

Fig. 2

Fig.2 shows the pulse generator output, the common-mode voltage across the shield, the voltage on one of the signal wires, and the amplifier output voltage. On both edges of the channel 1 signal we see an overshoot, caused by the inductance of the cable. This transient couples capacitively into the two wires of the twisted pair. Due to the asymmetry of the cables, the effect on the output voltage happens to come out inverted.

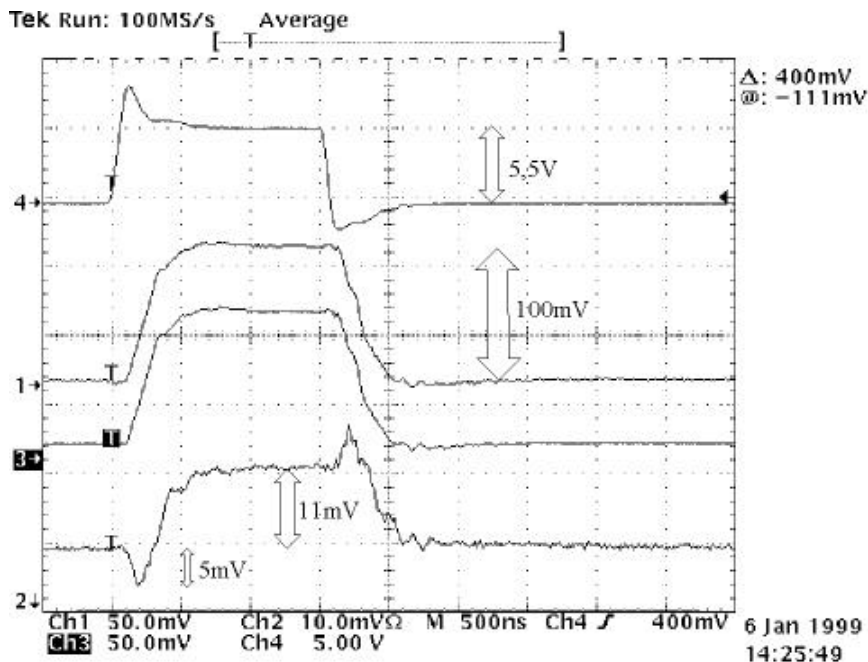


Fig.3

Channel 1 and channel 3 in Fig.3 display the signals on the two inputs of the amplifier.

With the scope's resolution, the asymmetry between the two signals causing the transients is not detectable: after all with an amplifier gain of 36, and an overshoot value of 5 mV on the output, we are looking for an input signal of 138 microvolts. Note that the Ch.3 sensitivity has changed to 50mV/div.

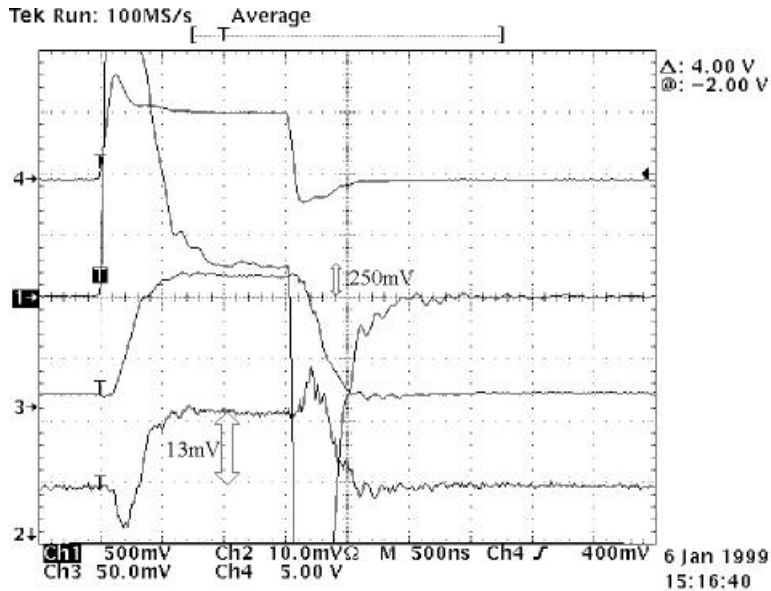


Fig. 4

After the transient has died out, the flat part of the common mode voltage remains. In fig. this is shown on channel 1. The current flowing through the shield can be calculated: $250\text{mV}/2,425\text{ohm} = 103\text{mA}$. The common mode rejection ratio can now be expressed in two ways: 1) outputvoltage/gain divided on the inputvoltage, or: 2) outputvoltage/gain divided by shieldcurrent.

1) CMRR: $250 \times 36 / 13 = 692,3$ which equals 57dB.

2) CMRR: $13 / 36 \times 103 = 3,5\text{uV/mA}$

The outputvoltage has been calculated back to the input.

The transient across the shield (fig. channel1) is caused by the selfinductance of the cables shield: the time is determined by the selfinductance and the total resistance in the circuit: 52,45 ohms.

The next picture, fig.5 shows the effect on the CMM behaviour when 5 turns of the cable are fed through an E42-3C8 core. The impedance in the path increases, resulting in a higher voltage on the inputside of the shield for the timeslot being observed. As a result the signal on the input of the amplifier (Ch.3) gets slower, losing high frequency components. Yet, the transients on the output of the amplifier (Ch.2), although smaller, remain! This supports the earlier idea that these transients are being caused by the asymmetry of the cable: in this case the capacitive asymmetry, because increasing the inductance by adding some ferrite doesn't help.

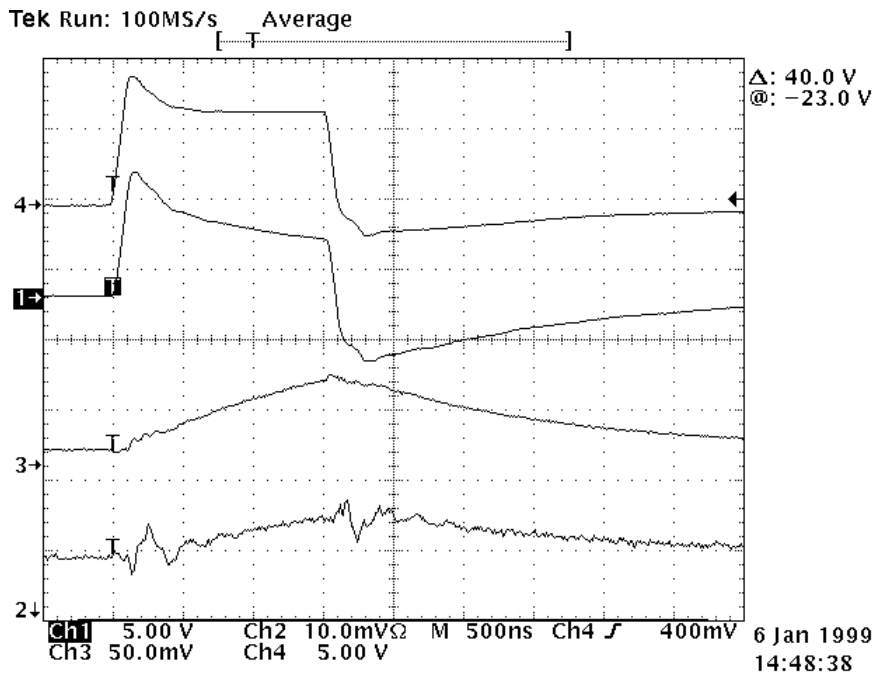


Fig.5

In fig.6 we can see the effect of a compensation capacitance of 15pF connected from one of the inputs to ground. No ferrite was used here. The transients on the output (Ch.2) have practically gone.

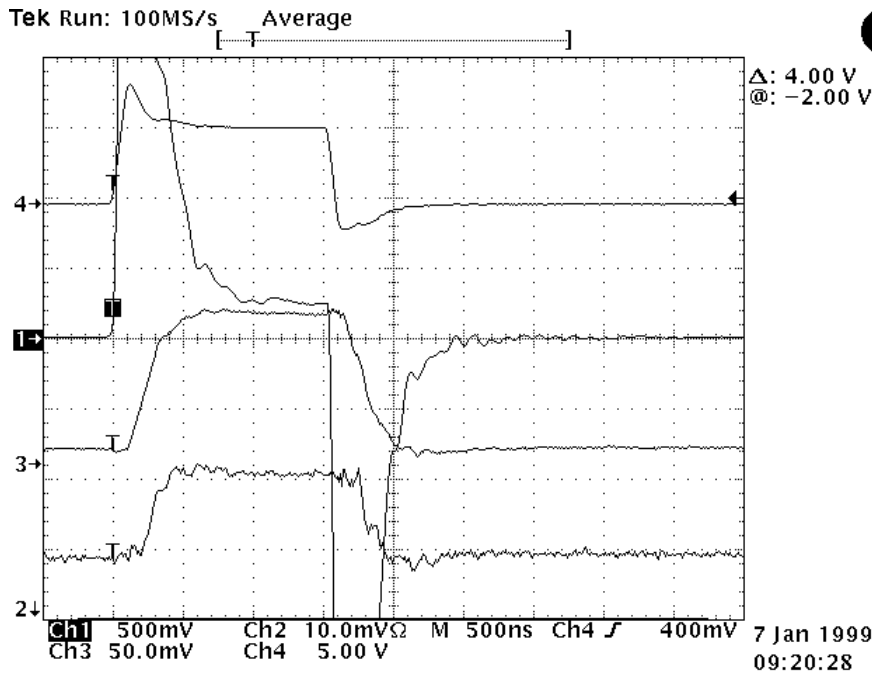


Fig.6

This compensation should work for common-mode noise on both signal-wires as well.