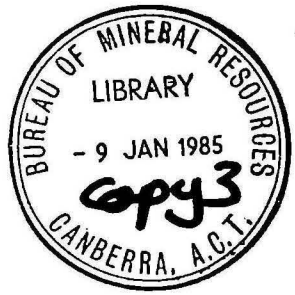

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD 1984/37

RECORD

MACQUARIE ISLAND GEOPHYSICAL OBSERVATORY

REPORT

OCTOBER 1982 - JANUARY 1983

by

Barry J. Page

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SUMMARY

The magnetic and seismological observatories at Macquarie Island were operated during the southern summer of 1982/83 by a relief officer from Mundaring Geophysical Observatory.

There were no significant interuptions to the standard programs, and preliminary data were sent to Australia for distribution overseas.

1. INTRODUCTION

The Macquarie Island Geophysical Observatory is operated by a geophysicist from the Geomagnetism and Seismology Section, Bureau of Mineral Resources, Geology and Geophysics (BMR). The observatory program comprises geomagnetic and seismological observations, and is part of the scientific operations of the Australian National Antarctic Research Expeditions (ANARE); logistic support is supplied by Antarctic Division, Department of Science and Technology. Observatory data are given in Table 1 and a brief history in the Appendix.

An observer was recruited for 1983 but withdrew for personal reasons shortly before the departure date. It was therefore necessary to send a temporary observer for the 1982/83 (southern) summer. The author took over the observatory as observer-in-charge from Ian Ferguson on 26 October 1982 and was relieved by Peta Kelsey on 26 January 1983.

The magnetograph comprised three variometers and a normal-run recorder. The resulting photographic record was processed daily. Twice-weekly absolute magnetic observations were made and a telex was forwarded to BMR Canberra at the end of each month reporting preliminary results.

The seismograph comprised a short-period vertical component seismometer and a visual recorder. Preliminary phase data were telexed at the beginning of each week to BMR Canberra via the Antarctic Division and to the French station Dumont d'Urville on the Antarctic continent.

2. GEOMAGNETIC OBSERVATORY

Figure 1 shows the dimensions and dispositions of the magnetograph piers in the variometer room. It is planned to install BMR electronic variometers (PEM-1) on the northern piers in 1984. The normal magnetograph occupies the southern piers.

La Cour magnetograph (20mm/hour)

The La Cour magnetograph functioned satisfactorily throughout the summer with only half an hour record loss when the above measurements were made.

The vertical intensity (Z) and horizontal intensity (H) baseline values remained constant throughout the summer. Observed baseline values are listed in Table 6. H, D, Z and T scale values were constant and are listed in Table 4.

The temperature coefficients were the same as for the first nine months of 1982. They were zero for D and Z, and 3.0 nT/deg C for H.

Parallax corrections were zero for H and Z, and -1.8 for D, for the summer period.

Orientation tests. No orientation tests were made during the report period

Magnetometers

Absolute instruments, were used twice-weekly as follows:

H: (1 observation each QHMs 177 (standard) 178, 179

MACQUARIE ISLAND VARIOMETER ROOM NOV. 82

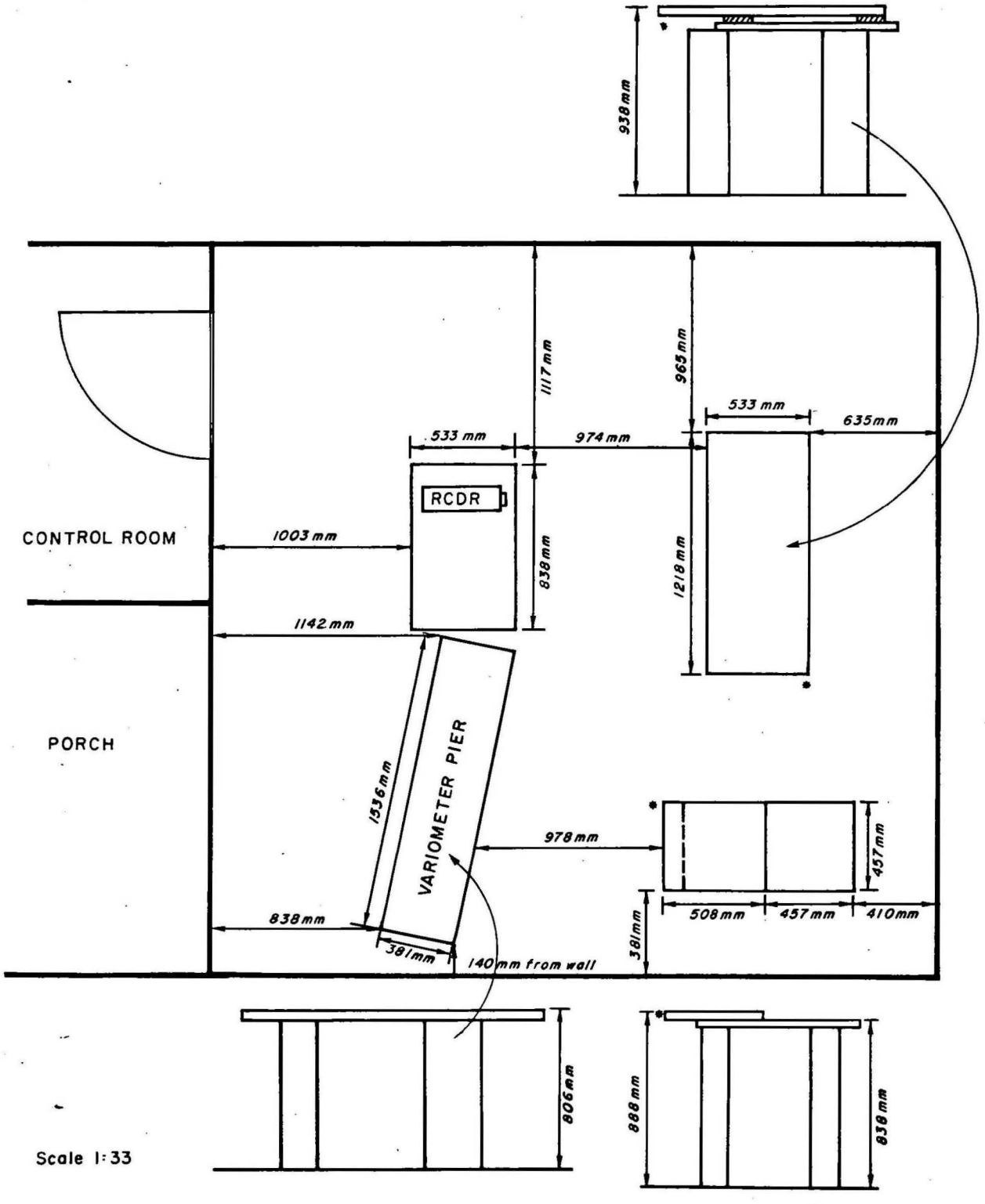

Fig.1

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D: (2 observations) Askania declinometer 640506 and circle 640616

F: (2 observations) PPM MNS2/2

Table 3 gives the preliminary instrument corrections.

Observations for H and D were carried out on pier E, and the detecting head for the MNS2 was set on pier W. As previously the F pier-difference was taken as zero (Davies, 1981). The vertical intensity (Zp) and Z-baseline values were derived from the PPM F readings and H, based on the previous month's H-baseline value.

The operation of the MNS2/2 was affected by a modification made in October 1982. Replacement components used were the best available at the time: the effect on the operation of the equipment was that several minutes had to elapse before the instrument readings stabilised. The sensor head fluid (water) was exchanged for kerosene on 19 January 1983.

Results from declinometer 640506 showed similar scatter in the D-baseline values as was obtained in 1981 with declinometer 640505 (Thomas, 1982). The three QHM's gave no trouble.

Data and results

K indices and preliminary monthly mean values for H, D and Z are included in Tabel 2; Table 5 lists the geomagnetic annual mean values and secular change from 1972 to 1982.

3. SEISMOLOGICAL OBSERVATORY

The seismograph consisted of a short-period vertical (SP-Z) Willmore Mark II seismometer (free period 1.0s), a seismometer control box, an AS320 preamplifier feeding an analog signal via cable to an AR311 power amplifier situated in the Science Block. This amplifier drove a hot pen mounted on a modified Geotech R11 recorder. Primary timing was supplied from Upper Atmospheric Physics laboratory clock, a Systron Donner. A secondary timing system (GED clock) was installed in November but was never required. A further back-up to the timing system was a Mercer chronometer. The GED clock supplied an accurate 50 Hz synchronising signal to an inverter which supplied power to the seismic recording drum, magnetograph recorder and magnetograph lamp supply.

The primary timing (UAP) was kept to within 7ms per day. Radio timemarks from VNG were available for comparison purposes. Minor modifications were necessary to the timing circuitry to accommodate the replacement GED clock. A block diagram of the timing system is given in Figures 2 and 3.

The seismogram was changed and a calibration pulse applied daily, at 00 UTC. Preliminary P-wave arrival times were telexed weekly to BMR Canberra and to the French Antarctic station Dumont d'Urville.

The preamplifier was changed on 28 January 1983 and an EA310 was installed in its place. The exchanged AS320 was returned to Canberra to be used as a spare for telemetry stations.

MACQUARIE ISLAND TIMING SYSTEM

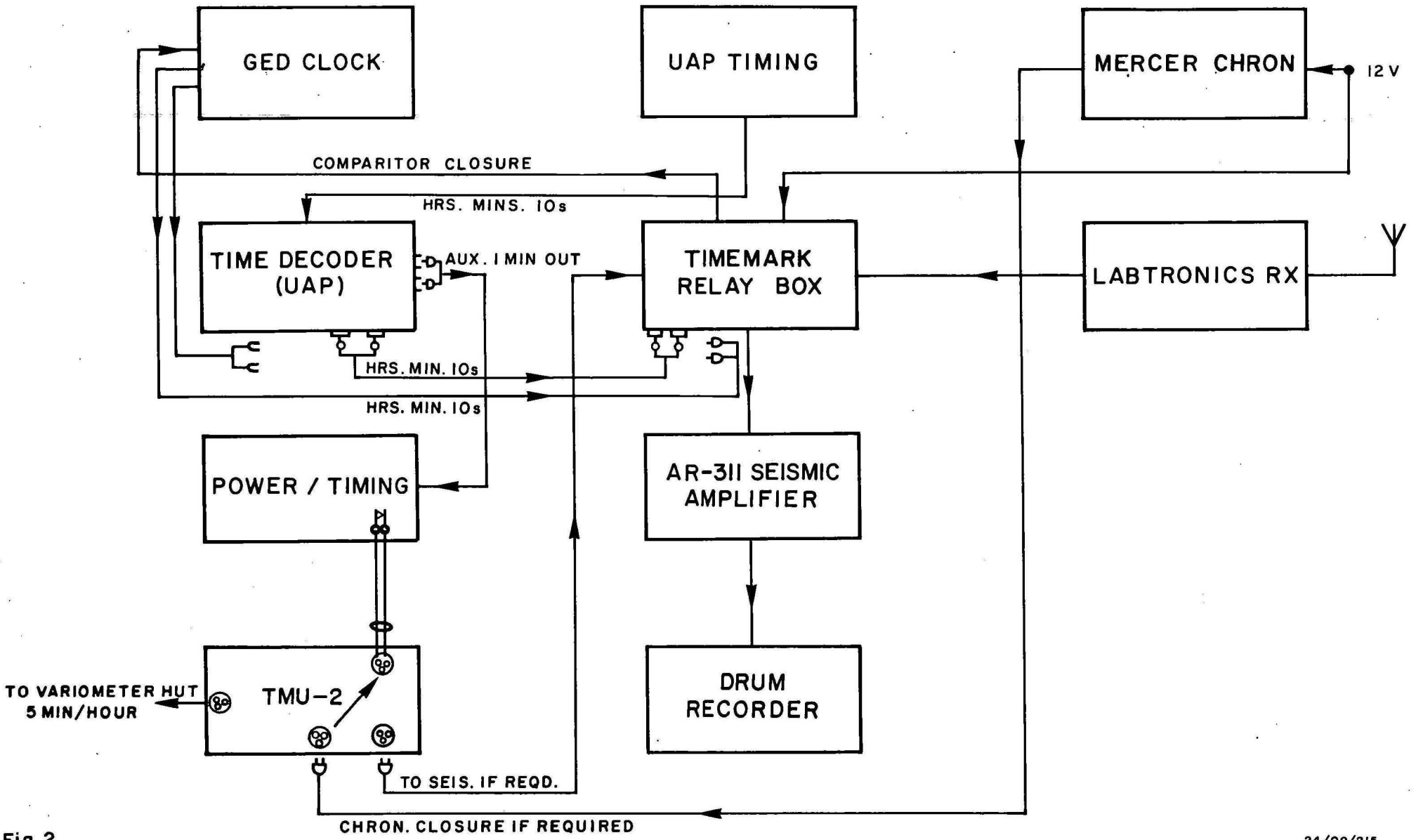

Fig. 2

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MACQUARIE TIMEMARK RELAY BOX

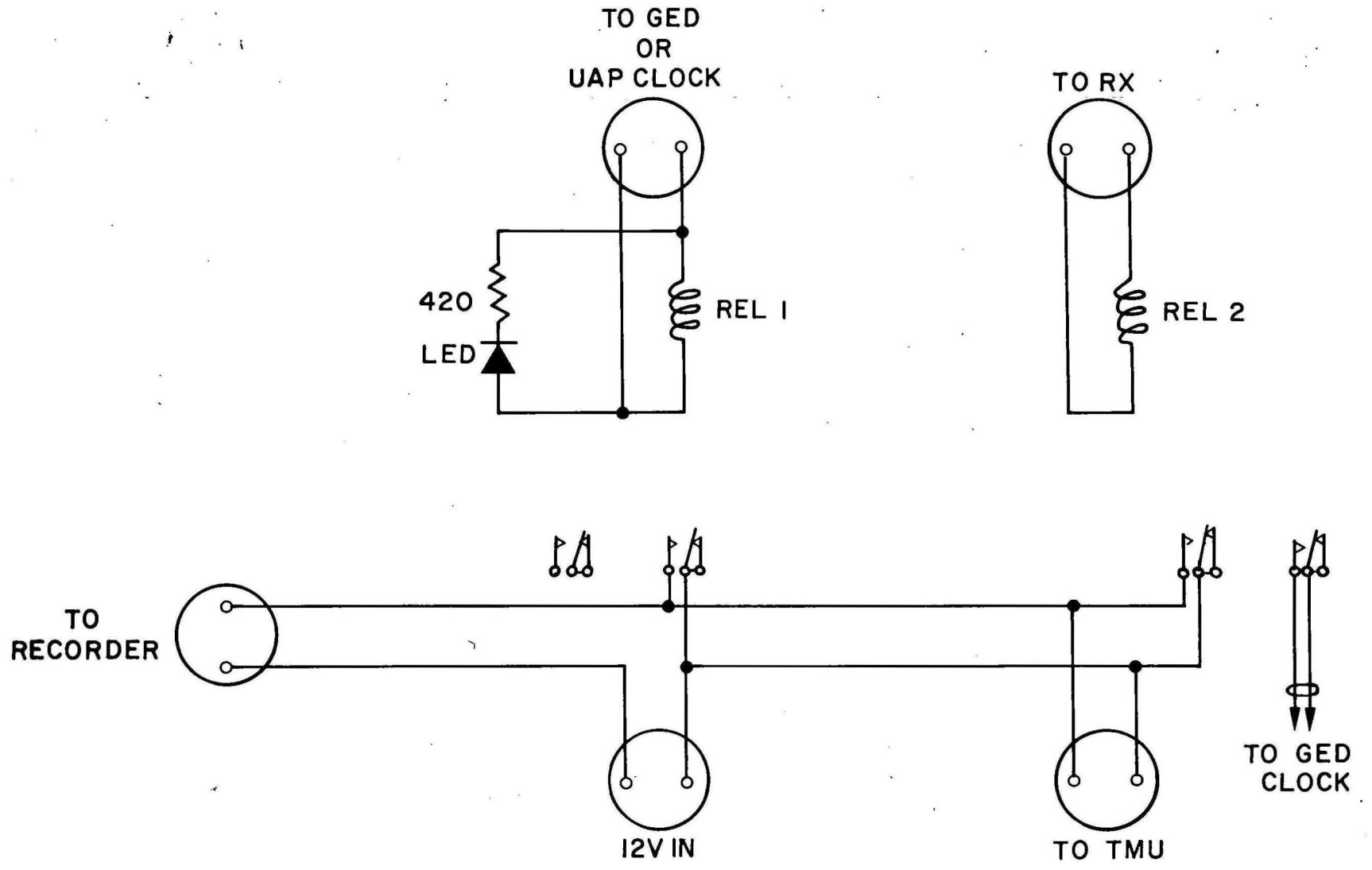

Fig.3

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4. CONTROL EQUIPMENT

The power and timing equipment is located in a room off one end of the Geolab in the Science Block. From here underground cables carry signals to an from the variometer hut and the seismograph vault. The EA310 amplifier is run from two 12-volt wet cells which are trickle charged continuously. A separate battery room in the Science Block is connected by cabling to the instrument room. The Battery Room is shared with the Upper Atmospheric Physics Group.

On 18 December 1982 the GED clock and inverter failed for reasons unknown. The inverter was restored, but the clock required components which were not held as spares. The affected circuitry (display) remained unserviceable for the duration of the summer. A replacement clock arrived on the relief ship.

ANARE radio transmission affected the operation of MC01 magnetograph calibrator and seismograph. The effect on the MC01 was unstable current readings and on the seismograph, pen deflections of 1 or 2 millimetres. These problems were overcome by arranging calibrations during periods of radio silence.

All other equipment operated satisfactorily with no major faults.

5. BUILDING MAINTENANCE

No major building maintenance was undertaken during the summer. Assistance was given with the recladding of some of the Nissen Huts.

The damage sustained by the variometer hut during the September 1982 airdrop was not repaired but repair materials were ordered. The resulting dampness on the western wall was minimal.

Battens were nailed around the base of the Absolute Hut in an attempt to keep seal pups from bumping the observation pier.

The carpenter renewed the door hinges on the Absolute Hut.

6. OTHER DUTIES

Additional duties such as regular Saturday busy-bee jobs, slushie duties, occasional cooking and garbage runs were carried out. Technical assistance was given to the UAP engineer and physicist at times.

7. ACKNOWLEDGEMENTS

Thanks go to all members of the 1982/83 expedition for their support and good company over the summer. In particular I wish to thank the UAP members Mike Craven (physicist) and Chris Eavis (engineer) for changing records whilst I was down the island.

8. REFERENCES

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THOMAS, G.H.Y., 1982 - Macquarie Island Geophysical Observatory, October 1981-January 1982. *Bureau of Mineral Resources, Geology and Geophysics, Australia, Record* 1982/36.

APPENDIX

GEOPHYSICAL OBSERVATORY HISTORY

MACQUARIE ISLAND

Building

1948 - Start of ANARE station on Macquarie Island.
1949 - Seismograph Hut constructed - included Geophysics Office.
1950 - Magnetic Variometer Hut erected.
- Magnetic Absolute Hut erected.
1968 - Geophysics Office constructed.
1979 - Science building constructed - included Geophysics Office, Upper Atmospheric Physics Laboratory and office for the Officer-in-Charge.

Seismological Observatory (Station MCQ)

1950 - Wood-Anderson seismograph (SP-N, E) installed.
1953 Dec - Replacement Wood-Anderson (SP-N, E) seismograph installed.
1956 Feb - Grenet SP-Z seismograph installed.
1961 Jan - Benioff SP-Z, N, E seismograph installed; Grenet and Wood-Anderson seismographs, withdrawn.
1962 Nov - Benioff SP-N, E withdrawn.
1967 Dec - Willmore Mark I SP-Z used to test sites near Seismic Hut and then installed; Benioff SP-Z withdrawn.
1969 Dec - Willmore Mark I SP-Z was replaced by a Willmore Mark II SP-Z.
1972 - Plateau seismograph (MQI), SP-Z installed.
1973 Jan - Willmore Mark II SP-Z was returned to Australia replaced by a Willmore Mark I.
1973 Nov - Plateau station (MQI) abandoned.
1975 - Noise tests of sites on Wireless Hill.
1976 - Willmore Mark II SP-Z re-instated; Mark I SP-N installed.
1979 - SP-N discontinued.
1981 Dec - Photographic Visual recorder installed.

Magnetic Observatory (Variometer Hut)

1950 Aug - Watts H variograph number 61911 was installed. Scale value was 8.5nT/mm.
1951 - Watts H variograph returned to Australia. Three-component normal La Cour magnetograph installed. Scale values - H, 12 nT/mm; D, 0.9'/mm; Z, 13 nT/mm.
1952 Apr 07 - Commencement of calibrated three-component recordings.
1960 Apr - Three-component insensitive La Cour magnetograph installed. Scale values - H, 63 nT/mm; D, 2.25'/mm; Z, 59 nT/mm.
1962 Dec - Normal La Cour magnetograph was replaced by a La Cour rapid run magnetograph (180 mm/hr). The insensitive La Cour magnetograph converted to 'normal' operation.

Scale values:

	Before Normal	After Rapid-run	Before Insensitive	After Normal
H (nT/mm)	12.6	5.4	63	24.6
D ('/mm)	0.92	1.03	2.35	2.35
Z (nT/mm)	14.2	5.3	59	20.6

1968 Feb 26 - D-fibre was replaced in an attempt to reduce erratic drift.
1968 Mar 09 - H-fibre was replaced - scatter and drift continued; scale value was reduced to 23.7 nT/mm.
1970 Feb 01 - H-fibre was replaced in the normal magnetograph. This reduced the H scale value to 19.3 nT/mm, and eliminated steep drift.
1978 Feb 15 - Rapid-run recording ceased.

TABLE 1
STATION DATA FOR MACQUARIE ISLAND, 1982

	Magnetic Absolute Hut	Seismograph Station (MCQ)
Geographic - latitude	54° 30.0'S	54° 29.9'S
- longitude	158° 57.0'E	158° 57.4'E
Geomagnetic - latitude	-61.1°	
- longitude	243.1°	
Elevation (m)	8	14
Foundation	Basalt	Basalt

TABLE 2
PRELIMINARY MEAN MONTHLY VALUES AND K-INDICES, 1982

	H nT	D(East) °	'	Z nT	F nT	K
January	12679	28	39.2	63703	64953	2.9
February	12653	28	44.5	63734	64978	4.7
March	12672	28	47.2	63705	64953	2.8
April	12661	28	48.4	63712	64958	3.3
May	12675	28	48.6	63706	64955	2.6
June	12676	28	48.4	63711	64960	3.2
July	12673	28	48.5	63710	64958	3.5
August	12660	28	50.1	63709	64955	3.3
September	12645	28	50.3	63716	64958	4.0
October	12651	28	49.6	63706	64950	3.5
November	12662	28	51.0	63710	64956	3.5
December	12666	28	50.0	63696	64943	3.7
Mean	12655	28	48.0	63710	64956	3.4

TABLE 3
PRELIMINARY INSTRUMENT CORRECTIONS, MACQUARIE ISLAND, 1982

Magnetometer	Correction at H = 12665nT	Correction
QHM 177	-13	-0.00103
QHM 178	- 4	-0.00032
QHM 179	- 3	-0.00024
Askania Dec 640505	0	-
Askania Dec 640506	0	-
MNS2/2	0	-

TABLE 4
MAGNETOGRAPH PARAMETERS, 1982

Component	Scale Value	Temp Co-efficient	Calibration Current	Coil Constant
Normal				
H Jan 01-Jun 14	19.37 nT/mm	3.0 nT/°C	60 mA	8.04 nT/mA
Jun 14-Dec 31	19.22 nT/mm			
D	2.38 min/mm	0	20 mA	8.04 nT/mA
Z	21.14 nT/mm	0	40 mA	7.49 nT/mA
T	1.42°C /mm	0.931 nT/°C	-	-

TABLE 5
GEOMAGNETIC ANNUAL MEAN VALUES
AND SECULAR CHANGE, 1972-1982

YEAR	D(E) ° '	I ° '	H nT	X nT	Y nT	Z nT	F nT
1972	27 22.1	-78 34.4	12937	11489	5947	-64008	65303
	(4.5)	(-1.6)	(-32)	(-38)	(+ 4)	(+23)	(-29)
1973	27 27.6	-78 35.8	12905	11451	5951	-63985	65273
	(6.7)	(-1.8)	(-40)	(-47)	(+ 4)	(+29)	(-36)
1974	27 34.3	-78 37.6	12865	11404	5955	-63956	65237
	(8.9)	(-0.6)	(-18)	(-31)	(+21)	(+30)	(-33)
1975	27 43.2	-78 38.2	12847	11373	5976	-63926	65204
	(8.4)	(-0.9)	(-25)	(-37)	(+16)	(+35)	(-39)
1976	27 51.6	-78 39.1	12822	11336	5992	-63891	65165
	(8.2)	(-0.8)	(-20)	(-32)	(+18)	(+30)	(-33)
1977	27 59.8	-78 39.9	12802	11304	6010	-63861	65132
	(11.5)	(-1.2)	(-29)	(-46)	(+24)	(+23)	(-29)
1978	28 11.3	-78 41.1	12773	11258	6034	-63838	65103
	(8.3)	(-1.1)	(-28)	(-39)	(+13)	(+31)	(-36)
1979	28 19.6	-78 42.3	12745	11219	6047	-63807	65067
	(9.2)	(-0.7)	(-22)	(-34)	(+20)	(+39)	(-42)
1980	28 28.8	-78 43.0	12723	11183	6067	-63768	65025
	(8.8)	(-0.4)	(-36)	(-37)	(+21)	(+33)	(-40)
1981	28 37.6	-78 44.6	12687	11136	6078	-63735	64985
	(10.4)	(-0.6)	(-22)	(-38)	(+23)	(+25)	(-29)
1982	28 48.0	-78 45.2	12665	11098	6101	-63710	64956

TABLE 6
OBSERVED MEAN BASELINE VALUES, 1982

Date	UT h	UT m	Baseline	Remarks
Horizontal Intensity			BHs (nT)	
Jan 01	00	00	12421	
Jan 25	00	00	12406	Adjustment
Feb 02	05	00	12213	Earthquake
Feb 11	07	00	12769	Adjustment
May 22	03	00	12710	Earthquake
Jun 09	23	00	13320	Adjustment
Jun 16	00	00	12499	Adjustment
Declination			BD(E)	
Jan 01	00	00	26° 52.6'	
Feb 01	00	00	26° 56.2'	Declinometer changed
Oct 25	00	00	26° 58.1'	Drift
Vertical Intensity			BZs* (nT)	
Jan 01	00	00	63535	
Jan 25	00	00	63549	Adjustment
Jun 27	16	00	63544	Earthquake
Jul 07	11	00	63550	Earthquake
Temperature			BT °C	
Jan 01	00	00	-80.4	
Jan 25	00	00	-79.3	Adjustment
Mar 16	00	00	-78.6	Drift
Jun 10	00	00	-78.1	Drift
Aug 04	04	00	-79.2	Thunderstorm

* Derived from H and F (MNS2/2).