



## Waikura Data Logger

SSEL Application Note 8

6 July, 2000

### Introduction

The Waikura Data Logger and is intended for recording the cathodic protection potential impressed on buried pipelines with respect to time.

### Background

The Waikura Data Logger is basically a 4-channel logger with fully differential inputs. It is supplied as either a 2 channel or a 4-channel device the only difference is how the software is configured and the logger calibrated, the size of the input plug and its wiring (4 and 7 pins respectively). The channel gain is set by series input resistors, and each channel is individually calibrated. Because of the limitation of the number of pins available in the input plug some compromises have been made.

- The 2-channel logger has both negative inputs connected to the ground pin effectively converting the logger to have 2 single ended (non-differential) inputs.
- In the 4-channel device 3 channels share a common negative input pin and the 100 mV input shares its negative input with logger common.

These compromises are in fact seldom a problem, as in real life, multi channel CP measurements often share a common reference point. The pipe itself is an excellent reference point from which to take measurements as it has a very low source resistance. Steel is a good conductor and the cross sectional area is very large so the voltage varies very little with distance along it.

### Applications

Many connections are possible, the examples given demonstrate some possibilities and point out some potential problems.

#### Single channel CP Potential

This is the simplest connection possible, in the case of two-channel logger the pipe is connected to pin A and the half cell to pin C. In the case of the 4 channel logger, the pipe is connected to pin A (the common) and the half-cell to pin B Channel 1. The voltage recorded is called the "Half Cell Voltage" and it is positive.

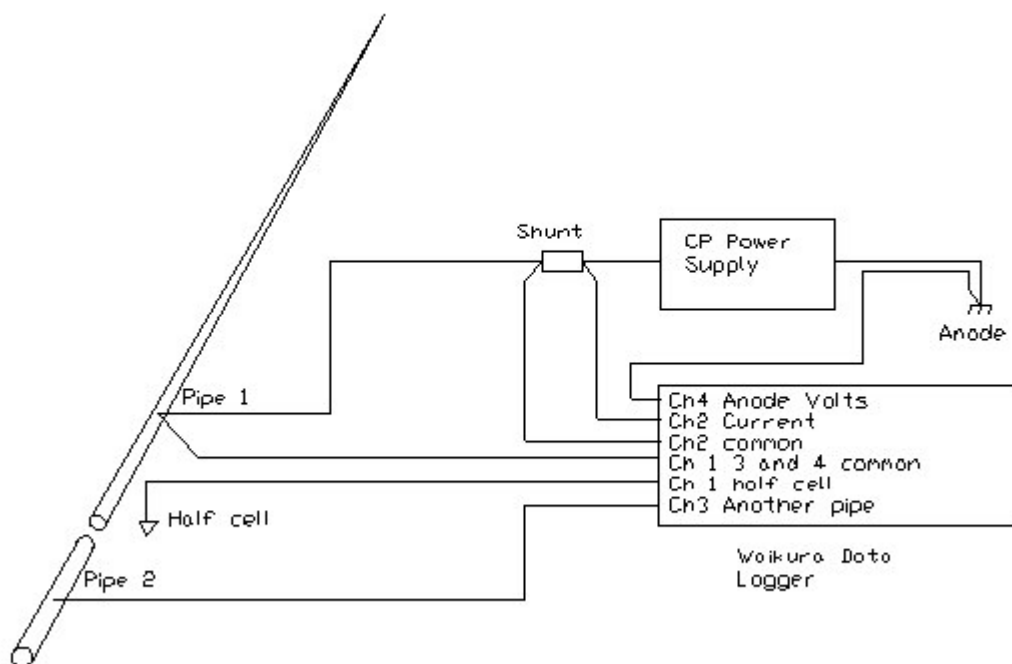
#### Two or three channel CP potential

Using the 4 Channel logger the actual CP voltage on up to 3 pipes may be logged. In this case the half-cell is considered the reference and connected to pin A, the three pipes are connected to channels 1, 3 and 4 respectively. As Channel 4 has a full-scale capability of over 100 volts the resolution is not as good as Channels 1 and 3 but at 24 mV will still give useful results. In this case all the voltages are recorded as negative and should be referred to as the "Pipe Voltage".

## Two Channel CP, Anode Voltage and Current

The circuit below shows how these 4 values may be logged accurately using the differential capabilities of the 4-channel logger.

- The circuit shows “Kelvin” connections to the points of measurement. This technique removes the errors in measurement due to current flowing in the cables. It is usually difficult to run sensing cables to the anode and the pipe as shown so connection must be made to the cables as they exit the CP power supply. If this is done either the error is accepted or compensated for in post processing in a spreadsheet. For this calculation to be done the resistance of the cable must be measured or calculated and Ohms law applied.
- The half-cell must be located close to the pipe and as far away from the anode as possible to avoid errors due to voltage gradients in the ground due to the anode current.
- As shown the pipe current will be recorded as a negative value. The wires to the shunt may be reversed to correct this without bad effects.
- The Voltage on pipe 2 will be recorded with respect to pipe 1. If the actual CP voltage on pipe 2 is required it may be calculated by post processing in a spreadsheet.
- Channel 3 could be used to measure the parasitic AC Voltage on Pipe 1 by connecting the input of a Waikura Rectifier to the pipe and the half cell, and the output to channel 3.



## Connections:

### 2 Channel Logger

Analogue Socket:	function	White sheathed Cable colour	2M long
A	Common for inputs and stop/start switch and RS232	Green	
B	Current input (+-150 mV)	Yellow	
C	Voltage input (+-10 V)	Red	
D	Hardware Stop/start switch (closed = stop)	Blue	

### 4 Channel Logger

Analogue Socket:	function	
A	Common for channels 1,3 and 4	Black
B	Channel 1 Voltage input (+-10 V)	Brown
E	Channel 2 Current input (+-150 mV)	Red
C	Channel 3 Voltage input (+-10 V)	Orange
D	Channel 4 Voltage input (+-100 V)	Yellow
G	Channel 2 and Stop/start switch common	Green
F	Hardware Stop/start switch (closed = stop)	Blue

## Notes

The common mode rejection ratio is not high, so to avoid significant errors the voltage between channel 2 common and channels 1 3 and 4 common, should be kept to less than 1 volt.

If channel 2 is not used it is advisable to connect its common to channels 1 3 and 4 common to reduce noise. That is, join pins A and G together.

The case is isolated from the internal wiring.