MIAC Controlled Underfloor Heating

by Ben Rowland, September 2010

Abstract

Using the versatile MIAC device, Ben shows us how to create your own underfloor heating system for a fraction of the price of most commercially available systems. Included in this article is the MIAC program itself, created using the powerful Flowcode programming language.

Requirements

Software:

- Professional or MIAC licence of Flowcode v3 or v4 for PIC.

Hardware:

- MIAC
- Other hardware listed in article

Introduction:

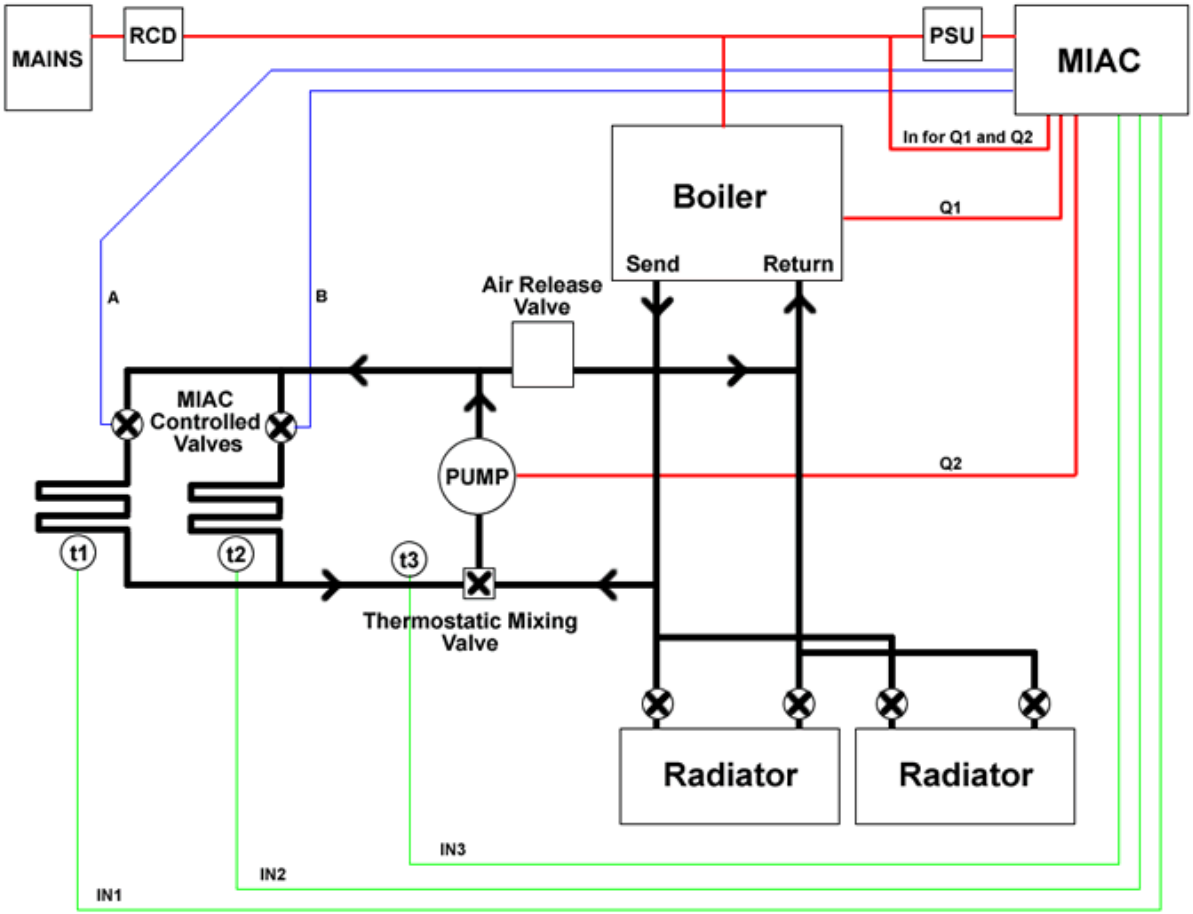
The MIAC is an industrial grade control unit similar to a PLC but more feature packed and easier to program without having to resort to using ladder logic.

To show off the capabilities of the MIAC and as winter is starting to set in I thought a good article would be to demonstrate how we can replicate an expensive under floor heating system for a house at a fraction of the cost. The heating system consists of a few major key elements.

- Boiler
- Electronic valves
- Thermostatic mixing valve
- Central heating pump
- Air release valve
- PEX under floor piping – Bought online from a under floor specialist
- Mains residual current detector (RCD)– Prevents risk of electrocution
- Temperature sensors
- MIAC
- Compression fittings to assemble manifold

A lot of the above items can be found in high street DIY shops but if you have a look on eBay or Amazon then you can find some very good deals, which may save you a huge amount of money.

Below is a basic schematic of a 2 loop under floor heating system.



Technique

The MIAC uses a look up table technique to read the thermistors t1 and t2, which are situated in the floor near the PEX heating loops. The look up table data was generated using the excel spreadsheet with values matching that of the thermistors. When the thermistors temperature drops below a threshold value we check to see if the individual loops are enabled and if they are then we open the valves connected to the individual loops. We then switch on the pump and the boiler.

As the boiler output water starts to heat up the thermostatic mixing valve does its work and starts to mix the cold from the output of the PEX loops with the hot from the boiler. We can monitor the temperature of the water running through the PEX loops by reading the thermistor t3. When this temperature is ok we can shut off the boiler and we can also shut off the pump. Every so often we can activate the pump for a bit to circulate the water and ensure that it is still up to temperature.

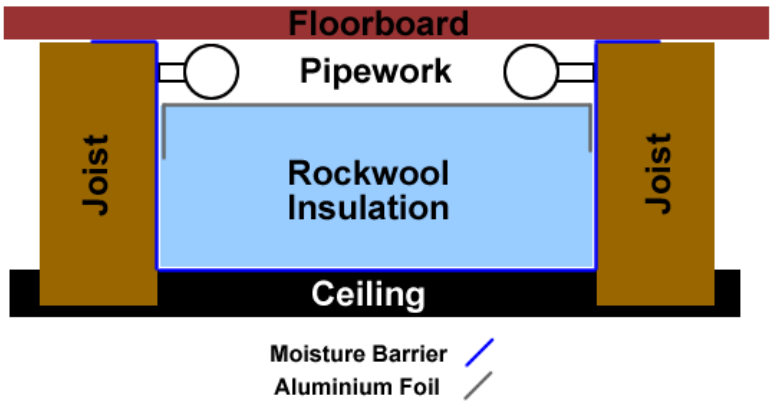
Here is a photo of my four loop under floor heating manifold made using compression fittings and copper piping. Note that when the photo was taken two of the PEX loops are disconnected and the central heating pipe connections are also disconnected.

Please note that the RCD or residual charge detector is an essential part of the system as it could make the difference between a nasty shock and death if you were to come into contact with a live cable. Reference to the existing boiler and thermostat wiring should be made so that the room thermostat can still work when the under floor heating system is not running.

The example program is very basic and simply checks the return temperature t3. When t3 drops below a threshold value the temperatures of t1 and t2 are read into the system. Depending on these temperatures the valves to the PEX loops are opened and then the boiler and the pump are switched on. When the return temperature t3 returns to a value above the switch off temperature the pump and boiler are switched off.

The program could be improved by allowing the loop1 and loop2 to be enabled or disabled separately to allow for zones to be left unheated if required. Another way to improve the system would be to add a timer functionality to allow the temperatures to vary eg drop slightly during the night.

After doing a fair amount of research I have found the following type of setup seems to work the best. If you leave a gap between the bottom of the PEX pipe work and the top of the foil layer then the foil layer will act as a radiation barrier and will redirect any downwards radiation back up to the floorboards.



A lot of people seem to recommend that you fill the air gap with a thermal mass such as cement mixed with sand. In my opinion this stops the radiation barrier (foil) from working effectively and also makes the system take longer to heat up. My primary concern though with this technique is that if you ever have to redo your ceiling then you will get all the sand and cement falling through from above. Plus if a pipe bursts for any reason then that will wet the sand and cement mixture and may cause it to make concrete underneath your flooring. Not ideal for getting the damaged pipe work out of the way.

If a warm water based system is not for you then the MIAC can also be used to directly drive electrical under floor heating elements. The relay contacts are rated up to 1800 – 2000W at mains voltage allowing you to drive small through to large, high power heating mats. To do this you would connect the neutral and ground signals from the mains to the heating mat. Then connect the live from the mains through one of the MIAC relays to the live from the heating mat. If you want full separation when the mat is not in use then you will have to use a second relay to connect and disconnect the neutral connection. Again a RCD should be used along with a great deal of precaution to avoid any injury caused by contact with mains voltage. Electrical under floor heating mats should also be placed on an insulated layer to avoid a high percentage of the heat escaping directly into the ground. Polystyrene sheets or other special kinds of insulation are available in a number of sizes for use with these types of system.

PLEASE NOTE:
Please note that all electrical work will need to be inspected by a qualified electrician. Electrical regulations may differ from country to country, so make sure you check your local legal requirements. Also the wattage I quoted for the electrical heating mat is subject to a 250V system. The ampage on the relay outputs, the screw terminals and the PCB tracking of the MIAC is rated to 8A. Therefore at 250V the theoretical power is 250V * 8A = 2000W. At 110V the wattage drops to a theoretical maximum of 880W. This project was done by me as an individual and is not in any way tied into Matrix Multimedia. Finally I am in no ways a qualified plumber or a qualified electrician so I got advise from qualified personnel when installing the system and then signed off the electrical and heating systems with approved professionals. If you decide to do similar things using Mains voltages or plumbing systems then please ensure to get help and advice from qualified professionals in your area before you begin and again before you switch on or commission the system. Matrix Multimedia will be in no ways held responsible.

Further reading

Below are some links to other resources and articles on related subjects, and technical documentation relating to the hardware used for this project...

Flowcode:	http://www.matrixmultimedia.com/flowcode.php
MIAC:	http://www.matrixmultimedia.com/miac.php
Learning Centre:	http://www.matrixmultimedia.com/lc_index.php
User Forums:	http://www.matrixmultimedia.com/mmforums
Product Support:	http://www.matrixmultimedia.com/sup_menu.php