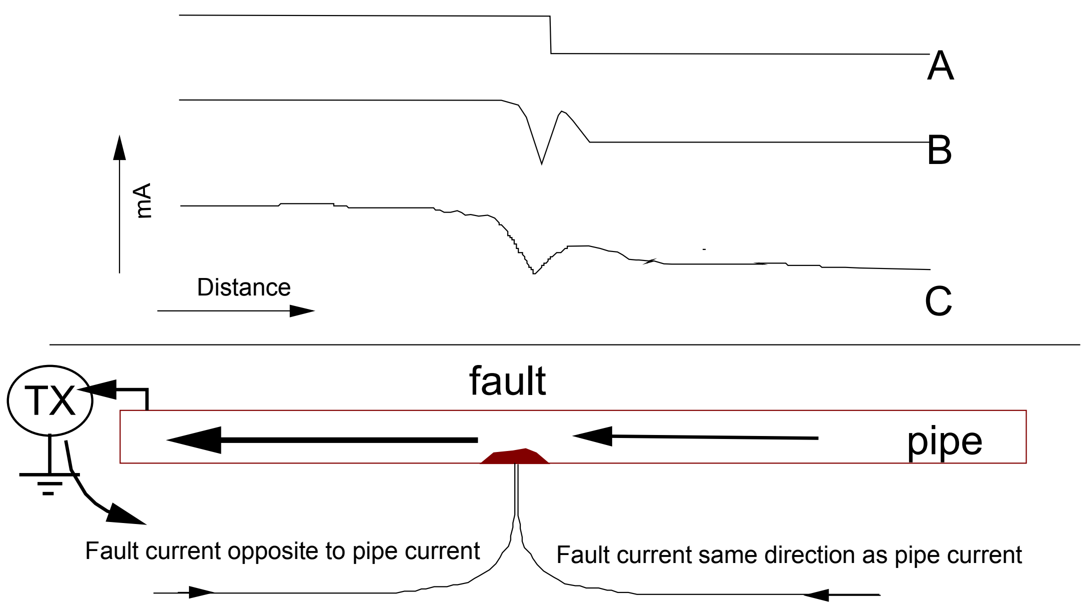
Interpretation of PCM Results

1 INTRODUCTION

The principle of the PCM is that the frequency used is so low (4Hz) that the effects of induced and capacitance coupling to other lines is reduced to almost zero. Also natural decay of the signal due to these effects is also reduced to almost zero.

It can be said therefore that the losses are due completely to resistive losses i.e. coating defects or contact to other structures.

2 INTERPRETING RESULTS FROM A SURVEY



Graph A
Shows what may be expected excluding any effects from fault currents. This is the ideal response and shows a loss of signal and a step response.

In practice the results obtained require some interpretation. This is because the signals received from the pipe, although far less prone to distortion, are effected by other signal paths in the ground. This is particularly the case at the point of coating defects.

Graph B
Shows the theoretical effects of the fault current in the ground. Note that the local fault current enters the pipe from both directions which distorts the magnetic field. Just before the fault the ground currents subtract from the pipe current and just after they add and is thus a local effect. Finally they settle to a steady state.

Graph C
Shows what would be expected in the real situation if PCM currents were plotted over a section of pipe with a coating defect.
This "zig zag" effect will spread over a range of say 2 to 10 meters either side of the fault depending on fault characteristics. This effect will be apparently worse when the survey is performed over just a few meters either side of a fault. This highlights the need to perform surveys over a complete section before attempting a more detailed survey of suspect areas.

The zig zag effect will vary depending on type and severity of fault. For instance there may be no zig zag effect if the fault is caused by a short to a structure, such as a pipe running across and at right angles to the surveyed pipe. (There may be some distortion of signal directly over the contact, but the zig zag effect will not be present due to the absence of ground current.)

4 SOURCES OF ERROR

As the PCM uses such a low frequency the sources of error are much reduced. However there are still certain circumstances that will create errors.

(a) Measurements taken near the transmitter anode bed or earth stake can be misleading. This is because all the signal current eventually finds it's way back to the earth stake or anode bed. The signal ground currents close to the transmitter are therefore significant and opposite to the pipe current.

The effect is that for the first 20 meters or so (depending on ground conditions) the measured current may increase. In fact the current on the pipe is probably at a constant level.

If it is necessary to survey this section of pipe it will be necessary to apply the transmitter at a different location and work back to this point.

(b) Errors due to locate (ELF/VLF) signal distortion can result in errors in 4Hz current measurement. This is because the 4Hz current measurement process relies on depth as measured by the VLF or ELF signal.

Always use the standard techniques to ensure measurements are valid such as confirming peak and null signals coincide and if in doubt check for field distortion by taking a depth reading and then raising the receiver a known height (say 1/2m) and confirming the depth measurement increases by the corresponding amount.

(c) Measurements at Ts, bends, abrupt change in depth etc. should be avoided as there will always be a degree of field distortion at these points.

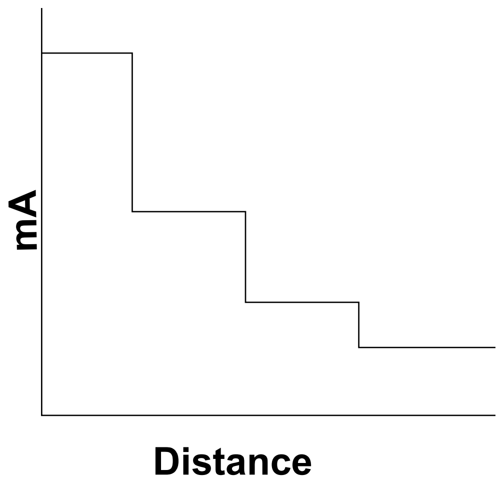
5 WHY dBmA?

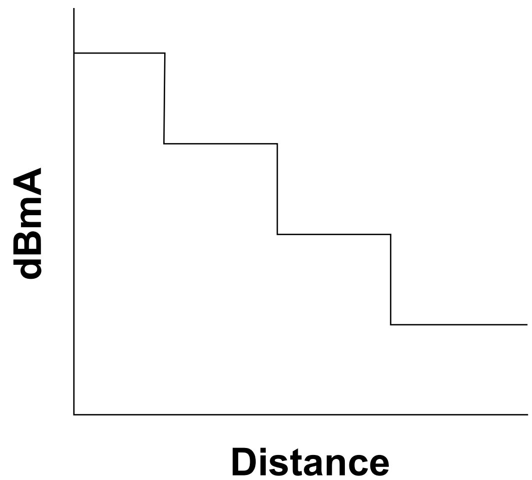
The PCM is capable or displaying current as Amps or dBmA. The advantage of displaying the readings as dBmA loss per distance is that the resulting graph is easier to analyse. (When logging results to the internal datalogger, both mA and dBmA are logged)

Taking a hypothetical situation where a pipe section has three faults of equal magnitude. One at the beginning, middle and one at the end. If the graphical results were to be represented using mA on the vertical scale the second and third faults would be shown as progressively smaller steps in the graph.

Using dBmA as the vertical scale would result in equal steps in the graph for equal size faults, regardless of how much current was lost at the first fault.

The graphs below show three equal faults and the effects on a graph showing mA and dBmA





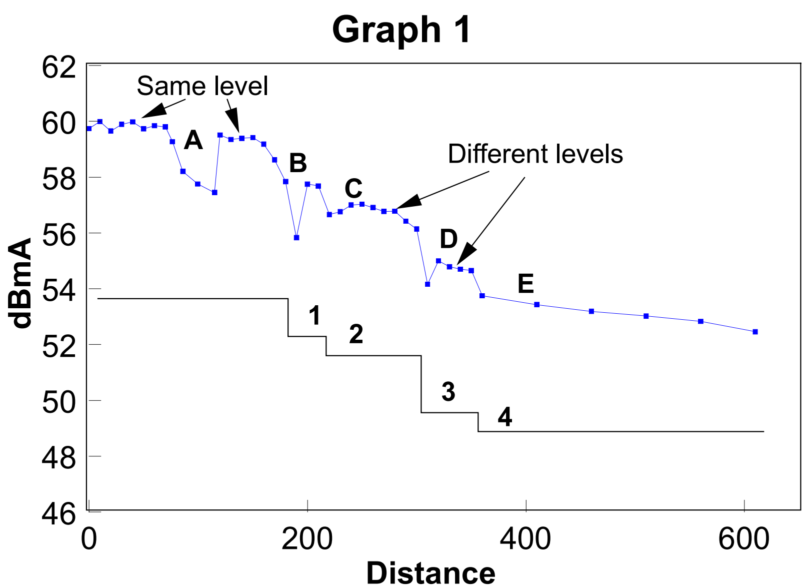
The graph showing mA at first glance suggests that the faults are of diminishing magnitude. The graph showing dBmA, clearly shows the magnitude of the faults are equal. Therefore dBmA shows the ratio of the faults, whereas mA alone may give rise to misinterpretation of data due to the high current loss near the transmitter and lower losses further away.

The following are two examples of data gathered during surveys:

Graph 1
The line marked 'A' to 'E' is the data collected, whilst the line '1' to '4' is the interpreted data.

At position 'A' the current falls and then returns to almost it's original level. This is probably due to field distortion of the locate signal and should be ignored or further investigation undertaken.

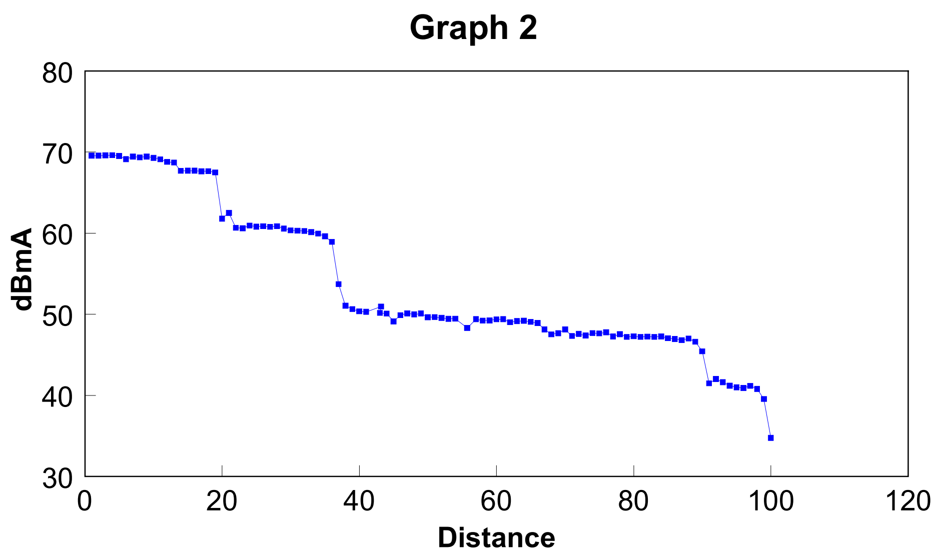
Steps 'B' to 'E' show definite steps (with some field distortion at the point of fault) and loss of signal. The recovered reading is less than the signal before the trouble.



Further investigations using the PCM A-Frame should now be undertaken so as to pinpoint the exact position of the faults.

Graph 2:

The following is again an example of a real survey, it shows the effects of branching, contacts to other structures give similar results. Each of the steps is branch in the pipeline. There is little distortion at the steps as there are no fault ground currents.



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