Multi-function Telemetry Module (MFTM): Wireline link to downhole instruments Supplemental Manual

Prepared for the University of Texas

by

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Contents

I. Introduction

The purpose of this manual is to cover some technical aspects of the MFTM that are not covered in the general reference manual.

The MFTM consists of five sections:

1. Bootstrap board for conversion of AC power to DC power
2. Patton model 1052 iDSL modem for wireline communications
3. Communications Board for system control and data processing
4. Vicor board and DC to Dc converters for tool power below the MFTM
5. RS232 to RS485 converter located on the backside of the chassis

1 2 3 4

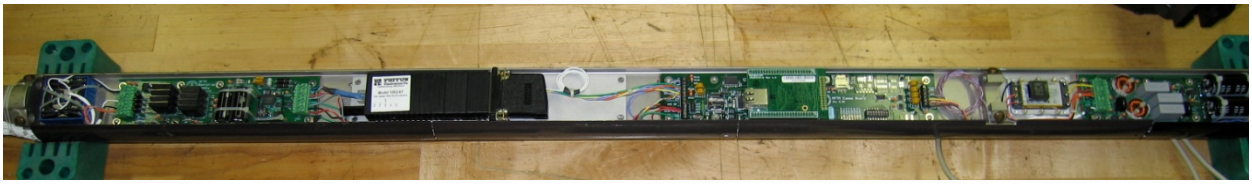

Figure 1

II. MFTM inventory

There are two versions of the MFTM and two sub versions giving us a total of four units.

MFTM-A-1

This was the first MFTM that was developed and consists of a communication board and a 12 VDC vicor power supply.

MFTM-B-1, MFTM-B-2, MFTM-B-3

All 3 of these MFTM's are essentially the same with two notable exceptions 1) Vicor power supplies 2) baud rate;

MFTM-B-1 & MFTM-B-2 are configured for use with the MDHDS for communications with a T2P at a baud rate of 9600 bps.

- Both have 24 VDC vicor power supplies that are disabled.
- Both communicate to the surface at 19200 bps over a Patton model 1052-iDSL modem.
- Both receive power from the AC lines 1 & 4.

MFTM-B-3 is configured for use with the MSS as a telemetry sonde with a baud rate of 115200 bps.

- 12 VDC vicor power supply that is enabled.
- Communicates to the surface at 19200 bps over a Patton model 1052-iDSL modem.
- Receives power from the AC lines 1 & 4.

When using the Multi-Function Telemetry Module (MFTM) with the Motion Decoupled Hydraulic Delivery System (MDHDS), Simple Instrument for Measuring Parameters In Situ (SCIMPI) or as a telemetry sonde for testing tools in the Borehole Research Group (BRG) test well, the MFTM should have the dipswitches set for the proper mode of operation. The following is an listing of the tools used with the MFTM:

1. Multi-Sensor Spectral Gamma Ray Tool (MGT)
2. Magnetic Susceptibility Sonde (MSS)
3. Dark Energy Biosphere Investigation tool (DEBI-t)
4. Motion Decoupled Hydraulic Delivery System (MDHDS)
5. Simple Instrument for Measuring Parameters In Situ (SCIMPI)

Other tools used with the MFTM

1. Enhanced Lamont Interface Cartage (ELIC)
2. Electrical Release System (ERS)

III. Overview of the dipswitch interface on the MFTM

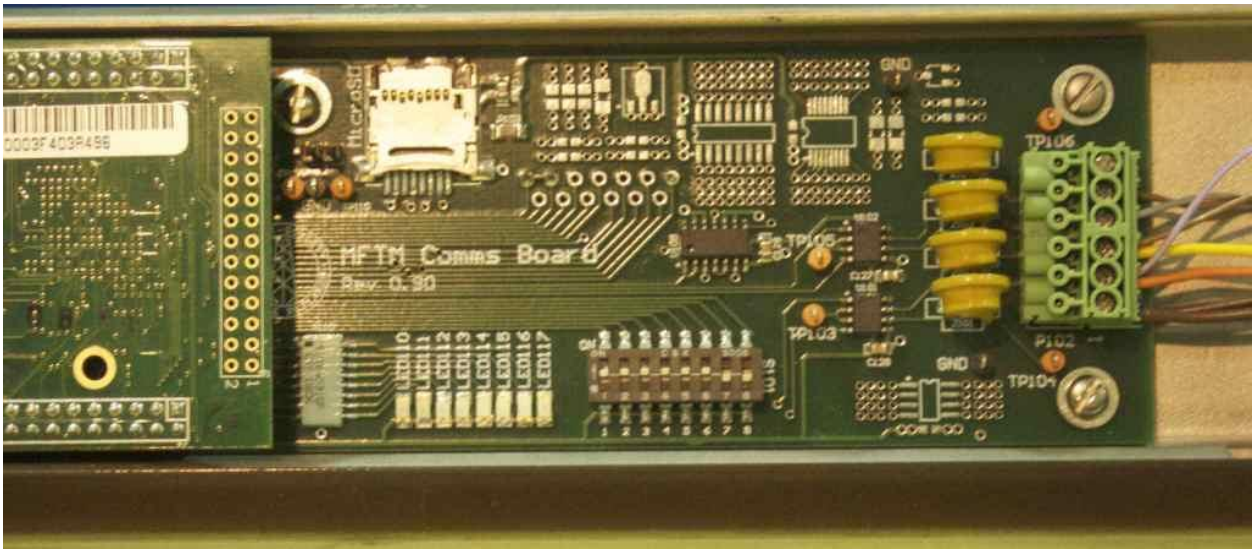

Figure 2: Communication Board Dipswitch location

The Dipswitch's on the MFTM Communication board will control the operational mode that the Communication's board will boot up in. A binary one (1) denotes the on position.

Normal mode (MGT, MSS,ELIC)

1. Switch 1 (Tool power supply off J2[36])
2. Switch 2 (No MGT)
3. Switch 3 (No MSS)
4. Switch 6,5,4 (Diagnostics mode view as binary)
    a. 000 (MODE_NORMAL)
    b. 001 (MODE_CHARGEN)
    c. 010 (MODE_LOOPBACK_ELIC)
    d. 011 (MODE_LOOPBACK_TOOLBUS)
    e. 100 (MODE_LOOPBACK_MGT)
    f. 101 (N/A)
    g. 110 (N/A)
    h. 111 (MODE_MDHDS)
5. Switch 7 (isUseDHCP)
    a. This is commented out in user main.
6. Switch 8 (isWaitForReset)
    a. Also known as "safe boot"mode

The positions of the switch are denoted as 1 (on) 0 (off).

IV. Overviews of different switch setting that are commonly used

DEBI-t

When running the DEBI-t the MFTM is setup as if a MSS was attached. And the basic string configuration is DEBI-t-MFTM-ELIC. The dipswitch settings are:

- 00100000

MSS

The MSS can be run by itself or as part of an Schlumberger (SLB) tool string. When run with the SLB tool string no MFTM is necessary. The string configuration would be MSS-ELIC and the communication to the ELIC would be RS232 through SLB pins 12 & 22.

When the MSS is run by itself, such as when running in the test well, the MFTM should be setup as a telemetry sonde. The dipswitch settings are:

- 01111100

MSS-MGT

The MSS and MGT can be run using the MFTM as a telemetry sonde or as an element in the SLB tool string. When the MSS-MGT is run by itself, such as when running in the test well, the MFTM should be setup as a telemetry sonde. The dipswitch settings are:

- 01111100

When the MSS and MGT are run in an SLB tool string the MFTM should be setup as central communication hub. The dipswitch settings are:

- 00000000

MDHDS

When running with the MDHDS it is assumed that the Temperature 2 Pressure (T2P) or the Sediment Temperature-Pressure (SET-P) is being used. In this configuration the MFTM is used as a telemetry sonde and does not supply power to tools below. The dipswitch settings are:

- 11111100

SCIMPI

When running with SCIMPI the MFTM is used as a telemetry sonde but also supplies power to SCIMPI until just before release. The dipswitch settings are:

- 01111100

V. Changing the Baud Rate

If and when the need arises to change the baud rate either for the RS232\RS485 output or input of the MFTM while in the MDHDS or SCMIPI modes the change must be made in the firmware. Baud rate for the DEBI-t, MSS and MSS-MGT modes of operation are set by the firmware located in the mftm_sub_glogals.h file and are listed as:

- MGT_BAUDRATE 57600
- ELIC_BAUDRATE 19200
- TOOLBUS_BAUDRATE 115200

If you want to change the baud rate for the MFTM in the MDHDS or SCIMPI mode you will need to edit the Sub_Surface_comm_handler.cc and change the value in the following lines of code:

- Int fd0 = OpenSerial (0, 9600, 1, 8, eParityNone);
- Int fd2 = OpenSerial (0, 19200, 1, 8, eParityNone);

The most common baud rates used

- 9600 T2P
- 19200 ELIC, SCIMPI, Patton Modems, TSCP (output to modem)
- 57600 MGT
- 115200 MSS, MTT, DEBI-t, TSCP (output to PC)

Quick steps to change baud rate

1. Start NBEclipse
2. Select workspace c:\Nburn\NBEclipse\MFTM
3. Open the mftm-sub project (Other projects can be in the workspace but not opened)
4. Edit the baud rates in the Sub_Surface_comm_handler.cc and save
5. Install a crossover cable from the PC to the NetBurner Mod 5234
6. Hit run to launch the installer

The Multi-function Telemetry Module (MFTM is designed to collect telemetry from a third party tool and in this application it will be monitoring data from either the T2P or the SET-P dedicated run down-hole logging tools. This system consists of the following components:

1. T2P or SET-P tool
2. MDHDS
3. Electrical Release System (ERS)
4. MFTM
5. Telemetry Surface Control Panel (TSCP)

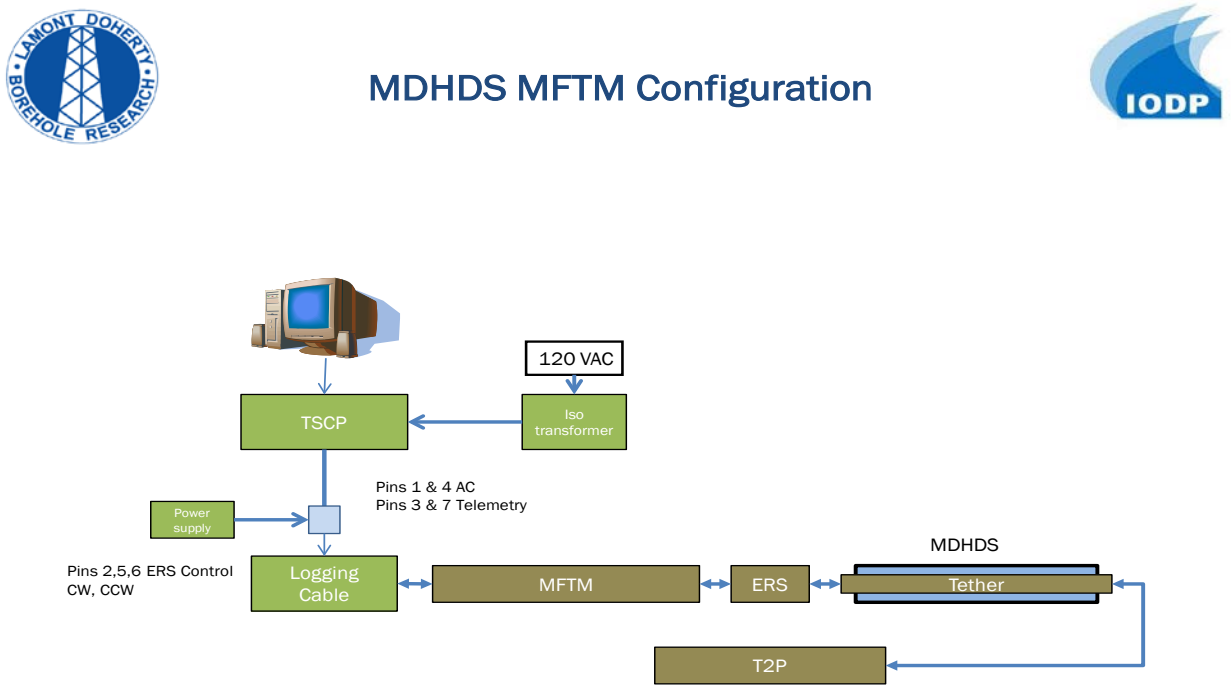

Figure 3: the basic configuration of the system with the MDHDS

VI. Communications

There are two communication paths in this configuration; one from the third party tool to the MFTM and the second from the MFTM to the TSCP. The third party tool transmits data at a one second rate over a RS232 connection configured as 9,600 baud, 8 data bits, 1 stop bit, and no parity. The connection is made over a tether that uses a RG142 50 ohm coaxial cable. Since there is no mechanical connection between the third party tool and the MFTM chassis the shield is ground (SLB pin 13) and the center conductor is transmit (SLB pin 11). The baud rate is configured within the Netburner firmware located in the Sub_Surface_Comm_handler. The TSCP outputs RS232 connection configured as 115,200 baud, 8 data bits, 1 stop bit and no parity. This connection is a DB9 connector located on the back panel of the TSCP.

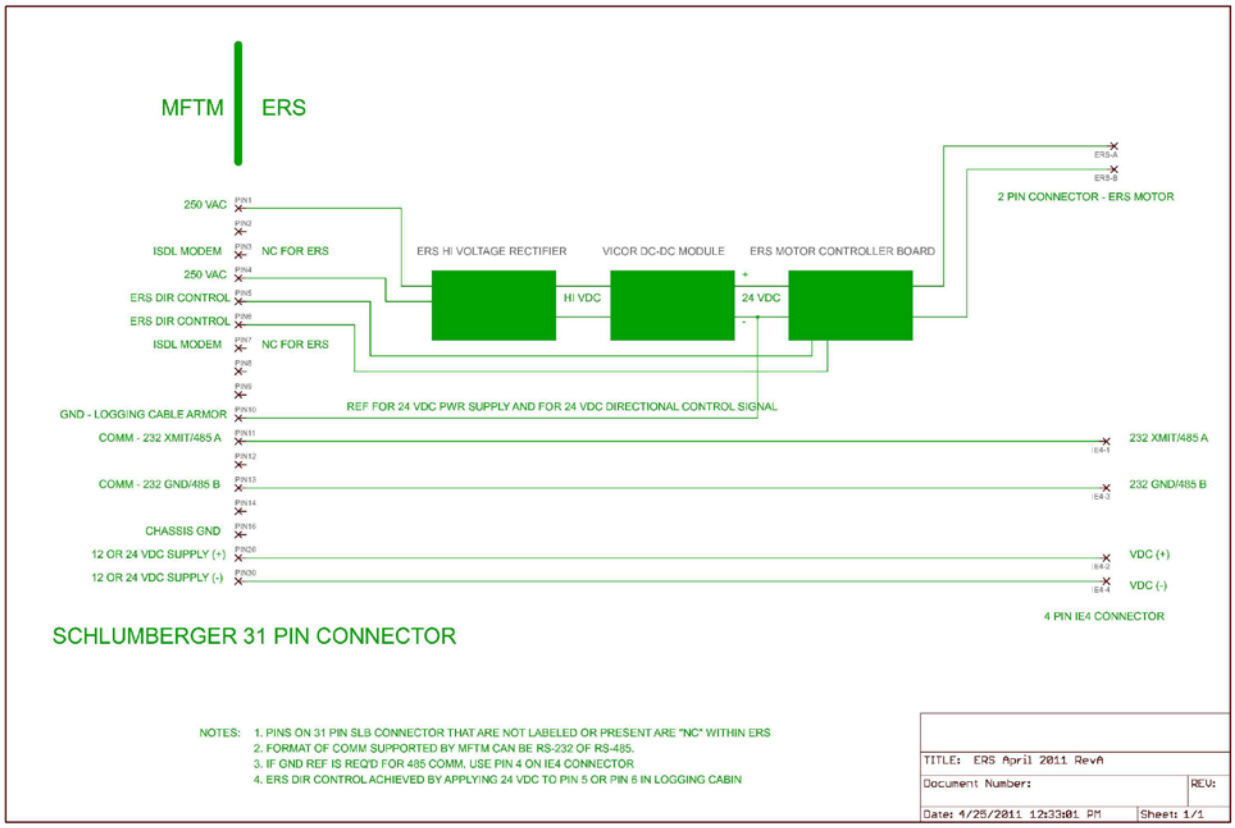

Figure 4: Connection diagram for the MFTM and ERS

VII. Dip Switch configuration

The Dip-switch's on the MFTM Communication board will control the operational mode that the Communication's board will boot up in. A one (1) denotes the on position.

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    h. 111 (MODE_MDHDS)
5. Switch 7 (isUseDHCP)
    a. This is commented out in user main.
6. Switch 8 (isWaitForReset)
    a. Also known as "safe boot"mode

Dip switch settings for MODE_MDHDS

1. 11111100

This dip switch configuration is defined as:

a. Tool power supply off (24 VDC Vicor supply)
b. No MGT
c. No MSS
d. Switch 4,5,6 MDHDS Mode
e. Use static IP 10.0.0.75
f. No WaitForReset

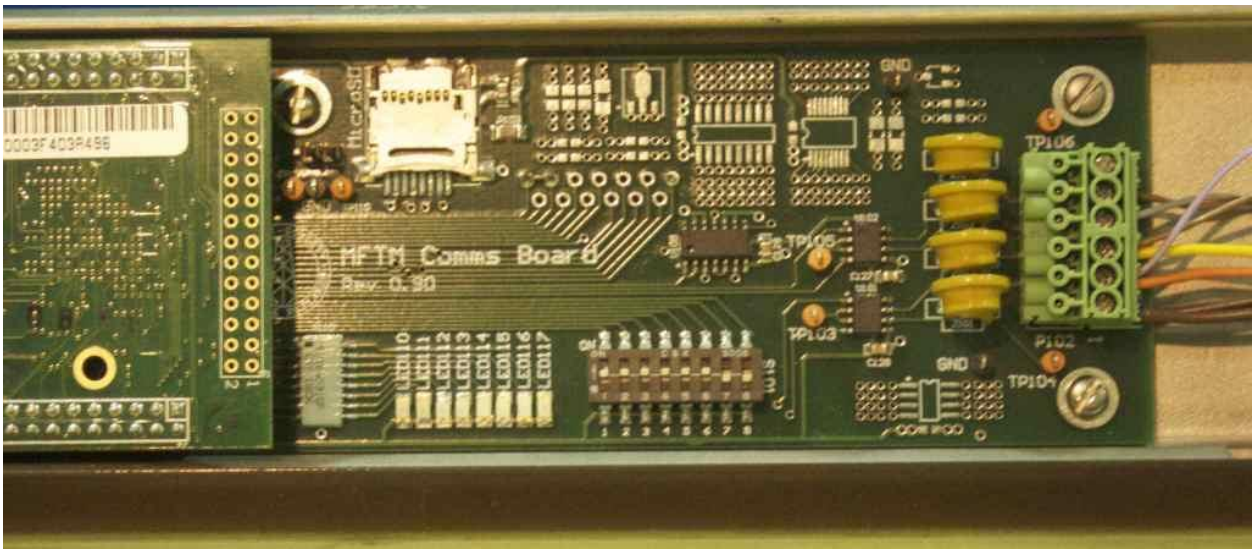

Figure 5: Dip Switch Settings

Figure 6: Telemetry Surface Control Panel (TSCP)

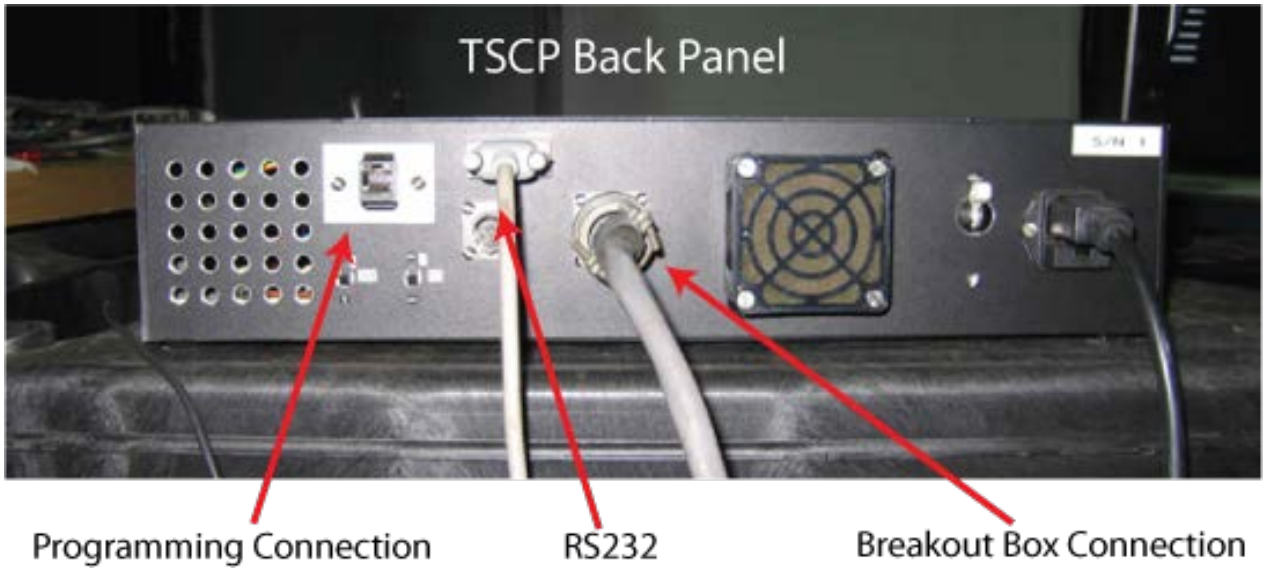

Figure 7: TSCP Back Panel

Figure 8: Telemetry Surface Breakout Box and Cable

VIII. Operation with the MDHDS

- Layout the MFTM on the bench and remove the electronics from the pressure housing. Insure that the dipswitch setting is configured for MDHDS. MDHDS dipswitch configuration is 11111100 where a 1 indicates on. Refer to fig 3. This step should be performed prior to shipping of the MFTM.
- On the back panel of the TSCP connect the surface breakout box. This is an 8-pin cannon connector.
- On the breakout box, connect the jumper cable, which has a cannon connector on one end and 8 - 2 mm banana plugs on the other.
- Connect the 2 mm banana plugs to the SLB logging cable interface.
- Connect the surface PC via the RS232 com port to the TSCP. The surface PC should have the T2P logging program (T2P Data Read) installed. This is a LabView program developed using LabView version 8.2.
- Three o-rings on the MFTM (McMaster part # 9452K69) should be visually inspected prior to any deployment and changed after 3-4 deployments.
- Assemble the SLB Cable Head – MFTM – ERS
- Connect the main power (120 VAC) from the isolation transformer to the TSCP and connect the isolation transformer to the power mains.

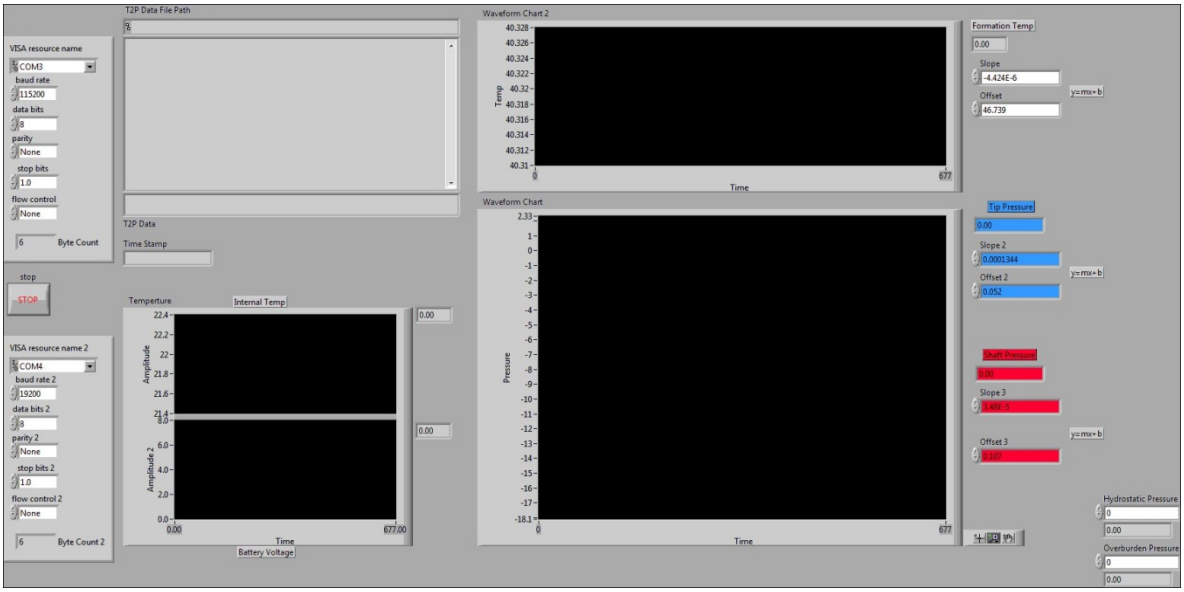

Figure 9: MDHDS-T2P-MFTM LabVIEW Control Panel

IX. Software

The program was written in LabView 8.2.1 and incorporates the following functions:

1. Writes the data to two different files Main and backup files.
2. Outputs the data stream on a second COM port.
3. Plots internal temperature and battery voltage.
4. Plots probe temperature, Tip pressure and shaft pressure.
5. Allows for scaling ADC outputs of probe temperature, Tip pressure and shaft pressure.

X. Caution

When using this system be aware that it will supply 250 VAC downhole. After assembling the system have the Schlumberger engineer check all connections before turning on power.

XI. MFTM Tool Specifications

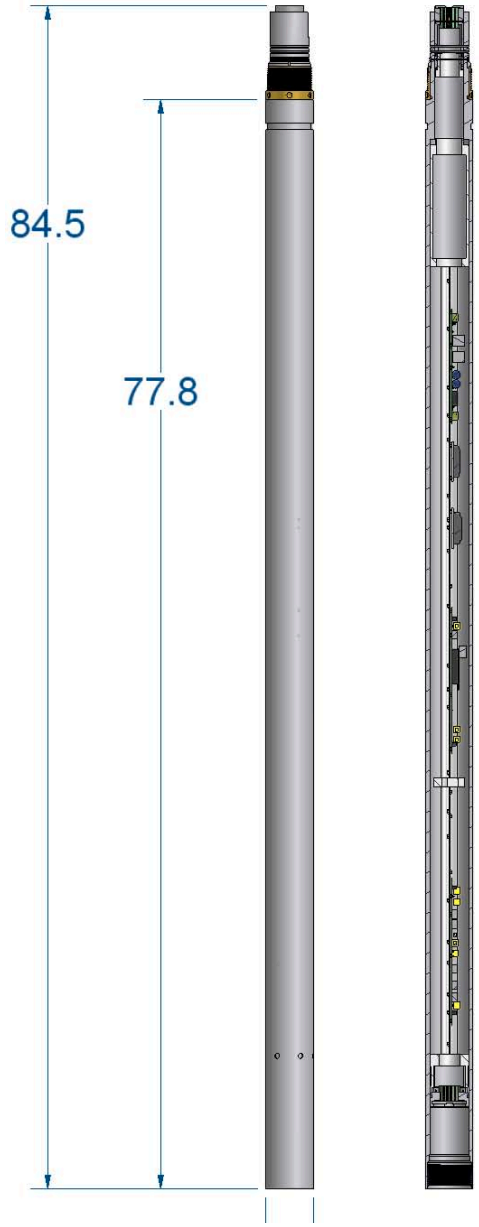

Figure 10: MFTM, dimensions in inches

Dimensions		
	Tool diameter	3-3/8 in. (8.6 cm)
	Tool length1	84.5 in. (214 cm)
	Tool weight	100 lbs (45 kg)
Environmental Limitations		
	Maximum temperature	158°F (70°C)
	Maximum pressure	10,000 psi (69 MPa)
	Shock	500 shocks of 25g for 2 ms
	Minimum borehole diameter	≥ 5 in. (13 cm)
Modem characteristics		
	Protocol	RS-232
	Baud rate	19200
	Duplex	Full
	Handshake	CTS
	Maximum cable length	20,000 ft (6,100 m)
Measurements*		
	Acceleration	± 8g
	Internal temperature	to 185°F (85°C)
	Cable tension	provided from cablehead
Downhole power		12 VDC at 2A
Up- and downhole connections		standard oilfield 31-pin

*effective makeup length is 77.8 in. (198 cm)