

# GUIDE Surface System: Real-Time Shock & Vibration



Transforming downhole data into downhole intelligence

**SUBJECT:** UNDERSTANDING AND ACCESSING REAL-TIME SHOCK/VIBRATION/RPM DATA

**PRODUCT:** TOLTEQ GUIDE MWD SURFACE SYSTEM

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## THE NEED FOR REAL-TIME DATA

MWD systems can fail for a number of reasons; one common reason is excessive downhole shock and vibration caused by extreme drilling conditions. An MWD tool failure is an expensive and time-consuming endeavor, and is one of the leading causes of rig downtime. For this reason, it is critical to monitor downhole drilling dynamics—especially shock and vibration.

The need for immediate, or real-time, shock and vibration data is clear.

All of Tolteq's MWD systems are equipped to monitor and record shock, vibration, and RPM, and to relay that vital information to the surface in real-time in conjunction with GUIDE MWD Surface System.

GUIDE offers multiple options for configuring and displaying real-time data. This document is divided into two sections: the first part will explain the different options for obtaining real-time shock and vibration; the second part will show you how to configure your software to receive and display this critical data.



**Figure 1: Tolteq GUIDE MWD Surface System**

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## ADVANCED DATA READINGS: SHOCK, VIBRATION, AND RPM

You can configure GUIDE MWD Desktop software to display both Standard and Advanced Data Readings on the Compass Rose screen, including gravity, temperature, shock, and vibration, as shown in Figure 1. Unlike Standard Data readings, however, **Advanced Data readings will not appear on the Compass Rose** screen unless you select them while configuring the file.

Shock and vibration are considered advanced data readings. There is a choice of nine Advanced Data readings that may be selected, but only three are displayed at any one time. Advanced Data readings are always displayed on the right side of the compass rose, as shown in Figure 2.

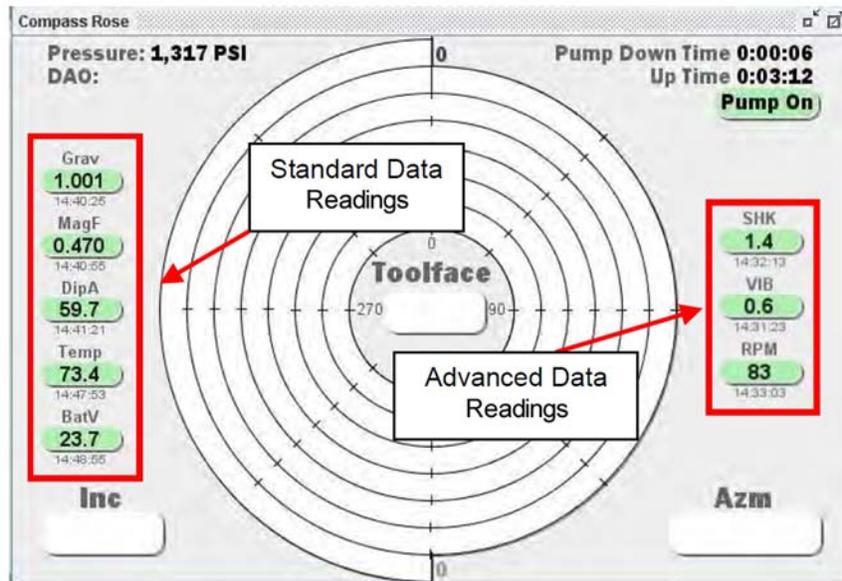


Figure 2: Compass Rose screen displays Standard and Advanced Data readings

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On the Compass Rose, Advanced Data readings always appear in the same order from top to bottom, with shock first, vibration second, and RPM last (1-3 in the following table). Table 1 shows the specific order of the nine readings, along with the GUIDE software abbreviation that identifies each reading. The resolution is the bandwidth requirement in bits for each reading. The higher the resolution, the longer it takes to transmit the reading to the surface.

**Table 1: Advanced Data readings and their display order, identifier, and resolution**

Order	Reading	Identifier	Resolution (Bits)
1	Shock	<i>SHK</i>	8
	Shock Range	<i>SHKR</i>	3
	Shock Warning	<i>SHKW</i>	1
2	Vibration	<i>VIB</i>	8
	Vibration Range	<i>VIBR</i>	3
	Vibration Warning	<i>VIBW</i>	1
3	Rotations Per Minute	<i>RPM</i>	8
	RPM Range	<i>RPMR</i>	3
	RPM Warning	<i>RPMW</i>	1

Due to its limited space, the Compass Rose can only display one advanced reading from each group at a time. If multiple readings from within the same group are chosen, the value will rotate based on the information that is received at that particular moment.

## OVERVIEW OF ADVANCED DATA READINGS

**Shock.** A shock is a sudden acceleration or deceleration caused by impacts on the bit or the drill string with the wellbore. The shock pulse is measured by an accelerometer as a plot of acceleration versus time. The reading pulsed to the surface is expressed as a peak value in G's, and is replaced by a new peak value the next time it is pulsed.

This reading provides the most accurate picture by transmitting actual values of what the tool is exposed to, but requires the most bandwidth to get the data to the surface (8 bits).

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**Vibration.** Vibration is the response of a system to an internal or external stimulus causing it to oscillate or pulsate. Vibration is measured in RMS to give a more accurate representation of the energy within the vibration and hence the force that will be exerted by the vibration. The reading reported to the surface is expressed as an average value based on a predetermined time interval.

This reading provides the most accurate picture by transmitting actual values of what the tool experiences; however, it requires the most bandwidth to get the data to the surface (8 bits).

**Rotation.** This reading measures the revolutions per minute—RPM—of the drillstring as it rotates around a fixed axis.

**Shock/Vibration/RPM Range.** Range is always displayed as a scale in the Compass Rose screen, with the exact value falling somewhere within the scale.

This reading provides a middle ground option in terms of bandwidth by reporting a set range instead of actual values. This option requires 3 bits of data to transmit. Table 2 lists the set ranges for Shock, Vibration, and RPM.

**Table 2: Ranges for Advanced Data readings**

SHKR	VIBR	RPMR
0.0 to 5.0	0.0 to 2.5	0.0 to 30.0
>5.0 to 10.0	>2.5 to 5.0	>30.0 to 60.0
>10.0 to 16.0	>5.0 to 8.0	>60.0 to 90.0
>16.0 to 24.0	>8.0 to 12.0	>90.0 to 120.0
>24.0 to 34.0	>12.0 to 17.0	>120.0 to 150.0
>34.0 to 48.0	>17.0 to 24.0	>150.0 to 180.0
>48.0 to 72.0	>24.0 to 36.0	>180.0 to 210.0
>72.0	>36.0	>210.0

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**Shock/Vibration/RPM Warning.** When selected, warnings will appear on the Compass Rose as either a green or red icon. The icon will normally appear as green until the threshold, as configured by the user (or based on the defaults), has been surpassed.

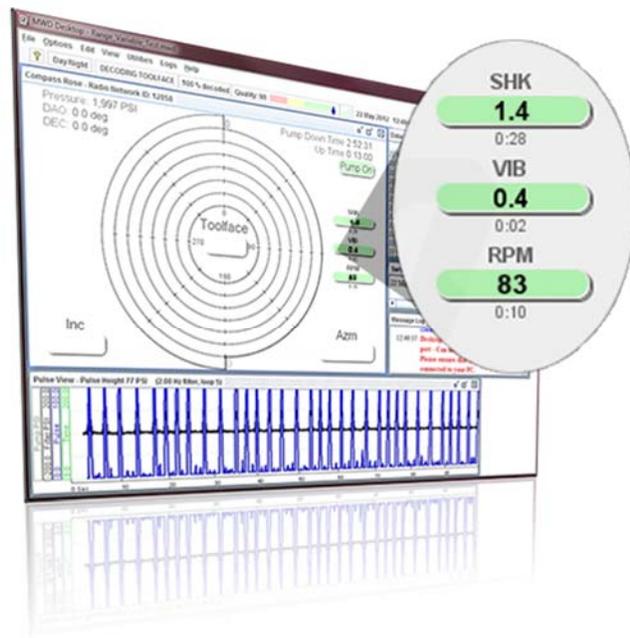
Because this reading does not provide an actual value, it requires the least bandwidth (1 bit), and only provides a warning (red icon) if you have exceeded 45G for shock or 25G for vibration.

## GUIDE: THE BEST TOOL FOR THE JOB

With its ability to display real-time data, GUIDE is an indispensable asset to your MWD setup.

The variety of Advanced Data readings provide you with a choice of accuracy versus speed in terms of data transmission bandwidth. The most accurate readings are also the most costly in bits. Based on your specific needs for a job, it may be necessary to prioritize one over the other.

Because all Advanced Data readings are transmitted in real time and allow you to detect and avoid extreme environmental forces, Tolteq recommends that you employ them in your configuration file; however, the combination you choose will ultimately be determined by your plan.



**The steps involved in selecting and displaying advanced data readings are described in the next section, "Selecting and Displaying Advanced Data Readings" on page 6.**

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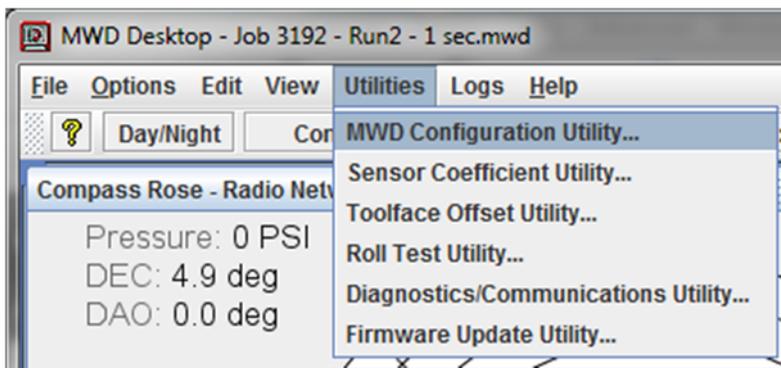
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## SELECTING AND DISPLAYING ADVANCED DATA READINGS

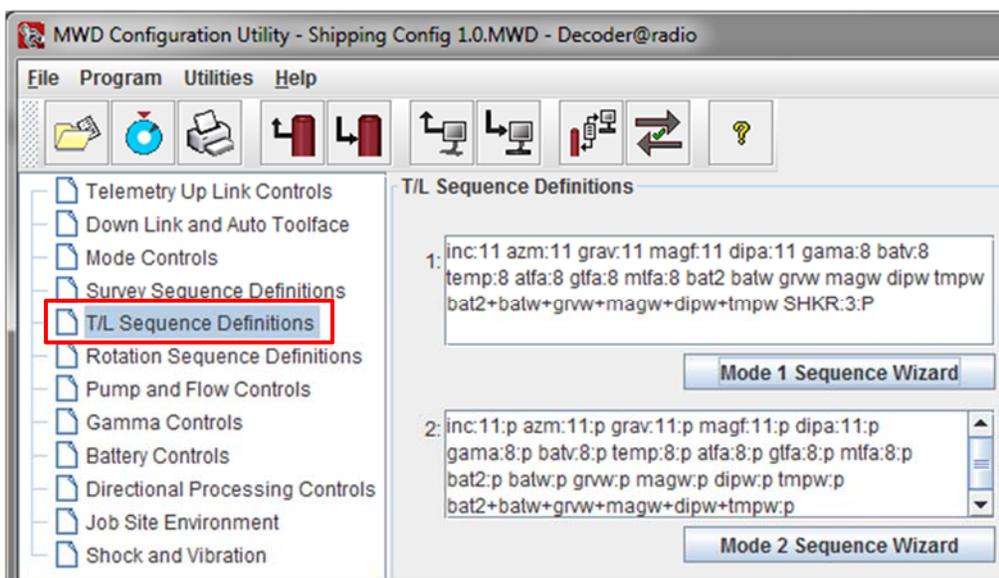
For this procedure, we will use MWD Desktop to describe the configuration of advanced data readings. MWD Decoder may also be used for this procedure with little or no variation to the steps involved.

To select and display advanced data readings on MWD Desktop, follow these steps:

1. On MWD Desktop, select **Utilities > MWD Configuration Utility**.



2. In the MWD Configuration Utility, select **T/L Sequence Definitions** from the Configuration tabs pane.

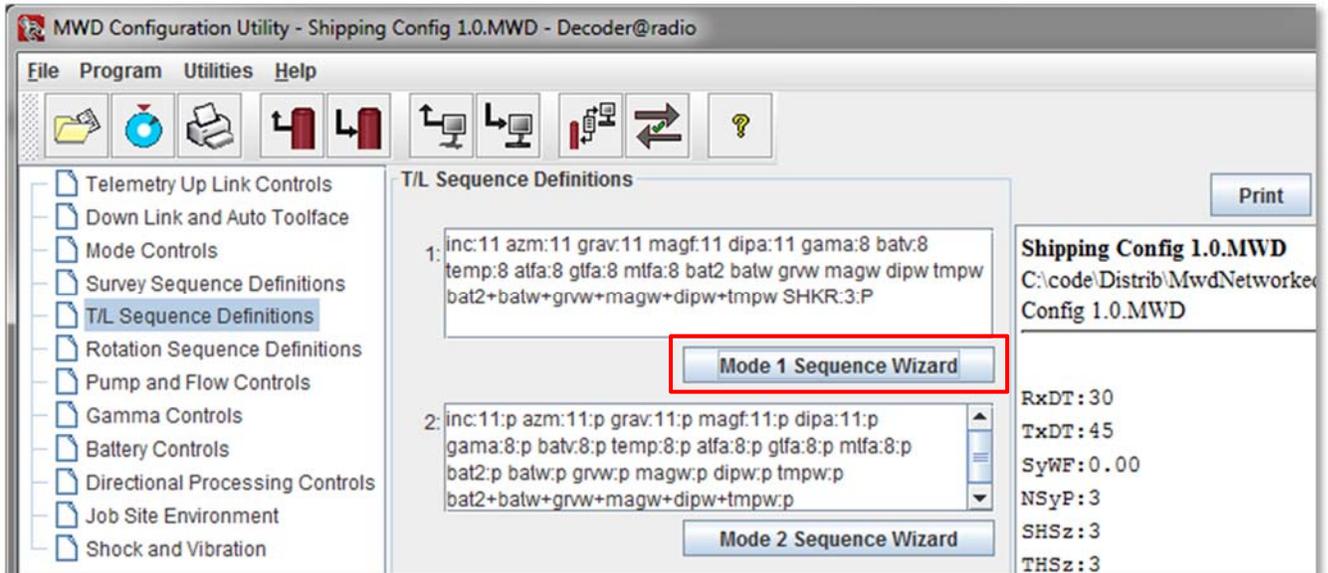


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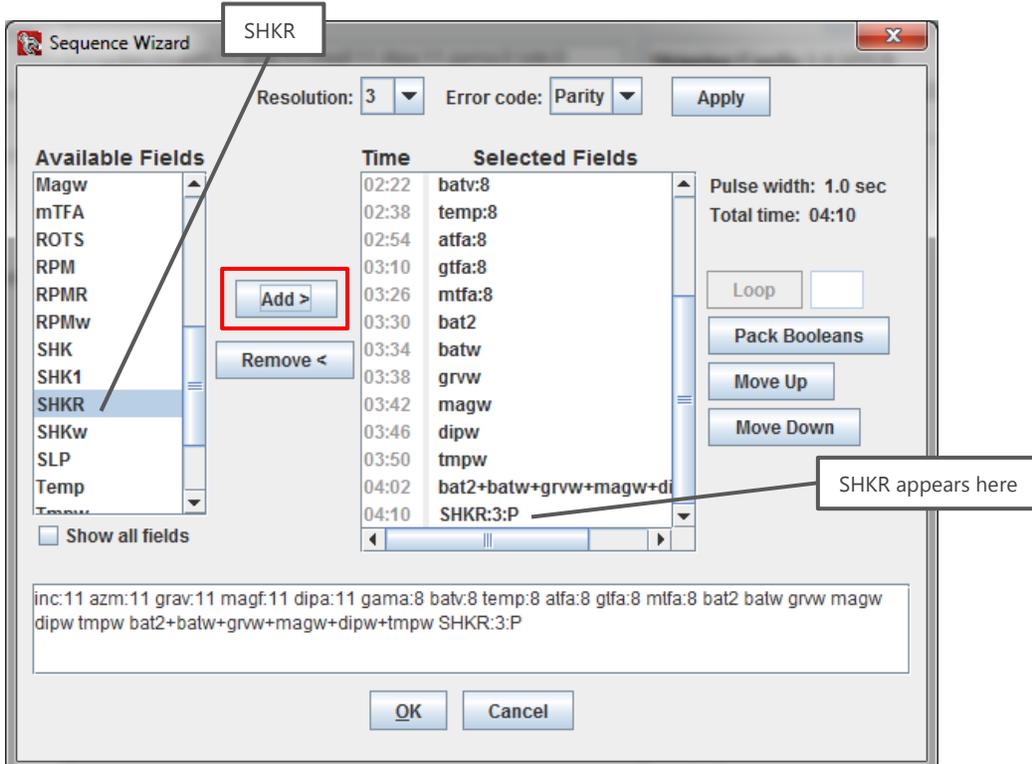


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3. Click **Mode 1 Sequence Wizard** button.



4. In the Sequence Wizard dialog box, select your desired data reading. In this example, **SHKR** (shock range) has been selected from the available fields. Click **Add**.

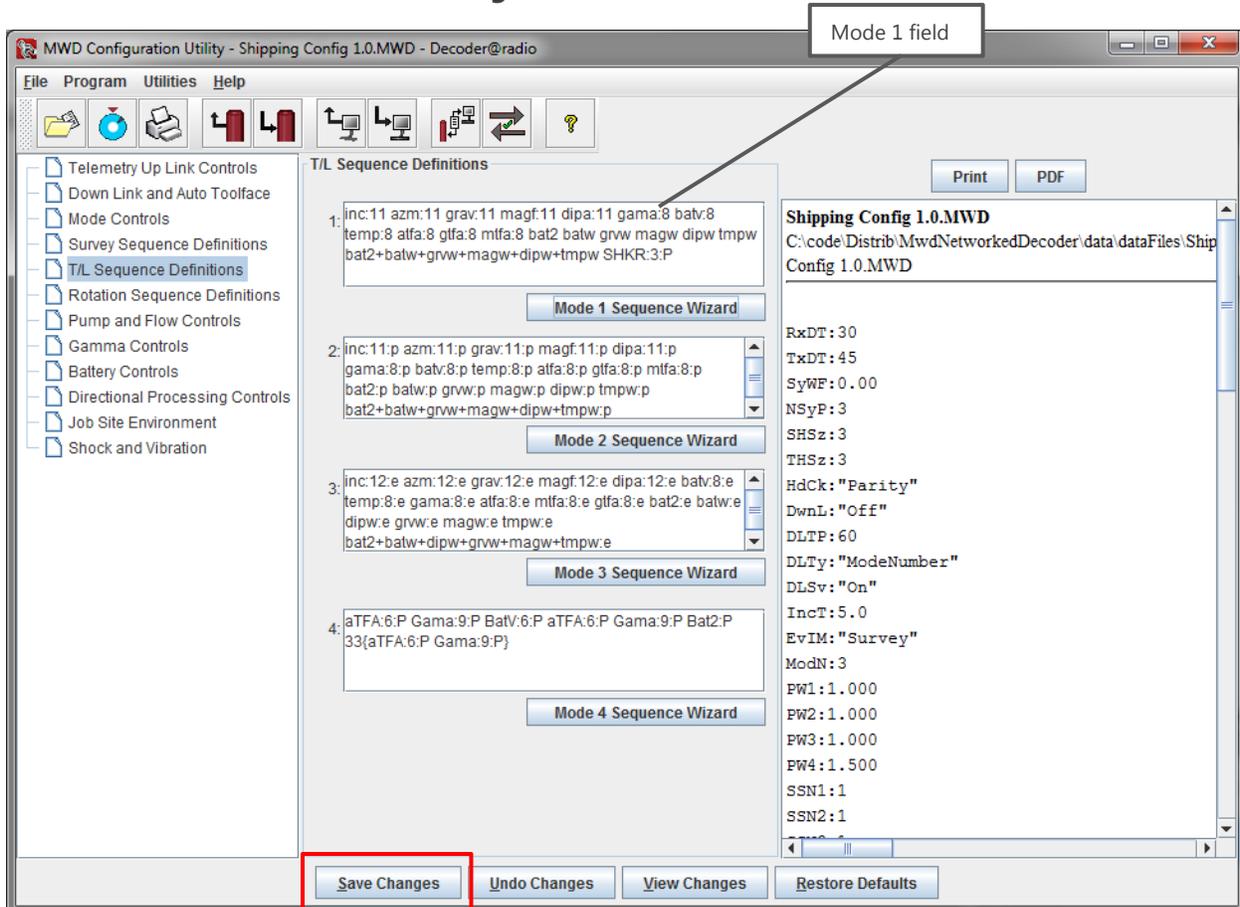


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5. Verify that your selected data reading is now displayed in the **Selected Fields** pane, as shown in the previous image. Click **OK** to exit the window.
6. In the **MWD Configuration Utility**, verify that your desired configuration has been made in the Mode 1 field. Click **Save Changes** button.

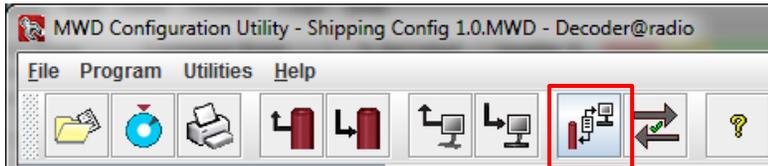


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7. In the toolbar, click **Send to both Tool and MWD Decoder** button.



8. Your chosen advanced data readings will appear on the Compass Rose screen after a few minutes (based on your configuration file).

**Note:** In the image below, the user selected the following Advanced Data readings: shock range (SHKR), vibration range (VIBR), and RPM range (RPMR).

