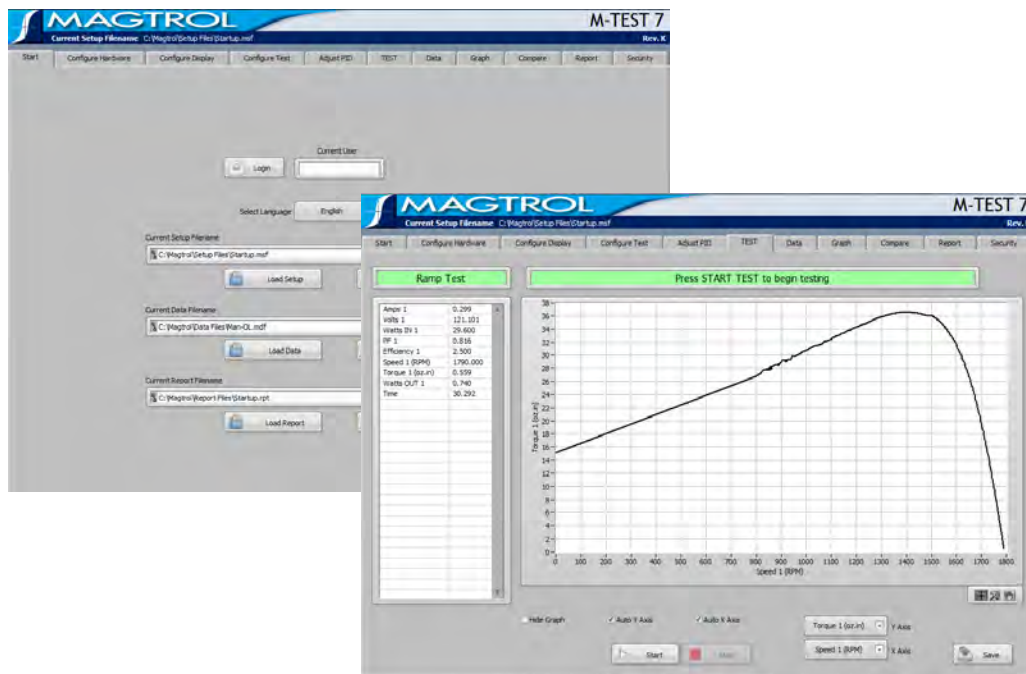




MAGTROL

M-TEST 7

Motor Testing Software



User's Manual

Purchase Record

Please record all model numbers and serial numbers of your Magtrol equipment, along with the general purchase information. The model number and serial number can be found on either a silver identification plate or white label affixed to each unit. Refer to these numbers whenever you communicate with a Magtrol representative about this equipment.

Model Number: _____

Serial Number: _____

Purchase Date: _____

Purchased From: _____

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Safety Precautions



1. Make sure that all Magtrol dynamometers and electronic products are earth-grounded, to ensure personal safety and proper operation.
2. Check line voltage before operating electronic equipment.
3. Make sure that dynamometers and motors under test are equipped with appropriate safety guards.

Revisions To This Manual

The contents of this manual are subject to change without prior notice. Should revisions be necessary, updates to all Magtrol User's Manuals can be found at Magtrol's web

Please compare the date of this manual with the revision date on the web site, then refer to the manual's Table of Revisions for any changes/updates that have been made since this edition.

REVISION DATE

1st Edition revision E - May 2018

Date	Edition	Change	Section(s)
05/23/18	1st Edition rev. E	All references of 6510e/6530 Power Analyzers changed to 7500 Series Power Analyzer.	1.1, 1.4, 5.7.1
09/21/17	1st Edition rev. D	Minimum system requirements updated.	1.1, 1.2
01/30/14	1st Edition rev. C	System requirements updated.	1.2
06/06/13	1st Edition rev. B	Speed Range control updated.	7.6.1
04/17/13	1st Edition rev. A	Refer to section 15.2 changed to 16.2.	A.2, A.3
04/17/13	1st Edition rev. A	Field 1-7 control updated.	13.1.1, 13.2.1, 13.3.1
04/17/13	1st Edition rev. A	Run control description updated.	8.1.1
04/17/13	1st Edition rev. A	Test Length control description updated.	7.4.1
04/17/13	1st Edition rev. A	Export control added.	7.3.1, 7.5.1
04/17/13	1st Edition rev. A	Maximum Temperature control description updated.	7.2.1, 7.3.1, 7.4.1, 7.5.1, 7.7.1
04/17/13	1st Edition rev. A	Relay 1 Alarm added.	5.6.2.1, 5.6.4.1
04/17/13	1st Edition rev. A	Pre-load Current control description updated.	5.3.1, 5.4.1
04/17/13	1st Edition rev. A	Screen shot replaced.	4.1, 7.1, 7.2, 7.3, 7.4, 7.5, 7.7, 7.8, 8.1, 9.1, 9.2, 9.3, 9.4, 9.5, 9.7, 10.1, 11.1, 12.1, 13.1, 13.2, 13.3, 13.4, 13.5, 13.6, 13.7
04/17/13	1st Edition rev. A	System requirements updated.	1.2
04/17/13	1st Edition rev. A	Micro Dyne and HD5 add to the motor testing instructions.	1.1

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Preface

PURPOSE OF THIS MANUAL

This manual contains information required for installation and general use of Magtrol's M-TEST 7 Motor Testing Software. To achieve maximum capability and ensure proper use, please read this manual in its entirety before operating. Keep the manual in a safe place for quick reference whenever a question should arise.

WHO SHOULD USE THIS MANUAL

This manual is intended for those operators in need of a software program to complement their Magtrol test equipment setup. The setup may include any of the following Magtrol products:

- Hysteresis, Eddy-Current or Powder Brake Dynamometer (HD, HD5, WB or PB)
- Micro Dyne
- In-Line Torque Transducer (TM, TF, TMB or TMHS)
- Power Analyzer (Model 5100, 5300, 5310, 5330, 6510, 6510e, 6530 or 6550)
- Dynamometer Controller (Model DSP6000, DSP6001 or DSP7000)

Optional auxiliary instrumentation can also be used.

MANUAL ORGANIZATION

This section gives an overview of the structure of the manual and the information contained within it. Some information has been deliberately repeated in different sections of the document to minimize cross-referencing and to facilitate understanding through reiteration.

The structure of the manual is as follows:

- Chapter 1: INTRODUCTION – Contains the technical data sheet for M-TEST 7 and highlights the new features of the software.
- Chapter 2: INSTALLATION – Provides general installation instructions for M-TEST 7 software; GPIB interface board; and National Instruments relay actuator PCI card.
- Chapter 3: NAVIGATION – Provides instruction for M-TEST 7 startup and navigation.
- Chapter 4: START – User interface for logging in/out, selecting language and loading/saving M-TEST 7 files.
- Chapter 5: CONFIGURE HARDWARE – User interface to select and set up parameters for testing instruments, controller, power analyzer, power supply and analog/digital I/O hardware being utilized in the test configuration.
- Chapter 6: CONFIGURE DISPLAY – User interface for selecting motor parameters to be acquired.
- Chapter 7: CONFIGURE TEST – User interface for configuring different test parameters.
- Chapter 8: ADJUST PID – Contains a routine to assist the operator in setting up proportional gain, integral and derivative (PID) values of the dynamometer controller.
- Chapter 9: TEST – User interface while the test is in progress.

- Chapter 10: DATA – Displays data in a tabular format and allows data saving and printing.
- Chapter 11: GRAPH – Displays a multi-plot graph and allows user selection of axis parameters and printing options.
- Chapter 12: COMPARE – Displays a graph for comparing an XY characteristic on up to five motors.
- Chapter 13: REPORTS – User interface for creating, viewing, saving and printing test reports.
- Chapter 14: SECURITY – User interface for enabling and setting up optional password protection.
- Chapter 15: CREATING TASKS – Provides step-by-step instructions for setting up analog input, analog output, digital input and digital output tasks.
- Chapter 16: TUNING SYSTEM RESPONSE (PID) – Provides instructions for adjusting PID parameters in ramp and curve tests.
- Appendix A: EXAMPLE TESTS – Contains example test setups for manual, curve, ramp, pass/fail, coast and overload to trip tests.

CONVENTIONS USED IN THIS MANUAL

The following symbols and type styles may be used in this manual to highlight certain parts of the text:



Note: This is intended to draw the operator’s attention to complementary information or advice relating to the subject being treated. It introduces information enabling the correct and optimal functioning of the product to be obtained.



CAUTION: THIS IS USED TO DRAW THE OPERATOR’S ATTENTION TO INFORMATION, DIRECTIVES, PROCEDURES, ETC. WHICH, IF IGNORED, MAY RESULT IN DAMAGE BEING CAUSED TO THE MATERIAL BEING USED. THE ASSOCIATED TEXT DESCRIBES THE NECESSARY PRECAUTIONS TO TAKE AND THE CONSEQUENCES THAT MAY ARISE IF THE PRECAUTIONS ARE IGNORED.



WARNING! THIS INTRODUCES DIRECTIVES, PROCEDURES, PRECAUTIONARY MEASURES, ETC. WHICH MUST BE EXECUTED OR FOLLOWED WITH THE UTMOST CARE AND ATTENTION, OTHERWISE THE PERSONAL SAFETY OF THE OPERATOR OR THIRD PARTY MAY BE PUT AT RISK. THE READER MUST ABSOLUTELY TAKE NOTE OF THE ACCOMPANYING TEXT, AND ACT UPON IT, BEFORE PROCEEDING FURTHER.

1. Introduction

1.1 ABOUT M-TEST 7

Magtrol's M-TEST 7 is a state-of-the-art motor testing program designed for use with Windows® 7 SP1 operating systems for PC-based data acquisition. Used in conjunction with Magtrol's Motor Testing Equipment, M-TEST 7 is equipped with ramp, curve, manual, pass/fail, coast and overload to trip testing capabilities to help determine the performance characteristics of a motor under test. The software also performs pass/fail testing for production line and inspection applications. The data generated can be stored, displayed and printed in tabular or graphic formats, and is easily imported into a spreadsheet. M-TEST 7 is ideal for simulating loads, cycling the unit under test and motor ramping. Magtrol can also make custom modifications to the software to meet your specific motor testing needs.

M-TEST 7 is equipped to work in conjunction with any of the following Magtrol motor testing instruments:

- Dynamometer Controller (DSP7000/6001/6000)
- Micro Dyne
- Hysteresis, Eddy-Current or Powder Dynamometer (HD, HD5, WB, PB)
- In-Line Torque Transducer (TM, TF)
- Power Analyzer (7530, 7510, 6530, 6510e, 6510, 6550, 5100, 5300, 5310, 5330)



Note: A DC power supply may be used in place of a power analyzer for reading back amps and volts. However, this is not recommended because readings will be less accurate and data transfer rates will be substantially slower.

Written in LabVIEW™, M-TEST 7 has the flexibility to test a variety of motors in a multitude of configurations. If you have a specialized test that you wish to perform, contact Magtrol Technical Assistance at 716-668-5555.

1.2 SYSTEM REQUIREMENTS

Minimum Recommended:

- Personal computer with Intel® Pentium® Core™2 Duo (or equivalent)
- Microsoft® Windows® 7 SP1
- 2 GB of RAM
- 4 GB of available hard drive space
- VGA color monitor with minimum screen resolution of 1024 × 768
- A USB interface can be used with the DSP7000. Optional RS-232 and GPIB interfaces are available. A GPIB or RS-232 interface is required for the DSP6000 and DSP6001.

1.3 SOFTWARE FEATURES

1.3.1 NEW FEATURES OF M-TEST 7

Magtrol's M-TEST 7 Software is an improved motor testing program that replaces M-TEST 5.0. The program is comprised of many new features that make it unique.

1.3.2 OTHER FEATURES

- New Graphical User Interface has user friendly tabbed pages for quick navigation.
- Optional Analog and Digital I/O provides more device flexibility.
- DSP7000 Programmable Controller Support.
- Supports the optional Analog and Digital I/O Modules on the DSP7000 Programmable Controller.
- Compare function allows overlay of data from five separate tests on the same graph.
- Expanded power analyzer and power supply selections.
- Cursor tools can obtain the X and Y coordinates of any point on a curve and magnify any section of the graph.
- Additional test choices (coast and overload to trip).
- Programmable analog and digital outputs per step in curve and pass/fail tests.
- Export graph images to clipboard or file.
- Two page report generates a five-axis graph on second page.
- Multiple Testing Options: Ramp, Curve, Manual, Pass/Fail, Coast, and Overload to Trip
- Displays 63 Tested and Calculated Parameters
- Three-Phase Power Analyzer Data Acquisition
- Motor Shaft Direction Indicator
- IEEE-488, USB and RS-232 Interface
- Dynamic PID Scaling
- PID Adjustment Routines
- Graphical Capabilities
- Curve Fitting
- Customized Reports
- Save/Load Setup Function

1.4 DATA SHEET



M-TEST 7 Data Sheet

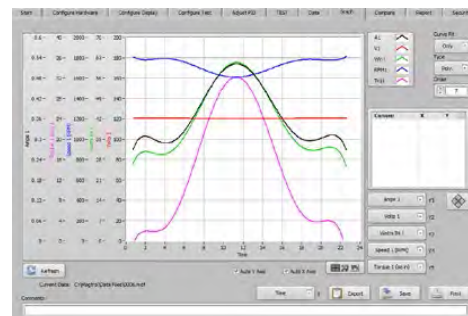
M-TEST 7 Motor Testing Software

NEW FEATURES WITH M-TEST 7

- New Graphical User Interface has user friendly tabbed pages for quick navigation.
- Optional Analog and Digital I/O provides more device flexibility.
- DSP7000 Programmable Controller Support.
- Supports the optional Analog and Digital I/O Modules on the DSP7000 Programmable Controller.
- Compare function allows overlay of data from five separate tests on the same graph.
- Expanded power analyzer and power supply selections.
- Cursor tools can obtain the X and Y coordinates of any point on a curve and magnify any section of the graph.
- Additional test choices (coast and overload to trip).
- Programmable analog and digital outputs per step in curve and pass/fail tests.
- Export graph images to clipboard or file.
- Two page report generates a five-axis graph on second page.



M-TEST 7 Hardware Configuration



M-TEST 7 Graphical Data Output

DESCRIPTION

Magtrol’s new M-TEST 7 is a state-of-the-art motor testing program for PC (Windows® 7 SP1) based data acquisition. Used with a Magtrol Programmable Dynamometer Controller, M-TEST 7 works with any Magtrol Dynamometer or In-Line Torque Transducer to help determine the performance characteristics of a motor under test. Up to 63 parameters are calculated and displayed utilizing M-TEST 7’s feature-rich testing and graphing capabilities.

An integral component of any Magtrol Motor Test System, M-TEST 7 performs ramp, curve, manual, pass/fail, coast and overload to trip tests in a manner best suited to the overall efficiency of the test rig. Written in LabVIEW™, M-TEST 7 has the flexibility to test a variety of motors in a multitude of configurations. The data generated from this user-friendly program can be stored, displayed and printed in tabular or graphical formats, and is easily imported into a spreadsheet.

Magtrol can also make custom modifications to the software to meet additional motor testing requirements.

ANALOG INPUT MEASUREMENT

Up to 128 thermocouples or analog sensors can be read and monitored during a motor test. Heat rise curves on the bearings, windings and housing of a motor can be performed and air flow/exhaust efficiencies can be measured with an air tool or internal combustion engine. M-TEST 7, with its complete dynamometer control, even allows for analog measurement while performing load simulation for duty cycle and life testing.

APPLICATIONS

M-TEST 7—besides being well-suited for simulating loads, cycling the unit under test and motor ramping—is also ideal for production line and inspection applications, due to its pass/fail test function. Another time-saving feature, that engineering labs will benefit from, is the ability to duplicate tests and run them automatically. This versatile program is extremely valuable to anyone involved in motor testing.

Specifications

M-TEST 7

STANDARD FEATURES

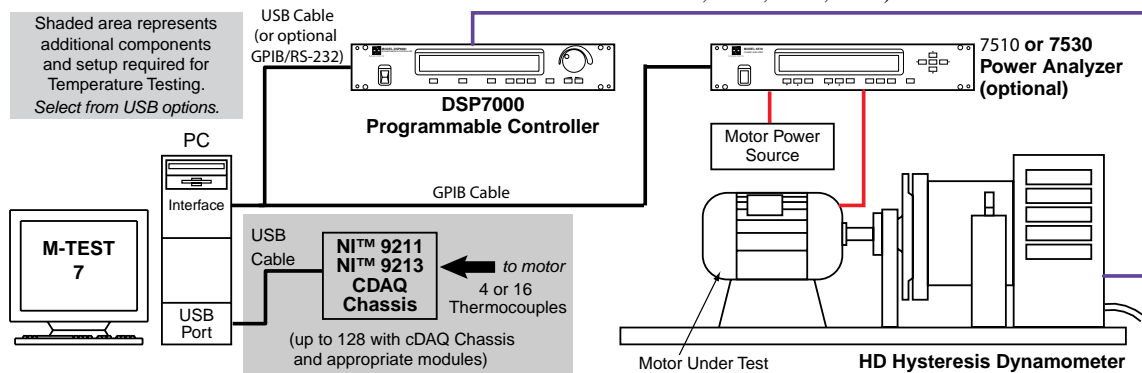
- Multiple Testing Options:**
 - Ramp:** Select from average ramp down/up or ramp down with inertia correction factor. Also allows extrapolation of free-run and locked-rotor data, plus interpolation of specific speed or torque data points.
 - Curve:** Test speed, torque, amps, watts input, watts output and open loop parameters. Capable of adjusting sampling rate and using step or ramp from one load point to the next.
 - Manual:** Controls test from front panel of the Dynamometer Controller or screen control while computer acquires data. Allows adjustment of sampling rate.
 - Pass/Fail:** Checks amps, input watts (with optional Power Analyzer), speed, torque and output watts against user-defined values.
 - Coast:** Counts degrees of revolution after motor power is removed.
 - Overload to Trip:** Loads and monitors temperature until the motors thermal cutout trips.
- Displays 63 Tested and Calculated Parameters:** Torque, speed and auxiliary input are displayed from the DSP6000/6001/7000 Controller; amps, volts and watts from an (optional) power analyzer. Calculated values including horsepower, efficiency, power factor, output watts and time can also be displayed. Optional analog and digital inputs can also be displayed.
- Three-Phase Power Analyzer Data Acquisition:** Obtain data on each individual phase and/or the sum used in the chosen parameters (amps, volts, input watts and power factor).
- Motor Shaft Direction Indicator:** Indicates if the motor is turning clockwise or counterclockwise.
- IEEE-488, USB and RS-232 Interface or GPIB-USB-HS:** Computer interface with National Instruments™ PCI-GPIB. RS-232 available with DSP7000, DSP6001 and DSP6000 only. USB on DSP7000 and Micro Dyne only.
- Dynamic PID Scaling:** Provides consistent control loop results throughout motor speed range during ramp test (for DSP6001/7000 only).
- PID Adjustment Routines:** Helps user adjust the system for ramp and step functions.
- Graphing Capabilities:** Display up to 5 test curves in a single graph; easy-to-read colored and labeled plots with several graph formatting options; manual or auto scaling.
- Curve Fitting:** A curve fitting routine can be applied to most motor test curves. Raw data and curve fit data can also be displayed simultaneously.
- Customized Reports:** Allows user to produce a one or two-page motor test summary, which can include the motor's serial number; maximum torque, speed, power and current values; operator name; time and date of test; motor direction; 32 data points; and an X-Y plot.
- Save/Load Setup Function:** Test procedure configurations may be stored and recalled using standard Windows® file structure.

SYSTEM CONFIGURATION

A Magtrol Dynamometer provides motor loading with a Magtrol Programmable Dynamometer Controller acting as the interface between the PC running M-TEST 7 and the dynamometer. If motor electrical parameters are to be measured or used to determine load points, a Magtrol Power Analyzer is also required. Interfacing between the computer and electronic instrumentation is via the National Instruments™ PCI-GPIB card, RS-232 serial interface or GPIB-USB-HS (when using a DSP7000, DSP6000 or DSP6001) or USB (DSP7000, Micro Dyne).

M-TEST 7 is equipped to work in conjunction with any of the following Magtrol motor testing instruments:

- Dynamometer Controller (DSP7000/6001/6000)
- Micro Dyne
- Hysteresis, Eddy-Current or Powder Dynamometer (HD, HD5, WB, PB)
- In-Line Torque Transducer (TM, TF, TMB, TMHS)
- Power Analyzer (7530, 7510, 6530, 6510e, 6510, 6550, 5100, 5300, 5310, 5330)



Ordering Information

M-TEST 7

SYSTEM REQUIREMENTS

- Personal computer with Intel® Pentium® Core™2 Duo processor (or equivalent)
- Microsoft® Windows® 7 SP1
- 2 GB of RAM
- 4 GB of available hard drive space
- VGA color monitor with minimum screen resolution of 1024 × 768
- National Instruments™ PCI-GPIB card, GPIB-USB-HS Interface (available from Magtrol)
- RS-232 serial interface can be used, instead of GPIB card, for interfacing with Magtrol DSP6000, DSP6001 or DSP7000 Controllers. In addition, a USB Interface can be used with the DSP7000 Controller.

ALTERNATIVE MOTOR TESTING SOFTWARE

In addition to M-TEST 7, Magtrol offers EM-TEST 2.0 specifically designed for endurance motor testing and DUAL-TEST 7 fully independent dual channel control software.

Description	Model/Part Number
EM-TEST2.0 Endurance Motor Testing Software	SW-EM-TEST2.0-WE
DUAL-TEST7 Dual Channel Motor Testing Software	SW-DUAL-TEST7-WE

SYSTEM OPTIONS AND ACCESSORIES

CATEGORY	DESCRIPTION	MODEL / PART #
TEMPERATURE TESTING HARDWARE	National Instruments™ 9211 4-Channel TC System	HW-TTEST-4
	National Instruments™ 9213 16-Channel TC System	HW-TTEST-16
	4-Channel TC Modules	73M231
	16-Channel TC Modules	73M233
	4-Slot cDAQ Chassis	73M224
	8-Slot cDAQ Chassis	73M229
CONTROLLERS	High Speed Programmable Dynamometer Controller	DSP6001/DSP7000
TESTING INSTRUMENTS	Hysteresis Dynamometers	HD series
	Eddy-Current Dynamometers	WB series
	Powder Brake Dynamometers	PB series
	In-Line Torque Transducers	TM/TMHS/TMB series
POWER ANALYZERS	High Speed Single-Phase Power Analyzer	7510
	High Speed Three-Phase Power Analyzer	7530
POWER SUPPLIES	Closed-Loop Speed Control and Power Supply	6100
	Power Supply for WB & PB Dynamometers series 2.7 and 43	DES 310/410
	Power Supply for WB & PB Dynamometer series 65, 115 and 15	DES 311/411
	Power Amplifier—required for all HD-825 Dynamometers	5241
MISC	Torque/Speed Conditioner	TSC 401
CARDS	GPIB Interface Card (PCI)	73M023
	Relay Actuator Card (for controlling motor power via M-TEST 7)	73M052
	USB-6525	73M218
CABLES	GPIB Cable, 1 meter	88M047
	GPIB Cable, 2 meters	88M048
	Torque Transducer Connector Cable	ER 113/01

For information on the most current software release available, refer to Magtrol's Web site at www.magtrol.com/motortest/mtest.html

2. Installation

2.1 INSTALLATION PROCEDURE

Insert the M-TEST 7 disk into your target computer's DVD drive.

When the following window appears (*Figure 2–1 Run Setup Window*), click Run setup.exe.

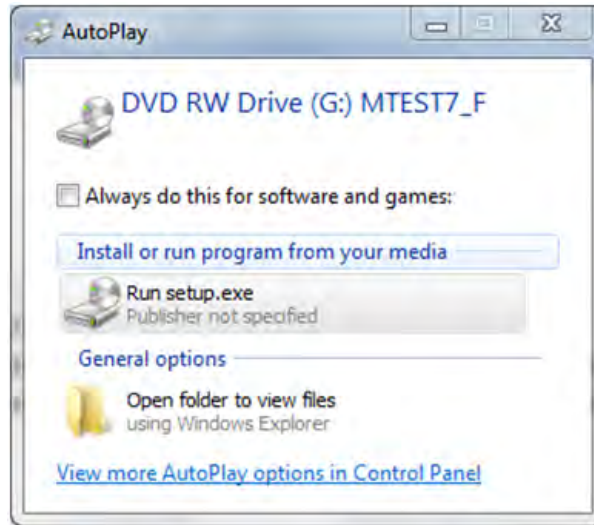


Figure 2–1 Run Setup Window

If you do not see this window, use Explorer to find the setup.exe file on the disk. Double-click this file to begin the installation process.

If security is enabled, allow Windows to install this program.

The default installation folders for M-TEST 7 and the required drivers appear in the next window (*Figure 2–2 M-TEST 7 Destination Directory Window*). You may change these if necessary but do not install M-TEST 7 in the Windows 7 Program Files (x86) folder.

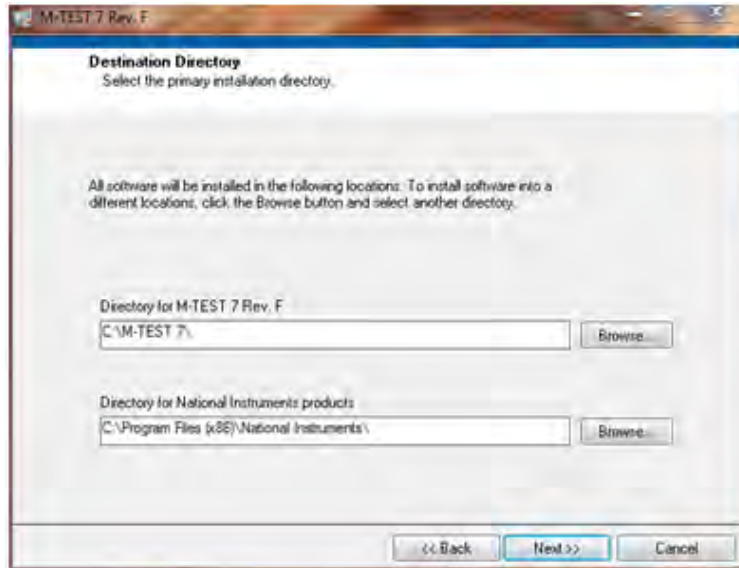


Figure 2–2 M-TEST 7 Destination Directory Window

A list of programs to be installed will be shown in the next window (Figure 2–3 Start Installation Window). Press Next>> to continue.



NOTE: The example shown here does not contain the complete suite of programs being installed.

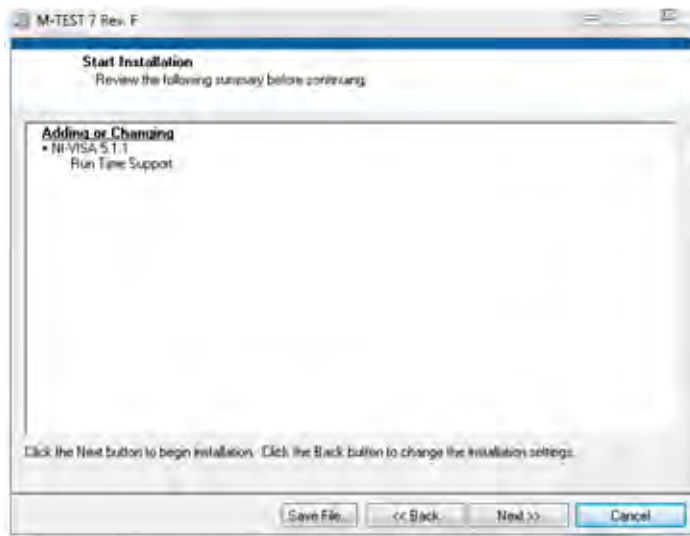


Figure 2–3 Start Installation Screen

The program files will begin loading onto the computer. Progress will be shown on the following window (*Figure 2–4 Installation Progress Window*).



NOTE: This process can take several minutes to an hour depending upon the computer being used. Please plan accordingly.

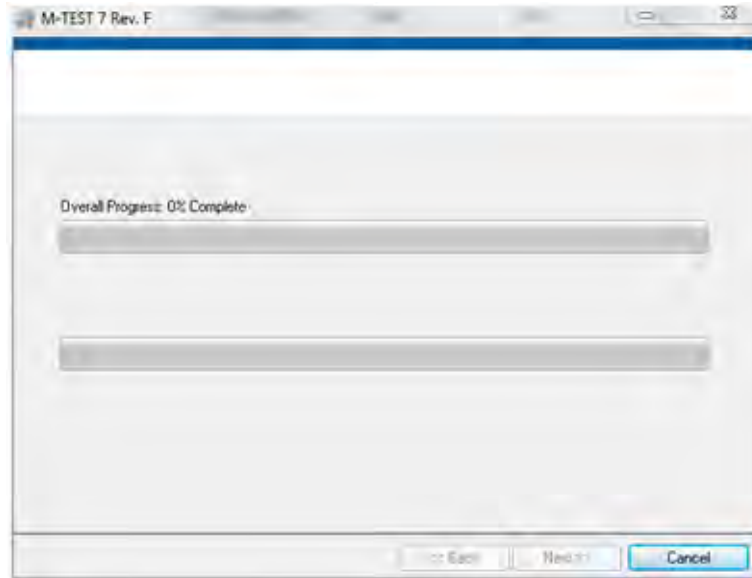


Figure 2–4 Installation Progress Window

When all programs are installed, the following window (*Figure 2–5 Installation Complete Window*) will appear. Click Finish to complete the installation.

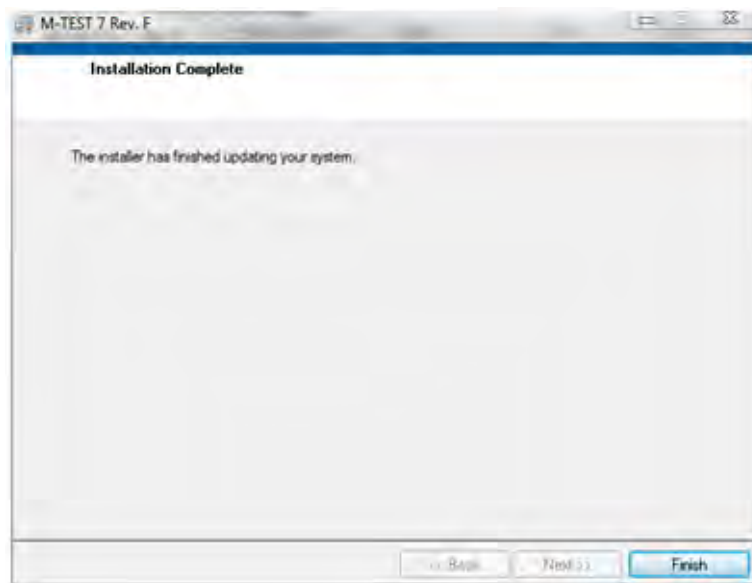


Figure 2–5 Installation Complete Window

GETTING
STARTED

M-TEST 7 requires license activation in order to run. When M-TEST 7.EXE is started, the following screen will appear:

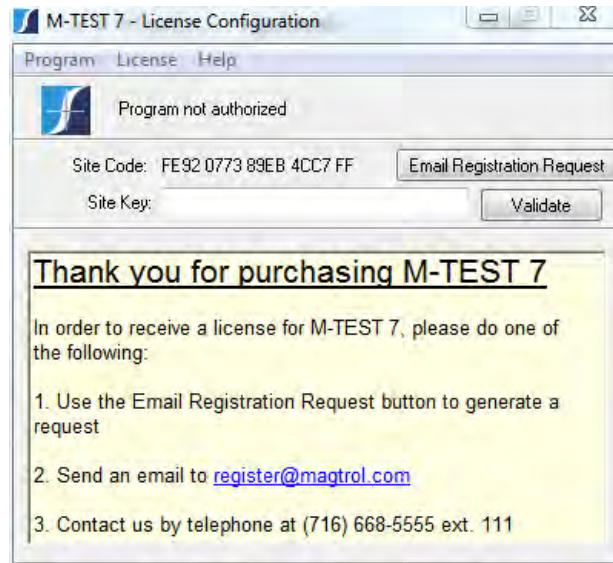


Figure 2–6 M-TEST 7 Email Registration Screen

The easiest way to obtain your Site Key and activate M-TEST 7 is to click the Email Registration Request button. The following message will appear:

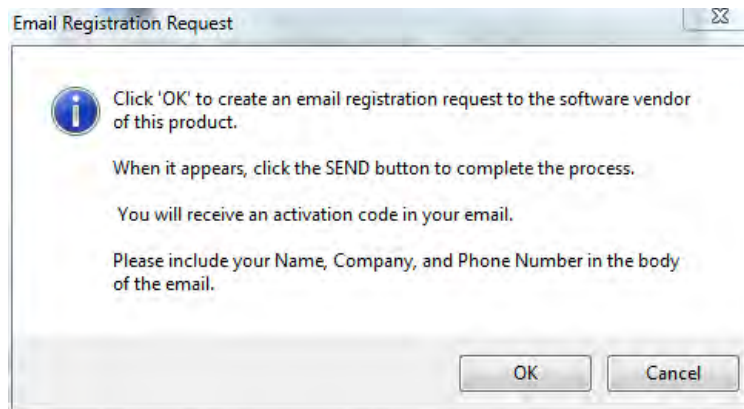


Figure 2–7 Email Registration Request Screen

Follow the instructions in the message and click OK.



NOTE: You may also click on the link register@magtrol.com or as a last resort, telephone us.

An email will be created with your SiteCode, requesting a SiteKey. Please include your name, company and phone number in the spaces provided.

In a short period of time, Magtrol will return an email with your SiteKey. Copy this key and paste it into the Site Key field in the License Configurator.

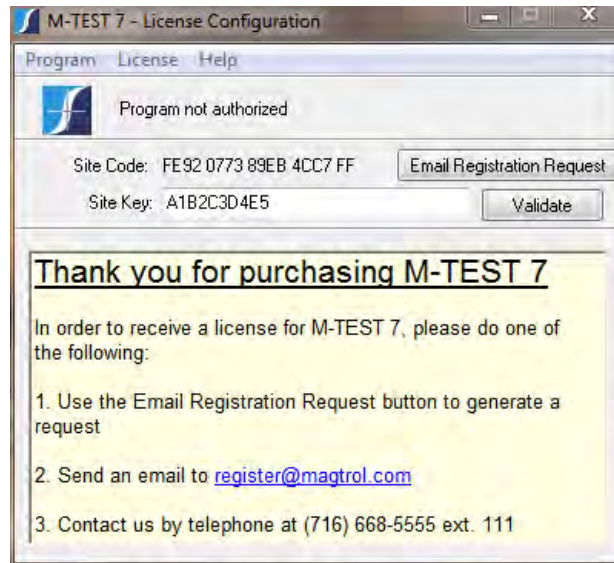


Figure 2–8 Enter Site Key in the Site Key Field

Press the Validate button and M-TEST 7 will be activated for use.

You may or may not be prompted to re-boot the computer. It is always a good idea to do this, so re-boot at this time.

You are now ready to begin using the M-TEST 7 motor testing software.

3. Navigation

3.1 NAVIGATING THE M-TEST 7 INTERFACE

M-TEST 7 uses several different types of user input controls. An explanation of each follows.



NOTE: By right-clicking any control, a description of that control's function can be read by selecting Description and Tip.



NOTE: Any control or parameter that does not apply to the current instrument in use or test selection will be grayed out. You may ignore all grayed out controls for your current test.

3.1.1 TABS

Each tab has a title and contains specific controls or information pertaining to its function. The Start tab is the default location and the remaining tabs follow a logical flow in the test setup and procedure. To change to a different tab, left-click your mouse on the tab title. While running an actual test, the tabs will disappear to prevent the user from interrupting a test in progress. Note: if the security function is enabled, tabs that are inaccessible to the user are grayed out.

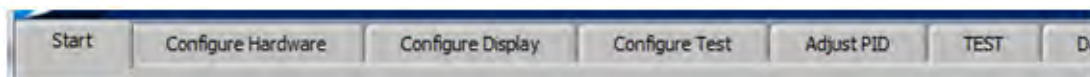


Figure 3–1 M-TEST 7 Tabs

3.1.2 STRING CONTROLS

String controls are primarily for text entered by the user. Left-click your mouse in the field and type in the information. If information is already in the field, you may left-click and hold the mouse while highlighting the text to be deleted or over-written.

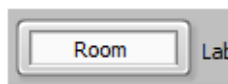


Figure 3–2 String Controls



NOTE: After entering a value in the control, click your mouse elsewhere on the screen or the value may not be retained.

3.1.3 NUMERIC CONTROLS

Numeric controls are used to enter instrument settings and test parameters. You may change the value by clicking on the up/down arrows to the left of the control, or by double-clicking in the field and entering the new value.

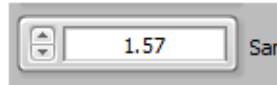


Figure 3–3 Numeric Controls



NOTE: After entering a value in the control, click your mouse elsewhere on the screen or the value may not be retained.

3.1.4 ENUMERATED CONTROLS

Enumerated controls are pre-filled with the available selections you may choose. You may change the selection by clicking on the up/down arrows to the left of the control, or by clicking in the control field and dragging to the desired item. If the available choices exceed the allotted space, a vertical scroll bar will appear to the right of the selection list.

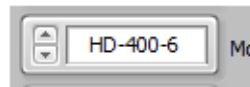


Figure 3–4 Enumerated Controls

3.1.5 TABLE CONTROLS

Table controls are used to enter test sequences or specific data points. The most reliable method of entering data is to click in the desired cell and type the value. As you begin entering data, the current row will highlight a light yellow color. Unused rows are the default white background. Please make certain that there are no extra highlighted rows than where you have entered data. This would indicate extraneous characters somewhere in that row and may adversely affect program operation.

From	To	Time
5	5	5
10	10	5
15	15	5
20	20	5

Figure 3–5 Table Controls

To delete a row, right-click somewhere in the row and select Delete Row from the menu.

You may also Cut and Paste single or multiple rows. Right-click in the table and select Show Selection. A small caret will appear in the upper left corner of one of the cells (*Figure 3–6 Show Selection Table Control*).

From	To	Time
5	5	5
10	10	5
20	20	5

Figure 3-6 Show Selection

Click, hold and drag the mouse cursor on the desired cells to cut. Colored outlines will appear around each of the selected cells (Figure 3-7 Table with cells selected).

From	To	Time
5	5	5
10	10	5
20	20	5

Figure 3-7 Table with cells selected

You may now right-click and cut data. The cut data may be pasted or inserted elsewhere in the table.

When the number of rows or columns exceeds the visible area, vertical and/or horizontal scroll bars will appear (Figure 3-8 Table with vertical scroll bar). With these you can enter almost an unlimited number of rows for more complicated test sequences.



Figure 3-8 Table with vertical scroll bar



NOTE: After you are finished entering values in the table, click your mouse elsewhere on the screen or the data may not be retained.

3.1.6 MENU RINGS

Menu rings are similar to enumerated controls; they allow selection of pre-determined parameters. You may select the next item by clicking the down arrow to the right of the field, or the preferred method of clicking and dragging to the desired selection.

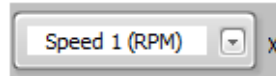


Figure 3–9 Menu Rings

3.1.7 LIST BOXES

List boxes are multiple line text controls that are typically pre-filled with information that you may re-order or move to another list box. Further information about the use of these is in *Chapter 6 Configure Display*. If the number of items exceeds the available space, there will be a vertical scroll bar on the right side of the list box to allow access to many more selections.

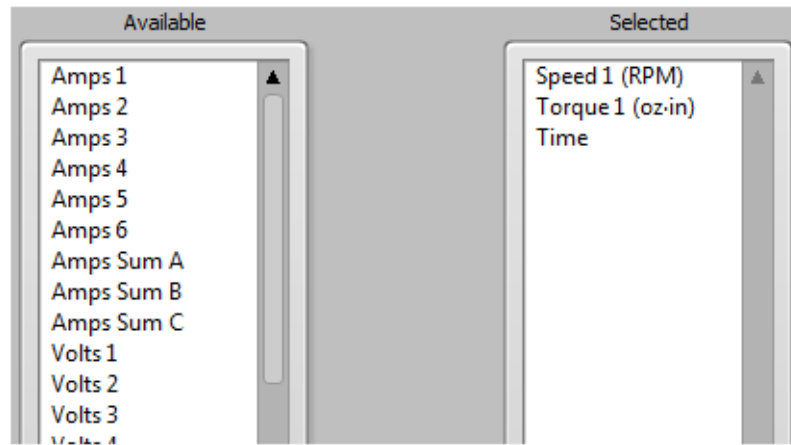


Figure 3–10 List boxes

3.1.8 BUTTONS

Buttons have the function name embedded on the button itself. Some buttons may have universal icons on them to assist the user.

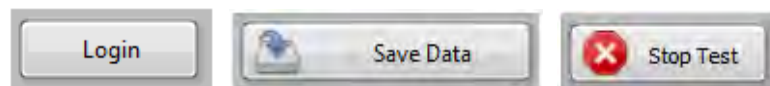


Figure 3–11 Buttons

3.1.9 SLIDERS

Sliders may be horizontal or vertical. There is a digital display associated with the slider that indicates very accurately the current slider position. The slider value may be changed by clicking, holding and dragging the slider control to the desired position, by clicking in the slider field at the desired value, or by double-clicking in the digital display and typing a value.

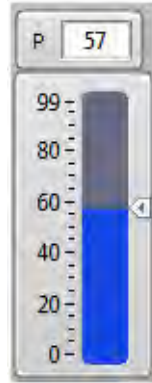


Figure 3–12 Sliders

3.1.10 CHECK BOXES

Check boxes have a Boolean function where checking the box is True, On, Enable or Logic 1. An unchecked box is False, Off, Disabled or Logic 0.

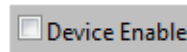


Figure 3–13 Check boxes

3.1.11 CLUSTERS

Clusters are groupings of various types of controls that function in some related manner.

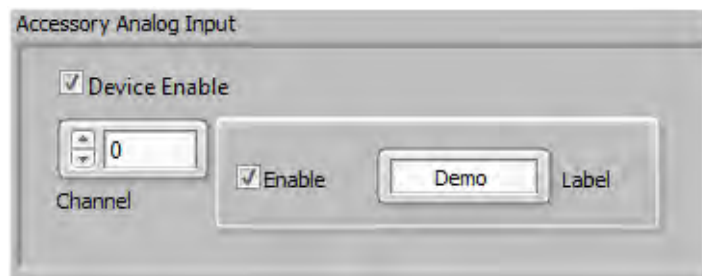


Figure 3–14 Clusters

4. Start

4.1 START TAB

This is the default tab when starting the M-TEST 7 program. From here you may import previously configured test setups, allow user login, and recall saved data or reports.

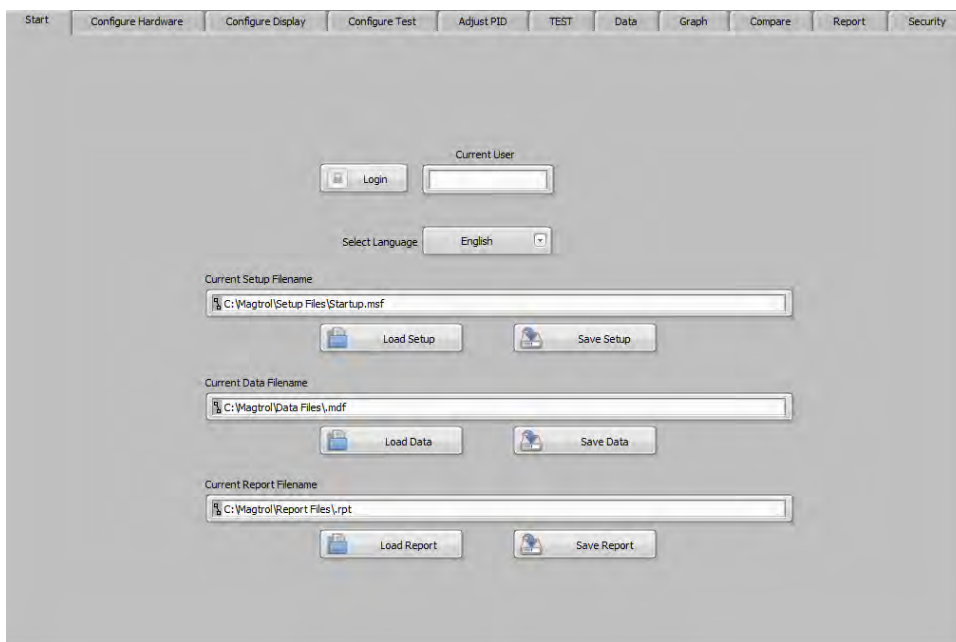


Figure 4-1 Start Tab

4.1.1 START TAB CONTROLS

Control	Function
Login	Press to log in as the current user. This will only have meaning if the security feature has been enabled. A new window shown below will pop up where the user enters their name and password. After entering this information, press the Login button to return to the Start tab.
Select Language	This control allows the user to select the language used throughout the program. The captions of all controls will be converted to the selected language for regional use. The contents of the control will not change; they will always remain in English.
Current Setup File Name	This indicates the path and filename of the test configuration currently loaded.
Load Setup	Press to specify the path and filename of the desired test configuration to load.
Save Setup	Press to specify the path and filename of the test configuration to save.

Control	Function
Current Data File Name	This indicates the path and filename of the test data currently loaded.
Load Data	Press to specify the path and filename of the desired test data to load.
Save Data	Press to specify the path and filename of the test data to save.
Current Report Filename	This indicates the path and filename of the test report currently loaded.
Load Report	Press to specify the path and filename of the desired test report to load.
Save Report	Press to specify the path and filename of the test report to save.

5. Configure Hardware

5.1 CONFIGURE HARDWARE TAB

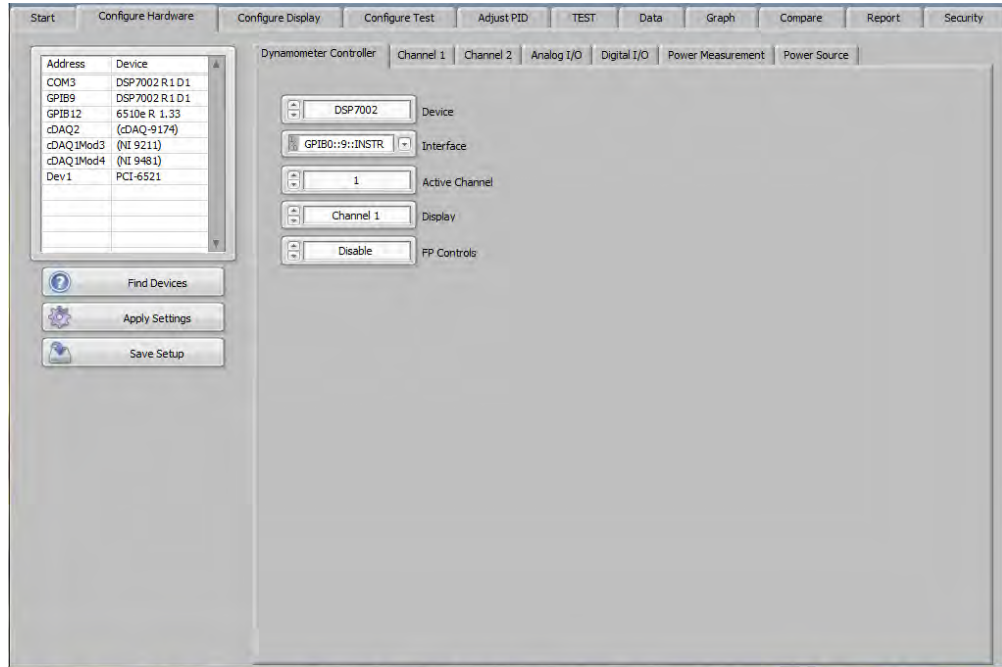


Figure 5–1 Configure Hardware Tab

5.1.1 CONFIGURE HARDWARE TAB CONTROLS

Control	Function
Device Listing	This indicates the address and device name of any GPIB, USB or NI-DAQmx device connected to or installed in the host computer. Devices that are not IEEE-488.2 compliant will show their address but the device name will typically be incorrect. This should not affect operation of these older, legacy devices. Each time you return to the Configure Hardware tab, the software will update the device listing.
Find Devices	Press to update the device listing.
Apply Settings	Press to immediately send configuration commands to the instruments in the system. Normally, this is not necessary since the commands are always sent at the beginning of each test. The reason for applying settings prior to starting the test is to see immediate changes in the instrument setup.
Save Setup	Press to save the setup to the path and filename that is currently in use. If you wish to change it, go to the Start tab and press the Save Setup button.

TEST SETUP

5.2 DYNAMOMETER CONTROLLER TAB

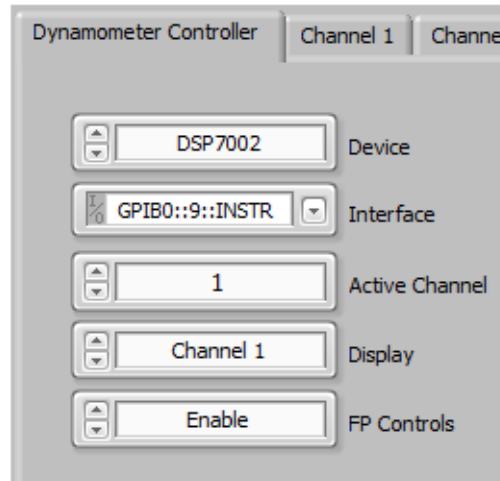


Figure 5–2 Dynamometer Controller Tab

5.2.1 DYNAMOMETER CONTROLLER TAB CONTROLS

Control	Function
Device (None, DSP6000, DSP6001, DSP7001, DSP7002, Micro Dyne)	Selects the dynamometer controller, if any, being used in this setup. While M-TEST 7 is specifically designed for the DSP7000 series controllers, several legacy models are also supported.
Interface (GPIB/COM)	Selects the GPIB, RS-232 or USB port that is used to communicate with the dynamometer controller. In some cases you may have two options for one instrument, e.g. a DSP7000 with standard USB and optional GPIB. In that case, select either of the two.
Active Channel (1/2)	In multiple channel dynamometer controllers such as the DSP6001 and DSP7002, this selects which channel is currently being used as the control source for the dynamometer. M-TEST 7 is designed to control one dynamometer at a time, so in the case of having two dynamometers connected to a DSP7002 you must select either channel 1 or 2 for the test.
Display (Channel 1, Channel 2, Channel 1 & 2)	Selects which channel of a DSP7002 is displayed on the front panel of the instrument. You may select channel 1, 2 or 1 & 2.
FP Controls (Enable/Disable)	Enables or disables the use of the front panel controls of the dynamometer controller. Also known as front panel lockout.

TEST SETUP

5.3 CHANNEL 1 TAB

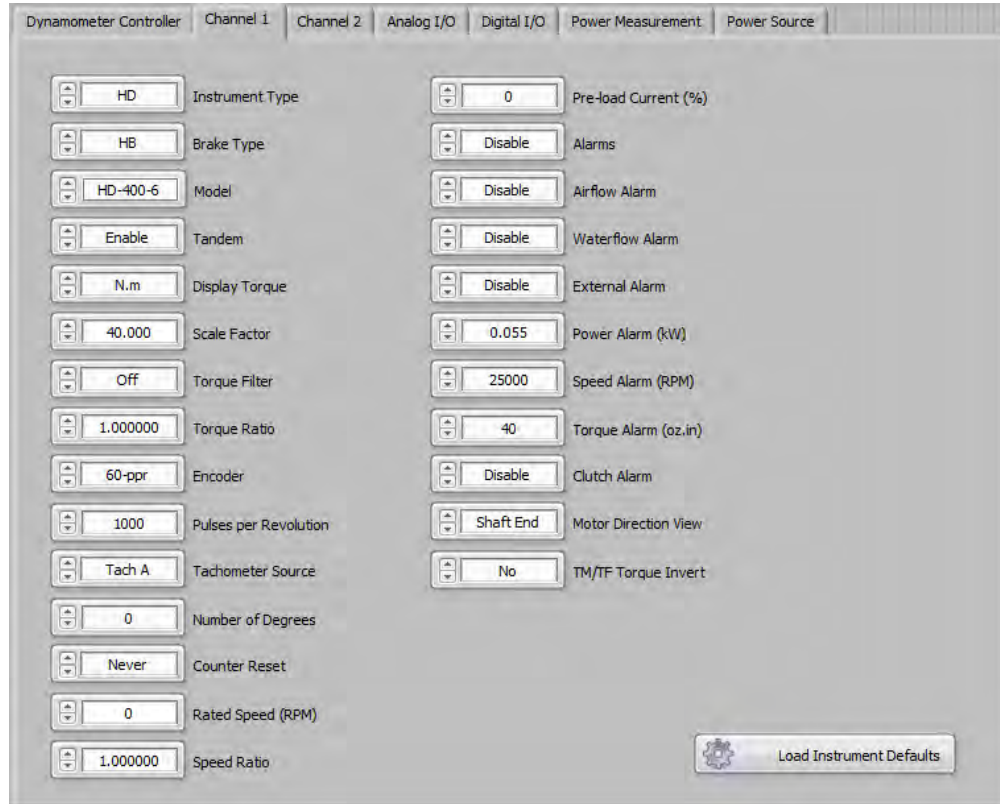


Figure 5–3 Channel 1 Tab

5.3.1 CHANNEL 1 TAB CONTROLS

Control	Function
Instrument Type (None, Brake, FR-10, FRS, HD, HD5, PB, TF, TM, WB)	Selects the type of instrument connected to channel 1 of the dynamometer controller.
Brake Type (None, HB, WB, PB)	Selects the type of brake being used in a non-conventional dynamometer configuration. Magtrol manufactures three types of brakes that may be used in this setup; HB (hysteresis brake), WB (eddy current brake) and PB (powder brake).
Model (depends on instrument type)	Selects the model number of the instrument being used. After making a model selection, always press the Load Instrument Defaults button at the lower right corner of the tab. This will import the critical parameters for that model and populate the controls.
Tandem (Enable/Disable)	Enables or disables the tandem function in a WB/PB dynamometer so that you may use each dynamometer type independently.

TEST SETUP

Control	Function
Display Torque (oz.in, oz.ft, lb.in, lb.ft, g.cm, kg.cm, mN.m, cN.m, N.m)	Magtrol dynamometers are scaled in several different units of torque. WB and PB dynamometers are N.m, while HD dynamometers can be oz.in, lb.in, g.cm, kg.cm, mN.m or N.m. Regardless of the dynamometer units of torque, M-TEST 7 will convert this to any other unit of torque you select. All torque data in the program will be in the selected unit and any commanded torque will also be in the new unit of measurement.
Scale Factor (0 - n)	The full scale torque value of the dynamometer selected. This is the dynamometer torque units, not the display torque units.
Torque Filter (Off, 2Hz, 3Hz, 5Hz, 10Hz, 20Hz, 25Hz, 50Hz, 100Hz)	Selects the cutoff frequency for the low-pass filter in the torque measurement circuit of the dynamometer controller.
Torque Ratio (0 - n)	<p>If a motor-gearbox combination is being used the gearbox ratio may be entered so that the motor torque will be indicated in the program, rather than the gearbox output torque. For example, if the gearbox multiplies the motor torque by 13.5, enter that value. The program will divide the measured torque by 13.5 to obtain the motor torque. There are losses associated with a gearbox that are not reflected in this value. However, you may change the ratio slightly to account for losses if they are known.</p> <p>Torque ratio = gearbox output torque / motor torque</p>
Encoder (1-ppr, 2-ppr, 6-ppr, 20-ppr, 30-ppr, 60-ppr, 600-ppr, 6000-ppr, USER)	Selects the pulse count per revolution of the encoder being used. This may be one of the standard values Magtrol uses on their dynamometers or a user defined count.
Pulses Per Revolution (0 - n)	The user defined pulse count per revolution for custom encoders.
Tachometer Source (Tach A, Quadrature, Analog Input 1 Ch. 1)	Selects the source of the speed signal being used for measurement and control. Normally, this would be Tach A which is the pulse input on the dynamometer controller but can also be from two other sources.
Number of Degrees (0 - n)	<p>The measurement angle for quadrature encoders.</p> <p>NOTE: The minimum pulse count when using quadrature encoders is 1000-ppr.</p>
Counter Reset (Never/1 Revolution)	Selects cumulative angle of rotation (Never) or resets the reading when +/- 360° is reached (1 Revolution).
Rated Speed (0-199999)	The maximum speed at rated torque for WB and PB dynamometers. Exceeding this will cause the dissipated power to be greater than the dynamometer rating.
Speed Ratio (0 - n)	<p>If a motor-gearbox combination is being used the gearbox ratio may be entered so that the motor speed will be indicated in the program, rather than the gearbox output speed. For example, if the gearbox divides the motor speed by 13.5, enter that value. The program will multiply the measured speed by 13.5 to obtain the motor speed.</p> <p>Speed ratio = motor speed / gearbox output speed</p>

Control	Function
Pre-Load Current (0-99.99)	The amount of load constantly applied to the motor by the dynamometer brake. This is an open loop function and the value represents the % of controller brake current output.
Alarms (Enable/Disable)	Enables/disables all internal alarms configured for use in the DSP6001/DSP7000.
Airflow Alarm (Enable/Disable)	Enables/disables the flow sensor on suitably equipped forced air cooled dynamometers.
Waterflow Alarm (Enable/Disable)	Enables/disables the flow sensor on suitably equipped liquid cooled dynamometers.
External Alarm (Enable/Disable)	Enables/disables the external alarm input on the DSP6001/DSP7000. Please refer to the controller manual regarding usage of this feature.
Power Alarm (0 - n)	The maximum power dissipation allowed for the dynamometer in use.
Speed Alarm (0 - n)	The maximum speed allowed for the dynamometer in use. The maximum torque allowed for the dynamometer in use.
Torque Alarm (0 - n)	The maximum torque allowed for the dynamometer in use.
Clutch Alarm (Enable/Disable)	When enabled, this checks if the electromagnetic clutch on a WB/PB tandem dynamometer is closed before starting the test. It will attempt three reads and if still not closed, an alarm will be indicated on the front panel display of the DSP7000.
Motor Direction View (Shaft End/Lead End)	Selects the view for determining motor direction.
Load Instrument Defaults	Press to load the default parameters for the model selected. This should always be pressed after selecting a new model.
TM/TF Torque Invert	Inverts the polarity of the torque output so rotation direction produces the same polarity between devices.

5.4 CHANNEL 2 TAB

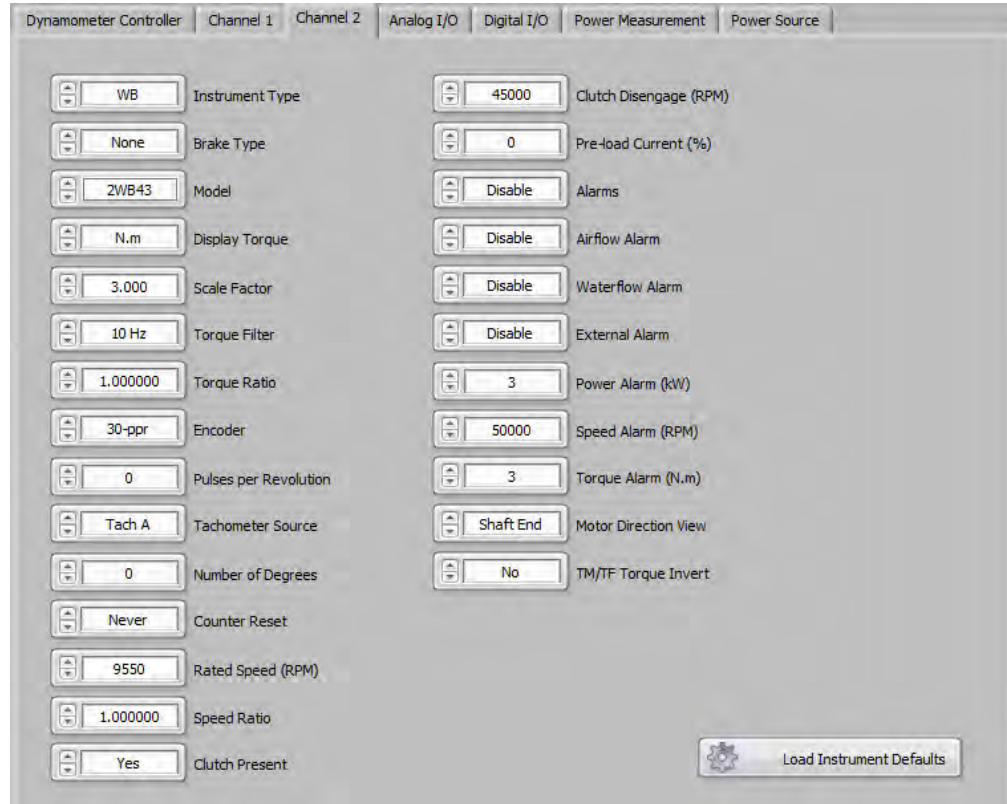


Figure 5–4 Channel 2 Tab

5.4.1 CHANNEL 2 TAB CONTROLS

Control	Function
Instrument Type (None, Auxiliary, FR-10, FRS, HD, HD5, PB, TF, TM, WB)	Selects the type of instrument connected to channel 2 of the dynamometer controller.
Brake Type (None, HB, WB, PB)	Selects the type of brake being used in a non-conventional dynamometer configuration. Magtrol manufactures three types of brakes that may be used in this setup; HB (hysteresis brake), WB (eddy current brake) and PB (powder brake).
Model (depends on instrument type)	Selects the model number of the instrument being used. After making a model selection, always press the Load Instrument Defaults button at the lower right corner of the tab. This will import the critical parameters for that model and populate the controls.
Display Torque (oz.in, oz.ft, lb.in, lb.ft, g.cm, kg.cm, mN.m, cN.m, N.m)	Magtrol dynamometers are scaled in several different units of torque. WB and PB dynamometers are N·m, while HD dynamometers can be oz·in, lb·in, g·cm, kg·cm, mN·m or N·m. Regardless of the dynamometer units of torque, M-TEST 7 will convert this to any other unit of torque you select. All torque data in the program will be in the selected unit and any commanded torque will also be in the new unit of measurement.

TEST SETUP

Control	Function
Scale Factor (0 - n)	The full scale torque value of the dynamometer selected. This is the dynamometer torque units, not the display torque units.
Torque Filter (Off, 2Hz, 3Hz, 5Hz, 10Hz, 20Hz, 25Hz, 50Hz, 100Hz)	Selects the cutoff frequency for the low-pass filter in the torque measurement circuit of the dynamometer controller.
Torque Ratio (0 - n)	<p>If a motor-gearbox combination is being used the gearbox ratio may be entered so that the motor torque will be indicated in the program, rather than the gearbox output torque. For example, if the gearbox multiplies the motor torque by 13.5, enter that value. The program will divide the measured torque by 13.5 to obtain the motor torque. There are losses associated with a gearbox that are not reflected in this value. However, you may change the ratio slightly to account for losses if they are known.</p> <p>Torque ratio = gearbox output torque / motor torque</p>
Encoder (1-ppr, 2-ppr, 6-ppr, 20-ppr, 30-ppr, 60-ppr, 600-ppr, 6000-ppr, USER)	Selects the pulse count per revolution of the encoder being used. This may be one of the standard values Magtrol uses on their dynamometers or a user defined count.
Pulses Per Revolution (0 - n)	The user defined pulse count per revolution for custom encoders.
Tachometer Source (Tach A, Quadrature, Analog Input 1 Ch. 1)	Selects the source of the speed signal being used for measurement and control. Normally, this would be Tach A which is the pulse input on the dynamometer controller but can also be from two other sources.
Number of Degrees (0 - n)	<p>The measurement angle for quadrature encoders.</p> <p>NOTE: The minimum pulse count when using quadrature encoders is 1000-ppr.</p>
Counter Reset (Never/1 Revolution)	Selects cumulative angle of rotation (never) or resets the reading when +/- 360° is reached (1 Revolution).
Rated Speed (0-199999)	The maximum speed at rated torque for WB and PB dynamometers. Exceeding this will cause the dissipated power to be greater than the dynamometer rating.
Clutch Present (Yes/No)	Customized tandem dynamometers may not be coupled with an electro-magnetic clutch. If no clutch is present, select No.
Speed Ratio (0 - n)	<p>If a motor-gearbox combination is being used the gearbox ratio may be entered so that the motor speed will be indicated in the program, rather than the gearbox output speed. For example, if the gearbox divides the motor speed by 13.5, enter that value. The program will multiply the measured speed by 13.5 to obtain the motor speed.</p> <p>Speed ratio = motor speed / gearbox output speed</p>
Clutch Disengage (0 - n)	The speed at which the clutch in a tandem dynamometer disengages.
Pre-Load Current (0-99.99)	The amount of load constantly applied to the motor by the dynamometer brake. This is an open loop function and the value represents the % of controller brake current output.
Alarms (Enable/Disable)	Enables/disables all internal alarms configured for use in the DSP6001/DSP7000.

Control	Function
Airflow Alarm (Enable/Disable)	Enables/disables the flow sensor on suitably equipped forced air cooled dynamometers.
Waterflow Alarm (Enable/Disable)	Enables/disables the flow sensor on suitably equipped liquid cooled dynamometers.
External Alarm (Enable/Disable)	Enables/disables the external alarm input on the DSP6001/ DSP7000. Please refer to the controller manual regarding usage of this feature.
Power Alarm (Enable/Disable)	The maximum power dissipation allowed for the dynamometer in use.
Speed Alarm (0 - n)	The maximum speed allowed for the dynamometer in use.
Torque Alarm (0 - n)	The maximum torque allowed for the dynamometer in use.
Motor Direction View (Shaft End/Lead End)	Selects the view for determining motor direction.
Load Instrument Defaults	Loads the default parameters for the model selected. This should always be pressed after selecting a new model.
TM/TF Torque Invert	Inverts the polarity of the torque output so rotation direction produces the same polarity between devices.

5.5 ANALOG I/O TAB



Figure 5-5 Analog I/O Tab

5.5.1 ANALOG INPUT 1

DSP7000 only with optional I/O card. Two analog inputs are available on this card. Each has a +/-10VDC range. Please refer to the DSP7000 manual for further details.

5.5.1.1 Analog Input 1 Controls

Control	Function
Channel 1	Check this box to enable data acquisition from channel 1 of the I/O card.
Label 1	Enter a name for this analog input. This name will appear as one of the selections in the Configure Display list boxes.
Channel 2	Check this box to enable data acquisition from channel 2 of the I/O card.
Label 2	Enter a name for this analog input. This name will appear as one of the selections in the Configure Display list boxes.

5.5.2 ANALOG OUTPUT 1

DSP7000 only with optional I/O card. Two analog outputs are available on this card. Each has a +/-10VDC range. Please refer to the DSP7000 manual for further details.

5.5.2.1 Analog Output 1 Controls

Control	Function
Channel 1	Check this box to enable analog output for channel 1 of the I/O card.
Label 1	Enter a name for this analog output. This name will appear in the Curve and Pass/Fail test Control Data table for programming output voltages in each step.
Channel 2	Check this box to enable analog output for channel 2 of the I/O card.
Label 2	Enter a name for this analog output. This name will appear in the Curve and Pass/Fail test Control Data table for programming output voltages in each step.

5.5.3 ANALOG INPUT 2

DSP7000 only with optional I/O card. Two analog inputs are available on this card. Each has a +/-10VDC range. Please refer to the DSP7000 manual for further details.

5.5.3.1 Analog Input 2 Controls

Control	Function
Channel 1	Check this box to enable data acquisition from channel 1 of the I/O card.
Label 1	Enter a name for this analog input. This name will appear as one of the selections in the Configure Display list boxes.
Channel 2	Check this box to enable data acquisition from channel 2 of the I/O card.
Label 2	Enter a name for this analog input. This name will appear as one of the selections in the Configure Display list boxes.

5.5.4 ANALOG OUTPUT 2

DSP7000 only with optional I/O card. Two analog outputs are available on this card. Each has a +/-10VDC range. Please refer to the DSP7000 manual for further details.

5.5.4.1 Analog Output 2 Controls

Control	Function
Channel 1	Check this box to enable analog output for channel 1 of the I/O card.
Label 1	Enter a name for this analog output. This name will appear in the Curve and Pass/Fail test Control Data table for programming output voltages in each step.
Channel 2	Check this box to enable analog output for channel 2 of the I/O card.
Label 2	Enter a name for this analog output. This name will appear in the Curve and Pass/Fail test Control Data table for programming output voltages in each step.

5.5.5 ACCESSORY ANALOG INPUT

The accessory analog input device. This requires a USB or PCI data acquisition device and an AI Task configured in Measurement and Automation Explorer. For more information on AI Tasks refer to Section 15.1.

5.5.5.1 Accessory Analog Input Controls

Control	Function
Device Enable	Check this box to enable the accessory analog input device.
Channel (0 - n)	The channel number of the accessory analog input device.
Enable	Check this box to enable the accessory analog input channel.
Label	Enter a name for this analog input. This name will appear as one of the selections in the Configure Display list boxes.

5.5.6 ACCESSORY TEMPERATURE INPUT

The accessory temperature input device. This requires a USB or PCI data acquisition device and an AI Task configured in Measurement and Automation Explorer. For more information on AI Tasks refer to Section 15.1.

5.5.6.1 Accessory Temperature Input Controls

Control	Function
Device Enable	Check this box to enable the accessory temperature input device.
Channel (0 - n)	The channel number of the accessory temperature input device.
Enable	Check this box to enable the accessory temperature input channel.
Label	Enter a name for this temperature input. This name will appear as one of the selections in the Configure Display list boxes.

5.5.7 ACCESSORY ANALOG OUTPUT

The accessory analog output device. This requires a USB or PCI data acquisition device and an AO Task configured in Measurement and Automation Explorer. For more information on AO Tasks refer to Section 15.2.

5.5.7.1 Accessory Analog Output Controls

Control	Function
Device Enable	Check this box to enable the accessory analog output device.
Channel (0 - n)	The channel number of the accessory analog output device.
Enable	Check this box to enable the accessory analog output channel.
Label	Enter a name for this analog output. This name will appear in the Curve and Pass/Fail test Control Data table for programming output voltages in each step.

5.6 DIGITAL I/O TAB

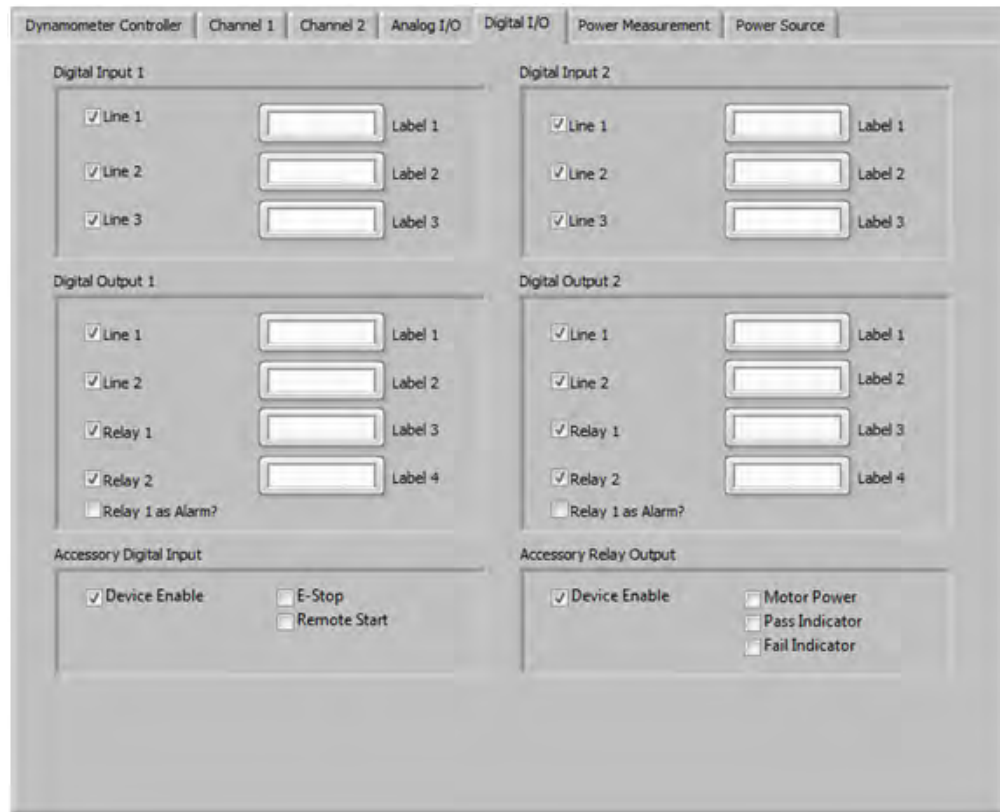


Figure 5-6 Digital I/O Tab

5.6.1 DIGITAL INPUT 1

DSP7000 only with optional I/O card. Three digital inputs are available on this card. Please refer to the DSP7000 manual for further details.

TEST SETUP

5.6.1.1 Digital Input 1 Controls

Control	Function
Line 1	Check this box to enable data acquisition from line 1 of the I/O card.
Label 1	Enter a name for this digital input. This name will appear as one of the selections in the Configure Display list boxes.
Line 2	Check this box to enable data acquisition from line 2 of the I/O card.
Label 2	Enter a name for this digital input. This name will appear as one of the selections in the Configure Display listboxes.
Line 3	Check this box to enable data acquisition from line 3 of the I/O card.
Label 3	Enter a name for this digital input. This name will appear as one of the selections in the Configure Display listboxes.

5.6.2 DIGITAL OUTPUT 1

DSP7000 only with optional I/O card. Two digital outputs and two relays are available on this card. Please refer to the DSP7000 manual for further details.

5.6.2.1 Digital Output 1 Controls

Control	Function
Line 1	Check this box to enable digital output for Line 1 of the I/O card.
Label 1	Enter a name for this digital output. This name will appear in the Curve and Pass/Fail test Control Data table for programming output state in each step.
Line 2	Check this box to enable digital output for Line 2 of the I/O card.
Label 2	Enter a name for this digital output. This name will appear in the Curve and Pass/Fail test Control Data table for programming output state in each step.
Relay 1	Check this box to enable relay 1 on the I/O card.
Label 3	Enter a name for this relay. This name will appear in the Curve and Pass/Fail test Control Data table for programming output state in each step.
Relay 2	Check this box to enable relay 2 on the I/O card.
Label 4	Enter a name for this relay. This name will appear in the Curve and Pass/Fail test Control Data table for programming output state in each step.
Relay 1 as Alarm	Enables use of relay 1 as an output when an alarm occurs.

5.6.3 DIGITAL INPUT 2

DSP7000 only with optional I/O card. Three digital inputs are available on this card. Please refer to the DSP7000 manual for further details.

5.6.3.1 Digital Input 2 Controls

Control	Function
Line 1	Check this box to enable data acquisition from line 1 of the I/O card.
Label 1	Enter a name for this digital input. This name will appear as one of the selections in the Configure Display list boxes.
Line 2	Check this box to enable data acquisition from line 2 of the I/O card.
Label 2	Enter a name for this digital input. This name will appear as one of the selections in the Configure Display listboxes.
Line 3	Check this box to enable data acquisition from line 3 of the I/O card.
Label 3	Check this box to enable data acquisition from line 3 of the I/O card.

5.6.4 DIGITAL OUTPUT 2

DSP7000 only with optional I/O card. Two digital outputs and two relays are available on this card. Please refer to the DSP7000 manual for further details.

5.6.4.1 Digital Output 2 Controls

Control	Function
Line 1	Check this box to enable digital output for Line 1 of the I/O card.
Label 1	Enter a name for this digital output. This name will appear in the Curve and Pass/Fail test Control Data table for programming output state in each step.
Line 2	Check this box to enable digital output for Line 2 of the I/O card.
Label 2	Enter a name for this digital output. This name will appear in the Curve and Pass/Fail test Control Data table for programming output state in each step.
Relay 1	Check this box to enable relay 1 on the I/O card.
Label 3	Enter a name for this digital output. This name will appear in the Curve and Pass/Fail test Control Data table for programming output state in each step.
Relay 2	Check this box to enable relay 2 on the I/O card.
Label 4	Enter a name for this digital output. This name will appear in the Curve and Pass/Fail test Control Data table for programming output state in each step.
Relay 1 as Alarm	Enables use of relay 1 as an output when an alarm occurs.

5.6.5 ACCESSORY DIGITAL INPUT

The accessory digital input device. This requires a USB or PCI data acquisition device and a DI Task configured in Measurement and Automation Explorer. For more information on DI Tasks refer to Section 15.3.

5.6.5.1 Accessory Digital Input Controls

Control	Function
Device Enable	Check this box to enable the accessory digital input device.
E-Stop	Reads the status of an external E-Stop signal. This is digital input line 0 of the device being used and should be set to logic high under normal operating conditions. A logic low would signify the E-Stop has been pressed.
Remote Start	Reads the status of an external remote start signal. This is digital input line 1 of the device being used and should be momentarily set to logic high to start the test.

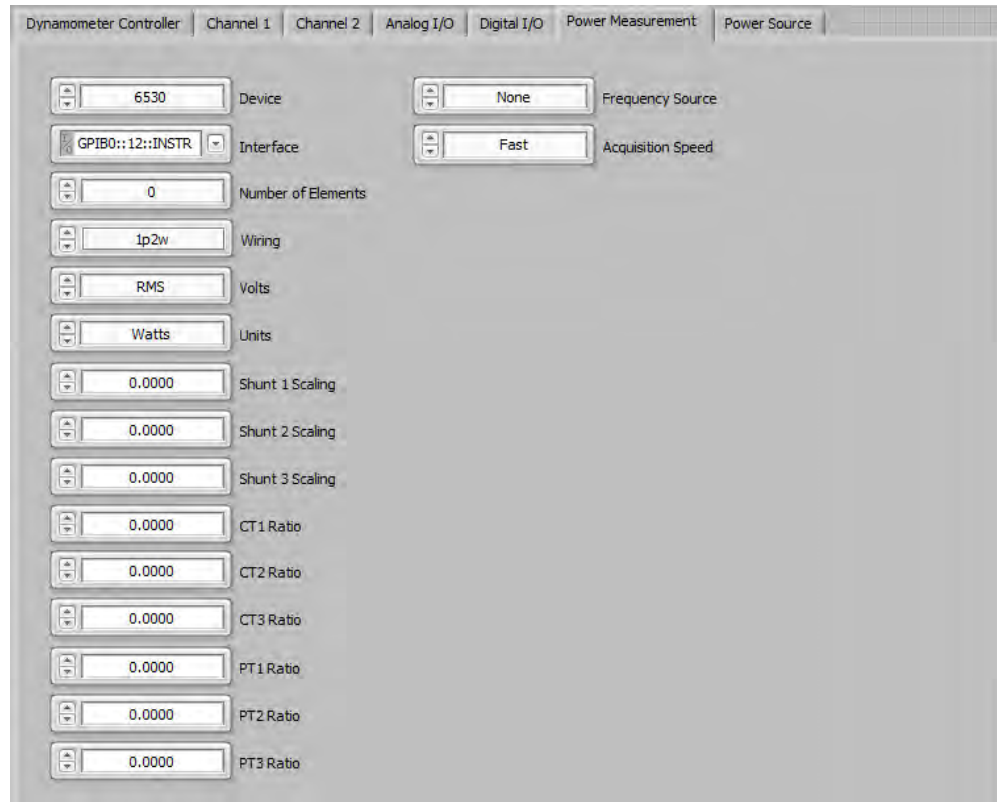
5.6.6 ACCESSORY RELAY OUTPUT

The accessory relay output device. This requires a USB or PCI relay device and a DO Task configured in Measurement and Automation Explorer. For more information on DO Tasks refer to Section 15.4.

5.6.6.1 Accessory Relay Output Controls

Control	Function
Device Enable	Check this box to enable the accessory relay output device.
Motor Power	<p>This is relay 0 of the device being used and will close when a test starts and open when the test finishes.</p> <p>When using a DC power source, this may be used in conjunction with relay 1 to reverse polarity to the motor. To close relay 0, enter a positive voltage setpoint. To close relay 1, enter a negative voltage. These relays can be used to control a higher current set of polarity reversing contactors.</p>
Pass Indicator	At the completion of a successful Pass/Fail test, relay 2 will close and remain closed until the next test begins. This relay can be used to illuminate a lamp or similar device to notify the user that the test is complete and the motor has passed all parameter checks.
Fail Indicator	At the completion of an unsuccessful Pass/Fail test, relay 3 will close and remain closed until the next test begins. This relay can be used to illuminate a lamp or similar device to notify the user that the test is complete and the motor has failed at least one of the parameter checks.

5.7 POWER MEASUREMENT TAB



TEST SETUP

Figure 5–7 Power Measurement Tab

5.7.1 POWER MEASUREMENT TAB CONTROLS

Control	Function
Device (None, EMI, HP603xA, HP66xxA, Lambda Genesys, Magna-Power TS, Power Ten, Sorensen DCS, Sorensen DHP, Sorensen XG, Xantrex XFR, Xantrex XDC, Xantrex XMP, AMREL SPS, 5100, 5300, 5310, 5330, 6510, 6510e, 6530, 6550, 7530, 7510 LMG310, N4L PPA15xx, N4L PPA25xx, N4L PPA55xx, WT210, WT230, WT500, WT1030, WT1600, WT1800, WT2010, WT3000, PZ4000, Micro Dyne)	Selects the electrical power measurement device in use (if any).

Control	Function
Interface (GPIB/COM)	This selects the GPIB, RS-232 or USB port of the power measurement device to be used. In some cases you may have more than one device connected and by selecting the unique address you can choose which to use without changing interface cables.
Number of Elements (1 - 6)	The number of input modules on the power analyzer in use.
Wiring (depends on instrument type)	The wiring method being used with the power analyzer. The available selections will be based upon the number of elements the power analyzer has installed.
Volts (RMS/MEAN)	The voltage measurement method for analyzers that allow it. In most cases the RMS mode will be used. When measuring certain types of waveforms, such as PWM or BLDC, the mean mode should be used.
Units (Watts/kW)	Selects watts or kilowatts displayed on the 5100.
Shunt 1 Scaling (0-99999)	Enter the scaling constant for the external shunt on phase 1 using this control. The constant is determined by dividing the full scale current of the shunt by the full scale voltage in mV. The result should be between 0.0001 and 99999. A value of 0.0000 disables the external sensor input.
Shunt 2 Scaling (0-99999)	Enter the scaling constant for the external shunt on phase 2 using this control. The constant is determined by dividing the full scale current of the shunt by the full scale voltage in mV. The result should be between 0.0001 and 99999. A value of 0.0000 disables the external sensor input.
Shunt 3 Scaling (0-99999)	Enter the scaling constant for the external shunt on phase 3 using this control. The constant is determined by dividing the full scale current of the shunt by the full scale voltage in mV. The result should be between 0.0001 and 99999. A value of 0.0000 disables the external sensor input.
CT1 Ratio (0.01-10000)	The amps scaling constant for the current transformer on phase 1. The constant is determined by dividing the primary current of the transformer by the secondary current. A value of 0.0000 disables the function.
CT2 Ratio (0.01-10000)	The amps scaling constant for the current transformer on phase 2. The constant is determined by dividing the primary current of the transformer by the secondary current. A value of 0.0000 disables the function.
CT3 Ratio (0.01-10000)	The amps scaling constant for the current transformer on phase 3. The constant is determined by dividing the primary current of the transformer by the secondary current. A value of 0.0000 disables the function.

Control	Function
PT1 Ratio (0.01-10000)	<p>The volts scaling constant for the potential transformer on phase 1. The constant is determined by dividing the primary voltage of the transformer by the secondary voltage.</p> <p>A value of 0.0000 disables the function.</p>
PT2 Ratio (0.01-10000)	<p>The volts scaling constant for the potential transformer on phase 2. The constant is determined by dividing the primary voltage of the transformer by the secondary voltage.</p> <p>A value of 0.0000 disables the function.</p>
PT3 Ratio (0.01-10000)	<p>The volts scaling constant for the potential transformer on phase 3. The constant is determined by dividing the primary voltage of the transformer by the secondary voltage.</p> <p>A value of 0.0000 disables the function.</p>
Frequency Source (None, A1, V1, A2, V2, A3, V3, A4, V4, A5, V5, A6, V6)	The parameter and channel being used for frequency measurement.
Acquisition Speed (Very Fast, Fast, Medium, Slow, Very Slow)	Selects the data acquisition speed for N4L power analyzers.

5.8 POWER SOURCE TAB

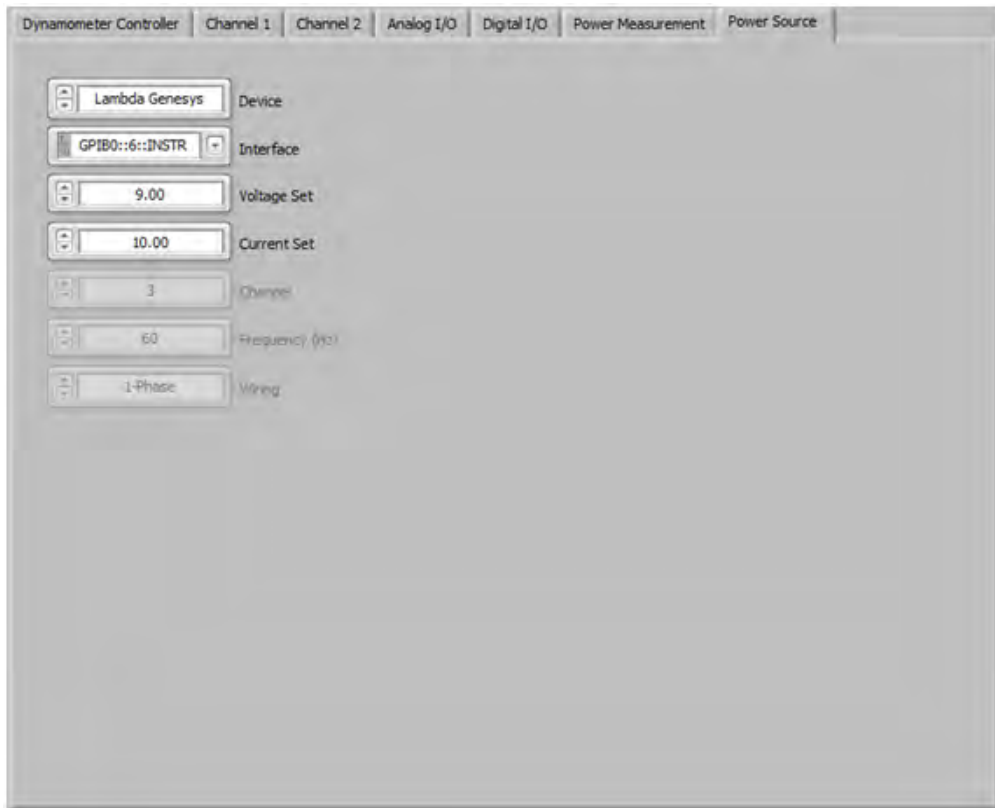


Figure 5–8 Power Source Tab

5.8.1 POWER SOURCE TAB CONTROLS

Control	Function
Device (None, Behlman BL3xxx, Chroma 61700, PPS UPC-32, Staco, AMREL SPS, EMI, HP603xA, HP66xxA, Lambda Genesys, Magna-Power TS, Power Ten, Sorensen DCS, Sorensen DHP, Sorensen XG, Xantrex XFR, Xantrex XDC, Xantrex XMP)	The motor power source being used (if any). When using a power source not being controlled by M-TEST 7, select None.
Interface (GPIB)	This selects the GPIB port of the power source to be used. In some cases you may have more than one device connected and by selecting the unique address you can choose which to use without changing interface cables.

TEST SETUP

Control	Function
Voltage Set (0 - n)	The desired test voltage.
Current Set (0 - n)	The current limit of the power supply.
Channel (0 - 16)	The Xantrex XMP can have several power supply modules in one chassis. Use this control to select the module to use.
Frequency (45 - 500)	The output frequency of the programmable AC power supply.
Wiring (1-Phase/3-Phase)	The output wiring mode of the programmable AC power supply.

6. Configure Display

6.1 CONFIGURE DISPLAY TAB

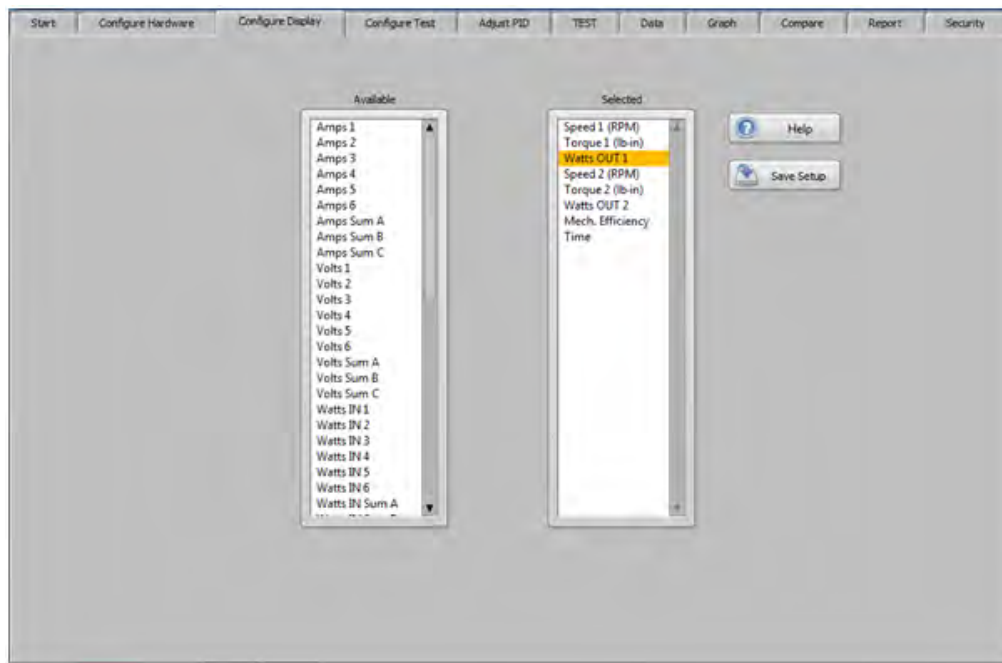


Figure 6-1 Configure Display Tab

6.1.1 AVAILABLE

The available parameters that can be measured and displayed during a test. Select an item by double-clicking on it. This will move it to the Selected parameters listbox.

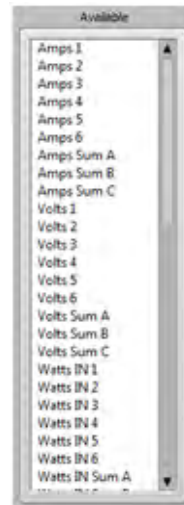


Figure 6-2 Available Parameters

TEST SETUP

6.1.2 **SELECTED**

The selected parameters that will be measured and recorded during the test. The order of parameters in the selected panel may be changed by clicking on that parameter and dragging it to the desired location. The order in which they appear in the panel is the same order they will appear in the data table during a test. To remove a parameter, double-click on it.

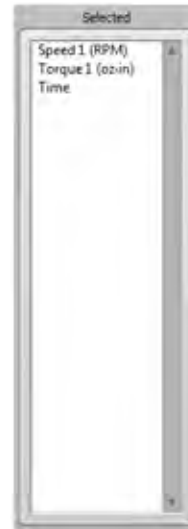


Figure 6–3 Selected Parameters

6.1.3 **HELP**

Describes operation of Available and Selected listboxes.

6.1.4 **SAVE SETUP**

This will save the setup to the filename that is currently in use. If you wish to change the filename, go to the Start tab and press the Save Setup button.

7. Configure Test

7.1 CONFIGURE TEST TAB

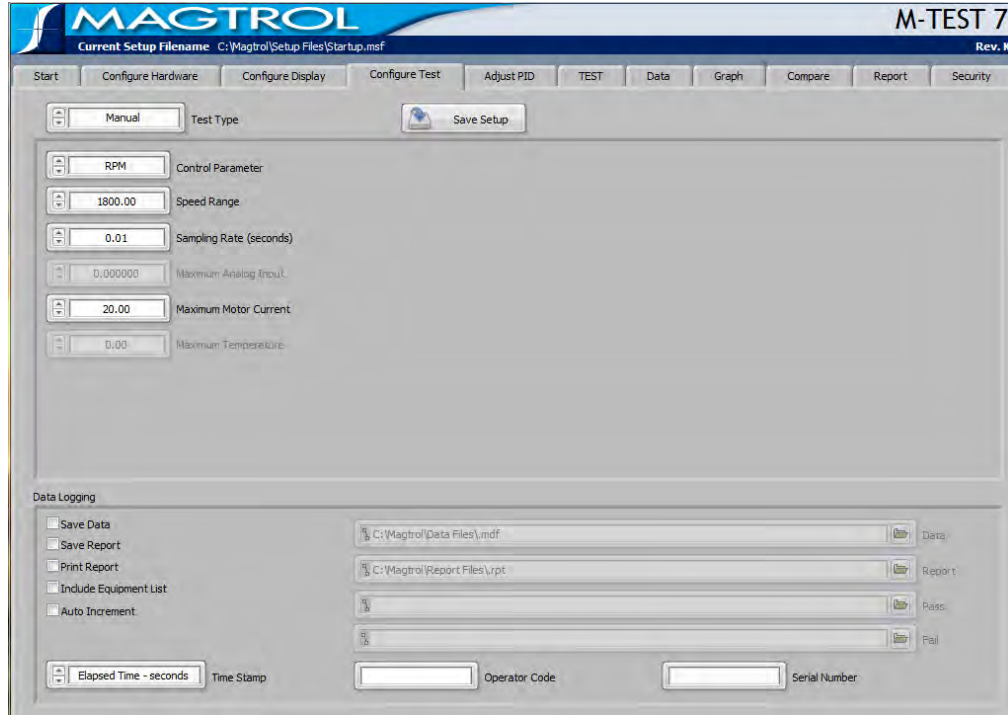


Figure 7-1 Configure Test Tab

7.1.1 CONFIGURE TEST TAB CONTROLS

Control	Function
Save Setup	This will save the setup to the filename that is currently in use. If you wish to change the filename, go to the Start tab and press the Save Setup button.
Test Type (Manual, Curve, Ramp, Pass/Fail, Coast, Overload to Trip, Calibration Display)	Selects the type of test to perform.

TEST SETUP

7.2 MANUAL TEST

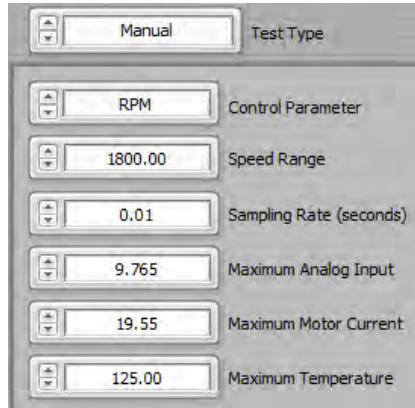


Figure 7–2 Manual Test Screen

7.2.1 MANUAL TEST CONTROLS

Control	Function
Control Parameter (RPM, Torque, Open Loop)	<p>The setpoint parameter used for this test. The test tab has a slider control for loading the motor by open loop current, speed or torque.</p> <p>When controlling by speed or torque, the controller uses its internal circuitry to close the loop on the desired setpoint. The PID controls are fully active for system response tuning.</p> <p>When in open loop, there is no closed loop stabilization.</p>
Speed Range (0 - n)	The value entered should be slightly greater than the free run speed of the motor. Adjusting the speed range properly will give the best dynamic range for the PID settings.
Sampling Rate (0.01 - n)	The time interval at which a data point will be stored when Timed Storage is selected. The maximum rate is 0.01 seconds (100 samples per second). Real-time data will be displayed in the data table and plotted on the graph. This data is not affected by the sampling rate.
Maximum Analog Input (0 - n)	The high limit for the accessory analog input device. A reading that exceeds this value will cause the test in progress to abort.
Maximum Motor Current (0 - n)	The high current limit for the power measurement device. Any current that exceeds this value will cause the test in progress to abort.
Maximum Temperature (0 - n)	The maximum temperature limit for the temperature measurement device. Any temperature that exceeds this value will cause the test in progress to abort.

TEST SETUP

7.3 CURVE TEST

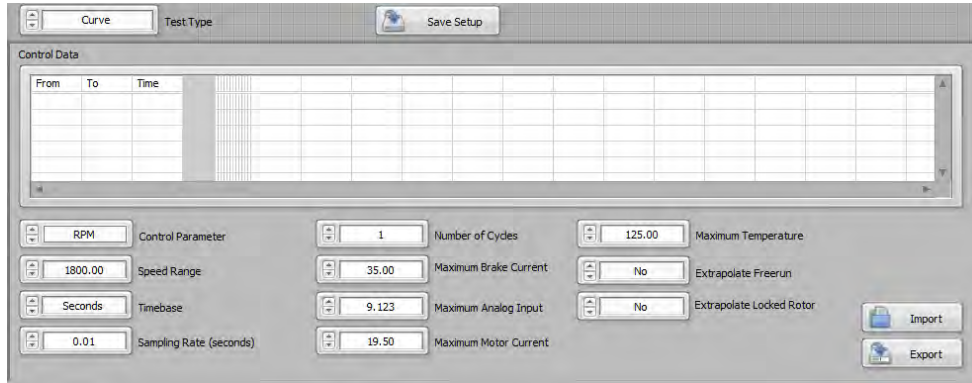


Figure 7–3 Curve Test Screen

7.3.1 CURVE TEST CONTROLS

Control	Function
Control Data	<p>The sequence of load points to be run during the test.</p> <p>To quickly load to a point and dwell there, enter the same load value in both the From and To columns. Enter the Time to hold at that load.</p> <p>To ramp to a load point, enter the starting load value in the From column and the final load value in the To column. Enter the amount of time to perform the transition in the Time column.</p> <p>Any number load points may be entered in order to create a load profile for this test.</p> <p>Use 888888 (six 8's) in the From and To columns to reset the load, open the motor power contactor, and wait for the motor to stop rotating. This is useful for tests that require a cooling off period before starting up again, and for making sure the motor is stopped before reversing direction.</p> <p>Use 999999 (six 9's) in the From and To columns to request a free run load point if under speed control, or a locked rotor point under any other control method.</p> <p>If you are using a programmable power supply, you must also enter the voltage for each step of the sequence. This allows changing the voltage for each step if desired.</p> <p>If optional analog and digital outputs, or accessory relays are being used, their value or state may also be entered in the appropriate column.</p> <p>Units (From, To) = control parameter units Units (Analog Output) = volts Units (Digital Output, Relay) = 0 for False, 1 for True</p>

TEST SETUP

Control	Function
Control Parameter (A1, A2, A3, A4, A5, A6, A SumA, A SumB, A SumC, Win1, Win2, Win3, Win4, Win5, Win6, W SumA, W SumB, W SumC, RPM, Torque, Wout, KWout, Open Loop, Hp)	<p>This is the setpoint parameter used for this test. When controlling by speed or torque, the internal circuitry of the controller closes the loop on the desired setpoint. The PID controls are fully active for system response tuning.</p> <p>When controlling by other parameters, M-TEST 7 uses a proportional control loop in conjunction with the open loop mode of the controller.</p>
Speed Range (0 - n)	The value entered should be slightly greater than the free run speed of the motor. Adjusting the speed range properly will give the best dynamic range for the PID settings.
Timebase (Seconds/Minutes)	The time units of the values in the Control Data table.
Sampling Rate (0.01 - n)	<p>The time interval at which a data point will be stored. The maximum rate is 0.01 seconds (100 samples per second). Real-time data will be displayed in the data table and plotted on the graph. This data is not affected by the sampling rate.</p> <p>To acquire a data point only at the end of each dwell period, enter 999999 (six 9's).</p>
Number of Cycles (1 - n)	The number of times to repeat the test sequence created in the Control Data table.
Maximum Brake Current (0-99.99)	The percentage of controller current applied to the dynamometer brake during a locked rotor instruction. This should be set to the lowest value that will stall the motor in order to reduce the amount of residual magnetism (cogging) on the brake.
Maximum Analog Input (0 - n)	The high limit for the accessory analog input device. A reading that exceeds this value will cause the test in progress to abort.
Maximum Motor Current (0 - n)	The high current limit for the power measurement device. Any current that exceeds this value will cause the test in progress to abort.
Maximum Temperature (0 - n)	The maximum temperature limit for the temperature measurement device. Any temperature that exceeds this value will cause the test in progress to abort.
Extrapolate Freerun (No, 2 points, 5 points, 10 points, 20 points, 50 points, 100 points, All points)	<p>Motors with linear torque-speed curves can have their uncoupled freerun parameters extrapolated from the data set. This assumes at least two load points are obtained during the test, and are tested in increasing torque or decreasing speed order.</p> <p>The least squares method is used to obtain the linear fit coefficients (slope and intercept) and the data is then calculated at zero torque.</p> <p>Select the number of data points desired from the first recorded data to calculate the freerun parameters. You may also select All when testing motors having a linear torque-speed curve to use the entire data set.</p>

Control	Function
Extrapolate Locked Rotor (No, 2 points, 5 points, 10 points, 20 points, 50 points, 100 points, All points)	<p>Motors with linear torque-speed curves can have their locked rotor parameters extrapolated from the data set. This assumes at least two load points are obtained during the test, and are tested in increasing torque or decreasing speed order.</p> <p>The least squares method is used to obtain the linear fit coefficients (slope and intercept) and the data is then calculated at zero speed.</p> <p>Select the number of data points desired from the last recorded data to calculate the locked rotor parameters. You may also select All when testing motors having a linear torque-speed curve to use the entire data set.</p>
Import	You may import data for this table from an external tab-delimited text file. Press this button to access the file dialog and choose the appropriate file.
Export	Exports the contents of the Control Data table to a tab-delimited text file. Press this button to access the file dialog and choose the file name.

TEST SETUP

7.4 RAMP TEST

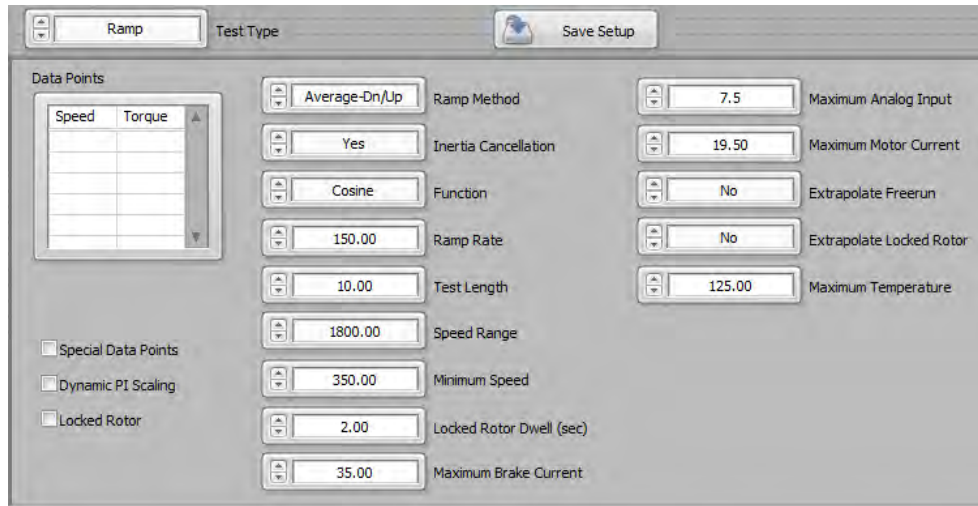


Figure 7–4 Ramp Test Screen

7.4.1 RAMP TEST CONTROLS

Control	Function
Data Points (0 - n)	<p>If Special Data Points is enabled, enter the values in decreasing order for speed, and increasing order for torque. If a matching value is not found within the measured data set, the software will interpolate the value from data obtained one point above and one point below. The process applies to all measured parameters.</p> <p>Data may also be entered by importing a tab-delimited text file containing the torque and speed points.</p> <p>Speed points: Enter specific speed points in the table in decreasing order. To obtain the full data set in addition to any speed points, enter 888888 (six 8's) as the final item in the Speed column.</p> <p>Torque points: Enter specific torque points in the table in increasing order. To obtain the full data set in addition to any torque points, enter 888888 (six 8's) as the final item in the Torque column.</p>
Import	You may import data for this table from an external tab-delimited text file. Press this button to access the file dialog and choose the appropriate file.
Special Data Points	Specific speed and torque points may be extracted from the data set and displayed apart from the regular data.
Dynamic PI Scaling	Enables scaling of the PI values from full value at the start of the ramp to a percentage of that value at the end of the ramp.
Locked Rotor	Performs a locked rotor test regardless of the minimum speed specified.
Ramp Method (Average - Dn/Up / Dynamic - CF)	<p>There are two ramp methods that may be used when performing complete motor performance curves. The first method is an average of the deceleration and acceleration curves. This typically produces the most accurate results and is somewhat dependent on the controller ramp tuning. Inertia cancellation is inherent with this choice, but may be disabled to view the effect of system inertia.</p> <p>The second method involves determining a correction factor based on a deceleration curve and a stabilized point. The correction factor is then applied to the entire data set. In order for this to work properly, the system tuning is highly critical</p>

Control	Function
Inertia Cancellation (Yes, No, Previous Value)	<p>Inertia cancellation is necessary in order to get accurate torque and power data during a ramp test. The stored energy of the rotating mass in the system tends to make the motor look stronger than it actually is during a deceleration ramp. Inertia cancellation removes the inertial component and gives data as if a number of discrete stabilized points were taken. Under most circumstances you will want to use inertial cancellation.</p> <p>The Average Dn/Up routine inherently uses inertia cancellation each time it is run.</p> <p>Once a Dynamic-CF test has been run with inertia cancellation, subsequent tests on the same motor, or same type of motor may be run using the coefficients obtained from the first run. Select Previous Value to use those coefficients without actually performing the inertia cancellation routine.</p>
Function (Linear/Cosine)	A linear ramp decelerates (and accelerates) the motor at a linear RPM per second rate. A cosine ramp uses a non-linear rate and is based on time.
Ramp Rate (0 - n)	The linear ramp rate in RPM per second.
Test Length (0 - n)	The time to ramp down and up..
Speed Range (0 - n)	The value entered should be slightly greater than the free run speed of the motor. Adjusting the speed range properly will give the best dynamic range for the PID settings.
Minimum Speed (0 - n)	<p>The low speed limit at which the ramp terminates or reverses.</p> <p>You may specify 0 (zero) to decelerate to locked rotor, or any speed above 150 RPM. The system response is such that accurately controlled operation in the range of 1-150 RPM is not possible without use of an optional speed encoder. For that reason we do not recommend trying to operate below 150 RPM, with the exception of locked rotor.</p>
Locked Rotor Dwell (0 - n)	The length of time, in seconds, to hold the motor at locked rotor before taking a reading and releasing. Use the minimum amount of time necessary to avoid excessive motor heating.
Maximum Brake Current (0 - 99.99)	The percentage of controller current applied to the dynamometer brake during a locked rotor instruction. This should be set to the lowest value that will stall the motor in order to reduce the amount of residual magnetism (cogging) on the brake.
Maximum Analog Input (0 - n)	The high limit for the accessory analog input device. A reading that exceeds this value will cause the test in progress to abort.
Maximum Motor Current (0 - n)	The high current limit for the power measurement device. Any current that exceeds this value will cause the test in progress to abort.

Control	Function
<p>Extrapolate Freerun (No, 2 points, 5 points, 10 points, 20 points, 50 points, 100 points, All points)</p>	<p>Motors with linear torque-speed curves can have their uncoupled freerun parameters extrapolated from the data set. This assumes at least two load points are obtained during the test, and are tested in increasing torque or decreasing speed order.</p> <p>The least squares method is used to obtain the linear fit coefficients (slope and intercept) and the data is then calculated at zero torque.</p> <p>Select the number of data points desired from the first recorded data to calculate the freerun parameters. You may also select All when testing motors having a linear torque-speed curve to use the entire data set.</p>
<p>Extrapolate Locked Rotor (No, 2 points, 5 points, 10 points, 20 points, 50 points, 100 points, All points)</p>	<p>Motors with linear torque-speed curves can have their locked rotor parameters extrapolated from the data set. This assumes at least two load points are obtained during the test, and are tested in increasing torque or decreasing speed order.</p> <p>The least squares method is used to obtain the linear fit coefficients (slope and intercept) and the data is then calculated at zero speed.</p> <p>Select the number of data points desired from the last recorded data to calculate the locked rotor parameters. You may also select All when testing motors having a linear torque-speed curve to use the entire data set.</p>
<p>Maximum Temperature (0-n)</p>	<p>The maximum temperature limit for the temperature measurement device. Any temperature that exceeds this value will cause the test in progress to abort.</p>

7.5 PASS/FAIL TEST

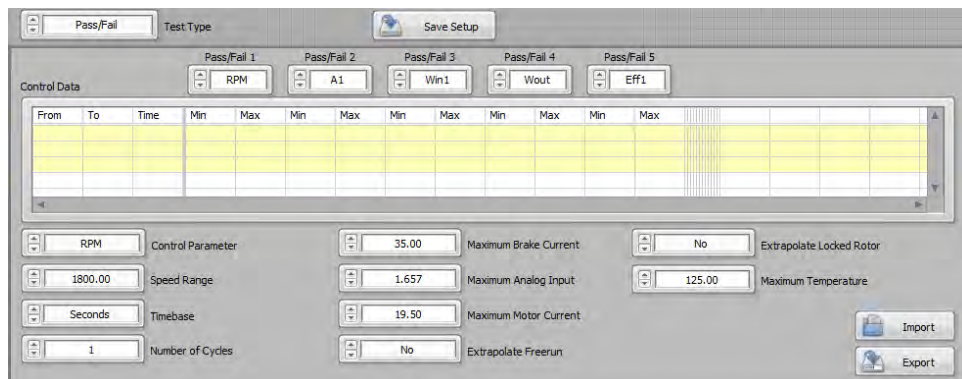


Figure 7–5 Pass/Fail Test

7.5.1 PASS/FAIL TEST CONTROLS

Control	Function
Pass/Fail 1 (None, A1, A2, A3, A4, A5, A6, A SumA, A SumB, A SumC, Win1, Win2, Win3, Win4, Win5, Win6, W SumA, W SumB, W SumC, RPM, Torque, Wout, Aux, Direction, KWout, Eff1, Eff2, Eff3, Eff4, Eff5, Eff6, E SumA, E SumB, E SumC, Hp)	Selects the first parameter to check against minimum and maximum values. The Min and Max values should be entered into the Control Data table directly below this control.
Pass/Fail 2 (same as Pass/Fail 1)	Selects the second parameter to check against minimum and maximum values. The Min and Max values should be entered into the Control Data table directly below this control.
Pass/Fail 3 (same as Pass/Fail 1)	Selects the third parameter to check against minimum and maximum values. The Min and Max values should be entered into the Control Data table directly below this control.
Pass/Fail 4 (same as Pass/Fail 1)	Selects the fourth parameter to check against minimum and maximum values. The Min and Max values should be entered into the Control Data table directly below this control.
Pass/Fail 5 (same as Pass/Fail 1)	Selects the fifth parameter to check against minimum and maximum values. The Min and Max values should be entered into the Control Data table directly below this control.

Control	Function
Control Data	<p>The sequence of load points to be run during the test.</p> <p>To quickly load to a point and dwell there, enter the same load value in both the From and To columns. Enter the Time to hold at that load.</p> <p>To ramp to a load point, enter the starting load value in the From column and the final load value in the To column. Enter the amount of time to perform the transition in the Time column.</p> <p>Any number load points may be entered in order to create a load profile for this test.</p> <p>Use 888888 (six 8's) in the From and To columns to reset the load, open the motor power contactor, and wait for the motor to stop rotating. This is useful for tests that require a cooling off period before starting up again, and for making sure the motor is stopped before reversing direction.</p> <p>Use 999999 (six 9's) in the From and To columns to request a free run load point if under speed control, or a locked rotor point under any other control method.</p> <p>If you are using a programmable power supply, you must also enter the voltage for each step of the sequence. This allows changing the voltage for each step if desired.</p> <p>If optional analog and digital outputs, or accessory relays are being used, their value or state may also be entered in the appropriate column.</p> <p>Units (From, To) = control parameter units Units (Analog Output) = volts Units (Digital Output, Relay) = 0 for False, 1 for True</p>
Control Parameter (A1, A2, A3, A4, A5, A6, A SumA, A SumB, A SumC, Win1, Win2, Win3, Win4, Win5, Win6, W SumA, W SumB, W SumC, RPM, Torque, Wout, KWout, Open Loop, Hp)	<p>This is the setpoint parameter used for this test. When controlling by speed or torque, the internal circuitry of the controller closes the loop on the desired setpoint. The PID controls are fully active for system response tuning.</p> <p>When controlling by other parameters, M-TEST 7 uses a proportional control loop in conjunction with the open loop mode of the controller.</p>
Speed Range (0 - n)	<p>The value entered should be slightly greater than the free run speed of the motor. Adjusting the speed range properly will give the best dynamic range for the PID settings.</p>
Timebase (Minutes - Seconds)	<p>The time units of the values in the Control Data table.</p>
Number of Cycles (0 - n)	<p>The number of times to repeat the test sequence created in the Control Data table.</p>

Control	Function
Maximum Brake Current (0 - 99.99)	The percentage of controller current applied to the dynamometer brake during a locked rotor instruction. This should be set to the lowest value that will stall the motor in order to reduce the amount of residual magnetism (cogging) on the brake.
Maximum Analog Input (0 - n)	The high limit for the accessory analog input device. A reading that exceeds this value will cause the test in progress to abort.
Maximum Motor Current (0 - n)	The high current limit for the power measurement device. Any current that exceeds this value will cause the test in progress to abort.
Extrapolate Freerun (No, 2 points, 5 points, 10 points, 20 points, 50 points, 100 points, All points)	<p>Motors with linear torque-speed curves can have their uncoupled freerun parameters extrapolated from the data set. This assumes at least two load points are obtained during the test, and are tested in increasing torque or decreasing speed order.</p> <p>The least squares method is used to obtain the linear fit coefficients (slope and intercept) and the data is then calculated at zero torque.</p> <p>Select the number of data points desired from the first recorded data to calculate the freerun parameters. You may also select All when testing motors having a linear torque-speed curve to use the entire data set.</p>
Extrapolate Locked Rotor (No, 2 points, 5 points, 10 points, 20 points, 50 points, 100 points, All points)	<p>Motors with linear torque-speed curves can have their locked rotor parameters extrapolated from the data set. This assumes at least two load points are obtained during the test, and are tested in increasing torque or decreasing speed order.</p> <p>The least squares method is used to obtain the linear fit coefficients (slope and intercept) and the data is then calculated at zero speed.</p> <p>Select the number of data points desired from the last recorded data to calculate the locked rotor parameters. You may also select All when testing motors having a linear torque-speed curve to use the entire data set.</p>
Maximum Temperature (0-n)	The maximum temperature limit for the temperature measurement device. Any temperature that exceeds this value will cause the test in progress to abort.
Import	You may import data for this table from an external tab-delimited text file. Press this button to access the file dialog and choose the appropriate file.
Export	Exports the contents of the Control Data table to a tab-delimited text file. Press this button to access the file dialog and choose the file name.

7.6 COAST TEST

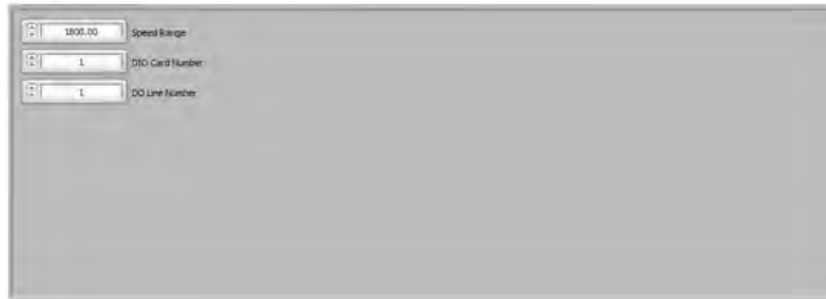


Figure 7–6 Coast Test Screen

7.6.1 COAST TEST CONTROLS

Control	Function
Speed Range (0 - n)	The value entered should be slightly greater than the free run speed of the motor.
DIO Card Number (1/2)	Which of two possible I/O cards is being used to control the motor power.
DO Line Number (1/2)	Which of two possible I/O lines is being used to control the motor power.

TEST SETUP

7.7 OVERLOAD TO TRIP TEST

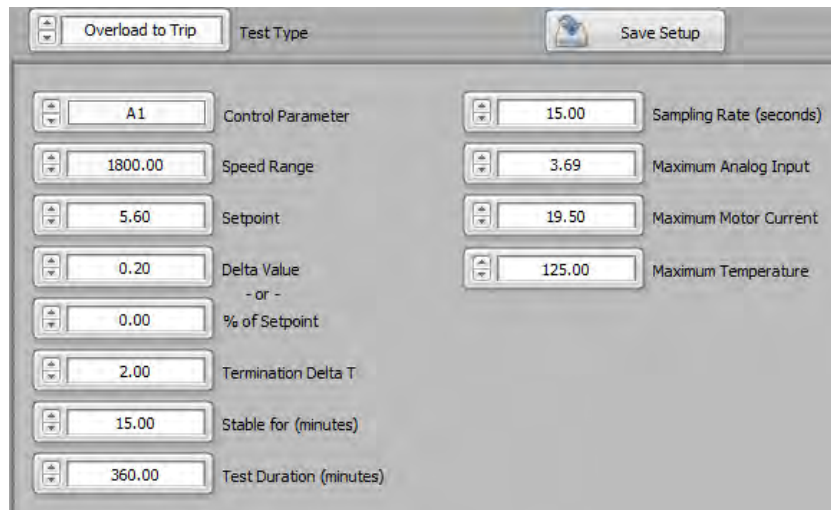


Figure 7–7 Overload to Trip Test Screen

7.7.1 OVERLOAD TO TRIP TEST CONTROLS

Control	Function
Control Parameter (A1, A2, A3, A4, A5, A6, A SumA, A SumB, A SumC, Win1, Win2, Win3, Win4, Win5, Win6, W SumA, W SumB, W SumC, RPM, Torque, Wout, KWout, Open Loop, Hp)	<p>This is the setpoint parameter used for this test. When controlling by speed or torque, the internal circuitry of the controller closes the loop on the desired setpoint. The PID controls are fully active for system response tuning.</p> <p>When controlling by other parameters, M-TEST 7 uses a proportional control loop in conjunction with the open loop mode of the controller.</p>
Speed Range (0 - n)	The value entered should be slightly greater than the free run speed of the motor. Adjusting the speed range properly will give the best dynamic range for the PID settings.
Setpoint (0 - n)	The initial value for the Control Parameter.
Delta Value (0 - n)	The amount of change in the setpoint value from one cycle to the next.
% of Setpoint (0 - n)	The percentage of initial setpoint change from one cycle to the next.
Termination Delta T (0 - n)	The temperature span at which the motor is considered to be thermally stable.
Stable for (0 - n)	The length of time, in minutes, the motor temperature has to remain within the Termination Delta T value to be considered thermally stable.
Test Duration (0 - n)	The overall length of test in minutes.
Sampling Rate (0.01 - n)	The time interval at which a data point will be stored. The maximum rate is 0.01 seconds (100 samples per second). Real-time data will be displayed in the data table and plotted on the graph. This data is not affected by the sampling rate.
Maximum Analog Input (0 - n)	The high limit for the accessory analog input device. A reading that exceeds this value will cause the test in progress to abort.
Maximum Motor Current (0 - n)	The high current limit for the power measurement device. Any current that exceeds this value will cause the test in progress to abort.
Maximum Temperature (0-n)	The maximum temperature limit for the temperature measurement device. Any temperature that exceeds this value will cause the test in progress to abort.

7.8 CALIBRATION DISPLAY

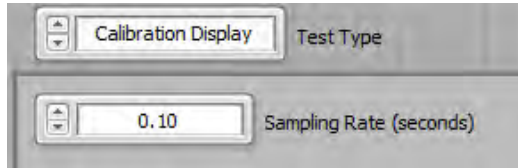


Figure 7–8 Calibration Display Screen

7.8.1 SAMPLING RATE [0.01 - N]

The time interval at which a data point will be stored when Timed Storage is enabled. The maximum rate is 0.01 seconds (100 samples per second). Real-time torque and speed data will be displayed in the large digital displays. This data is not affected by the sampling rate.

7.9 DATA LOGGING

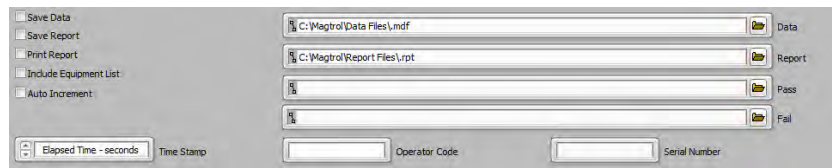


Figure 7–9 Data Logging Screen

7.9.1 DATA LOGGING CONTROLS

Control	Function
Save Data	Enables automatic data logging at the end of each test. A file will be created in the data path you have selected using the serial number with a Magtrol Data File extension (.mdf).
Save Report	Enables automatic report saving at the end of each test. A file will be created in the report path you have selected using the serial number with an .rpt extension. NOTE: This file is viewable only in M-TEST 7.
Print Report	Enables automatic report printing at the end of each test.
Include Equipment List	Adds a listing of Magtrol instruments used to the comments field of the data.
Auto Increment	Enables incrementing of the serial number by one at the end of each test. If the serial number is in the form of an alpha numeric, the software searches for the last number in the string. That number will be incremented by one at the end of the test. If no number is present in the string, a number will be added to the beginning of the string and incremented after each test.

TEST SETUP

Control	Function
Time Stamp (Elapsed Time - seconds, Elapsed Time - H:M:S, Actual Time - H:M:S)	Applies a time stamp to each data point acquired, if time is selected on the Configure Display tab. Time may be elapsed in seconds or H:M:S, or current time.
Data	The path where data will be stored when Save Data is enabled. Click the browse button on the right side of the control to select a new path.
Report	The path where reports will be stored when Save Report is enabled. Click the browse button on the right side of the control to select a new path.
Pass	The path and filename where passed motor data will be stored when the Pass/Fail test is run. Click the browse button on the right side of the control to select a new path and/or filename.
Fail	The path and filename where failed motor data will be stored when the Pass/Fail test is run. Click the browse button on the right side of the control to select a new path and/or filename.
Operator Code	The operator's name or initials for reports.
Serial Number	The alpha-numeric serial number of the motor for reports and filename generation.

8. Adjust PID

8.1 ADJUST PID TAB

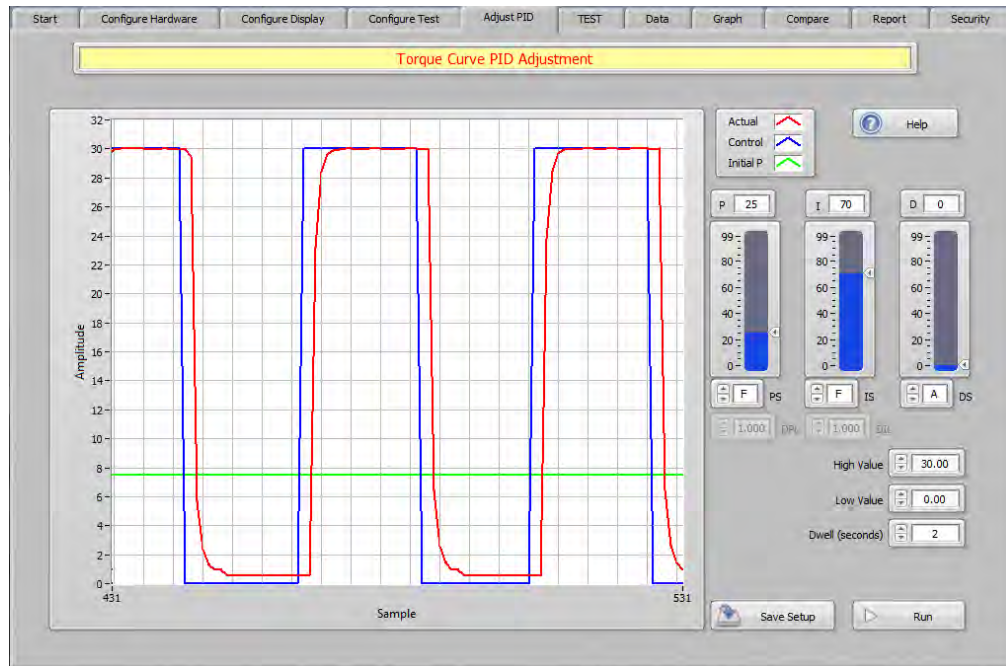


Figure 8-1 Adjust PID Tab

8.1.1 ADJUST PID TAB CONTROLS

Control	Function
Waveform Chart	<p>This chart shows the actual system response compared to the ideal response.</p> <p>For Ramp tests, you will be trying to achieve a constant RPM/second deceleration rate. The Actual and Ideal plots should be parallel, with little or no offset, and no instability.</p> <p>For Curve tests, the response can be set for any amount of overshoot desired in order to decrease response time. Ideally, the system should get to the setpoint and settle quickly.</p>
Legend	<p>The red plot indicates the actual system response to the control command. This plot will change as you make adjustments to the PID values.</p> <p>The blue plot indicates the control command being sent to the dynamometer.</p> <p>The dotted green plot indicates the initial setting level for the P parameter, which is equal to 25% of the target value.</p>

TEST SETUP

Control	Function
ESC (not shown)	Escapes from a loop that may be waiting too long for an event to occur. NOTE: This button is hidden during most portions of the test.
Help	Provides useful information about adjusting PID settings in the Ramp and Curve tests.
P (0 - 99)	The proportional gain in the control loop equation. This control acts as a fine setting within the specified scale, PS.
I (0 - 99)	The integral gain in the control loop equation. This control acts as a fine setting within the specified scale, IS.
D (0 - 99)	The derivative gain in the control loop equation. This control acts as a fine setting within the specified scale, DS.
PS (A, B, C, D, E, F, G, H, I)	The proportional gain scale in the control loop equation. This control acts as a coarse setting and is fine tuned with the proportional slider, P. The A scale is lowest in gain and I is the greatest.
IS (A, B, C, D, E, F, G, H, I)	The integral gain scale in the control loop equation. This control acts as a coarse setting and is fine tuned with the integral slider, I. The A scale is lowest in gain and I is the greatest.
DS (A, B, C, D, E, F, G, H, I)	The derivative gain scale in the control loop equation. This control acts as a coarse setting and is fine tuned with the derivative slider, I. The A scale is lowest in gain and I is the greatest.
DPL (0.001 - n)	Dynamically changes the proportional gain from 1 x P at the start of the ramp to DPL# x P at the end of the ramp. The default setting of 1.000 applies the same gain throughout the ramp.
DIL (0.001 - n)	Dynamically changes the integral gain from 1 x I at the start of the ramp to DIL# x I at the end of the ramp. The default setting of 1.000 applies the same gain throughout the ramp.
High Value (0 - n)	The maximum value for the control parameter selected for this test. The program will cycle between the Low Value and this value.
Low Value (0 - n)	The minimum value for the control parameter selected for this test. The program will cycle between the High Value and this value.
Dwell (0 - n)	The length of time, in seconds, to remain at each of the high and low values.
Motor Voltage (0 - n)	The voltage setpoint when using a programmed DC or AC power supply.
Save Setup	This will save the setup to the filename that is currently in use. If you wish to change the filename, go to the Start tab and press the Save Setup button.
Run	Begin the PID adjustment procedure. Run button switches to stop button during the process.

9. Test

9.1 MANUAL TEST

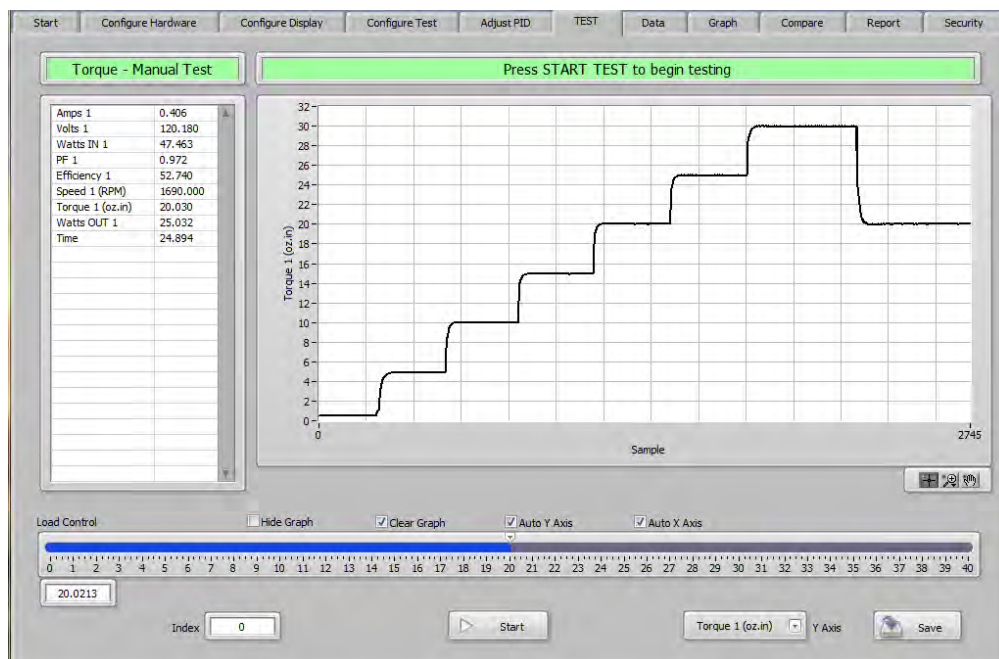


Figure 9-1 Manual Test Screen

9.1.1 MANUAL TEST CONTROLS

Control	Function
Data Table	Indicates selected parameter names and real-time data while the test is running.
Waveform Chart	Plots the selected parameter in real-time against the sample number. If auto-scaling of either axis is disabled, the upper and lower scale limits may be manually set by double-clicking either value and typing in a new one.
ESC (not shown)	Escapes from a loop that may be waiting too long for an event to occur. NOTE: This button is hidden during most portions of the test.
Hide Graph	Hides the graph during the test for fastest possible data acquisition. NOTE: If this box is checked, the graph is replaced by a large digital display of the selected parameter.
Clear Graph	Clears the graph of previous data at the beginning of the test.
Auto Y Axis	Enables auto-scaling of the Y-axis parameter.

TEST RUN

Control	Function
Auto X Axis	<p>Enables auto-scaling of the X-axis parameter.</p> <p>NOTE: During extremely long tests the graph is refreshing all the data that has been collected since sample 0. Eventually, you may run out of video memory which can cause a program crash. It is best to only display a small segment of the total acquired waveform while the test is running. This can be done by disabling the auto-scaling feature after a sufficient plot has been displayed. The graph will then scroll, which uses a significantly lower number of data points than the entire plot.</p>
Graph Palette	This provides several features for manipulating the plot being displayed. By clicking on the various icons you can move the plotted data within the boundaries of the graph and zoom in or out on small portions of the plot.
Load Control	Provides manual control of the selected parameter value while the test is in process. The slider scale will reflect minimum and maximum values for the control parameter selected.
Index	Displays the current number of data points that are being stored in memory.
Start	Begins the test.
Pause	Momentarily suspends data acquisition.
Store	Stores a single data point in memory when pressed.
Timed Storage	Automatically stores data to memory at the Sampling Rate setting.
Stop	Ends the test.
Y Axis	Selects the parameter to be plotted during the test.
Save	Saves the data to the current data path.

9.2 CURVE TEST

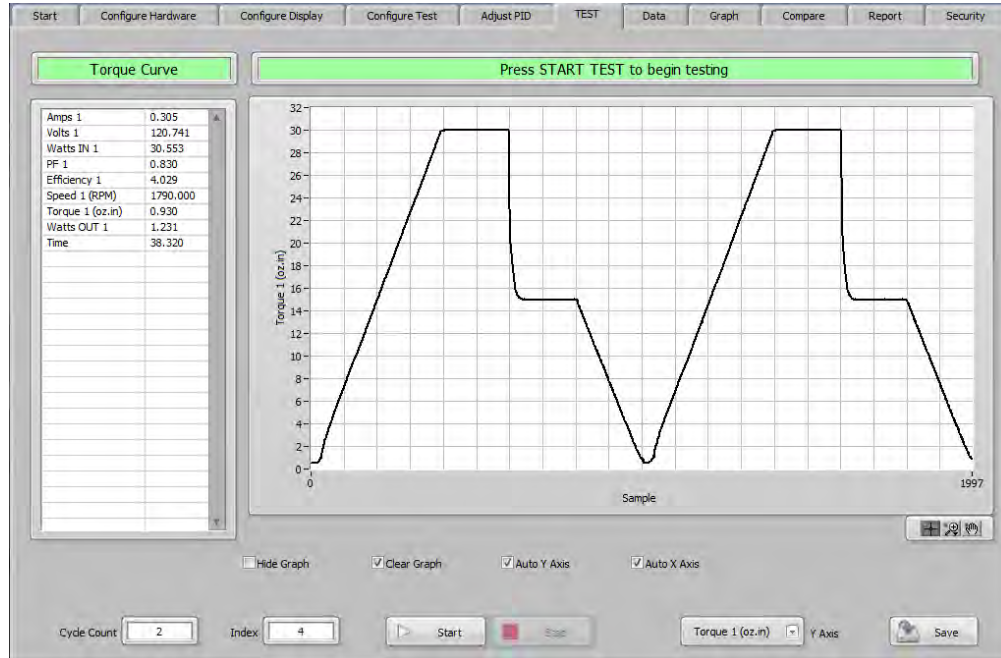


Figure 9–2 Curve Test Screen

9.2.1 CURVE TEST CONTROLS

Control	Function
Data Table	Indicates selected parameter names and real-time data while the test is running.
Waveform Chart	Plots the selected parameter in real-time against the sample number. If auto-scaling of either axis is disabled, the upper and lower scale limits may be manually set by double-clicking either value and typing in a new one.
ESC (not shown)	Escapes from a loop that may be waiting too long for an event to occur. NOTE: This button is hidden during most portions of the test.
Hide Graph	Hides the graph during the test for fastest possible data acquisition. NOTE: If this box is checked, the graph is replaced by a large digital display of the selected parameter.
Clear Graph	Clears the graph of previous data at the beginning of the test.
Auto Y Axis	Enables auto-scaling of the Y-axis parameter.

TEST RUN

Control	Function
Auto X Axis	Enables auto-scaling of the X-axis parameter. NOTE: During extremely long tests the graph is refreshing all the data that has been collected since sample 0. Eventually, you may run out of video memory which can cause a program crash. It is best to only display a small segment of the total acquired waveform while the test is running. This can be done by disabling the auto-scaling feature after a sufficient plot has been displayed. The graph will then scroll, which uses a significantly lower number of data points than the entire plot.
Graph Palette	This provides several features for manipulating the plot being displayed. By clicking on the various icons you can move the plotted data within the boundaries of the graph and zoom in or out on small portions of the plot.
Cycle Count	Displays the number of test cycles completed.
Index	Displays the current step within the test cycle.
Start	Begins the test.
Stop	Ends the test.
Y Axis	Selects the parameter to be plotted during the test.
Save	Saves the data to the current data path.

9.3 RAMP TEST



Figure 9–3 Ramp Test Screen

9.3.1 RAMP TEST CONTROLS

Control	Function
Data Table	Indicates selected parameter names and real-time data while the test is running.
XY Graph	Plots the selected parameters in real-time. If auto-scaling of either axis is disabled, the upper and lower scale limits may be manually set by double-clicking either value and typing in a new one.
ESC (not shown)	Escapes from a loop that may be waiting too long for an event to occur. NOTE: This button is hidden during most portions of the test.
Hide Graph	Hides the graph during the test for fastest possible data acquisition.
Auto Y Axis	Enables auto-scaling of the Y-axis parameter.
Auto X Axis	Enables auto-scaling of the X-axis parameter.
Graph Palette	This provides several features for manipulating the plot being displayed. By clicking on the various icons you can move the plotted data within the boundaries of the graph and zoom in or out on small portions of the plot.
Start	Begins the test.
Stop	Ends the test.
Y Axis	Selects the parameter to be plotted on the Y-axis during the test.
X Axis	Selects the parameter to be plotted on the X-axis during the test.
Save	Saves the data to the current data path.

9.4 PASS/FAIL TEST

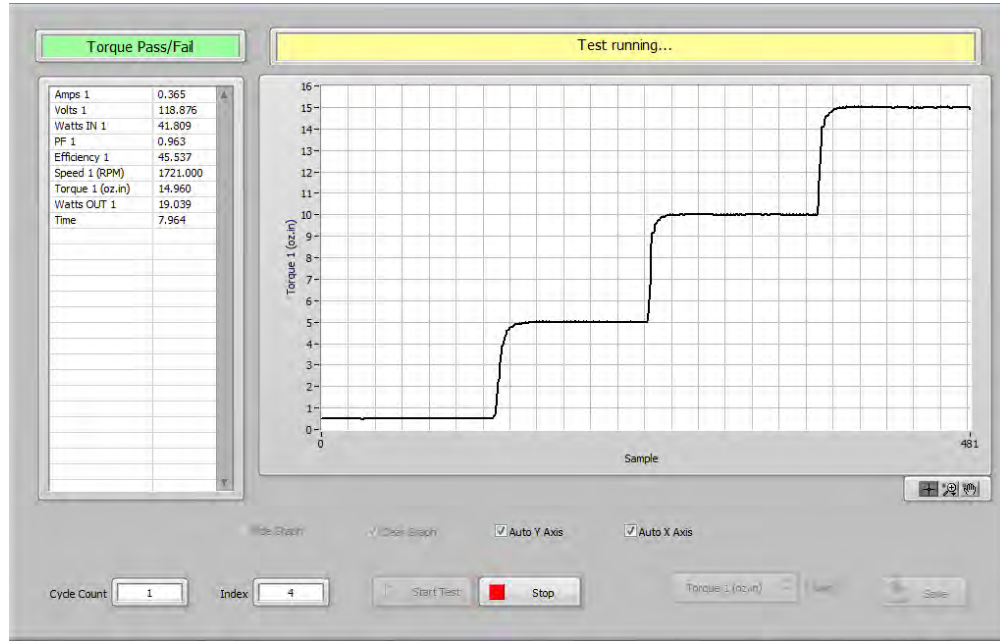


Figure 9–4 Pass/Fail Test Screen

9.4.1 PASS/FAIL TEST CONTROLS

Control	Function
Data Table	Indicates selected parameter names and real-time data while the test is running.
Waveform Chart	Plots the selected parameter in real-time against the sample number. If auto-scaling of either axis is disabled, the upper and lower scale limits may be manually set by double-clicking either value and typing in a new one.
ESC (not shown)	Escapes from a loop that may be waiting too long for an event to occur. NOTE: This button is hidden during most portions of the test.
Hide Graph	Hides the graph during the test for fastest possible data acquisition. NOTE: If this box is checked, the graph is replaced by a large digital display of the selected parameter.
Clear Graph	Clears the graph of previous data at the beginning of the test.
Auto Y Axis	Enables auto-scaling of the Y-axis parameter.

TEST RUN

TEST RUN

Control	Function
Auto X Axis	Enables auto-scaling of the X-axis parameter. NOTE: During extremely long tests the graph is refreshing all the data that has been collected since sample 0. Eventually, you may run out of video memory which can cause a program crash. It is best to only display a small segment of the total acquired waveform while the test is running. This can be done by disabling the auto-scaling feature after a sufficient plot has been displayed. The graph will then scroll, which uses a significantly lower number of data points than the entire plot.
Graph Palette	This provides several features for manipulating the plot being displayed. By clicking on the various icons you can move the plotted data within the boundaries of the graph and zoom in or out on small portions of the plot.
Cycle Count	Displays the number of test cycles completed.
Index	Displays the current step within the test cycle.
Start	Begins the test.
Stop	Ends the test.
Y Axis	Selects the parameter to be plotted during the test.
Save	Saves the data to the current data path.
Next Test	Begins the next test on the same or different motor.

9.4.2 PASS/FAIL DATA

When a test concludes, this table appears and indicates the numeric results of the test. Any parameter that falls outside the test limits will be highlighted in red.

The screenshot shows a software interface with a green button labeled 'Torque Pass/Fail' and a prominent red banner at the top that reads 'FAIL'. Below the banner is a data table with the following structure:

Time (sec.)	oz.in	A1	Win1	RPM	None	None						
2.002	0.521	0.292	29.295	1791.000								
4.028	4.984	0.307	32.780	1771.000								
6.067	10.000	0.333	37.259	1747.000								
8.123	15.010	0.365	41.809	1719.000								
10.266	19.970	0.405	46.967	1691.000								

Figure 9-5 Pass/Fail Data Screen

9.4.3 TEST LIMITS

When a test concludes, this table appears and indicates the numeric test limits set up for the test.

Test Limits										
oz.in	A1 Min	A1 Max	Win1 Min	Win1 Max	RPM Min	RPM Max	None Min	None Max	None Min	None Max
0	0	.5	0	30	1780	1800				
5	0	.6	0	35	1750	1800				
10	0	.7	0	40	1700	1800				
15	0	.8	0	45	1650	1800				
20	0	.9	0	50	1700	1800				

Figure 9–6 Test Limits Screen

9.5 COAST TEST

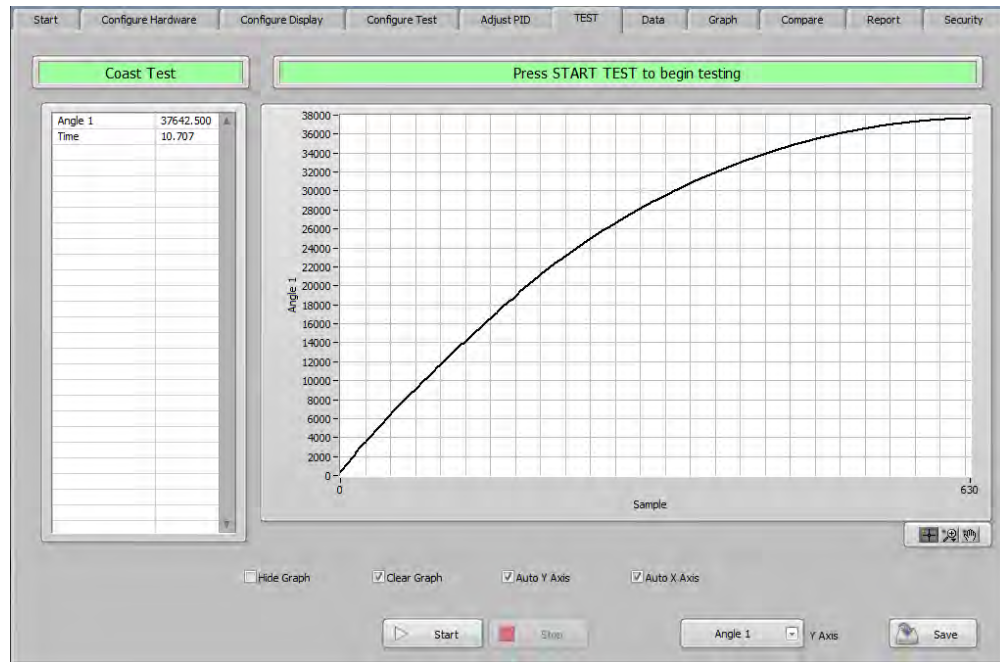


Figure 9–7 Coast Test Screen

9.5.1 COAST TEST CONTROLS

Contact	Function
Data Table	Indicates selected parameter names and real-time data while the test is running.
Waveform Chart	Plots the selected parameter in real-time against the sample number. If auto-scaling of either axis is disabled, the upper and lower scale limits may be manually set by double-clicking either value and typing in a new one.

TEST RUN

Contact	Function
ESC (not shown)	Escapes from a loop that may be waiting too long for an event to occur. NOTE: This button is hidden during most portions of the test.
Hide Graph	Hides the graph during the test for fastest possible data acquisition. NOTE: If this box is checked, the graph is replaced by a large digital display of the selected parameter.
Clear Graph	Clears the graph of previous data at the beginning of the test.
Auto Y Axis	Enables auto-scaling of the Y-axis parameter.
Auto X Axis	Enables auto-scaling of the X-axis parameter.
Graph Palette	This provides several features for manipulating the plot being displayed. By clicking on the various icons you can move the plotted data within the boundaries of the graph and zoom in or out on small portions of the plot.
Start	Begins the test.
Stop	Ends the test.
Y Axis	Selects the parameter to be plotted during the test.
Save	Saves the data to the current data path.

TEST RUN

9.6 OVERLOAD TO TRIP TEST

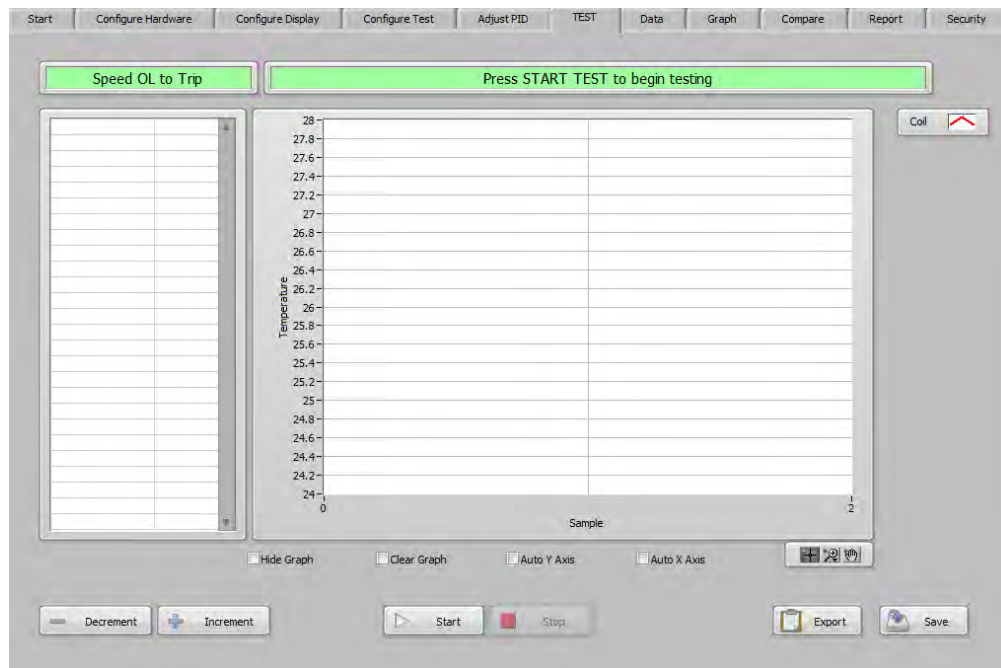


Figure 9–8 Overload to Trip Test Screen

9.6.1 OVERLOAD TO TRIP TEST CONTROLS

Control	Function
Data Table	Indicates selected parameter names and real-time data while the test is running.
Waveform Chart	Plots the thermocouple temperature in real-time against the sample number. If auto-scaling of either axis is disabled, the upper and lower scale limits may be manually set by double-clicking either value and typing in a new one.
ESC (not shown)	Escapes from a loop that may be waiting too long for an event to occur. NOTE: This button is hidden during most portions of the test.
Hide Graph	Hides the graph during the test for fastest possible data acquisition. NOTE: If this box is checked, the graph is replaced by a large digital display of the selected parameter.
Clear Graph	Clears the graph of previous data at the beginning of the test.
Auto Y Axis	Enables auto-scaling of the Y-axis parameter.
Auto X Axis	Enables auto-scaling of the X-axis parameter. NOTE: During extremely long tests the graph is refreshing all the data that has been collected since sample 0. Eventually, you may run out of video memory which can cause a program crash. It is best to only display a small segment of the total acquired waveform while the test is running. This can be done by disabling the auto-scaling feature after a sufficient plot has been displayed. The graph will then scroll, which uses a significantly lower number of data points than the entire plot.
Graph Palette	This provides several features for manipulating the plot being displayed. By clicking on the various icons you can move the plotted data within the boundaries of the graph and zoom in or out on small portions of the plot.
Start	Begins the test.
Stop	Ends the test.
Decrement	Reduces the value of the control parameter during the test.
Increment	Increases the value of the control parameter during the test.
Export	Save a bitmap of the graph to a file.
Save	Saves the data to the current data path.

9.7 CALIBRATION DISPLAY

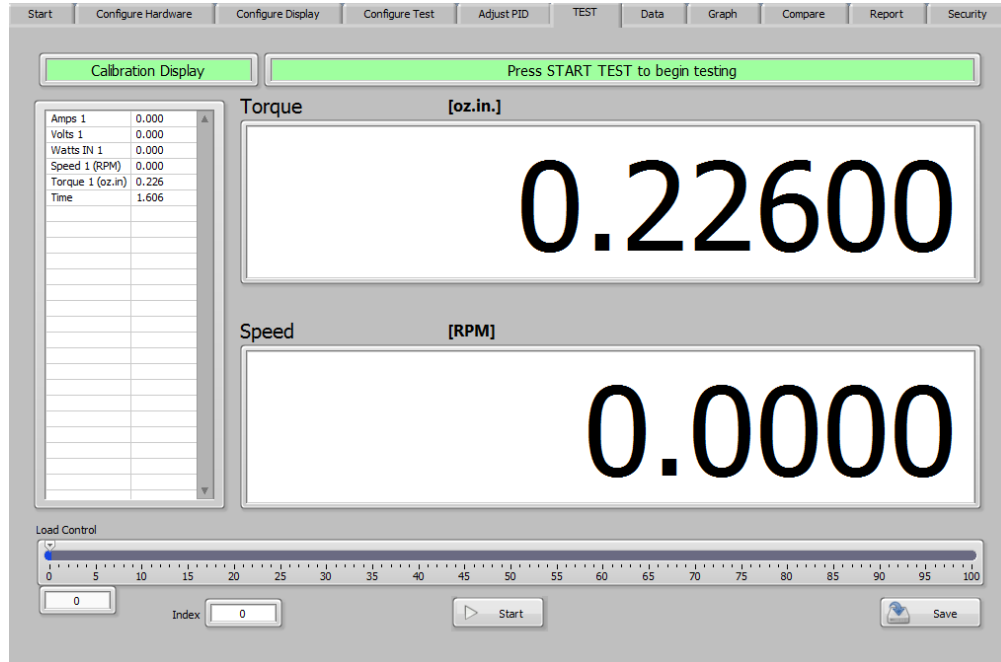


Figure 9–9 Calibration Display Screen

9.7.1 CALIBRATION DISPLAY CONTROLS

Control	Function
Data Table	Indicates selected parameter names and real-time data while the test is running.
Digital Display	Indicates torque and speed in real-time.
Load Control (0-99.99)	Provides manual control of the open loop current while the test is in process.
Index	Displays the current number of data points that are being stored in memory.
Start	Begins the test.
Pause	Momentarily suspends data acquisition.
Store	Stores a single data point in memory when pressed.
Timed Storage	Automatically stores data to memory at the Sampling Rate setting.
Stop	Ends the test.
Save	Saves the data to the current data path.

TEST RUN

10. Data

10.1 DATA TAB

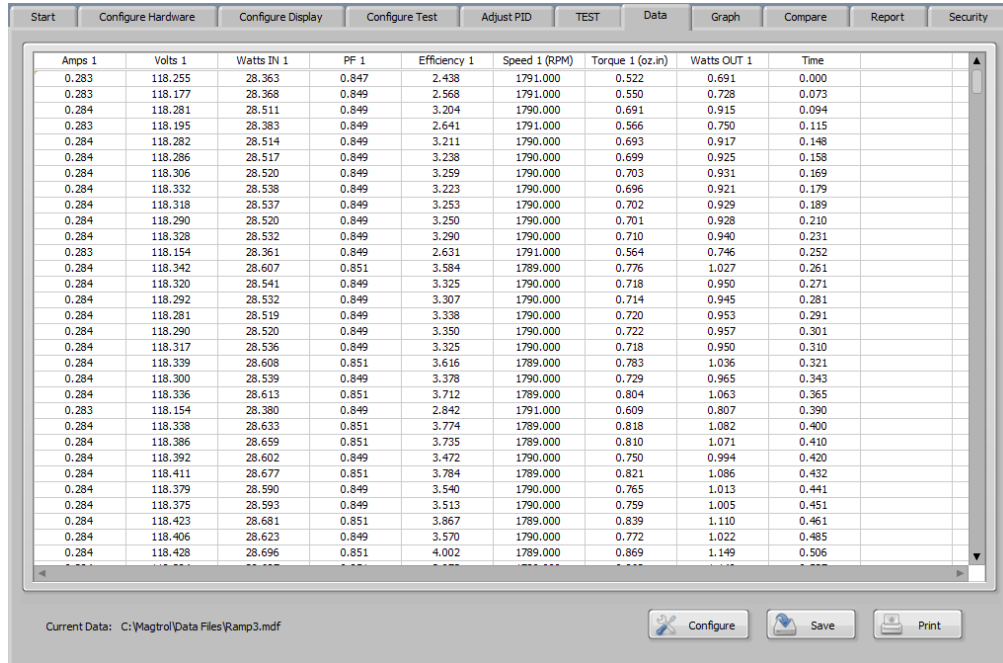


Figure 10–1 Data Tab

10.1.1 DATA TAB CONTROLS

Control	Function
Data Table	Displays the numeric values of all parameters stored during the selected test. Use the scroll bars to view data outside the currently visible limits.
Current Data	Displays the current data path and filename.
Configure	Configure the data printout.
Save	Saves the data to the current data path.
Print	Prints the formatted table to the default system printer. NOTE: While this print is more than sufficient for most applications, printing of data in a spreadsheet program will give many more options.

TEST RESULTS

10.1.1.2 Configure Print Control

Configures the parameter selection and order for the hardcopy print. When pressed the following window will pop up:



Figure 10–2 Configure Print Screen

Click on any of the Column Choices menus and select the parameter to print in that column. Press OK when finished to return to the Data tab.

11. Graph

11.1 GRAPH TAB

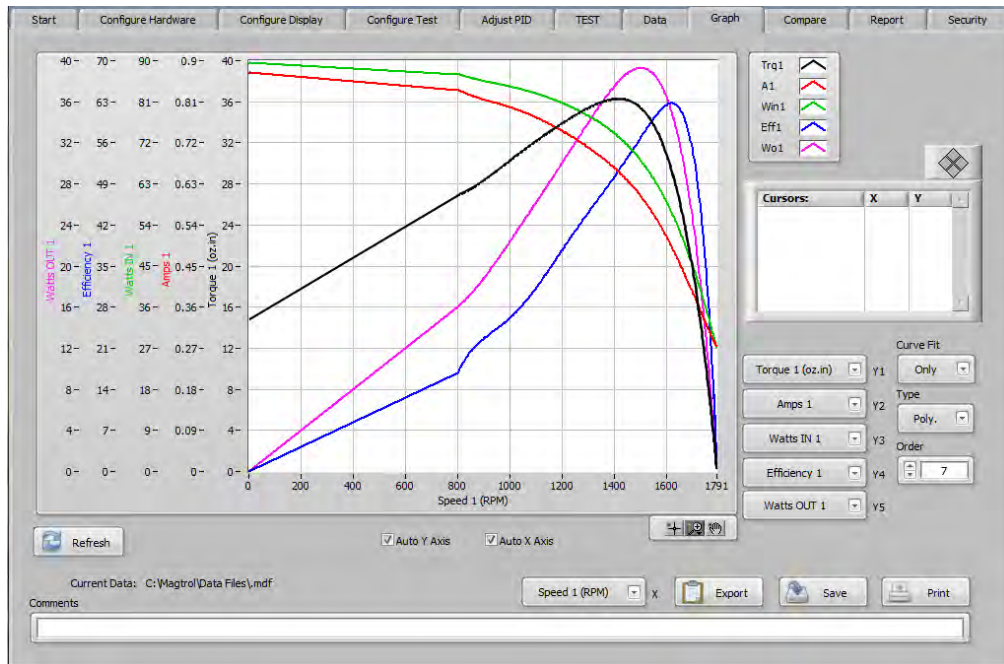


Figure 11-1 Graph Tab

11.1 GRAPH TAB CONTROLS

Control	Function
5-Axis Graph	This graph allows plotting of up to five parameters against a common X-Axis. As each parameter is added, the scale for that parameter appears to the left of the graph and the plotting area gets slightly smaller. Plots and scale titles are color coded for easy identification.
Graph Legend	Located to the upper right of the graph the legend expands as more plot parameters are selected. Each plot is identified with an abbreviated name and is color coded. There are many plot options available by right-clicking on the plot indicator in the legend. You can change color, line style, line width, etc. from the pop-up menu.
Curve Fit (Hide, Show, Only)	This feature Applies a polynomial or moving average curve fit to the graphical data. You may hide the smoothed plots, show both the raw and smoothed plots or just the smoothed plots.
Type (Poly., Avg.)	Selects the type of curve fitting routine to apply, either a polynomial fit or moving average.
Order (1-30)	Selects the order of the polynomial used in the curve fit routine. A setting of 2 or 3 should be sufficient for most curves, but may be increased to achieve a better representation.

Control	Function
Size (1-n)	The sample size of the moving average. The moving average can be any number of samples, but should be an odd number.
Cursors	<p>You may create single or multiple cursors on the graph. Each cursor will have a numeric X-Y value shown in the cursor display table. The cursor can then be dragged along the plot with your mouse, or moved with the left and right cursor buttons.</p> <p>CREATE A CURSOR Right-click in the cursor window. Select Create Cursor and Single-Plot.</p> <p>Cursor 0 will now appear in the plot area and in the cursor window. The cursor attributes are the default settings. You may change the parameter the cursor is locked to by selecting Snap To and dragging to the new parameter. The color, style, point style, etc. of the cursor itself can be changed from the Attributes menu.</p> <p>Repeat this process to add more cursors to the graph.</p>
Y1 Axis (None - n)	Selects the parameter to plot on the first Y-axis. The available parameters are the ones selected for acquisition during the test.
Y2 Axis (None - n)	Selects the parameter to plot on the second Y-axis. The available parameters are the ones selected for acquisition during the test.
Y3 Axis (None - n)	Selects the parameter to plot on the third Y-axis. The available parameters are the ones selected for acquisition during the test.
Y4 Axis (None - n)	Selects the parameter to plot on the fourth Y-axis. The available parameters are the ones selected for acquisition during the test.
Y5 Axis (None - n)	Selects the parameter to plot on the fifth Y-axis. The available parameters are the ones selected for acquisition during the test.
Refresh	Reset the graph to the default Line Style, Line Width, Line Color, Point Style, Bar Style and Interpolation settings.
Auto Y Axis	Enables auto-scaling of the Y-axis parameter.
Auto X Axis	Enables auto-scaling of the X-axis parameter.
Graph Palette	This provides several features for manipulating the plot being displayed. By clicking on the various icons you can move the plotted data within the boundaries of the graph and zoom in or out on small portions of the plot.
Current Data	This displays the current data path and filename.
X Axis (None - n)	Selects the parameter to plot on the X-axis. The available parameters are the ones selected for acquisition during the test.
Export	Save a bitmap of the graph to a file.
Print	Prints a hard copy of the graph. A Print Setup window will pop up that allows you to select the printer, color and orientation of the print.
Save	Saves the data to the current data path.

Control	Function
Comments	<p>You may type any comments you wish to retain with the data for this test, and also print on the hard copy of the graph.</p> <p>NOTE: If Include Equipment List is enabled from the Configure Test > Data Logging setup, the Magtrol instruments being used will be pre-filled in this field.</p>

12. Compare

12.1 COMPARE TAB

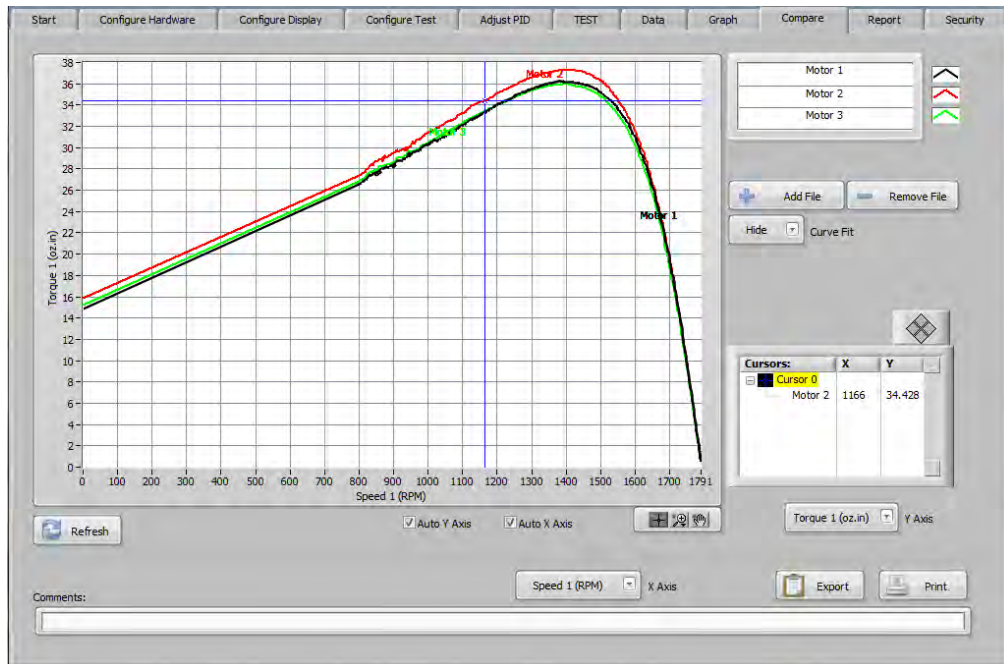


Figure 12–1 Compare Tab

12.1 COMPARE TAB CONTROLS

Control	Function
Graph	Displays the selected X-Y parameter plots for up to five data files. As each new file is added, the plot for that file will be displayed along with previous plots.
Graph Legend	Located to the upper right of the graph the legend expands as more files are added. Each plot is identified with the file name and is color coded. There are many plot options available by right-clicking on the plot indicator in the legend. You can change color, line style, line width, etc. from the pop-up menu.

Control	Function
Cursors	<p>You may create single or multiple cursors on the graph. Each cursor will have a numeric X-Y value shown in the cursor display table. The cursor can then be dragged along the plot with your mouse, or moved with the left and right cursor buttons.</p> <p>CREATE A CURSOR Right-click in the cursor window. Select Create Cursor and Single-Plot.</p> <p>Cursor 0 will now appear in the plot area and in the cursor window. The cursor attributes are the default settings. You may change the file the cursor is locked to by selecting Snap To and dragging to the new filename. The color, style, point style, etc. of the cursor itself can be changed from the Attributes menu. Repeat this process to add more cursors to the graph.</p>
Add File	Add a data file to the graph. You may select up to five files.
Remove File	Remove data from the graph. Left-click the mouse on the name of the file in the graph legend and press this button.
Curve Fit (Hide, Show, Only)	This feature will apply an n^{th} order polynomial curve fit to the plots. You may hide the smoothed plots, show both the raw and smoothed plots or just the smoothed plots.
Type (Poly., Avg.)	Selects the type of curve fitting routine to apply, either a polynomial fit or moving average.
Order (1-30)	Selects the order of the polynomial used in the curve fit routine. A setting of 2 or 3 should be sufficient for most curves, but may be increased to achieve a better representation.
Size (1-n)	<p>The sample size of the moving average.</p> <p>The moving average can be any number of samples, but should be an odd number.</p>
Y Axis (None - n)	Selects the parameter to plot on the Y-axis. The available parameters are the ones selected for acquisition during the test.
Graph Palette	This provides several features for manipulating the plot being displayed. By clicking on the various icons you can move the plotted data within the boundaries of the graph and zoom in or out on small portions of the plot.
Auto Y Axis	Enables auto-scaling of the Y-axis parameter.
Auto X Axis	Enables auto-scaling of the X-axis parameter.
Refresh	Reset the graph to the default Line Style, Line Width, Line Color, Point Style, Bar Style and Interpolation settings.
X Axis (None - n)	Selects the parameter to plot on the X-axis. The available parameters are the ones selected for acquisition during the test.
Export	Save a bitmap of the graph to a file.
Print	Prints a hard copy of the graph. A Print Setup window will pop up that allows you to select the printer, color and orientation of the print.

13. Report

13.1 ONE PAGE, NO GRAPH REPORT

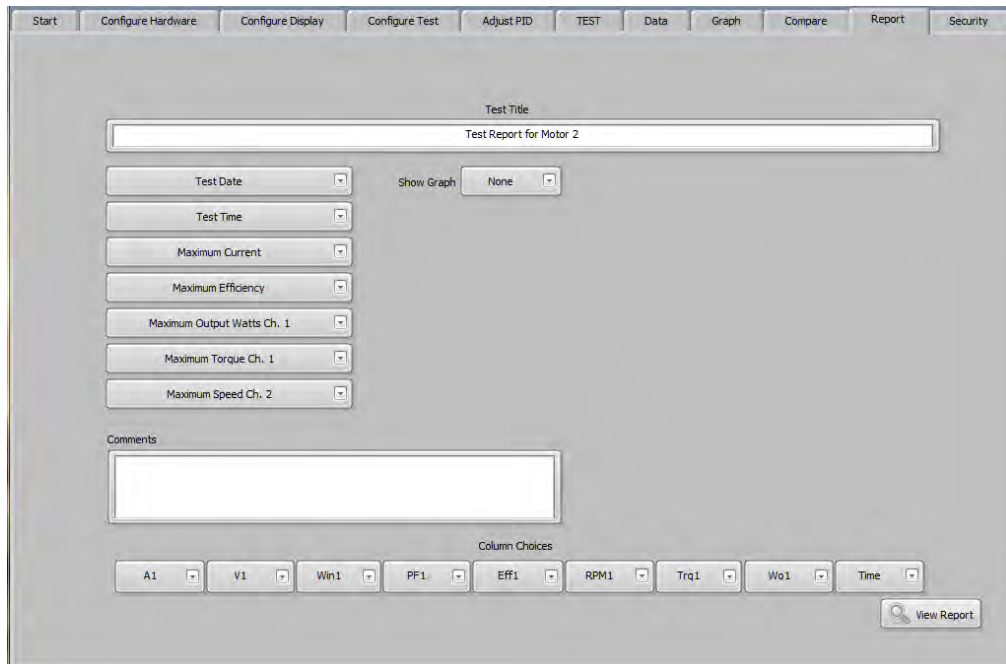


Figure 13–1 One Page, No Graph Report Screen

13.1.1 ONE PAGE, NO GRAPH REPORT CONTROLS

Control	Function
Test Title	Enter any text you wish to show at the top of the report.

TEST RESULTS

Control	Function
Field 1 (None, Test Date, Test Time, Serial Number, Operator Code, Maximum Current, Maximum Efficiency, Maximum Horsepower Ch. 1, Maximum Horsepower Ch. 2, Maximum Input Watts, Maximum Output Watts Ch. 1, Maximum Output Watts Ch. 2, Maximum Torque Ch. 1, Maximum Torque Ch. 2, Maximum Speed Ch. 1, Maximum Speed Ch. 2, Direction of Rotation Ch.1, Direction of Rotation Ch. 2, Maximum Output KW Ch. 1, Maximum Output KW Ch. 2)	The function to be printed on the first line of the report.
Field 2 (Same as Field 1)	The function to be printed on the second line of the report.
Field 3 (Same as Field 1)	The function to be printed on the third line of the report.
Field 4 (Same as Field 1)	The function to be printed on the fourth line of the report.
Field 5 (Same as Field 1)	The function to be printed on the fifth line of the report.
Field 6 (Same as Field 1)	The function to be printed on the sixth line of the report.
Field 7 (Same as Field 1)	The function to be printed on the seventh line of the report.
Show Graph (None, One page, Two page)	Selects the report format; one page with no graph, one page with graph, or two page.
Comments	The comments to include on the report.
Column Choices (None - any acquired parameter)	Configures the parameter selection and order for the numeric data in the report.
View Report	Shows the report screen. <i>See Figure 13–2 One Page, No Graph Report Screen</i>
Print	Print the report to the default system printer.
Save	Save the report to a path and filename. NOTE: reports are only viewable in M-TEST 7.
Close	Close the report viewer and return to the report configuration screen.

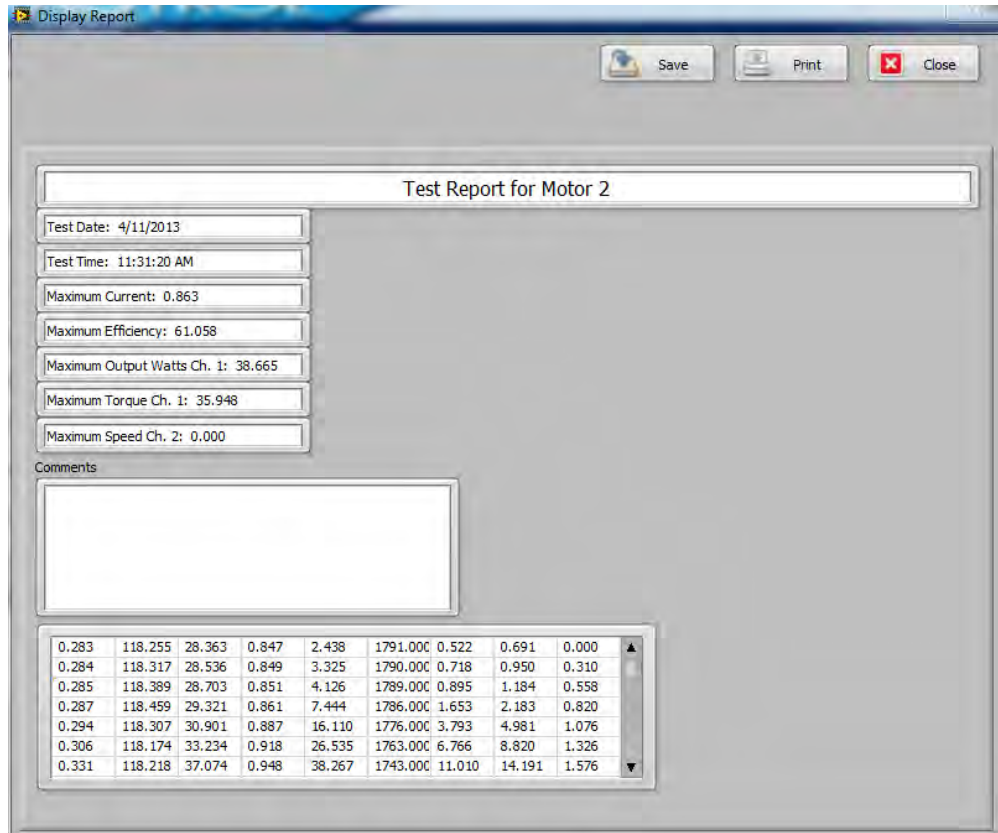


Figure 13-2 One Page, No Graph Report Screen

13.2 ONE PAGE, WITH GRAPH REPORT

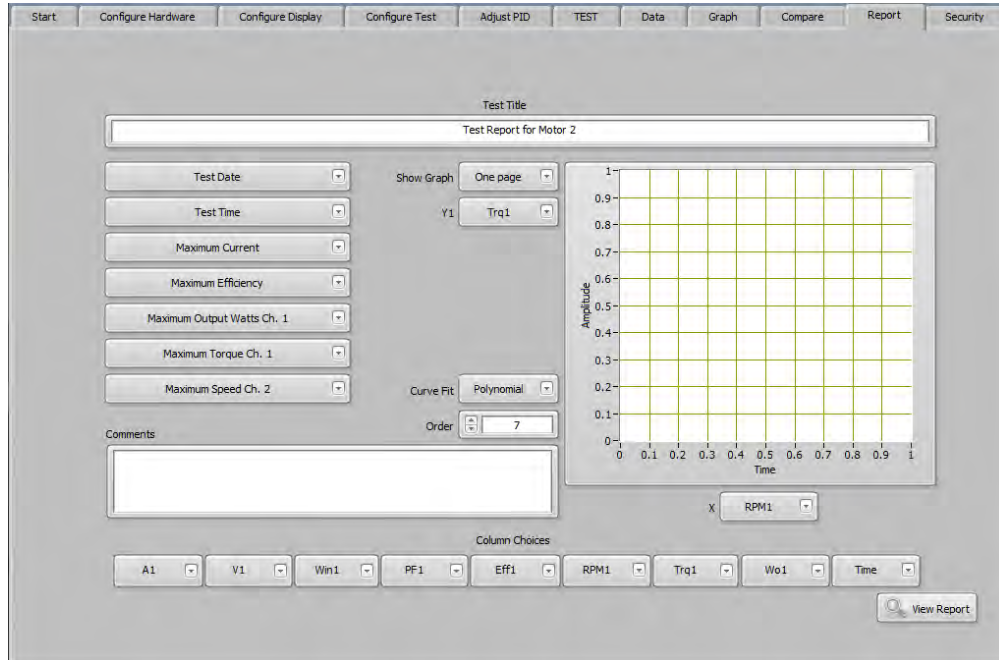


Figure 13–3 One Page, with Graph Report Screen

13.2.1 ONE PAGE, WITH GRAPH REPORT CONTROLS

Control	Function
Test Title	Enter any text you wish to show at the top of the report.
Field 1 (None, Test Date, Test Time, Serial Number, Operator Code, Maximum Current, Maximum Efficiency, Maximum Horsepower Ch. 1, Maximum Horsepower Ch. 2, Maximum Input Watts, Maximum Output Watts Ch. 1, Maximum Output Watts Ch. 2, Maximum Torque Ch. 1, Maximum Torque Ch. 2, Maximum Speed Ch. 1, Maximum Speed Ch. 2, Direction of Rotation Ch.1, Direction of Rotation Ch. 2, Maximum Output KW Ch. 1, Maximum Output KW Ch. 2)	The function to be printed on the first line of the report.
Field 2 (Same as Field 1)	The function to be printed on the second line of the report.

TEST RESULTS

Control	Function
Field 3 (Same as Field 1)	The function to be printed on the third line of the report.
Field 4 (Same as Field 1)	The function to be printed on the fourth line of the report.
Field 5 (Same as Field 1)	The function to be printed on the fifth line of the report.
Field 6 (Same as Field 1)	The function to be printed on the sixth line of the report.
Field 7 (Same as Field 1)	The function to be printed on the sixth line of the report.
Show Graph (None, One page, Two page)	Selects the report format; one page with no graph, one page with graph, or two page.
Y1 (None - any acquired parameter)	The parameter to plot on the Y-axis of the graph.
Curve Fit (None, Polynomial, Average)	Applies a polynomial or moving average curve fit to the graphical data.
Order (1-30)	The polynomial order for the curve fitting routine. A setting of 2 or 3 should be sufficient for most curves, but may be increased to achieve a better representation.
Size (1-n)	The sample size of the moving average. The moving average can be any number of samples, but should be an odd number.
Comments	The comments to include on the report.
X (None - any acquired parameter)	The parameter to plot on the X-axis of the graph.
Column Choices (None - any acquired parameter)	Configures the parameter selection and order for the numeric data in the report.
View Report	Shows the report screen. See <i>Figure 13–4 One Page, with graph Report Screen</i> .
Print	Print the report to the default system printer.
Save	Save the report to a path and filename. NOTE: reports are only viewable in M-TEST 7.
Close	Close the report viewer and return to the report configuration screen.

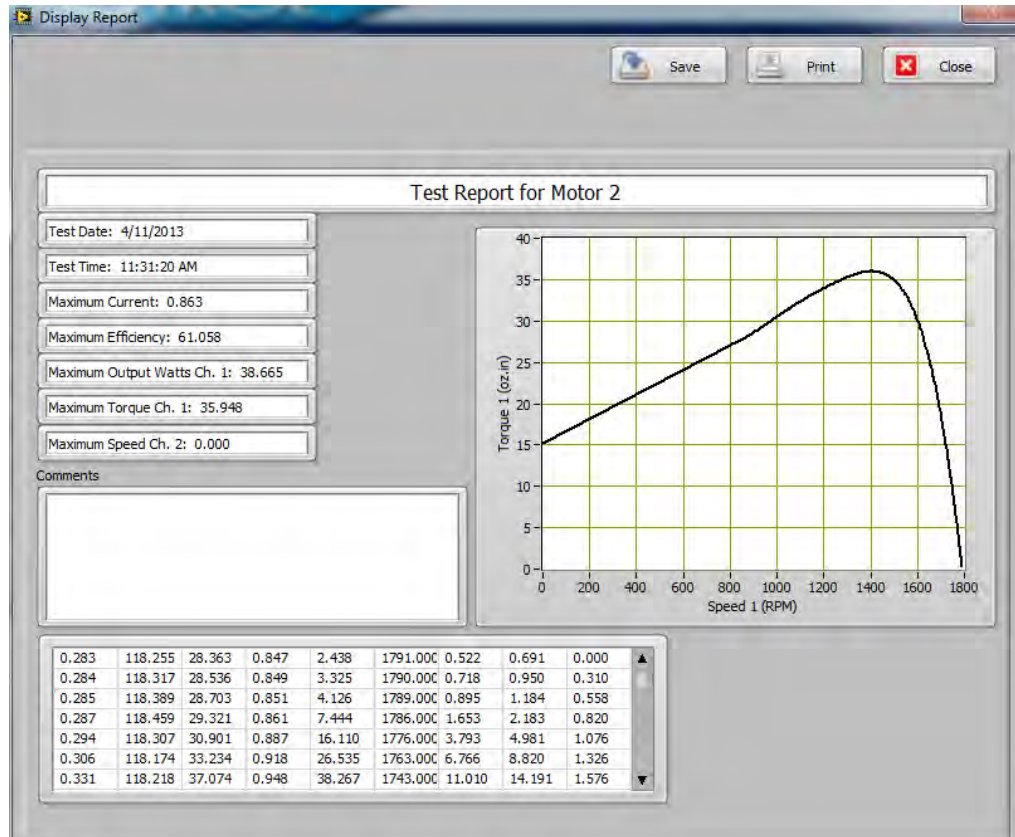


Figure 13-4 One Page, with Graph Report Screen

13.3 TWO PAGE REPORT

Start Configure Hardware Configure Display Configure Test Adjust PID TEST Data Graph Compare Report Security

Test Title
 Test Report for Motor 2

Test Date: [dropdown] Show Graph: Two page [dropdown]
 Test Time: [dropdown] Y1: Trq1 [dropdown]
 Maximum Current: [dropdown] Y2: A1 [dropdown]
 Maximum Efficiency: [dropdown] Y3: Win1 [dropdown]
 Maximum Output Watts Ch. 1: [dropdown] Y4: Wo1 [dropdown]
 Maximum Torque Ch. 1: [dropdown] Y5: Eff1 [dropdown]
 Maximum Speed Ch. 2: [dropdown] Curve Fit: Polynomial [dropdown]
 Order: 7 [dropdown]

Comments

X: RPM1 [dropdown]

Column Choices: A1 [dropdown] V1 [dropdown] Win1 [dropdown] PF1 [dropdown] Eff1 [dropdown] RPM1 [dropdown] Trq1 [dropdown] Wo1 [dropdown] Time [dropdown]

View Report

TEST RESULTS

Figure 13–5 Two Page Report Screen

13.3.1 TWO PAGE REPORT CONTROLS

Control	Function
Test Title	Enter any text you wish to show at the top of the report.
Field 1 (None, Test Date, Test Time, Serial Number, Operator Code, Maximum Current, Maximum Efficiency, Maximum Horsepower Ch. 1, Maximum Horsepower Ch. 2, Maximum Input Watts, Maximum Output Watts Ch. 1, Maximum Output Watts Ch. 2, Maximum Torque Ch. 1, Maximum Torque Ch. 2, Maximum Speed Ch. 1, Maximum Speed Ch. 2, Direction of Rotation Ch.1, Direction of Rotation Ch. 2, Maximum Output KW Ch. 1, Maximum Output KW Ch. 2)	The function to be printed on the first line of the report.
Field 2 (Same as Field 1)	The function to be printed on the second line of the report.
Field 3 (Same as Field 1)	The function to be printed on the third line of the report.
Field 4 (Same as Field 1)	The function to be printed on the fourth line of the report.
Field 5 (Same as Field 1)	The function to be printed on the fifth line of the report.
Field 6 (Same as Field 1)	The function to be printed on the sixth line of the report.
Field 7 (Same as Field 1))	The function to be printed on the seventh line of the report.
Show Graph (None, One page, Two page)	Selects the report format; one page with no graph, one page with graph, or two page.
Y1 (None - any acquired parameter)	The parameter to plot on the first Y-axis of the graph.
Y2 (None - any acquired parameter)	The parameter to plot on the second Y-axis of the graph.
Y3 (None - any acquired parameter)	The parameter to plot on the third Y-axis of the graph.
Y4 (None - any acquired parameter)	The parameter to plot on the fourth Y-axis of the graph.
Y5 (None - any acquired parameter)	The parameter to plot on the fifth Y-axis of the graph.
Curve Fit (None, Polynomial, Average)	Applies an n^{th} order polynomial curve fit to the plots. Both raw and smoothed plots will be shown.

Control	Function
Order (1-30)	The polynomial order for the curve fitting routine. A setting of 2 or 3 should be sufficient for most curves, but may be increased to achieve a better representation.
Size (1-n)	The sample size of the moving average. The moving average can be any number of samples, but should be an odd number.
Comments	The comments to include on the report.
X (None - any acquired parameter)	The parameter to plot on the X-axis of the graph.
Column Choices (None - any acquired parameter)	Configures the parameter selection and order for the numeric data in the report.
View Report	Shows report screen. See <i>Figure 13–6 Two Page Report Screen, Page One</i> , and <i>Figure 13–7 Two Page Report Screen, Page Two</i> .
Print	Print the report to the default system printer.
Save	Save the report to a path and filename. NOTE: reports are only viewable in M-TEST 7.
Close	Close the report viewer and return to the report configuration screen.

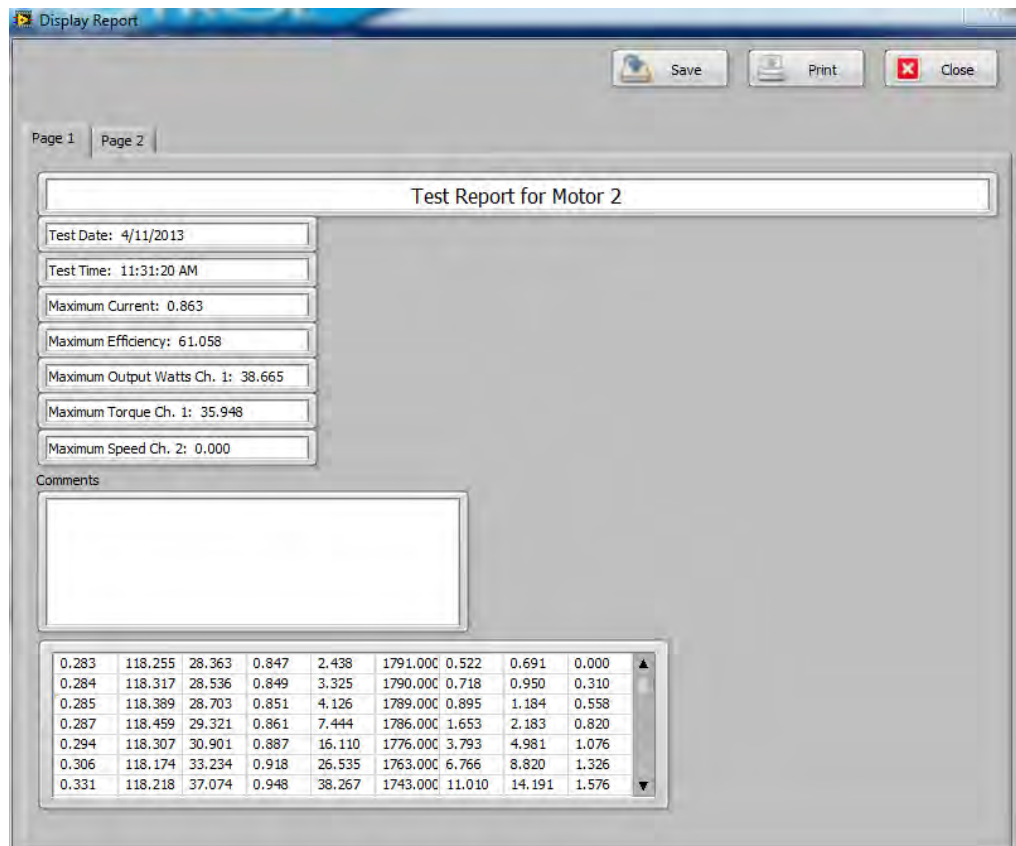


Figure 13–6 Two Page Report Screen, Page One

TEST RESULTS



Figure 13-7 Two Page Report Screen, Page Two

14. Security

14.1 SECURITY TAB

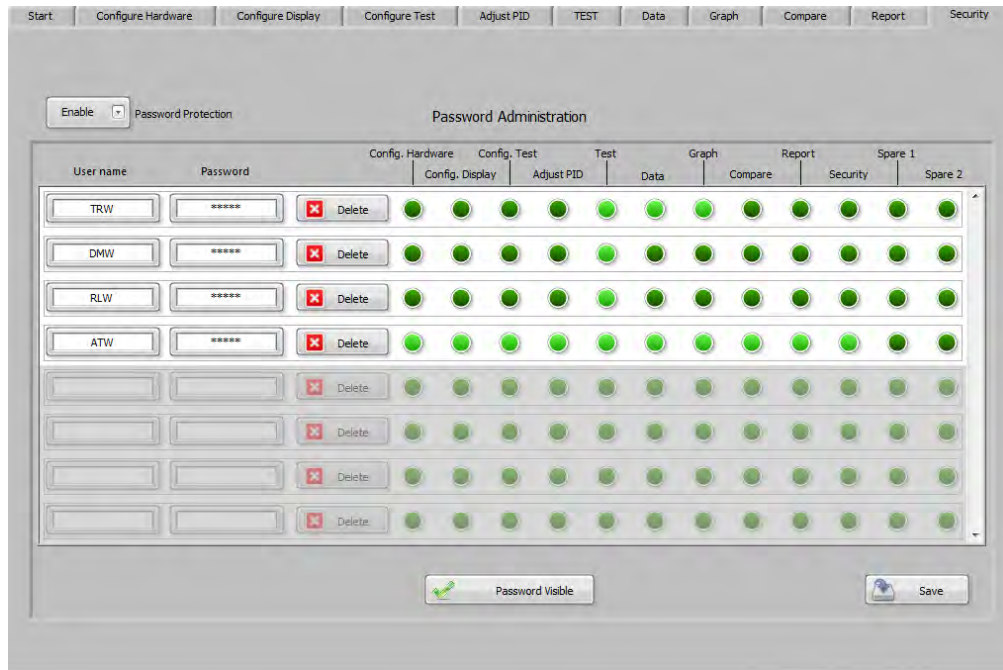


Figure 14–1 Security Tab

14.1.1 PASSWORD PROTECTION [ENABLE / DISABLE]

Enables various levels of security for multiple users.

14.1.2 PASSWORD ADMINISTRATION

14.1.2.1 USER NAME

Click in an available field and enter the user name you wish to add. As you begin typing, the entire row of options will be enabled.

14.1.2.2 PASSWORD

Click in the field and enter a password for this user. If Password Visible is not enabled you will see asterisks displayed for each character.

14.1.2.3 DELETE

Press to delete this user and their permissions.

14.1.2.4 PERMISSION LEDS

Each tab in M-TEST 7, except the START tab, has a LED associated with it. To give the user permission to access that tab, click on the LED in that column. An illuminated LED gives access to the tab; a non-illuminated LED denies access to the tab.

14.1.2.5 PASSWORD VISIBLE

When enabled, the actual password characters will be displayed for all users. This should be enabled only for the administrator.

14.1.2.6 SAVE

Whenever adding, deleting or making security level changes, press the Save button to retain the settings.



NOTE: To begin using security, close M-TEST 7 and then re-open. All tabs except START should be grayed out, denying access. Log in as a valid user to begin using your permitted functions.

15. Creating Tasks

15.1 CREATING ANALOG INPUT (AI) TASKS

1. To create an analog input task, double-click the Measurement & Automation Explorer (MAX) shortcut on your desktop.

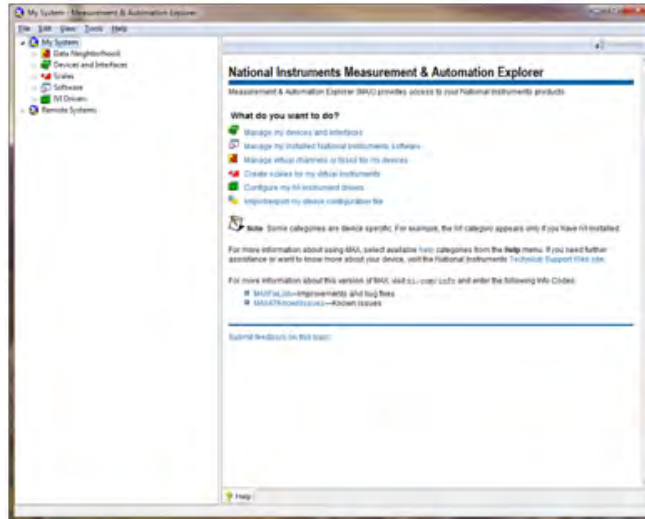


Figure 15–1 Measurement & Automation Explorer Screen

2. Expand Data Neighborhood by clicking on the small triangle next to it. If you see NI-DAQmx Tasks as one of the items, skip to step #6.

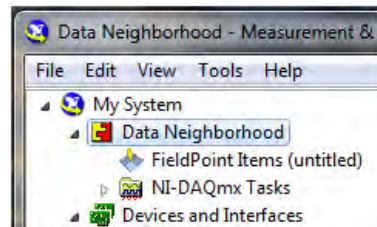


Figure 15–2 Measurement & Automation Explorer Screen with Data Neighborhood expanded

3. Right-click on Data Neighborhood and click Create New...

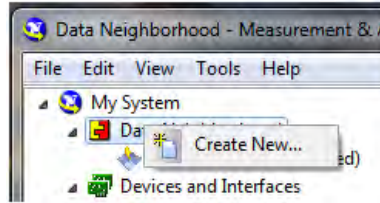


Figure 15–3 Create new Data Neighborhood

4. Click NI-DAQmx Task and then Next.

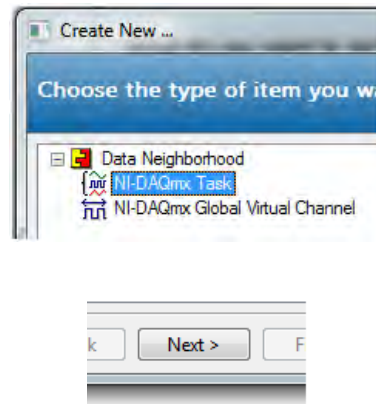


Figure 15–4 Select NI-DAQmx Task

5. Skip to step #7.
6. Right-click NI-DAQmx Tasks and click Create New NI-DAQmx Task...

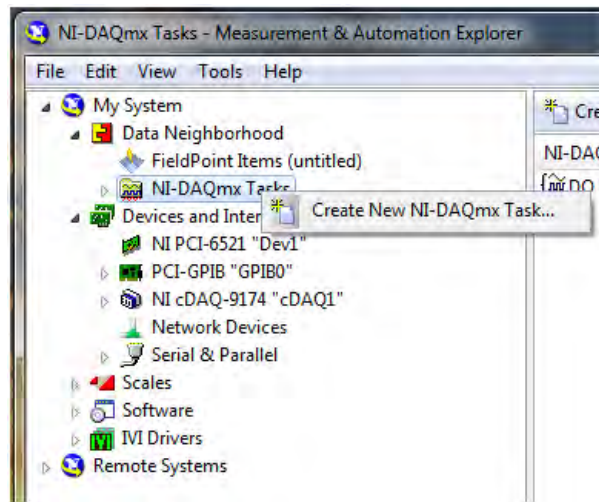


Figure 15–5 Create New NI-DAQmx Task

MAINTENANCE

7. Expand Acquire Signals.

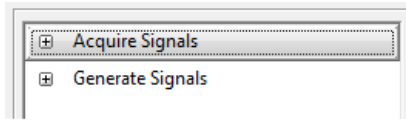


Figure 15–6 Acquire Signals Expanded

8. Expand Analog Input.

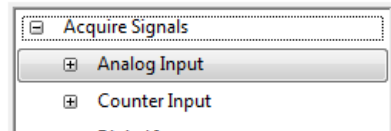


Figure 15–7 Analog Input Expanded

9. Click Voltage.

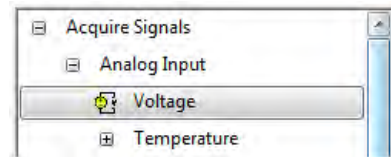


Figure 15–8 Voltage selected

10. The product being configured for voltage measurement is a USB-6009. This is an eight channel device and the tree will show the available channels. Expand Dev# (USB-6009).

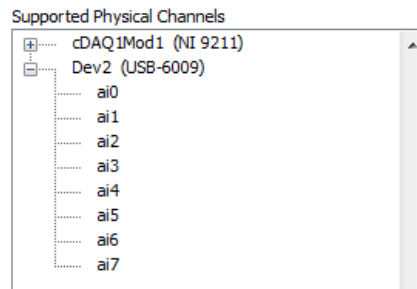


Figure 15–9 Supported Physical Channels

11. Click on the device so that all channels are highlighted.

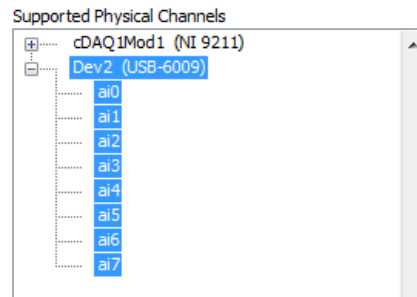


Figure 15–10 Highlighted channels

12. Click Next.
13. Type AI Task in the Enter Name: field. It is imperative that the name is entered exactly as shown.

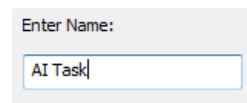


Figure 15–11 Enter AI Task in Enter Name Field

14. Click Finish.
15. AI Task will now appear in the Data Neighborhood tree.

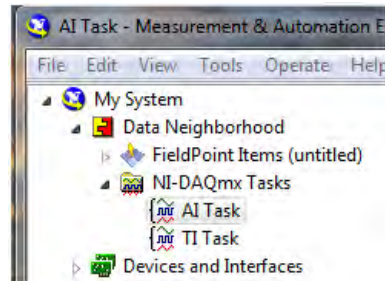


Figure 15–12 AI Task in Data Neighborhood Tree

16. The middle pane of MAX contains configuration settings for this analog input module.

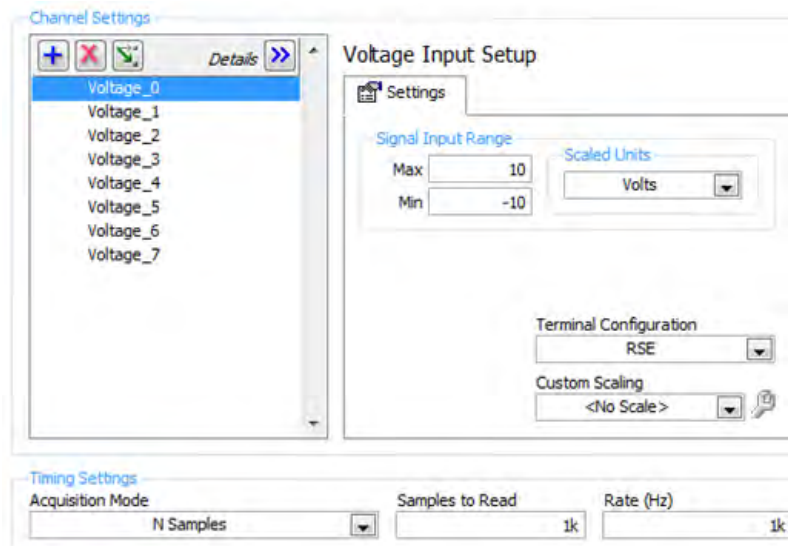


Figure 15–13 Configuration Settings

17. To configure all channels the same, click the first channel, scroll down to the last channel, then press the Shift key and click on the last item. Select the signal input range, scaled units and terminal configuration. Select the acquisition mode (1 Sample [On Demand]).

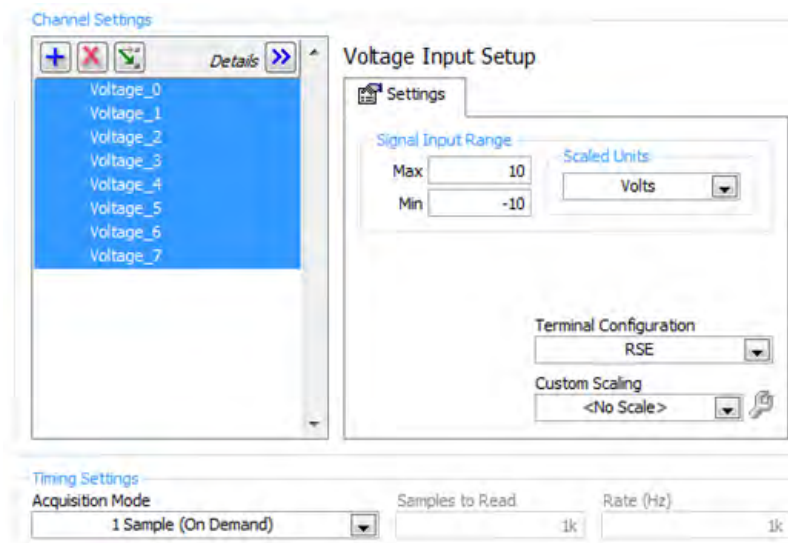


Figure 15–14 Configure All Channels the Same

18. Press the Save button.
19. Exit MAX by clicking the X in the upper right corner of the window.

- 20. This is all that is needed to enable the device for use in M-TEST 7. You are not limited to voltage inputs; you may select any of the analog input options that the device is capable of providing. You can change parameters for each individual channel of that device by selecting the channel and setting its parameters. You may also test the analog inputs by clicking the Run button. The acquired data will display in the table or you may select the graph from the Display Type control.

15.2 CREATING ANALOG OUTPUT (AO) TASKS

- 1. To create an analog output task, double-click the Measurement & Automation Explorer (MAX) shortcut on your desktop.

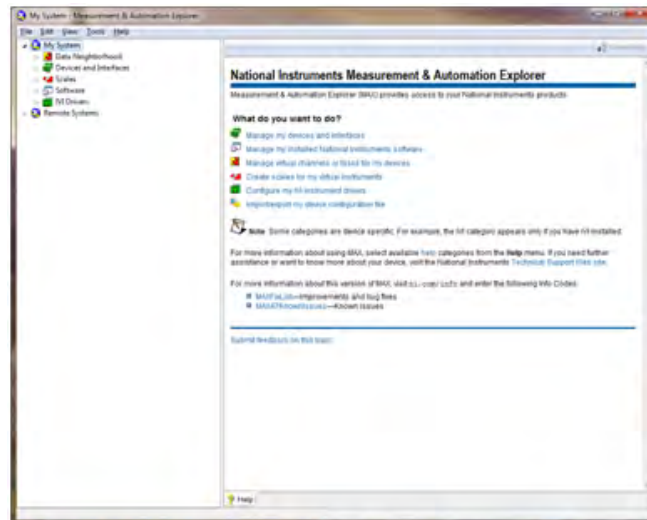


Figure 15–15 Measurement & Automation Explorer Screen

- 2. Expand Data Neighborhood by clicking on the small triangle next to it. If you see NI-DAQmx Tasks as one of the items, skip to step #6.

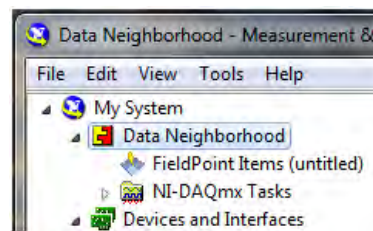


Figure 15–16 Measurement & Automation Explorer Screen with Data Neighborhood expanded

MAINTENANCE

3. Right-click on Data Neighborhood and click Create New...

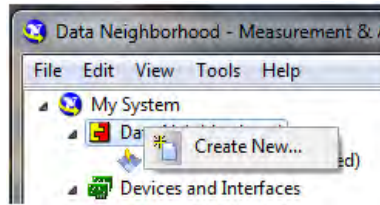


Figure 15–17 Create new Data Neighborhood

4. Click NI-DAQmx Task and then Next.

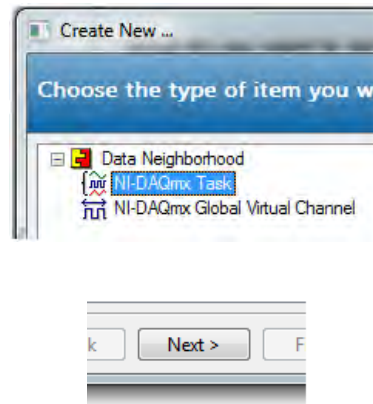


Figure 15–18 Select NI-DAQmx Task

5. Skip to step #7.
6. Right-click NI-DAQmx Tasks and click Create New NI-DAQmx Task...

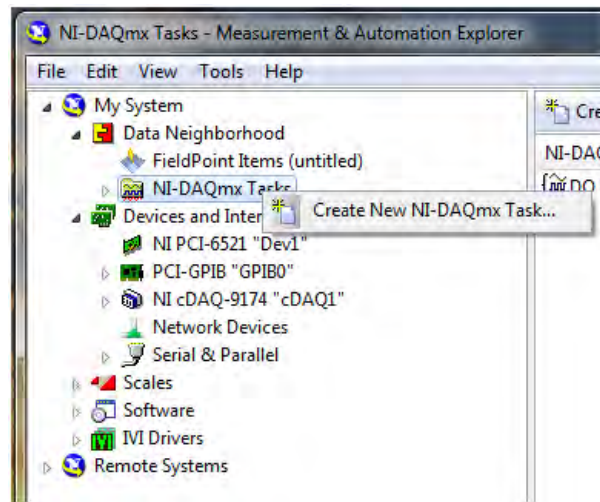


Figure 15–19 Create New NI-DAQmx Task

MAINTENANCE

7. Expand Generate Signals.

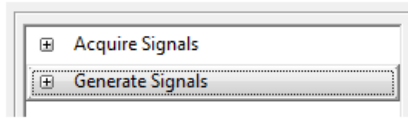


Figure 15–20 Generate Signals Expanded

8. Expand Analog Output.

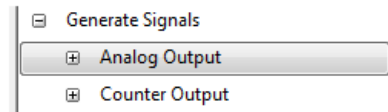


Figure 15–21 Analog Output Expanded

9. Click Voltage.

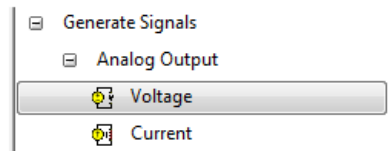


Figure 15–22 Voltage Selected

10. The product being configured for voltage output is a USB-6009. This is a two channel device and the tree will show the available channels. Expand Dev# (USB-6009).

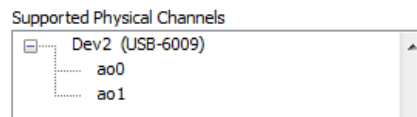


Figure 15–23 Supported Physical Channels

11. Click on the device so that all channels are highlighted.

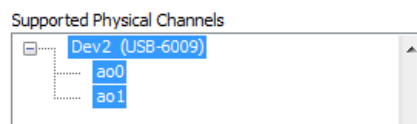


Figure 15–24 Highlighted Channels

12. Click Next.

13. Type AO Task in the Enter Name: field. It is imperative that the name is entered exactly as shown.

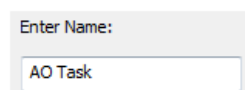


Figure 15–25 Enter AO Task in Enter Name Field

14. Click Finish.
15. AO Task will now appear in the Data Neighborhood tree.

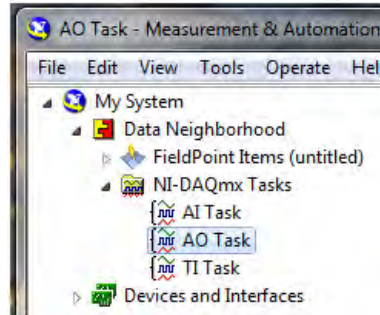


Figure 15–26 AO Task in Data Neighborhood Tree

16. The middle pane of MAX contains configuration settings for this analog output module.

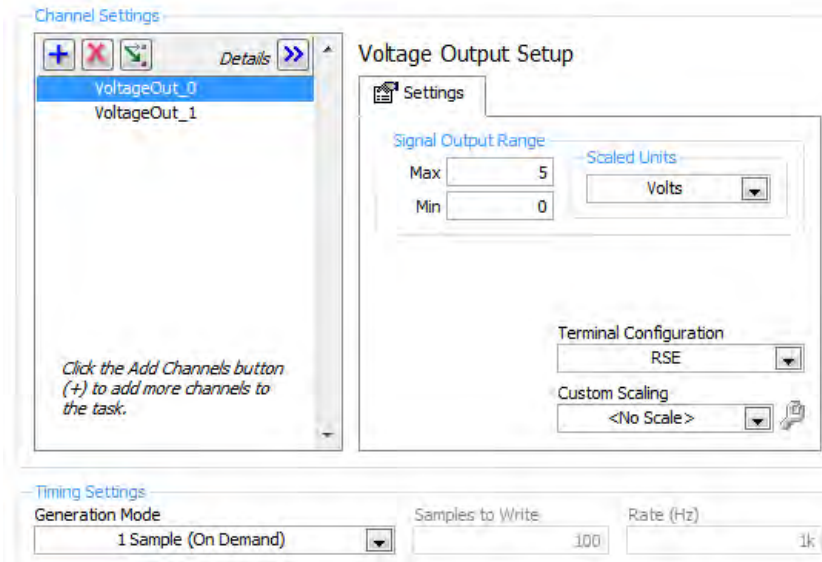


Figure 15–27 Configuration Settings

17. To configure all channels the same, click the first channel, scroll down to the last channel, then press the Shift key and click on the last item. Select the signal input range, scaled units and terminal configuration. Select the acquisition mode (1 Sample [On Demand]).

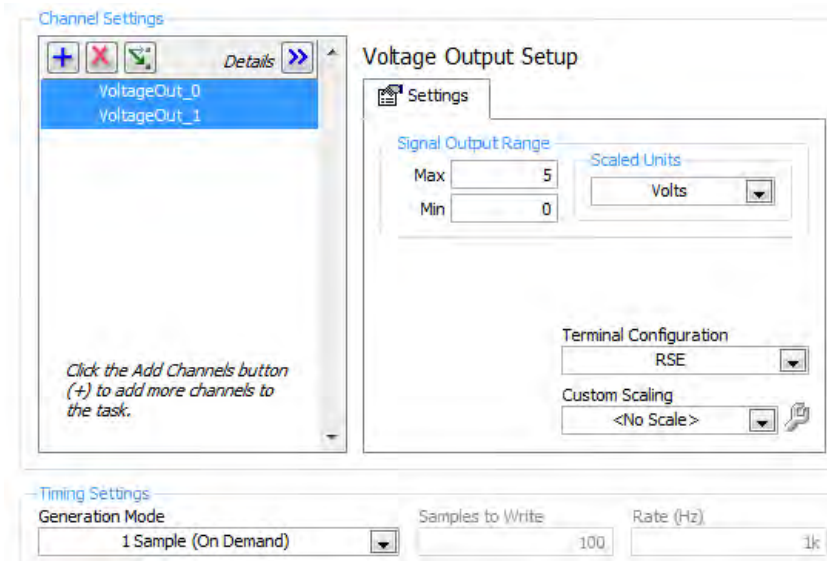


Figure 15–28 Configure all Channels the Same

18. Press the Save button.
19. Exit MAX by clicking the X in the upper right corner of the window.
20. This is all that is needed to enable the device for use in M-TEST 7. You are not limited to voltage outputs; you may select any of the analog output options that the device is capable of providing. You can change parameters for each individual channel of that device by selecting the channel and setting its parameters. You may also test the analog outputs by clicking the Run button. The acquired data will display in the table or you may select the graph from the Display Type control.

15.3 CREATING DIGITAL INPUT (DI) TASKS

1. To create a digital input task, double-click the Measurement & Automation Explorer (MAX) shortcut on your desktop.

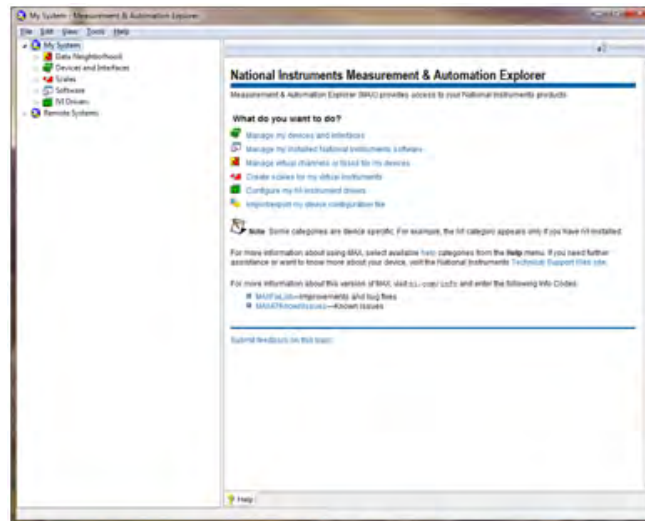


Figure 15–29 Measurement & Automation Explorer Screen

2. Expand Data Neighborhood by clicking on the small triangle next to it. If you see NI-DAQmx Tasks as one of the items, skip to step #6.

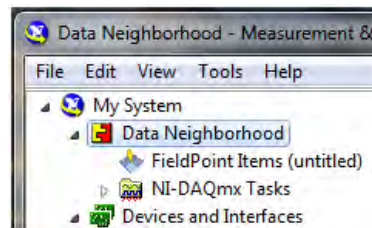


Figure 15–30 Measurement & Automation Explorer Screen with Data Neighborhood Expanded

3. Right-click on Data Neighborhood and click Create New...

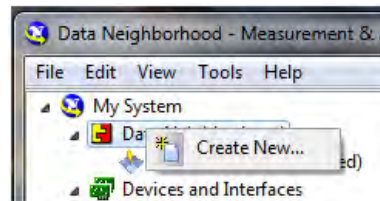


Figure 15–31 Create New Data Neighborhood

- 4. Click NI-DAQmx Task and then Next.

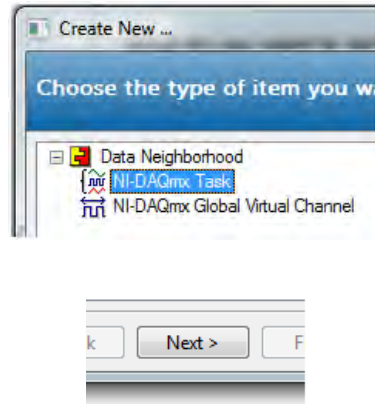


Figure 15–32 Select NI-DAQmx Task

- 5. Skip to step #7.
- 6. Right-click NI-DAQmx Tasks and click Create New NI-DAQmx Task...

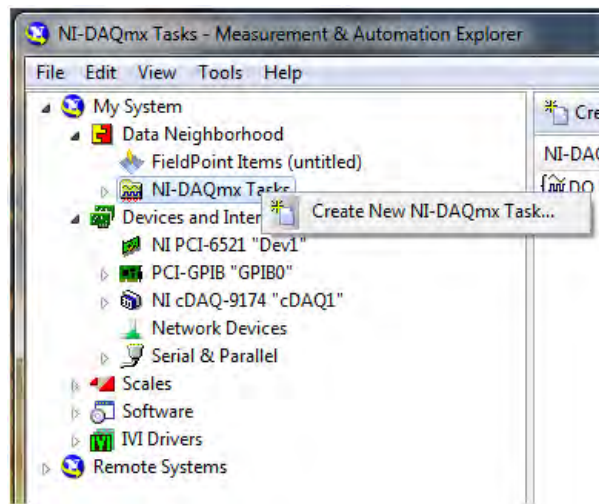


Figure 15–33 Create New Ni-DAQmx Task

- 7. Expand Acquire Signals.

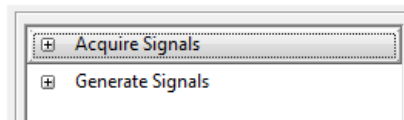


Figure 15–34 Acquire Signals Expanded

MAINTENANCE

8. Expand Digital Input.

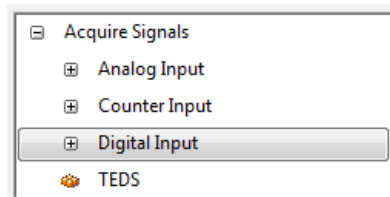


Figure 15–35 Digital Input Expanded

9. Click Port Input.

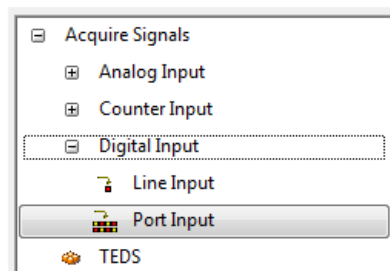


Figure 15–36 Port Input Selected

10. The product being configured for digital input is a PCI-6521. This is an eight channel device and the tree will show the available channels. Expand Dev# (PCI-6521).

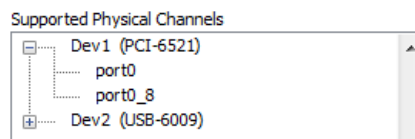


Figure 15–37 Supported Physical Channels

11. Click on the 8 channel port so that it is highlighted.

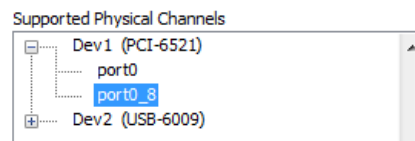


Figure 15–38 8 Channel Port Highlighted

12. Click Next.

13. Type DI Task in the Enter Name: field. It is imperative that the name is entered exactly as shown.

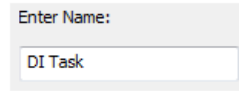


Figure 15–39 Enter DI Task in Enter Name Field

14. Click Finish.
15. DI Task will now appear in the Data Neighborhood tree.

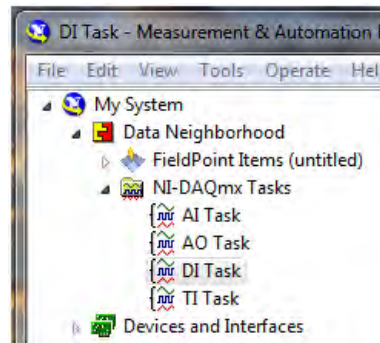


Figure 15–40 DI Task in Data Neighborhood

16. The middle pane of MAX contains configuration settings for this digital input device.

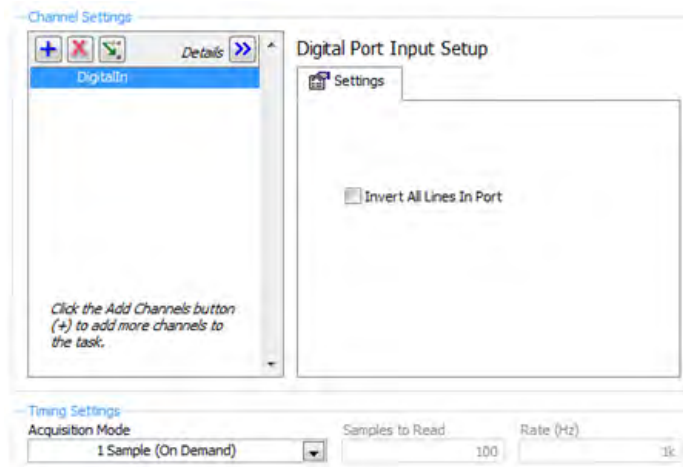


Figure 15–41 Configuration Settings

17. Select Invert All Lines in Port if desired and select the acquisition mode (1 Sample [On Demand]).
18. Press the Save button.
19. Exit MAX by clicking the X in the upper right corner of the window.
20. This is all that is needed to enable the device for use in M-TEST 7. You may test the digital inputs by clicking the Run button. The row of LEDs will indicate the current logic state of each line in the port.

MAINTENANCE

15.4 CREATING DIGITAL OUTPUT (DO) TASKS

1. To create a digital output task, double-click the Measurement & Automation Explorer (MAX) shortcut on your desktop.

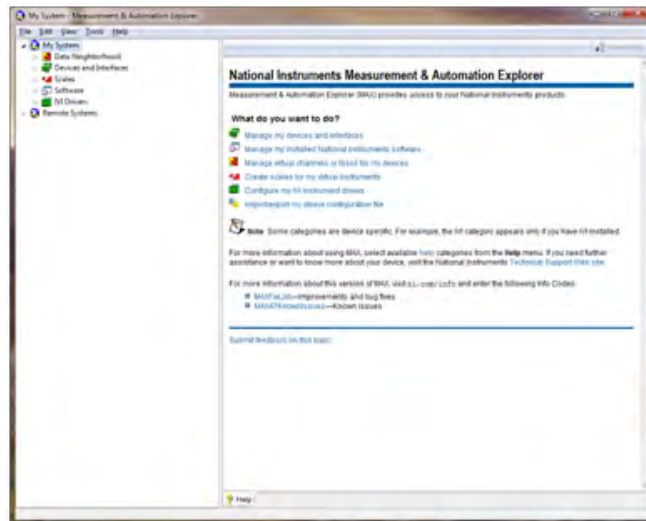


Figure 15–42 Measurement & Automation Explorer Screen

2. Expand Data Neighborhood by clicking on the small triangle next to it. If you see NI-DAQmx Tasks as one of the items, skip to step #6.

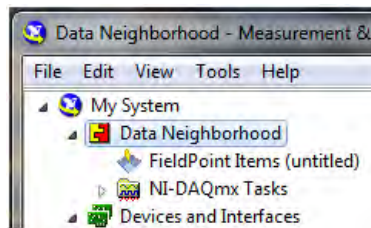


Figure 15–43 Measurement & Automation Explorer Screen with Data Neighborhood Expanded

3. Right-click on Data Neighborhood and click Create New...

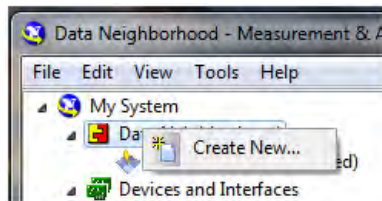


Figure 15–44 Create New Data Neighborhood

- 4. Click NI-DAQmx Task and then Next.

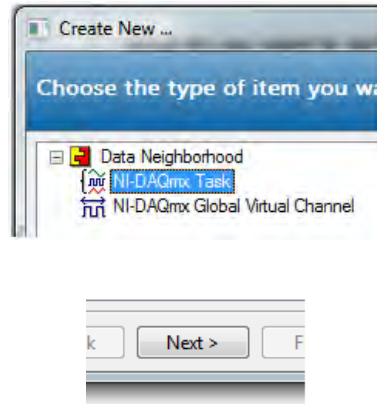


Figure 15–45 Select NI-DAQmx Task

- 5. Skip to step #7.
- 6. Right-click NI-DAQmx Tasks and click Create New NI-DAQmx Task...

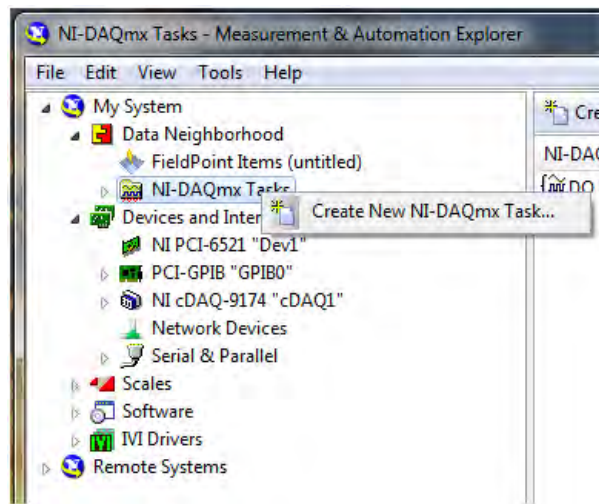


Figure 15–46 Create New NI-DAQmx Task

- 7. Expand Generate Signals.

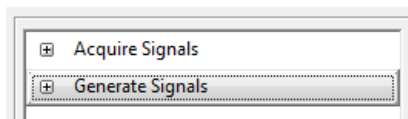


Figure 15–47 Generate Signals Expanded

MAINTENANCE

8. Expand Digital Output.

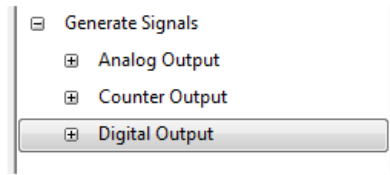


Figure 15–48 Digital Output Expanded

9. Click Port Output.

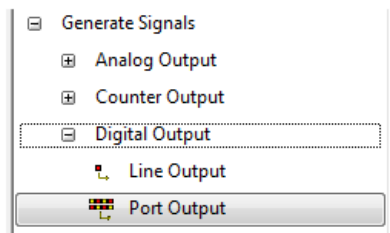


Figure 15–49 Port Output Selected

10. The product being configured for digital output is a PCI-6521. This is an eight channel device and the tree will show the available channels. Expand Dev# (PCI-6521).

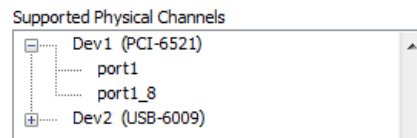


Figure 15–50 Dev# (PCI-6521) Expanded

11. Click on the 8 channel port so that it is highlighted.

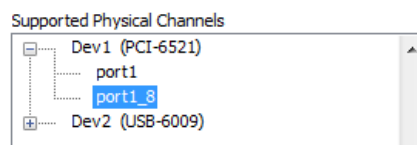


Figure 15–51 8 Channel Port Highlighted

12. Click Next.
 13. Type DO Task in the Enter Name: field. It is imperative that the name is entered exactly as shown.

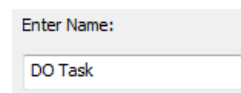


Figure 15–52 Enter DO Task in Enter Name Field

14. Click Finish.

15. DO Task will now appear in the Data Neighborhood tree.

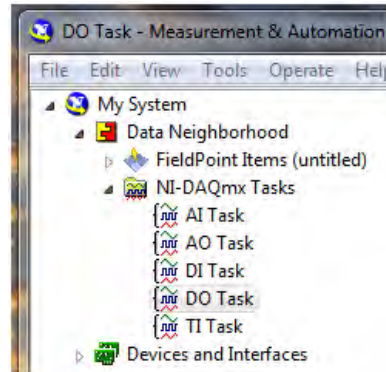


Figure 15–53 DO Task in Data Neighborhood

16. The middle pane of MAX contains configuration settings for this digital output device.

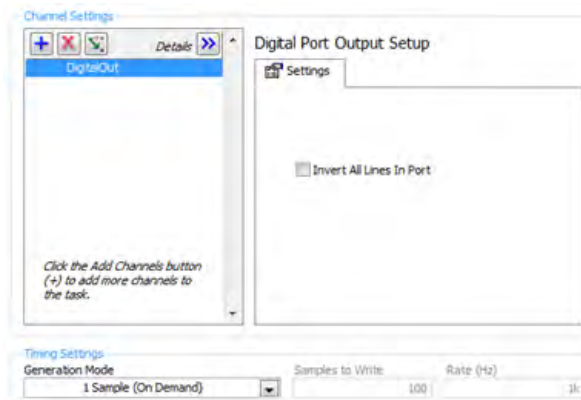


Figure 15–54 Configuration Settings

17. Select Invert All Lines in Port if desired and select the acquisition mode (1 Sample [On Demand]).
18. Press the Save button.
19. Exit MAX by clicking the X in the upper right corner of the window.
20. This is all that is needed to enable the device for use in M-TEST 7. You may test the digital outputs by clicking the Run button. Click any of the LEDs to change the logic state of that line in the port.

15.5 CREATING TEMPERATURE INPUT (TI) TASKS

1. To create a temperature input task, double-click the Measurement & Automation Explorer (MAX) shortcut on your desktop.

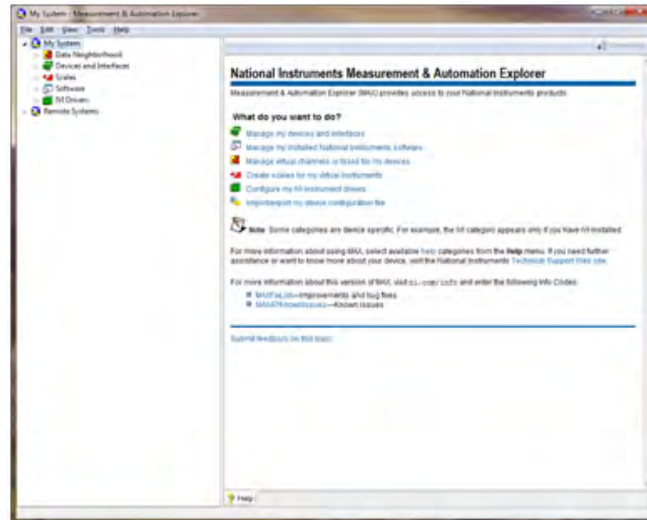


Figure 15–55 Measurement & Automation Explorer Screen

2. Expand Data Neighborhood by clicking on the small triangle next to it. If you see NI-DAQmx Tasks as one of the items, skip to step #6.

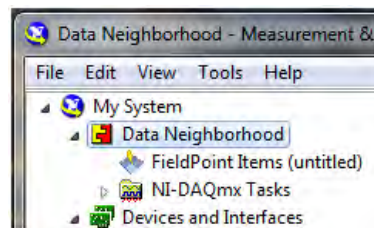


Figure 15–56 Measurement & Automation Explorer Screen with Data Neighborhood Expanded

3. Right-click on Data Neighborhood and click Create New...

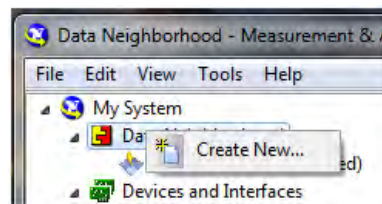


Figure 15–57 Create New Data Neighborhood

- 4. Click NI-DAQmx Task and then Next.

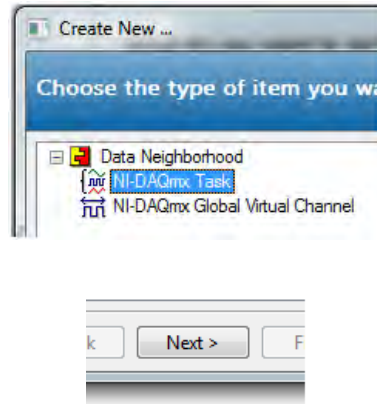


Figure 15–58 Select NI-DAQmx Task

- 5. Skip to step #7.
- 6. Right-click NI-DAQmx Tasks and click Create New NI-DAQmx Task...

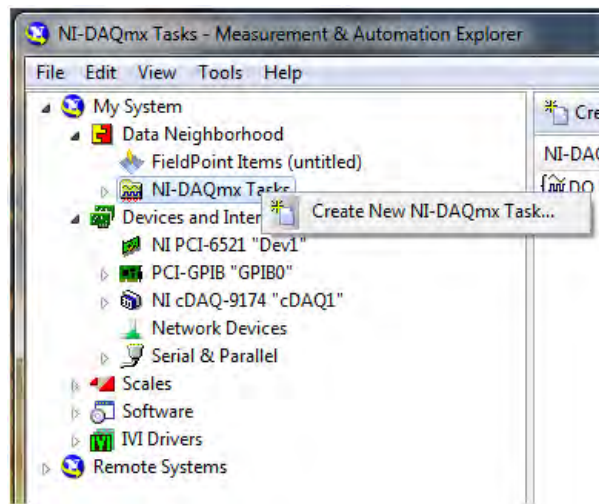


Figure 15–59 Create New NI-DAQmx Task

- 7. Expand Acquire Signals.

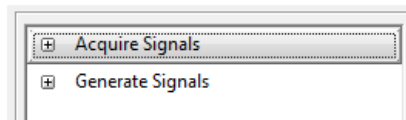


Figure 15–60 Acquire Signals Expanded

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8. Expand Analog Input.

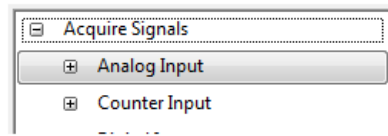


Figure 15–61 Analog Input Expanded

9. Expand Temperature.

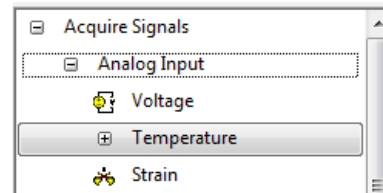


Figure 15–62 Temperature Expanded

10. Select the type of device used for measurement. In this example we will measure temperature with thermocouples. Click Thermocouple.

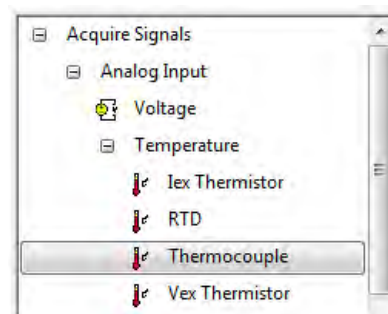


Figure 15–63 Select Temperature Device

11. The product being configured for thermocouple temperature measurement is a NI 9211 in the cDAQ chassis. This is a four channel device and the tree will show the available channels. Expand cDAQ1Mod1 (NI 9211).

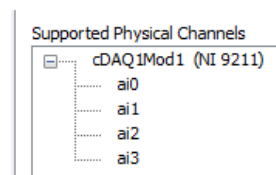


Figure 15–64 Temperature Input Supported Channels

- Click on the device so that all channels are highlighted.

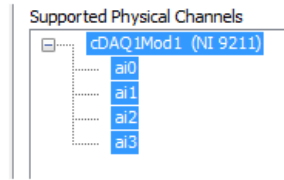


Figure 15–65 Temperature Input Channels Highlighted

- Click Next.
- Type TI Task in the Enter Name: field. It is imperative that the name is entered exactly as shown.

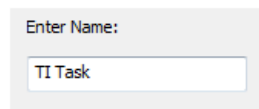


Figure 15–66 TI Task in Enter Name Field

- Click Finish.
- TI Task will now appear in the Data Neighborhood tree.

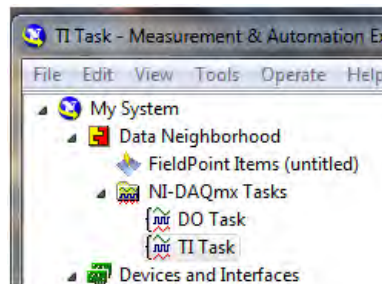


Figure 15–67 TI Task in Data Neighborhood

17. The middle pane of MAX contains configuration settings for this thermocouple module.

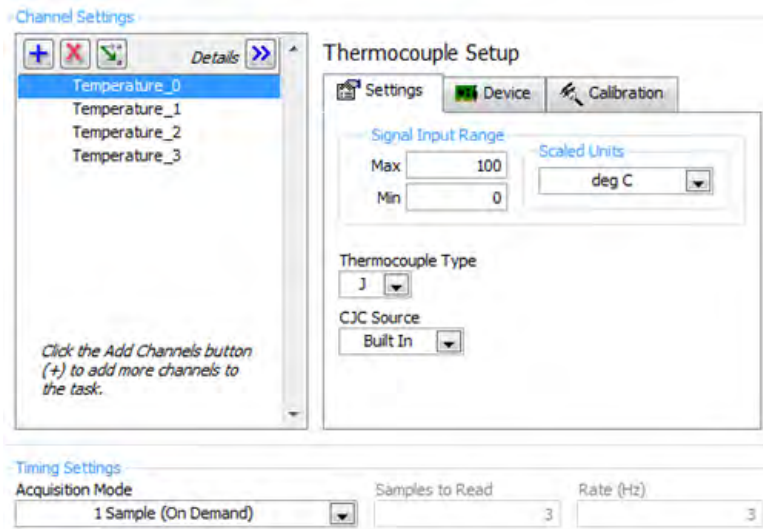


Figure 15–68 Configuration Settings

18. To configure all channels the same, click the first channel, scroll down to the last channel, then press the Shift key and click on the last item. Select the signal input range, scaled units and thermocouple type. Select the built-in CJC source and the acquisition mode (1 Sample [On Demand]).

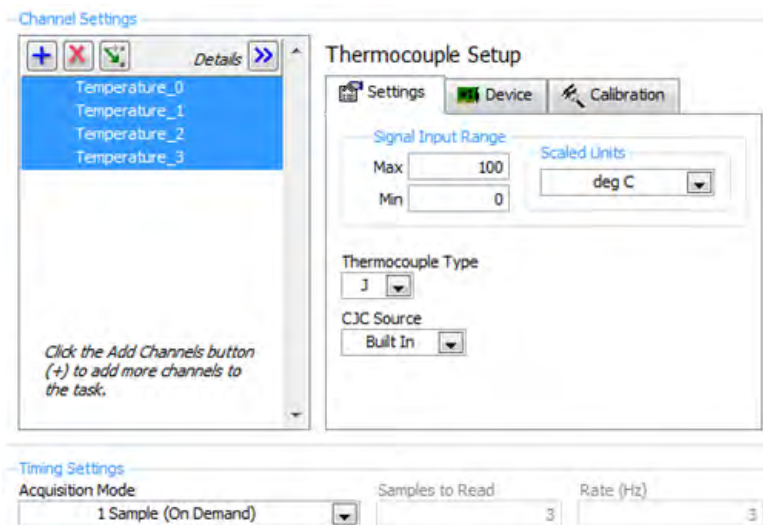


Figure 15–69 All Channels Configured the Same

19. Press the Save button.
 20. Exit MAX by clicking the X in the upper right corner of the window.
 21. This is all that is needed to enable the device for use in M-TEST 7. You are not limited to thermocouple inputs; you may select any of the temperature input options that the device is capable of providing. You can change parameters for each individual channel of that device by selecting the channel and setting its parameters. You may also test the temperature inputs by clicking the Run button. The acquired data will display in the table or you may select the graph from the Display Type control.

16. Tuning System Response (PID)

Proper tuning of the dynamometer system is necessary to achieve stable results and fast response to load commands. In most cases, the tuning is quite simple once you understand the basics. To help in this process, M-TEST 7 has included an Adjust PID procedure for both ramp and step type tests. We will look at each one in detail. In these examples, we are using a 120VAC PSC (permanent split capacitor) motor.

16.1 RAMP PID ADJUSTMENT

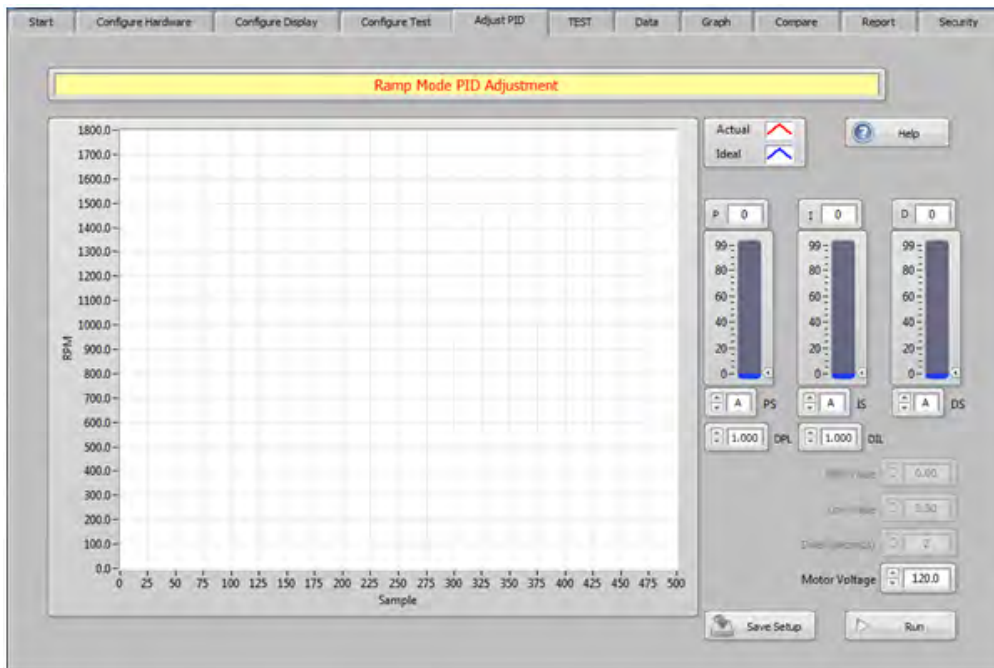


Figure 16–1 Ramp PID Adjustment Screen

Configure the hardware and test the way you wish to run during the actual ramp test. The values for maximum and minimum speed, ramp rate, ramp function, etc. will all affect the operation of the Adjust PID routine.

Start with something in the P slider or there will be no response. Configure the settings as shown in *Figure 16–2 Ramp Test Graph*.

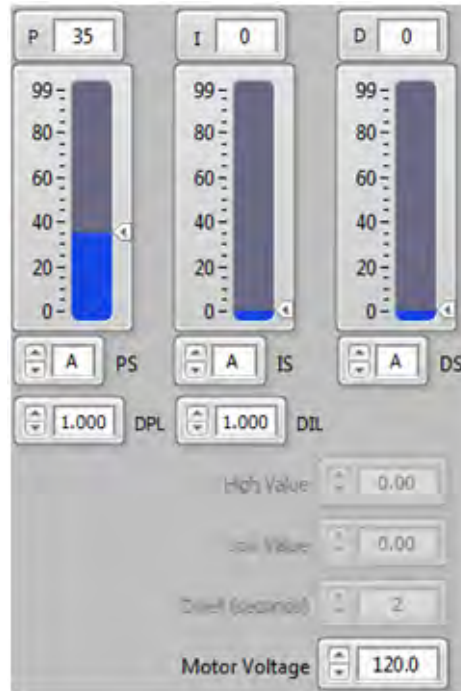


Figure 16–2 PID Settings



NOTE: If using a programmable power supply being controlled by M-TEST 7, enter the voltage you wish to operate the motor at during the procedure. If no power supply is selected, the Motor Voltage control will not be visible.

Press the Run button.

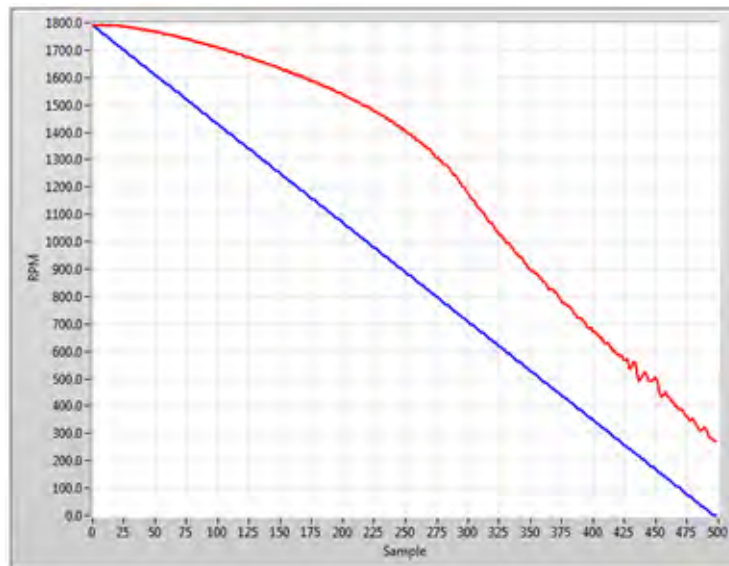


Figure 16–3 Ramp Test Graph

MAINTENANCE

Notice the “bump” when the motor begins decelerating and the large offset between the RED and BLUE lines. Ideally, the RED and BLUE lines should follow each other exactly, but this is not always possible. Let us add some integral term to the controller. Using the I slider, set a value of 35.

Press the Run button.

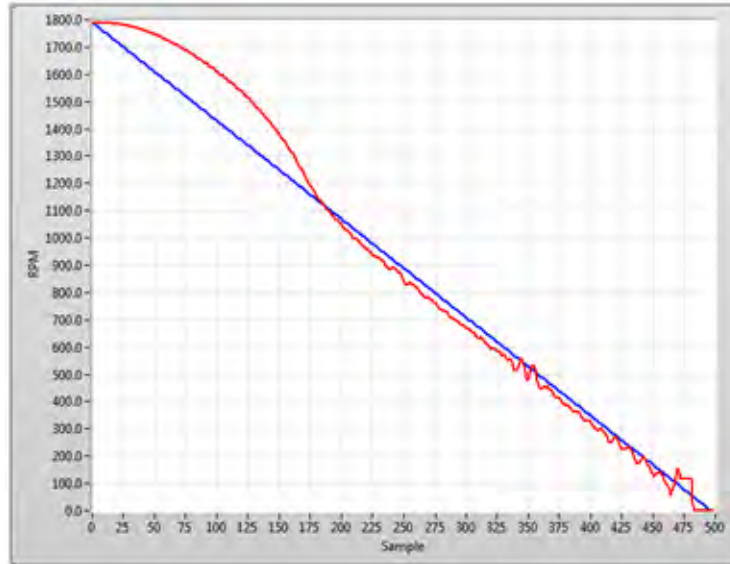


Figure 16–4 Ramp Test Graph with the I value adjusted

The offset has been mostly removed but the bump between 1800 RPM and 1150 RPM is excessive. It is acceptable to have some of this bump present but it should be diminished in the first 20% of the deceleration plot. This would typically be reduced by adding more integral gain. In this step we will do that by changing the IS setting from A to B.

Press the Run button.

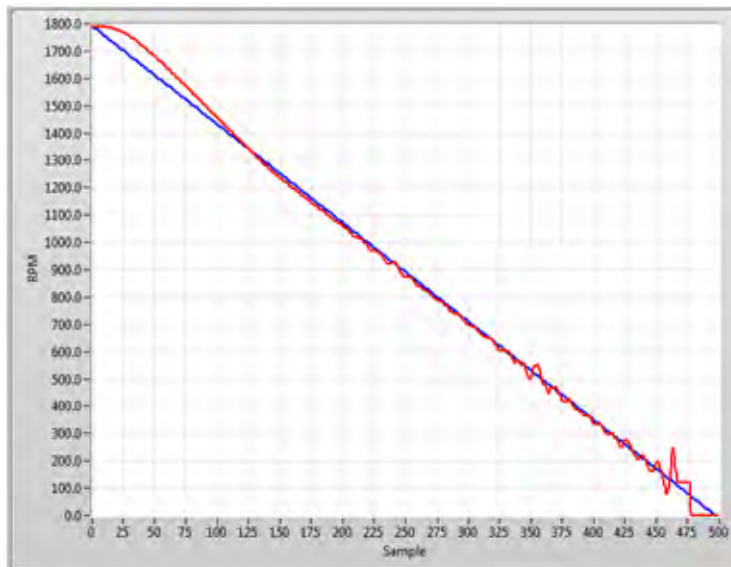


Figure 16–5 Ramp Test Graph with the IS Setting Adjusted

MAINTENANCE

The bump is significantly reduced to an acceptable level, the small amount of offset is gone, but there is a little instability at the lower portion of the plot. This may be corrected by using the dynamic integral scaling (DIL) to linearly reduce the amount of integral gain from 100% of the setting at the start of the ramp to 0.1% (0.001) at the end.

Press the Run button.

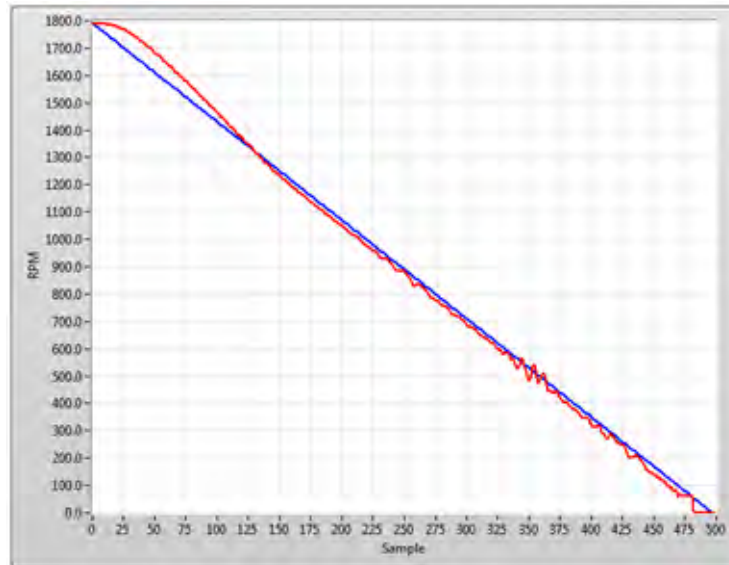


Figure 16–6 Ramp Test Graph with DIL Scaling Adjusted

The bump remained the same, the offset is almost the same, and the instability at the lower end is gone. In most cases use of the derivative gain (D) is not necessary, so the current settings should provide acceptable system response.



NOTE:

The instability seen around 500 RPM is due to a system resonance or some other characteristic of the motor being tested. You will ignore this as there is no way to tune it out.

This is just one example. Different motor types and test parameters will require more adjustments. There is no particular rule or formula that you must follow, so experimentation is in order. Once you have determined the correct settings, other motors of the same type tested on the same dynamometer can generally use the same PID values.

If you apply too much proportional gain you may get the following effect:

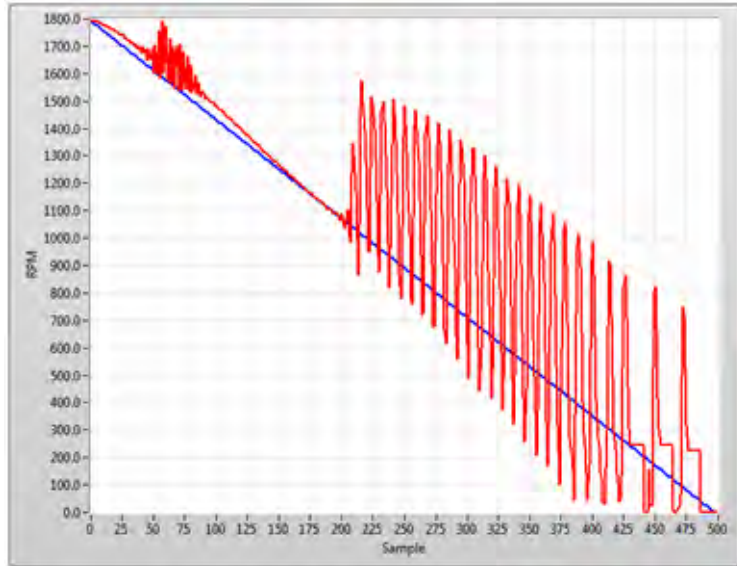


Figure 16–7 Ramp Test Graph with Too Much Proportional Gain

Likewise, too much integral gain may produce this:

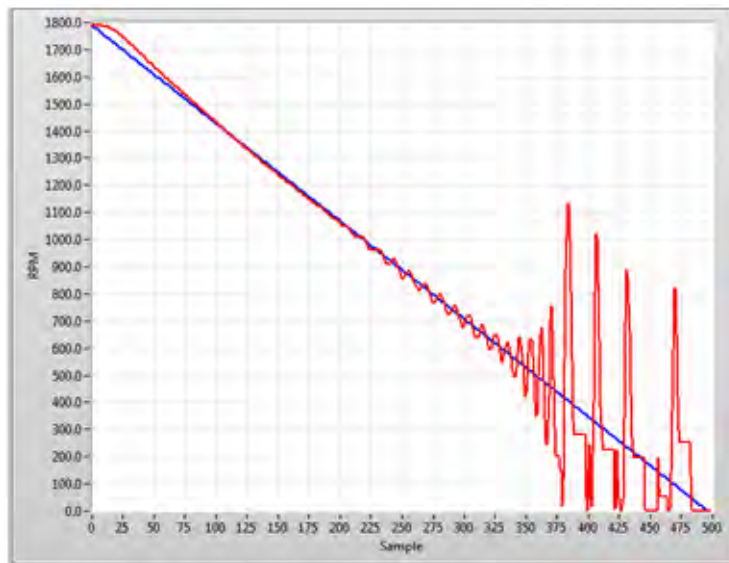


Figure 16–8 Ramp Test with Too Much Integral Gain

Neither of the above two settings will produce good results.

16.2 CURVE PID ADJUSTMENT

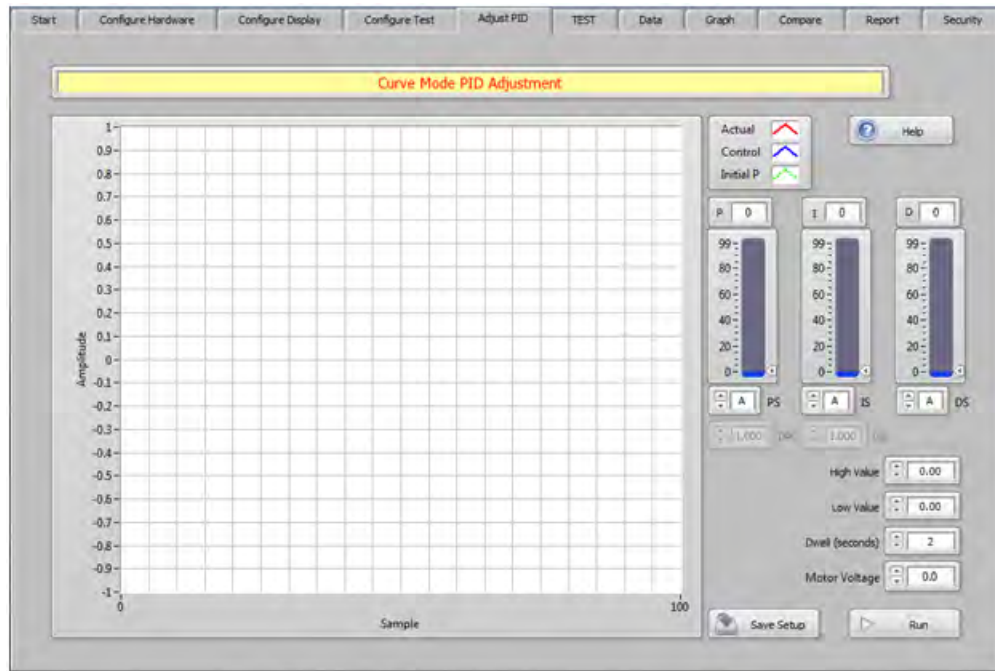


Figure 16–9 Curve PID Adjustment Screen

Configure your hardware and test the way you wish to run during the actual curve test. Notice that the Adjust PID screen is slightly different than for the Ramp test.

The High Value should be the maximum value that will be seen during the test. For example, when using torque as a control parameter, the control should be set to the maximum torque you will be testing. If speed is the control parameter, it should be the free run speed.

The Low Value should be the minimum value that will be seen during the test. For example, when using torque as a control parameter, the control would typically be set to zero. If speed is the control parameter, it should be the minimum speed you will be testing.

We need to start with something in the P slider or there will be no response. Configure the settings as shown in *Figure 16–10 Curve Test PID Settings*.

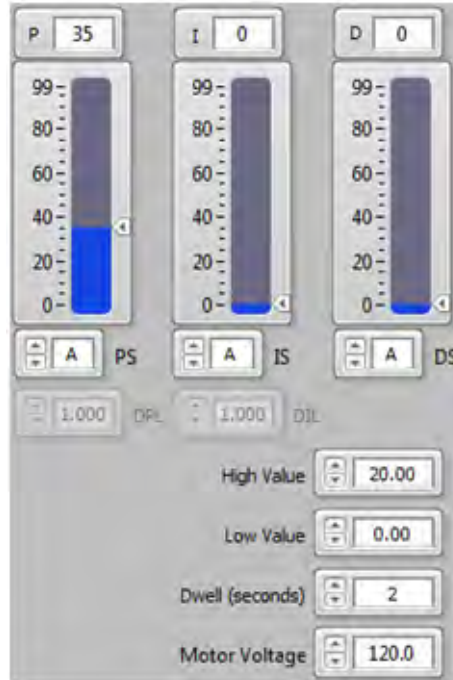


Figure 16–10 Curve Test PID Settings



NOTE: If using a programmable power supply being controlled by M-TEST 7, enter the voltage you wish to operate the motor at during the procedure. If no power supply is selected, the Motor Voltage control will not be visible.

Press the Run button.

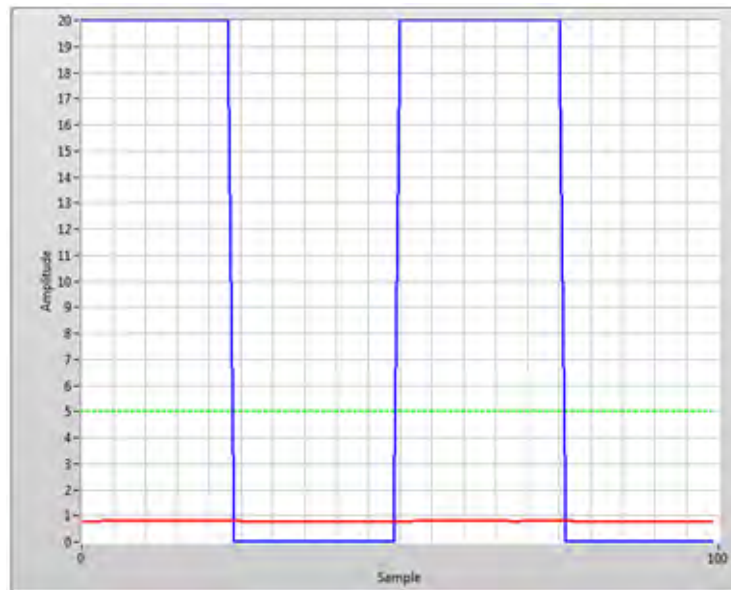


Figure 16–11 Curve Test Screen

MAINTENANCE

Notice that the RED line is not changing with the BLUE control signal. The goal in this first step is to increase the proportional gain until the RED line reaches the dotted GREEN line. Let's increase the proportional gain by changing the scaling (PS) setting from A to B.

Press the Run button.

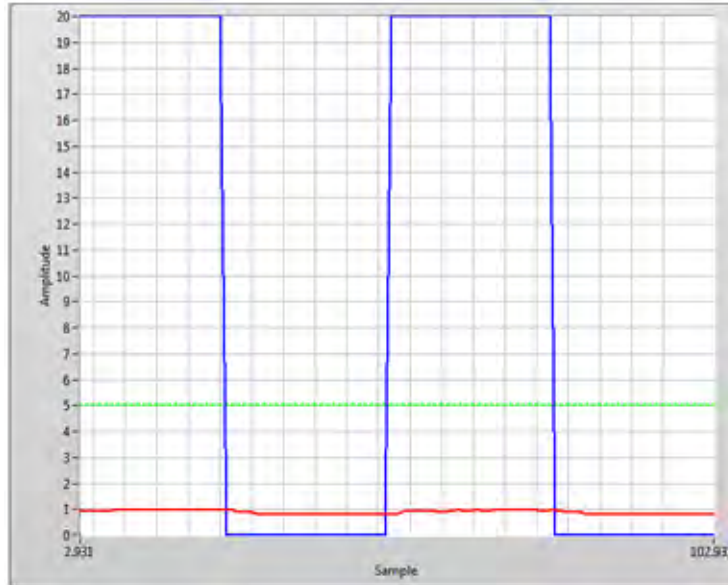


Figure 16-12 Curve Test Screen with PS Scaling Adjusted

The RED line now shows some small increase but still is not close to the GREEN line. Keep increasing the PS setting until the lines are close. This may be slightly above or below the GREEN line.

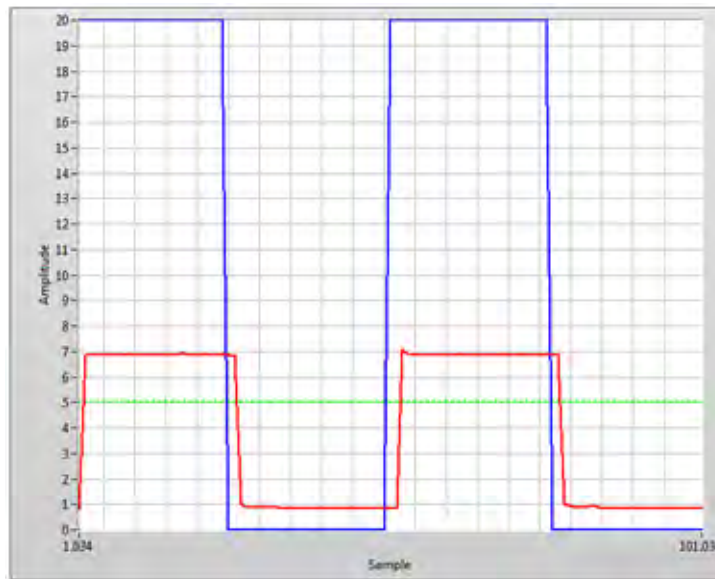


Figure 16-13 Curve Test Screen with Increased PS Scaling

MAINTENANCE

Now you may fine tune the proportional gain by using the P slider control. Make the adjustment until the RED line reaches the same value as the GREEN line.

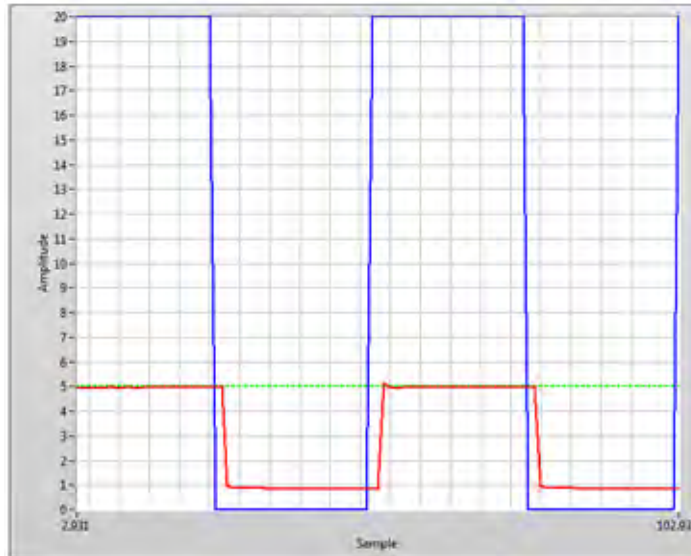


Figure 16-14 Curve Test Graph with Proportional Gain Adjusted

The proportional gain is now set correctly. The next step is to add integral gain until the RED line reaches our target load (BLUE line), gets there quickly and with little or no overshoot. Set the integral term (I) to 35.

Press the Run button.

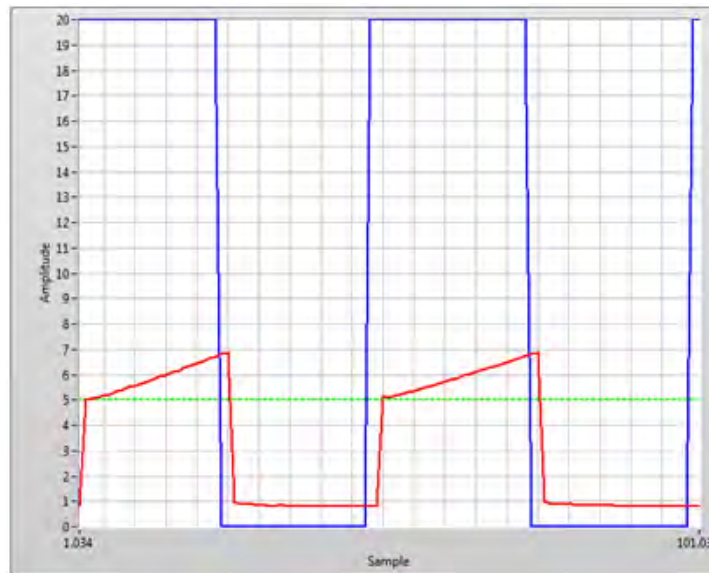


Figure 16-15 Curve Test Graph with Integral Gain Adjusted

MAINTENANCE

You may or may not see any change. In this example, the RED line shows some increase. Keep increasing the IS setting until the lines are close.

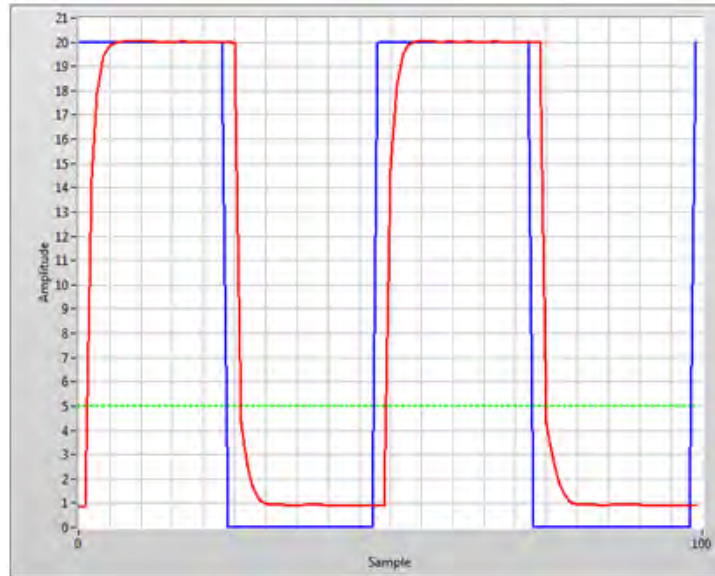


Figure 16–16 Curve Test Graph with the IS Setting Adjusted

This result is acceptable for use but you may notice the slight slowing down of the response as the RED line nears the upper BLUE line. Use the integral (I) slider to fine tune this so that the RED line has a sharper leading edge.

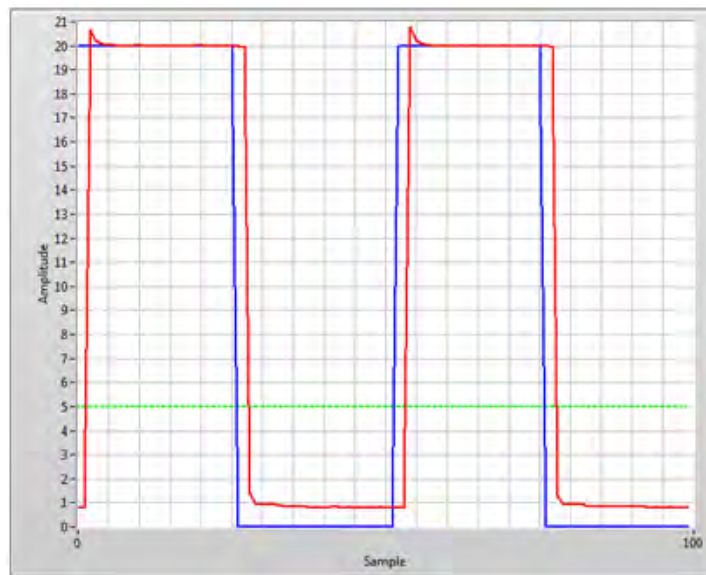


Figure 16–17 Curve Test Graph with a Sharper Leading Edge on the Red Line

In most cases use of the derivative gain (D) is not necessary, so the current settings should provide acceptable system response.

If you apply too much proportional gain you may not be able to find an integral setting that allows proper response. The following figure shows the change in system response between an integral gain setting of 74 (plot on the left of center) and 75 (plot on the right of center).

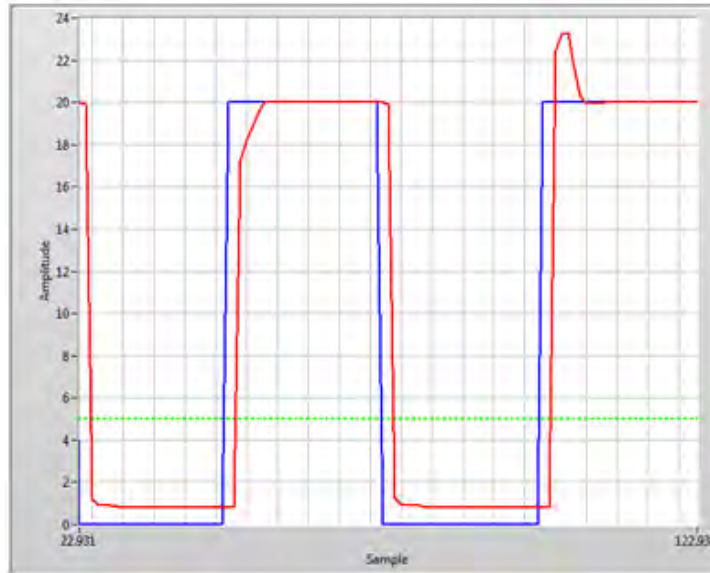


Figure 16–18 Curve Test Graph with Too Much Proportional Gain

Likewise, too much integral gain may produce this:

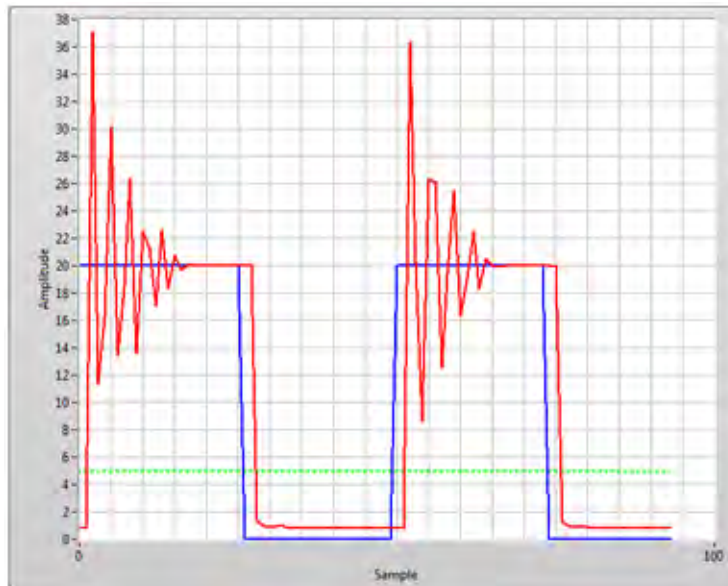


Figure 16–19 Curve Test Graph with Too Much Integral Gain

MAINTENANCE

Neither of the above two settings will produce good results.

This is just one example. Different motor types and test parameters will require more adjustments. There is no particular rule or formula that you must follow, so experimentation is in order. Once you have determined the correct settings, other motors of the same type tested on the same dynamometer can generally use the same PID values.

Appendix A: Example Tests

A.1 MANUAL TEST

Configure the hardware and display as desired.

On the Configure Test tab, select the control parameter you wish to use. In the first example we will use Open Loop.

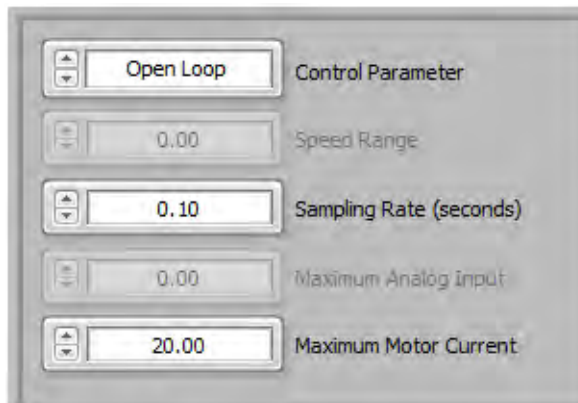


Figure A-1 Control Parameter Set To Open Loop

Click on the TEST tab and select the parameter to plot during the test, whether you want to hide the graph, clear the graph or set auto-scaling of the X- and Y- axes.

Press the Start Test button.

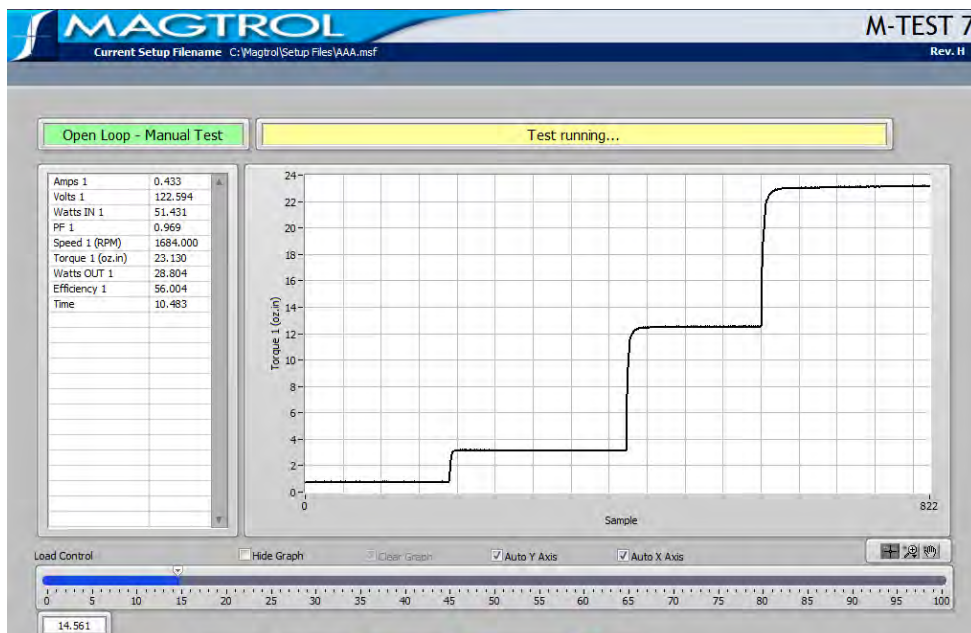


Figure A-2 Manual Test Example Screen

Use the Load Control slider to vary the amount of load applied to the motor. The slider scale is 0 to 100. This corresponds to the percentage of 1 Amp current being output to the dynamometer brake. All dynamometers require different amounts of brake current to achieve full load, but they will always be less than 1 Amp.

When using speed as the control parameter, the slider scale will be 0 to the Speed Range value.

When using torque, the scale will be 0 to the Torque Alarm value.

Speed or torque control will require proper adjustment of the PID settings. Please refer to section 16.2 for details.

A.2 CURVE TEST

Configure the hardware and display as desired.

In this example we will set up a torque controlled curve test that will load to several different torque values and use both the step and ramp functions to get to the load points.

On the Configure Test tab, set the controls as shown in *Figure A-3 Curve Test Example Settings*.

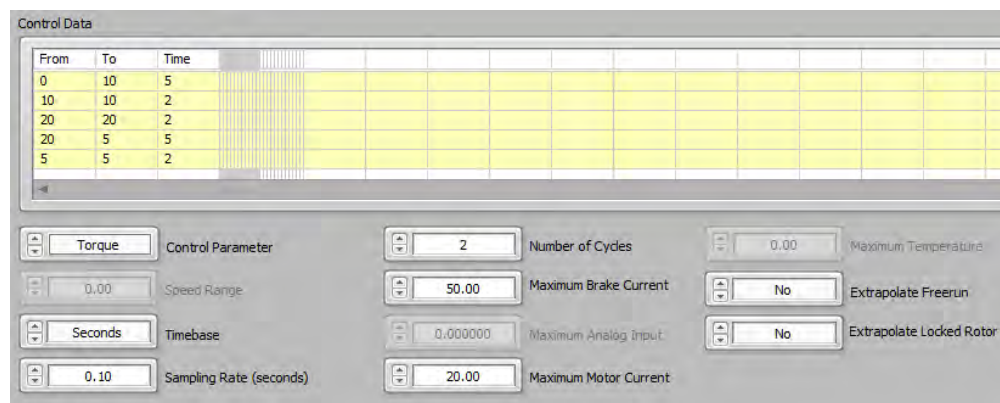


Figure A-3 Curve Test Example Settings

Speed, Torque, Amps, Watts or HP control will require proper adjustment of the PID settings. Please refer to section 16.2 for details.

This test will perform the following load profile (torque in oz-in):

- Ramp from 0 to 10 in 5 seconds
- Dwell at 10 for 2 seconds
- Step to 20
- Dwell at 20 for 2 seconds
- Ramp from 20 to 5 in 5 seconds
- Dwell at 5 for 2 seconds
- Repeat this sequence 2 times.

The data will be saved at 0.10 second intervals (RAM)

Click on the TEST tab and select the parameter to plot during the test, whether you want to hide the graph, clear the graph or set auto-scaling of the X- and Y- axes.

Press the Start Test button. *Figure A-4 Curve Test Example Result* shows the result.

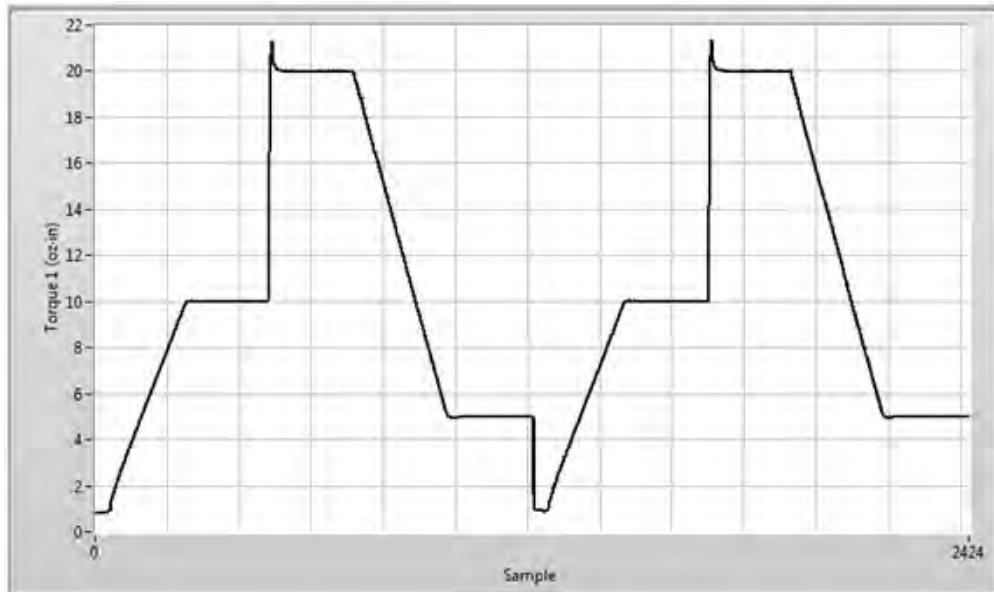


Figure A-4 Curve Test Example Result



NOTE:

Although the first row in the control table shows a ramp from 0 to 10, there is some small amount of residual torque in the dynamometer. This consists of bearing drag and windage which amount to approximately 1 oz-in. Therefore the minimum torque shown on the graph is not zero. You can never achieve lower torque than the residual value, nor greater speed than the motor is capable of.

A.3 RAMP TEST

Configure the hardware and display as desired.

In this example we will set up a ramp test using the linear, average-down/up routine from free run speed to 750 RPM. We will also include a locked rotor data point with 1 second dwell and 40% brake current. By reversing the ramp at 750 RPM we will avoid the motor instability that was observed around 500 RPM. This is not mandatory; you may continue ramping below that speed if desired.

On the Configure Test tab, set the controls as shown in *Figure A-5 Ramp Test Example Settings*.

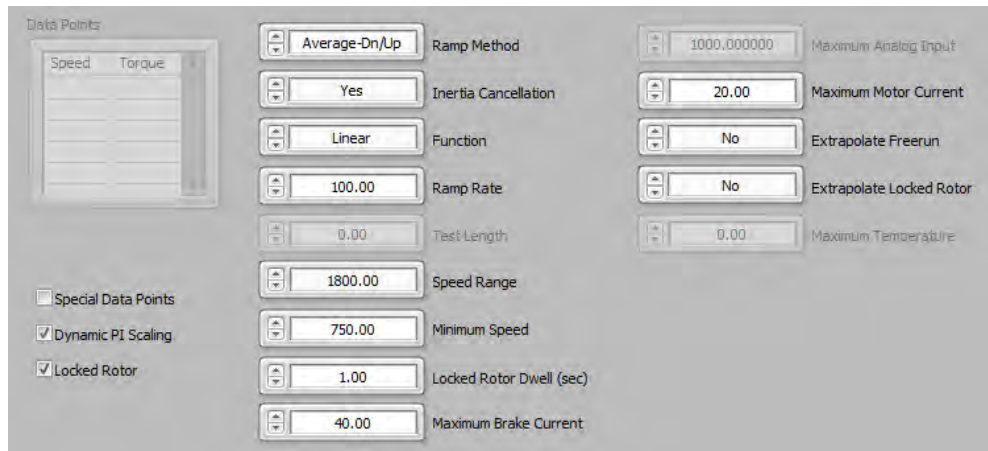


Figure A–5 Ramp Test Example Settings

The ramp test will require proper adjustment of the PID settings. Please refer to section 16.1 for details.

Click on the TEST tab and select the parameter to plot during the test, whether you want to hide the graph, clear the graph or set auto-scaling of the X- and Y- axes.

Press the Start Test button. *Figure A–6 Ramp Test Example Result* shows the result.

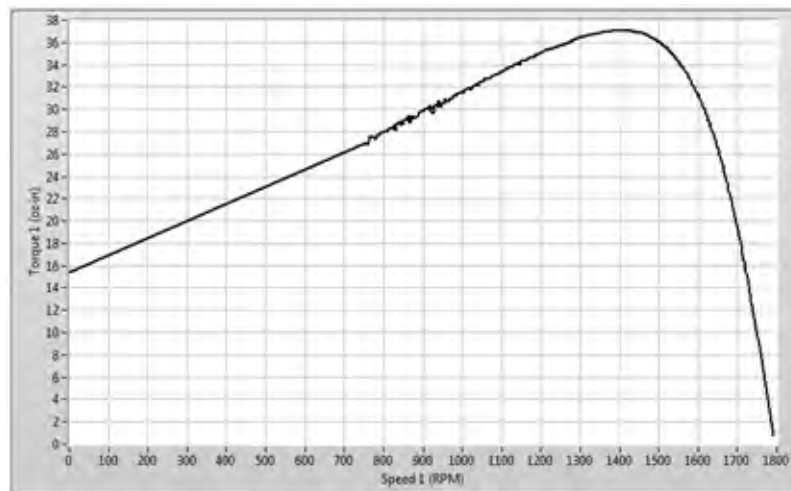


Figure A–6 Ramp Test Example Result

When the test runs, you will notice that there is a deceleration plot and an acceleration plot. Typically, these will be separated by a small space. This is due to system inertia which causes higher torque readings as the motor decelerates and lower torque readings as the motor accelerates. Since we have selected to compensate for the inertia of the system, these two plots are averaged and replaced by a single, inertially corrected plot. The locked rotor value is captured and appended to the ramp.

Figure A–7 Effect of Terminating Ramp at Lower Speed illustrates the effect of terminating the ramp at a lower speed, in this case 200 RPM. The motor instability at 500 RPM is clearly seen plus there is some additional instability near 200 RPM where the ramp reverses. At low speeds, the standard 60-ppr speed encoder on the dynamometer does not provide enough information for the closed loop function in the controller to operate effectively. Unless this portion of the speed-torque curve

is needed, it is best to avoid the lowest speeds.

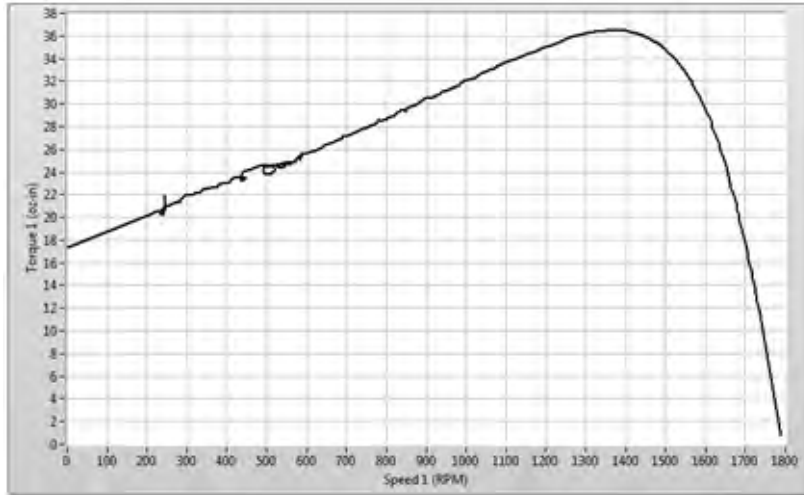


Figure A-7 Effect of Terminating Ramp at Lower Speed

A.4 PASS/FAIL TEST

Configure the hardware and display as desired.

In this example we will set up a torque controlled pass/fail test that will load to several different torque values using the step function. Pass/fail checking is performed only at dwell points, so if you include ramping from one load to the next, there will be no check during the ramp.

On the Configure Test tab, set the controls as shown in *Figure A-8 Pass/Fail Test Example Settings*.

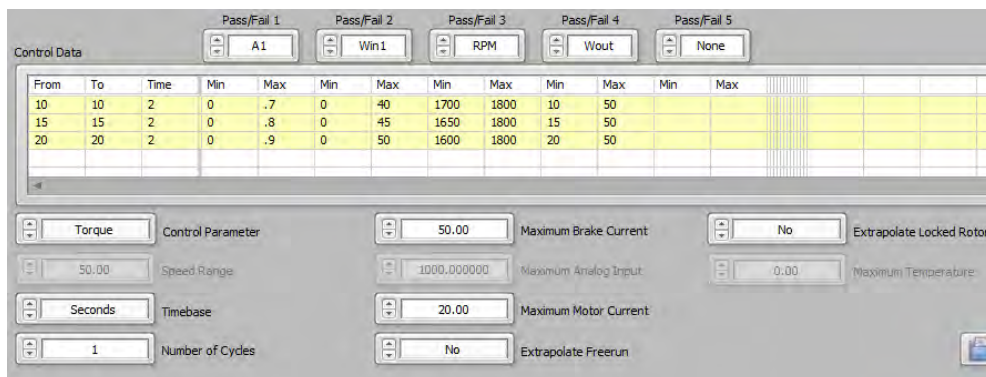


Figure A-8 Pass/Fail Test Example Settings

Speed, Torque, Amps, Watts or HP control will require proper adjustment of the PID settings. Please refer to section 16.2 for details.

Click on the TEST tab and select the parameter to plot during the test, whether you want to hide the graph, clear the graph or set auto-scaling of the X- and Y- axes.

Press the Start Test button. While the test is being performed, the screen shown in *Figure A-9 Pass/Fail Test Screen* will be seen.

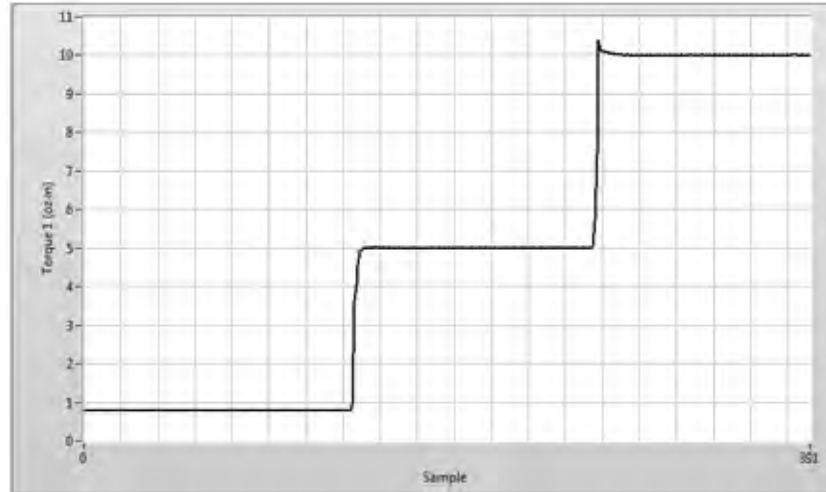


Figure A-9 Pass/Fail Test Screen

As the test steps through each load value, instantaneous checking is performed against the parameter min/max values. A failure to meet the specification will cause the test to abort at that value. Upon completion of the test, the screen shown in *Figure A-10 Pass/Fail Test Example Result* will appear. The status window will indicate either a PASS or FAIL message. The actual acquired data is displayed in the table below with any failed parameter being highlighted in RED.

ai		PASS							
Time (sec.)	oz.in	A1	Win1	RPM	Wout	None			
2.018	0.786	0.294	29.153	1790.000	1.040				
4.047	5.003	0.306	32.429	1772.000	6.556				
6.074	10.000	0.330	36.894	1750.000	12.941				
8.198	15.010	0.362	41.536	1724.000	19.136				
10.445	20.000	0.401	46.700	1699.000	25.128				

Figure A-10 Pass/Fail Test Example Result

The table in *Figure A–11 Pass/Fail Test Example Test Limits* shows the limits that were programmed for this test, and is included for easy reference.

Test Limits								
oz.in	A1 Min	A1 Max	Win1 Min	Win1 Max	RPM Min	RPM Max	Wout Min	Wout Max
0	0	.5	0	30	1780	1800	0	50
5	0	.6	0	35	1750	1800	5	50
10	0	.7	0	40	1700	1800	10	50
15	0	.8	0	45	1650	1800	15	50
20	0	.9	0	50	1600	1800	20	50

Figure A–11 Pass/Fail Test Example Test Limits

Figure A–12 Failed Test Example shows the screen when a motor fails to meet the specifications. In this case the minimum allowable Watts Output was set to 20 at a load of 15 oz.in. The measured power at that load was 19.155 watts, so the test fails and does not continue.

Test Limits								
oz.in	A1 Min	A1 Max	Win1 Min	Win1 Max	RPM Min	RPM Max	Wout Min	Wout Max
0	0	.5	0	32	1780	1800	0	50
5	0	.6	0	35	1750	1800	5	50
10	0	.7	0	40	1700	1800	10	50
15	0	.8	0	45	1650	1800	20	50
20	0	.9	0	50	1600	1800	25	50

Time (sec.)	oz.in	A1	Win1	RPM	Wout	None
2.026	0.830	0.314	31.029	1790.000	1.099	
4.066	4.995	0.323	34.185	1773.000	6.549	
6.112	10.000	0.343	38.437	1751.000	12.948	
8.147	14.990	0.371	43.019	1728.000	19.155	

Figure A–12 Failed Test Example

A.5 COAST TEST

The coast test is used to measure the number of revolutions after power is removed from the motor. This test requires the use of the optional I/O Board on the DSP7000. For best results, a high speed solid state relay should be used to control power to the motor. Once the motor is free running, M-TEST 7 will send a signal to de-energize the solid state relay. At the same time it will reset the internal counter in the DSP7000. The DSP7000 will count the number of pulses from the speed encoder in the dynamometer until there are no further pulses being seen. Based upon the PPR of the encoder, the software converts the number of pulses into degrees of revolution.

The schematic in *Figure A-13 DC Motor Circuit* shows a typical circuit for a DC motor using a solid state relay. This particular relay has 60 Volt, 60 Amp capacities.

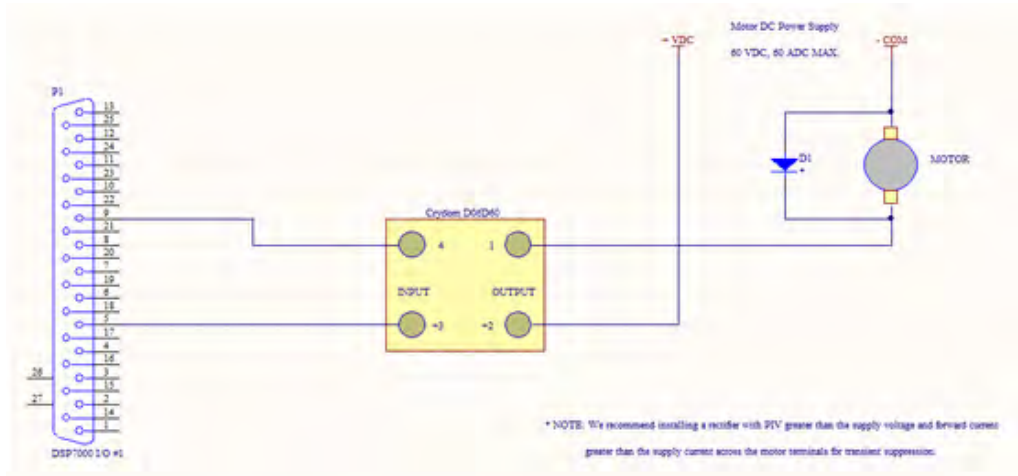


Figure A-13 DC Motor Circuit

Configure the hardware and display as desired.

On the Configure Test tab, set the controls as shown in *Figure A-14 Coast Test Example Settings*. The Speed Range should be set to the freerun speed of the motor being tested. The DIO Card Number and DO Line Number should correspond to the card and line you have connected to the solid state relay. Please see the DSP7000 manual for I/O card specifications.



Figure A-14 Coast Test Example Settings

Click on the TEST tab and select the parameter to plot during the test, whether you want to hide the graph, clear the graph or set auto-scaling of the X- and Y- axes.

Press the Start Test button. While the test is being performed, the screen shown in *Figure A-15 Coast Test Screen* will be seen.

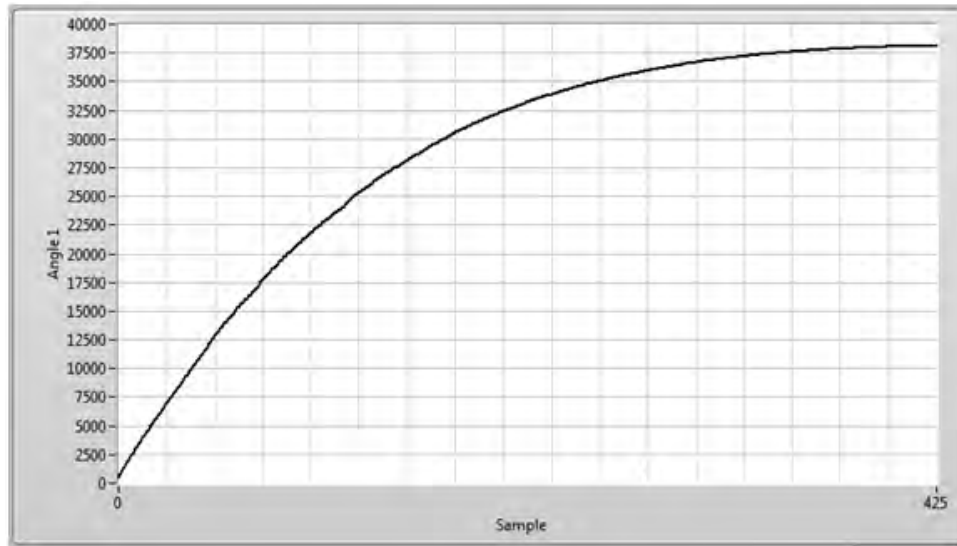


Figure A-15 Coast Test Screen

A.6 OVERLOAD TO TRIP TEST

This test is used to determine the temperature at which the thermal cutout in a motor opens. A thermocouple (or multiple thermocouples) is attached to the motor and monitored during the test. The motor is started and placed under load. When the motor temperature stabilizes, as defined in the test configuration, the load is increased. This process keeps repeating until the point where the thermal cutout opens. Temperature is recorded an additional 30 seconds to make sure there were no false trips. When multiple thermocouples are used, the hottest thermocouple will be used for the stabilization measurement and also for the temperature limit.

For this example we will be loading the test motor to a specific current level (0.98 amps). When the temperature stabilizes to within $\pm 2^{\circ}\text{C}$ for 15 minutes the load will increase to raise the motor current by 0.02 amps. This will repeat until the thermal cutout opens or the maximum test time of 180 minutes is reached.

On the Configure Test tab, set the controls as shown in *Figure A-16 Overload to Trip Test Example Settings*.

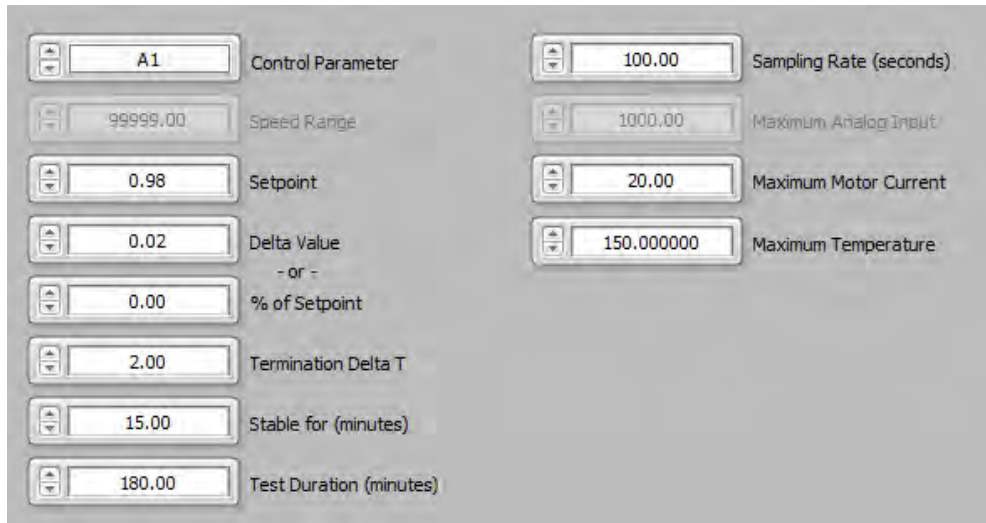


Figure A–16 Overload to Trip Test Example Settings

Press the Start Test button. While the test is being performed, the screen shown in Figure A–17 Overload to Trip Test Screen will be seen.

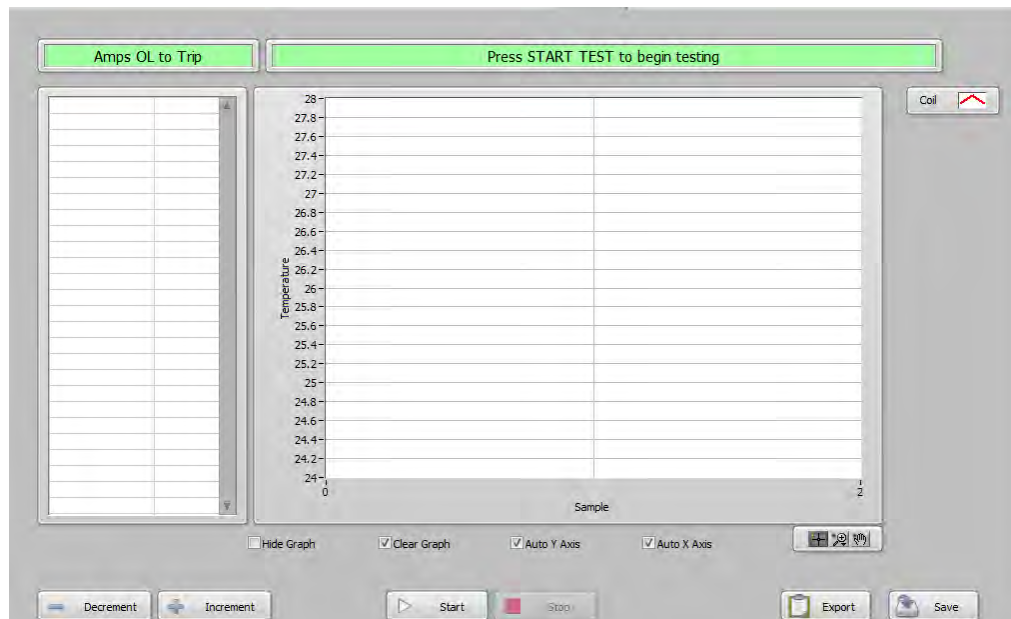


Figure A–17 Overload to Trip Test Screen

The table on the left is indicating real-time values while the graph is updating with a single reading every 15 seconds, which is the sample rate we have chosen. If the motor temperature is not increasing quickly enough, or if it is increasing too quickly, you may adjust the amount of load by using the Decrement or Increment buttons. A press of either button will immediately change the load by 0.02 amps, the Delta Value we set during configuration.

Figure A-18 Overload to Trip Test Example Result shows the completed test that had the thermal cutout trip at about 1 hour 34 minutes. The temperature had stabilized to our specifications and the load increased to 1.000 amps. The motor ran at this level of load for 28 minutes before the thermal cutout opened.

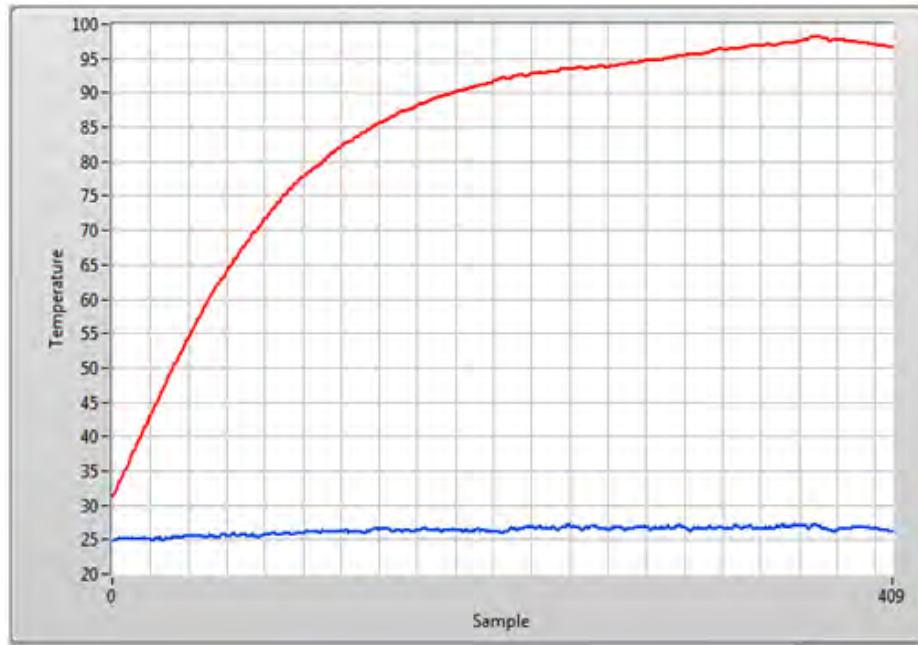


Figure A-18 Overload to Trip Test Example Result

Figure A-19 Overload to Trip Test Graph at Room Temperature clearly shows the graph of room temperature, coil temperature and motor current. You can see the increase in load (current) at approximately 4000 seconds and the thermal trip between 5600 and 5700 seconds.

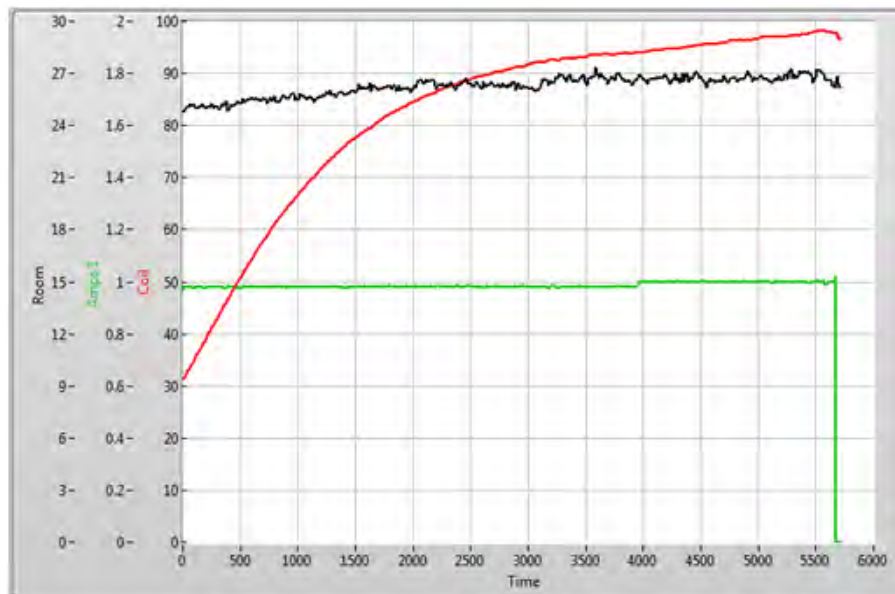


Figure A-19 Overload to Trip Test Graph at Room Temperature



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