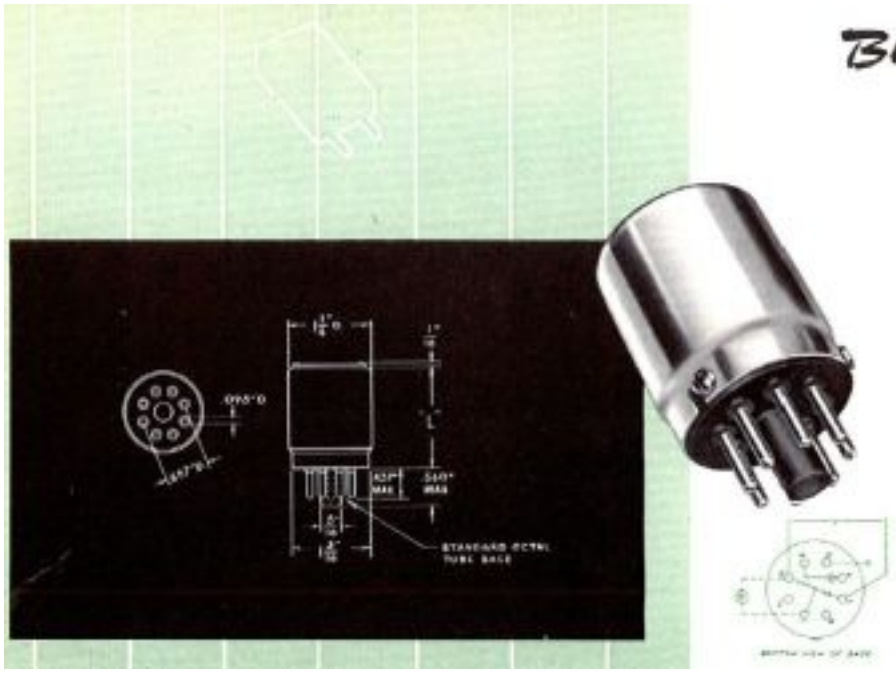
PAGE UNDER CONSTRUCTION

This old Bliley crystal oven type TCO-2A was a purchase from the Dayton hamvention fleamarket (for those who don't know, haven't been, etc.... the Dayton hamvention fleamarket is the closest a fanatical homebrewer can come to heaven, without actually departing planet Earth). The oven came on a small chassis with two 12AT7 (dual triode) valves, price for the whole thing was just US$1. The oven has a standard octal base and contains two crystals in HC6 holders. The heater is rated 6.3V 0.85A and claims a temperature of 75C.

See the photos below of the chassis and the oven, and even the oven with its can removed. The inside of the can is lined with some kind of cork material for thermal insulation. Click the photos for larger images!

{gallery}bliley/1{/gallery}

A year or two elapsed, in the blink of an eye as is customary, before it was time to look at this oven again. I found a little data on the internet on this oven, at NNN. The relevant section is shown below (click for larger image).

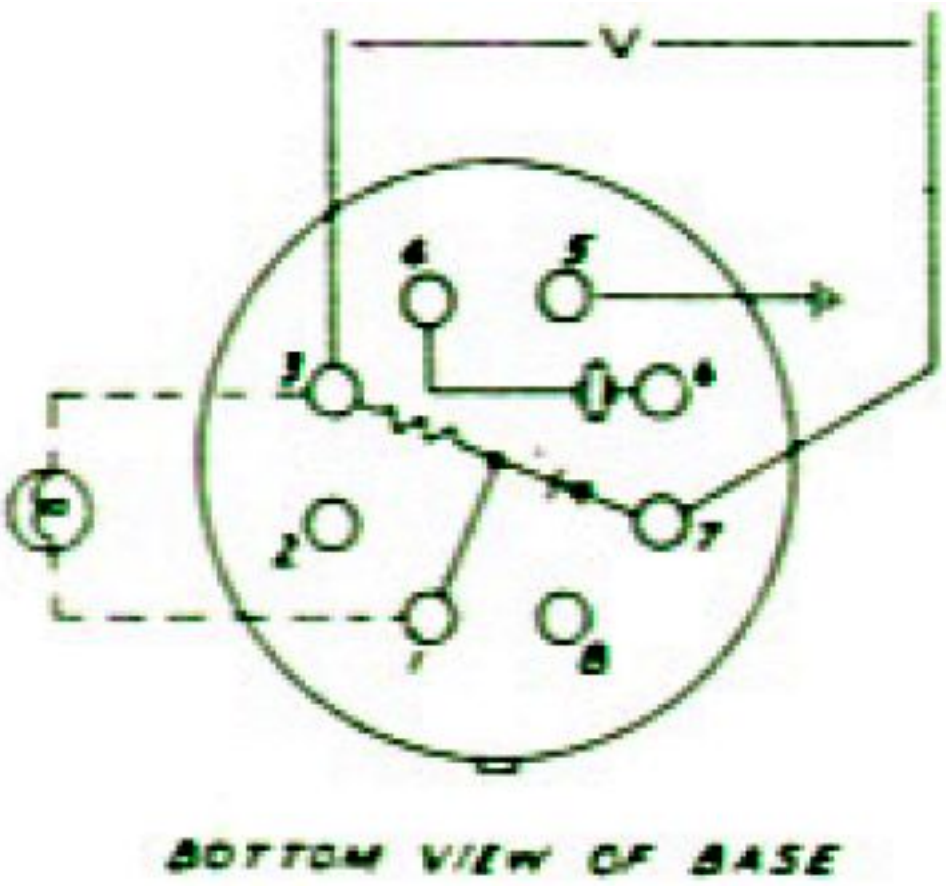


Bliley CRYSTAL OVENS

TCO SERIES

Designed specifically for use with Bliley types BH6A and SR11 crystal units. Standard models are supplied as indicated:

Model	Heater Voltage	Watts	Crystal Sockets	Control Temperatur
TCO-1A	6.3	5.5	1	75°C or 85°
TCO-1C	24 or 26.5	7.75	1	75°C or 85°
TCO-2	6.3	5.5	2	75°C
TCO-2	6.3	7.9	2	85°C
TCO-2D	24 or 26.5	7.75	2	75°C or 85°



Aside from a little data which I already knew (it is printed on the label at the top of the can), the very useful additional piece of information here, is the oven connections diagram seen here to the right. The resolution is rather limited but you can see the general idea. The thing that looks like a diode is in reality supposed to be the thermostat. The diagram shows where the voltage for the heater should be connected, and where you can connect a pilot light, which is supposed to come on when the oven is switched on by the thermostat.

I wasn't able to measure anything with a DVM between the pins that approximated the allegations of the diagram. I could measure a few ohms, seeming not inconsistent with a heater rated 6.3V 0.85A, between pins 5 and 7. Connecting 6.3V for some minutes did result in the can getting hot (very) but there was no indication of any thermostatic action or pilot lamp activity etc.

Recognising that it would potentially be an unsuccessful, one-way, destructive process, I

realised it needed opening up and some repair. The following photos (click for larger versions) show the dismtantled oven components and a close-up of the heater itself, which is sandwiched between a copper plate, between the crystals. The thermostat is the white cylindrical thing attached to the heater. It has a copper screw which presumably sets the temperature.

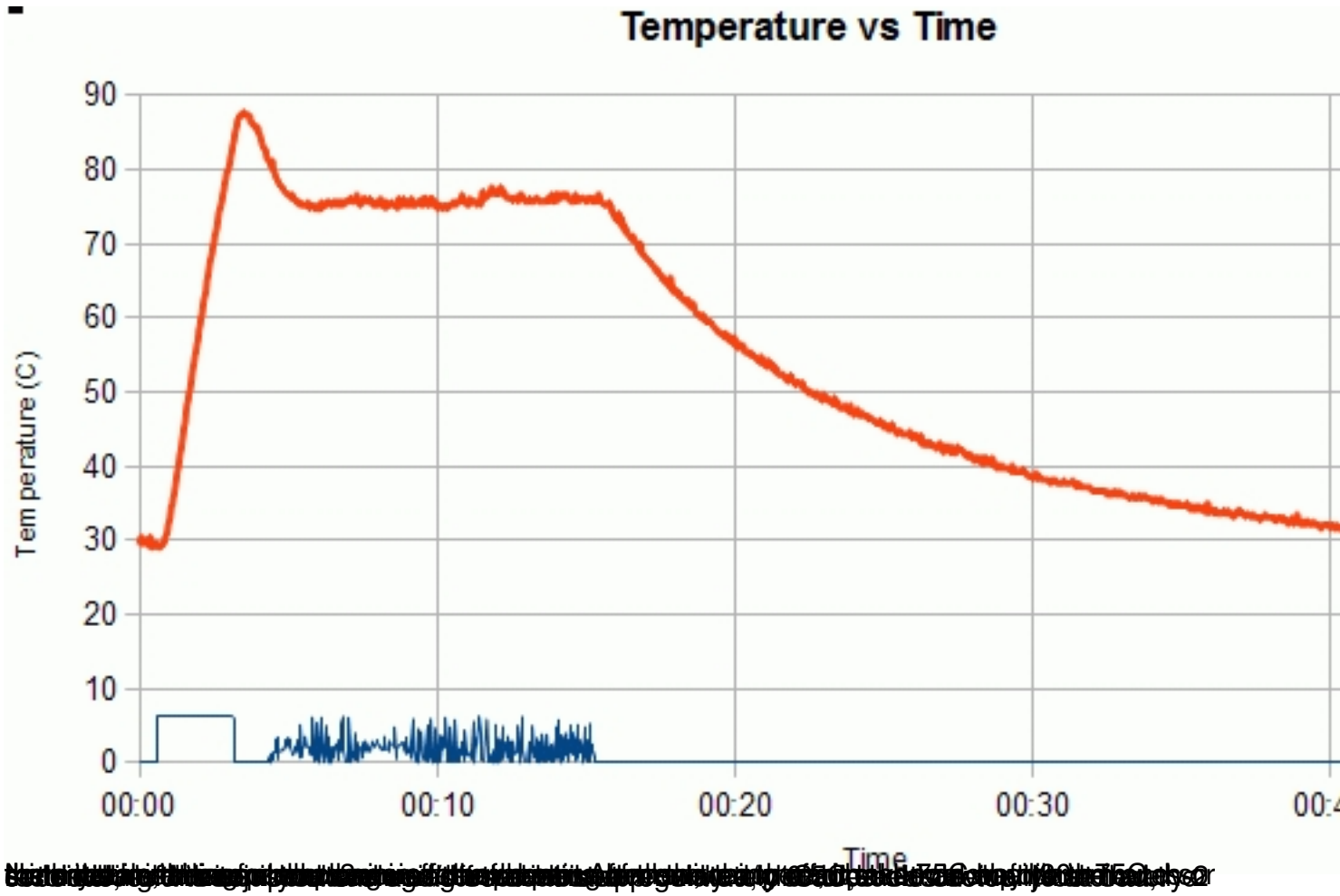
{gallery}bliley/2{/gallery}

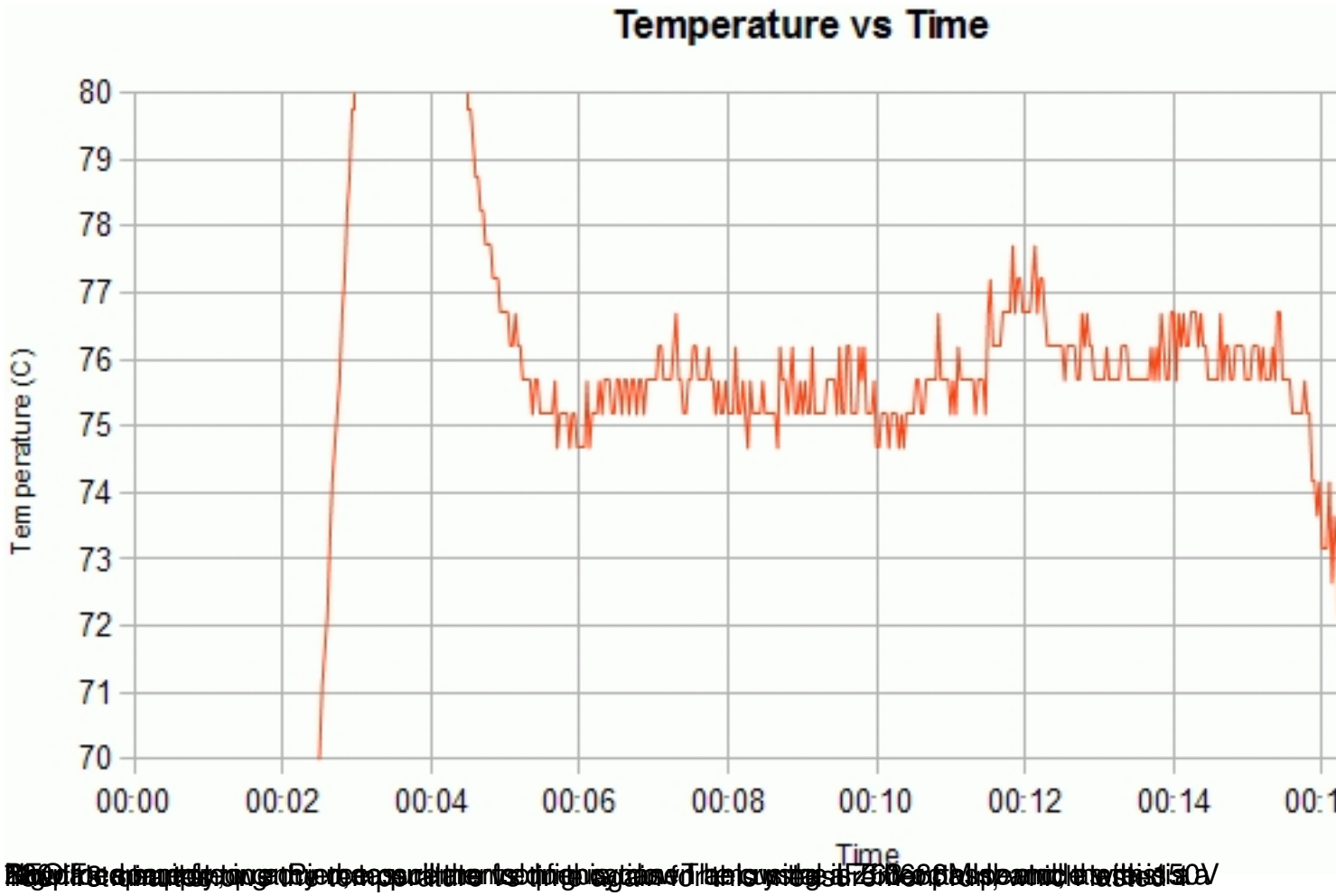
Some considerable force was required to prise the lower parts of the assembly from the octal base, so the exact cause of the fault was indeterminable. I assumed that somewhere underneath the crystal sockets, something had snapped, corroded, broken, shorted, or some combination of these. I worked out how to put it back together, with connections complying with the wiring diagram (left photo below).

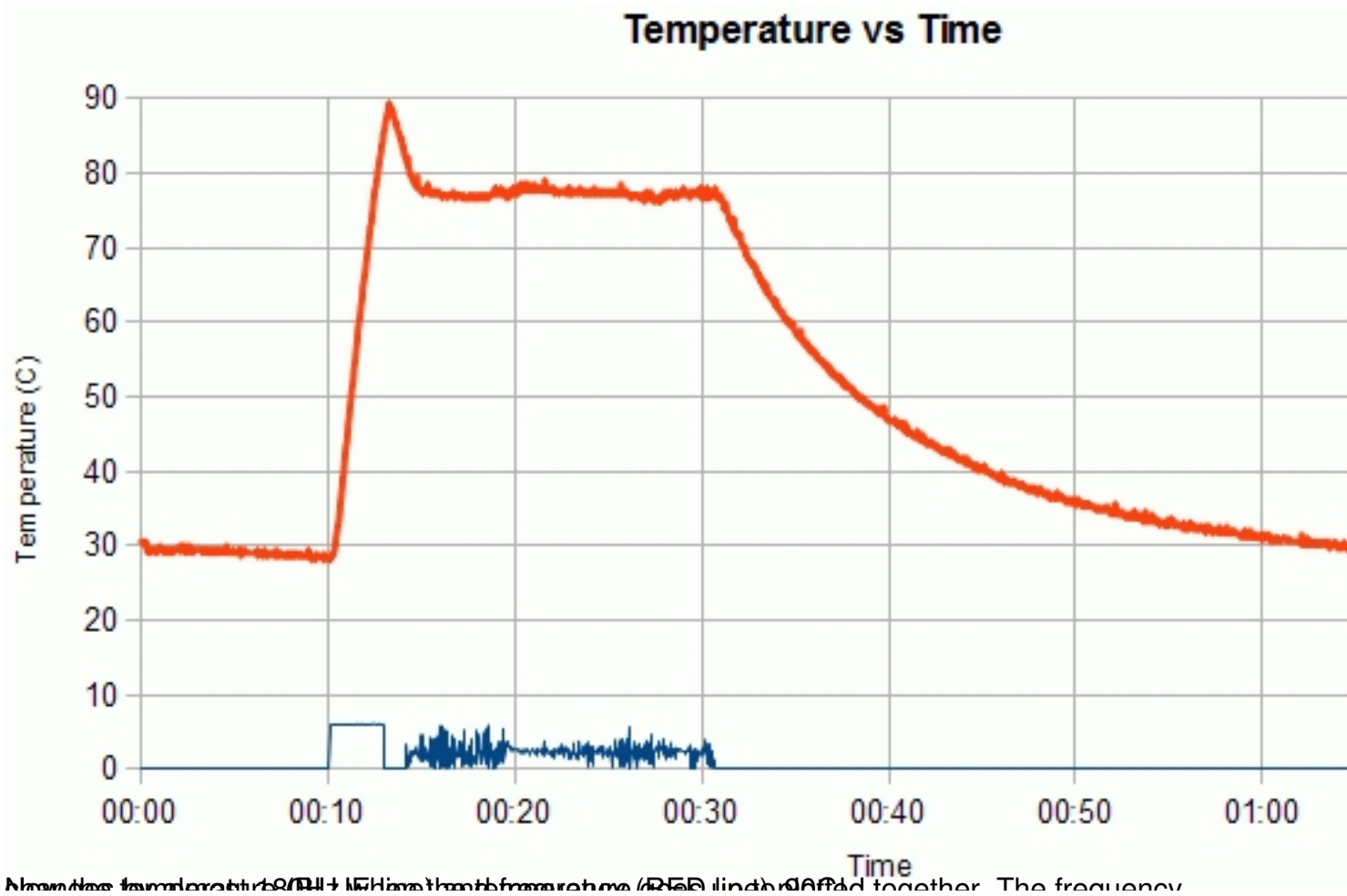
{gallery}bliley/3{/gallery}

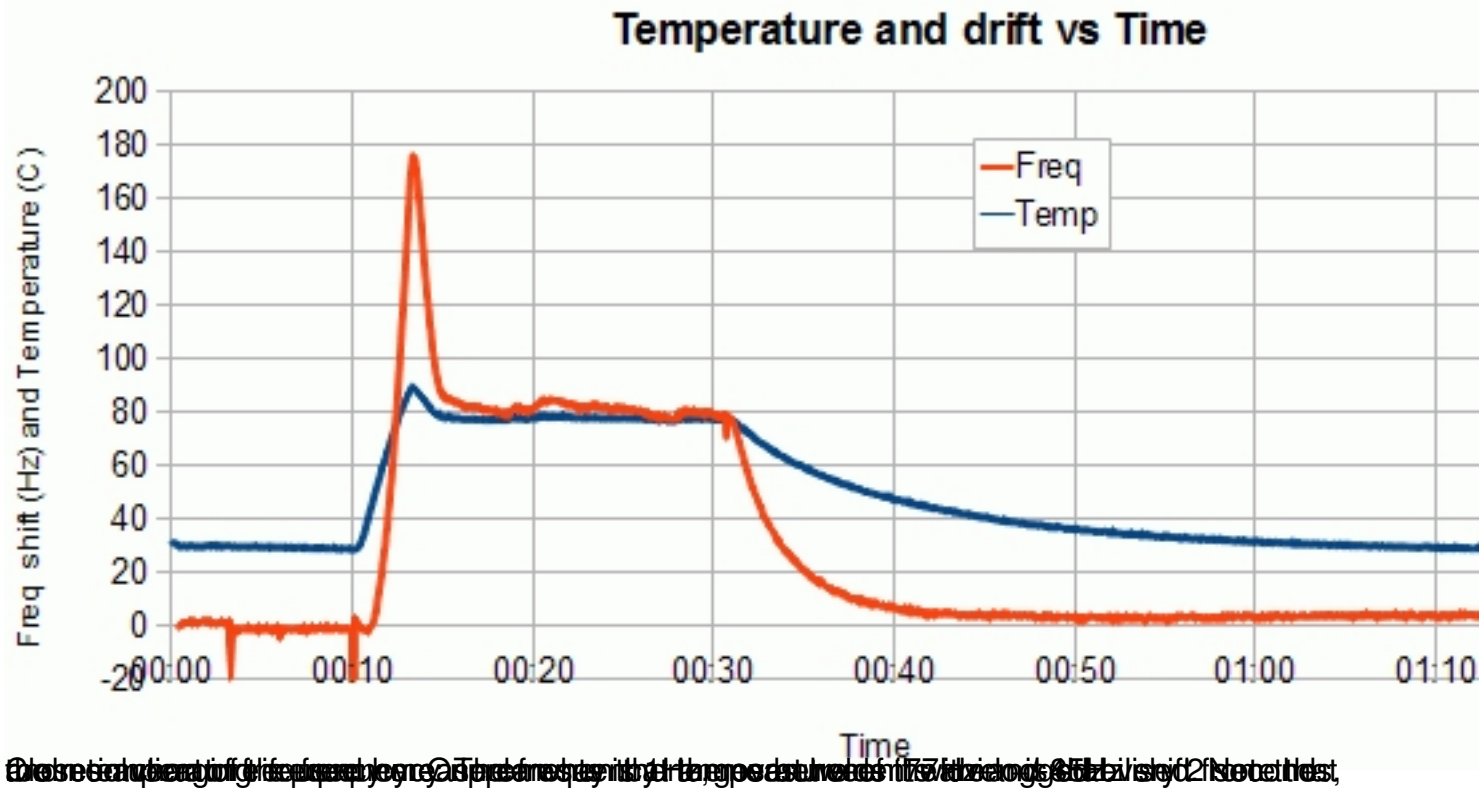
The HC6 crystals were snipped open. Inside one I put a modern HC49 crystal on 5.0688MHz; in the other a tiny PCB containing a TMP36 temperature sensor (above right). Now when power is applied and a pilot lamp connected, the light stays on for some minutes, then goes off for a minute when the oven has reached full temperature, and thereafter flashes intermittently to maintain the target temperature. So a successful repair! After some decades of inactivity, it all seems to work as it should.

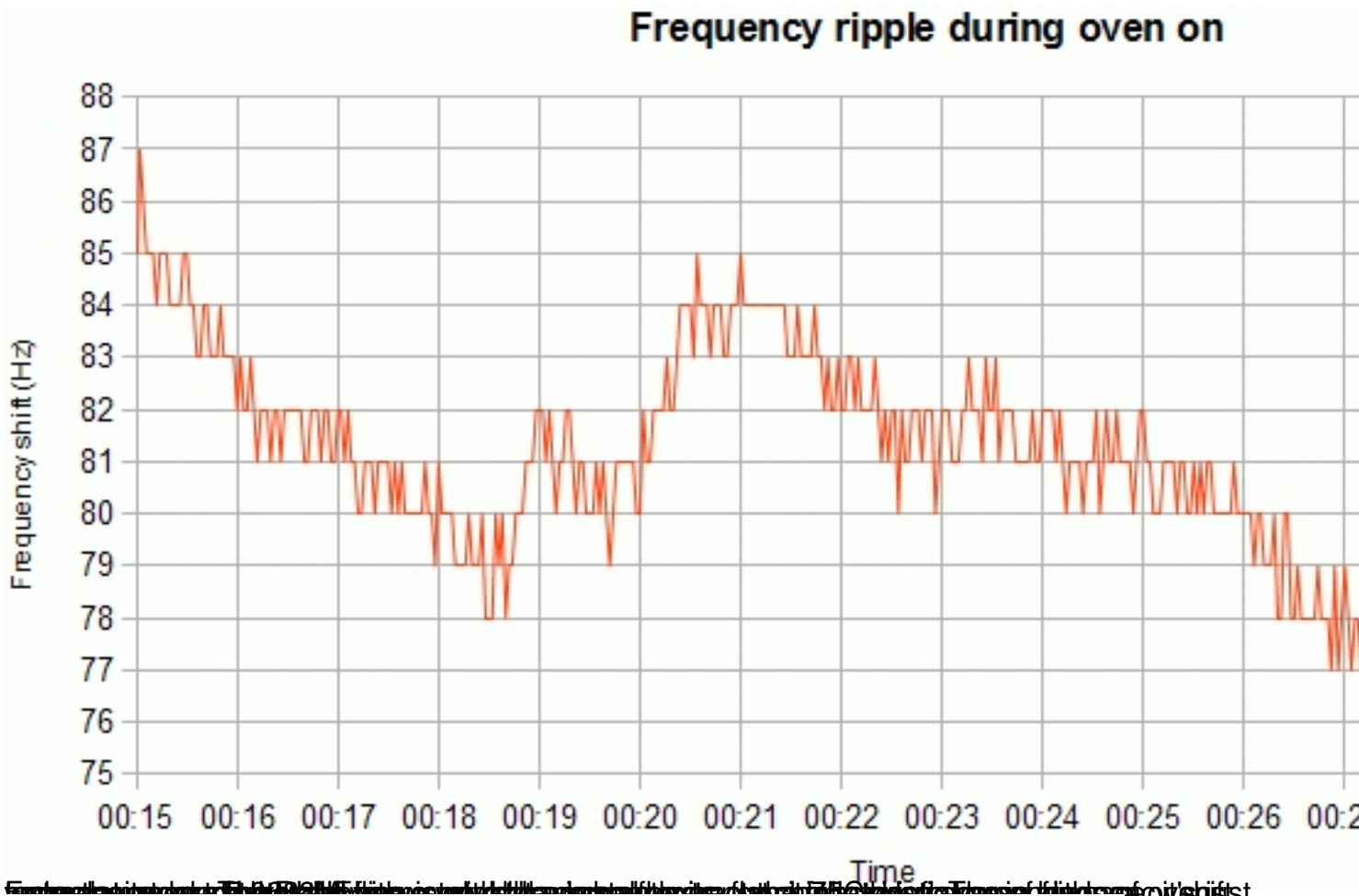
Now to make some measurements, again the Arduino frequency-counting data-logger project seems to be most useful. The chart below shows the temperature inside the oven, as measured using the TMP36 temperature sensor (RED line). At the same time, I measured the 6.3V at the pilot lamp, this is the BLUE line at the bottom. I was extremely impressed by this result.

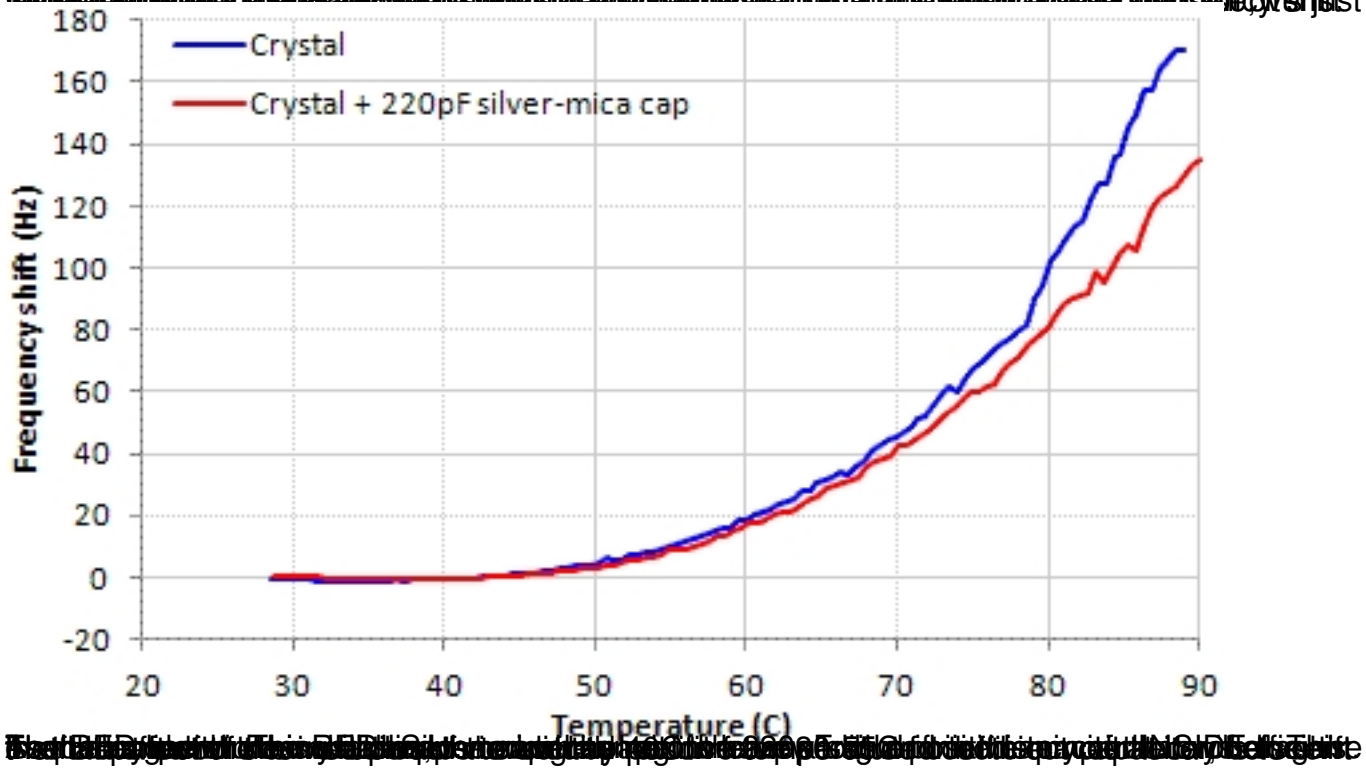

Temperature vs Time
Tem perature (C)
90
80
70
60
50
40
30
20
10
0
00:00
00:10
00:20
00:30
Time


Temperature vs Time
Tem perature (C)
80
79
78
77
76
75
74
73
72
71
70
00:00
00:02
00:04
00:06
00:08
00:10
00:12
00:14
Time


Temperature vs Time
Temperature (C)
90
80
70
60
50
40
30
20
10
0
00:00
00:10
00:20
00:30
00:40
00:50
01:00
Time


Temperature and drift vs Time
Freq shift (Hz) and Temperature (C)
200
180
160
140
120
100
80
60
40
20
0
-20
Freq
Temp
00:00
00:10
00:20
00:30
00:40
00:50
01:00
01:10
Time


Frequency ripple during oven on
Frequency shift (Hz)
88
87
86
85
84
83
82
81
80
79
78
77
76
75
00:15
00:16
00:17
00:18
00:19
00:20
00:21
00:22
00:23
00:24
00:25
00:26
Time


Crystal
Crystal + 220pF silver-mica cap
Frequency shift (Hz)
180
160
140
120
100
80
60
40
20
0
-20
20
30
40
50
60
70
80
90
Temperature (C)


Crystal
Crystal + 220pF silver-mica
Frequency shift (Hz)
5
4
3
2
1
0
-1
-2
30
35
40
45
50
Temperature (C)