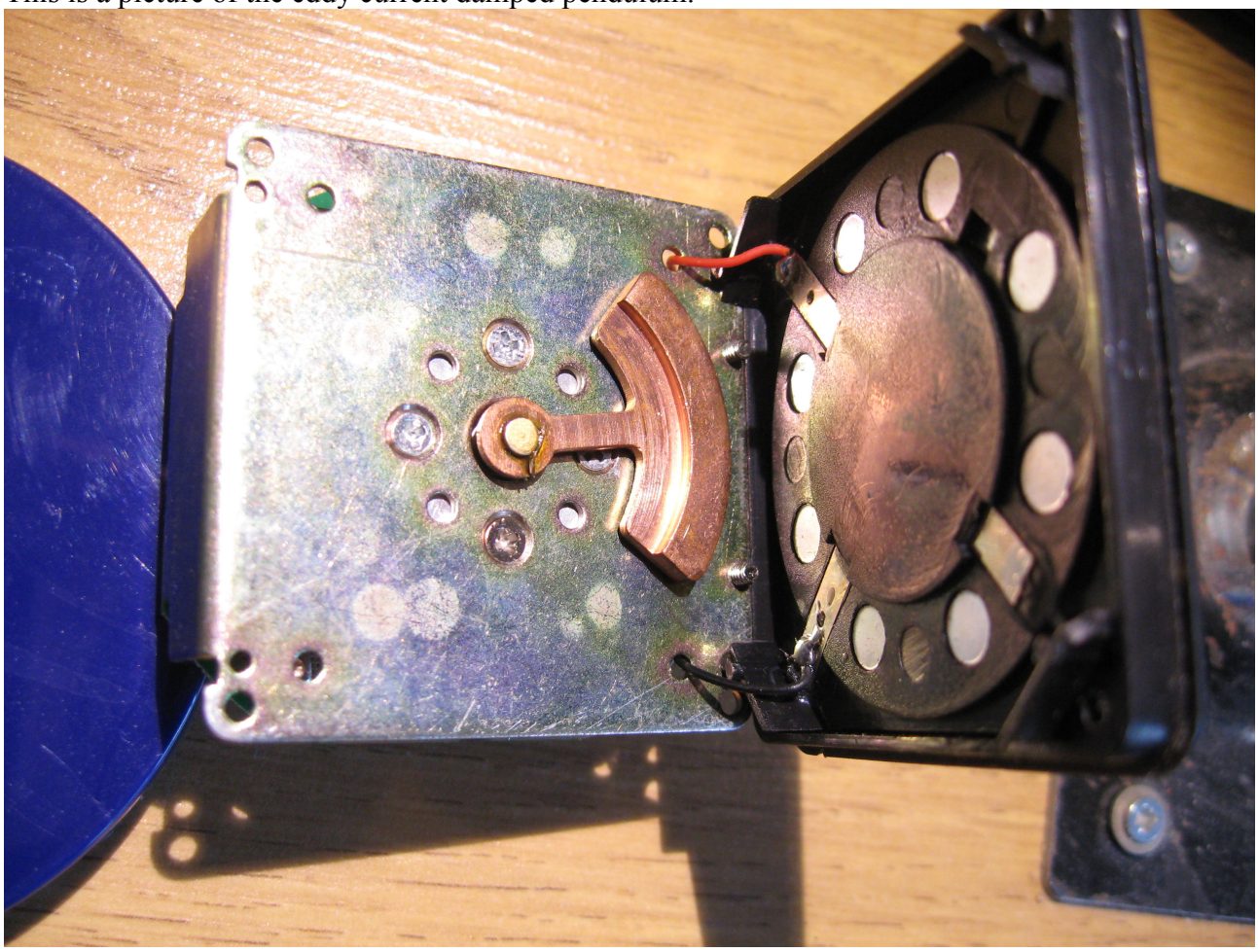
Hacking "Wixey" type angle gauges

Having bought one of these gauges I thought there might be the possibility of using it for angle measurements on machine tools. The first thing was to see if it could be connected to a shaft for measuring the angle of rotation. Opening the unit was the first step to get some idea how it works. This showed it was an eddy current damped pendulum coupled to a rotary encoder that works on the capacitive sense principle used in digital calipers.

This is a picture of the eddy current damped pendulum.



The 8 disks visible on the back cover are the magnets that provide the damping.
It looks like it should be possible to remove the pendulum and couple it to a shaft.

In some situations it would be an advantage to have the display remote from the encoder. The unit contains two printed circuit boards. One is the encoder. the other is the display. They are connected by a 12 pin plug and socket but only 6 connections are used. I separated the two boards and connected them together with a one metre length of 6 core screened cable. The unit still functioned a and examining the signals with an oscilloscope showed that they were not noticeably degraded. This suggests that it should be possible to use an even longer length of cable.

The next step was to examine the signals between the two boards to see if they could be decoded.
This is some information on these signals

Battery - is connected to metalwork

6 pin connector between boards.
NOTE This is a 12 pin plug & socket between the two boards but the two rows are paralleled so there is only six connections.

With display up.
Staring from left hand side of connector. (Call this pin 1.)

		Label	
Pin 1	Battery +	+3V	
Pin 2		EA	(Generated by display board)
Pin 3		DA	Data (generated by read head board.)
Pin 4		CLK	Clock signal (Generated by display board)
Pin 5	Battery -	GND	
Pin 6		VDD	This is at 1.495 volts with respect to ground (Generated by display board.)

All signals referenced to ground (Battery - ve)

Clock signal. (Originates on display board.)

Amplitude 3 volts
Static state +3V (Will call this logic "0")
Clock burst repeats every 22 mS
Clocks occur in 6 groups of 4

Group structure.

Goes to ground for (Logic 1) for 125 uS
Goes to +3V for 40 uS

Goes to ground for (Logic 1) for 100 uS
Goes to +3V for 40 uS

Goes to ground for (Logic 1) for 100 uS
Goes to +3V for 40 uS

Goes to ground for (Logic 1) for 100 uS
Goes to +3V for 70 uS This is the space between groups. After the last group the signal stays at +3v until the start of the next burst

Next group starts

DA signal Data

Static state +3V (Logic "0")

The least significant bits come first.
Data bit starts on positive going clock (Going from logic "1" to logic "0") of clock signal.
So need to clock data on negative going edge (Going from logic "0" to logic "1") of clock signal.

EA signal

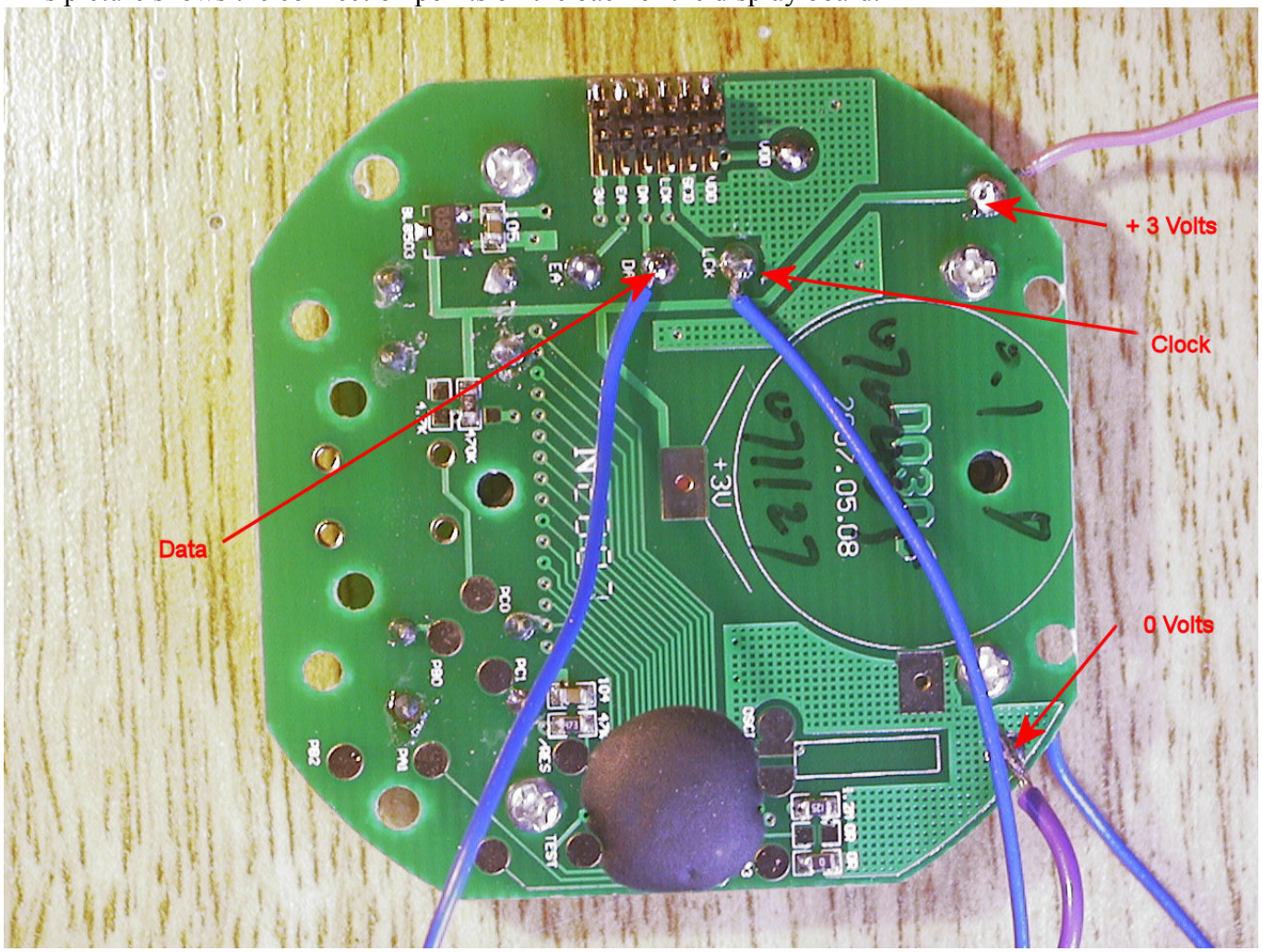
static state +3V

At +3 for about 16 mS (Logic "0")
At 0V for about 6.6 mS (Logic "1")

Goes to ground about 2.8 mS before start of clock burst. (Logic "1")
Goes high about 500 uS after end of clock burst. (Logic "0")

These signals are available on the back of the display board. Only the clock and data signals are required to read the data.

This picture shows the connection points on the back of the display board.



Reading data

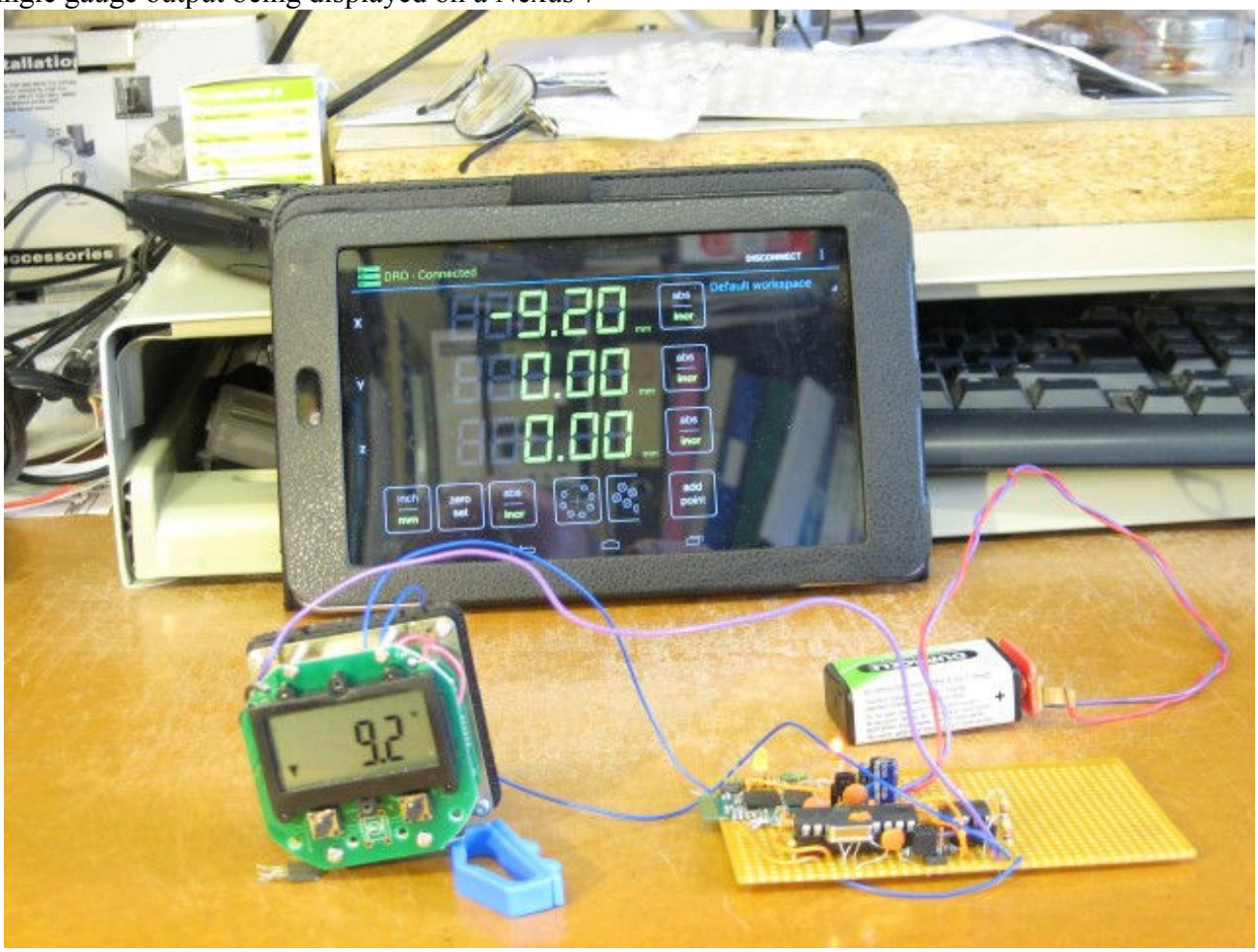
The data seems to use the same protocol as BIN6 linear scales but with different timing values.

Power up count value.

The count value on power up seems to be on a random 200 (Hex) boundary + a count that seems to be almost an absolute value if the position of the encoder is not moved. As there are 18 radial tracks on the encoder wheel 200 (Hex) probably corresponds to the spacing of these tracks which will be 20 Deg.

This is a correction to the information I originally gave.
I have found that 256 counts corresponds to 5 degrees so one count is 0.01953125 degrees. Bits 0 to 8 count the number of 0.0390625 degree units. Bits 9 to 23 count the number of 10 degree units. There will be 18432 counts per revolution. Bit 23 is used as a sign bit so the counter will overflow at a value of + or - 8388608 counts. This corresponds to 455 revolutions plus 40 degrees. I think this will mean that when the count overflows the readings will be wrong.

Angle gauge output being displayed on a Nexus 7



To get it to display the value correctly requires a different CPI value for metric and imperial use. When using in metric mode CPI needs to be set to 254 In imperial mode needs to be set to 10.

The interface board.