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Port Stanley Magnetic Observatory Installation Report 6 – 10 February 2003

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Foreword

This report details the modernisation of equipment operating at the Port Stanley magnetic observatory in the Falkland Islands. Port Stanley is one of three overseas magnetic observatories maintained and operated by the British Geological Survey in addition to three in the UK. Measurements are collated in Edinburgh and are primarily used to model the main magnetic field of the Earth.

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Our visit, and work carried out thereafter, would not have been possible without the considerable assistance provided by David McLeod the Engineering Manager at Cable and Wireless and the staff of the Cable and Wireless, Port Stanley. We would also like to acknowledge the assistance given by the staff of Mineral Resources, Port Stanley

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Summary

This report describes the modifications made to the Port Stanley Geomagnetic Observatory during a visit to the Falkland Islands in February 2003. Since the report is intended as a technical reference for observatory operation, the instruments, computing equipment, software and cabling have been described in detail. The modifications were undertaken to ensure the continued supply of high quality geomagnetic data from this observatory, and to this end, there are some further recommendations for future visits listed in the final section of the report.

1 Introduction

The magnetic observatory on Sapper Hill, near Port Stanley, Falkland Islands was installed by the British Geological Survey (BGS) in February 1994 with a proton vector magnetometer (PVM) oriented to measure variations in declination and inclination (dD/dI) as well as field magnitude. After eight years of service, much of the equipment was in need of replacement and in 2002 the dD/dI equipment was replaced by a three component fluxgate magnetometer and a proton magnetometer.

Throughout 2002 all the data logging and communications equipment worked well but intermittent problems were experienced with the fluxgate magnetometer. One of the tasks set for this visit was to investigate these problems.

As noted in the 2002 report the condition of the huts on Sapper Hill had deteriorated and during this service visit the marine plywood huts were replaced by two fibreglass huts

This report describes the work carried out during the installation visit between 6 and 10 February 2003, with a record of the new equipment and software installed, their configuration, and also the calibration measurements made during the visit.

2 Observatory Buildings

The fibreglass Cable and Wireless hut, used to house the computer and dD/dI coil switching circuits, was extended during 2002 and Cable and Wireless staff moved the BGS equipment from the shelving on the west wall to the north wall. This hut continues to give good protection for the new recording equipment, and provides a reliable power supply and network link.

During the service visit in February 2002 (Turbitt and Flower, 2002) it was noted that both the marine plywood instrument huts were in a poor condition and in urgent need of replacement. To prevent damage to the instruments two, 2 x 2 x 2.2 m, fibreglass huts were purchased from Glasdon Manufacturing Ltd and shipped south during August 2002. One of the main tasks of the 2003 service visit was to remove the plywood huts and replace them with the fibreglass buildings. This work was successfully carried out on 6 and 7 February. The fluxgate hut being replaced on the 6 February the D/I Absolute hut on the 7 February. A photograph of the new huts is on the front cover of this report.

All existing cables between the Cable and Wireless hut and the fluxgate hut are in good condition. The cable wiring details are described in Appendix E.

3 Fluxgate Magnetometer Observatory

In 2002 the PVM system was been replaced with a Danish Meteorological Institute (DMI) fluxgate magnetometer. GPS-timed, one-second samples are made of the fluxgate magnetometer's three magnetic channels along with one temperature channel. Once digitised, the samples are stored and filtered, using a 90-second Gaussian filter, to one-minute data points. In addition, the Geomag SM90R proton precession magnetometer is sampled every 10

seconds and also these data are reduced to one-minute values. One-minute data are stored within the data logger and are retrieved automatically by Edinburgh every 2 minutes.

A block diagram of the replacement system is given in Figure 2.

3.1 FLUXGATE MAGNETOMETER AND ADC

The main observatory magnetometer is a DMI FGE suspended triaxial fluxgate magnetometer. The magnetometer has a range of ± 4000 nT in each of its three magnetic components (approx. 400 nT/Volt) and a scale of 5 mV/K in its temperature channel. The triaxial sensor block was oriented such that one sensor was vertical (Z-sensor), one sensor was aligned along the instantaneous component of the magnetic vector in the horizontal plane (H-component) and the third sensor aligned perpendicular to both sensors in the horizontal plane (D-sensor).

Shortly after the installation of the fluxgate system (electronics serial number E0244, and suspended, triaxial sensor S0216) problems were noted. This problem was eventually traced to a bad solder joint in electronics package E0244 and on 8 May 2002 this package was replaced by fluxgate electronics E0111. This exchange of electronics resulted in a much improved output until November/December 2002 when irregular drifts in the closing error between the fluxgate and proton magnetometer were noted. The problem continued through January 2003 and an attempt was made during the February 2003 service visit to identify and solve the problem. Various theories regarding the source of this problem had been put forward and these included RF interference due to the recently installed 200 Kw HF transmissions from the nearby (60m distant) mast. Another faults in the fluxgate or problems with the spare, unused ADC channels being left open circuit in the ADC calibration box. All these possible problems were addressed by:

1. Covering both the fluxgate and fluxgate electronics with an earthed shield of aluminium foil.
2. Replacing fluxgate electronics E0111 with electronics package E0262.
3. Connecting all unused inputs on both ADC's to the ADC analogue ground.

Since carrying out this work the problems have disappeared but as we have only operated for two weeks since the changes were made it is too early to be confident that we have found the fault. The other difficulty is identifying exactly what the problem was, ADC or RF interference or faulty fluxgate electronics.

The analog-to-digital (ADC) module (GMAG-FGAD.014) is located beside the fluxgate electronics and contains two ADAM-4017, 16-bit converters. The first converter (address 01) has a dynamic range of ± 5 Volts (± 2000 nT), and a resolution of 0.1 mVolt. If the converter over-ranges, the acquisition software will automatically switch to the second converter (address 02), which has been configured with a dynamic range of ± 10 Volts and resolution of 1mV. The circuit diagram of this module is shown in Figure 8.

The fluxgate magnetometer, the ADAM-4017 modules and an ADAM-4520 module are powered from the 15 Volt line of the DC power supply (GMAG-PSU.001). The ADAM-4520, mounted within the power supply, is used to convert the RS485 output of the ADAM-4017 module to RS232 level, suitable for the recording PC. The power supply is housed with the recording PC in the Cable and Wireless hut and is connected to the sensor hut via a four-core screened cable as shown in Appendix E.

The DMI fluxgate magnetometer was, by default, configured for operation at mid-latitudes in the Northern Hemisphere, where the horizontal magnetic component (H) is in the range 0 to 32000 nT and the vertical component (Z) is in the range 32000 to 64000nT. The fluxgate therefore requires modification for installation at Port Stanley, where H and Z are approximately 19000 nT and –22000 nT respectively. Firstly, the fixed 32000 nT bias field on Z was disabled by removing the link between the bias generator and the bias coils (resistor R50), giving a Z bias field range of 0 to 32000 nT. Secondly, the direction of the Z bias field was reversed by swapping the two wires (blue and orange) to the Z bias coil within the magnetometer sensor. This allows a bias field between –32000 and 0 nT to be applied, but also inverts the magnetometer outputs on the Z channel. Hence the calibration value for the Z component has been entered as negative in the software configuration file (Appendix C).

The settings on the bias switches of the fluxgate magnetometer are:

| Z | | Y | | X | |
|--------|------|--------|------|--------|------|
| Coarse | Fine | Coarse | Fine | Coarse | Fine |
| 9 | 3 | 0 | 0 | 7 | F |

3.2 PROTON PRECESSION MAGNETOMETER

The PPM electronics box (Geomag SM90R, S/N 61528) sits on the floor of the hut beside the PPM voltage regulator box. The regulator box has been used since the original installation to regulate the +18 Volts from the DC power supply down to +12 Volts for the PPM and its details are documented in Riddick et al., 1995. With the inclusion of the new power supply, the supply voltage to the box is a maximum of 13.8 Volts, and this regulator box no longer serves any purpose. It is recommended that the box is removed during the next service visit.

The repositioning of the PPM sensor due to replacing the hut has caused a slight change in the site difference. The new site difference between the site of the absolute observations and the repositioned PPM sensor is given in Section 7. Site measurements were made before and after the hut replacement.

The calibration carried out on the PPM during the installation is listed in Appendix B, along with that carried out on the auxiliary Gem Systems GSM-19 PPM, used for the site difference measurement and the spare Geomag SM90R proton electronics package (Serial number 13158)

3.3 GPS TIMING

The existing Garmin GPS36 antenna/receiver has been re-used to provide a time reference against which the time and date on the acquisition system are synchronised to within 0.2 second of UTC. From its position inside the sensor hut, the antenna has a sufficiently unobstructed view of the sky to provide a time solution for most of the time, and is distant enough from any Cable and Wireless transmission equipment to avoid interference.

The antenna cable has been routed via the lightning-suppression box to the DC power supply. The power supply provides the 12 Volts necessary for the antenna and also a 9-way D-type connector from which the RS232 NMEA signal from the receiver is routed to COM1 on the logging PC.

3.4 POWER SUPPLY

The fluxgate magnetometer, the ADC, the PPM and the GPS are powered via a mains-to-DC converting power supply (GMAG-PSU.001), which produces a +15 Volt and a +13.8 Volt (nominally 12 Volt) output and provides breakout for the GPS signal and also conversion from RS485 to RS232 for the ADC signal. The circuit diagrams for the power supply are given in Figure 4 and Figure 5.

A single 12 V, 24 Ah battery is connected to the +13.8 V output of the supply to provide up to 10 hours of standby power in the event that mains power is lost to the observatory.

All of the connections from the power supply to the batteries, magnetometers, GPS and ADC are detailed in Appendix E.

3.5 LIGHTNING SUPPRESSION

The power and signal lines for the PPM, the fluxgate magnetometer and the GPS have been routed through one of two lightning suppression boxes to provide protection from externally induced current surges in any of the cables. One box is mounted on the wall of the Cable and Wireless hut, while the other has been placed on the top shelf, above the logging equipment. The wiring diagram of the lightning suppression box is given in Figure 9. The boxes contain Furse 30E and 15D suppression modules, which are connected to earth using a grounding spike external to the Cable and Wireless hut.

3.6 DATA RECORDING PC AND CONFIGURATION

The data logger installed at Port Stanley observatory is a DSP Design TP400 embedded PC (GMAG-QPC.01-016) with 64 Mb memory, floppy disk drive and a 2.5 inch, 30 Gbyte hard disk drive. The processor card provides a parallel port, and four serial ports, 10/100 base-T Ethernet, mouse and keyboard ports and VGA output and has been set to operate at 200 MHz.

An additional printed circuit board (PCB) has been included to convert the TTL level of COM4 to RS232. Note that COM4 has only a three-wire connection – Rx, Tx and GND. The four serial ports and their connections are listed in Table 2. The parallel port on the motherboard is not used.

Table 2 Serial Port Settings

| Port | QNX Port Name | Type | Address | Interrupt | Device |
|------|---------------|------------|---------|-----------|----------------------|
| COM1 | /dev/ser1 | 9-way male | 0x3F8 | IRQ4 | GPS |
| COM2 | /dev/ser2 | 9-way male | 0x2F8 | IRQ3 | ADAM-4520 |
| COM3 | /dev/ser3 | 9-way male | 0x3E8 | IRQ5 | PPM |
| COM4 | /dev/ser4 | 9-way male | 0x2E8 | IRQ9 | Mini Met data logger |

The PC is powered from the 12 Volt output of the DC power supply. This is converted internally to 5 Volts using a NFC10-12S05 10 Watt DC-DC converter. In this installation, the

12 Volts supply has been rewired to bypass the switch on the front panel to avoid the power being accidentally switched off as has commonly occurred during floppy-disk changes.

3.7 REMOTE COMMUNICATIONS

Prior to the visit, Cable and Wireless installed an Ethernet link and router, giving a single IP port in the equipment hut. This provides a means of access from Edinburgh to the operating system of the Port Stanley logger and also enables files to be received or transmitted, allowing the logger to be remotely monitored, changes or upgrades implemented and data retrieved.

The Ethernet link is defined by the following addresses:

IP Address: 195.248.193.234

Router Address: 195.248.193.233

Subnet Mask: 255.255.255.252

The hostname is, as yet undefined, but may be configured by Cable and Wireless in the future. The router configuration has been listed in Appendix D.

4 Observatory Software

The introduction of a real-time, multi-tasking operating system in the form of QNX 4.25j has enabled a more versatile data acquisition system to be developed and has allowed features, such as a graphical display and multiple data output, to be added. The Port Stanley observatory is running a beta version of the BGS SDAS v0.2 data acquisition software (Date: 24 January 2002), which simultaneously takes samples from the ADC and proton precession magnetometer synchronised to the GPS receiver time (UTC). Raw data are stored in an internal ring buffer in both unfiltered and one-minute filtered form. Additionally, Flare *Plus* format data are written to the internal hard disk and, optionally, to an external DOS-formatted floppy disk. QNX also allows remote access to the operating system, the acquisition system (SDAS) and data via the network link.

4.1 SOFTWARE CONFIGURATION

In the system configuration file `/etc/config/sysinit.1`, the acquisition software has been configured to launch automatically once the operating system starts. This file also defines the operating system drivers for the serial ports and disks.

Although some of the SDAS acquisition utilities require 'root' privilege, all are launched from the 'sdas' user ID. The account for this ID resides under the directory `/home/sdas` and contains all of the acquisition software, the acquisition configuration files and the locally recorded data. The significant directories for the acquisition are:

- | | |
|-----------------------------------|--|
| <code>/home/sdas/bin</code> | - Contains all of the acquisition executables and the main scripts |
| <code>/home/sdas/config</code> | - Files containing the configurable parameters for the acquisition |
| <code>/home/sdas/data/wave</code> | - Ring buffer directory. Each individual data channel is written to a separate directory; <code>chan_00</code> , <code>chan_01</code> , etc. |

- /home/data/archive - Location of extracted one-minute filtered data in Flare *Plus* format
- /home/data/log - Location of log files containing errors, warnings and status messages created by the acquisition software
- /dos/a - The DOS format floppy disk, to which a copy of the contents of /home/data/extract are written

The files in the configuration directory (/home/sdas/config) have been created to reflect the type of ADC, PPM and GPS used at the Port Stanley observatory, as well as the ADC and fluxgate magnetometer calibration parameters so that the output data are correctly scaled to nanoTesla. The significant files in this directory are:

- /home/sdas/config/general.cfg - Sets the parameters required by the acquisition clock, lists utilities to be started before and after the acquisition software and also sets some of the necessary directory paths for output files.
- /home/sdas/config/acquire.cfg - Instructs the acquisition software as to which drivers are to be started in order to collect data. Any parameters required by the drivers are set here, as are the serial port settings.
- /home/sdas/config/channels.cfg - This file is used to set the characteristics of each individual channel. The parameters here are linked to those in acquire.cfg, but this is the file where the channel names and calibrated conversion factors are set.
- /home/sdas/config/schedule.cfg - Configuration file for the SDAS schedule program. The schedule program executes utilities defined in this file at the allocated times. Utilities include extracting data from the ring buffer and deleting data and log files.
- /home/sdas/config/archive.ext - Configuration file for the extract utility, describing the Flare*Plus* format and the location of output files on the hard drive.
- /home/sdas/config/flare.ext - Identical to 'archive.ext', except that the location of the output file is set to the floppy disk rather than the hard drive.

The contents of these configuration files have been recorded in Appendix C, along with the contents of the system configuration file /etc/config/sysinit.1. In this configuration, the channel numbers with which the data are recorded are listed in Table 3.

Table 3 Input Data Channel Numbers

| Channel Number | Channel Name | Recording Interval | Channel Unit |
|----------------|----------------------|--------------------|--------------|
| 0 | H-component | 1 second | μ Volts |
| 1 | D-component | 1 second | μ Volts |
| 2 | Z-component | 1 second | μ Volts |
| 3 | Temperature | 1 second | μ Volts |
| 4 | PPM F value | 10 seconds | 0.01 nTesla |
| 5 | Filtered H-component | 1 minute | 0.1 nTesla |
| 6 | Filtered D-component | 1 minute | 0.1 nTesla |
| 7 | Filtered Z-component | 1 minute | 0.1 nTesla |
| 8 | Filtered Temperature | 1 minute | 0.1 °C |
| 9 | Filtered PPM F value | 1 minute | 0.1 nTesla |

4.2 DATA FILES

To allow the of use existing processing software with the minimum of modification, the extracted one-minute filtered data from the fluxgate and proton magnetometers are written in Flare *Plus* format. The data are stored on the hard-disk in 36000-byte day files with the name *yyyymmdd.fkqa*; where *yyyy* is the four-digit year, *mm* is the two-digit month and *dd* is the two-digit day. Each one-minute record is a 25-byte C structure, with Intel byte order, of the form:

```
struct FILE_DATA{
    char mon,day;
    char hr,min;
    long vh,vd,vz,vt,pf;
    char proton_sn;
};
```

Where:

mon is the month
day is the day of the month
hr is the hour
min is the minute
vh is the fluxgate variometer horizontal component (0.1 nT)
vd is the fluxgate variometer declination component (0.1 nT)
vz is the fluxgate variometer vertical component (0.1 nT)
vt is the fluxgate sensor temperature (0.1 °C)
pf is the PPM field magntitude (0.1 nT)
proton_sn is the PPM signal to noise indicator. Since this is not recorded here, it is always set to 'x'.

The amount of data stored in the hard disk archive and the floppy disk is dictated by the size of the respective disks. A 1.44 Mbyte floppy disk has a capacity of 40 days, and should therefore be changed once per month. The hard disk has such a large capacity that it should hold many years of archived data. The amount of ring buffer data, however, is regulated and older files are deleted by the 'hourly_proc' script. The size of the ring buffer is set in 'general.cfg' to 40000 hours (over 1600 days), while the size of the error log is set to 30 days.

5 Absolute Observations and Variometer Baselines

On 6 February 2003 , prior to the removal of the plywood huts two absolute observations were made and the results are given in Table 4. After the huts were replaced a further 8 observations were made and the results listed in Table 5.

Table 4 Fluxgate Magnetometer Baselines

| Observation Date | Declination | Horizontal Component | Vertical Component |
|---------------------|-------------------|-------------------------|--------------------|
| 6/2/2003 | 3° 54' 27" | 19202.6 | -22007.2 |
| 6/2/2003 | 3° 54' 31" | 19202.2 | -22007.6 |
| Mean | 3° 54' 31" | 19202.4 nT | -22007.4 nT |

Table 5

| Observation Date | Declination | Horizontal Component | Vertical Component |
|---------------------|-------------------|-------------------------|--------------------|
| 8/2/2002 | 4° 07' 44" | 19193.8 | -22084.3 |
| 8/2/2002 | 4° 07' 26" | 191934.0 | -22084.2 |
| 8/2/2002 | 4° 07' 22" | 19195.0 | -22084.1 |
| 8/2/2002 | 4° 07' 46" | 19195.4 | -22083.8 |
| 9//2002 | 4° 07' 26" | 19194.9 | -22085.2 |
| 9//2002 | 4° 07' 22" | 19193.0 | -22086.9 |
| 10/2002 | 4° 06' 51" | 19197.6 | -22084.0 |
| 10/2002 | 4° 07' 19" | 19198.0 | -22083.7 |
| Mean | 4° 07' 17" | 19196.2 nT | -22084.5 nT |

As noted in the 2002 service report there may be an error introduced to the absolute observations by some of the various radio transmitters sited on Sapper Hill and operated by Cable and Wireless, amongst others. This effect was also observed during the 2003 service visit. With the fluxgate theodolite on the tripod in the absolute observing hut, and the fluxgate electronics outside of the hut so that the joining cable was laid in a straight line between the two, it was possible to induce changes of up to 10 nT in the fluxgate reading by lifting the cable a few inches off the ground, i.e. changing the location of the cable within the electromagnetic field generated by the transmitters. This effect was difficult to quantify, but tests with a basic RF monitor indicated that both the D/I absolute position and the fluxgate hut are affected by the same magnitude of RF power from this mast which is 35 m away.

As can be seen from the repeatability, this effect has not significantly affected the quality of the baselines derived from absolute measurements conducted during the installation.

6 Fixed Mark Bearing

The bearing from the absolute observation position to the fixed reference mark has previously been measured to be $281^{\circ} 31' 01''$ with respect to True North (Riddick, 1999). This fixed mark, the memorial cross on Tumbledown Mountain, was used to derive declination from the absolute observations. Although the Tumbledown bearing was not re-determined, the bearing from the observation mark to an auxiliary fixed mark was measured against it. The auxiliary mark is the left-hand edge of the visible metal peg protruding from the concrete base of a former gun emplacement. The gun emplacement is located on top of the rocky outcrop overlooking the absolute observing position on Sapper Hill.

Hence, the bearing of the auxiliary fixed mark with respect to True North was measured as $1^{\circ} 43' 57''$ (Appendix A).

A further check on the memorial cross on Tumbledown may be made using a deep notch on the skyline approximately 21 minutes south of the Tumbledown memorial. The bearing of the “V” at the bottom of this notch was measured as $281^{\circ} 10' 11''$ w.r.t. True North ($0^{\circ} 20' 50''$ south of the memorial cross)

7 Total Field (F) Site Differences

Prior to replacing the huts a series of F site differences were made, these gave a total field difference between the proton magnetometer in the D/I absolute and the proton magnetometer in the fluxgate hut as -29.8 nT. This result compared favourably with -28.2 nT measured in February 2002. This value was used in the reduction of the two absolute made on 6 February.

Once the construction work on the huts and PPM sensor had been moved to its new position in the sensor hut as described in Section 3.2, the difference in the total field intensity was measured between the new location and the absolute observation site by running a second PPM at the over the absolute mark, at the same height as the theodolite. The second magnetometer was a Gem Systems GSM19 (S/N 701595).

Between 7 and 13 February 8 sets of measurements of the F site difference between the two positions were made. These gave a difference of 23.0 nT. This large change, 51.2 nT, between the site difference before and after replacing the huts and re-installing the proton magnetometer gave considerable cause for concern and checks were made to confirm that the new huts were completely non-magnetic. After carrying out a series of tests we reached the conclusion that the huts were non-magnetic but as they were slightly smaller than the original plywood huts we were experiencing problems due to interference between the fluxgate and proton sensors. This problem should be addressed during the next service visit, see Section 10

8 Instrument Calibrations

Appendix B lists the on-site calibrations of the ADC, the fluxgate and proton precession magnetometers.

9 Temperature Records

During the previous visit, a Tinytalk temperature logger (S/N 26851) was left in the sensor hut to take two-hourly samples of the ambient temperature of the instruments. These data were recovered and the logger re-launched on 7 February. The recovered data have been plotted in Figure 1.

Statistics taken from the temperature data:

| | |
|--|--------|
| Maximum temperature February 2002 to February 2003 | 32.2°C |
| Minimum temperature February 2002 to February 2003 | -6.3°C |
| Annual mean temperature Feb 2002 to Feb 2003 | 5.8°C |

10 MiniMet System

During the 2003 service visit instruments to measure temperature, humidity, wind-speed and direction were installed on a small mast adjacent to the Cable and Wireless instrument hut on Sapper Hill. The outputs of these sensors are digitised by a PIC16F877 Microcontroller and input through COM 4 on the data recording PC. All outputs are digitised every second and the data are output as a 9600 baud data stream in the format:

```
PST,SSS,DDD,HHH,TTTcrLf
```

Where:

- PST is the station header
- SSS is the wind speed
- DDD in the wind direction
- HHH the relative humidity
- TTT temperature

All the above values are given in counts and to convert to standard meteorological units the following conversion factors must be applied:

SSS wind speed in counts to knots, divide counts by 2.575

DDD wind direction in counts to 0 to 360 degrees, divide counts by 2.8

HHH humidity in counts to 0 to 100%, multiply counts by 1.21

TTT temperature in counts to -40 to +60°C, $((\text{counts} - 400) / 10)$

All circuit diagrams, wiring and a listing of the PIC software is given in Appendix F

The sensors used are:

| | |
|------------------------------------|--------------------------|
| Temperature and Humidity, | Rotronic HYGROMER MP100A |
| Wind Speed, Vector Instruments, | A100LM |
| Wind Direction, Vector Instruments | W200P |

11 Conclusions and Recommendations for Future Visits

In 2002 Port Stanley observatory was successfully upgraded from a proton vector magnetometer observatory, sampling at one-minute intervals, to a 1Hz fluxgate magnetometer observatory with GPS timing and remote network access. Where possible, existing equipment and cabling was re-used, but a new sensor, power supply and data recorder were installed

As described in Section 3.2, the PPM regulator box is superfluous and should be removed during a future visit.

Glossary

PPM Proton Precession Magnetometer – a scalar, full-field instrument, capable of giving a quasi-absolute measurement of the magnetic field.

SDAS Simple Data Acquisition Software – a BGS-developed set of programs which operate under the QNX operating system.

UTC Coordinated Universal Time – a global time reference, used to relate observations between observatories.

ADC Analog-to-digital converter – Used to convert the analogue output of an instrument to a digital record for recording and transmission.

QNX A UNIX-like, real-time, multitasking operating system for personal computers.

Fluxgate Abbreviation of fluxgate magnetometer – a vector magnetometer, here composed of three orthogonally-mounted elements.

PSU Power Supply Unit – A device for providing electrical power to another device or instrument, usually by conditioning another electrical power source.

Variometer An instrument which only measures variations of a natural element with respect to a fixed offset value, rather than measuring the true (absolute) value.

GPS Global Positioning System – A system consisting of an array of 24 satellites, base stations and remote receivers which has been designed to give accurate position and time.

PC Personal Computer – a term used to describe a computer capable of operating independently of other computers, typically based on the Intel 8086 chipset.

References

Most of the references listed below are held in the Library of the British Geological Survey at Keyworth, Nottingham. Copies of the references may be purchased from the Library subject to the current copyright legislation.

INTERMAGNET TECHNICAL REFERENCE MANUAL, 1999, *US Geological Survey*, Box 25046 MS968, Denver, CO 80225-0046, USA.

RIDDICK, J. C. AND HARRIS, T. J., 1994, Falkland Islands Magnetic Observatory Installation Report, *BGS Technical Report WM/94/18*

RIDDICK, J. C., TURBITT, C. W., MCDONALD, J., 1995, The BGS Proton Magnetometer ($\delta D/\delta I$) Observatory Mark II System, Installation Guide and Technical Manual, *BGS Technical Report WM/95/32*

RIDDICK, J. C., Report on Falkland Islands Magnetic Observatory Service Visit, 7-13 February 2001

Turbitt, C.W., Flower, S.M. 2002. Port Stanley Magnetic Observatory Service Report, *British Geological Survey Internal Report*, IR/03037.

Appendix A Absolute Observations

The following entries list the manual measurements made at the Port Stanley observatory absolute observing site using a fluxgate theodolite magnetometer. These null-method measurements are used to determine a precise vector measurement of the magnetic field to estimate the offsets, or baselines, of the vector variometer instrument.

ABSOLUTE OBSERVATION 1

Observatory: PST

Observer: JCR

Date: 06 Feb 2003

Site Difference: -28.2

Fixed Mark Reading

CL 1: 112° 46' 00"

CR 1: 292° 46' 03"

CL 2: 112° 46' 04"

CR 2: 292° 46' 07"

Mean: 202° 46' 04"

FM True: 281° 31' 01"

TN Circle: 191° 15' 03"

| Declination Observation | VarD(nT) |
|--------------------------|----------------|
| WU: 09:22 105° 02' 05" | 105.0347 -15.9 |
| EU: 09:23 285° 14' 01" | 285.2336 -15.3 |
| WD: 09:25 285° 10' 27" | 285.1742 -13.4 |
| ED: 09:26 105° 01' 01" | 105.0169 -13.4 |
| Mean: 09:24 195° 06' 54" | |

Declination: 09:24 003° 51' 51"

| Inclination Observation | PPMF(nT) | VarH(nT) | VarZ(nT) |
|-------------------------|----------|----------|------------|
| NU: 09:33 131° 10' 10" | -48.8306 | 29242.9 | -0.4 -10.5 |
| SD: 09:34 311° 11' 06" | -48.8150 | 29242.7 | -0.2 -9.9 |
| ND: 09:36 228° 59' 20" | -48.9889 | 29242.8 | 0.8 -9.2 |
| SU: 09:38 048° 59' 06" | -48.9850 | 29242.5 | 1.4 -8.2 |

Inclination: 09:35 -048° 54' 18"

Baselines

| | Absolute | GDAS | Baseline |
|---------|----------|---------|----------------------------|
| F (nT): | 29214.5 | 29242.7 | -28.2 |
| D(deg): | 3.8642 | -0.0433 | 3.9074 003° 54' 27" |
| H (nT): | 19203.0 | 0.4 | 19202.6 |
| Z (nT): | -22016.6 | -9.4 | -22007.2 |

Collimation Errors

Declination Delta: 000° -01' 10"
Declination Epsilon: 000° -04' 40"
Declination Zo: 3.5
Inclination Epsilon: 000° -04' 56"
Inclination Zo: 2.5

ABSOLUTE OBSERVATION 2

Observatory: PST

Observer: JCR

Date: 06 Feb 2003

Site Difference: -28.2

Fixed Mark Reading

CL 1: 112° 46' 04"

CR 1: 292° 46' 08"

CL 2: 112° 46' 12"

CR 2: 292° 46' 11"

Mean: 202° 46' 09"

FM True: 281° 31' 01"

TN Circle: 191° 15' 08"

Declination Observation VarD(nT)

WU: 09:45 105° 02' 16" 105.0378 -18.4

EU: 09:46 285° 12' 39" 285.2108 -18.7

WD: 09:42 285° 10' 53" 285.1814 -18.7

ED: 09:43 104° 59' 22" 104.9894 -18.7

Mean: 09:44 195° 06' 18"

Declination: 09:44 003° 51' 10"

Inclination Observation PPMF(nT) VarH(nT) VarZ(nT)

NU: 09:54 131° 10' 31" -48.8247 29240.1 1.0 -5.4

SD: 09:55 311° 11' 04" -48.8156 29240.1 1.0 -5.3

ND: 09:51 228° 58' 55" -48.9819 29240.4 1.5 -5.2

SU: 09:52 048° 58' 32" -48.9756 29240.3 1.5 -5.3

Inclination: 09:53 -048° 53' 58"

Baselines

Absolute GDAS Baseline

F (nT): 29212.0 29240.2 -28.2

D(deg): 3.8527 -0.0556 3.9083 **003° 54' 30''**

H (nT): 19203.5 1.2 **19202.2**

Z (nT): -22012.9 -5.3 **-22007.6**

Collimation Errors

Declination Delta: 000° -01' 10"

Declination Epsilon: 000° -04' 47"

Declination Zo: -1.6

Inclination Epsilon: 000° -04' 46"

Inclination Zo: 2.0

ABSOLUTE OBSERVATION 3

Observatory: PST

Observer: JCR

Date: 08 Feb 2003

Site Difference: 23.0

Fixed Mark Reading

CL 1: 136° 42' 39"
 CR 1: 316° 42' 49"
 CL 2: 136° 42' 59"
 CR 2: 316° 42' 55"
 Mean: 226° 42' 50"

FM True: 281° 31' 01"

TN Circle: 215° 11' 49"

| Declination Observation | VarD(nT) |
|--------------------------|----------------|
| WU: 15:04 309° 08' 34" | 309.1428 -37.6 |
| EU: 15:05 129° 19' 58" | 129.3328 -38.1 |
| WD: 15:06 129° 17' 02" | 129.2839 -38.6 |
| ED: 15:08 309° 05' 12" | 309.0867 -38.6 |
| Mean: 15:05 219° 12' 42" | |

Declination: 15:05 004° 00' 52"

| Inclination Observation | PPMF(nT) | VarH(nT) | VarZ(nT) |
|-------------------------|----------|----------|------------|
| NU: 15:12 131° 04' 37" | -48.9230 | 29176.7 | -34.5 49.3 |
| SD: 15:13 311° 06' 00" | -48.9000 | 29176.5 | -34.4 49.6 |
| ND: 15:15 229° 04' 54" | -49.0817 | 29176.4 | -33.7 50.3 |
| SU: 15:16 049° 03' 42" | -49.0617 | 29176.1 | -33.6 50.8 |

Inclination: 15:14 -048° 59' 30"

IR/03/037

Baselines

| | Absolute | GDAS | Baseline | |
|---------|----------|---------|-----------------|---------------------|
| F (nT): | 29199.4 | 29176.4 | 23.0 | |
| D(deg): | 4.0145 | -0.1143 | 4.1288 | 004° 07' 44" |
| H (nT): | 19159.8 | -34.1 | 19193.8 | |
| Z (nT): | -22034.3 | 50.0 | -22084.3 | |

Collimation Errors

Declination Delta: 000° -01' 35"
Declination Epsilon: 000° -05' 03"
Declination Zo: -0.6
Inclination Epsilon: 000° -04' 48"
Inclination Zo: 5.5

ABSOLUTE OBSERVATION 4

Observatory: PST

Observer: JCR

Date: 08 Feb 2003

Site Difference: 23.0

Fixed Mark Reading

CL 1: 136° 42' 56"
 CR 1: 316° 42' 53"
 CL 2: 136° 42' 46"
 CR 2: 316° 42' 51"
 Mean: 226° 42' 52"

FM True: 281° 31' 01"

TN Circle: 215° 11' 51"

Declination Observation VarD(nT)

WU: 15:22 309° 08' 10" 309.1361 -40.7
 EU: 15:23 129° 18' 25" 129.3069 -41.0
 WD: 15:24 129° 16' 30" 129.2750 -41.1
 ED: 15:26 309° 04' 45" 309.0792 -40.2
 Mean: 15:23 219° 11' 57"

Declination: 15:23 004° 00' 07"

Inclination Observation PPMF(nT) VarH(nT) VarZ(nT)

NU: 15:31 131° 05' 34" -48.9072 29174.4 -30.7 55.7
 SD: 15:33 311° 06' 41" -48.8886 29173.6 -31.0 56.4
 ND: 15:35 229° 03' 59" -49.0664 29173.2 -31.1 57.0
 SU: 15:36 049° 03' 04" -49.0511 29173.0 -31.1 57.2

Inclination: 15:33 -048° 58' 42"

Baselines

| | Absolute | GDAS | Baseline | |
|---------|----------|---------|-----------------|---------------------|
| F (nT): | 29196.6 | 29173.6 | 23.0 | |
| D(deg): | 4.0019 | -0.1218 | 4.1238 | 004° 07' 26" |
| H (nT): | 19163.0 | -31.0 | 19194.0 | |
| Z (nT): | -22027.7 | 56.6 | -22084.2 | |

Collimation Errors

Declination Delta: 000° -01' 20"
Declination Epsilon: 000° -04' 47"
Declination Zo: -2.1
Inclination Epsilon: 000° -04' 49"
Inclination Zo: 4.3

ABSOLUTE OBSERVATION 5

Observatory: PST

Observer: JCR

Date: 08 Feb 2003

Site Difference: 23.0

Fixed Mark Reading

CL 1: 215° 00' 14"

CR 1: 035° 00' 10"

CL 2: 215° 00' 18"

CR 2: 035° 00' 12"

Mean: 125° 00' 13"

FM True: 281° 31' 01"

TN Circle: 113° 29' 13"

Declination Observation

VarD(nT)

WU: 19:39 027° 23' 38" 27.3939 -34.9

EU: 19:41 207° 40' 30" 207.6750 -34.2

WD: 19:42 207° 31' 26" 207.5239 -34.2

ED: 19:43 027° 26' 06" 27.4350 -34.1

Mean: 19:41 117° 30' 25"

Declination: 19:41 004° 01' 12"

Inclination Observation

PPMF(nT) VarH(nT) VarZ(nT)

NU: 19:48 131° 06' 19" -48.8947 29175.0 -35.9 51.0

SD: 19:49 311° 04' 27" -48.9258 29174.3 -36.4 51.7

ND: 19:50 229° 03' 01" -49.0503 29173.5 -37.0 52.1

SU: 19:51 049° 05' 34" -49.0928 29173.7 -36.6 52.3

Inclination: 19:49 -048° 59' 27"

IR/03/037

Baselines

| | Absolute | GDAS | Baseline |
|---------|----------|---------|----------------------------|
| F (nT): | 29197.1 | 29174.1 | 23.0 |
| D(deg): | 4.0201 | -0.1027 | 4.1229 004° 07' 22" |
| H (nT): | 19158.5 | -36.5 | 19195.0 |
| Z (nT): | -22032.3 | 51.8 | -22084.1 |

Collimation Errors

Declination Delta: 000° -01' 39"
Declination Epsilon: 000° -04' 50"
Declination Zo: 16.1
Inclination Epsilon: 000° -04' 50"
Inclination Zo: -9.4

ABSOLUTE OBSERVATION 6

Observatory: PST

Observer: JCR

Date: 08 Feb 2003

Site Difference: 23.0

Fixed Mark Reading

CL 1: 215° 00' 16"
 CR 1: 035° 00' 13"
 CL 2: 215° 00' 19"
 CR 2: 035° 00' 24"
 Mean: 125° 00' 18"

FM True: 281° 31' 01"

TN Circle: 113° 29' 17"

Declination Observation VarD(nT)

WU: 19:55 027° 21' 42" 27.3617 -39.8
 EU: 19:56 207° 38' 57" 207.6492 -40.0
 WD: 19:58 207° 29' 53" 207.4981 -40.0
 ED: 20:00 027° 24' 53" 27.4147 -40.6
 Mean: 19:57 117° 28' 51"

Declination: 19:57 003° 59' 34"

Inclination Observation PPMF(nT) VarH(nT) VarZ(nT)

NU: 20:05 131° 06' 40" -48.8889 29172.7 -35.9 54.2
 SD: 20:06 311° 04' 51" -48.9192 29172.2 -36.4 54.4
 ND: 20:08 229° 02' 56" -49.0489 29170.9 -37.6 55.1
 SU: 20:09 049° 05' 26" -49.0906 29170.8 -37.7 55.2

Inclination: 20:07 -048° 59' 13"

Baselines

| | Absolute | GDAS | Baseline | |
|---------|----------|---------|-----------------|---------------------|
| F (nT): | 29194.6 | 29171.6 | 23.0 | |
| D(deg): | 3.9928 | -0.1199 | 4.1128 | 004° 06' 46" |
| H (nT): | 19158.5 | -36.9 | 19195.4 | |
| Z (nT): | -22029.1 | 54.7 | -22083.8 | |

Collimation Errors

Declination Delta: 000° -01' 28"
Declination Epsilon: 000° -04' 50"
Declination Zo: 17.1
Inclination Epsilon: 000° -04' 58"
Inclination Zo: -9.2

ABSOLUTE OBSERVATION 7

Observatory: PST

Observer: JCR

Date: 09 Feb 2003

Site Difference: 23.0

Fixed Mark Reading

CL 1: 079° 10' 46"

CR 1: 259° 10' 35"

CL 2: 079° 10' 41"

CR 2: 259° 10' 41"

Mean: 169° 10' 41"

FM True: 281° 31' 01"

TN Circle: 157° 39' 40"

| Declination Observation | VarD(nT) |
|---------------------------------|----------------|
| WU: 12:49 251° 30' 03" | 251.5008 -78.9 |
| EU: 12:51 071° 38' 50" | 71.6472 -77.8 |
| WD: 12:52 071° 38' 15" | 71.6375 -77.1 |
| ED: 12:53 251° 25' 39" | 251.4275 -76.5 |
| Mean: 12:51 161° 33' 12" | |
| Declination: 12:51 003° 53' 32" | |

| Inclination Observation | PPMF(nT) | VarH(nT) | VarZ(nT) |
|----------------------------------|----------|----------|------------|
| NU: 12:59 131° 08' 44" | -48.8544 | 29182.7 | -18.9 56.7 |
| SD: 13:00 311° 05' 23" | -48.9103 | 29182.6 | -19.1 56.7 |
| ND: 13:01 229° 00' 39" | -49.0108 | 29182.5 | -19.4 56.6 |
| SU: 13:03 049° 04' 03" | -49.0675 | 29182.3 | -19.7 56.5 |
| Inclination: 13:00 -048° 57' 39" | | | |

Baselines

| | Absolute | GDAS | Baseline |
|---------|----------|---------|----------------------------|
| F (nT): | 29205.5 | 29182.5 | 23.0 |
| D(deg): | 3.8922 | -0.2318 | 4.1240 004° 07' 26" |
| H (nT): | 19175.6 | -19.3 | 19194.9 |
| Z (nT): | -22028.6 | 56.6 | -22085.2 |

Collimation Errors

Declination Delta: 000° -01' 15"
Declination Epsilon: 000° -04' 39"
Declination Zo: -5.3
Inclination Epsilon: 000° -04' 42"
Inclination Zo: -14.3

ABSOLUTE OBSERVATION 8

Observatory: PST

Observer: JCR

Date: 09 Feb 2003

Site Difference: 23.0

Fixed Mark Reading

CL 1: 079° 10' 40"

CR 1: 259° 10' 33"

CL 2: 079° 10' 36"

CR 2: 259° 10' 31"

Mean: 169° 10' 35"

FM True: 281° 31' 01"

TN Circle: 157° 39' 34"

Declination Observation

VarD(nT)

WU: 13:07 251° 26' 55" 251.4486 -74.9

EU: 13:08 071° 42' 54" 71.7150 -75.4

WD: 13:10 071° 34' 35" 71.5764 -76.0

ED: 13:11 251° 29' 08" 251.4855 -76.0

Mean: 13:09 161° 33' 23"

Declination: 13:09 003° 53' 49"

Inclination Observation

PPMF(nT) VarH(nT) VarZ(nT)

NU: 13:15 131° 08' 18" -48.8617 29178.8 -21.8 59.2

SD: 13:17 311° 05' 06" -48.9150 29178.0 -22.2 60.1

ND: 13:19 229° 01' 05" -49.0181 29177.6 -22.5 60.4

SU: 13:20 049° 04' 08" -49.0689 29177.2 -23.0 60.6

Inclination: 13:17 -048° 57' 57"

Baselines

| | Absolute | GDAS | Baseline | |
|---------|----------|---------|-----------------|---------------------|
| F (nT): | 29200.9 | 29177.9 | 23.0 | |
| D(deg): | 3.8969 | -0.2259 | 4.1228 | 004° 07' 22" |
| H (nT): | 19170.6 | -22.4 | 19193.0 | |
| Z (nT): | -22026.8 | 60.1 | -22086.9 | |

Collimation Errors

Declination Delta: 000° -01' 31"
Declination Epsilon: 000° -04' 40"
Declination Zo: 14.7
Inclination Epsilon: 000° -04' 39"
Inclination Zo: -13.3

ABSOLUTE OBSERVATION 9

Observatory: PST

Observer: JCR

Date: 10 Feb 2003

Site Difference: 23.0

Fixed Mark Reading

CL 1: 011° 44' 16"
 CR 1: 191° 44' 15"
 CL 2: 011° 44' 19"
 CR 2: 191° 44' 25"
 Mean: 101° 44' 19"

FM True: 281° 31' 01"

TN Circle: 090° 13' 18"

Declination Observation VarD(nT)

WU: 15:27 004° 03' 23" 4.0564 -43.8
 EU: 15:28 184° 23' 54" 184.3983 -43.9
 WD: 15:30 184° 12' 24" 184.2067 -44.4
 ED: 15:31 004° 09' 17" 4.1547 -44.4
 Mean: 15:29 094° 12' 14"

Declination: 15:29 003° 58' 57"

Inclination Observation PPMF(nT) VarH(nT) VarZ(nT)

NU: 15:35 131° 11' 16" -48.8122 29175.9 -13.2 72.0
 SD: 15:37 311° 07' 18" -48.8783 29175.6 -13.4 72.1
 ND: 15:38 228° 58' 32" -48.9756 29175.2 -13.9 72.2
 SU: 15:39 049° 02' 30" -49.0417 29174.9 -14.2 72.4

Inclination: 15:37 -048° 55' 37"

Baselines

| | Absolute | GDAS | Baseline |
|---------|----------|---------|----------------------------|
| F (nT): | 29198.4 | 29175.4 | 23.0 |
| D(deg): | 3.9824 | -0.1318 | 4.1142 004° 06' 51" |
| H (nT): | 19184.0 | -13.7 | 19197.6 |
| Z (nT): | -22011.9 | 72.2 | -22084.0 |

Collimation Errors

Declination Delta: 000° -01' 24"
Declination Epsilon: 000° -05' 09"
Declination Zo: 24.3
Inclination Epsilon: 000° -04' 54"
Inclination Zo: -16.8

ABSOLUTE OBSERVATION 10

Observatory: PST

Observer: JCR

Date: 10 Feb 2003

Site Difference: 23.0

Fixed Mark Reading

CL 1: 011° 44' 23"
 CR 1: 191° 44' 21"
 CL 2: 011° 44' 11"
 CR 2: 191° 44' 20"
 Mean: 101° 44' 19"

FM True: 281° 31' 01"

TN Circle: 090° 13' 18"

Declination Observation VarD(nT)

WU: 15:42 004° 04' 46" 4.0794 -43.5
 EU: 15:44 184° 23' 42" 184.3950 -43.2
 WD: 15:46 184° 12' 48" 184.2133 -43.2
 ED: 15:47 004° 10' 08" 4.1689 -43.5
 Mean: 15:44 094° 12' 51"

Declination: 15:44 003° 59' 33"

Inclination Observation PPMF(nT) VarH(nT) VarZ(nT)

NU: 15:51 131° 12' 07" -48.7980 29176.6 -9.2 74.3
 SD: 15:52 311° 07' 10" -48.8806 29176.8 -8.7 74.6
 ND: 15:54 228° 57' 09" -48.9525 29176.5 -8.9 74.9
 SU: 15:55 049° 01' 55" -49.0319 29176.3 -9.3 74.9

Inclination: 15:53 -048° 54' 57"

Baselines

| | Absolute | GDAS | Baseline |
|---------|----------|---------|----------------------------|
| F (nT): | 29199.6 | 29176.6 | 23.0 |
| D(deg): | 3.9926 | -0.1294 | 4.1220 004° 07' 19" |
| H (nT): | 19189.0 | -9.0 | 19198.0 |
| Z (nT): | -22009.0 | 74.7 | -22083.7 |

Collimation Errors

Declination Delta: 000° -01' 23"
Declination Epsilon: 000° -04' 42"
Declination Zo: 22.7
Inclination Epsilon: 000° -04' 35"
Inclination Zo: -20.6

Appendix B Instrument Calibrations

This section details the calibrations carried out on the various instruments during the installation visit, plus a calibration of the fluxgate magnetometer prior to shipment to the Falkland Islands.

FLUXGATE MAGNETOMETER CALIBRATION, 7 FEBRUARY 2003

| | | | | | | | | | |
|------------------------------------|-----------------------------|-------------------|-----------|--------------------|----------------|-----------|---------------------------|----------------|-----------|
| Date | 7-Feb-03 | | | | | | | | |
| Fluxgate Sensor Electronics | Type | Serial No. | | Approx.H | 17000 nT | | | | |
| | FGE | S0216 | | Approx.Z | 45000 nT | | | | |
| | FGE-89E | E0262 | | | | | | | |
| Resistor DVM Temperature | Serial: | Value: | | 999.8 Ohms | | | | | |
| | Type: | Serial: | | Calibrated: | | | | | |
| | | | | | | | | | |
| | Horizontal Component | | | Declination | | | Vertical Component | | |
| | H+ | H0 | H- | D+ | D0 | D- | Z+ | Z0 | Z- |
| Vout | 8.7016 | -0.024 | -8.7432 | 8.706 | -0.038 | -8.7624 | 8.4488 | -0.161 | -8.7659 |
| R Voltage | 90.595 | 0 | -90.588 | 90.6 | 0 | -90.588 | 90.6 | 0 | -90.595 |
| Vout Range | | 17.4448 | | | 17.4684 | | | 17.2147 | |
| I Range | | 0.1812192 | | | 0.1812242 | | | 0.1812312 | |
| Coil Const. | | 38600 | | | 38593 | | | 38601 | |
| Field Range | | 6995.0628 | | | 6993.9873 | | | 6995.7073 | |
| Flux. Calibration | | 400.98269 nT/V | | | 400.37939 nT/V | | | 406.37986 nT/V | |

ADC AND FLUXGATE MAGNETOMETER CALIBRATION, 7 FEBRUARY 2003

| ADC #01 | | ADC Channel | | | |
|------------------------|---|-------------|---------|---------|---------|
| Applied Voltage | H | D | Z | T | |
| 4.5907 | | 4.5914 | 4.5906 | 4.5904 | 4.5906 |
| 0 | | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| -4.5913 | | -4.5943 | -4.5904 | -4.5906 | -4.5911 |
| 9.182 | | 9.1857 | 9.1810 | 9.1810 | 9.1817 |
| ADC Calibration | | 1.0004 | 0.9999 | 0.9999 | 1.0000 |

| ADC #02 | | ADC Channel | | | |
|------------------------|---|-------------|--------|--------|--------|
| Applied Voltage | H | D | Z | T | |
| 9.253 | | 9.256 | 9.255 | 9.253 | 9.253 |
| 0 | | 0.000 | 0.000 | 0.000 | 0.000 |
| -9.2534 | | -9.257 | -9.254 | -9.254 | -9.254 |
| 18.5064 | | 18.513 | 18.509 | 18.507 | 18.507 |
| ADC Calibration | | 1.000 | 1.000 | 1.000 | 1.000 |

| PPM Sensor | | PPM Electronics | | | |
|----------------------------------|-------------|-----------------|-------------------------|-------|-------------------------|
| Serial Number | Cal Box | Type | SM90R | S/N | 13158 Spare Electronics |
| | C0 | | | | |
| Proton Gyromagnetic Ratio | | | 267515250 | | |
| Switch Setting | Input Freq. | Cal Value | PPM Output Error | | |
| 7 | 833.33333 | 19572.67 | 19572.74 | -0.07 | |
| 9 | 1000 | 23487.20 | 23487.29 | -0.09 | |
| 6 | 1666.6667 | 39145.34 | 39145.53 | -0.19 | |
| 5 | 2000 | 46974.41 | 46974.59 | -0.18 | |
| 4 | 2500 | 58718.01 | 58718.31 | -0.30 | |
| 3 | 3333.3333 | 78290.68 | 78290.00 | 0.68 | |

| PPM Sensor | | PPM Electronics | | | |
|----------------------------------|-------------|-----------------|-------------------------|-------|--------|
| Serial Number | Cal Box | Type | GSM19 | S/N | 701595 |
| | C0 | | | | |
| Proton Gyromagnetic Ratio | | | 267515250 | | |
| Switch Setting | Input Freq. | Cal Value | PPM Output Error | | |
| 7 | 833.33333 | 19572.67 | 19572.80 | -0.13 | |
| 9 | 1000 | 23487.20 | 23487.32 | -0.12 | |
| 6 | 1666.6667 | 39145.34 | 39145.62 | -0.28 | |
| 5 | 2000 | 46974.41 | 46974.62 | -0.21 | |
| 4 | 2500 | 58718.01 | 58718.39 | -0.38 | |
| 3 | 3333.3333 | 78290.68 | 78291.03 | -0.35 | |

MAIN OBSERVATORY PROTON PRECESSION MAGNETOMETER CALIBRATION

| | | | | | |
|----------------------------------|--------------------|------------------------|---------------------------|--------------|-------|
| PPM Sensor | | PPM Electronics | | | |
| Serial Number | | Type | SM90R | S/N | 61528 |
| Cal Box | C0 | | | | |
| Proton Gyromagnetic Ratio | | | 267515250 \pm 40 T-1s-1 | | |
| Switch Setting | Input Freq. | Cal Value | PPM Output | Error | |
| 7 | 833.33333 | 19572.67 | 19572.83 | -0.16 | |
| 9 | 1000 | 23487.20 | 23487.35 | -0.15 | |
| 6 | 1666.6667 | 39145.34 | 39145.63 | -0.29 | |
| 5 | 2000 | 46974.41 | 46974.70 | -0.29 | |
| 4 | 2500 | 58718.01 | 58718.45 | -0.44 | |
| 3 | 3333.3333 | 78290.68 | 78291.17 | -0.49 | |

Appendix C Software Configuration Files

System and data acquisition configuration files that have been created or modified specifically for the Port Stanley observatory QNX PC are listed in the following sections.

OPERATING SYSTEM SET-UP - SYSINIT.1

Location: /etc/config/sysinit.1

```
#Image: /boot/sys/boot -v
#Image: /boot/sys/Proc32 -l 1
#Image: /boot/sys/Slib32
#Image: /boot/sys/Slib16
#Image: /bin/Fsys
#Image: /bin/Fsys.eide fsys -Ndisk0 -n0=hd0. -n5=cd0. eide -a1f0 -i14
#Image: /bin/mount -p /dev/hd0.0 /dev/hd0.0t77 /
#Image: /bin/sinit TERM=qnxm
#export NODE=1

# This file (/etc/config/sysinit.1) is the system initialisation file for
# QNX 4.25j (Patch E) running on a DSP Design TP400 PC configured for
# Geomag logging
# Chris Turbitt 11 October 2001

#####
# This section is the basic operating system setup
# Set the region and language for the keyboard (including Photon)
export KBD=en_GB_102.kbd
export ABLANG=en
export CON_KBD=UnitedKingdom

# Timezone set to GMT (all year). Iso set QNX time to real time clock (hw)
# time
export TZ=wet00west-01,M3.5.0/2,M10.5.0/2
/bin rtc hw

# Start the device manager - this must be started before any Dev.* devices
Dev -n 100 &
Dev.ansi -Q -n6 &
reopen /dev/con1

kbd $CON_KBD

# Start the serial port, parallel port and pseudo-tty drivers
# Note: ser3 and ser4 are on a Turbo I/O serial card
/bin/Dev.ser -N/dev/ser1 3f8,4 &
/bin/Dev.ser -N/dev/ser2 2f8,3 &
/bin/Dev.ser -N/dev/ser3 3e8,5 &
/bin/Dev.ser -N/dev/ser4 2e8,9 &
```

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Dev.par &
Dev.ptty -n20 &

Start the cron server
cron &

Start the POSIX message queue
Mqueue &

Start the floppy disk driver and the DOS file system manager for
the floppy drive
/bin/Fsys.floppy -a3f0 -i6
Dosfsys a=/dev/fd0 &

Start the CD-ROM driver and set the CD-ROM drive to /cd0
#/bin/Iso9660fsys /cd0=/dev/cd0.0 &

Make pipes faster by running them in memory
Pipe &

Start the 8087 emulator
emu87 &

Start the network name locator
nameloc &

Add an alias to the pathname prefix tree for the default console
prefix -A /dev/console=/dev/con1

Perform a consistency check on the QNX filesystem
chkfsys /

#####

This section starts the network drivers and services. It should be
entirely commented out unless a network card and TCP/IP software
are installed

Start the network device manager. This must be started before any Net.*
devices
/bin/Net &
sleep 1

Start the card-specific device driver by uncommenting one of the following
Ethernet drivers
Ethernet driver option 1: Intel PRO/100+ Ethernet card
#Net.ether82557 -pef00 -i1 -v &

Ethernet driver option 2: DSP Design TB486 Ethernet port
#Net.crys8900 -i1 -v &

Ethernet driver option 3: DSP Design TP400 Ethernet port

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Net.ns83815 -pf800 -i11 -I0 -11 &

sleep 1

Start the network manager's logical-to-physical node ID mapping table
netmap -f

If the file '/etc/config/bin/tcpip.1' exists, then execute it. This script
starts the QNX TCP-IP managers
if test -f /etc/config/bin/tcpip.\$NODE
then
 sleep 2
 ./etc/config/bin/tcpip.\$NODE
fi

#####

This section is used to automatically launch any applications at boot
time

If the file /etc/config/bin/ph.1 exists, start Photon
if test -f /etc/config/bin/ph.\$NODE
then
 ./etc/config/bin/ph.\$NODE
else
 tinit -t /dev/con1 &
 tinit -T /dev/con[2-6] &
fi

If required, start the SDAS acquisition
su sdas -c /home/sdas/bin/sdas.boot

INTERNET PROTOCOL SET-UP - TCPIP.1

Location: /etc/config/bin/tcpip.1

#!/bin/ksh

export SOCK=\$NODE

/usr/ucb/Socket fkqa &
/usr/ucb/ifconfig lo0 localhost up
/usr/ucb/ifconfig en1 fkqa up
/usr/ucb/inetd /etc/config/inetd.1 &

/usr/ucb/route add default 195.248.193.250

Attempt to map the users disk on mhub to /users. This will only be
successful on the MH LAN
#sleep 5
#/usr/ucb/mount_nfs -v mhub:/local53/users/DISKA /users

SDAS GENERAL CONFIGURATION FILE - GENERAL.CFG**Location: home/sdas/config/general.cfg**

```

# general.cfg - general SDAS parameters
#
# This file is in the form 'name value' - each of the name/value pairs
# is described below.

# ring_buffer_size - this should hold the size of the ring-buffer
# in hours: 1 day = 24, 1 week = 168, 28 days = 672
ring_buffer_size 40000

# log_buffer_size - this should hold the size of the error log buffer
# in days
log_buffer_size 30

# sdas_clock_params - this should contain any command line parameters
# needed by the sdas_clock program - enter 'sdas_clock -h' for details
sdas_clock_params "-s /dev/ser1 -l '4800 -osflow -ihflow -ohflow -lkhflow +raw' -f 700 -q -c"

# prog_before_<n> - a list (with n starting at 1) of programs and their
# command lines that should be started / stopped by sdas before the
# main programs have been started / stopped - the format
# is "program description:command command-line..."
prog_before_1 "SDAS error logger:errlog -bc $$SDAS_CONFIG_DIR/errlog.cfg"

# prog_after_<n> - a list (with n starting at 1) of programs and their
# command lines that should be started / stopped by sdas after the
# main programs have been started / stopped - the format
# is "program description:command command-line..."
prog_after_1 "SDAS data server:sdas_ds"
prog_after_2 "SDAS scheduler:schedule"

# Override some of the settings in ~/bin/sdas.setup
SDAS_HOME_DIR /home/sdas
SDAS_EXTRACT_DIR $$SDAS_REC_DIR/data/archive

```

SDAS ACQUISITION DRIVER CONFIGURATION - ACQUIRE.CFG**Location: /home/sdas/config/acquire.cfg**

```

# acquire.cfg - this database defines the acquisition programs
#
#           it is read by the process controller
#
#           it controls which acquisition programs will be run and
#           what devices they will connect to
#
# field | field |

```

```

# number | name           | description
# -----+-----+-----
--
# 1      | id             | unique index number for the invocation of this
#        |               | acquisition process - this is used to link to
other
#        |               | databases, e.g. channels.cfg - unless you have a
#        |               | good reason start at 0 and work up contiguously
#        |               | THESE NUMBERS MUST BE UNIQUE
# 2      | prog_name     | name of the acquisition program binary
# 3      | dev_name      | name of the IO device for acquisition (if any)
#        |               | the driver has its stdin/out redirected to this
#        |               | device
# 4      | buff_size     | size of the intermediate buffer between the
#        |               | device dev_name and the acquisition program -
#        |               | set to -1 for no buffer
# 5      | stty params   | a list of parameters that will be sent to the stty
#        |               | program to configure the device before the
#        |               | driver starts - set to a blank string if stty is
#        |               | not needed
# 6      | mode          | some drivers can be used in more than one mode
#        |               | this parameter specifies the mode - it is passed
#        |               | to the driver as -m <mode>
# 7      | sample rate   | some drivers allow you to specify the sample rate
#        |               | the rate may have a suffix of 'S', 'M' or 'H' to
#        |               | indicate that the rate is in hours, minutes or
#        |               | seconds - the is passed to the driver as -r
<rate>,
#        |               | if the sample rate is not needed, enter -1
# 8      | address       | some drivers need an address parameter - this
#        |               | is passed to the driver as -a <address> - hex
#        |               | numbers may be used if prefixed with 0x
# 9      | clock_reqd    | enter "yes" if the SDAS clock is needed by this
#        |               | driver, enter "no" otherwise
# 10     | debug        | debug level - typically 0 for no debugging
#        |               | information

# an entry for the input emulator
#0 input_emm "" "" "" 100s -1 yes

# an entry for an ADAM 4017 adc running at 1Hz
0 adc /dev/ser2 -1 "baud=9600 " -osflow -ihflow -ohflow -lkhflow"
ADAM_4017 1s 0x01 yes 0
1 ppm /dev/ser3 -1 "baud=1200 " -osflow -ihflow -ohflow -lkhflow" SM90R 6m
29 yes 0
2 filter /dev/null -1 "" COSINE_60S -1 0 no 0
3 filter /dev/null -1 "" COSINE_60S -1 1 no 0
4 filter /dev/null -1 "" COSINE_60S -1 2 no 0
5 filter /dev/null -1 "" COSINE_60S -1 3 no 0
6 filter /dev/null -1 "" COSINE_60S -1 4 no 0
7 closing_err /dev/null -1 "" "19200,-22000" -1 "5,7,9" no 0
8 mini_met /dev/ser4 0 "baud=9600" "PST" 1s "" yes 0

```

SDAS CHANNELS CONFIGURATION AND CALIBRATION – CHANNELS.CFG

Location:/home/sdas/config/channels.cfg

```

# channels.cfg - this database defines the channels that will be
#                recorded - it is read by the ring buffer manager to
#                map digitiser channels to SDAS channels - digitiser
channels

```



```

#           not mentioned in this file will be ignored by the ring-
buffer
#           manager and thus ignored
#
# field   | field           |
# number  | name            | description
# -----+-----+-----
# 1       | sdas_chan       | unique index for the SDAS channel number - unless
#         |                 | you have a good reason start at 0 and work up
#         |                 | contiguously
# 2       | chan_name       | name for this SDAS channel
# 3       | chan_type       | a code for the type of channel
# 4       | units           | name of the physical units being used
# 5       | offset          | this gets subtracted from the channel data
#         |                 | before it is stored
# 6       | scale           | the data is divided by this after the offset
#         |                 | has been removed and before it is stored
# 7       | acquire.id      | acquire id (from acquire.cfg) for the acquisition
#         |                 | process to which this channel spec. relates
# 8       | acq_type        | "main" or "aux" - many digitisers have two types
#         |                 | of input - "main" inputs are the seismic data
inputs
#         |                 | typically 24-bit 100Hz, "aux" inputs are much
slower
#         |                 | and lower resolution, e.g. 8 bit, 1Hz
# 9       | acq_chan        | the channel number used by the digitiser driver
#         |                 | typically 0-2 for "main" channels, 0-7 for "aux"
#         |                 | channels

0  "PST GDAS 1"      "H"           "0.1nT"  0.0  251.00  0  main 0
1  "PST GDAS 1"      "D"           "0.1nT"  0.0  249.65  0  main 1
2  "PST GDAS 1"      "Z"           "0.1nT"  0.0 -252.13  0  main 2
3  "PST GDAS 1"      "T"           "0.1dg.C" 1353900 500.0  0  main
3
4  "PST GDAS 1"      "F"           "0.1nT"  0.0  10.0   1  main  0
5  "PST GDAS 1"      "H filter"    "0.1nT"  0.0  1.0   2  main  0
6  "PST GDAS 1"      "D filter"    "0.1nT"  0.0  1.0   3  main  0
7  "PST GDAS 1"      "Z filter"    "0.1nT"  0.0  1.0   4  main  0
8  "PST GDAS 1"      "T filter"    "0.1dg.C" 0.0  1.0   5  main  0
9  "PST GDAS 1"      "F filter"    "0.1nT"  0.0  1.0   6  main  0
10 "PST GDAS 1"      "Closing Err" "0.1nT"  0.0  1.0   7  main  0

100 "PST"           "Wind Speed"  "Counts"  0.0    2.575  8  main  0
101 "PST"           "Wind Dir"    "Counts"  0.0    2.8    8  main  1
102 "PST"           "Rel Humid"   "Counts"  0.0    8.3    8  main  2
103 "PST"           "Temperature" "Counts"  400.0  1.0    8  main  3

```

SDAS AUTOMATIC PROCESSING SCRIPT - SCHEDULE.CFG

Location: /home/sdas/config/schedule.cfg

```
# example schedule file for SDAS
```

```
#
```

```
# S. Flower, Oct 2001
```

```
#
```

```
# At one minute past each hour delete the tail end of the ring buffer
```

```
*:1:0    del_data
```

```

# Every ten minutes, extract data to floppy disk
*:02:0    extract -e -o -c archive.ext %d-%M-%y %h:00:00 600
#*:04:0    extract -e -o -c flare.ext %d-%M-%y %h:00:00 600
*:12:0    extract -e -o -c archive.ext %d-%M-%y %h:10:00 600
#*:14:0    extract -e -o -c flare.ext %d-%M-%y %h:10:00 600
*:22:0    extract -e -o -c archive.ext %d-%M-%y %h:20:00 600
#*:24:0    extract -e -o -c flare.ext %d-%M-%y %h:20:00 600
*:32:0    extract -e -o -c archive.ext %d-%M-%y %h:30:00 600
#*:34:0    extract -e -o -c flare.ext %d-%M-%y %h:30:00 600
*:42:0    extract -e -o -c archive.ext %d-%M-%y %h:40:00 600
#*:44:0    extract -e -o -c flare.ext %d-%M-%y %h:40:00 600
*:52:0    extract -e -o -c archive.ext %d-%M-%y %h:50:00 600
#*:54:0    extract -e -o -c flare.ext %d-%M-%y %h:50:00 600

# Just after midnight delete the tail end of the log and set the hardware
# clock to the system clock
0:2:0    del_log
0:2:0    rtc_root -s hw

```

SDAS DATA EXTRACTION FORMAT DEFINITION (ARCHIVE) - ARCHIVE.EXT

Location: /home/sdas/config/archive.ext

```

# flare.ext - multiplexed configuration file
# for the SDAS extraction program
# designed to write one-minute data in
# Flare Plus format
# Chris Turbitt November 2000

# first we specify whether the data will be multiplexed or not
multiplexed

# we can use either ASCII or BINARY data - once specified this will be the
# data type used for header and data until a new directive is given
binary

# next we specify the data records
data
# we can specify field and record separators
#field separator " "
#record separator "\n"
missing data 99999

# once again we specify the fields that will go into the record - all
# the fields that were valid in the header section are valid here, as
# well as the CHANNEL (followed by the channel number)
field
    month
    zero pad
    width 1
end of field

```

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```
field
  day
  zero pad
  width 1
end of field
field
  hour
  zero pad
  width 1
end of field
field
  minute
  zero pad
  width 1
end of field
field
  channel 5
  zero pad
  width 4
end of field
field
  channel 6
  zero pad
  width 4
end of field
field
  channel 7
  zero pad
  width 4
end of field
field
  channel 8
  zero pad
  width 4
end of field
field
  channel 9
  zero pad
  width 4
end of field
field
  literal "x"
end of field
```

```
# finally we can specify how file names are to be constructed
filename
```

```
# we can specify APPEND or OVERWRITE (the default) to control how
# the file is opened
append
```

```
# we can use all the ONCE PER XXXX specifiers used for the header
# to specify how often to create a new file, eg. for day files
# use ONCE PER DAY - ONCE PER FILE is the default, meaning create a single
# data file for each run of the extract program
once per file
```

```
# we can use the same fields as in the header section to construct
# the filename
field
  literal "$SDAS_EXTRACT_DIR/"
end of field
field
  year
  zero pad
  width 4
end of field
field
  month
  zero pad
  width 2
end of field
field
  day
  zero pad
  width 2
end of field
field
  literal ".fkqa"
end of field
```

SDAS DATA EXTRACTION FORMAT DEFINITION (FLOPPY DISK) - FLARE.EXT

Location: /home/sdas/config/flare.ext

Note: This file is identical to /home/sdas/config/archive.ext, except that the filename is constructed using the following:

```
field
  literal "/dos/a/"
end of field
field
  literal "fkqa"
end of field
field
  month
  zero pad
  width 2
end of field
field
  day
  zero pad
  width 2
```

IR/03/037

end of field

field

literal ".qnx"

end of field

Appendix D Router Configuration

In order to connect the BGS data recording equipment to the internet, Cable and Wireless of the Falkland Islands have installed an Ethernet link with a router, giving a single IP address. The router configuration is listed below.

```

Telnet Password:      limiting
Enable Password:    unPack
Router Configuration:

!
version 12.0
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname bgf__flk
!
enable secret 5 $1$VB48$UXOtu9cxQRo900mAb8dOW0
enable password install
!
ip subnet-zero
ip domain-list horizon.co.fk
ip domain-name horizon.co.fk
ip name-server 195.248.193.250
ip name-server 194.119.128.71
!
!
!
interface Ethernet0
description LAN
ip address 195.248.193.233 255.255.255.252
no ip directed-broadcast
!
interface Serial0
description Leased 64K cct to C&W, shared port
bandwidth 64
ip unnumbered Ethernet0
no ip directed-broadcast
!
ip classless
ip route 0.0.0.0 0.0.0.0 Serial0
!
!
line con 0
transport input none
line vty 0 4
password limiting
login
!
end

```

Appendix E Cabling Details

| | | | |
|---------------------------------------|------------------------------------|---------------|----------------------------------|
| Cable: C1 | Description: Battery Supply | | |
| Connector Name: CON4 | Cable Type: | | Connector Name: |
| Connector Type: 3-pin XLR Male | 2-core unshielded | | Connector Type: Crimp Eye |
| Pin | Colour | Signal | Pin |
| 1 | Brown | +12 V | Battery positive |
| 3 | Blue | 0 V | Battery negative |

| | | | |
|---------------------------------------|---|---------------|---|
| Cable: C2 | Description: Proton Magnetometer Power Supply (18 V) | | |
| Connector Name: CON3 | Cable Type: | | Connector Name: Reg. Power In |
| Connector Type: 3-pin XLR Male | 3-core unshielded | | Connector Type: 3-pin XLR Female |
| Pin | Colour | Signal | Pin |
| 2 | Brown | +18 V | 1 |
| 3 | Green/ Yellow | 0 V | 3 |

| | | | |
|---------------------------------------|--|---------------|---|
| Cable: C3 | Description: Fluxgate Magnetometer Power & Signal | | |
| Connector Name: CON5 | Cable Type: | | Connector Name: ADC Power In |
| Connector Type: 4-pin XLR Male | 4-core Shielded | | Connector Type: 4-pin XLR Female |
| Pin | Colour | Signal | Pin |
| 1 | Red | +18 V | 1 |
| 2 | Yellow | Data + | 2 |
| 3 | Blue | Data - | 3 |
| 4 | Green | 0 V | 4 |

| | | | |
|---|---|---------------|---------------------------------------|
| Cable: C4 | Description: GPS Receiver Power & Signal | | |
| Connector Name: CON6 | Cable Type: | | Connector Name: |
| Connector Type: 5-pin XLR Female | 4-core Shielded | | Connector Type: 5-pin XLR Male |
| Pin | Colour | Signal | Pin |
| 1 | Red | +12 V | 1 |
| 2 | Yellow | Tx | 2 |
| 3 | Blue | Rx | 3 |
| 5 | Green | 0 V | 5 |

| | | | |
|--|---|---------------|--|
| Cable: C5 | Description: PPM Signal from Regulator Box | | |
| Connector Name: COM4 | Cable Type: | | Connector Name: RS232 Out |
| Connector Type: 9-pin D-type Female | 4-core Shielded | | Connector Type: 9-pin D-type Male |
| Pin | Colour | Signal | Pin |
| 2 | Blue | Rx | 3 |
| 3 | Red | Tx | 2 |
| 5 | Green | 0 V | 5 |

| | | | |
|--|--------------------------------|---------------|--|
| Cable: C6 | Description: ADC Signal | | |
| Connector Name: COM2 | Cable Type: | | Connector Name: CON8 |
| Connector Type: 9-pin D-type Female | 4-core shielded | | Connector Type: 9-pin D-type Female |
| Pin | Colour | Signal | Pin |
| 2 | Blue | Rx | 2 |
| 3 | Red | Tx | 3 |
| 5 | Green | GND | 5 |

| | | | |
|--|--------------------------------|---------------|--|
| Cable: C7 | Description: GPS Signal | | |
| Connector Name: COM1 | Cable Type: | | Connector Name: CON7 |
| Connector Type: 9-pin D-type Female | 4-core shielded | | Connector Type: 9-pin D-type Female |
| Pin | Colour | Signal | Pin |
| 2 | Blue | Rx | 2 |
| 3 | Red | Tx | 3 |
| 5 | Green | GND | 5 |

| | | | |
|--|------------------------------|---------------|---------------------------------------|
| Cable: C8 | Description: PC Power | | |
| Connector Name: POW-IN | Cable Type: | | Connector Name: CON8 |
| Connector Type: 9-pin D-type Female | 2-core unshielded | | Connector Type: 3-pin XLR Male |
| Pin | Colour | Signal | Pin |
| 2 | Brown | +12 V | 1 |
| 3 | Blue | 0 V | 3 |

| | | | |
|---------------------------------------|---|---------------|--------------------------------------|
| Cable: C9 | Description: Proton Magnetometer Power Supply (12 V) | | |
| Connector Name: | Cable Type: | | Connector Name: Power |
| Connector Type: 3-pin XLR Male | 3-core unshielded | | Connector Type: PT06W-08-33SN |
| Pin | Colour | Signal | Pin |
| 1 | Brown | +12 V | B |
| 3 | Green/ Yellow | 0 V | A |

| | | | |
|--|--|--------------------------------------|------------|
| Cable: C10 | Description: Proton Magnetometer Signal | | |
| Connector Name: RS232 In | Cable Type: 4-core Shielded | Connector Name: RS232 | |
| Connector Type: 9-pin D-type Female | | Connector Type: PT06W-08-33PN | |
| Pin | Colour | Signal | Pin |
| 2 | Blue | Rx | C |
| 3 | Red | Tx | A |
| 5 | Green | 0 V | B |

| | | | |
|---------------------------------------|---|---|------------|
| Cable: C11 | Description: Fluxgate Magnetometer Power | | |
| Connector Name: COM2 | Cable Type: 2-core unshielded | Connector Name: Power | |
| Connector Type: 4-pin XLR Male | | Connector Type: 4-pin XLR Female | |
| Pin | Colour | Signal | Pin |
| 1 | +18 V | Rx | 1 |
| 4 | 0 V | Tx | 4 |

| | | | |
|---------------------------------------|--|---------------------------------------|------------|
| Cable: C12 | Description: Fluxgate Magnetometer Signal | | |
| Connector Name: ADC Signal In | Cable Type: 2-core unshielded | Connector Name: Signal | |
| Connector Type: 6-pin MIL Male | | Connector Type: 6-pin MIL Male | |
| Pin | Colour | Signal | Pin |
| A | Shield | GND | A |
| B | Red | H | B |
| C | Yellow | D | C |
| D | Green | Z | D |
| E | Blue | T | E |

Appendix F MiniMet Configuration

The configuration of the sensors and their position relative to the cable and Wireless Hut is shown in the photo below.



Wiring of sensors to the PIC digitizer box.

The separation between the sensors on the mast to the PIC digitizer is approximately 6 m. The manufacturers supplied cable on the thermo/hygroprobe is long enough to span this distance but a join is necessary in the cables from the anemometer speed and direction sensors. The wiring connections and colour codes are given in the following table.

Anemometer Wind Speed (Type Vector 100LM)

| Anemometer | 4 core cable | MiniMet Box |
|-------------------|--------------|-------------|
| Red (+12 Volts) | Red | 7 |
| Blue (0 Volts) | Screen | 6 |
| White (TTL Speed) | Blue | 4 |

Anemometer Wind Direction (Type Vector W200P)

| Anemometer | 4 core cable | MiniMet Box |
|----------------|--------------|-------------|
| Red (+5 Volts) | Yellow | 5 |
| Blue (0 Volts) | Screen | 6 |
| Green (Wiper) | Green | 3 |

Temperature/Humidity (Rotronic MP100A)

| Rotronic MP100A | BoxMiniMet |
|-------------------------|------------|
| Green (+12 Volts) | 7 |
| Brown (Temperature) | 2 |
| White (Humidity) | 1 |
| Yellow/screen (0 Volts) | 6 |

MiniMet Box, +12 Volts from 13 Amp transformer plug, +12 Volts pin 7, 0 Volts pin 8

MiniMet Acquisition software listing

```
' ADCTHW
' ADC Temperature Humidity Windspeed and direction
' ADCTHW does not access local LCD
' PicBasic Pro program to display 10 bit ADC and counter results on LCD
' Three analogue chanelns are digitised
' Sensors are sampled every 5 seconds and output as a serial data string
' Wind direction ADC0 AN0
' Relative Humidity ADC1 AN1
' Temperature is input on ADC3 AN3
' Windspeed pulses are counted on AN4/RA4
' Define ONINT_USED to allow use of the boot loader.
' This will not affect normal program operation.
' This software was modified 5 November 2002
' to Output every 2 seconds at 9600 baud
' Modified 16 Dec 2002 to generate 20s temperature mean
' Modified 9 Jan 2003 to sample every second
' Modified 13 Jan 2003 to generate mean wind speed, wind direction, humidity
```

```
DEFINE ONINT_USED 1
' Define LCD registers and bits
'DEFINE LCD_DREG PORTD
'DEFINE LCD_DBIT 4
'DEFINE LCD_RSREG PORTE
'DEFINE LCD_RSBIT 0
'DEFINE LCD_EREG PORTE
'DEFINE LCD_EBIT 1
DEFINE HSER_RCSSTA 80h ' Serial port enable
DEFINE HSER_TXSTA 24h ' TX enable set BRGH
DEFINE HSER_BAUD 9600 ' Set baud 9600
DEFINE HSER_SPBRG 25 ' BRGH = 1 4 MHz osc
```

'Allocate variables

```

cxlow    VAR BYTE
cxhi    VAR BYTE
cylow    VAR BYTE
cyhi    VAR BYTE
czlow    VAR BYTE
czhi    VAR BYTE
leds    VAR BYTE
result0  VAR WORD
result1  VAR WORD
result2  VAR WORD
ctlow   VAR BYTE
counter  VAR WORD  ' Wind speed counter
total   VAR WORD
buf     VAR WORD[5]
Mean_t  VAR WORD
bufws   VAR WORD[5]
Mean_ws VAR WORD
bufwd   VAR WORD[5]
Mean_wd VAR WORD
bufh    VAR WORD[5]
Mean_h  VAR WORD
i       VAR WORD

```

Pause 500

```

OPTION_REG.7 = 0  ' PORTB pull-ups enabled
OPTION_REG.5 = 1  ' TMR0 Transition on RA4/T0CKI pin
OPTION_REG.4 = 1  ' Inc ctr on Hi to low on RA4/T0CKI

```

' PORT A Setup

```

ADCON1 = 132  ' Analog AN0,AN1,AN3 Digital AN2
TRISA = %00011111

```

```

' Set up TMR0 config

TMR0 = 0
TRISD = 0
TRISE = %00000001
Pause 100
total = 0

GoTo loop

' Subroutine to read ADC

getad:  PauseUs 50
        ADCON0.2 = 1
        PauseUs 50
        Return

' Get Channel 0
get0:  ADCON0 = $41 ' Set A/D to Fosc/8, CH 0 on
       GoSub getad
       cxlow = ADRESL
       cxhi = ADRESH
       Return

' Get Channel 1
get1:  ADCON0 = $49 ' Set A/D to Fosc/8, CH 1 on
       GoSub getad
       cylow = ADRESL
       cyhi = ADRESH
       Return

' Get Channel 2
get2:  ADCON0 = $59 ' Set A/D to Fosc/8, CH 2 on
       GoSub getad
       czlow = ADRESL
       czhi = ADRESH
       Return

```

```

loop: PORTD.0 = 0
      PORTD.1 = 1
      PORTD.1 = 0
' Read Wind speed

      Count PORTE.0, 500, counter
      PORTD.0 = 1 ' Flash LED

' Read ADC

      GoSub get0 ' Get Channel 0 Wind direction
      GoSub get1 ' Get Channel 1 Humidity
      GoSub get2 ' Get Channel 2 Temperature

' Convert 2 input bytes to a 10 bit number

      result0 = (cxhi * 256) + cxlow
      result1 = (cyhi * 256) + cylow
      result2 = (czhi * 256) + czlow

' Mean wind direction

      For i = 0 to 3
          bufwd[i] = bufwd[i+1]
      Next
      bufwd[4] = result0
      total = 0
      For i = 0 to 4
          total = total + bufwd[i]
      Next

      Mean_wd = total/5

```


' Mean wind speed

```
For i = 0 to 3
    bufws[i] = bufws[i+1]
Next
bufws[4] = counter
total = 0
For i = 0 to 4
    total = total + bufws[i]
Next
```

Mean_ws = total/5

' Mean temperature

```
For i = 0 to 3
    buft[i] = buft[i+1]
Next
buft[4] = result2
total = 0
For i = 0 to 4
    total = total + buft[i]
Next
```

Mean_t = total/5

' Mean humidity

```
For i = 0 to 3
    bufh[i] = bufh[i+1]
Next
bufh[4] = result1
total = 0
For i = 0 to 4
    total = total + bufh[i]
```

Next

Mean_h = total/5

' Output serial data

HSerout["PST, "] ' Station header

HSerout[DEC Mean_ws] ' Wind speed

HSerout[" ,"]

HSerout[DEC Mean_wd] ' Wind Direction

HSerout[" ,"]

HSerout[DEC Mean_h] ' Relative humidity

HSerout[" ,"]

HSerout[DEC Mean_t, 13,10] ' Temperature

counter = 0

' Set up to sample once every second

Pause 474

GoTo Loop

End

Figure 1 'Tinytalk' Temperature Data

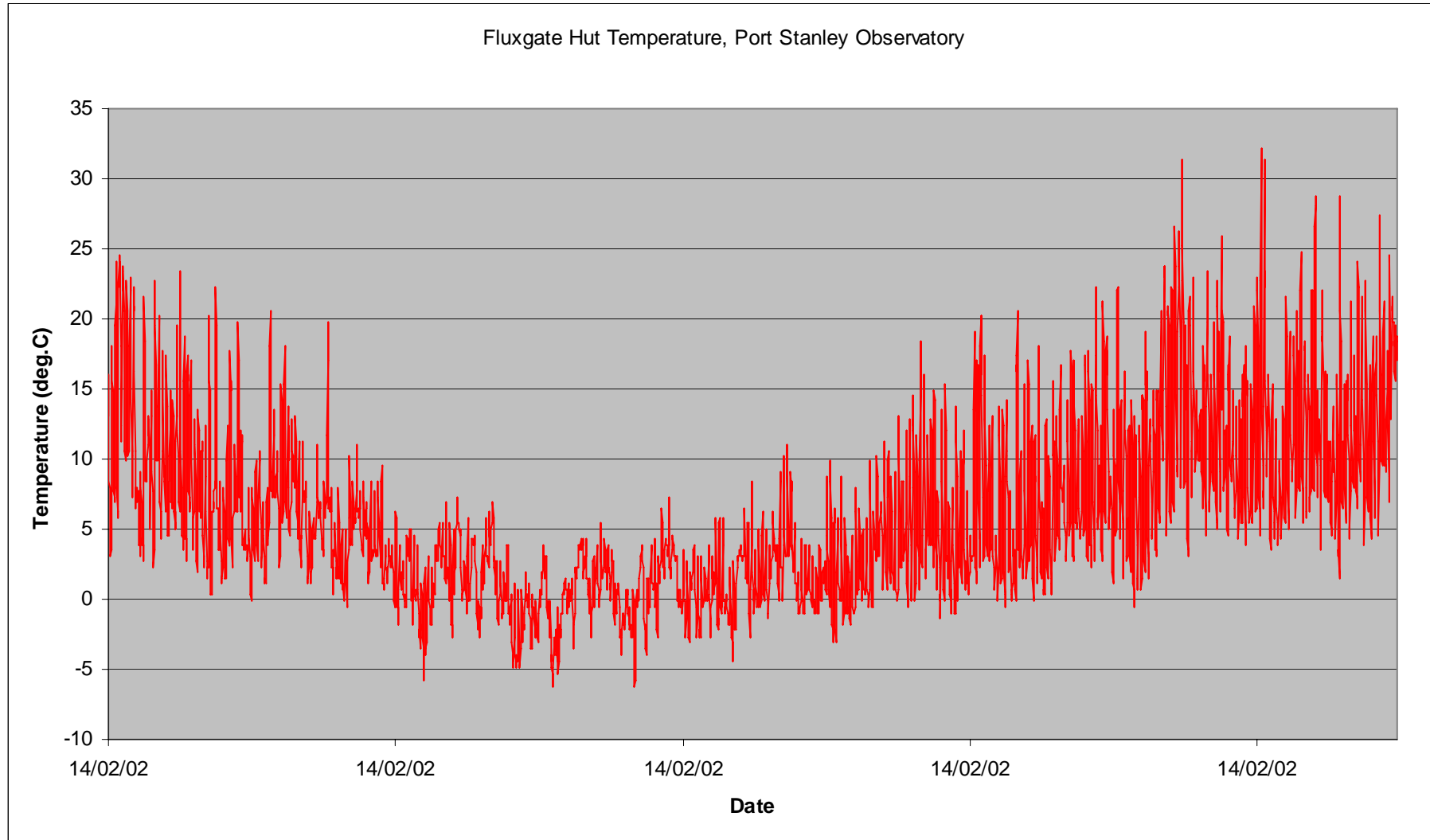
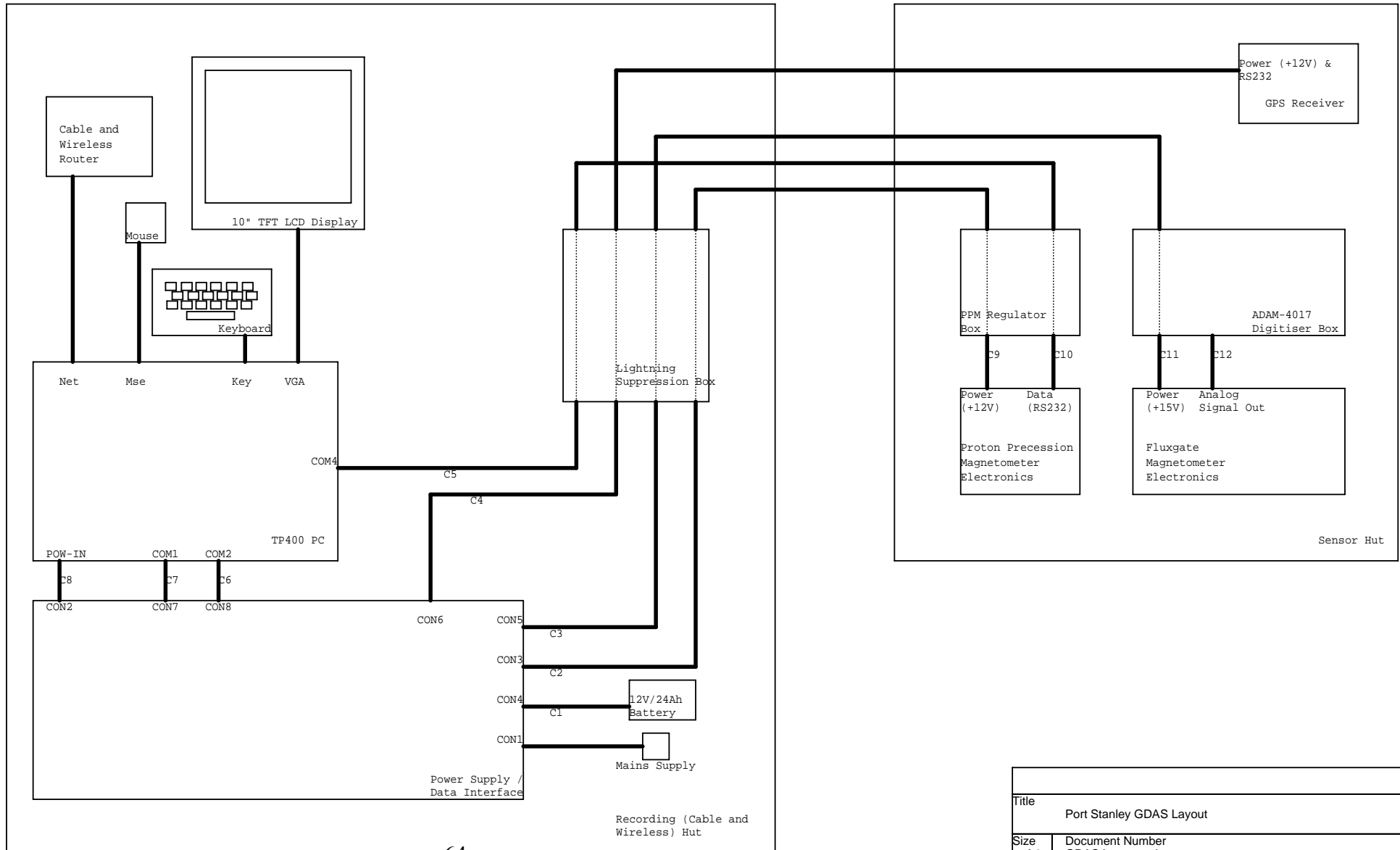
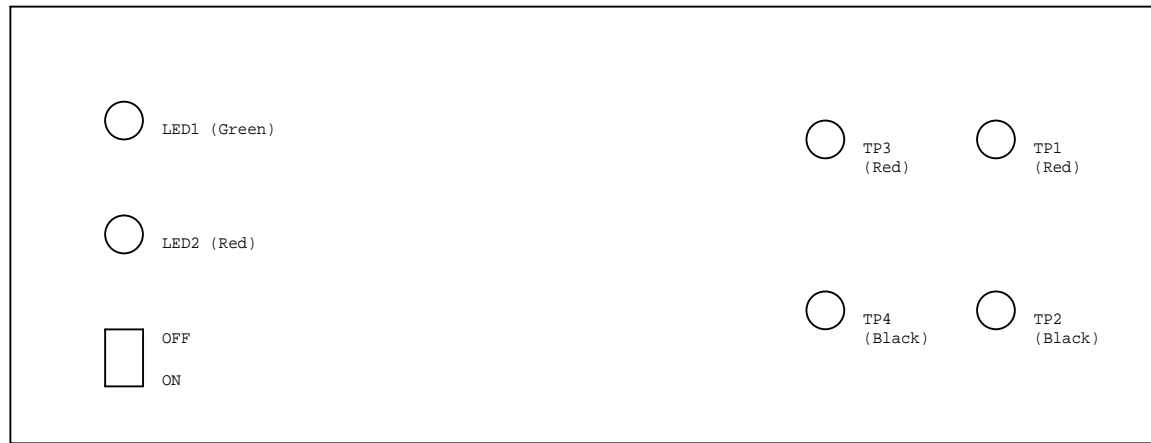


Figure 2 Observatory Layout

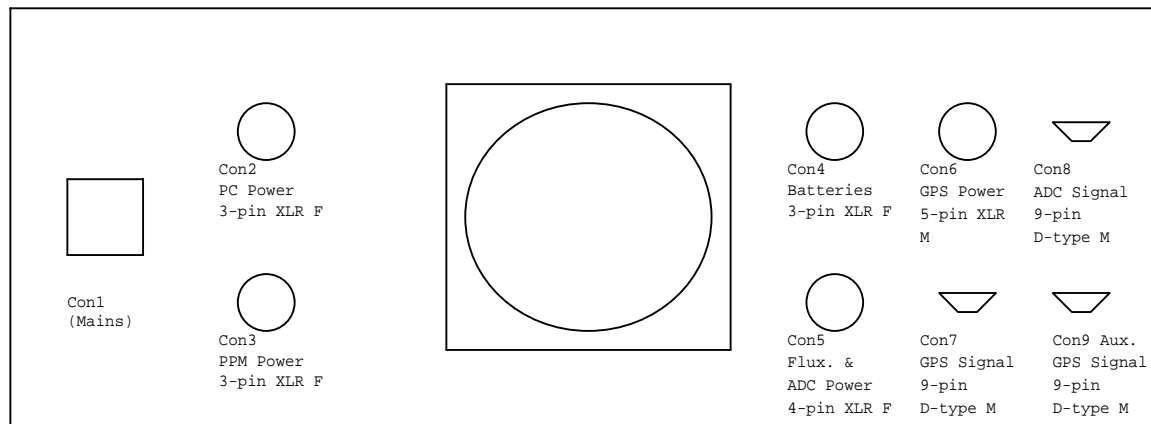


| | | |
|--------------------------|-----------------------|--------------|
| Title | | |
| Port Stanley GDAS Layout | | |
| Size | Document Number | Rev |
| A4 | GDAS Layout.opj | 1 |
| Date: | Tuesday, May 21, 2002 | Sheet 1 of 1 |

Figure 3 Mains Power Supply Panel Layout



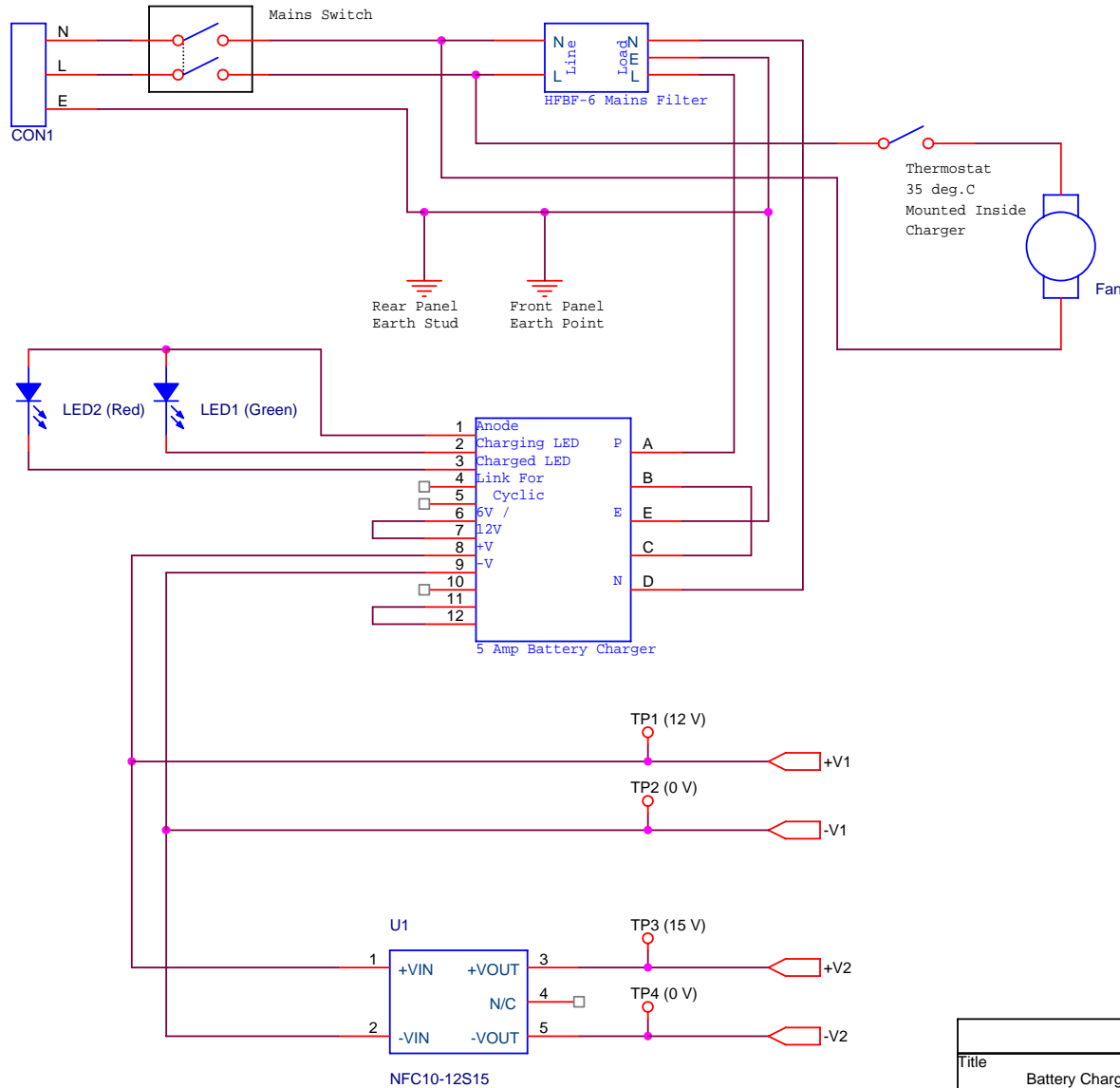
Front Panel



Rear Panel

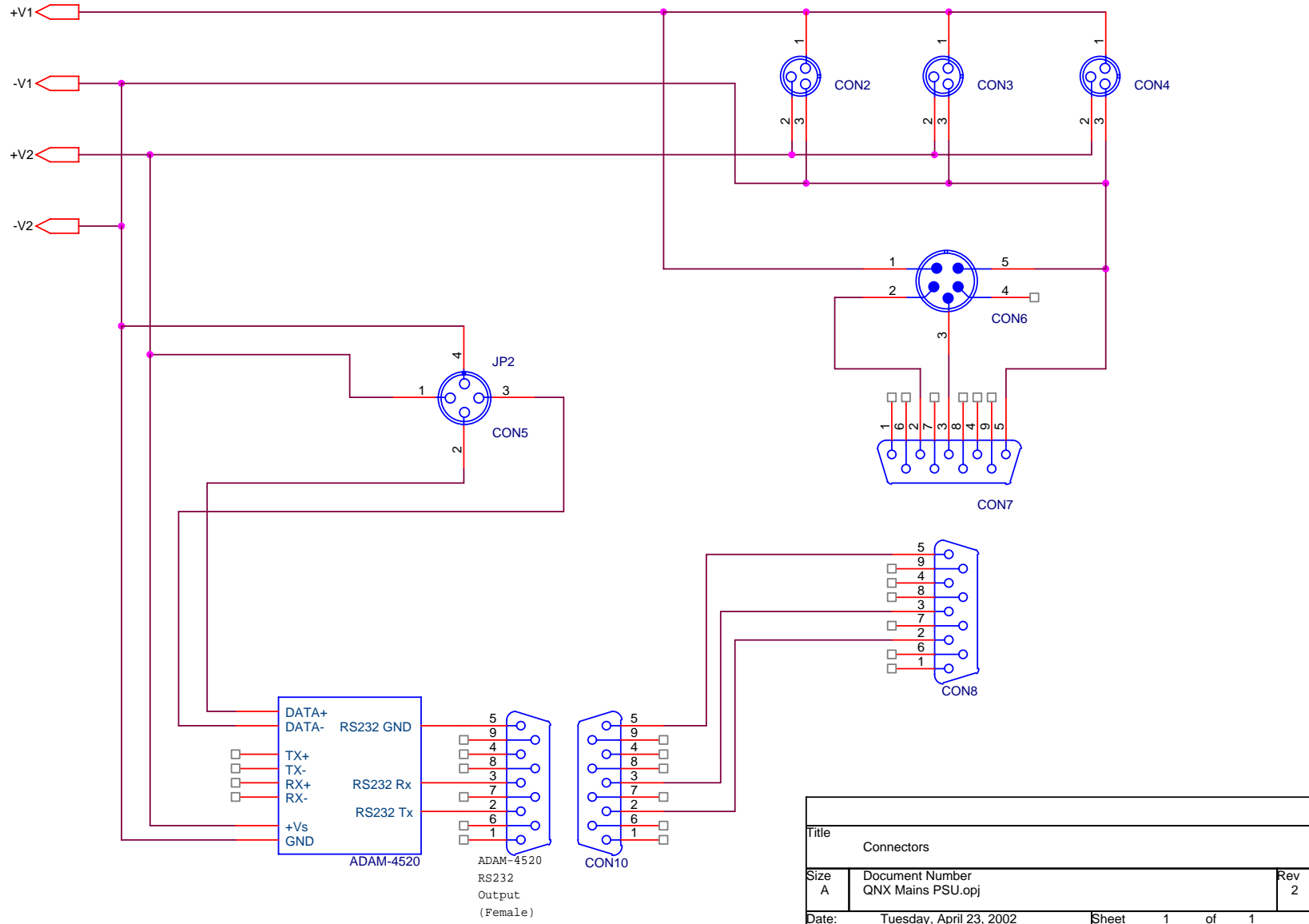
| | | |
|------------------------|-------------------------|--------------|
| Title | | |
| Mains PSU Panel Layout | | |
| Size | Document Number | Rev |
| A | QNX Mains PSU.opj | 1 |
| Date: | Tuesday, April 23, 2002 | Sheet 1 of 1 |

Figure 4 Mains Power Supply Battery Charger



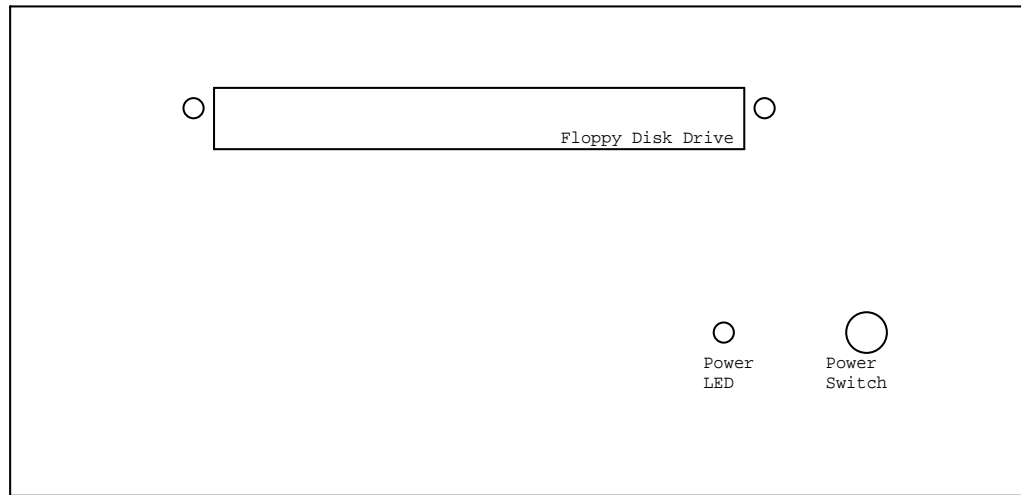
| | | |
|-----------------|-------------------------|--------------|
| Title | | |
| Battery Charger | | |
| Size | Document Number | Rev |
| A | QNX Mains PSU.opj | 2 |
| Date: | Tuesday, April 23, 2002 | Sheet 1 of 1 |

Figure 5 Mains Power Supply Connectors

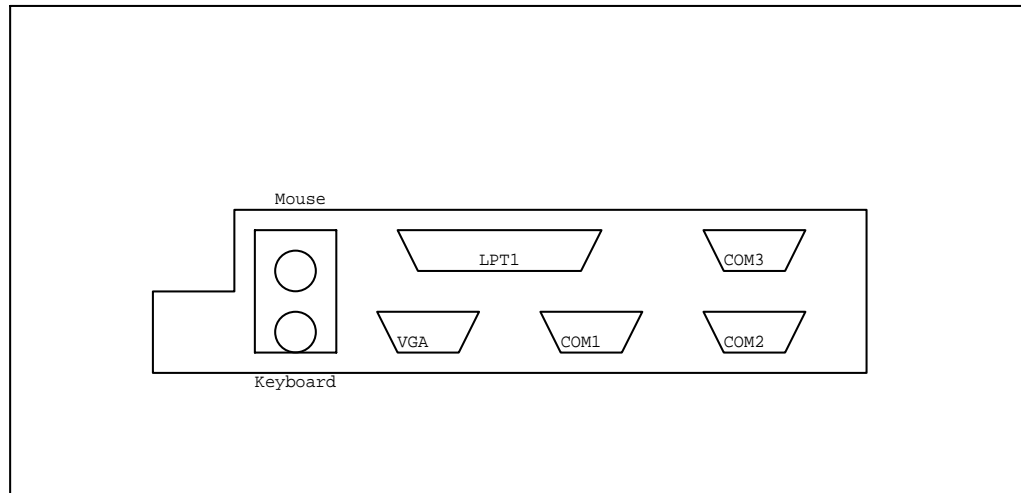


| | | |
|------------|-------------------------|--------------|
| Title | | |
| Connectors | | |
| Size | Document Number | Rev |
| A | QNX Mains PSU.opj | 2 |
| Date: | Tuesday, April 23, 2002 | Sheet 1 of 1 |

Figure 6 TP400 PC Panel Layout – Back and Front



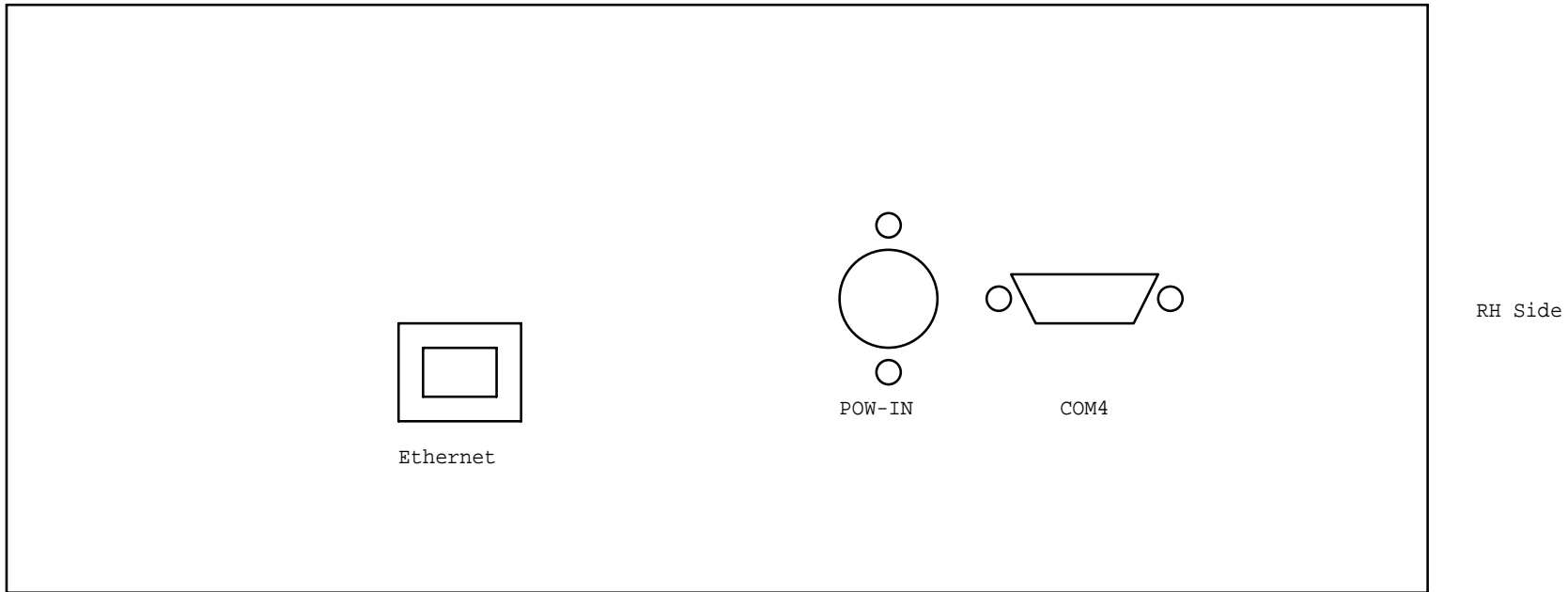
Front



Back

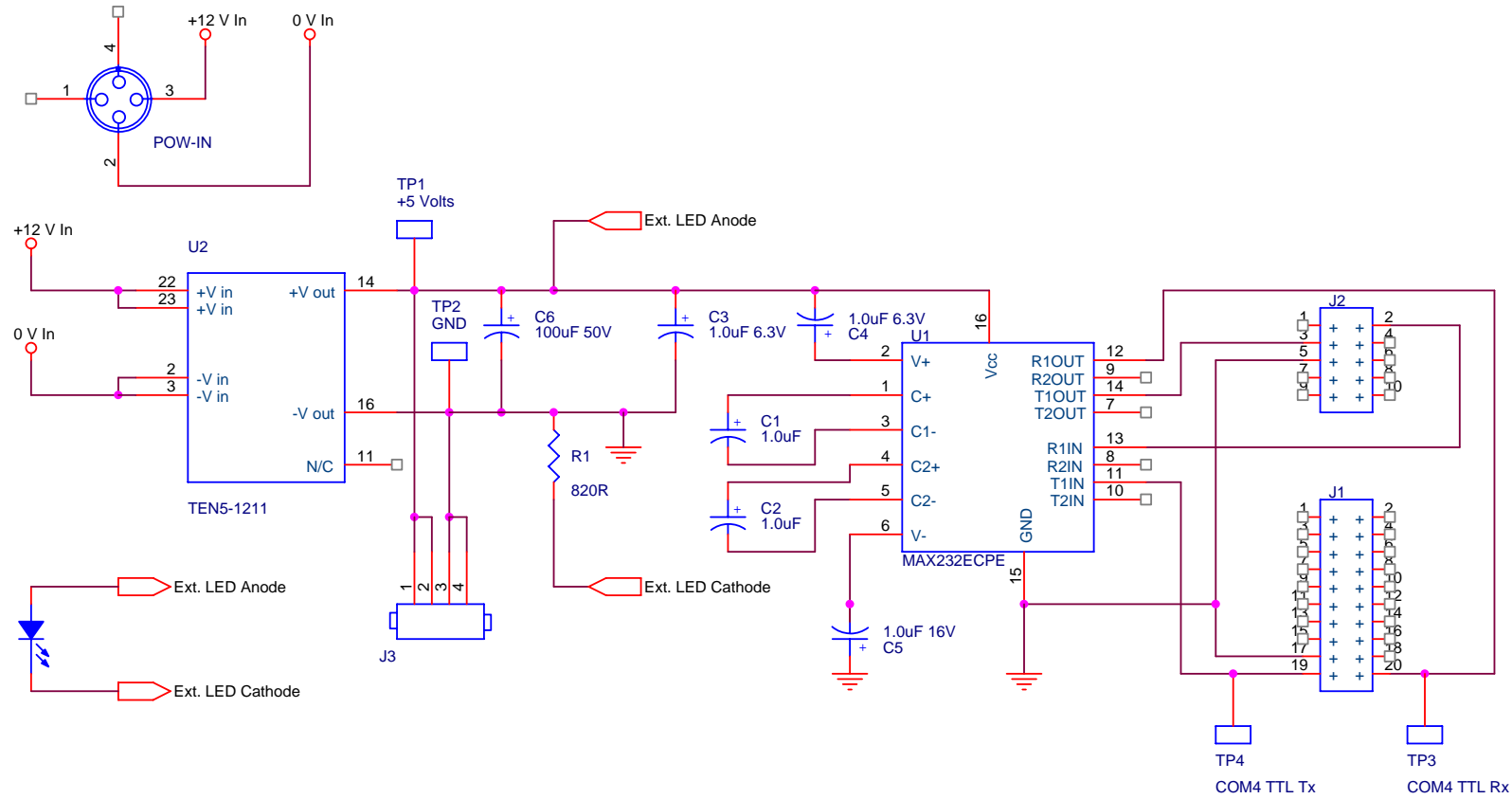
| | | |
|--------------------------------|-----------------------|--------------|
| Title | | |
| PC Panel Layout - Front & Back | | |
| Size | Document Number | Rev |
| A | TP400 PC.opj | 1 |
| Date: | Tuesday, May 21, 2002 | Sheet 1 of 1 |

Figure 7 TP400 PC Panel Layout – Right-hand Side



| | | |
|---------------------------|-----------------------|--------------|
| Title | | |
| PC Panel Latout - RH Side | | |
| Size | Document Number | Rev |
| A | TP400 PC.opj | 1 |
| Date: | Tuesday, May 21, 2002 | Sheet 1 of 1 |

Figure 8 TP400 Power Supply and COM4 Circuit Board

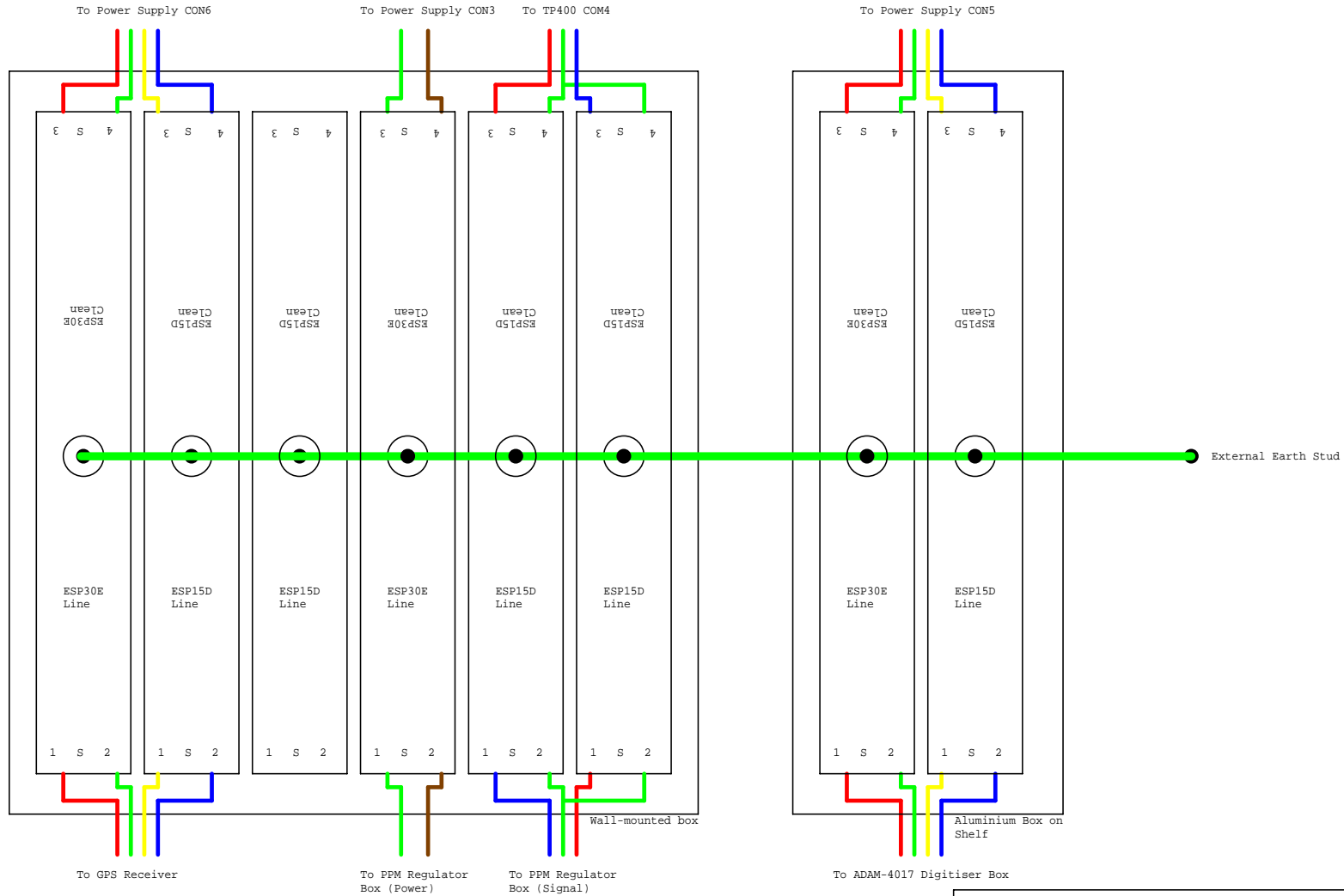


Parts:

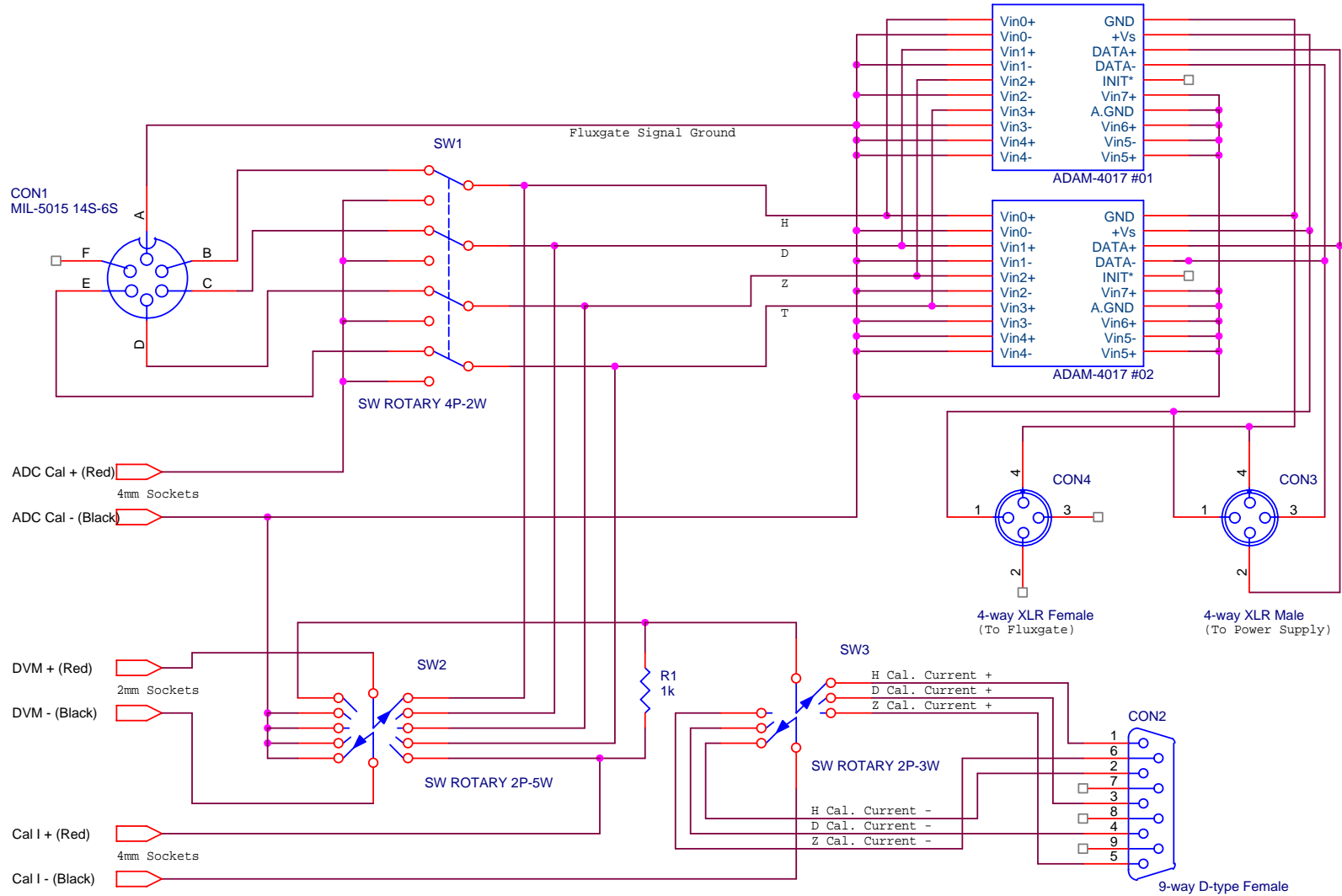
- U1 Maxim MAX232ECPE (RS 225-8510)
- U2 Traco TEN5-1211 (RS 293-2707)
- J1 tyco 20-way low profile straight mount IDC (RS 461-770)
- J2 tyco 10-way low profile straight mount IDC (RS 461-742)
- J3 tyco 4-way single row, straight mount HE14 header (RS 531-986)

| | | |
|----------------------------------|-----------------------|--------------|
| Title | | |
| TP400 PowerSupply and COM4 RS232 | | |
| Size | Document Number | Rev |
| A | TP400 PC.opj | 1 |
| Date: | Tuesday, May 14, 2002 | Sheet 1 of 1 |

Figure 9 Lightning Suppression Box



| | | |
|-----------------------------|-------------------------|--------------|
| Title | | |
| Lightning Suppression Boxes | | |
| Size | Document Number | Rev |
| A4 | GDAS Layout.opj | 1 |
| Date: | Wednesday, May 22, 2002 | Sheet 1 of 1 |



| | | |
|---|--------------------------------|--------------|
| Title | | |
| Fluxgate magnetometer and ADAM-4017 Cal Box | | |
| Size | Document Number | Rev |
| A | Fluxgate and ADAM-4017 Cal Box | 4A |
| Date: | Monday, February 24, 2003 | Sheet 1 of 1 |