RFR02 Theory of Operation
Part #**1000052365 and 1000053245**

SCOPE:
To provide a high level description of the RFR02‘s hardware functionality.

REFERENCE DOCUMENTS:
104008104 Rev03 RFR02 RFID READER BOARD SCHEMATIC
104309102 Rev01 RFR02 DC TO DC POWER SUPPLY BOARD SCHEMATIC
106153 Rev01 INTERNAL WIRING DIAGRAM RFR02 RFID READER

THEORY OF OPERATION:
(Refer to schematic 104008104 Rev 3)
RF SECTION:
All of the RF signal encoding and decoding is done by an RFID ASIC “U1” on schematic 104008104. The ASK encoded transmit signal is comes out on pin 2 of the ASIC and is then feed in a filter network to reduce spurious content and provide correct output impedance matching. The filter network consists of L1 thru L4 and C9,C2 ,C35, C45. After the signals pass through the filter network they are feed to an RF switch “SW1”, this switch connects the signal to on of two antenna ports “J2” or “J6”. Control ‘SW1 is done by the microcontroller “U3”. The 13.56 MHz signal used by the ASIC to communicate with the RFID tags is generated by crystal Y1 which is connected to pins 5 and 6 of the ASIC. Control of the ASIC is done using Microcontroller U3 thru a 4 wire interface. This 4 wire interface uses a bidirectional clock for synchronizing data transfer between the two.

ANTENNA SENSE:
To ensure that only Accu-Sort antennae are used with the RFR02, the unit has antenna sense circuitry which consists of U15, R54 thru R59 and capacitors C55 thru C58. A small current is sourced out of each antenna connection port via R54 and R59. On the antenna side a 10K resistor is connected from the center conductor to ground. When an antenna is connected to the reader it will a cause a 2.5 VDC level on the center conductor of the antenna connector. This voltage is the filter to removed any RF component and feed into a unity gain buffer “U15”, the output of the buffer is feed into the ADC input s of the microcontroller. If the voltage measured by the ADC falls within the specified window it assumes that an Accu-Sort antenna is connected to the reader, if the voltage is not within this window the microcontroller will turn off the U1 transmitter.

COMMUNICATION:
There are three possible connections for communicating to the RFR02, but only one at a time can be active. The first is an RS232 connection through the setup port. Connecting to this port starts at J3, TX and RX signals then pass through a filter/transient protection circuit consisting of L18 thru L21 and CR15 and 16 before reaching a U4 a RS232 transceiver. This IC translates RS232 signal levels to TTL and vice versa. All data regardless of which communication port is being used is routed through data switch U7.

Control of U7 is again done by the microcontroller using two control lines to determine which communication port is used.

The second port that can be used for communication is the Network RS232. This port is exactly the same as the previously mentioned RS232 port except that J5 is used for the connection point and L14 through L17 and CR13 and 14 are used for filtering and transient protection.

The third port that can be used for communication is the Network RS422. Connection to this port starts at J7. L23 through L28 and CR2 through CR5 again act as filter/transient protection. U5 is the RS422 driver and U6 is the receiver, both of these ICs have run off an isolated 5VDC power and ground generated from DC to DC converter U12. The ability of RS422 signals to run in excess of 1000 feet facilitate the need of isolated power to avoid ground loops and keep the signals within the CMRR of the device specs. Two opto-isolators U113 and U14 convert the isolated TTL levels from the RS422 devices to the common ground reference used by the rest of the circuitry.

TRIGGER INPUTS :

There are two trigger inputs that will allow the RFR02 to work in an autonomous mode. These inputs are available on connector J9, each input can be used in a isolated or non-isolated manner. When using the non isolated inputs pins 1 and 2, the output of the interface circuit should be an open collector/drain configuration and will need to be active low to initiate the trigger cycle on the unit. Each non-isolated input has filtering /transient protection, for Input #1 L7 ,L8 and CR7 provide this protection while L9, L10 and CR8 due the same for Input # 2. The non isolated inputs are internally pulled to 5VDC through a 2.2k resistor. When using the isolated inputs the end user must supply both a positive and negative voltage reference to active the trigger cycle. U9 and U10 are the opto-isolators used for each isolated input.

OUTPUTS:

The RFR02 has two solid state relay outputs available on connector J8, K8 and K9 are the actual SSR and are controlled by the microcontroller. The firing of these relays are configurable by the user see installation manual for details.

STATUS LEDS:

(Refer to schematic 104309102 Rev01)

There are 3 status LEDS on the RFR02 which are mounted on the DC to DC Power Supply Board. They indicate Power (Green), active communication from Host (Red), active antenna (yellow) and valid communication to RFID Tag (blue). The control for these LEDS comes from J4 on the reader board and connects to J3 on the DC to DC Power Supply Board.

POWER SUPPLY:

(Refer to schematic 104309102 Rev01)

There are two power options available on the RFR02 the first is a 12VDC where the end user purchases the RFR02 Power Supply part #1000052837, The second being a 10 to 30 VDC power option, this option allows the end user to connect the unit to an existing power source. If using the 10 to 30 VDC option a shielded cable with flying leads on one end and a connector that mates to the RFR02 power input connector on the other is recommended for use, Accu-Sort Part #:1000052775. Regardless of the power option all external power passes through the DC to DC Power Supply Board before it is feed to the RFR02 reader board. This power supply board contains all the necessary filtering and transient protection necessary to provide clean power to the reader board. Note when the 10 to 30 VDC power option of the RFR02 is ordered, U1 and SH1 are installed on the DC to DC power supply board. When the 12VDC power option is ordered U1 and SH1 are not installed and jumper wires are placed between pins 1 and 3 and 2 and 5 of the U1.

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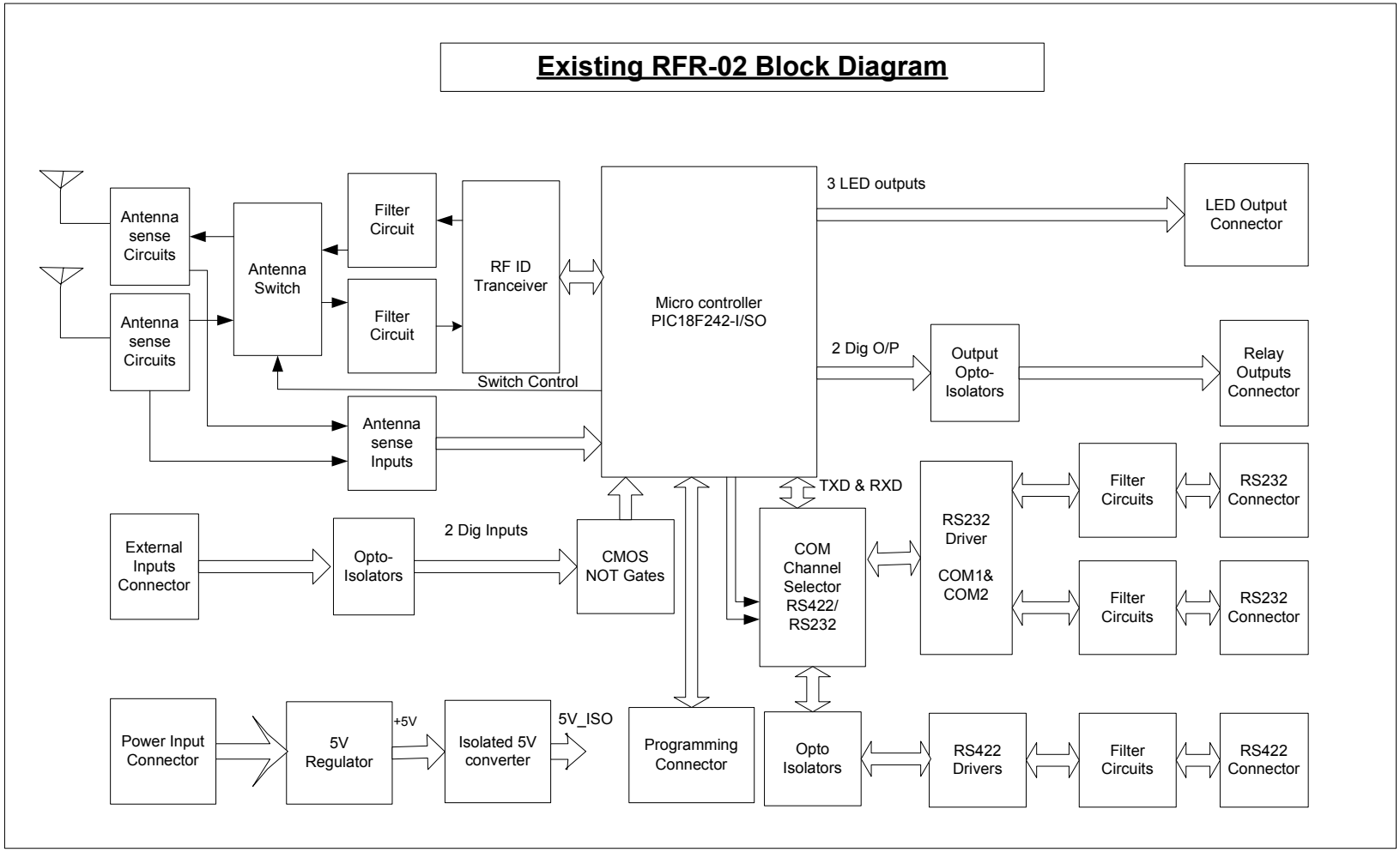
Existing RFR-02 Block Diagram
Antenna sense Circuits
Antenna sense Circuits
Antenna Switch
Filter Circuit
Filter Circuit
RF ID Tranceiver
Micro controller PIC18F242-I/SO
3 LED outputs
LED Output Connector
2 Dig O/P
Output Opto-Isolators
Relay Outputs Connector
Switch Control
Antenna sense Inputs
TXD & RXD
RS232 Driver
COM1& COM2
Filter Circuits
RS232 Connector
Filter Circuits
RS232 Connector
External Inputs Connector
Opto-Isolators
2 Dig Inputs
CMOS NOT Gates
COM Channel Selector RS422/ RS232
Power Input Connector
5V Regulator
+5V
Isolated 5V converter
5V_ISO
Programming Connector
Opto Isolators
RS422 Drivers
Filter Circuits
RS422 Connector

Figure 1.