HID CORPORATION
Subsidiary of Palomar Technologies Corporation

Preliminary Document
15May1998

End Item Specification – 4065A Rev A
ProxPoint OEM Module Wiegand Reader

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1. ProxPoint OEM Module Wiegand Reader - Product Description

1.1 Scope

This document describes the physical characteristics, functional requirements and software features contained in the ProxPoint OEM Module Wiegand Reader. It also describes the design process necessary to incorporate an RFID function into a OEM application. It also lists the product specifications, including performance, environmental and operational criteria.

1.2 Functional Summary

ProxPoint OEM Module is an OEM product designed to enable manufacturers to integrate RFID into existing or new non-RFID products. The hardware is a fully functional RFID reader with the exception of the antenna coil, which is usually custom designed to fit into the OEM's product.

The final assembly that results from this integration is not covered by the various regulatory entities. This is the responsibility of the Reader integrator (OEM) and are listed in the sections below for reference only.

The ProxCard II (or equivalent) formatted ID cards (transponders) are energized by the Reader. The Reader generates a magnetic field by circulating current at 125kHz in an antenna. Whenever the transponder is in the "read-zone" it will be continually sending a stream of data to the Reader The Reader receives the analog frequency shift keyed (fsk) data from the transponder and extracts the digital information using a micro-controller. The Reader formats and outputs the ID card information over the Wiegand interface. The Wiegand interface is a standard used in the Access Control Industry.

1.3 Reference Documents

- UL 294 Access Control Specification for Underwriters Laboratories
- Security Industries Association 26-Bit Reader Interface Standard
- ISO 7811 Standards for Identification Cards
- BZT (Germany) Approval Standard
- FCC Code of Federal Regulations
- DTI (UK) Approval Standard
- CE Mark EMC Standards

2. Physical Characteristics

2.1 Product Identification

The HID model number is 4065A - for the ProxPoint OEM Module Wiegand Reader.

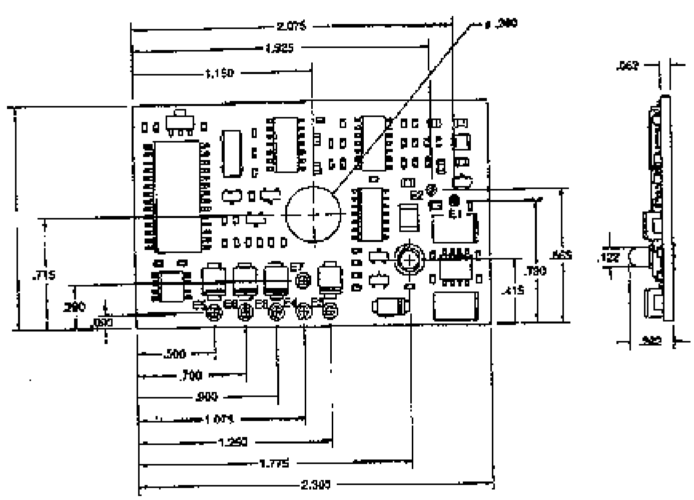
2.2 External Labels

The ProxPoint OEM Module circuit card assembly shall be labeled showing the following:

- Part Number
- Date code/Serial number

2.3 ProxPoint OEM Module Circuit card dimensions

Figure 1



Unless Otherwise Specified
Tolerance: xxx=.020

2.4 Product Packaging

Each unit shall be packed in a static resistant bag, and marked with:

- Model number
- Date code/Serial number

2.4.1 Packaging Notes

Unless otherwise specified:

1) Configure Item 1 (reader circuit card assembly) per Item 3 (Configuration Procedure).
2) Package Item 1 (completed Reader circuit card assembly) into Item 2 (shipping bag).
3) Mark Item 2 (bag) with Date code/serial number and Model number.

2.5 Cabling Requirements

The unit shall meet Wiegand Interface specifications for distances from the controller up to 500 feet on 22 AWG wire.

2.6 Mounting Options - Circuit Card Assembly

The ProxPoint OEM Module circuit card assembly is mounted to bosses, holes or fasteners as appropriate. The physical dimensions and mounting holes locations data should be used to design this assembly into existing or new electromechanical assembly.

2.7 Antenna Design Guidelines

There are specific design and mounting requirements regarding the antenna coil. The electromechanical design of the whole assembly must be studied to maximize the performance of an integrated ProxPoint OEM Module RFID Wiegand reader. The following categories will help to direct the design process towards a RFID reader with predictable and consistent performance.

2.7.1 Antenna design basics

The antenna should be designed to minimize DC resistance, maximize the self resonant frequency, and utilize the correct wire, tooling and manufacturing process so as to minimize part inconsistencies. Antenna designs are coils of wire that form the inductive part of an L-C circuit that resonates at 125kHz. Basically, the circuit is made up of a capacitor, which is already located on the ProxPoint OEM Module circuit card, and an inductor. The inductor in this case is the antenna coil, which is customized electrically and physically to function in the OEM application.

2.7.2 Antenna types

Antenna coils can be fabricated in any number of methods, but generally two types are used, including 1) Wire wound on a bobbin or other support method or 2) Wire wound on a fixture that is then treated to form a "Stand alone" part. The second method generally results in a consistent, reproducible part that is cost effective in fairly low volumes. A type of magnet wire that has a polybond coating in addition to the insulation is used. The coating can be heated or soaked in a solvent in such a way as to bond all the wire turns together after curing. A sample design of this type will be used to show what electrical, material and process parameters will be necessary to produce a part that can easily be specified for ProxPoint OEM Module applications. Other antenna coil types will use the same electrical parameters.

2.7.3 Electrical Parameters for a "Stand-alone" Antenna coil

The finished coil should have the following parameters specified:

Inductance:	720uH +/- 2%
DC resistance:	33 ohms or less
Wire gauge:	36 AWG or larger
Number of turns:	Depends on dimensions of coil

The inductance is the most important parameter specified. If the inductance value is correct, the coil will function in the circuit. This value should be within 2% of the nominal to maintain consistent performance from unit to unit. Machine - wound coils give the most consistent results.

The self resonant frequency is the frequency at which the coil inductance will resonate with the distributed capacitance present in the windings. High distributed capacitance will lower the self resonant frequency of the coil. If this self resonant frequency is too low (it should be high compared to 125kHz) then the antenna will be inefficient. Some factors that influence distributed capacitance are coils that are wound too tightly, and wire that is too fine in gauge.

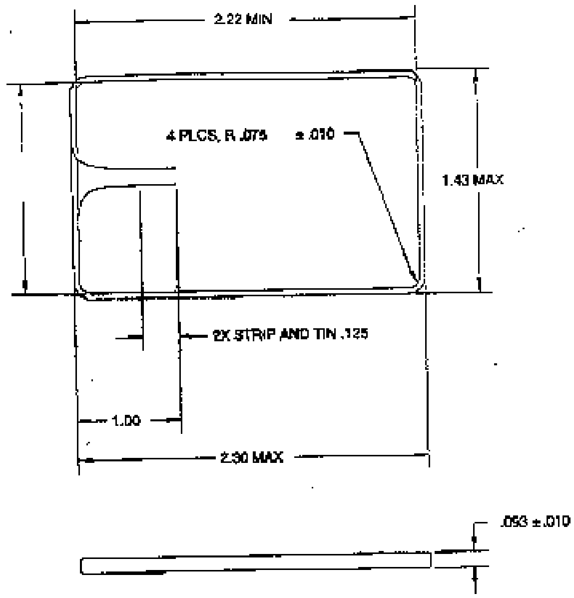
Wire gauge and DC resistance are directly related. The larger wire gauges result in lower DC resistance and allow more current to circulate, forming a stronger magnetic field. Usually the gauge is restricted by the physical dimension available to fit the antenna coil. A 30 AWG wire used in a 1.5in X 3.0in coil will usually result in a 3 to 5 inch read range (over a 5V to 12V DC input range).

2.7.4 Physical Design

To maximize the field, the antenna should be designed as large as possible and still fit within the constraints of the enclosure. The inside surface area should be maximized, so the windings should be grouped together in as small a pattern as possible. Refer to the following dimension drawing showing a sample coil. The winding pattern is contained in a small .125" x .125" group.

2.7.5 Sample antenna dimension drawing

Figure 2



2.7.6 Proximity to Metal

If an application requires that the body of the coil be less than ½" away from any metallic surface of the assembly, the Inductance and other electrical parameters must match or exceed the stated values **while the antenna is mounted in its representative location**. This will insure that ProxPoint OEM Module application will meet the optimum performance. Care must be taken to re-measure the stated parameters when the coil is removed from the assembly, so that the newly measured values are used to test the part when the manufacturing process is complete.

2.7.7 Noise sources

The ProxPoint OEM Module reader assembly is susceptible to interference from noise sources. Electrical noise can be radiated through the air to the reader or conducted into the reader via system cables. Usually, it is low frequency sources that effect the performance by shortening the read range. If noise sources are suspected, turn off the possible noise source and verify the performance returns to normal. Radiated noise can be suppressed by shielding with grounded metal between the interferer and the reader circuitry. Conducted noise can be suppressed by supplying cleaner power (linear supplies are recommended), eliminating shared power and/or conditioning inputs with added filtering. Consult with HID Corporation customer service for further technical assistance.

2.7.8 Antenna Wire Connections

The newly designed antenna connects to the ProxPoint OEM Module circuit card assembly by soldering the tinned leads into two eyelet's labeled E1 and E2 (see figure 1).

2.8 Interface Wire Connections

Wiegand	Connection
N/A	E8
Data1	E6
Data0	E5
Ground	E4
+DC	E3
Shield Ground	E7

2.9 Product Configuration/Ordering Options

4065 A X X XX -XXXX Y

- Y – Customer Custom Artwork or Firmware Number - 1 through 9, A through Z
- XXXX – Customer Custom Number
- XX – Configuration Options - see paragraph 4.3 (00 standard)
- X – Connection Options - N = None, P = Std Pigtail
- X – Hardware Options - N = None, L = LED
- A – Current Revision Letter - changes for upgrades
- 4065 – Model Number 4065 = ProxPoint OEM Module Wiegand Reader

➢ Standard Part Number = 4065ALN00 is a ProxPoint OEM Module Wiegand Reader With (L)LED installed with (N)No connection options.

3. Product Specifications

3.1 Read Distance - Typical, with 1.5" x 3" Antenna coil

➢ Non-Metallic Mounting (16VDC - maximum)	3.0 inches (7.6 cm)
➢ Mounted on Metal (16VDC - maximum)	2.5 inches (6.3 cm)
➢ Non-Metallic Mounting (4.75VDC - minimum)	3.0 inches (7.6 cm)
➢ Mounted on Metal (4.75VDC - minimum)	2.5 inches (6.3 cm)

3.2 Environmental Characteristics

➢ Operating Temperature Range	-30°C to 65°C (-22°F to 150°F)
➢ Storage Temperature Range	-40°C to 85°C (-40°F to 185°F)
➢ Operating Humidity Range	5% to 95% non-condensing
➢ Operating Vibration Limit	.04 g^2/Hz 20-2000Hz
➢ Operating Shock Limit	30g, 11mS, Half Sine
➢ Weight	.5oz (12gms)

3.3 Power Requirements - Typical - Depend on custom antenna design

➢ Power supply	Linear type recommended
➢ Operating Voltage Range	4.75VDC -16VDC

- ➢ Absolute Maximum — 16VDC
- ➢ Peak Current 4.75VDC (maximum) — 60mA
- ➢ Peak Current 12VDC (maximum) — 60mA
- ➢ Peak Current 16VDC (maximum) — 60mA
- ➢ Average Current 4.75VDC – 16VDC (maximum, mounted on metal) — 35mA
- ➢ Average Current 4.75VDC – 16 VDC (maximum, non-metalic mounting) — 30mA
- ➢ Average Current 4.75VDC - 16VDC (nominal, mounted on metal) — 23mA
- ➢ Average Current 4.75VDC - 16VDC (nominal, non-metalic mounting) — 22mA
- ➢ Transient Protection (all terminals) — 8,000 volts
- ➢ Reverse Voltage Protection — YES
- ➢ Input Voltage (maximum data-0/1 lines) — 16VDC
- ➢ Input Voltage (maximum Interface lines) — 16VDC

3.4 Operating Parameters

- ➢ Excitation Frequency — 125KHz
- ➢ Duty Cycle (alternate power level rate) — 20% @ 100mS period
- ➢ Read and Report Speed (26 bit Wiegand Card) — 440mS
- ➢ Maximum Cable Distance to Host — 500 feet (152 meters)
- ➢ LED Type — Bi-colored Red/Green
- ➢ LED Control (default) — internal/dual
- ➢ Wiegand Data Pulse Widths (default) — 40uS
- ➢ Wiegand Data Interval (default) — 2mS
- ➢ Anti-Pass Back Delay (default) — 1 second

4. Functional Description

4.1 Accuracy

The unit will not have more than 1 miss-read per 10 million.

4.2 Standard Options

OPTION #	DESCRIPTION	
00 (standard)	Beep on, RDR flashes Green LED on card reads	LED normally Red

4.3 Green and Red LED Operation

In the standard mode (00), the Reader has a red LED and flashes it to green whenever a card is read.

4.4 Wiegand Message Format

In the Wiegand format, the ID card is programmed with a specific bit pattern and the Reader acquires the data, checks the customer code and generally sends out the same bit pattern as previously programmed on the card. Consult factory for variations to this method. A 26 bit Wiegand format will be used in the examples below.

The 26 bits of transmission from the Reader to the panel consists of two parity bits and 24 code bits. The bits are transmitted in the order described. The first bit transmitted is the first parity bit, P1, it is even parity calculated over the first 12 code bits. The last bit transmitted is the second parity bit, P2, it is odd parity calculated over the last 12 code bits:

- Code Format

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
P1	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	P2

- Parity Format

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
P1	E	E	E	E	E	E	E	E	E	E	E	E													
													O	O	O	O	O	O	O	O	O	O	O	O	P2

- P1: First, or even parity bit
- C: Code bits
- P2: Second, or odd parity bit
- E: Bits for calculation of even parity
- O: Bits for calculation of odd parity

Data format within the 24 code bits which includes the portioning of the bit, the designation of the Most Significant Bit (MSB) or the Least Significant Bit (LSB) shall be subject to definition by the panel and Reader manufacturers and may remain proprietary.

4.4.1 Wiegand Output Specification

The specifications of voltage, current, power and timing are from the perspective of the Reader. A common signal ground is defined as a voltage reference that is common to both the Reader and the control panel. The voltages for the data outputs are referenced from the power supply ground located at the Reader. The voltage measured for the power to the Reader is referenced from the power supply return connection location at the Reader, not at the source of the power. The voltage, current, and timing of the data pulses are measured at the Reader in reference to the power supply/signal ground at the Reader. The voltage, current and timing of a signal driving an auxiliary input device on a Reader is measured at the control panel that is controlling the input device (with reference to the signal ground at the panel).

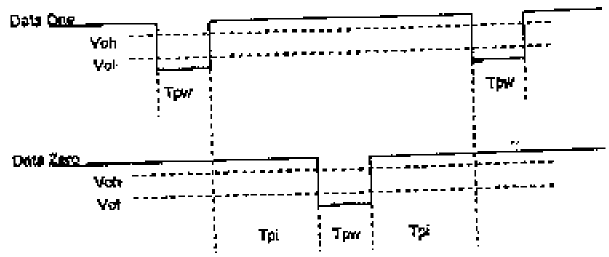
4.4.2 Physical Interface

The Reader is available with a Pigtail. The pigtail is a 18" cable with 5 conductors plus a drain wire to connect with the shield in the cable. Not all of the connections are necessary. Only the power, ground and data lines are essential for Wiegand operation. See the signals in bold type below. The following cable conductor assignments and typical wire colors are listed below.

- 1) **+DC (Power)** **Red** - provides power from the panel to the Reader. The voltage on this conductor will be 5VDC or 12VDC. The actual operating range is 4.75VDC to 16VDC. Power to the Reader is either supplied by the control panel or by a separate power supply. Linear supplies are recommended for RF Reader devices
- 2) **Ground** **Black** - provides electrical common between the Reader and the panel. All other voltage levels are compared against this conductor.
- 3) **Data Zero** **Green** - a signal from the Reader to the panel. A pulse on this conductor indicates a data bit with the binary value of zero.
- 4) **Data One** **White** - a signal from the Reader to the panel. A pulse on this conductor indicates a data bit with the binary value of one.
- 5) **N/A** **Orange - This line is not used for Wiegand mode.**
- 6) **Shield Ground** Drain or shield wire - a connection to provide a ground for the cable shield. It is used to minimize radiated RF voltages and possible incoming RF electrical noise.

4.4.3 Data Pulses

The Data One and Data Zero signals are normally held at a logic high level until the Reader is ready to send a data stream. The Reader places asynchronous low pulses on the appropriate data lines to transmit the data stream to the panel. The following timing parameters shall be observed:



- ➤ Tpw Pulse Width Time - 30uS (minimum) to 50uS (maximum)
- ➤ Tpi Pulse Interval Time - 1.8mS (minimum) to 2.2mS (maximum)

4.4.4 Example Output

Below is an example of a ID card with the number of "816" decimal, which will be outputted by the ProxPoint OEM Module Reader, the number "02004CA0661" hex. Note that the customer code is never transmitted or displayed:

```
                                       sentinel parity                                        parity
customer code      10 zeros                 bit  even  facility code       card number            odd
[0 0 0 0 0 0 1] [0 0 0 0 0 0 0 0 0 0] [1] [0] [0 1 1 0 0 1 0 1] [0 0 0 0 0 0 1 1 0 0 1 1 0 0 0 0] [1]
|  0  |  2  |  0  |  0  |  4      |  C  |  A  |  0  |  6  |  6  |  1  |
Wiegand Output                   |0  |  C  |  A  |  0  |  6  |  6  |  1  |
Hex code numbers                    [  6  |  5  ][  0  |  3  |  3  |  0  |
Decimal conversion                  [   101     ][        0816          ]
```

4.4.5 Special Wiegand Configurations

Consult factory if the special Wiegand output formats are needed. The following settings can be factory configured:

- ➤ Wiegand Data Pulse Widths — 25uS to 1mS in 4uS steps
- ➤ Wiegand Data Pulse Interval — 50uS to 6mS in 25uS steps
- ➤ Anti-Pass Back Delay — 1 to 6 seconds in 25mS steps