DESCRIPTION OF DEVICE OPERATIONS

The DR4220 "DigiReader" is the newest addition to the Westinghouse Security Electronics line of proximity access control readers. In conjunction with an access control unit (ACU), the DR4220 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, tamperproof applications. The DR4220 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 DR4220 generates a 132 KHz signal which drives a 12" x 12" loop antenna made out of copper traces on the pcb. When a card is within proximity (16 to 20 inches from the surface of the board), its coil picks up the 132 KHz magnetic field, which is rectified to power the card ASIC. The IC divides the 132 KHz clock by two and emits its own unique ID code in the form of a 10 msec, 66 KHz phase shift keyed (PSK) signal burst. The DR4220 picks up the return signal with the loop antenna, amplifies and filters it. The 132K 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.

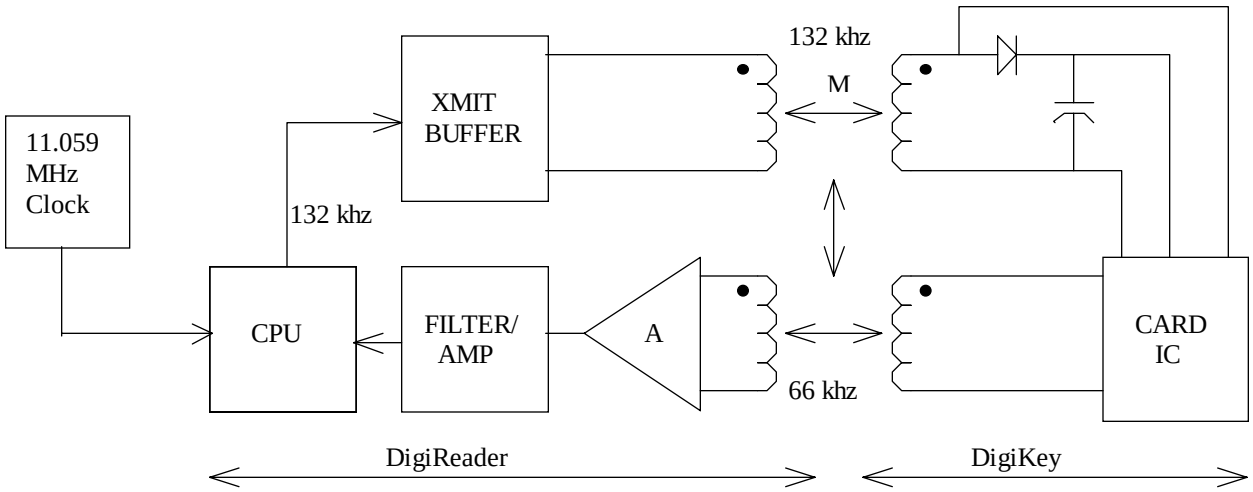

Figure 1. Overall System Block Diagram

Circuit descriptions

The DR4220 is composed of two main sections. The digital section contains the circuit power supply, the microcontroller, the reset circuit, the I/O interface and the RS485 interface chip. The analog section contains the tristate buffer driver,
the transmitter tuned circuit, the peak detector, the filter circuit and the amplifier gain circuit.

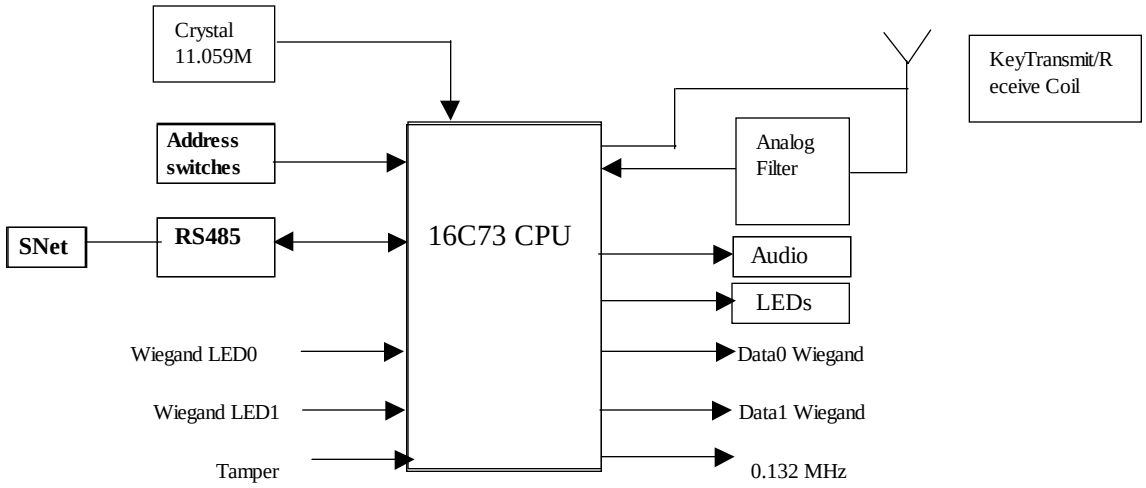

Figure 2. Device Circuit Block Diagram

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 5 VDC to power the digital and analog chips and a linear regulator to generate 12 VDC for the beeper and LEDs.

2) Microcontroller section:

An 8 bit microcontroller (16C73A) running at 11.059 Mhz supplies the clock signal to a divided by 112 circuit to generate a 132 Khz pulse. The 132 Khz signal is fed to the transmitter. It is also divided by 2 and used to clock a D flip-flop to sample the received signal. The digitized data is then sent to the microcontroller. The microcontroller verifies the start of the signal by checking the preamble bits and read in the data bits. It descrambles the decoded data, check for errors and sends the card ID code to the ACU via the RS485 interface chip when polled. A power monitor IC is used to reset the

microcontroller when VCC drops below 4.5 VDC. The microcontroller also reads the dip switches for device ID number, controls a bi-color LED and a beeper.

Analog section

1) Transmitter circuit:

The 132 Khz signal is buffered by a 74AC125 to drive a series resonant circuit tuned to 132 KHz. Series resistors are used to determine the power output under control of the microcontroller. An 18 turn coil (260 uH) made out of PCB traces and a 5600 pF ceramic cap comprises the series tune circuit.

2) Receiver circuit:

A peak detector circuit is used to sample the received 66 Khz signal at the peaks of the 132 Khz waveform. The signal is then AC coupled and fed through the circuit to remove the remaining 132 Khz signal, leaving only the 66 Khz signal biased at 2 volts DC. It is then fed to RF mixer clocked at 66 KHz to produce the signal digital key data to the microcontroller.