Rotronics Systems Limited

MiWi module – FRZ200 – 1000

Module user guide – Rotronics Systems internal use only.

1.1 General description

This module is a radio data transmitter / receiver using FSK modulation operating on 915mHz for short range telemetry. It has been developed for Next Control Systems in the UK as a component module part of a remote temperature measurement system.

1.2 Warning notice

The module RF stage is not to be modified in any way without repeating RF compliance testing.
The RF and micro-controller stages must not be fed from a DC supply greater than 3.6v.

No other antenna apart from the 1/4wave screw on antenna may be used with this module.

1.3 Technical specifications

Operating frequency 915.000mHz.

RF power output 90.9dBuV/m (-15dB).

Modulation FSK 200kHz deviation.

DC power supply 3.6v DC.

Inputs analogue (0-2.500v) and digital (I2C).

1.4 Hardware description

The module circuit board measures 80mm long x 42mm wide. Height with battery fitted is 20mm.

Primary electrical interconnections are via a 9 way FFC connector. There are links for setting options, see **1.5** below, and connections for in-circuit programming of the processor
and reading the unique MAC address back for identifying individual modules.

1.5 Circuit description

Read in conjunction with “Transmitter120.pdf” circuit diagram.

The RF chip (IC1) is an integrated, single chip ISM band sub-GHz transceiver. It has a inbuilt frequency synthesiser clocked by a external 10mHz crystal and generates 915mHz radio frequency. The receiver is zero-IF architecture and has the following components: LNA, down conversion mixer, channel filter, baseband limiting amplifier and received signal strength indication (RSSI).

IC 1 has an internal transmit / receive switch with a external impedance matching network coupling to the screw-on 1/4wave antenna.
The quality of received data is checked and validated with RSSI and DQI (Data Quality Indicator) blocks built in internally.
The RF transceiver chip is controlled through a 4-wire SPI bus from a Microchip controller on the module.

The SPI bus is connected to two local memory chips, the MAC address chip (IC3) which is pre-loaded with a unique address for each module, and a EEPROM memory (IC2) to store data blocks if the transceiver is unable to communicate with it's host for a period.

The Microchip controller (IC4) has two clocks, a standard clock crystal (32.768kHz) for the period timing and an internal 12mHz oscillator for the processor clock.

The controller has three 10bit ADC ports, a USB port and a I2C serial data port.

A board mounted 3v6 Li-SOCI cell is the normal source of power when the module is used with an analogue signal conditioning option board to measure temperature with a probe.

External 5v DC power connection when the unit is used in the controller is regulated on the module to 3v3 DC.

The module has three possible modes of operation, as a remote radio data transceiver, a repeater to pass the data through, and a controller which communicates with the remote data transceivers.

These options are set using solder bridges on Lk1 and Lk2
Remote radio data transceiver – no links
Repeater radio transceiver – link Lk2
Controller for network – link Lk1 & Lk2

1.5 Board interconnections

Read in conjunction with “Transmitter120.pdf” circuit diagram

Cn 1 – M4 threaded fixer for ¼ wave antenna.
Cn 2 – Programming header for manufacturing use only.
Cn 3 – Data and power connector for MAC reading and control.
Cn 4 - Panel reset switch – membrane connector.
Cn 5 – Analogue and I2C connections to signal conditioning option boards.
Cn 6 – Connector for temperature and humidity module (Sensiron part).

1.6 System description

The *controller,* model number GENII/WARP/200, monitors and stores readings from the remote transmitters, displaying parameters on a 4.3” LCD display, with toggle buttons on a panel membrane to view readings from the different remote transmitters.

The controller comprises a MiWi module (FRZ200 – 1000), an embedded computer module (Re2) and a mother board that holds these two units, provides DC voltage power conversion, and interfaces to the LCD screen mounted on it's rear.

The controller is powered by a plug top DC power supply, 15v 5w.

-

The *remote transmitter,* model number GENII/FRZ/200A and B, measures up to two temperatures using platinum temperature probes.

The remote transmitter comprises a MiWi module (FRZ200 – 1000) and an analogue signal conditioning option module that can be set to different ranges, A and B.

The remote transmitter is powered by a 3v6 LiSOCI cell. Energy saving techniques are used to achieve up to 4 year battery life.

-

The *repeater*, model number GENII/SRPT/200, receives remote transmitter's in it's vicinity and automatically associates itself with either a controller, or another repeater to pas the data back to the controller.

The repeater comprises a MiWi Module (FRZ200 – 1000) and a battery backup board to provide a 21 hour backup in the event of mains loss.

The controller is powered by a plug top DC power supply, 12v 1w.

-

1.7 Module operation

A *remote radio data transceiver*, when first powered up or, whenever the front membrane button is pressed and released, will transmit association data packets based on the unique MAC address factory set in IC3.

The *controller* will receive these data packets, and pass them to an embedded computer module which checks that the MAC address of the transmitter module exists within its database.

If the MAC address is not in the embedded computer module table then it will not respond to the remote transmitter. If the MAC address is in the computer table then it will transmit an acknowledgement to the remote transmitter and an association communications link is created between the specific remote transmitter and the controller. Up to 120 remote transmitters can be used.

Thereafter, at 60 second intervals, the remote transmitter will wake up, transmit its sensor values to the controller, and wait for an acknowledgement in return.
If the remote transmitter receives a valid controller acknowledgement then it will go back to sleep.

If the remote transmitter does not receive an acknowledgement from the controller then it will re transmit the sensor values. After 3 resends with no acknowledgement received the remote transmitter will log the sensor values in IC2, and then goes back to sleep.

The remote transmitter will continue to wake up every 60 seconds and repeat the 3 resends sequence, log the data in IC2, and then go back to sleep.

After 15 consecutive transmit attempts (60 seconds apart) with no acknowledgement from the controller, the remote transmitter will go through its association routine again in and effort to establish a new communications link with the controller.

The association routine will be repeated after every 15 consecutive transmit attempts with no acknowledgement received from the controller.

If during any communications event the remote transmitter receives a valid acknowledgement from the controller, then in addition to transmitting the current sensor values, it will also transmit 5 historical values from its local memory store.

Thereafter the remote transmitter will continue to transmit the current value plus 5 historical values to the controller every 60 seconds until the local log memory store is empty.

Each transmitter module is provided with variable timing functions that prevent the occurrence of simultaneous transmissions from more than one transmitter module at a time.

The *repeater* module's MAC address in IC3 is programmed into the controller's embedded computer module table.

A repeater module when first powered up or, whenever the front membrane button is pressed and released, will transmit association data packets.
The controller and/or any other signal repeater module in the system installation will receive these data packets and transmit their acknowledgement back to the repeater module.

The repeater module will assess the RSSI signal strength of each acknowledging device and automatically associate itself with the device that it considers has the strongest signal.

Once the repeater module has associated with either a controller or another repeater module then it will “ping” the associated device every 10 seconds and wait for an acknowledgement in return.

If a repeater module fails to receive a valid acknowledgement after 2 consecutive “pings” then it will consider that communication path is off line and will stop sending acknowledgements to any remote transmitter that may be currently associated with it.

If an acknowledgement is subsequently received from it’s associated device, then the

repeater module will resume sending acknowledgements to all currently associated transmitters.

If a repeater module does not receive a valid “ping” acknowledgement for 5 minutes then it will re-start the association process. The signal repeater module will once again assess the RSSI signal strength of each acknowledging device and automatically re associate itself with the device that it considers has the strongest signal.

A transmitter module when first powered up or, whenever the front membrane button is pressed and released, will transmit association data packets.

A controller and/or any other signal repeater module in the system installation will receive these data packets and transmit their acknowledgement back to the transmitter module.

The remote transmitter will assess the RSSI signal strength of each acknowledging device and automatically associate itself with the device that it considers has the strongest signal.

If the remote transmitter's MAC address is not in the controller table then it will not respond to the repeater module. If the MAC address is in the controller table then it will transmit an acknowledgement to the repeater module and an association communications link may be created between the specific repeater module and the controller.

Thereafter, at 60 second intervals, the remote transmitter will wake up, transmit its sensor values to its currently associated device, and wait for an acknowledgement in return.

If the remote transmitter receives a valid acknowledgement from its associated device then it will go back to sleep.

REH/October2012