INSTRUCTION MANUAL

VIBRATING WIRE DATALOGGER

Model MB-6TL

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1 APPLICATIONS

The MB-6TL unit is a self-powered, portable unit designed to read and store data from vibrating wire sensors and thermistors.

It is equipped with a differential reading circuit which provides immunity against electrical noises. The sensitivity of this circuit enables the reading of very weak signals. This allows the MB-6TL unit to read gages that are not readable with other readout units.

The use of a differential circuit with sinusoidal excitation eliminates harmonics problems. The latter may occur in readout units which use square wave scanning techniques.

2 PRODUCT

2.1 GENERAL DESCRIPTION

The MB-6TL readout unit is housed in a light and robust, splash-proof sealed case. The unit is completely watertight with the cover closed but not submersible.

The readout unit is supplied complete with:

- a battery charger,
- a RS-232 serial interface cable,
- a jumper cable fitted with four alligator clips at one end,
- MBTALK utility software
- and a carrying pouch.

It is powered by one internal rechargeable battery. Under normal conditions, the unit can provide several hours operation when properly charged.

A four line graphic LCD display shows all important information during measurement and navigation into the different menus.

2.2 FRONT PANEL

The MB-6TL front panel comprises two connectors, a graphic LCD display and several switches, as shown on the following figure.

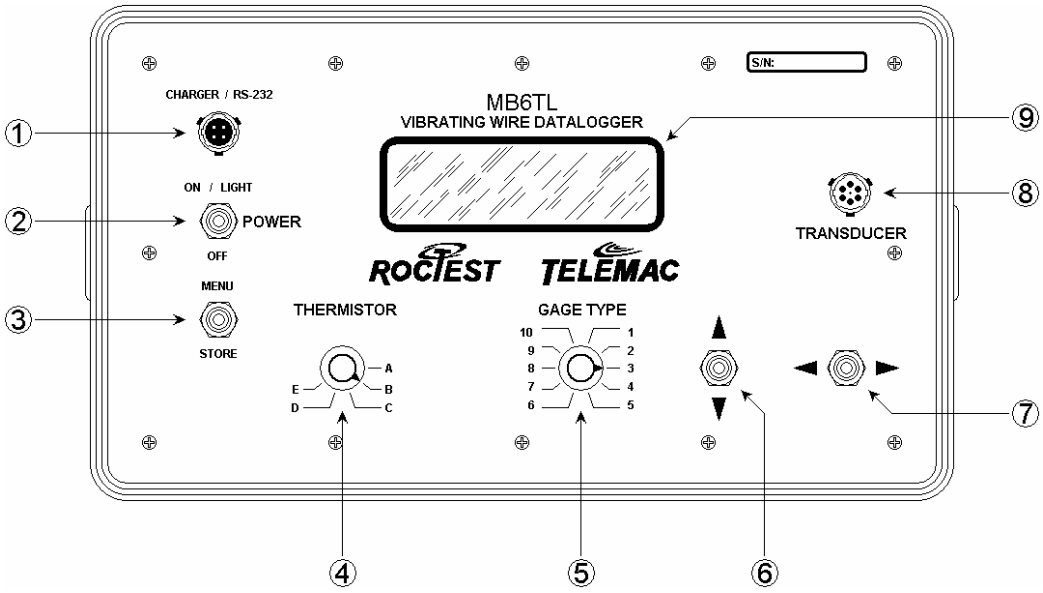


Figure 1: MB-6TL front panel

CHARGER and RS-232 connector (#1)

This socket is used to connect the battery charger and to communicate through the RS-232 serial port. The charge input is provided by a wall-plug adapter (120V 60Hz, or 220V 50Hz optional). The readout unit is able to function while the battery is charging.

ON/OFF and LIGHT switch (#2)

The ON/OFF switch is a spring loaded, double position switch. By momentarily turning the switch ON, a timer circuit starts and activates the readout unit for 10 minutes if the gage or thermistor is not connected, and, 90 minutes if the gage or thermistor is connected. Any time a rotary switch is used (#4 or #5), the timer circuit is reset and the readout unit will remain ON for another 10 or 90 minutes. The readout unit is turned off when the switch is moved to the OFF position.

To shut down the readout unit at any time, hold the switch to OFF position during fifteen seconds.

The same switch is used to control the display light. Push up and hold to turn the display light on or off.

Note: The display light doubles the MB-6TL power consumption. This feature should be used as seldom as possible in order to extend battery life.

MENU and STORE switch (#3)

This switch is used to access the menu, or to store a current reading. The switch is also used throughout the menu functions to quit a current window or to select a current item.

THERMISTOR rotary switch (#4)

This switch allows the selection of the type of thermistor in the gage.

GAGE TYPE rotary switch (#5)

This switch allows the reading of up to ten different gage types.

UP/DOWN switch (#6)

This switch is used to display the stored data readings and to scroll among the selections when a menu is displayed.

LEFT/RIGHT switch (#7)

This switch is used to select a user-configured sensor.

TRANSDUCER connector (#8)

The six pin male electrical connector accepts the mating connector mounted on one end of the jumper cable. The gage end of the jumper cable is fitted with four alligator clips that connect to the gage leads.

LCD display (#9)

It is a liquid crystal display with four lines of twenty characters each. The display can be back-lit by using the ON/OFF light switch.

2.3 ROTARY SWITCHES DETAILS

2.3.1 THERMISTOR SELECTOR

The correspondence between the letters A through E is shown in the following table and is also listed in the summary instructions printed under the front cover.

Selector position	Function
A	2kΩ thermistor reading
B	3kΩ thermistor reading
C	10kΩ thermistor reading
D	ohmmeter mode
E	battery check mode

Table 1: Function vs. Thermistor selector position

The D position turns the readout unit into an ohmmeter. This feature is useful when the thermistor integrated in the gage is not standard and cannot be read with other positions. The display will then show the resistance value in ohms or kilo-ohms, as well as the battery voltage.

The E position displays the battery voltage instead of the temperature. If this position is selected, the display will show “BATT.” and the voltage in volts along with the gage readings.

2.3.2 GAGE TYPE SELECTOR

Positions 1 to 9 refer to standard gages listed under the MB-6TL cover. Position 10 is intended for gages which do not correspond to any of the other types.

The rotary switch position determines the excitation frequencies as well as the appropriate gage constant. The latter allows the conversion of frequency reading into LINEAR units. For more information, please refer to next chapter (MB-6TL functions).

The following table shows the gage type corresponding to each switch position.

Position	Gage type	Gage constant	Readout operating range
1	VBS-2	N/A*	175 - 380 μs
2	JM, VH	1.0000	300 - 900 μs
3	SM-2, EM-2, IRHP	0.3911	310 - 770 μs
4	PWS –P -F, TPC, EPC	1.0156	420 - 1000 μs
5	None	1.1560	620 - 1390 μs
6	EM-5, EM-10, SM-5	4.0624	900 - 2300 μs
7	None	N/A*	460 - 1030 μs
8	CL1	N/A*	740 –1600 μs
9	C-110	N/A*	580 – 2300 μs
10	All gages	1.0000	180 - 2300 μs

* Gage types without gage constant will display their reading in frequency instead of LINEAR units.

Table 2: Gage type vs. Selector position

2.4 FLASH MEMORY

The MB-6TL contains FLASH programmable memory. This feature allows the loading of factory issued internal software updates via the RS-232 serial port, without opening the unit or sending it back to the factory.

3 QUICK START OVERVIEW

This section is intended to help the user getting up and running quickly. It is suggested that time be taken to read the manual on occasion or if problems develop.

Get started before going on site by checking the following points:

- Decide which mode is going to be used: Notepad or User mode. If necessary, upload a configuration file in order to use the User mode (see chapter 5.2.5).
- Check the memory status (see chapter 4.3.2).
- Check the battery level of the MB-6TL readout unit (see chapter 7.2).
- Check the date and time settings (see chapters 5.2.1 and 5.2.2).

On site, proceed as follows:

- Connect the jumper cable to the readout unit.
- If using the Notepad mode, select the correct positions for gage and thermistor types using the list inside cover (see chapter 2.3 above).
- Connect red and black leads of the jumper cable to vibrating wire gage leads, then white and green leads of the jumper cable to thermistor leads (see chapter 4.1.1).
- Turn the MB-6TL on. Wait for the end of the self-test sequence. The readout unit starts in Notepad mode.
- If using the User mode, select the desired sensor with left and right arrows.
- Take a reading using STORE switch. The reading number on upper left of the display increments automatically (see chapter 4.2).
- Continue the same way for all instruments. Previous readings can be seen using up and down arrows (see chapter 4.3.1).
- When finished, shut down the readout unit.

Back from site, collect the data with MBTALK software. Use either key L for only the last readings of each sensor or key A to save all readings (see chapters 5.2.3 and 5.2.4).

If necessary, clear the memory of the readout unit to leave free memory for next readings (see chapter 4.3.3).

4 MB-6TL FUNCTIONS

The MB-6TL readout unit is designed to read values in different units from vibrating wire sensors and thermistors and to store them. Furthermore, a simple menu gives access to other useful functions described in this section.

4.1 GAGE READINGS

4.1.1 GAGE CONNECTIONS

The readout unit MB-6TL is supplied with one multi-core cable fitted with a mating female connector at one end and a set of four color coded alligator clips at the other. The conductor's insulation is color coded to match that of the alligator clips and the instrument cable conductors' insulation jacket.

Connect the alligator clips to the gage lead wire according to the table below.

Note: The IRC-41A is the standard data cable coming out from the vibrating wire sensor.

	Connections				
Cable	Wire High (red)	Wire Low (black)	Temp. High (white)	Temp. Low / Shield (green)	
IRC-41A	red	black	white	green	shield

Table 3: Wiring code for electrical cables

The jumper cable should never be short-circuited when it is connected to the readout unit front panel.

4.1.2 LOGGER MODES

The logging feature of the MB-6TL allows readings to be kept in memory. There are two different logger modes:

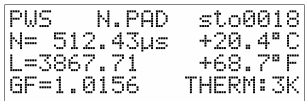
- the Notepad mode
- the User mode

4.1.2.1 NOTEPAD MODE

The Notepad mode acts like a manual readout unit with basic storage capabilities. In the Notepad mode, the gage type and thermistor type are determined by the two selector knobs, and the STORE switch is used to record the displayed reading in memory. Gage type, thermistor type, current date and time are also recorded with each reading.

When the MB-6TL is turned on, it automatically enters the Notepad mode.

Below is an example of the LCD display, when in the Notepad mode with the selector switches in position 4 (PWS gage) and B (3kΩ thermistor):



In this example, there are already 17 readings stored; the current reading is number 18 in the Notepad as indicated by '`sto0018`'.

4.1.2.2 USER MODE

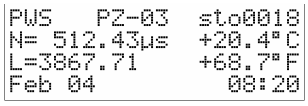
The User mode minimizes the risk of manipulation errors and is useful in sorting the data resulting from a measuring session.

A configuration file is used to describe a reading session of up to 256 sensors. It can be edited to describe a site run, for example, or a large number of sensors in several switching boxes. Please refer to the paragraph about MBTALK software for more information about editing a file and uploading it.

When in the User mode, the gage and thermistor selector switches are not used.

To enter the User mode, press the RIGHT arrow. The first line of the LCD displays the label of the first configured sensor. The RIGHT and LEFT arrows are used to scroll among all the configured sensors or to go back into the Notepad mode.

This is an example of the LCD display when in User mode:



In this case, ‘`PZ-03`‘ is the label of the corresponding sensor, and ‘PWS‘ is its configured type. The label and gage type have been set from the uploaded configuration file. In this example, there are already 17 readings stored for that sensor; the current reading is number 18 as indicated by ‘`sto0018`‘.

4.1.3 TYPES OF READINGS

Depending on the gage type selected (please refer to table 2), the readout unit will display the NORMAL (N) reading, either the LINEAR (L) reading or the frequency (F) and the gage temperature.

<u>NORMAL readings</u>

A NORMAL reading is displayed in the format: N=512.388µs. It is the vibrating wire period in microseconds after excitation, displayed with a resolution of 0.01µs.

LINEAR readings

A LINEAR reading is displayed in the format: L=3867.71. It is calculated thanks to the following relation.

$$L = K \cdot \frac{10^9}{N^2}$$

where L = LINEAR reading in LINEAR units

N = vibration period in microseconds

K = gage constant, specific for each type of gage (cf. table 2)

Physically, the LINEAR reading is proportional to the strain of the gage.

The use of the LINEAR readings simplifies data conversion to engineering units, which is described in each individual gage instruction manuals.

Frequency readings

When the selected gage type does not use a gage constant (cf. table 2), the LINEAR reading is not displayed. It is replaced by a frequency reading, according to the following equation:

$$F = \frac{10^6}{N}$$

where F = frequency in Hertz

N = vibration period in microseconds

Note: The MB-6TL displays the NORMAL readings with two decimal places, but uses three decimal places for internal processing. For this reason, the LINEAR or frequency values displayed by the unit may vary slightly (less than 0.01%) with respect to the values computed manually, using the equations below. The displayed values are most accurate ones.

Temperature readings

The MB-6TL readout unit reads the thermistor integrated in the gage, converts the resistance value into temperature and displays the temperature in degrees Celsius and Fahrenheit.

In order to obtain correct readings, the rotary switch must be set on the appropriate position for the thermistor type used (please refer to table 1).

If the thermistor rotary switch is set on either A, B, or C and the gage does not have a thermistor or does have a thermistor but not connected to the readout unit, the readout unit's internal temperature is displayed.

The ohmmeter on position D may be used if the thermistor is not standard or during troubleshooting operations when checking the integrity of the cable. The display will then show the resistance value in ohms or kilo-ohms, as well as the battery voltage.

If the thermistor rotary switch is set to position D and no thermistor is connected to the readout unit, it will display: "------ Ω".

4.2 STORING DATA

The currently displayed reading is stored in memory by pushing down the **MENU and STORE** switch. Readings are stored along with the current time and date, the gage type and thermistor type.

When the **MENU and STORE** switch is pressed, '`sto`' changes to '`STO`' (as shown in the following example), indicating that the displayed reading is being recorded.

```
PWS   N.PAD  STO0018
N= 512.43µs  +20.4°C
L=3867.71    +68.7°F
GF=1.0156   THERM:3K
```

When the switch is released, the storage index is incremented by one, to indicate the number of the next record. The MB-6TL waits a few seconds before accepting a new STORE command to avoid storing the same reading twice.

The amount of storage for a given sensor is limited only by the total amount of free memory. The total number of readings that can be stored in the Notepad and User mode combined is 4 000.

4.3 OTHER FUNCTIONS

4.3.1 STORED DATA DISPLAY

The UP and DOWN arrows are used to display previously stored readings for a given sensor. '`sto`' will then become a flashing '`dis`' (as shown in the following example) to indicate that the display mode is active.

```
PWS   N.PAD  dis0018
N= 512.43µs  +20.4°C
L=3867.71    +68.7°F
Feb 04 2005 08:20:16
```

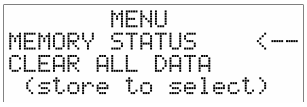
The readings are displayed in the same format as they were recorded.

4.3.2 MEMORY STATUS

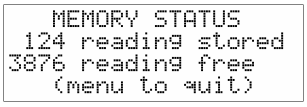
The battery-backed RAM memory will store a total of 4 000 readings. The MEMORY STATUS function lets you know how much space there is for new readings, or how many readings are currently stored in memory.

To access the MEMORY STATUS function, perform the following steps:

1. Press the **MENU** switch to access to the MB-6TL main menu.



2. Press **STORE** to select memory status.



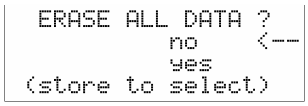
3. Press **MENU** to return to the Main Menu screen

Press **MENU** once more to resume normal operation.

4.3.3 CLEARING DATA

When the memory is full, stored readings can be cleared to allow space for new readings. Also, this can be done to erase unwanted data to avoid potential confusion. It is important to note that cleared readings are permanently erased. The configuration in User mode is not affected by this operation: sensors' definitions are still in memory after clearing data.

To clear the memory, press **MENU** to enter the menu mode and use the **UP/DOWN** arrows and the **STORE** switch to navigate in the menu and select the desired option (similar to the example above). The MB-6TL asks for a confirmation before deleting any data.



5 MBTALK SOFTWARE

MBTALK is a software utility included with the MB-6TL, to facilitate communicating with the unit and converting the data to work with popular software such as LOTUS-123® and EXCEL®.

This program is working under MS-DOS operating system and requires an emulator to work properly.

The entire cd-rom provided with the readout unit must be copied on the hard disk in order to download data properly. It requires less than 200 kilobytes free.

5.1 INITIATING COMMUNICATION

To communicate with the MB-6TL readout unit, proceed as follows:

1- Connect the RS-232 serial interface cable to the unit and to a communication port of the computer.

2- Power on the readout unit. The message “CABLE CONNECTED” is displayed.

3- Run MBTALK software. By default, it uses the COM1. If another communication port is used, for example COM2, open a DOS session and type: mbtalk com2

4- When the MBTALK screen appears, press <ENTER> once more.

At this point, the following menu is displayed.

```
MB-6TL   VIBRATING WIRE DATALOGGER

                          Command
Set date                   : D
Set time                   : T
Save last reading do disk  : L
Save all data to disk      : A
Upload configuration       : C
```

The blue panel at the bottom of the window gives information about the current process.

When the MB-6TL is connected to the PC, it is not possible to use any of the switches on the MB-6TL panel, except for the power-off switch. Disconnecting the RS-232 serial cable will resume normal operations.

To quit the MBTALK window, hit key F10.

5.2 RUNNING COMMANDS

After each command, please wait until the MB-6TL acknowledges it by displaying a star or ‘Done’.

5.2.1 SET DATE

Hit the D key to set date.

MBTALK displays the date and prompts for a new value. Wait until the complete two following lines are displayed.

```
Current date is:2005:02:04
Enter new date (yyyy-mm-dd):
```

The date can be any valid date between 1995 and 2100. Values for day, month, and year may be separated by any character but must respect the number of characters required for each field. If an invalid date is entered, the value entered is ignored and MBTALK displays an error message.

In order to control the date setting, hit D and enter nothing.

Resetting the date parameter does not affect the date where previous stored data where read.

5.2.2 SET TIME

Hit the T key to set time.

MBTALK displays the time and prompts for a new value. Wait until the complete two following lines are displayed.

```
Current time is:16:24:55
Enter new time:
```

The time must be entered in a 24-hour format (e.g. 2:15pm is 14:15). Values for hour, minute, and second may be separated by any character but must respect the number of characters required for each field. If an invalid time is entered, the value entered is ignored and MBTALK displays an error message.

In order to control the time setting, hit T and enter nothing.

Resetting the time parameter does not affect the time where previous stored data where read.

5.2.3 SAVE LAST READINGS TO DISK

Hit the L key to download the last readings to disk. Only the most recent one of each sensor is transferred. Enter a filename without any extension: MBTALK adds 6TL extension automatically. Wait until the end of the operation, when 'Done' is displayed.

Make sure that the destination disk has enough free space on it or the command fails.

This operation creates one file with a .6TL extension. Its format is based on the following: sensor name (or NOTEP when in Notepad mode), thermistor position, gage type position, date and time of reading, period in micro-seconds, reading in LINEAR unit, temperature reading and unit, I, serial number of readout unit, date and time of downloading.

Example of downloaded file:

```
NOTEP, B, 4, 2005/02/04, 08:20:25, 513.19, 3856.26, 20.5, C, I, 105A0423, 2005/02/04, 08:54:17
PZ-03, B, 4, 2005/02/04, 08:21:15, 511.99, 3874.36, 20.4, C, I, 105A0423, 2005/02/04, 08:54:17
```

5.2.4 SAVE ALL DATA TO DISK

Hit the A key to download all data stored in the Notepad mode to disk. Enter a filename without any extension: MBTALK adds 6TL extension automatically. Wait until the end of the operation, when 'Done' is displayed.

Make sure that the destination disk has enough free space on it or the command fails.

This operation creates two types of files:

- one file with a .6TL extension: containing all values of all sensors, including values recorded when in Notepad mode. Its format is based on the following: sensor name, thermistor position, gage type position, date and time of reading, period in micro-seconds, reading in LINEAR unit, temperature reading and unit, I, serial number of readout unit, date and time of downloading. Readings from the Notepad mode are considered as being part of a configured sensor named NOTEP.

- several files with a .DAT extension: one file per user specified sensor in User mode and a Notepad one. Their names are based on the sensor name and on its reading parameters (for example, PZ-03B4.DAT: sensor name followed by the thermistor and the gage type positions). Their format is based on the following: date and time of reading, period in micro-seconds, reading in LINEAR unit, temperature reading and unit, serial number of readout unit.

Example of .6TL file:

```
NOTEP, B, 4, 2005/02/04, 08:20:16, 512.43, 3867.71, 20.4, C, I, 105A0423, 2005/02/04, 08:54:17
NOTEP, B, 4, 2005/02/04, 08:20:25, 513.19, 3856.26, 20.5, C, I, 105A0423, 2005/02/04, 08:54:17
PZ-03, B, 4, 2005/02/04, 08:20:50, 512.43, 3867.71, 20.4, C, I, 105A0423, 2005/02/04, 08:54:17
PZ-03, B, 4, 2005/02/04, 08:21:15, 511.99, 3874.36, 20.4, C, I, 105A0423, 2005/02/04, 08:54:17
```

Examples of .DAT file:

1- NOTEPB4.DAT:

```
label:     NOTEP    Thermistor type:      B  Gage type:     4  Readout SN:     105A0423

DATE            TIME            PERIOD          LINEAR          THERMISTOR      Download date
(Y/M/D)         (H:M:S)         (usec)          (unit)          (deg. C int)    (Y/M/D)
2005/02/04      08:20:16        512.43          3867.71         20.4            105A0423
2005/02/04      08:20:25        513.19          3856.26         20.5            105A0423
```

2- PZ-03B4.DAT:

```
label:     NOTEP    Thermistor type:      B  Gage type:     4  Readout SN:     105A0423

DATE            TIME            PERIOD          LINEAR          THERMISTOR      Download date
(Y/M/D)         (H:M:S)         (usec)          (unit)          (deg. C int)    (Y/M/D)
2005/02/04      08:20:50        512.43          3867.71         20.4            105A0423
2005/02/04      08:21:15        511.99          3874.36         20.4            105A0423
```

5.2.5 UPLOAD A CONFIGURATION FILE

The MB-6TL features the ability to upload a configuration file which is useful for programming a measuring session.

Notes about the configuration file:

- Its name is not case sensitive.

- Always enter its extension.

- Be sure it is not in use during the upload operation.

- Place it in the same directory than the software MBTALK.

Hit the C key to proceed to upload a configuration file. MBTALK accepts a file name with any extension, but it is recommended to use a .CON extension.

Uploading a new configuration erases definitively the previous configuration and all stored data, including those into the Notepad mode.

Please refer to next paragraph for details about configuration file format.

5.3 EDITING PARAMETERS

To be able to work under the User mode, a configuration file has to be prepared and uploaded in the readout unit.

A configuration file is basically an ASCII file with a list of sensor definitions. We advise to use the extension .CON to remember easily its purpose.

Use the following syntax to define a sensor:

@[sensor name],[gage type position],[thermistor position]

A maximum of 6 characters for the sensor name is allowed. The gage type position is a number between 1 and 10. The thermistor position is A, B, C, D or E.

Example:

To define the vibrating wire piezometer PZ-03, a PWS gage type (position 4) using a 3kΩ thermistor (position B), write the line: @PZ-03,4,B

A default configuration file is available with the software MBTALK: INIT00.con. It can also be used as an example.

It is possible to configure two identical sensors and to load them into the readout unit. It is obviously not recommended to do so, in order to avoid any mistake during operation.

6 OPERATION

The general procedure for the measurement of a series of vibrating wire instruments is the following.

1. Setting up the readout unit.
2. Recording readings.
3. Retrieving readings.

6.1 SETTING UP

If measurements are going to be done through the User mode, the instruments have to be correctly entered in the readout unit.

This can be done by using a configuration file and MBTALK software. Create a list of the instruments with their reading parameters (gage and thermistor types) and upload it thanks to command C of MBTALK.

If only the Notepad mode is used on site, there is nothing particular to configure on the readout unit.

6.2 RECORDING READINGS

Several checks on the MB-6TL can be done on site, just before doing measurements:

- is the list of instruments for User mode ok?
- is the battery charge ok?
- is it enough free memory space?
- are the date and time settings ok?

Then proceed with the measurements using the following procedure.

- Connect the jumper cable to the readout unit.
- If using the Notepad mode, select the correct positions for gage and thermistor types using the list inside cover.
- Connect red and black leads of the jumper cable to vibrating wire gage leads, then white and green leads of the jumper cable to thermistor leads (see chapter 4.1.1).
- Turn the MB-6TL on. Wait for the end of the self-test sequence. The readout unit starts in Notepad mode.
- If using the User mode, select the desired sensor with left and right arrows.

- Take a reading using STORE switch. 'sto' changes to 'STO' (as shown in the following example), indicating that the displayed reading is being recorded. When the switch is released, the storage index is incremented by one, to indicate the number of the next record. The MB-6TL waits a few seconds before accepting a new STORE command to avoid storing the same reading twice. During readings, avoid water or mud splashes on the contacts.

- Continue the same way for all instruments: if using the User mode, select the desired instrument, connect it, read it and store the measurement. If using the Notepad mode, set the correct parameters for gage and thermistor types, connect the instrument, read it and store the measurement. Previous readings can be seen using up and down arrows.

- When finished, shut down the readout unit.

6.3 RETRIEVING READINGS

Back from site, collect the data with MBTALK software. Use either key L for only the last readings of each sensor or key A to save all readings (see chapters 5.2.3 and 5.2.4).

If necessary, clear the memory of the readout unit to leave free memory for next readings.

7 MAINTENANCE

7.1 READOUT UNIT

Keep the front panel dry and clean. If it is necessary to clean it, use a soft cloth and clean water. The use of chemical cleaners or solvent is not recommended and may damage the plastic protection.

As with all electronic instruments, this unit must be protected against shock as well as against water and dust. Avoid storage and use of the unit in extreme temperatures.

7.2 BATTERY

Use the position E of the thermistor selector to check the battery level. If the battery voltage goes under 12V, the message "BATTERY TOO LOW, PLEASE RECHARGE" is displayed. Nevertheless, the readout unit will still operate. If the battery voltage goes below 11 volts, the same message is displayed and the readout unit turns off automatically.

When the unit is not in use, we recommend connecting the charger. The electronic circuit inside is designed for continuous charging. Approximately fourteen hours are needed for a complete charge.

In the case of low battery, data already recorded are not lost. They are saved due to another independent small battery.

7.3 ELECTRICAL CONNECTORS

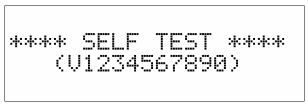
In order to ensure good electrical contact, periodically clean the alligator clips as well as the cable connectors using a clean rag dampened with alcohol. Do not use any harsh cleaners on the MB-6TL front panel, mild soapy water is recommended.

8 TROUBLESHOOTING

Keeping the readout unit clean and dry as well as a secure storage decreases its chance to fail.

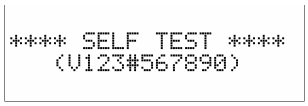
8.1 READOUT UNIT SELF-TEST SEQUENCE

When the MB-6TL readout unit is powered up, it performs a basic check of its internal circuit and it displays the following screen.



The results of this test are displayed inside brackets, on the second screen line. The first character (V) is displayed if the internal voltage regulator operates properly.

The following numbers refer to gage type numbers and are displayed successively, as the checking goes along. If an error is found during the test, one or several of the characters will be replaced by the symbol # (see example below).

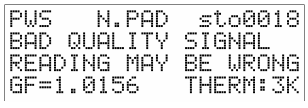


The previous example indicates that the readout unit cannot operate properly when the gage selector is set to position 4. The readout unit functions properly for the other gage types.

8.2 GAGE READING

Error messages that may appear are the following ones.

8.2.1 BAD QUALITY SIGNAL

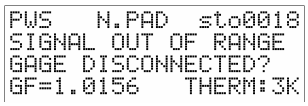


Diagnosis:

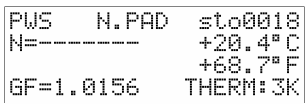
The readout unit received a low quality signal which may affect the reading accuracy or may produce false readings. The message is displayed between readings.

Check the selected gage type and its connection. Refer to the gage operation manual for gage testing procedures.

8.2.2 NO OUTPUT SIGNAL



in turn with



Diagnosis:

The readout unit does not receive the output signal from the gage. Check the jumper cable connecting the readout unit to the gage. A damaged gage or a broken cable may produce this type of error.

To check the continuity of the gage cable, connect the jumper cable to the gage and position the thermistor selector to D. It will measure the resistance of the cable and gives a good indication of its integrity as well as the sensor wealth.

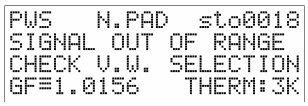
The resistances of coils in good working condition are as follows:

Gage Type	Resistance (in Ohms)
SM-2W	144
VBS	115
SM-2A, EM-2, IRHP	45
SM-5A, SM-5B, EM-5, EM-10	144
VH	90
NIVOLIC, SSG, PWS, JM, TPC, EPC	187

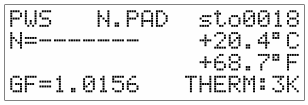
Table 4: Coil resistance of different sensors

The table above gives an idea of the theoretical resistance of the coils. Do not forget to add twice the resistance of the cable itself (22 gage copper = approximately 0.07Ω/m). Please refer to the sensor instruction manual for more information.

8.2.3 SIGNAL OUT OF RANGE



in turn with



Diagnosis:

The wire frequency is outside the selected gage type range. Most likely, the selected gage type does not match the gage being read.

Make sure that the gage rotary switch position is in accordance with the sensor. Consult the sensor instruction manual for more information. If the gage type was properly selected and the trouble remains, switch off the readout unit and switch it on again in order to perform the self-test sequence. Make sure that no fault is detected concerning the gage type used. If no error is indicated, check the gage connection as well as the gage itself.

8.3 TEMPERATURE READING

If the displayed temperature shows “(int.)” and the gage is equipped with a thermistor, then a bad connection or a temperature out of the MB-6TL range is most likely the problem.

Check the integrity of the sensor cable by using the MB-6TL as an ohmmeter.

8.4 COMMUNICATION TROUBLES

In the case of MBTALK having difficulties to communicate with the MB-6TL, for example during downloading data from the unit, check the following points.

- Is the unit turned on? Is the battery level over 11V?

- Check the steps of the communication procedure (connect the cable, power the unit, run MBTALK and press ENTER key to get the menu).

- Make sure that there is only one MBTALK session opened.

- Is the RS-232 cable correctly connected to the computer and to the readout unit?

- Make sure that the communication port of the computer is working properly. Try with another port or another computer.

- Make sure to use the correct communication port, COM1 or COM2 and to use the good instruction to run MBTALK. By default, MBTALK uses the COM1.

- The unit may need to be reset. Upload the default configuration file using the file provided on the cd-rom (Init00.con).

8.5 UNSTABLE READING

- Check if the same trouble occurs with another instrument.

- Check the connection between the instrument and the jumper cable.

- Check the connection between the jumper cable and the readout unit.

- If using a junction box, check if the same trouble occurs directly using the leads coming out the sensor. Is the environment quiet? Are there some activities around the borehole like excavation works which create vibrations?

- Check the sensor itself. Use the readout unit as an ohmmeter and check the resistance of the gage as described above. Consult the sensor instruction manual.

- The sensor may be damaged.

8.6 NO READING

- Check the battery level of the readout unit.

- Check the connection between the instrument and the jumper cable.

- Check the connection between the jumper cable and the readout unit.

- Check the sensor itself. It may be damaged.

8.7 BATTERY TROUBLE

If after several hours of charging, the message “Battery low, please recharge” is still displayed, contact Roctest – Telemac for testing and/or repair.

Battery replacement must be performed by a qualified technician.