Allflex Model No. RS250V2-xx
Stick Reader

FCC ID: NQY-930040

Theory of Operation

General Description
The Stick Reader is a radio frequency identification (RFID) scanning device that activates and reads passive transponders which conform to International Standards Organization (ISO) 11784 and 11785 specifications. The Reader emits a transponder activation signal comprising a 134.2KHz sinusoidal unmodulated carrier in an 80 millisecond on / 30 millisecond off burst mode, and contains receive circuitry that amplifies, detects, and decodes binary coded information contained in the transponder. Decoded transponder information is subsequently conveyed to external data processing equipment via a standard RS232 serial data interface.

Block Diagram Description
The Reader consists of a microcontroller device that performs communications, transponder decoding, and general housekeeping tasks. The microcontroller contains embedded oscillator circuitry operating in conjunction with a 17.1776 MHz crystal, which clocks the execution rate of software instructions. This microcontroller clock frequency is also used to derive the 134.2KHz intentionally radiated transmitter signal through a divide by 128 counter. The 134.2KHz output frequency is power amplified and applied to the Reader's integral transmit/receive antenna. The 134.2KHz activation signal is turned on and off in the aforementioned burst pattern by means of an on/off control line emanating from the microprocessor, and connected to the divide by 128 counter's reset line. In this fashion, when the Reader has power applied to it, and the Read button is depressed, the 134.2KHz activation signal is continuously generated in the 80/30 millisecond burst pattern.

The Reader can detect and decode the two types of transponders that are defined within the ISO Standards. The first transponder type, referred to as "HDX" accumulates energy from the Reader's activation signal during the 80 millisecond "on" interval, and following cessation of this signal, the HDX transponder transmits its internally stored binary coded information using a two frequency FSK modulation scheme during the 30 millisecond "off" interval. The second transponder type, referred to as "FDX-B", uses instantaneous energy received during the 80 millisecond activation signal "on" interval to back-scatter ASK modulate the 134.2KHz carrier signal with its internally stored binary coded information; the FDX-B transponder is dormant during the 30 millisecond "off" interval. Thus, HDX transponder information is received by the Reader while the activation signal is "off" and FDX-B transponder information is received by the Reader while the activation signal is "on".

HDX transponder signals are demodulated, resulting in digital data and synchronizing clock signals that are input to the microcontroller device, where an ensemble of algorithmic software procedures extract the transponder's binary coded information. This information is subsequently parsed and formatted in a multiplicity of possible formats, according to configurations specified by the user and stored internally in the microcontroller's non-volatile memory. The resulting transponder information is then transmitted on the RS232 serial output interface to any of a number of possible user peripheral devices that are electrically compatible and suitably configured to accept this information.

FDX-B transponder signals are extracted from simultaneous presence with the 134.2KHz activation signal through a series of detection, filtering, and amplification processes. Data and synchronizing clock signals are derived, and input to the microcontroller where an ensemble of

algorithm software procedures, different from those used for HDX, extract the transponder's binary coded information. This information is subsequently parsed and formatted in a multiplicity of possible formats, according to configurations specified by the user and stored internally in the microcontroller's non-volatile memory. The resulting transponder information is then transmitted on the RS232 serial output interface to any of a number of possible user peripheral devices that are electrically compatible and suitably configured to accept this information. The ID Code information is also stored in a non-volatile memory from which it can be retrieved via the serial port at a later time.

During the time the transponder activation signal is active, a red indicator light flashes in unison with the 80/30 millisecond on/off period, to provide an indication the Reader is active and scanning. Upon successful detection of a valid transponder, the Reader momentarily flashes a green indicator light, and sounds an audible beeper. When a valid transponder is detected, the transponder activation signal is automatically shut off, thus extinguishing the red indicator light. In order to initiate another reading cycle, the operator must requires release and again depress the Read button.

A voltage regulator circuit generates a stable internal voltage for analog and logic circuitry. The Reader is designed to operate from an external 6 volt DC regulated power supply, which determines the 134.2KHz transmit power level. The Reader becomes powered upon application of 6 VDC to its power leads, and does not contain an internal power on/off control.

Software Architecture
Embedded software code executed in the microcontroller device are responsible for Reader operation. Upon application of power, the microcontroller prepares itself for operation by recalling stored configuration parameters, and checking their validity. Software then awaits depression of the Read button in order to set the activation signal into operation, and to search for decodable data at the HDX and FDX-B data inputs. When valid transponder information is successfully decoded, this information is transmitted out from the microcontroller through the RS232 serial data interface. When transponders are not being detected and transmitted via the serial interface, the microcontroller is able to accept a limited number of commands on its RS232 serial input. These commands are capable of (a) querying the Reader about its version and configuration, (b) changing its configuration, (c) listing the valid command set, and (d) controlling the Reader's operating mode. When invalid or unrecognized commands are received, the Reader transmits error code messages in response. The User Manual contains a list of these commands and descriptions of their use and effect.

Schematic Diagram Notes
1. There are no specific circuits, devices, or techniques employed for limiting or controlling spurious electromagnetic emissions, other than good circuit and PCB design techniques, careful PCB layout, and PCB ground/power plane utilization.
2. Data and power signals enter the Reader via a single shielded cable that comprises the only electrical interface to the Reader.
3. The microcontroller clock crystal is a 0.01% tolerance, 50ppm stable device, and the 134.2KHz transmitter frequency is derived from this time base.
4. Spurious emissions are limited by internal voltage regulation that drives all logic and analog circuitry. Transmitter power is limited by the input power specification, which is 6.0 volts DC maximum.
5. The transmitter/receiver antenna is integral to Reader's physical packaging, and is permanently connected to the Reader electronics module via soldered wires

*** End ***