



ToolWare Version 7.0 Operations Manual



PO Box 16460, Portland OR 97292-0460 • 800-852-1368 • Fax 800-582-9015

www.aimco-global.com

Table of Contents

Introduction	2
Setup	
Setting Up Parallel Connection.....	3
Setting Up a USB Connection	4
Setting Up an Ethernet Connection	4
Features	7
File.....	7
Tool	7
Calibrate	8
Encrypt File.....	8
DSP	8
Socket Tray	13
System	13
Curveware	15
Parameter Sets.....	17
Logic I/O	20
Stats	27
AcraVision	29
Updated Features from V6.0.3 to V7.0.0.....	31
Troubleshooting	33
Sample Logic	36
Batch Counting.....	36
Turning an output on for a short duration (One-Shot).....	37
Changing Parameter Sets	38

ToolWare 2006

Introduction

ToolWare is a software package designed for communicating with AcraDyne Evolution Series Controllers. Some features in ToolWare are only available on controllers with a DSP version of 3.01 or higher. There is also a separate microcontroller called SCC (Spindle Control Card). Versions below 4.0 run 2001 logic while systems 4.0 or higher run 2002 logic. If you wish to update your controller software, please contact your sales representative.

Depending on the interface and the model of controller, there are three ways to connect: Parallel, USB, or Ethernet. The parallel connection requires a Candongle (Part No: 21387), the USB connection requires a Controller Interface Module (Part No: 23112), and the Ethernet connection requires the controller to be an Evolution III model and either on the network or use a network crossover cable.

Setup

Setting up a Parallel Connection

There are a few things that need to be set on a computer with XP or Windows 2000 to ensure that CAN Communication will take place.

1. In the Bios, ensure the parallel port is enabled and set to address 378
2. In the Device Manager, Ports, LPT1, and Port Settings tab, check the enable legacy plug and play detection checkbox and the 'Use Any Interrupt' radio box is selected.
3. Most importantly, the user must have administrative rights on the computer in order to access the parallel port.

Instructions for addressing the above three items:

1. BIOS:

Different systems have different ways of accessing the BIOS. Consult the manufacturer's documentation. These are some of the most common methods: At boot time, hit the DEL, F2, F10 or Shift+F10 keys, depending on the make and model of the computer. Once in the BIOS, the menu system will have to be looked at to find the actual place for the settings. Usually there is a "Peripheral" menu.

2. Device Manager:

- Click on Start, Control Panel.
- If the top left-hand button says "Switch to Classic View", then click on it. Otherwise select "System" from the right-side screen. This opens the system Properties dialog box.
- Click on the hardware tab and then the Device Manager button. This opens the device manager dialog box.
- Click on View, Devices by Type.
- Find Ports and left-click on the + sign.
- Double click the LPT1 port.
- Click on the Port Settings Tab.
- Click the Legacy Box and the Use any Interrupt radio button.
- Click on OK to close the dialog boxes and Close the control panel.

3. Administrative Rights:

If the system is not set up for administrative rights, the system administrator will need to help make the change. If the computer is not on a company network, it is likely you have administrative rights. If the computer is on a company network, check with your computer department (Information Systems).

Setup (cont.)

Setting up a USB Connection

The ToolWare CD contains the USB drivers necessary to install the CIM (Controller Interface Module).

1. Turn on the computer.
2. Insert the CD in the CD drive.
3. Plug the USB cable into your computer's USB port or USB hub.
4. Follow the computer prompts to install new hardware. The location of the drivers will be on the CD in the driver's directory. After that, the CIM is installed.
5. Plug the network cable into the RJ45 connector on the CIM.
6. Run the setup.exe program located on the CD. This will install the ToolWare 2006 software onto your hard drive. If an earlier version of ToolWare is already installed on your system, it will not remove or overwrite the software. Instead, both versions will be installed. The old version can be uninstalled at any time.
7. Run ToolWare 2006 and click on File, Controller Connection. Set the connection to USB.

Setting up an Ethernet Connection

In order to use a computer and connect to an Evolution III controller, the controller must be configured for the same subnet as the computer. For example, the IP address of the controller is set to 200.200.200.191. If the computer is set to IP address 192.168.2.1, it will not connect. If the computer is set to 200.200.200.2, then it will work.

In addition, the physical connection between the two must also be made. It can be made by both pieces of equipment being connected through an Ethernet hub/switch, or by connecting the computer directly to the Ethernet port on the controller using an Ethernet crossover cable.

To Configure the IP Address of an XP computer:

1. Click on Start, Settings, Control Panel.
2. Click on Network Connections.
3. Find the appropriate connection (usually local connection) and double click.
4. Click on Properties.
5. Find TCP/IP in the small, white window and double click. **Note:** You may have to scroll through the list because it is usually the last entry.

To Configure the IP Address of an XP computer (cont.)

6. If an IP address already exists, make sure you write it down so you can change it back. If the radio box is set to obtain IP address automatically, change it to use the following IP address. Enter the appropriate address. In the example above it would be 200.200.200.2.
7. Set the subnet to 255.255.255.0.
8. Click on OK.
9. Click on OK in the next box.
10. Click on Close.
11. Close the Control Panel

To configure the IP address of an Evolution III controller:

There are two choices: 1) Connect a monitor, keyboard and mouse to the controller and perform the steps listed to configure an XP computer, or 2) Change the computer to match the controller's subnet as mentioned above and connect using Remote Desktop and then make the IP address change.

To connect to the controller using Remote Desktop:

If you have Windows 2000 you will need to use Terminal Services Client. If you have Windows XP, you can do the following:

Go to Start, All Programs, Accessories, Communications, Remote Desktop Connection. Enter the IP Address of the controller (200.200.200.191 is the default when it leaves AcraDyne). Click on Connect. You will be asked for a login and password. The login is evuser and the password should be left blank. You can then perform the same functions as above to change the IP address.

To use ToolWare via Ethernet:

1. Open ToolWare.
2. Go to File, Controller Connection.
3. Set up your IP address and Port information (Port 1100 by default).
4. Click on Connect.
5. Select DSP, View, Revision.
6. Do you see the DSP revision? If so, you are now connected through Ethernet.

Note: The following assumes you have access to the sysmon directory on the controller. Use Remote Desktop to create a share if it is not already set up.

Setting up an Ethernet Connection (cont.)

Use Excel to View your Rundowns:

1. Open Excel.
2. Use the Data menu.
3. Import External Data.
4. Import Data.
5. Select “Look In” and find your controller’s sysmondb.mdb file.
6. Finish.

Use Access to View your Rundowns:

Use the link function to link the sysmon table to your access database and view the data

Use Remote Desktop to Copy the File to a Local Hard Drive:

- When first starting Remote Desktop Connection, there is an Options button.
- Click on the Options button and another window will open. There will be a Resources tab.
- Click on the Resources tab.
- Under local devices, click Hard Drives.

This will list the local hard drives as well as the controllers’ hard drive in Windows Explorer on the remote system.

Use a Shared Drive to Copy Database:

Open Windows Explorer and either create a mapped drive or search for the controller in My Network Places. Look for the sysmon share. In the sysmon directory there is a file entitled SysMonDB.mdb. This is an access database with the rundown information stored in it. There is also a .txt file called Rundowns.txt that has the data collected in a comma delimited format.

Features

The following are descriptions of the menu items found in the ToolWare software.

File

Controller Connection

- Used to select between Parallel, USB, or Ethernet.

Login

- Login is not required for general access. On occasion when advanced features need to be accessed, a password will be given and entered here.

Exit

Tool

View

Cal Value

- Shows the current calibration value of the tool as well as the factory calibration.

Parameters

- Reads all the tool parameters and displays on the screen.

Eeprom Location

- Reads one eeprom location and displays it on the screen.

All Eeprom Locations

- Reads all eeprom locations and displays them in numerical order on the screen.

RPMs

- Only available if controller is running DSP Code Version 3.01 or higher.
- Performing this test will determine the actual RPM of the tool. **Note:** To test the max speed of the tool, set the tool's RPM Free Speed parameter to 100%.

Diagnostics

- Only available if controller is running DSP Code Version 3.01 or higher.
- Shows maximum torque the transducer can attain and the zero torque voltage level. This can be used to help determine if a tool has a transducer problem.

Monitor

Button States

- Tracks and displays the current state of the tool buttons and logic buttons (clockwise, center, counter-clockwise and trigger).

Write

Features (cont.)

Parameters

- Only available at technician level. Each tool has a special parameter file that defines the tool. Using this feature the parameter file can be transferred to the tool. Note: It must be an encrypted file.

Eeprom

- Only available at technician level. Writes a given value to a specific memory location in the tool ID board.

ID

- Only available at technician level. Used to write the serial number to the tool.

Tubenut

- Writes special features that are strictly for tubenut use.

LED States

- Turns the tool lights on, off, or flashes. Used for testing of tool.

Calibrate

Buttons

- After a tool has been worked on, it is possible the relationship between hall sensors and magnet have changed. Using the Tool Button Calibration screen calibrates the field strength between the two.

Tool

- Use this screen when calibrating the tool against an external torque measuring system. To begin calibration, click on the Manual Cal menu item and follow the instructions. Note: Be certain that Adaptive Control is turned off in the DSP before proceeding.

Reset Tool Calibration

- Resets tool calibration to factory default

Set Factory Calibration

- Only available at technician level. Writes current calibration into factory calibration position.

Encrypt File

- Only available at technician level. Creates a parameter file for programming the Tool ID board.

DSP

View

Parameters

- Displays the DSP Parameters on the screen

Eeprom Location

- Displays the value of only 1 eeprom location

DSP (cont.)

Revision

- Displays the current DSP revision

Write

Parameters

- There are several parameters listed in tabular form on the screen.

1. Tool Button Positions

- a. The light ring buttons can be redefined by writing to the “Button Map” parameter in the DSP eeprom.
- b. Each of the buttons on the light ring can be programmed as Fwd, Rev, Aux, or No Function.
- c. The condition of “no buttons” on the light ring can also be configured as Fwd, Rev, Aux, or No Function.
- d. Currently the Aux position has no function as far as the DSP is concerned and is only recognized by the programmable I/O.
- e. Programmable I/O must be programmed separately to match the button map.

2. CAN

Do not make any changes

3. Start Delay

When on, the transducer signal is ignored by the set number of milliseconds.

4. Rundown, Backoff, Rundown

- a. On initial rundown, the tool runs down until it sees the RBR first rundown torque parameter programmed in the DSP eeprom “RBR Rundown1 inlb” or the tool max torque.
- b. The tool will dwell in the down position for a period of time. The time “RBR Dwell Down ms” is adjustable in the DSP eeprom.
- c. The tool then backs off for a number of degrees (programmable in the DSP eeprom “RBR Backoff Deg”) at the backoff RPM. The backoff RPM is the same as the rundown RPM except when a 3000 tool is used with a doubler. In this case the backoff RPM is $\frac{1}{2}$ the rundown RPM.
- d. After backoff, the tool will dwell for a period of time, adjustable in the DSP eeprom “RBR Dwell Up ms”, then rundown a second time to target.
- e. In a Multiple, the first rundown will tighten to “RBR Rundown1 inlb”; the second rundown will stop at threshold for synchronization.
- f. A variation of the algorithm, Rundown-Backoff, can be enabled in ToolWare. When enabled, RB uses all of the same parameters as RBR.

DSP (cont.)

- i. In RB, the tool will Backoff to the value in DSP eeprom “RBR Backoff Deg” then stop and report the torque read at “RBR Backoff Deg”, and the final angle. If the tool does not reach the programmed Backoff angle, then no torque will display and a low angle indication will be given with the final angle.
 - ii. No plot information is collected in RB mode. In RBR, only the second rundown is collected for plotting.
 - iii. RB is just a truncated version of RBR with only basic functions, no hi/lo control limits are supported in the Backoff portion of RB.
5. Soft Start
Sets how the tool reacts during the soft start period
6. Multiple
When controllers are used in a multiple using an NSM module this feature should be turned on to ensure synchronization
7. Adaptive Control
 - a. Works with Torque Control and Torque Control/Angle Monitoring strategies.
 - b. Works with all configurations including Tube Nut and RBR.
 - c. In Rundown-Backoff-Rundown only takes the second rundown into adaptive calculations.
 - d. Two Modes of operation:
 - i. Adapt 10, the control target torque is adjusted by the difference between the mean of the first 10 rundowns and the hi/lo limit mean.
 - ii. Adapt All, the control target torque is adjusted by a percentage of the difference between the mean of each consecutive 10 rundowns and the hi/lo limit mean.
 - iii. The percentage adjustment is a variable parameter in the DSP eeprom “Adaptive Adjustment %”.
 - e. Enabling and mode selection is done by writing to the DSP eeprom parameter “Adaptive Control”.
 - f. In AutoCal, the sample count is stopped until all cal rundowns are done.
 - g. The Pset target reinitializes as the control target when: a new parameter set is loaded, when an DSP eeprom write is executed or defaults restored, when the controlling transducer is changed (tool or aux),
 - h. Samples used in adaptive calculations are limited to the torque high and low parameters.

8. Rehit Reject

- a. If enabled, Rehit Reject will stop the control if the angle of rotation between cycle complete torque and threshold torque is less than a certain number of degrees.
- b. The angle of rotation parameter “Rehit Reject Angle” is adjustable in the DSP eeprom.
- c. Enabling / disabling this function is done by programming the DSP eeprom parameter “Rehit Reject”.

9. Data Collection

Sets the number of points during data collection for use with Curvieware. There is no need to make any changes.

10. Tubenut

- a. The tubenut algorithm will run automatically when a tubenut wrench is detected by the DSP.
- b. Direction buttons on the light ring are ignored, the throttle is the only button recognized.
- c. SoftStart is automatically enabled when a tube nut wrench is detected.
- d. The tool will run down to target (torque or angle), and stop.
- e. When the throttle is released, the tool will reverse at the “Tube Nut Backoff RPM” (adjustable in the DSP eeprom) until the “Tnut Home inlb” torque is read (adjustable in the Tool ID eeprom).
- f. Once this torque has been reached, the tool will hold the wrench in the home position for a period of time “Tube Nut Dwell ms” (adjustable in the DSP eeprom) at the “Tnut Hold inlb” torque (adjustable in the Tool ID eeprom).
- g. The “Tnut Hold inlb” torque is an open loop torque value mathematically determined from tool parameters. This open loop value will always result in a somewhat lower torque and may need to be increased higher than the “Tnut Home inlb” torque.
- h. If at any time the tool is not in the home position, press and release the throttle and the tool will seek the home position.
- i. The tube nut algorithm can run in Pinch Safe mode. This mode is configured by writing to the Tool ID eeprom parameter “Tnut Pinch Safe”.
- j. “Tnut Pinch Safe” can operate in 2 modes. Stop on pinch (mode 2) or Auto Back off on pinch (mode 1).
 - i. In the first 70 degrees of rotation, the torque command is limited to the open loop torque calculated based on “Tnut Safe inlb”.

DSP (cont.)

- ii. If in the first 70 degrees of rotation the tool sees a torque higher than the “Tnut Safe inlb” parameter (adjustable in the TID eeprom), or the time is greater than the tube nut safe time (calculation shown below), or if a zero speed condition occurs, the tool will stop. If the tool is in STOP ON PINCH mode the tool will wait until the throttle is released. If the tool is in AUTO BACK OFF mode the tool will automatically attempt to return to the home position.
- iii. In Auto Back Off on pinch mode, the tool will attempt to back off until the throttle is released, or for minimum of “Tube Nut Dwell ms” if the throttle is released.
- iv. In Stop on pinch mode, upon releasing the throttle the tool will seek the home position normally.
- k. The tubenut safe time is the sum of the Softstart dwell time, the Softstart ramp time, and the “Tubenut Safe Time Lag”. These parameters are programmable and exist in the DSP eeprom.
- l. The DSP has a hard coded maximum limit of 45 inlb for “Tnut Home inlb”, “Tnut Hold inlb” & “Tnut Safe inlb”.
- m. Tubenut wrenches plugged into a controller set up as Multiples will cause an “Illegal Tool” fault.
- n. If a reverse control strategy is entered, the tube nut wrench will ignore the reverse and run the strategy type in the forward direction.

11. Transducer

Currently only internal transducers are being used so you can ignore this option

12. Misc.

When working with multiples or long rundown times it is possible the free rundown time may need to be adjusted. The other settings should be left alone.

Eeprom

Only available at technician level. Writes a value to a specific memory location in the DSP.

Reset to Defaults

Resets the DSP to its default state – Note: In DSP Version 3.00 and earlier this has Adaptive Control in the ON position and usually should be changed to OFF after a reset.

Socket Tray

Test

Allows operator to see sockets are pulled from socket tray

System

Collect All Settings

Allows the operator to download logic, parameter sets, eeprom locations and rundown information all from one location. The operator will be asked for a file name. All the files will reference that name with different extensions or simple name changes.

If the operator selects all checkboxes and uses a file name of NewFile the following files would be generated:

- NewFile.pst for parameter sets
- NewFile.lio or NewFile.plc depending on if they have 2002 or 2001 logic.
- NewFileDSPParms.txt for the DSP parameters
- NewFileToolParms.txt for the Tool Parameters
- NewFileToolEeprom.txt for the tool eeprom locations
- NewFileRundowns.txt for the rundown information. The rundown file will be broken down into sections for each parameter set.

View

Status

Rundown Data

- Reads the rundown data for 1 parameter set. This can be as many as 100 rundowns depending on the number of parameter sets set up in the controller and the last time the controller was reset.
- The data collected here can be saved to a file and used later in the Stats section

Parameter Sets

SCC Version

Monitor

Fault Codes

See "Troubleshooting" section for a description of fault codes

Rundowns

Reset All

Can be used to reset selected controller resets. Each item can be found on individual menus as well

Serial Out

Configures the optional serial port (Part No:21747) connected to the Spindle Card. There are three output choices.

Standard Output

Overall Cycle Pass or Fail, Torque Pass or Fail, Torque High Limit, Torque Low Limit, Torque Final, Angle Pass or Fail, Angle High Limit, Angle Low Limit, Angle Final, Carriage Return, Carriage Return
PP002400016000200P003600010000205

Socket Tray (cont.)

Profibus: “%CAN”, Current Parameter Set, Overall Cycle Pass or Fail, Torque Pass or Fail, Torque High Limit, Torque Low Limit, Torque Final, Angle Pass or Fail, Angle High Limit, Angle Low Limit, Angle Final, “NAC%”

%CAN1PP002400016000200P003600010000205NAC
%

This also allows parameter set selection through the serial port. If the following message is received, it will change the parameter set and send a response message:

%CAN41NAC% (Where 4 indicates message to change parameter set and 1 indicates which parameter set to select)

%CAN8FNAC% is the return message indicating the parameter has been changed, where the 8 is the msg indicator and the F represents the parameter set currently selected in the controller.

Standard Output
w/LF and PSET:

Overall Cycle Pass or Fail, Torque Pass or Fail, Torque High Limit, Torque Low Limit, Torque Final, Angle Pass or Fail, Angle High Limit, Angle Low Limit, Angle Final, Pset, Carriage Return, Line Feed

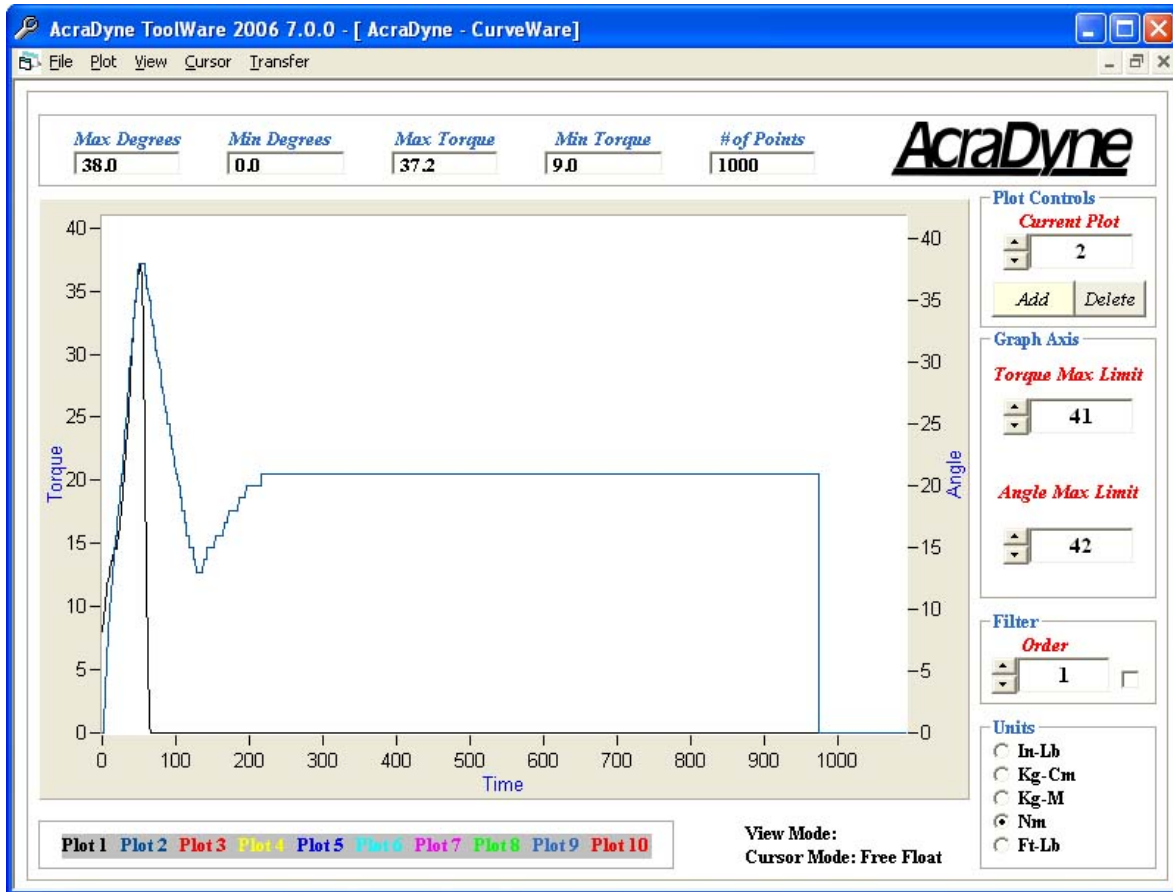
PP002400016000200P0036000100002051

Change Password

Temporary Password

An AcraDyne technician or an AIMCO sales rep can create a temporary password to give to a customer. This password will be valid for the day it is given. This can be used when a customer needs to access technical areas on a temporary basis. It is based on the calendar date and will be valid until midnight of that date.

Curvieware



Curvieware reads the last rundown out of the controller and graphs it. The information is stored in RAM and therefore if the controller is turned off the rundown is erased.

Menu Selections:

File

Load Curve

Loads a previously saved plot into the graph area

Load Collection

Loads a group of plots previously saved under 1 name

Save Collection

Saves a group of plots under 1 name

Plot

Add

Adds a plot from a file to plots currently in the graph area

Delete

Removes the selected plot from the graph area and re-numbers existing plots.

View

Zoom

Pan

Zoom Out

Auto Scale

Curvieware (cont.)

Cursor

Cursor On

Mode

Free Float

Snap

Transfer

Receive

Tool Tq Curve

Pull torque data from the controller. Start by first setting the number of data points (1000 by default – Maximum of 4000). Once selected a file name is required to save the data for later retrieval if interested.

Aux Transducer Tq

Used by AcraDyne Technicians

Angle

Pull Angle data from the controller. Start by first setting the number of data points (1,000 by default - Maximum of 4,000). Once selected a file name

Other Screen Items:

Min/Max Degrees

Lists the minimum and maximum degrees shown in the graph area

Min/Max Torque

Lists the minimum and maximum torque shown in the graph area

Number of Points

The number of data points retrieved from the controller. The maximum is 4000

Current Plot – Add/Delete

Add

Adds a plot from a file to plots currently in the graph area

Delete

Removes the selected plot from the graph area and re-numbers existing plots.

Torque Max Limit

Sets the Y Axis scale for torque

Angle Max Limit

Sets the Y Axis scale for angle

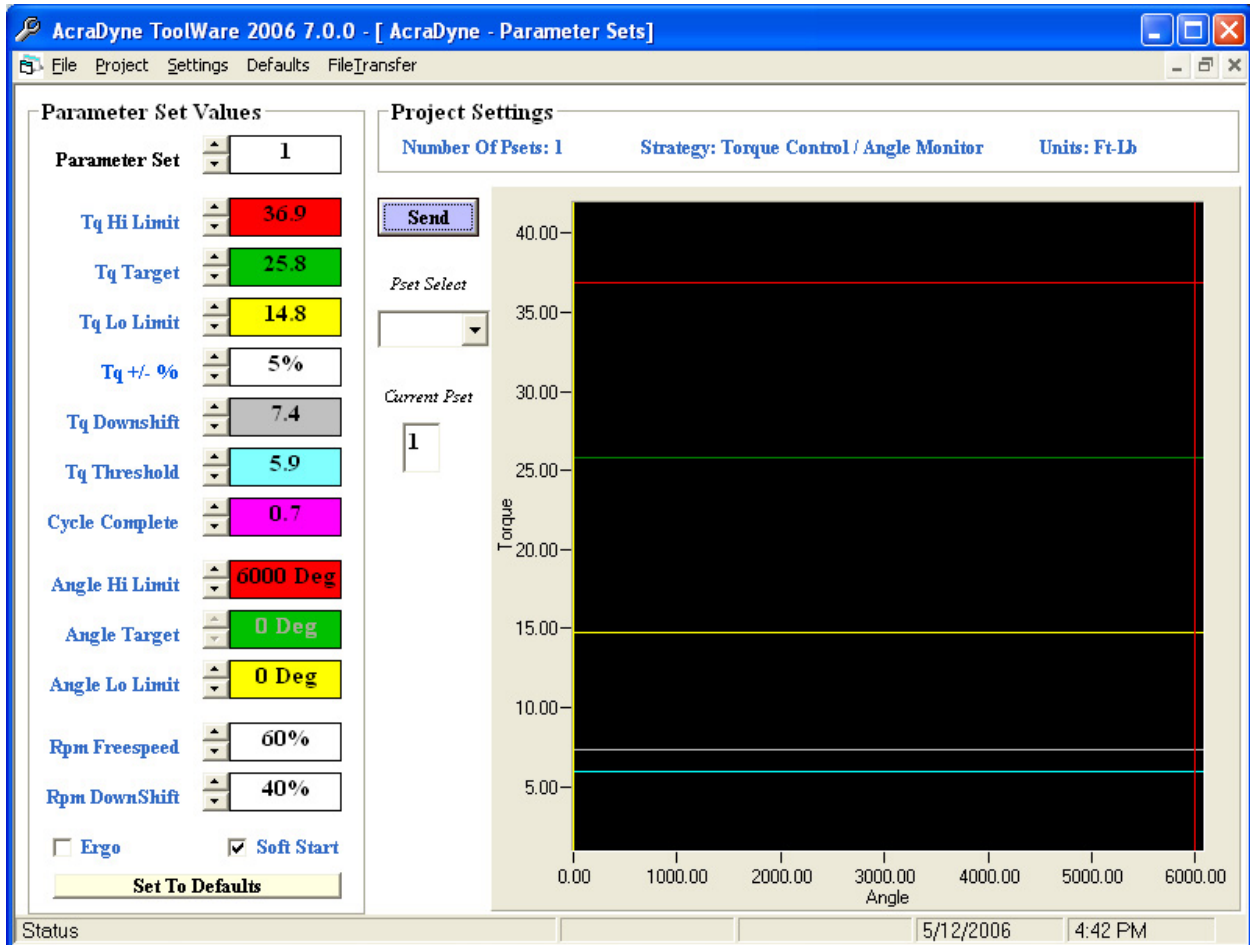
Filter

Currently has no affect

Units

Used to change the left Y axis unit of measure

Parameter Sets



File

New Project

Starts a new set of parameter sets

Load Project

Loads a set of parameter sets previously saved

Save Project

Saves the current group of parameter sets to a file

Exit

Exits parameter sets and returns to the main program

Project

Parameter Sets

Add Parameter Set

Adds a parameter set to the group of parameter sets up to a maximum of 8

Remove Parameter Set

Removes the parameter set currently listed in the window

Parameter Sets (cont.)

Curve

Load

Loads a previously saved curve into the parameter set graphing window

Strategy

Torque Control

Only uses torque to control the tool

Torque Control / Angle Monitoring

Uses torque to control the tool but will give an indicator and stop if the maximum angle is exceeded.

Torque Monitoring / Angle Control

Controls the tool based on Angle after threshold is reached

Torque Control / Angle Control

Uses both Torque and Angle to control the tool. As long as either torque or angle is reached and the other reading is within the high/low range the cycle will complete.

NOTE: Reverse strategies are the same as the forward strategies but running the tool in counter-clockwise rotation

Rev. Torque Control

Rev. Torque Control / Angle Monitoring

Rev. Torque Monitoring / Angle Control

Rev. Torque Control / Angle Control

Defaults

Sets the default values used when creating a new parameter set. Also sets the default unit of measure. To set the unit of measure, click on Defaults and then pick the unit of measure you wish to use. Click on Exit to set the local screen. You then need to reload your parameters by loading a file or downloading from the controller in order to show the values correctly.

File Transfer

Send

Transmits the current parameters from your ToolWare screen to the controller. It does not matter what parameter set you have selected, the controller will switch to parameter set 1 after all parameter sets have been loaded.

Receive

Allows you to copy the parameter sets from a controller to the working area of ToolWare. This does not make a copy on the computer. You need to use File, Save As to save it to the computer.

Reset to Factory Defaults

Resets the controller's parameters to the factory settings.

Parameter Set Notes:

Unit of Measure	_____	_____	_____	_____
Torque High Limit	_____	_____	_____	_____
Torque Target	_____	_____	_____	_____
Torque Minimum	_____	_____	_____	_____
Torque Downshift	_____	_____	_____	_____
Torque Threshold	_____	_____	_____	_____
Cycle Complete	_____	_____	_____	_____
Angle High Limit	_____	_____	_____	_____
Angle Target	_____	_____	_____	_____
Angle Low Limit	_____	_____	_____	_____
RPM Freespeed	_____	_____	_____	_____
RPM Downshift	_____	_____	_____	_____
Ergo Mode?	_____	_____	_____	_____
Soft Start?	_____	_____	_____	_____

Unit of Measure	_____	_____	_____	_____
Torque High Limit	_____	_____	_____	_____
Torque Target	_____	_____	_____	_____
Torque Minimum	_____	_____	_____	_____
Torque Downshift	_____	_____	_____	_____
Torque Threshold	_____	_____	_____	_____
Cycle Complete	_____	_____	_____	_____
Angle High Limit	_____	_____	_____	_____
Angle Target	_____	_____	_____	_____
Angle Low Limit	_____	_____	_____	_____
RPM Freespeed	_____	_____	_____	_____
RPM Downshift	_____	_____	_____	_____
Ergo Mode?	_____	_____	_____	_____
Soft Start?	_____	_____	_____	_____

Clear Rundown Information

Clears any rundowns stored in the spindle card of the controller. If the controller is an Evolution III this will not clear the rundowns stored on the hard drive. This also occurs when a parameter has been changed and uploaded to the controller.

Creating Multiple Parameter Sets

Selecting “Projects – Parameter Sets” you can Add or Remove parameter sets

Setting Strategy

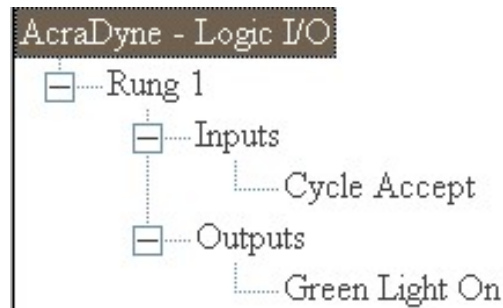
After selecting a parameter set by using the up or down arrows select “Strategy” and then pick the strategy you wish to use. Strategies are assigned per parameter set. For example, parameter set 1 can be Torque Control while parameter set 2 can be Torque Control/Angle Monitoring.

Logic I/O 2001 and 2002

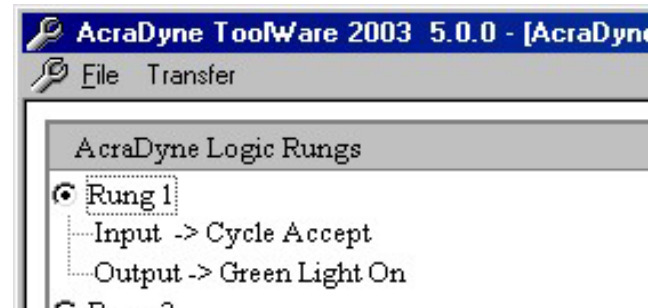
The Logic I/O section of ToolWare allows the user to interface with external equipment. The controller comes with default settings to handle most applications, but these can be changed to accommodate more demanding situations. A basic knowledge of ladder logic is extremely useful when programming the Logic I/O. There are two versions of Logic I/O in ToolWare 2006. The major differences between Version 2001 and 2002 are the addition of "OR" statements and a different interface layout in 2002.

The basic concept of the Logic I/O is based on a system of inputs and outputs. For a given state of an input, the state of an output can be changed. Let's look at a few examples:

VERSION 2001



VERSION 2002

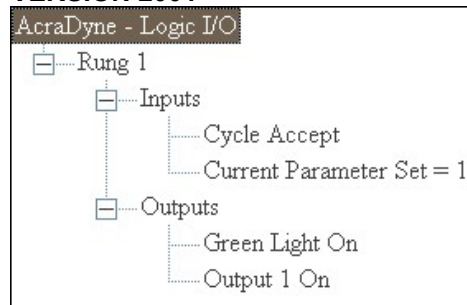


Example of one basic rung in the Logic I/O 2001 and Logic I/O 2002.

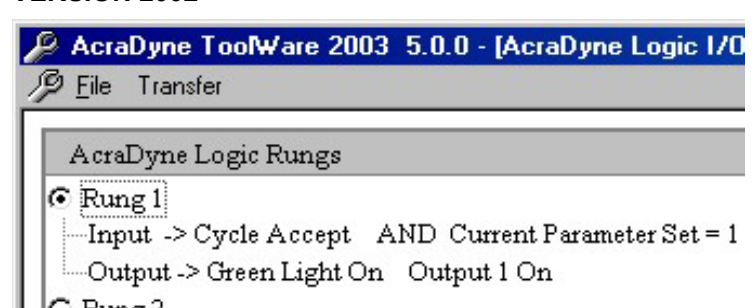
In the examples above we have one rung of logic. Each rung contains one set of inputs that control one set of outputs. Each rung in a program is analyzed completely independent from all other rungs. Therefore; for this rung, any time a cycle is accepted (all operating parameters were performed within specified limits) the green light on the tool is illuminated.

It is also possible to have multiple inputs and outputs in a single rung. An example of multiple inputs and outputs is shown below.

VERSION 2001



VERSION 2002



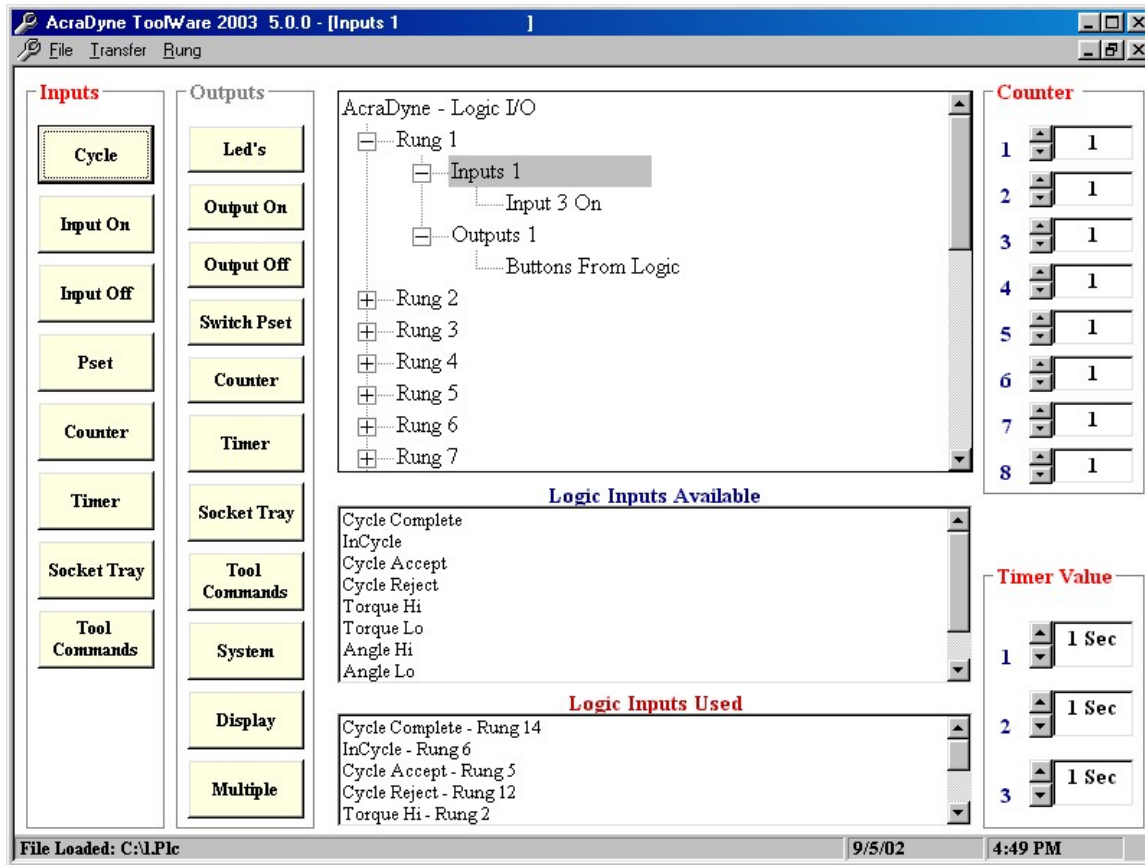
Example of a more complex rung using Logic I/O version 2001 and Version 2002

In the above example two input conditions must be met before the output conditions are performed. The tool must perform an accepted cycle **and** must be operating in parameter set 1. In the ToolWare program if more than one input situation is used, all must be true before the output conditions will be performed. Therefore, if the tool performed an

Logic I/O 2001 and 2002 (cont.)

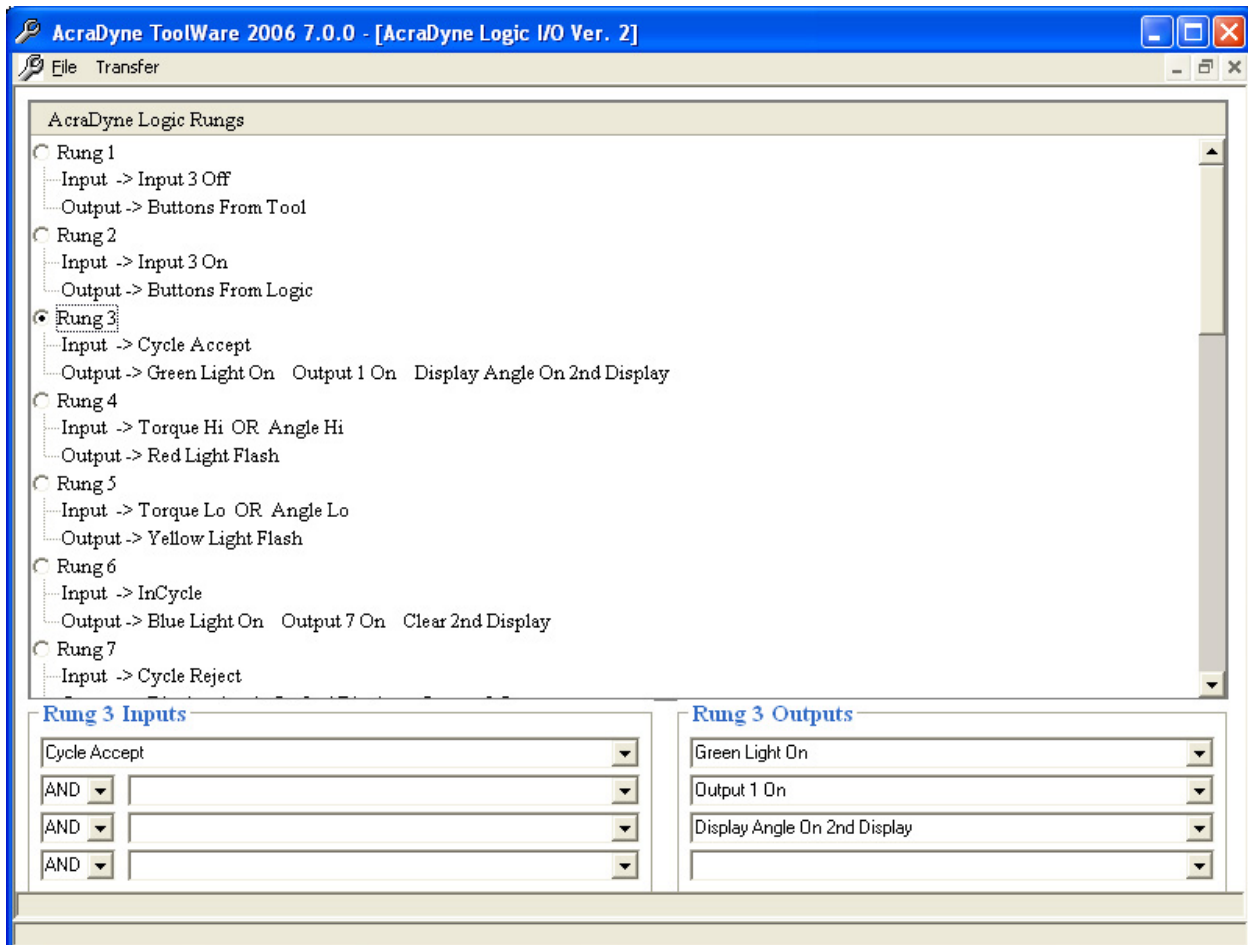
accepted rundown but was operating in parameter set 2, the output conditions would not be executed. When both input conditions are met both output conditions are done. So in this example, the green indicator lights would turn on and output 1 would become active.

There are 12 outputs and 12 inputs on the logic interface board of the Evolution II or higher controllers. The outputs are capable of supplying +24 VDC @ 4 amps overall maximum and can be wired either normally open or normally closed. The inputs operate on a +24 VDC signal.



The Logic I/O section of ToolWare Version 2001 (above) and Version 2002 (next)

Logic I/O 2001 and 2002 (cont.)



The Logic I/O screen contains several key areas. On the far left-hand side we have input conditions and output conditions. The top-center area contains the logic program. On the far right-hand side are the adjustments for timers and counters. The bottom-center area contains sections for logic outputs available and logic outputs used. Let's look at each of these areas in detail.

LOGIC INPUT CONDITIONS

ToolWare contains a large array of input conditions. Inputs are separated into 8 categories.

Cycle – Refers to any condition after the tool has completed a fastening cycle. Examples include high torque, low torque, high angle, etc.

Pset – Refers to the current operating parameter set of the tool. There are 8 parameter sets standard on all Evolution controllers.

Input On – Used in conjunction with the 12 user inputs on the logic I/O card of the Evolution controller. The input condition will be true any time +24VDC is present on the selected input. (Normally Open)

Logic I/O 2001 and 2002 (cont.)

Input Off – Also used in conjunction with the 12 user inputs on the logic I/O card of the Evolution controller. The input condition will be true any time there is no voltage present on the selected input. (Normally Closed)

Counter – Refers to 1 of the 8 available internal counters in the ToolWare program. Counters will be true when the number of counts is equal to or greater than the user selected number. This feature is commonly used with cycle accept to count fasteners in a work cell.

Timer – Refers to 1 of 3 available internal timers. Timers have 2 different input options. Timer complete becomes true only when the timer has reached the user set timer value. Timer on and not complete is true only during the time it takes to reach the user set value.

Socket Tray – Socket tray options are used in conjunction with an optional external socket tray. The socket tray contains various internal led's that can be used to walk the operator through complex tightening patterns or repair procedures.

System – Used to indicate when there is a system fault, which prevents the tool from operating.

Tool Commands – Becomes true when a tool is in a specific operational direction. For example when the tool is in forward, reverse or the auxiliary position.

LOGIC OUTPUT CONDITIONS

ToolWare also contains a large array of output conditions. Outputs are separated into 10 categories.

LEDs – Controls the operation of the tool and controller led's. There are 4 LEDs: green, yellow, red and blue. Led's can be set to either be constant on or flash.

Switch Pset – Allows for the automatic changing from one parameter set to another.

Output ON – Used in conjunction with the 12 user outputs on the logic I/O card of the Evolution controller. The output will become active once the input conditions are met. (Normally Open)

Output OFF – Also used in conjunction with the 12 user outputs on the logic I/O card of the Evolution controller. The output will become inactive once the input conditions are met. (Normally Closed)

Counter – Counters have 2 possible operations. When the input condition becomes true you can either increment the counter or reset the counter to 0.

Timer – Similar to counters, timers have 2 possible operations. When the input conditions are met a timer can either be started or reset to 0. Timers do not automatically reset to 0 once the input condition becomes false; they must be reset to 0.

Logic I/O 2001 and 2002 (cont.)

Socket Tray – Socket tray options are used in conjunction with an optional external socket tray. The socket tray contains various internal led's that can be used to walk the operator through complex tightening patterns or repair procedures.

Tool Commands – Allow for remote operation of the tool. It is important to note that the tool buttons must be disabled in order to use the remote operation features. Also, a tool direction (forward or reverse) must be sent before the enable (run) tool function is sent.

Display – Allows for the programmer to set the functionality of the second red segment display found on all Evolution controllers. The default selection is to display rotational angle on the second display.

System – Enables various special applications. For example, enabling various network communication protocols.



Second display

Illustration of the second display on the Evolution controller

CREATING LOGIC PROGRAMS

By using the file pull-down menu you can create and save logic programs. Once these files are created they can be sent to the controller by using the Transfer pull-down menu. The Transfer menu allows you to send new programs to the controller and receive the existing program from the controller. Additionally, the reset defaults option can be used to return the logic section of the controller to the original settings.

There are 2 methods to create logic programs. The easiest method is to receive the factory default settings from the controller and modify this program. The other option is to start a program from scratch.

To add a rung to a program press the blue circle with the white (+) inscribed. This will display a new rung (for new programs you have to click AcraDyne Logic I/O portion at the top-center portion of the screen to view the new rung). By pressing the (+) in the box in front of Rung 1 the rung will expand to show both an input and output section. By highlighting the input portion of the rung the input icons to the left become active. By highlighting the output portion of the rung the output icons to the left become active.

With the input icons active, clicking on any of the 8 categories will tell you which logic inputs you have available for use. By double clicking the desired input situation it will be placed in the input portion of the current rung. A (+) will appear in front of the input text when it has been chosen. By clicking the (+) the input rung can be expanded to show all input criteria for a given rung. Remember that all input criteria must be triggered to trigger the output events. Selection for output criteria works the same as input criteria.

By double clicking on the Rung text you can rename the rung. This is particularly useful in long programs to keep work organized. Also, if it is necessary to change either input or output criteria they can be removed by highlighting and then pressing the (x) located on the top toolbar. Entire rungs cannot be deleted, but empty rungs do not effect operation.

Logic I/O 2001 and 2002 (cont.)

When returning the controller to factory defaults the current settings are as follows:

<u>OUTPUTS</u>		<u>INPUTS</u>	
RELAY 1	CYCLE ACCEPT	INPUT 1	TOOL FORWARD
RELAY 2	CYCLE REJECT	INPUT 2	TOOL REVERSE
RELAY 7	IN CYCLE	INPUT 3	DISABLE TOOL
		INPUT 4	TRIGGER

There are some special points to remember when programming the logic I/O:

- The same input can be used in more than one different rung.
- An output can only be used in one rung.
- When using timers and counters the preset values for number of counts and using the icons located on the right-hand side of the screen can change time.
- Timers and counters must be reset.
- When using remote start you must first disable tool buttons, then select the direction of rotation and lastly send the start command.
- The controller can always be set to factor default settings by choosing Transfer → Factory Defaults.
- Outputs can be wired and programmed as either normally open or normally closed.
- It is important not to have conflicting I/O statements, especially when programming the tool lights. For example, having two rungs, one of which is turning a light on while the second is trying to turn the same light off.
- The I/O is intended to be used only to enhance the ability to interface with the nutrunning system. It is not intended to control non-nutrunning equipment or to function as a line PLC.

Menu Items in Logic I/O 2002:

File

New

Starts a new logic program from scratch with no information in the rungs

Save

Saves the logic listed in the rungs to a file for later retrieval.

Open

Retrieves Logic File previously saved. Opening the file only opens the file in the ToolWare screen and does not load the file into the controller. Use Transfer - Send to send to the controller.

Print

Transfers the rung information into Notepad making it available to print

Exit

Exits Logic I/O and returns to main program

Transfer

Send

Sends the logic from the ToolWare screen to the controller

Receive

Receives the logic currently in the controller and displays it in the ToolWare screen

Reset To Factory Defaults

Resets the logic in the controller to the factory defaults

Logic I/O NOTES:

Stats

From the stats menu the user can view the statistics from any stored rundown data file. The statistics consist of population, mean, Cp, Cpk, 6Sigma, range, max torque, and min torque. There are two charts on the stats screen: a histogram and x bar chart. The equations used are as follows:

POP

Population; The total number of observations used to calculate the statistical data

CPK

Process capability which takes both sigma and mean into account

The equation for CPK is the smaller of:

$$(\text{Upper Limit} - \text{Mean}) / 3 \text{ Sigma } \textit{or} (\text{Mean} - \text{Lower Limit}) / 3 \text{ Sigma}$$

CP

Overall capability which is the ratio of 6 sigma to the tolerance

The equation for CP is:

$$(\text{Upper Limit} - \text{Lower Limit}) / 6 \text{ Sigma}$$

6 Sigma

The standard deviation multiplied by 6. A total range of 6 sigma will include 99.7% of all data. The equation for 6 sigma is as follows:

$$\sqrt{\frac{n \sum x^2 - (\sum x)^2}{n(n-1)}}$$

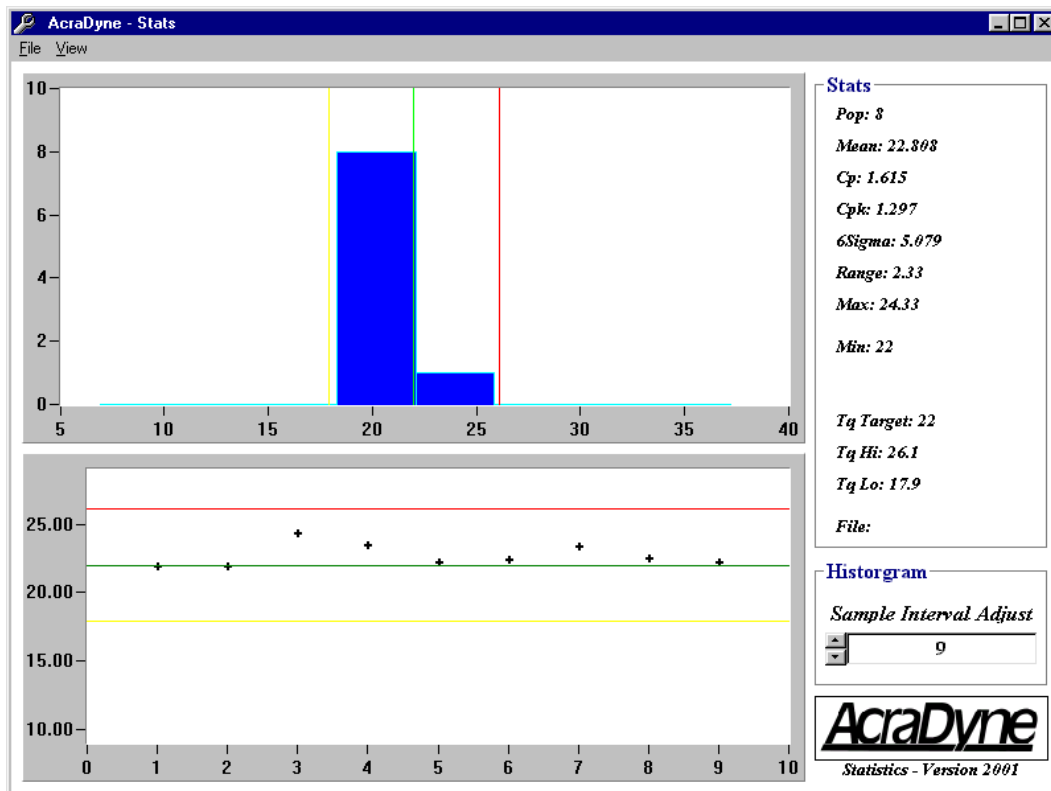
/X

X-Bar; Mean; (Sum of All Readings) / (Number of Readings)

R

Range; The difference between the maximum and minimum reading

Stats (cont.)



File

Load – Allows the user to load a data file. Data files are saved in the data transfer - store to file section of ToolWare. Stats will only work with data files that are saved via ToolWare.

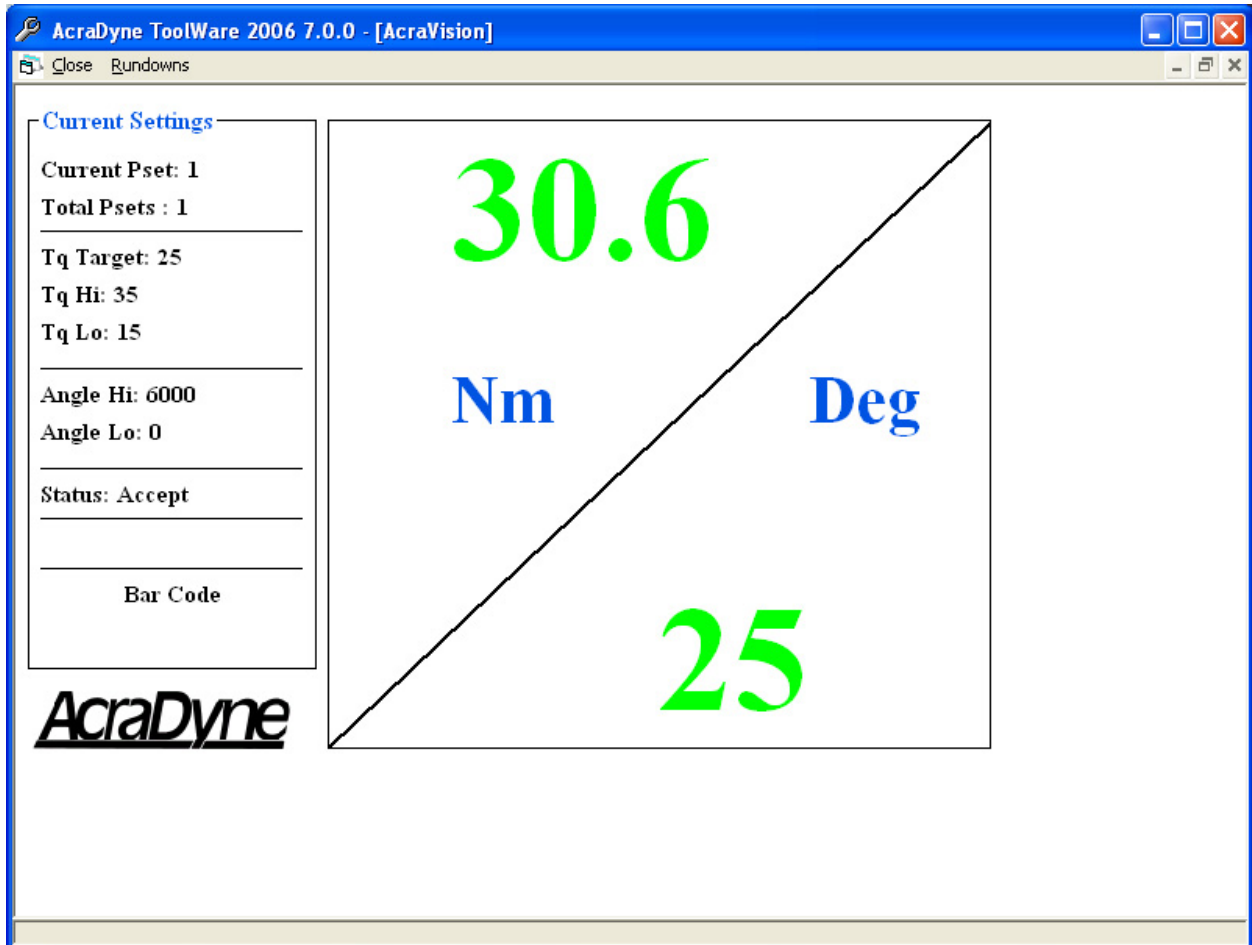
Save – Allows the user to save a statistical file.

Print – Allows the user to print the statistical data.

View

Data File - The Data File option allows the user to view the rundown data, which was used to generate statistical data, in notepad a format.

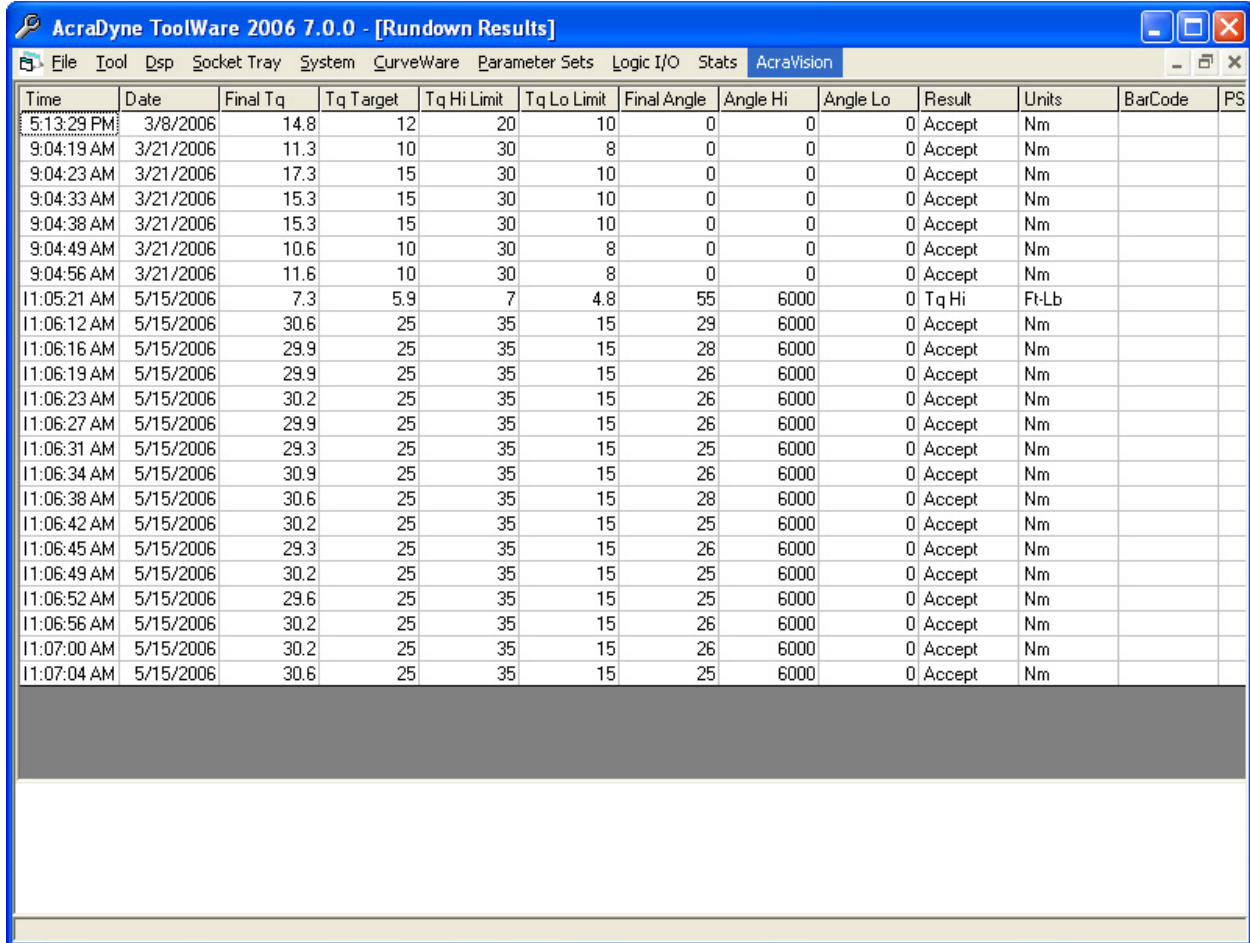
AcraVision



AcraVision displays the current rundown information in an easy-to-read screen.

AcraVision (cont.)

Using the Rundowns menu item, any rundowns recorded on the AcraVision screen can be displayed in a columnar format. The information is also available in a .txt file in the program files/toolware2006 directory.



The screenshot shows the AcraVision software window titled "AcraDyne ToolWare 2006 7.0.0 - [Rundown Results]". The window contains a table with 13 columns: Time, Date, Final Tq, Tq Target, Tq Hi Limit, Tq Lo Limit, Final Angle, Angle Hi, Angle Lo, Result, Units, BarCode, and PS. The table lists 20 rows of data, including times, dates, torque values, and results. The results are mostly "Accept", with one "Tq Hi" result at 11:05:21 AM. The units are "Nm" for most entries and "Ft-Lb" for the "Tq Hi" entry.

Time	Date	Final Tq	Tq Target	Tq Hi Limit	Tq Lo Limit	Final Angle	Angle Hi	Angle Lo	Result	Units	BarCode	PS
5:13:29 PM	3/8/2006	14.8	12	20	10	0	0	0	Accept	Nm		
9:04:19 AM	3/21/2006	11.3	10	30	8	0	0	0	Accept	Nm		
9:04:23 AM	3/21/2006	17.3	15	30	10	0	0	0	Accept	Nm		
9:04:33 AM	3/21/2006	15.3	15	30	10	0	0	0	Accept	Nm		
9:04:38 AM	3/21/2006	15.3	15	30	10	0	0	0	Accept	Nm		
9:04:49 AM	3/21/2006	10.6	10	30	8	0	0	0	Accept	Nm		
9:04:56 AM	3/21/2006	11.6	10	30	8	0	0	0	Accept	Nm		
11:05:21 AM	5/15/2006	7.3	5.9	7	4.8	55	6000	0	Tq Hi	Ft-Lb		
11:06:12 AM	5/15/2006	30.6	25	35	15	29	6000	0	Accept	Nm		
11:06:16 AM	5/15/2006	29.9	25	35	15	28	6000	0	Accept	Nm		
11:06:19 AM	5/15/2006	29.9	25	35	15	26	6000	0	Accept	Nm		
11:06:23 AM	5/15/2006	30.2	25	35	15	26	6000	0	Accept	Nm		
11:06:27 AM	5/15/2006	29.9	25	35	15	26	6000	0	Accept	Nm		
11:06:31 AM	5/15/2006	29.3	25	35	15	25	6000	0	Accept	Nm		
11:06:34 AM	5/15/2006	30.9	25	35	15	26	6000	0	Accept	Nm		
11:06:38 AM	5/15/2006	30.6	25	35	15	28	6000	0	Accept	Nm		
11:06:42 AM	5/15/2006	30.2	25	35	15	25	6000	0	Accept	Nm		
11:06:45 AM	5/15/2006	29.3	25	35	15	26	6000	0	Accept	Nm		
11:06:49 AM	5/15/2006	30.2	25	35	15	25	6000	0	Accept	Nm		
11:06:52 AM	5/15/2006	29.6	25	35	15	25	6000	0	Accept	Nm		
11:06:56 AM	5/15/2006	30.2	25	35	15	26	6000	0	Accept	Nm		
11:07:00 AM	5/15/2006	30.2	25	35	15	26	6000	0	Accept	Nm		
11:07:04 AM	5/15/2006	30.6	25	35	15	25	6000	0	Accept	Nm		

Updated features from ToolWare V6.0.3 and ToolWare V7.0.0

Starting with opening ToolWare, the login screen does not automatically open. ToolWare now assumes user mode unless someone logs in.

File, Controller Connection:

- Added USB as an option.
- When selecting parallel or USB, it is possible you will need to close the program and start it again to initiate the drivers.
- Earlier problem when selecting Parallel the message "Not Connected" did not go away. It will now disappear.

File, Login

- Certain advanced features are only available if you are logged in.

Tool, Write, Eeprom

- Instead of disappearing after each write, it stays open and increments the Eeprom address.

Tool, View, RPMs

- Only available if Controller is running DSP Code Version 3.01 or higher.
- Performing this test will determine the actual RPM of the tool. Note: To test the max speed of the tool, set the tool's free speed parameter to 100%.

Tool, View, Diag

- Shows maximum torque the transducer can attain and the zero torque voltage level. This can be used to help determine if a tool has a transducer problem.

Tool, Calibrate, Reset Tool Calibration

- This feature is the same as on the KDM to reset tool back to factory calibration.

DSP, Write, Parameters - Rundown Backoff

- Available in DSP Version 3.01 Backoff degrees has been increased to 6000

System, View SCC Version

- Added to collect the current Eeprom revision information.

System, Reset All

- Allows operator to reset Parameters, Logic I/O, DSP and Tool Cal from one screen.
- Each item is individually selectable.

System, Collect All Settings

- Added to the System Menu for downloading logic, parameter sets, eeprom locations, and rundown information all from one location.

Updated features from ToolWare V6.0.3 and ToolWare V7.0.0 (cont.)

System, Serial Out

- Has been modified depending on the Eeprom version to select which style of serial data is transmitted through the optional serial port. 1=Original Output, 2=Output used for Profibus, and 3=Original output with a carriage return/line feed instead of two carriage returns at the end of the line. It also has an added byte representing the parameter set.
- Note: Profibus selection can be used without the Profibus card and will also allow for the selection of parameter set through the optional serial port. If interested, contact AcraDyne for more detailed instructions.

System, Temporary Password

- If user is logged on as a technician, (using the password option) this will be available.
- Temporary password will be generated and good only for that day.
- Technicians and Sales Representatives will use this when working with customers. They should not be getting into eeprom locations and some other sensitive areas. However, at times we need them to be our eyes and hands. In these cases they can be issued a temporary password that will allow them to do all the functions necessary to collect data and will expire so as to maintain security.

Curveware

- Removed the DataLogger reference.
- Added a second Y axis on the right side of the graph to represent degrees.
- Removed the screen asking for number of samples.
- Number of samples will now be collected based on “# of Points” text box.
- Torque Max Limit Manual Selection.
- Degree Max Limit Manual Selection.

Logic I/O

- When starting Logic I/O it checks to see which logic version internally and opens the appropriate logic screen.

AcraVision, Rundowns

- AcraVision now stores rundowns in a text file on the hard drive of the computer running ToolWare.
- These are viewable and can be reset in the AcraVision screen.

Troubleshooting

Fault Description:

TID Timeout: No communication between the tool and controller. This fault condition is usually caused by a problem in the tool ID board. Try connecting another tool to the controller.

Tool GND: The tool ground loop is broken. This fault condition is usually caused by a problem in the controller. Try the tool and cable on another controller. This fault can be intermittent.

Power on Throttle: The system thinks that the tool throttle is being activated or the run command through logic I/O is turned on. You can verify this by monitoring the tool buttons in ToolWare. Make sure that the throttle is returning home completely after being released. Determine that the I/O wiring is correct and the run command is not always active. It might be necessary to recalibrate the trigger using ToolWare.

Button Timeout: The button signals from the tool are not being received by the controller in a certain amount of time. Try connecting another tool to the system.

Button State: An illegal light ring state has occurred. Two or more direction halls are enabled. You can verify this by monitoring buttons using ToolWare. Try recalibrating the buttons using ToolWare (CW, Center, and CCW). This can be an intermittent problem when using a 220V controller and long tool cables.

Undefined Voltage: Either the controller voltage configuration or the tool voltage parameter are undefined. Try the tool on another system.

Incompatible Voltage: The controller is not compatible with the tool.

Illegal tool: A tubenut tool is connected to a system setup for multiples.

Free Run Timeout: The tool has run for a period of time before seeing the threshold torque. The throttle must be released and pressed again before the tool will run again. This time is adjustable using ToolWare. The default value is 5 seconds.

Troubleshooting (cont.)

Load Run Timeout: The tool has run for a period of time after seeing the threshold torque. The throttle must be released and pressed again before the tool will run again. This time is adjustable using ToolWare. The default value is 15 seconds.

Hall Error: The motor hall sensors (for commutation) have achieved an illegal state a specific number of times. If the tool does not run at all or the square drive has to be rotated before the tool will run the motor is probably damaged. Run this tool on a different controller to determine where the problem lies. If the tool always runs for a period of time before the error occurs it may be necessary to disable the hall error using ToolWare. This error is more noticeable when running 3000 series tools on 220V with long tool cables.

Tool Offset: Based on the offset value of the transducer during re-zero and the tool cal value, the tool cannot mathematically reach the target torque. This problem can occur if the cal value has been drastically changed and the target torque is near the max torque of the tool. Try resetting the cal value to defaults and calibrating the tool using an approved rotary transducer.

Tool Level: The tool transducer output voltage has exceeded the maximum or minimum allowable value. Try the tool on another system.

Locked Rotor: The controller has not sensed hall transitions from the motor for a period of time. This is possible if the tool is trying to achieve a high torque at a low speed. Increase the rundown speeds and make sure the tool is calibrated properly. It is also possible that the controller is faulty. If the tool does not run at all try connecting it to a different controller.

Drive Fault: The servo drive is not trying to run the tool. Try the tool on another controller.

Pset Value: An illegal rundown parameter set has been sent to the controller. Try resetting the parameter sets back to defaults.

Troubleshooting (cont.)

MCU Parameter: The controller did not receive the entire parameter set from the KDM or ToolWare. Try resending the parameter set.

TID Parameter Value: The tool sent an illegal parameter to the controller. Try cycling power to the system. Also, try the tool on another system.

TID Parameter Timeout: The tool did not respond to a requested parameter for a period of time. Try cycling power to the system. Also, try the tool on another system.

Target Value Fault: The target torque is set higher than the capacity of the tool.

Collect Overrun: During the fastening sequence, the number of storage points for plotting has been exceeded and the earliest data will be overwritten. This will only affect the plotting of the torque curve.

No Direction Hall: The tool was told to start running either from the throttle or through logic I/O but it wasn't told what direction to go. Use ToolWare to monitor the buttons. Make sure the wiring to the I/O is correct if running the tool remotely.

Xdcr Level: The tool transducer output voltage has exceeded the maximum or minimum allowable level.

SCC Eeprom Value: A parameter being written to the SCC is beyond the legal range.

Sample Logic

Batch Counting

----- RUNG #1 -----

Input -> Input 3 Off

Output -> Buttons From Tool

----- RUNG #2 -----

Input -> Input 3 On

Output -> Buttons From Logic

----- RUNG #3 -----

Input -> Cycle Accept

Output -> Output 1 On & Display Counter 1 Count & Timer 1 Start (3 Sec) & Green Light On

----- RUNG #4 -----

Input -> Torque Hi OR Angle Hi

Output -> Red Light Flash

----- RUNG #5 -----

Input -> Torque Lo OR Angle Lo

Output -> Yellow Light Flash

----- RUNG #6 -----

Input -> InCycle

Output -> Timer 1 Clear & Clear 2nd Display & Output 7 On

----- RUNG #7 -----

Input -> Cycle Reject

Output -> Display Counter 1 Count & Output 2 On

Batch Counting (cont.)

----- RUNG #8 -----

Input -> Timer 1 On AND Not Complete

Output -> Increase Counter 1

----- RUNG #9 -----

Input -> Counter 1 = 2

Output -> Timer 2 Clear & Timer 2 Start (3 Sec)

----- RUNG #10 -----

Input -> Timer 2 On AND Not Complete

Output -> Reset Counter 1 & Output 3 On & Blue Light On & Display Counter 1 Count

Turning an Output on for a Short Duration then Turning it Back off (One-Shot)

----- RUNG #1 -----

Input -> Input 3 Off

Output -> Buttons From Tool

----- RUNG #2 -----

Input -> Input 3 On

Output -> Buttons From Logic

----- RUNG #3 -----

Input -> Cycle Accept

Output -> Timer 1 Start (3 Sec) & Display Angle On 2nd Display

----- RUNG #4 -----

Input -> Torque Hi OR Angle Hi

Output -> Red Light Flash

Turning an output on (cont.)

----- RUNG #5 -----

Input -> Torque Lo OR Angle Lo

Output -> Yellow Light Flash

----- RUNG #6 -----

Input -> InCycle

Output -> Blue Light On & Output 7 On & Clear 2nd Display & Timer 1 Clear

----- RUNG #7 -----

Input -> Cycle Reject

Output -> Display Angle On 2nd Display & Output 2 On

----- RUNG #8 -----

Input -> Timer 1 On AND Not Complete

Output -> Green Light On & Output 1 On

Changing Parameter Sets

----- RUNG #1 -----

Input -> Input 3 Off

Output -> Buttons From Tool

----- RUNG #2 -----

Input -> Input 3 On

Output -> Buttons From Logic

----- RUNG #3 -----

Input -> Cycle Accept

Output -> Green Light On & Output 1 On & Display Angle On 2nd Display

----- RUNG #4 -----

Input -> Torque Hi OR Angle Hi

Output -> Red Light Flash

Changing Parameter Sets (cont.)

----- RUNG #5 -----

Input -> Torque Lo OR Angle Lo

Output -> Yellow Light Flash

----- RUNG #6 -----

Input -> InCycle

Output -> Blue Light On & Output 7 On & Clear 2nd Display

----- RUNG #7 -----

Input -> Cycle Reject

Output -> Display Angle On 2nd Display & Output 2 On

----- RUNG #8 -----

Input -> Input 5 On

Output -> Switch to Parameter Set 1

NOTES:

NOTES:



AIMCO CORPORATE HEADQUARTERS

10000 SE Pine Street
Portland, Oregon 97216
Phone: (503) 254-6600
Toll Free: 1-800-852-1368

AIMCO CORPORATION DE MEXICO SA DE CV

Ave. Cristobal Colon 14529
Chihuahua, Chihuahua. 31125
Mexico
Phone: (01-614) 380-1010
Fax: (01-614) 380-1019