# CRYPTAG ®

## READER MANUAL

## IDENTEC READER TYPES LS1 and LS3

IDENTEC LIMITED
Mercantile Road
Rainton Bridge Industrial Estate
Houghton-le-Spring
Co. Durham. DH4 5PH

Tel: +44 (0) 191 584 4084
Fax: +44 (0) 191 584 9077
Technical support: 0800 018 1661
Web site: www.identec.co.uk
e-mail: info@identec.co.uk

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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, and is therefore subject to possible interference. Any application should bear this in mind, and in particular it should not be possible for personal safety to be jeopardised by a failure to read.

This reader neither uses nor generates hazardous voltages. You should not connect any such voltage to it.

CE

This product complies with the following European Community directives

**Low Voltage Directive. (73/23/EEC)**
**EMC Directive. (89/336/EEC)**

# 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 GRANT AUTHORISATION: JHD-DLS

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# 1. CRYPTAG READERS LS1 and LS3

## *1.1 **Introduction***

Cryptag is a radio frequency tag identification system. Its multiple reading feature means that the reader can simultaneously identify and report one or more tags.

This combined manual covers the following reader types

| | | |
|---|---|---|
| LS1 Wiegand Output | LS1 RS232 Output | LS1 Clock/Data Output |
| LS3 Wiegand Output | LS3 RS232 Output | LS3 Clock/Data Output |

LS3 readers contain an internal look-up table which modifies the way in which the tag's identity is reported, whereas LS1 readers report a number which is derived directly from the tag's identity. See Appendix A for details of output formats.
LS1 and LS3 are configurable readers, having separate transmit an receive aerials, allowing the reader's transmitter and receiver(s) to be located to suit the application.

## *1.2 **Unpacking***

Check that the package contains

- Reader controller unit
- Tuning module and connection cable
- SL1 or SL2 Receiver modules. At least one is required, but more may have been ordered. Normally two are supplied, but up to 4 can be fitted.
- Loop wire (8 metres maximum)
- Warning label (s)
- Manual

## 2. READER LOCATION

### *2.1 Factors affecting the site*

Care is needed in selecting the location for the LS1/LS3 reader components. The location of the transmitter and receiver aerials should be determined by a suitably qualified person.

Do not locate Cryptag reader aerials too close to another reader
If tags can pick up signals from two or more readers they respond to neither. The minimum separation is 1¼ times the combined reading range (i.e. 2½ times the range of two similar readers).

Do not mount the aerials directly on to metal.
If the transmitter loop is too close to a metal surface or closed metal loop, it will reduce reading range and increase current consumption. The loop can be mounted parallel to a metal surface with a minimum recommended spacing of 200mm (8 inches).

Metal can also affect the receiver, in two ways. It can reduce the sensitivity of the receiver. Ferrous metal can act as a concentrator for interference signals, so the receiver should be kept away from the ends of ferrous metal rods and the edge of ferrous metal structures (including reinforcing mesh).

Keep the receiver aerials away from possible interference sources
Interference (also referred to as noise) can reduce the reading range and make reading slower. Computer monitors can affect performance at up to 6m (20ft). Most monitors have less effect, but it does depend on the scan frequency.

The transmitter loop and the receivers should have minimum coupling.
This is covered in the installation instructions.

A Site Survey (using an MS1 Site Survey Meter) is essential.

When deciding where the reader aerial system is to be mounted, bear in mind where tags are to be worn.

### *2.2 Transmitter Loop Location*

The transmitter loop should be positioned so that it can activate tags. If a corridor is to be covered the best place for the loop is usually around the corridor. The maximum wire length is 8 metres, which is just enough to go round a double door.

The main limitation on the transmitter loop location is that it should not be close to a closed metal loop (or continuous metal surface), as the closed loop will absorb energy out of the loop. (Reducing range and increasing current consumption.) It is sometimes possible to break a closed loop by cutting away a section, but be sure not to cause any structural damage.

Watch out for metal doors. A pair of metal doors can together behave as a closed loop. this can lead to the situation where the range is good when the doors are open, but not when they are closed.

If there is a closed metal loop the transmitter loop should be at least 200mm (8 inches) away from it. Even so the range will be affected. For instance if the loop is on the inside of a metal frame, reading will be poor on the outside. Contact Identec if this is the case.

### *2.3 **Receiver Location***

Points to consider

- A good place to detect tags
- No coupling with the transmitter loop
- Away from interference (as identified in the Site Survey)

A typical LS1/LS3 installation has 2 receivers. With more than one receiver, the aim should be to ensure that there will usually be at least one receiver which will pick up the signals from a tag. Identec can advise on possible receiver locations.

The receivers are affected by the transmitter signals, and so should be placed in "null" orientations. For a null the ferrite rod inside the receiver should either be pointing straight at the wire of the transmitter loop, or the ferrite rod should be parallel to the wire of the transmitter loop. The closer the ferrite rod is to the transmitter wire the more difficult it is to align it to get a null. We recommend a minimum spacing of 50mm (2 inches).

The output of the receivers is summed. This means that if one receiver is subject to interference the whole reader is affected. Every receiver position is important.

### *2.4 **Possible Receiver locations***

If only one receiver is being used it should ideally be in the centre of the loop. It should be mounted in the same plane as the loop, with a preference for the rod being horizontal and pointing across the direction of travel. (Not all of these may be possible, but the preference order is that given.)

What if tags should only be read on one side of the loop? The receiver can be on that side of the loop, but take care. If the receiver is far enough from the loop to prevent tags from being read on the wrong side, reading on the right side of the loop starts to drop off.

Multiple receivers can be placed either side (or above) a doorway. Receivers above the door should be horizontally across the top of the doors. Receivers in walls on either side of the door can be either horizontal or vertical. If they are vertical they should be either well above or well below the height at which tags will be worn.

For vehicle tagging the loop will often be in the ground, especially if tags are fitted to the underside of vehicles. The receivers should point across the roadway. (The tags should be fitted to the vehicles so that their ferrite rods also point across the roadway.) If the receiver is to be placed in a roadway, ask Identec for type SL3. This is based on LS1, but has extra mechanical protection.

# 3. INSTALLATION AND COMMISSIONING

## *3.1 Tools and materials for installation*

No special tools are required.

## *3.2. Preparation*

Open the Controller Unit lid by removing the 4 front screws.
Open the Tuning Modules.
Loosen the terminal blocks.

**CAUTION**
**Take care not to move or damage internal components**

## *3.3 External Connections*

For most installations using Wiegand format, the connections will be

| | |
|---|---|
| 0V | Power supply –ve (and data reference) |
| 12V | Power supply +ve (12V to 14V, 220mA typical) |
| D0 | Wiegand D0 line |
| D1 | Wiegand D1 line |

The LS1 does not have any LED indications.

The HOLD line can be used to buffer the output data, if there is a suitable signal available.

For details of other output formats refer to Appendix A. This includes the relay connections which are only provided on RS232 output readers.

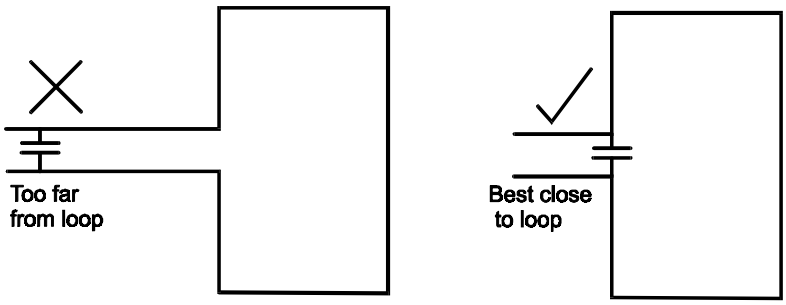
The reader has the option of an isolated output section. For details of how to use this refer to Appendix B.

The power supply voltage must be a minimum of 12V and a maximum of 14V **at the reader**. Avoid excessive voltage drops in the power supply cable.

## *3.4 Mounting*

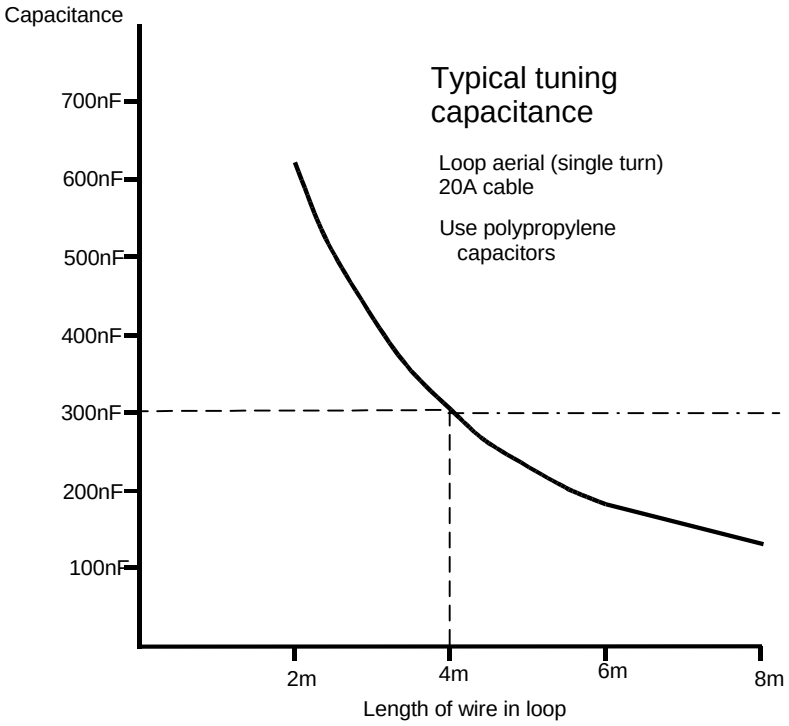
3.4.1 Select a convenient position for the transmitter loop and the receivers. (see Section 2.)

3.4.2 Select the location of the controller unit and the Tuning Module. The Tuning Module must be placed next to where the transmitter loop is to go. If the Tuning Module is not right next to the transmitter loop performance will be affected. The Tuning Module contains capacitors to make the resonant frequency of the loop 132kHz. If the reader is being installed in an outdoor location the Tuning Module will need to be protected, but for the time being access to it is needed.




On the left there is wire between the loop around the door and the Tuning Module. This wire adds something to the inductance of the loop but nothing to the useful area of the loop, so it reduces the field created by the loop.

3.4.3 Run the transmitter loop in the selected location, noting the total length of wire used. Mount the Tuning Module, and connect the transmitter loop wire into one pair of terminals. Make sure that the terminals are well screwed down as poor contact will affect performance.




Set the capacitance of the Tuning Module at an initial value as shown in the graph. Select the capacitors that get closest to this value.

3.4.4 Mount the Reader Controller Unit in a suitable position. When connecting to the reader controller, refer to Figure 3.

3.4.5 Mount the receiver(s) in the selected position. If SL1 receiver modules are used there should be a means of adjusting their position to get a null. SL2 receiver modules have an internal adjustment.

3.4.6 Connect the Tuning Module to the Reader Controller, using the cable supplied. The connections are to TX1 and TX4.

Connect each receiver to the Reader Controller, which has terminals for up to 4 receivers. Each receiver is connected to one of the 4 terminal blocks on the daughter board inside the Reader Controller. The connections are

| | |
|---|---|
| 0V | Green wire |
| 12V | Red wire |
| Sig(nal) | White (or yellow) wire |
| Screen | Braid |

If more than one receiver is being used, all but one will be temporarily disconnected during commissioning. You may wish to leave them unconnected, but ensure they are protected.

3.4.7 Make the power supply and data connections to the Reader Controller. Make sure that the voltage drop on the cable will not be excessive. (Assume a current of 350mA.)

3.4.8 If the Reader is not to be commissioned immediately replace the cover on the Reader Controller, and the Tuning Module.

### *3.5 **Commissioning***

*If any problems are experienced during commissioning, refer to the Trouble-shooting Section (Section 4)*

Refer to Figure 3 for the location of terminals, indications, controls and test points.

3.5.1 If necessary remove the cover of the Reader Controller. Check the following-

**Wiring** is correct and secure
**Links** are correctly positioned
If there is no wire to 5V(W) then LK1 and LK2 should be in. There need be no wire to 0V(W), which is connected to 0V.
If there is a wire to 5V(W) but no wire to 0V(W) then LK1 should be in and LK2 should be out.
If there are wires to 5V(W) and 0V(W) then both links should be out.
**Potentiometers** are fully clockwise.
A range of suitable **Cryptags** is available.
For **LS3** readers, ensure that the **look-up table** has been loaded. (Appendix C.)

3.5.2 Apply power to the system. When power is first applied LED3 comes on momentarily.

Measure the voltage between 0V and +12V terminals. This voltage must be at least 12V, and it must not exceed 14V.

3.5.3 The transmitter loop should be tuned. Connect a current meter in series with the 12V power supply. Adjust the capacitance inside the Tuning Module to give minimum current consumption. This should also correspond to maximum range, but it is more important to minimise the current.

3.5.4 Ensure that there are no Cryptags close to the Reader (i.e. within 3 metres)

Each receiver should be aligned for minimum coupling to the transmitter loop. Connect an oscilloscope to TP3, with the ground lead clipped to the bolt which secures the 5V regulator. Set the oscilloscope to 200mV/cm, 1ms/cm, and trigger on AUTO.

Disconnect all but the receiver being aligned by removing the signal lead from the terminal block, and notice how the noise on the scope trace varies as the receiver is moved. Adjust the receiver's alignment for a minimum. The ideal level is below 200mVpp (peak-to-peak), but below 500mVpp is acceptable.

If more than one receiver is being used, connect them all. Carry out a phase check to ensure that the signals from a tag are being added (rather than subtracted). Bring a tag in towards the reader, and observe its signal on the oscilloscope. Reverse one of the receivers by turning it through 180 degrees, and see whether the signal from the tag is improved.

If there is more than one receiver, adjust one of the receivers to minimise the noise. Once again aim for below 200mVpp.

Hint:
Sometimes it is not possible to adjust the receiver's alignment accurately enough. An alternative is to put a slight kink into the transmitter loop. Once the best alignment has been achieved, make sure it's not going to move.

3.5.5 If the internal LED (LED3) is on at all, turn RV1 (see Figure 3) anticlockwise until LED 3 is permanently off. (If there are no Cryptags present LED 3 will only light if there is external interference. Reducing receiver sensitivity using RV1 will eliminate interference, but it may also affect the range.)

3.5.6 Bring a Cryptag towards the Reader from the front with its face parallel to the Reader. When LED 3 starts to flash the Cryptag is being read. This indicates the range of the reader.

3.5.7 If the range is greater than desired, reduce the transmitter power output using RV2 until the desired range is achieved.

3.5.8. RV1 (threshold) should be re-adjusted for best performance, setting the threshold level so that noise is ignored, but tags are read. Turn RV1 fully clockwise, and then turn it slowly anti-clockwise until LED3 stops flickering. A small amount of flickering is acceptable, but a large amount of flickering will make reading slow.

3.5.9. Now carry out system checks with the equipment to which the Reader is connected. (In the Fault Finding this is referred to as the controller)

3.5.10 Replace the cover on the Reader Controller. and fit the 4 screws.
Replace the cover on the Tuning Module and fix the screws.
Check that the receivers are not going to move.
Check that any length of transmitter wire near the receivers isn't going to move.
Check that any exposed components are sealed against water ingress, paying particular attention to the Tuning Module.

### *3.6 **Warning Labels***

Each Reader is supplied with a Warning Label which identifies a Cryptag Control Zone and advises against loitering. These labels are particularly recommended for situations where Active Cryptags might be left in the vicinity of a reader.

## 4. TROUBLE-SHOOTING

The equipment to which the reader is connected is referred to here as the controller. The controller is expected to receive the output signal (Wiegand, RS232 or Clock/Data as applicable). It should also control the external LEDs.

### 4.1 **LED3 does not come on momentarily when power applied**

Check: +12V with respect to 0V.

If 12V not present check wiring
If 12V is present, suspect the Reader Controller

### 4.2. **LED3 does not come on when Cryptag presented**

Check: Is the transmitter loop properly connected?
The field from the loop can be checked using the MS1 Site Survey Meter on 132kHz.

Check: Receiver(s) connected correctly.
There should be a signal on TP3, which varies as the alignment changes. If a tag is present its output should be visible on TP3 (provided the tag is within 0.5 metres of the receiver and is receiving 132kHz.)

Check: Do transmit and receive areas overlap?
The tag will only be read if it is receiving a 132kHz signal, AND its output can be picked up by the reader.

Check: Adjustment of RV1 and RV2 (See Commissioning section.)

### 4.3 **LED3 permanently flickering**

Re-adjust RV1 (See Commissioning Section)
If LED3 is beating steadily, look for a tag within range of the reader.

### 4.4 **LED3 responds to tag but no response by Controller**

Check: Cryptags are valid for this Reader (refer to Appendix A for LS1 and Appendix C for LS3.)

Check: Wiring to Reader and correct if necessary.

Check: Is Hold line high. If it is low (<2.5V) the Reader will not transmit data .

**NOTE**: The presence of pulses could be tested with a Logic Probe or oscilloscope.

## 4.5 **Transmit Range insufficient**

(for instance as measured with MS1 Site Survey Meter)

Check: Is RV2 fully clockwise?

Check: Is the loop properly tuned?
Check: Is the loop properly connected?

Check: Is the loop close to closed loops which act as a shorted turn?

With an oscilloscope, monitor the 132kHz on either side of R41 (near the TX terminals). When the reader is transmitting the two signals should be in phase, and the amplitude on the output side should be fractionally smaller. (approximately 8Vpp on input side, and 7Vpp on output side are typical)

| | |
|---|---|
| Voltages exactly the same: | Transmit loop not connected (before Tuning Module) |
| Phase Error over 10 degrees: | Loop out of tune |
| Output voltage below 75%: (and in phase) | Look for closed metal loops near transmit loop. |

## 4.6 **Receive Range insufficient**

Check: Is the receiver close to a computer monitor or any other potential source of interference?
Remove power from the reader and scan the area with a MS1 Site Survey Meter.

Check: Is the +12V supply between 12V and 14V?

Check: Is the reader too close to another Cryptag reader?

Check: Adjustment of RV1 (See Commissioning Section)

Check: Tag orientation is correct (including rotation in its own plane)

Check: Is the receiver mounted on or near metal?
(It is possible to shield the receiver, but this is rare.)

## 4.7 **Unreliable or Slow Reading**

See also the checks for insufficient range.

# 5. TECHNICAL

## *5.1 Principles of operation*

The reader contains a transmitter and a receiver, both under the control of a processor. in the LS1/LS3 the transmitter loop and receiver locations are configurable.

The transmitter sends out signals (at 132kHz) that will be picked up by any Cryptag in its vicinity. Each Cryptag will respond (at 66kHz) and a dialogue takes place which identifies the Cryptag. The nature of the dialogue is well disciplined so that more than one Cryptag can be interrogated and correctly read without interaction.

After the interrogation dialogue the Reader communicates the identity of valid tags it has seen. Tag transmissions are buffered.

## *5.2 Reading Range*

The reading range depends on the configuration. With a 2 metre square transmit loop, and 2 receivers the range with an active Cryptag (TM1) should be 1.5 metres (5 ft) or more. Range quoted is typical under optimum conditions and with a minimum 12V supply. Normal variation is $\pm$ 10%.

Often the coverage, that is those areas where a Cryptag will be read, is more important than the maximum range. The transmit range for a 2 metre square loop should be typically 2 metres. The receive range for a single receiver is over 1.5 metres (in the absence of excessive noise). When more than one receiver is used the range of each will drop slightly, but the overall coverage is improved.

The range at which a Cryptag will be identified is affected by -

Cryptag orientation - Figures quoted assume optimum orientation. Rotating through $45^0$ reduces the range by about 15%. At exactly $90^0$ tags will not be read at all. The optimum orientation varies around the reader.

Presence of metal - The Reader should not be mounted directly on or near a metal surface. As well as reducing range metal will increase power consumption.

Electrical interference - The transmission from Cryptag to Reader is at low power and may be affected by sources of electrical interference such as computer monitors.

The range of the Reader can be deliberately reduced. There is a potentiometer to reduce the power of transmissions to the tag and therefore reduce range. Another potentiometer reduces the input sensitivity of the receiver. This eliminates interference, and in some cases reducing the sensitivity may increase the range.

## *5.3* ***Dimensions***

| | Reader Controller | Tuning Module | SL1 | SL2 |
|---|---|---|---|---|
| Length | 260mm (10.2 inches) | 147mm (5.8 inches) | 180mm (7.1 inches) | 158mm (6.2 inches) |
| Width | 240mm (9.4 inches) | 87mm (3.4 inches) | 20mm dia. (0.8 inches) | 83mm (3.3 inches) |
| Depth | 63mm (2.5 inches) | 32mm (1.3 inches) | | 44mm (1.7 inches) |
| Weight | 2.2kg (4.8lb) | 0.5kg (1.1lb) | 0.35kg (0.8lb) | 0.5kg (1.1lb) |

Tuning module and SL1/SL2 weights include their cable.

## *5.4* ***Environmental***

| | | |
|---|---|---|
| Temperature | $-20^0$ to $+ 60^0$C ($-4^0$F to $140^0$F) | |
| Housing Material | Reader Controller - | Steel |
| | Tuning Module - | ABS Box |
| | SL1 - | Sealed PVC tube |
| | SL2 - | ABS Box |

## *5.5* ***Electrical***

5.5.1 Power Input

12V minimum to 14V maximum
180mA typical, 200mA maximum including 15mA interface circuit current.
(Current measured at nominal supply voltage, maximum transmitter power, and no tags present.)
If the transmitter loop is mounted near a closed metal loop, or is badly tuned, the current consumption can rise to 350mA maximum.

5.5.2 Outputs (see Figure 2 for interface circuits)

Data Output

DATA0 and DATA1 lines. Normally high (+5V), pulsing to low 0.4V. Format - See Appendix A.
1k ohms pull-up to 5V(W).
In Wiegand and Clock/Data readers the data lines **cannot handle more than 5mA maximum**.

HOLD

Input impedance 100k ohms pull-up to 5V(W)
Input capacitance 1nF
High or floating for Data output
Low to freeze data output transmission
Nominal switching level 2.5V

(**NOTE**. If HOLD goes low during a transmission, that transmission will continue to completion.)

| | |
|---|---|
| Data Buffer | Up to 10 tags can be stored. This limits the number of tags that can be identified simultaneously. |
| Max Voltage | The + 5V(W) input must never exceed 6.5V<br>Other data lines (DATA0, DATA1, LED, HOLD) must not fall below - 0.3V or above 6.5V.<br><br>Protection circuits are incorporated to prevent damage from transient spikes (above normal EMC limits). |
| Cable Length (Data) | Wiegand and Clock/Data - 100m (300 ft) maximum.<br>(**NOTE**. Cable length may also be limited by the equipment at the other end.)<br><br>RS232 - 20m (60 ft) maximum (9600 baud)<br><br>Power supply cable length is limited by voltage drops. |
| Output Timing | When the Cryptag has been read its identity is stored. The identity data is buffered to ensure that there is a minimum inter-burst period between a pair of data transmissions. The inter-burst time is configurable, and the standard value is 100ms.<br>(See Appendix A). |
| Interrogation Time | 230ms maximum per Cryptag. This may increase in the presence of interfering signals. |
| Transmission Time | Nominally 1ms per bit, but can be altered on request. (See Appendix A.) |
| Pulse Width | Nominally 50 µs. |

5.5.3. Radio Transmissions

| | |
|---|---|
| Reader to tag | 132kHz carrier<br>Magnetic field determined by loop dimensions. |
| Tag to reader | 66kHz (Phase locked to 132kHz)<br>Magnetic field, <-10db µA/m at 10m. |

5.5.4 EMC

| | |
|---|---|
| Emission | Exempt according to MPT1337 (Dept of Trade and Industry) |
| Susceptibility | Not affected by 4kV, 150ns pulses (such as defined by IEC Standard 801-4, 1988) |

## *5.6 **Cryptags***

Current Cryptag types are:

TM1 personnel tag
TA1 article tag
TK3 keyfob tag (replaceable battery)

All of these are active (battery powered) tags.

All Cryptags have a Public Identity (PID) of 16 bits and a Hidden Identity (HID) which is theoretically 16 bits, but in practice one bit cannot be identified and the useful size is 15 bits. The identity of the Cryptag is a total of 31 bits giving 2 billion possible identities.

Current production tags are programmed by Identec and can be supplied with sequential numbers. Once the identity has been programmed it cannot be altered, and tag identities are not duplicated.

Older (pre 1999) tags had a fixed identity. In order to obtain sequential numbering with older tags it is necessary to use an LS3 reader with its look-up table, as described in Appendix C.

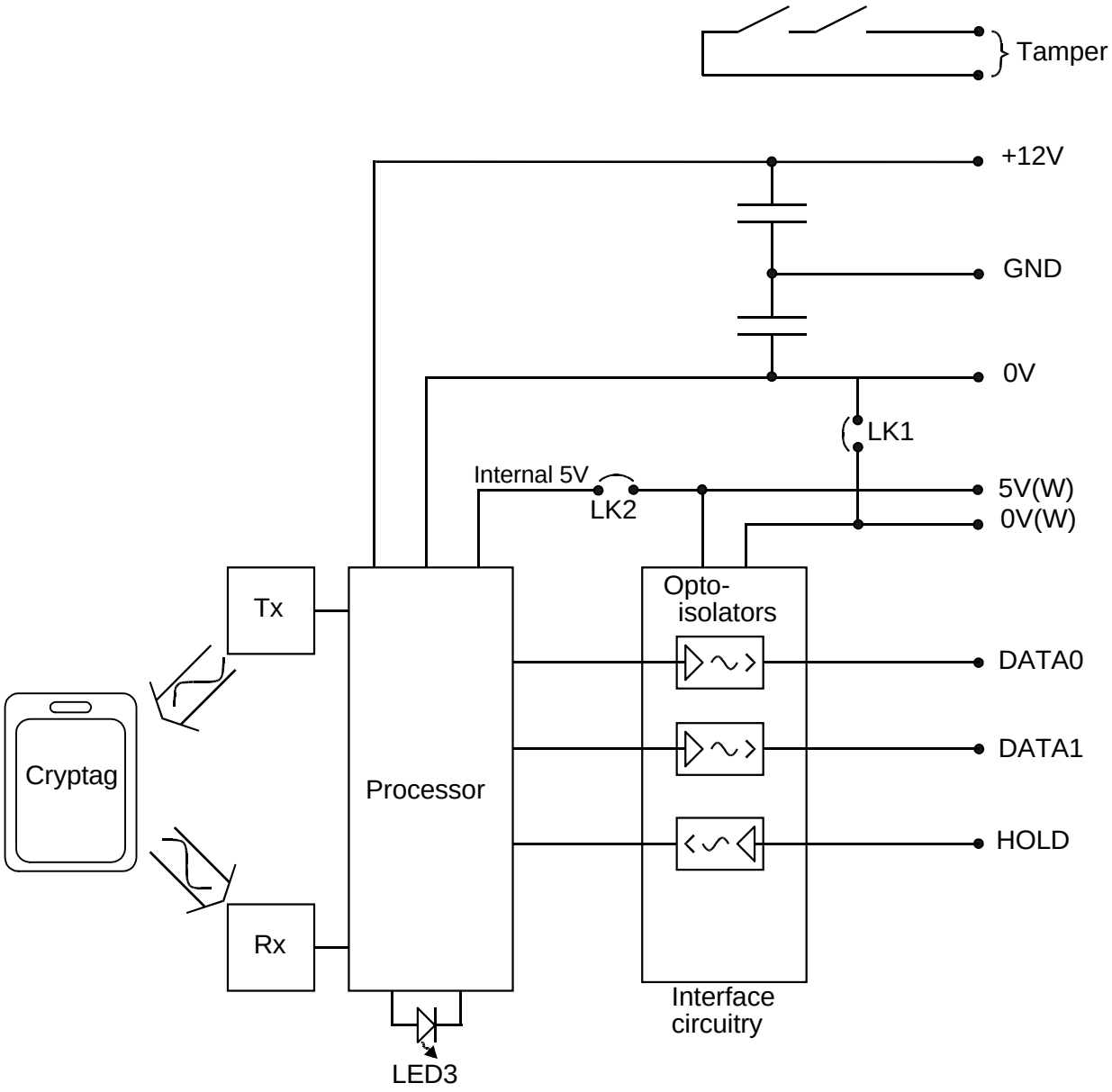
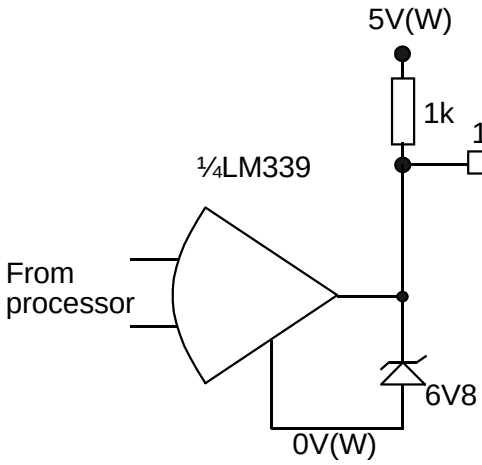



Figure 1: Reader Block diagram

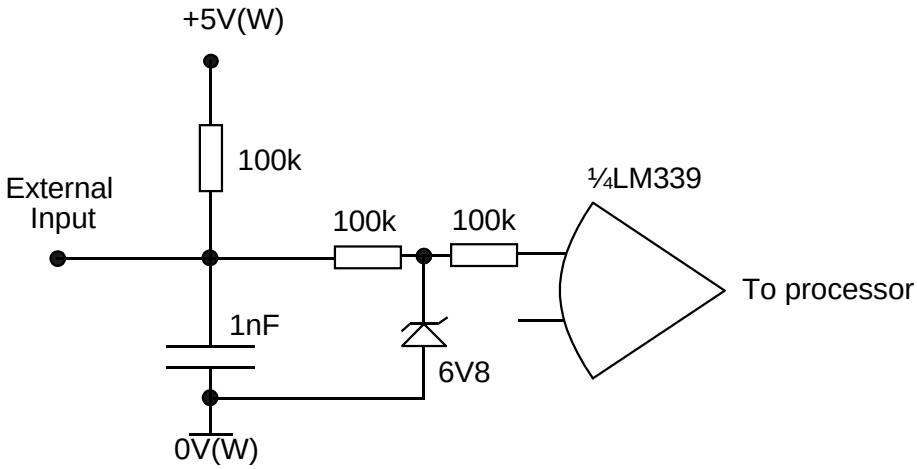
Wiegand outputs (also Clock/Data, but not RS232)




Wiegand output
- Normally high
- Pulses low on relevant line for each bit
- Each pulse is 50µs long
- Typical pulse separation 1ms

Clock/Data output
- Clock on Data 1 line pulses for each bit
- Data (Data0 line) is inverted
- Data is valid while Clock low
- Card Present (on Relay NO) is low throughout the transmission

Hold input




HOLD input
- High or floating has no effect
- Low inhibits output data
- If HOLD goes low during a transmission the transmission will be completed.

Fig 2: Interfaces

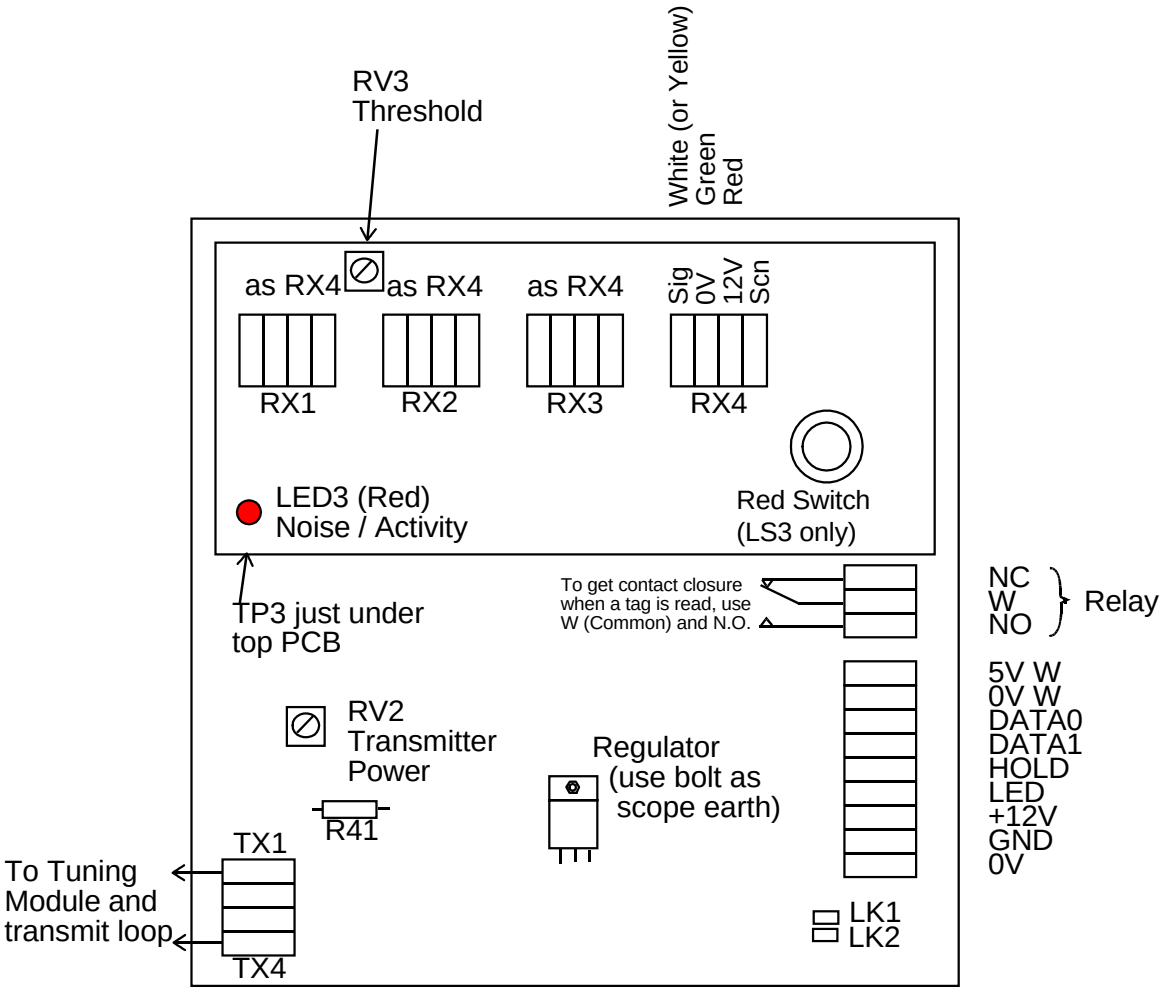



Figure 3: Unit Connections

## APPENDIX A

### Output Formats and Data connections

*The output format of the reader is configurable. This appendix gives some typical formats and the terminal connections to use.*

### *A.1 **Wiegand output***

The number of bits and their allocation is usually customer specific, but some LS1 readers are supplied with a standard 26 bit format.

| Output bit | |
|---|---|
| 1 | Even parity on Bits 1-13 |
| 2-9 | Hidden Identity (least significant byte) |
| 10-25 | Public Identity |
| 26 | Odd parity on Bits 14-26 |

The most significant part of the Hidden Identity (HID) is ignored. (On some LS1 readers, it will be checked so only tags with some HIDs will be reported.)
Tags are reported when they are first seen, and then only if the tag has been out of the field for at least 2 seconds.

Timing 1 ms bit period
50µs bit low pulse for each bit

Buffering The reader ensures a minimum period (100ms) between transmissions. This ensures that the controller does not confuse the two transmissions.

With current Cryptags the tag numbers are programmed to suit customer requirements. If older tags (pre 1999) are present on the site there is a possibility of numbering problems if the Access Control system is not sufficiently flexible. Two ways to avoid these are

a) Use LS3 readers, as described in Appendix C.

b) Make the user number as long as possible (ideally 31bits) and derive the tag number from the tag's identity

Tag number = HID * 65536 + PID

### *A.2 **RS232 output***

The standard output format is 9600 baud, 8 data bits, no parity and one stop bit. The data transmitted is

HID:HHHH PID:PPPPP<LF><CR>

Where HHHH is the Hidden Identity in hexadecimal, and PPPPP is the Public Identity in decimal, <LF> is line feed and <CR> is carriage return.

The RS232 output is on the D0 terminal. The D1 terminal is not used. RS232 readers have a single pole relay fitted, as shown in Figure 3. The HOLD input has no effect on RS232 readers.

## *A.3* ***Clock/Data output***

This format emulates magnetic stripe card readers, and is supplied to conform to specific customer requirements. For details of the encoding format, contact Identec.

Terminals for Clock/Data output readers

| | |
|---|---|
| D0 | Data output (inverted data) |
| D1 | Clock output (Data output is valid while Clock is low) |
| Relay NC | Card Present (low throughout data transmission) |

## APPENDIX B

### Power Supplies and Earthing

*This Appendix explains the options available, when they should be used, and how to implement them.*

### *B.1 **Circuitry***

Refer to Figure 1 (Block Diagram).

The reader has two sets of Circuitry, which are electrically isolated using opto-isolators.

| | |
|---|---|
| Reader Electronics - | Connected to 0V |
| | +12V |
| Output Interface - | Connected to 0V(W) |
| | +5V(W) |

The ground connection (GND) is connected via 1nF capacitors to 0V and +12V.

The other connections (DATA 0, DATA 1, LED, and HOLD) are connected to the Interface Circuitry, and must be referenced to 0V(W)

The Reader electronics contain a 5V regulator. This can also be used to supply the Interface Circuitry

There are two links related to the power supplies -

LK1 connects 0V and 0V(W)
LK2 connects 5V(W) to the Reader's own 5V

### *B.2 **Normal Arrangement** (Interface powered internally)*

In this arrangement the external connections are -

| | |
|---|---|
| 0V | LK1 In |
| +12V | LK2 In |
| DATA 0 | |
| DATA 1 | |
| LED | |
| HOLD | |

0V and 0V(W) are connected by LK1
5V and 5V(W) are connected by LK2

All outputs are referenced to 0V (and to 0V(W) ).

This arrangement will be used when the Controller (the unit to which the Reader is connected) can provide a 12V supply with sufficient current.

The 12V supply must be capable of supplying 350mA to cover the case where the loop is not tuned The current requirement is reduced if the range is reduced using RV2.

*B.3.* ***Separate 12V supply*** *(non-isolated, with interface powered externally***)**

This arrangement is used when the controller cannot provide the required 12V power and an external supply is used. The 12V supply must not be grounded except through the Reader.

Connections are -

| | |
|---|---|
| 0V | LK1 In |
| +12V | LK2 Out |
| +5V (W) | |
| DATA 0 | |
| DATA 1 | |
| LED | |
| HOLD | |

0V and 0V(W) are connected by LK1. It is best to use the 0V connection.
5V(W) is supplied separately by the controller so LK2 is out.

The outputs are referenced to 0V (and to 0V(W) ).

The 12V supply must be capable of supplying 335mA to cover the case where the loop is not tuned. The current requirement is reduced if the range is reduced using RV2.

The 5V Interface Circuitry supply current (taken from the controller) will be 15mA.

*B.4* ***Totally Isolated***

This arrangement is used when the Reader and/or its 12V supply must be totally isolated from the interface to the controller. A typical case will be when the 12V supply is shared, and the other use must itself ground the 0V line.

Connections are -

| | |
|---|---|
| 0V | LK1 Out |
| +12V | LK2 Out |
| 0V(W) | |
| +5V(W) | |
| DATA 0 | |
| DATA 1 | |
| LED | |
| HOLD | |

Interface circuitry connections are referenced to 0V(W) and not 0V.

The 12V supply must be capable of supply 335mA to cover the case where the loop is not tuned. The current requirement is reduced if the range is reduced using RV2.

The 5V Interface Circuitry supply current will be 15mA max.

*B.5.* ***Ground***

The GND connection can be connected to local metal objects. This may improve range if the Reader is affected by some types of interference.

## APPENDIX C

## LS3 Look-up Table

***This section applies to LS3 readers only. LS1 readers report the tag's identity number.***

### *C.1 Introduction*

Cryptags have a unique identity number. In current production Cryptags this is programmed into tags before they are shipped, but in earlier (pre 1999) Cryptags the number was put in at an earlier stage. This meant that it was not possible to supply tags with particular numbers. Many Access Control systems do not have the flexibility to handle what are effectively random numbers, and the LS3 reader was introduced to provide sufficient flexibility for those applications.

The LS3 reader contains a look-up table in non-volatile memory. This stores the identities of tags which are valid for that site, together with the number that is to be reported for that tag. The numbers are reported as a Site Code (fixed for the site) and a User Number which is normally sequential.

The look-up table can be programmed into the LS3 reader in two different ways.

1. using ENCODER STATION LE1
2. using MASTER TAG MT1

Normally readers are configured initially using an LE1 Encoder Station, and the MT1 is a portable "encoder" used for updating installed readers.

### *C.2* ***Operation of Encoder LE1*** *(for full instructions see LE1 Operational Manual)*

The LE1 Encoder is used before a batch of tags and LS3 readers is shipped. The tags within the shipment are loaded into the encoder. Each tag is then given a small label which identifies its User Number.

The look-up table is downloaded into each of the readers for that shipment. Only readers that have the correct look-up table downloaded into them will report the tags correctly.

The look-up table can also be downloaded into an MT1 Master Tag. The look-up table can then be downloaded into existing readers on site.

### *C.3 Operation of Master Tag MT1*

The MT1 Master Tag is most commonly used to upgrade an existing installation, for instance to add more tags. This will only work if the MT1 Master Tag is correctly programmed for that reader, so that a Master Tag is site specific. It is not necessary to remove the reader's cover before using the Master Tag..

With LS3 the Master Tag MT1 has to be located carefully, so that it gets a good signal from the transmitter loop, and is close to a receiver so that the reader gets a good reply. This best position will depend on the reader's configuration.

**Master Tag Operations during upload**

| | Master Tag indications RED | GREEN |
|---|---|---|
| Initially | OFF | OFF |
| Present in field, power up and data integrity test | ON | ON |
| Test Passed | OFF | ON for 5 seconds maximum<br>If this state persists the Site Code is incorrect. Contact Identec. |
| Loading | OFF | Flashing (on & off equal times) |
| Load Finished | OFF | Flashing (on 3 times more than off)<br>(Continued for 10 seconds after leaving field) |
| Red Led – Error message | RED | GREEN |
| Power up test failed | ON | OFF |
| Battery Low | ON | Flashing (on & off equal times) |
| Loading (Bad Frames) | ON<br>OFF<br>(Alternating) | OFF<br>ON |
| Load Failed | FLASHING<br>(on 3 times longer than off) | OFF |

**Power Up Test Failed**

Remove Master Tag from field and wait till no LEDs are on.
Reintroduce to field

If it fails again try a different Reader. Failure again means:-

a) Wrong Master Tag
b) Fault in Master Tag
c) Very low battery
d) Reader transmit power set close to minimum

**Battery Low**
OK for one reader upload but replace battery before next reader. Disconnecting the battery will not affect the stored data.

**Bad Frame**
This is OK but not recommended. Your master Tag will keep trying if it loads a bad frame. The more red light you see in general the harder it is finding it to upload so try a different position of the Master Tag relative to the Reader.

**Load failed**
Try again after removing the tag from the field.

Try a different Reader to see if the fault is in the Tag or the Reader

Report any difficulty to your supplier

### *C.4 **Example of Look Up Table.***

| Tag number | | User number |
|---|---|---|
| **HID (Hexadecimal)** | **PID (Decimal)** | **(Decimal)** |
| 000D | 00100 | 0001 |
| 0AAF | 64436 | 0002 |
| BDCE | 37000 | 0003 |
| 000A | 00010 | 0004 |
| OA01 | 01952 | 0005 |
| 881F | 26534 | 0006 |
| 6654 | 32212 | 0007 |
| 1010 | 11414 | 0008 |
| | | 0009 |

Next Tag will be 0009