ioSmart

RS-485 ioSmart Card Reader

Installation Manual

KANTECH

From Tyco Security Products

Technical support

For technical assistance with the Kantech RS-485 ioSmart Card Reader and other Kantech products, contact technical support, Monday to Friday. The following table lists technical support phone numbers.

USA and Canada	GMT - 05:00			
North America	Toll Free	+1 888 222 1560	08:00 to 20:00	
	Direct	+1 450 444 2030	kantechsupport@tycoint.com	
Latin America	GMT - 03:00			
Argentina, Buenos Aires	Direct	+54 11 5199 3104	08:00 to 20:00	
Brazil, Sao Paolo	Direct	+55 11 3181 7377	ingenieria@tycoint.com	
Chile, Santiago	Direct	+56 2 3210 9662		
Colombia, Bogota	Direct	+57 1 344 1422		
Colombia, Cali	Direct	+57 2 891 2476		
Colombia, Medellin	Direct	+57 4 204 0519		
Costa Rica, National	Direct	+506 4 000 1655		
Dominican Republic, Santo Domingo	Direct	+1 829 235 3047		
El Salvador, San Salvador	Direct	+503 2 136 8703		
Guatemala, Guatemala City	Direct	+502 2 268 1206		
Mexico, Mexico City	Direct	+52 55 8526 1801		
Panama, Panama City	Direct	+507 836 6265		
Peru, Lima	Direct	+51 1 642 9707		
Venezuela, Caracas	Direct	+58 212 720 2340		
Asia	GMT + 08:00			
	Toll free	+800 CALL TYCO	09:00 to 17:00	
		+800 2255 8926	apac.support@tycoint.com	
	Direct	+86 21 6023 0650		
China	Direct	+400 671 1528		
India	Direct	+1 800 1082 008		
Australia	Direct	+02 9684 3980		
EMEA	GMT + 01:00			
United Kingdom	Direct	+44 330 777 1300	08:00 TO 18:00	
Israel	Direct	+972 772 201 350	emea-accesscontrol-support@tycoint.com	
Spain	Direct	+900 99 31 61		
France	Direct	+0800 90 79 72		
Germany	Direct	+0800 1806 757		
Italy	Direct	+39 0230 510 112		
Belgium	Direct	+0800 76 452		
Ireland	Direct	+180 094 3570		
Bahrain	Direct	+800 04127		
Nordic Countries	Direct	+45 4494 9001		
Greece	Direct	+00800 3122 9453		
Russia	Direct	+81 0800 2052 1031		
Turkey	Direct	+00800 31923007		
United Arab Emirates	Direct	+800 03107123		
South Africa	Direct	+27 21100 3882		

Go to www.kantech.com for both the French and Spanish versions of this manual.

Copyright information

Contents

Safety Instructions

This equipment, (card reader iO Smart RS485) shall be used installed and used within an environment that provides the pollution degree max 2 and overvoltages category II, in NON HAZARDOUS LOCATIONS only. The equipment is FIXED and is powered from a Limited Power Source from the controller to which it is connected; it is designed to be installed by Service Persons only; [Service Person is defined as a person having the appropriate technical training and experience necessary to be aware of hazards to which that person may be exposed in performing a task and of measures to minimize the risks to that person or other persons].

Compliance specifications

This chapter outlines the standards approvals that the ioSmart Card Reader complies to.

FCC

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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 provide reasonable protection against harmful interference in a residential installation. This equipment generates and uses radio frequency energy and if the user fails to install and use it in accordance with the instructions, it may cause harmful interference to radio communication. 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 receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

CE compliance

- **EN60950**: Information technology equipment. Safety. General requirements.
- **EN50133-1**: Alarm systems and access control systems for use in security applications.
- **EN55024**: Information technology equipment. Immunity characteristics. Limits and methods measurement.
- **EN55022, Class B**: Information technology equipment. Radio disturbance characteristics.
- **EN50364**: Limitation of human exposure to electromagnetic fields from devices operating in the frequency range 0 Hz to 300 GHz, used in electronic article surveillance (EAS), radio frequency identification (RFID) and similar applications.
- **EN300 330-1**: Electromagnetic compatibility and radio spectrum matters (ERM); short range devices (SRD); radio equipment in the frequency range 9 kHz to 25 MHz and inductive loop systems in the frequency range 9 kHz to 30 MHz; part 1: technical characteristics and test methods.
- **EN300 330-2**: Electromagnetic compatibility and radio spectrum matters (ERM); short range devices (SRD); radio equipment in the frequency range 9 kHz to 25 MHz and inductive loop systems in the frequency range 9 kHz to 30 MHz; part 2: harmonized EN under article 3.2 of the R&TTE directive.
- **EN301 489-1**: Electromagnetic compatibility and radio spectrum matters (ERM); electromagnetic compatibility (EMC) standard for radio equipment and services; part 1: common technical requirements.

- **EN301 489-3**: Electromagnetic compatibility and radio spectrum matters (ERM); electromagnetic compatibility (EMC) standard for radio equipment and services; part 3: specific conditions for short-range devices (SRD) operating on frequencies between 9 kHz and 40 GHz.

UL Standards compliance

- **UL-294** (UL standard for access control equipment, USA).

  Note: Use only UL 294 or UL 1076 listed power supply.

- **UL-94 HB** (UL flammability standard).

NIST (National Institute of Standards and Technology)

An approved laboratory has validated the encryption algorithm used in this product. It is compliant with the NIST algorithm validation suite.

RoHS (Restriction on Hazardous Substances)

This standard restricts the use of the following substances: lead, cadmium, mercury, chromium IV, polybrominated biphenyl (PBB), and polybrominated diphenyl ether (PBDE) in electrical and electronic equipment.

WEEE (Waste Electrical and Electronic Equipment)

This regulation is used for waste electrical and electronic equipment, and addresses the disposal and the environmental handling of these products.

System overview

This chapter discusses the following topics:

- Overview
- Unpacking the ioSmart Card Reader
- ioSmart Card Reader models
- Technical features

Overview

The Kantech ioSmart Card Reader family provides a high level of security by enabling end-to-end encryption between the I.D. badge credentials and the Kantech access control management software. The ioSmart Card Reader uses a well-recognized encryption algorithm (AES-128, a U.S. NIST encryption specification) to accomplish this.

To ensure this high level of security, this encryption is used between the I.D. badge and the card reader, between the card reader and the controller and between the controller and the Kantech access control management software[1].
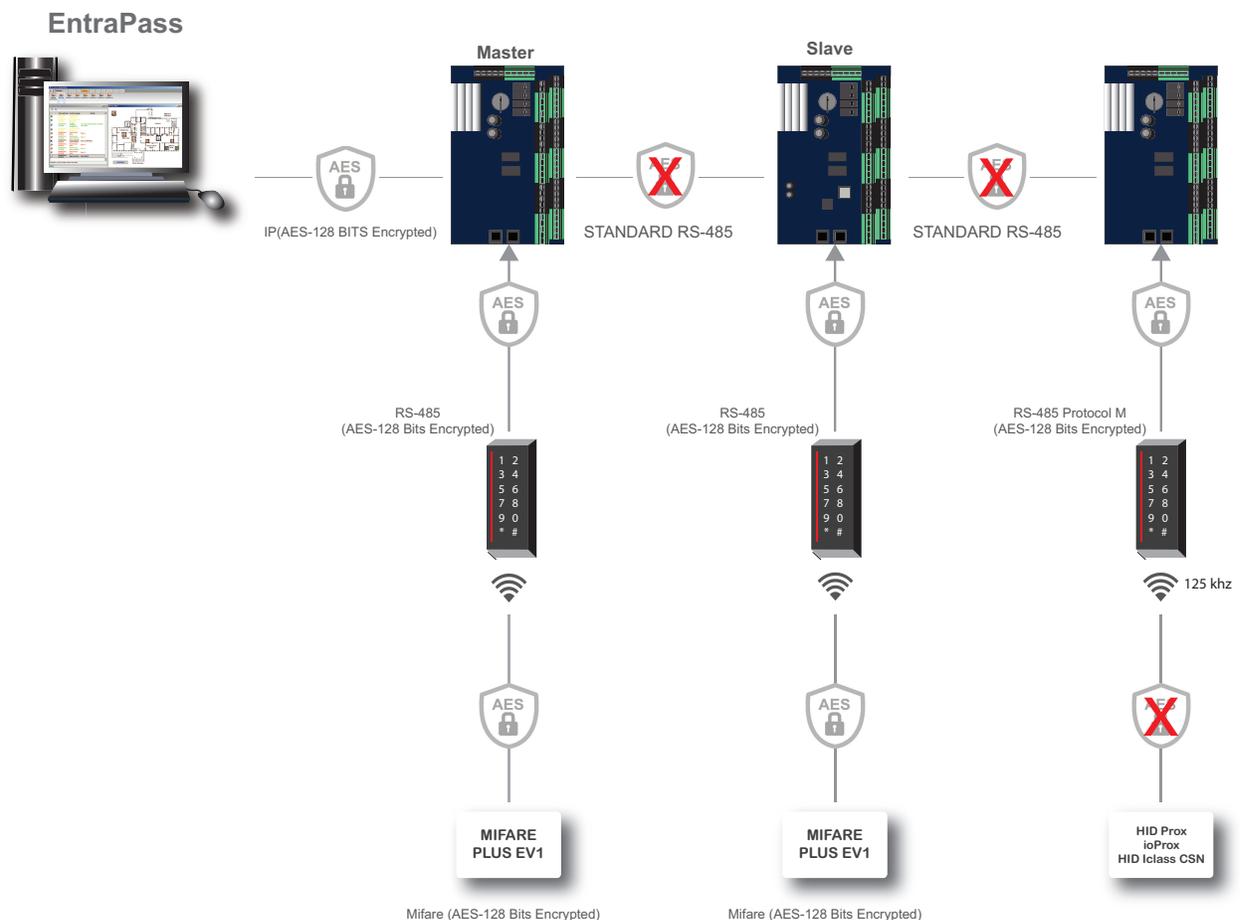
The reader also supports the transmission of card numbers using the Wiegand protocol. Supported formats include the standard 34-bit format, the standard 26-bit format, most common HID formats and other Kantech proprietary formats like eXtended Secure Format (XSF) and Smartcard Secure Format (SSF).

The design of these readers supports indoor as well as outdoor installations. For PIN entry and other functions, some models of these readers integrate a backlit, capacitive touch keypad. The absence of moving parts and exposure to the environment ensures years of reliability[2].

To provide an easy upgrade path to customers, some models support both the ioSmart Card technology and the Kantech proximity technology (ioProx)[2].

To future-proof the product, these readers are field upgradable with future releases of their firmware[3].

[1]For this functionality, connect the Kantech ioSmart Card Reader to the Kantech Access Controller in RS-485 mode. Use an Ethernet connection to connect the controller to the EntraPass software.

[2]Refer to the Technical specification chapter for more details on the available models and the supported credentials for each model.

[3]Use a RS-485 connection to perform the upgrade. If you use a Kantech Access Controller with the EntraPass software you can perform this upgrade using the operation menu.

Unpacking the ioSmart Card Reader

Before installing the reader, check that the product box contains the following parts:

- One ioSmart Card Reader
- Two 11.1 k Ω resistors
- Four 5.6 k Ω resistors
- One Philips head screw, #6-32
- One installation sheet

ioSmart Card Reader models

There are two ioSmart Card Reader sizes, the mullion and the single gang. The mullion has three models and the single gang has three models.

The various models include the ioSmart Card technology without a keypad and multi-technology readers with or without a keypad. The ioSmart Card technology supports the 13.56 MHz smart cards while the multi-technology readers support 125 kHz proximity and 13.56 MHz smart cards.
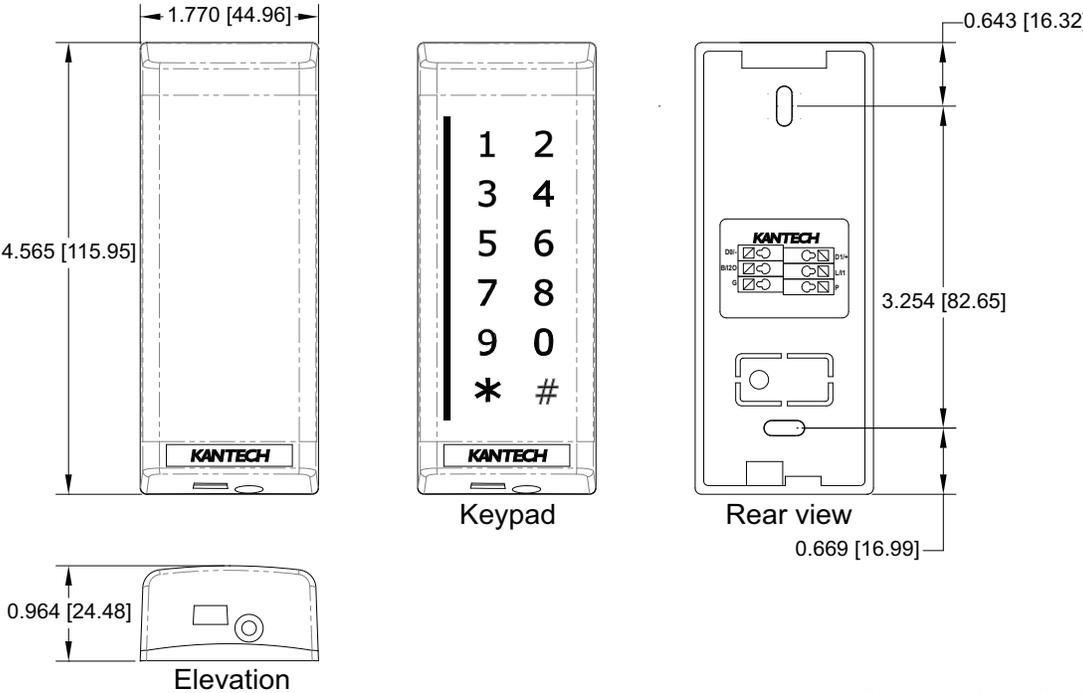
Mullion ioSmart Card Reader

The following table lists the three mullion ioSmart Card Reader models.

Model	Type	RFID
KT-MUL-SC	Mullion	13.56 MHz
KT-MUL-MT	Multi-technology mullion	13.56 MHz + 125 kHz
KT-MUL-MT-KP	Multi-technology mullion with a keypad	13.56 MHz + 125 kHz

Mullion ioSmart Card Reader

The following diagram shows the dimensions of the mullion ioSmart Card Reader.
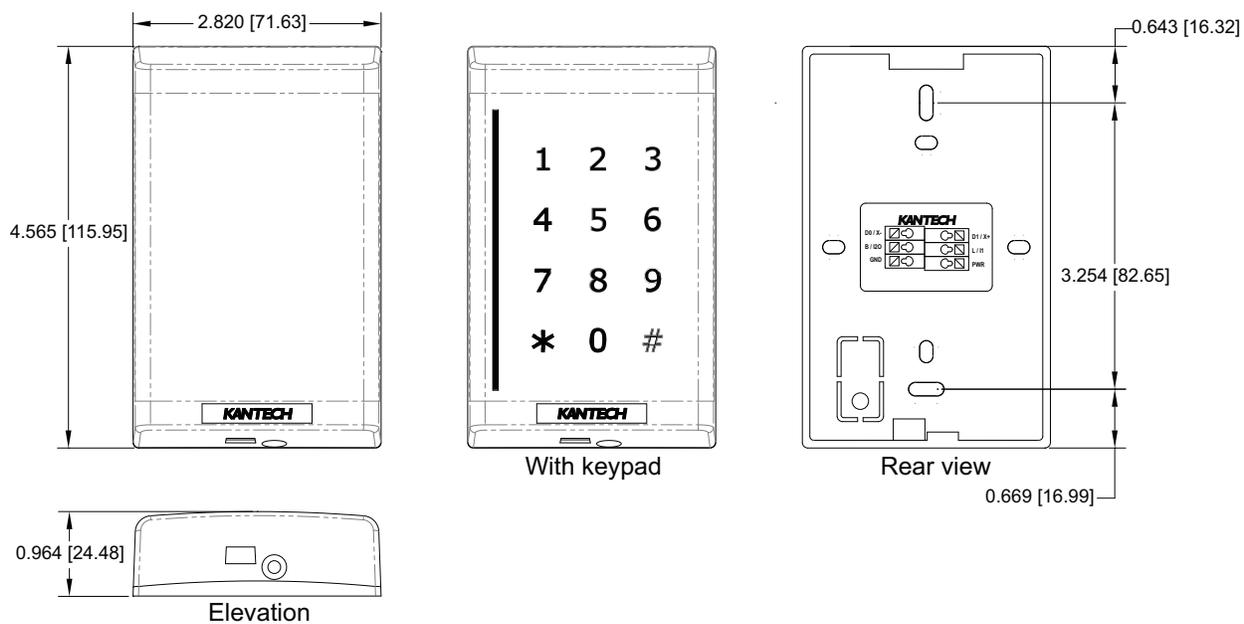
Mullion ioSmart Card Reader dimensions

Single gang ioSmart Card Reader

The following table lists the three single gang ioSmart Card Reader models.

Model	Type	RFID
KT-SG-SC	Single gang	13.56 MHz
KT-SG-MT	Multi-technology single gang	13.56 MHz + 125 kHz
KT-SG-MT-KP	Multi-technology single gang with a keypad	13.56 MHz + 125 kHz

Single gang ioSmart Card Reader

The following diagram shows the dimensions of the single gang ioSmart Card Reader.

Single gang ioSmart Card Reader dimensions

Technical features

This section describes the controllers that both the wiegand and RS-485 modes support. It also outlines how the reader automatically detects which mode after installation. It explains that existing access cards that use either the Kantech ioProx or Mifare Plus technology are compatible with the ioSmart Card Reader. The functionality of the keypad and how the no interaction setting is configured using the EntraPass software is discussed. Finally an explanation of the various LED statuses and the security optical tamper is provided.

Wiegand mode

The ioSmart Card Reader is compatible with all access controllers through the Wiegand interface port.

RS-485 mode

The RS-485 mode supports two access controllers, the Kantech KT-400 and KT-1.

RFID technologies

Wire loop antennas are used to generate the radio frequency identification (RFID) signals and are compatible with ioSmart, ioProx and HID proximity cards.

Capacitive touch keypad

The 12 capacitive touch keys are backlit with light-emitting diodes (LEDs). By default the backlighting will illuminate in the following situations:

• The user taps the keypad. The first tap is not considered an entry.
• The user swipes a card.

Once the backlighting initiates, the keypad has focus and the user can enter digits. The reader will dim and turn off to save energy with **no interaction** for 10 seconds.

> *Note: Use the EntraPass software to configure the **no interaction** time to suit your own preference. The default is 10 seconds.*

Auto-detection

After installation, no configuration is necessary. The reader will default to Wiegand automatically. With RS-485 detection, a format switch will be automatic.

LED status bar

The LED status bar indicates various access conditions to the user. These are the default colors:

• **Red:**   Locked
• **Green:**   Unlocked
• **Blue:**   Keypad press
• **Yellow:**   Tamper detection

> *Note: In RS-485 mode up to eight status colors are supported and can be customized through the EntraPass software.*

Optical tamper

For tamper security a light reflective sensor on the reader detects a reflective part on the mounting plate. Tamper detection initiates if the reader separates from the mounting plate more than 5 mm. A detachable bracket enables direct wall mounting, in this position, tamper detection initiates if the whole assembly separates from the wall.

The security enhancing optical tamper is available in both RS-485 mode and Wiegand mode. In Wiegand mode, the KT-400 and KT-1 controllers support the feature.

Technical specifications

The following table outlines the technical specifications for both the mullion and single gang ioSmart Card Readers.

	Mullion			Single Gang		
Model	KT-MUL-MT-KP	KT-MUL-MT	KT-MUL-SC	KT-SG-MT-KP	KT-SG-MT	KT-SG-SC
RF Technologies	13.56 MHz 125 kHz	13.56 MHz 125 kHz	13.56 MHz	13.56 MHz 125 kHz	13.56 MHz 125 kHz	13.56 MHz
Power Consumption (mA) @ 12 VDC Peak /Average	200 mA / 80 mA	100 mA / 70 mA	100 mA / 70 mA	200 mA / 80 mA	100 mA / 70 mA	100 mA / 70 mA
Weight	110 g (0.24 lbs)	110 g (0.24 lbs)	105 g (0.23 lbs)	175 g (0.4 lbs)	170 g (0.37 lbs)	165 g (0.36 lbs)
Capacitive Touch Keypad with backlighting	Yes	No	No	Yes	No	No
Typical Read Range 125 kHz ioProx ID-1 Credentials (Cards)	Up to 5.1 cm (2")			Up to 6.8 cm (2.7")		
Typical Read Range 13.56 MHz MIFARE Plus EV1, encrypted sector, ID-1	Up to 3.8 cm (1.5")			Up to 4.3 cm (1.7")		
Mounting	Mullion			Single Gang, North America / Europe		
Dimension in millimeters (H.W.D)	115.8 x 44.6 x 24.7			115.8 x 71.5 x 24.7		
Dimensions in inches (H.W.D.)	4.56 x 1.75 x 0.97			4.56 x 2.81 x 0.97		
Supported Credentials 125 kHz	ioProx and HID®			ioProx and HID®		
Supported Credentials 13.56 MHz	MIFARE Plus EV1 and ISO/IEC 14443A and 14443B					
Wiring Terminal	6 Screwless Poles					
Tamper	Optical					
Wiegand Communication Formats	Kantech SSF, Kantech XSF, 34-bit, 26-bit					
Sounder	Integrated					
AES-128 Security	From the ioSmart card to the reader. From the reader to the access control unit over RS-485					
Output	RS-485: 1 supervised open-drain, up to 750 mA					
Operating Temperature	-40 °C to +70 °C (-40 °F to +158 °F)					
Operating Humidity	0 to 95% non-condensing					
LED Indicator	Multi-Color Bar: Red, green, yellow, blue, configurable					
Inputs in Wiegand mode	LED and buzzer					
Inputs in RS-485	2 to 4, configurable					
Input Voltage	8.5 VDC to 16 VDC (provided by UL listed, power limited power source)					
Housing	Polycarbonate, smoked black					
Flammability Rating	UL94 V-2					
Firmware	Fully upgradable via RS-485					
Ingress Protection Rating	IP55					
Communication	RS-485 (AES-128) or Wiegand					
Cabling	3 twisted pairs AWG 22 unshielded or CAT5, up to 150 m (500')					
Warranty	Limited Lifetime					
Certifications	FCC, IC, CE, UL, NIST, FIPS 197, RoHS, WEEE					

Mounting

This chapter describes how to mount the ioSmart Card Reader in the most appropriate location and how to set-up the tamper detection. There are two levels of tamper detection; the first is if an intruder pulls the front cover from the back panel, the second is if an intruder pulls the entire panel from the wall. To guarantee correct setup a trained installation technician should install the reader and follow the instructions provided in this manual.

Overview

A wall is the best place to mount the single gang reader while a doorframe is the best location for the mullion reader.

To mount the reader, complete the following steps:

⚠ ***Do not over tighten the screws especially if mounting on an uneven wall***.

1 - Pull the controller's wires from the wall and put them through the hole in the mounting plate.

2 - Attach the mounting plate to a flat wall using two screws, #6-32.
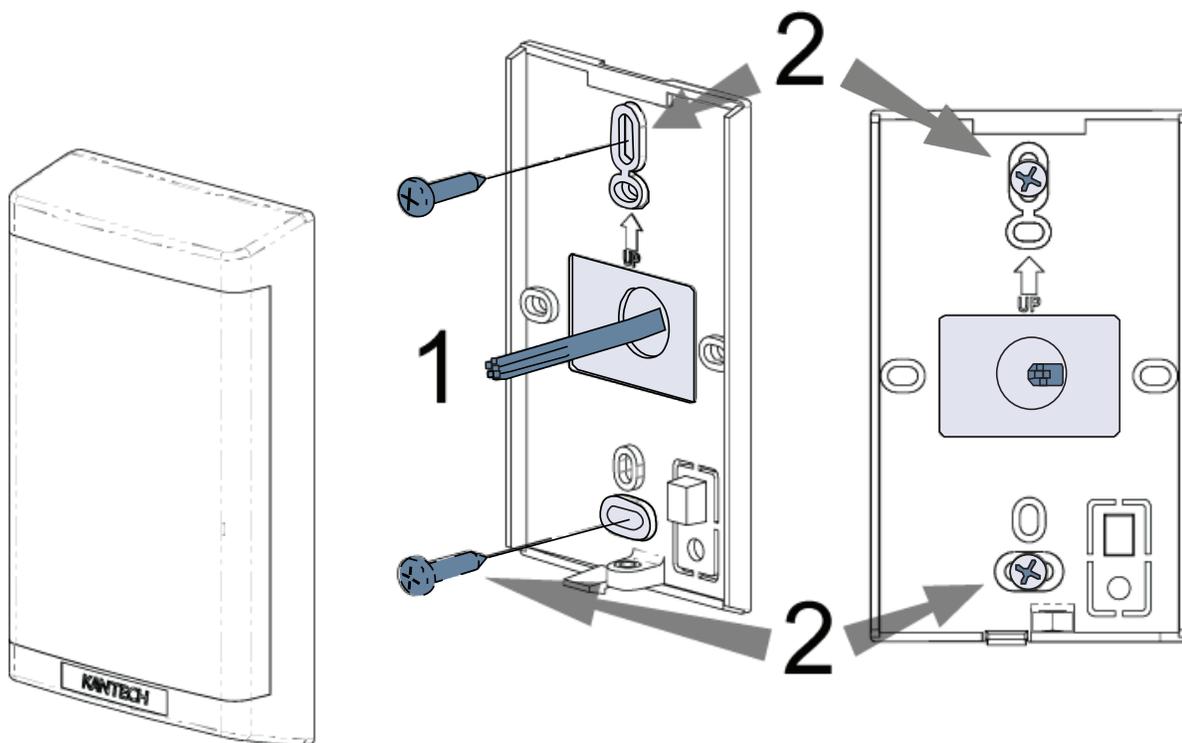
Front cover and mounting plate wire and screw holes

3 - For a high level of tamper detection, cut the plastic tamper tab from the mounting plate.

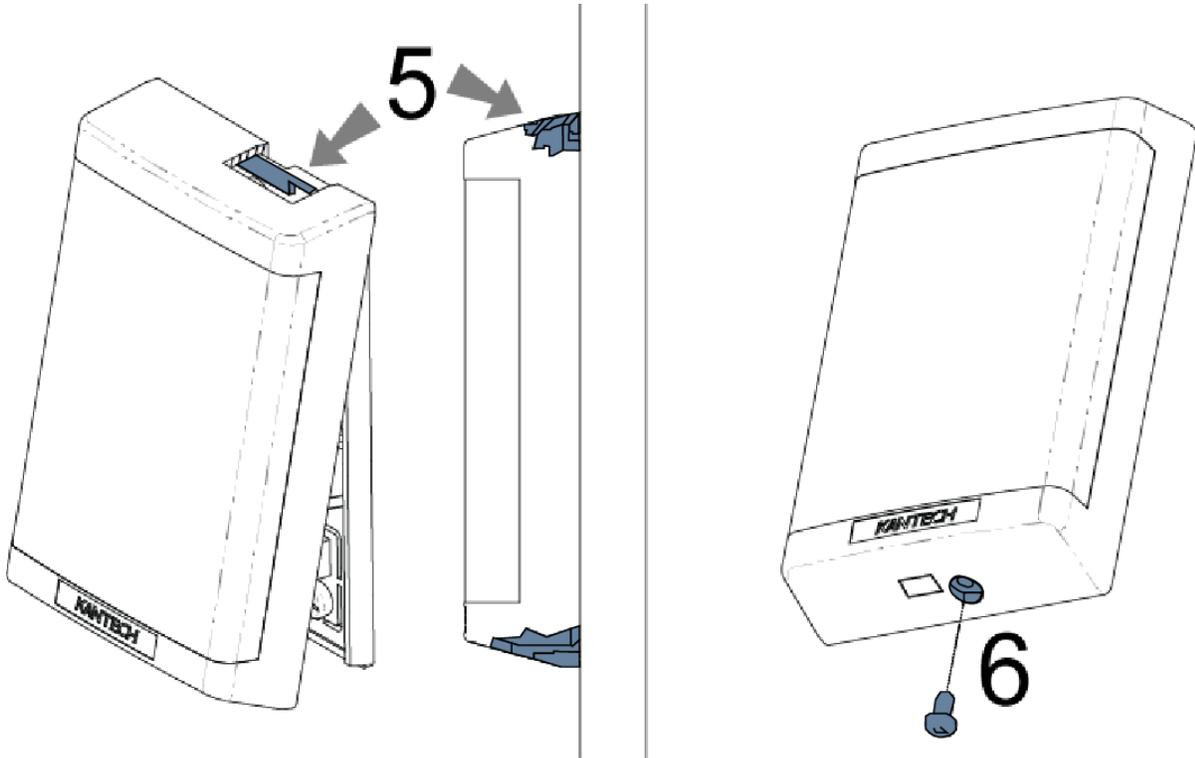**4 -** Fasten the white reflector tab into the mounting plate hole with a screw, #6-32.
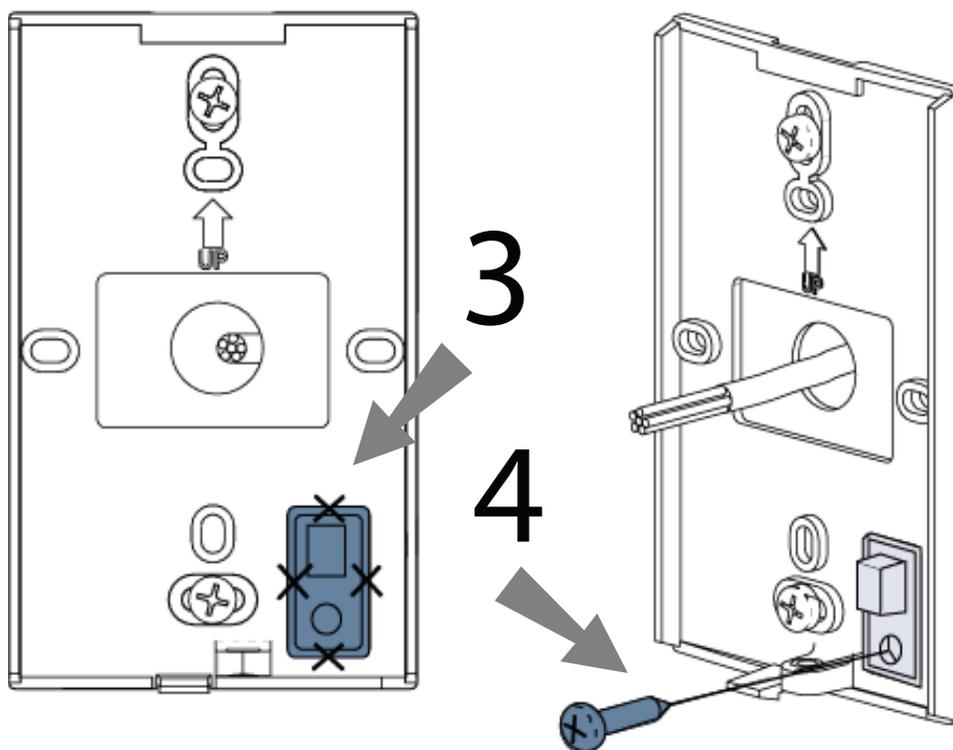
Mounting plate tamper tab and screw hole

5 - After wiring the reader, insert the hook at the top of the cover into the mounting plate tab and press the bottom of the cover until the bottom hook snaps into place.

   Note: *The chapter **Wiring** describes how to wire the reader.*

6 - Use the provided Philips head screw, #6-32 to secure the bottom of the reader.

Cover securing hook and screw

The mounting position is successful if you; heard a click when attaching the front cover to the mounting plate, and you used the screw to fasten the white reflector tab to the mounting plate. If the mounting plate bends, reconsider positioning in a new location.

Wiring

This chapter discusses the following topics:

- Overview
- Wiring distance
- Six pole screwless terminal block
- RS-485 wiring
- RS-485 CAT5 wiring
- RS-485 lock output wiring
- Wiegand wiring
- Wiegand CAT5 wiring
- Connecting multiple readers to a controller

Overview

To connect the reader to the controller use 3 twisted pairs, 22 AWG (American wire gauge) or CAT5 cable. If using CAT5 cable use two wires for GND and two wires for PWR. The recommended maximum length is 150 meters (500 feet) between the reader and its power source.

Wiring distance

The following table outlines the maximum cable distances between the reader and the controller. Results based using a Kt-400rev1 or KT-1. Results for KT-400 (with heat sinks); divide distance by half.

| Protocol	Max Cable Distance @12 vdc	Wiring per line (1 door)	Equipment per wiring line (1 door)	Example of total equipment (based on KT-400)
RS-485	152 meters (500 feet)	Home run	2 x Reader 1x Door contacts 1 x T.Rex-xxx	8 x Readers 4 x Door contacts 4 x T.Rex-xxx
RS-485	152 meters (500 feet)	Home run	1 x Reader with Keypad 1 x Door contacts 1 x T.Rex-xxx	4 x Reader with keypad 4 x Door contacts 4 x T.Rex-xxx
Wiegand	152 meters (500 feet)	Weigand, reverse Wiegand*	2 x Reader	8 x Reader
Wiegand	76 meters (250 feet)	Weigand, reverse Wiegand*	1 x Reader 1 x Reader with keypad	4 x Reader 4 x Reader with keypad

*Reverse wiegand only with ioSmart SSF and ioProx XSF Cards on KT-400 controller.

RS-485 (COM2) 500ft per line

IN Readers

T.Rex

OUT Readers

Door Contacts

Example of a home run RS485 connection

Six pole screwless terminal block

The following diagram shows the ioSmart Card Reader six pole screwless terminal block.
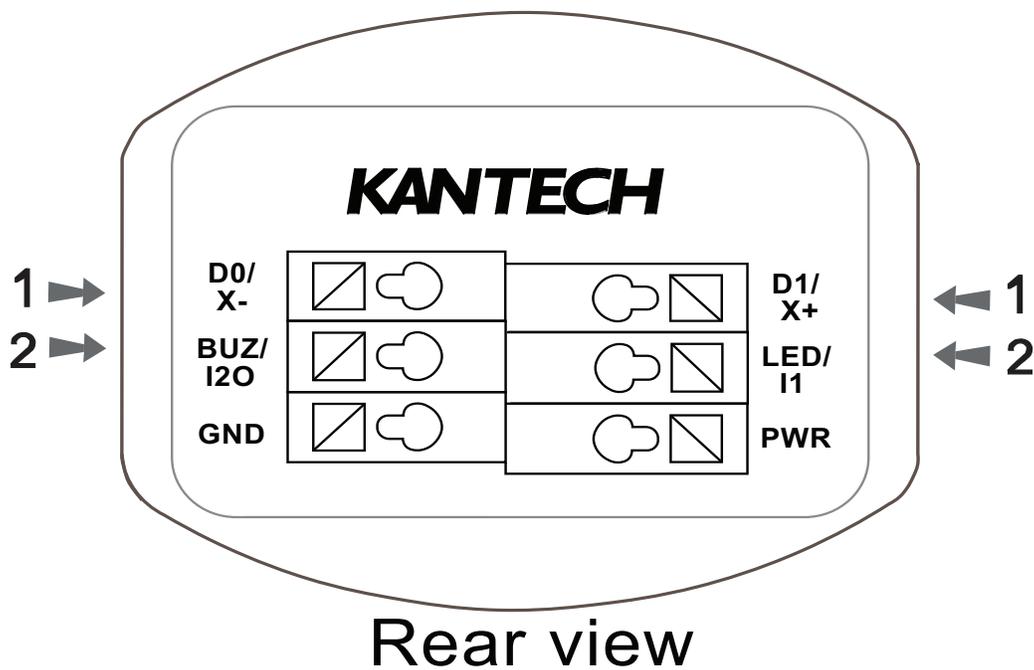
1	Open-collector 22 Ω series resistor maximum 50 mA
2	4.7 k pull-ups to +5 VDC

Six pole screwless terminal block

The terminal block consists of the following input and output terminals:

- **D0 and D1 outputs:** Open collector with a 22 Ω series resistor, with a maximum of 50 mA
- **LED input terminal:** 4.7 k pull-ups to +5 VDC
- **GND terminal:** Ground
- **PWR terminal:** 8.5-16 VDC

RS-485 mode

In RS-485 mode the LED and BUZ inputs are not required so the option to configure them for other purposes is available. For example configure the BUZ input to an open-collector supervised output and use it as either a standard or a lock output. Other options include a door contact input or a request to exit (REX).

Wiegand mode

In Wiegand mode the Wiegand terminals share the RS-485 port terminals. The BUZ and LED inputs are standard BUZ and LED terminals and not inputs.

The Wiegand mode output formats are as follows:

- Kantech Smartcard Secure Format (SSF) is the default transmission.
- Kantech eXtended Secure Format (XSF) transmission.
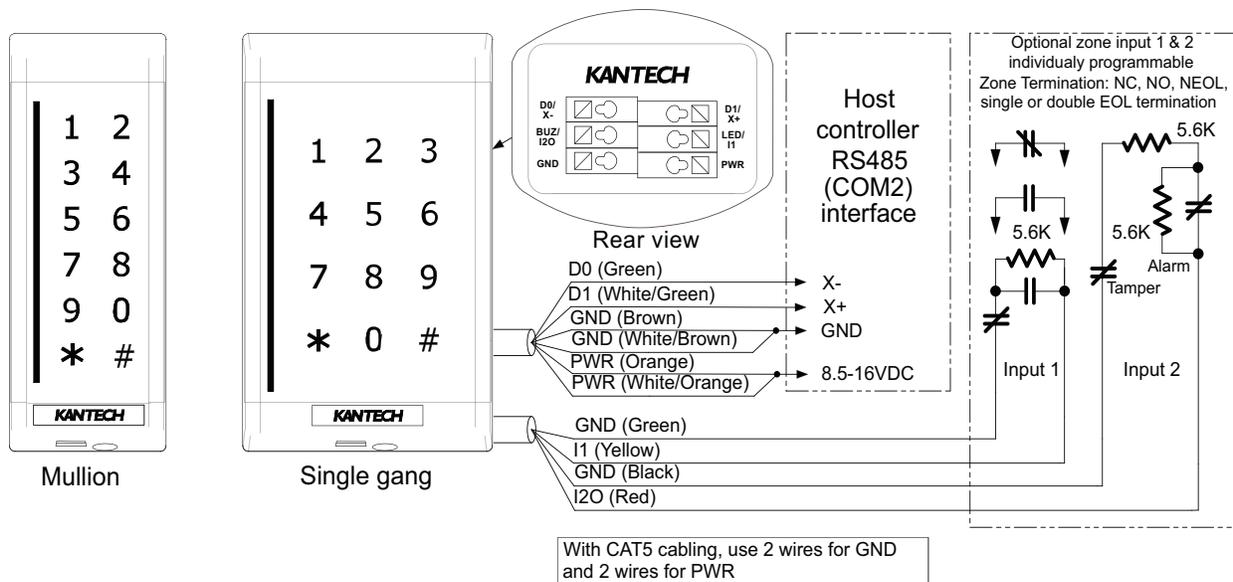- 34-bit transmission.
- 26-bit transmission.

RS-485 wiring

The following wiring diagram shows how to connect the reader to the controller in RS-485 (COM2) mode.
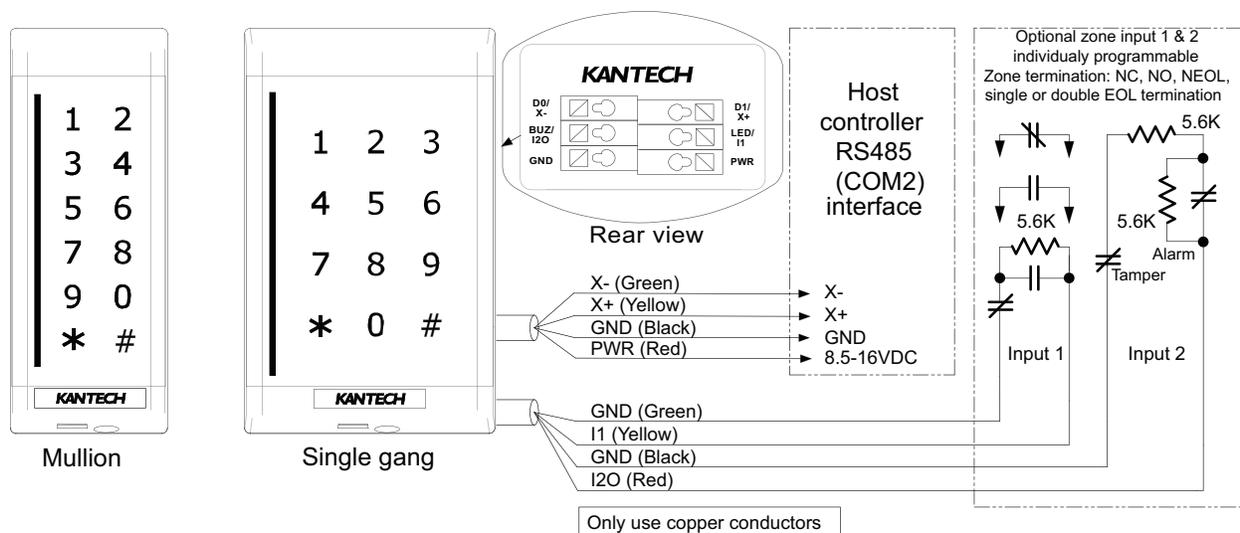
RS-485 wiring diagram
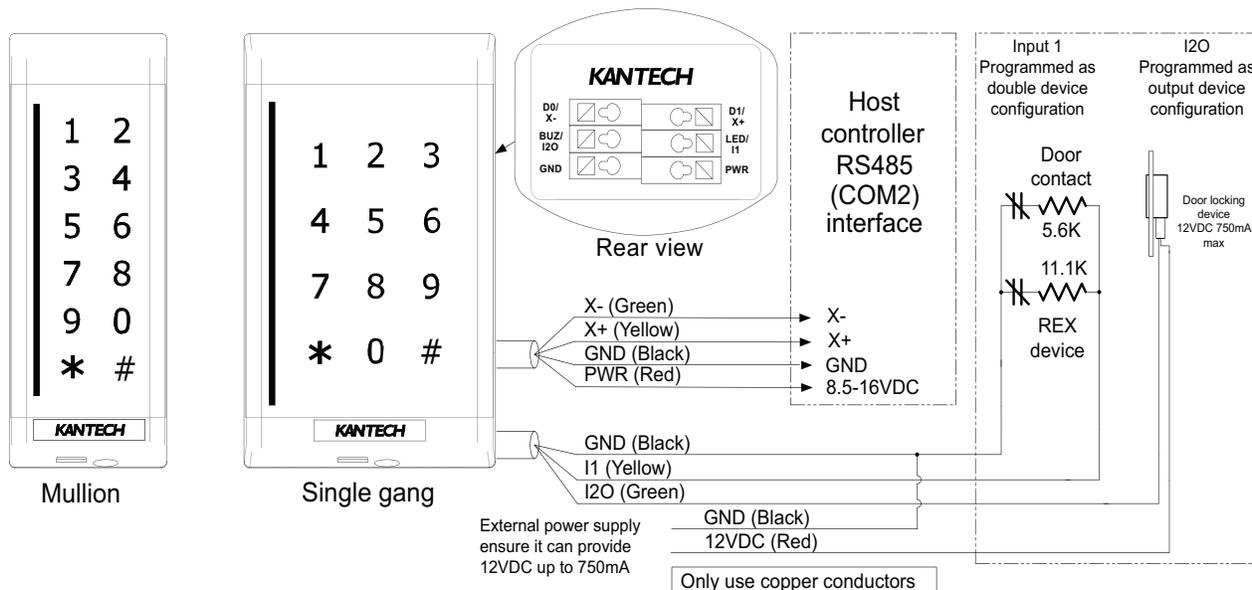
RS-485 CAT5 wiring

The following wiring diagram shows how to connect the reader to the controller in RS-485 mode using CAT5 cable.

RS 485 wiring diagram using CAT5 cable
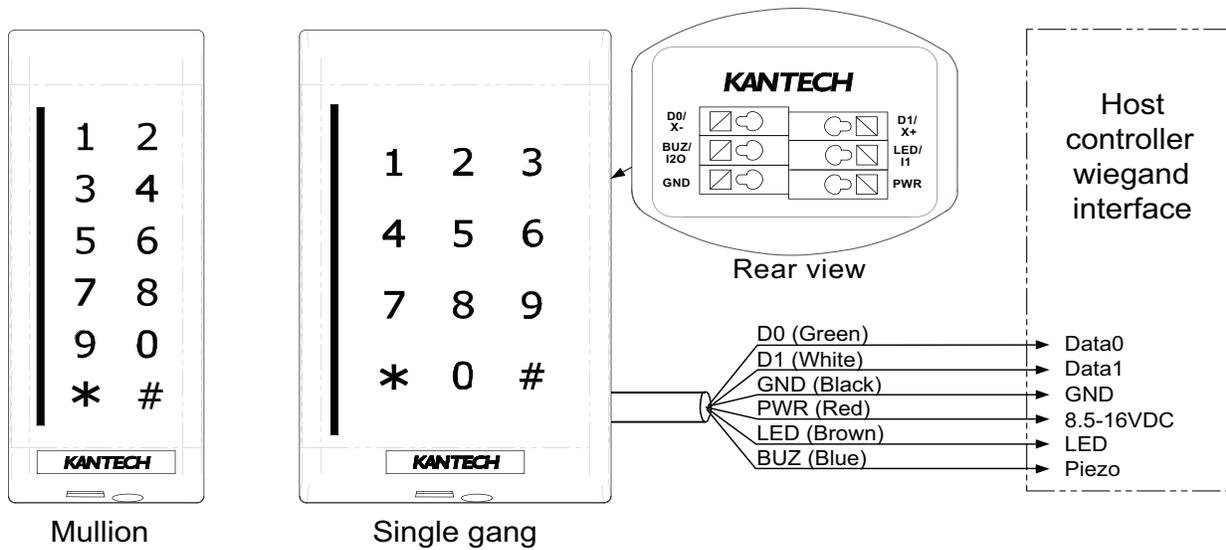
RS-485 lock output wiring

The following wiring diagram shows how to connect the BUZ input to a lock output in RS-485 mode.

*RS-485 lock ouput wiring diagram*

Wiegand wiring

The Wiegand interface uses three wires, one common ground (GND) and two data transmissions (D0 and D1). The following wiring diagram shows how to connect the reader to the controller in Wiegand mode.

Wiegand wiring diagram

Wiegand CAT5 wiring

The following wiring diagram shows how to connect the reader to the controller in Wiegand mode using CAT5 cable.
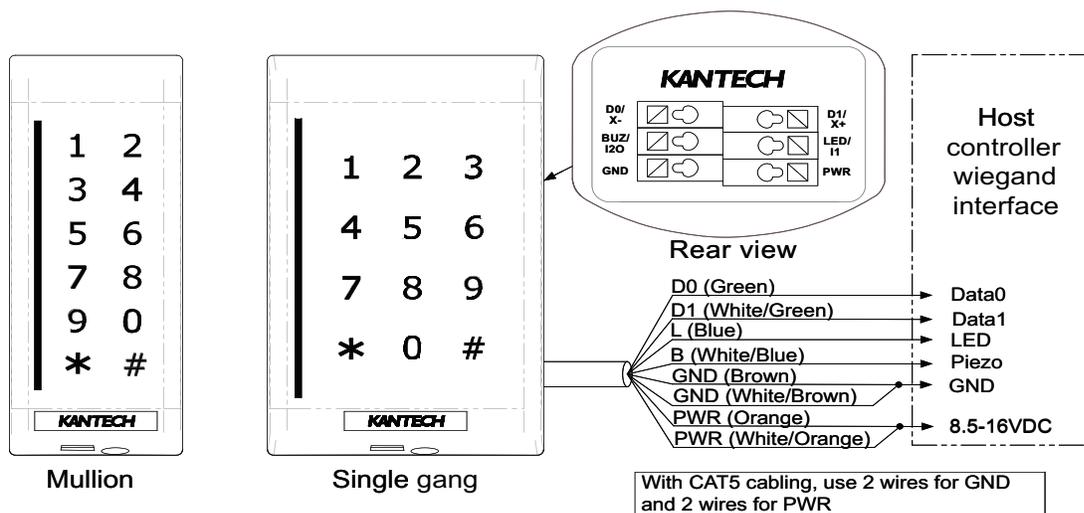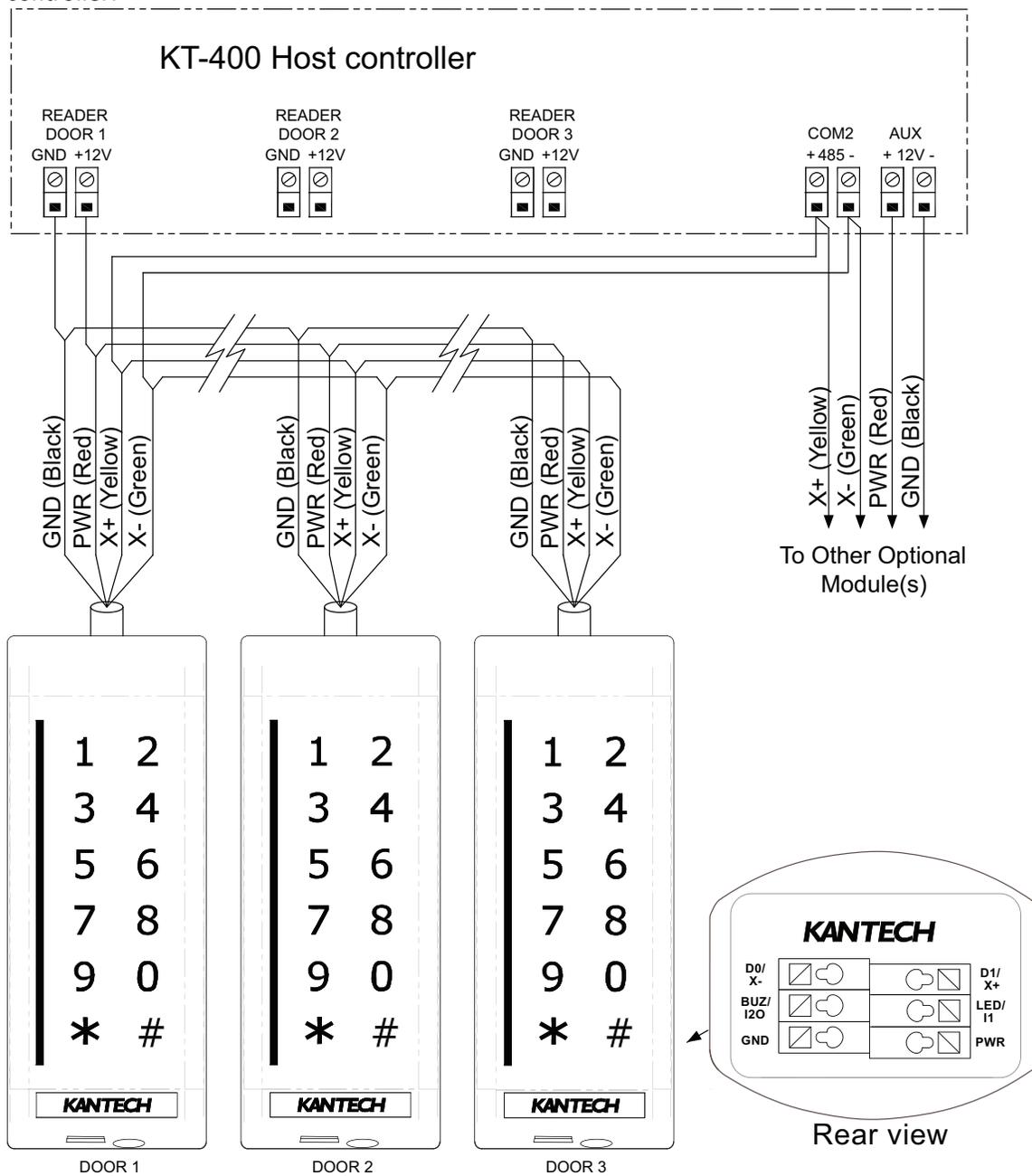

Wiegand wiring diagram using CAT5 cable

Connecting multiple readers to a controller

This section describes how to connect multiple readers to a controller. Both daisy chain and star wiring methods are available.
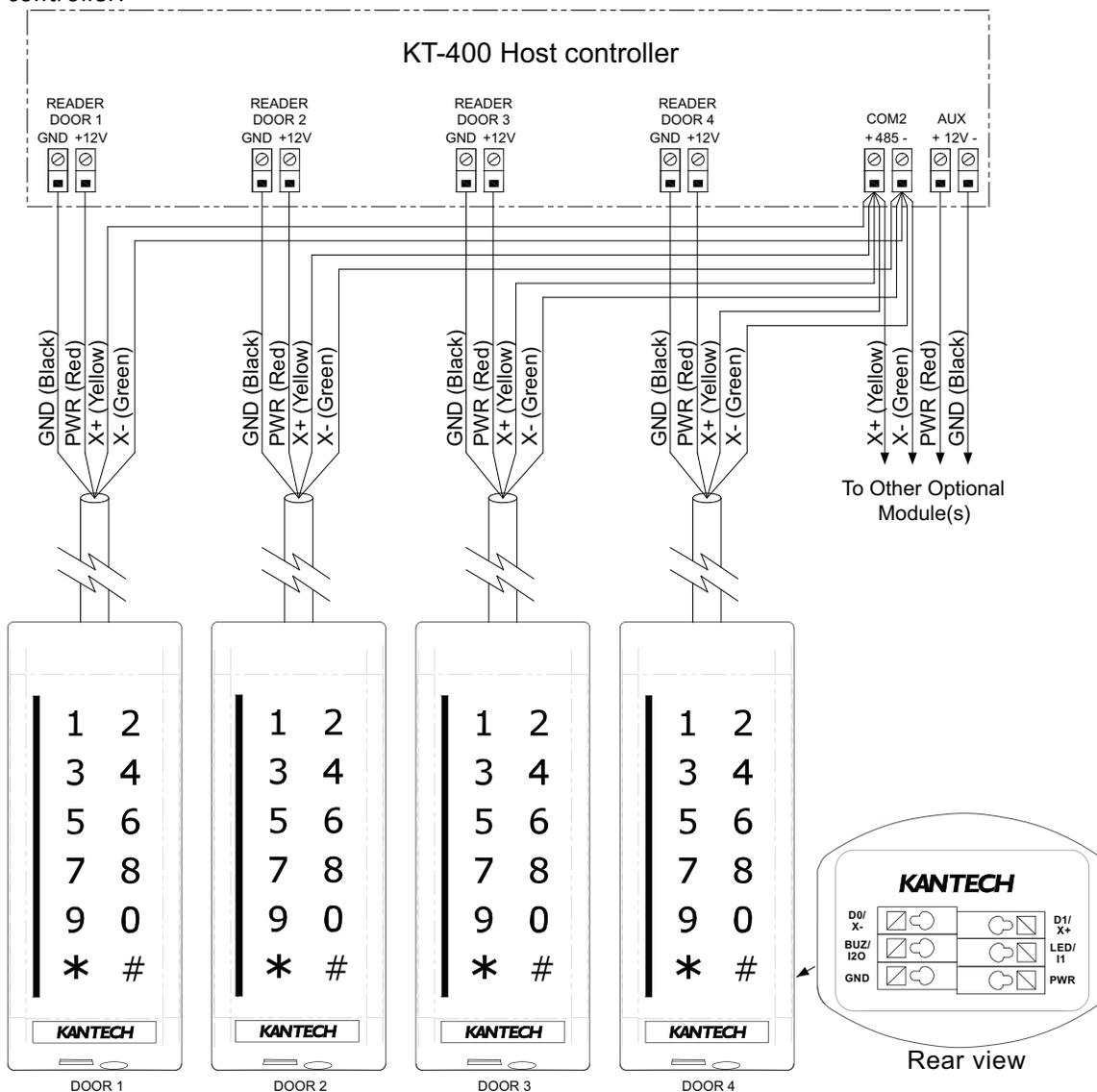
Daisy chain wiring

The following diagram shows the daisy chain wiring method to connect multiple readers to a controller.

Daisy chain wiring diagram

Star wiring

The following diagram shows the star wiring method to connect multiple readers to a controller.

Star wiring diagram

Configuring the reader

This chapter describes how to configure the reader by short circuiting the wires on the terminal, and by using your Kantech smart card. It also describes how to assign an identification number and color to a reader for easy identification when using an EntraPass application.

## Configuring the reader using the terminals

This section discusses the following topics:

- SSF transmission format
- XSF transmission format
- 34-bit transmission format
- 26-bit transmission format
- Send Unique Identifier (UID)

SSF transmission format

If RS-485 communication is not detected on power up, the reader will default to Kantech Smartcard Secure Format (SSF). SSF is the factory default.

The following diagram and procedure describe how to return the reader to factory default format from other transmissions:
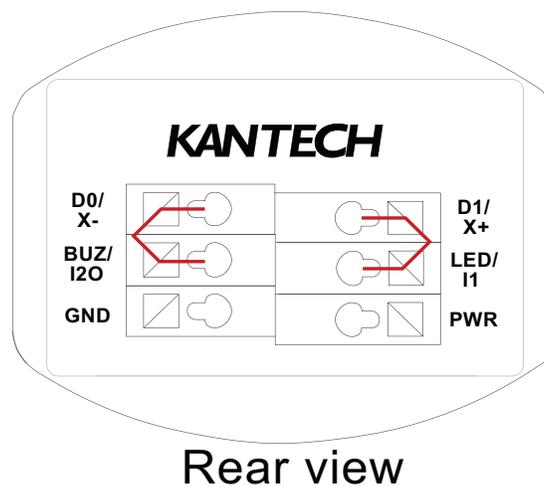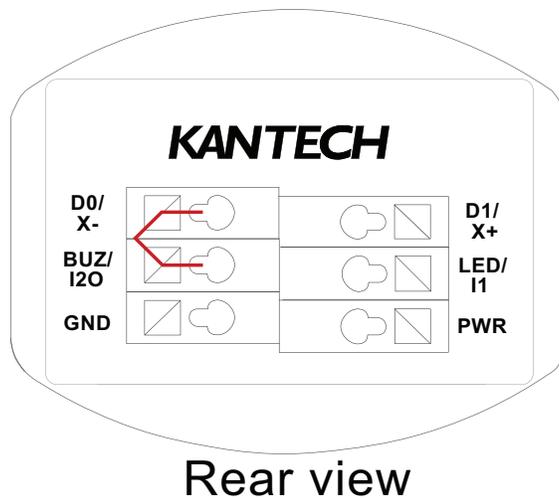

Factory default terminal block shorting diagram

> **Note:** *Forcing factory default will delete all custom settings from the reader.*

1 - Short circuit together the D0 and BUZ terminals.

2 - Short circuit together the D1 and LED terminals.

3 - Apply power to the reader.

4 - A simultaneous sequence of four beeps and flashes, four times is a signal of a successful return to the SSF transmission format. A sequence of rapid beeps and flashes for four seconds is the signal of an unsuccessful return to the SSF transmission format.

XSF transmission format

The following diagram and procedure describe how to enable the Kantech eXtended Secure Format (XSF):
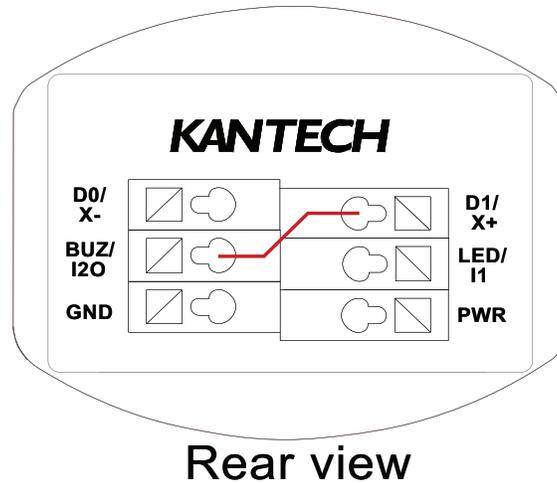

Rear view

XSF terminal block shorting diagram

1 - Short circuit together the D0 terminal with the BUZ terminal.

2 - Apply power to the reader.

A simultaneous sequence of three beeps and flashes, four times is a signal of a successful configuration to the XSF transmission format. A sequence of rapid beeps and flashes for four seconds is the signal of an unsuccessful configuration to the XSF transmission format.

34-bit transmission format

The following diagram and procedure describe how to enable Wiegand 34-bit format transmission:

34-bit terminal block shorting diagram

1 - Short circuit together the D1 terminal with the BUZ terminal.

2 - Apply power to the reader.

A simultaneous sequence of one beep and flash, four times is a signal of a successful configuration to the 34-bit transmission format. A sequence of rapid beeps and flashes for four seconds is the signal of an unsuccessful configuration to the 34-bit transmission format.

26-bit transmission format

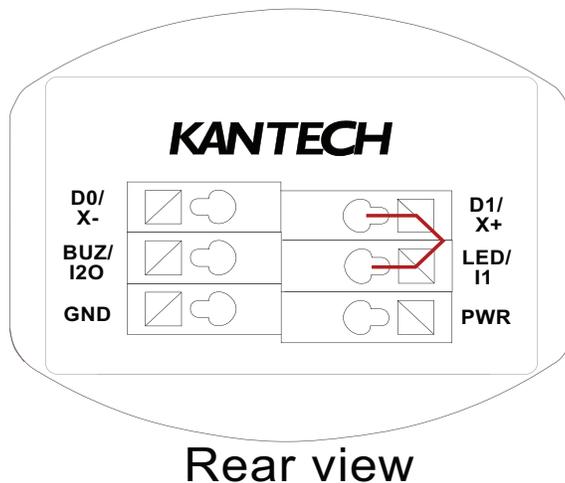The following diagram and procedure describe how to enable Wiegand 26-bit format transmission:

Rear view

26-bit terminal block shorting diagram

1 - Short circuit together the D1 terminal with the LED terminal.

2 - Apply power to the reader.

A simultaneous sequence of two beeps and flashes, four times is a signal of a successful configuration to the 26-bit transmission format. A sequence of rapid beeps and flashes for four seconds is the signal of an unsuccessful configuration to the 26-bit transmission format.

Send Unique Identifier (UID)

If RS-485 communication is not detected on power up, the following diagram and procedure describe how to configure the reader to send the UID with supported 13.56 credentials.
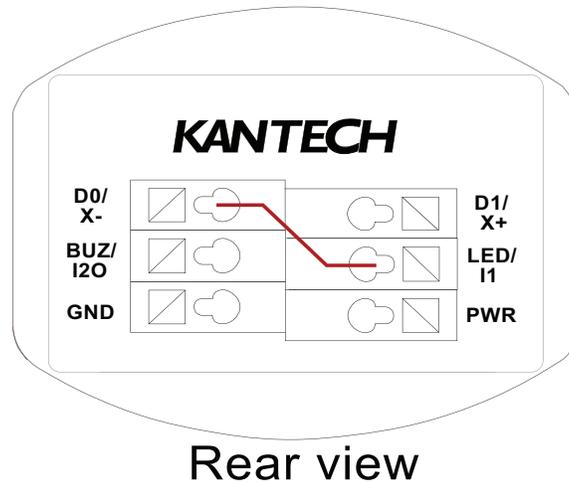

Rear view

UID terminal block shorting diagram

1 - Short circuit together the D0 terminal with the LED terminal.

1 - Apply power to the reader.

A simultaneous sequence of five beeps and flashes, four times is a signal of a successful configuration to the UID-option. A sequence of rapid beeps and flashes for four seconds is the signal of an unsuccessful configuration to the UID format.

Configuring the reader using a Kantech smartcard

This section describes how to use a Kantech smartcard to configure a reader. This method is an alternative to using the terminal block to short together two or more outputs.

Up to seven different modes are available for configuration. The following steps describe the first two modes. For other modes follow the same steps, but substitute the appropriate values from *Table 1*. To configure a reader using a card, complete the following steps:

1 - Reset the reader to factory default mode and present the card within the first 10 seconds, maintain contact for at least four seconds. The reader will beep once and the LED will flash once.

2 - To enable Wiegand 34-bit format transmission, present the card to the reader once. Five seconds later, the reader will beep once and the LED will flash once to confirm mode 1. To enable Wiegand 26-bit format transmission, present the card to the reader twice. Five seconds after the last card presentation, the reader will beep twice and the LED will flash twice to confirm mode 2.

3 - Present the card one final time to confirm configuration. The reader will acknowledge the new configuration with a one second continuous beep and LED activation.

The following table outlines the amount of card presentations required for each mode.

Mode	Card presentations	Functions
1	Once	34-bit Wiegand transmission
2	Twice	26-bit Wiegand transmission
3	Three times	XSF transmission format
4	Four times	SSF transmission format
5	Five times	Send UID only
6	Six times	14443 Type B enabled
7	Seven times	HID Prox disabled

Table 1 Card configuration modes

> **Note:** *If you select a nonexistent mode, the error mode is triggered, this is a burst of beeps and a flashing LED for four seconds.*

Once the configuration is confirmed, the reader will accept another configuration within 10 seconds. If you want to use the card to reconfigure the reader, you have to return to factory default mode.

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