SR320 RFID Reader Theory of Operation

The SR320 RFID reader consists of the Interface Board, Controller Board, and an RF Board as shown in Figure 1.

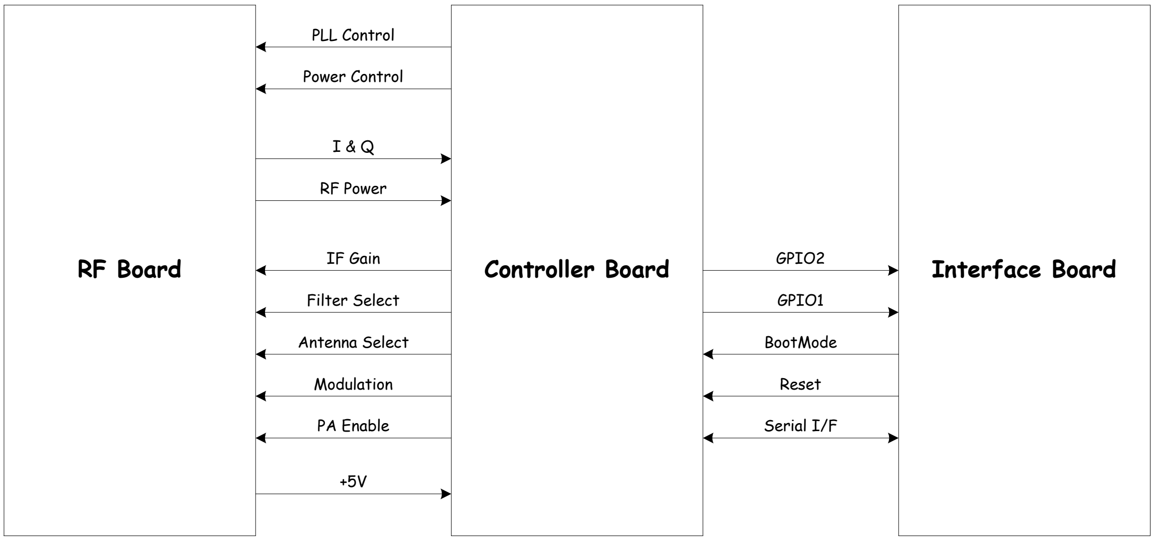


Figure 1: SR320 RFID Reader Block Diagram

A block diagram of the Interface Board is shown in Figure 2. The Interface Board contains an Arm9 microprocessor that provides the primary interfaces of the reader. Those interfaces include three light emitting diodes (LEDs), digital I/O in the form of 4 inputs and 4 outputs, 4 configuration switches, a reader RESET switch, an RS-232 compatible serial port, and a 10/100 Base-T Ethernet interface.

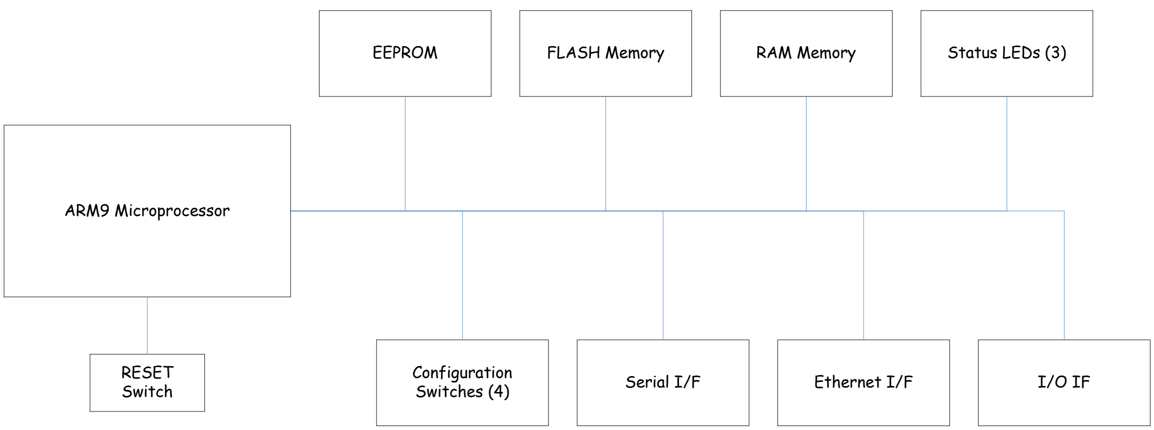


Figure 2: Interface Board Block Diagram

A host computer commands the Interface Board via the Ethernet interface using the EPC-Global Reader Protocol based on the June 26, 2005 draft release specification.

The Controller Board is commanded by the Interface Board's Arm9 to perform communication with RFID tags. The Controller Board consists of an Arm7 microcontroller and a digital signal processor (DSP). The Arm7 receives requests from the Interface board over a TTL serial port. The Arm7 then controls the RF Board to perform the RFID forward link modulation and reception of the RFID tag's backscatter, which is decoded by the DSP and transmitted to the Arm7 over a SPI interface. A block diagram of the controller board is shown in Figure 3 below.

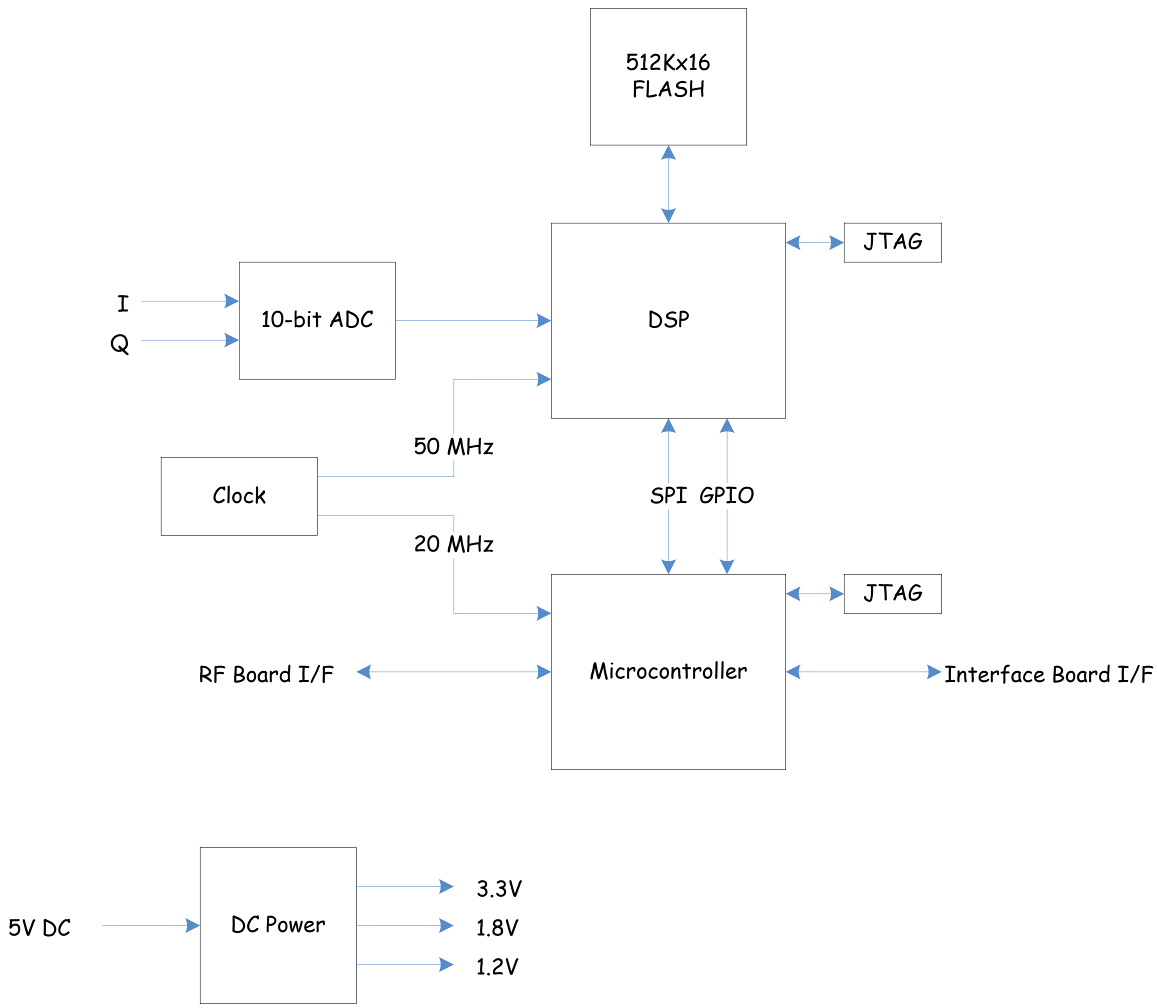


Figure 3: Controller Board Block Diagram

The RF Board consists of a transmitter and receiver, both employing the same local oscillator and direct up- and down-conversion from the carrier frequency, configured for operation within the US Industrial Scientific and Medical (ISM) band at 902-928 MHz. A block diagram of the RF Board is shown below in Figure 4. The transmitter signal both provides power to passive tags and delivers commands to the tags. The system is thus full-duplex in the sense that the transmitter continues to operate during reception of tag signals, but half-duplex in terms of data transmission, since when tag data is being received the transmitted signal is unmodulated CW. In a typical exchange, the transmitter is first powered up and commanded to send a CW signal to provide power to tags in the read zone. Then a baseband on-off-keyed modulation, appropriately filtered, is imposed on the CW signal with a mixer. The reader data provides tags with synchronization information, requests tags to transmit their unique IDs and other data in memory, and may write new data to a tag or erase its memory, etc. After a command is given, the transmitter continues to transmit unmodulated CW power at the carrier frequency; this CW signal both provides power to operate the tag's integrated circuit, and provides the RF signal that the tags backscatter to send their signals back to the reader. The details vary depending on the protocol being used.

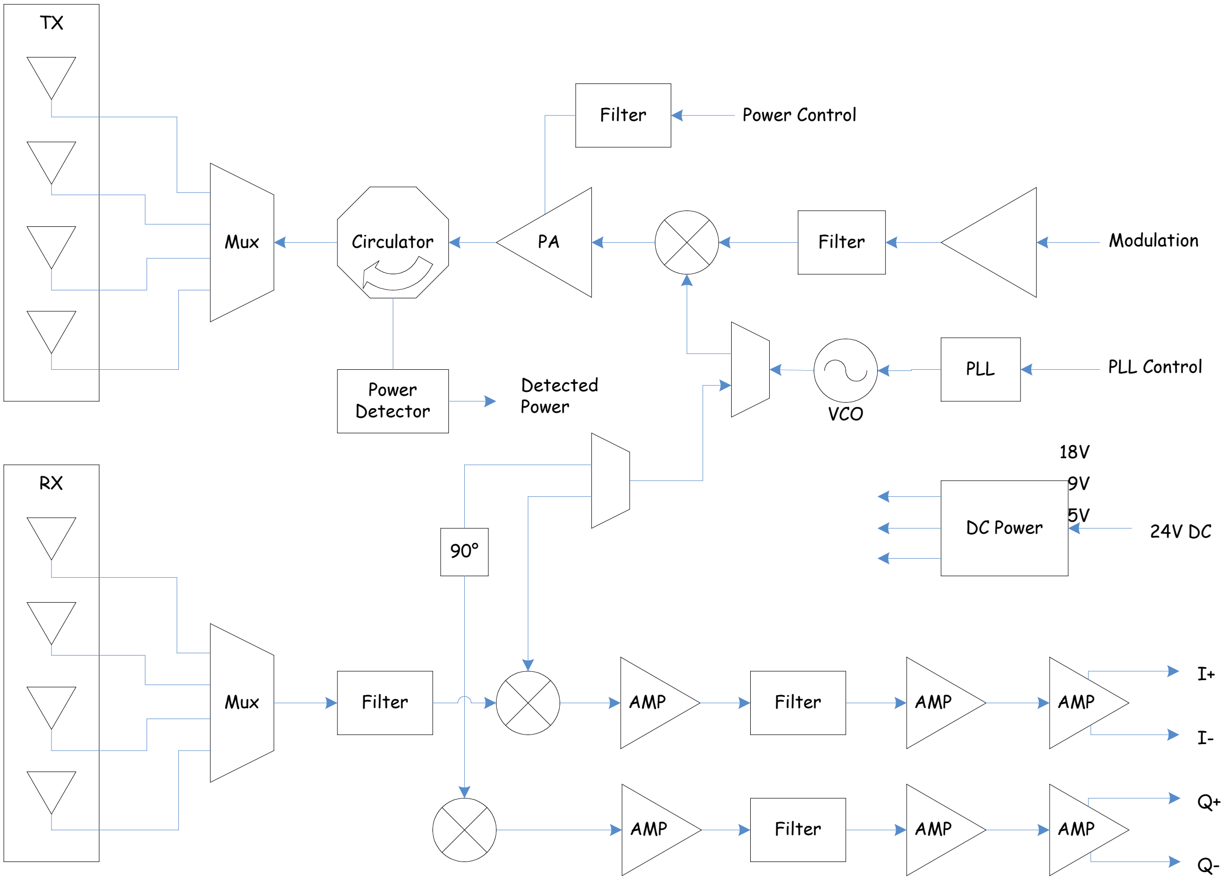


Figure 4: RF Board Block Diagram

The backscattered signal is filtered and then mixed to baseband using the same VCO signal employed by the transmitter; the SR320 reader is a ***homodyne*** radio. In-phase / quadrature (I/Q) demodulation is employed in order to ensure that the baseband signal can be received despite variations in the absolute phase of the reflected carrier. (Without this provision, depending on the exact separation of the tag and reader antenna, the cable lengths, and other factors that cannot be controlled, the reflected signal would at times be in quadrature with the signal from the VCO, so that the mixer would produce no baseband output.) The outputs of the two mixers are filtered and amplified and then demodulated to extract the reflected signal from the tags. After each command set the power shuts down while processing of the commands proceeds. The nominal channel spacing is 500 KHz, providing 50 channels (with guard bands) within the ISM band. In accordance with FCC regulations, the carrier frequency periodically 'hops' in a pseudo-random fashion over the ISM band to avoid persistent interference with other unlicensed users.

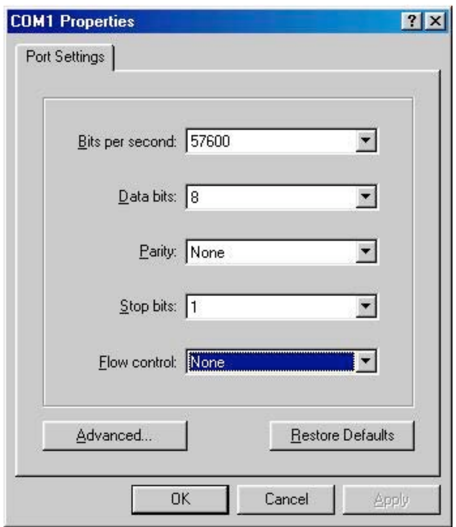
Operating SR320 Test Software Using The Console.

Index:

1. Settings and Set Up

Note: Since the instructions are provided to demonstrate the device's use during certification testing, only set up for MS Windows is provided – as used during certification testing.

a) Connect RS232 cable to SR320 reader as well as computer.
b) Open Windows HyperTerminal, or equivalent, and input the following settings:
   Bits per second: 57600
   Data bits: 8
   Parity: none
   Stop bits: 1
   Flow Control: none



c) Apply 24V power supply; boot up sequence should occur.
   Note: The recommended power supply is a CUI Inc power supply, model No: 3A-501DN24
d) Allow the boot up sequence to finish, and hit <enter> to activate console, when instructed.

2. RFTEST Menu

a) Navigate to the working directory by typing:
   cd work/c3test
b) To initiate the test menu (RFTEST), type the command:
   ./rftest
   The RFTEST menu should appear.
c) To select a specific output RF power, at the Test Menu, choose option ***a) Set TX RF Power***.
d) After selecting this option, choose the desired output (0dBm to 31dBm) by inputting the value and hitting <enter>.
e) Next, to select the antenna port, choose option ***b) Set Antenna***.
f) Choose the desired antenna port by inputting a value 0, 1, 2, or 3. The following is the antenna association:
   0: TX1 and RX1
   1: TX2 and RX2
   2: TX3 and RX3
   3: TX4 and RX4
   Where the ports are appropriately labeled on the reader.
g) Next, to select a frequency, choose option ***c) Set Frequency***. The desired outcome is listed below in the *Table 1: Channel Frequencies*.

Channel/input	Frequency (MHz)	Channel/input	Frequency (MHz)
0	902.75	26	915.75
1	903.25	27	916.25
2	903.75	28	916.75
3	904.25	29	917.25
4	904.75	30	917.75
5	905.25	31	918.25
6	905.75	32	918.75
7	906.25	33	919.25
8	906.75	34	919.75
9	907.25	35	920.25
10	907.75	36	920.75
11	908.25	37	921.25
12	908.75	38	921.75
13	909.25	39	922.25
14	909.75	40	922.75
15	910.25	41	923.25
16	910.75	42	923.75
17	911.25	43	924.25
18	911.75	44	924.75
19	912.25	45	925.25
20	912.75	46	925.75
21	913.25	47	926.25
22	913.75	48	926.75
23	914.25	49	927.25
24	914.75	255	Frequency Hopping
25	915.25		

Table 1 Channel Frequencies.

h) Next, for the desired waveform, choose the ***d) Set Waveform***, option.
The options are listed below in *Table 2: Waveform Options*.

Input	Selection	Property
0	0) CW	Transmits a CW pulse
1	1) CW-ModOff	Transmits a CW pulse without modulation
2	2) C3 Read Tags (ATP)	Transmits Class 3 modulation in an attempt to read
3	3) C3 TX Test (CTP)	Transmits full Class 3 modulation
4	4) C1G2 Read Tags (ATP)	Transmits C1G2 modulation in an attempt to read
5	5) C1G2 TX Test (CTP)	Transmits full C1G2 modulation

Table 2: Waveform Options

i) To set the waveform delay, choose option ***e) Set Waveform Delay***, and enter desired delay (in ms).

j) Last to trasmit a waveform loop chosen earlier, choose option ***f) Transmit Waveform Loop***. Hit <enter> to stop transmission.

k) To exit the RFTEST menu, hit ***x***.