MEDCO
Modelling Engineering & Development Company Limited

Tubing Ovality Monitor

TOM

User Manual

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Tubing Ovality Monitor - *TOM*

Tubing Ovality Monitor is a system to measure coiled tubing string ovality. The system consists of two parts:

Laser measuring head

This is the actual sensor device. The laser measuring head has laser transmitters and receivers. For as long as the pipe remains within an area of 64 x 64 mm squared, the laser measuring head will measure the pipe ovality accurately and is actually programmed to make 10 readings per second. Thus even at coiled tubing speeds of 120 ft/min, the device will measure the ovality 5 times per foot.
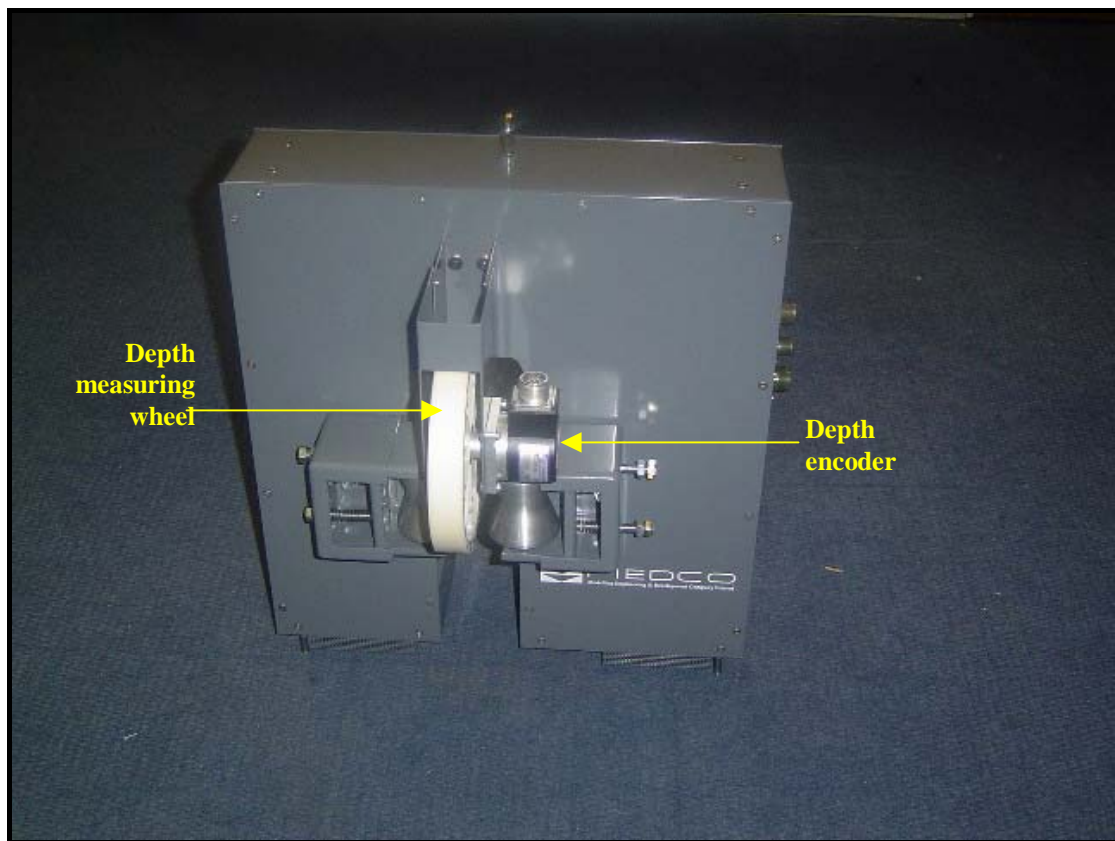

Laser measuring head

The laser measuring head requires 230 VAC to operate and transmits data to the *controller* through a serial port (*RS-232*).

Furthermore, in extreme weather conditions it is necessary to keep the laser device at a reasonable operating temperature. The optimum temperature range is between 0°C to 45°C. Thus, the laser measuring head is equipped with a climate control sub-system which will self-start once the conditions approach uncomfortable. This climate control system utilises 12 vdc power and can be supplied directly from a truck battery. The current drawn by the climate control system would be around 15 amps.

Controller Box

The controller box communicates with the laser measuring head to acquire, display, and store the data in real time.
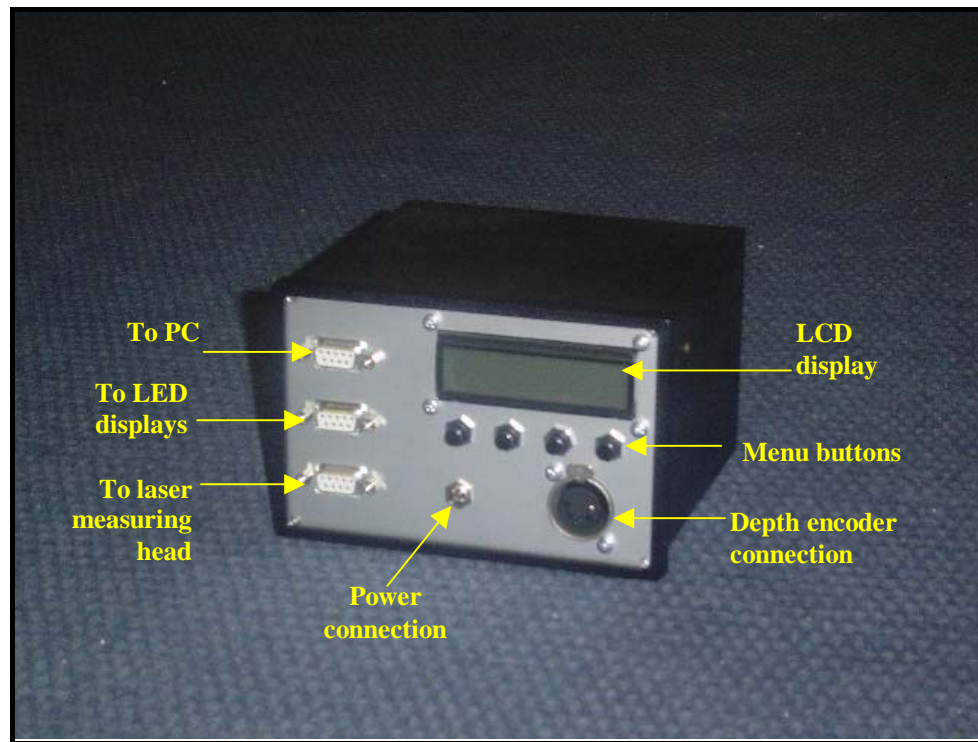
Controller Box

The controller box has it's own *LCD* display, which automatically displays the data. In addition, the user can use additional *LED* displays to display the data remotely.

The communication between the controller box and the laser measuring head is through a serial port (*RS-232*). While the communication with *LED* displays is through *RS-485* serial port. Note that the parameters transmitted to the controller are assigned a code to identify them. The codes are as follows:

- 1 = Depth
- 2 = Ovality
- 3 = Maximum Diameter
- 4 = Minimum Diameter

Thus, if it is desired to use *LED* displays to display the data, then it will be necessary to assign the *LED* display the corresponding address of the desired parameter.

Another *RS-232* serial port is provided for communication with the computer. MEDCO supplies a utility program, called **TomData**, which can be used to download the data from the controller box. (Follow the hyperlink to download TomData http://www.medcotas.com/tom/TomData%20Setup.exe).

Furthermore, the controller box is connected directly to the depth encoder, thus providing the encoder with the excitation in addition to receiving and analysing the encoder signals.

The controller box saves the *Depth*, *Ovality*, *Maximum Diameter*, and *Minimum Diameter* data at every depth measure unit (example ft or m) in it's own memory. This is done automatically and the existing data is over-written if the same depth is reached. Thus, in the case of changing the coiled tubing, it would be necessary to re-initialise the memory, so as not to confuse the data of different coiled tubing strings.

Using the Menu Buttons
The menu buttons can be used to perform any one of three functions. The buttons are activated by pressing and releasing. To enter in the menu mode, use the left-most button. Then use the middle buttons to scroll through the menu options (Set Depth, Set K-Factor, Initialise Memory).

Use the right-most button to select the required function, then use the left-most button to move left-wards (i.e. like left arrow) and the right-most button to move right-wards (i.e. like right-arrow). Once the digit that requires changing is highlighted (flashing) then use the middle buttons to increase or decrease the value. Once finished editing the value, scroll the right-most digit then use the right-most button to exit the editing mode. Finally, use the right-most button again to SAVE the changes.

Cables Bundle

A cable bundle consisting of four individual cables is supplied with the unit. Each cable is used for a specific task:

1. **Encoder cable**: This cable is used to connect between the *control box* and the *depth encoder*.
2. **Serial data cable**: This cable is used for connecting between the serial port on the *control box* (bottom connector) to *the laser measuring head*.
3. **AC Power**: This cable is used to supply the *laser measuring head* with AC power. Plugs directly to a power socket.
4. **DC Power**: This cable is used to supply DC power to the *climate control* system within the *laser measuring head*. Can be connected directly to a truck battery, hence the connections to the battery are loose.
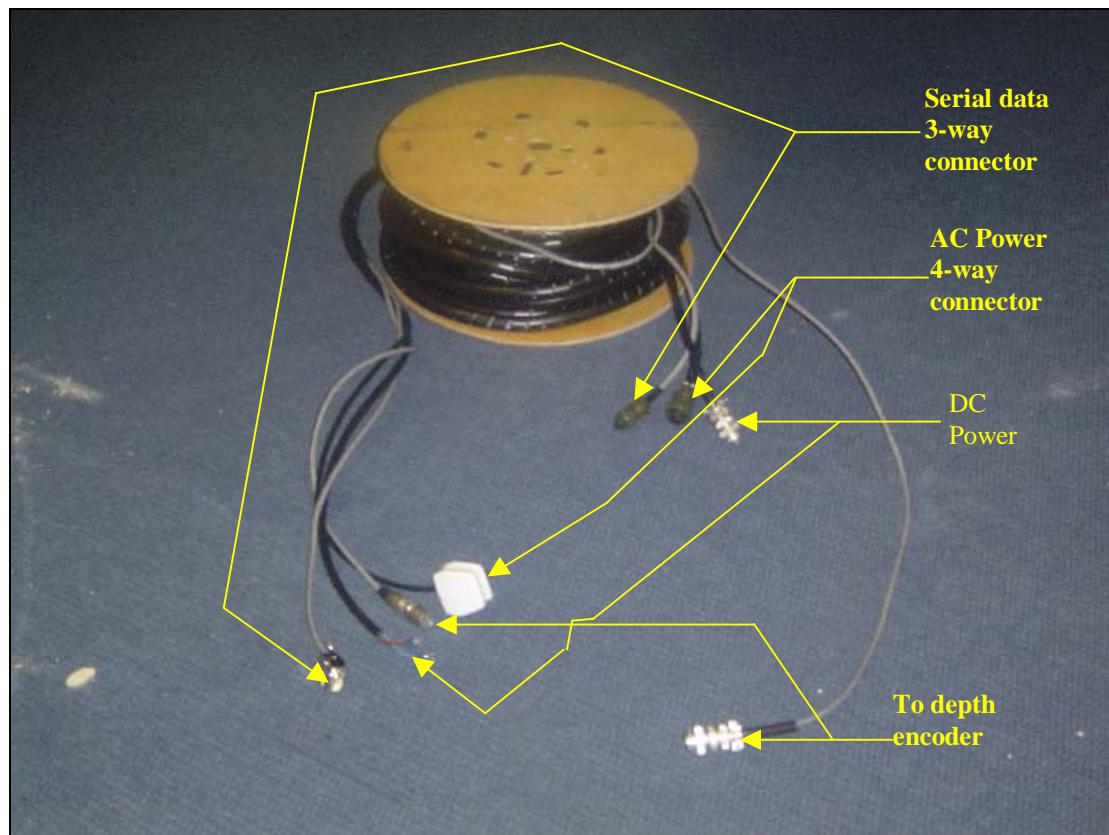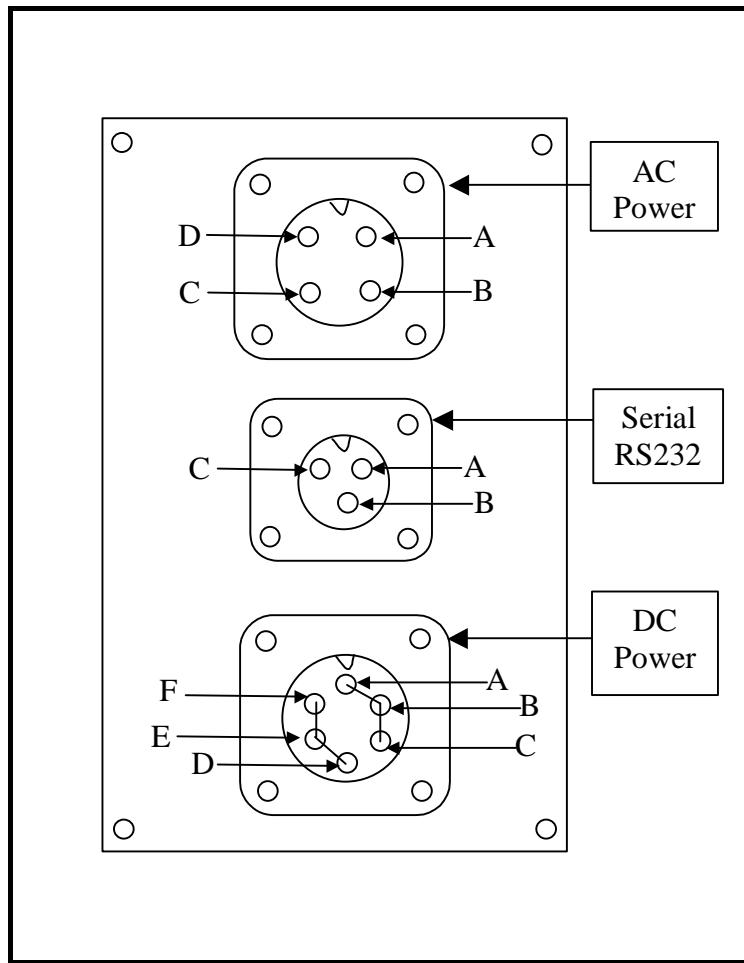

Cables bundle

NOTE: Both the depth encoder and the DC power cable use the same type of connector. Thus, it is important that they are distinguished. The depth encoder cable is generally longer and thinner.

Connections

AC Power

Serial port

DC Power

Front view of chassis mount connectors
On the side of the Laser Measuring Head

AC Power – 4 way connector
A = Live
B = Neutral
C = Ground
D = Not connected

Serial RS232 – 3 way connector
A = Pin 2 on 9-way D-type connector for serial RS232
B = Pin 3 on 9-way D-type connector for serial RS232
C = Pin 5 on 9-way D-type connector for serial RS232

DC Power – 6 way connector
A = +12 vdc
D = Ground or 0 vdc
Short A, B, and C on both 6-way connectors, i.e. on the chassis mount male and cable mount female
Short D, E, and F on both 6-way connectors, i.e. on the chassis mount male and cable mount female

Connecting Control Box to PC

For real time data, the user can use *DART* software or *Hyperterminal* to view the data. If using the *DART* software, see the DART manual on how to setup the serial port protocol (*Edit Settings > Serial Port*).

For both, *DART* and *Hyperterminal*, the serial port protocol is as follows:
- Baud Rate/Bits per second = 19200
- Data bits = 8
- Stop bit =1
- Parity = None
- Handshake/Flow Control = None

For *DART* only:
- Delimiter = Space
- Terminator = Carriage Return + Line Feed

And the number of parameters is 4 abd there sequence is as follows:
1. Depth
2. Ovality
3. Maximum Diameter
4. Minimum Diameter

Using TomData

The *TomData* utility program can be used to perform several functions. Upon starting the program, use the Setting menu option to set the appropriate com port on your PC and leave the other settings as per their default values, i.e. Speed = 19200 and Hand Shaking = None.
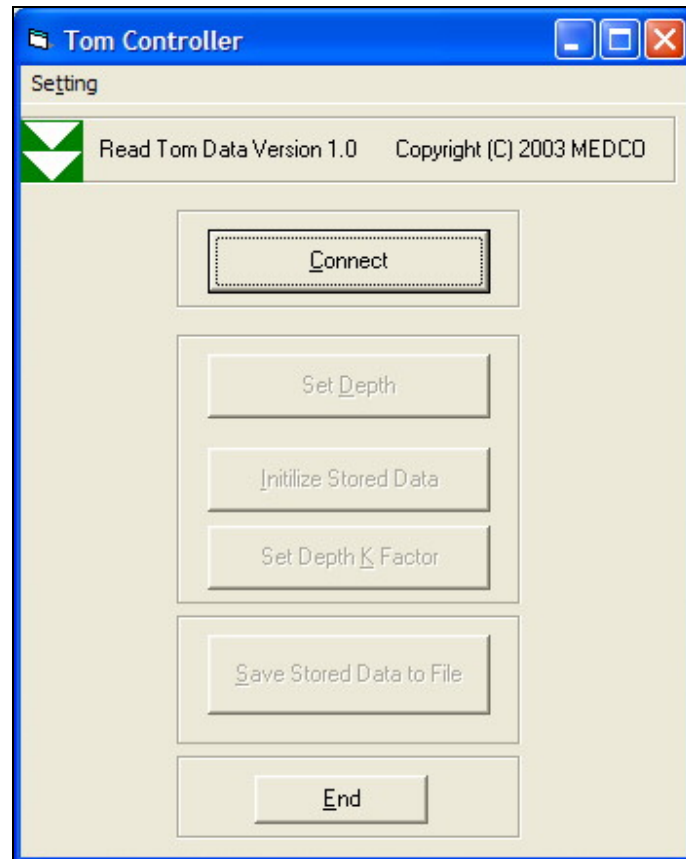
TomData

The following functions are available in *TomData*:

- **Connect**: This function must be used first to connect to the *control box*.
- **Set Depth**: Use this button to re-set the depth.
- **Initialize Stored Data**: Use this button to erase the data in the *control box* and prepare to read ovalities of another coiled tubing string.
- **Set Depth K-Factor**: Use this button to change the K-Factor of the depth encoder. The depth encoder produces 600 pulses per revolution and the depth measuring wheel has a 500mm circumference. Thus, the K-Factor will be 365.76 to display depth values in feet. (K-Factor = 304.8 * 600 / 500).
- **Save Stored Data to File**: Use this button to download the data stored in the *control box* and save it in a database file ("mdb"). You can then use FACT to display the data versus the string length.
- **End**: Use this button to exit *TomData*.