CRYPTAG® CENSUS®

CR1-DS READER SITE MANUAL

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This manual is provided for information purposes only. All information included in this manual is subject to change without notice. Identec is not responsible for any damages, direct or indirect, arising from or related to the use of this manual, or associated product.

WARNING NOTICE

This product uses radio frequency signals to identify tags, and is therefore subject to possible interference. Any application should bear this in mind, and in particular it <u>should not</u> be possible for personal safety to be jeopardised by a failure to read.

Cryptag Census neither uses nor generates hazardous voltages. You should not connect any such voltage to the reader.

CE

This product complies with the following European Community directives: [1]

Low voltage directive (73/23/EEC)
[2]**EMC Directive (89/336/EEC)**

[1,2]FCC Regulations

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) this device must not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Identifier: JHD-CEN1

Note:
Systems that comply with FCC regulations operate at different frequencies, and only such systems are to be installed in USA. These systems have some performance differences (in particular a slight increase in reading speed). Throughout this manual, the effect of the change in frequency is noted, e.g. “131kHz (in USA, 153kHz)”. The part numbers of readers and tags for use in USA have an “A” added, e.g. CR1A, TC1A. Any reference in this manual to CR1 also applies to CR1A.

This manual covers the two aerial version (CR1-DS, or in USA CR1A-DS).
Other variants of CR1 are covered by separate manuals.

[1]For more information on approvals, refer to Appendix E.

CONTENTS

#Software Options

Cryptag Census readers can be supplied with a number of software options, which may affect the reader's response and/or performance. These are marked in the text with "#".

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1. CRYPTAG CENSUS

1.1 Introduction

Cryptag Census has two basic components, the reader and the tags. The reader will identify all Cryptag Census tags within its reading range. (We refer to this as the Reading Zone.) In the simplest form, the reader will report each tag as it is seen, but many other software variants are possible, so that for instance the reader may only report tags belonging to the installation. If you have an application, talk to Identec. It's quite possible that it's already provided for.

Readers are supplied fitted with an internal aerial, but this can be replaced by an external aerial loop or multi-turn coil, for instance, to customise the reading range. It is possible to fit more than one aerial, to give the best possible performance, or to track tags as they pass the reader.

Tags are programmable, but once they have been programmed they cannot be reprogrammed and become "Read Only". Tags contain a small lithium battery, which should normally last many years. Readers can be configured to indicate when the battery of a tag is going low.

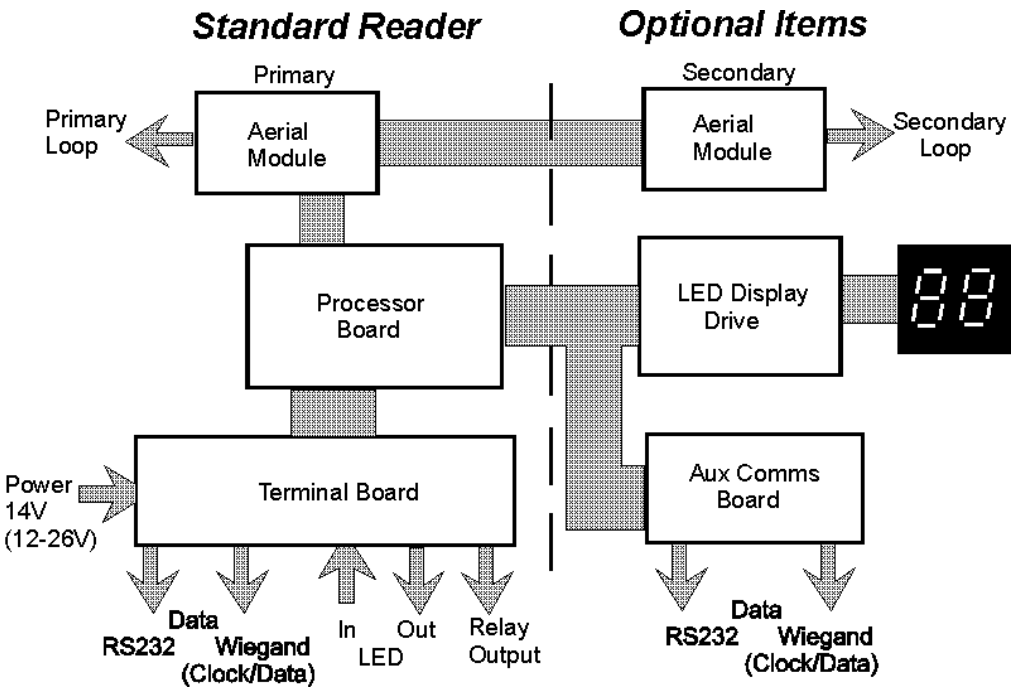
Cryptag Census is an advanced third generation RFID (Radio Frequency Identification) product from Identec Ltd of County Durham, England. It can be used as a standalone product in simple applications (such as opening a single door), or as part of an integrated solution where the output of the Cryptag Census reader is used by other equipment. Cryptag Census combines fast, high integrity, multiple reading of all tags present, good reading range, and ease of installation.

This manual is intended for use by installation and commissioning engineers on site. Most of the information you need to know about installing the reader is available on the Installation Sheet on the inside of the reader's lid. This manual contains some additional background information on Cryptag Census. There is also a more comprehensive Product Reference Manual available, for System Design engineers.

1.2. The reader

A Cryptag Census reader identifies tags (sometimes referred to as tokens or cards) using low frequency radio signals.

Cryptag Census readers use a single aerial coil for transmitting and receiving. The coil is tuned for the transmitter frequency of 131 kHz (in USA 153kHz), using a parallel capacitor. The internal coil is a 2 turn loop around the perimeter of the reader. This can be replaced by an external coil, which will usually be a single loop for anything larger than the reader's internal aerial, although a small mullion aerial can also be fitted.



The basic CR1 reader consists of the Processor Board (the heart of the reader), the Terminal Board (which contains the connections to the outside world), and the Aerial Module (which links up with the aerial loop). The same Aerial Module can be used with either the internal aerial, or an external aerial.

[#]The CR1 reader can be fitted with a number of options, some of which involve extra boards to allow for the use of multiple aerials. CR1-DS requires a second Aerial Module and an Aux Comms Board. Any CR1 type reader can be fitted with a tag counter display to show how many tags are present.

1.3 Tags

Cryptag Census tags are designed for long reading range, and are therefore "active" tags containing a small lithium battery. Batteries will normally last many years.

Tags have a 64 bit identity number, although many applications will use fewer bits. The identity is programmable, but once a tag has been programmed it cannot have its identity altered. Tags never reveal their identity number directly, but it is discovered by the reader after an interrogation dialogue.

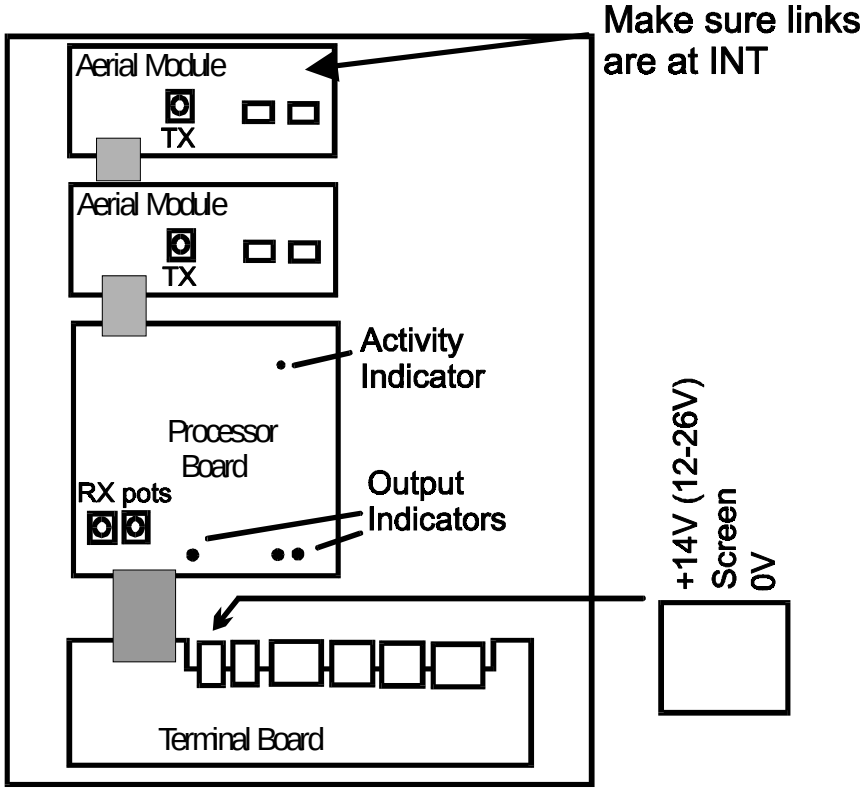
The tags are robustly constructed, and extremely reliable.

[#]Software options can affect performance.

1.4 Getting started

If you want to see the reader working, just follow these simple instructions, using the primary Aerial Module.

1. Carefully remove the lid from the reader. Using the 2.5mm screwdriver provided, connect 14V to the power connections. Make sure the polarity is right!



2. Bring a tag near the reader.
With the internal ferrite aerial near the loop terminals on the Aerial Module, the reading range is only about 10cm (4 inches), when the TX and RX potentiometers are fully clockwise (their factory setting).

3. The Activity Indicator LED will flicker when the tag is within range.
[#]Most readers report data when the tag first enters the Reading Zone. This is usually shown by the Output Indicator LEDs flashing once. To get the reader to report the tag again, move the tag well away from the reader for several seconds, then bring it back to the reader as in Step 2.

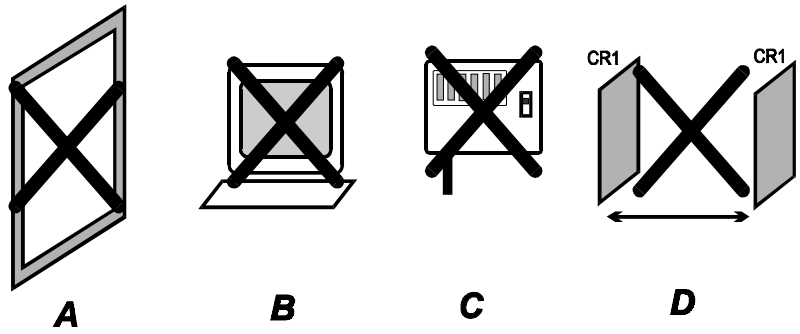
4. You can get the reader to produce test messages.
Press the red button on the Processor Board and hold it down for at least 3 seconds before releasing it. The reader will send test messages on its Wiegand and RS232 outputs. You will see the Output Indicator LEDs come on while the data is sent. Tag data will be reported on both outputs.

[#]Software options can affect performance.

2. READER LOCATION

2.1 Siting the reader

Appendix B covers the selection of the reader configuration (internal or external aerial, etc.). This section is about where exactly the reader should be positioned. The intended location should have been checked already, but you should confirm that nothing has changed, and if necessary perform another Site Survey (see Section 2.2).



A Do not position aerials less than 200mm (8 inches) from a metal surface, or loop. Any large metal structure may affect performance. See Appendix A.9. *A large metal sheet will reduce reading range behind it, giving some partial screening. See Appendix A.10 for more details.* Do not have the end of a piece of ferrous metal near the aerial.

B Do not position aerials less than 1.5 times the reading range from a computer monitor, e.g. 4.5 metres (14 ft) from a 2 metre (6ft 6 in) square loop.

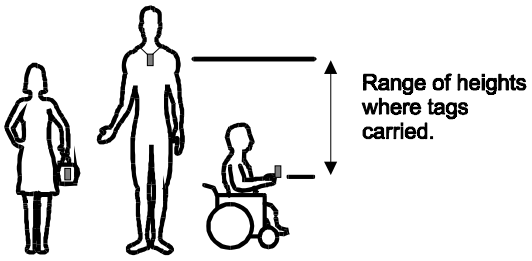
C Do not position aerials less than 1.0 times the reading range from large mains or data cables unless you have **thoroughly** checked them with a Site Survey Meter. If other cables are at 90^{o} to the plane of the loop, they will have less effect. Some older types of fire alarm system and motor drives can produce a lot of interference.

D Do not position aerials less than 3.0 times the average reading range from another reader's aerial. Think vertically as well as horizontally, as tags can be read through walls, floors and ceilings.

Make sure that the situation isn't going to change after you've installed the reader, particularly on new or refurbished buildings. Is there any other equipment, filing cabinets or cabling to be installed?

A readers with an internal aerial, or an external mullion aerial, should normally be positioned on the wall beside the door. They should be near to the door handle, on the "insecure" side. The location of larger external aerial loops should have been decided already, and will depend on where tags are to be read.

Check that no problems will arise from tags being read behind the reader or to the side. (The reading zone is almost spherical.)



Before positioning the aerials, consider their height from the floor. When tags are being carried by people, the best height should be selected with regard to both the way in which tags will be read, and the visibility of the LEDs.

The best height is generally where tags will naturally be presented face on to the reader. With a hands-free technology, tags are carried at a wide range of heights. (Around the necks of the tallest people, in bags carried by shorter people, and possibly held by users in wheelchairs.) If tags are to be presented to the reader, the reader should be within reach of people in wheelchairs.

If tag holders must be able to see the LEDs, make sure that they will be visible to all users. The CR1 reader provides outputs for additional external LEDs, which may be more suitable.

Finally make sure that the cable runs from the reader, especially to the external aerial, are not too long. The normal maximum cable length from the reader electronics to the external aerial is 10 metres (33 ft), but you are advised to have the electronics as close as possible to the aerial to ease commissioning and subsequent servicing.

If in doubt, ask. Your supplier should be able to give you advice on particular situations.

2.2 Site Survey

The Site Survey is a very important part of the installation. It is the key to a trouble-free installation.

a) First, check again to make sure that there isn't anything that's going to produce interference or affect performance. (All of these justify special attention during a Site Survey.)

Computer screens (VDU or monitor)
Other electronic equipment
Metal structures (e.g. windows, doors, other frameworks)
Partitioning that may be on metal supports
Mains switch boxes or fuse boxes.
Unscreened or badly screened data cables (including alarm cables).
Fluorescent lights or low voltage lighting.

b) Make sure you have a Tuning / Noise MS3. **Type MS1 is not suitable for Cryptag Census.** (In USA it should be an MS3A.)

c) Before you start the survey, make sure all electrical equipment is switched on, and any cables are supplying typical signals.

d) MS3 allows interference (noise) to be measured in one of two ways. You can either scan around the proposed reader location using the probe pod, or you can connect it to an aerial loop. **DO NOT CONNECT BOTH A LOOP AND A POD, OR YOU MAY GET MISLEADING RESULTS.**

Press the NOISE button on the MS3 and the LEDs will show what range you might expect. With a pod, the range is in metres, but with an aerial loop it will be a percentage of the standard range for that size loop (see Appendix A), as the sensitivity of loops vary. For TC1 tags

	If Red comes on	If Amber comes on
Pod	less than 1 metre	less than 2 metres
Loop	less than 33%	less than 67%

More than one LED may come on. Assume the worst, so that if red is coming on the effect on range will be the same as if only red is on. (There is an exception. If an LED only comes on occasionally there may be time for tags to be read in between, but reading will be slow.)

The purpose of the survey is to discover whether there are any potential sources of interference, and to find the best location for the aerial. The way this is done depends on the type of aerials used.

If separate receiver pods are being used the test should be done as close as possible to where the pod will be mounted, and in the same orientation. It is a good idea to move the pod around and change its orientation, to see if there is any possible problem. If only green is on at the intended location, but moving a short distance makes it turn red there is something there to be investigated. (This is the kind of situation that's likely to get worse when anything's moved.)

Where a loop aerial is being used the best test is to measure what happens with the loop itself, but clearly this isn't always practical. With the probe, scan all round where the loop will be, as one noisy spot can have a big effect. If there is noise where the loop is to go, think about moving the loop or using a separate receiver pod (i.e. CR1-DS1 reader version).

Remember that the Survey Meter is only a rough guide to the range expected. If it shows amber the range might be anything from just below a metre to over two metres. If it shows green that might mean that the range is only about 2 metres, which may not be enough for the desired performance.

e) It's a good idea to put the Survey Meter near any cables in the vicinity of where readers are to be located. If the field from the cable extends out a significant distance (in relation to the desired reading range and the distance from the cable to the reader aerial) it is a good idea to find out what the cable is for, and whether the loading is likely to change.

f) Find out whether any changes are planned, which may affect the validity of your survey. Is everything switched on?

2.3 Positioning multiple aerials

CR1-DS readers use two separate aerial loops. Their relative positioning is to some extent dependent on the type of software fitted. This is a brief summary, and for more information refer to Appendix D.

Dual Access Control Reader

The two aerials are to appear as two separate readers, and normally the aerials will be located at different doors. As they are part of the same reader their reading zones could overlap without problems, but make sure that tags will always be picked up by the correct "reader".

Control version of Direction Sensing

This is used with a physical barrier, and the two aerials would cover either side of a door. The reading zones may overlap, but they must be arranged so that when a tag approaches the door it will always be detected first by the correct aerial.

Tracking version of Direction Sensing

This is used where there is no physical barrier, or there is a door which is not locked. Tags are reported after passing through both aerials, so the aerials must be located so that both pick up all tags which pass through. In addition they must be arranged so that the correct aerial detects the tag first, as otherwise the wrong direction may be reported, or the tag isn't reported at all.

Safety version of Direction Sensing

The aerial layout will normally be the same as Tracking.

Most applications of CR1-DS will use external loop aerials. Their size and location will depend on the application, but it should be borne in mind that there is an effect on performance. The best detection rate is obtained with Master/Slave aerials. Next best is a loop through which tags pass, while a loop at the side of a corridor or in the floor or ceiling has the lowest detection rate.

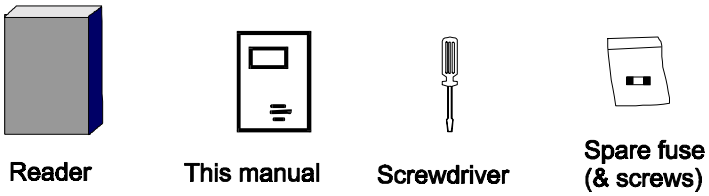
If the aerial is at the side of the corridor or in the floor it is a good idea to consider whether the detection rate will be sufficient. Consider how tags are likely to be carried, and what range of tag orientations are likely. Remember that at the limit of reading range only the optimum orientation works, so the range needs to be more than enough. If there is any doubt, do an experiment.

3. INSTALLATION

If this is the first time you have installed a Cryptag Census reader, you should have this manual beside you as you work. When you are more familiar with the reader, you should find all the information you need on the Installation Diagram on the inside of the lid.

3.1 Unpacking

Carefully remove all the equipment from the packaging. Check and inspect for visual damage and check against the delivery note to make sure there are no missing items. If any items are missing or damaged, inform your supplier **immediately.**



Take great care when removing the lid of the reader. **Do not handle individual circuit boards without following anti-static precautions.**

3.2 Special Tools and Materials

Most of the tools required to install a Cryptag Census reader will be found in a competent electrician's tool box, and in most cases what you need will depend on the particular installation. The only special tool needed is the 2.5mm screwdriver provided with the reader, for use on the terminal blocks.

> **The demountable screw terminals used for external connections to the Cryptag Census CR1 reader can be a little confusing at first. Only use the screwdriver supplied with the reader.**
>
> **Before inserting the wire, always make sure the terminal is open, by turning the screw anti-clockwise for about 5 turns. Then insert the wire, and tighten.**
>
> **The screw is not necessarily electrically connected when the terminal is open. If you probe an open terminal you are likely to get misleading results.**

The reader is normally supplied with the cover secured by 6 cross-headed screws. Some or all of these can be replaced by any M3 security or tamperproof screws. You will need the appropriate security screwdriver if you select such screws (and remember to leave one on site).

3.3 Cabling

You must use screened cable for the connections to the reader, and if applicable for the connections to an external aerial. (Radio approvals require this.) Suitable cable is readily available, or it can be obtained from Identec. Foil screened cables with a drain wire are suitable.

For the multi-core screened cable used to connect to the reader, Identec recommend a 12-core screened cable (e.g. 7/0.2mm, 24a.w.g). You may need fewer cores, but any spare cores can be used as additional 0V/14V power connections.

Cable lengths are limited principally by voltage drops in the power lines. Wiegand and Clock/Data outputs can be used up to 100 metres (330 ft). RS232 outputs should not be used for over 10 metres (33 ft). (Unless it has been configured for less than 9600 baud.)

The reader requires between 12V and 26V d.c. power (14V nominal)**.** If there is a long cable run, the voltage drop may be excessive. The reader should not be operated with less than 12V input at the reader terminals. (A buzzer comes on below 11.5V.) If the reader takes more than 400mA the maximum voltage is below 26V (see Appendix A.6).

For the cable between the reader electronics and external aerials, refer to Section 3.6.

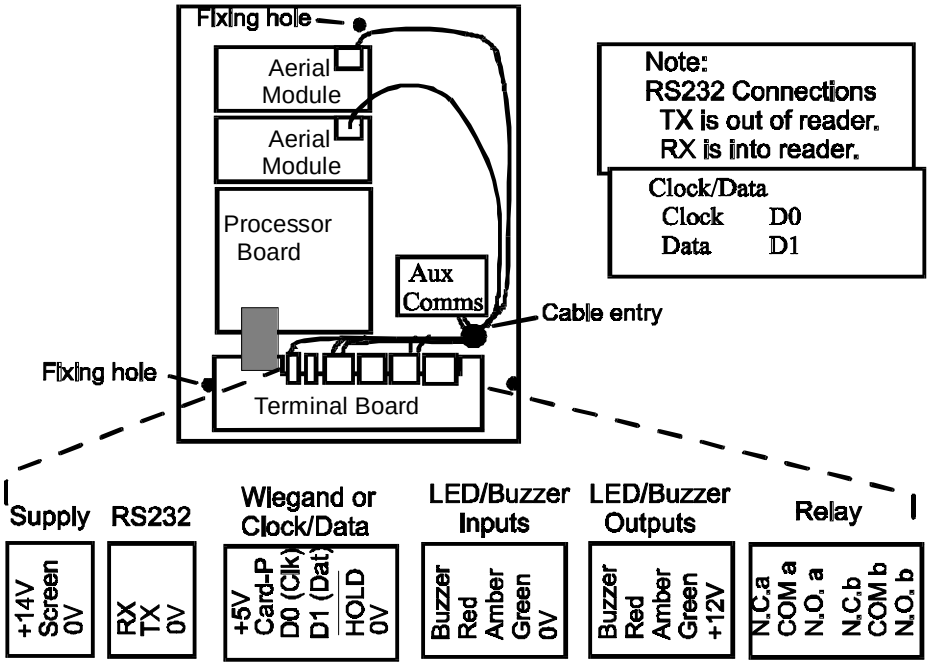
3.4 Installation of the basic reader

This applies to all readers, with or without external aerials. If optional boards are fitted to the reader, you should install the basic reader first.

Has a Site Survey been done? If not, refer to Section 2.

Carefully remove the reader's lid, and put it aside to make sure it doesn't get scratched or damaged. (The lid is held on by 6 M3 screws accessible from the front.) Handle the reader with care, ensuring that the internal components are not damaged. **To minimise the dangers of damage due to electrostatic discharge, avoid touching the circuitry.**

The reader's location (and the type of aerial being used) should have been decided already. If not refer to Chapter 2 and Appendix B of this manual for details.



Route the cables to the reader, so that they can come in through the hole in the back panel. All cables for the reader, including those to external aerials will come through the same hole. **To make it easier to bring the cables in to the back of the reader,**

Identec can supply a backbox which is fitted to the wall behind the reader.

Where a backbox is being used, fit the backbox to the wall, and route all cables into it

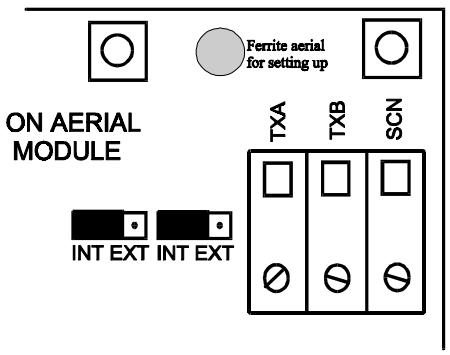
before fitting the reader itself. (The fitting of the reader may be left until commissioning.) Attach the reader using the screws supplied. Bring the cables in through the knockout holes.

Attach the reader using the 3 fixing holes in the back panel. Make sure that the back of the reader is not twisted, and is flat.

If the reader is being installed in an outdoor location, take the reader off again, and waterproof the cable entry area and fixing holes. See Section 3.5.

Connect the cables to the appropriate terminal blocks, except for the +14V input. **(Remember to use the screwdriver provided for the terminals, and unscrew the terminal before inserting the wire, to make sure that the terminal is open.)**

If you are using an external loop aerial, it is usually best to commission the basic reader, before switching over to the external aerial(s). (*Such readers should have an internal ferrite aerial. If they have a large internal loop, and the reader is in or on metal, reading may be affected*.) Make sure the links on the Aerial Module are set at INT.

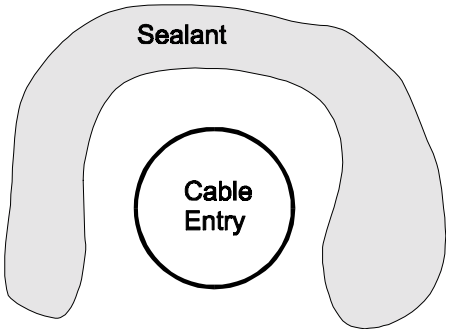


If the reader has two Aerial Modules, connect the wiring to the second aerial, **but leave the links on both Aerial Modules at INT.** This will allow you to commission the reader using only the internal aerial. If you are using an Aux. Comms Board, you may find it easier not to connect wiring to it at present. (This will depend on the system to which it is connected, so this manual cannot lay down hard and fast rules.)

3.5 Waterproofing the reader

The CR1 reader's lid is fitted with a sealing gasket to prevent water ingress. **(The gasket will only seal properly if the reader's base is flat.)**

The cable entry hole must be protected to ensure that water does not get in. The cable itself should be angled so that water will not run into the reader. Apply a silicone based sealant around the cable entry hole.



This should be taken around the top and sides of the hole, but take care to leave a gap at the bottom. (If there is any way that water gets in you need to make it easy for the water to get back out.) Reattach the reader before the sealant dries off, making sure that the sealant will stop any water running down into the cable entry hole. The reader's fixing holes, and any other holes in the base plate, should also be protected.

If there is a danger that water may get inside the reader, consider drilling holes in the bottom of the reader baseplate to allow water to drain out. (This may be advisable where condensation forms easily on the inside of the reader.)

When using a backbox behind the reader, seal all cable entries to the backbox, except at the bottom. Make sure that there is a drainage hole at the bottom of the backbox. Seal between the backbox and the back of the reader using silicone rubber. In exposed situations it is also advisable to seal between the backbox and the wall.

3.6 Mullion Aerial

External aerials are usually large single turn loops, but an exception is the Mullion Aerial. The Mullion Aerial is self-contained, and is already fitted with an internal tuning capacitor. It is supplied with a cable, which can if necessary be extended up to 10 metres (33 ft) in length. The Mullion Aerial is fitted with a 6 core screened cable:

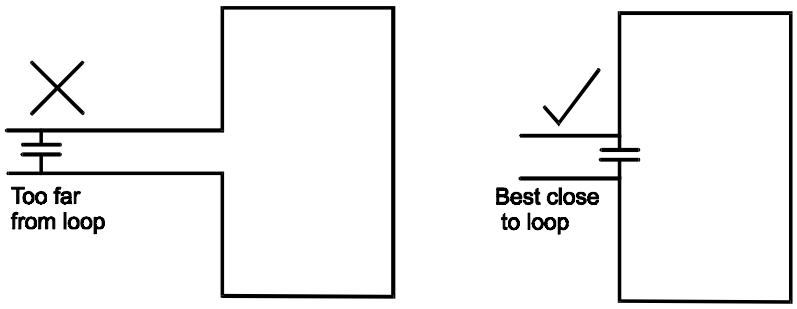
Screen	SCN on Aerial Module
Black	TXA on Aerial Module
Blue	TXB on Aerial Module
Red	Red on LED outputs block on Terminal Board
Green	Green on LED outputs block on Terminal Board
White	+12V on LED outputs block on Terminal Board

3.7 External Aerial Loop Installation

The wire of the loop must not be positioned on a closed metal frame. Appendix B.5 contains some suggestions of how to mount loops when there is a metal frame.

An external loop is connected to the CR1 reader electronics using up to 10 metres (33 ft.) of 2 core screened cable (7/0.2mm or 24 a.w.g. minimum). The two cores are connected to the TXA and TXB terminals. The screen should be connected to the terminal marked "SCN".

The tuning capacitor should be fitted across the loop, **as close to the loop as practical.**

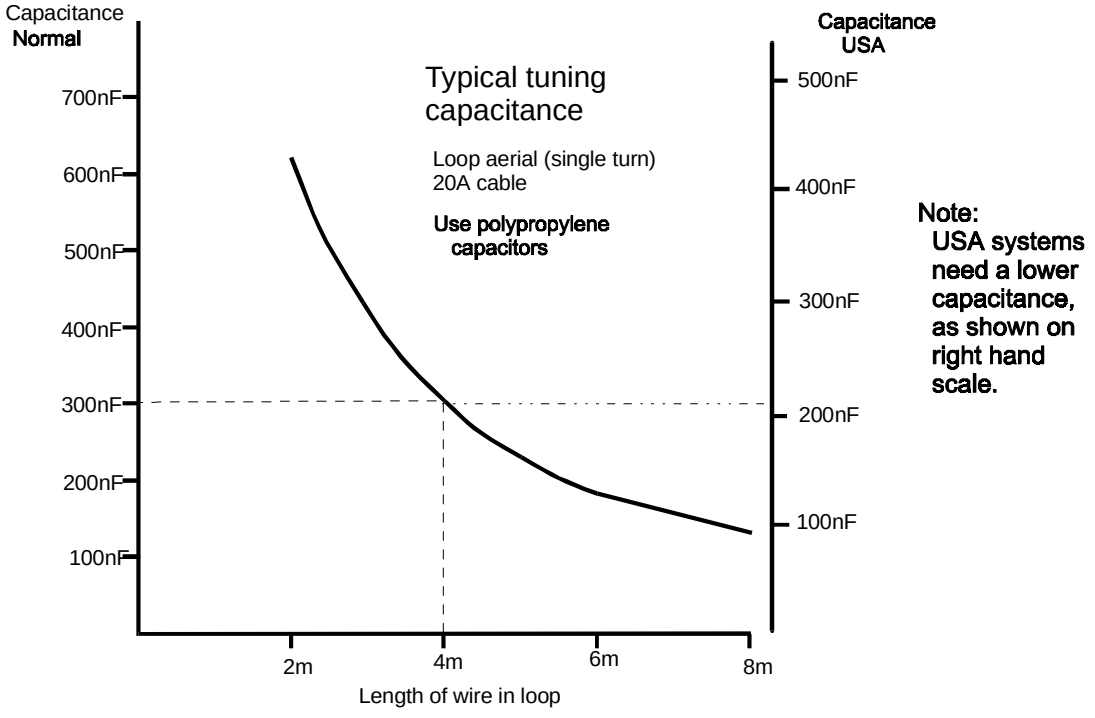


The loop itself should be made up of heavy duty wire, with a continuous rating of at least 20A. If the wire is too thin it will reduce the range achieved, as will having a significant distance from the tuning capacitor to the actual loop. The connections between the tuning capacitor and the loop should be well made. If a terminal block is used it should checked for the tightness of connections.

It is better to be able to adjust the tuning capacitance during commissioning, to obtain the best tune. It is recommended that you use an Identec Tuning Module (Part No 91-8968), which is a simple capacitance box. Alternatively you can select capacitors for your application. (The capacitors should be polypropylene, 250V minimum rating. Identec can supply suitable capacitors.) If you are fitting a reader in an outdoor application, make sure the tuning capacitors are suitably protected. (This means waterproofing them, and if necessary giving them physical protection.)

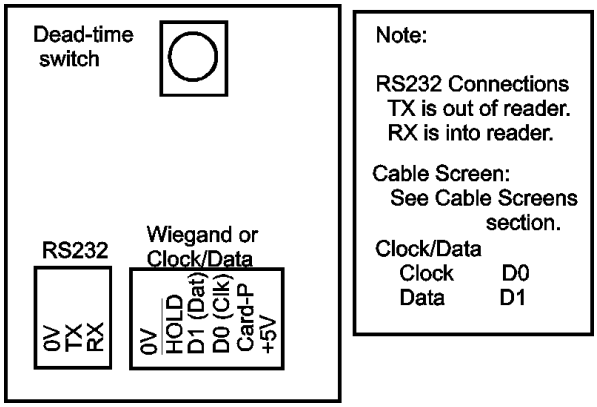
The value of tuning capacitor needed will depend on several factors:

Length of wire in loop	(most important)
Shape of loop	(less important)
Diameter of wire	(less important)
[1]Presence of nearby metal	(can be important)



[1]Metal may also seriously affect reading range.

3.8 Auxiliary Comms Board



The Auxiliary Comms Board is fitted on CR1-DS dual aerial readers, and the reader will contain appropriate software. (Refer to Section 4.3 and Appendix D.) The Auxiliary Comms Board should be wired as shown. **The 0V connections to the Auxiliary Comms Board are duplicates of other connections, and may cause "earth loop" type problems. If tag data is not reported correctly, try removing these connections.**

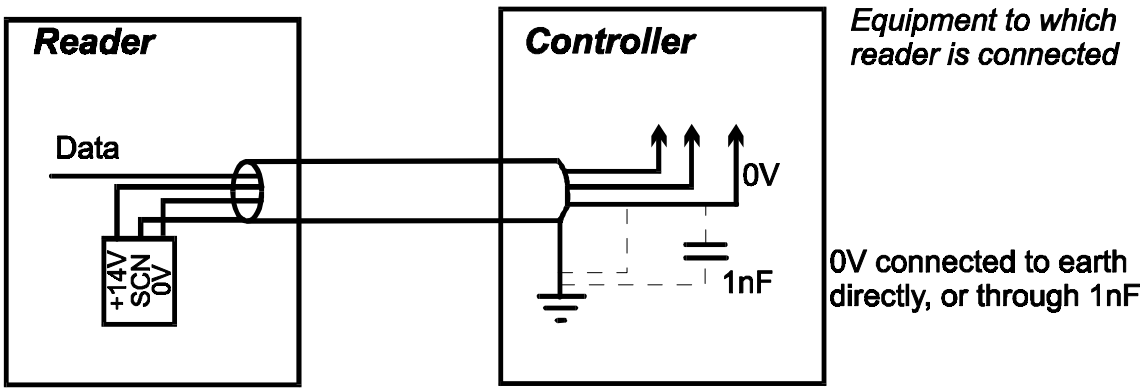
3.9 Cable Screens

All cables should be screened, and the cable screens must be connected correctly.

Main cable - to SCN connection on Terminal Board.
Aerial cable - to SCN connection on Aerial Module.
Aux. Comms - to SCN connection on Terminal Board.[2]
Other cables - to SCN connection on Terminal Board.
(e.g. remote indicators)

The screen of the main cable (to the Terminal Board) should be connected to earth at the Controller end.

If the 0V connection to the reader is not connected to earth at the controller (i.e. the other end of the main cable from the reader), there should be a 1nF capacitor between 0V and earth at the controller end.



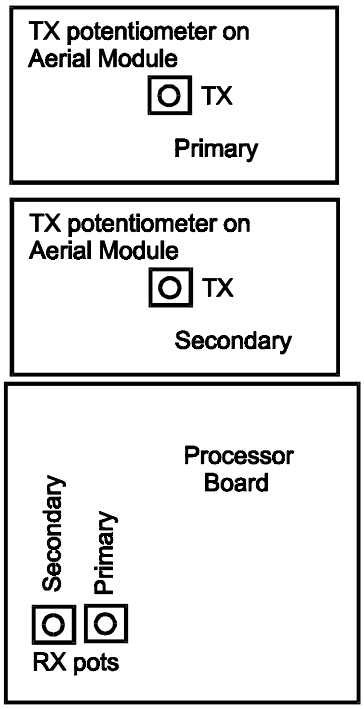
[2]If this causes earth loop problems, insert a 1 nF capacitor in series.

4. COMMISSIONING

4.1. Basic reader with internal aerial

It is better to commission the basic reader first with an internal aerial. Readers for use with external aerials should have a small ferrite inductor acting as an aerial. It is fitted near the aerial connections on the Aerial Module and has a range of 10cm (4 inches). If the reader has an internal aerial loop around its perimeter there may be reasons[1] why you cannot commission the reader with its internal aerial. If so connect the external loop (and put the links to EXT), but note that the reading range will be different. Furthermore the current consumption may be excessive if the loop is not tuned properly.

Make sure that the TX potentiometer on the aerial modules, and the RX potentiometers on the processor board are turned fully clockwise. (This is the factory setting.)



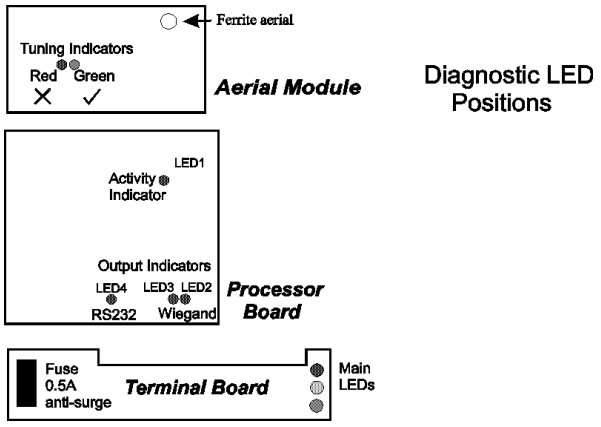
Connect a d.c. current meter (ammeter) in series with the +14V supply line, and power up the reader. The current should be about 300mA for a CR1-DS (with internal ferrite aerial on the primary Aerial Module and no loop fitted to second Aerial Module), but will be more if some optional modules are fitted. For instance the LED module increases the current by about 100mA depending on how many segments are lit. If the current exceeds 400mA the maximum voltage will be below 26V. (See Appendix A.6)

The current will be higher if the external loops are connected, and they are not properly tuned. If the current exceeds the expected current by more than 100 mA, switch off immediately and check the wiring. If the current is still higher than expected, refer to the Troubleshooting section (Chapter 5).

The green LED on each of the Aerial Modules should be on. If not (i.e. the red LED is

[1]Such as the reader being in a metal box, or mounted on a metal surface.

on instead) it means the aerial loops are not tuned. If external loops are being used this can be ignored for the time being.



LED Indications

	No tag	Tag first identified	Tag still present
Terminal Board *(software defaults)*			
# Red	ON	Flashes off	ON
# Amber	OFF	Flashes	Flashes
# Green	OFF	Flashes	OFF
Processor Board			
Activity Indicator	OFF	Flashes 12/sec	Flashes 12/sec
	(Activity Indicator LED on for 1 sec at power up.)		
Output Indicators	OFF	Flashes	OFF
	(Flash briefly at end of power up.)		
Aerial Module			
Red	ON means the aerial is out of tune.		
Green	ON means the aerial is in tune, or open circuit.		

When the reader is first powered up, it will go through a start-up sequence, shown by the Activity Indicator LED on the processor board coming on for one second, followed by the Output Indicators flashing briefly. After this the Activity Indicator will also come on (and flash at around 12 times per second) when there is a tag close to the reader[2]. If there is no tag present, the Activity Indicator should be off. If it is flickering without a tag near the reader, there is interference at 98kHz (in USA 115kHz). You should investigate the source of the interference. (see the Troubleshooting section)

Check that tags are detected at a range of about 1.2 metres (4 ft) with the large internal loop, or 10cm (4 in) with the ferrite aerial. First check that the Activity Indicator LED (LED1) on the processor board indicates that the tag is being read, then check that the tag is being reported. (For Wiegand or Clock/Data outputs, LED2 and LED3 will flash while the data is being sent. All readers will flash LED4 while data is being sent. [#]Some versions will also give an audible beep when a tag is first read.) Once a tag has been reported, it will usually have to be removed from the reading zone for several seconds

[2] Some special versions of software may flash less frequently.
[#]Software options can affect performance.

before it will be reported again. If tags are not being read or are being read but not reported, refer to the Troubleshooting section.

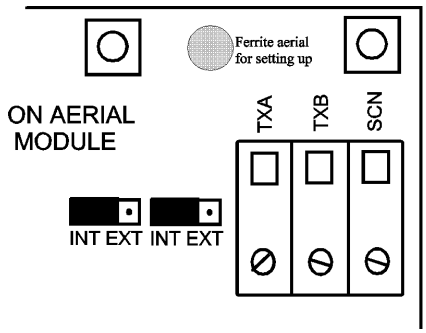
If the reader is to use external aerial loops, refer to section 4.2.

If the reader is using the internal aerial, you may wish to reduce the reading range. To do so turn the TX potentiometer on the aerial module anti-clockwise to achieve the desired range. It is rarely necessary to adjust the RX potentiometers.

4.2. External aerials

It is assumed that you have already commissioned the reader with an internal aerial on the primary Aerial Module, as described in Section 4.1 above. (If you cannot use the internal loop, you will have shown that the reader works with the external loop, but it will not be optimised.)

When you change to the external aerials, make sure you change the 2 links on the Aerial Modules from INT to EXT.



Mullion aerials should now operate correctly. Their reading range should not normally need to be adjusted, and both TX and RX potentiometers should be fully clockwise.

The external aerial loops need to be tuned. For each one adjust the tuning capacitor to bring the aerial into tune. If the aerial loop is not properly tuned, the range will be reduced, and the reader will take more current. **You will not get more range from the reader if it is out of tune, even though it takes more current. All you do is create heat.** It is important for the aerial to be properly tuned, particularly for smaller loops.

Possible techniques for tuning the aerial. Select the one you find most suitable.

1. If you have an Identec Tuning Unit (e.g. MS3), remove the connections to the reader, and connect the Tuning Unit to the aerial loop and capacitors. Follow the instructions that come with the Tuning Unit, which will tell you whether the capacitance is too high or too low. Remove the Tuning Unit, and connect the aerial to the reader.

OR

2. Adjust the capacitance so that the green LED on the Aerial Module is on. If it is on over a range of values, go for the middle of the range. This is adequate for most applications.

   (If you cannot find any capacitance value which gives green, turn the TX pot down a little. This has the effect of widening the range where you get the green

LED on. When you are nearer a good tune, turn the TX pot back up. Remember to put it back to fully clockwise when you finish. If the green LED won't come on with the TX pot fully clockwise, and you are sure the aerial is tuned, don't worry.)

OR

3. Put a meter in series with the 14V power input to the reader. Adjust the capacitance to give minimum current.

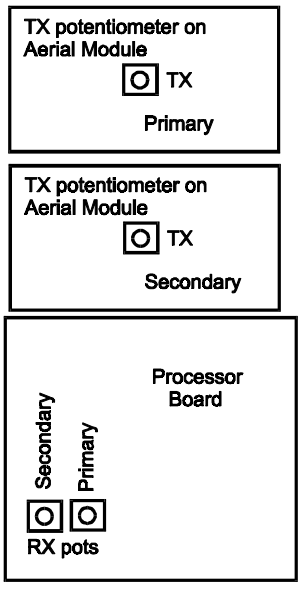
OR

4. If you have a dual-trace oscilloscope with you, the best tune is when the voltage across the coil is exactly in phase with the amplifier output. Connect probes either side of R20 on the Aerial Module, with the ground connection on TP7 on the Processor Board. With too little capacitance, the signal from the right hand side of the resistor (the smaller signal) will lag, while with too much it will lead.

   It is not a good idea to adjust the capacitance to give maximum range. This is rarely accurate enough, and usually gives excessive current.

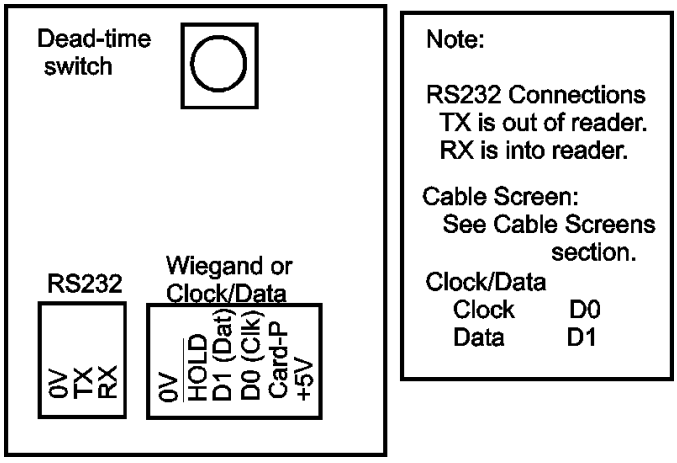
You may wish to reduce the reading range. As with internal loops, you should turn the Aerial Module's TX potentiometer anti-clockwise, until you get the range you want. It is rarely necessary to adjust the RX potentiometer.

Each TX potentiometer is on the appropriate Aerial Module. The RX potentiometer for the primary Aerial Module (above the processor board) is the right hand (inner) one, which is marked RXA.



With two aerials you should check the tuning and range of each with the other disconnected from the reader, but with the tuning capacitors attached. They are unlikely to affect each other unless they are very close. If the application requires that the reading zone of the two aerial loops do not overlap, check that there really is a region between them where tags are not read, by disconnecting each aerial loop in turn to measure the extent of the other's reading zone. For other applications check that tags are reported by the correct reader. Repeat this check for tags in different orientations and approaching the reader from different directions.

4.3 Auxiliary Comms Board



If you are using a Direction Sensing option, the Dead Time switch may need to be set.

For the Direction Sensing (Control) software option, a tag will be reported when it is first seen at one aerial[3], but it should not reported again if it is then seen at the other aerial within the period set by the Dead Time switch.

For the Direction Sensing (Tracking) option, a tag will only be reported if it is seen at both aerials within the Dead Time. It is reported from the aerial that sees it last.

For the Safety option, the tag will only be reported once it has left one or the other reading zone for the Dead Time. The tag is reported from the aerial which saw it last, but the tag will be reported even if only one aerial sees it.

The time is normally increased by one second per notch.

(Where the CR1-DS is being used with the two aerials acting as two essentially independent readers, the Dead Time switch has no effect.)

4.4 User Instruction

Before you leave the site at the end of commissioning, please devote some time to User Instruction. The information you need is in Appendix F.

[3]Each aerial of the CR1 behaves as a separate reader in these options.

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5. TROUBLESHOOTING

5.1 Finding the cause of the problem

Sometimes the reader doesn't work straight away. This should help you find out why. (The Product Reference Manual has more information.)

It is quite rare for the reader itself to fail, so use this section to check the installation thoroughly. If you experience a problem not covered here, please let us know, so that the manual can be improved.

Troubleshooting starts with the reported symptoms, and suggests possible causes for each. The equipment to which the reader is connected is referred to as the controller.

If you are asked to check the wiring, make sure that the wires are firmly held in the terminal block.

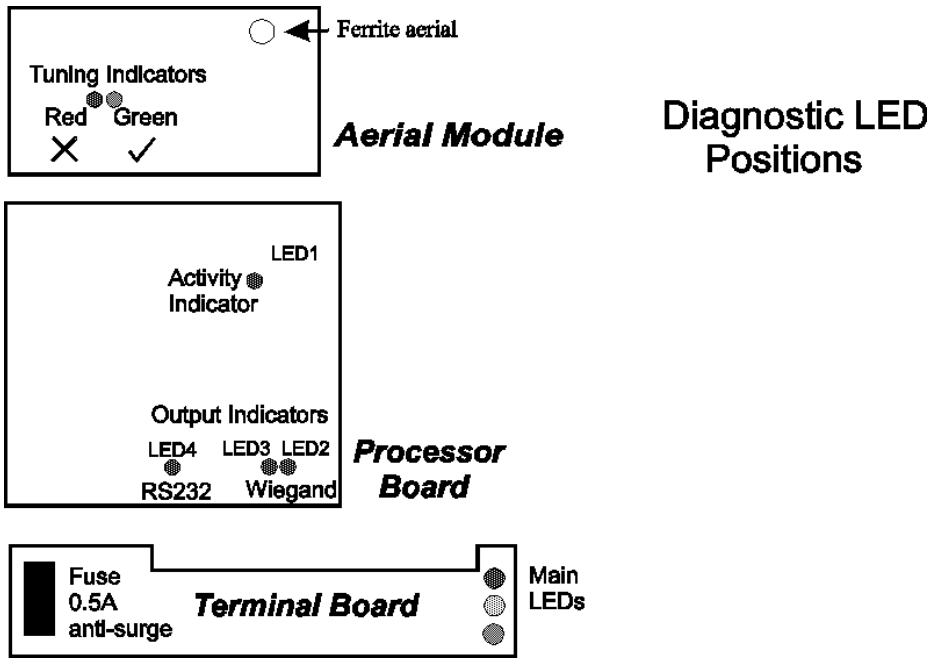
START HERE. (The reader's cover should be removed.)

NO LEDs ON AT ALL (No Main LEDs, no LEDs on processor board or Aerial Module.)

Check: No LEDs are on at all. In very bright sunlight you might not see them very easily.

Check: Power Supply wiring to the reader.
(should be between 12V and 26V with the reader connected.)

Check: Power supply fuse not blown. (500mA anti-surge)
(If it is blown, find out why before replacing. The fuse must be anti-surge, particularly for readers with dual aerials.)



[#]*LED Indications*

	No tag	Tag first identified	Tag still present
Terminal Board *(software defaults)*			
# Red	ON	Flashes off	ON
# Amber	OFF	Flashes	Flashes
# Green	OFF	Flashes	OFF
Processor Board			
Activity Indicator	OFF	Flashes 12/sec	Flashes 12/sec
	(Activity Indicator on for 1 sec at power up.)		
Output Indicators	OFF	Flashes	OFF
	(Flash briefly at end of power up.)		

Aerial Module

Red — ON means the aerial is out of tune.
(If green comes on when a tag is brought in, it is near being in tune.)

Green — ON means the aerial is in tune, **or is open circuit**.

ACTIVITY INDICATOR LED DOES NOT COME ON (On Processor Board)
(Activity Indicator should come on for any tag.)

Check: Aerial loop is connected. (No aerial gives green on Aerial Module.)
Check: Does using internal loop cure problem?
Check: Jumpers for internal/external aerial loop correctly set.
Check: Are you using a Cryptag Census tag?

ACTIVITY INDICATOR LED CONTINUALLY FLASHING
(Activity indicator should normally be off with no tags present.)

Check: Are there any tags left in field? (Remember that the reading zone can be larger than you expect.)
Check: Are there any computers nearby?
Check: Other sources of possible interference.

ACTIVITY INDICATOR SHOWS TAG IS READ, BUT NO RESPONSE BY CONTROLLER. (i.e. no output message)

Check: Do LEDs for Wiegand outputs and RS232 output flash when tag is brought in to reader?
(The reader will send test messages if the red button on the processor board is held down for at least 3 seconds. This is a more convenient way of checking that the data is getting through. See Section 1.4.)

(No LED flash seen when tag brought in)

Check: Is the tag valid for this reader? (The reader may be programmed to ignore some tags, using a software option.)
Check: Is the Hold line held low? This will stop tags being reported.
Check: Are you sure the tags are out of the reading zone for the timeout which is normally several seconds? (You will know when the tag has left the reading zone, because the Activity Indicator will cease flashing.)

[#]Software options can affect performance.

(LEDs flash when tag is brought in)

Check: Wiring from reader to controller. (If you are using the Aux Comms Board, refer also to Section 3.8.)

Check: Are these tags programmed into the controller?

TAGS ARE READ, BUT RANGE INSUFFICIENT

Check: Is the aerial of the reader mounted on metal?

Check: Are the TX potentiometers on the Aerial Modules, and the RX potentiometers on the Processor Board, fully clockwise?

Check: Is the reader well separated from other readers?

Check: Is the reader near computer monitors, or any sources of interference? (Note: Some sources of interference are not detected by the Activity Indicator. If you think there may be interference, refer to Section 5.3.)

Check: Is the aerial properly tuned? Check the Tuning Indicator on the Aerial Module shows green. Make sure the aerial connections are properly tightened.

RED LED ON AERIAL MODULE IS ON

Check: Is the aerial properly tuned?
(Note: If you cannot get the green LED to come on, turn the TX potentiometer down a little. If the green LED is now on, but it changes to the red LED if the capacitance is either reduced or increased by a small amount, then don't worry. Turn the TX potentiometer back to fully clockwise.)

INDICATOR LEDs (OR BUZZER) NOT RESPONDING CORRECTLY

(Remember that the LEDs respond either to the reader, or to external commands.)

Check: Voltage levels on LED input terminals. When the relevant LED input line is taken to 0V, the LED should come on.[#]

Check: Connections to LED output terminals. If there are connections, try removing them. When the terminal is taken to 0V, the LED should light.

Check: Is what you see correct? (Is it part of the software you have?)

RELAY OUTPUT DOES NOT OPERATE (WHERE APPLICABLE)

(The relay option is only enabled in some software options.[#])

Check: Does the version you have include relay operation?

Check: Is the relay clicking? (Most versions will operate when a tag is brought in to the reader.)

Check: Is the relay meant to operate on this sort of tag? (Some versions only operate the relay on some tags.)

Check: Connections to the relay (if it is clicking).

READING SLOW OR UNRELIABLE

Refer to the suggestions for reduced range.

TAG BATTERIES GOING FLAT VERY QUICKLY

([#]This may be noticed in different ways, depending on the system to which the readers are connected. Some systems will give a "Low Battery" message, or the reader can be configured to flash one of the LEDs very quickly if the tag's battery is low.}

Check: Is the tag being left close to the reader? If a tag is continually responding to a reader, the battery will go flat in a matter of weeks. (Remember that a tag in the margin of the reading zone may be responding, but the reader cannot identify it so doesn't report it.)

READER PRODUCING "BEEP" SOUND EVERY FEW SECONDS

Check: It is probable that a tag has been left in the reading zone. This is the loiter warning on some software versions[#].

READER PRODUCING "DOUBLE BEEP" SOUND EVERY FEW SECONDS

Check: Is the input voltage to the reader at least 12V. A low voltage warning operates at 11.5V.

TAG NUMBERS REPORTED INCORRECTLY

Check: Wiegand wires reversed. This will give a binary number that is the "one's complement" of the true number. It may also be reported as a "reverse swipe" or even "Duress" on some Access Control systems.

Check: Controller is set up for the correct format.

Check: Have you set your system up correctly? If the system uses Site Codes, it may report invalid tags if the Site Code is wrong.

5.2 Repair

The reader is designed to be "Installer-Friendly", and is rarely damaged, so please check the installation thoroughly. In the unlikely event that you find that the reader is faulty, you can exchange individual PCBs, or replace the entire reader. (Remember to follow the correct procedures for static-sensitive products, if replacing PCBs.)

Identec encourages its customers to return faulty equipment, as investigation of faults may help us improve the product.

12 month "no-quibble" guarantee

All Identec readers and tags are guaranteed for 12 months from the date of despatch from the factory.

[#]Software options can affect performance.

[#]Software options may affect performance.

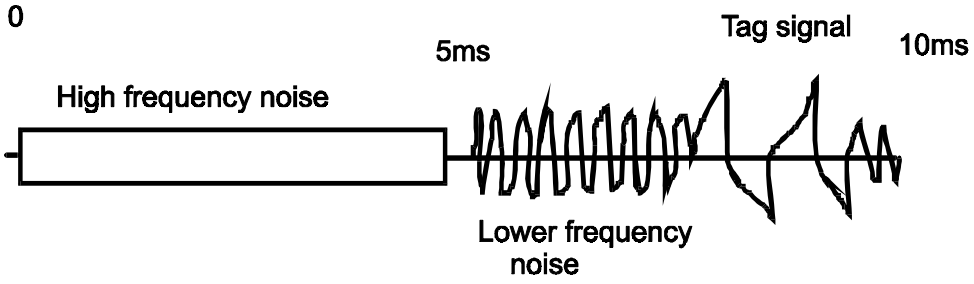
5.3 Interference

Some types of interference are not detected by the Activity Indicator LED. These can be checked using an oscilloscope.

Connect the 'scope probes to the Processor Board, and set the 'scope as follows:

Signal probe to TP1 or TP2 for the Primary Aerial Module.
(TP3 or TP4 for the secondary Aerial Module.)
Probe earth to TP5 (0V)
Trigger probe to TP8 (Trig.)[1]

Signal	200mV/cm, AC coupled
Timebase	1ms/cm
Trigger	on -ve edge.



(**Note**: For USA systems, the trace will be compressed in the time scale.)

With no tags present, the trace has two distinct parts, separated by a small gap after 5ms (in USA, 4.2ms). The first part is when the reader is transmitting, and there is some high frequency noise. The second half of the trace is when the reader is receiving, and there will be some lower frequency noise. If a tag is brought in to the reader, its signal will appear in this part of the trace, somewhere between 5ms and 9ms (in USA 4.2ms to 7.5ms). The tag signal will move about within this region, but for each tag it will last 1ms (in USA 0.8ms).

Check the noise level on the right hand side of the screen, in comparison to the signal from a tag. Interference will stop a tag from being read when its magnitude is similar to the signal from a tag. For full reading range, this corresponds to about 100 to 200mV peak-to-peak. This figure is the same for all aerial sizes, but the larger the aerial, the greater the voltage from the same interference source. (CR1-DS1 readers with separate receiver aerials will usually show a little more noise.)

Very strong signals can affect the reader's receiver, yet might not appear at the receiver's demodulator output. Such interference may be observed on TP7 (TP6 for the secondary Aerial Module), where the normal noise level is about 0.5V peak-to-peak.

[1] Except on readers that use the Card Present output on the Aux. Comms Board. An alternative trigger signal is pin 11 (the right hand pin) of the L2750 power amplifier (heatsinked) on the Aerial Module.

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Appendix B SELECTING THE READER

B.1 The decision process

This appendix describes how to select the reader for a particular location. Consider

What do you want the reader to do?
Where do you want tags to be read?
Where do you not want tags to be read?
What aerial configuration (if any) will meet your needs?
Will it work in the intended location?
Are there any other limitations?

Following this process will help give you a successful installation.

You have selected a CR1-DS1 reader which has separate transmit and receive aerials. The normal reasons for selecting a CR1-DS1 are

Where direction sensing is needed

It is impractical to fit loops either side of the door.

Where direction sensing is not needed

a) The is localised noise which prevents the loop around the door being used as the receive aerial.
b) Tags should only be read on one side of the door. (Other field shaping options are possible.)

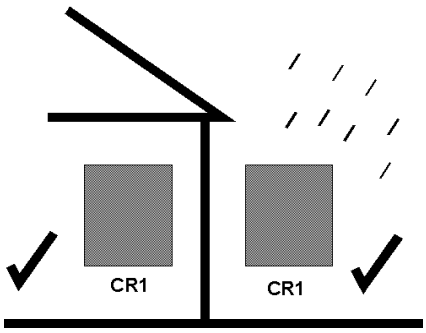
You should be aware that the CR1-DS1 reader's range depends on the aerials used. Tags will be read if they are within range of both a transmit loop and a receiver pod, and they must also be in an orientation that couples in to both.

The transmit loop needs to be away from metal which could act as a shorted turn. The receiver pods must be kept away from noise. They have a typical reading range of 2.5 metres, but this will reduce in the presence of noise.

B.2 Environment

Cryptag readers work in most environments, over a temperature range of -20ºC to +60ºC.

The CR1-DS1 reader can be installed indoors, or outside. (Outdoor locations require some weatherproofing precautions.)



B.3 Where will tags be read?

In most applications you will want tags to be read as they approach or pass a reader. Tags on those "paths" need to be detected reliably, taking into account their orientation (are the tags horizontal or vertical etc.), and the number of tags passing the reader.

The Data Sheet range is for a tag in the optimum orientation, and a relatively interference-free environment, and many factors can reduce range. Not every tag that just comes within the quoted range will be detected. There will be cases where tags are read at slightly greater distances than you expect. Reading range can be turned down.

If there are metal structures near the reader, reading range is normally reduced, but there are anomalous cases where it is increased, although this is rare with CR1-DS1 because of the need to couple to both loop and pods.

It is important you look all around the reader, in case there are places where you don't want tags to be read. When doing this, think vertically as well as horizontally, and look at other floors if there are any. (The reading range in the plane of the loop is almost the same, so the Reading Zone is almost spherical.)

There are cases where the reading range must be much higher in one direction than another. It is possible to screen the back of an aerial loop, greatly reducing the range in the "reverse" direction, with less loss of range in the "forward" direction. Refer to Appendix A.10. (Alternatively consider separate receivers - see Appendix H.)

B.4 Limitations

Before deciding on a reader configuration and position, make sure there isn't something that will stop it from working.

Readers should <u>not</u> be installed where performance is going to be affected by external factors such as large items of metal, or equipment that will cause interference.

The reader's aerial should not be installed on a metal surface, which can act as a short-circuit turn to the transmit loop. (There is no problem putting the reader electronics on a metal surface**,** if there is an external aerial loop away from the metal. If you must have the transmit loop near metal, it may need retuning.)

The reader's aerial must not be installed on to closed metal loops such as

partition supports and door frames. The closed metal loop is nearly as bad as a metal sheet. (See the next section - B.5 for more details.)

The receiver pods should be kept away from sources of interference such as VDUs, monitors, photocopiers etc.. Other things to look out for are large cables (mains and data), and ferrous metal near the reader. If in doubt, check the area with a Tuning and Noise Meter MS3 (or in USA MS3A). Make sure that possible sources of interference are turned on. (For details of how to use the Site Survey Meter, refer to Chapter 2.)

A Do not position transmit loops less than 200mm (8 inches) from a metal surface. For more information, refer to Appendix A.9. *There is an exception here if a sheet of metal is being used deliberately as a screen, to reduce the reading range in one direction. Refer to Appendix A.10.*

B Do not position receiver pods less than 1.5 times the reading range from a computer monitor, e.g. 4.5 metres (14 ft) from a 2 metre (6ft 6 in) square loop.

C Do not position receiver pods less than 1.0 times the reading range from large mains or data cables unless you have **thoroughly** checked them with a Noise Meter. If possible have the plane of the loop at 90^{o} to the other cables.

D Do not position aerials less than 3.0 times the average reading range from another reader's aerial. Once again, think vertically as well as horizontally. For a Direction Sensing option, where the fields from different aerials of the same reader should not overlap, you can get away with slightly less.

The proposed location should be given a Site Survey, as described in Chapter 2.

B.5 Aerial Loops near metal (transmit loops)

There are often situations where aerial loops must go near to metal structures. This section looks at various possible situations, and how to deal with them. Reading range will be affected, but by following these suggestions the effect will be minimised.

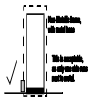
Case 1: Wooden door in a metal frame.

The first question to answer is whether there is a complete closed (electrically conducting) loop, so is the frame connected to metal across its base? If there is not a complete closed loop, then you can put the loop up against the door frame. The tuning capacitor should be located near the base of the door.
(The metal frame will increase the effective wire size, so the tuning capacitor will be slightly higher than normal for the aerial size.)

Be on the lookout for the case where the floor looks non-metallic, but has a metal structure below.

If there is a closed loop where you would like to place the aerial, it may be possible to break it without doing any damage. **(Before you make a cut, you must make sure that it won't affect structural integrity.)** If there is just a metal strip across the base, it may be possible to shorten one end by a small amount, breaking the closed loop. If you can make a break in the closed loop, it is much better if you put the tuning capacitor near to the break.

If you are left with a closed loop that cannot be broken, you must separate the aerial loop from the closed loop. You will need to construct a channel for the aerial, at least 200mm (8 inches) away from the metal frame. Ideally the aerial loop should be on the side where you want better tag reading. Alternatively it may be possible to put the aerial loop on the wall away from the metal frame. (It doesn't matter if the wire has to run next to the base of the frame. One side of a loop can be next to metal, if the other three sides are clear.)



Case 2: Metal door inside metal frame

Under these circumstances it doesn't matter whether the frame produces a closed loop, because the metal door will when it is closed. You must stand the aerial loop clear of the frame as shown above. With the metal door, there will be more difference between the reading range on either side of the door, and between whether or not the door is open.

Case 3: Metal door inside non-metallic frame

In this relatively rare situation, it will probably be best to run the aerial loop in the wall at least 200mm (8 inches) away from the metal door.

Case 4: Metal "tiles" under floor

Metal coated floor tiles are commonly used to prevent static discharges and reduce electrical interference. There may be occasions when you wish to have part of an aerial loop going across such tiles. If the rest of the aerial loop is clear of metal, this is not a problem. It will generally be easier to pass the wire under the tiles, but as only one side of the loop is next to metal it will be all right. (If there is also a metal frame, the aerial loop must be positioned away from the metal, except for the one side that goes under the tiles.)

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