Enclosure 7

INSTALLATION & TUNING PROCEDURES FOR RF DSP SYSTEMS

Revision 1.0

DIALOG ID TECHNOLOGY
Gol[illegible]raat 24
3846 AT [illegible]ARDERWIJK
The Netherlands
Tel [illegible]20040

DIALOC reserves the right to modify the equipment described in this manual at any time and without notice.

Trademarks

EAS TESTER is a trademark of CustomWare.

Table of Contents

Paragraph	Description	Page

Scope of Document

This document provides shortened installation and Tune-Up procedures for installing the DIALOC Radio Frequent Digital Signal Processing EAS system.

Manual Structure

This system manual is organised with the following structure:

Chapter **1.0** Describes the RF DSP system components and how they work.

Chapter **2.0** Lists the tools recommended to install tune and test the system.

Chapter **3.0** Lists and describes steps required to install the system.

Chapter **4.0** Lists and describes steps required to install the system.

Chapters **5.0** Lists and describes steps to tune and test the system.

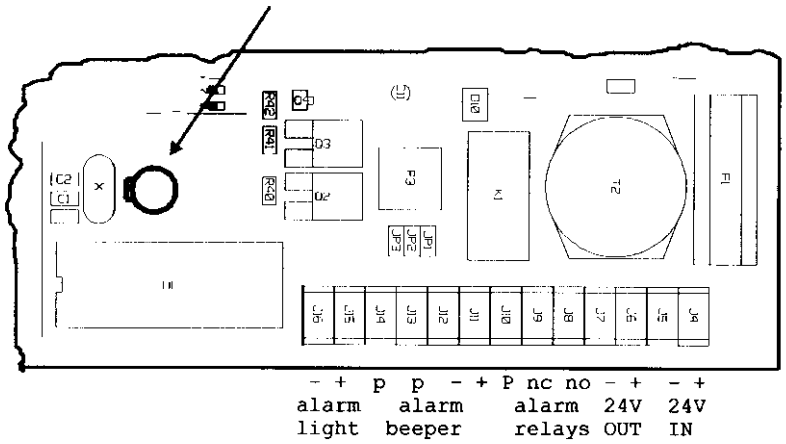
Chapter **6.0** Describes how to trouble shoot the systems.

Inside this manual are AVI movies, when you received this manual on CD and your PC/software is capable to run AVI movies, you can play these movies. This can be very helpful for new technicians to see the adjustments happening on a screen.

Warnings!

Please take notice of these warnings before continuing:

- Never touch the trimmer closest to the crystal on the RF DSP receiver board. This trimmer is used to adjust the crystal frequency to exactly 10 MHz. When you touch this trimmer, the background cancelling will not work anymore.



How to test this background cancelling function: Connect your scope to Tp1 & GND of the Rx board, hold a tag still between the antennas and check if the tag disappears within 4 seconds. If this is not the case, the Rx trimmer obviously has been touched. Replace the receiver board and sent it for factory re-tuning.

Transmitter board rev. 05

Do not use the sweep nor frequency jumpers on the transmitter board, they are in the RF DSP system of no use anymore. Their appropriate positions should be:

SWEEPJP7 = 82
FREQ JP6 = 8
FREQ JP8 = 8

Always use the 24V IN and out connections when daisy chaining RF DSP systems, the filter function for a 24V-power line is very important for the RF DSP system.

1.0 System description

1.1 System overview

DIALOC's RF DSP electronic article surveillance system dramatically cuts inventory shrinkage losses from customer shoplifting and employee pilferage. Although not foolproof, the RF DSP system can reduce losses in retail stores so effectively that savings will quickly exceed system's cost. This manual describes how the RF DSP system functions and how to install and tune it.

The basic RF DSP system consists of two antennas, a power supply, detachers and/or deactivators and tags attached to selected inventory. The antennas stand next to the entrance or exit path so that people must pass between the antennas. In larger installations, combinations of antennas are used to span wide openings.

Store personnel attach tags to the items they waist to protect. Clerks then remove, detune, or deactivate these Tags from purchased items at checkout if someone should try to exit through the system with an item protected by a live tag, an alarm sounds. The manager can then intercept or verify whether the item has been properly purchased.

1.1.1 How the system basically functions

The power supply step-down the AC line voltage and coverts it into a DC voltage useable by the antennas. The transmitter board drives a loop antenna, which generates a field of energy around the antennae. When a DIALOC tag enters this field, it responds to the transmitter's signal by resonating and emitting a signal of its own. The receiver antenna picks up the Tag's signal, and converts the tag signal information into digital information. This digital information is then sent to a microprocessor. This microprocessor verifies the signal through a software program. If verification is positive, an alarm is triggered.

1.1.2 System effectiveness

It is possible to subvert the RF DSP system. For example, Tags can be shielded so they won't respond to the signal. Alternatively, customers can remove tags from protected merchandise. Each sensing system has areas where Tag detection is weaker. Professional thieves learn these and other tricks, to evade security measures. However, professional thieves account for only a small percentage of inventory loss.

More theft loss arises from impulsive shoplifters, who sense an opportunity to steal and spontaneously act to take advantage of it. DIALOC's RF systems obvious presence acts effectively to discourage these casual shoplifters. Moreover, they seldom learn how to beat the system.

1.2 The power supply

The power supply is mounted on the wall so that it is near both an AC power outlet and the system. Mounted on the unit's face are:

- Green LED to indicate when power is ON
- Key switch to turn the unit ON or OFF.

One power supply powers three antennas maximum.
The standard power supply operates from 90-260VAC. The power supply is rated at two amps of current.

2.0 Recommended Tools and Equipment

2.1 Electronic Test Equipment

Table 2.1 lists the electronic equipment recommended for tuning the **DIALOC** RF systems.

Table 2.1 Recommended Electronic Test Equipment

Equipment	Comments
Oscilloscope, FLUKE 96B ScopeMeter series II	60 MHz bandwidth, 2 channel. 10:1 & 1:1 probes.
EAS tester, CustomWare.	Transmitter signal tester.

2.2 Installation Tools

The tools listed in Table 2.2 are recommended for installing the **DIALOC** RF systems.

Table 2.2 Recommended Installation Tools

Hexagon spanner 2,5 mm.	Outlet tester
Wrenches: · Adjustable 10" Crescent · Combination end 9/16" · Allen set, long and short	Pliers: · Long nose, miniature & regular · Slip joint
Diagonal cutter.	Hack saw, with extra blades
Electronic hand drill and bits: · Steel bits, assorted sizes · Wood bits, assorted sizes	Electronic rotary hammer · Drill bits; should fit to anchors that are used.
Electrical tape	Wire stripper
Extension cord, 3-conductor, 2,5 mm^2 heavy duty	Tuning tool, plastic/non-conductive
Hammer.	Tape measure, 10 m.
Nut driver, 7mm.	Utility knife
Marker, black felt	Wire snake
Screwdrivers, assorted sizes · Regular · Phillips	Nut driver for used bolts to bolt down the antennas.

3.0 The Installation

3.1 Pre Installation tests.

3.1.1 Place Antennas

Use care when you place and install antennas. Let them stand unsupported only as long as required to verify their arrangement.

Single aisle systems contain a receiver on one side of the aisle, and a transmitter on the other.

Dual aisle systems usually have one transmitter placed in the centre, with receivers on either side.

Multiple aisle systems alternate receivers and transmitters. When you are installing more than three antennas, use for the test set-up no more than three antennas at a time.

Place the antennas where you have planned for the proper aisle width and to maintain clearance from fixtures that produce interference. Moreover, be careful with doors that open inward.

Distances between antennas depend on tags used with the system.

Table 3.1.1 Tag Type versus Aisle width.

Tag Type	Recommended Aisle Width for 8 MHz. Tags.	
Minifo, Stickertag 4 - 4 cm	120 cm	
Stickertag 5 – 5 cm	140 em	
Softtag	150 cm	
Deltatag	190 cm	

3.1.2 Test setup

The system has been tested and pre-adjusted. It is delivered with wired connectors, place these connectors to the appropriate board connector.
When the mains plug(s) (are) is wrong replace them first. If you need to re-connect the 24V wires see figure 3 first.

Now you may switch on the System.
The system is ready for testing; you can test the system for detection.

Make sure the system is operating correctly before you drill any holes in the floor. If the system is not operating satisfactory, you may need to move it away from the doorframe or other noise sources.
Mark mounting holes on the floor.

3.2 Install the Antennas

3.2.1 Mark Mounting Holes

Use the base plates as a guide to mark the floor for holes that will accept mounting anchors. Mark both holes in each base, and if necessary mark the middle hole for cable directions.

- **If the floor is carpeted,** DO NOT try to drill through the carpet. Doing so could damage the carpet. Instead, place the base and mark the floor with a felt pen. Then use a centre punch to mark the floor through the carpet. Move the base plates out of the way. Cut 25 mm. (1 inch) square holes in the carpet. Wrap a small amount of black insulating tape around the shaft of the drill bit (do not cover drill tip) This will prevent carpet from unravelling when you drill trough.
- **Tile floors,** to give a nice installation the grouting between large floor tiles can be removed and connecting wires between antennas can be placed in the gap. Push the wire down into the gap with a screwdriver making sure not to puncture the insulation.

3.2.2 Drill Holes

- In Cement Floors, use a heavy duty rotary hammer drill with carbide tipped masonry bit to drill antenna mounting holes in the floor at least 8 cm (3") deep. Vacuum or sweep drilling debris from around and inside holes immediately after drilling all holes. Throughout the installation keep the area as neat as possible.
- In Wood Floors, use the hand drill to drill pilot holes for lag screws, which will secure the antennas.

3.2.3 Install Anchors

Install all anchors in cement floors. Don't install lag screws on wood floors at this time.

NOTE: **NEVER PLACE WIRING OVERHEAD**

- If the installation is in new construction, have the customer install a 3/4" conduit that contains pull wires.
- If the floor covering is thick carpet, snake wires under the carpet and the carpet pad. The carpet must be thick enough to ensure that it does not bulge over the wires. Otherwise, the carpet will wear trough.
- If the site has an accessible space under the floor, you can drill through the flooring and run the wires underneath the floor.
- If the site is in new construction, or the customer is remodelling extensively, you can have the customer cut a 5 mm (1/8") wide channel in the flooring. Specify the depth of the channel according to the number of wires to be buried.]

3.3 Install the Power Supply

Check the planned power supply location for adequate ventilation. It should be within one and a half-meter (five feet) of a 3-wire grounded outlet. Try to mount the power supply in an inconspicuous, yet accessible location, since site personnel will need to access the unit to turn it on and off.

Check the power indication on the outside of the cover to ensure that it is appropriate for the available power.
Mount the power supply.

3.4 Complete the Installation

When making wiring connections, you should strive to do neat, clean and professional work. You should cut the cables to size and not coil excess cable due to poor cable cutting.

3.4.1 Place Power Supply Cable

Place the power supply cable from the power supply to the closest antenna. In carpeted areas, when possible, "snake" the wire under the carpet, if the carpet is not glued down or too thin. On hard floors, install a wiremold in high traffic areas. Use a 3/4" conduit in new construction. Connect the power supply.

3.4.2 Mount Antennas

In Cement Floors, place the antennas over the bolts and attach nuts (and washers) tight enough to support the antennas yet loose enough to allow for later cable placement. Leave the antenna covers off the unit for access to tune and test the system.

In Wood Floors, place the antennas over the mounting holes and insert lag screws tight enough to support the antennas, yet loose enough to allow for later cable placement. Leave the antenna covers off the unit for access to tune and test the system.

NOTE:

If you are installing a single system in a heavy traffic area, you can consider installing the antenna covers facing to the outside of the gate. Doing so will help you when you have to adjust or service the system during opening hours of the shop. For the antennas of the system, it is no problem.

3.4.3 Double Check Your Work

Double-check all electrical connections. Even if you have previously installed many EAS systems, small interruptions can cause you to overlook things. When you have finished double checking all connections, (install wiremold covers).

When you are sure that the wiring is correct, you can plug in the mains plug and turn the switch on the PSU. Check the mains indicator on the PSU if it is lit. Check if all the green POWER LED's on the main boards (Transmitter and Receiver) and on the modules are lit.

If the LED's are off, there are two possibilities:

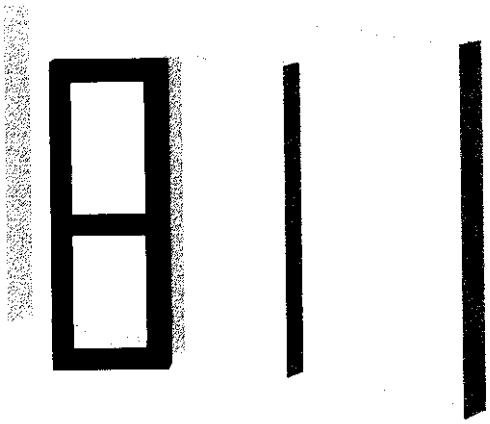
1. There is no mains power; check mains cable, plug & wall socket.
2. Wrong wire connections; check wiring.

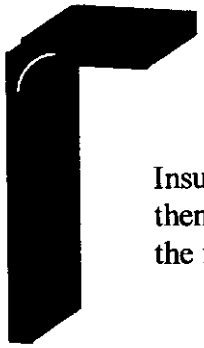
3.5 Attack resonance

Resonance is the enemy number one for a system. Since the tag is a resonated device, the system is very sensitive for resonance. Therefor it is wise to check the environment for resonance's.

Imagine these figures as being an aluminium shopfront, door and doorframe.

At every corner, the aluminium bars will touch. At this point, there will be capacitance and inductance. At this moment you see three big tags if you where a system.

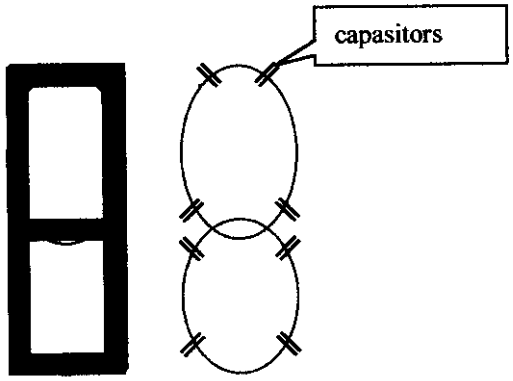




Insulate these connection points or shortcircuit them by interconnecting the corners as shown in the figure next to this text.

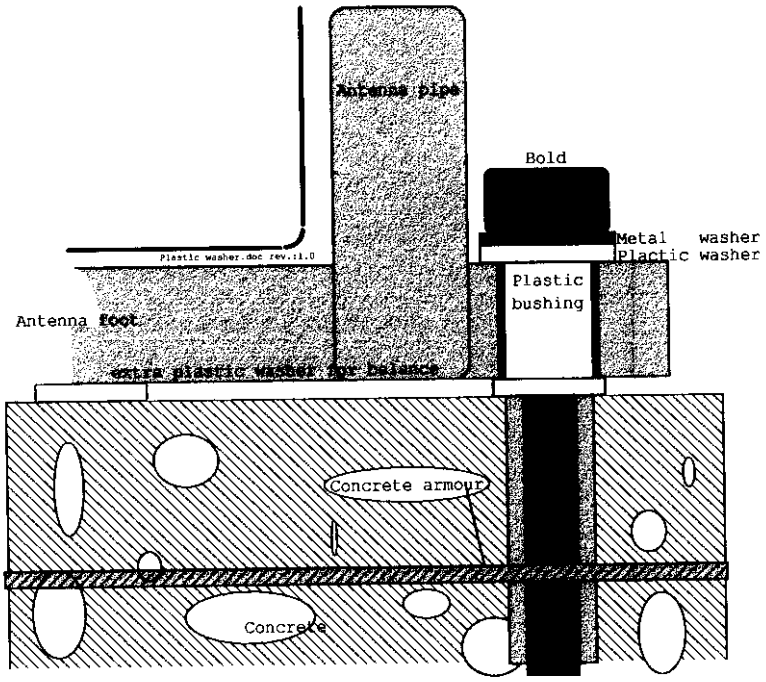
3.5.1 Insulate Door Handles

If there are, aluminium or metal doors around the system try to insulate door handles and try to short-circuit door frames as this will reduce interference.



The door frame create loops, at every corner of this loop there is a capacitor. These loops act as tags. By short-circuiting these "capacitors" you stop the loops from being resonant.

3.5.2 Plastic bushings and washers



This set of plastic insulators should he used on painted antennas and for insulation when metal concrete plugs are used.
To prevent the antenna from making contact with the metal armour used in concrete floors. The extra plastic washers are for balance and should be placed at the opposite side of the bolds, to prevent the antenna form waggling on it's bolds.

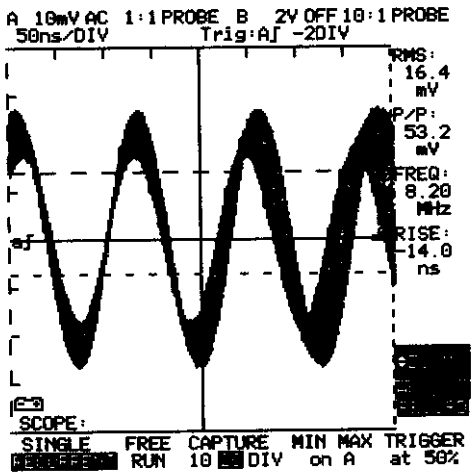
3.6 Final Installation Steps

Tighten the antennas on their mountings. Leave the antenna covers off to provide access for tuning and testing the system. Attach plastic chain, if needed. Remove all packing material and installation debris from the area. You are now ready to connect the power cables to the system.

5.5 Transmitter antenna trimmer adjustment.

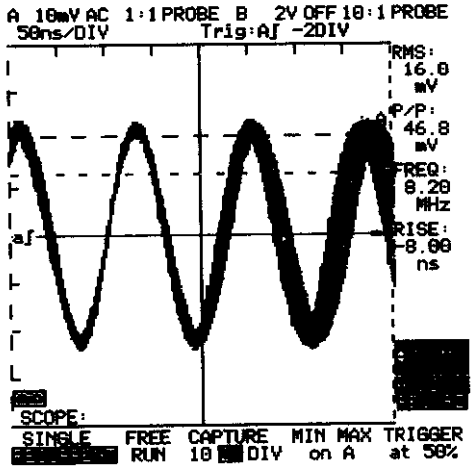
Probe 1:1	!!	Sec/Div.:	50 nSec
Adjustment:	Tx trimmer	Volts/Div.:	10 mV
Setting:	see fig.	Coupling:	AC

Figure – 5.5a



Tx antenna trimmer adjusted wrong.

Figure – 5.5b



Tx antenna trimmer adjusted right.

!! Make a loop with your scope probe by connecting the GND lead to the probe tip, not to the insulation. Position this loop inside the transmitter antenna so that you can see the transmitter signal as shown in one of the figures.
Adjust the antenna trimmer as shown in Figure B. by doing this you resonate the antenna exactly for the used transmitter frequency.

NOTE: When the level of the output signal dramatically changes. Check **§ 5.1** ones more.

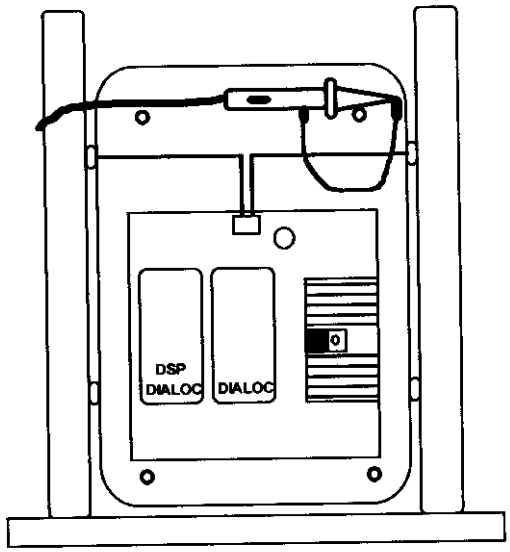


Figure – 5.5c Scope probe loop.

On the next page there are two AVI files, when you use the manual on a computer, you can see the adjustments on screen.

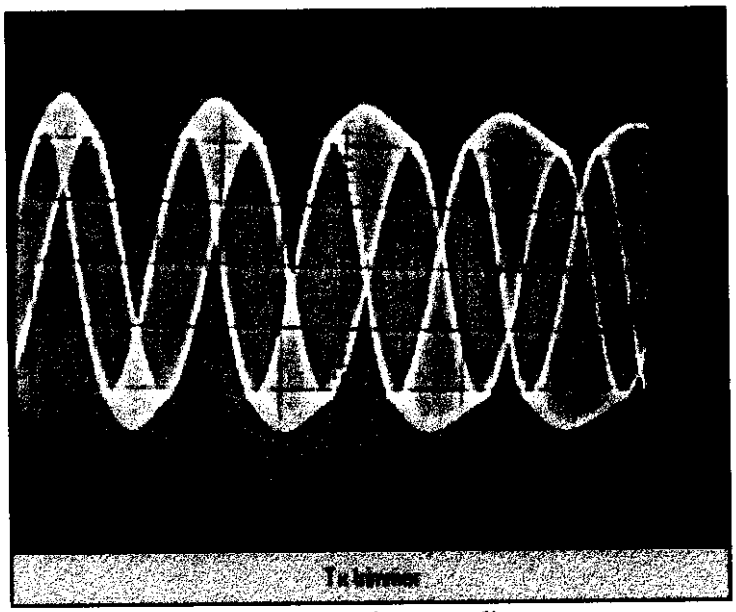


Figure 5.5d Right antenna trimmer adjustment.
Scope probe connected to ANT & ANT.

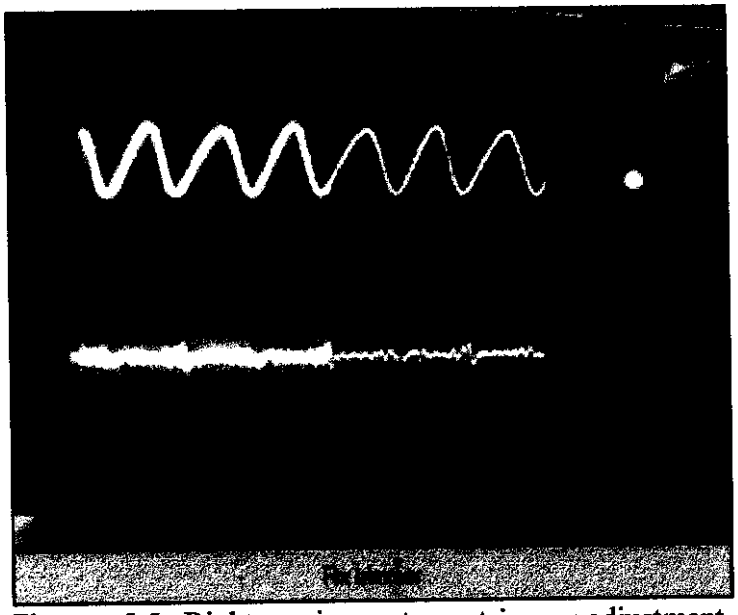


Figure - 5.5e Right receiver antenna trimmer adjustment.
Scope probe connected to TP1 receiver and GND.

4.0 The Receiver

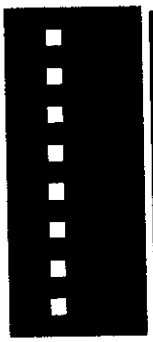
4.1 Power Connection

Power from the PSU should be daisy chained from antenna to antenna via the power cable similar to that provided with the PSU. The 24 VDC is connected to Rx TB1 on the receiver board. The red marked (+) conductor is connected to pin 13 (J4) and the black (-) conductor to pin 12 (J5). When the green power LED is on, you can start configuring the receiver.
When you need the 24V OUT for the next antenna, you should connect the red marked wire to pin 11 (J6) and the black wire to pin 10 (J7). See also Figure - 3 Power wire set-up diagram.

4.2 Configuring the Rx dip-switches

4.2.1 Configuring the receiver detection algorithm.

Software version 1.0
The dipswitches have the following function:



No.:	OFF	Function	ON
1	Fast (1/12)	Background noise cancelling	Normal (1/24)
2	0,75 sample	Pulse width tolerance	0,5 smp
3	0,5 sample	Time history	0,25 smp
4		Future use	
5		Future use	
6		Future use	
7		Future use	
8	Normal operation	Hardware test & software test.	Test position

The first three dipswitch settings can offer solutions when environments are complicated.

4.2.2 The test position

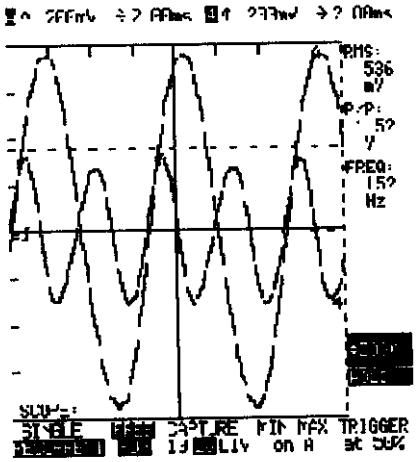
When you flip dipswitch 8 to ON the system will start to do a test procedure for software and hardware functionality. The LED's will lit one by one, when the last LED is lit the alarm outputs will be tested one by one also, Doing this test will ensure you that the processor board is fully operational. If one test fails the system will stop and blink one LED. When this happens constantly, replace the board and send it for repair.

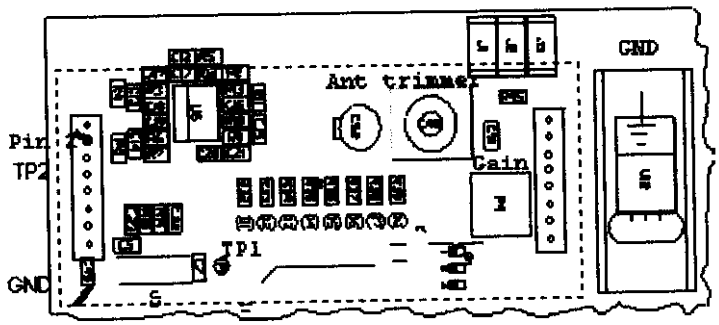
5.0 Receiver Tune-Up

NOTE: Some of the adjustments listed below will cause the system to alarm and hence the signal under observation will be blanked out. To prevent this from happening, remove the beeper pitch setting jumper from its pins. By doing this the system will not beep while making adjustments. The relays (click) still functions. You may also lower the beeper's volume by turning the volume potentiometer **fully clockwise.**

5.1 Rx Antenna trimmer adjustment

Probe 1:1 TP2 (pin 2)	Sec/Div.: 5 mSec
Adjustment: Ant trimmer	Volts/Div.: 0.1V
Setting: see Fig. AVI file	Coupling: AC





Adjust Rx antenna trimmer so that the sinewave shape reaches the double frequency of the Tx sweep frequency. Compare with TP1 in Tx antenna if necessary. If you can't get the double sinewave, (because the antenna(s) is (are) too close to metal and it(they) is (are) unbalanced) you can do the following:

1. Connect your scope to Rx TP 1,
2. Switch OFF the system,
3. Flip dipswitch 8 to the ON position,
4. Switch the system ON,
5. Adjust Rx antenna trimmer until you get the highest tag signal.
6. Flip dipswitch 8 back to OFF. The system will return to normal operation.

5.2 Baseband Gain setting

Check the baseband gain of the system by using the tags used in this installation. as follows:
Turn the gain potentiometer completely counter clockwise, keep a hardtag tag 50 centimetres in front of the system, for a stickertag 30cm is enough, at a height of 55 centimetres (off the floor). Start turning the gain potentiometer clock-wise until the system makes an alarm. You should get a detection of 50/30 centimetres in front of the system.

NOTE: As the overall sensitivity of the system increases when turning up the gain potentiometer, we advise to adjust the gain on a detection distance of 50 centimetres on hardtags and 30 cm for stickertags.
The customer should test detection quality like:
- Take a tag attached to an item, act inconspicuously.
- Walk trough the system as a shoplifter would walk/act.

5.3 LED bar explanation

The row of red LEDs shows the following:

No.:	Explanation when lit with tag,	When lit without tag.
1	Amplitude of label signal is found.	**Reduce Rx gain.**
2	History of last 12 cycles was found.	**Reduce Rx gain.**
3	Pulse width of tag signal is a stickertag.	N.A.
4	Pulse width of tag signal is a hardtag.	N.A.
5	Future.	N.A.
6	Future.	N.A.
7	RF overload. AD converter.	**When lit with/without tag, reduce Rx or Tx gain.**
8	System is alarming.	**Reduce Rx gain.**

CAUTION: Over increasing, the sensitivity may cause false alarms due to resonance. Always cheek- if all red LEDs are OFF constantly when no tag is offered to the system.

5.4 Sounder adjustment

P3 is the volume potentiometer for the beeper volume, maximum counter clockwise is maximum volume.
The jumpers just underneath this potentiometer are the pitch jumpers, with these you can change the pitch of the beeper.
Position J1 = Constant beep
Position J2 = Slow pulsing beep
position J3 = Fast pulsing beep

6.0 Trouble Shooting

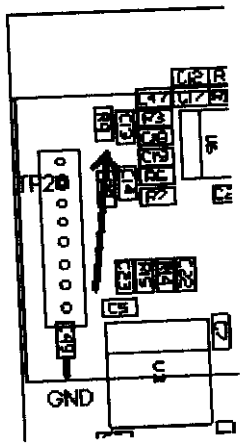
Problems listed in this chart assume that all of the preceding difficulties have been resolved. To use this guide, start at the top, move down the list to the first problem that matches your situation, and try the suggested remedies.

6.1 Verify Power Lines

Using a DMM or your scope, connect to the Test Points (TP) indicated and an available GND post to verify that the value is within the expected range.

Note: There is no adjustment for these test points, so if any of the values are incorrect the board or PSU should be replaced.

PSU	TB1	Mains power (new PSU)	90V- 260V, 47 – 63 Hz
	TB2	Expected value range	24V DC ±5% - 2Amp.



Tx Board rev 05

TB1	Expected value range	24V DC ±5%
U1	DC regulator 15V	15V DC ±1%

Rx DSP Board rev 1.1

TB1	Expected Value Range	24V DC ±5%
U11	DC regulator 7815	15V DC ±2%
U12	DC regulator 7805	0,5VDC ±2%
R9	Software check	2,5VDC stable

It can be very helpful to write down settings of a system. Doing this could help you remembering what has been checked the last time, or what a college has been looking for.
DIALOC could supply you with these types of papers, which can be placed in the systems covers.

6.2 Receiver function

In this section, we followed the signal path, which means that TP2 is in front of TP1. The Rx signal is influenced by the Tx signal and is adjustable with the Rx antenna trimmer and the Rx gain potentiometer. If not yet done you should do the **"Check for Tx antenna complete"** first.

6.2.1 Limited or no signal on TP2 in the Receiver

Set the Rx gain to 12 o'clock.
Check if the power LED on the main board is lit,

- if ON, check if dipswitch 8 in test position functions.
- if not, check power supply and cable connections.
  - If OK, check if R9 has a level of 2,5V DC stable.
  - If not, check the PSU, and cables.
    - if OK, replace the Rx main board.

6.2.2 Limited or no tag signal on TP1 in the Receiver

This is a very small signal and we suggest you flip dipswitch 8 first to the ON position and than switch the system OFF and ON. Now the background cancelling is not functioning any more, therefor you should see noise and tags signals now.

Position your test-tag between the antennas, so that it would normally give a very good tag signal.

- if not, check if LED No. 7 stays OFF when tag is shown.
- If OK, replace the RF DSP board.
- If not, reduce Rx gain until LED 7 stays OFF.

6.3 Receiver does not alarm on the tag signals.

The tag signal is visible on TP1 but the system does not react to it. At this moment, you should do the background noise-cancelling test first.
Connect your scope to Tp1 & GND of the Rx board, hold a tag still between the antennas and check if the tag disappears within 4 seconds. If this is not the case, the Rx trimmer obviously has been touched. Replace the receiver board and sent it for factory re-tuning.
Check if LED No. 7 stays OFF when tag is shown.

- if OK, replace the Rx main board.
- If not, reduce Rx gain until LED 7 is OFF.

Make sure the TEST tag is the same frequency that the transmitter and receiver have been adjusted for. Also, use several tags to make sure they are at the same detection level.

6.3.1 Disturbance

Most common problems with receivers are that they receive not only the tag-signals but also disturbance. Mostly this disturbance is coming from external sources. Some times the transmitter causes (metal objects like coils and ID cards with RF coils) to resonate. This is a similar signal as tags produce, that's why the system is very sensitive to this type of interference.

6.3.2 Noise tests

A good test in noisy environments is to lower the Tx GAIN slowly set the Rx in test mode, and check on Rx TP 1 whether the noise level rises or lowers. By doing this, you will be able to recognise whether the disturbance is active or passive.
- When the signal rises, the receiver is listening more to the (active) noise than to it's own transmitter.
- When the signal is lowering, the receiver receives less transmitter signal, but the passive noise source is also receiving less and therefore "produces" less disturbance for the system.

Now that we know what type of disturbance it is, it will be easier to find the noise source. In both cases, it is advisable to eliminate the noise source.