Data Report

NBP00-07A

October 25 – November 16, 2000

United States Antarctic Program

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Introduction

The NBP data acquisition systems continuously log data from several instruments throughout the cruise. This document describes the format of that data and its location on the distribution DAT tapes. It also contains important information which may affect how this data is processed such as instrument failures or other known problems with acquisition.

The data collected during this cruise is distributed on a CD-ROM written in ISO9660 level-1 format. This data format has very strict requirements on filenames and organization. However, it is readable by virtually every computing platform.

The data is contained in Unix tar archives. All of the data has been compressed using Unix “gzip” compression. Gzipped files have a “.gz” extension. Tools are available on all platforms for uncompressing and de-archiving these formats. On Macintosh, Stuffit Expander 5.5 will open a tar archive and uncompress gzipped and Unix compressed files. For Windows computers WinZip, a shareware utility included on this CD (remember, it is shareware) will open these files.

IMPORTANT: Read the Acquisition Problems and Events section, for important information that may affect the processing of this data.

Archive Data Extraction

It is often useful to know exactly how an archive was produced when expanding its contents. The tar files were created on an SGI using the following commands:

```
tar cvf archive-file files-to-be-archived
```

To create a list of the files in the archive:

```
tar tvf  archive-file  > contents.list
```

To extract the files from the archive:

```
tar xvf  archive-file file(s)-to-extract
```

G-zipped files will have a ".gz" extension on the filename. These files can be decompressed after de-archiving, using:

```
gunzip filename.gz
```

The directories in the archive are structured in the following manner:

CD 1 of 1

NBP0007A.gmt
NBP0007A.mgd
NBP0007A.ps
NBP0007A.trk
Adcp/proc/adcp2000.jj
Adcp/raw/pingdata
Calibr8/ RADCALC.doc
RADCALC.txt
cal_coef.doc
cal_coef.txt
TSGCALC.doc
TSGCALC.txt
geopdata/geopdata.tar
images/
7AIMAGES.tar
ocean/007AMPCO.tar
007ATSG.tar
007AXBT.tar
report/ 7ADAT.doc
7ADAT.htm
7ADAT.txt
rvdas/nav/0007A3DF.tar
007AADCP.tar
007AGP02.tar
007AGYR1.tar
007ANGL1.tar
007APCOD.tar
rvdas/uw/007ABAR1.tar
007ABAT1.tar
007AGRV1.tar
007AMET1.tar
007APCO2.tar
007ASIM1.tar
007ATSG1.tar
007AKNUD.tar
007ASVP.tar
007ASYN.tar
007ASTC.tar
Utils/Mac/Stuffit.hqx
PC/Winzip70.exe
SeaSoft/SeaSoft4.234

Distribution Contents

ADCP Raw

The ADCP data set is broken up into files representing 24 hours of data collection. The raw files are named PINGDATA.xxx and the processed files are named ADCP2000.xxx, where xxx represents a day number. Note that these extensions do NOT represent Julian day numbers. Please refer to the file's creation date. The processed serial data can be viewed with Matlab or similar programs.

Some ADCP data is also transmitted to RVDAS. East and North vectors for ship's speed relative to the reference layer and ship's heading are archived in the navigational data section of RVDAS.

ADCP Processed

Processed ADCP data is contained in this directory in files representing Julian Days. For more information about how to process this data, please contact Dr. Erick Firing at the University of Hawaii at: efiring@soest.hawaii.edu

Cruise Track

A GMT cruise track file (NBP0007A.trk) is included, which contains the longitude and latitude at one-minute intervals extracted from the NBP0007A.gmt file.

NBP Data Products: MGD77, JGOFS and SEIS

JGOFS

The JGOFS data set consists of a single file produced each day named jgDDD.dat.gz where DDD is the Julian day the data was acquired. The ".gz" extension indicates that the individual files are compressed before archiving. The daily file consists of 22 separate columnar fields in text format, which are described below. The JGOFS data set is obtained primarily by applying calibrations to raw data and decimating to whole minute intervals. However, several fields are derived measurements from more than a single raw input. For example, Course Made Good (CMG) and Speed Over Ground (SOG) are calculated from gyro and GPS inputs by the NGL software package. Similarly, the wind direction field is the vector sum of the separate X and Y inputs received from the wind instrument. The JGOFS data set was used to produce the daily data plots during the cruise. *Note: Null, unused, or unknown fields are filled with 9's in the JGOFS data. TSG data is processed by RVDAS. This data set can be found in geopdata/geopdata.tar.*

Field	Data	Units
01	GMT date	dd/mm/yy
02	GMT time	hh:mm:ss
03	NGL latitude (negative is South)	dd.dddd
04	NGL longitude (negative is West)	ddd.dddd
05	speed over ground	Knots
06	GPS HDOP	-
07	Gyro Heading	Degrees (azimuth)
08	course made good	Degrees (azimuth)
09	mast PAR	Einsteins/meters^2 sec
10	sea surface temperature	°C
11	sea surface conductivity	siemens/meter
12	sea surface salinity	PSU
13	sea depth (uncorrected, calc. sw sound vel. 1500 m/s)	meters
14	true wind speed (port windbird)	meters/sec
15	true wind direction (port windbird)	degrees (azimuth)
16	ambient air temperature	°C
17	relative humidity	%

Field	Data	Units
18	barometric pressure	mBars
19	sea surface fluorometry	volts (0-5 FSO)
20	not used	-
21	PSP	W/m^2
22	PIR	W/m^2

MGD77

The MGD77 data set is contained in a single file for the entire cruise named NBP0007A.mgd, There is also a file named NBP0007A.gmt. This file is the output of the mgd77togmt utility using NBP0007A.mgd as input. The "gmt" file can be useful for plotting data using the GMT plotting package. The directory /geopdata/PROC contains a file from each day of data acquisition named: Dddd.fnl.gz, where ddd is the Julian day. These files contain all the data used to produce the "mgd" file, but in a space-delimited columnar format that may be more accessible for some purposes. In addition, these files contain data at one-second intervals rather than one minute and are individually "gzipped" to save space. Below is a detailed description of the MGD77 data set format.

All decimal points are implied. Leading zeros and blanks are equivalent. Unknown or unused fields are to be filled with 9's. All "corrections", such as time zone, diurnal magnetic, and Eotvos, are understood to be added.

Col	Len	Type	Description
1	1	int	DATA RECORD TYPE Set to "3" for data record.
2-9	8	char	SURVEY IDENTIFIER
10-14	5	int	TIME-ZONE CORRECTION: In hundredths of hours. Corrects time (in characters 13-27) to GMT when added: equals zero when time is GMT.
15-16	2	int	YEAR 2 digit year
17-18	2	int	MONTH (e.g. May is represented as 05)
19-20	2	int	DAY Day of month
21-22	2	int	HOUR
23-27	5	real	MINUTES X 1000
28-35	8	real	LATITUDE X 100000 + = North; - = South. (–9000000 to 9000000)
36-44	9	real	LONGITUDE X 100000 + = East; - = West. (–18000000 to 18000000)
45	1	int	POSITION TYPE CODE: 1=Observed fix; 3=Interpolated; 9=Unspecified
46-51	6	real	BATHYMETRY, 2- WAY TRAVELTIME: In 10,000th of seconds. Corrected for transducer depth and other such corrections
52-57	6	real	BATHYMETRY, CORRECTED DEPTH: In tenths of meters.
58-59	2	int	BATHYMETRIC CORRECTION CODE: This code details the procedure used for determining the sound velocity correction to depth
60	1	int	BATHYMETRIC TYPE CODE: 1 = Observed; 3 = Interpolated (Header Seq. 12); 9 = Unspecified
61-66	6	real	MAGNETICS TOTAL FIELD, 1^{ST} SENSOR: In tenths of nanoteslas (gammas).
67-72	6	real	MAGNETICS TOTAL FIELD, 2^{ND} SENSOR: In tenths of nanoteslas (gammas). For trailing sensor.
73-78	6	real	MAGNETICS RESIDUAL FIELD: In tenths of nanoteslas (gammas). The reference field used is in Header Seq. 13.
79	1	int	SENSOR FOR RESIDUAL FIELD 1 = 1^{st} or leading sensor; 2 = 2^{nd} or trailing sensor; 9 = Unspecified
80-84	5	real	MAGNETICS DIURNAL CORRECTION: In tenths of nanoteslas (gammas). (In nanoteslas) if 9-filled (i.e., set to "+9999"), total and residual fields are assumed to be uncorrected; if used, total and residuals are assumed to have been already corrected.
85-90	6	F6.0	DEPTH OR ALTITUDE OF MAGNETICS SENSOR: In meters. + = Below sea level 3 = Above sea level

Col	Len	Type	Description
91-9	7	real	OBSERVED GRAVITY: In 10^{th} of mgals. Corrected for Eotvos, drift, tares.
98-10	6	real	EOTVOS CORRECTION: In tenths of mgals. E = 7.5 V cos phi sin alpha + 0.0042 V*V
104-108	5	real	FREE-AIR ANOMALY In tenths of milligals Free-air Anomaly = G(observed) – G(theoretical)
109-113	5	char	SEISMIC LINE NUMBER: Used for cross-referencing with seismic data.
114-119	6	char	SEISMIC SHOT-POINT NUMBER
120	1	int	QUALITY CODE FOR NAVIGATION: 5=Suspected, by the originating institution;6=Suspected, by the data center, 9=No identifiable problem found

SEIS

The SEIS data set consists of a single file produced each day named mseis.dDDD.gz where DDD is the Julian day the data was acquired. The ".gz" extension indicates that the individual files are compressed before archiving. The daily file is a merge of navigation, bathy and syntron data based on shot trigger time. *Note: This data set can be found in geopdata/geopdata.tar.*

```
119:20:00:52.113489200   -63.022401   -59.865492 146.899994 4.000000 943.900024 GCS900228     005
469.00001E00/04/29:00:00:16110606000000000703000 0.020.051 00000000-00101AP1N
00015350000000002AP1N 00016350100100003AP1N 00016549900000004AP1N 000163496-0300005AP1N
00015850200200006AP1N 000157503003000
```

Field	Data	Units
1	RVDAS Time Tag	
2	Latitude	
3	Longitude	
4	Heading	Degrees
5	Speed	Knots
6	Depth	Meters
7	Syntron string	

RVDAS

rvdas/uw
rvdas/nav

Daily data processing of the RVDAS data is performed to convert values into usable units and as a check of the proper operation of the DAS. Both the raw and processed data sets from RVDAS are included in the data distribution. Below you will find detailed information on the data included. Be sure to read the "Significant Acquisition Events" section below for important information about data acquisition during this cruise.

Meteorological and Light Data

Measurement	File ID	Collect. Status	Rate	Instrument
Air Temperature	met1	continuous	0.5 sec	R. M. young 41342C
Relative Humidity	met1	continuous	0.5 sec	Rotonics MP-101A-C4
Wind Speed/Direction	met1	continuous	0.5 sec	Belfort Model 5-122AHD
PIR (LW radiation)	met1	continuous	0.5 sec	Eppley PIR
PSP (SW radiation)	met1	continuous	0.5 sec	Eppley PSP
PhotoActive Radiation	met1	continuous	0.5 sec	BSI QSR-240
Barometer	bar1	continuous	9 sec	AIR-DB-3A

Navigational Data

Measurement	File ID	Collect. Status	Rate	Instrument
Attitude GPS	3df1	continuous	1 sec	Ashtech ADU2
P-Code GPS	PCOD	continuous	1 sec	Trimble 20636-00SM

Gyro	gyr1	continuous	0.2 sec	Yokogawa Gyro
NGL	ngl1	continuous	1 sec	NGL Processed Nav Data

Geophysical Data

Measurement	File ID	Collect. Status	Rate	Instrument
Gravimeter	grv1	continuous	1 sec	Lacoste & Romberg Gravity
Bathymetry	bat1	continuous	varies	ODEC Bathy 2000
Bathymetry	sim1	depth < 2500 m	varies	Simrad EK500 Sonar
Bathymetry	knud	hf when bathy and SeaBeam not on	varies	Knudsen 320B/R Echo Sounder
Seismic Shot Header	syn1	when shooting seismic	varies	Syntron Seismic Controller

Oceanographic Data

Measurement	File ID	Collect. Status	Rate	Instrument
Conductivty	tsg1	continuous	15 sec	SeaBird 21
Salinity	tsgfl	continuous	15 sec	calculated from conductivity
Sea S Temperature	tsg1	continuous	15 sec	SeaBird 3-01/S
Fluorometry	flr1 & tsg1	flr1 not collected	15 sec	Turner 10-AU-005
pCO_2	pco2	continuous	70 sec	
ADCP	adcp	continuous	1 sec	RD Instruments

Data File Names and Structures

RVDAS data is divided into two broad categories, ***Underway*** and ***Navigation***. The groups are abbreviated “uw” and “nav”. Thus, these two subdirectories exist under the top-level rvdas directory. The instruments are broken down as shown. Each data file is g-zipped to save space on the distribution. Not all data types are collected everyday or on every cruise.

RVDAS data files are named following the convention: NBP[CruiseID][ChannelID].dDDD.

- The CruiseID is the numeric name of the cruise, for example: NBP0007A.
- The FileID (aka Channel ID) is a 4-character code representing the system being logged, for example: met1 (for meteorology)
- DDD is the Julian day of the data collection

Underway Data	Channel ID
Barometer	bar1
Bethy 2000	bat1
Fluorometer	flr1
Gravimeter	grv1
Magnetometer	mag1
Meteorological	met1
Simrad	sim1
Thermosalinograph	tsg1
pCO_2	pco2
Syntronics	syn1
Seismic Time Clock	stc1
Knudsen	knud
Sound Velocity Probe	svp1

Navigation Data	Channel ID
Ashtech GPS	3df1
Trimble GPS (P-Code)	PCOD
Gyro Compass	gyr1
Furuno GPS	gp02
NGL	ngl1
ADCP course	adcp

Data is received by the RVDAS system via RS-232 serial connections. The data files that comprise the rvdas data set are described below. A time tag is added to each line of data received and the data is written to disk.

```
YY+DDD:HH:MM:SS.SSS [data stream from instrument]
```

Where, YY: two-digit year, DDD: Julian Day, HH: 2 digit hours, MM: 2 digit minutes SS.SSS: seconds. All times are UTC.

The delimiters used to separate fields in the raw data files are usually spaces and commas, but other delimiters are used (::, =, @) and occasionally there is no delimiter. Care should be taken when reprocessing the data that the fields separations are clearly understood. An example data string is included.

bar1

```
00+019:23:59:57.441  963.25
```

Field	Data	Units
1	Time Tag	
2	Pressure	mBar

bat1

```
00+019:23:59:53.901 ;I04485.3ME-23.0,I00000.0,-99.9, 0000@01/11/00,23:59:52.08 PW2 PF1 SF1 PL3
MO4 SB3 PO0 TX1 TR: GM5 1500 06.7 -72.1
```

Field	Data	Units
1	RVDAS Time Tag	
2	Flagged Low Freq. Chn. Depth w/ units ;FDDDDD.DUN F= V valid, I invalid	meters
3	Low Freq. Echo Strength EEE.EE	dB
4	Flagged High Freq. Chn. Depth – unused	
5	High Freq. Echo Strength – unused	
6	Signed Heave Data SHHHH	cm
7	Date	mm/dd/yy
8	Time	hh:mm:ss
9	transmit pulse window type: PW1 Rectangular, PW2 Hamming, PW3 Cosine, PW4 Blackman	
10	Primary transmit frequency PF1 3.5 kHz, PF2 12.0 kHz	
11	Parametric mode secondary freq. SF1 3.5 kHz, SF2 12.0 kHz	
12	pulse length: PL1 200usec, PL2 500usec, PL3 1msec, PL4 2msec, PL5 5msec, PL6 10msec, PL7 25msec. If transmit mode is FM: PL1 25msec, PL2 50msec, PL3 100msec.	
13	Operating Mode: MO1 CW parametric, MO2 CW, MO3 FM parametric, MO4 FM	
14	Frequency sweep bandwidth: SB1 1 kHz, SB2 2 kHz, SB3 5 kHz	
15	power level: PO1 0dB, PO2 -6dB, PO3 -12dB, PO4 -18dB, PO5 -24dB, PO6 -30dB, PO6 -30 dB, PO7 -36dB, PO8 -42dB	
16	Transmit Mode: TX1 single ping active, TX2 pinger listen, TX3 multipinging TR, TX4 multipinging TR, TX5 multipinging TTRR, TX6 mulitpinging TTTTRRRR, TX7 mulitpinging TTTTTRRRRR	
17	Transmit Rate: TR3 4Hz, TR4 2Hz, TR5 1Hz, TR6 .5Hz, TR7 .33Hz, TR8 .25Hz, TR9 .20Hz, TR: = .10Hz, TR; = .05Hz	
18	System Gain Mode: GM0 hydrographic AGC, GM1 to GM9 hydrographic +3db to + 27db manual. GMA to GMD hydrographic + 30db through + 60db manual, GME to GMK sub-bottom 1 through sub-bottom 7	
19	speed of sound	m/sec
20	depth of sonar window below sea-level	meters
21	background noise level in fixed point reference	dB/V

flr1

```
00+019:23:59:58.061 0  0818 ::  1/19/00 17:23:17 = 0.983  (RAW)   1.2 (C)
```

Field	Data	Units
1	RVDAS Time Tag	
2	marker 0 to 8	
3	4-digit index	
4	date	mm/dd/yy
5	time	hh:mm:ss

Field	Data	Units
6	signal	
7	signal units of measurement	
8	cell temperature	
9	temperature units	

grv1

```
99+099:00:18:19.775 your_line#1999 99 01818 9735.4
```

Field	Data	Units	Conversion
1	RVDAS Time Tag		
2	text string		
3	gravity device date	yyyyjjjhhmmss	
4	gravity count	count	mgal = count x 1.0047 + offset

knud

```
99+099:00:18:19.775 hf,305.2,lf,304.3
```

Field	Data	Units
1	RVDAS Time Tag	
2	hf – high frequency flag (12 kHz)	
3	high fequency depth	meters
4	lf – low frequency flag (3.5 kHz)	
5	low frequency depth	meters

mag1

```
99+099:00:00:23.203 %  0  98 235928    0?372453
```

Field	Data	Units
1	RVDAS Time Tag	
2	% 0 denotes G-866 magnetometer	
3	Julian Day	
4	Time	
5	0? denotes high noise condition	
6	Magnetic Data (last digit is 10^{th}'s place)	nT

met1

```
00+019:23:59:59.761 $MET:  0.84, 1.12, 0.76, 1.06, 4.98, 0.26, 1.49, 3.93, 8.94, 0.80, 0.01,
0.01, 0.01, 0.22, 0.02, 0.1,40.11,4.96
```

Field	Data	Units	Conversion
1	RVDAS Time Tag		
2	$MET		
3	starboard windbird north rel. speed vector voltage	V	m/s = 7.553 x voltage
4	starboard windbird east rel. speed vector voltage	V	m/s = 7.553 x voltage
5	Port windbird north rel. speed vector voltage	V	m/s = 7.553 x voltage
6	Port windbird east rel. speed vector voltage	V	m/s = 7.553 x voltage
7	Air temperature	V	°C = 10 x voltage - 50
8	PIR Eppley Pyrgeometer	V	W/m^2 = 923.87 x voltage
9	PSP Eppley Pyranometer	V	W/m^2 = 194.53 x voltage
10	Temperature at the Relative Humidity Sensor	V	°C = 10 x voltage – 40
11	Relative Humidity	V	%RH = 10 x voltage
12	PAR Irradiance	V	Ei/m^2s = 1662.24 x voltage
13	spare		
14	high resolution infrared sensor (S. Li's instrument)	V	
15	direct output infrared sensor (S. Li's instrument)		
16	spare		
17	spare channels		

Field	Data	Units	Conversion
18	AC line voltage	V	VAC = 150 x voltage
19	uMac Temperature	C	
20	uMac DC Supply	V	

pCO_2

```
00+021:23:59:43.190 2000021.9992 2382.4 984.2 30.73 50.8 345.9 334.1 -1.70 -68.046 -144.446 Equil
```

Field	Data	Units
1	RVDAS Time Tag	
2	pCO_2 Time Tag (decimal is time of day)	yyyjdd.fod
3	raw voltage	mV
4	barometer	mBar
5	cell temperature	°C
6	flow rate	cm^3/min
7	concentration	ppm
8	pCO_2 pressure	microAtm
9	Equilibrated temperature	°C
10	Latititude	degrees
11	Longitude	degrees
12	Flow Source (Equil = pCO_2 measurement)	

sim1

```
00+005:00:00:52.388 D1,23583509,1479.6, 17,  1,  0
```

Field	Data	Units
1	RVDAS Time Tag	
2	Header	
3	Time Tag	hhmmss.sss
4	depth	m
5	bottom surface backscattering strength	dBar
6	transducer number (1 = 38 kHz)	
7		

stc1

```
00+019:23:59:46.976 ##ryyyydddhhmmssuuuuuuSSCC
```

Field	Data	Units
1	RVDAS Time Tag	
2	r is the innput time code "B" for IRIG-B	
3	yyyy is the year (FFFF if IRIG input)	
4	ddd is the 3 digit day of the year	
5	hh is 2 digit hour of day	
6	mm is 2 digit minute of hour	
7	ss is 2 digit second of minute	
8	uuuuuu is 6 digits for microseconds digits	
9	SS is 2 hex character DP-Extd_Sts dual port RAM value	
10	CC is checksum	

svp1

```
00+019:23:59:46.976 1234.56
```

Field	Data	Units
1	RVDAS Time Tag	
2	Sound velocity	m/s

syn1

```
00+120:10:46:30.665 *GCS900228     005   811.00001E00/04/29:10:45:5311060600000000403000-
0.050.023    00000000-00101AP1N 000156498-0100002AP1N 000163501001000003AP1N 000162497-0200004AP1N
000158500000000005AP1N 000155501001000006AP1N 000157500000000
```

Field	Data	Units
1	RVDAS Time Tag	
2	String tag	
3	Number of bytes	
4	Line number	
5	Shotpoint number	

tsg1

```
00+019:23:59:46.976 15A16CFC163F8C2C100
```

Field	Data	Units
1	RVDAS Time Tag	
2	Seabird Hex string (see notes on converting to real units)	

3df1

PBEN: Measurement Data

```
00+019:23:59:57.054 $PASHR,PBN,345609.00,-1695527.0,-1569301.4,-5925126.0,-068:49.6968,-
137:12.8448,00047.7,-000.69,000.67,-000.51,08,????,02,01,02,01*32
```

Field	Data	Units
1	RVDAS Time Tag $PASHR	
2	PBN	
3	GPS Time sec. of the week	seconds
4	Station Postion: ECEF X	meters
5	Station Postion: ECEF Y	meters
6	Station Postion: ECEF Z	meters
7	Latitude (- = South)	deg:min
8	Longitude (- = West)	deg:min
9	altitude	meters
10	velocity in ECEF X	m/sec
11	velocity in ECEF Y	m/sec
12	velocity in ECEF Z	m/sec
13	number of satellites used	
14	site name	
15	PDOP	
16	HDOP	
17	VDOP	
18	TDOP	

ATTD: Attitude Data

```
00+019:23:59:57.854 $PASHR,ATT,345610.0,252.82,+000.52,+001.95,0.0011,0.0068,0
```

Field	Data	Units
1	RVDAS Time Tag $PASHR	
2	ATT	
3	GPS Time sec. of the week	seconds
4	heading (rel. to true North)	degrees
5	pitch	degrees
6	roll	degrees
7	Measurement RMS error	meters
8	Baseline RMS error	meters
9	attitude reset flag	

GGA: GPS Position Fix – Geoid/Ellipsoid

```
00+019:23:59:57.134 $GPGGA,235956.00,6849.6968,S,13712.8448,W,1,08,01.0,+00048,M,,M,,
```

Field	Data	Units
1	RVDAS Time Tag $GPGGA	
2	UTC time at position	hhmmss.ss
3	Latitude	ddmm.mmm
4	North (N) or South (S)	
5	Longitude	ddmm.mmm
6	East (E) or West (W)	
7	GPS quality (1=GPS 2=DGPS)	
8	Number of GPS satellites used	
9	HDOP	
10	Antenna Height	meters
11	M for Meters	
12	Geoidal height	meters
13	M for meters	
14	age of diff. GPS data	
15	differential reference station ID	

gyr1

```
00+019:23:59:59.952 $HEHRC25034,-020*73
```

Field	Data	Units
1	RVDAS Time Tag	
2	$HEHRC	
3	Heading XXXXX = ddd.dd	degrees
4	Rate of Change SYYY S = +/-, YYY = r.rr	
5	Checksum	

ngl1

```
00+019:23:59:59.857 -68.82822,-137.21416,1.10,279.27,251.10,0.00,0.00,0,18.2587,1,1146973
```

Field	Data	Units
1	RVDAS Time Tag	
2	Latitude (south is negative)	degrees
3	Longitude (west is negative)	degrees
4	Ship Speed	knots
5	Course made good	degrees
6	Gyro Heading	degrees
7	PDOP	
8	HDOP	
9	quality	
10	GPS up	
11	Fix Number	

PCOD

GGA: GPS Position Fix – Geoid/Ellipsoid

```
00+019:23:59:59.301 $GPGGA,235958.409,6849.6944,S,13712.8472,W,1,06,1.2,092.4,M,047.3,M,,*67
```

Field	Data	Units
1	RVDAS Time Tag	
2	$GPGGA	
3	UTC time at position	hhmmss.sss
4	Latitude	ddmm.mmm
5	North (N) or South (S)	
6	Longitude	ddmm.mmm

Field	Data	Units
7	East (E) or West (W)	
8	GPS quality (1=GPS 2=DGPS 3=P-CODE)	
9	Number of GPS satellites used	
10	HDOP	
11	Antenna Height	meters
12	M for Meters	
13	Geoidal height	meters
14	M for meters	
15	age of diff. GPS data	
16	differential reference station ID	
17	checksum	

GLL: GPS Latitude/Longitude

```
00+019:23:59:59.381 $GPGLL,6849.6944,S,13712.8472,W,235958.409,A*35
```

Field	Data	Units
1	RVDAS Time Tag	
2	$GPGLL	
3	Latitude	degrees
4	North or South	
5	Longitude	degrees
6	East or West	
7	UTC of position	hhmmss.sss
8	staus of data (A = valid)	
9	checksum	

VTG: GPS Track and Ground Speed

```
00+019:23:59:59.382 $GPVTG,238.7,T,182.3,M,001.8,N,003.3,K*41
```

Field	Data	Units
1	RVDAS Time Tag	
2	$GPVTG	
3	heading	degrees
4	degrees True (T)	
5	heading	degrees
6	degrees magnetic (M)	
7	Ship speed	knots
8	N = knots	
9	speed	km/hr
10	K = km per hour	
11	checksum	

adcp

```
00+019:23:59:59.099 $PUHAW,UVH,-1.48,-0.51,250.6
```

Field	Data	Units
1	RVDAS Time Tag	
2	$PUHAW	
3	UVH (E-W, N-S, Heading)	
4	Ship Speed relative to reference layer, East vector	kn
5	Ship Speed relative to reference layer, North vector	kn
6	Ship heading	degrres

Ocean Data Files

ocean/

tsgfl

```
00+075:00:00:04.467 -01.488 -01.720 02.6783 33.63748 1.002442 0.002442
```

Field	Data	Units
1	RVDAS Time Tag	
2	Internal water temperature	°C
3	Sea Surface Temperature	°C
4	Conductivity	Siemens
5	Salinity	PSU
6	Fluorometry	V
7	unused	

xbt

During the cruise Expendable Bathythermographs were used to obtain water column temperature profiles. These were used to adjust the sound velocity profile for the SeaBeam system. The data files from these launches are included.

pCO2-merged

Some data files are “processed” into a slightly different form. The pCO_2 data is merged with data from other sources for ease of data analysis.

```
00+019:23:58:15.502 2000019.9983 2445.2 965.0 32.90 52.8 372.3 352.5 -1.27 -68.8285 -137.2080
Equil -68.8280 -137.2079 -1.58 33.60 0.97 9.06 307.23 50.0
```

Field	Data	Units
1	RVDAS Time Tag	
2	pCO_2 Time Tag (decimal is time of day)	yyyjdd.fod
3	raw voltage	mV
4	barometer	mB
5	cell temperature	°C
6	flow rate	cm^3/min
7	concentration	ppm
8	pCO_2 pressure	microAtm
9	Equilibrated temperature	°C
10	Latitude	degrees
11	Longitude	degrees
12	Flow Source (Equil = pCO_2 measurement)	
13	RVDAS latitude	degrees
14	RVDAS longitude	degrees
15	TSG external temperature	°C
16	TSG salinity	PSU
17	TSG fluorometry	V
18	RVDAS true wind speed	m/s
19	RVDAS true wind direction	degrees
20	uncontaminated seawater pump flow rate	l/min

PROCESSING DATA

RAW TSG

Raw TSG data is stored as a hex string 20 bytes long.

Bytes	Data
1-4	Sensor Temperature
5-8	Conductivity
9-14	Remote Temperature
15-17	Fluorometer voltage
18-20	unused voltage

In all of the formulas listed below, the variables can be found in the TSGcal file.

Calculating Temperature

```
T = decimal equivalent of bytes 1-4
Temperature Frequency:  f = T/19 +2100
q = ln(fo/f)
Temperature = 1/{a + b * q + c * q2 + d * q3} -273.15 (degrees C)
```

Calculating Conductivity

```
C = decimal equivalent of bytes 5-8
Conductivity Frequency f = sqrt(C*2100+6250000)
Conductivity = (afm +bf2 +c +dt)/[10(1+ep)] (siemens/meter)
note e = epsilon in the TSGcal file
```

Claculating Fluorometry Voltage

```
f = decimal equivalent of bytes 15-17
Fluorometry Voltage = f/819
```

PAR

raw data = V

calibration scale = 9.99×10^{-18} V/(quanta/cm ^{2}sec)

offset (V_{dark}) = 0.3 mV

$(((V - V_{dark})/scale)/6.022 \times 10^{23}) \times 10^4$ cm^2/m^2 x 10^6 = Einstiens/m^{2}sec

or

$(V - V_{dark}) \times 1662.24$ = Einstiens/m^{2}sec

PSP

raw data = V

calibration scale = 8.31×10^{-6} V/(W/m^2)

signal conditioner1 = 309.3

signal conditioner2 = 2

V / (scale x conditioner1 x conditioner2) = W/m^2

or

V x 194.53 (W/m^2)/V = W/m^2

PIR

raw data = V

calibration scale = 3.52×10^{-6} V/(W/m^2)

signal conditioner1 = 307.5

signal conditioner2 = 1

V / (scale x conditioner1 x conditioner2) = W/m^2

or

V x 923.87 (W/m^2)/V = W/m^2

NBP0007A Sensors

Shipboard Sensors

Sensor	Description	Serial #	Last Cal.	Status
Port Anemometer	Belfort 5-122AHD	7956	4/1/00	collect
Stbd Anemometer	Belfort 5-122AHD	7957	4/27/00	collect
Barometer	Atmospheric Instr. AIR-DB-3A	2G2461	1/24/00	collect
Mast PRR	BSI PRR-610	9696	3/18/99	not collect
UW PRR	BSI PRR-600	9695	3/18/99	not collect
Rel. Hum./Air Temp	Rotronics MP-101A-C4	R45618	6/20/00	collect
Mast PAR	BSI QSR-240	6356	2/3/00	collect
P-Code GPS	Trimble 20636-00 (SM)	0220035116	4/7/00	collect
Attitude GPS	Ashtech 12	700273F2114 FW 7B13-D1-C21		collect
Pyranometer	Eppley PSP	32850F3	2/25/00	collect
Pyrgeometer	Eppley PIR	32845F3	2/2/00	collect
Dry Air Temp	R. M. Young 41342C	1645	2/9/00	collect
TSG	SeaBird SBE21	218091-1390	11/20/99	collect
TSG Remote Temp	SeaBird 3-01/S	031497	1/18/00	collect
Fluorometer	Turner 10-AU-005 Lamp: daylight 10-045, reference filter: 10-052, emission filter: 10-051, excitation filter: 10-050.	5651 FRTD		collect
Magnetometer	EG&G G-866			not collect
Gravimeter	Lacoste & Romberg Gravity Meter			collect
Bathymetry	Simrad EK-500	3001	11/1/95	collect
Bathymetry	Knudsen 320B/R	K99894		collect
Bathymetry	SeaBeam 2100			collect
Bathymetry	Bathy 2000	1846		collect

Acquisition Problems and Events

This section lists all known problems with acquisition during this cruise including instrument failures, data acquisition system failures and any other factor affecting this data set. The format is jjj:hh:mm (jjj is julian day, hh is hour, and mm is minute). All times are in GMT.

Start	**End**	**Description NAVIGATION**
299:17:23	318:14:41	Start NAVIGATION data logging
Start	**End**	**Description MET**
299:17:50	318:14:44	Start MET data logging
Start	**End**	**Description OCEAN**
301:22:51	318:14:25	Start OCEAN data logging
Start	**End**	**Description GEOPHYSICAL**
300:12:02	318:14:25	Start logging (mag1 off-line)
304:19:00	317:14:00	knud off-line
317:14:00	318:14:25	bat1 off-line
309:02:33	313:22:10	stc1 off-line
317:09:17	318:14:25	mag logging

SeaBeam

SeaBeam data was collected for Julian days 302.15:50 through 318.14:20. The track corresponds with the location of the OBS lines.

On day 306 from 12:10 to 23:17 the SeaBeam was up and down numerous times. Nothing appeared to be wrong, but the machine kept locking up, requiring a reboot. This was the only problem that occurred during operations.

Data dristribution has been made on 4mm DAT tapes (90 meter, DDS1). The original 8mm tapes recorded directly on the SeaBeam system will be returned to RPSCHQ. The SeaBeam dataset will include only the raw data collected for the cruise. No ping editing or processing was performed.

Calibrations

SEA-BIRD ELECTRONICS, INC.
1808 136th Place N.E., Bellevue, Washington 98005 USA
Phone: (425) 643 - 9866 Fax: (425) 643 - 9954 Internet: seabird@seabird.com

SENSOR SERIAL NUMBER = 1390
CALIBRATION DATE: 20-Nov-99

CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

GHIJ COEFFICIENTS

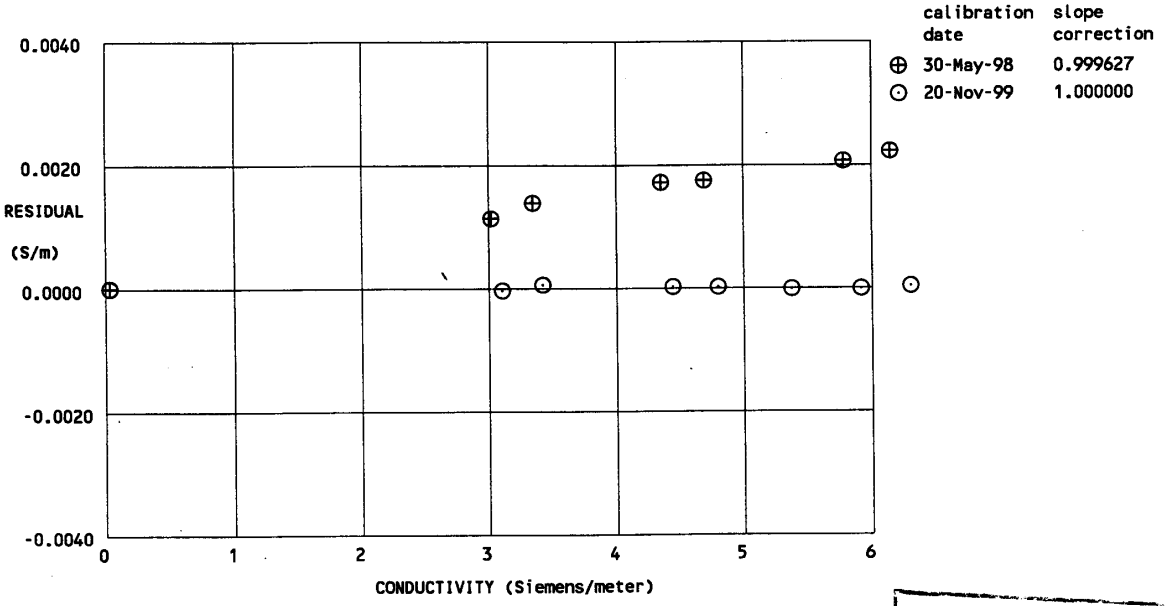
g = -3.93202500e+00
h = 4.70256307e-01
i = 7.32400918e-04
j = -1.40591115e-05
CPcor = -9.57e-08 (nominal)
CTcor = 3.25e-06 (nominal)

ABCDM COEFFICIENTS

a = 1.47556503e-02
b = 4.52645265e-01
c = -3.91849365e+00
d = -9.05554567e-05
m = 2.2
CPcor = -9.57e-08 (nominal)

BATH TEMP (ITS-90 °C)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (kHz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
22.0000	0.0000	0.00000	2.88550	0.00000	0.00000
1.0000	36.0948	3.07458	8.53995	3.07454	-0.00004
4.5000	36.0923	3.39296	8.92178	3.39301	0.00005
15.0000	36.0872	4.41063	10.04412	4.41064	0.00001
18.4999	36.0860	4.76818	10.40948	4.76819	0.00001
23.9999	36.0835	5.34578	10.97375	5.34576	-0.00002
29.0000	36.0788	5.88528	11.47555	5.88526	-0.00002
32.5000	36.0722	6.26964	11.81996	6.26966	0.00002

Conductivity = $(g + hf^2 + if^3 + jf^4) / [10(1 + \delta t + \epsilon p)]$ Siemens/meter
Conductivity = $(af^m + bf^2 + c + dt) / [10(1 + \epsilon p)]$ Siemens/meter
t = temperaure [deg C]; p = pressure [decibars]; δ = CTcor; ϵ = CPcor;
Residual = (instrument conductivity - bath conductivity) using g, h, i, j coefficients



POST CRUISE CALIBRATION

SEA-BIRD ELECTRONICS, INC.
1808 136th Place N.E., Bellevue, Washington 98005 USA
Phone: (425) 643 - 9866 Fax: (425) 643 - 9954 Internet: seabird@seabird.com

SENSOR SERIAL NUMBER = 1390
CALIBRATION DATE: 20-Nov-99

TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

g = 4.19943404e-03
h = 6.02868891e-04
i = 5.34296192e-06
j = -1.77943713e-06
f_0 = 1000.000

IPTS-68 COEFFICIENTS

a = 3.64763555e-03
b = 5.88552771e-04
c = 1.03072229e-05
d = -1.77889932e-06
f_0 = 2522.389

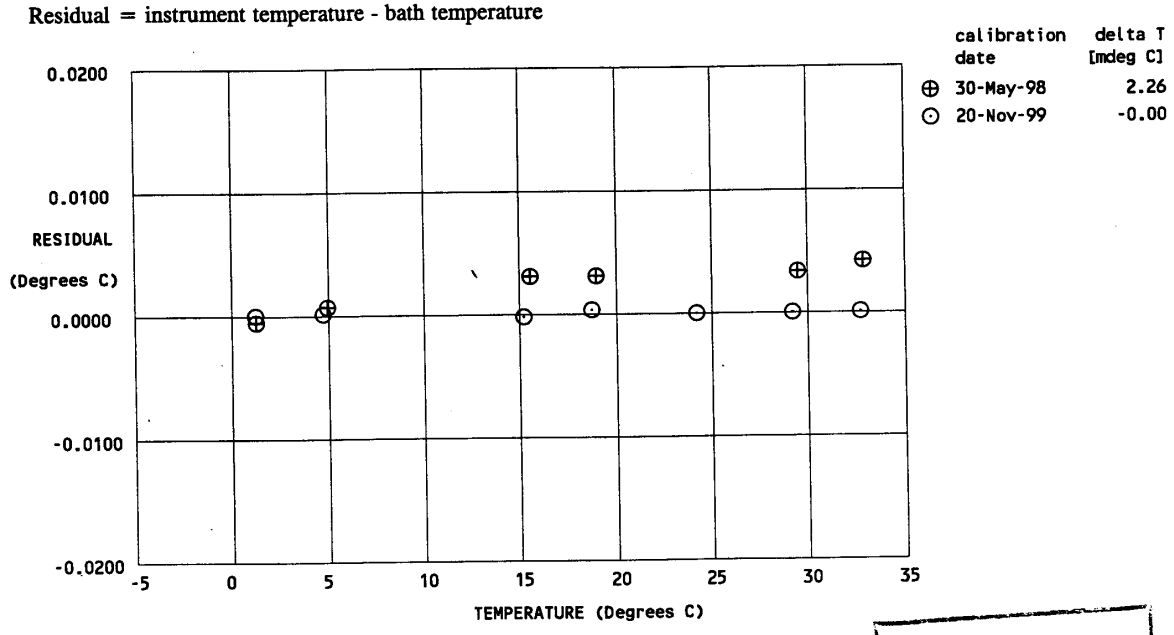
BATH TEMP (ITS-90 °C)	INSTRUMENT FREQ (Hz)	INST TEMP (ITS-90 °C)	RESIDUAL (ITS-90 °C)
1.0000	2522.389	1.0000	-0.00004
4.5000	2727.711	4.5001	0.00009
15.0000	3414.661	14.9997	-0.00026
18.4999	3668.526	18.5002	0.00027
23.9999	4093.784	23.9998	-0.00005
29.0000	4509.404	29.0000	-0.00002
32.5000	4817.316	32.5000	0.00001

Temperature ITS-90 $= 1/\{g + h[\ell n(f_0/f)] + i[\ell n^2(f_0/f)] + j[\ell n^3(f_0/f)]\} - 273.15$ (°C)

Temperature IPTS-68 $= 1/\{a + b[\ell n(f_0/f)] + c[\ell n^2(f_0/f)] + d[\ell n^3(f_0/f)]\} - 273.15$ (°C)

Following the recommendation of JPOTS: T_{68} is assumed to be 1.00024 * T_{90} (-2 to 35 °C).

Residual = instrument temperature - bath temperature



POST CRUISE CALIBRATION

SEA-BIRD ELECTRONICS, INC.
1808 136th Place N.E., Bellevue, Washington 98005 USA
Phone: (425) 643 - 9866 Fax: (425) 643 - 9954 Internet: seabird@seabird.com

SENSOR SERIAL NUMBER = 1497
CALIBRATION DATE: 18-Jan-00s

TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

g = 4.73691894e-03
h = 6.67739744e-04
i = 2.79602279e-05
j = 2.53178815e-06
f_0 = 1000.000

IPTS-68 COEFFICIENTS

a = 3.68135846e-03
b = 5.95340602e-04
c = 1.52182163e-05
d = 2.53329409e-06
f_0 = 5371.624

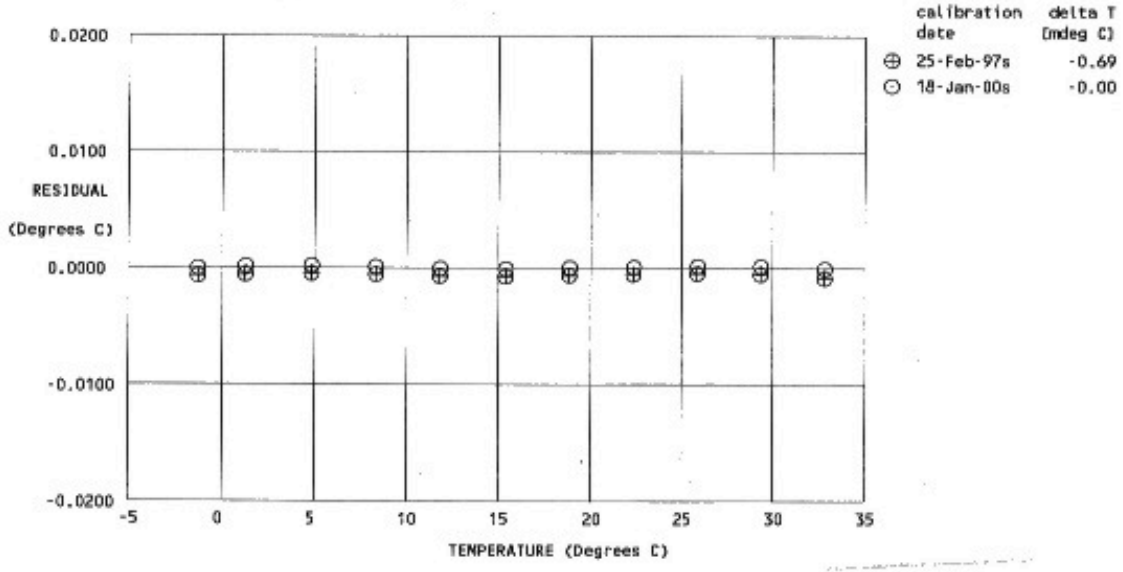
BATH TEMP (ITS-90 °C)	INSTRUMENT FREQ (Hz)	INST TEMP (ITS-90 °C)	RESIDUAL (ITS-90 °C)
-1.5107	5371.624	-1.5108	-0.00009
1.0502	5691.558	1.0503	0.00007
4.6236	6160.724	4.6237	0.00012
8.1303	6647.544	8.1303	0.00003
11.6338	7160.779	11.6337	-0.00010
15.1939	7710.510	15.1938	-0.00013
18.6574	8273.271	18.6574	-0.00003
22.1579	8870.651	22.1580	0.00002
25.6854	9502.321	25.6855	0.00011
29.1564	10153.553	29.1565	0.00010
32.6314	10835.493	32.6313	-0.00012

Temperature ITS-90 $= 1/\{g + h[\ell n(f_0/f)] + i[\ell n^2(f_0/f)] + j[\ell n^3(f_0/f)]\} - 273.15$ (°C)

Temperature IPTS-68 $= 1/\{a + b[\ell n(f_0/f)] + c[\ell n^2(f_0/f)] + d[\ell n^3(f_0/f)]\} - 273.15$ (°C)

Following the recommendation of JPOTS: T_{68} is assumed to be 1.00024 * T_{90} (-2 to 35 °C).

Residual = instrument temperature - bath temperature



THE EPPLEY LABORATORY, INC.
12 Sheffield Ave., P.O. Box 419, Newport, RI 02840 USA
Telephone: 401-847-1020 Fax: 401-847-1031
Email: eplab@mail.bbsnet.com Internet: www.eppleylab.com

EPLAB
Scientific Instruments for Precision Measurements Since 1917

STANDARDIZATION OF EPPLEY PRECISION INFRARED RADIOMETER Model PIR

Serial Number: 32845F3

Resistance: 721 Ω at 23 °C
Temperature Compensation Range: -20 to 40 °C

This pyrgeometer has been compared with Precision Infrared Radiometer, Serial Number 29326F3 in Eppley's Blackbody Calibration System under radiation intensities of approximately 200 watts meter^{-2} and an average ambient temperature of 25 °C.

As a result of a series of comparisons, it has been found to have a sensitivity of:

4.17 x 10^{-6} volts/watts meter^{-2}

The calculation of this constant is based on the fact that the relationship between radiation intensity and emf is rectilinear to intensities of 700 watts meter^{-2}. This radiometer is linear to within ±1.0% up to this intensity.

The calibration of this instrument is traceable to the International Practical Temperature Scale (IPTS) through a precision low-temperature blackbody.

Shipped to:
Antarctic Support Associates
Port Hueneme, CA

S.O. Number: 57886
Date: February 29, 2000

Date of Test: February 2, 2000

In Charge of Test: R. T. Eppley

Reviewed by: Thomas D Kirk

Remarks:

DO NOT DESTROY
Biospherical Instruments Inc.
CALIBRATION DATA

Biospherical Instruments Inc.

CALIBRATION CERTIFICATE

Calibration Date	2/3/00
Model Number	QSR-240
Serial Number	6356
Operator	TPC
Standard Lamp	94532(03/13/98)
Probe Excitation Voltage Range:	5 to 18 VDC(+)
Output Polarity:	POSITIVE

Probe Conditions at Calibration(in air):

Calibration Voltage:	6	VDC(+)
Probe Current:	1.1	mA

Probe Output Voltage:

Probe Illuminated	88.7	mV
Probe Dark	0.2	mV
Probe Net Response	88.5	mV

Corrected Lamp Output:

Output In Air (same condition as calibration):

8.56E+15	quanta/cm²sec
0.014	uE/cm²sec

Calibration Factor:
(To calculate irradiance, divide the net voltage reading in Volts by this value.)

Dry:	1.03E-17	V/(quanta/cm²sec)
	6.23E+00	V/(uE/cm²sec)

Notes:
1. Annual calibration is recommended.
2. Calibration is performed using a Standard of Spectral Irradiance traceable to the National Institute of Standards and Technology (NIST).
3. The collector should be cleaned frequently with alcohol.
4. Calibration was performed with customer cable, when available.

QSR240R 05/24/95

rotronic
instrument corp

160 E. Main Street, Huntington, NY 11743 • 516-427-3898 • FAX 516-427-3902 • 1-800-628-7101 • http://www.rotronic-usa.com

CERTIFICATE OF TEMPERATURE CALIBRATION

Model : MP101A
Serial # : 45618

In reference to the values published in standard DIN 43760, the manufacturer of the Pt100 RTD used in this instrument has specified a maximum tolerance of +/- 0.2 Deg. C, both at 0 and 100 Deg. C.

The measuring circuit of this instrument has been electronically tested with a Pt100 simulator with an accuracy of 0.1% in reference to the values of standard DIN 43760. This instrument was also placed in a ventilated tunnel having a minimum air velocity of 180 Ft/min. and calibrated against a certified thermometer traceable to the National Institute of Standards and Technology..

Based on the above procedure, the accuracy of this unit has been found to be as follows:

	Reference	Reading	Correction
Simulator :	-25.0	-25.0	0.0
	0.0	0.0	0.0
	25.0	25.0	0.0
	50.0	50.0	0.0
Thermometer :	29.5	29.1	0.4

Note: Temperatures Values in Deg.C

By: Date:6/20/2000

ROTRONIC Instrument Corp.

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CERTIFICATE OF HUMIDITY CALIBRATION

Model : MP101A
Serial # : 45618

This instrument was placed in a ventilated tunnel having a minimum air velocity of 180 Ft/min. and calibrated against two reference instruments.

Calibration of the reference instruments was both with saturated salt solutions and with a certified chilled mirror instrument, traceable to the National Institute of Standards and Technology (NIST). A certified, traceable thermometer was used to monitor temperature. The %RH values of the saturated salt solutions were taken from the tables published by the National Bureau of Standards (now NIST), L. Greenspan, Journal of Research, Vol. 81A, January - February 1977. Details regarding calibration with saturated salt solutions may be found in ASTM standard E104-85.

Based on the above procedures, the accuracy of this instrument has been found to be as follows:

Reference	Reading	Correction
35.0	35.0	0.0
80.0	80.0	0.0
0.3	0.3	0.0

Note: Humidity Values in %RH.

By: _____ Date:6/20/2000

ROTRONIC Instrument Corp.