DIGITAL KEY READER MODEL DR4201
OPERATIONAL DESCRIPTION

Introduction

The DR4201 "DigiReader" is the newest addition to the WSE line of proximity access control readers. In conjunction with an access control unit (ACU), the DR4201 controls door access by interrogating a specified area around the door for persons possessing a "DigiKey" card which emits a valid code for entry. The reader is mounted to a permanent fixture (usually an adjacent wall) in the vicinity of the doorway. Because of the frequency of operation, it may be mounted behind a sealed wall for more secure, tamper-proof applications. The DR4201 is powered by a 24 volt DC source and has a RS485 interface for communication with the ACU host system. Communication between the reader and card is accomplished via magnetically coupled antennae and is described below.

Description of antenna system

The simplified DigiReader-card system block diagram is shown in figure 1. The 11.059 MHz oscillator in the DR4201 generates a 138.2 KHz signal which drives a 1.85" x 2.87" loop antenna made out of copper traces on the pcb. When a card is within proximity (0 to 2 inches from the surface of the board), its coil picks up the 138 KHz magnetic field, which is rectified to power the card ASIC. The IC divides the 138 KHz clock by two and emits its own unique ID code in the form of a 10 msec, 69 KHz phase shift keyed (PSK) signal burst. The DR4201 picks up the return signal with the loop antenna, amplifies and filters it. The 138 KHz clock for the drive circuit is also fed to a D-flip flop and divided by 2 to clock the received signal. The in-phase signal becomes a one and the out-of-phase signal becomes a zero. A microcontroller IC performs the tasks of finding the 8 bit preamble from potential ambient noise, collecting and descrambling the data and error checking. The received card ID code is then passed along to the ACU to determine the validity of the code and control the door lock relays.

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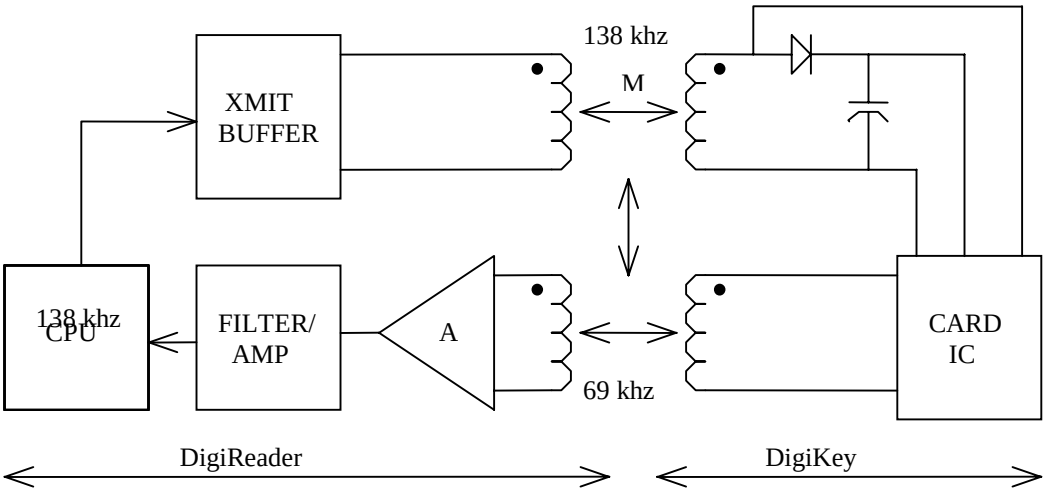

Figure 1. Overall System Block Diagram

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Circuit description

The DR4201 is composed of two main sections. The digital section contains the circuit power supply, the micro-controller, the I/O interface and the RS485 interface chip. The analog section contains the tri-state buffer driver, the transmitter tuned circuit, the peak detector, the filter circuit and the amplifier gain circuit.

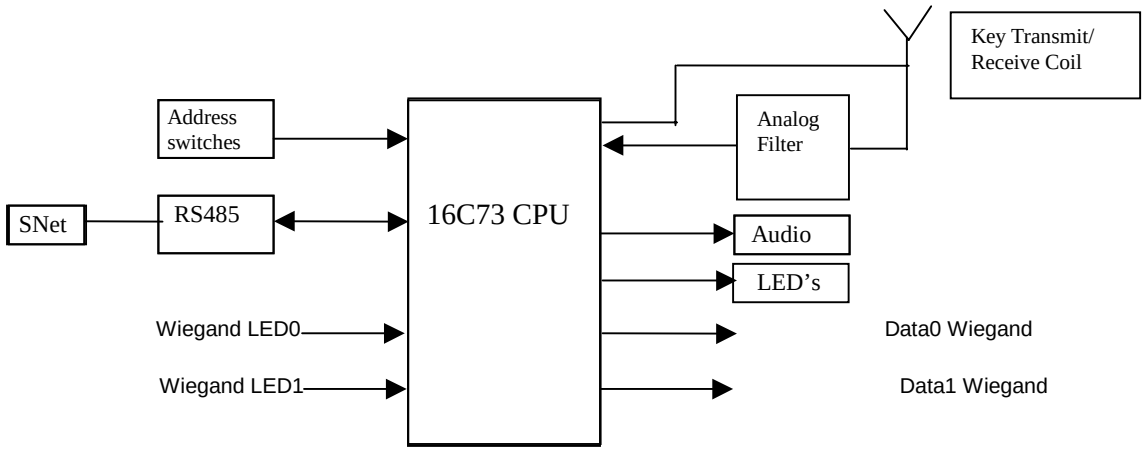

Figure 2. Device Circuit Block Diagram

Digital section:

1) Circuit power supply:

The input power is fed through two common mode filter chokes and a diode for protection against reverse polarity. It is then fed to a linear voltage regulator to generate 12 VDC to power the analog chips, the beeper, and a linear regulator to generate 5 VDC to power the digital chips.

2) Micro-controller section:

An 8 bit micro-controller (16C73A) running at 11.059 MHz uses an internal counter to generate 138.2 Khz clock signal. This 138 KHz signal drives the RF transmitter. This signal is also digitally divided externally to create a 69KHz signal used by an RF mixer to digitize the key return signal. The digitized data is then sent to the micro-controller. The micro-controller verifies the start of the signal by detecting a preamble pattern; then clocks the remainder of the serial data bits. It unscrambles the decoded data, check for errors and sends the card ID code to the ACU via the RS485 interface when polled. The micro-controller

also reads the dip switches for device ID number, controls a bi-color LED and a beeper.

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Analog section

1) Transmitter circuit:

The 138 KHz signal is buffered by a 74AC125 to drive a series resonant circuit tuned to 138 KHz. Series resistors are used to determine the power output under control of the micro-controller. An 50 turn coil (318 uH) made out of PCB traces and a 4230 pF ceramic cap comprises the series tune circuit.

2) Receiver circuit:

The received 69 KHz signal is AC coupled into a series of filter stages to remove 138 KHz signal, leaving only the 69 KHz signal biased at 2 volts DC. It is then fed to RF mixer clocked at 69 KHz to produce the digital key data which is sampled by the micro-controller.