

# 688-52 FSK Card Reader

## with selectable outputs

The 688-52 FSK card reader consists of three parts: a potted unit containing the electronics, a front cover, and an optional spacer plate. A fixed 10 way colour coded cable protrudes from the back of the potted unit.

The reader will read the code from an HID H10301/4/6 transponder and output the code in one of many user selectable formats.

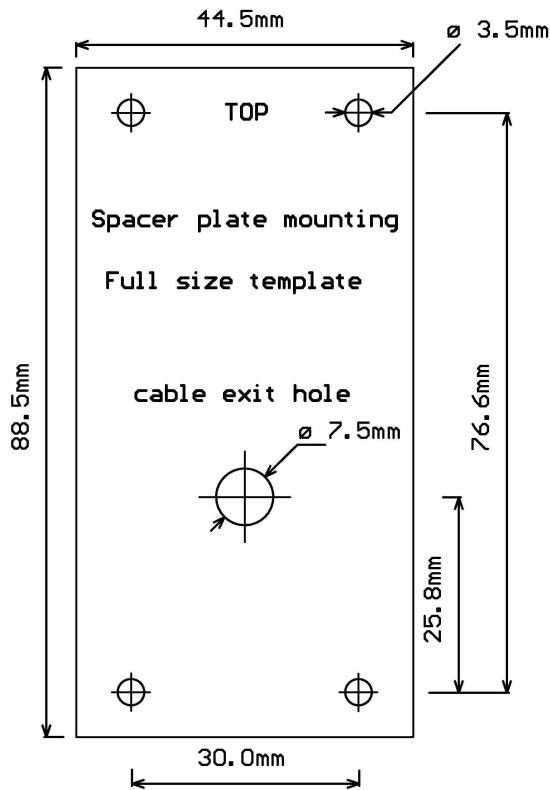
The unit also allows the user control of the three LEDs and beeper. A 6 way DIP switch under the front cover is used to select the required output format and LED operational modes.



### Specifications

- Power requirements: +5.0 V to +13.6 V DC. Current consumption 75 mA (typical)
- Operating Frequency: 125 kHz
- Card types supported: HID H10301 (26 bit format), H10306 (34 bit format), H10304 (37 bit format)
- Output formats supported: Wiegand, Mag Stripe emulation, Clock/Data, RS232 (9600,n,8,2) with both EIA compatible levels and TTL levels
- Continuous output with tag in field or single transmission
- Typical read range: 60 mm for ISO cards, 30 mm for keyring tags
- 3 indicator LEDs (RED, YELLOW, GREEN), controlled by user
- Beeper (4 kHz tone) controlled by user, additionally emits a 50 ms beep when card is read
- Operating temperature range: -20 °C to +60 °C
- 10 way cable: 1m long
- Weight: 100 grams
- Dimensions: Reader 89 x 45 x 17 mm, optional spacer plate 89 x 45 x 7 mm

## Physical Dimensions and Mounting Details



If the spacer plate is used the reader cable may be brought out of one of four exit points on the spacer: top, bottom, left or right. This enables the cable to be run on the surface of the wall. If no spacer plate is used a recommended hole size of 7.5 mm must be drilled in the wall at the cable exit position to allow the cable to exit perpendicular to the reader.

The optional spacer plate may also be used when mounting the reader on a metal surface to reduce the negative effects of metal on the read range.

## Wire Connections

The table below details the function of each wire.

| Colour | Name                   | Function   |
|--------|------------------------|--|
| GREY   | PRESENT                | Open collector output, drives low for duration of output transmission (Note 1)                         |
| WHITE  | CLOCK/DATA0/<br>TTL TX | Open collector output, outputs tag code in selected format (Note 1)                                    |
| BROWN  | DATA/DATA1             | Open collector output, outputs tag code in selected format (Note 1)                                    |
| YELLOW | YELLOW LED             | Input, controls YELLOW LED in LED Mode 1, active low (Note 2)  |
| ORANGE | RED LED                | Input, controls RED LED in LED Mode 1, active low (Note 2)   |
| GREEN  | GREEN LED              | Input, controls GREEN LED in LED Mode 1 and both RED and GREEN LEDs in LED Mode 2, active low (Note 2) |
| BLUE   | BEEPER                 | Input, controls BEEPER, active low (Note 2)  |
| PURPLE | RS232 TX               | Output, RS232 Tx, EIA compatible levels/polarity   |
| RED    | +VDC                   | Power, connect to positive of power supply (+5V to +13.6V) (Note 3)                                    |
| BLACK  | 0V                     | Power, connect to 0V of power supply   |

**Note 1.** Open collector outputs are pulled high internally to +5V through 10k resistors.

**Note 2.** Inputs are pulled high internally and require to be taken low to control the beeper and LEDs, they may be left floating if unused.

**Note 3.** For maximum read range the supply voltage should be greater than +5.5V. For voltages in the range +5.0V to +5.5V the DC supply needs to be externally regulated.

## Output Mode Selection

The 6 way switch is used to select the output format and LED mode.

| SW1 | SW2 | SW3 | SW4 | Output format              |
|-----|-----|-----|-----|----------------------------|
| ON  | ON  | ON  | ON  | Inhibit – turn off coil    |
| ON  | ON  | ON  | OFF | Unused                     |
| ON  | ON  | OFF | ON  | Unused                     |
| ON  | ON  | OFF | OFF | RS232 – long number format |
| ON  | OFF | ON  | ON  | Unused                     |
| ON  | OFF | ON  | OFF | Unused                     |
| ON  | OFF | OFF | ON  | Unused                     |
| ON  | OFF | OFF | OFF | RS232 – site/card format   |
| OFF | ON  | ON  | ON  | Mag Stripe – Fast          |
| OFF | ON  | ON  | OFF | Unused                     |
| OFF | ON  | OFF | ON  | Unused                     |
| OFF | ON  | OFF | OFF | Mag Stripe – Slow          |
| OFF | OFF | ON  | ON  | Basic Clock/Data           |
| OFF | OFF | ON  | OFF | Unused                     |
| OFF | OFF | OFF | ON  | Unused                     |
| OFF | OFF | OFF | OFF | Wiegand                    |

## LED Mode Selection

| LED Mode | SW5 | Function   |
|----------|-----|--|
| 1        | ON  | 3 Individual LEDs each controlled by their own input |
| 2        | OFF | RED/GREEN with single control line (GREEN LED)       |

**Note.** In LED Mode 2, both RED and GREEN LEDs are controlled by the GREEN LED input: when the GREEN LED input is floating or pulled high, the RED LED is on and the GREEN LED is off; when the GREEN LED input is pulled low (connected to 0V), the GREEN LED is on and the RED LED is off, the YELLOW LED is always off.

## Continuous/Single Transmission Mode Selection

| Mode       | SW6 | Function   |
|------------|-----|--|
| Continuous | ON  | While a tag is in the field the reader continuously transmits the code in the format selected by the DIP switches 1-4. Repetition rate is format dependant but varies between 80ms to 260ms  |
| Single     | OFF | When a tag enters the field the code is transmitted once only. The tag must be removed from the field for at least 1 second before the same tag can be re-read and it's code re-transmitted. |

## RS232 Output modes

There are three different serial data/RS232 outputs from the reader. The purple RS232 wire outputs EIA compatible RS232 with voltage levels: -V for binary '1' and +5V for binary '0' - this output is suitable to connect directly to a computer serial comm port or serial to USB adapter. The brown DATA wire duplicates this but with TTL voltage levels: 0V for binary '1' and +5V for binary '0'. The white TX wire outputs an inverted version with TTL voltage levels: +5V for binary '1' and 0V for binary '0' - this output is suitable to connect directly to the USART of a microprocessor.

RS232 format data is output on all three wires when an RS232 mode is selected.

The format is 9600 baud, 8 data bits, no parity, and 2 stop bits.

## Long number format

The code is output in the following structure:

|          |             |         |         |          |
|----------|-------------|---------|---------|----------|
| STX(02h) | DATA(ASCII) | CR(0Dh) | LF(0Ah) | ETX(03h) |
|----------|-------------|---------|---------|----------|

The DATA bytes vary depending on the type of card presented to the reader:

### H10301 (26 bit format)

DATA = 8 ASCII characters representing the 24 data bits of the tag code converted to a decimal number, e.g. '11727146' (31 31 37 32 37 31 34 36 hex)

### H10306 (34 bit format)

DATA = 10 ASCII characters representing the 32 data bits of the tag code converted to a decimal number, e.g. '0280162602' (30 32 38 30 31 36 32 36 30 32 hex)

### H10304 (37 bit format)

DATA = 11 ASCII characters representing the 35 data bits of the tag code converted to a decimal number, e.g. '10280162602' (31 30 32 38 30 31 36 32 36 30 32 hex)

## Site/card number format

The tag code is output in the following structure:

|              |                      |                |                        |             |             |              |
|--------------|----------------------|----------------|------------------------|-------------|-------------|--------------|
| STX<br>(02h) | SITE CODE<br>(ASCII) | SPACE<br>(20h) | CARD NUMBER<br>(ASCII) | CR<br>(0Dh) | LF<br>(0Ah) | ETX<br>(03h) |
|--------------|----------------------|----------------|------------------------|-------------|-------------|--------------|

The SITE CODE and CARD NUMBER bytes vary according on the type of card presented to the reader:

### H10301 (26 bit format)

SITE CODE = 3 ASCII characters representing the upper 8 bits of the tag code converted to a decimal number.

CARD NUMBER = 5 ASCII characters representing the lower 16 bits of the tag code converted to a decimal number.

The two numbers are separated by a SPACE = 20h ASCII

Example: a card with the following 24 data bits: 101100101111000100101010

Outputs: '178 61738' (31 37 38 20 36 31 37 33 38 hex)

### H10306 (34 bit format)

SITE CODE = 5 ASCII characters representing the least significant 13 bits of the upper 16 bits of the tag code converted to a decimal number.

CARD NUMBER = 5 ASCII characters representing the lower 16 bits of the tag code converted to a decimal number.

The two numbers are separated by a SPACE = 20h ASCII

Example: a card with the following 32 data bits: 00001010110110000000010101101111

Outputs: '02776 01391' (30 32 37 37 36 20 30 31 33 39 31 hex)

### H10304 (37 bit format)

SITE CODE = 5 ASCII characters representing the least significant 13 bits of the upper 16 bits of the tag code converted to a decimal number.

CARD NUMBER = 6 ASCII characters representing the lower 19 bits of the tag code converted to a decimal number.

The two numbers are separated by a SPACE = 20h ASCII

Example: a card with the following 35 data bits: 01001100100101111101101010100101010

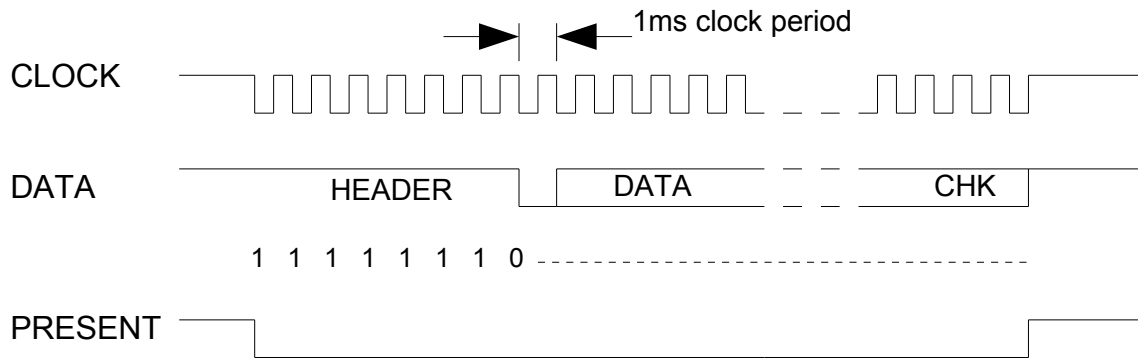
Outputs: '3223 447786' (31 39 36 30 37 20 34 34 37 37 38 36 hex)

### Clock/Data Mode

In this mode 40 bits of the tag code are clocked out with an eight bit header and an eight bit checksum

|                   |                |          |
|-------------------|----------------|----------|
| HEADER (11111110) | DATA (40 bits) | CHECKSUM |
|-------------------|----------------|----------|

The HEADER is hex FE. The DATA consists of 40 tag code bits sent MSB first. The checksum is the byte addition of the 5 bytes of DATA bits, e.g. tag code 07FFFFFFFFh has the checksum 07h+FFh+FFh+FFh+FFh=03h



Data is set up on the falling edge of the clock and is stable on the rising edge of the clock.

When an **H10301** card is presented to the reader the data bits will consist of 16 zero bits and 24 card data bits.

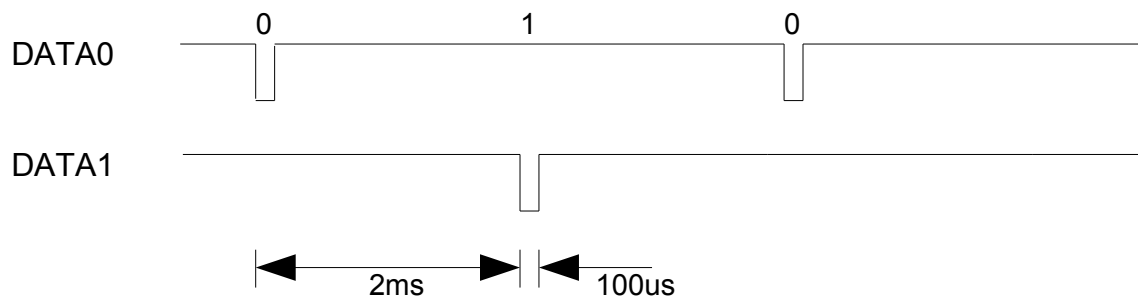
When an **H10306** card is presented to the reader the data bits will consist of 8 zero bits and 32 card data bits.

When an **H10304** card is presented to the reader the data bits will consist of 5 zero bits and 35 card data bits.

## Wiegand Output Modes

In this mode the tag code is pulsed out on DATA0 (white wire) and DATA1 (brown wire). Both are normally high. When a tag is presented to the reader, one of 26, 34, or 37 bits are transmitted in the following way:

A binary 1 is represented by a 100us pulse low on DATA1. A binary 0 is represented by a 100us pulse low on DATA0. There is a 2ms inter bit delay.



### H10301 (26 bit format)

All 26 bits are transmitted

### H10306 (34 bit format)

All 34 bits are transmitted

### H10304 (37 bit format)

All 37 bits are transmitted

## Slow Mag Stripe Mode

In this mode the decimal tag number is clocked out on CLOCK (white wire) and DATA (brown wire) at 100 characters per second. The format is standard as found on Track 2 of a magnetic card:

|                |    |      |    |     |                |
|----------------|----|------|----|-----|----------------|
| 10 leading 0's | SS | DATA | ES | LRC | 5 trailing 0's |
|----------------|----|------|----|-----|----------------|

SS = start sentinel (B hex)

ES = end sentinel (F hex)

LRC = longitudinal redundancy check

The DATA varies depending on the type of card presented to the reader:

### H10301(26 bit format)

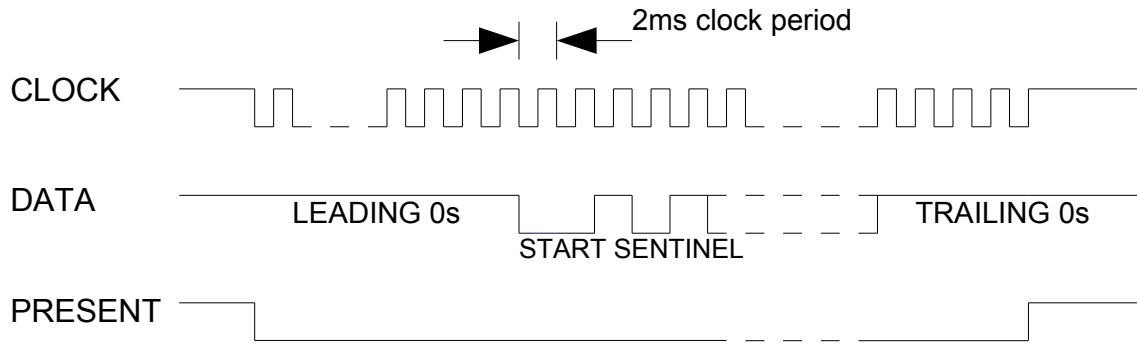
DATA = 8 decimal digits with leading zeros. The most significant decimal digit is transmitted first.

### H10306(34 bit format)

DATA = 10 decimal digits with leading zeros. The most significant decimal digit is transmitted first.

### H10304(37 bit format)

DATA = 11 decimal digits with leading zeros. The most significant decimal digit is transmitted first.



Each character is 5 bits long. The first four bits are the hex digit (0-F) least significant bit first. The fifth bit is the odd parity bit. A 0 is represented by a high level on the DATA wire and a 1 is represented by a low level on the DATA wire. Data is set up on the falling edge of the clock and is stable on the rising edge of the clock. The PRESENT output goes low for the duration of the transmission simulating the CARD PRESENT from a mag. card reader.

### Fast Mag Strip Mode

This mode differs from the slow magstripe mode in the following ways:

- the clock period is 250us
- ends with 10 trailing zeros
- for H10304 (37 bit format) output is 12 decimal digits with leading zeros

All other aspects of this format are the same as the slow magstripe format.