

# Model 9404 & 9504

*FastLab and LabMaster Systems Instruction Manual*



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## SAFETY RECOMMENDATIONS

To prevent fire or shock hazard, do not expose the unit to rain or moisture.

WARNING



**RISK OF ELECTRIC SHOCK!  
DO NOT OPEN THE ENCLOSURE!**

WARNING



**TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT REMOVE EXTERIOR PANELS. NO USER SERVICEABLE PARTS ARE INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.**

This symbol is intended to alert the user to special conditions concerning personal safety labeled “WARNING” and to situations that may damage the equipment or recorded data, labeled “CAUTION.”



This symbol is intended to alert the user to the presence of important operating and maintenance or servicing instructions in the literature accompanying the unit.



## INFORMATION

This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer’s instructions, may cause interference to radio and television reception. If this equipment does cause interference to radio reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

1. Relocate the equipment with respect to the receiving device.
2. Move the equipment away from the receiver, or vice versa.
3. Plug the equipment into a different outlet so that equipment and receiver are on different branch circuits.
4. If necessary, the user should consult the dealer or a factory-qualified service technician for additional suggestions.

WARNING



**TO PREVENT ELECTRIC SHOCK, DO NOT USE THE POLARIZED AC PLUG WITH AN EXTENSION CORD, RECEPTACLE OR OTHER OUTLET UNLESS THE BLADES CAN BE FULLY INSERTED TO PREVENT BLADE EXPOSURE.**

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## 1.0 PRELIMINARIES

### 1.1 PRECAUTIONS.

Please observe the following precautions when setting up and using the Model 9404 FastLab or Model 9505 LabMaster.

#### 1.1.1 On Safety

Operate the unit only on 85-265 vac, 40/440 Hz. A standard U.S. grounded cable is provided.

#### NOTE

When used on International power systems, be certain to verify the power and ground wiring adapters prior to applying power!

Unplug the unit from the wall outlet if it will not be used for an extended period of time. To disconnect the cord, pull it out by the plug. Never pull on the cord itself.

#### 1.1.2 Site Considerations

Since the FastLab and LabMaster are computer equipment, take the same precautions with it as you would a portable or laptop personal computer. Allow adequate air circulation to prevent internal heat buildup.

Do not setup or operate in close proximity to heat sources such as radiators or air ducts.

The unit, particularly the disk drives, has been designed for operation in a horizontal position. Do not operate it in an inclined position.

#### 1.1.3 Handling

The FastLab is a durable design and can be transported easily. However, avoid placing the FastLab and LabMaster in situations that will induce vibration.

### 1.1.4 Cleaning

Since The FastLab and LabMaster systems are computer equipment, use the same cleaning routine as you would for a personal computer. The FastLab and LabMaster systems are not watertight so do **NOT** let them get wet. Keep solvent type cleaners away from the front panel display or monitor. Care for the floppy drive and remote keyboard as you would for a personal computer.

#### 1.1.5 On Repackaging

Do not throw away the carton and packing materials if possible. They make an ideal container in which to transport the unit.

If you have any questions about this unit, contact your RS Technologies dealer or factory-qualified technician.

#### 1.1.6 Before You Begin

#### NOTE:

Notes are enclosed in shaded boxes.

Check the packing list to be sure that all accessories were shipped with your recorder.

To perform most operations, one or more keys are pressed separately in a row. These keystrokes are shown as: ! 1 2 3

Pressing one or more keys at the same time performs some other operations. These keystrokes are shown with "plus" signs as: C + A In some submenus, the arrow keys, Q R Y Z are used to move around a given menu in order to make a selection.

## 1.2 INTRODUCTION

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This introduction provides an overview of the manual and the FastLab and LabMaster instruments. The only difference is that the FastLab has an integrated display panel and is therefore more portable. Since they use the same software and have the same capabilities, the manual applies to both instruments.

### 1.2.1 How to Use This Manual

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It is recommended that each operator read through the entire manual to become completely familiar with the system. This manual is arranged to help you quickly find the information needed for the operation of the FastLab and LabMaster systems. The manual consists of the following sections.

- Preliminaries, Section 1.0, provides an introduction to the FastLab, LabMaster, and manual
- Preparation, Section 2.0, provides an overview of setting up the equipment
- Operation, Section 3.0, describes how to collect data and generate outputs
- Other Information, Section 4.0, contains additional information about the equipment and how it is used

### 1.2.2 Overview of the FastLab Model 9404 and LabMaster Model 9504

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The FastLab and LabMaster recorders are fully configurable for research and production applications. The following paragraphs provide an overview of how to use the FastLab and LabMaster.

#### 1.2.2.1 Data Recording

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These recorders feature four standard channels of bridge conditioning or high level signal input for measuring total input torque, clamping force, and thread torque, plus an auxiliary input channel for an additional device. Other devices may include displacement sensors, ultrasonic devices, etc. Angle encoder input is included with the input torque channel for measuring the angle of fastener rotation. The input channels can be programmed for different signal gains by placing a jumper inside of the DB-15 connector shell for the given channel. Refer to the tables in paragraph 1.3.

#### 1.2.2.2 Data Playback

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The FastLab and LabMaster systems generate several graphs including torque vs. angle, torque vs. time, and torque vs. clamp force plots. The numerical data can be printed on an Epson- or HP-compatible printer. Entry of report parameters is made using the remote keyboard.

#### 1.2.2.3 Data Storage

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Data can be stored on the internal hard disk drive, letting you store the test results in user-defined files or directories. A standard 3.5-inch floppy disk drive is provided to allow data archiving or to transfer the test results to other computers. Test reports can be archived in Microsoft Excel compatible form.

At any data write or data read menu, you have the choice to write or read the data from the current directory as shown at the bottom left of the menu screen, or to change to a new directory by selecting the Change Directory choice. The Change Directory choice prompts you to enter the full path to the desired directory. If the directory does not exist, you are asked if you want to create the directory. Once the directory has been changed, it becomes the default directory for all data write or read options. The new directory remains the default directory until changed or until the program is restarted where it defaults to the C:/9404 directory again. Being able to change to other directories on the hard drive allows test data, test setup files, and waveform files for a test to be stored in a unique directory.

#### 1.2.2.4 Menu Display

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Operation of these recorders is menu-driven. Every part of the program is accessible from the Main Menu that is displayed when the program is started. The basic submenus are selected by pressing the associated function key. Additional submenus are selected by pressing the appropriate numeric key. Each submenu lets you initiate an operation, enter setup information or make setup feature selections, or select data output. The user-friendly operational prompts let you take data and produce the output quickly.

**1.2.2.5 Other Convenient Features**

The software program lets you calculate the coefficients for thread friction, underhead friction, thread friction torque, and underhead friction torque. You can plot up to four user-defined automatic test torque and tension data points.

**1.3 CONNECTIONS**

In order to perform the data recording and playback operations with this equipment, the FastLab or LabMaster components, keyboard, and all inputs must be properly connected. The actual connections may vary due to the type of testing you will be performing and your system configuration.

Generally a rotary torque-angle transducer is connected to Channel 0 on the connector panel. The program dedicates this channel to input torque and angle signals. Channel 1 on the connector panel is dedicated to clamp force. Channel 2 on the connector panel is dedicated to thread torque measurements. Channel 3 is defined as the auxiliary channel and can be used as a low level mV/V or high level +10 vdc signal.

While Channel 1 is predefined as the clamp force channel, a torque sensor can be connected to its input. The engineering units are displayed as force but as long as the calibration is proper, the numbers will be accurate. It should be noted that Channel 1 ignores any negative going signal because it is dedicated to measuring force.

A parallel printer, either Epson LQ-compatible or Hewlett-Packard, connects to the LPT1 connector. The Utilities Menu provides a submenu for selecting the printer.

Tables 1-1 and 1-2 list data pertaining to their respective indicated channel inputs. Figure 1-1 and 1-2 illustrate the channel receptacle pinouts.

Table 1-1. Channel 0 Input	
<b>A. Load and Encoder Channel Pin Designations</b>	
Mating Connector	DB15 Male
Analog Inputs	Pins 1,2
Analog Excitation	Pins 9,10
Analog Shield	Connects to AGND
Encoder Input	Optional
Encoder Excitation	Pins 7,8
Encoder Input	Pins 14,15
Encoder Shield	Connects to DGND
Transducer Identification	Connect pin 1 of DS2401 to pin 8 of DB15; connect pin 2 of DS2401 to pin 6 of DB15 (requires Dallas Semiconductor DS2401)
<b>B. Analog Input Range</b>	
Jumper Position	Signal Level
3 & 12	Up to 2.5 mV/V
4 & 12	Up to 4.5 mV/V
None	Up to +10 vdc
11 & 12	Connect a low drift precision resistor for custom gains where gain = $(1+49400/Rg)$

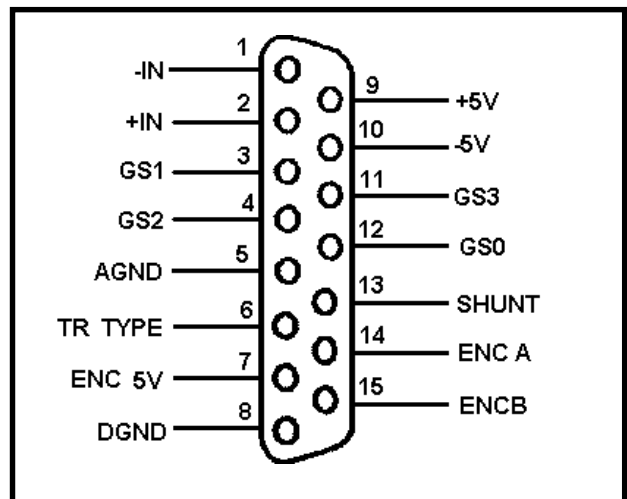


Figure 1-1. Channel 0 Pinouts

Table 1-2. Channel 1 Through 3 Inputs	
<b>A. Strain Channel Pin Designations</b>	
Mating Connector	DB15 Male
Analog Inputs	Pins 1,2
Analog Excitation	Pins 9,10
Analog Shield	Connects to AGND
Transducer Identification	Connect pin 1 of DS2401 to Pin8 DB15; connect pin 2of DS2401 to pin 6 of DB15(requires Dallas Semiconductor DS2401)
<b>B. Analog Input Range</b>	
Jumper Position	Signal Level
3&12	Up to 2.5 mV/V
4&12	Up to 2.5 mV/V
None	Up to +10 vdc
11&12	Connect a low drift precision resistor for custom gains where $gain = (1 + 49400/R_g)$

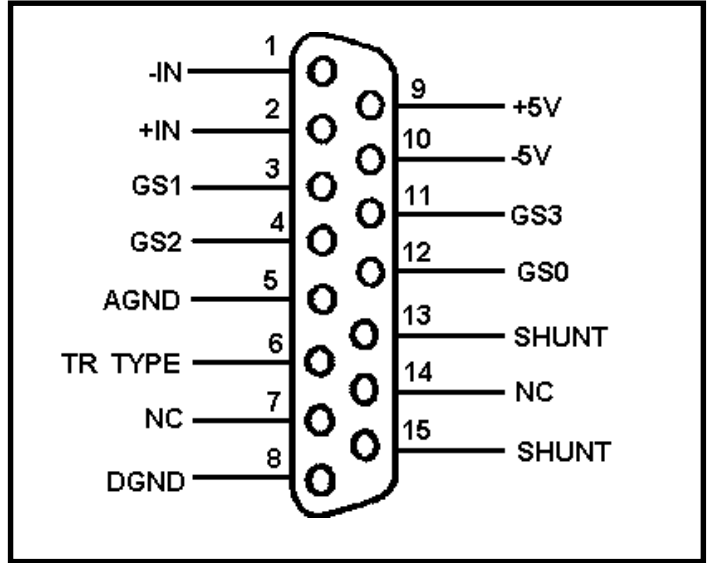


Figure 1-2. Channels 1-3 Pinouts



- **# : Calculate  $T_h$ ,  $T_t$ ,  $K$ .** This option is used for performing advanced analysis only when a torque-tension research head is being used. It allows graphing of such advanced analysis features as underhead friction torque, thread friction torque, torque-tension coefficient, etc.
- **\$ : Store Test to Limit Results.** This command stores the numerical data results of the last test that was run.
- **% : Print/Recall/Write Limit Results.** This set of commands lets you print numerical data limit results, save them to disk in a \*.RPT file format, recall previously saved results, or plot torque-tension statistics.
- **^ : Save/Recall Recorded Data to Disk.** This command saves the graphic data taken from the last test run to an ASCII data file in a \*.RST file format to be used with a plot program.
- **& : View/Print/Plot Recorded Data.** This selection lets you view, print, or plot the graphic data for the last rundown in memory. It is also used for multiple plot graphing.
- **\* : Utilities & Tool Definitions.** This selection lets you clear test results from memory, set engineering units (Nm, lb-ft, lb-in, etc.), define tools or torque-angle transducers, check calibration, set data and time, change password, perform diagnostics, or set the type of printer.
- **( : Directions: CW.** Pressing the ( key toggles between clockwise or counter clockwise mode for test recording.
- **Q : Exit Program.** This selection lets you quit the program and exit to DOS. To return to the program, type `d c` and press `E` at the DOS prompt.

## 2.4 SETUP MENU OVERVIEW (F2)

There are eight selections that can be accessed from the Setup Menu as shown in Figure 2-2. You can usually set up to record data by reviewing and making any necessary changes in the first six items contained in the Setup Menu, paragraphs 2.4.1 through 2.4.6. The remaining paragraphs let you save the setup, recall an existing setup, or jog the drive motor (if used).

- Select Tools/Transducers (para 2.4.1)
- Select Standard/ Locknut Test Mode (para 2.4.2)
- Select Tool Control Mode (para 2.4.3)
- Set Recording Parameters (para 2.4.4)
- Set Limits and Fastener Data (para 2.4.5)
- Set AutoPlot/ Real-Time Plot/ Save (para 2.4.6)
- Jog Motor (para 2.4.7.)
- Save Setup (para 2.4.8)



- Recall Setup (para 2.4.9)

Figure 2-2. Setup Menu

### 2.4.1 Select Tools/Transducers

This selection lets you select the tools and transducers to be assigned to the FastLab or LabMaster input channels for your test. After selecting this option, a chart is displayed that shows each input channel, the currently assigned transducer for each

channel, and whether the channel is enabled or disabled. You can then select a channel to disable or to which you want to assign a different transducer.

#### 2.4.2 Select Standard / Locknut Test Mode

This selection lets you select the test mode that is appropriate for your test requirements. Depending upon the test mode, you may be required to enter the specifications required to complete the test.

#### 2.4.3 Select Tool Control Mode

This option gives you the option of selecting one of four available tool control modes. The choices are as follows:

- **Manual** for use whenever you are not using the control signals from the computer to control the speed, torque, direction, or shutoff point of an electric or pneumatic tool, such as with a hand tool or power tool controlled by another device.
- **Electric-Return to Start** for use with an electric drive system controlled by the FastLab or LabMaster that will return the position it was in when the test was started. When you select this option, you are prompted to enter values for full scale speed and torque based on the capabilities of the drive.
- **Electric-Tighten Only** for use with an electric drive system controlled by the FastLab or LabMaster that will tighten to a shutoff point and hold position, such as when running a relaxation-type test to attain a given clamp load and not release immediately.
- **Pneumatic** for use only when using an RS Technologies Pneumatic Control Module in conjunction with your FastLab or LabMaster system, and you want to have the system control the pneumatic tool shutoff point.

#### 2.4.4 Set Recording Parameters

This selection lets you choose between recording versus time and recording versus angle, and also gives a variety of options based on either mode. It also gives options for electric tool control if one of the electric options was selected in the Select Tool Control Mode menu.

#### 2.4.5 Set Limits and Fastener Data

This selection lets you set torque and angle specification limits, set up to four points to read torque and obtain tension (or read tension and obtain torque), specify fastener data (customer, part number, job number, etc.) for report headings, and set tool control limits.

#### 2.4.6 Set AutoPlot/Real Time Plot/Save

This menu lets you set up the graphical interface for your test, and to select from a variety of AutoSave features.

#### 2.4.7 Jog Motor

This option is displayed only when using one of the electric tool control modes. It lets you jog the motor by using the computer keyboard. After selecting this option, enter the RPM at which you want to rotate the motor, and then enter the torque you want the motor to apply. Press **F** to spin the motor clockwise or **R** to spin the motor counterclockwise. Press **X** to stop the motor and exit the jog function.

#### 2.4.8 Save Setup

This option lets you save the current test setup information to disk into a file with a \*.SED extension. The filename is taken from the *Mfg. Part No* field in the Set Fastener Data portion of the program.

#### 2.4.9 Recall Setup

This option lets you recall a previously saved test setup file with a \*.SED extension from a list. The setup file contains all of the information used to run your test, such as which transducers were used, which plot functions and values were entered, the test mode, the record mode and associated parameters, the limits and fasteners data, and more.

### IMPORTANT

Before recalling a saved setup file, be sure to clear limit results from memory by pressing \* 1 1 from the Main Menu.

## 2.5 UTILITIES MENU OVERVIEW

The Utilities Menu is displayed after you press \* from the Main Menu. It lets you select from the following as shown in Figure 2-3:

- Clear Results From Memory (para 2.5.1)
- Set Engineering Units (para 2.5.2)
- Define Tools/Tq & Angle Transducers (para 2.5.3)
- Define Transducers (para 2.5.4)
- Calibrate Tools/Transducers (para 2.5.5)
- Check Calibration (para 2.5.6)
- Set Date and Time (para 2.5.7)
- Change Password (para 2.5.8)
- Diagnostics (para 2.5.9)
- Set Graphics Printer (para 2.5.10)



Figure 2.3. Utilities Menu

### 2.5.1 Clear Results From Memory

This selection lets you clear the current limit results data or the MultiPlot data from their respective memory buffers. This data is retained through power-down/power-up cycles until cleared either by accessing this screen, when a different test setup is recalled, or when the MultiPlot feature is disabled during the test setup process.

### 2.5.2 Set Engineering Units

This selection lets you establish the engineering units used for the torque measurement. The related units for force and dimensions are automatically chosen. For example, if English units, such as lb-ft are chosen, force will be labeled as pounds, and dimensions as inches. If SI units are chosen, such as Nm, force will be in Newtons and dimensions in millimeters.

### 2.5.3 Define Tools/Torque & Angle Transducers

This selection lets you define the torque-angle or torque-only transducers that will be used with Channel 0 during testing. You are prompted to enter values for the following fields when defining a torque-angle sensor:

- **Tool Name.** This may be the capacity of the tool or special ID number as desired.
- **F.S. Torque.** This is the full scale of the transducer.
- **Cal Torque.** This is the calibration value provided by the manufacturer or calibration lab.
- **Tq Precision.** This represents the number of places to the right of the decimal point.
- **Pulses per Rev.** This represents the pulses per revolution.
- **Angle Precision.** This represents the number of places to the right of the decimal point.

### 2.5.4 Define Transducers

This selection lets you define the transducers that will be used with Channels 1 through 3. Since Channel 1 is typically used to measure clamp force, the units for full scale and calibration will be in terms of force (lbs, N, or Kg). Otherwise, the entries are similar to those for torque-angle sensors (refer to para 2.5.3 above) with the exception of the angle characteristics.

### 2.5.5 Calibrate Tools/Transducers

This selection lets you assign and calibrate a transducer to a given channel either automatically through the use of a calibration resistor, or manually

by applying a known force or torque. First, you select the channel you want to calibrate. Then, you select the type of calibration. Simply follow the prompts to complete the calibration.

### 2.5.6 Check Calibration

This selection lets you check the calibration of the connected tools or transducers without changing the transducer. You select the channel you want to calibrate, and then system does the rest.

### 2.5.7 Set Date and Time

This selection lets you change the date and time should they ever require updating. Simply access the screen from the Utilities Menu and follow the prompts to make the desired changes.

### 2.5.8 Change Password

This selection lets you protect the setups and transducer data that has been entered into the system through use of a password. The default password is "12345" and can be reset to any desired 6-digit password.

### 2.5.9 Diagnostics

This selection lets you perform a calibration (similar to that described in paragraph 2.5.6), observe the raw analog transducer inputs, read the angle encoder, or print the current program settings.

### 2.5.10 Set Graphics Printer

This selection lets you select the printer drive that is compatible with the printer you are using with the local printer port. Available printer types include most common Epson- and HP-compatible bubble-jet, ink-jet and laser printers.

## 2.6 FILE TYPES

The FastLab and LabMaster use three main types of files in addition to the operating files. They are as follows:

- The \*.SED file (para 2.6.1)
- The \*.RPT file (para 2.6.2)
- The \*.RST file (para 2.6.3)
- The MRUN.PRN file (para 2.6.4)

### 2.6.1 \*.SED File

A file with a \*.SED extension is used to store setup information for a particular type of test. It is named by entering an eight character (or less) name in the *Mfg. Part No* field in the Set Fastener Data portion of the program (refer to the paragraph 3.5). To do so from the Main Menu, press @ 5 4. After the \*.SED file is named and the test setup is complete, it should be saved to disk by pressing @ and 8 from the Main Menu. If you want to run the same type of test at a later date, you can simply recall the setup file from a list by pressing @ 9 1 from the Main Menu.

### 2.6.2 \*.RPT File

A file with the \*.RPT extension is used to hold the results of the tests you run and the statistical summary data for the test. It is named by typing in an eight character (or less) name in the *QC Lot No field* in the Set Fastener Data portion of the program (refer to paragraph 3.5). As you run your tests, you can save the results to the limit results table by pressing \$. After your tests are complete, you can save the limit results table to disk by pressing % 2 1 or by printing it out by pressing % 1. Previously saved test results can be retrieved by pressing % 3 1 and then picking which file you want from a list. When the limit results table is saved to disk, the current test setup in memory is saved with it, so that when you retrieve the limit results, the setup is saved at the same time.

### 2.6.3 \*.RST File

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A file with the \*.RST extension is used to store all of data points taken during a test and is used with the plot program to generate graphs. Unlike the \*.RPT file, which only holds a few select points, such as the peak torque, peak angle, etc. the .RST file hold every sample obtained during the course of the rundown.

After you run a test in the manual save mode, you are given the option to save the rundown to disk by pressing ! . After choosing the directory to which you want to save, you will be given the option of creating a new file or saving to an existing file. By choosing an existing file name from the list, you can append rundowns (max of 30) so that you have more than one in that same file. If you do choose to append, be sure that the same record mode was used (record vs. time or record vs. angle), and that the same channels were enabled during the test in order to prevent corruption of the data (\*.RST file).

To run the plot program and view your data graphically, exit the program by pressing Q at the Main Menu, and then type PLOT and press E at the DOS prompt.

### 2.6.4 MRUN.PRN File

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The MRUN.PRN file is a temporary file where the software stores the MultiPlot file data. It remains available until you choose to erase the data in the Utilities Menu or redefine the configuration of the MultiPlot feature in the Setup Menu. If you want to save this file for future use, quit the program and use standard DOS or Windows commands to rename the file giving it a different name. To access the file at a later time, rename it as MRUN.PRN before starting the test program.

## 2.7 IMPORTANT DATA BUFFERS

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There are two data buffers that are used with the program, the results buffer and the MultiPlot buffer. They are described below.

### 2.7.1 Results Buffer

---

This buffer is created to store the numerical data collected while recording. Accessing the clear function in the Utilities Menu clears this buffer. The information in this buffer is stored automatically or manually in the \*.RPT file described in paragraph 2.6.2.

### 2.7.2 MultiPlot Buffer

---

This buffer contains the graphic data recorded when the MultiPlot feature is enabled. The type of data that is collected is determined when the feature is first enabled. The data in this buffer is cleared manually by accessing the Clear Memory function in the Utilities Menu. MultiPlot data is also cleared if you disable the MultiPlot feature, or when you recall another setup file (\*.SED). If you want to save the MultiPlot data, refer to paragraph 2.6.4.

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## 3.0 OPERATION

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### 3.1 GENERAL INFORMATION

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This section provides details on operating the Model 9404 FastLab and Model 9504 LabMaster.

The main paragraphs are as follows:

Tool Setup (para 3.2)

Transducer Calibration (para 3.3)

Recalling Existing Test Setups (para 3.4)

Edit Test Setups (para 3.5)

Recording Data (para 3.6)

Motor Operation (para 3.7)

Saving Data Manually (para 3.8)

Graphic Data (para 3.9)

Limit Results (para 3.10)

Recalling Previous Data (para 3.11)

Calculate Th, Tt, and K (para 3.12)

Clearing Data (para 3.13)

Changing Engineering Units (para 3.14)

Resetting Time and Date (para 3.15)

Changing Password (para 3.16)

Set Graphics Printer (para 3.17)

Maintenance and Troubleshooting (para 3.18)

### 3.2 TOOL SETUP

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The procedure for setting up a new transducer or tool is outlined below. You may enter setup data for up to 10 torque-angle transducers for use with Channel 0, and up to five transducers each for Channels 1 through 3. You will need the calibration data for the transducers or tools when you make the entry so be sure that you have the transducer calibration certificate.

#### 3.2.1 Setting Up A Torque-Angle Sensor

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Use this procedure to set up a torque-angle sensor for use with Channel 0. A torque-only transducer may also be set up for this channel if desired.

1. Access the Utilities Menu from the Main Menu by pressing \* .
2. Press 3 to define a torque-angle sensor for use with Channel 0.
3. When you are prompted for the password, enter the password and press E .

4. Use the arrow keys to move the selection box to the tool that you want to set up and press E .
5. You are first prompted for the name of the transducer. You may choose to identify the transducer by its capacity or special ID number. Enter an appropriate name and press E .
6. You are next prompted for the full scale value of the transducer. Enter this value and press E .
7. You are next prompted for the calibration value of the transducer. Enter this value and press E .
8. You are next prompted for the precision of the transducer. This will be the number of places to the right of the decimal point. Enter this value and press E .
9. You are next prompted for the pulses per revolution of the transducer. If selecting to set up a torque-only sensor, enter 0. Enter this value and press E .
10. You are next prompted for the precision of the angle measurement. This will be the number of places to the right of the decimal point. Enter this value and press E to return to the Utilities Menu.

#### 3.2.2 Setting Up Other Transducers

---

Use the following procedure to set up transducers for use on Channels 1 through 3. Typically, a fastener tension load cell is used in Channel 1, with data labeled in terms of force (lbs. or N); a thread torque sensor is used in Channel 2, with data labeled in terms of torque (lb-ft, Nm, etc.); and some other device in Channel 3. The entries are the same but will have torque or force labels associated with them.

1. Access the Utilities Menu from the Main Menu by pressing \* .

2. Press 4 to define a transducer for use with Channels 1 through 3.
3. When you are prompted for the password, enter the password and press E .
4. Press 1 to define a transducer for Channel 1, press 2 to define a transducer for Channel 2, or press 3 to define a transducer or other type of device for Channel 3.
5. Use the arrow keys to move the selection box to the transducer that you want to set up and press E .
6. You are first prompted for the name of the transducer. You may choose to identify the transducer by its capacity or special ID number. Enter an appropriate name and press E .
7. You are next prompted for the full scale value of the transducer. Enter this value and press E .
8. You are next prompted for the calibration value of the transducer. Enter this value and press E .
9. You are next prompted for the precision of the transducer. This will be the number of places to the right of the decimal point. Enter this value and press E to redisplay the Define Transducers Menu.
10. You can choose to enter setup data for another transducer for the same or another channel or simply press X to return to the Utilities Menu.

### 3.3 TRANSDUCER CALIBRATION

The FastLab and LabMaster let you perform a calibration in two different ways. One is an automatic shunt calibration where a precision resistor of a known value is “shunted” across the +power and +signal leads of the transducer to simulate a load. The other is called a manual calibration where a known load is actually placed on the transducer via deadweights or a reference standard load cell. Refer to paragraph 3.3.1 for a procedure for automatic calibration and to paragraph 3.3.2 for manual calibration.

#### 3.3.1 Automatic Calibration

Use the following procedure to assign a transducer to a channel and perform an automatic “shunt” calibration.

1. From the Main Menu, press \* to select the Utilities Menu.
2. From the Utilities Menu press 5 to select calibration.
3. When prompted, enter the password and press E .
4. Select the channel of the transducer that will be calibrated by pressing the associated number as displayed.
5. Select the tool that will be assigned to the channel and calibrated.
6. Press 1 to select automatic shunt calibration.
7. Make sure that no load is on the transducer and press E .
8. The recorder will take the zero reading and then the shunt calibration reading. It will then inform you of the calibration results.

#### 3.3.2 Manual Calibration

Use the following procedure to assign a transducer to a channel and perform a manual calibration.

1. From the Main Menu, press \* to select the Utilities Menu.

2. From the Utilities Menu press 5 to select calibration.
3. When prompted, enter the password and press E .
4. Select the channel of the transducer that will be calibrated by pressing the associated number as displayed.
5. Select the tool that will be assigned to the channel and calibrated.
6. Press 2 to select manual calibration.
7. Enter the first (or only) load point and press E .
8. Press # to record the point and end the calibration or press E to continue taking additional points (up to 5).
9. When all calibration points are taken, the Fast-Lab or LabMaster will inform you of the results.

### 3.3.3 Check Calibration

Use the following procedure to check the calibration of the transducers already assigned to the enabled channels without making any other changes.

1. From the Main Menu, press \* to select the Utilities Menu.
2. From the Utilities Menu press 6 to check calibration.
3. Select the channel of the transducer that will be calibrated by pressing the associated number as displayed.
4. Make sure that no load is on the transducer and press E .
5. The recorder will take the zero reading and then the shunt calibration reading. It will then inform you of the calibration results.

### 3.4 RECALLING AN EXISTING TEST SETUP

Refer to the following procedure to recall a previous test setup for use or modification.

1. Access the Setup Menu from the Main Menu by pressing @.
2. Press 9 to select the Recall Setup Menu.
3. Either press 1 to recall a test setup from the current directory or press 2 to change the directory. If you chose to change the directory simply enter the complete path and filename and press E . The Recall Setup menu is redisplayed so that you can press 1 to recall the setup.
4. Use the up or down arrow key to move the selection box through the list of available test setups. When the desired test setup is boxed, press E .
5. The Setup Menu is redisplayed. You may then use the test setup as it exists or modify it as needed.

#### NOTE

It is always a good idea to briefly review a test setup prior to using it.

### 3.5 EDIT TEST SETUPS

The recommended procedure for setting up a test is outlined below. After the engineering units are properly selected, the process is basically a review of the selections and entries made in the Setup Menu, Selections 1 through 6.

1. To ensure that the desired engineering units are selected, access the Utilities Menu from the Main Menu by pressing **\***. Then press **2** to reach the Set Engineering Units screen. Press **E** to cycle through the available selections (Nm, Kgm, Lb-in, and Lb-ft) or press **X** to return to the Utilities Menu. Then press **X** to return to the Main Menu.
2. Access the Setup Menu from the Main Menu by pressing **@**.
3. Press **1** to review the Select Tools & Transducers Menu to ensure that the channels are enabled and the transducers for each channel are correctly assigned.
4. To assign a new transducer, press the number of the channel (displayed at the far left of the line that you want to change).

5. Press **1** to toggle the channel on or off or press **2** to choose from a list of available transducers for that channel.
6. Use the arrow keys to move the selection box to highlight the transducer you want to assign and press **E** to return to the previous menu.

#### NOTE

All input channels can be turned off except for the input torque channel. A tool or transducer must first be defined in the Utilities menu to be available for selection (refer to either paragraph 3.2.1 or 3.2.2).

7. Press **2** to review the Select Standard/Locknut Test Mode Menu to ensure that the desired test analysis mode is selected and that the parameters pertaining to it are correctly programmed. The system then prompts you to clear previously obtained limit results or MultiPlot file data from memory. It is always a good idea to clear this data before running any tests using a different mode. Make your test mode selection based on the descriptions provided below.

- **Standard.** This is the standard analysis mode used for testing fasteners that have no prevailing torque features.
- **Locknut-No Clamp Load Attained.** This is used for testing only the thread torque on a fastener. You need to specify the number of degrees you want to travel up the fastener (*Max Angle*), and the *Start Window* in degrees. If the *Start Window* is set to zero, then the *Breakthrough Torque* is not calculated. If the *Start Window* is greater than zero, the *Breakthrough Torque* will be found as the maximum torque within the specified range. This test automatically sets the recording threshold to a negative number so that both data recording and the maximum angle count begin immediately. Refer to Figure 3-1 for an illustration of the Locknut Setup Parameters.
- **Locknut-Attaining Clamp Load.** This test

reads data in the “on” direction and stops when it reaches the clamp load level specified in the Set Control Limits portion of the program (under the Set Limits and Fastener Data section). It then reads data in the “off” direction until the fastener returns to its original position. This test automatically sets the input torque threshold to a negative value. This allows recording of data immediately when the recording starts. The Number of Cycles defaults to 1. Multiple cycles can be selected but each cycle is considered a sample for statistics. When this option is selected, you are prompted for the following test parameters (refer to Figure 3-1):

- ◆ Tension Threshold Multiplier = 0.10
- ◆ On Torque End Angle = 180
- ◆ Off Torque Start Angle = 180
- ◆ Start Window = 0

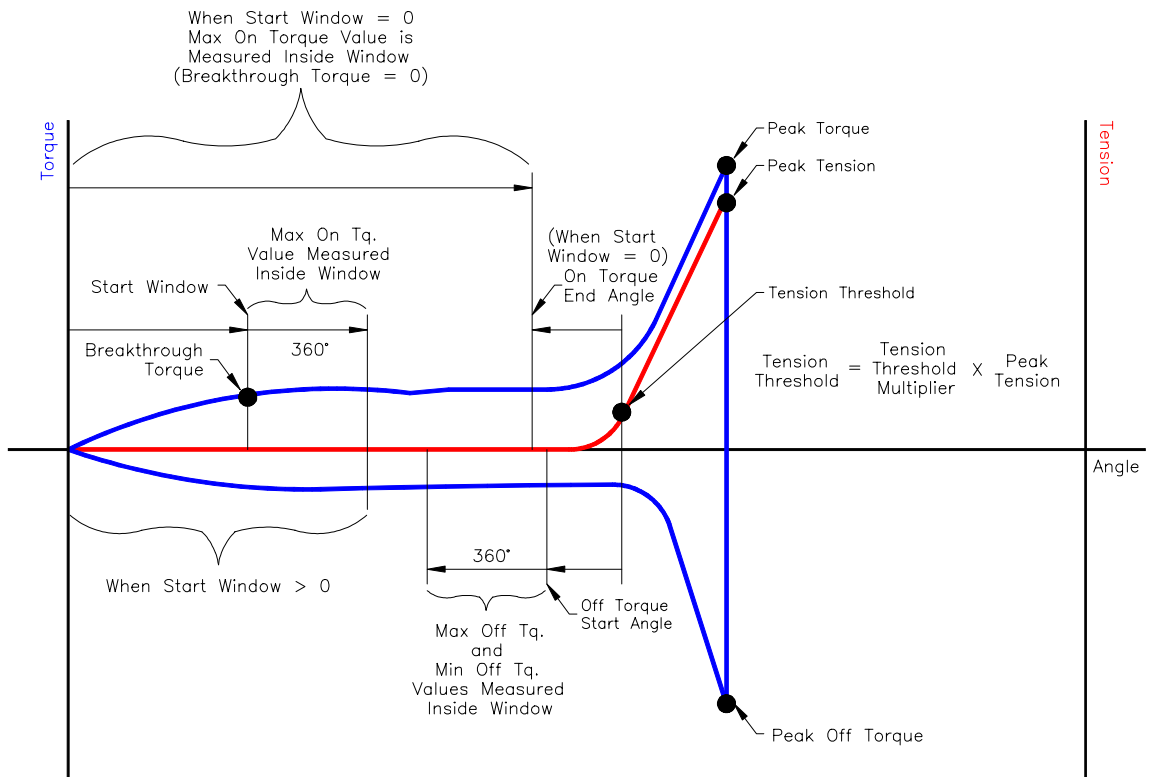


Figure 3-1. Locknut Parameters Illustrated

These values are the factory default values and may be suitable for many test setups. Each value can be changed to ensure that prevailing torque values do not include the aligning zone when clamping. The end of the *On Torque Measurement* window is defined as a number of degrees away from a tension reference point. The *Tension Threshold Multiplier* value determines this reference point on the clamp force waveform. The number of degrees away from this reference point should be enough to ensure that the fastener is not in the clamping region. The tension reference point is determined by multiplying the clamp load shut-off value by the *Tension Threshold Multiplier* ( $Tension\ Threshold = Tension\ Threshold\ Multiplier \times Peak\ Clamp\ Force$ ).

When the *Start Window* value is set to zero, the program includes the on-torque readings from the start of motion to the end of the measuring window. No *Breakthrough Torque* will be calculated in this mode. Setting the *Start Window* to a number greater than zero will enable the measuring of *Breakthrough Torque*. The number entered here is the number of degrees from the start of motion in which the peak breakthrough torque will be measured (refer to Figure 3-1). After the fastener has been rotated that number of degrees, the prevailing on-torque measurement begins and lasts for 360 degrees of rotation. The breakthrough value will be reported on the Limit Results report if these readings are stored to memory.

- **Locknut-IFI Specifications.** This test defaults as a five-cycle locknut test where data is taken on the first and fifth cycles. The first cycle goes to clamp; the remaining cycles do not go to clamp. This option lets you change the *Number of Cycles* value to allow reporting of other than the fifth off reading. If you change the number of cycles to 3, the program will cycle the fastener three times and

report the first on and third off readings. Each group of cycles (three as just mentioned) counts as one sample for statistics of the sample is stored to memory.

When selecting this option, you are prompted for several parameters, including *Tension Threshold Multiplier*, *ON* and *OFF Torque Angle*, and *Start Window* angle (refer to Figure 3-1). These parameters have the same factory default values as described in the Locknut Attaining Clamp Load notes above. These values may be changed to allow proper measurement of the prevailing torque. This recording mode turns off the AutoPlot feature and selects the AutoSave Limit Results Only and the AutoSave feature. It also sets the torque threshold to a negative number.

- **Locknut-Chrysler.** This is the same as the Locknut IFI test described above, except that *each* cycle goes to clamp.
- **Yield Determination.** This feature is based on a General Motors specification that requires data be recorded versus angle. When yield determination is selected, the user is prompted to enter three values. The first two represent points on the rising slope of the clamp force curve (30 and 80 percent are the default values). These are used to draw a straight line back to zero angle. The third value is the number of degrees used to offset the straight line (30 degrees is the default value). Note that the default values for the three parameters are specified by the test specification upon which the feature is based.

The intersection of the straight line with the clamp force curve at the upper end is used to indicate the yield point. In the case where the fastener is taken to fracture, the feature displays the number of degrees from yield to failure which is an indication of the angular ductility of the fastener.

- **Joint Rate Simulator.** This is a special feature used only by special test stands used for power tool calibration. Information on use of this feature is provided with those test stands.
  - **Wheel Nut Test.** This feature is used for special testing on threaded fastener test systems that are configured for wheel nut testing. Information on this feature is supplied – with those test stands.
  - **Wear Test.**
  - **Static Cycle Test.**
8. Press 3 to review the Select Tool Control Mode Menu to ensure that the selected control mode matches the system and test configuration. This option gives you the option of selecting one of four available tool control modes. The choices are described in the notes below.
- **Manual.** Use this mode whenever you are not expecting a control signal from the computer to control the speed, torque, direction, or shutoff point of an electric or pneumatic tool.
  - **Electric-Return to Start.** This is the mode you normally select when using an electric drive system controlled by the FastLab or LabMaster. The electric drive system simplifies running your tests, especially five-cycle tests like IFI and Chrysler, as all parameters, such as speed, direction, torque, clamp force, angle, and shutoff, are under the direct control of the computer. When you select this option, you are prompted to enter values for full scale speed and torque based on the capabilities of the drive. If you are unsure of which values to enter, please contact RS Technologies for assistance.
  - **Electric-Tighten Only.** This mode is used when running a relaxation-type test to attain a given clamp load and not release immediately.
  - **Pneumatic.** Use this mode only if using an RS Technologies Pneumatic Control Module in conjunction with your FastLab or LabMaster system, and want to have the system control the pneumatic tool shutoff point.
9. Press 4 to review the Set Recording Parameters Menu and ensure that the recording parameters are properly set to conform to the test requirements. Press 1 to toggle between recording versus time and recording versus angle. Then press E to continue and enter the parameters that are required to test versus that recording base. The options are as follows.
- **Record vs. Time.** This recording mode takes a data point approximately every 0.2 milliseconds. You will be prompted for the following parameters.
    - ◆ **Full Scale Time (sec.)** Set this value to slightly more time than you expect you test to take, based on drive speed, threshold, and advanced trigger percent. Remember that a locknut test must be given enough time to go up and back on the fastener.
    - ◆ **Advanced Trigger Time (%).** This field is a percentage of the full scale time for which you want to see data prior to the threshold point being reached. For example, if the *Full Scale Time* is set as 10 seconds, *Advanced Trigger* as 10%, and *Threshold* as 10 Nm, while the fastener is being tightened, all data is read by the computer. When the torque threshold point of 10 Nm is reached, the computer retains one second of data prior to the event (10% of 10 seconds) and continues to record data for an additional nine seconds.
    - ◆ **Threshold.** This field establishes the point when data recording starts (excluding the *Advanced Trigger* percent), and is the zero reference point for angle. The *Threshold* is usually set to a positive number for testing standard fasteners, and to a negative number for locknut

testing so that data recording begins immediately.

- ◆ **Number of Cycles.** Set this field to the number of test cycles to run on the same fastener. This number is usually set to one unless running the IFI test, the Chrysler test, or some other specialized test mode.

#### NOTE

The following five parameters are available only when operating in the Electric Tool Control Mode.

- ◆ **Rundown RPM.** This field sets the speed at which you want the electric tool to run **before** the torque threshold point is reached.
- ◆ **Tightening RPM.** This field sets the speed at which you want the electric tool to run **after** the torque threshold point is reached.
- ◆ **Torque.** This field sets the maximum amount of torque you want to allow the electric tool to apply during the test. This value is used in order to protect the connected transducers during testing, and is not to be confused with the *Torque Control Limit* that actually stops tool movement.
- ◆ **On Dwell Time (sec).** This option is used primarily for locknut testing to allow the fastener to cool down. It represents the amount of time the tool pauses after tightening before returning to its origin.
- ◆ **Off Dwell Time (sec.)** This option is used primarily for cycle testing, such as IFI, Chrysler, etc. to allow the fastener to cool down between cycles. It is the amount of time the tool pauses between cycles after returning to its origin.
- **Record vs. Angle.** This recording mode takes a data point approximately every 0.25

degrees (depending upon angle resolution). It contains the following selections:

- ◆ **Full Scale Angle (deg).** Set this value to slightly more angle than you expect your test to take, based on threshold and advanced trigger percent.
- ◆ **Advanced Trigger Angle (%).** This field represents a percentage of the full scale angle for which you want to see data prior to the threshold point being reached. For example, if the *Full Scale Angle* is set as 100 degrees, *Advanced Trigger* as 10%, and *Threshold* as 10 Nm, while the fastener is being tightened, all data is being read by the computer. When the torque threshold is reached, the computer retains 10 degrees of data prior to the event (10% of 100 degrees) and continues to record data for an additional 90 degrees of turn.
- ◆ **Threshold.** This field sets the point where data recording starts (excluding any advanced trigger percentage). The threshold is usually set to a positive number for testing standard fasteners, and to a negative number for Locknut testing so that data recording begins immediately.
- ◆ **Cycle Complete.** This value is used to determine test completion. The test ends when the torque has dropped below the *Cycle Complete* value for the amount of time specified by the *Cycle End Time*.
- ◆ **Number of Cycles.** Set this value to the number of test cycles to run on the same fastener. This number is usually set to a one unless a specialized test mode is required.

#### NOTE

The following five parameters are available only when operating in the Electric Tool Mode.

- ◆ **Rundown RPM.** This field sets the speed at which you want the electric tool to run prior to the threshold point being reached.
  - ◆ **Tightening RPM.** This field sets the speed at which you want the electric tool to run after the threshold point is reached.
  - ◆ **Torque.** This sets the maximum amount of torque you want the electric tool to apply during the test. This value is used in order to protect the connected transducers during testing, and is not to be confused with the *Torque Control Limit* that actually stops tool movement.
  - ◆ **ON Dwell Time (sec).** This field is primarily used for locknut testing to allow the fastener to cool down. It represents the amount of time the tool pauses after tightening before returning to its origin.
  - ◆ **OFF Dwell Time (sec).** This field is primarily used for cycle testing, such as IFI, Chrysler, etc., to allow the fastener to cool down between cycles. It is the amount of time the tool pauses between cycles after returning to its origin.
10. Press 5 to review the Set Limits and Fastener Data Menu to ensure that all entries are suitable for the test. This menu lets you set torque and angle specification limits, set up to four points to read torque and obtain tension (or read tension and obtain torque), specify fastener data (customer, part number, job number, etc.), and set tool control limits. These options are explained below.
- **Set Torque Limits.** Press 1 to enter the torque specification limits for the fastener under test. These values are used in the statistics calculations to determine if the results are in range, to find the  $C_{pk}$ , and are also printed out on the Limit Results table as part of the test report.
  - **Set Angle Limits.** Press 2 to enter the angle specification limits for the fastener under test. The angle is measured from the torque threshold to the point at which peak torque is reached. These values are used in the statistics calculations to determine if the results are in range, to find the  $C_{pk}$ , and are also printed out on the Limits Results table as part of the test report.
  - **Set Clamp Force Points.** Press 3 to set clamp force points (this option is displayed only when the clamp force channel is enabled). First, you are prompted to either specify the tension points at which to find the torque, or the torque points at which to find the resultant tension. Next, you are prompted to enter up to four points that are within the range of torque or tension you expect to achieve during your test. These points are displayed as columns of data on your Limit Results printout. These data points are used to construct the statistics graph.
  - **Set Fastener Data.** Press 4 to enter the data that is displayed and printed on your graphs and test reports, some of which are used as the names of files.
    - ◆ **Customer.** Enter the name of your customer (up to 20 characters) and press E . This name is printed out on test reports.
    - ◆ **Customer Part No.** Enter the customer part number (up to 14 characters) and press E . The number entered here is displayed on graphs, test reports, and on the lower right corner of the status screen.
    - ◆ **Mfg. Part No.** Enter the manufacturer's part number (up to eight characters) and press E . This number is the name of your set up test file that is then given a .SED extension when saved to disk (to save, press @ 8 from the Main Menu).

The setup file contains all of the current settings (torque, angle, control limits, full scale time, advanced trigger percentage, etc.) and can be retrieved at a later date by pressing @ 9 1 from the Main Menu when you wish to run the same sort of test. Since it is used as a DOS filename, the manufacturer's part number should not contain spaces, forward slashes, back slashes, commas, or periods.

- ◆ **Mfg. Job No.** Type in the manufacturer's job number (up to 14 characters) and press E . This item is displayed on test reports.
- ◆ **Operator.** Type in the operator's name (up to nine characters) and press E . This item is displayed on test reports.
- ◆ **QC Lot No.** Type in the quality control lot number (up to eight characters) and press E . This is the name of your test report that is given a \*.RPT extension when saved to disk (to save, press % 2 1 from the Main Menu). The report file contains all of the limits results from the test you run, and the set up information that was used to run the test. Since it is used as a DOS filename, the QC Lot Number should not contain spaces, forward slashes, back slashes, commas, or periods.
- **Set Control Limits.** Press 5 to set the shut-off control limits that control where the test will terminate by entering a value for torque, angle, or tension. In the electric tool control mode, the tool movement stops when the control limit is reached. In the manual control mode, data collection is not affected by these parameters. If you are using a pneumatic tool in conjunction with an RS Technologies Pneumatic Control Module and are operating in pneumatic tool control mode,

the tool shuts off when the torque control limit is reached.



### IMPORTANT

Only one control limit should be enabled while the other two are set to zero. The tension limit is not displayed if the clamp force channel is turned off. Setting a control limit to zero disables it.

11. Press 6 to review the Set AutoPlot/Real Time Plot/Save Menu to ensure that the proper plotting and saving parameters are selected. This menu lets you set up the graphic interface for your test, and to select from a variety of automatic save features.
  - **Auto Plot OFF (or ON).** The AutoPlot feature is the plot that is displayed immediately after a test is run. It scales itself according to the maximum and minimum values obtained for torque, angle, tension, time, etc. during the test. If "OFF" is displayed, press 1 if you want to turn it on, and select from a list of available graphs. If ON is displayed, press 1 if you want to turn it off. If you want to change the current AutoPlot setup, turn it off then on again to reconfigure it.

### NOTE

Auto Plot should be turned off when running a specialized cycle test like IFI or Chrysler. It is automatically turned off when one of these test modes is selected.

- **Real-Time Plot OFF (or ON).** The Real-Time Plot is displayed while you are performing your test. The X-axis automatically defaults to angle or time depending on which recording mode is selected, but you must you must pick the parameter (torque,

tension, etc.) that you want displayed on the Y-axis, and also must input a number for the upper limit on the Y-axis. If OFF is shown, press 1 if you want to turn it on and specify the Y-axis values. If ON is displayed, press 1 if you want to turn it off. If you want to change the current Real-Time Plot setup, turn it off then on again to reconfigure it.

- **Multiple Rundown Plotting OFF** (or ON). Also known as MultiPlot, this is a graphing option that lets you put one or more plots (with a recommended maximum of ten) on the same graph within the FastLab or Lab-Master program. You are first prompted to select a parameter to plot on the X-axis and then you must enter an X-axis offset. The first plot starts at the origin, while subsequent plots are offset from each other by the value you give to the X-axis offset (setting the offset to zero makes all plots start at the origin). Next, you must specify the parameter to display on the Y-axis. If Off is shown, press 1 if you want to turn it on, and then specify the MultiPlot parameters. If ON is displayed, press 1 if you want to turn it off. MultiPlot creates a temporary file in DOS call MRUN.PRN where it stores its plots. This file is erased when the MultiPlot file is cleared (by pressing \* 1 2 from the Main Menu), so for more permanent storage of your graphs, save your rundowns to a \*.RST file instead of the MultiPlot file. The MultiPlot file should be cleared before attempting to store plots of a different nature (i.e., time on X-axis instead of angle, etc.). To store rundowns to a MultiPlot file, press @ when prompted after running your tests in the manual save mode.

#### NOTE

MultiPlot should be turned off when running a specialized cycle test like IFI or Chrysler. It is automatically turned off when one of these test modes is selected.

- **Select Automatic Save Function.** After selecting this option, press 1 to toggle through the various AutoSave modes. When the one you want is displayed, press X to return to the previous menu. The selections are as follows:
    - ◆ **Manual.** In this mode, you must manually save your results to disk after running tests by pressing ! to store the rundown to a \*.RST file and by pressing \$ to save the limit results.
    - ◆ **AutoSave Limit Results Only.** In this mode, the limit results are automatically saved to memory after running a test. This mode is automatically turned on when running a specialized cycle test like IFI or Chrysler.
    - ◆ **AutoSave Rundown to File Only.** In this mode, the data rundown from the test is automatically saved to a \*.RST file after the test has been run. Prior to running your test, you are prompted to enter a name for the \*.RST file.
    - ◆ **AutoSave Limits and Rundown.** In this mode, the limit results are automatically saved to memory and the data rundown from the test is automatically saved to a \*.RST file after the test is completed. Prior to running the test, you are prompted to enter a name for the \*.RST file.
12. After making changes to the test setup, you should save the test setup by pressing 8 from the Setup Menu. The setup is saved as the file named after the *Mfg. Part No.* field in the Set Fastener Data portion of the program. You can then press 1 to save the setup to the current directory or press 2 to change directories.
  13. After saving your changes, press X to return to the Main Menu.

### 3.6 RECORDING DATA

Since the FastLab and LabMaster are such versatile recorders with many programmable features, it is difficult to anticipate each possible test requirement. Therefore, the following procedure is very general.

1. Once the test setup is complete, make sure that the test parts are properly fixtured.
2. If new or different transducers or load cells are being used, make sure that you have followed a complete calibration routine for each.
3. To RESET the zeros on all enabled channels, press ! from the Main Menu.
4. Make sure the correct rotational direction is chosen (CW or CCW). Press ( to change direction.
5. If the FastLab or LabMaster will be controlling the test, make sure the FastLab Control Module is powered-up and set for automatic operation.
6. Press r t to begin the test. If an automatic storage was selected, enter the filename
7. Rundown the fastener as required.
8. If the automatic save feature is not enabled, save the data as needed.
9. Refer to paragraph 3.9 for details on viewing or plotting graphic data, or 3.10 for limit results.

### 3.7 MOTOR OPERATION

If the connected drive motor is used in the automatic mode, all motor control is handled by the test computer and motor servo. In some situations, it may be desired to jog the motor using manual control. You can do so by using the computer keyboard or the Servo Control Panel.

#### 3.7.1 Jog Motor by Keyboard

This option is displayed in the Setup Menu only when one of the electric tool control modes has been selected. It lets you jog the motor by using the computer keyboard. After selecting this option from the Setup Menu, enter the RPM at which you want to rotate the motor, and then enter the torque you

want the motor to apply. Press f to spin the motor clockwise or r to spin the motor counterclockwise. Press X to stop the motor and exit the jog function.

#### 3.7.2 Jog Motor by Servo Control Panel

The motor can be jogged in the clockwise or counterclockwise direction by placing the AUTO MANUAL selector switch in the MANUAL position and pressing the JOG CW or the JOG CCW pushbuttons.

### 3.8 SAVING DATA MANUALLY

If you have not chosen to record the data automatically use the following procedure to save data to the hard disk or other installed drive.

1. Press ^ 1.
2. To save it to the current drive and directory, press 1. To change the directory, drive, or both, press 2 and enter the desired drive and directory. If the directory you enter does not currently exist, it is created. Then press 1 to select to save the data to the current drive and directory.
3. You can choose to save the data to a new file or append the data to an existing file. Use the down arrow key to make this selection. If you select to save as a new file, you are prompted for the file name.
4. Press E to save the data and return to the Main Menu.

### 3.9 GRAPHIC DATA

The following paragraphs provide procedures to view and print the graphic data recorded by the FastLab and LabMaster.

#### 3.9.1 Viewing Graphic Data

Use the following keystrokes to view the indicated data for the current rundown.

- For Input Torque vs. Angle press & 1 1
- For Clamp Force vs. Angle press & 1 2
- For Clamp Force & Input Torque vs. Angle press & 1 3
- For Clamp Force vs. Input Torque press & 1 4
- For Clamp Force & K vs. Input Torque press & 1 5
- For the M-Alpha Plot press & 1 a
- For the F-Alpha Plot press & 1 b

#### NOTE

When you select either M-Alpha or F-Alpha, you are prompted for the Lower Point, Upper Point, the torque Offset, and the RP Offset.

- For the MultiPlot press & 2

#### 3.9.2 Printing Graphic Data

After you have displayed one of the plots as described in paragraph 3.9.1, you can send the plot to the local printer by pressing 1 or send it to the attached plotting device by pressing 2.

#### 3.9.3 Using the Graphic Cursors

After you have displayed plot as described in paragraph 3.9.1, you can identify the x- and y-axis coordinates and include them in the printout by pressing the left or right arrow keys. The program displays a set of crosshairs that you can move along the course of the plot to any desired point. The numerical x- and y-axis points are displayed right below the plot.

These values can also be included in a printout if you choose to print while the crosshairs are displayed.

### 3.10 LIMIT RESULTS

Use the following keystrokes to print and recall the limit results.

- To Print the Limit Results, press % 1
- To Save the Limit Results to disk, press % 2
- To Recall the Limit Results from disk, press % 3
- To Plot the torque and tension statistics, press % 4
- To clear the Limit Results, press ) 7
- To store the Limit Results, press \$

### 3.11 RECALLING PREVIOUS DATA

To recall existing data use the following procedure.

1. Press ^ 2.
2. To recall data from the current drive and directory, press 1. To change the directory, drive, or both, press 2 and enter the desired drive and directory. The contents of the directory are displayed so that you can highlight the desired file and recall it.
3. Once recalled, the data may be viewed or printed as described in paragraph 3.9 or 3.10.

### 3.12 ADVANCED ANALYSIS

The testing software furnished with the FastLab and LabMaster provides an advanced analysis feature to calculate the coefficients of friction for underhead torque,  $T_h$ , thread torque,  $T_t$ , and the “K” factor if thread torque data has been recorded. First, you need to enter the dimensions of the fastener and through-hole so that the calculations can be performed. Then, you can select the data to be plotted and how you want it displayed. The following paragraphs describe how to use this feature.

#### NOTE

The Advanced Analysis capability can be used only when the thread torque channel is enabled and a torque-angle transducer is used. The thread torque bridge of a torque-tension research head provided the necessary data.

#### 3.12.1 Enter Fastener Data

First you need to enter the dimensions of the fastener and through-hole. Use this procedure to input the fastener parameters.

1. To input the fastener data, press # from the Main Menu to display the Advanced Analysis menu.
2. Press 1 to input the fastener parameters required to perform the calculations. Refer to Figure 3-2 for parameter definitions.
3. When the Set Fastener Parameters screen is displayed, the first parameter is the nominal diameter of the fastener. Enter this value and press E .

#### NOTE

All dimensions will be in terms of the engineering units selected: inches if English units have been chosen; millimeters if SI units have been chosen.

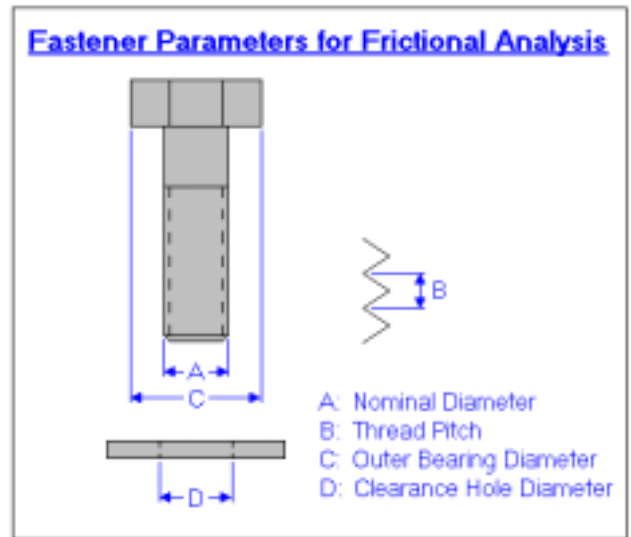


Figure 1. Fastener Parameters for Frictional Analysis

4. Enter the thread pitch of the fastener and press E .
5. Enter the pitch diameter and press E .
6. Enter the outer bearing diameter and press E .
7. Enter the clearance hole diameter and press E .
8. The program re-displays the Advanced Analysis menu so that you can select a plot for graphing as described in paragraph 3.12.2 below. Otherwise, press X to return to the Main Menu.

#### 3.12.2 View, Print, or Plot Calculated Values

Once the fastener data has been properly entered as described in paragraph 3.12.1, you can select one of the available plots for display and printing or plotting. Refer to the following procedure.

1. To view and print or plot the calculated data, press # from the Main Menu to display the Advanced Analysis menu.
2. Press 2 to display the View/Print/Plot Calculated Values menu.

3. A list of the available plots is displayed. Press  $\alpha$  to display versus angle or press  $f$  to display versus clamp force.
4. Press the number associated with the plot you want to display. Refer to Figures 3-3, 3-4, or 3-5 for examples of the plots. After the plot is displayed you can press  $1$  to print the plot or  $2$  to send it to the attached plotter, or press  $X$  to return to the Advanced Analysis menu.

### 3.13 CLEARING DATA

To clear the data from the current limit results and MultiPlot buffers, press  $*$  from the Main Menu to select the Utilities Menu. Then press  $1$  to elect to clear either the current limit results or the MultiPlot. Press  $1$  to clear limit results from memory, or press  $2$  to clear the Multi-Plot file from memory. Then press  $X$  to return to the previous menu.

### 3.14 CHANGING ENGINEERING UNITS

To change engineering units, press  $*$  from the Main Menu to select the Utilities Menu. Then press  $2$  to reach the Set Engineering Units screen. Press  $E$  to cycle through the available selections (Nm, Kgm, Lb-in, and Lb-ft) or press  $X$  to return to the Utilities Menu.

### 3.15 RESETTING DATE AND TIME

To change the date and time, should they ever require updating, press  $*$  from the Main Menu to select the Utilities Menu. Then press  $7$  from the Utilities Menu to reach the Set Time Date screen. The system displays the current settings for review. Press  $1$  to change the date, press  $2$  to change the time, or press  $X$  to exit. Follow the prompts to make the desired changes.

### 3.16 CHANGING THE PASSWORD

The FastLab and LabMaster protect certain valuable transducer and setup information from unauthorized changes. To change the password, press  $*$  from the Main Menu to select the Utilities Menu. Then press  $8$  from the Utilities Menu to select the Change

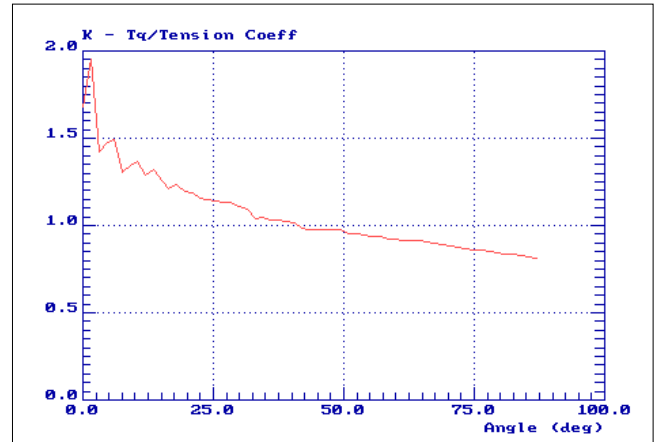


Figure 3-3. Tq/Tension Coeff. vs. Angle

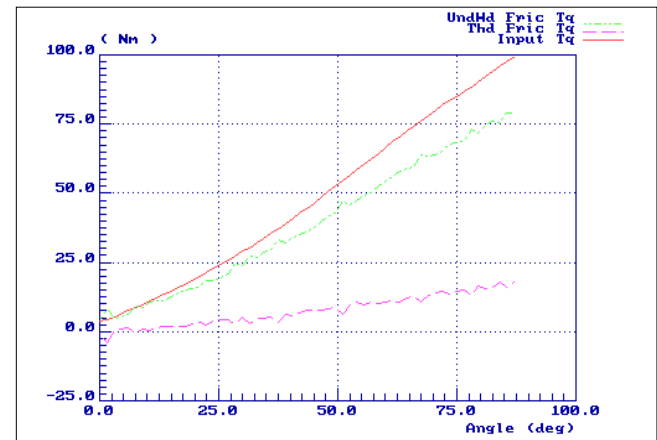


Figure 3-4 Friction & Input Tqs. vs. Angle

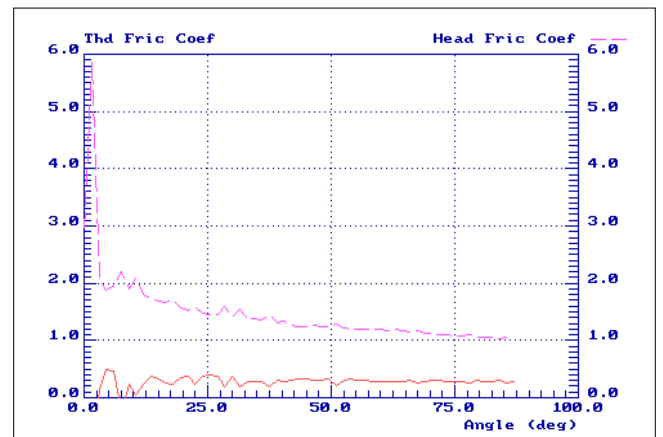


Figure 3-5. Friction Coeffs. vs. Angle

Password screen. You are prompted to enter the current password and press **E** . Then you are prompted to enter the new password and press **E** . Finally, you are prompted to enter the new password a second time to confirm the entry and press **E** . The default password is “12345” and can be reset to any desired password up to 6-digits.



**CAUTION**  
**BE SURE TO RECORD THE**  
**PASSWORD IN A SAFE PLACE.**

### 3.17 SET GRAPHICS PRINTER

When connecting a graphics printer to the system, either upon initial setup or when connecting a new printer, you should make sure that a compatible printer driver is selected. To select the graphics printer, press **\*** from the Main Menu to select the Utilities Menu. Press **O** from the Utilities Menu to display the Select Graphics Printer screen. Then press the **1** key to scroll through the available driv-

ers. When you find the one that best matches your printer, press **X** to return to the Utilities Menu.

### 3.18 MAINTENANCE & TROUBLE SHOOTING

There are very few user-serviceable items on either the FastLab or the LabMaster. If you are having difficulty in setting up or calibrating a transducer, setting up a test, recording data, or printing or plotting data, make sure you have reviewed the information in Sections 2 and 3 of this manual.

If you continue to have difficulty, contact the factory and ask to speak to a qualified fastener testing system technician. Before calling, make sure you have the model and serial number for the FastLab or LabMaster and the software version number that you are running.

It may also be helpful to print the program settings and send it along with an explanation of the problem to the factory for review. The program settings can be obtained by accessing the Diagnostic feature in the Utilities menu. Press **\*** **9** **4** to obtain this printout.

## 4.0 OTHER INFORMATION

### 4.1 FASTENING THEORY

The following information is provided as explanation of some of the sample plots included with the Model 9504 LabMaster demonstration diskette.

#### 4.1.1 Introduction to Torque-Turn Signature Analysis

Fastener engineers and mechanical designers have much to learn from the art of “torque-turn signature analysis.” Experienced practitioner of fastener signature analysis are capable of stripping away much of the mystery and uncertainty which often is associated with the strength and reliability of threaded fasteners and bolted joints.

Illustrated in this short introduction are examples of typical signatures that many readers can readily identify. The basic concepts of “torque-tension” combined with a fundamental understanding of the strength of materials and basic stress analysis provide the engineer with the knowledge needed for understanding signature analysis threaded fasteners. The following examples are found on the LabMaster demonstration diskette for the laboratory test systems and portable transient recorders manufactured by RS Technologies. The plots are identified by the “\*.RST” filenames associated with each example.

The torque-angle signatures can be analyzed to determine installation torque, thread strip, underhead embedment, bolt yield, and most important, fastener tension. The M-Alpha (torque vs. angle) and F-Alpha (force vs. angle) plots draw a reference line to the “elastic origin” and are directly linked to the SR1 Bolted Joint Design software for Windows 95 distributed by RS Technologies.

#### 4.1.2 Example 1: Tighten.RST

In this example a M12x1.75 fastener is tightened to 60 lb-ft. The signature has been recorded with a “record threshold” of 20 lb-ft. As shown in Figure 4-1, this plot shows the torque and tension vs. the angle of turn, with “0” angle located at the threshold.

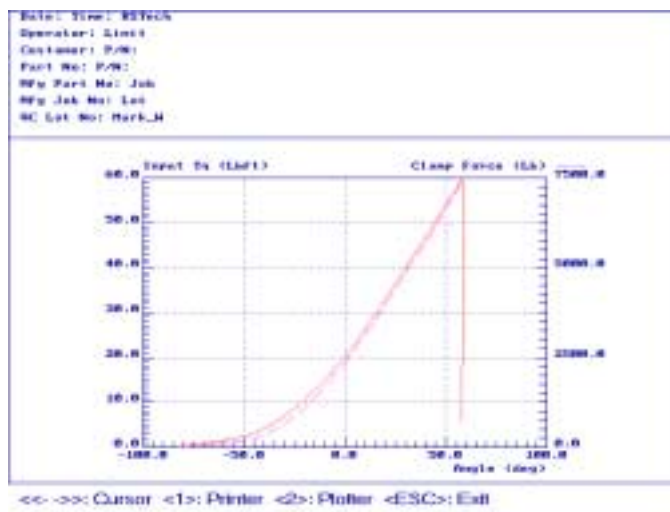


Figure 4-1. Torque-Tension-Angle Diagram

The LabMaster software automatically locates the “elastic origin” when it draws the M-Alpha Diagram by projecting a tangent line from the final point on the torque-angle curve to the “0” torque or, if present, the prevailing torque level. The M-Alpha Diagram for the TIGHTEN.RST file, illustrated in Figure 4-2, shows that the installation torque resulted in a projected elastic tightening angle of approximately 85 degrees, resulting in a clamp force



about 7,500 lb.

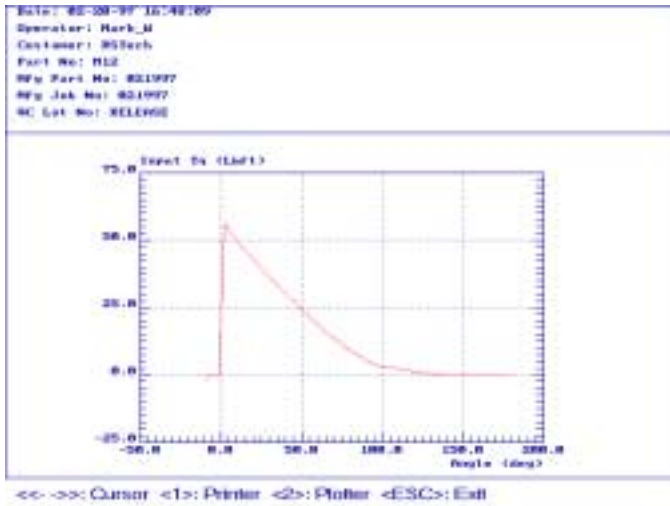
Figure 4-2. M-Alpha Diagram

The corresponding F-Alpha curve, illustrated in Figure 4-3, confirms the relationship between torque and angle with the concept of the “elastic



**4.15 Example 3: RELEASE.RST**

If the torque-angle signature is recorded when a fastener is loosened, the elastic tightening angle can be estimated. Thus the approximate fastener tension released can be directly estimated once the F-Alpha slope for the joint has been established. Refer to Figure 4-6. M-Alpha plots and release-angle plots can be used to directly estimate bolt tension, or preload, which is the ultimate goal of the fastener



tightening process.

Figure 4-6. Release Angle Diagram

**4.16 Additional Information**

Additional information about fastening theory is available from RS Technologies, Ltd. Please call or fax your request.

## 4.2 SPECIFICATIONS

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The following specifications apply in general to most FastLab and LabMaster systems. Some special system configurations may include or delete identified features.

### 4.2.1 Overall System

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**Microprocessor**... Type and speed specified at time of purchase; typical 350 MHz Pentium II™.

**Analog Signal Conditioning**... Full Bridge Strain Gage Transducer compatible.

**Sensitivity**... 1 mV/V to 4 mV/V

**Excitation**... 10 vdc

**Resolution**... 12 bits

**Common Mode Rejection**... 130 dB

**Sampling Rate**...5kHz Max.

**Temp Range**...0-45° C

**Printer/Plotter Compatibility**... Epson- and HP-compatible printers and plotters.

**Power Requirements**... 85-265 vac (40-440 Hz)

**Power Consumption**... 40 Watts

### 4.2.2 Encoder Input

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**Counter Resolution**...32 bit

**Input Frequency**...1 MHz max.

**Inputs**... A, B, Z

**Excitation**...5v

### 4.2.3 Digital I/O

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**Outputs**...4 bits

**Inputs**...4 bits

**Compatibility**... TTL

**Optical Isolation**... Available

### 4.2.4 Flat Panel Display (Model 9404)

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**Dot Color** ... Program displays in Blue or White

**Type** ... VGA, flat panel

**Viewing Area** ... 8.5-inch W by 6.5-inch H

**Resolution** ... Set by software

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