



# **Access Control Standard Protocol for the 26-BIT Wiegand<sup>™</sup> Reader Interface**

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# Access Control Standard ol for the 26-BIT Wiegand™ Reader Interface

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## Introduction and Justification

### 1.1 Scope and Purpose

The specifications in this standard define a commonly used interface between card readers and control panels used in the Access Control, Security, Time and Attendance, and other related industries. The standardization of the interface makes the design of readers and control panels uniform for manufacturers and makes system design and integration systematic for architects, designers, specifiers and users.

This standard provides specifications for the electrical elements that define the transfer of data from the reader to the control panel, power requirements/limitations, and control of devices contained on the reader. These elements are used to design functional electrical circuits that connect the reader and the control panel. Configuration variations are allowed and each variation is identified in accordance with the variations list in Appendix A. The names of the various configurations correspond directly to the functional differences.

This standard is for adoption by manufactures to establish a common interface which provides compatibility and interoperability of readers and control panels and by consultants, specifiers and users setting criteria to achieve uniformity in the technical design criteria, requirements or guidelines of systems.

This standard does not preclude manufacturers from including additional features on either readers or panels. The specification defines the minimum set of features a reader or panel must provide to be in compliance. Manufacturers may have additional features as long as they do not conflict with features specified herein.

This standard is voluntary and self enforcing.

## 1.2 Establishment of Need

Manufacturers of existing readers and panels have attempted to design their products to be compatible with an industry de facto standard. However, due to the lack of an actual definitive standard, products from different manufacturers may or may not be compatible with each other.

## 1.3 Related Documents

This standard is intended to allow compliance with the following standards from Underwriters Laboratories Inc. and The Federal Communications Commissions (FCC):

- UL 294, Access Control System Units
- UL 1076, Proprietary Burglar Alarm Units and Systems
- All Federal Communications Commissions Regulations

The following standards are employed.

- IEEE 260-1977 Standard Letter Symbols for Units of Measurements

## 2.1 Conventions

The specifications of voltage, current, power, and timing are from the perspective of the source of the signal. 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 located 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).

This does not eliminate interdependence of the wiring between the reader and control panel, but gives rise to guidelines for the specification of wiring between the reader and control panel.

## 2.2 Definitions and Glossary

For the purpose of this standard, the terms listed in 2.2 have there indicated meaning.

**Card** A portable media that carries data that is associated with the identity of an individual or property. The media may include a photo, printed matter, bar code, magnetic stripe, encoded barium ferrite, radio frequency identification device, laser encoded media, Wiegand™ Wire strips, smart card integrated chip, contact memory button, or other to be defined.

**Common Signal Ground** The voltage reference used to determine all signal/data voltage measurements.

**Control Panel** A device that accepts and process data from a reader and controls any or all input devices contained in a reader.

**Data One** The signal line that is designated as the output that delivers the pulses that are interpreted as binary ones.

**Data Zero** The signal line that is designated as the output that delivers the pulses that are interpreted as binary zeros.

**LED Control** The signal line that is designated as the output that determines the state of the LED contained on the reader. The LED may be off, red, green or amber.

**Pulse Interval Time (T<sub>pi</sub>)** The time interval between data pulses. The interval is determined from when the signal reaches the lower threshold for the high voltage level (V<sub>oh</sub>) until the signal reaches the upper threshold for the low voltage level (V<sub>ol</sub>).

**Pulse Width (T<sub>pw</sub>)** The time interval of the data signal that indicates a binary one or zero. The interval is determined from when the signal reaches the upper threshold for low voltage level (V<sub>ol</sub>) until the signal reaches the lower threshold for the high voltage level (V<sub>oh</sub>).

**Reader** A device that decodes data from a portable data carrying media (card).

**Wiegand™ Interface** The electrical and physical definition of the connection between a reader and control panel. The electrical characteristics are loosely based on the fundamentals of the Wiegand™ Effect. The Wiegand™ Effect is the storage of magnetic energy by a highly processed ferromagnetic wire called the Wiegand™ Wire.

### 3. Physical Interface

#### 3.1 Wiring

The reader and panel are connected with a five conductor cable. The following cable conductor assignments shall be observed. If a connector is provided, the connector shall be labeled and identified in the installation instructions with the designations below indicating function and/or color.

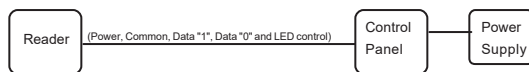
<u>COLOR</u>	<u>FUNCTION</u>
Red	Power
Black	Common or Data Return
White	Data One
Green	Data Zero
Brown	LED Control

#### 3.2 Conductor Definition

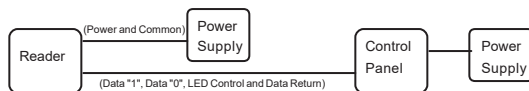
##### 3.2.1 Red

The red conductor provides power from the panel to the reader (unless the reader is powered separately). The voltage on this conductor will be either 5,12 or 24 VDC. The reader may accept a range of voltages but must specify, on a label and the installation instructions, the voltage(s) or voltage range and current for the unit. The control panel will specify, on a label or installation instructions, the outputs that supply power to the readers by the voltage and current.

This specification applies to configurations that employ the control panel's power supply to provide power to the reader as well as configurations that require a separate power supply. If power is supplied locally at the reader, then the red conductor is not connected at the panel. See figure below



Power to the Reader supplied by the Control Panel



Power to the Reader supplied by a separate Power Supply

##### 3.2.2 Black

The black conductor provides electrical common (data return) between the reader and the panel. All other voltage levels are compared against this conductor.



### 3.2.3 White

The white conductor is a signal from the reader to the panel. A pulse on this conductor indicates a data bit with the binary value of one.

### 3.2.4 Green

The green conductor is a signal from the reader to the panel. A pulse on this conductor indicates a data bit with the binary value of zero.

### 3.2.5 Brown

The brown conductor is a signal from the panel to the reader and controls the state of the reader LED.

## 3.3 Cable Guidelines

The following minimum cable size and maximum cable lengths shall be used as guidelines for recommendations for interconnections of the data lines and LED control. The power supply conductors will be specified by the reader manufacturer in accordance with section 4.1 Power.

<u>CABLE LENGTH</u>	<u>CONDUCTOR SIZE</u>
UP TO 61m (200.1ft)	7/30 6.35 mm (22 GA)
UP TO 91m (301.8ft)	10/30 8.38 mm (20 GA)
UP TO 153m (502 ft)	16/30 10.2 mm (18 GA)

## 3.4 Reader Connection

The reader shall provide a means of connection to the cable such as a terminal strip, wire pigtail, manufacturer supplied connector or other suitable connection for its intended application. The manufacturer will specify conductor size and connection information in product literature. The connection shall be suitable for the specified environmental conditions or for the compliance of UL Standards.

## 3.5 Panel Connection

The panel shall provide a means of connection to the cable such as terminal strip, wire pigtail, manufacturer supplied connector or other suitable connection. The manufacturer will specify conductor size and connection information in product literature. The connection shall be suitable for the specified environmental conditions or for the compliance of UL Standards.

## 4. Electrical Interface

### 4.1 Power

The control panel shall provide power to the readers at 5 VDC or 12 VDC or 24 VDC, described in the table below. The control panel is not restricted to a single voltage and where possible multiple voltages may be provided. The reader shall operate within the ranges of 5

VDC, 12 VDC or 24 VDC, described in the table below, when power is supplied through the Red, Power conductor. Readers that operate at other voltages or consume more current than the reader current maximum must be powered either locally (separately) or as specified by the reader manufacturer. The reader manufacturer shall specify the operating voltage(s) and current consumption of each reader device. The voltage levels listed below are the values measured at the reader under maximum load. The reader manufacturers will provide specifications for the minimum size and maximum length of the conductors that will supply the power to the reader.

Voltage Levels	Voltage Tolerance	Absolute Voltage Range	Supply Current Minimum	Reader Current Consumption Maximum
5 VDC	+/- 5%	4.75 - 5.25	100 mA	100 mA
12 VDC	+20%/- 10%	10.80-14.50	250 mA	250 mA
24 VDC	+15%/- 10%	21.60-28.80	250 mA	250 mA

## 4.2 Signal Levels

The Data One, Data Zero, and LED Control conductors provide logic signals between the reader and the panel. The logic voltage level for the Data Outputs (Data 1 and 0) indicated are the voltages measured at the panel. The logic voltage levels for the Control and Auxiliary inputs (LED) are the voltages measured at the reader. The logic voltage levels are defined as follows:

Voltage Levels	Data Outputs (Data 1 and 0)	
	Minimum	Maximum
Voh	4.0	5.5 V
Vol	0.0	1.0 V
Ioh	0.0	1.0 mA
Iol	-25.0	0.0 mA

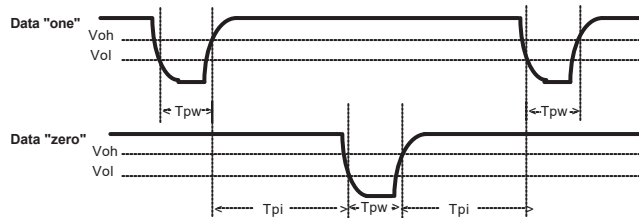
Voltage Levels	Control and (LED) Auxiliary inputs	
	Minimum	Maximum
Vih	3.33	5.5 V
Vil	0.0	1.7 V
Iih	-1.0	0.0 mA
Iil	0.0	25.0 mA

### 4.2.2 Open Collector Outputs

The use of open collector outputs for the signals Data "ones or zeros" and LED (Auxiliary input) control is permitted. Biasing must be provided at the input.

### 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 going pulses on the appropriate data lines to transmit the data stream to the panel. The data pulses for the Data One and Data Zero shall not overlap or occur simultaneously. The following timing parameters shall be observed:



<u>SYMBOL</u>	<u>DESCRIPTION</u>	<u>MIN</u>	<u>MAX</u>
TPW	Pulse Width Time	20 $\mu$ s	100 $\mu$ s
TPI	Pulse Interval Time	200 $\mu$ s	20 mS

### 4.4 LED Function

The LED signal is provided by the panel to control the reader LED state. Both red LEDs and red/green LEDs are supported. Red LEDs can be red or off. Red/green LEDs can be red or green. The following table provides the LED states for the indicated logic levels.

<u>LED CONTROL SIGNAL</u>	<u>RED/GREEN LED</u>	<u>RED LED</u>
HIGH	RED	OFF
LOW	GREEN	RED

The meaning of the various LED states shall be defined by the panel manufacturer. This includes blinking, alternating between red and green, and oscillation of the red/green LED to produce a third color.

## 5. Data Format

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

[illegible]

## PARITY FORMAT

[illegible]

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 partitioning 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.

## **APPENDIX A**

### **Required Specifications Provided by Manufacturer**

The following information must be supplied by the device manufacturer on a label or in the installation instructions

#### **Configurations**

Para #	Parameter	Configuration Options		
4.1	Voltage	5	12	24
4.2.2	Open Collector Output	Y	N	

Note: Configuration name is determined by combinations of the above parameters.

#### **Additional Auxiliary Data**

Para #	Parameter
3.1	Interconnecting Conductor Color and Function Assignments
3.3	
3.4 / 3.5	
4.1	
4.4	
5	MSB or LSB, data format

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