# Proximity Readers Handbook

## HB00117 Issue 1

**Applicability**

This handbook applies to the PR500 Proximity Reader, the HD500-2 Heavy Duty Proximity Reader, the SP500 Switch Plate Proximity Reader and the PM500 Panel Mount Proximity Reader



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**NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:**

- **Reorient or relocate the receiving antenna.**
- **Increase the separation between the equipment and the receiver.**
- **Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.**
- **Consult the dealer or an experienced radio/TV technician for help.**

## Safety

This equipment must be powered by a supply which is suitably insulated from the mains. The supply should be classed as SELV under the terms of EN60950.

The power supply must be connected to safety earth. A mains isolation switch should be provided by the installer. Any third party equipment connected must also be suitably insulated from the mains supply.

Any fuses which are replaced must be of the recommended rating and type.

Wiring connected by the installer must be adequate. The use of inadequate wiring may present a fire hazard.

Except where specified the equipment is not suitable for outside use.

Except where specified this equipment is not for use in safety critical applications.

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## Chapter 1

# Introduction

The **PR500**, **HD500-2**, **SP500** and **PM500 Proximity Readers** are designed to read the codes contained in Cotag coded cards and tags and to pass these codes, if valid, to a host system. These Readers are primarily for use by OEMs to provide proximity reading for their own proprietary access control systems.

Each Reader requires a power supply, but can usually share the same supply as the door lock.

## Reader types

The PR500 Proximity Reader is a general purpose proximity reader which is small and slim and can be mounted on a wall or door frame.

The HD500-2 Heavy Duty Proximity Reader has a stainless steel frame, held in place by four tamper-resistant screws, which covers the mounting screws. This makes it suitable for applications where vandalism could be a problem.

The SP500 Switch Plate Proximity Reader fits a standard single surface-mount or flush fitting back box, either metal or plastic, such as is used for light switches and mains plug sockets2-hole mounting for screwing it to a standard single-way back box.

The PM500 Panel Mount Proximity Reader can be mounted within a sheet metal or plastic panel using four screws.

## Data output

The Readers provide Wiegand or Magnetic Stripe format data output, or ASCII data output at TTL voltage levels (0V and +5V). (The Readers are available in AB format if you require BCLINK data output, but this option is not described in this handbook.)

For some OEM systems, the data lines from two Readers can be connected in parallel, the host polling each Reader in turn using the Data Hold input. When this input is held low, the Reader buffers the data from one transaction. The host must release the Data Hold line and read the message before the next card is read, or else the message is discarded by the Reader.

# Interrogation of cards and tags

The Reader uses “standard interrogation” which reads the card code just once and outputs the data in a little under half a second for standard cards and tags, or in one tenth of a second for fast cards and tags. If there is too much electrical noise to read a card or tag, the amber LED indicator on the unit flashes.

The interrogation routine checks both the Distributor Code and the Secondary Code* of a card or tag and sends data to the host system only if both are valid.

*Note that the Secondary Code check can be disabled with some interfaces - see chapter 3 for details.

# Setting up the Reader

You configure the Reader by presenting it with two coded cards. The first card (the configuration card) defines the type of data interface, and various other features*. The second card (any of the ordinary Distributor Coded cards which will be used with the system) teaches the Reader its Distributor and Secondary Codes. Note that you cannot teach the Reader its Distributor and Secondary Codes without first presenting the configuration card.

When the Reader is powered up, it waits 4 seconds for a configuration card to be presented. If it doesn’t read a configuration card in this time, it enters the configured operating mode.

*All the features which can be set using the configuration card are listed on the first page of chapter 3. **It is most important that you read and understand chapter 3 of this handbook before you attempt to install a Reader**.

Chapter 2

# Installing and connecting

## PR500 Proximity Reader

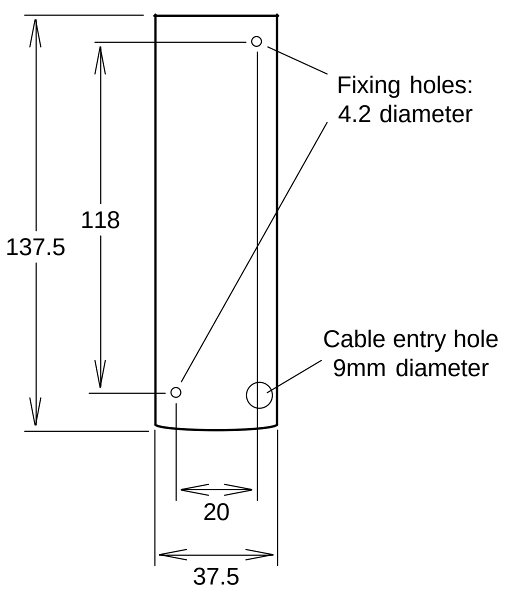
The Reader is supplied with the cover separate. If the cover has been fitted for any reason, remove it by pushing in the lug on its lower edge using a suitable screwdriver.

1. Choose a suitable position to mount the Reader near the door.

   The Reader has a maximum range of 30cm (12in) so it must be mounted in a position where the card or tag can easily be brought within this distance. We recommend it is mounted approximately one metre (3.5ft) above the ground. Also consider ease of access to the door once the card or tag has been read, for example, it is better to mount the Reader near the opening side of the door rather than the hinge side.

2. The Reader should be mounted with the LEDs at the top left. Mark out and drill the two mounting holes. Don't fix the Reader to the wall yet. The holes accept 4mm machine screws or No 8 wood screws.

Fixing Dimensions (mm)




The cover overlaps the base slightly on all sides so you must allow a little extra room all round.

3. Route the cables into the Reader: you can use either the cut-out in the base or the one in the lower edge at the bottom of the Reader.

   The connections required for the Reader are power supply connections (0V and +12V DC or +24V DC), data output connections for Wiegand or Magnetic Stripe (D0, D1, DA) or ASCII/TTL ($\overline{H}$, D0, DA), and a connection from the host to the Data Hold input ($\overline{H}$) if data lines from two Readers are to be connected in parallel.

   To promote EMC compliance we recommend you use 812 Cable as described here. Trim back and insulate the screens at the PR500. Connect the screens at the host only: do not connect the screens to the PR500.

4. When you have routed the cables into the Reader you can screw it to the wall.

5. Make the connections shown in the following table:

| Reader | Function |
|---|---|
| V+ | Power supply +12V unregulated or 24V battery-backed*<br>(absolute max 32V, min 10.6V, 100mA max) |
| 0V | Power supply 0V (-ve)<br>(also ground reference for data output) |
| $\overline{H}$ (C) | “Data Hold” for Wiegand and Mag Stripe<br>“CTS” for ASCII/TTL |
| D0 (D) | “Data Zero” for Wiegand<br>“Data” for Mag Stripe<br>“TXD” for ASCII/TTL |
| D1 | “Data One” for Wiegand<br>“Strobe” for Mag Stripe |
| DA | “Data Available” for Wiegand<br>“Present” for Mag Stripe<br>“RTS” for ASCII/TTL |
| Horn (Adr) | Horn - 0V to sound, +5V to turn off |
| R | Red LED control - 0V for red LED |
| R/G | Single wire LED control<br>0V for green LED, +5V for red LED |

*The PR500 is designed to be operated by 12V unregulated power supplies, or 24V battery-backed power supplies. Operating voltage range is 10.6 to 32.0V. The upper voltage is intended to be compatible with the charging of 24V lead-acid batteries. Charge methods vary, and may be temperature dependent. 32V max is intended to be compatible with commonly used charging methods. If the upper operating voltage is exceeded then permanent damage may be caused. Installers and systems designers should check the max power supply voltage under all conditions. Do not operate the PR500 using unregulated 24V supplies. The PR500 current consumption can be significantly less than 100mA. The unloaded peak voltage from a nominal 24V unregulated supply will exceed the absolute max.

6. **Do <u>not</u> fit the front cover to the Reader until you have configured it and tested it** (see the end of this chapter).

# HD500-2 Heavy Duty Proximity Reader

1. Choose a suitable position to mount the Reader near the door.

   The Reader has a maximum range of 25cm (10in) so it must be mounted in a position where the card or tag can easily be brought within this distance. We recommend it is mounted approximately one metre (3.5ft) above the ground. Also consider ease of access to the door once the card or tag has been read, for example, it is better to mount the Reader near the opening side of the door rather than the hinge side.

2. You can mount the Reader using any of the six mounting holes in the black plastic enclosure - the diagram at the end of this section shows the fixing dimensions and is drawn actual size so you can use it as a template when drilling the holes.

   The Reader should be mounted with the strip of LEDs at the top left.

   Note that you do not need the stainless steel frame when mounting the Reader - you fasten it to the Reader afterwards to prevent anyone undoing the mounting screws.

3. Mark out and drill the mounting holes, but **don't fix the Reader to the wall yet**.

   The holes accept 4mm machine screws or No 8 wood screws.

4. The connections required for the Reader are power supply connections (0V and +12V DC or +24V DC), data output connections for Wiegand or Magnetic Stripe (D0, D1, DA) or ASCII/TTL (H, D0, DA), and a connection from the host to the Data Hold input (H) if data lines from two Readers are to be connected in parallel.

   To promote EMC compliance we recommend you use 812 Cable as described here. Trim back and insulate the screens at the HD500-2. Connect the screens at the host only: do not connect any of the screens to the HD500-2.

Route the cables into the Reader from behind, then make the connections shown in the table below.

| Reader | Function |
|---|---|
| V+ | Power supply +12V unregulated or 24V battery-backed*<br>(absolute max 32V, min 10.6V, 100mA max) |
| 0V | Power supply 0V (-ve)<br>(also ground reference for data output) |
| H (C) | “Data Hold” for Wiegand and Mag Stripe<br>“CTS” for ASCII/TTL |
| D0 (D) | “Data Zero” for Wiegand<br>“Data” for Mag Stripe<br>“TXD” for ASCII/TTL |
| D1 | “Data One” for Wiegand<br>“Strobe” for Mag Stripe |
| DA | “Data Available” for Wiegand<br>“Present” for Mag Stripe<br>“RTS” for ASCII/TTL |
| Horn (Adr) | Horn - 0V to sound, +5V to turn off |
| R | Red LED control - 0V for red LED |
| R/G | Single wire LED control - 0V for green LED, +5V for red LED |
| TAMPER | Tamper circuit connection (hard wired link)# |

*The HD500-2 is designed to be operated by 12V unregulated power supplies, or 24V battery-backed power supplies. Operating voltage range is 10.6 to 32.0V. The upper voltage is intended to be compatible with the charging of 24V lead-acid batteries. Charge methods vary, and may be temperature dependent. 32V max is intended to be compatible with commonly used charging methods. If the upper operating voltage is exceeded then permanent damage may be caused. Installers and systems designers should check the max power supply voltage under all conditions. Do not operate the HD500-2 using unregulated 24V supplies. The HD500-2 current consumption can be significantly less than 100mA. The unloaded peak voltage from a nominal 24V unregulated supply will exceed the absolute max.

#Two terminals are provided for use with a system 24hour tamper protection circuit. These terminals are hard wired together on the Reader’s circuit board. If you connect cables to these terminals, an open circuit will indicate that the wires have been cut.

5. Route the cable neatly then fix the Reader to the wall or door frame.

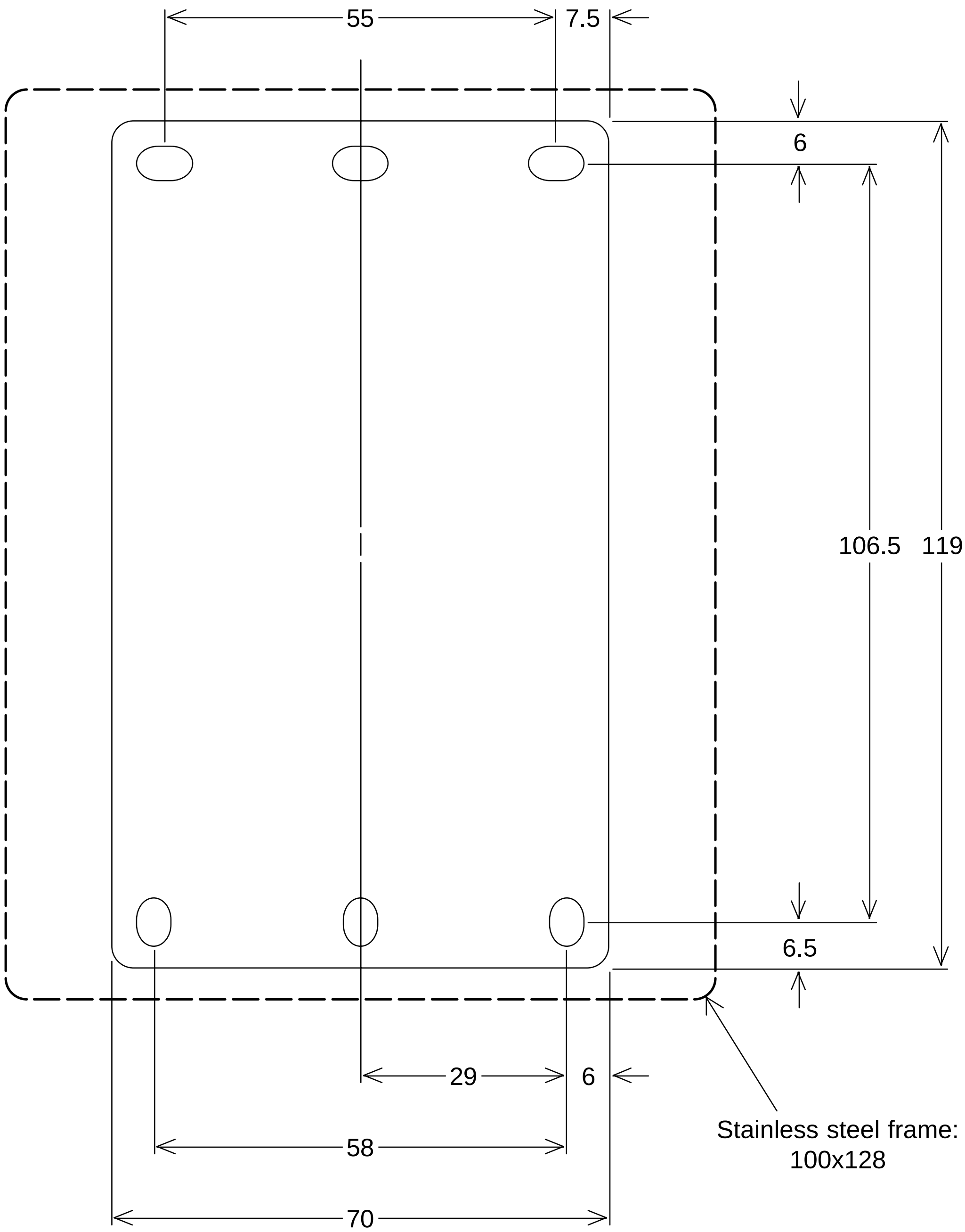
6. **Do <u>not</u> fit the stainless steel frame to the Reader until you have configured it and tested it** (see the end of this chapter).

7. When you have configured the Reader and tested it to make sure that it is working correctly, you can fasten the Reader’s stainless steel frame using the four “Resistorx” M4x12 screws provided. These tamper-resistant screws can only be inserted or removed using the correct tool which is not supplied with

the Reader: it can be obtained from Bewator Ltd as part number TX-20H.

Mount the HD500-2 Reader in a suitable position near the door approximately 1m from the floor with the LEDs at the top left. You can fasten the Reader's plastic case to the wall or door frame using any of the six mounting holes provided, as shown in the diagram below:

Fixing Dimensions (mm)



# SP500 Switch Plate Proximity Reader

1. The SP500 Reader fits a standard single surface-mount or flush fitting back box, either metal or plastic, such as is used for light switches and mains plug sockets.

   The Reader has a maximum range of 30cm (12in) so it must be mounted in a position where the card or tag can easily be brought within this distance.

2. The connections required for the Reader are power supply connections (0V and +12V DC or +24V DC), data output connections for Wiegand or Magnetic Stripe (D0, D1, DA) or ASCII/TTL (H, D0, DA), and a connection from the host to the Data Hold input (H) if data lines from two Readers are to be connected in parallel.

   To promote EMC compliance we recommend you use 812 Cable as described here. If the Reader is mounted in a plastic back box then connect the screens at the host end only; at the SP500 the screens must be cut back and insulated. If the Reader is mounted in a metal back box then the overall screen must be connected at the host end and also to the metal back box. Do <u>not</u> connect any of the screens to the SP500 itself in either of these situations.

   Route the cables into the back box, then make the connections shown in the table below.

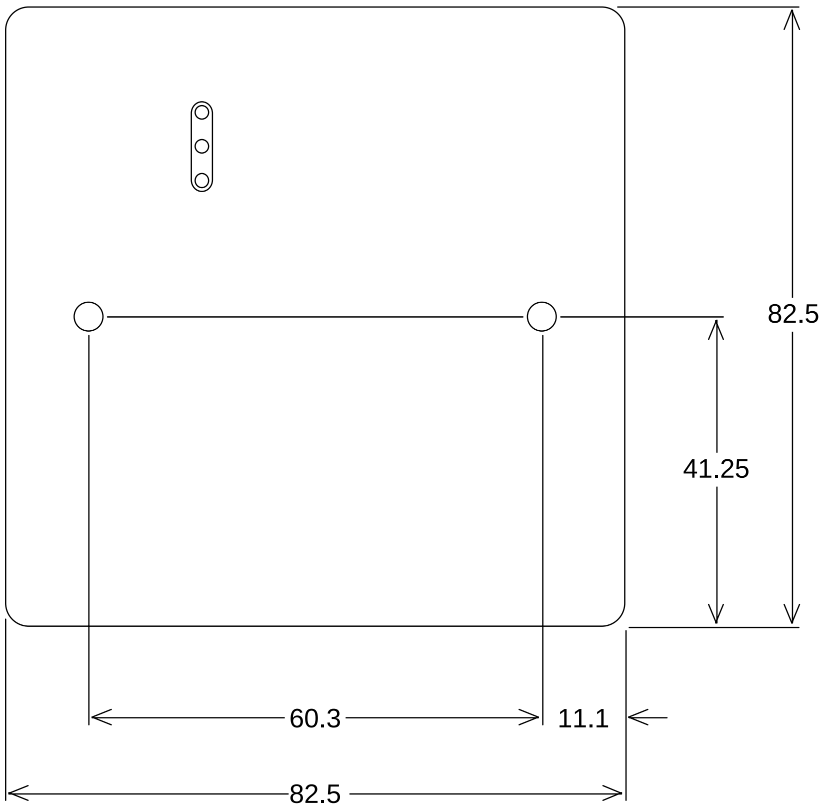
| Reader | Function |
|---|---|
| V+ | Power supply +12V unregulated or 24V battery-backed*<br>(absolute max 32V, min 10.6V, 100mA max) |
| 0V | Power supply 0V (-ve)<br>(also ground reference for data output) |
| H (C) | “Data Hold” for Wiegand and Mag Stripe<br>“CTS” for ASCII/TTL |
| D0 (D) | “Data Zero” for Wiegand<br>“Data” for Mag Stripe<br>“TXD” for ASCII/TTL |
| D1 | “Data One” for Wiegand<br>“Strobe” for Mag Stripe |
| DA | “Data Available” for Wiegand<br>“Present” for Mag Stripe<br>“RTS” for ASCII/TTL |
| Horn (Adr) | Horn - 0V to sound, +5V to turn off |
| R | Red LED control - 0V for red LED |
| R/G | Single wire LED control - 0V for green LED, +5V for red LED |
| TAMPER | Tamper circuit connection (hard wired link)# |

*The SP500 is designed to be operated by 12V unregulated power supplies, or 24V battery-backed power supplies. Operating voltage range is 10.6 to 32.0V. The upper voltage is intended to be compatible with the charging of 24V lead-acid batteries. Charge methods vary, and may be temperature dependent. 32V max is intended to be compatible with commonly used charging methods. If the upper operating voltage is exceeded then permanent damage may be caused. Installers and systems designers should check the max power supply voltage under all conditions. Do not operate the SP500 using unregulated 24V supplies. The SP500 current consumption can be significantly less than 100mA. The unloaded peak voltage from a nominal 24V unregulated supply will exceed the absolute max.

#Two terminals are provided for use with a system 24hour tamper protection circuit. These terminals are hard wired together on the Reader's circuit board. If you connect cables to these terminals, an open circuit will indicate that the wires have been cut.

3. Screw the Reader to the back box using the two M4 screws provided.

Fixing Dimensions (mm)




4. **Do <u>not</u> clip the plastic lid on the front of the Reader until you have configured it and tested it** (see the end of this chapter).

5. When you have configured the Reader and tested it to make sure that it is working correctly, press the plastic cover onto the front until it clips into place. Make sure you get the cover the correct way round so that the LEDs can shine through the translucent panel.

# PM500 Panel Mount Proximity Reader

1. The PM500 Reader can be mounted within a sheet metal or plastic panel using four screws. If the panel is made of metal, the Reader must be mounted behind a 40mm square cut-out in the panel which must be positioned in the centre of the four mounting holes as shown in the diagram overleaf.

   When mounted in a metal panel, the Reader has a maximum range of 15cm (6in) so it must be mounted in a position where the card or tag can easily be brought within this distance.

2. The connections required for the Reader are power supply connections (0V and +12V DC or +24V DC), data output connections for Wiegand or Magnetic Stripe (D0, D1, DA) or ASCII/TTL (H, D0, DA), and a connection from the host to the Data Hold input (H) if data lines from two Readers are to be connected in parallel.

   To promote EMC compliance we recommend you use 812 Cable as described here. If the Reader is mounted in a plastic panel then connect the screens at the host end only; at the PM500 the screens must be cut back and insulated. If the Reader is mounted in a metal panel then the overall screen must be connected at the host end and also to the metal panel. Do <u>not</u> connect any of the screens to the PM500 itself in either of these situations.

   Route the cables into the panel, then make the connections shown in the table below.

| Reader | Function |
|---|---|
| V+ | Power supply +12V unregulated or 24V battery-backed*<br>(absolute max 32V, min 10.6V, 100mA max) |
| 0V | Power supply 0V (-ve)<br>(also ground reference for data output) |
| H (C) | “Data Hold” for Wiegand and Mag Stripe<br>“CTS” for ASCII/TTL |
| D0 (D) | “Data Zero” for Wiegand<br>“Data” for Mag Stripe<br>“TXD” for ASCII/TTL |
| D1 | “Data One” for Wiegand<br>“Strobe” for Mag Stripe |
| DA | “Data Available” for Wiegand<br>“Present” for Mag Stripe<br>“RTS” for ASCII/TTL |
| Horn (Adr) | Horn - 0V to sound, +5V to turn off |
| R | Red LED control - 0V for red LED |
| R/G | Single wire LED control - 0V for green LED, +5V for red LED |
| TAMPER | Tamper circuit connection (hard wired link)# |

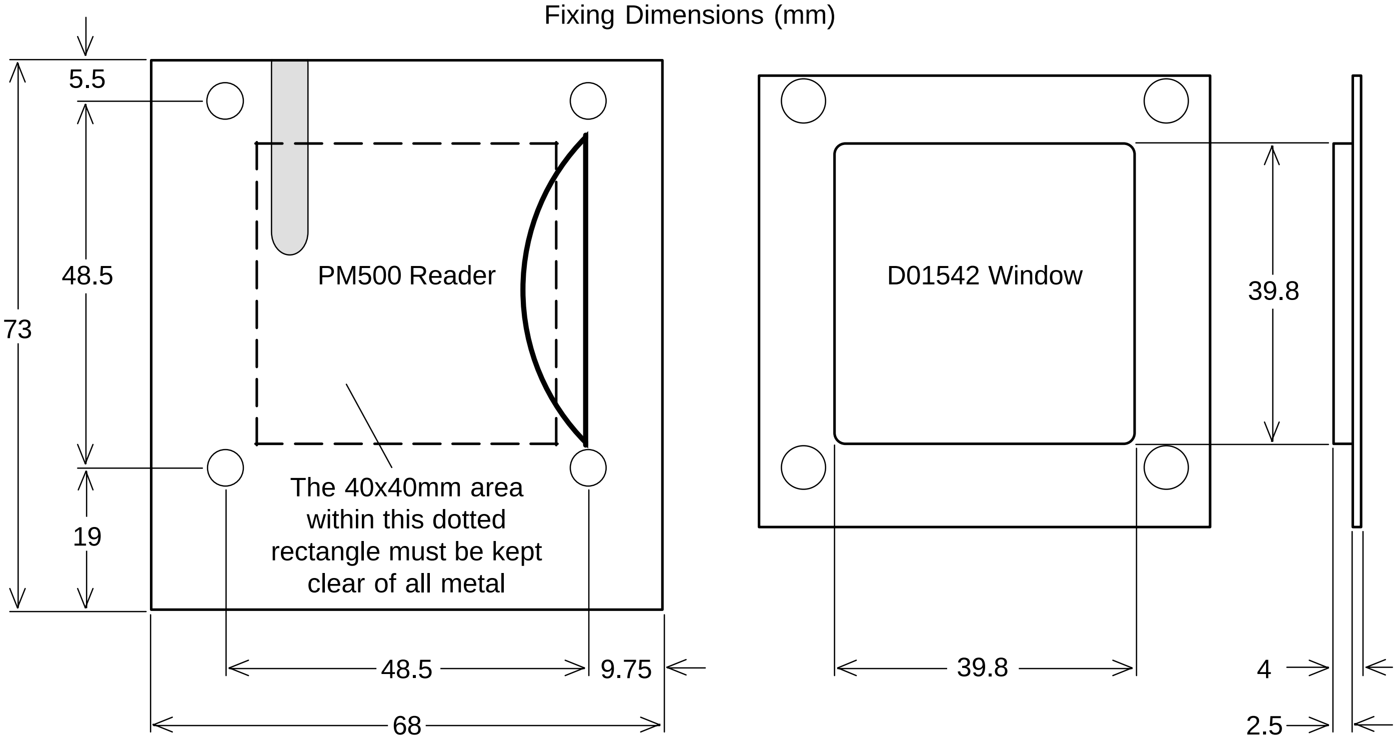
*The PM500 is designed to be operated by 12V unregulated power supplies, or 24V battery-backed power supplies. Operating voltage range is 10.6 to 32.0V. The upper voltage is intended to be compatible with the charging of 24V lead-acid batteries. Charge methods vary, and may be temperature dependent. 32V max is intended to be compatible with commonly used charging methods. If the upper operating voltage is exceeded then permanent damage may be caused. Installers and systems designers should check the max power supply voltage under all conditions. Do not operate the PM500 using unregulated 24V supplies. The PM500 current consumption can be significantly less than 100mA. The unloaded peak voltage from a nominal 24V unregulated supply will exceed the absolute max.

#Two terminals are provided for use with a system 24hour tamper protection circuit. These terminals are hard wired together on the Reader's circuit board. If you connect cables to these terminals, an open circuit will indicate that the wires have been cut.

3. Mount the Reader on the panel using four M4 nuts and bolts or self-tapping screws.

   If you wish you may fit the transparent window Part Number D01542 which gives a flush finish to the panel across the 40mm square cut-out.

Fixing Dimensions (mm)




4. Configure the Reader and test it (see next section).

# Configuring and testing the Reader

1. If the Reader has already been configured by your supplier, you can power it up and test it, see step 3 below.

2. If you need to configure the Reader yourself, power it up and present the configuration card to the Reader within 4 seconds of power up. During this 4 second period, the green LED is lit.

   The Reader bleeps when it has read the configuration card and the amber LED lights for a short period. After reading the configuration card, the Reader gives you a further 8 seconds to present one of the normal programmed cards which will be used with the system. Doing this teaches the Reader its Distributor and Secondary Codes. (If you do not present a DC/SC card to the Reader within the 8 seconds, the Reader enters its normal operating mode.)

   The Reader bleeps when it has read the DC/SC card and the amber LED lights for a short period. After the newly configured hold-off time has elapsed, the Reader enters its normal operating mode.

3. After configuring the Reader, test it by presenting a valid card. The Reader's LEDs should change from red to green (if the LEDs are under internal control), the horn should bleep, and the host should receive the data output.

4. If the Reader is working, you can complete the installation:

   Clip the front cover in place on the PR500 and SP500 Readers.

   Fit the stainless steel frame on the HD500-2 Reader using the four "Resistorx" M4x12 screws provided. These tamper-resistant screws can only be inserted or removed using the correct tool which is not supplied with the Reader: it can be obtained from Bewator Ltd as part number TX-20H.

Chapter 3

# Setting up

You must set the following functions on a Reader before it will operate correctly:

- Distributor Code
- Secondary Code

You will probably need to set the following:

- Data interface option

You may need to set the following:

- Horn operation
- Internal/external/single-wire control of LEDs
- Hold-off time and repeat data delay
- Leading parity calculation for Wiegand data output
- Position of Secondary Code in data output
- Secondary Code check disable
- ASCII interface protocol and baud rate
- Data Hold input signal polarity

## Configuring the Reader

You configure the Reader by presenting it with two coded cards. The first card (the configuration card) defines the type of data interface, and all the features listed in the third group above. The second card (any of the ordinary Distributor Coded cards which will be used with the system) teaches the Reader its Distributor and Secondary Codes. Note that you cannot teach the Reader its Distributor and Secondary Codes without first presenting the configuration card.

When the Reader is powered up, it waits 4 seconds for a configuration card to be presented. If it doesn't read a configuration card in this time, it enters its configured operating mode.

## The configuration card

If you need to change the data interface or any of the other settings, you need to use a configuration card programmed in 63 bit display format on the 633-2 Programmer. Data fields in the configuration card set up various options described below.

The configuration code is a 64-bit binary number which determines how the Reader operates. Here is the complete 64-bit configuration code, with each bit represented by a letter or number. The fields in the code represented by the letters and numbers are defined in the next section “Programming the configuration card”.

**`0xxs xxxx xxxx xxxx xxxx xbff xxxx xxxh xxhe hhhh pxxx xxrg crrr rrrr iiii iiii`**

The code is written down as sixteen 4-bit groups. Each 4-bit group can be represented by a single hexadecimal digit which can be typed directly into the 633-2 Programmer in 63-bit display format.

An **x** means that this bit of the code is not used.

(BCLINK users please note that “type” bits are not shown here.)

The next section “Programming the configuration card” defines each of the fields in the configuration code. You should type each field into the 633-2 Programmer in the order in which they are described. We have shown a diagram with each entry, showing the position of the hex character in the configuration code. For example, the hex character determining the horn configuration is the ninth character:

| | | | | | | | | 9 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 0 | 0 | 0 | | 0 | | | | | | | | | |

Because the second to the fifth and the seventh characters are unused, they are set to zero, and we have shown this in the diagram.

(Existing users please note that the new PR500 and HD500-2 may require a slightly different configuration from the old PR500, HD500 and 5291 Readers.)

# The DC/SC card

To teach the Reader its Distributor and Secondary Codes you use any of the normal cards which will be used with the system (any of the cards which are issued to cardholders). We shall call this the “DC/SC card”.

# Programming the configuration card

## `0xxs` (secondary code swap)

| 1 | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 0 | 0 | 0 | | 0 | | | | | | | | | |

The **s** bit determines whether the secondary code is output from the Reader’s data interface as bits 33 to 48 (the position which it occupies in the code which is programmed into the cards and tags), or whether its position in the data output is swapped to bits 17 to 32.

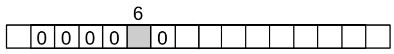
This feature is available so that cards programmed in the DEC/DEC display format on the 633-2 Programmer can output secondary code data using the 32-bit Wiegand or 26-bit Wiegand data interfaces (interface numbers 02 and 12 hex respectively). This feature is invalid for interfaces 47, 4D, 4E, 4F, 59, BC, BD and BE.

Secondary code swap bit (**s**):

**0** the secondary code is output in its normal position (bits 33 to 48).

**1** the secondary code is output in the swapped position (bits 17 to 32).

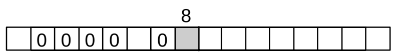
## xbff (ASCII interface protocol and baud rate)




The 3 bits **bff** determine the protocol and baud rate of the ASCII/TTL interface. To work out the hex number you need to type into the Programmer, refer to the following table:

| Hex number | ASCII protocol and baud rate |
|---|---|
| 0 | 7 data bits, even parity, 1 stop bit, 1200 baud |
| 1 | 7 data bits, odd parity, 1 stop bit, 1200 baud |
| 2 | 7 data bits, no parity, 1 stop bit, 1200 baud |
| 3 | 8 data bits, no parity, 1 stop bit, 1200 baud |
| 4 | 7 data bits, even parity, 1 stop bit, 9600 baud |
| 5 | 7 data bits, odd parity, 1 stop bit, 9600 baud |
| 6 | 7 data bits, no parity, 1 stop bit, 9600 baud |
| 7 | 8 data bits, no parity, 1 stop bit, 9600 baud |

## xxxh (Data Hold input signal polarity)



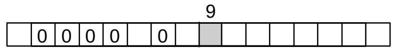

The **h** bit determines the polarity (active-low or active-high) of the Data Hold input.

**Note**: if you are using the ASCII data output you must set Data Hold to be active-high - the **h** bit must be set to 1.

To work out the hex number you need to type into the Programmer, refer to the following table:

| Hex number | Data Hold polarity |
|---|---|
| 0 | Active-low |
| 1 | Active-high |

## xxhe (horn configuration)

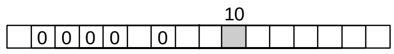



The **h** bit determines whether the horn bleeps for 100ms when the Reader reads a valid card.

The **e** bit determines how the horn operates when it is controlled externally by the host. If this bit is 0, the horn sounds when the host pulls the horn input down to 0V and continues sounding until the host lets the horn input float high again. If this bit is 1, the horn sounds for 1 second when the host pulls the horn input down to 0V and then switches off automatically, irrespective of the state of the horn input. (Note that while the horn is operating there may be some loss of range, and the amber LED may flash.)

| Hex number | Internal control | External control |
|---|---|---|
| 0 | 100ms bleep | follows horn input |
| 1 | 100ms bleep | sounds for 1 second |
| 2 | no bleep | follows horn input |
| 3 | no bleep | sounds for 1 second |

## hhhh (hold-off time)

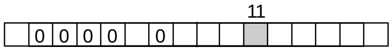



When the Reader reads a valid card, it does not poll again until the hold-off time has elapsed. During the hold-off time the Reader maintains the state of the LED indicator (if the LEDs are under internal control).

To work out the hex number you need to type into the Programmer, refer to the following table:

| Hex number | Hold-off time |
|---|---|
| 0 | 1s |
| 1 | 1s |
| 2 | 2s |
| 3 | 3s |
| 4 | 4s |
| 5 | 5s |
| 6 | 6s |
| 7 | 8s |
| 8 | 10s |
| 9 | 15s |
| A | 20s |
| B | 30s |
| C | 40s |
| D | 50s |
| E | 60s |
| F | do not use - for test purposes only |

## pxxx (calculation of leading parity bit for 26-bit Wiegand interfaces)

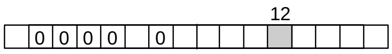



Leading parity bit (**p**):

**0** the Reader does not calculate a leading parity bit.

**8** the Reader calculates an even leading parity bit based on the first 13 bits of the 26-bit Wiegand interface (interface number 12). This saves you from having to program the leading parity bit into the cards. The trailing odd parity bit is still calculated as normal.

## xxrg (internal/external control of red and green LEDs)




To work out the hex number you need to type into the Programmer, refer to the following table:

| Hex number | Red LED | Green LED |
|---|---|---|
| 0 | External | External |
| 1 | Internal | Internal |
| 2 | Internal | External |

Use the **0** setting when the drives for the red and green LED indications are supplied by the host system. When you drive the LEDs externally, you have to pull down the corresponding connection from +5V to 0V. The R/G connection lights the green LED and the R connection lights the red LED.

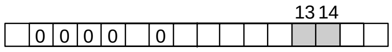
Use the **1** setting if you want the Reader alone to control the LEDs. The red LED is lit when no card or tag is in range. The green LED lights after a valid card read and stays on until the card is removed from the reading area of the Reader, or the hold off time expires, whichever is longer. The amber LED flashes if there is electrical noise in the reading area which may affect reading of cards and tags.

The **2** setting requires external control of the green LED from the host, but the Reader controls red and amber LEDs. This provides single-wire control of the LED indication from the host. It works as follows:

- The red LED is lit when no card or tag is in range.
- When the Reader reads a card or tag, the host processes the data from the Reader, unlocks the door and lights the green LED by pulling the R/G connection down to 0V. This also turns the red LED off.
- When the host releases the green LED control, the green LED goes off and the red LED lights.

- The amber LED flashes if there is electrical noise in the reading area which may affect reading of cards and tags.

## crrrrrrr (Secondary Code check disable, and repeat data delay - RDD)

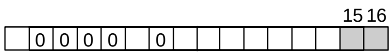



Bit **c**, when set to 1, disables the Secondary Code check so the Reader outputs data from a card or tag without checking that the Secondary Code is valid. (This bit does not affect interfaces 47, 59, BC, BD or BE.)

The seven bits **rrrrrrr** set the repeat data delay time or RDD. If you set these bits to any number from 0 to 127 (00 to 7F in hex), the RDD is set to this number of seconds (note that the timings are approximate). You must convert the decimal number into hexadecimal, for example, 10 is $A_H$, 20 is $14_H$, etc. If you are setting bit **c**, remember that you will have to add 128 (80 in hex) to the RDD value.

**What is the Repeat Data Delay?** When the Reader reads data from a card, it sends card data to the host. After it has done this, it will not send the same card data to the host again until the RDD time has elapsed. This prevents the system becoming overloaded with lots of data from one card being read over and over again.

## iiiiiiii (interface number)




This field sets the data interface number (two hexadecimal digits). See the chapter on data interfaces and, if necessary, contact your supplier to find out what setting you should be using. The interface number given to you by your supplier is a two digit hexadecimal number and therefore can be entered directly into the 633-2 Programmer without conversion.

Note: the Proximity Readers have a limited set of interfaces available compared with earlier Readers. Please check that the interface number you are using is available on the Reader - the following interface numbers are available: 02, 04, 0E, 12, 24, 47, 4D, 4E, 4F, 59, 60, 64, BC, BD and BE.

### Note to existing users of PR500 and HD500

We have changed the configuration slightly in the new Readers. For many interface settings, the repeat data delay and secondary code check disable were built into the chosen interface number. You now have the option of changing these, but if you wish to keep the same operating style you will have to modify your configuration card. Please refer to the description of the available interfaces in chapter 4.

# Programming the DC/SC card

The card you use to teach the Reader the Distributor and Secondary Codes can be any normal Distributor Coded card programmed with the correct Secondary Code (any of the cards which are issued to cardholders).

Set your 633-2 Programmer to any of the Distributor Coded display formats (usually Dec/Dec, but could be Hex/Dec or Hex/Hex or Hex/BCD), enter the correct Secondary Code in the SITE or SECONDARY field and program the card (the card number does not matter).

# Presenting configuration card and DC/SC card to the Reader

1. Power up the Reader and present the configuration card within 4 seconds of power up. During this 4 second period, the green LED is lit.

   The Reader bleeps when it has read the configuration card and the amber LED lights for a short period.

2. After reading the configuration card, the Reader gives you a further 8 seconds to present one of the normal programmed cards which will be used with the system. Doing this teaches the Reader its Distributor and Secondary Codes. (If you do not present a DC/SC card to the Reader within the 8 seconds, the Reader enters its normal operating mode.)

   The Reader bleeps when it has read the DC/SC card and the amber LED lights for a short period. After the newly configured hold-off time has elapsed, the Reader enters its normal operating mode.

# Changing the Secondary Code or Distributor Code

If, after setting the Distributor and Secondary Code, you need to change either of them, power up the Reader, present the configuration card within 4 seconds and then present the new DC/SC card within 8 seconds.

# Examples of working out what to program into the configuration card in 63-bit mode on the Programmer

When you refer to the earlier section entitled "Programming the configuration card", you can look up the hexadecimal numbers you need in the tables and write them down as you go. You then enter the hexadecimal numbers into the Programmer in 63-bit display format.

If you ever need to convert decimal and binary numbers to hexadecimal digits, here is a table giving the decimal (top row), binary (middle row) and hexadecimal (bottom row) equivalents for all possible 4-bit numbers:

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 0000 | 0001 | 0010 | 0011 | 0100 | 0101 | 0110 | 0111 | 1000 | 1001 | 1010 | 1011 | 1100 | 1101 | 1110 | 1111 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |

## Example 1

- Output the secondary code as bits 17 to 32 of the data output (1 in hex)
- Next four digits always zero (0000 in hex)
- ASCII output settings not applicable (0 in hex)
- Next digit always zero (0 in hex)
- Data Hold active-low (0 in hex)
- Horn enabled (0 in hex)
- Hold-off time: 2 seconds (look up in table - 2 in hex)
- Wiegand leading parity enabled (8 in hex)
- Single-wire control of red/green LED (2 in hex)
- Secondary Code check enabled (msb zero). RDD: 5 seconds decimal (05 in hex)
- Wiegand data output (interface number 12 in hex)

Write down the hex digits in order: 1000000002820512 and enter it into the 633-2 Programmer in 63-bit display format.

## Example 2

- Do not swap position of secondary code (0 in hex)
- Next four digits always zero (0000 in hex)
- ASCII output settings not applicable (0 in hex)
- Next digit always zero (0 in hex)
- Data Hold active-low (0 in hex)
- Internal horn disabled (2 in hex)
- Hold-off time: 30 seconds (look up in table - B in hex)
- Wiegand leading parity disabled (0 in hex)
- Internal control of red/green LED (1 in hex)
- Secondary Code check enabled (msb zero). RDD: 60 seconds decimal (3C in hex)
- 4101/4010 data output (interface number 59 in hex)

Write down the hex digits in order: 000000002B013C59

The Programmer doesn't need the leading zeros, so the number you enter in 63-bit display format is: 2B013C59 (hexadecimal).

Note that the reader will start to work normally only after the selected hold-off time has elapsed.

Chapter 4

# Data interfaces

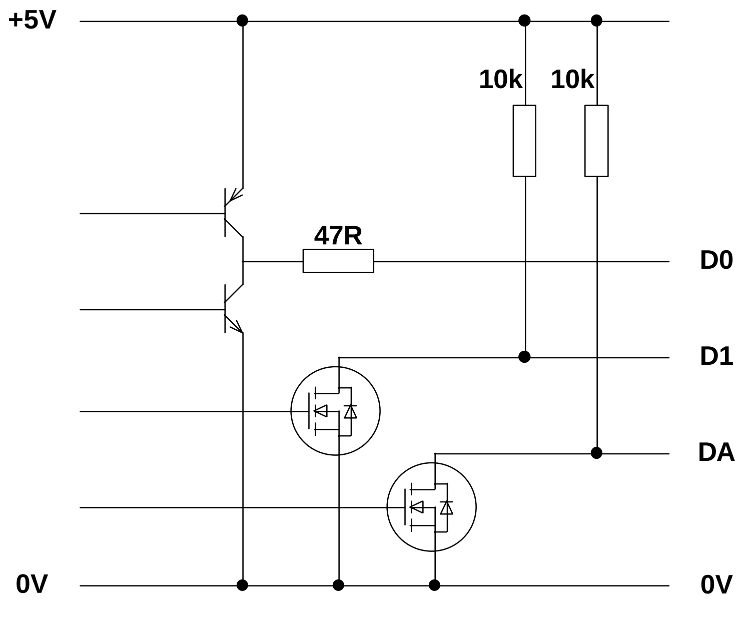
The Reader Interface offers a choice of Wiegand or Magnetic Stripe data output to communicate with a host system. An ASCII data output is also available at TTL voltage levels (0V/+5V), which can be converted to an RS232 data output using the optional 5810 RS232 Converter. You select the interface you require by programming a 63-bit configuration card and presenting it to the Reader, see chapter 3. (The Readers are available in AB format if you require BCLINK data output, but this option is not described in this handbook.)

## Electrical characteristics of outputs from the Reader

The Wiegand and Magnetic Stripe interfaces use the data lines D0, D1 and DA. The ASCII/TTL interface uses D0 and DA, and input H.

The D1 and DA outputs are driven by open drain drivers which can each sink up to 250mA. When a driver is off, its output is pulled up to +5V (the regulated logic voltage on the board) by a 10k resistor (and also by whatever is connected at the host end). D0 is not pulled up - it can be driven high or low by the Reader, and can also float in a high impedance state as shown in the diagram below.

The diagram below shows the logical implementation of the data outputs:



The polarities of the three data outputs (D0, D1 and DA) are all active-low.

# Data Hold input

With the Wiegand and Magnetic Stripe interfaces, the Data Hold input (H) can be used by the host to buffer one data message in the Reader until the host is ready to read it. This enables the data lines from two Readers to be connected in parallel, the host polling each in turn by releasing its Data Hold input, reading the data, then asserting the Data Hold input again. The Reader will store the message until the next card is read.

With the ASCII/TTL interface, the Data Hold input (H) is used as the CTS input to the Reader.

# Wiegand

## Connections

The pin connections for the Wiegand interface are as follows:

0V (ground)
D0 (logic 0)
D1 (logic 1)
DA (data available)

## Electrical characteristics

The interface provides three outputs: logic zero data (D0), logic one data (D1) and data available (DA).

Data transfer is performed by pulsing the D0 line to indicate a logic zero and by pulsing the D1 line to indicate a logic one. The pulses are active-low. The voltage of the data lines is +5V or 0V.

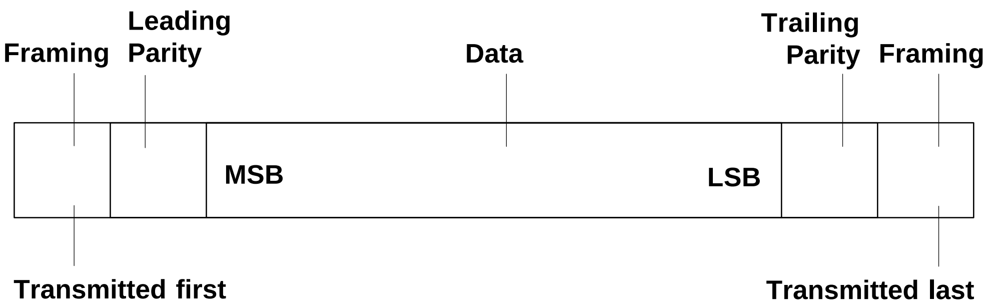
The Data Available output (DA) is provided to tell the host system it must read a data message from the Reader. If the Data Hold input (see above) is not active, DA becomes active 1ms before data is sent and is released 1ms after the data has been sent. If the Data Hold input is active, DA becomes active but data is not sent until Data Hold is released, DA remaining active until 1ms after the data has been sent. When used in association with the Data Hold input (see above), DA enables the data lines from two Readers to be connected in parallel. The polarity of the DA output is active-low.

# Data format

There are three aspects to the format of the data message, all of which can be varied, depending on the interface number you use:

- Framing bits at the start and finish of the message.
- Any parity bits which may be used.
- The data from the card.

The following diagram shows a typical message structure.




Framing bits are usually either not used or confined to start and stop bits which have a fixed state.

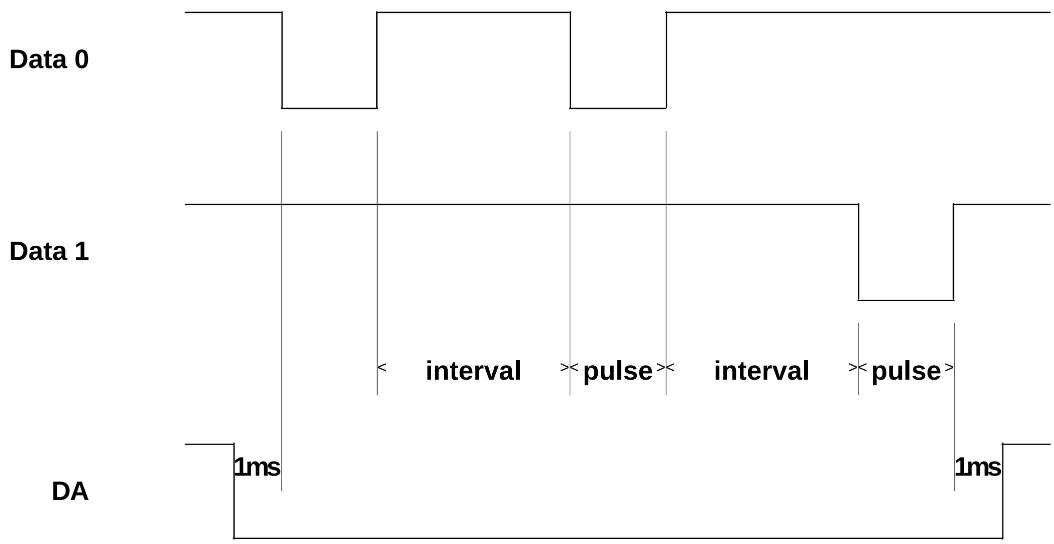
Parity bits are used to check the integrity of the data message. Parity may be odd or even and it may be calculated from the data only or from the data and some framing bits. The Reader can calculate the leading parity bit based on the first 13 bits of 26-bit Wiegand format if you require, see chapter 3.

## Card data

Data from the card can be any number of bits up to a maximum of 48. This includes any parity check bits which may be stored in the card code. The interface selected also determines whether the data is sent most significant bit first or least significant bit first.

# Interface settings

All other options to do with the Wiegand interface such as variation of pulse width and interval are selected using the interface number programmed into the configuration card (see chapter 3). The following diagram shows some typical timings for a Wiegand interface:




The following Wiegand data outputs are available:

| Interface Number | Function |
|---|---|
| 02 | lower 32 bits of data msb first,<br>100µs pulse, 400µs space |
| 04 | start bit 1, lower 32 bits of data lsb first, stop bit 0,<br>50µs pulse, 2ms space |
| 0E | lower 25 bits of data msb first, trailing parity bit,<br>50µs pulse, 450µs space |
| 12 | leading parity bit (if configured), lower 24 bits of data msb first,<br>trailing parity bit, 50µs pulse, 3ms space<br>(use for “standard” 26-bit Wiegand) |
| 24 | data bit 32, four zeros, lower 31 bits of data msb first,<br>50µs pulse, 1.2ms |
| 59 | 4101/4010 Controller interface - use when connecting to<br>4422 swipe module or 4010 swipe Controller<br>- set 4101/4010 Controller to interface 303 |

Note: if you cannot use one of the above data output formats then you need to use a different Reader such as the 5311 driving a PR100, HD100, SP100 or PM100 Reading Head.

# Magnetic Stripe

A Magnetic Stripe interface is provided which simulates the output of a magnetic card reader.

## Connections

The pin connections for the Magnetic Stripe interface are as follows:

0V (ground)
D0 (data)
D1 (strobe)
DA (present)

## Electrical characteristics

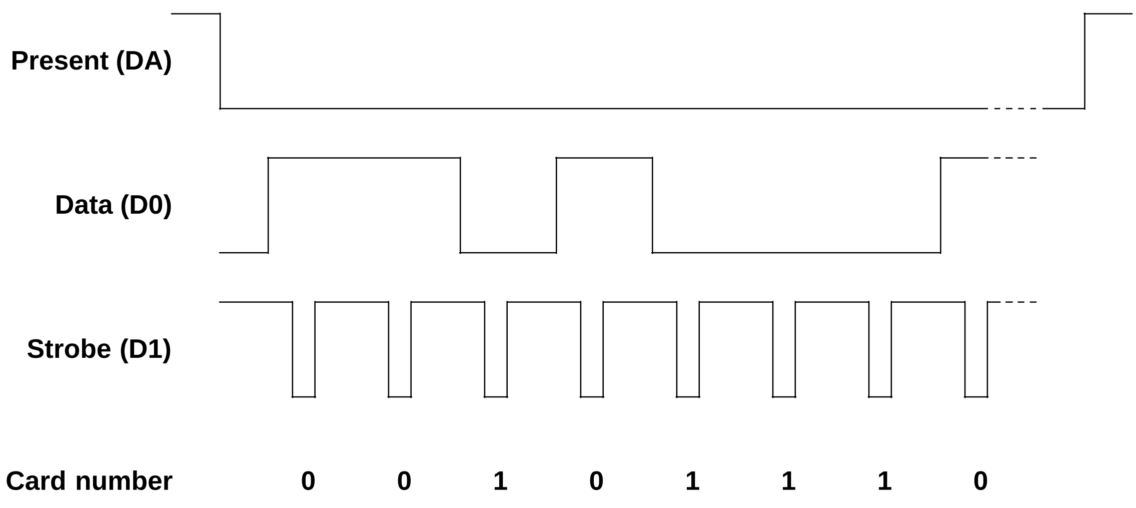
The interface provides three outputs: Present, Data and Strobe.

**Present** is a signal given by a magnetic card reader indicating that a card has been inserted in the slot. On the Proximity Readers, this signal becomes active just before data is sent and is released after the data has been sent. The polarity of the signal is active-low.

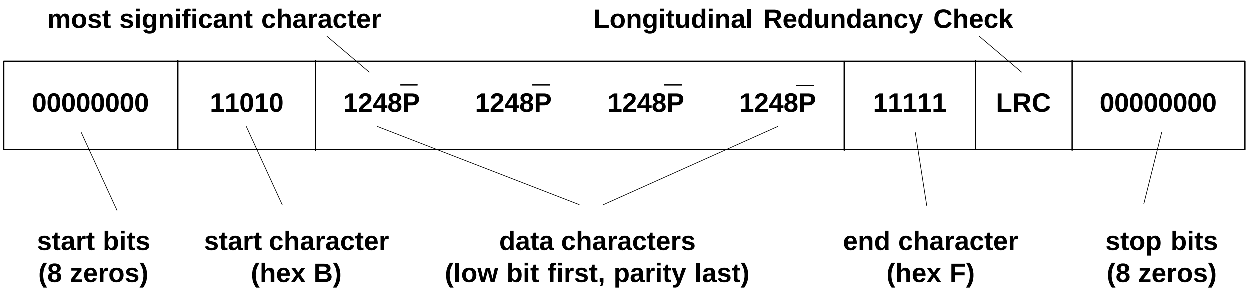
**Data** is a signal whose level reflects the value of the bit in the code. The polarity of the signal is “inverse logic”, which means a high signal indicates a zero and a low signal indicates a one.

**Strobe** is a series of clock pulses. The polarity of the signal is active-low. Data can be sampled on either the rising edge or the falling edge of the Strobe signal.

The following diagram should make clear the action of all three signals in a data transfer:



The following diagram shows the format of the Magnetic Stripe output:




This example shows an output of 4 data characters only - all of the Mag Stripe interfaces which are available on the Proximity Readers output 10 or 11 data characters as shown below.

The following Mag Stripe data outputs are available:

| Interface Number | Function |
|---|---|
| 47 | 5 Secondary Code characters (Secondary Code not checked),<br>5 data characters (lower 16 bits of data),<br>1.5ms bit period, 500µs strobe |
| 4D | 5 Secondary Code characters, insert character “6”,<br>5 data characters (middle 16 bits of lower 32 bits of data),<br>1.5ms bit period, 500µs strobe |
| 4E | 5 Secondary Code characters, insert character “6”,<br>5 data characters (lower 16 bits of data),<br>1.5ms bit period, 500µs strobe |
| 4F | 5 Secondary Code characters,<br>5 data characters (lower 16 bits of data),<br>1.5ms bit period, 500µs strobe |
| BE | with bit 32 of the card programmed to 0:<br>5 Secondary Code characters, 5 data characters,<br>1.5ms bit period, 500µs strobe |
| BE | with bit 32 of the card programmed to 1:<br>bottom 31 bits of card code are converted to a decimal number and are then output as ten data characters,<br>1.5ms bit period, 500µs strobe<br>(this interface is used for Bewator IB1 coded cards) |

With interface BE (bit 32 programmed to 0) and interfaces 47, 4D, 4E and 4F, secondary codes from 0 to 65535 and card numbers from 0 to 65535 are each output as five decimal characters, ten characters in all, Secondary Code first, most significant character first. It is best to use the Cotag Programmer in DD display format to program the cards, but even if it is set up in HH and the Secondary Code or card number contain hexadecimal digits A to F, the card will still work with the magnetic stripe interface.

With interface BE (bit 32 programmed to 1), the bottom 31 bits of card code are converted to a single decimal number which is then output as ten characters, most significant character first.

# ASCII data output - TTL voltage levels

## Connections

The pin connections for the ASCII/TTL interface are as follows:

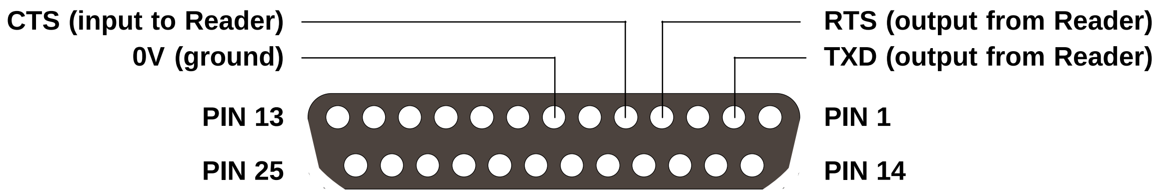
0V (ground)
D0 (TXD)
DA (RTS)
H (CTS)

**Note**: you must set the Data Hold input to be **active-high** - the bit in the configuration code which selects the Data Hold polarity must be set to 1 (the **h** bit in the **xxxh** field), see chapter 3.

The protocol (number of data bits, parity and baud rate) is defined in the **xbff** field in the configuration code, see chapter 3.

## Electrical characteristics

This output is at TTL voltage levels (0V/+5V). It can be converted to RS232 voltage levels using the 5810 RS232 Converter. This consists of a cable attached to a D-type connector shroud containing the converter. The pin connections to the 25-way D-type connector on the 5810 RS232 Converter are as follows:




25-way D-type female connector
(viewed from mating side)

## Data format

The following ASCII data outputs are available:

| Interface Number | Card data output |
|---|---|
| 60 | ***hhhhhhhh#** |
| 64 | ***hhhhhhhh#<c/r><l/f>** |

The output consists totally of ASCII characters:

***** is the ASCII asterisk character. It is used to indicate the start of data.

**hhhhhhhhh** is a sequence of ASCII characters representing the eight hex digits of the 32-bit card number (the lower 32 bits of the tag code).

**#** is the ASCII hash character. It is used to indicate the end of data.

**<c/r>** is the ASCII code for “carriage return” (hex D).

**<l/f>** is the ASCII code for “line feed” (hex A).

## Protocol

The baud rate, start/data/stop bits and parity can be selected by setting bits in the **xbff** field in the configuration code, see chapter 3.

# 4101/4010 Controller interface

The Readers can be connected to a 4422 swipe card module installed in a 4101 or 4010 Controller, or directly to a 4010 swipe Controller, the pin connections being as follows:

| Reader | 4422 swipe module or 4010 swipe Controller |
|---|---|
| D0 | D0 |
| D1 | D1 |
| 0V | 0V |

| Interface Number | Function |
|---|---|
| 59 | Wiegand output to 4422 swipe module or 4010 swipe Controller |

Chapter 5

# Operation

Once you have set up all the options described in chapter 3, "Setting up", normal operation simply consists of presenting your card or tag to the Reader and awaiting the response. The Readers are always used in conjunction with a host system which controls the door lock mechanism and takes decisions about when to activate it.

## LEDs

Under internal control (LEDs driven by the Reader), the green LED lights when the Reader detects the presence of a valid card and stays green for the hold off time, or for as long as a card is within range of the antenna. The red LED lights when there is no valid card in range, unless there is too much electrical noise in the reading area in which case the amber LED flashes.

Under single wire control (red and amber LEDs driven by the Reader, green LED driven by host), the host lights the green LED when it has verified the card number and unlocked the door. When the host releases the green LED control, the green LED goes off and the red LED lights. If there is too much electrical noise in the reading area the amber LED flashes.

Under external control (LEDs driven by host), the green and red LEDs light when their respective connections are pulled low by the host.

## Card interrogation

### Standard interrogation routine

When the Reader detects a card, it reads all 64-bits of code in one burst. The security codes are checked against those stored in the Reader (which were read from the DC/SC configuration card, see chapter 3). If they are valid then a data message is transmitted via the selected interface. (Note that interfaces 47, 59, BC and BE do not check the Secondary Code before outputting data.)

After the card code has been read successfully, polling is suppressed altogether for a period called the "hold-off time". This time is specified in the configuration card (see chapter 3).

If the card remains in range of the Reader after the hold-off time, so is read more than once, no further data messages are transmitted until a period of time has elapsed called the “repeat data delay” (RDD). This time is set to a value specified in the configuration card (see chapter 3).

The length of time between the card being detected by the Reader and the data being transmitted to the host is 0.4 seconds for standard cards, and 0.1s for fast cards.

# Using cards

Because the Proximity Readers are very small, they are designed for use with a hand-held card. Present the face of the card near the Reader and wait for the green light to come on.

## Looking after a card

- Don’t let the card get too hot - for example if left in a car on a sunny day. The operating temperature range for the card is -20 to +50°C.
- Don’t let the card get wet and especially not submerged. Don’t send your card to the laundry!
- Don’t deliberately bend the card and take care not to sit on it in your pocket.
- Do not dispose of the card in a fire.
- To clean the card, use a damp cloth. Don’t use any solvents and don’t immerse it in anything.

# R&TTE Directive 1999/5/EC
# Declaration of Conformity (DoC)

***We, Bewator Group Ltd***
***of Albany Street, Newport, South Wales, UK, NP20 5XW***

***Representative:*** **P Buckle**
**Bewator Access Centre (Cambridge),**
**Bewator Ltd, Mercers Row, Cambridge UK, CB5 8EX**

***declare under our sole responsibility that the product:***

***Type:*** Mk2 500 Series Readers

***Product:*** PR500

***to which this declaration relates is in conformity with the essential requirements and other relevant requirements of the R&TTE Directive (1999/5/EC). The product is compliant with the following standards and/or other normative documents:***

**Safety: (article 3.1a): EN 60950 showing compliance with LV Directive, 73/23/EEC**

**EMC: (article 3.1b): EN 301 489 showing compliance with EMC Directive, 89/336/EEC**

**Spectrum: (article 3.2): Compliant to EN 300 330**

**See Technical Construction File No TCF 0008**

***Signature:*** P.M. Buckle ............................

***Name:*** **P Buckle**

***Title:*** **Compliance Engineer, Bewator Access Centre (Cambridge)**

***Dated:*** **22 July 2003**

# R&TTE Directive 1999/5/EC
# Declaration of Conformity (DoC)

***We, Bewator Group Ltd***
***of Albany Street, Newport, South Wales, UK, NP20 5XW***

***Representative:*** **P Buckle**
**Cambridge Technology Centre, Bewator Ltd,**
**Mercers Row, Cambridge UK, CB5 8EX**

***declare under our sole responsibility that the product:***

***Product:*** HD500-2 Series Readers

***Type:*** HD500-2, SP500, PM500

***to which this declaration relates is in conformity with the essential requirements and other relevant requirements of the R&TTE Directive (1999/5/EC). The product is compliant with the following standards and/or other normative documents:***

**Safety: (article 3.1.a): EN60950 showing compliance with LV Directive, 73/23/EEC**

**EMC: (article 3.1.b): EN 301 489 showing compliance with EMC Directive, 89/336/EEC**

**Use of Spectrum: (article 3.2): Compliant to EN 300 330**

**See Technical File No TF 0010 Iss 1**

***Signature:*** ..................................

***Name:*** **P Buckle**

***Title:*** **Compliance / Design Engineer, Cambridge Technology Centre**

***Dated:*** **06 Feb 2003**