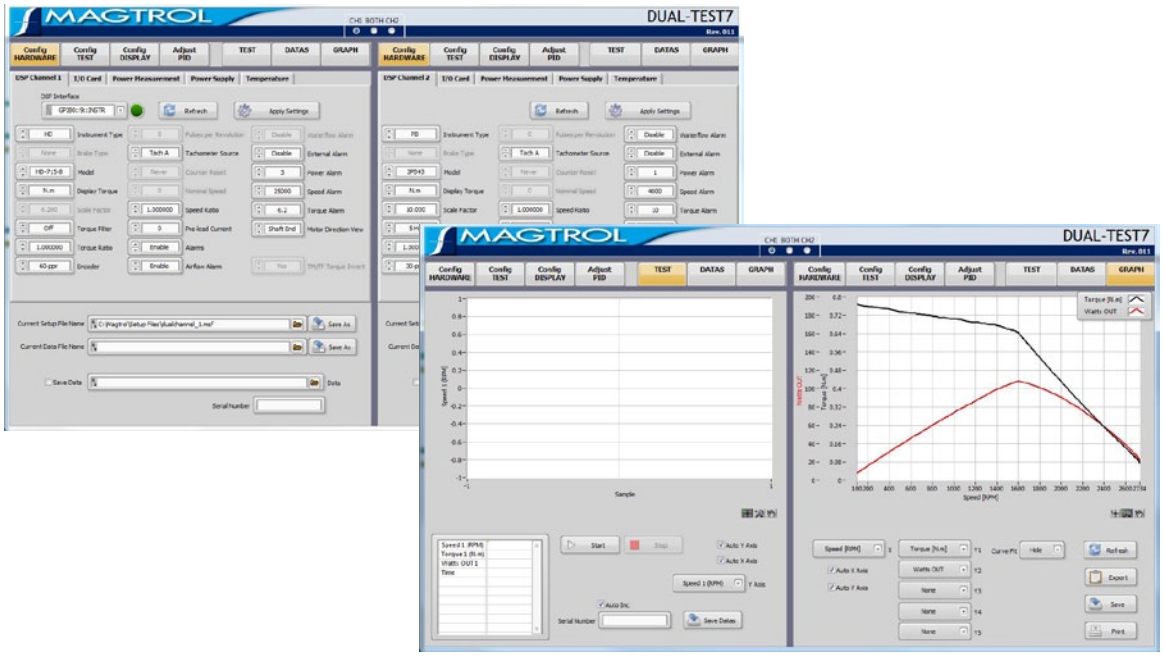
MAGTROL

DUAL-TEST7

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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1st. Edition – February 2014

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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 site at www.magtrol.com/support/manuals.htm.

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 - February 2014

Date	Edition	Change	Section(s)
02/12/14	1st Edition		

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Preface

PURPOSE OF THIS MANUAL

This manual contains information required for installation and general use of Magtrol's DUAL-TEST7 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)
- In-Line Torque Transducer (TM, TF, TMB or TMHS)
- Power Analyzer (Model 5100, 5300, 5310, 5330, 6510, 6510*e*, 6530 or 6550)
- Dynamometer Controller Model DSP7002

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 DUAL-TEST7 and highlights the new features of the software.

Chapter 2: INSTALLATION – Provides general installation instructions for DUAL-TEST7 software.

Chapter 3: NAVIGATION – Provides instruction for DUAL-TEST7 startup and navigation.

Chapter 4: START – User interface for logging in/out, selecting language and loading/saving DUAL-TEST7 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 TEST – User interface for configuring different test parameters.

Chapter 7: CONFIGURE DISPLAY – User interface for selecting motor parameters to be acquired.

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: CREATING TASKS – Provides step-by-step instructions for setting up temperatur input tasks.

Chapeter 13: TUNING SYSTEM RESPONSE (PID) – Provides instructions for adjusting PID parameters.

Appendix A: EXAMPLE TESTS – Contains example test setups.

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.

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1. Introduction

1.1 ABOUT DUAL-TEST7

Magtrol's DUAL-TEST7 is dual channel motor testing program designed for use with Windows® XP sp3/7/8 operating systems for PC-based data acquisition. Used in conjunction with Magtrol's Motor Testing Equipment, DUAL-TEST7 is equipped with curve testing capabilities to help determine the performance characteristics of a motor under test. The data generated can be stored, displayed and printed in tabular or graphic formats, and is easily imported into a spreadsheet. DUAL-TEST7 is ideal for simulating loads, cycling the unit under test on two channels of the DSP7002 controller unit. Magtrol can also make custom modifications to the software to meet your specific motor testing needs.

DUAL-TEST7 is equipped to work in conjunction with any of the following Magtrol motor testing instruments:

- Dynamometer Controller DSP7002
- Hysteresis, Eddy-Current or Powder Dynamometer (HD, HD5, WB, PB)
- In-Line Torque Transducer (TM, TF)
- Power Analyzer (6530, 6510*e*, 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™, DUAL-TEST7 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 +41264073000.

1.2 DATA SHEET

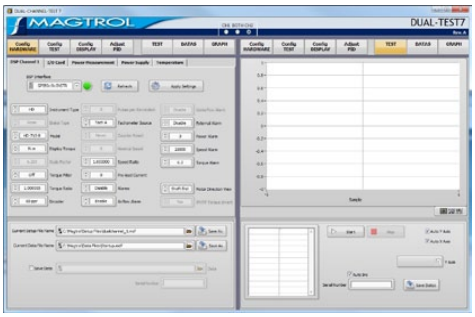
MAGTROL

DUAL-TEST7
Data Sheet

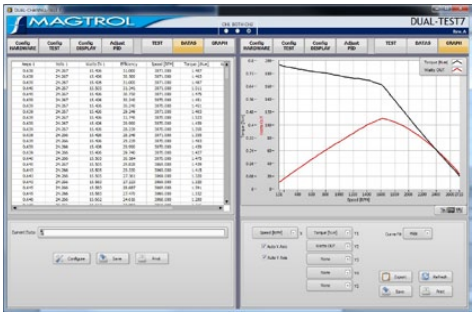
DUAL-TEST7
Motor Testing Software

SPECIFIC FEATURES

- DSP7002 Programmable Controller Support
- Full independent dual channels control software
- Supports the optional Analog and Digital I/O Modules on the DSP7002 Programmable Controller.
- Expanded power analyzer and power supply selections.
- Programmable analog and digital outputs per step
- 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.
- Displays 63 Tested and Calculated Parameters: Torque, speed and auxiliary input are displayed from the DSP7002 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.
- USB Interface : Computer interface USB2.0 available with DSP7002. Optional IEEE-488 or RS-232 can be added.
- 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.
- Save/Load Setup Function: Test procedure configurations may be stored and recalled using standard Windows® file structure.



DUAL-TEST7 Hardware Configuration



DUAL-TEST7 Graphical Data Output

DESCRIPTION

Magtrol's DUAL-TEST7 is a state-of-the-art motor testing software for PC (Windows® XP sp3/7/8) based data acquisition. Used with a Magtrol Programmable Dynamometer Controller DSP7002, DUAL-TEST7 works on two channels independently with any Magtrol Dynamometer or In-Line Torque Transducer to help determine the performance characteristics of a motors under test. Up to 63 parameters are calculated and displayed utilizing DUAL-TEST7's feature-rich testing and graphing capabilities.

An integral component of any Magtrol Motor Test System, DUAL-TEST7 performs curve tests in a manner best suited to the overall efficiency of the test rig. Written in LabVIEW™, DUAL-TEST7 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.

DUAL-TEST7

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. DUAL-TEST7, with its complete dynamometer control, even allows for analog measurement while performing load simulation for duty cycle and life testing.

APPLICATIONS

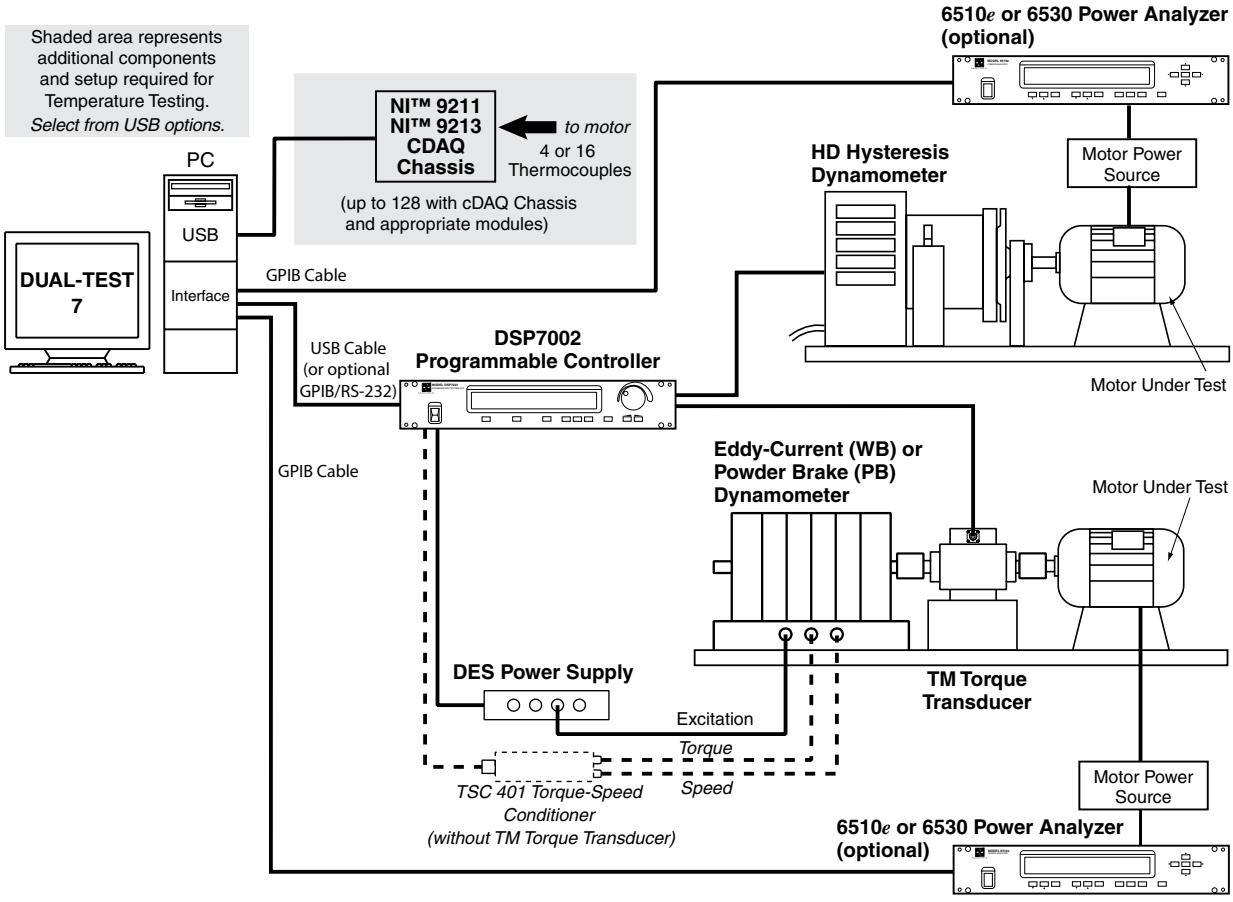
DUAL-TEST7—besides being well-suited for simulating loads, cycling the unit under test and motor ramping—is also ideal for production line, due to the full dual channels tests functions. Another time-saving feature, that engineering labs will benefit from, is the ability to duplicate tests and run them automatically. This versatile program is extremely valuable to anyone involved in motor testing..

SYSTEM CONFIGURATION

A Magtrol Dynamometer provides motor loading with a Magtrol Programmable Dynamometer Controller acting as the interface between the PC running DUAL-TEST7 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 USB, the National Instruments™ GPIB card or RS-232 serial interface. Only the DSP7002 can work in dual channel, other additional option as like as Power Analyzer, power supply should be dubbed.

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

- Dynamometer Controller DSP7002
- 2x Hysteresis, Eddy-Current or Powder Dynamometer (HD, HD5, WB, PB)
- 2x In-Line Torque Transducer (TM, TF, TMB, TMHS)
- 2x Power Analyzer (6530, 6510e, 6510, 6550, 5100, 5300, 5310, 5330)



Ordering Information DUAL-TEST7

SYSTEM REQUIREMENTS

- Personal computer with Intel® Pentium® Core™2 Duo processor (or equivalent)
- Microsoft® Windows® XP sp3/7/8
- 2 GB of RAM
- 2 GB HDD of available hard drive space
- VGA color monitor with minimum screen resolution of 1280 × 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 DSP7002 Controllers. In addition, a USB Interface can be used with the DSP7002 Controller.

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	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	6510*e*
	High Speed Three-Phase Power Analyzer	6530
POWER SUPPLIES	Power Supply for WB & PB Dynamometers series 2.7 and 43	DES 410
	Power Supply for WB & PB Dynamometer series 65, 115 and 15	DES 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/software.html*

Due to the continual development of our products, we reserve the right to modify specifications without forewarning.

2. Installation

2.1 INSTALLATION PROCEDURE

Insert the DUAL-TEST7 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 DUAL-TEST7 and the required drivers appear in the next window (*Figure 2–2 DUAL-TEST7 Destination Directory Window*). You may change these if necessary but do not install DUAL-TEST7 in the Windows 7 Program Files (x86) folder.

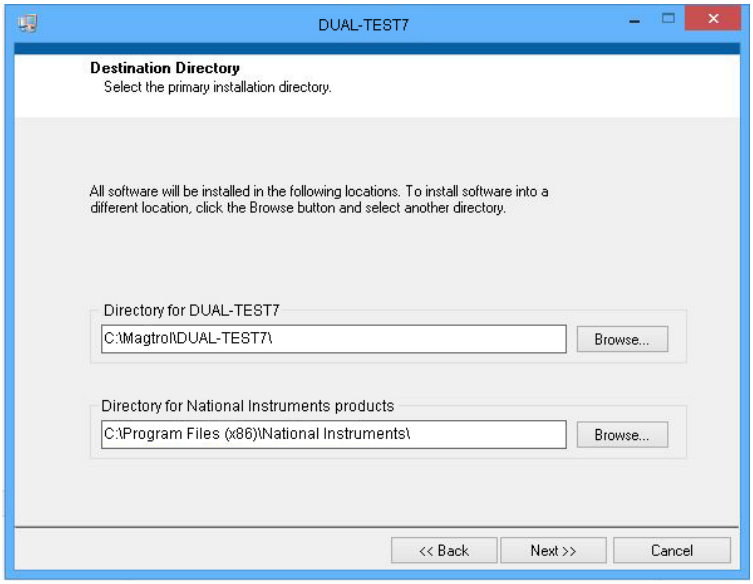


Figure 2–2 DUAL-TEST7 Destination Directory Window

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.

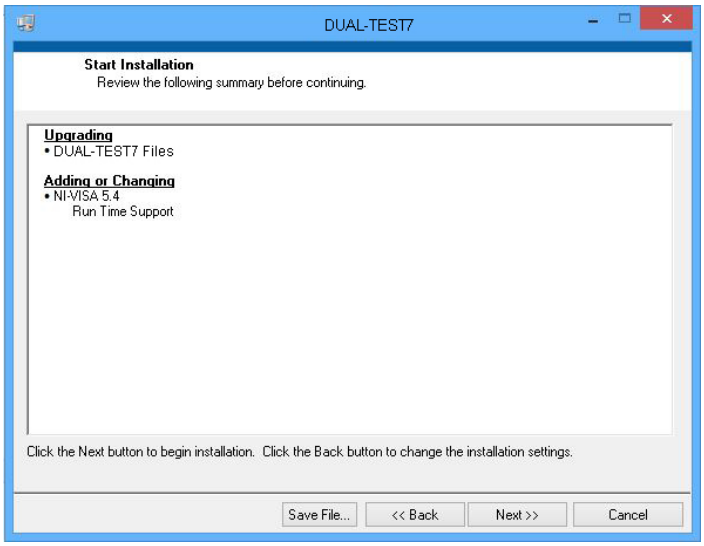


Figure 2–3 Start Installation Screen

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.

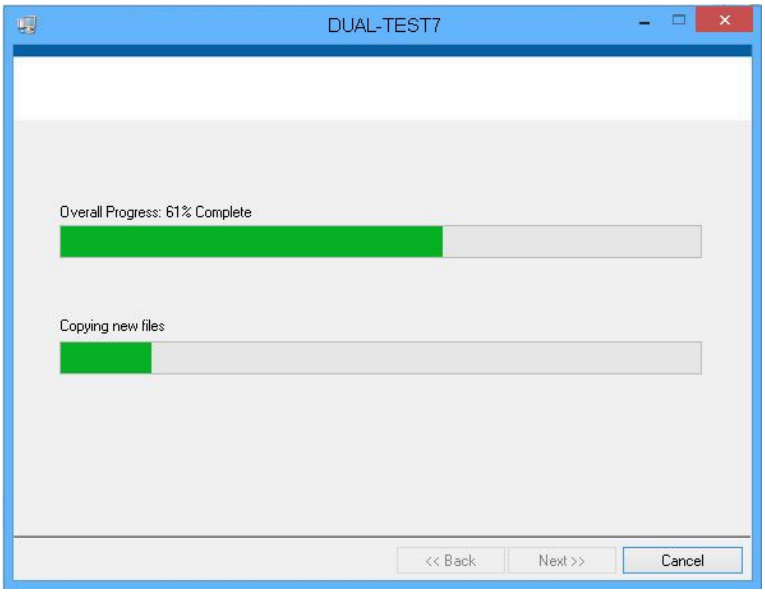


Figure 2–4 Installation Progress Window

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

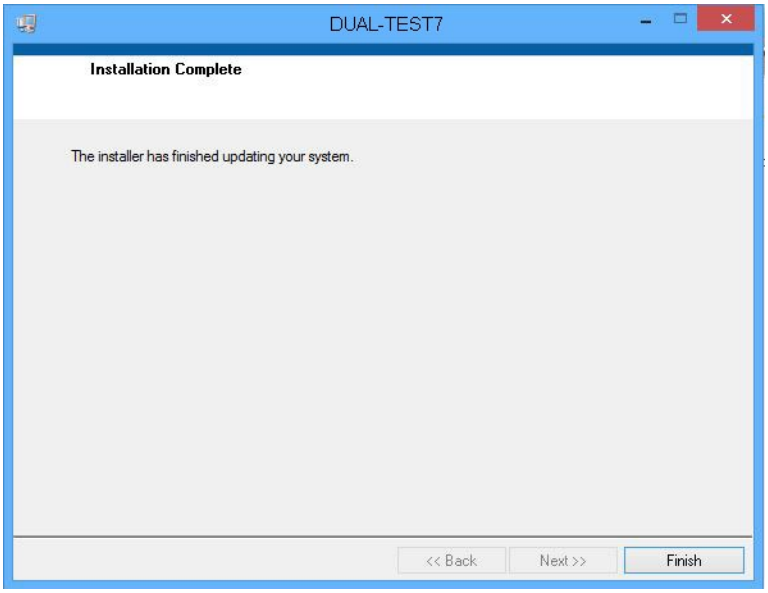


Figure 2–5 Installation Complete Window

3. Navigation

3.1 NAVIGATING THE DUAL-TEST7 INTERFACE

DUAL-TEST7 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.

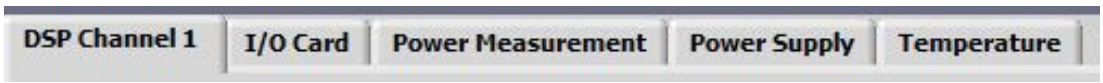


Figure 3–1 DUAL-TEST7 Tabs

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.

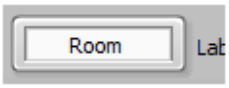


Figure 3–2 String Controls

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.

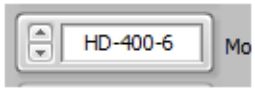


Figure 3–4 Enumerated Controls

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.

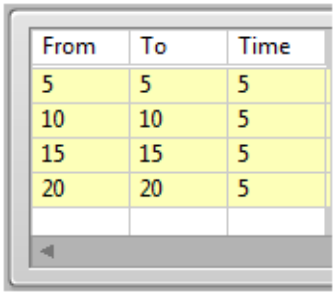


Figure 3–5 Table Controls

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*).

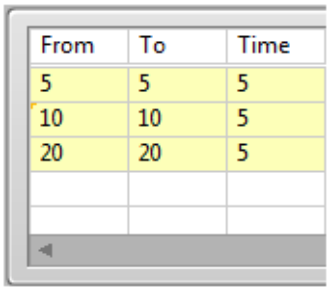


Figure 3–6 Show Selection

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*).

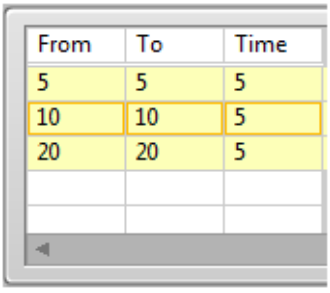


Figure 3–7 Table with cells selected

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.

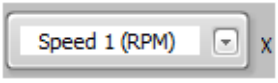


Figure 3–9 Menu Rings

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.

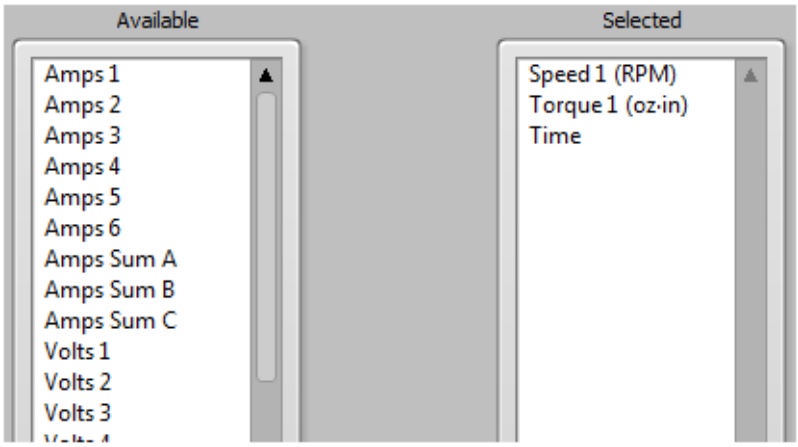


Figure 3–10 List boxes

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.

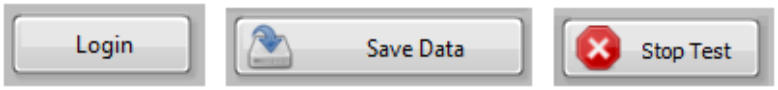


Figure 3–11 Buttons

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.

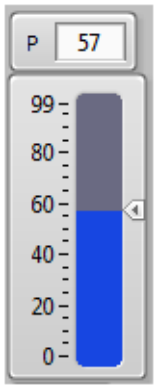


Figure 3–12 Sliders

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.

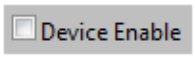


Figure 3–13 Check boxes

3.1.11 CLUSTERS

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

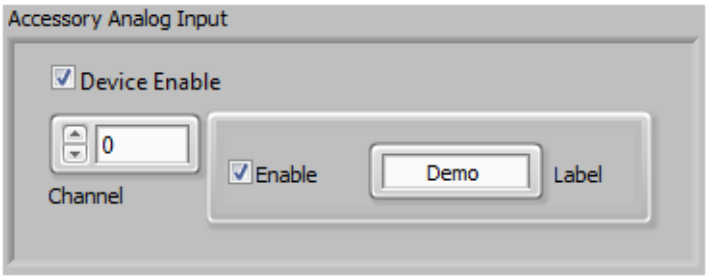


Figure 3–14 Clusters

4. Start

4.1 START WINDOWS

This is the default display when starting the DUAL-TEST7 program. From here you may select all function and display, import previously configured test setups, recall saved data

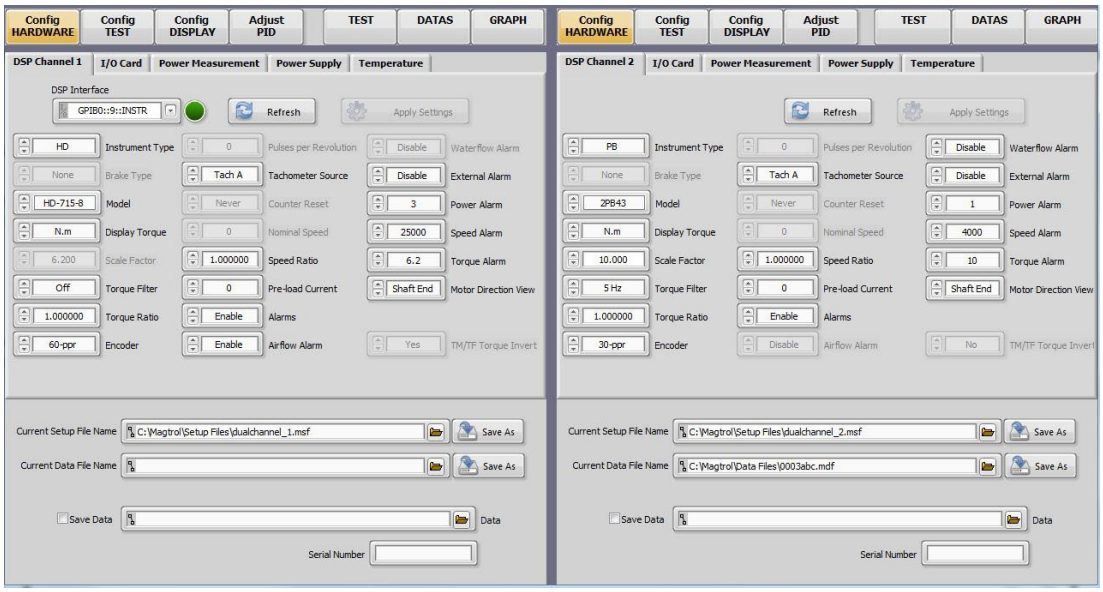


Figure 4–1 Start Tab

The display is separate in two distinct columns. Left column for Channel 1 control, right column for Channel 2 control.

4.1.1 SETUP/DATA MANAGEMENT CONTROL

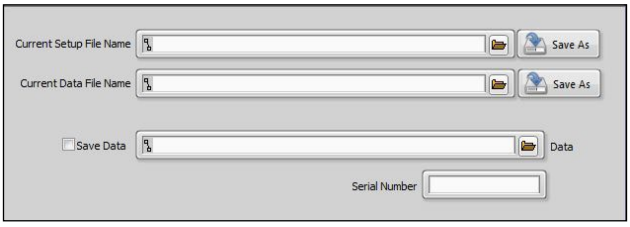


Figure 4–2 Data Management Control

Control	Function
Current Setup File Name	This indicates the path and filename of the test configuration currently loaded.
Save as (setup)	Press to specify the path and filename of the test configuration to save.

Control	Function
Load Setup …	Press to specify the path and filename of the desired test configuration to load
Current Data File Name	This indicates the path and filename of the test data currently loaded.
Save as (data)	Press to specify the path and filename of the test data to save.
Load Data …	This indicates the path and filename of the test data currently loaded.
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).
Data	When enable Save Data, select the folder path where the file will be created at the end of the test
Serial Number	The alpha-numeric serial number of the motor for filename generation.

This part is common at the Config hardware, Config Test and Config Display

5. Configure Hardware

5.1 CONFIGURE HARDWARE

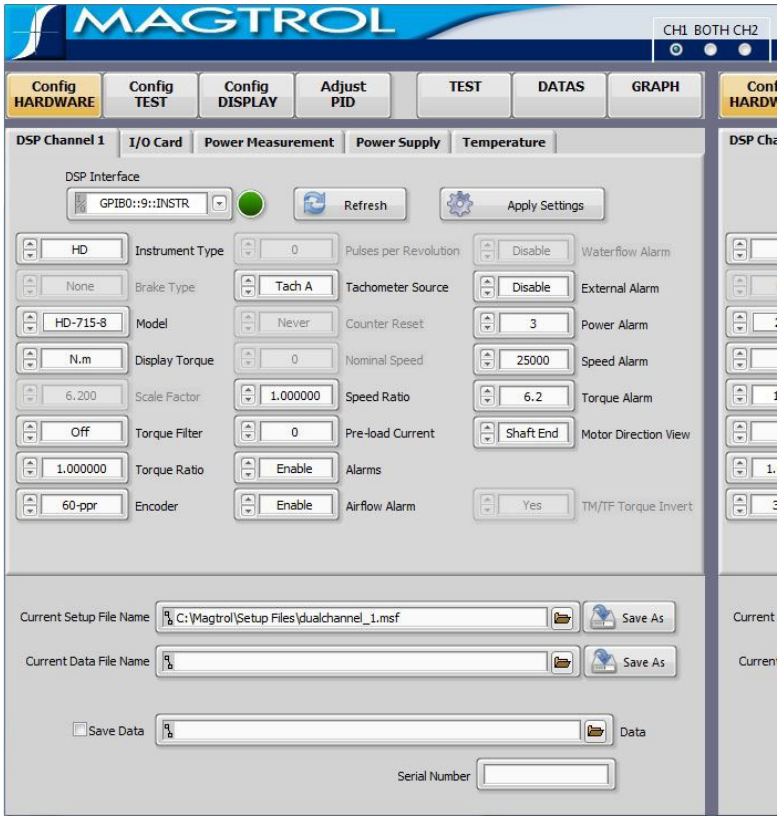


Figure 5–1 Configure Hardware

5.1.1 SELECT DISPLAY

This button switch the display channel on 1, 2 or both.

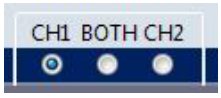


Figure 5–2 Select Display

5.2 DYNAMOMETER CONTROLLER

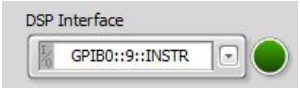


Figure 5–3 Dynamometer Controller

5.2.1 DYNAMOMETER CONTROLLER CONTROLS

Control	Function
DSP Interface	Selects the GPIB, RS-232 or USB port that is used to communicate with the dynamometer controller.
Green light	This indicator inform if the communication is established or not.

5.3 DSP CHANNEL 1 TAB

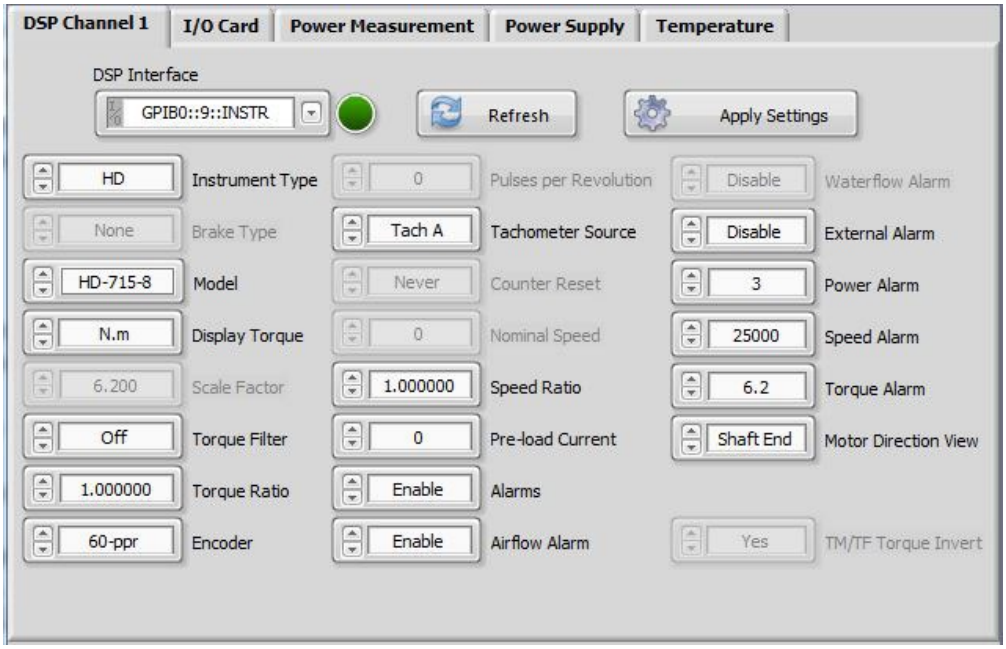


Figure 5–4 DSP Channel 1 Tab

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.

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, DUAL-TEST7 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)	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. Torque ratio = gearbox output torque / motor torque
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)	The measurement angle for quadrature encoders. **NOTE:** The minimum pulse count when using quadrature encoders is 1000-ppr.
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)	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. Speed ratio = motor speed / gearbox output speed

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.
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. 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.
Motor Direction View (Shaft End/Lead End)	Selects the view for determining motor direction.
Refresh	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.
Apply Sattings	Press to immediately send configuration commannds 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.

5.4 I/O CARD TAB

Figure 5–5 I/O Card Tab

5.4.1 ANALOG INPUT 1

DSP7002 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

5.4.1.1 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.

5.4.2 ANALOG OUTPUT 1

DSP7002 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

5.4.2.1 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 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 test Control Data table for programming output voltages in each step.

5.4.3 DIGITAL INPUT 1

DSP7002 only with optional I/O card. Three digital inputs are available on this card. Please refer to the DSP7000 manual for further details.

5.4.3.1 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.

5.4.4 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.

5.4.4.1 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.

Control	Function
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.
Relay 2 as Power ?	Enables use of relay 2 as a Motor Power control relay.

5.5 POWER MEASUREMENT TAB

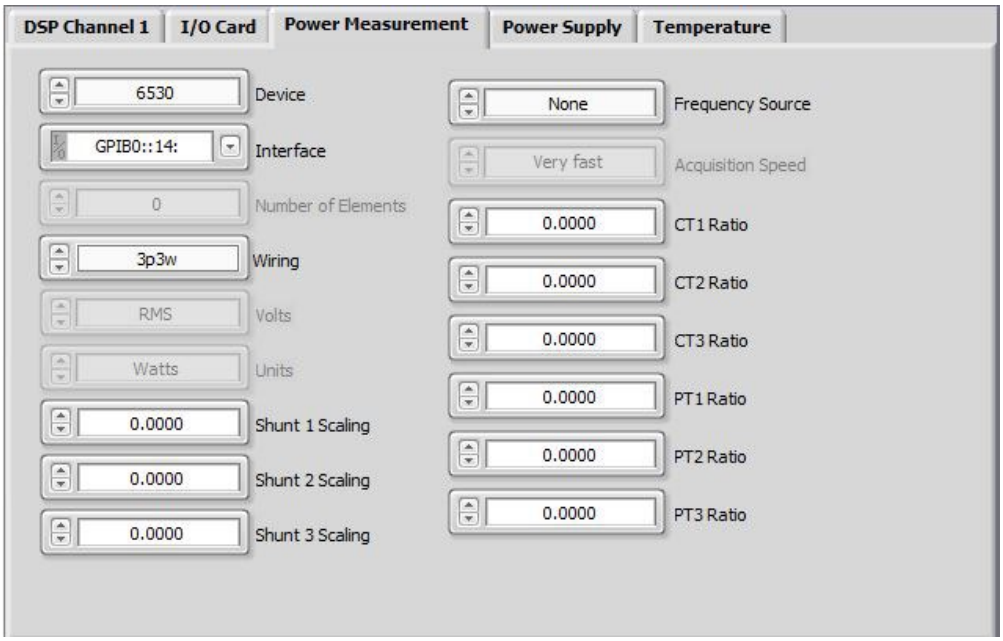


Figure 5–6 Power Measurement Tab

5.5.1 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, LMG310, N4L PPA15xx, N4L PPA25xx, N4L PPA55xx, WT210, WT230, WT500, WT1030, WT1600, WT1800, WT2010, WT3000, PZ4000)	Selects the electrical power measurement device in use (if any).
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.

Control	Function
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.
PT1 Ratio (0.01-10000)	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. A value of 0.0000 disables the function.

Control	Function
PT2 Ratio (0.01-10000)	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. A value of 0.0000 disables the function.
PT3 Ratio (0.01-10000)	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. A value of 0.0000 disables the function.
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.

5.6 POWER SOURCE TAB

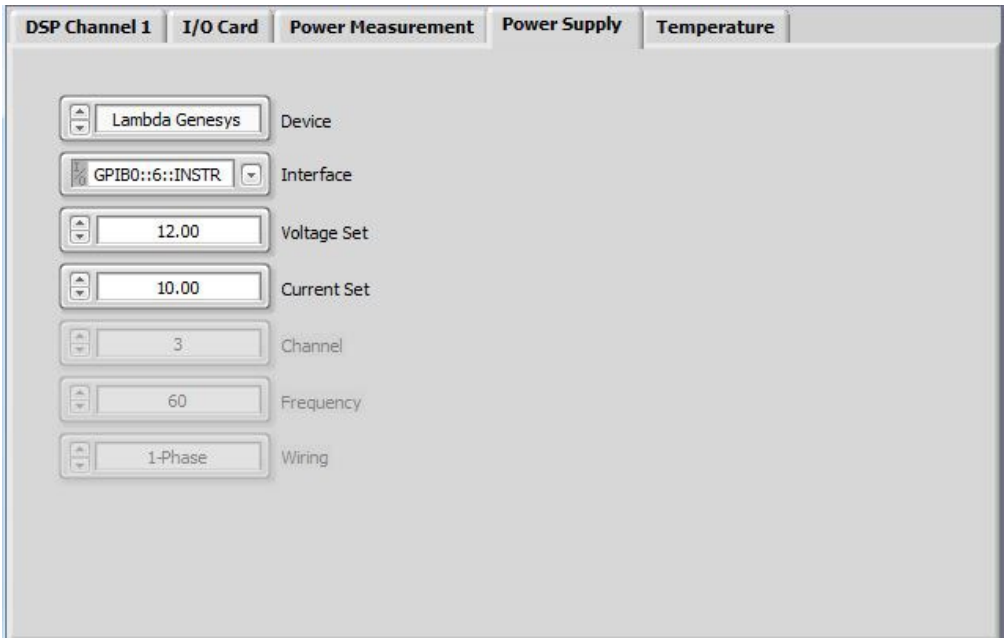


Figure 5–7 Power Source Tab

5.6.1 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 DUAL-TEST7, 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.
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.

5.7 TEMPERATURE INPUT TAB

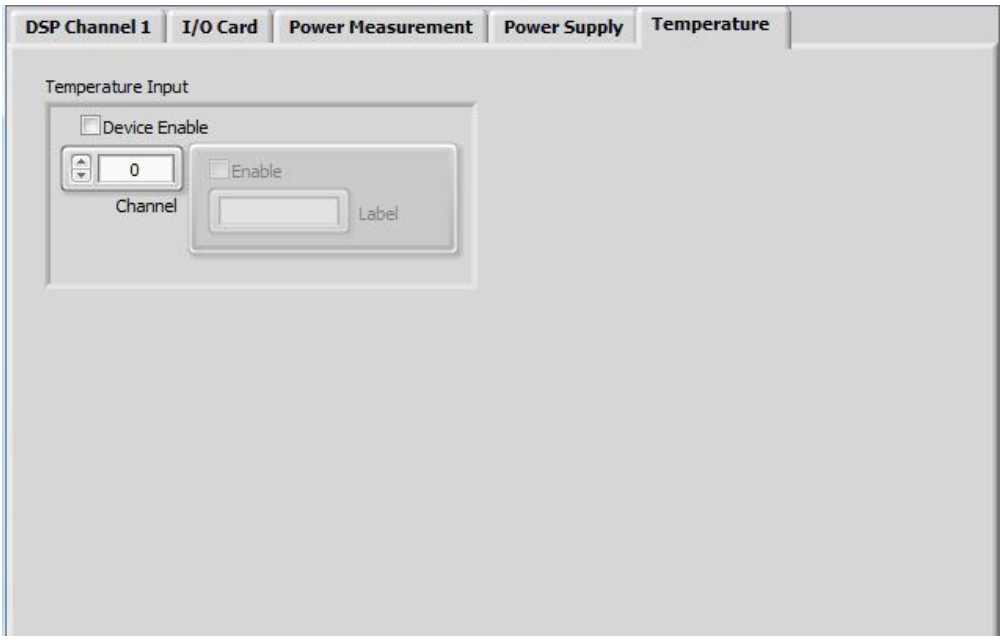


Figure 5–8 Temperature Input Tab

5.7.1 TEMPERATURE INPUT TAB CONTROLS

Control	Function
Device Enable	Check this box to enable the accesory 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 selecttions in the Configure Display list boxes.

6. Configure Test

6.1 CONFIGURE TEST TAB

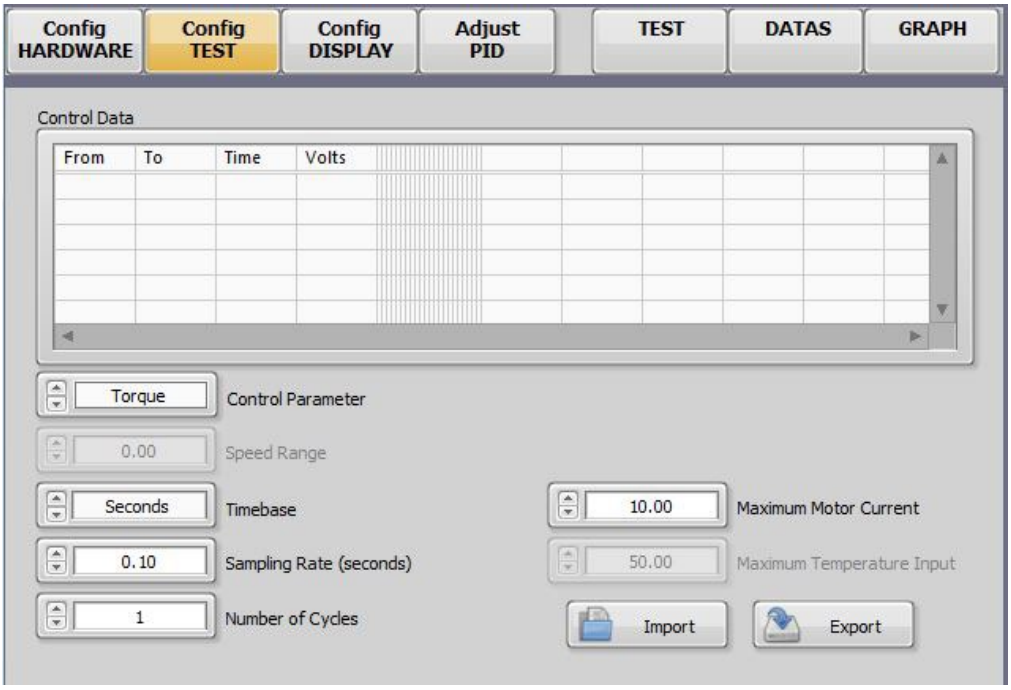


Figure 6–1 Configure Test Tab

6.2 CONFIGURE TEST TAB CONTROLS

Control	Function
Control Data	The sequence of load points to be run during the test. 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. 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. Any number load points may be entered in order to create a load profile for this test. 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. If optional analog and digital outputs, or accessory relays are being used, their value or state may also be entered in the appropriate column. Units (From, To) = control parameter units Units (Analog Output) = volts Units (Digital Output, Relay) = 0 for False, 1 for True
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)	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. When controlling by other parameters, DUAL-TEST7 uses a proportional control loop in conjunction with the open loop mode of the controller.
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)	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.
Number of Cycles (1 - n)	The number of times to repeat the test sequence created in the Control Data table.
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.

Control	Function
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. Configure Display

7.1 CONFIGURE DISPLAY TAB

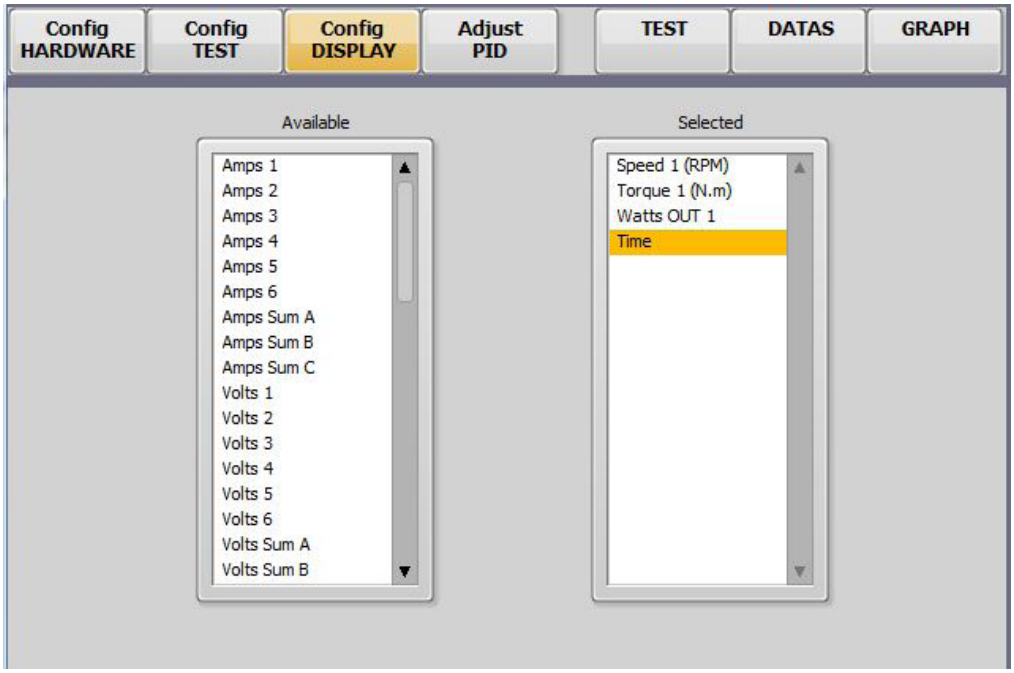


Figure 7–1 Configure Display Tab

7.1.1 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.

7.1.2 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.

8. Adjust PID

8.1 ADJUST PID TAB

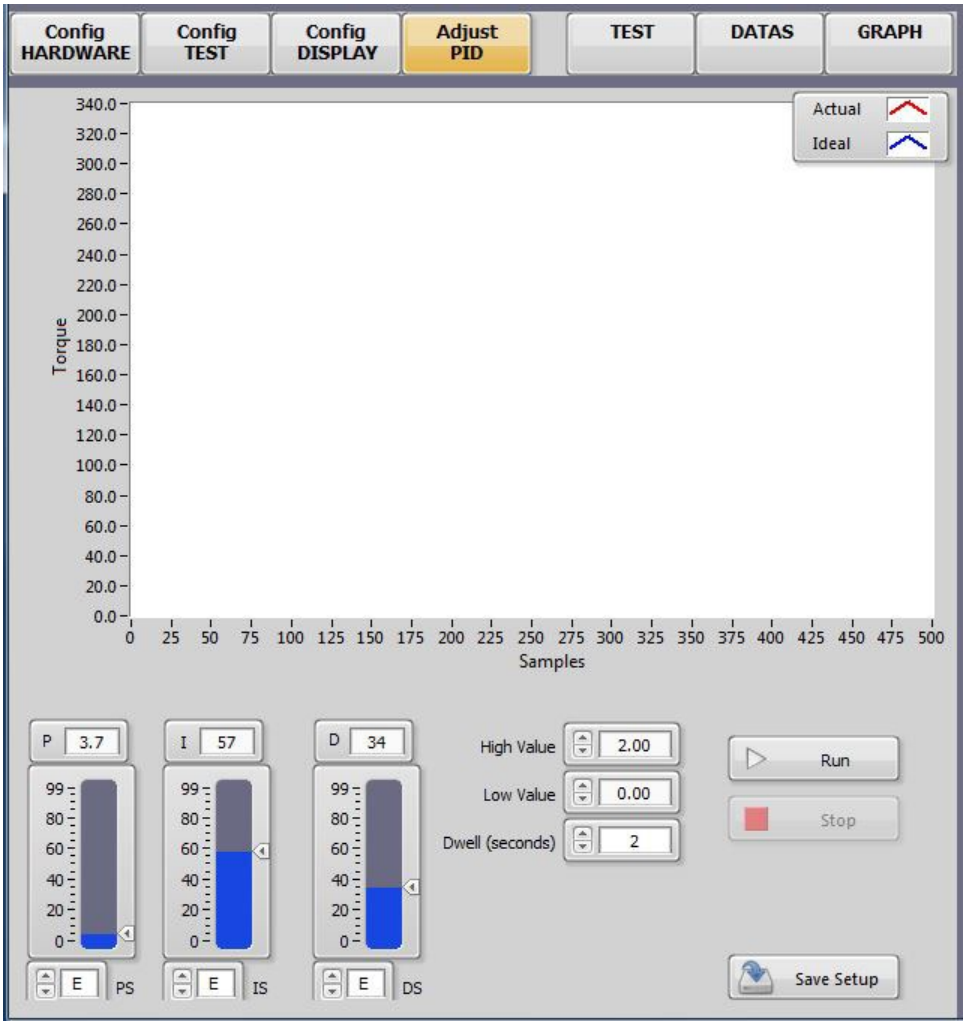


Figure 8–1 Adjust PID Tab

8.1.1 ADJUST PID TAB CONTROLS

Control	Function
Waveform Chart	This chart shows the actual system response compared to the ideal response. 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.

Control	Function
Legend	The red plot indicates the actual system response to the control command. This plot will change as you make adjustments to the PID values. The blue plot indicates the control command being sent to the dynamometer. The dotted green plot indicates the initial setting level for the P parameter, which is equal to 25% of the target value.
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.
Stop	Stop the PID adjustment procedure

9. Test

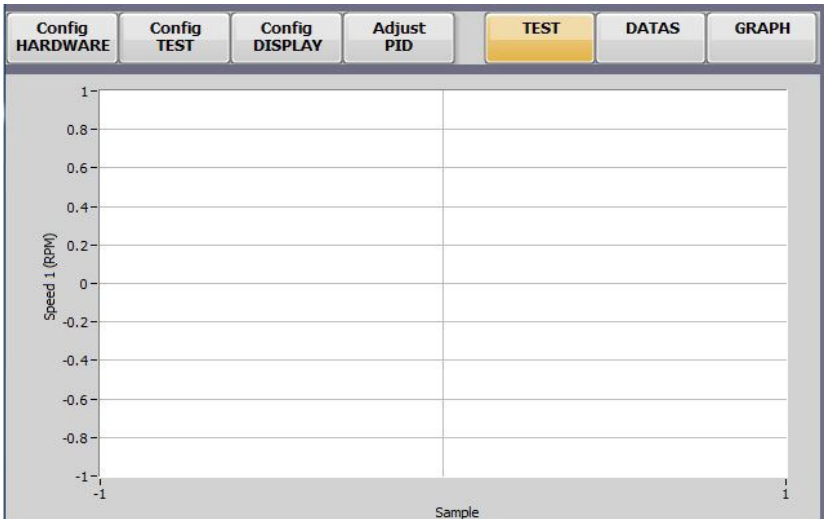


Figure 9–1 Test Screen

9.1 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.
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.
Y Axis	Selects the parameter to be plotted during the test.
Save Datas	Saves the data to the current data path.

10. Data

10.1 DATA

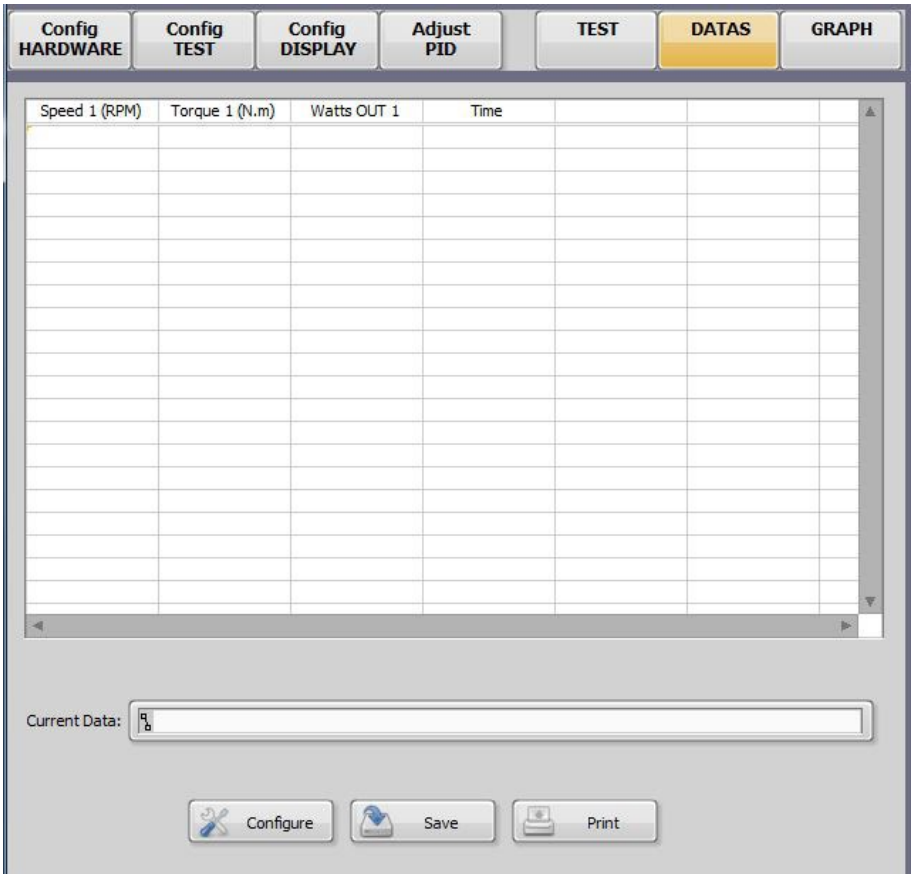


Figure 10–1 Data

10.1.1 DATA 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.

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:

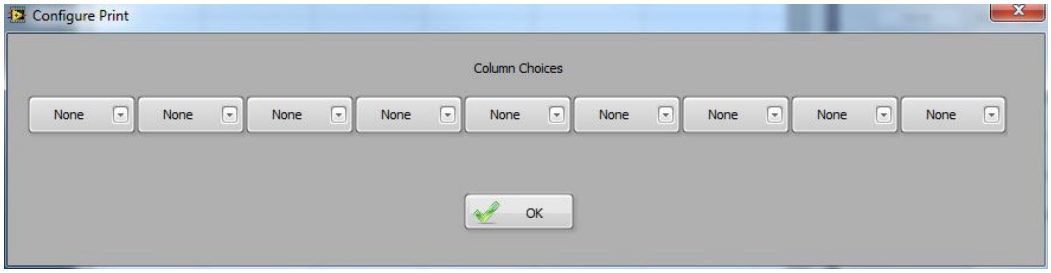


Figure 10–2 Configure Print Window

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

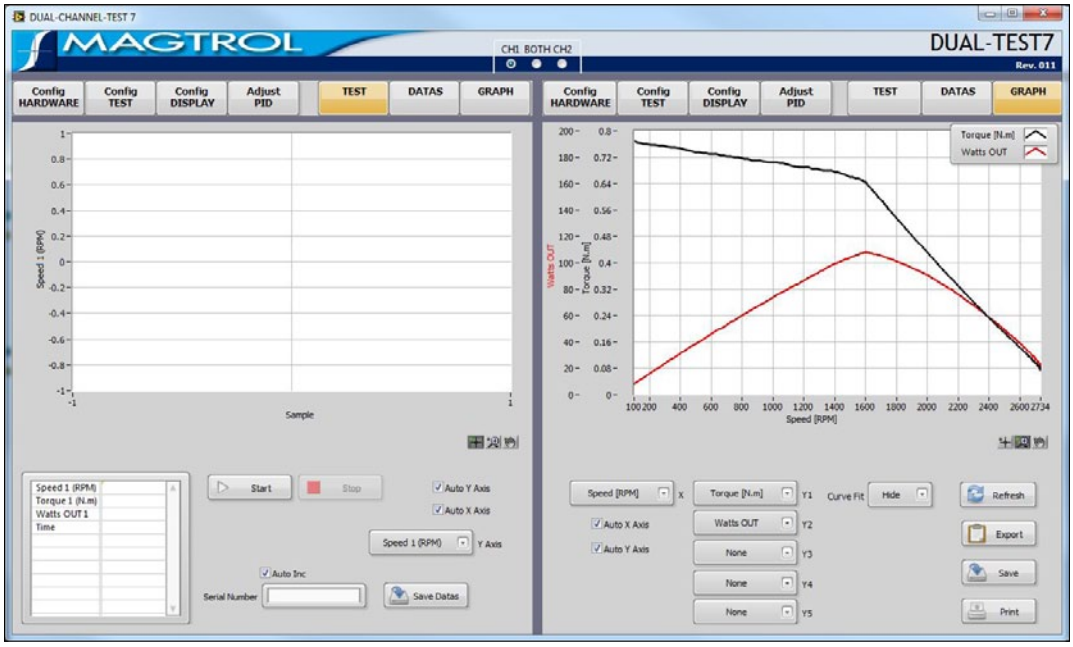


Figure 11-1 Graph

11.2 GRAPH 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.
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.
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.
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.

12. Creating Tasks

12.1 CREATING TEMPERATURE INPUT (TI) TASKS

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

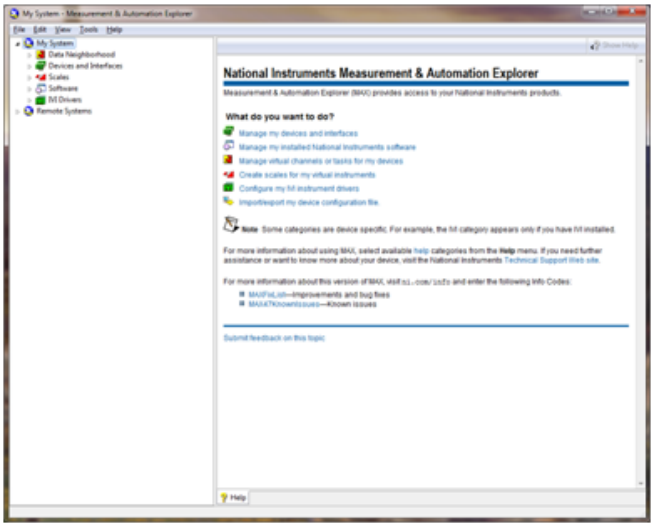


Figure 12–1 Measurement & Automation Explorer Screen

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.

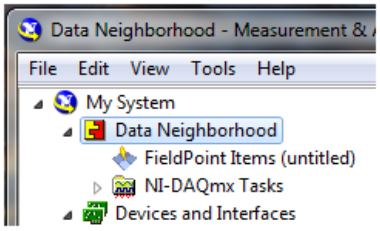


Figure 12–2 Measurement & Automation Explorer Screen with Data Neighborhood Expanded

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

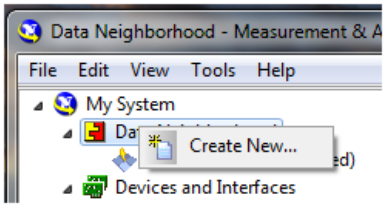


Figure 12–3 Create New Data Neighborhood

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4. Click NI-DAQmx Task and then Next.

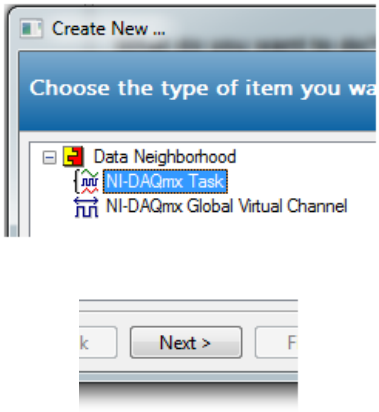

Figure 12–4 Select NI-DAQmx Task

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

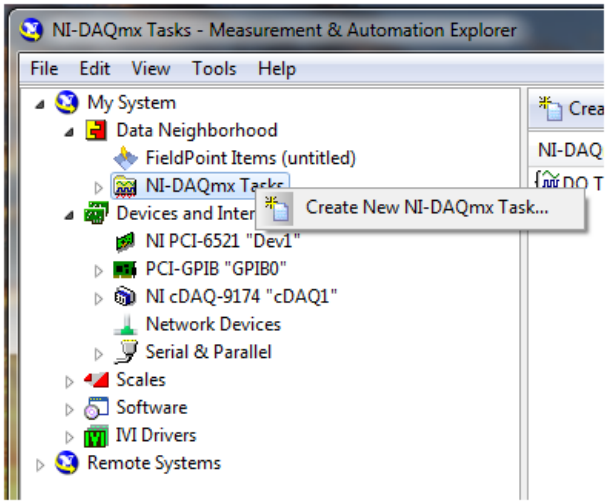

Figure 12–5 Create New NI-DAQmx Task

7. Expand Acquire Signals.

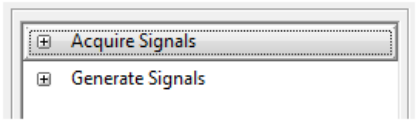

Figure 12–6 Acquire Signals Expanded

MAINTENANCE

8. Expand Analog Input.

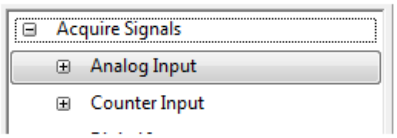

Figure 12–7 Analog Input Expanded

9. Expand Temperature.

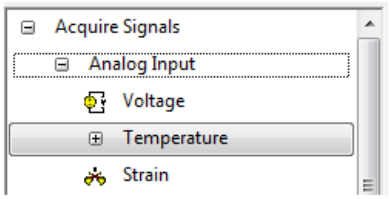

Figure 12–8 Temperature Expanded

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

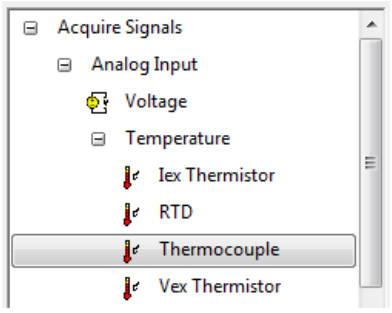

Figure 12–9 Select Temperature Device

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).

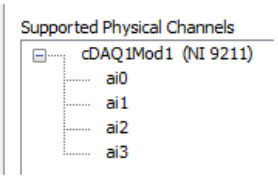

Figure 12–10 Temperature Input Supported Channels

MAINTENANCE

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

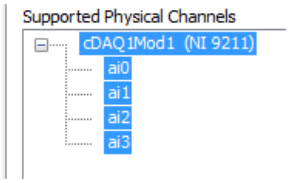

Figure 12–11 Temperature Input Channels Highlighted

13. Click Next.
14. Type TIx Task in the Enter Name: field. It is imperative that the name is entered exactly as shown.
    - x:1 for channel 1
    - x:2 for channel 2

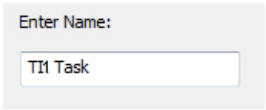

Figure 12–12 TIx Task in Enter Name Field

15. Click Finish.
16. TIx Task will now appear in the Data Neighborhood tree.

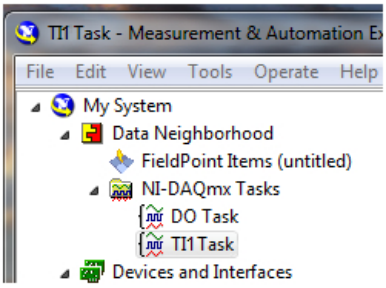

Figure 12–13 TIx Task in Data Neighborhood

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

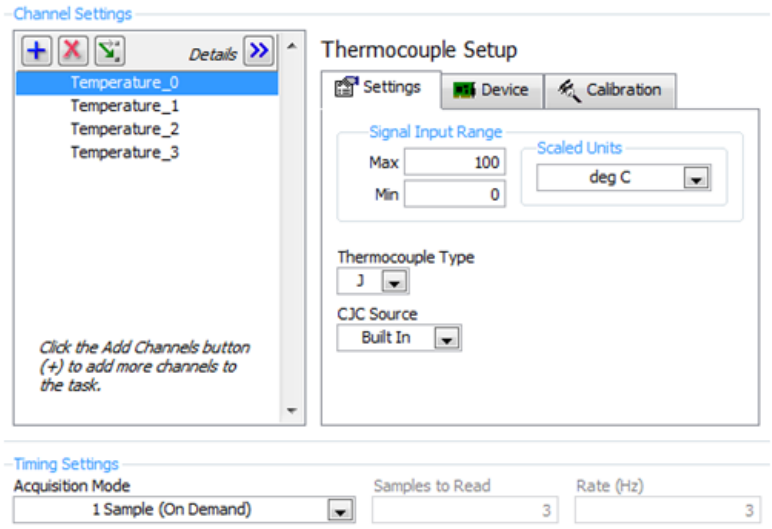

Figure 12–14 Configuration Settings

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]).

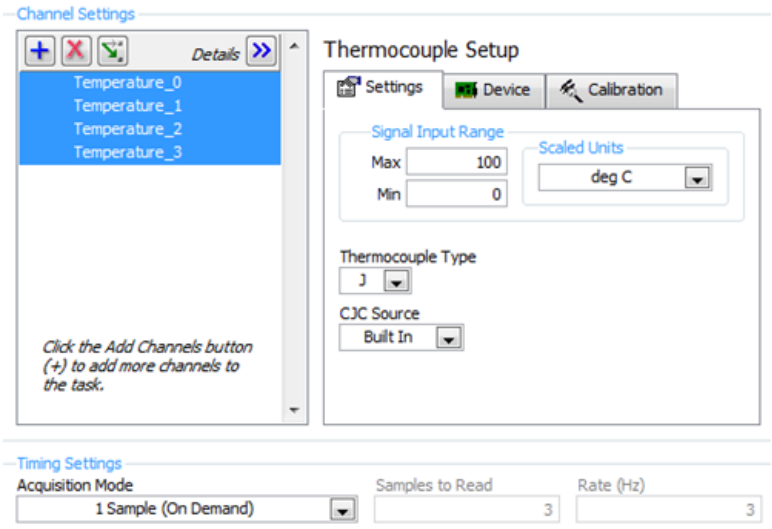

Figure 12–15 All Channels Configured the Same

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 DUAL-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.

MAINTENANCE

13. 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, DUAL-TEST 7 has included an Adjust PID procedure for step type tests. We will look at in detail. In these examples, we are using a 240VAC PSC (permanent split capacitor) motor.

13.1 PID ADJUSTMENT

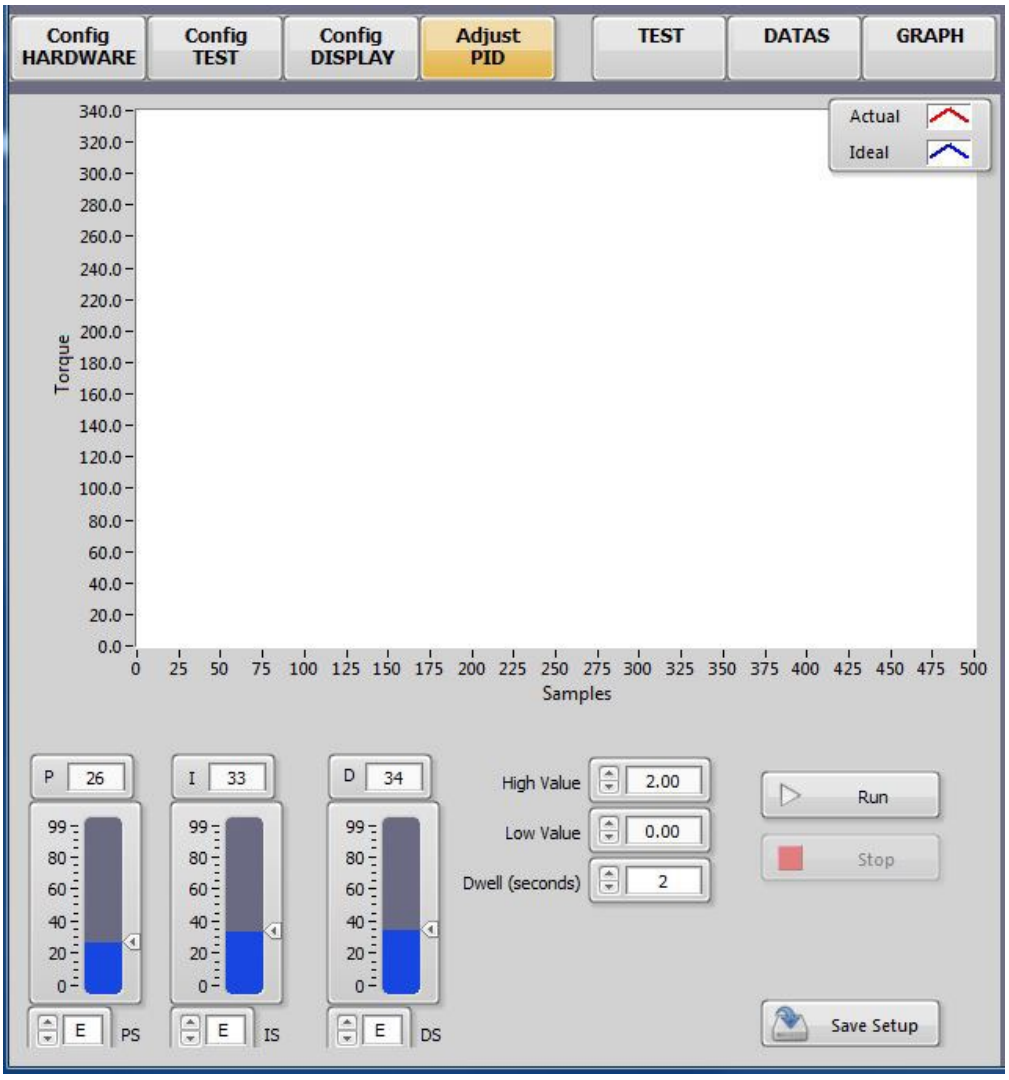

Figure 13–1 PID Adjustment Window

Configure your hardware and test the way you wish to run during the actual curve 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 13-2.

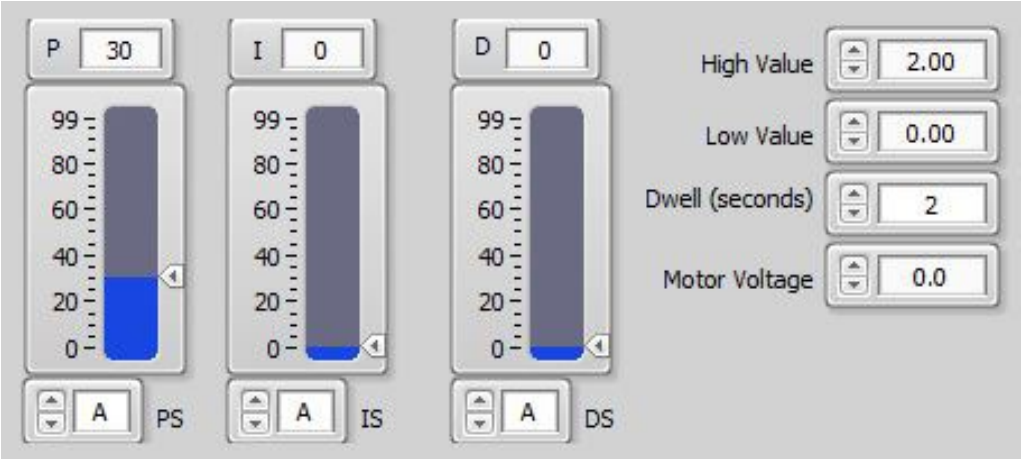

Figure 13–2 PID Settings

NOTE: If using a programmable power supply being controlled by DUAL-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.

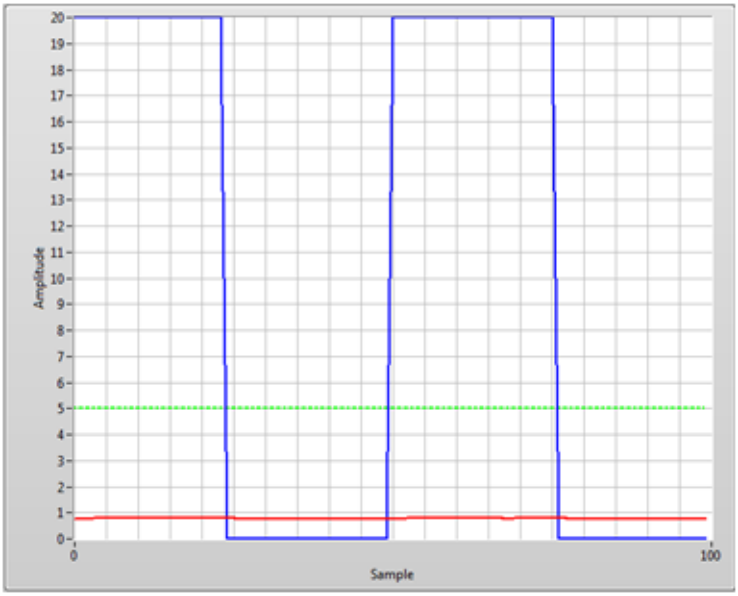

Figure 13-3 Test Screen

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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.

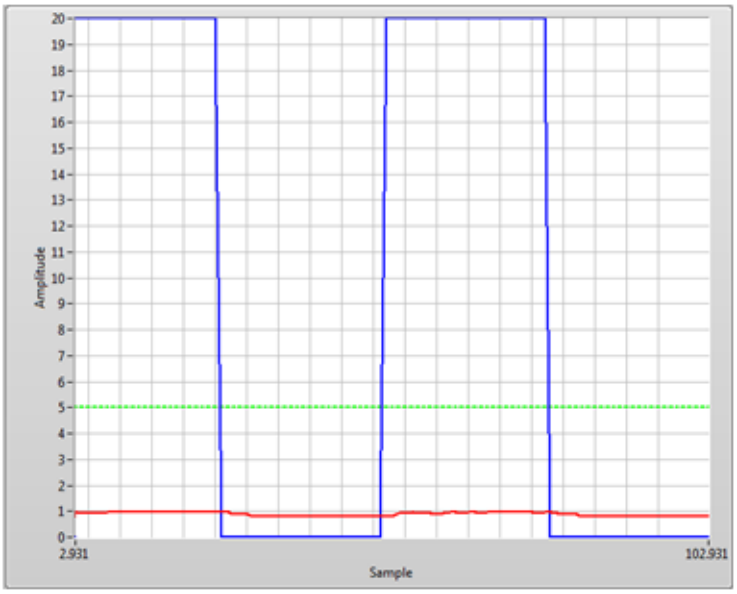

Figure 13-4 Test Screen with PS Scaling Adjusted

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.

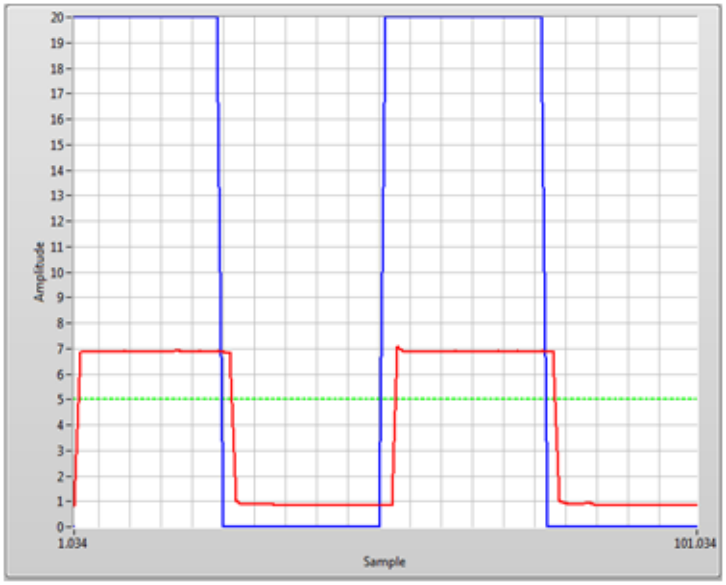

Figure 13-5 Test Screen with Increased PS Scaling

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.

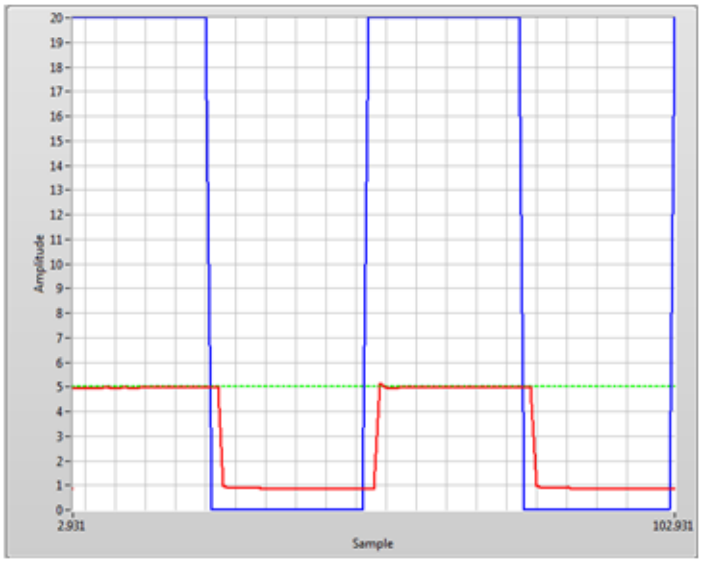

Figure 13-6 Test Graph with Proportional Gain Adjusted

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.

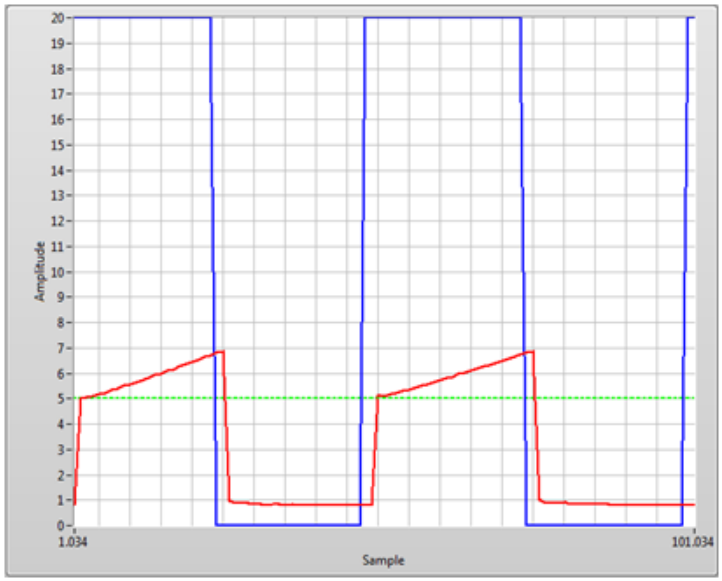

Figure 13-7 Test Graph with Integral Gain Adjusted

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.

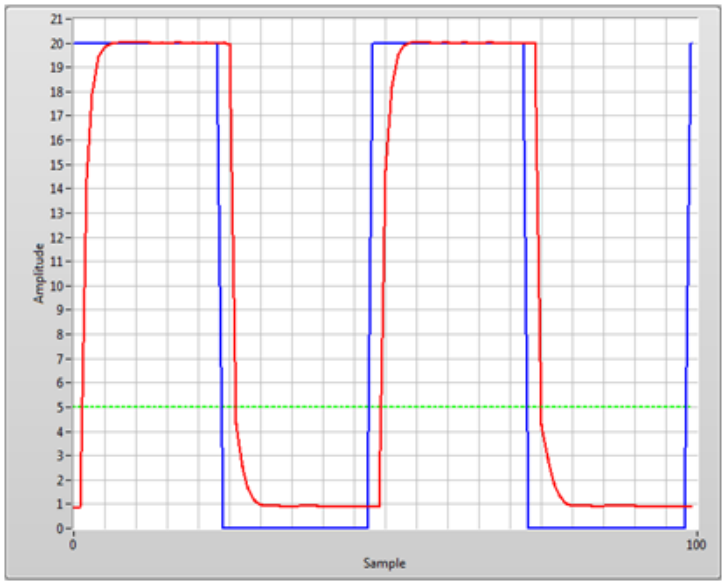

Figure 13-8 Test Graph with the IS Setting Adjusted

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.

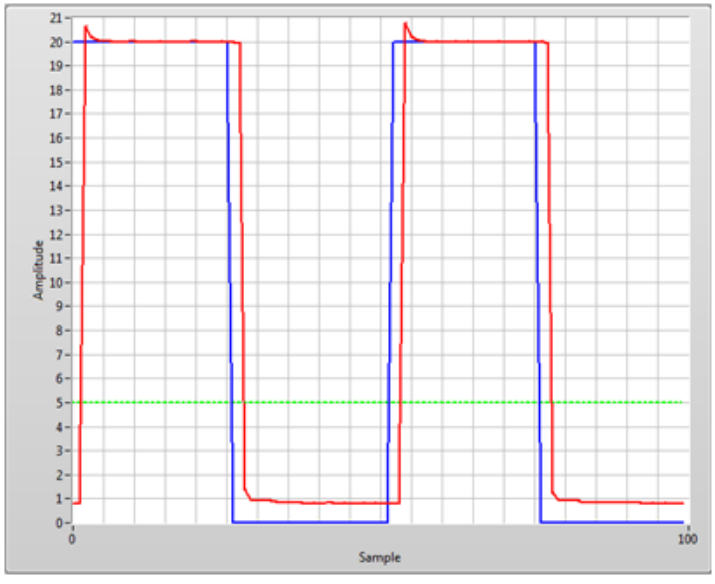

Figure 13–9 Test Graph with a Sharper Leading Edge on the Red Line

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).

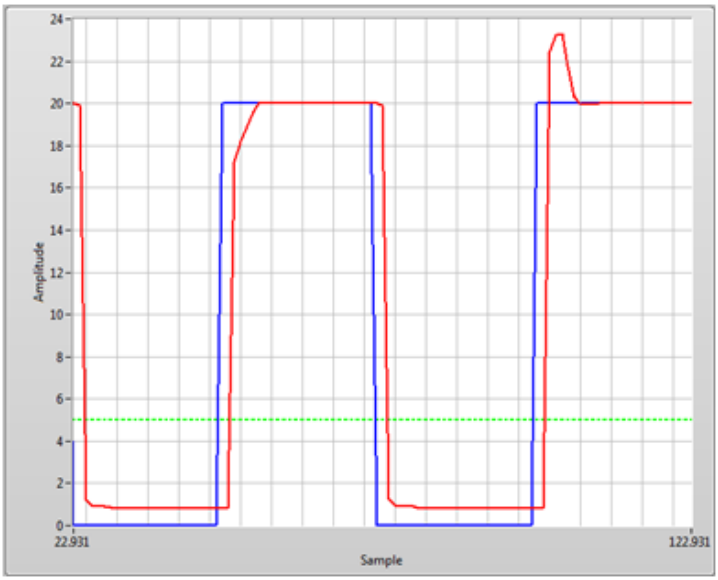

Figure 13-10 Test Graph with Too Much Proportional Gain

Likewise, too much integral gain may produce this:

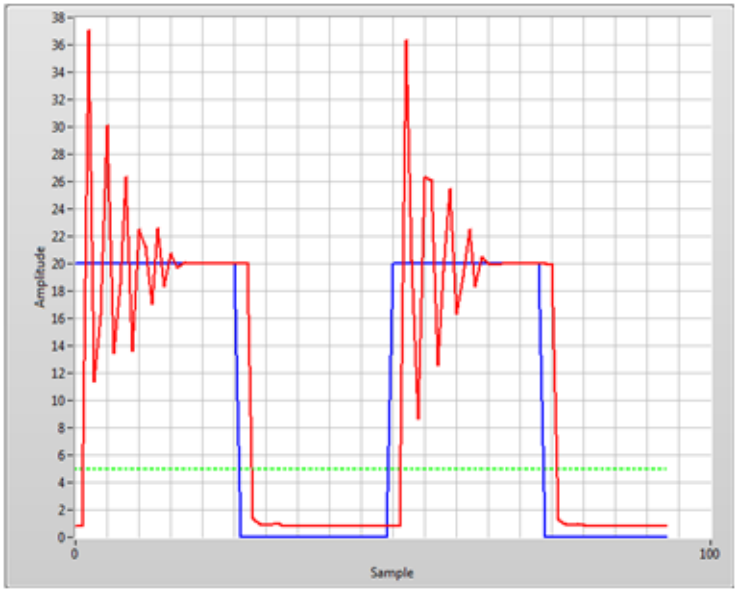

Figure 13-11 Test Graph with Too Much Integral Gain

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

To work with two channels simultaneous, you need to know some information:

1. Only the DSP7002 is a common device, all other device as like as Power Supply, Power Measurement and temperature device will be doubled.

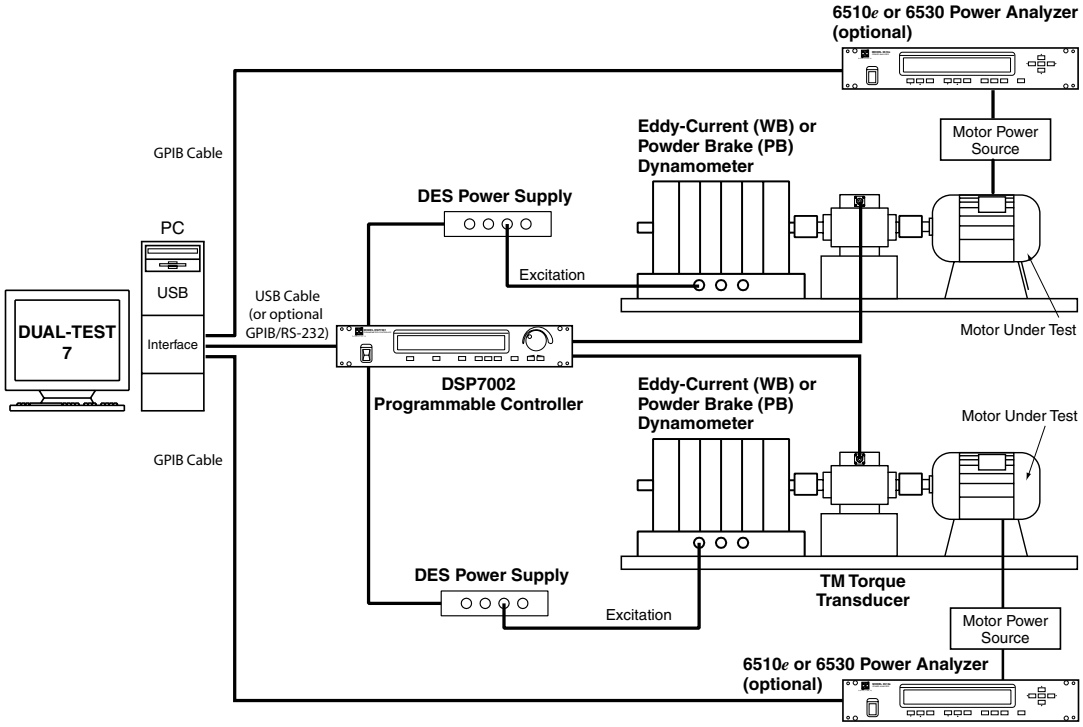

Figure A–1 Configuration Example

2. When using two channels, the sampling rate of the acquisition is reduced due to the communication port splitting.
3. Each channel works independently, but if a test running on one of the channels, the configuration cannot send on other channel. It should take a lot of time and the test of first channel will be not consistent.

A.1 TEST CONFIGURATION

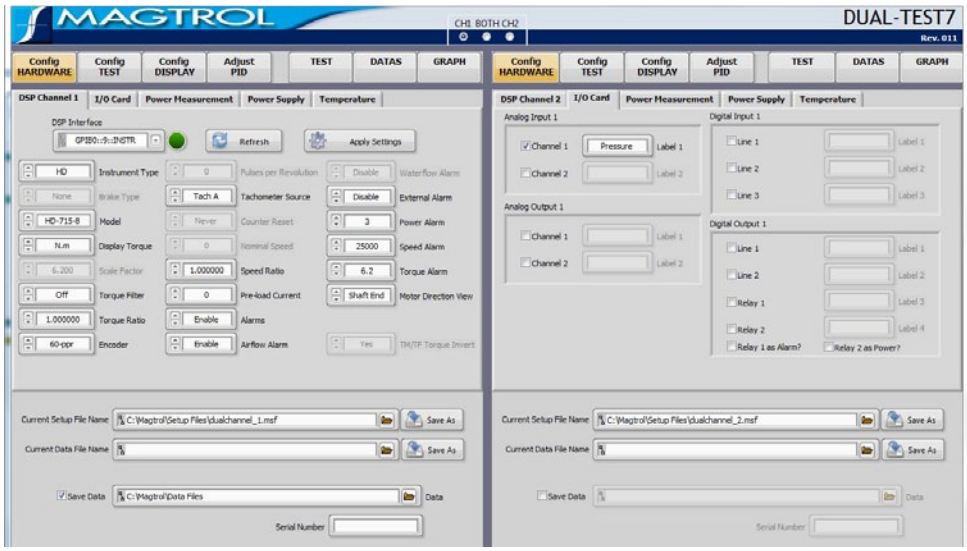

Figure A–2 Configuration of two Channels

At first, selects all configurations for both channels. Config HARDWARE, Config TEST, Config DISPLAY

A.2 PID CONFIGURATION

Follow the instructions in chapter 8 to adjust the PID setting for two channels. This part of configuration should also do before starting tests. Adjust the PID for two channels.

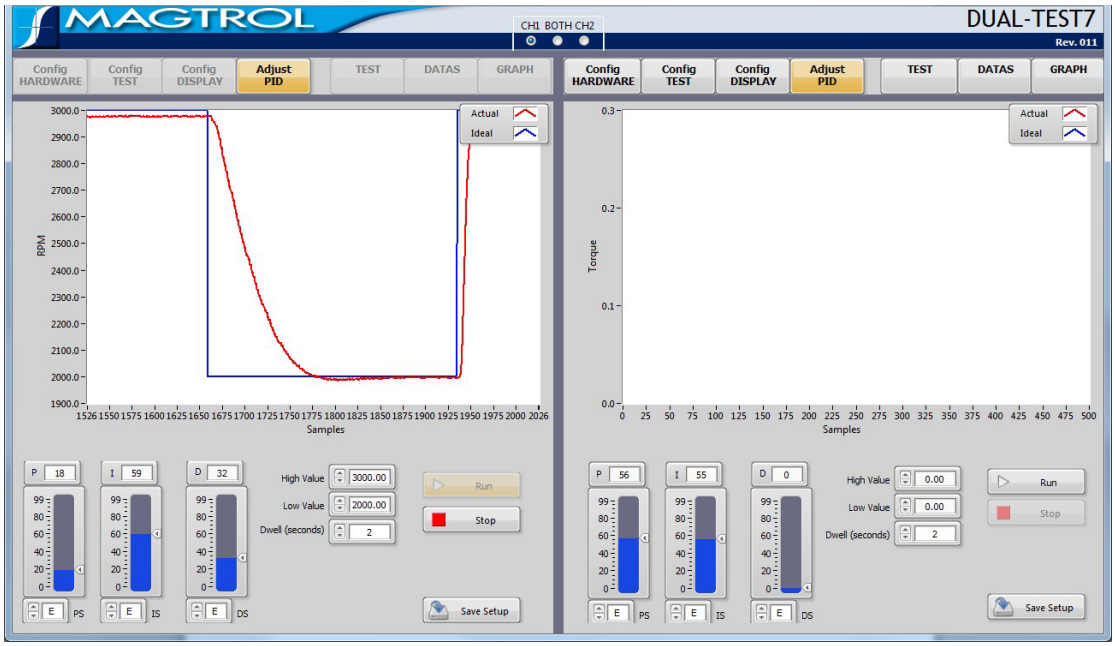

Figure A–3 Speed PID Adjust on Channel 1

APPENDIX

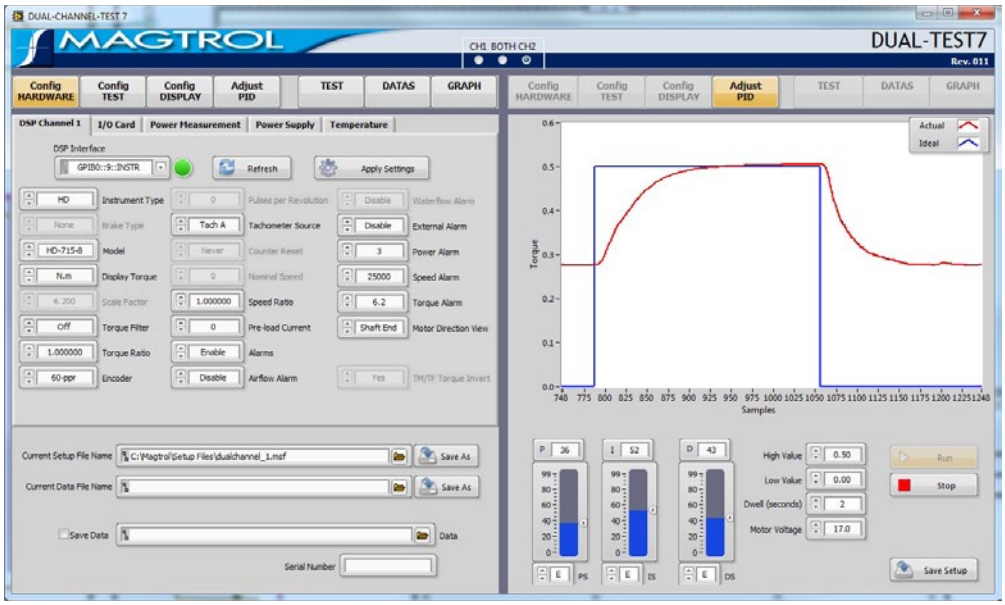

Figure A–4 Torque PID Adjust on Channel 2

A.3 TEST

Configure the Control Data array of two channels.

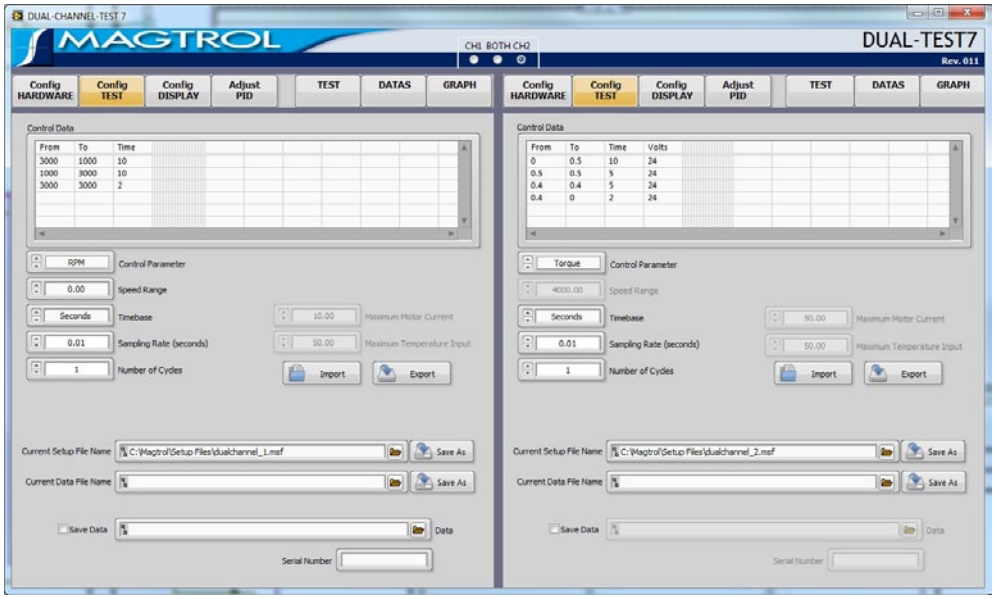

Figure A–5 Control Data Array

Start tests on both channels.

APPENDIX

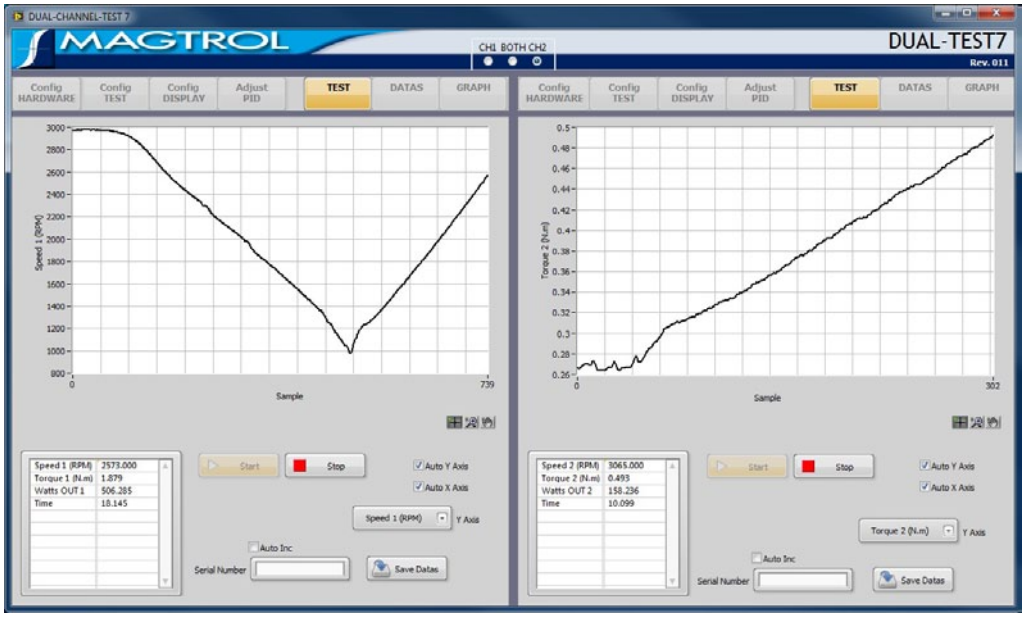

Figure A–5 Test on Two Channels Simultaneous

It's important to consider that when run simultaneous tests, the sampling rate of each channel decrease due to the splitting communication port between two channels of DSP7002, Power Measurements and Power Supply.

If an error occurs on one channel, both channel test will be stopped.

APPENDIX

Service Information

RETURNING MAGTROL EQUIPMENT FOR REPAIR AND/OR CALIBRATION

Before returning equipment to Magtrol for repair and/or calibration, please visit Magtrol's Web site at http://www.magtrol.com/support/rma.htm to begin the Return Material Authorization (RMA) process. Depending on where the equipment is located and which unit(s) will be returned, you will be directed to either ship your equipment back to Magtrol, Inc. in the United States or Magtrol SA in Switzerland.

Returning Equipment to Magtrol, Inc. (United States)

When returning equipment to Magtrol, Inc.'s factory in the United States for repair and/or calibration, a completed Return Material Authorization (RMA) form is required.

1. Visit Magtrol's Web site at http://www.magtrol.com/support/rma.htm to begin the RMA process.
2. Complete the RMA form online and submit.
3. An RMA number will be issued to you via e-mail. Include this number on all return documentation.
4. Ship your equipment to:
   MAGTROL, INC.
   70 Gardenville Parkway
   Buffalo, NY 14224
   Attn: Repair Department
5. After Magtrol's Repair Department receives and analyzes your equipment, a quotation listing all the necessary parts and labor costs, if any, will be faxed or e-mailed to you.
6. After receiving your repair estimate, provide Magtrol with a P.O. number as soon as possible. A purchase order confirming the cost quoted is required before your equipment can be returned.

Returning Equipment to Magtrol SA (Switzerland)

If you are directed to ship your equipment to Switzerland, no RMA form/number is required. Just send your equipment directly to Magtrol SA in Switzerland and follow these shipment instructions:

1. Ship your equipment to:
   MAGTROL SA
   After Sales Service
   Route de Montena 77
   1728 Rossens / Fribourg
   Switzerland
   VAT No: 485 572
2. Please use our forwarder : TNT • 1-800-558-5555 • Account No 154033
   Only ship ECONOMIC way (3 days max. within Europe)
3. Include the following documents with your equipment:
   - Delivery note with Magtrol SA's address (as listed above)
   - Three pro forma invoices with:
     - Your VAT number
     - Description of returned goods
     - Noticed failures
     - Value - for customs purposes only
     - Origin of the goods (in general, Switzerland)
4. A cost estimate for repair will be sent to you as soon as the goods have been analyzed. If the repair charges do not exceed 25% the price of a new unit, the repair or calibration will be completed without requiring prior customer authorization.

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