

**AC-1100**

**Proximity Card Reader (RS-485)**

## **Technical Reference Manual**

**Revision C**

2005-11-04

[AC-1100 TRM Rev C ENG-US]

# Proximity Card Reader (RS-485)

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## Introduction

The KeyMaster AC-1100 is a slimline proximity card reader/writer for a range of contactless identification and transaction applications, including access control, time & attendance reporting, membership cards, electronic keys, parking systems and prepaid card systems.

The AC-1100 employs very large scale integration (VLSI) surface-mount components, and utilizes the I/O capability of the system controllers to deliver a compact, flexible proximity solution. A single tri-color LED and an internal piezo buzzer indicate status and error information.

This document forms part of a set covering the installation of KeyMaster Systems and should be read in conjunction with the master document, entitled 'KeyMaster Systems Hardware Installation Guidelines', which is distributed as *AC-6000 HIG Rev B ENG-US.pdf*.

## Features

- Supports Hitag™ 1, Hitag™ 2 and H4102 (a.k.a. EM4102) transponder technologies
- Industry standard 125 kHz operation
- Can be mounted directly on metal surfaces
- Up to 4" reading distance (transponder dependent)
- RS-485 host interface
- Tri-color LED indicator
- Piezo audio buzzer
- 12 V<sub>dc</sub> operation
- Compact size - (w) 1.77" x (h) 4.92" x (d) 0.98"
- Weather resistant housing



*AC-1100 proximity card reader*

## Information regarding UL evaluation of this product

This product meets the UL Listing requirements for the United States of America and Canada. Please refer to the document entitled 'KeyMaster System Hardware Installation Guidelines' for detailed information on the UL Listing of KeyMaster system components.

## Card and tag technologies

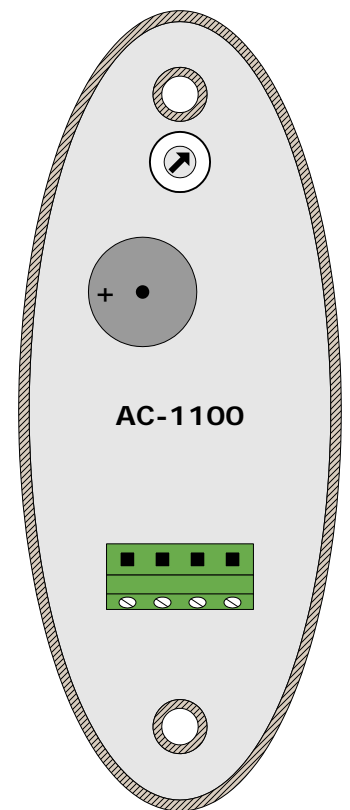
The AC-1200 reader can read Hitag 1, Hitag 2, H4001 and H4102 (EM4102) proximity tags and cards. The following table lists the tag formats.

Tag formats		
Tag type	Data size	AC-1100 output
EM4102	32 bits	KeyMaster proprietary encoded 32 bits
H4001	32 bits	KeyMaster proprietary encoded 32 bits
H4002	32 bits	KeyMaster proprietary encoded 32 bits
Hitag 1	32 bits	KeyMaster proprietary encoded 32 bits
Hitag 2	32 bits	KeyMaster proprietary encoded 32 bits

## PCB Layout

The circuitry of the AC-1100 Proximity Reader is sealed within a protective resin potting inside the nylon housing. The fixed 4-way terminal block provides connection for power and the RS-485 scanner network. The AC-1100 Proximity Reader is addressed using a rotary switch. **You will need to re-power the AC-1100 proximity reader if you change the address setting of the rotary switch.**

The following diagram shows the rear of the AC-1100 unit:



*Circuit layout*

## Installation

Installation of the AC-1100 includes the following tasks, which are detailed in the sections to follow:

- Prepare to mount the reader
- Set the network address of the reader
- Connect the RS-485 network cable
- Connect the power supply cabling
- Mount the reader

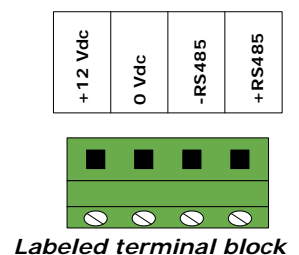
The power supply and network cabling are connected to a four position terminal block fixed in the resin potting at the rear of the AC-1100 reader.

The terminals can accept wiring up to 1 mm<sup>2</sup> in cross section, which is equivalent to 18 AWG. The conductors used should not exceed this size.

Please refer to the KeyMaster System Hardware Installation Guidelines, file name 'AC-6000 HIG Rev B ENG-US.pdf' for more comprehensive installation information.

**Note:** To Prevent EMI between readers, ensure the readers are mounted at least 6" apart.

The terminals are labeled on the rear of the unit as shown in the diagram below.



The following procedure is used when cables are connected to the terminal block:

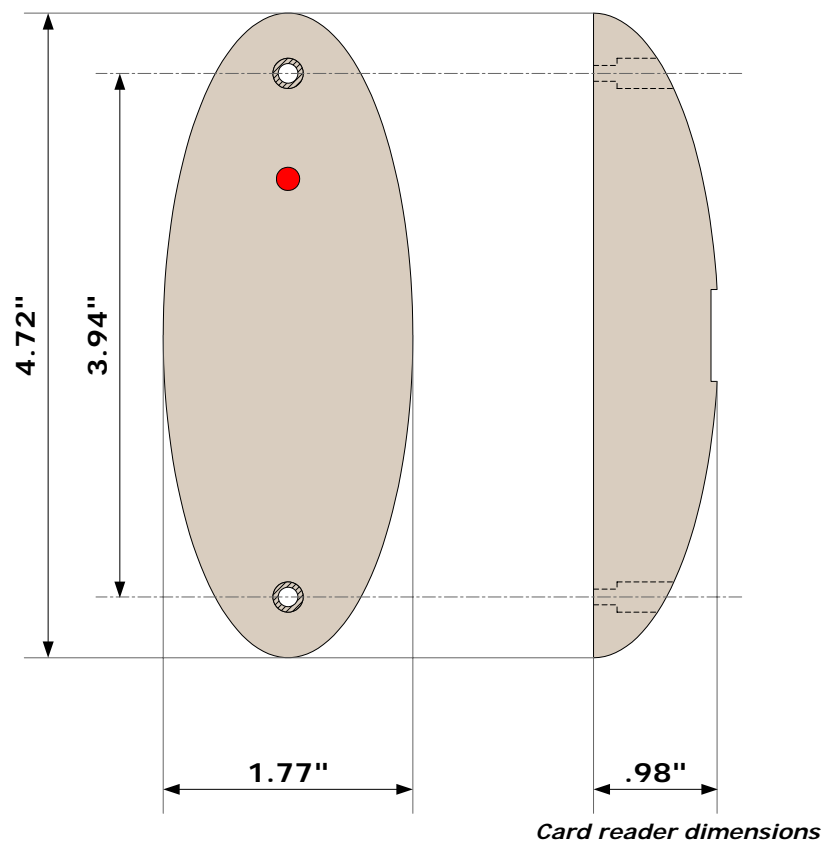
- 1/4" of the insulation is carefully stripped from the end of each conductor
- The terminal screw is loosened
- The bare portion of the conductor is inserted into the terminal orifice
- The terminal screw is fastened

The recommended screwdriver is a slot-head type screwdriver suitable for size 0 or size 1 screws (3/32" wide blade). The screws should not be over-tightened as this may damage the conductor.

## Mounting

The AC-1100 proximity card reader can be mounted against most surfaces, including metal. Two 0.2" diameter-mounting holes are countersunk into the front of the housing.

Screws and wall anchors are provided with the unit.



When mounting the AC-1100 proximity reader, the following procedure is used:

- Hold the reader in the position where it is to be mounted
- Mark the positions of the mounting holes on the mounting surface and then remove the reader
- Drill holes in the mounting surface using a suitable drill bit of the correct gauge
- Drill or auger a hole for the cable feed if necessary
- Feed the cable through the mounting surface to the scanner
- Set the address and connect the cables, as detailed in the following sections
- Insert wall anchors into the holes if necessary
- Align the reader with the holes and fasten the mounting screws



For proper operation, it is best not to subject the AC-1100 proximity card reader to excessive heat, moisture, vibration or electrical interference.

For back-to-back operation (opposite sides of a door) always maintain a minimum distance of 6" between the two card readers. A suitably grounded metal shield may be inserted between the back-to-back readers to reduce undesirable crosstalk.

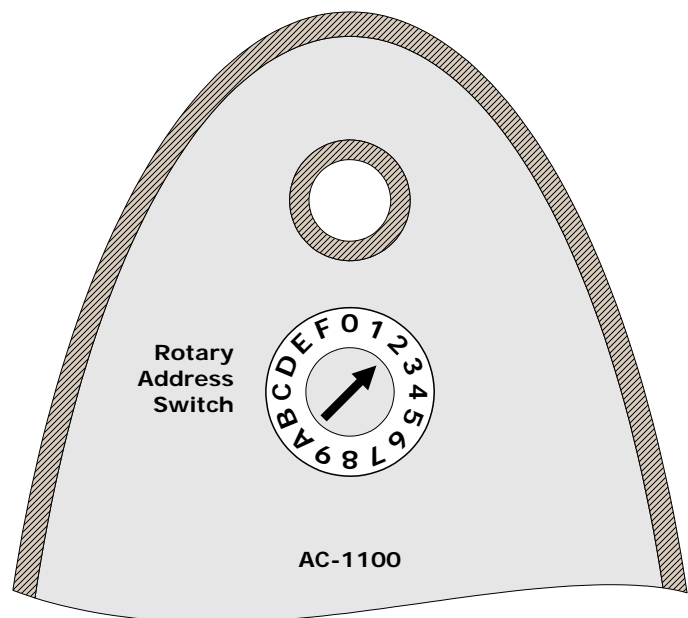
## Addressing

Each device on the RS-485 scanner network must have a unique address to ensure proper communications. The address of the AC-1100 reader may be set to any decimal number between 0 and 15.

Adjusting the rotary switch located at the rear of the unit sets the network address. A small, slot-head screwdriver is suitable for this purpose. The blade of the screwdriver is inserted into the slot indicated by an arrow in the diagram below.

The switch indicates the positions 0 to 15 in hexadecimal notation. Addresses 0 to 9 correspond with decimal values. The uppercase letters A to F, where A represents 10 and F represents 15, represent addresses 10 to 15.

The factory default setting for the AC-1100 address is 0.



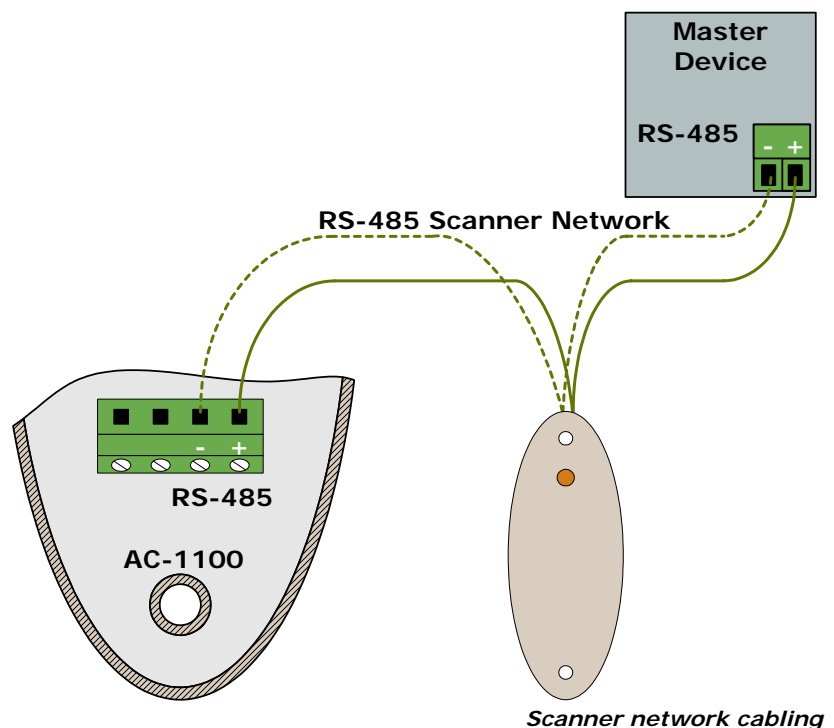
*Address selection (address 2 shown)*

## Connecting the RS-485 scanner network

The AC-1100 proximity reader is monitored and controlled by its host device via the RS-485 scanner network. A comprehensive discussion of this RS-485 networking system is available in the RS-485 Wiring Guide, file name *RS-485 HIG Rev A ENG-US.pdf*.

The RS-485 scanner network operates in half duplex mode, with the host device acting as master and the AC-1100 card readers acting as slaves. Only one master device may be connected to a group of AC-1100 card readers on the RS-485 scanner network.

The AC-1100 is connected to the RS-485 network via the four-way terminal block fixed in the resin potting at the rear of the unit. The RS-485 terminals are labeled '-' and '+'. Connect all '-' terminals to the '-' line and the '+' terminals to the '+' line of the RS-485 scanner network.



The recommended cabling type for the RS-485 scanner network is a shielded cable containing size 24 AWG, stranded conductors arranged in twisted pairs. Belden P/N 9842 or equivalent, 24AWG 2-pair, shielded cable is an example.

The network cable must be run in a multi-drop fashion from one device to the next.

The position of the host device in the RS-485 scanner network is not important – it may be located at the end of the network or in the middle.

Where the scanner network exceeds 200 yards, ensure that the devices at the physical ends are resistively terminated. Do this by placing a 120  $\Omega$  resistor across the network lines (from + to - on the connector).

## DC power supply

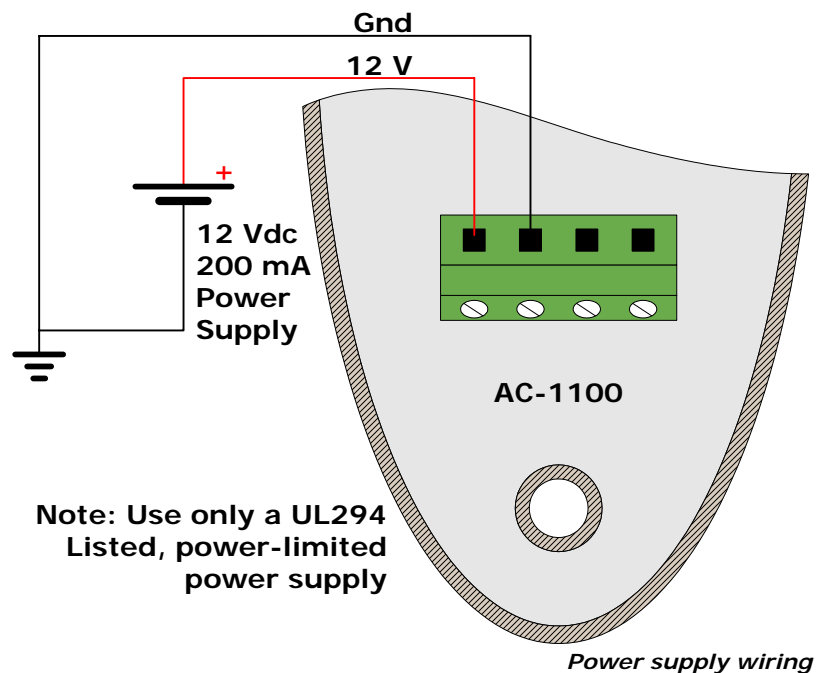
The AC-1100 should be powered by a UL294 Listed, power-limited power supply capable of delivering a minimum current of 200 mA under all conditions.

The power supply wiring is connected to the AC-1100 Proximity Card Reader via the four-way terminal block fixed in the resin potting at the rear of the unit.

The power supply terminals are labeled +12 V<sub>dc</sub> and 0 V<sub>dc</sub>.

Power supply for the AC-1100 unit may be taken directly from the host controller's auxiliary power terminals, provided that the power supply and cabling are UL Listed in compliance with the requirements detailed in the document 'Powering KeyMaster Systems', file name *Power HIG Rev B ENG-US.pdf*.

**The UL294 Listed, power-limited power supply used to supply the host controller must be able to deliver sufficient power to supply the controller and auxiliary device/s.**



Under certain circumstances it may be acceptable to use an additional pair within the network cable to transmit 12 V<sub>dc</sub> power to the AC-1100 unit. For a detailed discussion on the supply of power to KeyMaster System devices, please refer to the power supply wiring guidelines mentioned above.

## Diagnostic Status Indicators

The AC-1100 card reader includes a tri-color LED indicator that can emit red, green or amber light. The reader also has a piezo buzzer set in the resin at the rear of the unit.

The LED and buzzer are used to indicate normal access control events and to diagnose card reader malfunction.

When 12 V<sub>dc</sub> power is applied to the AC-1100 reader, the LED flashes amber and the buzzer emits a short tone. When successful communication with the controller is established, the LED continuously flashes green at one-second intervals.

When a proximity card is successfully read by the AC-1100, the buzzer sounds.

The status of an access control transaction is indicated by the LED; green for access allowed and red for access denied.

The following table describes the various states of the LED and buzzer for assistance in the diagnosis of typical reader behavior:

AC-1100 diagnostics	
<b>Condition:</b>	<b>LED flashing Amber</b>
<b>Description:</b>	<i>Some form of RS-485 scanner network problem exists.</i>
<b>Possible causes:</b>	AC-1100 reader is not connected to the RS-485 scanner network. Cable problems such as induced noise, cable breaks, core reversal or ground loops between the devices. Incorrect or duplicate scanner address. No host device found on the RS-485 scanner network. (The host may be switched off).
<b>Condition:</b>	<b>LED on Amber and/or buzzer on continuously</b>
<b>Description:</b>	<i>Some form of power or CPU problem exists.</i>
<b>Possible causes:</b>	The AC-1100 reader is experiencing operational problems which could be a result of inadequate power supply. This condition may also arise if the AC-1100 electronic circuitry is physically damaged.
<b>Condition:</b>	<b>LED flashing Green</b>
<b>Description:</b>	<i>The AC-1100 reader is operating normally.</i>

## Product Specifications

AC-1100 specifications	
Power requirement	
Operating voltage (dc)	12 V <sub>dc</sub>
Maximum current	200 mA
Operating parameters	
Excitation frequency	125 kHz
Typical reading distance	0" to 4" (dependent on transponder type)
Environmental characteristics	
Operating temperature	32°F to 158°F
Storage temperature	14°F to 176°F
Operating humidity range	5% to 95% non-condensing
Enclosure	Nylon
RS-485 scanner network	
Transient protection	Yes
Maximum distance from host device (if powered by host device)	220 yards
Maximum network distance	1300 yards (4000 ft.)

## FCC Compliance Statement

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: Re-orient 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. Consult the dealer or an experienced radio/TV technician for help.

- Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
- The unit is intended to be powered by a UL294 Listed, power-limited power supply.