



Introduction

Cathodic Protection (CP) is applied to buried steel pipelines to complement the protection provided by pipe coating.

If the coating is damaged causing holidays, or if there is an electrical contact between the pipeline and another metal structure, it is necessary to increase the CP current to compensate for the resulting losses.

Excessive current can be detrimental to the pipe. The engineer responsible for the pipeline integrity must therefore achieve a fine balance between effective protection and acceptable current consumption.

If the current becomes excessive or the cathodic protection ineffective, the pipeline must be surveyed to search for the major faults. Radiodetection's Pipe Current Mapper (PCM) has been specifically designed to perform this function.

Shortcomings of commonly used traditional methods of surveying for faults:

The Line Drop Method

The potential gradient between two access points is measured and the current derived through calculation. This method is lengthy, complicated, costly and presents a significant risk of error in measurements and calculation.

The Pearson Method

Two electrodes are placed on the ground and used to detect the fault current. This method is personnel intensive and impractical in very dry soil conditions; it does not measure current losses, so cannot differentiate between minor and major faults.

The Current Gradient Method

A traditional pipe locator is used to detect an a.c. current (typically 1 kHz) applied to the pipeline.

Large signal losses are assumed to be due to large faults. In fact the losses are also due to capacitance losses along the pipeline, so faults are very often masked by the natural decay of the signal.

This current does not exactly mirror the CP d.c. current. The effect can be particularly misleading at pipeline branches. Capacitance losses also limit the length of pipeline that can be surveyed in one operation.



To Ground Bed

300 mA

700 mA

The Radiodetection PCM approach

The PCM has been designed to overcome the shortcomings of the existing techniques and now provides pipeline engineers with an accurate, cost-effective product that can be used in all weather and ground conditions.

An extremely low, "near d.c." frequency (4 Hz) is used to mirror as closely as possible the d.c. current generated by the cathodic protection. It also avoids signal losses caused by capacitance so nearly all the signal loss is due to coating faults or shorts to other structures.

Conventional pipe locators cannot practically detect such a low frequency, so the receiver is fitted with a precision, high performance magnetometer. This detects and measures the 4 Hz magnetic field. Advanced signal processing techniques filter and amplify the signal, so that push button current measurements (magnitude and direction) of the "near d.c." signal can be made.

Integral datalogging functions enable the storage of this data so that current loss versus distance can be plotted.



PCM Transmitter

The PCM system's high-powered transmitter makes long range signal detection possible up to 20 miles (32 km), therefore fewer hookups are required.

The transmitters flexible power requirements enable it to utilize the variety of supplies available at most transformer rectifier stations. This allows the transmitter to provide its full 150 W of output power over prolonged periods, without costly battery replacements. Hookup is a simple four wire connection procedure.

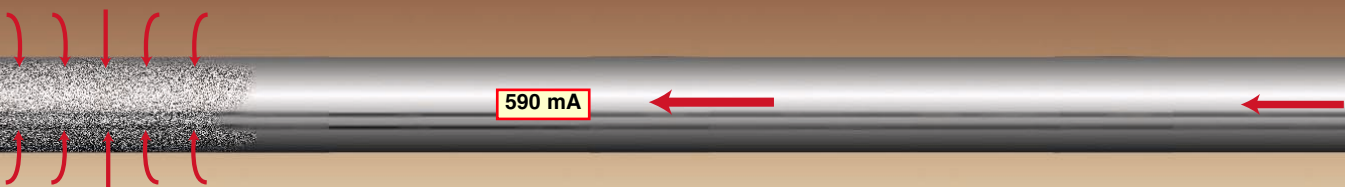
The transmitter has been designed to be compatible with both distribution and transmission networks.

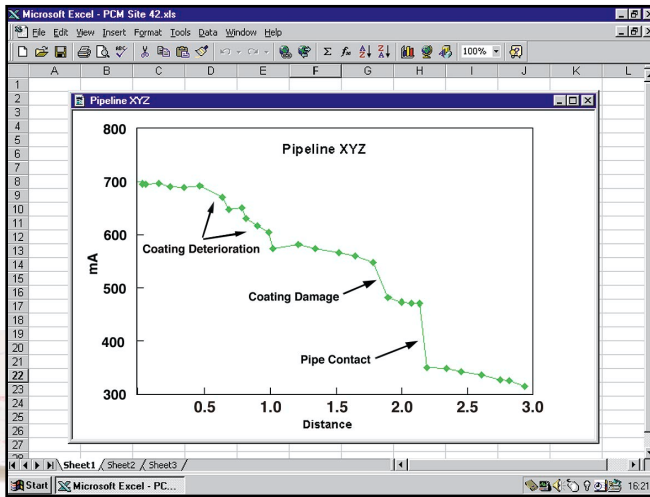
PCM Receiver

The hand held receiver unit first locates the pipeline, even in heavily congested areas, and then provides the operator with a measurement of current magnitude and direction of the near d.c. signal as applied by the system's transmitter.

The receiver makes the required calculations and displays the results at a single button press. The measurement can be stored, with a further button press, in the integral datalog. This provides the operator with a method that quickly troubleshoots the CP system by pinpointing metallic contacts and locating areas of coating defects.

Additional cable locate modes also allow the unit to be used as a traditional cable and pipe locator.





Signal entering the ground is detected through the A-Frame spikes and amplified by the receiver electronics. An arrow on the display points to the direction of the fault enabling quick and easy pinpointing.

GPS Compatibility

Global Positioning Systems (GPS) are becoming an affordable accessory to most survey equipment. The PCM has taken full advantage of this technology by providing an RS232 datalink in a standard format.



Data Analysis

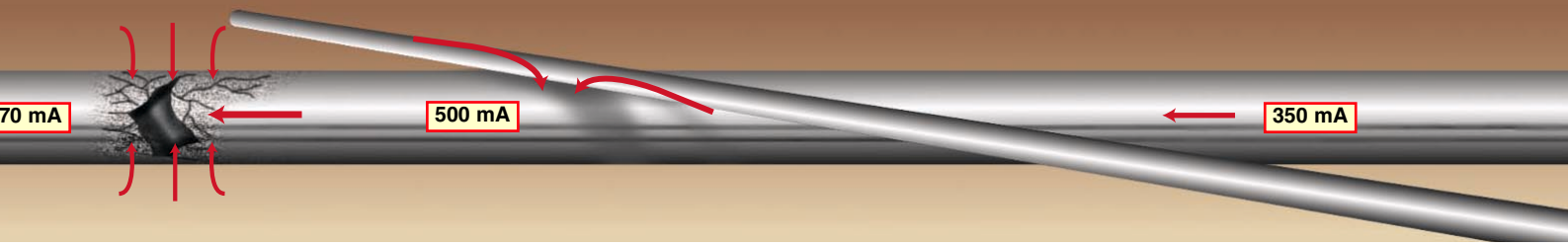
The PCM is provided with a simple to operate, Windows® based upload software package. The "Icon" operated software enables the uploading of the PCM data and automatic conversion to a text format. This is compatible with commercially available spreadsheet software packages.

A typical example relating to the pipe graphics is illustrated above.

The data collected by the PCM can be fed automatically to the GPS data logger so that positional information is recorded with PCM data. The result is an extremely efficient use of personnel. The data can then be used to plot graphs of the PCM current. Faults can be clearly identified with their position and imported into a Global Information System (GIS) so that pipeline maps can be generated.

Optional PCM Accessory A-Frame Attachment

Careful use of the PCM will give the location of coating faults to within just a few yards (metres). The addition of the optional A-Frame attachment enables the operator to pinpoint the fault to within a few inches (centimetres) keeping the excavation to a minimum.



PCM benefits

The PCM has been designed for the pipeline industry with support from Gas Industry leaders. It addresses problems associated with traditional methods of pipeline surveying by providing the following benefits:

- An accurate method of evaluating and mapping cathodic protection current losses.
- Current magnitude and direction measurements are made above surface without the need for connections to the ground or pipe.
- Near d.c signal mirrors closely the CP current.
- For use in all weather and ground conditions.
- One man operation.
- Indication of fault magnitude, hence avoiding unnecessary and costly excavations.
- High powered transmitter enables analysis from one transformer rectifier to the next.
- Transmitter can be powered from CP transformer eliminating need for batteries.
- Integral datalogging.
- RS232 interface allows uploading of data for graphical representation of records on site.
- GPS compatibility.
- Optional A-Frame accessory for accurately pinpointing coating defects.

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