MILLI-VOLT RF RECEIVER CIRCUIT DESCRIPTION

1. DC/DC CONVERTER

The converter converts the relatively low input voltage from two thermopiles put in series to two higher voltages, one regulated at 3V and one range-limited in 6 – 10 V. At room temperature, the converter can start to convert when input voltage is 700mv or higher. And once started, it will continue to convert even when input voltage is dropped to lower than 200mv.

Voltage Input:

Low voltage input from two thermopiles. Each has an open circuit voltage range from 460 mv to 750 mv and an internal resistance of 2.7 to 3.7 ohms.

Control Input:

A digital control signal coming from the microprocessor can turn ON/OFF the DC/DC converter.

Voltage Output:

Vcc, regulated at 3V.
Vmotor, range limited to 6 – 10 V.

2. PILOT VALVE DRIVER

This driver is a power MOSFET functioning as an ON/OFF switch controlled by the microprocessor.

Control Input:

A digital control signal coming from the microprocessor can turn ON/OFF the pilot valve driver.

Output:

When driver is ON, the output voltage follows thermopile #1 voltage. When the driver is OFF, the output is lower than 10 mv.

3. MAIN VALVE DRIVER

This driver is a power MOSFET functioning as an ON/OFF switch controlled by the microprocessor.

Control Input:

A digital control signal coming from the microprocessor can turn ON/OFF the main valve driver.

Output:

When driver is ON and receiver is in REMOTE mode, the output voltage follows thermopile #1 voltage. When driver is ON and receiver is in LOCAL mode, the output voltage is about 45% of the thermopile #1 voltage.

When the driver is OFF, the output is lower than 10 mv.

4. STEPPER MOTOR DRIVERS

Four motor drivers are used to drive the four coils of the unipolar stepper motor. The drivers will be turned ON one at a time to drive only one coil. Each of the drivers can sink 150 mA.

Control Inputs:

Four digital control signals coming from the microprocessor can turn ON/OFF the motor drivers.

Driver Outputs:

When a driver is ON, its output voltage is within 0.5 V. When a driver is OFF, its output is the same as Vmotor (6 – 10v).

Motor Sensing Outputs:

Four voltage dividers scale down the motor driver output voltage for the microprocessor to measure the voltage across the drivers. These outputs are for diagnostics and other purpose.

5. FAN DRIVE AND OPTO ISOLATIOIN

The fan drive consists of a phase detector, an over current detector and a triac. The phase detector detects the phase of the input line voltage. The over current detector generates an active output signal when the fan current is too high. The triac is used to turn on the fan in each of the half cycles of the line voltage.

This circuit is voltage isolated from the rest of the receiver board by three opto-isolators.

Control Input:

A digital control signal coming from the microprocessor can turn ON the triac at a desired phase in each of the line voltage cycles.

Fan Output:

When triac is triggered, the line voltage is applied to the fan for the rest of the line cycle.

Over Current Output:

When fan current is too high, this output generates an active low signal to interrupt the microprocessor.

Phase Detection Output:

When line voltage is present, this output provides an active low signal for the microprocessor.

6. RF RECEIVER

This is a saw based RFM RX1120 303.875 MHz receiver chip. To save power, the receiver is turned ON for 80ms every 500 ms.

Control Input: (pin 8 & 9)

The RF receiver ground pin is connected to an output pin of the microprocessor. This output pin can sink 10mA. The RF receiver consumes about 1.4 mA. When this pin is held LOW, the RF receiver is ON. When this pin is driven HIGH, the RF receiver is OFF.

Antenna Input: (pin 10)

A quarter-wave-length wire is attached to the RF receiver antenna input as RF antenna.

Data Output: (pin 7)

Demodulated pulses sent to the microprocessor. The data sent to the receiver chip contains a signal sink algorithm, a preamble with transmitter identification and instruction code.

7. MODE SELECTION

A sliding switch is used to select one of the two working modes: REMOTE or LOCAL.

In REMOTE mode, the microprocessor turns ON the RF receiver for 80 ms every 500 ms. If a valid RF command is received, the microprocessor will control the fan speed and/or the flame height (by driving the stepper motor to the desired position) accordingly.

In the LOCAL mode, the RF receiver is not enabled (currently it is always enabled. This will be changed soon.). The main valve remains in ON state and the fan is ON at the highest speed.

8. GAS TYPE SELECTION

A three-pin header is used to accept a jumper. The jumper position informs the microprocessor of the gas type used.

9. LED INDICATOR

An LED indicator is used to provide feedback to the user.

At start up, the LED is turned ON for 10 seconds to inform the user that the valve knob can be released.

When a valid RF command is received, the LED flashes once to acknowledge the successful reception.

When internal or external error condition is detected, the LED is used to flash a predetermined error code.

10. THE CLOCK

A 1 MHz ceramic resonator generates the microprocessor clock.