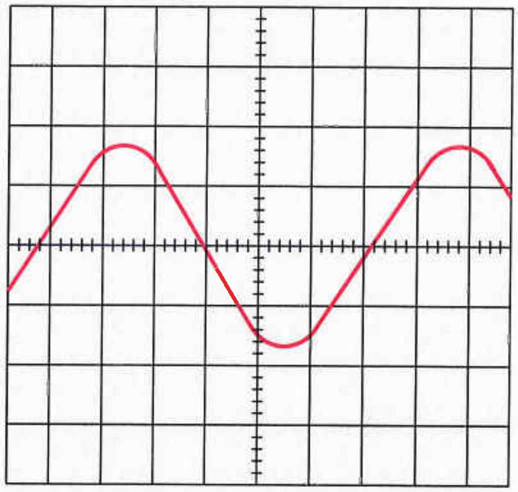
KB Transmitter
Circuit Board Test Points

TP 1 81.4 Hz Sinewave, 3.4 V P-P
TP 2 VCO, 2 V P-P
TP 3 Limiter / Filter output, 50 mV P-P
TP 4 Driver output of Q5 (Same value as TP5), 1.1 V P-P
TP 5 Driver output of Q6 (Same value as TP4), 1.1 V P-P
TP 6 RF Amplifier output (Same value as TP7) 20 V P-T
TP 7 RF Amplifier output (Same value as TP6) 20 V P-T

NOTE: ALL TEST POINT MEASUREMENTS ARE BASED ON THE STANDARD 3' (.91m) SINGLE-AISLE SYSTEM.



TEST POINT #1

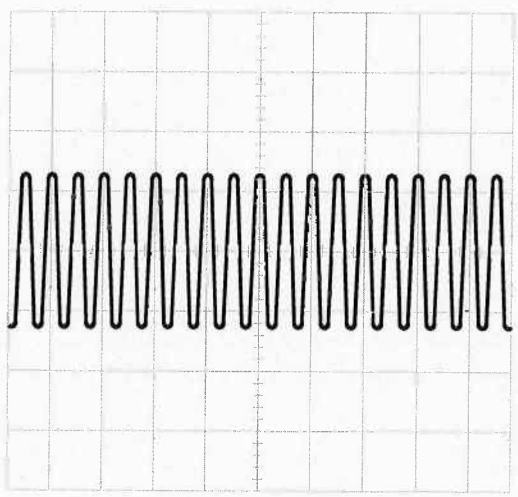


Scope settings using an X10 probe (channel 1):

.1V/Div 2mS/Div AC Coupling Trigger off channel 1

TP1 is the sine wave sweep signal derived from the component U1 (12 MHz oscillator/frequency divider) and shaped by component U4 and it's surrounding circuitry (active low pass filter). The purpose of this signal is to sweep the VCO circuitry. The frequency of the signal (81.4 or 79.7 Hz) is determined by the jumper settings at S2 on the transmitter board. This signal should be approximately 3.4 V P-P (+/- .2V).

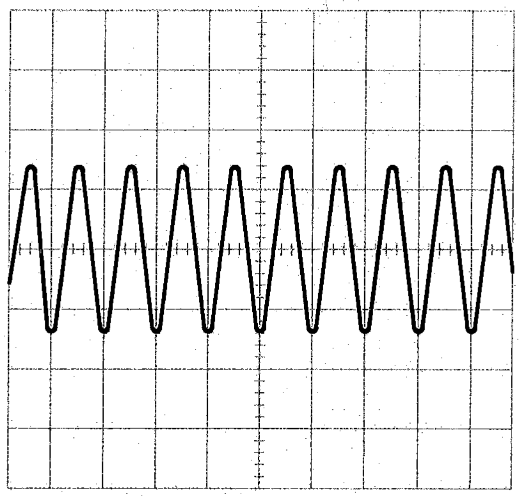
TEST POINT #2



Scope settings using an X10 probe (channel 1):

.1V/Div .2uS/Div AC Coupling Trigger off channel 1

TP2 is the frequency swept (RF) output signal from the VCO. The voltage at TP2 should be approximately 2.5 V P-P (+/- .2 v)

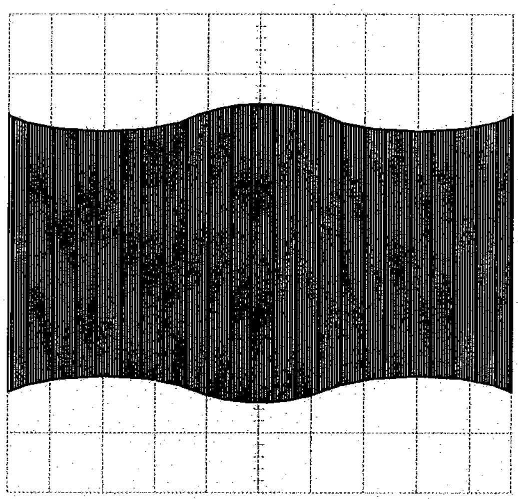


Scope settings using an X10 probe (channel 1):

2 mV/Div .2uS/Div AC Coupling Trigger off Channel 1

TP3 is the RF output of component U6 (limiter) and it's preceding filter circuitry. The voltage at TP3 should be 50 mV P-P (+/- 10 mv).

TEST POINT #4 & 5

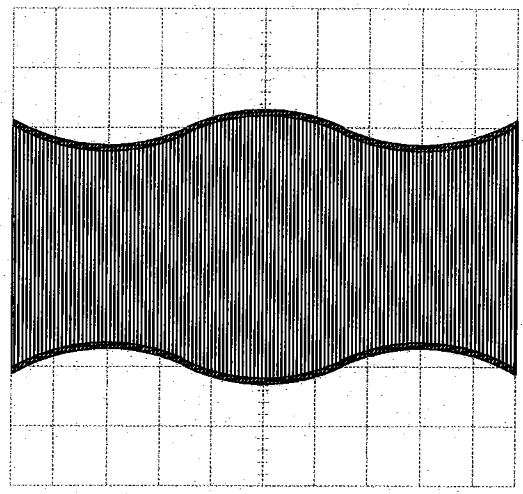


Scope settings using an X10 probe (channel 1):

50 mV/Div 1mS/Div AC Coupling Trigger off Channel 1

TP4 & 5 are the RF output signals coming from driver transistors Q5 and Q6. These signals should be identical to each other. The voltage at TP4 & 5 should be 1.1 V P-P (+/- .3 V P-P).

KB Transmitter Test Points



<u>Scope settings using an X10 probe (channel 1):</u>

.5 V/Div	2 ms/Div	AC Coupling	Trigger off TPE on receiver board using a 1:1 scope probe

TP 6 & 7 are the RF amplifier output signals (balanced by T2) of the transmitter prior to final filtering. These signals should be identical to each other. The voltage at TP6 & 7 should be 20 V P-T (+/- 3 V) with R37 (level) set at the 12 o'clock position.

KB Receiver
Detailed Technical Description

Refer to the KB receiver block diagram for the detailed technical description.

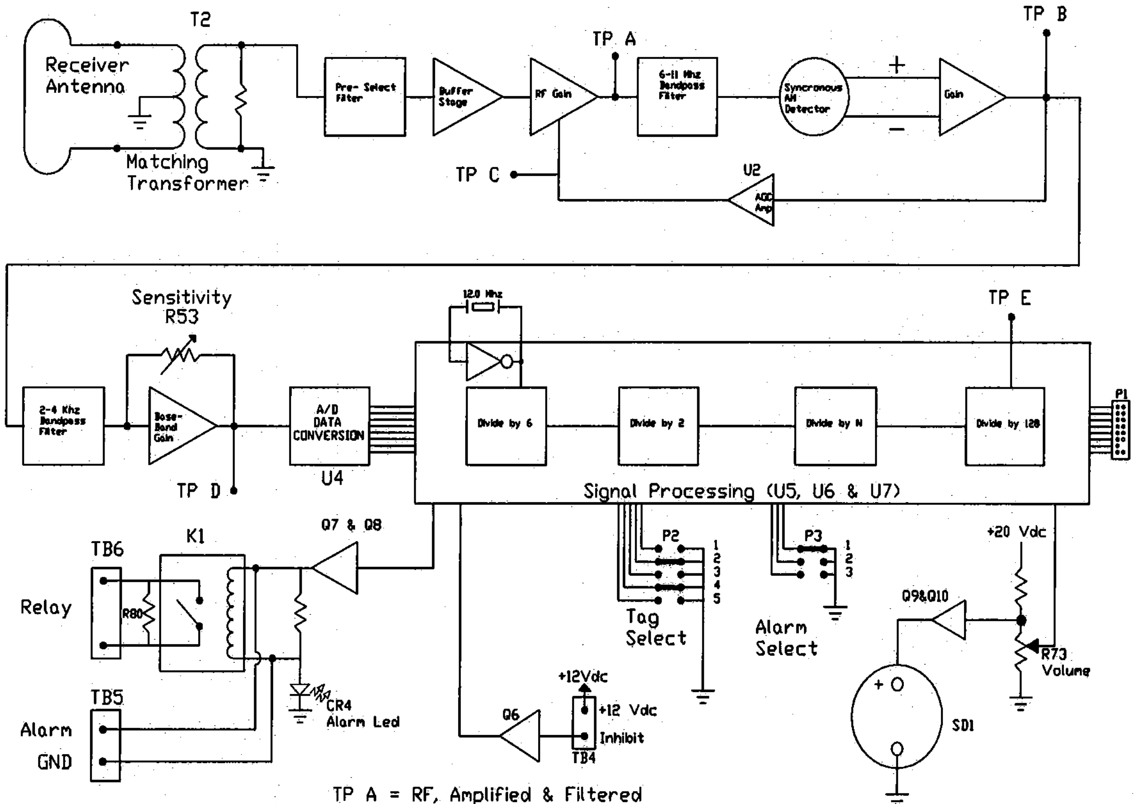
The swept RF signal generated by the transmitter is received in the KB receiver's loop antenna, combined in the antenna matching transformer (T2) and fed to an 11 MHz pre-select low-pass filter. The output of the preselect low-pass filter feeds a buffer stage consisting of transistor Q1 and its surrounding circuitry (R4-R6). The output from Q1 (receive signal) is amplified by a variable gain RF amplifier stage formed by transistors Q2 thru Q5. The output of the RF amplifier stage is filtered by a passive 6 MHz to 11 MHz bandpass filter so that the primary signal reaching the detector (U1) is only the frequency swept transmitter signal. The output of the synchronous AM detector (U1) is connected to one of U2's quad operational amplifiers (op-amp) and DC coupled to another circuit using a second op-amp from U2. This circuit is used for automatic gain control (AGC) on the receiver. The AGC voltage (DC) is sent back to the variable gain of the RF amplifier circuitry. This creates an AGC loop which regulates the gain of the RF amplifier and keeps the input level of the detector (U1) constant regardless of input-signal strength. Small signals created by the resonant circuit tag passing between the transmitter and receiver, are detected by U1 and coupled to an active 2 KHz to 4 KHz bandpass filter. The bandpass filter is followed by a baseboard gain stage supplied by two of U3's quad op-amps. Gain is adjustable in this stage by setting potentiometer R53 as required for different aisle widths, tag types, or environmental noise. Testpoint D on the receiver board is available for observing the band-base signal (noise activity) with an oscilloscope. The base-band or video signal is converted from an analog voltage to digital signals by U4 (A/D converter). The data bus from U4 feeds the digital signals by U4 (A/D converter). The data bus from U4 feeds the digital data to a signal processor chip (U5). This chip performs several functions. One function is to control the operation of U5 and U7 to provide output to P1 (A test board is available which mates to P1 and provides test signals useful for troubleshooting). The primary function of U5 however, is to process the data from U4 and determine whenever signals are present indicating that a resonant tag has passed between the transmitter and receiver. The jumper positioning at P2 selects the sweep frequency, "tag type", and reaction level of U5. When a sufficient amount of tag information has been acknowledged by U5, it will generate a pulse signal for a pre-setable period of time controlled by jumper select P3. The pulsing signal from U5 is amplified by transistors Q9 and Q10 to drive an audible an audible alarm sounder (SDI). The voltage to the sounder is adjusted by potentiometer R73 which acts as a volume control for the alarm sound.

The KB receiver has the ability to drive an external alarm light source. At the customers request, additional circuitry consisting of relay (K1), power resistor (R80) and terminal block (TB6) can be added to the receiver board. When U5 acknowledges the presence of a resonant tag, it generates a pulse signal for a specified duration of time (set at P3). The pulsing signal from U5 is amplified by transistors Q7 and Q8. The output from Q7 drives an alarm light emitting diode (CR4) and relay circuit (K1). The alarm L.E.D. (CR4) and audible alarm sounder (SD1) will turn on at the same time during an alarm condition. The output of relay K1 is tied to a 5 watt power resistor (R80) and terminal block (TB6). Resistor R80 is used to pre-warm the external alarm light to prevent power surging on the KB receiver relay (K1). The wires from the external alarm light connects to terminal block TB6.

Note: The following circuit board connections are not required if you are using a EASI deactivation unit.

The KB receiver also has the capability to accept external signals from other manufactures frequency swept deactivation units. This maybe necessary when other than EASI manufactured deactivation units are in close proximity to a EASI detection system. System inhibiting can be achieved be connecting a twisted shielded pair of wires from the deactivation unit (Inhibit output) to terminal block TB4 on the receiver board. The pulse of "inhibit" signal generated from a deactivation unit, will alert the microprocessor (U5) that deactivation of a resonant tag is taking place. The receiver will then be inhibited and will temporarily ignore other signals coming from U4 unit until the inhibit signal is no longer present to TB4. The reason for this is to prevent system "false" or "phantom" alarm conditions from occurring during deactivation time.

Receiver Block Diagram

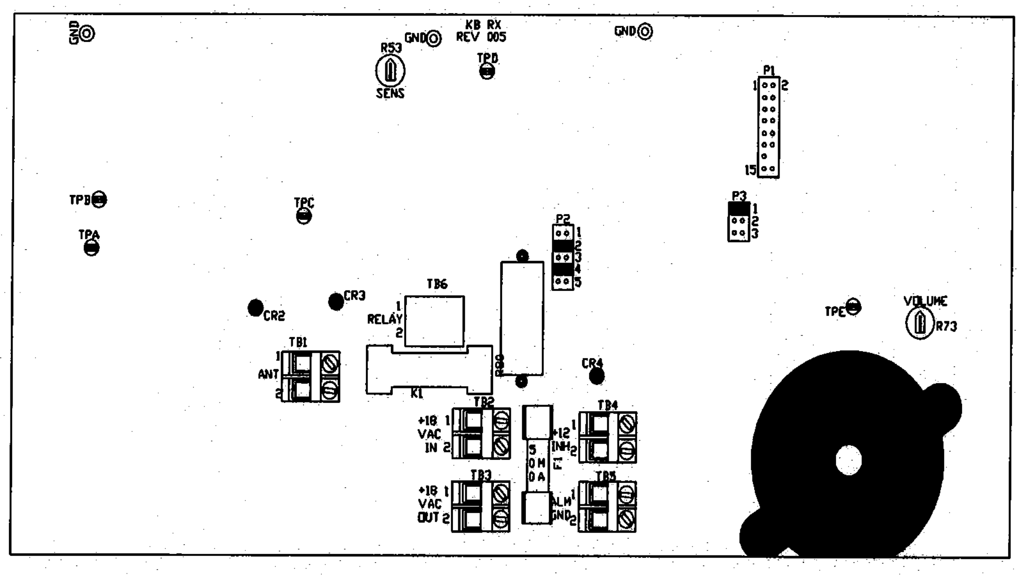


TP A = RF, Amplified & Filtered
TP B = Detector Output
TP C = AGC Voltage
TP D = Tag Signal
TD E = Oscilloscope Sync

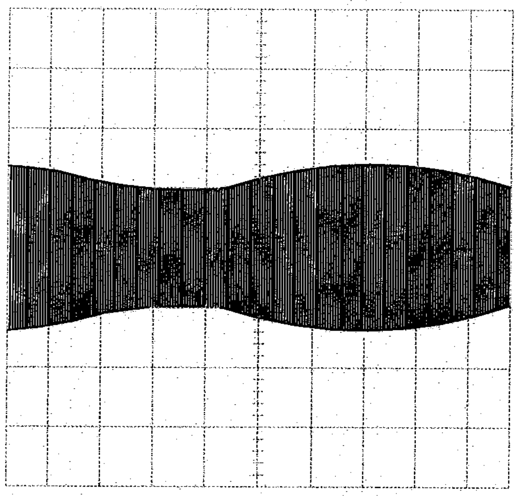
KB Receiver
Circuit Board Testing Points
Quick Guide

TP A	RF Signal, approximately 120 mv P-T
TP B	81.4 Hz recovered signal, 200 mV P-P
TP C	AGC Voltage, approximately 6 Vdc
TP D	Video signal, approximately 500 mV P-P
TP E	81.4 Hz square wave, 5 Vdc P-P

NOTE: ALL TEST POINT MEASUREMENTS ARE BASED ON THE STANDARD 3' (.91M) SINGLE AISLE



TEST POINT A

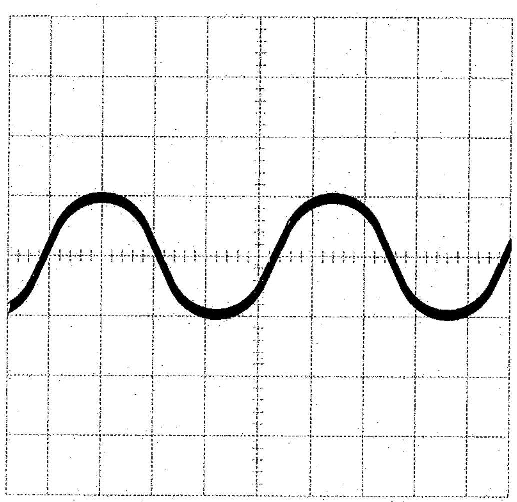


Scope settings using an 10X probe (channel 1):

5mV/Div 2mS/Div AC Coupling Trigger off TPE on RX (use a 1:1 scope probe)

TPA is the RF signal received from the transmitter after it has been amplified and filtered. This signal should be approximately 120 mV P-T (+/- 10 mV). The amplitude of this signal is determined by the setting of R37 (level) on the transmitter board.

TEST POINT B

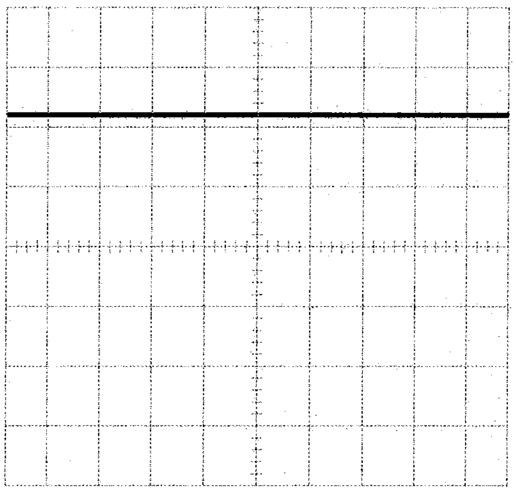


Scope settings using a X10 probe (channel 1):

10 mv/Div 2 ms/Div AC CouplingTrigger off TPE on receiver board (use a 1:1 scope probe)

TPB is the differential output of the synchronous detector (U1) combined by one of U2's quad op-amps (this signal is the transmitter sweep signal with the RF removed). The amplitude of this signal should be 200 mV P-P (+/- 50mV).

TEST POINT C

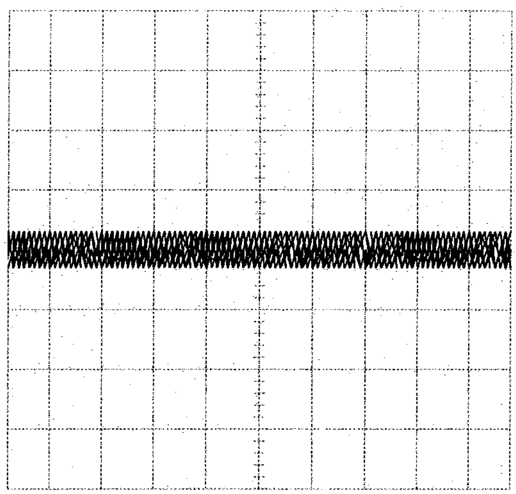


Scope settings using an X10 probe (channel 1):

.1V/Div 2mS/Div DC Coupling Trigger off Ch. 1

TPC is the AGC voltage and is the DC voltage used to control the gain of Q3 and Q5. With the transmitter R37 (level) at the 12 o'clock position, the dc voltage should be approximately 6 Vdc (+/- 1V).

TEST POINT D
WITHOUT TAG SIGNAL

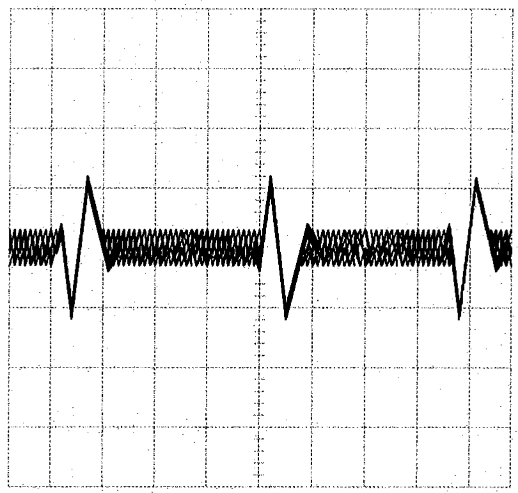


Scope settings using an X10 probe (channel 1):

.2V/Div 2mS/Div AC Coupling Trigger off TPE on RX (Use a 1:1 scope probe)

TPD is the received video signal prior to being sent to the microprocessor (U5). With the transmitter R37 (level) at the 12 o'clock position and receiver R53 (sensitivity) at the 11 o'clock position. The amplitude of this signal should be approximately 1V P-P (+/- 200mV). The DC voltage should be 2.5 Vdc (+/- .1V)

TEST POINT D
WITH TAG SIGNAL

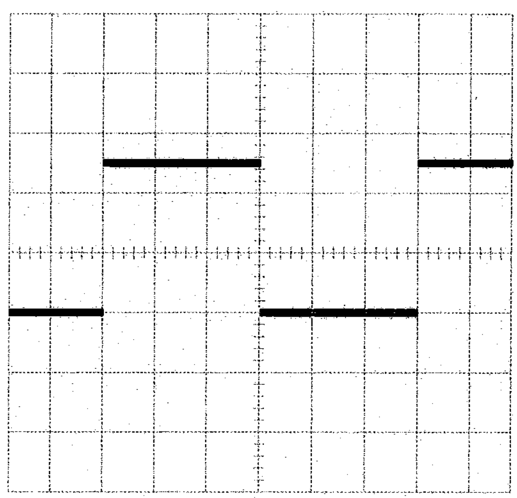


Scope settings using an X10 probe (channel 1):

.2V/Div 2mS/Div AC Coupling Trigger off TPE on receiver board (use a 1:1 probe)

This picture shows the tag signal present at TPD on the receiver. When the tag signal exceeds the 1.8 V P- P threshold, the detection system will recognize the tag (label) and emit an audible alarm.

TEST POINT E

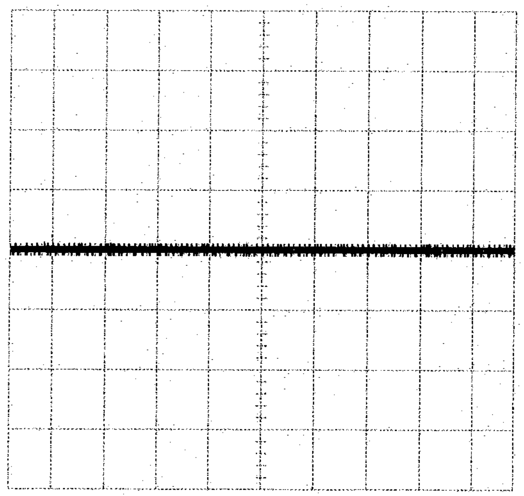


Scope settings using a X10 probe (channel 1):

.2V/Div 2mS/Div DC Coupling Trigger off channel 1

TPE is the receiver syncing pulse generated by the microprocessor (U5). The amplitude of the square wave should be 5 V P-P (+/- .5v)

TEST POINT #2
(WITHOUT TAG SIGNAL)

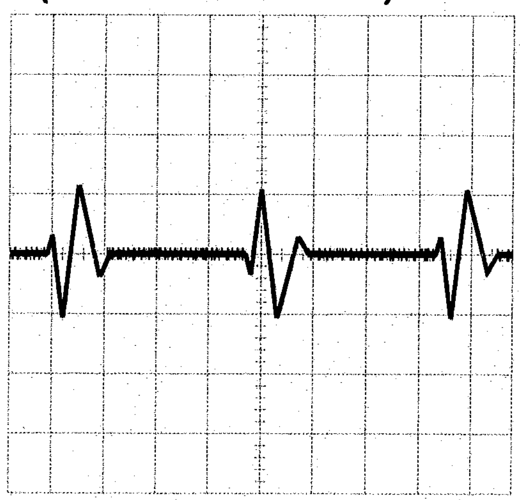


Scope settings with an X10 probe (channel 1):

50 mv/Div 2 ms/Div AC Coupling Trigger off TPE on receiver board.(use a 1:1 probe)

The video signal at TP2 (test board) is similar to the video signal at TPD (receiver board) with the exception that it has been digitally filtered to reduce noise. This signal is used to observe the output of the parallel bus at P1 of the receiver board during the tuning and troubleshooting of the system. The amplitude should be approximately 200 mV P-P (+/- 50 mv)

TEST POINT #2
(WITH TAG SIGNAL)



Scope settings with an X10 probe (channel 1):

.1V/Div 2 ms/Div AC Coupling Trigger off TPE on receiver board (Use a 1:1 probe)

TP2 should look exactly as TPD when it has a tag signal the noise level will be reduced and the tag signal will be more pronounced. The tag signal shown is approximately 2 V P-P.

CHANGING KB-1 ANTENNA CONFIGURATIONS

Changing the antenna configuration requires that you remove the interior of the antenna. You will need the following tools:

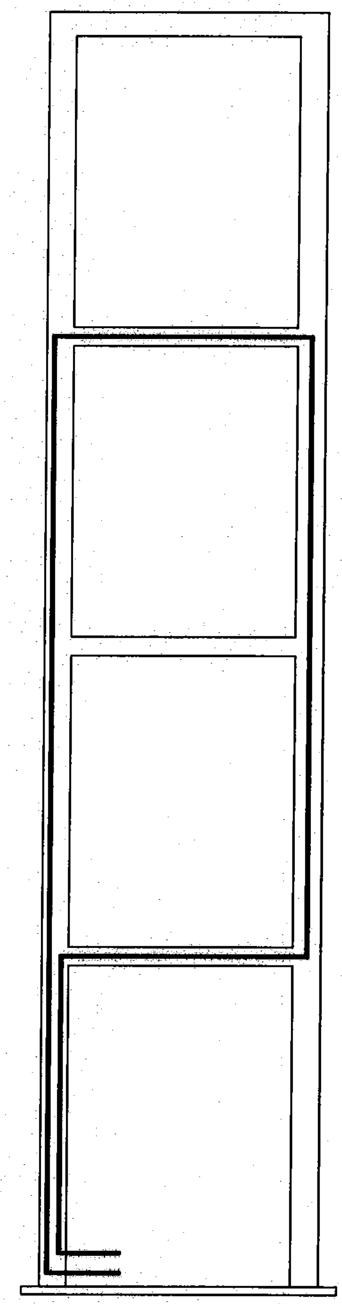
Phillips Screwdriver
Flat Head Screwdriver
Wire Cutters
Wire (if changing from two loop to three loop configuration)

To remove the interior of the antenna do the following:

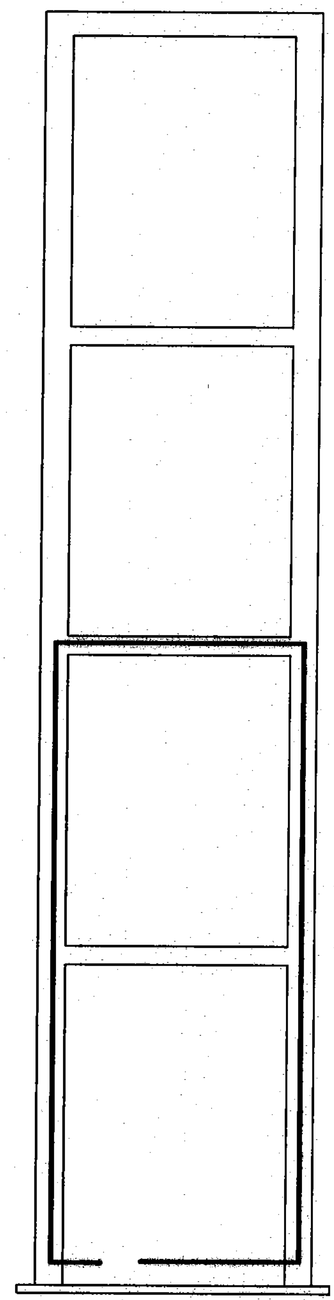
1) Remove the two screws on the back of the antenna.
2) Remove the cover from the circuit board housing.
3) Remove the circuit board from the circuit board housing.
4) Remove the circuit board housing.
5) Slide the interior frame of the antenna out of the bottom of the exterior antenna frame.
6) Rewire the antenna in accordance to the proper configuration. See attached wiring diagram.
7) Re-install the interior antenna frame into the exterior antenna frame making sure that the antenna wire is not pinched.
9) Re-install the circuit board housing and the circuit board.

If you are changing the wire when reconfiguring the antenna you must use the same gauge and style of wire. The system is designed for this wire and will not function properly if it is not used.

3 LOOP CONFIGURATION



2 LOOP CONFIGURATION



System Troubleshooting Guide
Basic

A unique signal must be introduced into the detection field of EASI KB EAS system in order for it to alarm. It is possible that outside sources, such as those mentioned in the pre-installation section, can simulate this signal and induce unwanted noises or resonance causing false/phantom alarms, weak/intermittent detection and in extreme cases no detection.

This guide is intended to provide basic troubleshooting techniques for the KB systems. It will only provide basic instructions, which should not be used as the only determining factors in the troubleshooting process.

When experiencing problems with the system it is important to first establish if the problem is caused by the system or the environment around the system. The following steps will guide you to this determination.

Some Important Notes Before Proceeding:

- Adhering to the PRE-INSTALLATION guidelines and proper tagging procedures will help to ensure trouble-free performance.

- When attempting to troubleshoot multiple single-aisle or dual-aisle systems it is important that you work with only ONE system at a time (unplug all other EASI systems).

- When attempting to work on a system that is designated as a slave you must change this systems transmitter back to the MASTER mode (please reference the master/slave section for help with this).

It is important that the following steps be done in order. This will allow a better troubleshooting flow when assistance is required.

- **Double check the following adjustments before doing anything else.**

Transmitter

Aisle Width = 36in (91.4cm)	R37 (level) - Arrow at 12 o'clock position
Aisle Width = 48in (122cm)	R37 (level) - Arrow at 1 o'clock position
Aisle Width = 66in (168cm)	R37 (level) - Arrow at 2 o'clock position

Tag Frequency = 8.2 MHz	R16 (sweep) - Arrow at 11 o'clock position R24 (center) - Arrow at 11 o'clock position
Tag Frequency = 9.5 MHz	R16 (sweep) - Arrow at 11 o'clock position R24 (center) - Arrow at 12 o'clock position
Tag Frequency = 10 MHz	R16 (sweep) - Arrow at 1 o'clock position R24 (center) - Arrow at 1 o'clock position

S1 Jumper ON left position for master
S2 Jumper ON right position for 81.4 Hz
P2 Both jumpers ON "M" position for master

Receiver

Aisle width = 36in (91.4cm)	R53 (sens) - Arrow at 11 o'clock position
Aisle width = 48in (122cm)	R53 (sens) - Arrow between 10 and 11 o'clock
Aisle width = 66in (168cm)	R53 (sens) - Arrow at 10 o'clock position

(R73) Volume Arrow at 12 o'clock position

P2 Jumpers ON positions 2 & 4 (81.4 Hz/soft tag/Med. fast tag reaction)
Jumpers ON positions 3 & 4 (81.4 Hz/hard tag/Med. fast tag reaction)

P3 Jumper ON position 1 (fast beep)
Jumper ON position 2 (slow beep)

Note: The sweep setting at P2 (position 1) on the receiver board must match the sweep setting at S2 on the transmitter board. If the sweep settings are incorrectly matched, the system will NOT detect the presence of security tags (labels).

Step #1 applies to both single-aisle and dual-aisle systems.

1) Grasp hold of the system power supply. It should be warm to the touch.

The system should be temporarily moved to a different location in the site (Away from tagged merchandise). If the system is operating in the temporary location then the problem is caused by the environment around the system.

- **If the problem still exists go to step #4.**
- **If the system is a single-aisle and is now working, return the system to its original location and continue with step #2.**
- **If the system is a dual-aisle and is now working, return the system to its original location and continue with step #3.**

2) When returning the system to its original position rotate it 180 degrees (half-circle). This will reverse the position of the transmitter and receiver antennas and could move the receiver away from the source of the problem.

If the system is mounted to a moveable baseplate and the power supply wire is too short, it is acceptable to either lengthen the power supply wire or change the input from the power supply the other circuit board.

Warning: there are support brackets welded to the bottom of the baseplate and care should be taken not to place the baseplate on top of the power supply wire. It is suggested that this wire be taped to the underneath with duct tape or a similar product.

3) Proceed to the advanced troubleshooting procedures. The problem is beyond the basic troubleshooting steps and the equipment needs to have electronic test equipment attached to it for measurement.

- Check transmitter TP 6 & 7 for a non-distorted RF output.
- Check receiver TPD for less than 1 volt of noise when no tag is present.
- Check receiver test board TP2 for less than 1/2 volt of noise when no tag is present.
- Check sweep of transmitter. Transmitter should be set to the following:

  8.25 MHz (Center Frequency) - 7.5 to 9.0 MHz
  9.5 MHz (Center Frequency) - 8.55 to 10.45 MHz
  10.0 MHz (Center Frequency) - 9.0 to 11.0 MHz

Note: If system is phantoming only during certain parts of the day tune system to 7.6 - 9.0 MHz to eliminate possible low frequency band interference.

2) If a resonance is observed at receiver TPD check for and move the following items:

   - Labels (tags) within 3' of system
   - Computer cables
   - Telephone wires
   - Electrical wires
   - Neon signs (unplug sign temporarily and observe detection system)
   - Other cables or wires
   - Metal railing (touch or bang on railing with hands while observing system)
   - Metal Doors (open and close doors while observing system)
   - Door Frames (touch or bang frame and observe system)
   - Metal shelving
   - Display lighting

Note: If wires are in close proximity to the system try moving them to as close to the floor as possible, or loop them into circles of at least 8" and lay them as close to the floor as possible.

3) If unable to move the possible sources of interference, try placing the transmitter antenna next to the suspected source of the noise or interference.

4) If still unable to locate interference, try temporarily moving system to a different location in the site to determine if it is a problem with the system or a problem caused by the environment.

   A. If the system functions away from the counter or doorway again attempt to locate the source of outside interference.
   B. If the system does not function away from the counter or doorway test the circuit boards by referring to the transmitter and receiver sections of the manual.

5) If wiring/cabling inside checkout counter(s) are producing electrical interference to the system:

   A. Straighten loose wiring out near the detection system and loop excess wire/cable into 8 inch (20.3cm) circles. Use cable ties or electrical tape to keep wire loops intact. Lay the wire / cable loops flat down on floor of counter.
   B. Try shielding the wires from the detection system by lining the inside of the counter with aluminum foil.
   C. If any of the wires or cables are found to be the source of electrical interference, use a power core to suppress the wire noise. Taking the wire or cable and looping it twice around the inside of the power core (where the inside groove is located) can do this. Firmly press shut the power core until it locks into place around the wire / cable.
   D. If the receiver antenna is near the counter, try turning the system around 180 degrees so that the transmitter antenna is near the counter.

NOTE: Keep excess wire loops as far from detection system as possible. If excess wiring/cabling is in a fixed location and can not be straightened out, try to loop any excess wiring into 8 inch circles (20.3cm) where possible and lay loops flat down on floor of counter. Power cores can be purchased from EASI.

6) If the system's power supply wire is next to or grouped with other electrical wiring:

   A. Take up any excess power supply wire (close to system) and loop it into circles of 8 inches (20.3cm). Lay the wire loops flat down on the floor.
   B. Use a power core (close to system) to suppress noise on the power supply wire.
   C. If the power supply transformer is plugged into an outlet with other electrical devices (e.g. soda machine, computers, neon signs, VCR's) it may be necessary to isolate the system's power from these devices or unplug the device that is causing the interference to the system.

7) If the detection system is being affected by the doorway:

   A. Determine if the door or door frame is producing the resonance or interference.
   B. If the door is creating the resonance, insulate the door handle(s) or push/pull bar(s) from the main body of the door. Use nylon or plastic washers in between the door and handle. If the resonance is still present at TPD (on receiver), drill and tap metal screws into the corners of the door. This will create a shorted turn effect in the door and solidify its structure (main body).
   C. If the door slides on metal railing, ground the door to the railing by using wire that will flex when the door slides open and closed. Use metal screws to tap into the door and railing.
   D. If the door frame is producing the resonance, drill and tap metal screws into the outside corners of the frame. If the resonance is still present, ground the door frame to the door using flexible wiring.

Note: When connecting the flexible wiring to the door and railing, make sure that the jacket of the wire is stripped back exposing the bare or tinned copper.

8) If still unable to eliminate or identify source of problem, contact EASI for service support.

NO DETECTION

1) Check power lights (red LED's) on both transmitter and receiver:

A. Remove metal covers from the bottom of the system.
B. Verify that all power lights are on.

- Transmitter - CR5 (Fuse Indicator)
  - CR10 ("Power On" Indicator)

- Receiver - CR2 ("Power On" Indicator)
  - CR3 (Fuse Indicator)

Note: CR4 on the receiver will not be on except when the system alarms.

C. If CR5 (on transmitter) and/or CR3 (on receiver) are not on, check the fuses on the circuit boards:

- Visually inspect the fuse for signs of damage. If the fuse appear to look good, check the fuses for continuity with an ohmmeter.

- If the fuse is bad, replace fuse using the following specifications:

  - The transmitter board uses a 1 amp/250 volt fast blow fuse.
  - The receiver board uses a 500 ma/250 volt slow blow fuse.

Note: If the fuse keeps going bad (opening), replace the appropriate circuit board.

D. If all the power lights are off:

- Inspect all power wires for damage (pinched wire or cut wire). A short in the wiring will damage the power supply.

- Locate power supply and confirm that it is still plugged into the AC outlet.

- Check the interconnects (white plastic connector) between the power supply and system. Turn system over and check connector(s) underneath the base plate. Verify that the connectors are locked together.

  Note: The connectors may have electrical tape covering them.

- Check the power supply by lightly touching it with one hand. It should be warm to the touch. If the supply is cold, it is either bad or the AC outlet is off. Check power supply for output voltage. It should measure approximately 20Vac (+/- 2 volts).

- If the power lights on one side of the system are "off", check the wire connections going to the transmitter and receiver boards.

- If still unable to determine power source problem, contact EASI for additional instructions.

2) Perform tune-up procedures on system checking for proper signals at test points.

   A. If test points do not match examples in transmitter and receiver sections replace appropriate circuit board.

3) Make sure a good tag and the proper size tag for the aisle width is being used to test the system.

4) Determine if the system is completely non-functional or if there is some level of operation.

   A. Test all planes of detection to verify non-detecting areas of system (front flat, and side carry).

5) If system has multiple aisles determine if the problem is located on one aisle or on multiple aisles (refer to transmitter and receiver board layout diagram).

   A. If one aisle of a multiple aisle system is having the problem make it the aisle with the master transmitter and turn off all other systems until the problem has been eliminated.
   B. If the problem is on a multiple-aisle system try changing the configuration (i.e. change the location of transmitters with receivers).
   C. If the system is slaved try changing the master transmitter to a slave and the slave transmitter to a master.

6) If the problem still continues, contact EASI for further instructions.

Replacement Of EASI Model KB Circuit Boards

Note: Unplug the System Before Proceeding!

Tools Required:

#1 Phillips Screwdriver
Small Common Screwdriver
#3 Phillips Screwdriver

Removing Receiver Circuit Board

1) Remove the two screws from the top of the circuit board housing cover.
2) Disconnect the power wires that are attached to the receiver circuit board at TB2 and/or TB3 (Blue terminal strips next to fuse).
3) Remove the antenna wires from the circuit board at TB1.
4) Remove the 3 screws holding the circuit board in the housing.
5) Pull circuit board straight up and out of the housing.
6) Installation is the reverse of removal.

Note: If using a lighted system, remove the external alarm light wires from the circuit board at TB6.

Removing Transmitter Circuit Board

1) Remove the two screws from the top of the circuit board housing cover.
2) Disconnect the power wires that are attached to the transmitter circuit board at TB4 and/or TB5 (Blue terminal strips left of the fuse).
3) Remove the antenna wires from the circuit board at TB3.
4) Remove the 3 screws holding the circuit board in the housing.
5) Pull circuit board straight up and out of the housing.
6) Installation is the reverse of removal.

Return Ship To:

EAS Industries, LLC
1256 North Church Street
Moorestown, NJ 08057
856-222-4788