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# SOFTWARE MANUAL

## PHOENIX AC DRIVE DX, EX, DS & ES DRIVEMASTER



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## 1.0 Introduction

The US Drives Drivemaster software is designed to control, setup, and monitor the PHOENIX DX & EX line of digital AC drives from US Drives, Inc. Drivemaster software has an interface that allows the user to control the drive "online" (when connected to the drive via a serial interface) or to perform various management functions offline and save the changes to be downloaded to the drive at a later date. The PHOENIX DX & EX serial protocol is based upon the Modbus RTU protocol and features full CRC protection in both directions. The following sections of this manual describe the installation and setup of Drivemaster software, as well as the operation of Drivemaster's various windows and dialog boxes.

## 2.0 Initial Setup

First, run the setup.exe provided for Drivemaster, and follow the instructions to install Drivemaster. Upon running Drivemaster for the first time, you will probably need to adjust the Serial Port configuration to match the settings on your drive (i.e. adjusting the baud rate for higher-speed communication, etc). See "Configuring the Serial Port" for instructions on how to do this.

Next, you can connect to a drive to test your serial port configuration and to upload the drives data for use with offline editing or downloading to another drive. Connect the serial port you configured to the drive and select "Upload to PC" from the File menu. Input the correct Drive Address into the appropriate box and click "Start Upload". The upload will take around four minutes at the default 9600-baud connection speed, or about 30-90 seconds at 19.2 kbd.

Or, you can use the existing files provided to edit offline and download to drive later.

Drivemaster is now set up and ready to run. The remainder of this document provides detailed descriptions of the operation of each window and dialog.

### 3.0 Main Window

The main window contains all other windows of the Drivemaster program, as well as the main menu, which is used to select among the various functionality available in the software.

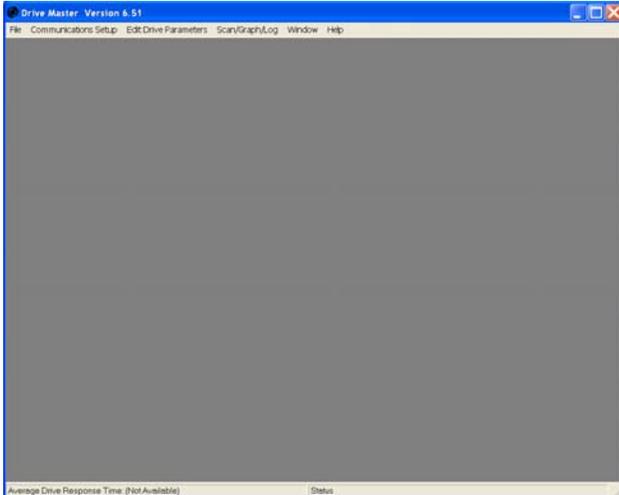


Figure 1. The Main Window.

**File Menu** – Contains operations for dealing with data files transferred to and from the drive.

- Upload To PC – Upload all data from a drive to a file for offline editing. Requires a connection to the drive. See the “Upload/Download Dialog” section for details.
- Download To Drive – Download all data from a drive information file to the drive, overriding its parameters with the ones in the file. Requires a connection to a drive. See the “Upload/Download Dialog” section for details.
- Print Parameter List – Print drive information file either uploaded or edit offline.
- Compare Files – Compare two drive information files, producing a report that lists the differences between them. See the “File Compare Window” section of this manual for details.
- Exit – Closes Drivemaster.

**Communications Setup Menu** – Contains operations for adjusting the way Drivemaster behaves.

- Configure Serial Port – Allows the user to set the details of the serial port and adjust it to match the configuration of your drive. See “Configuring the Serial Port” for more information.
- Configure Ethernet – Allows the user to set details at the IP address. See “Configuring Ethernet Control” for more information.
- Apply Firmware Upgrade - Allows the user to upgrade a drive to a specific software version.

**Edit Drive Parameters Menu** – Contains operations for editing drive parameters.

- Edit Parameter File (Offline) – Allows the user to edit a drive information file while not connected to a drive, so that changes to the drive’s settings can be designed elsewhere and then simply downloaded on-site. See “Edit Parameter File (Offline) Window” for more information.
- Edit Parameters Online – Allows the user to get drive parameter value reports updated on the fly, save drive parameter values to a file, and change drive parameters directly. Requires a connection to a drive. See “Edit Parameters Online Window” for more information.
- Customize Quick Setup Menu – Wizard which guides you thru setting up the Drive Quick Setup Menu. See the “Customizing Quick Setup Menu Wizard” section of this manual for details.

**Scan/Graph/Log Menu** – Contains operations to graph and log drive parameters.

- Online Graph/Log – Allows the user to graph selected drive parameter value at a periodic rate. Graphically display and log to a file selected drive parameters values at a periodic rate. See “Online Graph/Log” window for more information.

**Window Menu** – Contains operations to arrange Drivemaster windows.

- Cascade – Rearranges Drivemaster open windows cascaded.
- Tile Horizontally – Rearranges Drivemaster open windows horizontally.
- Tile Vertically – Rearranges Drivemaster open windows vertically.

**Help Menu** - Contains information about Drivemaster.

- About Drive Master – Shows Drivemaster version information.

### 4.0 Configuring the Communications

Before the Drivemaster software can communicate with a drive, the Drivemaster communication must be setup. You can configure serial port and Ethernet setup individually. Using the serial port or Ethernet connection can be selected by opening either configuration. A short cut to open either configuration "CTRL+S" for configuring Serial port or "CTRL+E" for configuring Ethernet can be used.

#### 4.1 Configuring the Serial Port

Before the Drivemaster software can communicate with a drive, the serial port settings must be configured to match the settings on the drive. (The default settings are identical to the default settings of the drive, but depending on your application you may wish to adjust those settings. If so, you must also adjust the Drivemaster serial port configuration to match them.)

The Serial Port Configuration dialog is accessed via the Communication Setup menu. It contains options for setting the port, baud rate, and parity of the serial interface. (The number of stop bits and data bits in the communications protocol depend on the other settings, so you cannot directly adjust them.) "Set to Defaults" will reset all these parameters to the factory defaults (which match the factory defaults of the drive.)

**Note:** If you are using a USB-to-serial adapter, you will have to set up a "virtual" COM port to represent one of the available COM ports. Consult your adapter's manual or manufacturer for directions to set up a virtual COM port or determine which COM port your adapter is registered as.

When you click "Apply" or "OK", Drivemaster will attempt to open the serial port using the settings you selected. If it cannot open the serial port (probably due to a misconfiguration or another application currently using the chosen serial port) it will announce an error, and all drive operations that require a connection will be disabled until you reconfigure the serial port.

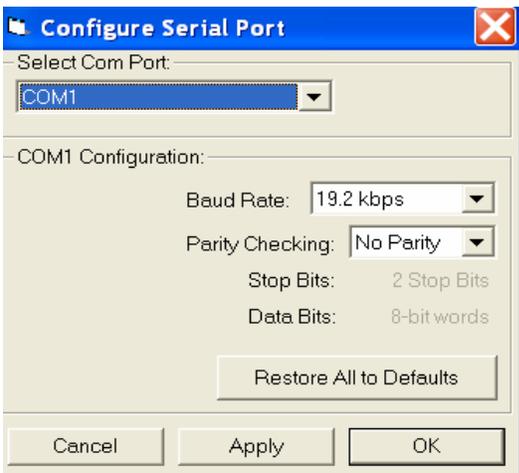


Figure 2. The Serial Port Configuration Dialog.

### 4.2 Configuring the Ethernet Control

Before the Drivemaster software can communicate with a drive, the Ethernet control settings must be configured to match the Ethernet Communication board.

The Ethernet Control Configuration dialog is accessed via Communication Setup menu. It contains options for setting the IP address and port number. Drivemaster communicates using Modbus USD protocol on Modbus TCP Ethernet frame. The default port number for Modbus TCP is 502. The user can enter more than one IP address and same to a list. By double clicking on an IP address in the list will load for use. The Ethernet Communication board has a security feature that allows only communications with private key authentication. This communication connection is established using a password that is matched with the Ethernet Communication board. By selecting "Use Private Key Authentication" and entering the correct password, you will be connected to the Ethernet Communication board using DRIVEMASTER. When you click "Apply" or "OK", Drivemaster will now use the IP address and port number using the settings you selected.

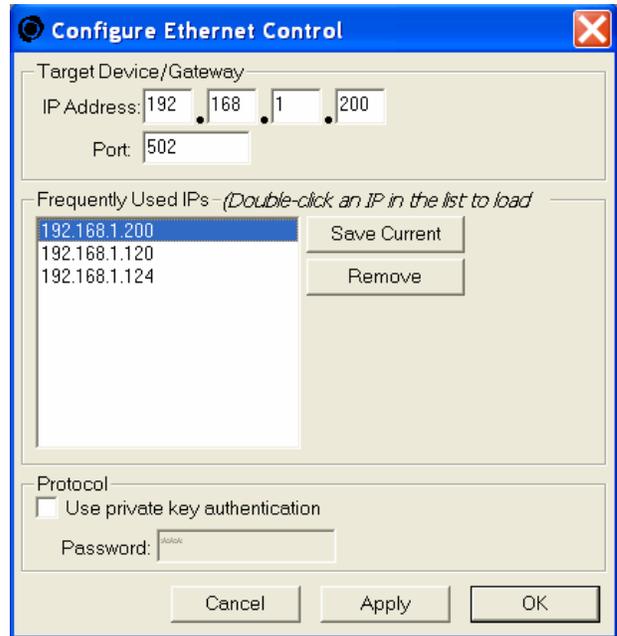


Figure 3. The Ethernet Control Configuration Dialog.

5.0 Upload/Download Dialog

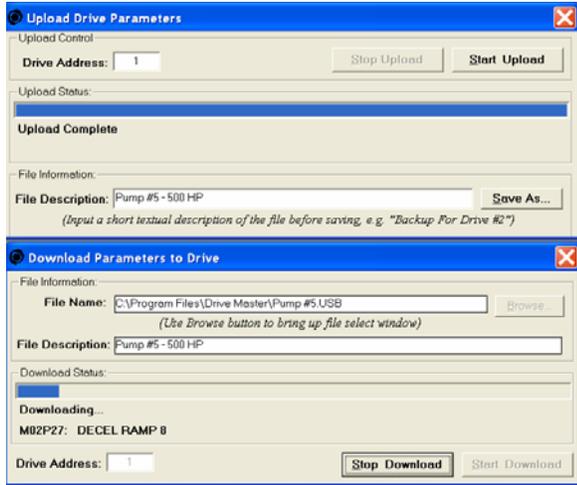


Figure 4. The Upload/Download Dialog.

The Upload/Download dialog (accessed via the File menu) allows the user to upload all of the parameter data for a drive to the computer and storing it in a drive parameter data file (.USB file). The parameter data can then be edited by the Edit Parameter File (Offline) window or kept as a backup. Downloading the USB file later will overwrite existing parameters. This allows most of the management and setup work for the drive to be done offline, and the computer need only be connected to the drive long enough to download the finished file.

To upload drive parameters, select "Upload to PC" from the main window's File menu. This will open the dialog for uploading. Enter the drive address of the drive whose parameters you wish to upload into the "Drive Address" box. (The address the drive will listen on for serial communications is determined by M11P23, "Serial Address". The address you attempt to upload from must be the same as this one or the drive will not respond.) Next, click "Start Upload" to begin uploading the drive's data. A progress bar will appear showing the status of the upload, and the two textboxes will show the uploads progress parameter-by-parameter. When the textbox reads "Upload Complete", the user can save the uploaded parameters by clicking "Save As" to get a standard windows file selection dialog. A description for the file being saved can also be typed in before saving. You may now download it to a drive (see below) or open it in the offline editor window (see "Edit Parameter File (Offline)").

To download a file, select "Download to Drive" from the File menu. This will open the dialog for downloading. Click "Browse..." and find the file you

wish to download, verify that the Drive Address is correct as before, and click "Start Download" to begin downloading the drive data.

The download will write out the parameters from the drive parameter data file (.USB file) to the drive, display the description of the drive parameter data file (.USB file), and the textboxes and progress bar will show the current status of the download. When the entire file has been downloaded, the textbox will read "Download Complete." If an error is returned by the drive during either upload or download, it will be reported to the user and the operation will immediately abort.

**Tip:** When your drive is finally properly configured, upload a snapshot of its parameters and keep it someplace safe as a backup. If something then goes wrong, you can upload a new snapshot and use the Compare window to compare it to the "correct" settings, to determine whether the problem lies in a parameter that was erroneously changed.

## 6.0 Edit Parameters Online Window

The user can save the drive parameters by clicking "Save to File" to get a standard windows file selection dialog. A description for the file being saved can also be typed in before saving.

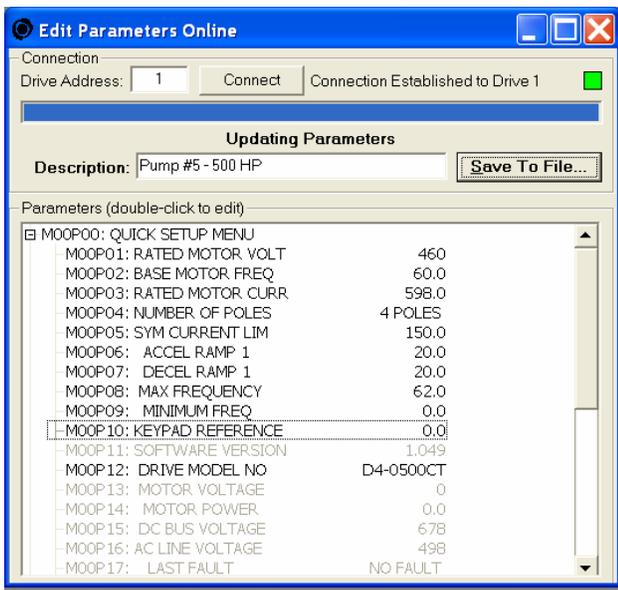


Figure 5. The Edit Parameters Online Window.

The Edit Parameters Online window allows the user to keep track of the status of a drive in real-time, log the data received, and also change the parameters on the fly. The Edit Parameters Online window is accessed from the Edit Drive Parameters menu. At the top of the window, input the drive address you wish to query in the "Drive Address" box. This should match the drive's "Serial Address" parameter (M11P23). Next, click the "Connect" button to connect to the drive. The progress bar will display the status of the connection, as Drivemaster connects to the drive and uploads the complete parameter list. The colored box in the upper left will flash to indicate communication with the drive.

When the connection and upload is complete, the tree view on the window will be filled with the menus and parameters available on the drive. Clicking on the plus sign next to the menu will expand that menu's parameters and clicking on the minus sign next to the menu will contract that menu's parameters. The expanding menu will display the parameters and parameter values.

At a periodic interval, Drivemaster will poll the drive and read in the new values of the parameters. At anytime, you may click on a value and edit it live; your change will be sent to and verified from the drive immediately, and the new value will be displayed. Grayed-out parameters are read-only and cannot be edited. Parameters with names for their values will allow the user to select from among the named values.

## 7.0 Edit Parameter File (Offline) Window

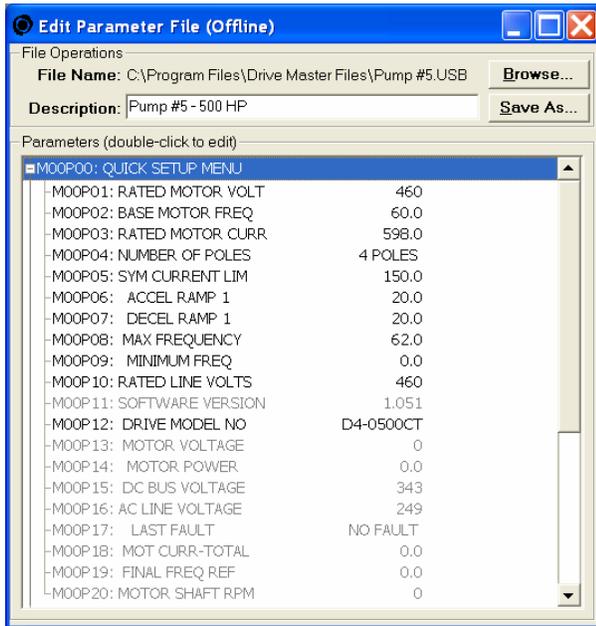


Figure 6. The Edit Parameter File (Offline) Window.

The Edit Parameter File (Offline) window allows the user to edit the parameter values stored in a drive parameter data file (.USB file) and save them to a new file. This is especially useful after deployment, when a drive may not be in a readily accessible location—the drive’s parameters can be uploaded to a laptop by Drivemaster and then taken elsewhere to be analyzed and edited. The edited file with corrected parameters can subsequently be brought back and downloaded to the original drive to update it, making updating settings in the field much more convenient.

Superficially, the Edit Parameter File (Offline) window (accessed from the Edit Drive Parameters menu) strongly resembles the Edit Drive Parameters Online window. The major difference is that no connection to a drive is required to use the Edit Parameter File (Offline) window. Click “Browse...” and find the file you wish to edit. Drivemaster will load the drive parameter data file (.USB file) into memory, display the description of the drive parameter data file (.USB file), and display the tree view much like that seen in Edit Parameters Online mode. Clicking on the plus sign next to the menu will expand that menu’s parameters and clicking on the minus sign next to the menu will contract that menu’s parameters. The expanding menu will display the parameters and parameter values.

The parameters value can be clicked and edited exactly as with the Edit Parameters Online window. Parameters that are grayed out are read-only

parameters and cannot be changed (such as, for example, the firmware version number of the drive). Clicking a parameter that has names for its values (such as the drive’s current Ramp Mode, for example) allows the user to select from all named values. A description for the file being edited can also be typed in. When finished editing, click “Save As...” to save the file. You will be given a standard windows save-file dialog to choose a file name. The resulting file can then be downloaded to a drive as normal.

## 8.0 File Compare Window

Microsoft Excel) if automated processing or charting is desired.

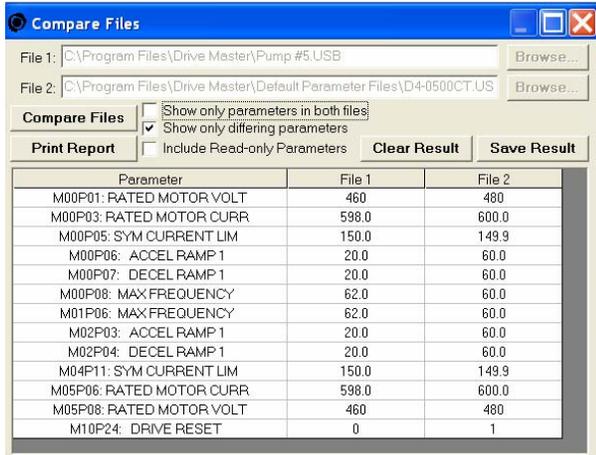


Figure 7. The Compare Files Window.

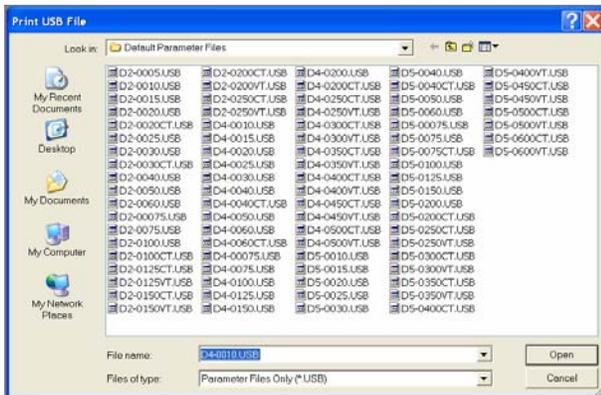
The File Compare window allows the user to view the differences between two drive parameter data files (.USB file). This can be immeasurably useful for troubleshooting purposes; by uploading and keeping a safe copy of the “correct” parameter data for the drive, a problem due to an accidentally changed parameter or a typo in editing can be detected simply by uploading the “bad” drive data and comparing the resulting file to the “known-good” file. (For example, mistakenly entering a reference frequency of 600 instead of 60.0 may cause problems, but this will be apparent upon examining the differences between the files.)

To compare two files, open the File Compare window (select “Compare Files” from the File menu). Click the two “Browse” buttons and select a file to compare (by default, File 1 is the last file you uploaded, downloaded, or edited offline) and a file to compare it to (the second file is blank by default). Click “Compare Files” to begin comparing the files.

The results are displayed in a spreadsheet format; the keypad number and name of the parameter are listed at the far left, the parameter values for File 1 are listed on the left, and the parameter values for File 2 are on the right. Parameter values that are the same are not shown by default; un-checking “Show only differing parameters” will show parameters that are shared among the files as merged cells with the value in between the two columns.

After the comparison is complete, the spreadsheet can be erased by clicking “Clear Result”, saved to a file by clicking “Save Result”, or a hard copy printed by clicking “Print Report”. The saved result file is a text file separated by tabs, which is human-readable and can be imported into any software package that supports tab-separated tables in ASCII format (e.g.

## 9.0 Print Parameter List



**Figure 8. The Print Parameter List Window.**

The Print Parameter List window allows user to print a hard copy of any drive parameter data file (.USB file). This file can be an uploaded file, to be downloaded file, or edited offline file.

To print a file, select "Print Parameter List" from the main window's file menu. This will open a standard windows file selection dialog. Find the file you wish to print and click "Open".

A standard windows print dialog which allows you to print a hard copy to selected printer by clicking "Print".

## 10.0 Customizing Quick Setup Menu Wizard

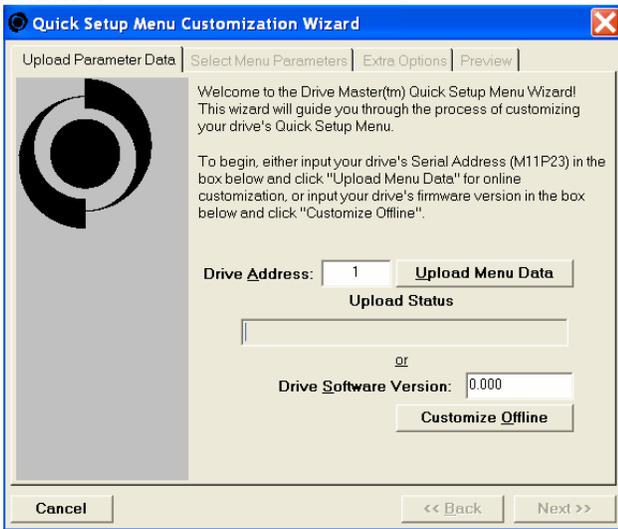


Figure 9. The Upload Parameter Data Window.

The Customize Quick Setup Menu wizard allows the user to select parameters for Quick Setup Menu. The wizard also allows you to adjust the scale and choose/create text for Quick Setup Menu M00P19 and M00P20.

To access the customizing wizard, open Customize Quick Setup Menu wizard from the Edit Drive Parameters menu.

To begin, either: (1) Input your drive’s Serial Address (M11P23) in the “Drive Address” box on the Upload Parameter Data window, and click “Upload Menu Data” for online customization, or: (2) input your drive’s Software Version (M11P27) in the “Drive Software Version” box and click “Customize Offline”. After loading is complete, click “Next >>”.

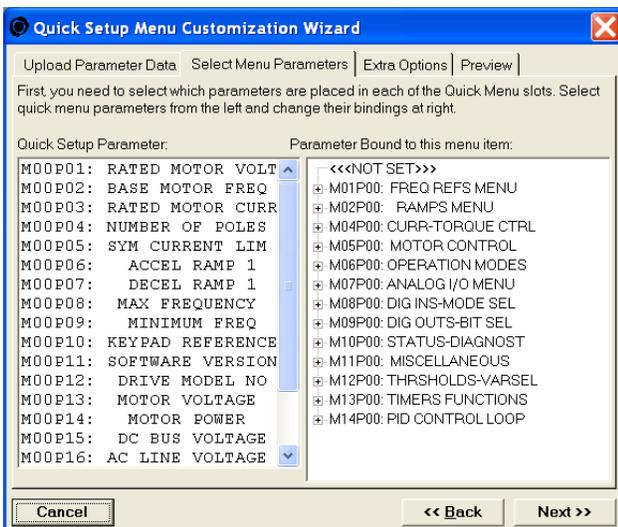


Figure 10. The Select Menu Parameters Window.

In the Select Menu Parameters window, the Quick Setup Parameter are on the left, and parameters to be selected for the Quick Setup Parameter and are on the right.

Select a Quick Setup Parameter on the left and change the binding parameter by clicking on a parameter on the right.

After finishing the choices, click “Next >>”. You can also go back to the previous window by clicking “<< Back”.

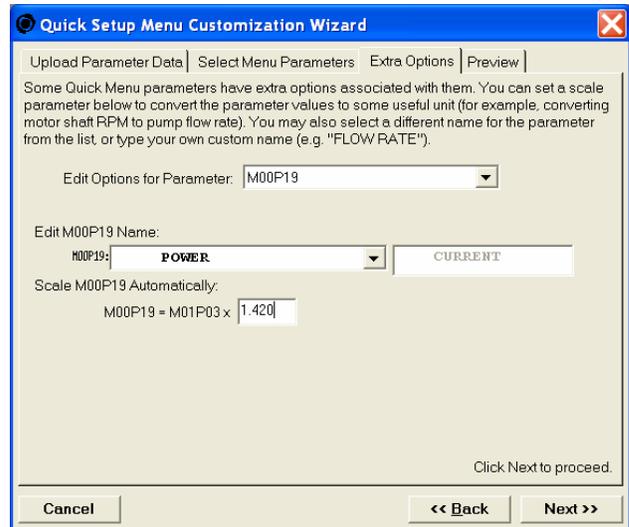


Figure 11. The Extra Options Window.

Some Quick Setup Menu parameters (M00P19, M00P20) have extra options associated with them. You can set a scale parameter to convert the parameter values to some useful unit (for example, converting motor shaft RPM to pump flow rate). You may also select a different name for the parameter from the list, or type your own custom name (e.g. “Flow Rate”). To edit these extra options, choose the parameter to edit in the “Edit Options for Parameter” box on the Extra Options window. When you are finished, click “Next>>”.

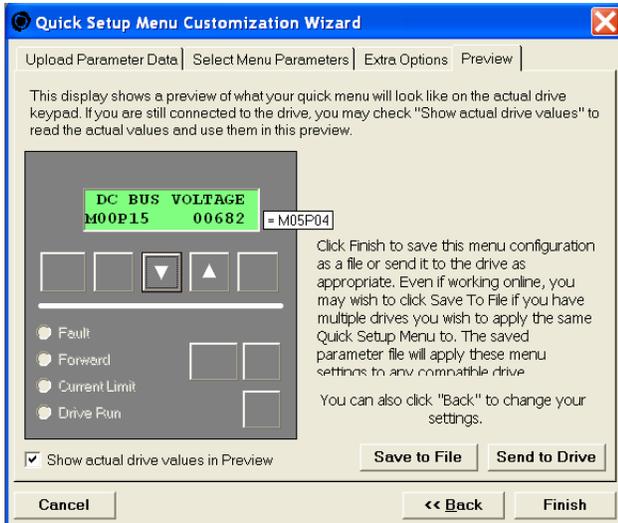


Figure 12. The Preview Window.

The Preview window displays a preview of what your Quick Setup Menu will look like on the actual drive keypad. If you are still connected to the drive, you may check "Show actual drive values in Preview" to read the actual values and use them in this preview.

Click "Send to Drive" to send this Quick Setup Menu configuration to the drive. If you have multiple drives you wish to have the same Quick Setup Menu, you may click "Save to File" to create a drive parameter data file (.USB file). This drive parameter data file (.USB file) can now be downloaded to any compatible drive. You can also click "<< Back" to change your settings or "Finish" to exit.

### 11.0 Online Graph/Log Window

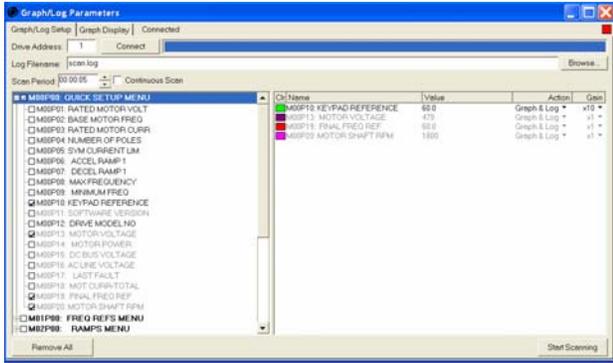


Figure 13. Graph/Log Setup Tab in Online Graph/Log Window.

The window allows the user to keep track of the status of a drive in real-time, log the data received, and also change the parameters on the fly. The Online Graph/Log window is accessed from the Scan/Graph/Log menu. At the top of the window, input the drive address you wish to query in the "Drive Address" box. This should match the drive's "Serial Address" parameter (M11P23). Next, click the "Connect" button to connect to the drive. The progress bar will display the status of the connection, as Drivemaster connects to the drive and uploads the complete parameter list. The colored box in the upper right will flash to indicate communication with the drive.

When the connection and upload is complete, the tree view on the left side of the window will be filled with the menus and parameters available on the drive. Skim through these parameters and check the boxes next to the parameters you wish to monitor (click "Remove All" to uncheck all currently checked parameters). Input your desired scan period in hours, minutes, seconds, into the "Scan Period" box or check "Continuous Scan" box.

Next, input a name for the file (the default is simply "scan.log") in the "Log Filename" box, or click the "Browse..." button next to it.

The log file is human-readable ASCII, but is also tab-separated so that it can also be imported in a tabular format into most popular software (e.g. Microsoft Excel) for automated data processing.

On the right side of the window the selected parameter will appear with parameter values in the value field. You, the user can now choose an action for each parameter. By clicking on the parameter

action field, a list of actions for that parameter will display the user has a choice for Graph & Log, Graph only, Log only, and View or Edit only. Each parameter has a color and gain field for graphing purposes. By clicking on the color box, a color selecting standard window is displayed and change to a different color can be made. This color field allows you to have a color choice for each parameter value to be graphically displayed. By clicking on the parameter gain field, a window with gain values to choose will display. This field allows you to adjust the graphical display of the parameter values.

Click "Start Scan" to start scanning. To end scanning, click the same button again (It will change to read "Stop Scan" when scanning is active).

At intervals determined by the scan period you inputted, Drivemaster will poll the drive and read in the new values of the parameters in the value field. At the end of the scan period, depending on the action field for each parameter, the value will display on the "Graph Display" tab and/or written to the log file. At anytime, you may click on a value and edit it live; your change will be sent to and verified from the drive immediately, and the new value will be displayed. Grayed-out parameters are read-only and cannot be edited. Parameters with names for their values will allow the user to select from among the named values.

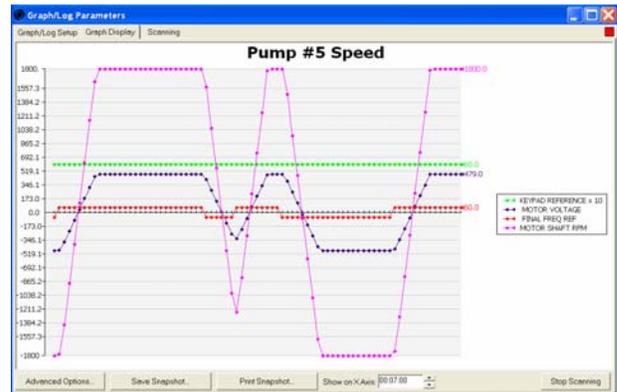


Figure 14. Graph Display Tab in Online Graph/Log Window.

Finally, clicking on the graph display tab displays a graph of the histories of parameters that are selected for graphing on the previous tab. The horizontal axis shows the most recent scan sweeps, or simply the most recent ones if the window is short. The vertical axis of the graph plots the parameter values over time, and is scaled so as to fit the minimum and maximum values of all graphs displayed.

Clicking "Print Snapshot..." allows the user to print a hard-copy of the currently visible graph. "Save Snapshot..." allows the user to save an image file of the same information. Clicking the "Advanced Options" button opens the Configure Graph options dialog box as described below.

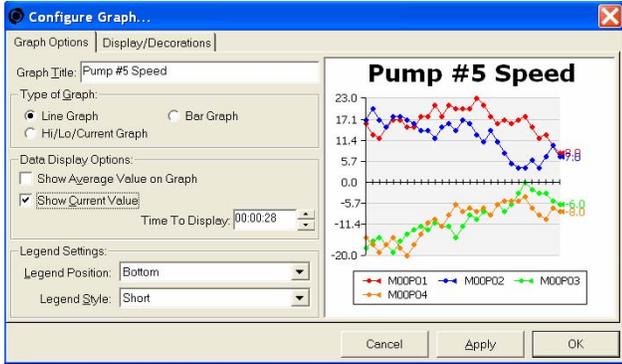


Figure 15. Graph Options Tab in Advance Options Configuration Window.

The Graph Configuration display allows you to adjust some of the display settings for your graph display. On the left side you have two tabs, "Graph Options" and "Display/Decorations", along with the graph example in the right side. On the Graph Options tab, you may enter a title in the "Graph Title" text box which is displayed as the header for the graph. You can choose the "Type of Graph" to display ("Line Graph", "Hi/Lo/Current Graph", or "Bar Graph").

Optionally, you may add a legend in one of four different locations on the graph, associating each color with its parameter. The parameter number or parameter name (choose Short or Long) and graph display gain will appear in the legend (e.g. "MOOP15", "DC Bus Voltage"), alongside a sample arrow line, data point and arrow for reference. You can include with the graph display the average values or current values of the parameter displayed.

Finally, you may adjust how much data is displayed on the graph at one time, by inputting a maximum length of time into the box marked "Time to Display". For example, if you enter "00:05:00" into this box, the graph will only display results less than five minutes old, even if more data exists. (This time is relative to the most recently collected data point, so if you pause scanning, the graph will pause as well.)

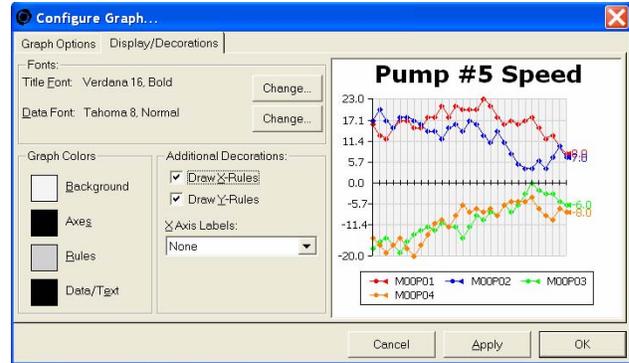


Figure 16. Display/Decorations Tab in Advance Options Configuration Window.

Using the Display/Decorations tab, you can change the fonts for the Title and Data, as well as the graph colors for the Background, Axes, Rules and Data/Text. By clicking on the "Change" button for Fonts, a font selecting standard window is displayed and a change to a different font can be made. By clicking on the color box for Graph Colors, a color selecting standard window is displayed and a change to a different color can be made.

The X-Axis and Y-Axis can be displayed on the Graph by selecting the appropriate box. The X-Axis labels, which is either the parameter number or parameter name (choosing Short or Long) can also be displayed. The X-Axis labels are only displayed in Hi/Lo/Current Graph or Bar Graph display.

When you are done with your choices, click "Apply" button to see changes immediately, click "OK" button for changes to take effect and exit the window, or click "Cancel" to exit the window without changes.

### 12.0 Upgrade Drives Firmware Wizard

firmware upgrade file. After selecting your firmware, upgrade file, click "Next>>". You can also go back to the previous window by clicking on "<< Prev".

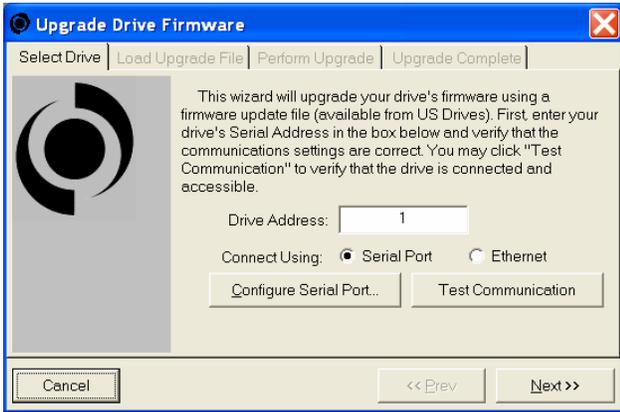


Figure 17. The Select Drive Window.

To upgrade drives Firmware, select "Apply Firmware Upgrade" from the main windows Communications Setup menu. This will open a Upgrade Drive Firmware wizard. This wizard will upgrade your drives firmware using a firmware update file (.FUP file) available from US Drives.

First, enter your drive's "Serial Address" parameter (M11P23) in "Drive Address" box, in the Select Drive window. You can choose a Serial Port or Ethernet communication connection. The communication connections you have choosen can also be configured by clicking Configure Serial Port or Configure Ethernet. Configuring the communications is explained in section 4.0 Configuring the Communications. After everything is configured, you may click "Test Communication" to verify that the drive is connected and accessible. After communication connection is successful, click "Next>>".

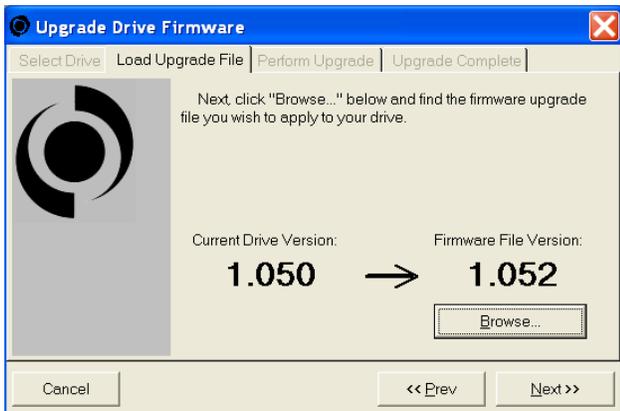


Figure 18. The Load Upgrade File Window.

In the Load Upgrade File window click "Browse" to find the Firmware Upgrade File (.FUP file) you wish to apply to your drive. The latest Firmware Upgrade files are available from US Drives. Depending on your application, you may be provided with a customized



Figure 19. The Perform Upgrade Window.

Drivemaster is ready to upgrade your drives firmware. Click "Next>>" to begin the upload. This upgrade will take several minutes, depending on your communications settings. DO NOT turn off or disconnect the drive during the upgrade, doing so may leave your drive in an unrecoverable state, requiring factory maintenance repair.

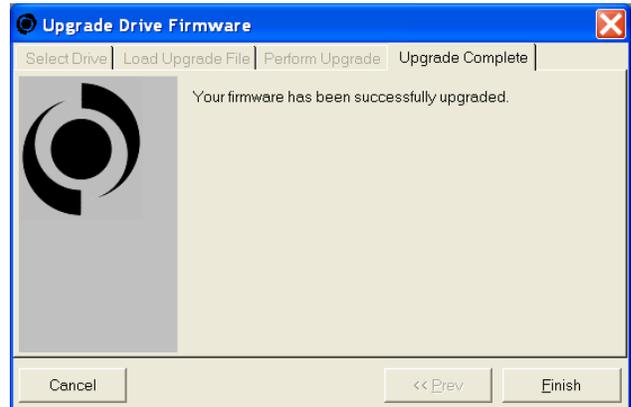


Figure 20. The Upgrade Complete Window.

Your firmware has been successfully upgraded. Click "Finish" to exit Upgrade Drive Firmware Wizard.

### 13.0 How to View Drivemaster Version

By Selecting "About Drivemaster..." from the Help Menu in Drivemaster will display the current Drivemaster Version.



Figure 21. The About Box, Showing the Version Support Information.

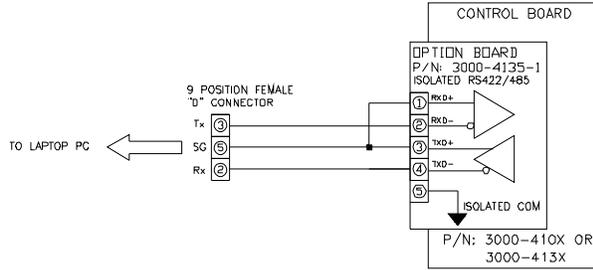
## **COMMON OPTIONS AND INTERCONNECTS**

**WARNING:** To avoid a hazard of electric shock, after the input and control power is removed from the drive and the ROM display is no longer lit, wait five (5) minutes for DC bus capacitors to fully discharge before opening the drive. Verify that the voltage on the DC bus capacitors has discharged by measuring the DC bus voltage at the +DC & -DC terminals of the drive. The voltage must be zero.

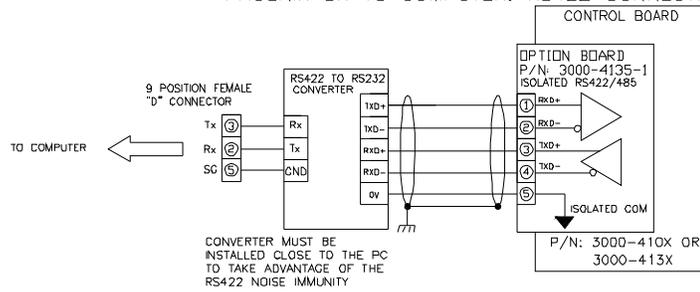
**CAUTION:** This drive contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed.

Isolated Communications Card 3000-4135-1 (1 of 2)

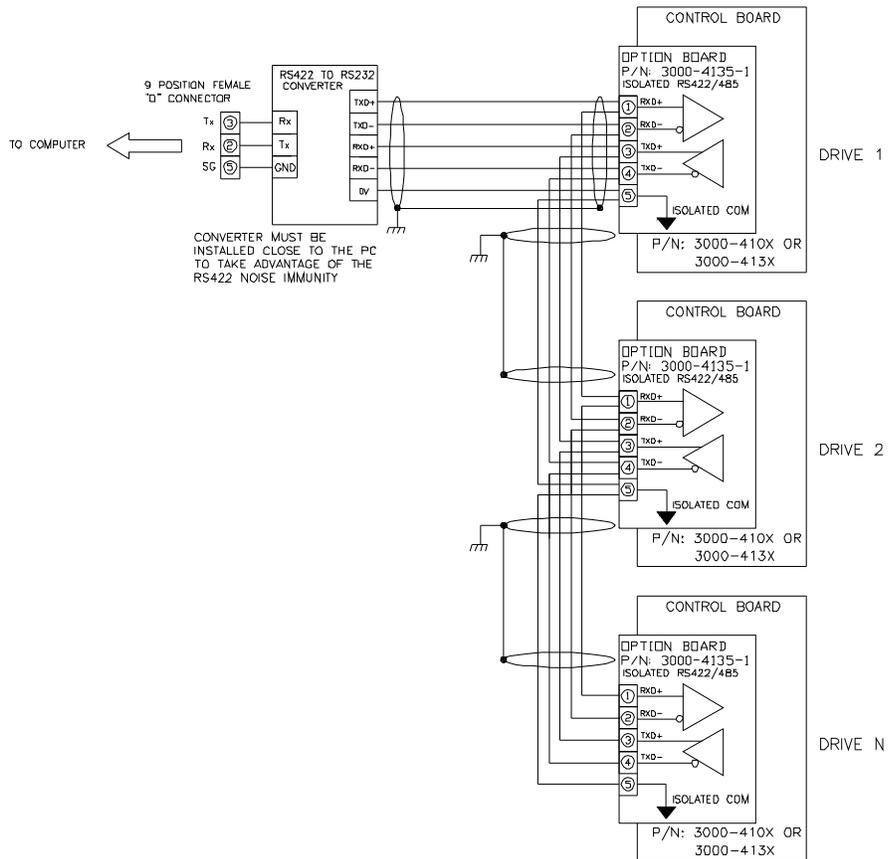
PHOENIX DX TO LAPTOP PC RS232 CONNECTION



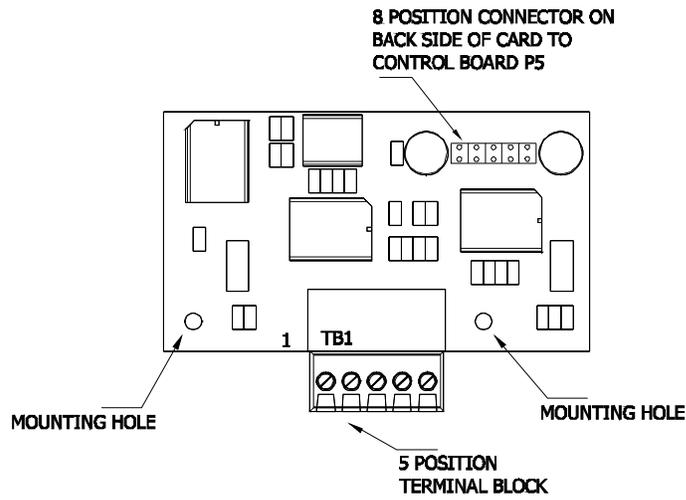
PHOENIX DX TO COMPUTER: RS422 CONNECTION



PHOENIX DX TO COMPUTER: RS485 4-WIRE PARTY-LINE CONNECTION

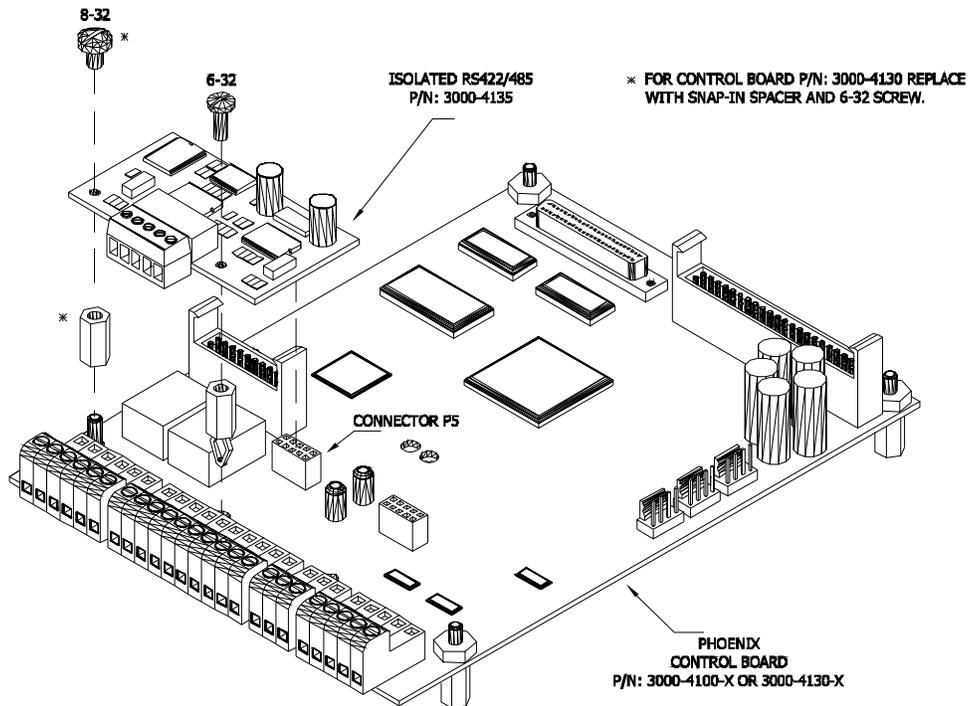


Isolated Communications Card 3000-4135-1 (2 of 2)



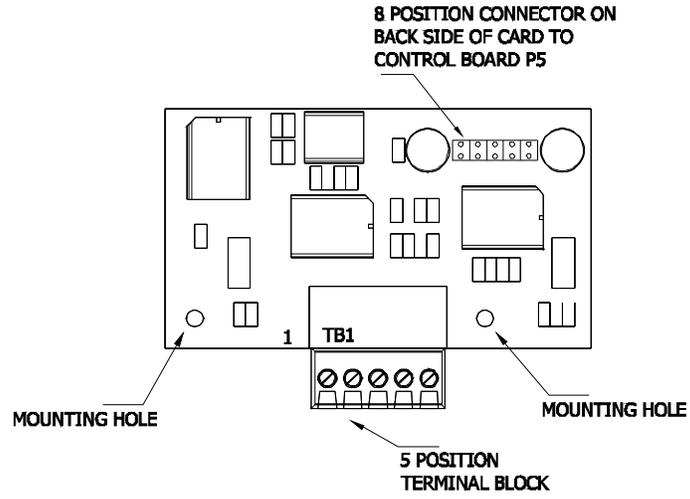
TB1 CONNECTION DATA:

MAXIMUM TORQUE: 2.2 Lb-in [0.25 N-m]  
 WIRE SIZE: 26-16 AWG [0.14 - 1 mm]

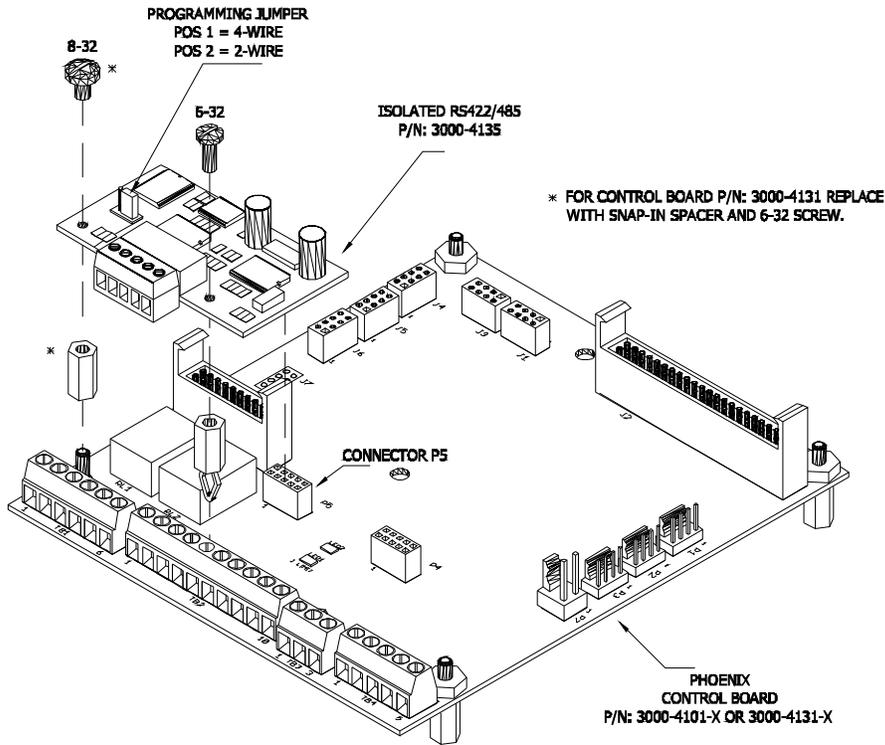


Mounting Diagram  
 For Control Board 3000-4100 & 3000-4130

Isolated Communications Card 3000-4135-1 (2 of 2)

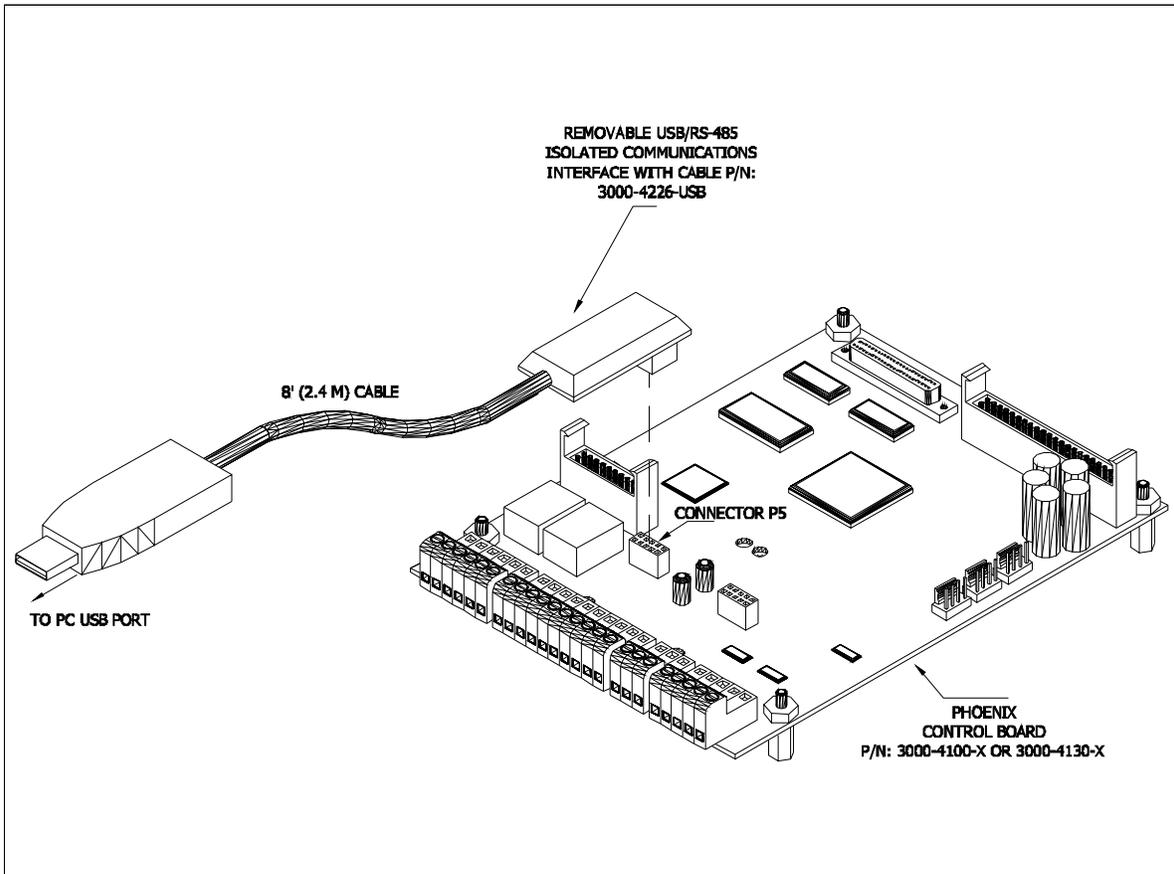


TB1 CONNECTION DATA:  
 MAXIMUM TORQUE: 2.2 Lb-in [0.25 N-m]  
 WIRE SIZE: 26-16 AWG [0.14 - 1 mm]



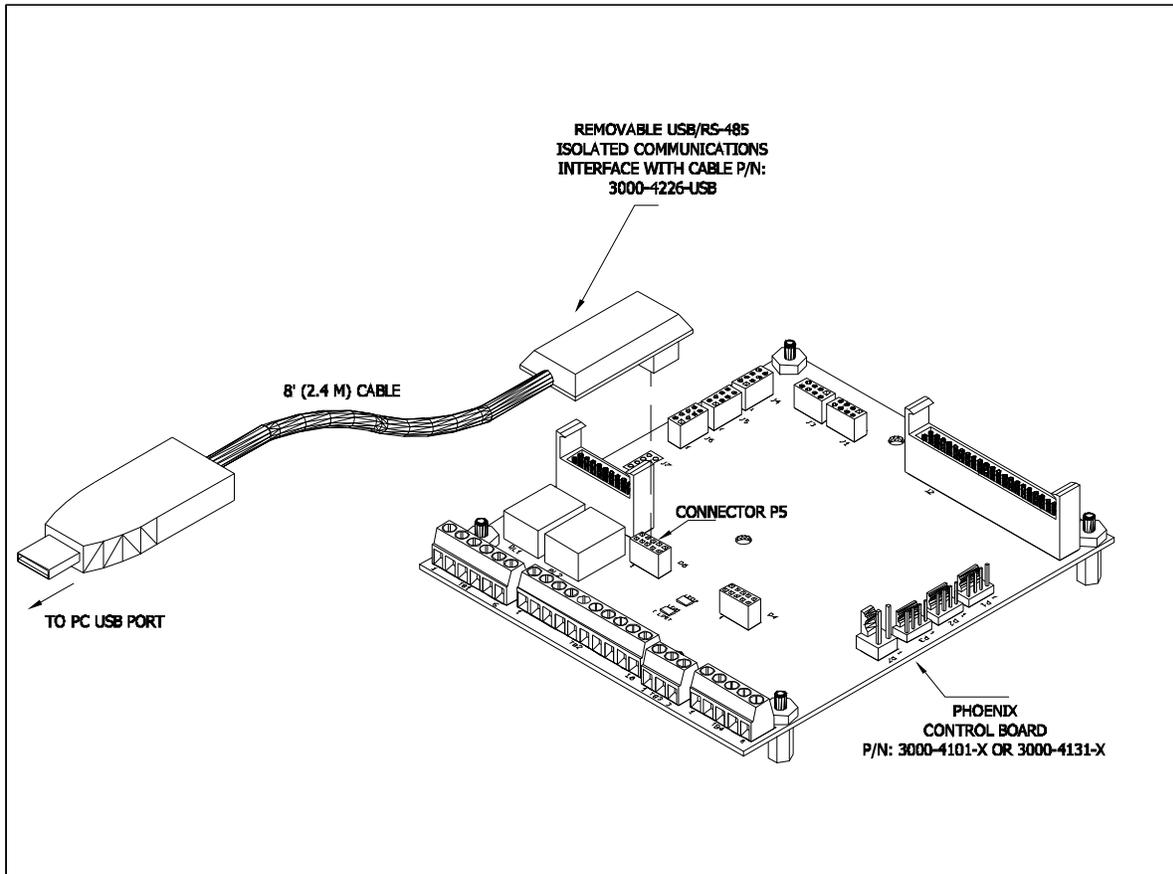
Mounting Diagram  
 For Control Board 3000-4101 & 3000-4131

**Removable USB/RS-485 Isolated Communications Interface with Cable  
P/N: 3000-4226-USB**



Mounting Diagram  
For Control Board 3000-4100 & 3000-4130

**Removable USB/RS-485 Isolated Communications Interface with Cable**  
**P/N: 3000-4226-USB**



Mounting Diagram  
For Control Board 3000-4101 & 3000-4131

***"THE HIGH HORSEPOWER DESIGN EXPERTS"***

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