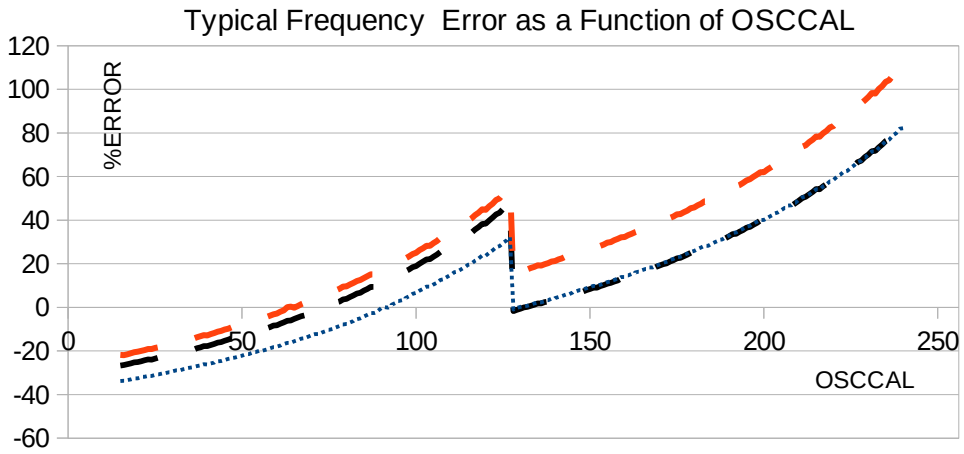
PCB 111000: Calibrating the devices

Both devices can be calibrated in the programming jig or after assembly in the project pcb.
User calibration factors are saved in the EEPROM.

Both Atmega devices used by the project pcb run off their internal 8MHz RC oscillators. The precise frequency of an individual oscillator is controlled by the value saved in its OSCCAL register which can be anything between 0 and 255. Plots of frequency error against OSCCAL are shown in the figure below. It can be seen that:

the frequency can be increased to a maximum of about 16MHz
and reduced to a minimum of about 5.5MHz
There is at least one value of OSCCAL for which the error is very small and is often two



Performance of the 8 MHz internal RC oscillator

The devices are supplied with a preset value of OSCCAL. This often provides sufficient accuracy to enable the pcb to communicate with a PC at a baud rate of at least 57.6kB. This cannot be guaranteed however and it may be necessary to reduce the baud rate significantly. Devices can therefore be calibrated using the programming pcb or after they have been loaded onto a project pcb. User calibration factors are generated which are stored in EEPROM as follows:

For the Atmega 328: in locations 0x3FE and 0x3FF.
For the Atmega 168: in locations 0x1F7 and 0x1F8.

A HW_setup macro called by all the projects checks these locations. If they are equal and of any value between 0x0F and 0xF0 it assumes that they are user defined calibration factors and copies them to OSCCAL the resister that the HW uses to calibrate its oscillator.

PCB 111000: Calibrating the devices

Calibrating the devices in the programming jig

The following programs are provided to calibrate devices in the programming jig:

Auto_cal_168 (or 328): This identifies to first suitable OSCCAL value and saves it to EEPROM.

Manual_cal_168 (or 328): This prints out the calibration error for 40 sequential values of OSCCAL and enables to user to select a suitable user calibration value.

Plot_cal_168 (or 328): This is used to produce plots (as shown above).

Auto cal is necessary when the default value of OSCCAL is not sufficiently good to enable sensible communication with a PC.

Calibrating the devices in the project pcb

The following programs are provided to calibrate devices in the project pcb:

Proj_9B_168_auto_cal:
Proj_9A/D_168/328_manual_cal

The mini_OS checks the calibration of the Atmega 328 at every POR and does an auto cal if necessary.

Emergency restoration of calibration factors

Note: Calibration programs will not normally accept unsuitable values for OSCCAL. However if the 328 EEPROM gets corrupted the clock frequency may be changed so the p/r user prompt becomes "garbage" and communication with the PC is severed. If this happens select the LHS for the DPDT switch. Power cycle the pcb and reconnect to the terminal program. Pause a moment, then select the RHS for the DPDT switch and finally press the vertical push button switch. This should restore the p/r prompt.

If communication with the Atmega 168 gets severed run its auto cal routine

Note: If the project macro setup_HW; is replace by setup_HW_E; the Atmega 328 calibration can be checked by pressing x instead of r at the p/r prompt. The user will be presented with a menu offering Version data or the option to perform a quick cal on the Atmega 328.
Also note that additional files will have to be included using the project header file.