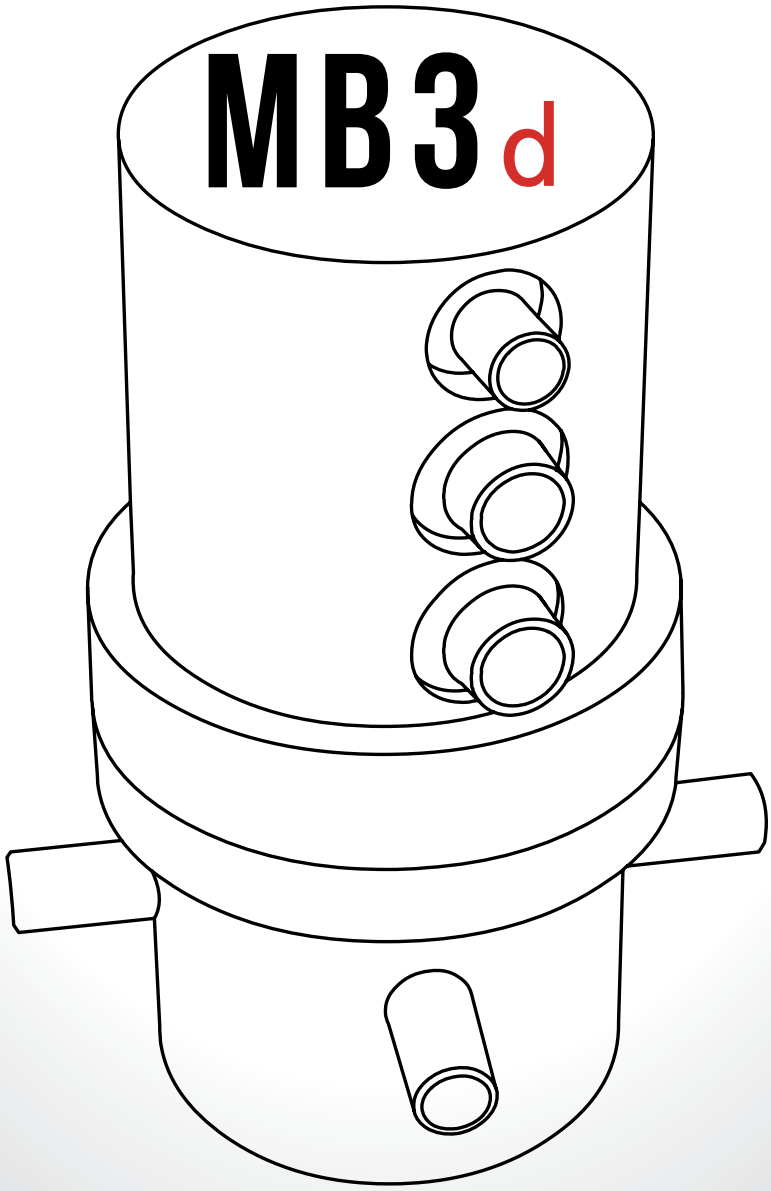
USER GUIDE



SEISMO WAVE

TABLE OF CONTENTS

- Documentation may be modified at any time by the manufacturer
- Non contractual photos and diagrams

MB3 OVERVIEW

The Microbarometer MB3 is a sensor dedicated to monitor infrasound signals.
The core of the sensor is an aneroid capsule coupled with a magnet & coil transducer. A secondary coil wrapped around the main one ensures remote calibration capability.

Two versions are proposed:

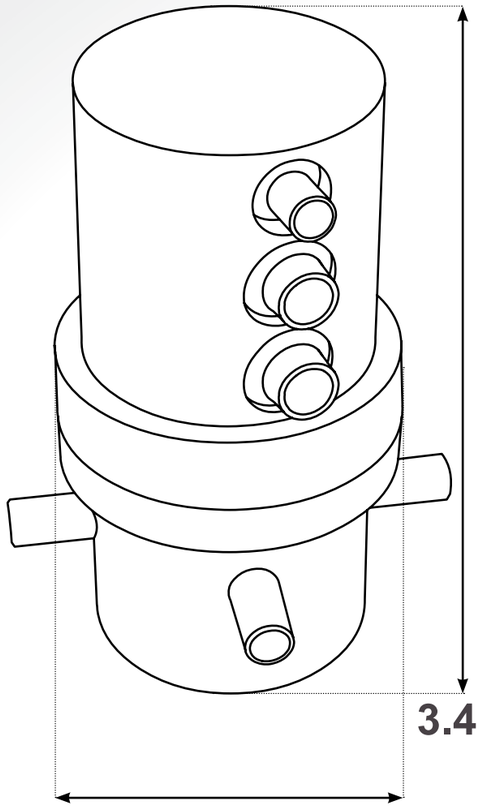
- One analog (MB3a) compatible with usual digitizers.
- The second one is digital (MB3d) embedding a low consumption high performance 24 bit ADC.

The system is composed of one main part, the transducer block that can be easily assembled with 2 different blocks:

- The analog block for the MB3a
- Or the digital block for a MB3***d***

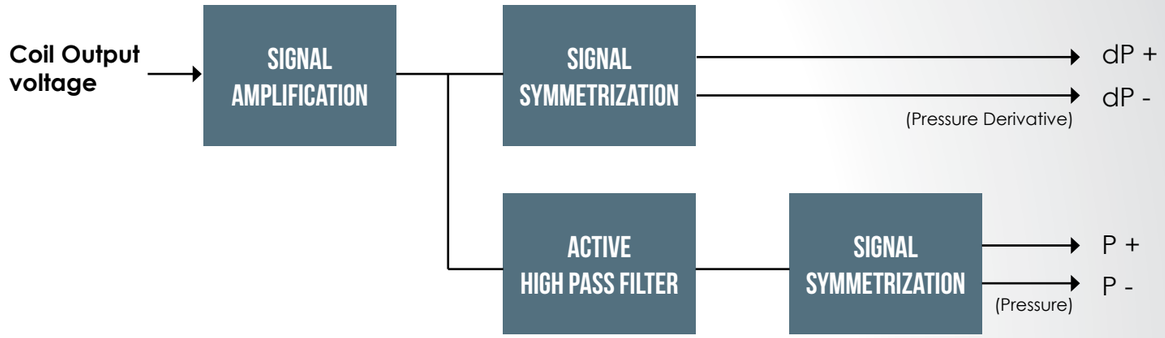
under CEA licence

MB3*d* DIMENSIONS

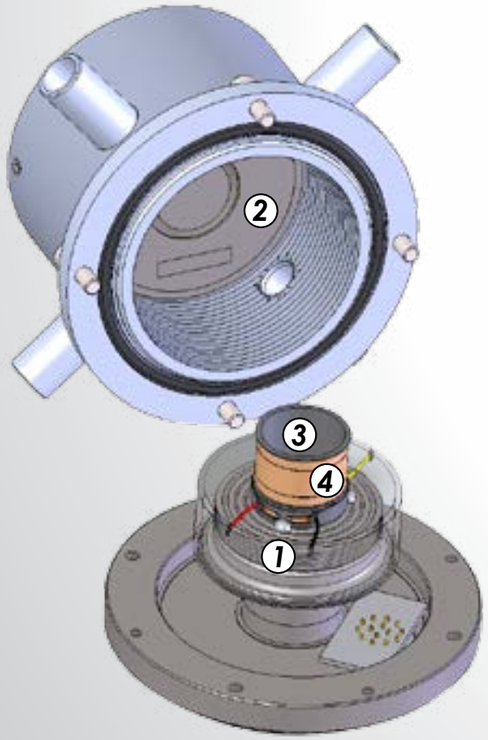


- Pressure sensitive element ①: aneroid capsule (bellows sealed under vacuum)
- Transducer: magnet ② and coil ③ velocity transducer (easily adjustable according to the altitude if needed on site see infra: magnet adjustment)
- Calibration coil: second coil ④ wrapped over the measurement coil

Pressure outputs



TRANSDUCER BLOCK



The sensor can be easily set in pressure output mode or pressure derivative output mode.

Technical characteristics

Bandwidth ($f_{-3\ dB}$)	Pressure output: 0,01 - 27 Hz Pressure derivative output: DC - 27 Hz
BLDR* [0,02 ; 4] Hz	117 dB @ f< 1,6 Hz 109 dB @ f= 4 Hz
Self-noise	0.13 mPa/√Hz @ 1 Hz < 10 dB under LNM
Resolution [0,02 ; 4] Hz	1,75 mPa_{RMS}
Default sensitivity (Adjustable gain)	Pressure output: 20 mV/Pa Pressure derivative output: 2 mV/Pa.s^{-1} Calibration output: 6Pa/V
Auxiliary outputs: • Temperature sensor • Atmospheric pressure sensor	 [-40 ; + 110]°C, 10 mV/°C, ±0,2°C [150 ; 1150] hPa, 1 mV/hPa offset stability: 0,25% full scale uncertainty: 1,5% full scale

* (Bandwidth Limited Dynamic Range)

DIGITAL BLOCK

- 24-bit sigma delta digitizer, low noise and low power consumption
- Integrated GPS dating
- Integrated electrical calibration
- 1 GB internal storage miniSEED

Technical characteristics

Clipping Level and output range	Pressure: ±min (12000 [Pa/s]/2.ϖ.f[Hz] ; 1000[Pa]) Pressure derivative: ±10000 (Pa/s)
Sampling rate	20, 50,100 Hz
Nominal sensitivity	1,178 10^{-4} Pa/lsb or 1,178 10^{-3} Pa/s/lsb @ gain = 1
Built in gain	1, 2, 4, 8 (Digitizer gain)
Data storage	1 GB / miniSEED
Power requirements	12 V DC (7-20V) 840 mW

PIN OUT

GPS Connector

RF coaxial TNC
Amphenol / Ref : f242178

Power supply

3-pin connector

Fischer DBPU105Z052	Signal
1	+12 V
2	GND
3	Not connected

Signal

18-pin connector

Fischer DBPU105A038	Signal
1	Reserved
2	USB_dP
3	Reserved
4	RS232 Rx (cmd)
5	Reserved
6	Reserved
7	Reserved
8	GND
9	USB_DM
10	Power Vbatt
11	GND
12	Reserved
13	RS232 Tx (data)
14	Reserved
15	Reserved
16	Reserved
17	USB_+5V
18	Reserved

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature	-20°C to + 50°C
Storage temperature	-30°C to + 70°C
Seismic sensitivity	< 30 Pa/m.s-2
Sealing	CEI 60529-IP67 (with acoustic inlets sealed)
Shock / Drop	NF EN 60721-3-1, 2M1 (free fall, impact, shock)
Transport	NF EN 60721-3-2, 2M3 (vibration)
EMC	NF EN 55024 classes A & B (immunity) NF EN 55022 class B (emission)

PERFORMANCES OVERVIEW

SELF-NOISE

The MB3 is ows a very low instrumental noise (<-80 dB.Pa / √ Hz @ 1 Hz). The sensor solves the Low Noise Model with at least a 10 dB margin (Bowman model ITW 2007 Tokyo).
This sensor has been designed especially to meet the IMS requirements for infrasound stations.

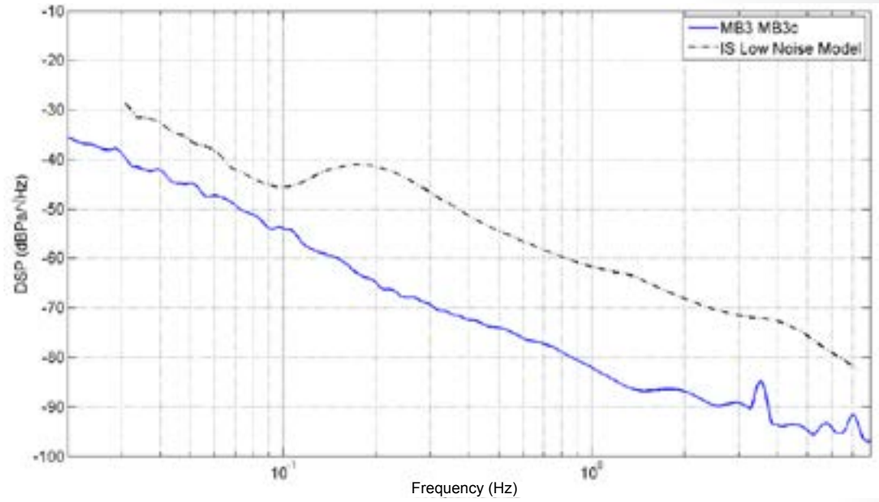


Fig. 1: Power Spectral Density of MB3 instrumental noise (blue) compared to the Bowman Low Noise Model.

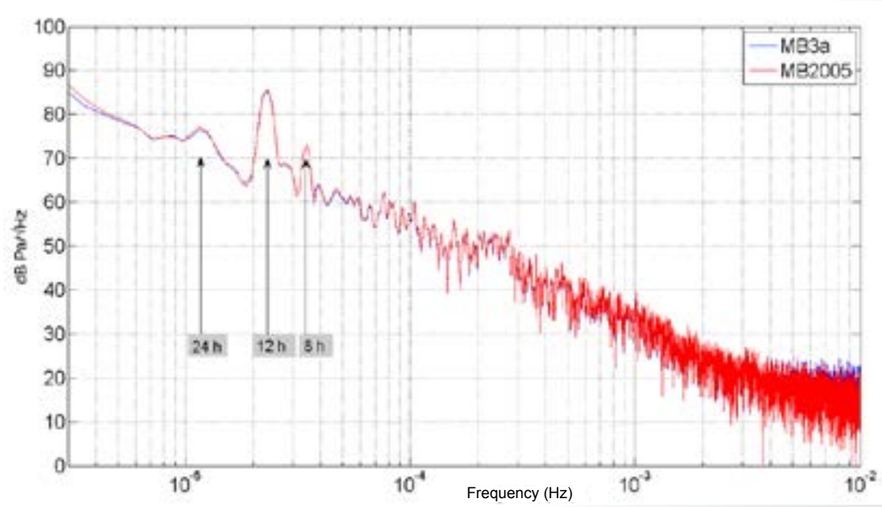


Fig. 2: The low frequency acoustic power spectral density, measured in observatory, (seismic station of Lormes, Nièvre, France) using a MB3a, compared with a co-located reference MB2005.

TRANSFER FUNCTION AND SENSITIVITY

The figure below shows a MB3a pressure output transfer function estimations.

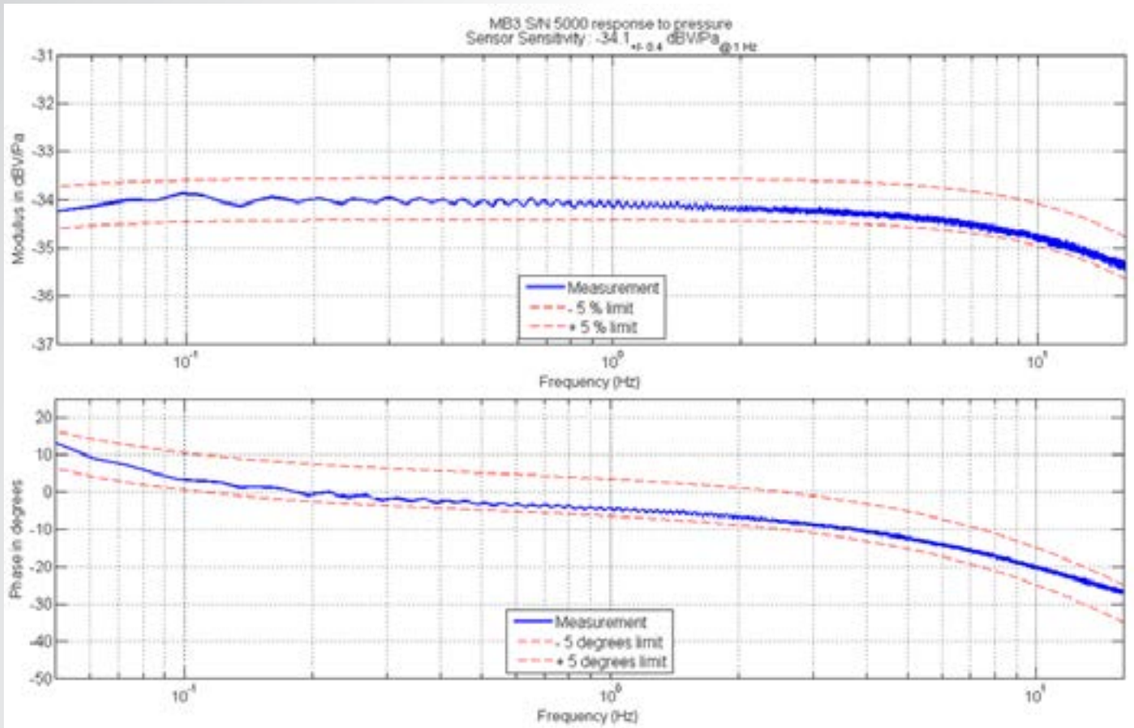


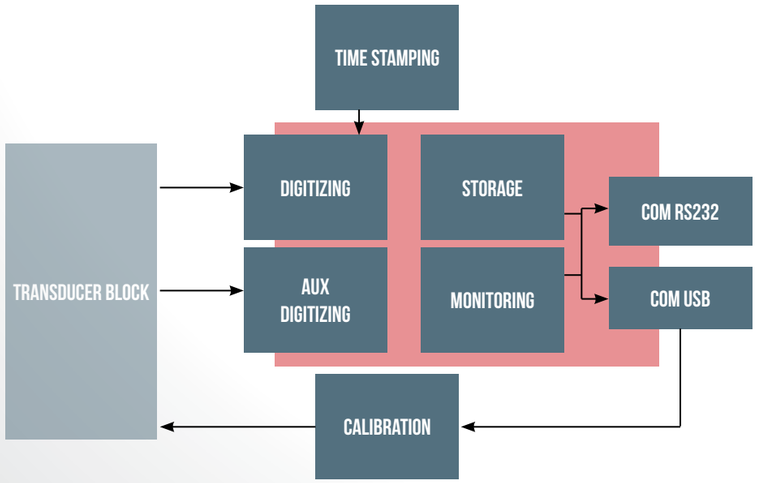
Fig. 3: Estimation of a MB3a transfer function compared with a theoretical response (amplitude ± 5%, phase ± 5%)

CONNECTIONS PRINCIPLES

Two communication interfaces are available in MB3d: RS232 and USB. This two interfaces use the same communication protocols:

- A NMEA-based protocol for command, configuration and control
- An implementation of SEEDlink protocol over RS232 for data retrieval

USB interface is recognized by the OS (Windows and Linux) as a virtual RS232 port (CDC-ACM device) and could be used with a standard RS232 client (hyperterminal on Windows or minicom on Linux)



PPS BOARD

MB3d provide datation for measurement detected from a GPS signal. It incorporates a system for maintaining the clock signal during 12H. In case of signal loss, the drift will be less than 100µS after 1h30 (with stable temperature). After 12 hours, It will therefore less than 800µs.

GETTING STARTED WITH MB3d.

LIST OF ACCESSORIES

Ref	Designation	Nb	Delivered	Datasheet
MB3d	Digital MB3	1	Yes	None
Battery	Battery YUASA 12 V NP 12-12	1	optional	Appendix 3
RSN279	GPS Antenna Procom 2000 TNC 3V	1	optional	Appendix 2
RSN801	12V power cable to connect sensor to battery	1	optional	None
RSN819	USB / 18 pin to connect sensor to PC	1	optional	None
TNC MF adaptor	Right angle TNC NF adaptor	1	optional	None
Magnet Wrench	To adjust the magnet	1	Yes	None

TOOLS NEEDED (NOT DELIVERED)

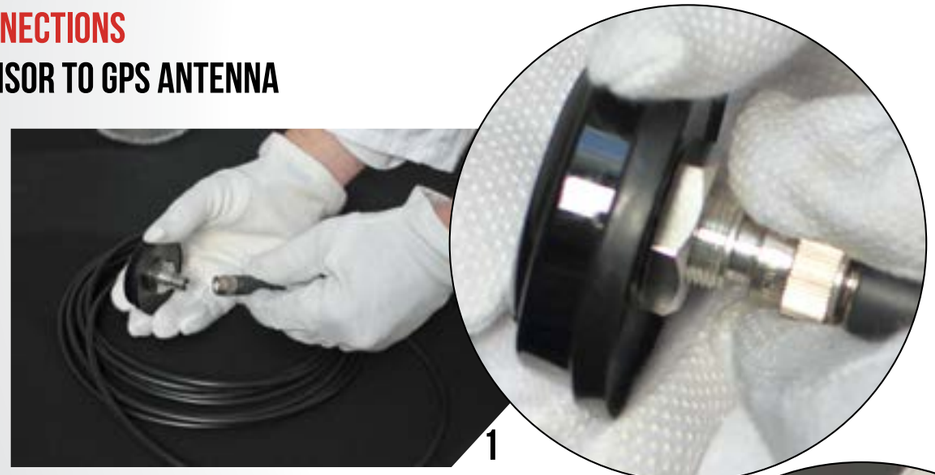
- One allen wrench 2.5
- One PC for data extraction and configuration / full supported OS Windows Xp or 7 / Linux
- Software and drivers needed: see Software ToolKit

SPECIAL WARNINGS AND PRECAUTIONS FOR USE

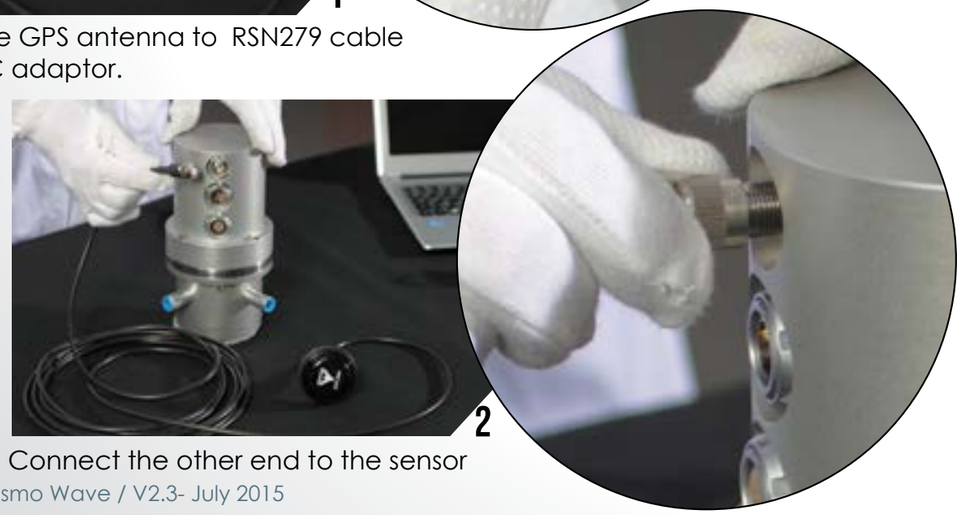
- The sensor must be placed on a stable and horizontal ground.
- The sensor must be sheltered from wind and rain.
- The battery must be sheltered from rain.
- Caution:
  1. The maximum input voltage is 23V for 1second
  2. A component protects against wrong polarity up up to 20V. In this case, the detector is not functional but it is not damaged.
  3. There is no component against charges inside the detector. You need to install an external protection component on your data transmission line and your GPS line.
  4. Differential measure: Do not ground any of the differential outputs (the device must have a floating mass)
  5. Common ground:
  - When MB3 gets power using 18 pin signal cable and a digitizer : connect the pin 8 of the cable to the GND of the digitizer.
  - If sensor is connected to battery using 3 pin power cable : use the M4 thread on the stainless flange to connect to ground via measuring device.
- Read attentively the battery recommendations before using it
- Connect the sensor to a wind-noise system if possible:
  (See Appendix 1: air input dimensions.)

CONNECTIONS

SENSOR TO GPS ANTENNA

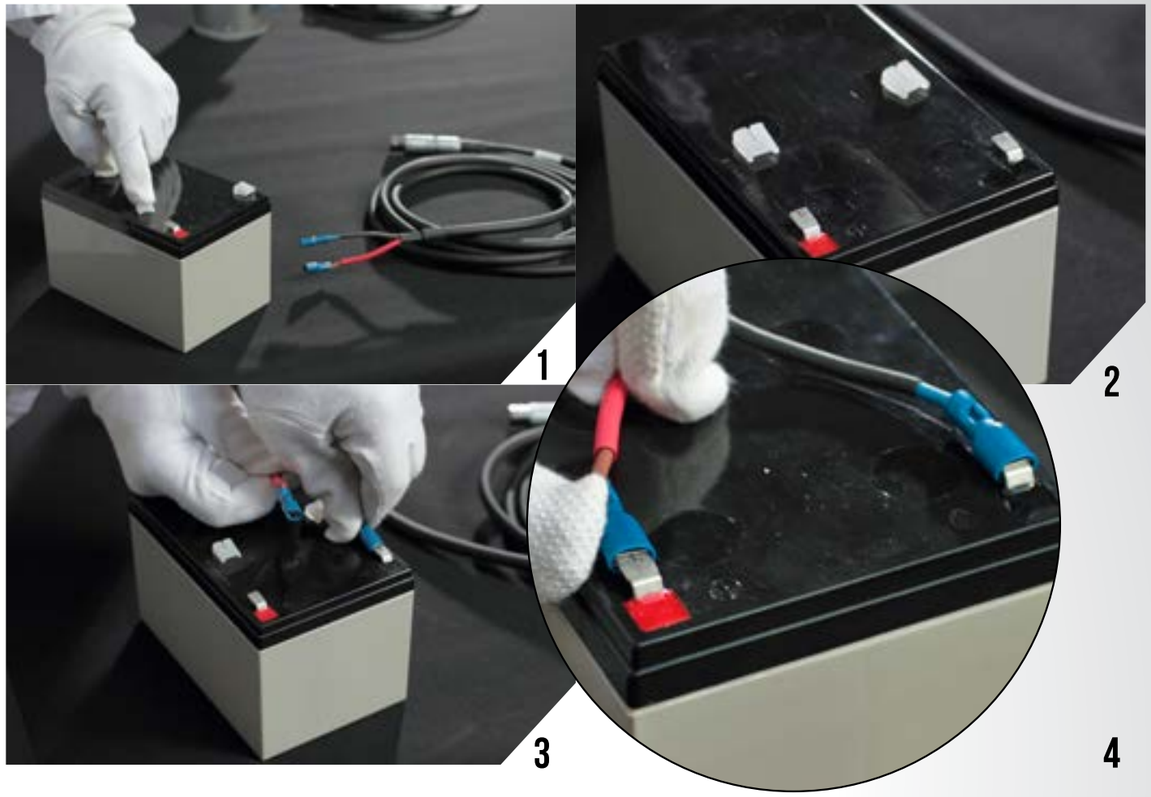


Connect de GPS antenna to RSN279 cable or TNC/TNC adaptor.



Connect the other end to the sensor

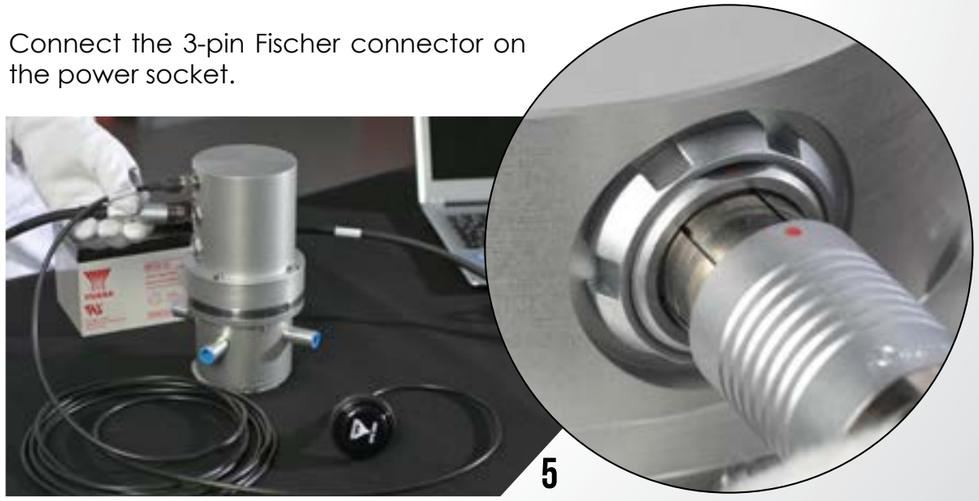
Sensor to battery



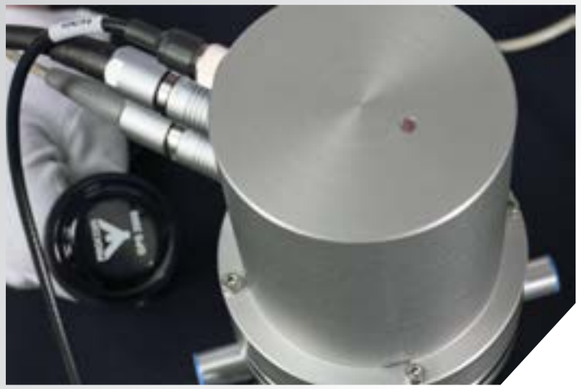
On one side of the cable, there are 2 different wires (black - and red +) and on the other extremity, there is a 3-pin Fischer connector.

- Remove the protective caps from both pods «Fast On».
- Connect the two black and red wires respectively on the black and red «Fast On» pods of the battery.

Connect the 3-pin Fischer connector on the power socket.



Always align the red dots facing each other and push.



2 searching for satellites*...

3 ready to operate

5 s

The Red LED (located on top of the sensor) lights after 5 sec.
MB3 searches for satellites. The RED LED blinks continuously until the signal is acquired, then it remains flashing slowly (1 flash per 5 seconds) when the system receives the GPS signal.
* This operation may last (at cold start) up to 20 min depending on your GPS reception.

Sensor to your PC

Connect via USB: First installation

The RSN819 signal cable proposes a USB socket that has to be virtually declared as a RS232 COM port. In order to configure this COM port, install the driver MB3.inf (provided in Software toolkit)
Follow the instructions: See appendix 6. Cf p.31

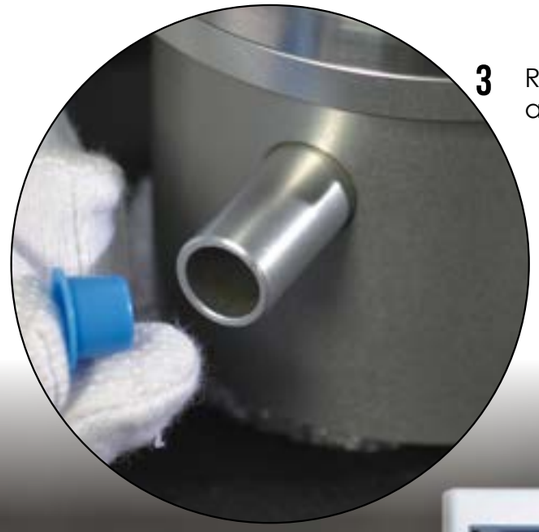
Connect via USB: Plug and data acquisition

RSN819-1 cable has at one end a USB plug, and at the other end, a 18-pin Fischer connector
First, connect the USB plug to your PC, and then connect 18-pin Fischer connector to the digital block.

Always align the red dots facing each other and push

Connect the USB plug to your PC.
Check if the USB plug is recognized.
Otherwise, see appendix 6. Cf p.31

2



3 Remove plastic covers before starting data acquisition

4 Launch the software **Dionisos™** (report to software user guide)

ADJUSTMENT

CHECKING CONFIGURATION AND STATUS

Using Dionisos

Please report to Dionisos User Guide p. 9 states of health dock and 29 viewing states of health

Using standard commands

Memento: principle of low level commands

Note: the com port of your USB connection must be known before executing any command

- Open the command prompt windows
(C:\Windows\system32\cmd.exe)

- Initialize the Communication:

```
C:\Users\my_directory\mb3d -serial COMx 0
```

① ② ③ 3a 3b

Use the following command and parameters
1. Directory path
2. Executable filename « mb3d »
3. COM port characteristics: defined with the mandatory option "–serial" followed by:
   a. The port ID (for example COM1 on Windows or /dev/ttyACM0 on linux)
   b. The communication speed (depends on your MB3d RS232-configuration – default is 115200, and could be 0 in case of USB connection)

- If data extraction is needed, set «dumpms» option

```
C:\Users\my_directory\mb3d -serial COMx 0 –dumpms
```

Data will be recorded in the default named file "data.mseed"
Then use standard command protocol
See appendix 4 NMEA command and appendix 5 SEEDlink command

Here are the most usefull Low Level Commands to check the status and the configuration of your sensor :

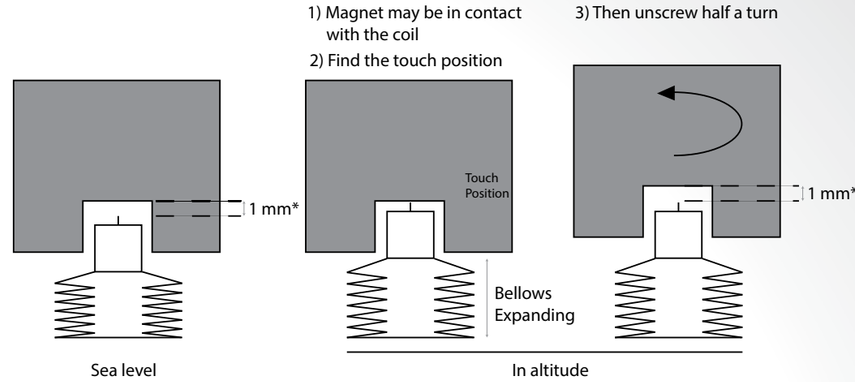
$PMB3QSTAT

returns the following information:
1. Power Supply (mV)
2. Firmware Version
3. Uptimes (seconds)
4. Electric Gain: 1, 2, 4 and 8
5. Cover State: 0: Open, 1: Closed
6. Magnet/Coil Contact:
   H: no contact, L : contact
7. Dating state: X: GPS Signal Absence, G: synchronized sensor will GPS signal and E: detection of dating error.
8. Value of outside temperature (1/100°C)
9. Value of atmospheric Pressure (in Pa)
10. Value of internal temperature (1/100°C)

$PMB3QRUN

returns the active configuration:
1. R or M, respectively for Active Config or Working Config
2. Sampling Frequency
3. Gain
4. LED Status
5. Serial RS232 baudrate
6. Network code
7. Location code
8. Station code
9. ADC input selection
10. Channel code
11. Should be 0.

MAGNET ADJUSTMENT



*1 mm corresponds to unscrew the magnet half a turn

MB3 are initially adjusted at the sea level. The coil is centered in the middle of the magnet. When a sensor is located in high altitudes (>1000 m), it is needed to re-position the magnet according to the new position of the bellows (expanded by a lower static pressure). It is easily done by screwing or unscrewing the magnet (no need to open sensor). An impedance measurement using the provided MB3d software (Dionisos) ensures a very quick adjustment.

To do this, follow the different steps below:

1 Remove plastic caps before adjustment.

2 Reverse the sensor carefully to put the transducer block on top.

3 Connect the USB plug to your PC.
Check if the USB port is recognized.
Otherwise, see trouble shooting
Cf p. 14

```
$PMB3QSTAT:
```

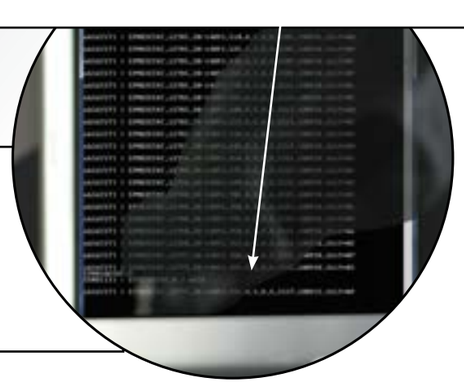
H or L specifies if there is a contact between magnet and coil or not

The command response is :

```
mb3d[57] $PMB3STAT,1278,20-14093,630,8,C,H,X,2317,100928,2619*07
```

3

Before adjustment, the GPIO signal return H



4

Unscrew (thanks to the Allen Wrench) the 2 screws to unlock the magnet.

5

Using the magnet wrench, screw or unscrew the magnet, depending on the impedance value.

A

Case (A), no electrical mass-continuity (H).

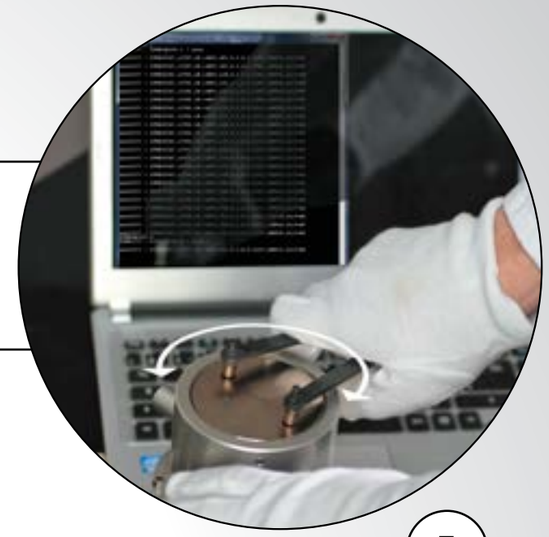
At first, screw the magnet to reach electrical mass-continuity position (about 0.2 Ω). Go to step 6

B

Case (B) low impedance value (L): Go to step 6

6

Unscrew the magnet until getting a high impedance value H, and stop.



7

To reach the right magnet position, screw the magnet until it is flush with the coil, just before the reverse of status (L)

8

Finally, unscrew the magnet half a turn.

9

Screw the two locking screws.

Please report to Dionisos User Guide p. 38 magnet position panel

INFRASOUND SIGNAL ACQUISITION

USING SOFTWARE (DIONISOS)

Please report to Dionisos User Guide p. 14 data acquisition

USING STANDARD COMMANDS

1. Launch the MB3d.exe client with the «dumpms» option (see memento in checking status)

```
C:\Users\my_directory\data_directory>mb3d -serial COMx 0 –dumpms
```

Data will be recorded in the file named "data.mseed" in the current directory (data_directory)
If several acquisitions, do not forget to rename the data file name.

2. Specify the data channel using command: SELECT BDF (See appendix 5 SEEDLink protocol)
Note: BDF is the default main channel code.
Note: auxiliary measurments are available with default channel code LKO (temperature in 10^{-2} °C) and LDO (absolute pressure in Pa).

3. Extract Data for a given time interval using command TIME.

```
TIME aaaa,mm,jj,hh,mnmn,ss, aaaa,mm,jj,hh,mnmn,ss
```

Example: To download data from a signal acquisition between the 16/04/2014 at 15H00 and the 17/04/2014 at 9H00, execute the following command:

```
TIME 2014,04,16,14,00,00,2014,04,17,08,00,00
```

Note: Time must be in UTC (Universal Time Coordinated).
Note: The TIME command do not allow to get the latest data. To extract the most recent recordings using this command, you have to specify only the start time.
Note: Do not forget to close the connection using command: BYE

4. Display saved data
The data.mseed file follows the miniSEED standards. It can be displayed using any compatible software.

MAINTENANCE AND AFTER-SALES SERVICE

If needed, send back the sensor in its original package to :

Seismo Wave
ROUTE DE TREGUIER – ROSPEZ
22300 LANNION
PHONE: + 33 (0)2 96 46 16 11
SAV@SEISMOWAVE.COM

The product warranty (1 year), will no longer be valid if the product has been opened, disassembled or damaged.

After a technical evaluation, the service will send you a proposal for an intervention (if covered or not by the warranty) and if needed a quote and a deadline.

The product will be repaired after receiving your official agreement.

RECYCLING

Do not through any device into rubbish.
Send it back to Seismo Wave, the product will be recycled.

TROUBLE SHOOTING

THE RED LED BLINKS 2 TIMES PER 5 SEC

Sensor clock is correctly synchronized but there is a temporary loss of GPS signal. It may last within 12 hours (the system maintains the time stamping without any GPS signal). Over this laps, the system reboots and a new GPS synchronisation is needed.

THE RED LED BLINKS 3 TIMES PER 5 SEC

An error has occurred during the GPS synchronization. Reboot the sensor and report the problem to your supplier.

THE USB IS NOT RECOGNIZED

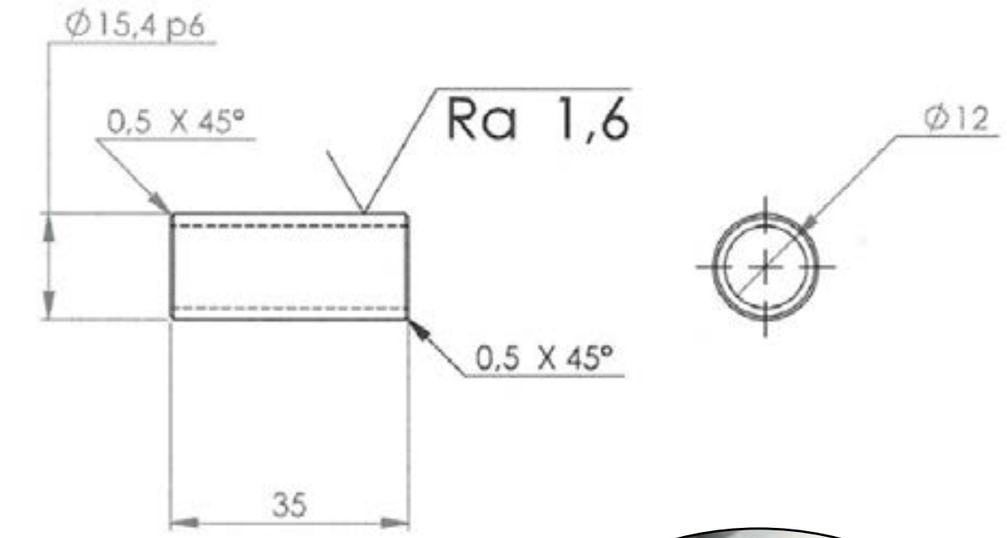
MB3d Driver is not well configured so that the virtual RS232 port does not exist.
Folow instructions appendix 6. Cf p.31

GLOSSARY

ADC	: Analog to Digital Converter
CEA	: Commissariat à l'Energie Atomique et aux énergies renouvelables
CTBT	: Comprehensive Nuclear-Test Ban-Treaty
DSP	: Density Spectral Power
EMC	: ElectroMagnetic Compatibility
GND	: Ground
IMS	: International Monitoring System
LNM	: Low Noise Model
MAC	: Magnet Adjustment Cable
MB2005	: MicroBarometer 2005 version
MB3	: MicroBarometer third generation
NMEA	: National Marine Electronics Association
PP	: Peak to Peak
SEED	: Standard for the Exchange of Earthquake Data

APPENDIX

APPENDIX 1: AIR INPUT DIMENSIONS



dimensions in mm

APPENDIX 2: GPS ANTENNA

GPS 2000

Active Receiving Antenna for the 1575 MHz NAVSTAR GPS Satellite Navigational System for Maritime and Landmobile Use

DESCRIPTION

- Flat-pack GPS-antenna for fixed installations.
- Full hemispherical coverage.
- Built-in high gain, low-noise amplifier.
- Right-hand circular polarization (RHCP).
- Available in black or white, see model survey.
- 3 V or 5 V supply voltage (12 V available on request).
- DC supply via RF-connector.
- EMC tested to IEC 801 and IEC 255.
- Provided with FME (male), TNC (female) connector, or models with permanently attached 0.15 m cable with FME (male) connector, see model survey.
- Wide range of FME-accessories available.

GPS 2000B

GPS 2000W

GPS 2000B-P0.15

GPS 2000W-P0.15

FME-VERSION

TNC-VERSION

Models with permanently attached cable

MOUNTING

The gasket should be entirely supported by the mounting plane.

Do not use sealer on rubber gasket or other places.

ORDERING DESIGNATIONS

TYPE	COLOUR	PRODUCT NO.
FME CONNECTOR		
GPS 2000B-FME-5V	Black	112000026
GPS 2000B-FME-3V	Black	112000029
GPS 2000W-FME-5V	White	112000024
GPS 2000W-FME-3V	White	112000023
TNC CONNECTOR		
GPS 2000B-TNC-5V	Black	112000028
GPS 2000B-TNC-3V	Black	112000032
GPS 2000W-TNC-5V	White	112000027
GPS 2000W-TNC-3V	White	112000019
PERMANENTLY ATTACHED CABLE		
GPS 2000B-P0.15-5V	Black	112000072
GPS 2000B-P0.15-3V	Black	112000074
GPS 2000W-P0.15-5V	White	112000071
GPS 2000W-P0.15-3V	White	112000073

SPECIFICATIONS

ELECTRICAL GENERAL SPECIFICATIONS	
MODEL	GPS 2000
ANTENNA TYPE	Active patch antenna
FREQUENCY	1575 MHz
IMPEDANCE	Nom. 50 Ω
POLARIZATION	Circular right-hand
COVERAGE	Hemispherical
GAIN (in axial direction)	28 dBi (typ.)
CROSSPOLARIZATION ATT.	> 10 dB (typ.)
SELECTIVITY	> 45 dB down @ ± 45 MHz
BUILT-IN AMPLIFIER	
GAIN	> 30 dB (typ.)
NOISE FIGURE	< 1 dB (typ.)
1 dB COMPRESSION POINT	Approx. +7 dBm
SWR (output)	< 2.0
SUPPLY VOLTAGE	5 ± 0.5 VDC or 3 V ± 0.3 VDC (12 V available on request)
CURRENT CONSUMPTION	Approx. 20 mA
MECHANICAL	
MOUNTING	14 mm / 0.55 in. dia. hole
MOUNTING THICKN.	0.7 ÷ 4.5 mm / 0.028 ÷ 0.18 in.
MATERIALS	Cu-nite brass, seawater resistant Lexan
COLOUR	Black or white, see ordering designations
TEMP. RANGE	-50° C ÷ +70° C
CONNECTOR	FME (male), TNC (female) or models with 0.15 m RG 316 permanently attached cable with FME (male) connector, see ordering designations
RECOMMENDED INSTALL. TORQUE	0.5 ± 1 Nm
HEIGHT	16 mm / 0.63 in.
OUTER HEIGHT	26.5 mm / 1.04 in. total (FME) 38 mm / 1.50 in. total (TNC) 27 mm / 1.22 in. total for P0.15 models
WIDTH/LENGTH	ø55 mm / ø2.17 in.
WEIGHT	Approx. 120 g / 0.26 lb.

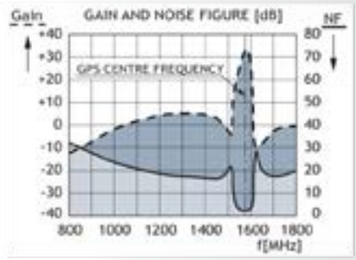
FME-SYSTEM ACCESSORIES

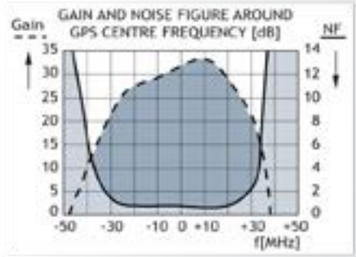
FME-CABLES	
TYPE	PRODUCT NO.
1 m FME	130000437
2 m FME	130000447
3 m FME	130000457
4 m FME	130000466
5 m FME	130000474
6 m FME	130000483
4 m FME-white	110000064
6 m FME-white	110000066
12 m FME-white	110000068
18 m FME-white	110000069

For further information about other types of FME-cables and FME-connectors, please compare the cable and connector data sheets under accessories.

FME-CONNECTORS	
TYPE	PRODUCT NO.
FME-FME	130000583
FME-P (Prolongation)	130000565
FME-N	130000571
FME-FSMA (Female-SMA)	130000578
FME-BNC	130000566
FME-TNC	130000569
FME-UHF	130000572
FME-MUHF (Mini-UHF)	130000573
FME-EMUHF (Elbow-MUHF)	130000582
FME-EBNC (Elbow-BNC)	130000580
FME-ETNC (Elbow-TNC)	130000581
FME-SMA	130000577

TYPICAL RESPONSE CURVES





NP SERIES - **NP 12-12**

Data Sheet

Reliability is your Security

Utilizing the latest advance design Oxygen Recombination Technology, Yuasa have applied their 80 years experience in the lead acid battery field to produce the optimum design of Sealed Lead Acid batteries.

FEATURES

- Superb recovery from deep discharge.
- Electrolyte suspension system.
- Gas Recombination.
- Multipurpose: Float or Cyclic use.
- Usable in any orientation.
- Superior energy density.
- Lead calcium grids for extended life.
- Manufactured World wide.
- Application specific designs.

Technical Features

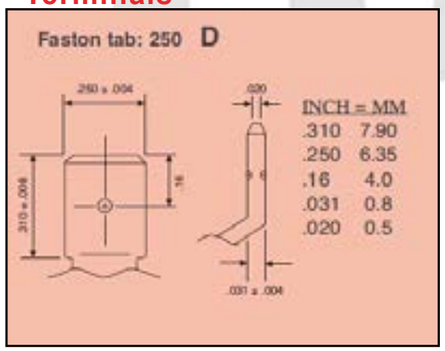
Sealed Construction
Yuasa's unique construction and sealing technique ensures no electrolyte leakage from case or terminals.

Electrolyte Suspension System
All NP batteries utilize Yuasa's unique electrolyte suspension system incorporating a microfine glass mat to retain the maximum amount of electrolyte in the cells. The electrolyte is retained in the separator material and there is no free electrolyte to escape from the cells. No gels or other contaminants are added.

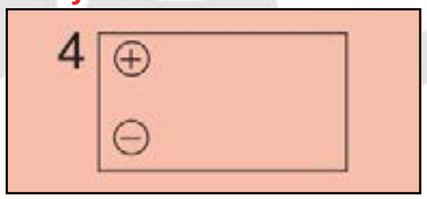
Control of Gas Generation
The design of Yuasa's NP batteries incorporates the very latest oxygen recombination technology to effectively control the generation of gas during normal use.

Low Maintenance Operation
Due to the perfectly sealed construction and the recombination of gasses within the cell, the battery is almost maintenance free.

Terminals



Layout



Terminals
NP batteries are manufactured using a range of terminals which vary in size and type. Please refer to details as shown.

Operation in any Orientation
The combination of sealed construction and Yuasa's unique electrolyte suspension system allows operation in any orientation, with no loss of performance or fear of electrolyte leakage.

Valve Regulated Design
The batteries are equipped with a simple, safe, low pressure venting system which releases excess gas and automatically reseals should there be a build up of gas within the battery due to severe overcharge. Note. On no account should the battery be charged in a sealed container.

General Specifications

Nominal Capacity (Ah)	NP12-12
20hr to 1.75vpc 30ºC	12
10hr to 1.75vpc 20ºC	11.1
5hr to 1 .70vpc 20ºC	10
1 hr to 1 .60vpc 20ºC	7.2
Voltage	12
Energy Density (Wh.L.20hr)	1 04
Specific Energy (Wh.kg.20hr)	36
Int. Resistance (m.Ohms)	1 6
Maximum discharge (A)	75
Short Circuit current (A)	360
Dimensions (mm)	
Length	151
Width	98
Height overall	97.5
Weight (Kg)	4.05
Terminal	D
Layout	4
Terminal Torque Nm	-

Data Sheet

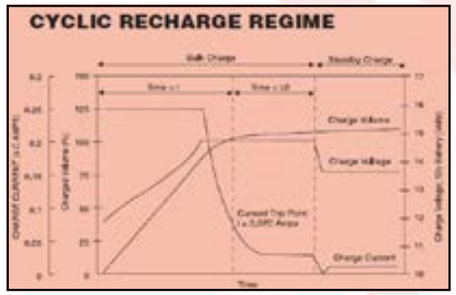
NP SERIES - **NP 12-12**

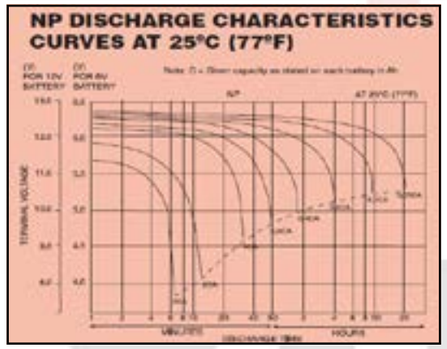
Lead Calcium Grids
The heavy duty lead calcium alloy grids provide an extra margin of performance and life in both cyclic and float applications and give unparalleled recovery from deep discharge.

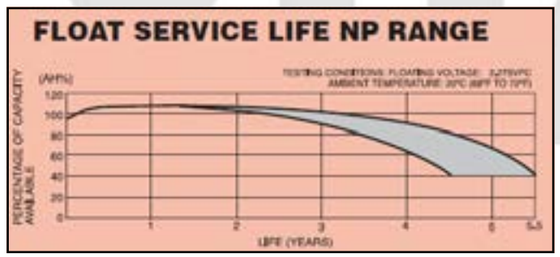
Long Cycle Service Life
Depending upon the average depth of discharge, over a thousand discharge/charge cycles can be expected.

Float Service Life
The expected service life is five years in float standby applications.

Separators
The use of the special separator material provides a very efficient insulation between plates preventing inter-plate short circuits and prohibiting the shedding of active materials.



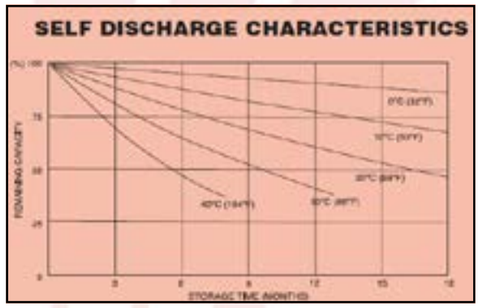


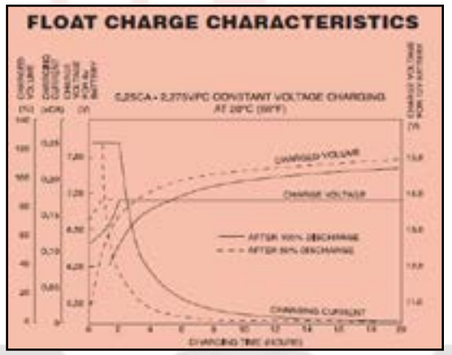


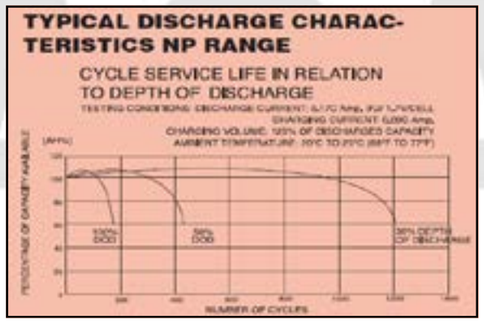
Long shelf Life
The extremely low self discharge rate allows the battery to be stored for extended periods up to one year at normal ambient temperatures with no permanent loss of capacity.

Operating Temperature Range
The batteries can be used over a broad temperature range permitting considerable flexibility in system design and location.

Charge – 15°C to 50°C
Discharge – 20°C to 60°C
Storage – 20°C to 50°C (fully charged battery)







Yuasa Battery Inc.
2901 Montrose Ave
Laureldale, PA 19605
www.yuasabatteries.com

Registered number 1548820

Cat. No.	NP 12-12 March 09

Distributed by

APPENDIX 4: NMEA MESSAGES

1. Based on the NMEA Protocol
2. All messages of commands, controls and status respect the following form:

```
$PMB3MSG,PARAM1,PARAM2,PARAM3,PARAM4,….,PARAMX*CS,<CR><LF>
```

Message Header | Message Identifier | Parameters | Value of Checksum | Carriage Return and Line Feed

3. The checksum is systematically added when the MB3 talks but is optional for commands and query.
4. Parameters can be omitted. Default or precedent value is used. For example1:

```
$PMB3CONF,PARAM1,PARAM2,,,,PARAM6,PARAM7,,,,PARAM11*CS
```

The Checksum CS is computed with a XOR function over all ASCII characters between the first character '$' (excluded) and the final one '*' (excluded). It must be written in hexadecimal form over 2 zero-padded IPPERCASE DIGITS.

On front page, list of the most important NMEA messages:

Message Identifier	Query, Command or Answer	Message Description	Parameters Numbers	Parameters Description
BOOT	Cmd	Reinitialize station	φ	φ
BOOT	Ans	Station is starting up	φ	φ
QRUN	Query	Query Active config	φ	φ
QCONF	Query	Query working config	φ	φ
CONF	Ans	Return config parameters	11	1: R or M, respectively for Active Config or Working Config 2: Sampling Frequency 3: Gain 4: LED Status 5: Serial RS232 baudrate 6: MiniSEED network code 7: MiniSEED location code 8: MiniSEED station code 9: ADC input selection 10: MiniSEED Channel code 11: Should be 0.
SCONF	Cmd	Set config parameters (working config)	10	1: Sampling Frequency : 8, 20,40, 50, 100 or 200 2: Gain :1, 2, 4 or 8 3: LED Status: 0: Inactive, 1: Flashing Light 4: Serial RS232 baudrate: 4800,9600,38400,57600,115200 5: MiniSEED network code: Empty or exactly two digits: XX 6: MiniSEED location code : Empty or exactly two digits: 00 7: MiniSEED station code: up to 5 digits 8: ADC input Selection : 0: Pressure Derivative, 1: Pressure 9: Channel code : Exactly 3 digits 10: Reserved, should be 0. Characters accepted for MiniSEED ID: A to Z and 0 to 9
WCONF	Cmd	Write Working Configuration (will be effective after next REBOOT)	φ	φ
QSTAT	Query	Health State Status	φ	φ
STAT	Ans	Health State Status	10	1: Power Supply (mV) 2: Firmware Version: Number of version, date of compilation (with Julian calendar format) 3: Uptime (seconds) 4: Electric Gain: 1, 2, 4 or 8 5: Transducer presence: O: Open, C: Closed 6: Magnet/Coil Contact: H: no contact, L : contact 7: Time stamping: X: GPS Signal loss, G: GPS signal synchronized or E: time stamping error. 8: Value of outside temperature (1/100°C) 9: Value of atmospheric Pressure (in Pa) 10: Value of internal temperature (1/100°C)
CALSINSTART	Cmd	Calibration	3	1: Sinus frequency in mHz: [40 - 60000] 2: Sinus amplitude in mV:]0 - 10000] 3: Repeatition number (in signal period):1 to 65535
CALMLSSTART	Cmd	MLS Calibration	3	1: MLS Sequence Order: 2 to 15 2: Sinus amplitude in mV: 2500, 5000 or 10000 3: Repeatition number :1 to 65535
CALSTOP	Cmd	Stop Calibration	φ	φ
QID	Query	Acknowledgment	φ	φ
ID	Ans	Acknowledgment	2	1: Serial Number 2: Station Code
WIPE	Cmd	Empty Data Memory	1	1: DATA This command needs a checksum (5B)

1 : Cmd : command
2 : Ans : answer
φ no mandatory arguments

APPENDIX 5: SEEDLINK COMMANDS

A SEEDlink transaction starts as soon as a SEEDlink command is sent.

Once the SEEDlink transaction has started, the answers from NMEA commands are encapsulated in the LOG MiniSEED channel.

This transaction is closed using the command BYE.

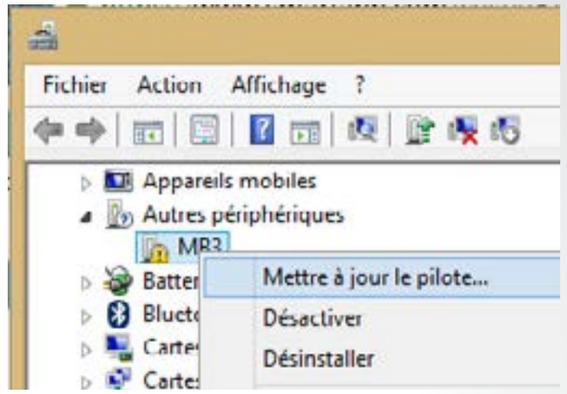
Below, a summary list of sandard commands accepted for SEEDlink transaction:

Commands	Commands Description
HELLO	MB3d returns the version number of the Seedlink and station
SELECT	Used without pattern all selectors are canceled. Otherwise, the pattern is a positive selector to enable matching MiniSEED stream transfer
STATION	Used only for compatibility with standard tools. MB3d will always answer OK
TIME	Extracts the time window from begin time to end time.
END	End of handshaking in multi-station mode.
BYE	Closes the transaction
DATA	Starts realtime SEEDlink transmission for selected channels

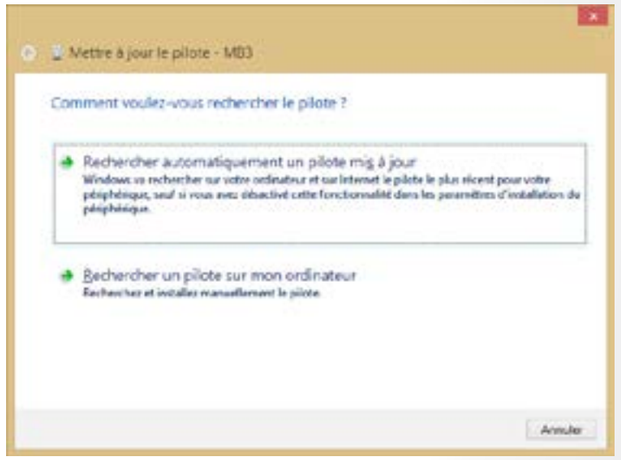
APPENDIX 6: USB CONFIGURATION

1. Driver installation on Windows OS

- Open the configuration panel windows and then the Device Manager
- In section "Other devices", find the item "MB3"



- Right click and run Driver update
- Set up the path of the driver mb3.inf, and install it.



2. Know the COM id assigned by the OS

- Open the configuration panel windows and then the Device Manager
- In section "Port COM / LPT" find the device "MB3 USB to Serial Converter". It gives the COM id.

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