Advanced Control Technologies, Inc.
Theory of Operation
Project: ZCS0#0
Project No.: 0707-01
Project Engineer: Chad Snead

Purpose: The purpose of this document is to describe the operation of the ZCS0#0.

General Operation:

The ZCS0#0 is an RS232 based ZWave Controller. It provides communication between the other ZWave devices in the network and the Front-End software on the computer.

Theory of Operation:

The circuit is design to accept 9VAC or 9 to 12VDC. The appropriate voltage is delivered to the circuit via a wall transformer. When a signal is applied, the AC/DC signal goes through a diode (D1 of daughter board), which rectifies the AC voltage to a Raw DC voltage. The Raw DC is filtered by a 100uF capacitor (C1 of daughter board) to reduce the AC ripple. The voltage then goes to a 5V regulator (U1 of daughter board), which regulates the Raw DC to a solid DC value of 5V. The 5V signal is then applied to the RS232 Transceiver (U2 of daughter board) and the USB1 location on the ZCU000 application board. U2 accepts the RS232 signal and converts it to an ASCII Signal that the Z-Wave module (U1 on the ZCU000 application board) can understand. The 5V signal travels though the ferrite bead (FB1 on the ZCU000 application board) to remove any noise the may exist on the line. The voltage is then applied to the 3.3V regulator (U3 on the ZCU000 application board). The 3.3V is applied to the ZWave Module and to the five pull-up resistors (R7-R11 on the ZCU000 application board). The ZWave Module takes care of all the RF communication and communicates to the RS232 Via its TXD and RXD I/O's

Advanced Control Technologies, Inc.
Technical Description
Project: ZCS000 & ZCU001
Project No.: 0707-01 & 0715-01
Project Engineer: Chad Snead

The ZCS000 and the ZCU001 were designed for third party usage.

The device takes commands from a software front-end system via the USB port for ZCU001 and the RS232 port for the ZCS000 and sends the appropriate RF command to the additional devices within the RF network. The ZCU001 and ZCS00 simply provide a route for the commands. This cannot be a stand-alone controller. The computer must be running the desired application that controls the ZCU001 and ZCS000.

The ZCS000 and ZCU001 use a high-speed micro-controller to execute instructions, and to control communications with other devices. It also features a flash memory IC to provide non-volatile retention of certain data.

These units operate in half-duplex fashion to provide two-way communications. The communications, while varied, most often consist of a command from the remote control followed by an acknowledgement by the addressed module(s) that a valid command was received.

The transceiver operates in the 900MHz ISM band at 908.42 MHz. The data, which is digital in nature, is Manchester encoded and sent using FSK modulation at a 9600 bit/sec rate. The deviation of the modulation is plus and minus 20 KHz.

A 7.3769 MHz crystal oscillator is used both as a clock for the micro-controller and also as a reference oscillator for the fractional PLL frequency synthesizer. This PLL is used to generate both the local oscillator for the receiver and the fundamental frequency of the transmitter. The output power of the transmitter portion of the transceiver is controlled by the micro-controller which causes the transmit power to be very low for some setup functions.

Modulation of the transmitter is accomplished in the PLL by having the micro-controller cause it to use one divisor when the modulating data is low and a slightly different one, when it is high.

The receiver is a single conversion type. The local oscillator runs at 908.275 MHz (145 KHz below the receive frequency).

A wireless transmission occurs briefly in response to a command issued by the front-end software.

The communications are done using a protocol called the Z-Wave protocol, which is a wireless network protocol that has been especially designed for home automation products. It defines how various types of information are to be formatted into frames. These frames not only include commands and data, but also source and destination information, as well as checksums that are used for error detection. The ZCS000, ZCU001, the remote control, and other modules make up a wireless local network, where each of the modules can function as wireless repeaters (also half duplex). There is provision within the protocol for intelligent and adaptive routing and also for handling collisions.

Except for a handful of discrete passive components, the entire transceiver is contained in one integrated circuit, the Zensys ZW0102 Asic. The transmitter and receiver share a common antenna. A SAW filter is used to help minimize receiver overload from strong signals on nearby frequencies. The antenna used in the ZCS100 and ZCU001 is integrated into the PCB. There are no external connections to the antenna. There is also no provision of any kind for an external

ground connection. Any conducted emissions from the transceiver that may appear on the power lines are minimal and within applicable FCC limits.

Advanced Control Technologies, Inc.
Theory of Operation
Project: ZCU001, ZCU011
Project No.: 0715-01, 0716-01
Project Engineer: Chad Snead

Purpose: The purpose of this document is to describe the operation of the ZCU0#1.

General Operation:

The ZCU0#1 is an USB based ZWave Controller. It provides communication between the other ZWave devices in the network and the Front-End software on the computer.

Theory of Operation:

The circuit is design to accept 9VAC or 9 to 12VDC. The appropriate voltage is delivered to the circuit via a wall transformer. When a signal is applied, the AC/DC signal goes through a diode (D1 of daughter board), which rectifies the AC voltage to a Raw DC voltage. The Raw DC is filtered by a 100uF capacitor (C1 of daughter board) to reduce the AC ripple. The voltage then goes to a 5V regulator (U1 of daughter board), which regulates the Raw DC to a solid DC value of 5V. The 5V signal is then applied USB1 location on the ZCU000 application board. The 5V signal travels though the ferrite bead (FB1 on the ZCU000 application board) to remove any noise the may exist on the line. The voltage is then applied to the 3.3V regulator (U3 on the ZCU000 application board) and the USB transceiver chip (u1 on the ZCU000 application board). The 3.3V is applied to the ZWave Module and to the five pull-up resistors (R7-R11 on the ZCU000 application board). The USB transceiver chip (U1 on the ZCU000 application board) receives the data from the computer and converts it to ASCII code that the ZWave module can understand. Y1 on the ZCU000 application board provides the clock that is needed by the USB transceiver and the External EEPROM (U2 on the ZCU000). The external EEPROM stores the information that is displayed when the unit is first plugged into the computer. The ZWave Module takes care of all the RF communication and communicates to the RS232 Via its TXD and RXD I/O's