Pro Elite II RFD Module User's Guide

Overview:

The Pro Elite II RFD module has been designed and tested to perform Radio Frequency networking functions that allow for the transfer of data between external devices such as water softener controls, water filter monitor, solenoid control modules and remote monitoring systems.

The RFD module contains an onboard TI MSP430 Microprocessor and TI CC1101 based Radio Front End chip combined on one IC. The onboard microprocessor and Radio Front end chip perform all necessary over-the-air network protocol duties freeing the upper level device to perform its primary function.
The RFD module presents a "wired" RS232 look to the external device.

The external device communicates with the RFD module through a simple RS232 like interface.

Below are the descriptions for the physical and logical interfaces that must be provided by the external device in order for the RFD module to function properly.

Electrical Interface:

5 pins: RFD onboard connector is a 5 pin Samtec TSW-105-06-T-S connector. The external device must provide a compatible plated through hole or socket to accommodate this connectors pins.

Following is the pinout for this connector:

Pin1: Power (Vcc)	2.5 – 3.3 V	DC
Pin2: Ground	Gnd	
Pin3: Tx	0 – Vcc	
Pin4: Rx	0 – Vcc	
Pin5: Enable~	0 – Vcc	

Tx, Rx interface pins attach directly to the UART pins of the embedded microprocessor.

Current consumption of the RFD is typically 17mA during transmit mode.
Current consumption of the RFD module is typically 16mA during receive mode.

Serial Communication Interface:

RS232 serial communication is supported by the onboard microprocessor of the RFD.

The physical layer is defined below.

Voltage levels of the Rx Tx pins as well as enable must be limited to 0V - Vcc.

The Tx pin is an unbuffered output from the onboard microprocessor.

The Rx pin is an unbuffered input to the onboard microprocessor.

The enable pin of the RFD module controls the on board power supply regulator circuit.

The external device can cause a reset of the RFD module by momentarily de-asserting and re-asserting the enable signal.
After assertion of the RFD module will do a power-up reset and reload on board firmware that reinitializes all functions (radio and microprocessor).

Physical Layer:

The baud rate of the UART is set to:

19200 bits per second
8 data bits
No parity
1 stop bit

The parameters are not adjustable by the external device.

Logical Layer:

The serial programming interface defines a logical protocol that allows an external device to communicate with the RFD module.

Transmit data packet format (all values in hexadecimal):

- Number of bytes to transfer (must be between 1 and 64 bytes)
- Data bytes

Receive data packet format (all values in hexadecimal):

- Number of bytes to receive (must be between 1 and 64 bytes)
- Data bytes

ENQFRMRFD (0x0E) is issued by the RFD board. This byte is sent approximately every 16 milliseconds until a response is received from the external device.

External device must reply with the following information:

XMTR (0x1A) character, which puts the RFD module into transmit mode, followed by the transmit data packet.

RECV (0x19) character, which puts the RFD module into receive mode.

In receive mode the RFD, on receipt of a valid over the air data packet, will respond to the external device with a receive data packet.

The RFD module handles all the transfer of data between modules configured as a transmitter module or as receiver module.

Modular Device Compliance Statements

Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

INDUSTRY CANADA STATEMENTS

Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

This device has been designed to operate with the antennas listed below, and having a maximum gain of -1.0 dB. Antennas not included in this list or having a gain greater than -1.0 dB are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

Approved Antenna is: Johanson Technology Ceramic Chip Antenna Part Number: 0915AT43A0026

OEM Responsibilities to comply with FCC and Industry Canada Regulations

The Pro Elite II RFD Module has been certified for integration into Pentair products only under the following conditions:

1. The antenna(s) must be installed such that a minimum separation distance of 20cm is maintained between the radiator (antenna) and all persons at all times.
2. The transmitter module must not be co-located or operating in conjunction with any other antenna or transmitter.

As long as the two conditions above are met and sufficient separation of the module inside an end-product is observed during installation to prevent RF coupling to wires or circuits, further transmitter testing will not be required. Pentair integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

IMPORTANT NOTE: In the event that these conditions cannot be met (for certain configurations or co-location with another transmitter), then the FCC and Industry Canada authorizations are no longer considered valid and the FCC ID and IC Certification Number cannot be used on the final product. In these circumstances, the Pentair will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC and Industry Canada authorization.

End Product Labeling

The Pro Elite II RFD Module is labeled with its own FCC ID and IC Certification Number. If the FCC ID and IC Certification Number are not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. In that case, the final end product must be labeled in a visible area with the following:

"**Contains Transmitter Module FCC ID: YIT-RFD1**
"**Contains Transmitter Module IC: 9032A-RFD1**
or
"**Contains FCC ID: YIT-RFD1**
"**Contains IC: 9032A-RFD1**

The Pro Elite II RFD Module must only use the approved antenna(s) listed above, which have been certified with this module.

Pentair is to maintain control of this module and its implementation into their products only.

The user manual for the end product must include the following information in a prominent location:

"To comply with FCC and Industry Canada RF radiation exposure limits for general population, the antenna(s) used for this transmitter must be installed such that a minimum separation distance of 20cm is maintained between the radiator (antenna) and all persons at all times and must not be co-located or operating in conjunction with any other antenna or transmitter."