Environmental Control with a MIAC System

by Leigh Morris June 2012

Abstract

Discover how easy it is to create complex electronic systems with the MIAC. In this article we demonstrate how simple it is to create an environmental control system using Flowcode and the MIAC.

Requirements

Software:

- Professional or Educational version of Flowcode V5 for PICmicros

Hardware:

- MIAC
- MIAC Advanced expansion module
- MIAC GPS expansion module

Introduction

This demonstration application highlights a number of capabilities of the MIAC Master and the MIAC System.

The setup consists of a MIAC System, comprising a Master MIAC, an Advanced and GPS Expansion Modules. Two Temperature sensor probes are attached to the inputs of the Advanced Module, Sensor 1 for Internal Temperature and Sensor 2 for External Temperature. In this application only the SD Card interface of the GPS Module is used, so it could equally well be a Serial Module instead.
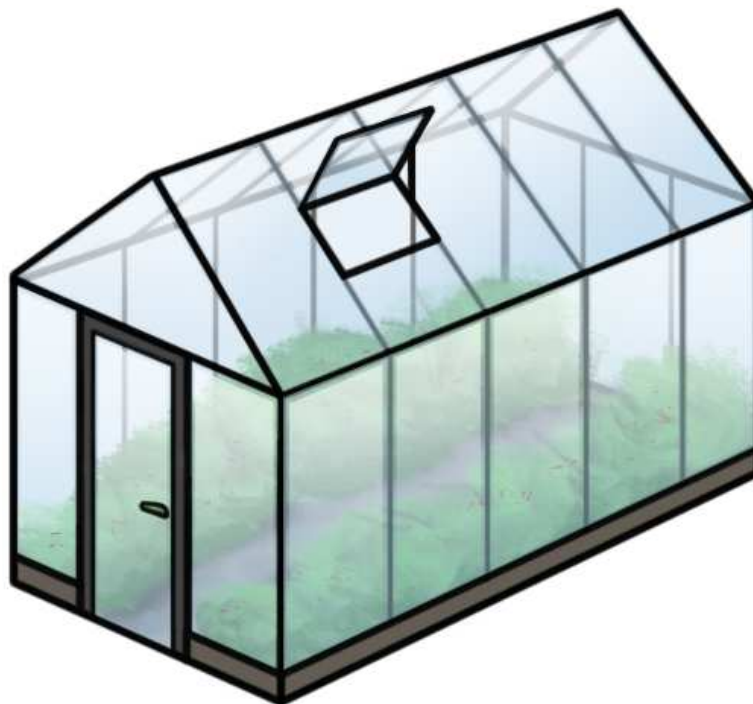
The Program

The Master MIAC is also used to control two outputs, relay Q1 to control a heating element, and A and B terminals to provide a bi-directional bridged output to drive a motor to raise or lower a venting hatch via a winding mechanism.

The main part of the program first sets up the initialization of the modules and components, this is done in the macro "Startup".

The main program then loops looking for the depression of the Menu (Green) Key whilst reading (GetAdvInfo macro) and displaying (DisplayDetails macro) the values of the two sensor inputs and Real Time Clock of the MIAC Expansion Advanced Module.

Environment control is done in the CheckStatus macro. This macro checks the Internal Temperature against the Set Point Temperature, if it is lower by more than one degree Celsius, then the Heating state is entered and the Q1 relay output is enabled. If the Internal Temperature raises more than one degree Celsius above the Set Point Temperature then the Venting state is entered and the OpenVent macro is called. The OpenVent macro powers the motor output forwards for 3 seconds to raise the vent. Similarly once the Internal Temperature falls again the macro CloseVent is called to power the motor in the reverse direction to lower the vent.

This application also uses the SD Card of the GPS Expansion Module to record the Internal and External Temperatures every hour. This is done in the macro DoLog, and appends a line every hour to the file log.txt. This line of data is a Comma Separated Variable list containing the time, date, internal temperature, external temperature and system status, such that this file can be imported into a spread sheet or database.

Pressing the Green Menu key presents three options: Set Date, Set Time and Set Temp, whereupon each parameter can be updated. The readjusted clock setting is written to the Real Time Clock of the Advanced Module and the Set Point Temperature is persisted in the MIAC EEPROM.

Safety Note

If the Heating Output control relay Q1 is used to switch a mains powered heater then ensure that this is done by a qualified electrical engineer and is suitably insulated so as to pose no danger accidentally.
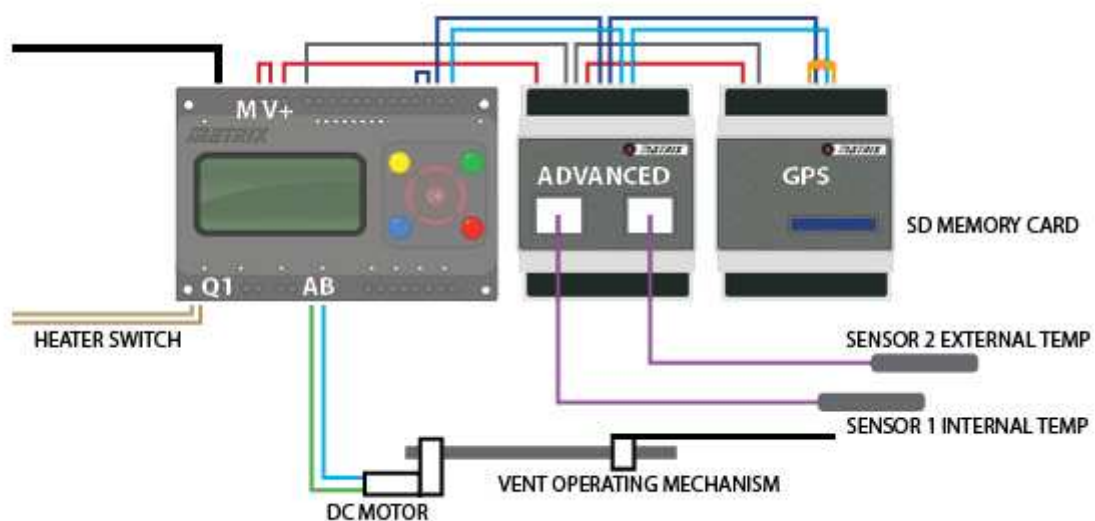
Further developments and improvements

The temperature probes (Matrix Part HSTMP) are resistive (20k ohms at 25 deg C) and together with the internal 15K resistor produce an input voltage to the ADC convertor of the Advanced Module. The voltage to temperature conversion formula in the GetAdvInfo macro is a linear approximation and will increase in error as the temperature deviates further from 25 deg C. Please see the information provided with the Temperature Probe.

The temperature measurements could be averaged over several readings to avoid status changes on spurious events.

The application currently uses one Set Point temperature and a fixed 1 deg C hysteresis above and below for the heating and cooling phase. You might like to add separate temperature set points for the upper cooling phase point and the lower heating phase point, say for example to provide frost protection only.

The provision of a Real Time Clock also provides the means to control other features such as lighting during night time hours only.

With the addition of upper and lower limit switches on the vent raising mechanism the simple timers in the OpenVent and CloseVent macros can be aborted to avoid motor stalling conditions.
The GPS Module could be used to also provide location information into the log file, such as in the case of multiple installations.

The Menu and Parameter setting macros could be improved by introducing a timeout such that the unit reverts to monitoring if it is accidentally left at the Menu setting.

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

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