Tasmania Department of Mines—Unpublished Report 1989/01

Unidata installation on a landslip at Taroona.

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Abstract

Distortion of the Channel Highway near the entrance to the Taroona school complex indicates land movement in the area. A concrete retaining wall is cracked near the head of the land movement. A strain gauge was installed across this crack to monitor the land movement. Details of the installation, support hardware, and software needed to service the installation are discussed.

INTRODUCTION

Ground movements have affected the Channel Highway near the entrance to the Taroona school complex for at least a decade. Recent distortions in the roadway posed a potential hazard to motorists and prior to corrective measures, an inspection of the area was undertaken. The culvert beneath the roadway was distressed, with cracking and movement on at least one joint. A large diameter drainage pipe between house numbers 147 and 149 Channel Highway was similarly affected. Tests pits in the roadway revealed at least 500 mm of corrective hotmix and other road building material.

The area appears to be subject to land movement. Restoration of location and level monitoring pegs installed in 1977, and a re-survey of same in 1988, suggests that the 1977 survey line has moved downslope as a block. Two landslides are present near the foreshore north of the high school buildings.

A concrete retaining wall occurs on the boundary between house numbers 147 and 149 Channel Highway. The wall is cracked, and movement of the wall is indicated by a change in attitude of the palings of a paling fence erected on top of it. One crack is located at the head of any visible land movements. To monitor the rate of land movement, a strain gauge was placed across this crack.

INSTALLATION

The strain gauge measures movement, or put another way, the width of the crack between two anchor points on the concrete wall. If the movement of the wall is up or down, this movement can also be interpreted as a downslope movement. Thus care must be taken when interpreting the results. It is suggested that the interpreter consult the surveyor when processing the data (see Figure 1 for site location).

The UNIDATA recorder is situated next to the strain gauge inside a grey enclosure with UNIDATA printed on the lid. A special triangular key is required to open the lid to service the unit (explained in Sedgman, 1988). Power to the unit is supplied via a power point from the kitchen of number 147 Channel Highway. The power supply to the strain gauge is separate from the main supply, and is located next to the Unidata recorder on the retaining wall. This unit also has the strain gauge amplifier, calibration, and offset adjustments (these should never have to be altered).

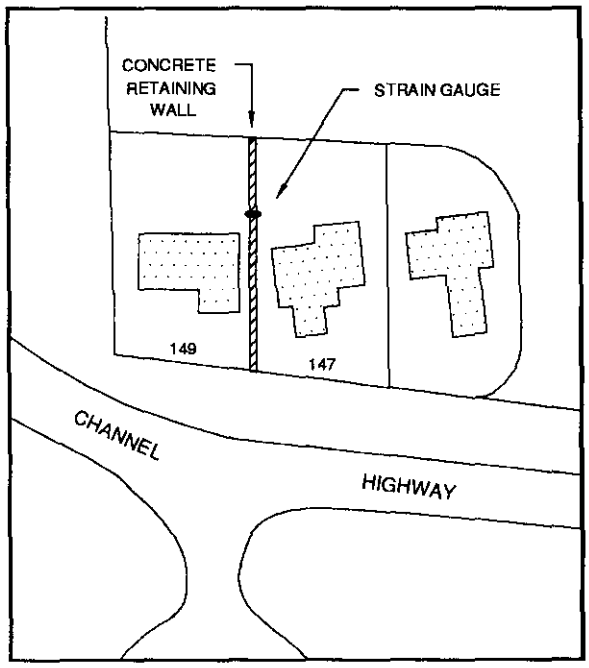


Figure 1. *Location of Unidata installation, Channel Highway, Taroona*

Data are recorded at three-hour intervals. All strain measurements are averaged over this period. A description of the program which controls the data logger is given in Appendix 2.

MAINTENANCE

The installation should be serviced by the Toshiba laptop computer at least once every six weeks or so, as the battery within the data logger can be drained and data stored over this period would be lost.

To carry out any electrical or mechanical maintenance you require a multimeter, screw drivers, and a pair of shifting spanners. Remove the lid of the enclosure and connect the negative lead of the multimeter to pin 41. To measure the output for the strain gauge, connect the positive probe to pin 39 on the termination strip.

CIRCUIT CONNECTIONS

Transducer	*Termination strip pin No.*
Strain gauge	Signal 39, power external (40) Ground 41.

Maintenance requirements are as follows:

1: *Effect*—Strain gauge readings go off scale.

Remedy—Adjust the threaded rod assembly until the reading is 1.25 volts on the multimeter.

2: *Effect*—Periodic breaks in readings.

Remedy—Check power supply for possible break down or power switch turned off.

REFERENCES

SEDGMAN, R. J. 1988. Unidata installation at S. Pickett's house, Windermere Road, Windermere. *Unpubl. Rep. Dep. Mines Tasm.* 1988/26.

Radio Spares Data notes March 1988, section 6684.

Unidata Handbook version 1.8

[3 March 1989]

APPENDIX 1

Strain gauge

To measure strain it was decided to use what is called a proving ring. This consists of four strain gauges mounted on an aluminium ring (two on opposite external sides, and two on opposite internal sides) (see fig. 2). An amplifier, which gives an output of 0 to 2.55 volts, is required to give an output which is suitable for measuring with the Unidata loggers. The one chosen was the Radio Spares type 308-815 (see fig. 3 for construction details).

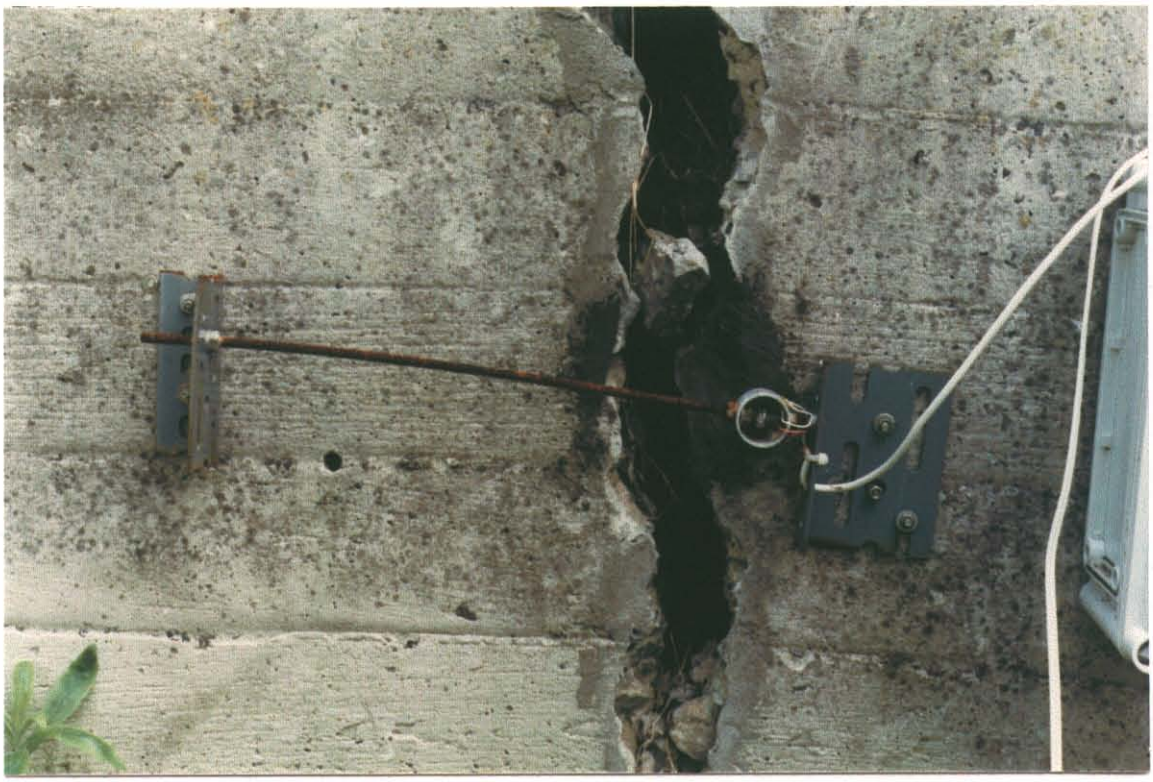


Figure 2. *Proving ring, Taroona Unidata installation.*

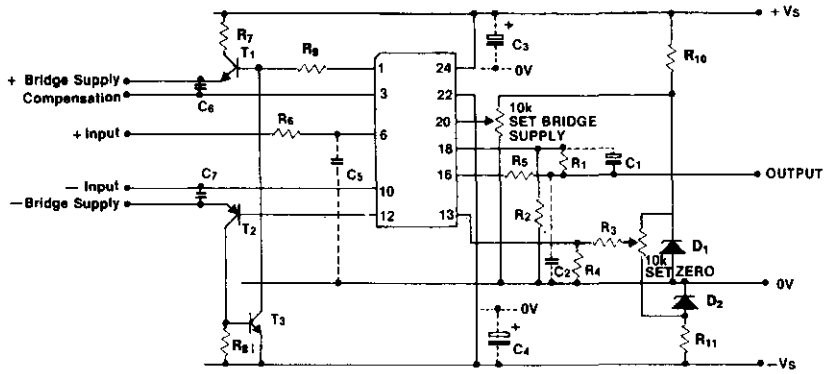
6604

Specification

(At 25°C ambient and ±12V supply unless otherwise stated.)

Supply voltage	±2 to ±20V dc
Input offset voltage	1mV max
Input offset voltage/temperature	1μV/°C max
Input offset voltage/supply	5μV/V max
Input offset voltage/time	1μV/month max
Input impedance	>2.5MΩ min
Input noise voltage	1μVp.p max
Band width (unity gain)	400kHz
Output current	5mA
Output voltage span	±(V_s-3)V
Closed loop gain (adjustable)	5 to 10,000
Open loop gain	>100dB
Common mode rejection ratio	>100dB
Bridge supply voltage/temperature	20μV/°C
Maximum bridge supply current	12mA
Power dissipation	0.5W
Warm up time	5mins
Operating temperature range	−25°C to +85°C

Basic circuit for printed circuit board 435-692 (gain approx. 1000).



Component values

R_1 100k	R_7 47R	C_2, C_5 10n (typ.)
R_2 100R	R_8 10R	C_3, C_4 10μ(tant.)
R_3 100k*	R_9 1k0	T_1 BD 135
R_4 68R*	R_{10} 680R	T_2 BD 136
R_5 10R	R_{11} 680R	T_3 BC 108
R_6 100R(typ.)	C_1, C_6, C_7 100n (typ.)	D_1, D_2 1N827

A glass fibre printed circuit board, stock number 435-692, is available for the basic circuit as given in Figure 7.

The board is 46 x 98mm in size and is complete with screen printed component identification and a solder mask.

Only typical values are given for certain components, as adjustment of these values may be necessary in specific applications to obtain optimum noise reduction (see Minimisation of Noise, page 5).

*R_3 and R_4 values may be adjusted to alter the zero adjustment range when compensating for bridge imbalance.

Notes:

Gain is defined as $1 + \frac{R_1}{R_2}$

Zero adjustment range $\pm 6.2 \times \frac{R_4}{R_3 + R_4}$ Volts

Total bridge supply = 2 × bridge ref input (pin 20)

C_5 may be omitted for input lead lengths of less than 10 metres.

T_1 and T_2 provide bridge currents up to 60mA and should be kept away from the amplifier.

T_3 and R_5 provide current limit of approx 60mA.

Where high stability power supplies are being used zero and bridge supply reference may be taken direct from the power rails.

Figure 3. *Construction details of amplifier*

APPENDIX 2

Scheme definition

Scheme BDWTRN, Title: Strain gauge measurement

Communication port: 1

Access form: 1

Logger size: 8K

Logger cycle rate: 5 seconds

Log interval: 180 minutes

Instument: 6801 measuring strain gauge

Log a0 as AV disp, being strain gauge

Total 1 entries, 1 bytes logged, 6656 log entries giving a maximum logging time of 832 days, 0 hours

LOTUS file generated

Printout to screen

Plot 2

Figure 4. *Taroona Unidata installation.*