



Measuring up on **all scales.**

INSTRUCTION MANUAL

VIBRATING WIRE DATALOGGER

Model MB-6TL (MSHA)

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ROCTEST INCORPORATED
MODEL MB-6TL
PERMISSIBLE VIBRATING WIRE DATALOGGER



APPROVAL NO. 2G-4040-0

**TESTED FOR INTRINSIC SAFETY
IN METHANE-AIR MIXTURES ONLY**

- WARNINGS:**
1. DO NOT OPEN UNIT IN A HAZARDOUS AREA. UNIT DOES NOT CONTAIN ANY USER SERVICEABLE PARTS, INCLUDING BATTERIES.
 2. DO NOT CONNECT TO THE CHARGER/RS-232 CONNECTOR IN A HAZARDOUS AREA.
 3. MSHA APPROVED FOR USE WITH THE FOLLOWING MODEL SENSORS ONLY: VBS-2, SM-2A, SM-2W/SM-5A/SM-5B/EM-5, PWS, IRHP/IRCL, IRB, TH-W, AND JM-E/JM-S/JM-F/JM-T.

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1 INTRODUCTION

1.1 DESCRIPTION

The MB-6TL readout is a self-powered, portable unit. It is designed to read vibrating wire instruments. In order to read a vibrating wire gage, the MB-6TL readout unit performs the following operations:

1. It generates a frequency sweep to cause the wire to vibrate. This step is the “excitation” of the wire.
2. Once the wire is excited, the MB-6TL amplifies the signal created by the wire vibrating in proximity to the coil, and measures the vibration period.

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.

The MB-6TL 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 to read gages that are not readable with other readouts.

For NORMAL readings, the period of the wire vibration is displayed directly in μ seconds ($1 \mu\text{s} = 10^{-6}$ seconds). For LINEAR readings, the vibration period is used in a linearization function to calculate the “linearized reading”. The readout unit simultaneously displays the NORMAL (N) and LINEAR (L) values as well as the temperature in $^{\circ}\text{C}$ and $^{\circ}\text{F}$. In positions 1 and 7 used to read the VBS and MSMS-4 gages, the linearized reading is replaced by the frequency (F) in Hertz (Hz).

The MB-6TL electronics are mounted inside a splash-proof sealed case. It is not submersible.

The MB-6TL vibrating wire readout unit provides complete compatibility with the MB-6T readout, and includes the following enhancements:

- Data-logging
- Real-time clock/calendar
- Lithium powered memory back-up
- RS-232 Serial communication port
- 4-line alpha-numeric LCD display

1.2 FRONT PANEL

The MB-6TL readout unit's front panel comprises various switches, connecting sockets for the gage/battery charger cables and a liquid crystal display screen. Each of the components is described in the following sections.

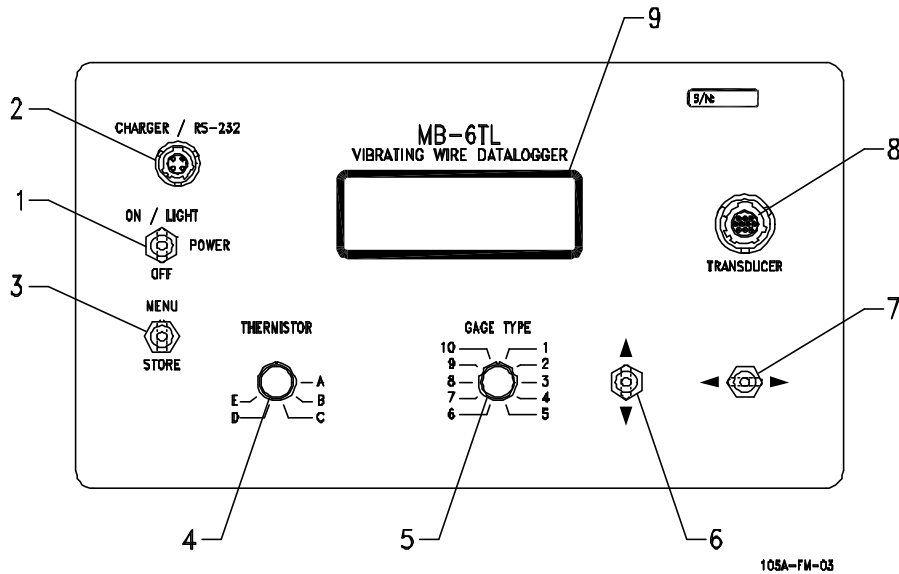


FIGURE 1: MB-6TL Front Panel

ON/OFF LIGHT Switch (#1)

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 or selector is used, 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. The same switch is used to control the display light. Press and hold to turn the display light on off.

CHARGER and RS232 Connector (#2)

This socket is used to connect the battery charger and/or to communicate with the RS-232 serial port. A complete battery charge will take up to 14 hours. The readout unit will function while the battery is charging.

Note: The display light doubles the MB-6TL power consumption. This feature 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 the current reading. The switch is also used throughout the menu functions to quit the current window or to select the current item.

THERMISTOR Selector (#4)

This switch allows the user to select the type of thermistor in the gage. The correspondence between the letters A through E is shown in Table 1 below and also listed in the summary instructions printed under the front cover. In the case of the gages using the $R_{25} = 2 \text{ k}\Omega$ thermistor, switch the selector to "A". For gages using the $R_{25} = 3 \text{ k}\Omega$ or $10 \text{ k}\Omega$ thermistors, select the "3 k" or "B" and "10 k" or "C" positions respectively.

The "OHMS" or "D" position activates an ohmmeter function which measures resistance. This feature is useful when the thermistor integrated in the gage does not have an R_{25} equal to either $2 \text{ k}\Omega$, $3 \text{ k}\Omega$ or $10 \text{ k}\Omega$. The display will then show the resistance value in Ω or $\text{k}\Omega$, as well as the battery voltage. If the gage has no thermistor, the readout unit will display: "---- Ω ". This function may also be used to check the continuity of the gage cable (refer to section 8).

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

Position	Function
A	2K -Thermistor - Standard
B	3K Thermistor - Optional
C	10K Thermistor - Optional
D	Ohmmeter Mode
E	BATTERY Check Mode

TABLE 1 Thermistor Type or Function vs. Selector Position

GAGE TYPE Selector (#5)

A 10 position rotary switch enables the user to read up to 10 different gage types. Positions 1 to 9 refer to standard gages listed under the MB-6TL cover. Position 10 is intended for special applications. For instance: the gage in use does not correspond to any of the other types listed in the MB-6TL cover. The rotary switch position determines the excitation frequencies as well as the linearization equation with the appropriate gage factor. If the gage reading is out of the range specified by the switch position, then the readout unit will display the following error message "SIGNAL OUT OF RANGE CHECK V.W. SELECTION".

The table 2 shows the gage type corresponding to each switch position.

Position	Gage type	Gage constant	Readout operating range
1	VBS-2-3	N/A*	175 - 380 μ s
2	JM	1.0000	300 - 900 μ s
3	SM-2, MSMS-3, IRB, VH	0.3911	310 - 770 μ s
4	PWS -P -F, TPC, EPC	1.0156	420 - 1000 μ s
5	EM-3, MSMS-6	1.1560	620 - 1390 μ s
6	EM-5, SM-5	4.0624	900 - 2300 μ s
7	MSMS-4	N/A*	460 - 1030 μ s
8	CL1, CLX	N/A*	740 - 1600 μ s
9	C, F, SC	N/A*	580 - 2300 μ s
10	ALL GAGE	1.0000	180 - 2300 μ s

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

TABLE 2 Gage Type vs Selector Position

Note: Position 10, ALL GAGE is intended for special applications. Always use the position corresponding to the gage type.

UP/DOWN Switch (#6)

Used to display the stored data readings. Pressing UP will display the previous readings. This switch is also used to scroll among the selections when the menu is displayed.

LEFT/RIGHT Switch (#7)

Used to select a user-configured sensor.

TRANSDUCER Connecting Sockets (Gage and Thermistor) (#8)

A 10 pin male electrical connector mounted on the front panel accepts the mating connector mounted on one end of the patch cord. The gage end of the patch cord is fitted with 4 alligator clips that connect to the gage leads.

Warning: The jumper cable leads should never be short-circuited when connected to the readout unit front panel.

Display Screen (LCD) (#9)

The display is a liquid crystal display with 4 lines of 20 characters each. The display can be back-lit by using the ON/OFF light switch.

2 QUICK START OVERVIEW

This section is intended to help you get up and running quickly. It is suggested that you take time to read the manual when you get a chance or if problems develop.

2.1 MANUAL READINGS (READINGS NOT STORED IN THE DATALOGGER.)

1. Connect patch cord to the transducer input.
2. Turn power on.
3. Use list of gage types inside cover to select gage type, 1-10
4. If thermistors are used, use list of thermistors inside cover to select thermistor type. A-E (standard is 2k, selection A)
5. Connect **red / black** leads to vibrating wire gage, and **white / green** to thermistor leads.
6. If MB-6TL has turned itself off, (it will after a short time) turn it back on.
7. Take readings

2.2 NOTEPAD READINGS

1. Do steps 1-6 as in above Manual reading section.
2. The MB-6TL will normally start at notepad. You will see the word **NOTEPAD** at the top of the readout screen. If you do not see **NOTEPAD** at the top, use the **left/right** arrows to scan through the instruments in the configuration file until **NOTEPAD** appears.
3. In the upper right of the readout screen you will see **sto001**.
4. Press the **MENU / STORE** switch to **STORE** and the screen will change to **STO001**. The reading is being stored as reading number 001.
5. When the screen changes to **sto002** you are ready to store the next number.
6. Readings can be displayed by scanning through the readings with **the up / down arrows**. (the readings can also be down loaded into a computer see section 1.3.5 "Downloading data")

2.3 USING THE MB-6TL AS A DATALOGGER (USER MODE)

To use the MB-6-TL as a datalogger you must

- 1 create an instrument file on your computer

2 upload the file to the MB-6TL

3 collect the data

4 download the data from the MB-6TL to your computer

2.3.1 CREATE AN INSTRUMENT FILE ON YOUR COMPUTER

1. Make a directory (md) on your computer for the MB-6TL software. Use what you want, I will use MB6 as an example. [C:\>**md mb6**]
2. Open the directory [C:\>**cd mb6**]
3. Copy all software from the disk supplied onto the directory [C:\mb6>**copy a:*.***]
4. Make a configuration file. This file will list the labels of the instruments, as well as the type of instruments, and resistance of the thermistors.
 - [C:\mb6>**edit file1.con**] where in this case file1.con is the name of the file. *.con should be used as a file extension. **(Any text editor that saves files as unformatted ASCII text may be used in place of the edit processor)**
 - Enter instruments into the file starting with an @ sign and using the following guidelines.
 - LABEL :6 characters max
 - GAGE TYPE :1 through 10 from inside MB-6TL cover or page 4
 - THERMISTOR TYPE :A,B,C,D,E from inside MB-6TL cover or page 3
 - Example
@well1,4,a
@pcell1,4,a
@stran3,6,a
 - Save the *.con file using **Alt F** then **S**, or use mouse to click **File** then **save**.
 - Exit the Edit processor by **Alt F** then **X**, or use mouse to click **File** then **exit**.

2.3.2 UPLOAD THE FILE TO THE MB-6TL

5. Start the MBTALK program. [C:\mb6>mbtalk] **note:** if you will be using a port other than com1 you will need to set that port. For example if you are using com port 2 use [C:\mb6>mbtalk com2]
6. Plug the CHARGER/RS-232 cable into the MB-6TL and into your computer and wall power.
7. Hit the enter key on your computer and you should see a screen with **MB-6TL VIBRATING WIRE DATALOGGER** at the top. (the order of operation is important, if this screen is not seen unplug then re-plug the CHARGER/RS232 cable then hit enter key again.
8. Enter "c" to start the upload program.
9. At the bottom of the screen, fill in the filename where prompted, Example;
Please enter filename: **file1.con**
10. If the file does not load, check connections and try again.
11. Once loaded, disconnect Charger/RS-232 cable from MB-6TL
12. Cycle through the instruments you loaded into the MB-6TL by using the **left/right** arrows. Instruments should be loaded and you are ready to take readings

2.3.3 TAKING DATALOGGER READINGS

13. Choose the desired instrument by using the **left/right** arrows to scroll through the instruments.
14. In the upper right of the readout screen you will see **sto001**.
15. Press the **MENU / STORE** switch to STORE and the screen will change to **STO001**. The reading is being stored as that number.
16. When the screen changes to **sto002** you are ready to store the next number for that instrument or change to another instrument.

2.3.4 DOWNLOADING DATA

1. On your computer, open the directory in which you have stored the **MB-6TL** files [C:\>cd mb6]
2. Start the MBTALK program. [C:\mb6>mbtalk] (note: if you will be using a port other than com1 you will need to set that port. For example if you are using com port 2 use [C:\mb6>mbtalk com2])
3. Plug the CHARGER/RS-232 cable into the MB-6TL, your computer, and wall power.

4. Hit the enter key on your computer and you should see a screen **with MB-6TL VIBRATING WIRE DATALOGGER** at the top. (The order of operation is important, if this screen is not seen, unplug then re-plug the CHARGER/RS232 cable, then hit enter key again.
5. Follow directions to download data, either **A**: all files, or **L**: last readings, to a file that will have a “.6TL” extension. **(Do not add the .6TL extension, the extension will be automatically added.)**
6. When ready, exit the **Mbtalk** program by hitting the **F10** key
7. If appropriate clear MB-6TL memory
 - **MENU/STORE** switch to **MENU**
 - **UP/DOWN** arrow switch to **CLEAR ALL DATA**
 - **MENU/STORE** switch to store to select choice.
8. **The data is saved two ways.** Data is saved as a block with the ***.6TL** extension, and as individual instrument files, each with a ***.DAT** extension. These files can be viewed and worked with by most spreadsheet files, or in any program which uses ASCII files such as the Edit program .
 - Below is an example a ***.DAT** file (Note all data for instrument PZ1-02 which is a type 04 instrument and thermistor type a)

Label:	PZ1-02	Thermistor type:	A	Gage type:	4	Readout SN:	6M65L
DATE	TIME	PERIOD	LINEAR	THERMISTOR	Download date		
(Y/M/D)	(H:M:S)	(usec)	(unit)	(deg. C int)	(Y/M/D)		
12/23/96	10:14:22	550.12	3355.87	26.3	6M65L		
12/23/96	10:14:25	550.12	3355.87	26.3	6M65L		
12/23/96	10:14:30	550.09	3356.26	26.3	6M65L		
12/23/96	10:21:36	550.11	3356.06	26.3	6M65L		

Opening a spreadsheet file under the ***.6TL** extension will give readings on all the instruments saved in that file, with a column for instrument code name, thermistor type, date and time of reading, period in (μ sec), linear units, temp, serial number of unit, download date and time.

- Below is an example of a ***.6TL** file (Note data is for three different instruments.)

NOTEP	A	2	12/23/96	10:21:07	550.12	3304.32	26.3	C	I	6M65L	12/23/96	10:23:06
PZ1-01	A	4	12/23/96	9:45:16	550.11	3356.06	25.5	C	I	6M65L	12/23/96	10:23:06
PZ1-02	A	4	12/23/96	10:14:22	550.12	3355.87	26.3	C	I	6M65L	12/23/96	10:23:06
PZ1-02	A	4	12/23/96	10:14:25	550.12	3355.87	26.3	C	I	6M65L	12/23/96	10:23:07
PZ1-02	A	4	12/23/96	10:14:30	550.09	3356.26	26.3	C	I	6M65L	12/23/96	10:23:07
PZ1-02	A	4	12/23/96	10:21:36	550.11	3356.06	26.3	C	I	6M65L	12/23/96	10:23:07

3 SET-UP

3.1 INSPECTION

Unpack the MB-6TL readout unit. The pocket in the carrying pouch includes the patch cord, the battery charger and the communication cable.

3.2 BATTERY CHARGING

The readout unit has an integral lead-acid battery which delivers 12 V, 2.3 A.h. The MB-6TL is equipped with a floating charge circuit. The charger should be plugged in permanently to maintain the battery at its maximum charge.

Note: Keep the readout unit fully charged especially if it is not used for a long period of time. A battery discharged under 11 volts can suffer permanent damage.

The readout unit has a working capacity of approximately 20 hours (10 hours if the display light is on permanently). If the battery voltage goes below 12 volts, the following message will be displayed: "BATTERY TOO LOW, PLEASE RECHARGE". Nonetheless, the readout unit will still operate. If the battery voltage goes below 11 volts, then the same message will be displayed and the readout unit will turn off automatically.

To charge the battery, insert the charger plug into the CHARGER socket located on the front panel, then connect the charger to the appropriate power source. Approximately 14 hours are needed for a complete charge.

3.3 GAGE CONNECTIONS

The readout unit is supplied with a patch cord fitted with four alligator clips at one end. The alligator clips are color-coded to match with the conductor insulation color of the gage lead wires. Connect the alligator clips to the gage lead wires according to the table 3:

Item	Connections				
	WIRE HI (RED)	WIRE LO (BLACK)	THERM HI (WHITE)	THERM LO/SHIELD (GREEN)	
IRC-31 cable	Red	black	white	shield	-
IRC-41A cable	Red	black	white	green	shield

TABLE 3 Wiring Code For Electrical Cables

Vibrating wire gages and thermistors are not usually affected by polarity changes (HI and LO reversal). However, if problems occur during gage readings, check the polarity with the connection guide shown above.

Note: If the readings appear to be unstable, try connecting the cable shield to the thermistor input low on the readout unit.

4 LOGGER DESCRIPTION

The logging feature of the MB-6TL allows readings to be kept in memory and the transfer of the stored readings to a computer or the display of stored data the MB-6TL's LCD. The MB-6TL has two different logger modes:

- (1) the NOTEPAD mode
- (2) the USER mode.

4.1 NOTEPAD MODE

The NOTEPAD mode acts like a manual readout unit (like the MB-6TL) 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. The gage type, thermistor type, current date and time are also recorded with each reading. The UP/DOWN switch can be used to display previous readings. All stored readings can also be transferred to a computer using the RS-232 serial port (described below).

This is an example of the LCD display, when in the NOTEPAD mode with the selector switches in position 4 (PWS gage) and "A" (2k thermistor):

PWS	NOTEPAD	sto021
N=	512.43us	20.4°C
L=	3867.71	68.7°F
GF=	1.0156	IRAD2K

In this example, there are already 20 readings stored, the current reading is number 21, in the NOTEPAD as indicated by 'sto021'.

4.2 USER MODE

In the USER mode, a configuration file is used to describe a reading session of up to 256 sensors. Each sensor is described by its name (with a 6-character label), the gage type and the thermistor type. When in the USER mode, the gage and thermistor selector switches are not used.

The USER mode minimizes the risk of manipulation errors and is useful in sorting the data resulting from a measuring session. A configuration file can be edited to describe a site run, for example, or a large number of sensors in several switching boxes. This configuration file can be edited on a computer and uploaded through the RS-232 serial port.

When the MB-6TL is turned on, it automatically enters the NOTEPAD mode. To enter the USER mode, press the RIGHT arrow. The first line of the LCD then 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. For each sensor, it is possible to display the stored readings by using the UP and DOWN arrows.

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

PWS	SG-01	sto007
N=	512.43us	20.4°C
L=	3867.71	68.7°F
May	23	10:42

In this case, SG-01 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 6 readings stored (the current reading would be number 7) for that sensor, as indicated by 'sto007'.

The total number of readings that can be stored in the NOTEPAD and USER mode combined is 4000.

4.3 FLASH MEMORY

The MB-6TL contains FLASH programmable memory. This feature permits the user to load factory issued internal software updates via the RS-232 serial port, without opening the unit or sending it back to the factory. As new updates become available, they will be sent to the user on diskette, along with loading instructions.

5 LOGGER FUNCTIONS

5.1 STORING DATA

The currently displayed reading is stored in memory by pressing 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” (upper-right corner of LCD) changes to uppercase, 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 will wait for a new reading cycle 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 (see section 5.3.1).

5.2 DISPLAY STORED DATA

The UP and DOWN arrows are used to display previously stored readings for a given sensor. The sto (upper-right corner of LCD) will then become a dis to indicate that the display mode is active. The readings are displayed in the same format as they were recorded.

5.3 MB-6TL MAIN MENU

The main menu tree of the MB-6TL is presented in figure 1.0. By pressing the menu switch the user may clear all data stored in memory or read the memory status.

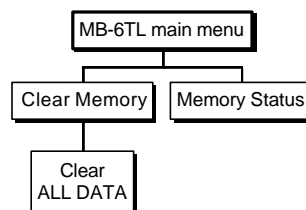


FIGURE 2 MB-6TL Main Menu Tree

5.3.1 MEMORY STATUS

The battery-backed RAM memory will store a total of 4000 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:

```
MENU
MEMORY STATUS  <--
CLEAR MEMORY
(store to select)
```

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

```
MEMORY STATUS
124 readings stored
3876 readings free
(menu to quit)
```

3. Press **MENU** to return to the Main Menu screen
4. Press **MENU** once more to resume normal operation.

5.3.2 CLEARING THE 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.

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 option you want (similar to the example above). The MB-6TL will ask you to confirm your selection before deleting any data.

5.4 DOWNLOADING STORED DATA

The MBTALK Software offers two options for downloading the stored readings from the MB-6TL's memory to a computer. The first one is to download ALL (**A**) readings of each sensors, and the other is to download only the LAST (**L**) reading (most recent) of each sensors.

When the RS-232 cable is connected to the MB-6TL, the LCD display will freeze and the unit will wait for commands coming from the MBTALK software running on the computer. The MB-6TL will remain in that state until the cable is disconnected.

The readings are downloaded in a spreadsheet compatible format. When the download is executed, MBTALK creates one file per configured sensor. Readings from the NOTEPAD mode are considered as being part of a configured sensor named NOTEP. The names of the files are composed from the label, the type of thermistor and the type of gage of the sensor. The extension of these files is always ***.DAT**.

For example, if the label is **PZ210**, the thermistor type is **A** (the selector position for a 2k thermistor), and the gage type is **4** (the selector position for PWS), then the corresponding file created containing all data for this sensor will be **PZ210A4.DAT**.

If a file already exists (because a download operation has previously been done for this configured sensor), the readings are automatically appended to the end of the existing file.

Another file which contains all the readings of the current download is also created. The name of this file is entered by the user, but the extension must be ***.6TL**.

The user must make sure that there is sufficient available space on the computer's disk before downloading. It takes approximately 170 bytes of floppy or hard disk space per reading. So a download operation of the complete memory (4000 readings) requires up to 1 Megabyte of free space.

It is possible to edit or print the ***.DAT** files created by MBTALK with any text editor or spreadsheet software.

This is an example of a file named **SG-01A6.DAT** :

```
label: SG-01 Thermistor type:  A      Gage type:  6      Readout SN:  00

DATE          TIME          PERIOD          LINEAR          THERMISTOR      Download date
(Y/M/D)      (H:M:S)        (usec)         (unit)         (deg. C int)   (Y/M/D)
1995/03/24   08:49:33       1228.28        2692.70        25.9           1995/03/24
1995/03/24   08:49:38       1228.29        2692.66        25.9           1995/03/24
1995/03/24   08:49:42       1228.29        2692.66        25.9           1995/03/24
1995/03/24   08:49:52       1228.21        2693.01        25.9           1995/03/24
```

6 SOFTWARE UTILITIES

This chapter is about the software utilities 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[®].

These programs are for MS-DOS computers (IBM compatible). If another type of computer is used (Macintosh, UNIX,..), an MS-DOS emulator will be necessary.

This chapter will show you how to:

1. Install the software on your computer.
2. Prepare the MB-6TL for communication.
3. Set the date
4. Set the time
5. Save data from the MB-6TL to disk
6. Configure the MB-6TL

6.1 MBTALK - COMMUNICATION SOFTWARE

MBTALK is a software program used to communicate with the MB-6TL using an IBM compatible computer. Besides the usual functions found in other communication software, it includes special features designed especially for the MB-6TL.

To prepare the computer for communication, perform the following:

1. Connect the RS-232 serial interface cable to the MB-6TL.
2. Connect the other end of the cable to the RS-232 connector of the computer (COM1 or COM2).
3. Make the directory containing **MBTALK.EXE** the current directory, or add it to your PATH command (consult your DOS manual if necessary).

4. Type: `MBTALK [port] <ENTER>`
Where [port] is optional when using **COM1**. COM1 or COM2 is the name for the first or second serial port on IBM compatible computers.

So, if you're using COM1, type: `MBTALK <ENTER>`

or if you're using COM2, type: `MBTALK COM2 <ENTER>`

5. When the MBTALK screen appears, press `<ENTER>` once more

At this point you will see the following menu:

```
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
```

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.

6.1.1 MBTALK COMMANDS

The commands listed bellow are not part of the of the MB-6TL operation itself, but are active only when using **MBTALK**.

F1 Display help information.

A brief summary of the **MBTALK**'s commands will be displayed on the status line.

F10 Quit program.

Pressing **<F10>** will terminate any recording to file, end the program and return to DOS.

6.2 MBTALK MENU

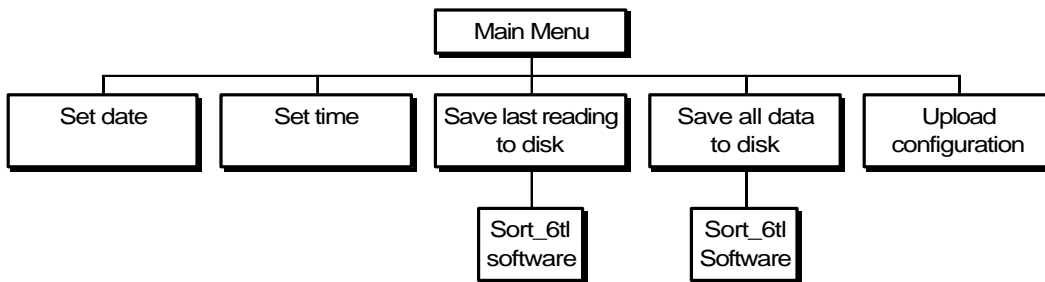


FIGURE 3 MBTALK Menu Tree

6.2.1 SET DATE

Used to set date information of the MB-6TL. By pressing <D>, MBTALK will display the date and prompt you to enter a new value.

```
Current date is:03:20:1995
Enter new date (yy-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. If an invalid date is entered, the value entered will be ignored and MBTALK will display an error message:

6.2.2 SET TIME

This option is used to set the time. By pressing <T> in the MB-6TL menu, MBTALK will display the current time and prompt you to enter a new value if necessary.

```
*
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. If an invalid time is entered, the value entered will be ignore and MBTALK will display an error message.

6.2.3 SAVE LAST READING TO DISK

By pressing <L>, the user downloads the last reading to disk. **Only** the last reading (the most recent) of each sensor will be transferred. MBTALK will ask the user to enter a filename, and will automatically add the extension “.6TL”.

6.2.4 SAVE ALL DATA TO DISK

By pressing <A> the MB-6TL will send **all** data including the data stored in the NOTEPAD MODE to disk. The user will be prompted for a filename and MBTALK will automatically add the extension “.6TL”. Make sure that the destination disk has enough free space on it or the command will fail. The format of the resulting file (*.DAT) is described in section 5.4.

6.2.5 UPLOAD CONFIGURATION

The MB-6TL features the ability to upload a “configuration file” which is very useful for programming a measuring session. By pressing <C> in the menu, MBTALK will ask you to enter the configuration file's name. MBTALK will accept a filename with any extension, but we recommend using ***.CON**.

6.2.6 EDITING THE CONFIGURATION FILE

To edit your configuration file, use a text editor that saves files as unformatted (ASCII) text (for example: EDIT.EXE, included with MS-DOS).

WARNING

Do not edit your configuration file with a word processor that only saves files in a special format. The MB-6TL will not be able to read it correctly.

To make changes in your configuration file using MS-DOS' EDIT, follow these steps:

1. At the DOS prompt type: **EDIT INIT00.CON**
where **INIT00.CON** is the filename.
2. Modify **INIT00.CON** as necessary. Configuration of each sensor must begin on a separate line with the "@" character. Refer to appendix A for an example of a configuration file).
3. When you are finished editing your configuration file, save your changes and quit the text editor.

7 GAGE READINGS

Depending on the gage type selected (refer to Table 2), the readout unit will display the NORMAL (N) reading and the LINEAR (L) reading or the FREQUENCY (F).

7.1 NORMAL MODE READING

NORMAL readings are displayed in the format: $N = 324.47\mu\text{s}$. These readings correspond to the vibrating wire period. The period is displayed with a $0.01\mu\text{s}$ accuracy.

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

7.2 LINEAR AND FREQUENCY READINGS

7.2.1 LINEAR READING

In the linear mode, the vibrating wire period is linearized using the following equation:

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

Where:

K = gage constant , specific to each kind of gage (refer to table 2)

N = NORMAL reading in $\mu\text{seconds}$

L = LINEAR reading.

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

7.2.2 FREQUENCY READING

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

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

Where:

N = NORMAL reading in μ seconds

F = Frequency in Hertz.

7.3 GAGE CONSTANT

The gage constant is used in the linearization function. This constant depends on the gage type as well as on the wire length. Table 2 summarizes the gage constants for the gage instruments.

7.4 TEMPERATURE READING

The MB-6TL readout unit reads the thermistor integrated in the gage, then converts the resistance value into temperature and displays the temperature in $^{\circ}$ C and $^{\circ}$ F. In order to obtain correct readings, rotate the selector switch to the position corresponding to the type of thermistor in the gage. The thermistor response curve corresponds to the DALE curve 1, either the 2k, 3k or 10k. If the thermistor is not one of the above, then position the switch to "D" (OHMS) and record the resistance value. The resistance is converted to temperature using conversion tables appropriate for the thermistor.

If the thermistor rotary switch is positioned on either on "A" or 2k, "B" or 3k, "C" or 10k and the gage does not have a thermistor or does have a thermistor that is not connected to the readout unit then the readout unit's internal temperature is displayed.

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

8 TROUBLESHOOTING

8.1 MB-6TL SELF-TEST

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

```
**** SELF TEST ****  
  
(V1234567890)
```

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 characters **(1234567890)** 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: “#”.

For example:

```
**** SELF TEST ****  
  
(V123#567890)
```

The above example indicates that the readout unit cannot operate properly when the gage selector is set to position 4. The readout unit will function without any trouble for the other gage types.

8.2 GAGE READING

Other error messages that may appear, are:

1. Message

```
BAD QUALITY SIGNAL  
  
READING MAY BE WRONG
```

DIAGNOSIS:

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

Check the selected gage type and its connection (refer to section 3.3). Refer to the gage operation manual for gage testing procedures.

2. Message

SIGNAL OUT OF RANGE
GAGE DISCONNECTED?

in turn with:

N= _____	20.4°C
	68.7°F

DIAGNOSIS:

The readout unit does not receive the output signal from the gage. Check the patch cords 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, insert the gage patch cord into the transducer socket and position the thermistor selector to "D" (OHMS). The reading:"-----Ω" means that a cable is severed or that a gage is broken.

Note:

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

Gage Type	Resistance OHMS
SM-2W	144
VBS	115
SM-2A	57
SM-A, SM-B, EM, VH	90 or 140
PWS, JM, TPC, EPC	187

3. Message:

SIGNAL OUT OF RANGE
CHECK V.W. SELECTION

in turn with:

N= _____	20.4°C
	68.7°F

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 table 2 or with the chart in the readout unit cover. If the gage type was properly selected and the trouble remains, then switch off the readout unit and switch it on again in order to perform the "self-test" procedure. Make sure that no fault is detected concerning the gage type used. If no error is indicated by the "self-test" procedure, check the gage connection as well as the gage itself.

8.3 TEMPERATURE READING

Extreme temperatures (cold as well as hot) may significantly influence the readings. Therefore, the gage temperature should be recorded during each data reading and added into the conversion calculations.

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 (-40°C to 65°C) is most likely the problem.

9 MAINTENANCE

9.1 BATTERY

To optimize battery life, always keep the readout unit battery fully charged and avoid extensive discharges. To charge the battery, follow the procedure described in section 3.2.

Note: If after charging, the message “BATTERY LOW, PLEASE RECHARGE”, is still displayed, then return the readout unit along with the charger to ROCTEST for testing and/or repair. Battery replacement must be performed by a qualified technician.

9.2 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.

During readings, avoid water or mud splashes on the contacts.

9.3 UNIT

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

11 MISCELLANEOUS

11.1 EXAMPLE OF CONFIGURATION FILE

Filename: `init00.con`

```
@SG-01,1,A
@SG-02,1,A
@SG-03,1,A
@SG-04,1,A
@PZ-01,6,A
@PZ-02,6,A
@PZ-03,6,A
@PZ-04,6,A
@PZ-05,6,A
@PZ-06,6,A
@PZ-07,6,A
@PZ1-01,4,A
@PZ1-02,4,A
@PZ1-03,4,A
@WVA-01,1,A
@WVA-02,1,A
@WVA-03,1,A
@WVA-04,1,A
@WVA-05,1,A
@WVA-06,1,A
@WVB-01,3,A
@WVB-02,3,A
@WVB-03,3,A
@WVB-04,3,A
@WVB-05,3,A
@WVC-01,2,A
@WVC-02,2,A
@WVC-03,2,A
@WVC-04,2,A
@WVC-05,2,A
@WVC-06,2,A
@WVC-07,2,A
@WVC-08,2,A
```

The first field is the label, followed by the gage type and the thermistor type as indicated in the MB-6TL's cover.

The following list shows the valid values for each field:

LABEL	: 6 characters maximum.
GAGE TYPE	: 1 through 10
THERMISTOR TYPE	: A,B,C,D,E

In the example above, the first sensor is configured as a VBS (type 1) with a thermistor of 2 k Ω (type A).

11.2 PROGRAMMING A MEASURING SESSION

Follow the steps below to prepare the MB-6TL for a measuring session. All settings must be made, though not necessarily in the order shown.

1. Set the onboard real time clock (sections 6.2.1 and 6.2.2)
2. Upload configuration file (sections 6.2.5 and 11.1)
3. Clear the onboard memory if necessary (section 5.3.2)

11.3 RESULTS FROM A MEASURING SESSION

It is assumed here that the instrument contains valuable data collected during a previous measuring session.

1. Run the MBTALK software (see section 6.1).
2. Turn on the MB-6TL.
3. Connect the communication cable.
4. Press <ENTER> on the computer's keyboard.
5. Select <A> to download all data, or select <L> to download only the last reading (see section 5.4)
6. Clear the MB-6TL's memory if appropriate.