The BAS Low Power Magnetometer

BAS-TD002

Field Deployment Manual

eXtreme Instrumentation

for scientific pioneers of the Polar regions

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This symbol identifies an electrical hazard.


This symbol identifies other hazards.

End of Document Symbol

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Warnings and Cautions

Warning **The equipment supplied by Extreme Instrumentation is designed for use in extreme environmental conditions which, if the appropriate safety procedures are not observed and / or enforced, may be hazardous. It is the customer's responsibility to comply with local, State or Federal Health and Safety regulations and ensure that all personnel are trained in the safe operation of equipment in extreme environmental conditions.**

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Low Power Magnetometer

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Introduction

This manual describes the field deployment procedure for a British Antarctic Survey's Low Power Magnetometer (LPM).

This manual covers the actual field deployment, the preparation procedure is covered in a companion manual - "LPM pre-deployment and general manual".

Both manuals assume that the LPM is being deployed at a snow/ice site in the Antarctic.

The deployment team will normally consist of at least two people – three or four is better to assist in carrying the heavy items. It is recommended that at least one of the deployment team should be familiar with the LPM's and have already completed one deployment. The deployment team should also perform all the pre-deployment preparation tasks.

Note that these are provisional instructions, please provide feedback both on the deployment method and the instructions.

READ ALL OF THE MANUAL BEFORE YOU START

Locations

The magnetic deviation at each intended location needs to be known so that a magnetic bearing can be used to align the solar panel to TRUE North. The IGRF model is a convenient way of obtaining the deviation.

The TRUE bearing is the MAGNETIC (ie compass) plus the Deviation. Hence for a compass to point TRUE north where the deviation is -24° the compass will be pointing on a magnetic bearing of +24°, likewise to point TRUE east the compass will point on a magnetic bearing of 114°.

At all locations the first step is to unload the transport of the heavy objects (in particular the battery boxes) before moving to a distance of at least 75m from the magnetometer site. Note this is important so that ferrous materials do not effect the magnetometer as it initialises as this could effect the whole years data.

Site Layout

Site layout drawings are given in appendix 1. These drawings are available as site001.pdf and site002.pdf for printing.

Points to note are:

a/ Obviously NO ferrous metal near the magnetometer head. All tools and materials should be moved at least 75m from the system before it is powered up. Personnel at the site should stand near the enclosure when the system is first powered up.

b/ The guy ropes should join the ground at an angle no steeper than 45°

c/ The solar panel faces TRUE north, the direction may be counter intuitive at some sites.

d/ The plug panel is on the west side, the dump box the east.

Deployment Procedure

General points

a/ Make every effort to keep the connectors free from snow.

b/ All unused sockets must be covered with dust caps or self amalgamating tape.

c/ Check the sex of each connector as you plug it in - all the connectors are unique and its impossible to incorrectly plug the system together but you can damage the amphenol connectors by plugging in two males to each other.

d/ DO NOT open the logger boxes, they are filled with loose polystyrene balls.

e/ Make sure that you are familiar with the amphenol screw-in connectors. To connect them properly they need to be fully screwed home. Gently wobble the connector as you screw the connector home. Only screw the connector with the end ring, beware of screwing the middle ring which will dismantle the connector (usually damaging the wires).

f/ Practice with the amphenol bayonet connectors (large 15 way power connector to the logger and the 7 way maggy connector to the enclosure and the logger) with no power to the system. Practice plugging in a logger in an enclosure without any plug panel connections.

Step 1

Unload. The transport will need to be removed by at least 75m before the logger is powered up.

Step 2

Place the enclosure solar panel side down on the snow, slide the scaffold poles into the keyklamps. The dump box should go about ½ way between the enclosure clamps on the opposite side from the plug panel (not shown in photo) and should be square onto the main enclosure (turn it as far into the enclosure as it will go). Only 10cm of scaffold pole should project above the enclosure keeklamps, attach the guy clamps to this end (see detail on photos in step 7 and 14). One of the three wings of the clamp should point across the enclosure to the wing of the clamp on the other pole. Attach the keeklamp baseplates at the long end of the tube (ie at the bottom).

Plug the solar panel cable (small two way connector on white cable) into the dump box, and plug the dump box into the main enclosure (2nd socket from top) using the short thick grey lead with 7 way connectors - this lead should pass between the solar panel and the enclosure.

Step 3

Sight along a scaffold leg to align the leg to north. Stand about 5m behind the system and give directions to another person to which way the system should be rotated. You will be facing north so the compass will need to read the negative of the deviation for your location.

Step 4

Dig a hole immediately behind the feet of the scaffold poles. This will need to be large enough to take two battery boxes next to other such that the top of the boxes are completely buried and covered by at least 15 cm of snow. Make the bottom of the hole as flat as possible. Keep the north wall of the hole vertical. Dig a short “shelf” at the top of the north side of the hole and place a piece of dunnage there and tap down firm to make it as level as possible. The scaffold feet will rest on this dunnage allowing them to be close to the hole edge without crumbling the hole wall.

Step 5

Make sure that the battery boxes serial numbers are marked on the deployment checksheet, example in appendix 3, deploycheck.pdf supplied for printing.

Place the battery boxes in the hole with their connection boxes facing true west. It is advised to use a Pulk sledge for transporting the battery boxes, even over short distances.

Connect the two battery boxes together with the short grey lead with 10 way connectors. Make doubly sure that the plug on the end of the cable that will plug into the bottom socket of the enclosures plug panel is male (ie has pins) as you will not be able to finally plug this in until the enclosure is upright and the hole will probably have snow in it by then. Protect the connector at the end of the long gray lead from snow ingress using a plastic bag. The unused socket on the battery boxes should be left with a dust cover in place.

Step 6

Put the feet of the scaffold poles on the dunnage shelf at the north wall of the hole.

Perform step 3 again to align the poles directly true north. This is the final alignment. It is best to put the rope loops on the guy clamps at this stage as they are hard to reach once the enclosure is lifted up.

Carefully raise the enclosure so that feet are resting on the dunnage shelf and the scaffold poles become upright. One person should hold the unit steady from now until it is securely guyed.

Step 7

Attach the guy ropes. These come in two parts. A short strop or loop that attaches to the clamp and a long rope that goes from the anchor to the loop. The snow anchor is a 1m aluminium stake; in poor snow conditions this should be supplemented by a wooden cross piece - bury the cross piece horizontally in a T shaped slot and hammer the aluminium stake in vertically just behind it. The rope then attaches to the vertical stake (or the crossing point) and comes out of the bottom of the T shape - none of the anchor should be above the surface.

The anchors should be placed so that the ropes come off the enclosure at a 90° angle to each other and at 45° to the line between the scaffold poles (see site diagrams in appendix 1), the anchors should be at least 2.5m from the base of the scaffold pole. Securely fasten the long rope

from anchor to its short strop - tighten up using a lorry drivers hitch. Use the spirit level to make sure the poles are vertical in both planes. Fill in the holes at the bottom of the scaffold poles and tamp down.

Add a snow pile onto each anchor of about 10cm. This is to stop the anchor abalating in its first year.

Tie back any surplus rope - if there is a huge amount you can cut it off by wrapping about 5cm of the rope with self amalgamating tape and then cutting in the middle with the bolt cutters.

Step 8

Connect the battery box to the enclosure using the long grey lead with 10 way connectors, prepared in step 5. This plugs into the bottom connector of the plug panel. Run this lead down the scaffold pole with cable ties. Fold any loose lead as close to the battery boxes as possible and then fill the battery box hole with snow.

Step 9

Make sure the serial number of the maggy sensor is recorded in the deployment checklist.

Find the position for the maggy sensor tube by laying the cable out in a line (taking care not to get snow into the connector). Allow for at least 1m extra cable at the maggy end and at the enclosure end.

Drill or dig a hole 1.25m deep for the maggy sensor - the sensor is marked at the 1.25M level. Place the maggy sensor in the hole, gently tamp snow into the hole whilst checking that the tube is absolutely vertical in all directions with the spirit level - this is done by one person holding the tube vertical and another putting a LITTLE snow into the hole, patting it down and then making sure the tube is vertical in two orthoganal directions, adding a little more snow etc.

Run the amoured part of the maggy cable vertically from the tube through a loop and then back down the sensor tube into the snow. The cable is then routed from the sensor head to the enclosure in a shallow (5cm) trough from the sensor to the scaffold leg of the enclosure. Plug the maggy connector into the top most connector on the plug panel.

Step 10

Dig, hammer (taking care not to damage the cable), or push the temperature probe 1.25m (again marked on the pole) into the snow 1m west of the enclosure. The cable for travels undersnow to the scaffold leg and then up to the enclosure. Plug this in the 6 way socket on the plug panel (3rd from top).

Step 11

Make sure all the connections are properly plugged in. The only external connection left unplugged is a spare input on the dump box, this must be left with a dust cover or a self amalgamating tape cover – this is the connector for wind generator. IF THE OPTIONAL WIND GENERATOR IS TO BE INSTALLED , THIS IS THE BEST STEP TO DO IT - FOLLOW THE SEPARATE INSTRUCTIONS “lpm wg instructions.doc”

Make sure all cables are securely cable tied and can not move in the wind. Make sure all loose ends of rope etc are tied or taped back so that nothing can flap in the wind.

Fill in the serial numbers of the temperature probe and enclosure in the deployment check sheet.

Remove all tools from the immediate area, and fetch the logger box.

Step 12

Open the enclosure (NB the key goes the ‘wrong’ way).

Clip in the logger box, the bottom wings on the logger box slide behind the bar, whilst the large holes in the top wings go over the shoulder screws (spring loaded) and then the logger drops down a couple of mm and is locked into place.

Step 13

Plug in the magnetometer lead (7 way connector on the right) into the logger.

Confirm that nobody and no items are anywhere near the magnetometer sensor head then:

Plug in the large 15 way connector into the logger.

There may be a brief led flash or beep immediately as you plug it in - this is normal.

After about 30s, the red and then the yellow led will flash once in turn - this is normal.

Within another 60s (time may vary) the yellow led should flash 5 times, this indicates that the unit has passed its self tests and is operating normally.

If the unit has passed its self tests, take a note of the serial number of the logger for the deployment checklist, then carefully shut the outer enclosure and fully lock with the key.

Finish filling out the deployment checklist and then go home.

If the unit has **failed** its self tests (a fail indicated by multiple flashes of the red led or an absence of the pass indication of 5 flashes of the yellow led) then unplug the large 15 way connector and follow the troubleshooting guide.

Troubleshooting

Make sure you make notes of everything you do.

If the red led was on constantly then goto Trouble1.

If the red led repeatedly flashed to indicate that the unit failed the self tests then goto Trouble2.

If no Leds flash at all goto Trouble3.

Trouble 1

Unplug the large 15 way connector and wait at least five minutes before trying step 13 again. If necessary try this up to three times (waiting five minutes each time) before trying another logger box.

Trouble 2

After unplugging the large 15 way connector; unplug the 7 way magnetometer lead from the logger and plug it back in as carefully as possible. Unplug the 7 way connector from the outside of the plug panel and plug it in again carefully. Try step 13 again. If necessary try this twice before trying another logger box.

Trouble 3

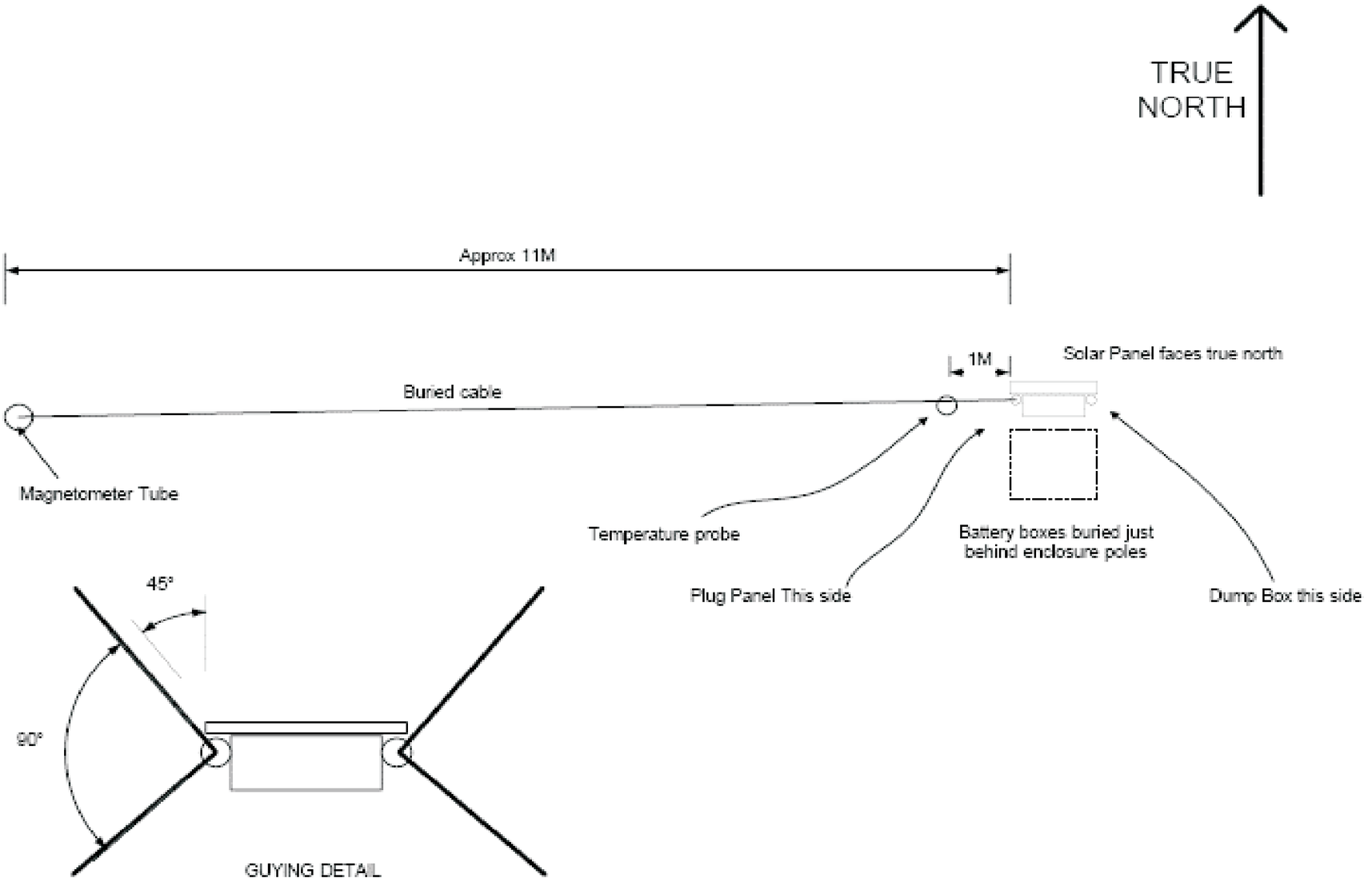
Unplug the large 15 way connector and try to plug it in again. Make sure that the connector clicks home fully. If the problem still remains, then unplug the large 15 way connector from the logger. Unplug the battery box to enclosure lead (bottom connector on plug panel) and replug it in again carefully. Try Step 13 again.

If the problem still remains then try the spare logger.

If the problem still remains then use a DVM to read the voltage between din rail 12 and 16. A point probe can be pushed onto the cable grub screws. This should be 12-15V. If the voltage is correct then there is nothing further you can do, another logger or enclosure is needed. Take the loggers back to base and contact me. Leave the enclosure in the field and correctly closed.

If the voltage between din rail 12 and 16 is 0V then you will need to dig the battery boxes up and check the connectors.

DO NOT SCALE



Issue	remarks	initial	date
1	new	mcr	07/11/00
2	removed cat	mcr	8-11-02

BRITISH ANTARCTIC SURVEY

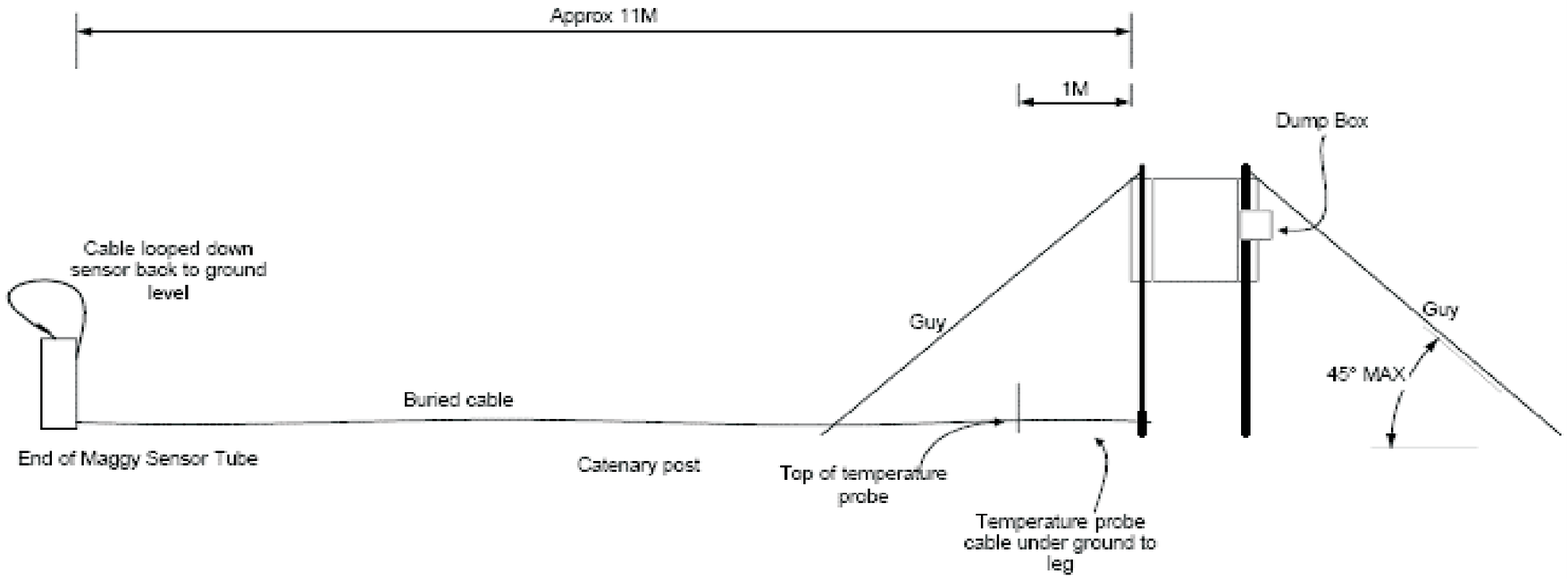
UMAG PROJECT

SITE LAYOUT

Sheet 1 of 1

SITE-001

DO NOT SCALE



Issue	remarks	initial	date
1	new	mcr	07/11/00
2	Removed cat	mcr	08/11/02

BRITISH ANTARCTIC SURVEY

UMAG PROJECT

SKETCH OF SYSTEM FROM THE SOUTH

Sheet 1 of 1

SITE-002

Appendix II

Materials and Tools

LPM System

Enclosure
2 prepared battery boxes
Magnetometer sensor tube
2 2.5M scaffold tubes
2 keyklamp bases
2 three way guy clamps
4 short guying strops
4 long rope guys
Dump box
4 snow anchors (useful to take some wood for cross pieces for bad snow conditions).
Short snake (dump box to enclosure connection lead)
Long snake (battery box to enclosure connection lead)
Short stubby (battery box to battery box connection lead)
Temperature probe pole
Logger Box (+ spare logger box)
Extra materials are required if the system is to have a wind generator – see the Forgen 500 deployment instructions.

Tools

Ice Drill
2 Shovels
2 Key Klamp Allen keys
2 Metal enclosure box keys
1 battery box clip tool.
2 Medium adjustable spanners
Wire snips (for cutting cable ties)
Bolt cutters (for cutting rope)
Spirit level
Compass
Digital Volt Meter
Long distance tape measure
Medium hammer
Digital camera
Pencil
Warm clothes and gloves (it WILL be cold up there).
GPS to record position.
A pare length of rope – not exactly needed but might save the day.

Sundries

Self amalgamating tape
20 x Large cable ties
20 x Medium cable ties
20 x Small cable ties
3 x Plastic bags (to protect connectors from snow)
Spare Keyclamp grub screws
Spare guy clamp

Appendix III

Deployment Checklist

Site name .....

Deployment date.....

Deployment team
.....

General weather conditions
.....

Battery box serial numbers ..... and .....

Magnetometer sensor serial number .....

Temperature probe serial number .....

Enclosure serial number .....

Removed tools from site .....

Checked for loose cables, flapping ropes, everything ship shape .....

Passed self tests 1st time ? .....

Logger serial number .....

Position from GPS .....

Altitude above sea level if available .....

Make any notes that will be useful for the future, or notes from the trouble shooting.

Appendix IV

Document History

V2.1 – 24/5/06 Minor updates following test deployment at Cambridge.

V2.0 – 21/5/06 Updated for Italian LPM shipment 2006.

V1.0 – Version for LPM's shipped to Japanese Antarctic Program. 2002.

V0.9 - BAS internal deployment manual.