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# **1. Getting Started with ToolWare**

## **1.1 Terminology and Abbreviations**

Terminology and abbreviations used in this manual are described in the table below.

Table 1.1 Terminology and Abbreviations

<b>Term/Abbreviation</b>	<b>Explanation</b>
Tool	AcraDyne Nut runners including Pistol, Straight and Tubenut wrench
Controller	AcraDyne iEC Controller or iControl Controller
CIM	Controller Interface Module is an adapter between the Controller CAN bus and PC USB port
Rundown	A complete tightening cycle
SCC	Spindle Control Card
CNC	Communications Network Card
Gen 1	Tool with Light Ring
Gen 3 / 4	Tool with Multi-Function Button (MFB)

## **1.2 Introduction to ToolWare**

### **1.2.1 About this document**

This document is a manual for using ToolWare software. It consists of three parts:

Chapter 1: "Getting Started with ToolWare" introduces the software and gives step-by-step instructions on using it to run AcraDyne tools.

Chapter 2: "Working with ToolWare" gives detailed explanation of the software features and functions.

Chapter 3: "Addendum" provides reference information needed for troubleshooting and general knowledge.

### **1.2.2 ToolWare Overview**

ToolWare is a software program designed for configuring AcraDyne electric tools and controllers directly from PC for threaded assembly applications.

The ToolWare version in use must be compatible with the firmware of the Controller which consists of DSP firmware and CNC (Communication Network Card) firmware.

#### **ToolWare compatibility with Torque Tool Controller Firmware**

ToolWare Version	Compatible Firmware Release	
	DSP	CNC card
2.1.0.0	2.10	5.10

Note. If you wish to update your controller software, please contact your AIMCO sales representative.

## **1.3 ToolWare Installation**

### **1.3.1 PC Requirements**

ToolWare requires a PC with 512 MB or higher RAM and Windows 98 or later version OS.

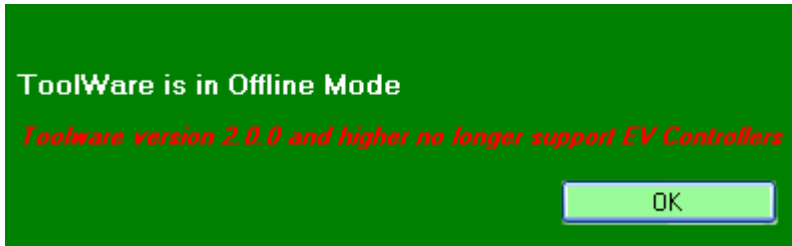
### **1.3.2 Installing ToolWare**

To install ToolWare:

- Insert the installation CD and installation will start automatically. You can also manually start it by double clicking on "Setup.exe".
- Follow instructions on screen to complete installation.
- User should have Administrative Privileges to install ToolWare.

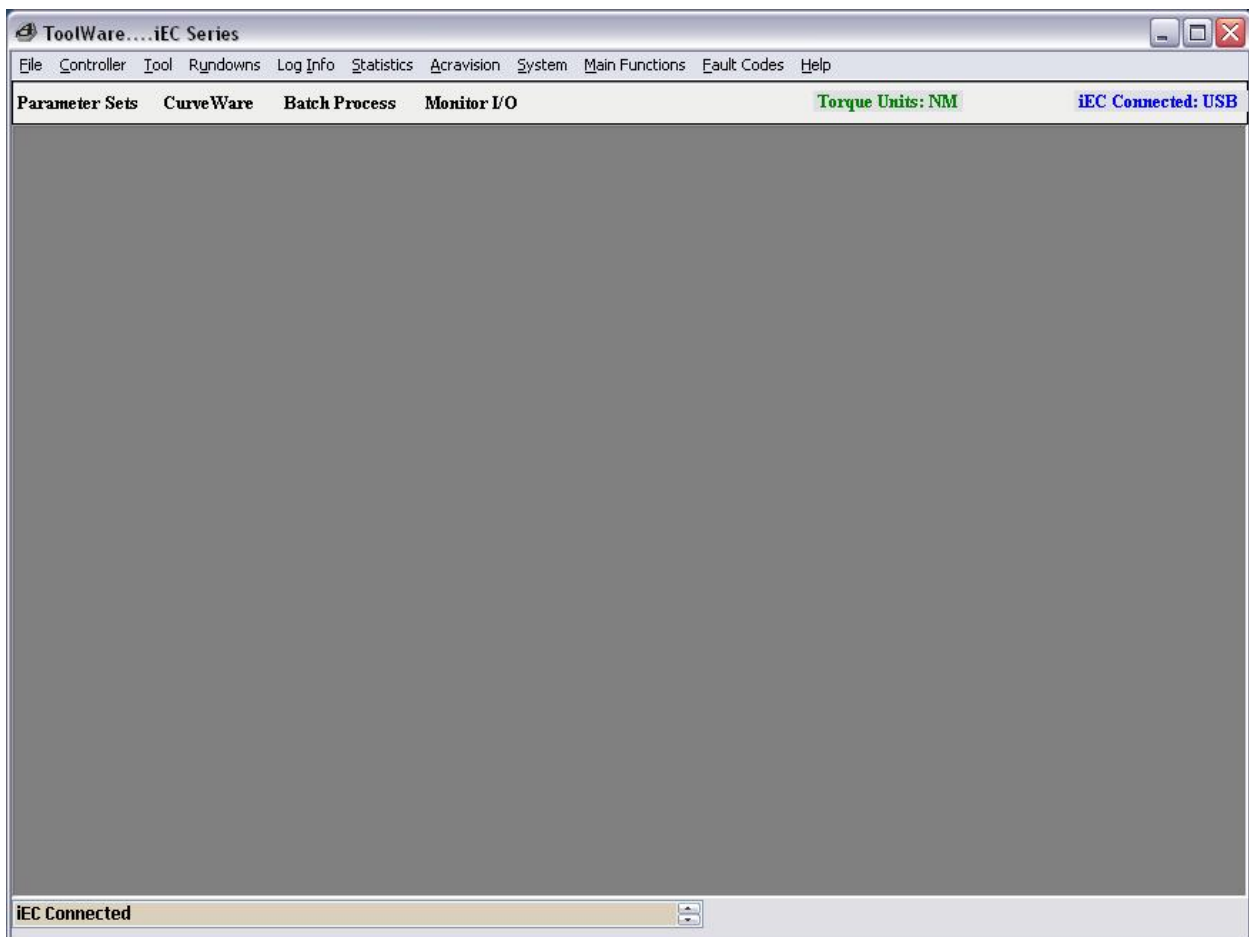
## 1.4 Introduction to ToolWare User Interface

When ToolWare is initially opened, the selection box shown in Figure 1.4.1 will appear.



**Figure 1.4.1** Dialog box for selection of controller platform being used

The ToolWare interface is similar to the workspace of most MS Windows applications. Figure 1.4.2 shows the main screen and structure consisting of two menu bars.



**Figure 1.4.2** Main Screen of ToolWare

### 1.4.1 ToolWare Menu Structure

Menu Level		Supported Functionality	
<b>File</b>	Connection	Establish Connection with the Controller	
	Open	Open a file	
	Save	Save a file	
	Print	Prints screen graphic or data file	
	LogIn	Login to the program to access appropriate menu items	
	LogOff	Program remains open, some menu items not accessible	
	Exit	Close the program	
<b>Controller</b>	View Firmware Rev.	Returns controller's Servo & firmware version	
	Edit Configuration Parameters	Modify controller configuration	
	View / Edit Date/Time	Set the date & time in the Controller	
	Reset Controller to Defaults	Restore factory values of controller parameters	
<b>Tool</b>	View	Tool Parameters	View tool parameters
		Torque Cal Value	View the tool calibration value
		RPM's	View tool output drive rotations / minute
		Cycle Count	View number of cycles run by tool
		Motor Temp	View motor temp from tool
	Edit	Tool Setup	Set up tool parameters
	Calibrate	Torque	Calibrate the tool to a master transducer
		Buttons and LED's	Program and test buttons and LED's
Service and Calibration Log		Set alerts for tool service and calibration	
<b>Rundowns</b>		Display rundown data in a tabular format	
<b>Log Info</b>	Usage	View tool and controller usage information	
<b>Statistics</b>		Performs statistical analysis of a previously saved rundown-data file	
<b>AcraVision</b>		Displays real-time rundown information in full-screen view	
<b>System</b>	Socket Tray Monitor	Displays which socket is being used when operating a socket-tray error-proof system	
	Serial Test	Used for testing of serial data string information.	
	Fault Codes	Displays a list of fault codes for the controller and tool.	
<b>Main Functions</b>	Parameter Sets	Opens the parameter set programming window.	
<b>Main Functions (continued)</b>	CurveWare	Displays rundown graphs for analysis	
	Statistics	Performs statistical analysis of a previously saved rundown-data file	
	Monitor I/O	Displays the status of I/O signals	
	Batch Processing	Allows set up of multi-step, multi-parameter tightening applications	
<b>Fault Codes</b>		Displays a list of fault codes of the controller and tool.	
<b>Help</b>	About ToolWare	Displays the latest version of the ToolWare.	
	ToolWare Help	Opens a PDF Help file	

### 1.4.2 Lower Menu Bar

Lower Menu Bar is a shortcut to the frequently used Upper Menu items located under <Main Functions> submenu. These frequently used functions include:

- Parameter Sets
- CurveWare
- Batch Process
- Monitor I/O

### 1.4.3 Status Bar

Status Bar is combined with the Lower Menu Bar. Information displayed on the status bar is listed in the Table 1.4.3

**Table 1.4.3 Status Bar Contents**

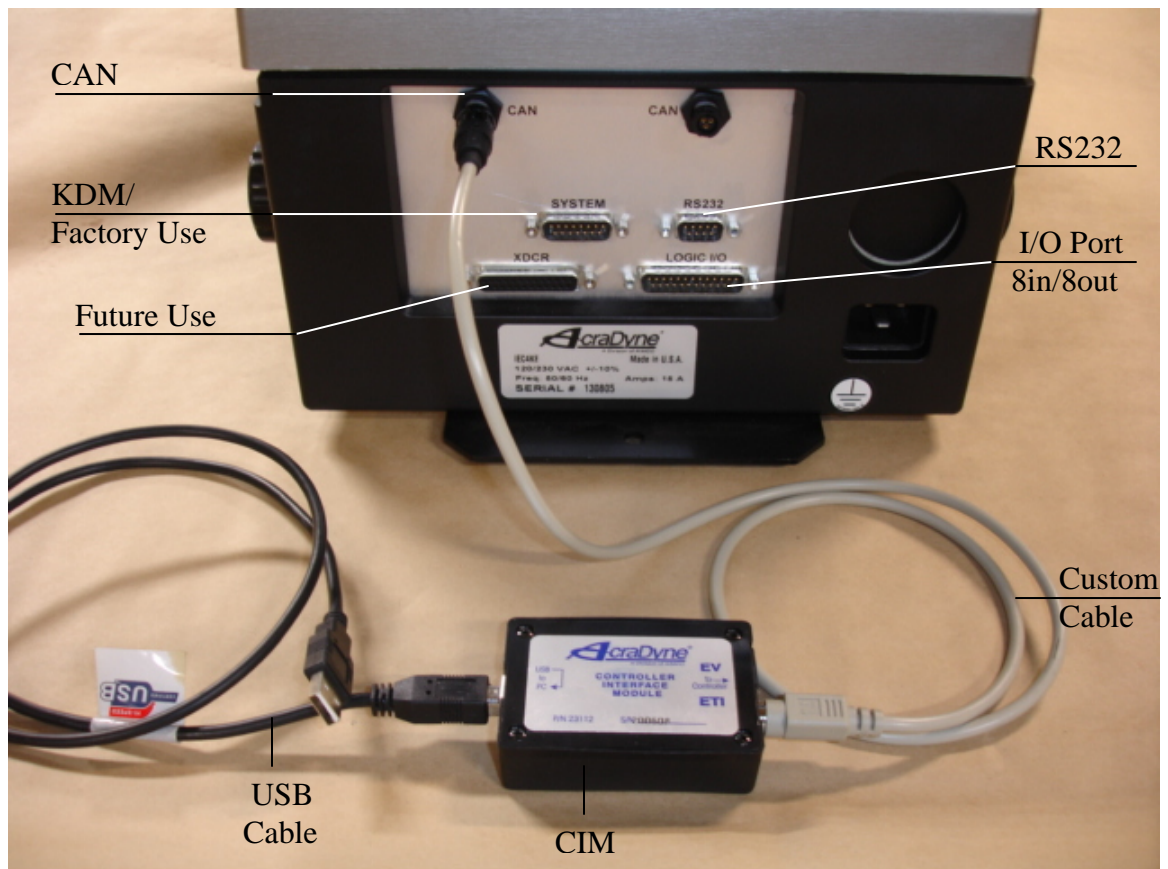
<i>Status Item</i>	<i>Display Options</i>
Torque Units	N*m
	Lbs*ft
	Lbs*in
	KgCm
	KgM
Connection	Offline
	USB
	Ethernet

## 1.5 Connecting IEC Controller with PC

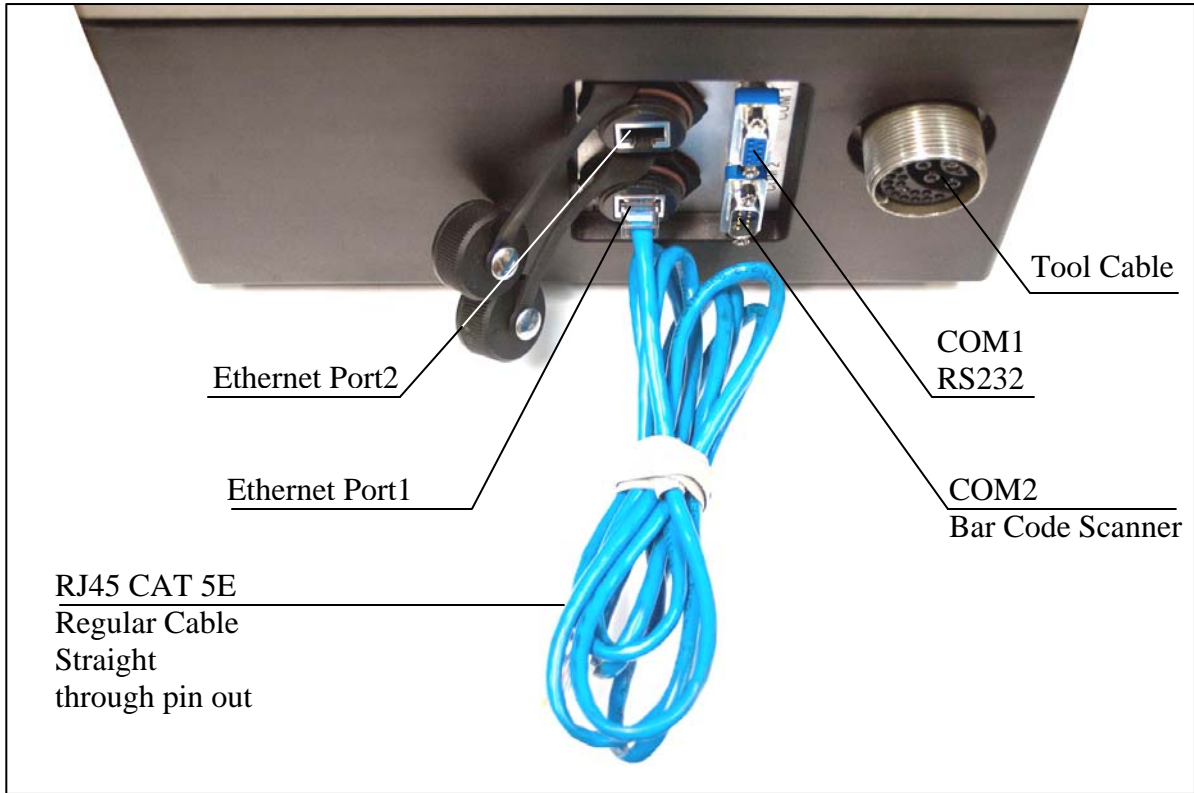
ToolWare supports four options of connecting Controller to PC depending on the interface and the model of AcraDyne Controller:

- To USB port through the CIM adapter (P/N # AEC-CIM)
- To Ethernet port through the Ethernet crossover cable
- Through the Ethernet network using standard Ethernet cable.

Figure 1.5.1 and Figure 1.5.2 show the Communication / Connection interface panels of iEC Controller.

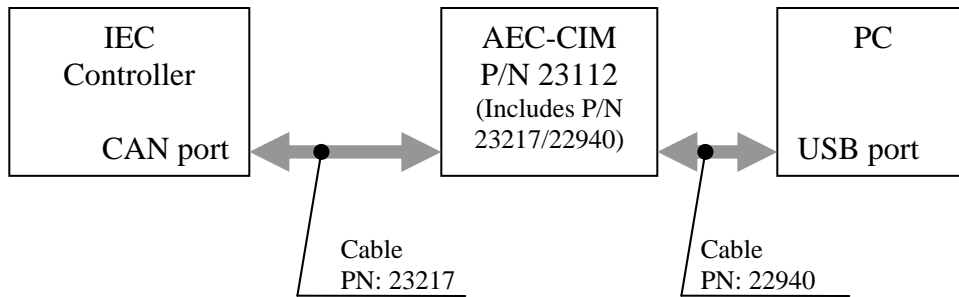


**Figure 1.5.1 iEC Controller Bottom panel**

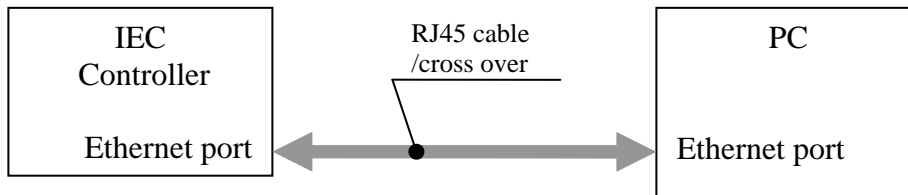


**Figure 1.5.2 iEC controller electrical interface, top panel (Some connections available on iEC3 and iEC4 models only)**

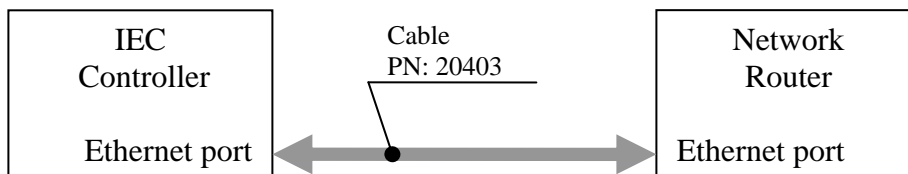
### 1.5.1 Connecting to USB port



### 1.5.2 Connecting to Ethernet Port



### 1.5.3 Connecting to the network



## **2. Working with ToolWare**

### **2.1 Connecting PC with the Controller**

#### **2.1.1 Setting up USB Connection**

Follow the steps below to set up USB connection.

- Turn on the computer.
- Plug the USB cable (PN: 22940) into your computer's USB Port or USB Hub and the other end to the CIM Module (PN: 23112).
- Plug the 23217 cable into the connector on the CIM and the other end of the cable to either of the CAN ports in the controller.
- Launch ToolWare and configure it for USB connection by selecting File/Connection/USB.

#### **2.1.2 Setting up Ethernet Connection**

##### Make physical connection

Connection options:

- Use Ethernet crossover cable to connect Controller to PC directly.
- Use standard Ethernet cable to connect Controller to network router.

##### Specify the IP Address of controller in the PC

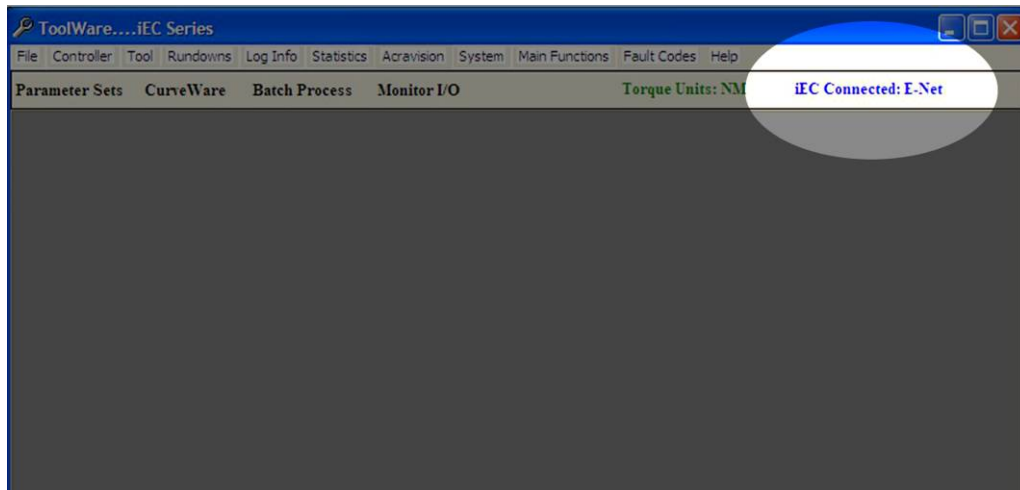
- Open Control Panel by clicking *<Start/Settings/Control Panel>*.
- Select *<Network Connections>* for configuration.
- Double click *<Local Area Connection>* to open its Status Window.
- Click on *<Properties>* button to open Properties Window.
- Scroll the list of connections to find *<Internet Protocol (TCP/IP)>* and double click it to open Internet Protocol Properties window.
- Click on *<Use the following IP address>* and enter the IP address of 10.10.30.155
- Set the subnet mask to 255.255.255.0.
- Click on *<OK>* button to exit *<Internet Protocol Properties>* window.
- Click on *<OK>* button to exit *<Local Area Connection Area Properties>* window.
- Click on *<OK>* button to exit *<Local Area Connection Area Status>* window.
- Exit *<Control Panel>* window.

##### Configure ToolWare for connection with PC:

- Launch ToolWare program.
- Click on *<File/Connection/TCP/IP>* to open *<TCP/IP Connection Setup>* window.
- Specify IP address of controller (10.10.30.150 by default)
- Click on *<Connect>* button to establish connection.
- Verify communication by reading DSP firmware version:
  - Select *<DSP/View/Revision>*;
  - Verify the DSP firmware version returned successfully.

### Successful Connection

A successful Ethernet connection will be indicated by the following text on the main screen of the ToolWare program:



## 2.2 Setting Parameters

In ToolWare, select <Main Functions/Parameter Sets> from the top menu or select <Parameter Sets> directly from the lower menu to open <Parameter Sets View/Edit> window shown in the Figure 2.3

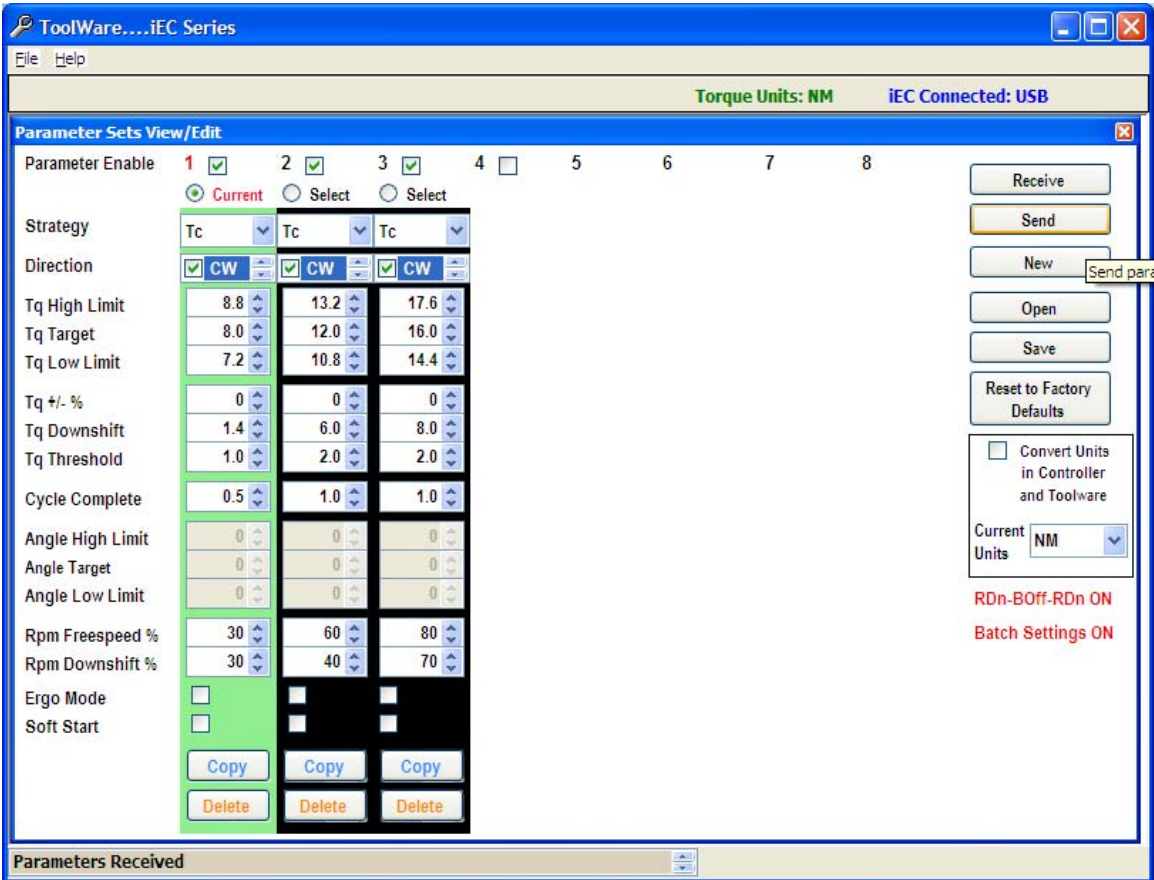


Figure 2.2 Parameter Sets View/Edit Window

### 2.2.1 Parameter Entry Fields

**Strategy** - Select one of four fastening strategy options.

- **Tc - Torque Control** strategy uses torque as the only control parameter. The Tool stops when *Tq Target* is reached. Rundown is considered to be successful (Accept) if the final torque value falls within the range specified by *Tq High Limit* and *Tq Low Limit* parameters.
- **Tc-Am - Torque Control/Angle Monitoring** strategy is convenient for detection of cross threaded or stripped fasteners. Rundown is considered to be successful (Accept) if the final torque value falls within the range specified by *Tq High Limit* and *Tq Low Limit* and final angle value falls within the range specified by *Angle High Limit* and *Angle Low Limit* parameters.

- **Tm-Ac - Torque Monitoring / Angle Control** strategy. The tool stops when *Angle Target* is reached or *Tq High Limit* is exceeded. Rundown is considered to be successful (Accept) if the final torque value falls within the range specified by torque upper and lower limits.
- **Tc-Ac - Torque Control / Angle Control** strategy. The tool stops if target torque or target angle is reached, whichever happens first. Rundown is considered to be successful (Accept) if both the final torque value and final angle value fall within their respective high and low limits.

**Direction** - defines fastening direction. It should be clock-wise (CW) for right-threaded fasteners and counter-clock-wise (CCW) for left-threaded fasteners.

**Tq High Limit** - used for Accept / Reject decision. Rundown does not pass if the measured torque exceeds this limit.

**Tq Target** - the target torque value.

**Tq Low Limit** - used for Accept / Reject decision. Rundown does not pass if the torque measured at the end of rundown is below this limit.

**Tq ± %** - high and low torque limits are automatically and symmetrically set around the target value.

**Tq Downshift** - the torque value at which the tool changes the speed from Freespeed RPM to Downshift RPM, in order to provide better accuracy of a final torque

**Tq Threshold** - specifies torque threshold value as a start point for the rundown cycle data acquisition.

**Cycle Complete** - the torque value that defines the completion of a fastening cycle. The cycle is complete if, after rising above the Tq Threshold value, torque drops below the Cycle Complete value.

**Angle High Limit** - is used for Accept / Reject decision. Rundown does not pass if the measured final angle exceeds this limit.

**Angle Target** - the target angle value

**Angle Low Limit** - used for Accept / Reject decision. Rundown does not pass if the final angle is below this limit.

**Rpm Freespeed %** - specifies initial tool output-drive speed. The parameter is expressed as a percentage of the tool's maximum rated speed.

**Rpm Downshift %** - specifies the speed of the tool after the Tq Downshift value is reached. The value is expressed as a percentage of the tool's maximum rated speed.

**Ergo Mode** - activates tool power ramping-down mode when fastening achieves Target Torque or Target Angle value. This feature reduces torque reaction in the hand-held tool as final torque or angle is achieved.

**Soft Start** - activates tool power ramping-up from zero to *Rpm Freespeed%* value. This allows for slower engagement of the fastener into the application.

## 2.2.2 Other Controls

**Parameter Enable** - check boxes allow the user to generate up to eight different sets of parameters. Each set can be used individually or sets can be arranged into batch sequence. If the box is unchecked and the parameters are sent to the controller it deletes the parameter set.

**Copy** - button allows the user to copy one set of parameters into another. The user must specify the destination parameter set number.

**Delete** - removes parameter from overall set.

**Receive** - downloads parameters from the iEC Controller to PC. Downloaded parameters are displayed but not saved in the PC.

**Send** - uploads the current parameters from ToolWare to the controller. The controller will automatically switch to Parameter Set #1 after all parameter sets have been loaded.

**New** - allows the user to create a new set of parameters, regardless of what set is selected as currently active in the Controller or in the ToolWare.

**Open** - opens a saved Parameter file stored in the computer and displays it in the ToolWare Screen. Parameter set must be SENT to the controller to be used.

**Save** - saves the parameter sets displayed on the ToolWare screen as a file to a designated location on the computer.

**Reset to Factory Defaults** - resets the controller's parameters to the factory settings.

- If **Reset To Factory Defaults** is selected while tool is connected to controller, three parameter sets will be configured at 20%, 40% and 60% of the tool's maximum rated torque
- If **Reset To Factory Defaults** is selected while tool is disconnected from controller, eight parameters sets will be configured at 10 Nm, 20Nm, 30 Nm, 40 Nm, 50 Nm 60 Nm, 70 Nm and 80 Nm

**Change units** - changes the torque units in the ToolWare. Select SEND to change units in the Controller also.

**Convert Units in Controller and ToolWare** - if checked, automatically converts units in controller and ToolWare to new units when new unit of measurement is selected.

**If Rundown-Backoff-Rundown, Low Speed Control and / or Batch Settings are active in the controller, User will be notified on this screen.**

## 2.3 CurveWare

In ToolWare, select <Main Functions/CurveWare> from the top menu or select <CurveWare> directly from the lower menu to open <CurveWare> window shown in the Figure 2.3. Only rundown information after most recent Power On of the controller can be graphed.

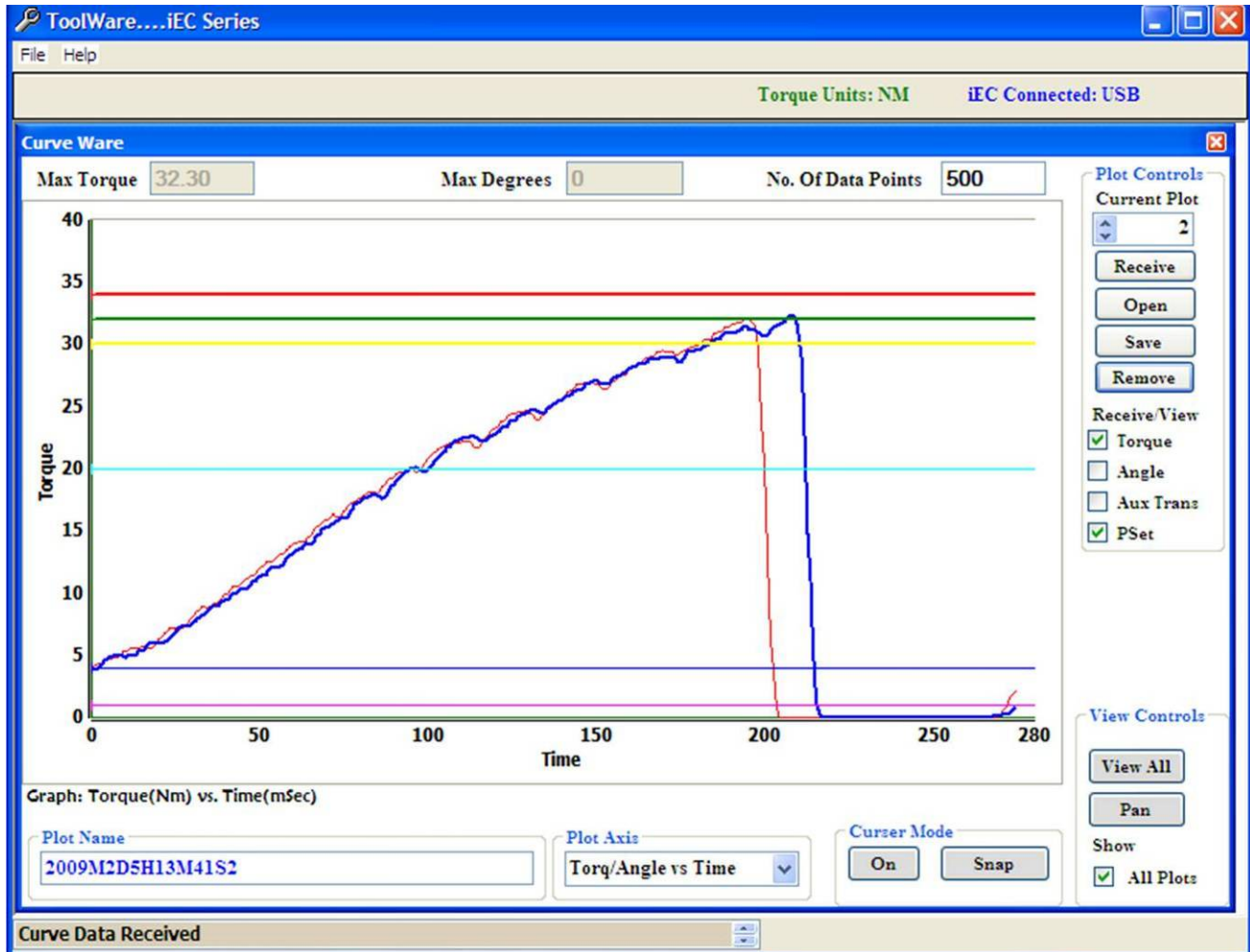


Figure 2.3 CurveWare example

**Max Torque** - is the upper torque limit of the rundown

**Max Angle** - is the upper angle limit of the rundown

**No. of Data Points** - is the number of data points that should be used in the plot. Maximal number of acquired data points is 4000.

**Current Plot** - the N<sup>th</sup> rundown that has been recorded is highlighted in the graph.

**Receive** – downloads last rundown data from the Controller.

**Save** - saves data points of all curves in the plot in ASCII file.

**Remove** - removes the currently selected plot from the graph.

**Receive/View** - Receive/View allows the user to choose the display features of the graph.

**Torque** – downloads and displays torque data points.

**Angle** – downloads and displays angle data points.

**Pset** - displays markers indicating parameter set values.

#### **View Controls**

**Pan** - reposition the view in the drawing area.

**Pan/Zoom** – change magnification.

**View All** – return to the original dimensions.

**Show All Plots** - displays all the plots.

**Cursor mode** - restricts cursor locations to curve data points.

**Plot Axis** - allows user to choose between *Torque/Angle Vs Time* and *Torque Vs Angle*. The axes of the graph will change accordingly.

**Plot Name** – allows the user to rename the plot. By default, the plot name is formed by using the date and time at which the plot was created.

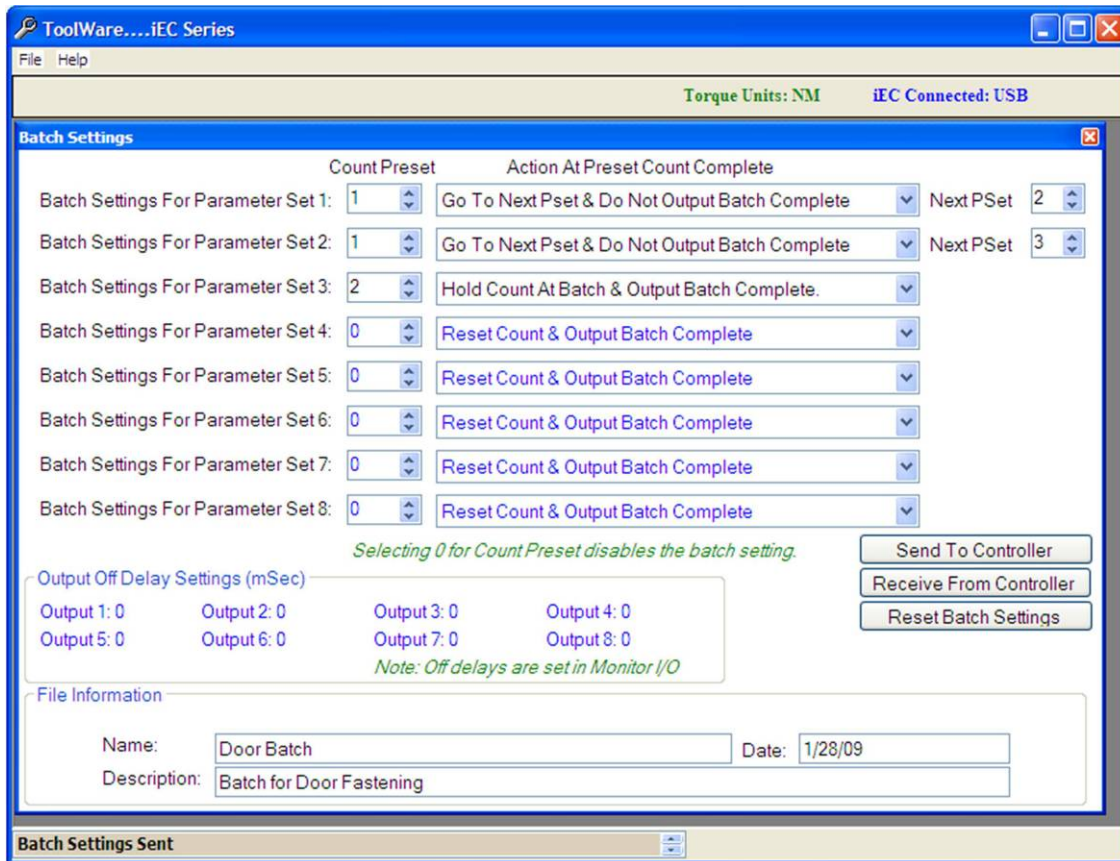
***CurveWare allows for 10 sequential curves to be overlaid upon each other for analysis purposes.***

## **2.4 Batch Processing**

In ToolWare, select <Main Functions/Batch Processing> from the top menu or select <Batch Processing> directly from the lower menu to open <Batch Processing> window shown in the Figure

A sample batch process is displayed in Figure 2.4.

ToolWare allows the user to specify Psets for the sequence of rundowns. During the batch process the controller monitors each rundown and switches Psets automatically. We can control the actions of the controller as each step in the batch is completed.



**Figure 2.4 Sample Batch Process**

**Count Preset** – defines the number of accepted (ACCEPT) rundowns that must be completed for the associated parameter set

**Action At Preset Count Complete** - The choice of options for end-of-batch events is:

- Reset count and output batch complete
- Hold count and output batch complete
- Disable tool – Hold count and output batch complete
- Go to next Pset & do not output batch complete
- Go to next Pset and output batch complete

**Next Pset** – determines the parameter set that is automatically activated when the count for the associated Pset is reached

**Output off Delay Settings** - is set in the Monitor I/O screen which displays programmed off delay for each Logic IO output.

**Send To Controller** - downloads the configured Batch Process to the controller.

**Receive From Controller** – uploads active batch process from controller to the ToolWare for viewing and / or editing.

**Reset Batch Settings** – resets batch settings to the default of no batch settings. If a controller is connected to the PC at the time of resetting, the batch process is erased from the controller.

**Save Batch Setting** - go to File > Save Batch IO Settings option to save it to a text file.

**Open a Batch Setting File** – to open a previously saved Batch Process file, go to File > Save Batch IO Settings.

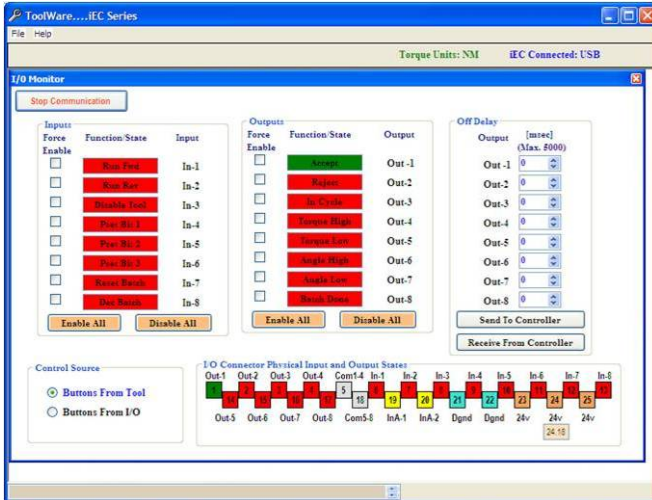
**File Information** - Allows the user to describe information about the batch setting file that is being used. This information is saved along with the batch information when saving it to a file.

## **2.5 Monitoring I/O**

In ToolWare, select <Main Functions/Monitor I/O> from the top menu or select <Monitor I/O> directly from the lower menu to open <Monitor I/O> window shown in the Figure 2.3.

The I/O function is only available in iEC2, iEC3 and iEC4 models. A connector kit is available from AIMCO that allows the user to connect and route wiring to a variety of devices, including light-towers, socket trays, audible signals and PLC modules. The part number is #23490. Contact your AIMCO representative for this item.

This screen allows the user to activate and display the operation of the input and output signals to the controller. **Off Delays** of outputs in this screen and send it to the controller or receive the same from the controller. For testing and setting purposes the physical outputs and logical inputs can be forced ON/OFF temporarily. This screen also shows the state of the physical I/O. We can temporarily change the control source between Tool buttons and Logic I/O port.



**Figure 2.5 Monitor I/O screen**

**Off Delay** - specifies how long the output signal will be ON before turning OFF. Each of the 8 input fields corresponds to the output field. Example: If 200 is the value in the first field that the output signal for Accept will be ON for duration of 200 mSec. If the value is 0, then the corresponding output will remain ON indefinitely or until the next rundown starts.

- Control Source** – allows user to choose the source that controls the tool operation
- Buttons From Tool** – Normal operating condition; tool lever and control ring control tool operation
  - Buttons From I/O** – For testing purposes; allows the tool lever and control ring to be over-riden by buttons on the Monitor I/O screen

**Force Enable** – When Buttons From I/O is selected, this field selects which inputs and outputs can be forced through the Monitor I/O screen

**Function/State** – When Buttons From I/O is selected and the operation is selected by checking Force Enable, clicking on this field will force the respective operation to take place, regardless of tool button positions. This field will be red when the operation is off and will turn green when the operation is on.

**I/O Connector Physical States** - this diagram is a real time display of the I/O connector. Each position corresponds to the indicated terminal on the 25-pin I/O connector on the bottom of the controller.

**2.6 File Menu**

In ToolWare, select <File> from the top menu. File Menu enables us to select the Connection type with which we want the ToolWare to connect to the Controller.

**2.6.1 Connection**

This enables the user to specify how ToolWare will connect with and communicate to the Controller. The options are as follows:

**USB** - is used if the computer is connected with the controller using the USB connection in the computer.

**Ethernet** - can be selected to set the IP address the connection should use.

**Offline mode** - gives the user the opportunity to conduct programming and configuration without being connected to the controller

### **2.6.2 Open**

Enables the user to select the file to open

### **2.6.3 Save**

Saves the file to the PC in the specified directory

### **2.6.4 Print**

Print the Screen or the Data.

### **2.6.5 Login**

Login is not required for general access, though advanced features are not available in this mode. On occasion, when advanced features need to be accessed, a password will be given and can be entered here.

An AcraDyne technician or an AIMCO salesperson 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.

Contact your AIMCO sales representative to get more information on passwords for use with ToolWare.

### **2.6.6 Logoff**

Log out of the user level the user is in.

### **2.6.7 Exit**

Exits ToolWare

## 2.7 Controller

### 2.7.1 View Firmware Rev

Displays the current DSP revision and Servo Rev

### 2.7.2 Edit Configuration Parameters

The user can Edit the controller configuration from this screen. The screen is shown in Figure 2.7.2.

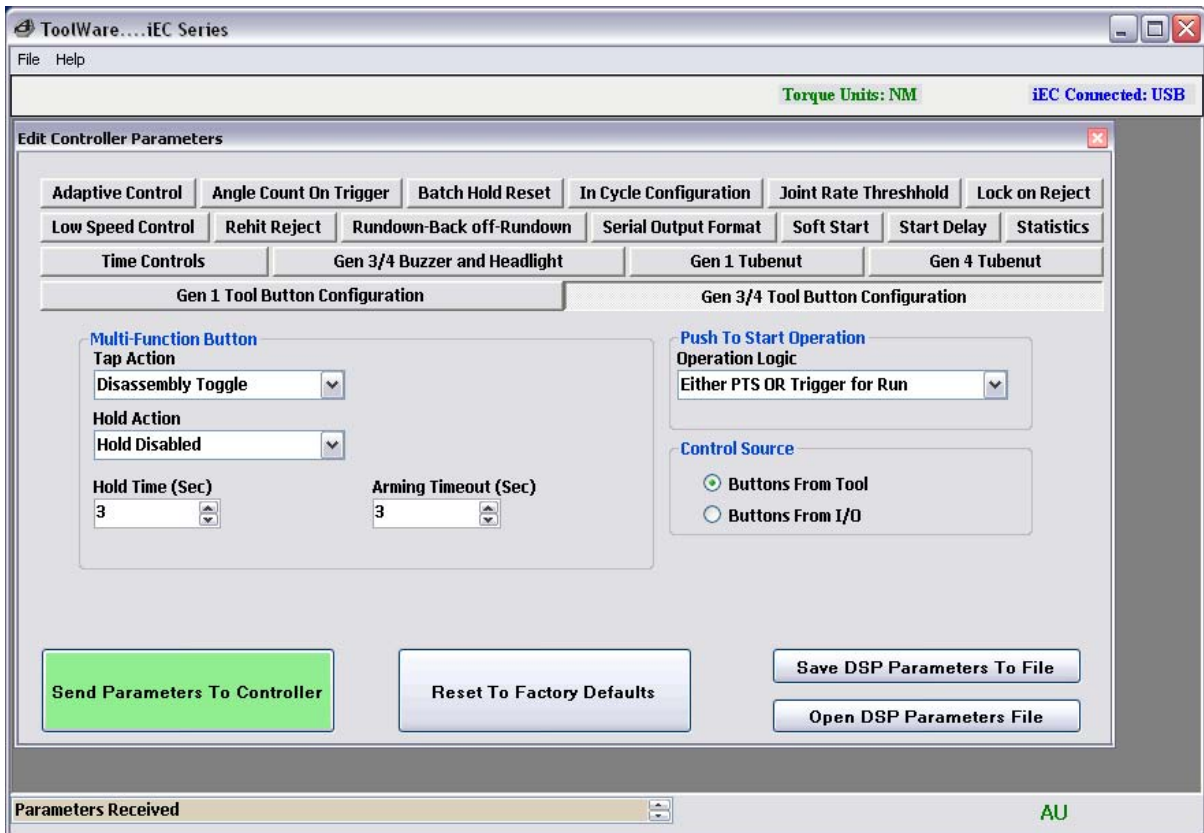


Figure 2.7.2 Edit Controller Parameter screen

### Adaptive Control

**Enable - Adaptive** control is a useful option when a high CPK (Process Capability) is chosen as the most important variable. This is done by adjusting the control to ensure the average applied torque is centered between the upper and lower control limit.

This feature has three options, which are explained below.

**Off** - Turns adaptive control off. The tool will produce torque until the target torque is achieved. Therefore, all results will be equal to or greater than the target. This will cause the average torque to be greater than the target torque, thus making it extremely difficult to produce a high CPK.

**First Ten** - Takes an average of the first ten readings in a new parameter set and adjusts the control to make the average torque correspond with the target torque. Therefore, there will be readings both above and below the target torque, thus maximizing CPK.

- **All** - Similar to above, but continually adjusts the control based on the average of the previous ten readings in an attempt to maximize CPK.

**Pct Adjustment: % Adjustment** - Determines how much of a correction adaptive control will try to make. The higher the number, the greater the correction adaptive control will make.

### **In Cycle Configuration**

**At Threshold** – the tool status is switched to <In Cycle> when torque reaches torque threshold set point.

**At Throttle** – the tool status is switched to <In Cycle> immediately when rundown is triggered.

### **Rehit Reject**

This feature prevents operator from attempting to tighten the fastener that has already been tightened. If this feature is enabled, the rundown will stop if the angle of rotation between cycle complete and threshold torque is less than a specified number of degrees.

**Rehit Reject On/Off** - If Enabled will abort the attempt to fasten a pre-tightened fastener. The default setting for this option is off.

**Rehit Reject Angle** - Used to determine if a fastener is already tightened. If the angles of rotation between cycles complete torque and cycle threshold torque is less than the programmed angle, then the fastener is assumed tightened and no pass/reject will be reported.

### **Rundown-Backoff-Rundown**

This feature includes three modes that engage reverse rotation of the tool.

**Enable** – activates the feature. There are three options available when the feature is enabled.

- **Rundown-Backoff-Rundown** – Rundown to the 1<sup>st</sup> Rundown torque (specified below) then reverse the fastener a set number of degrees and re-tighten the fastener to the target torque established in the parameter set.
- **Rundown-Backoff** - holding the throttle lever down, the tool will rundown to 1st Rundown Torque, reverse the fastener a set number of degrees
- **Off** - Switches the Rundown-Backoff or Rundown-Backoff-Rundown to off mode

**Dwell Down** - Dwell time [ms] between first rundown and the start of back off.

**Dwell Up** - Dwell time [ms] between back off and the start of second rundown.

**Back Off Degree** - The amount of rotational degrees the fastener is backed off after reaching 1st rundown torque.

**1<sup>st</sup> rundown (in-lbs)** - The initial rundown torque, measured in (in-lbs).

### **Soft Start**

This feature allows the user to set the speed and timing of how quickly the tool ramps up to Freespeed RPM

**Dwell (ms)** - the amount of time that the tool will rotate at slow speed before progressing to the Freespeed RPM (default 500 ms)

**Dwell (RPM)** - the RPM at which the tool will run during soft start period (default 90)

**Ramp (ms)** - the amount of time from the end of the soft start period until the tool reaches the Freespeed RPM (default 600 ms)

### **Start Delay**

**Start Delay On/Off** - When enabled, the tool will ignore programmed torque parameters until the timer runs out. This is often used in jobs with prevailing torque that exceeds target torque. The default setting is disabled

**Start Delay (ms)** - The amount of time at the beginning of the fastening cycle, measured in milliseconds, which the tool will ignore programmed torque parameters. (default 500 ms)

## **Time Controls**

**Free Run Timeout** – The amount of time, in seconds, the tool is allowed to run free without the load (before reaching cycle threshold). This is a safety feature in case the tool is placed down on the throttle. The default setting is 5 seconds.

**Load Timeout** - The amount of time the tool is allowed to run after crossing cycle threshold. The default setting is 15 seconds.

**Cycle Complete** - The amount of time, in ms, the torque must remain below cycle complete before the event is counted as a cycle and the final torque is displayed (default 200 ms).

**Locked Rotor** - Safety feature which shuts off the tool when it has reached a stalled condition. The amount of time, which the tool can remain in a stalled condition, is programmed (in milliseconds). The default setting is 100 ms.

## **Gen 1 Tool Button Configuration**

This feature allows the user to program the functionality of the light ring. The default setting for this section is

- CW - Forward;
- Center - Reverse
- CCW - Auxiliary

**Control Source** allows user to choose the source that controls the tool operation Buttons from Tool/IO - Determines the source of the Trigger, Forward, Reverse, and Aux Commands.

## **Gen3 / 4 Tool Button Configuration**

### **Multi-Function Button (MFB)**

- Tap action: triggered if button held less than hold time.
- Hold action: triggered if button held to hold time or longer.
- Hold Time: Amount of time required to hold the MFB until Hold Action is triggered.
- Arming Timeout: Amount of time after the tool is armed, that the tool will automatically disarm.

### **Tap MFB Function Options**

Actions will commence upon release of the MFB button on the tool as programmed

- Arming (TubeNut Tool Default): Tapping MFB button arms (activates) the start function but does not start the tool. Blue status light illuminates to indicate tool is Armed. Arming will reset in 3 seconds if tool start is not initiated.
- Change PSET: Tapping MFB button toggles between PSET 1 and PSET 2. Status lights flash indicating PSET 1 is selected or twice if PSET 2 is selected
- Reset Reject Tone: Tapping MFB button silences reject tone
- Tap Disabled: Tapping MFB button has no effect on tool

### **Hold MFB Function Options**

Actions will commence after Hold timer preset time has elapsed (Adjustable in Hold Time window) Default value is 1 second.

- Arming (TubeNut Tool Default): Holding MFB button arms (activates) the start function but does not start the tool. Blue status light illuminates to indicate tool is Armed. Arming will reset in 3 seconds if tool start is not initiated.
- Change PSET: Holding MFB button toggles between PSET 1 and PSET 2. Status lights flash indicating PSET 1 is selected or twice if PSET 2 is selected
- Reset Reject Tone: Holding MFB button silences reject tone
- Hold Disabled (Default): Holding MFB button has no effect on tool

### **Push to Start Operation**

Choices are:

- Both Push to Start (PTS) and Trigger must be depressed for tool start
- Either PTS or Trigger may be pressed for tool start (Default)

**Control Source** allows user to choose the source that controls the tool operation Buttons from Tool/IO - Determines the source of the Trigger, Forward, Reverse, and Aux Commands.

### **Gen1 Tube Nut**

**Tube Nut Back off RPM** - The speed, expressed in RPM, which a tube nut tool will return to the open position upon release of throttle. The default setting for this is 100 RPM.

**Reverse Dwell** - The amount of time before the output tries to return to home, after the throttle is released (default 500 ms).

**Home Dwell** - The amount of time that the output is held at home position (default 500 ms).

## **Serial Output Format**

This function allows the user to select the format of the information in the ASCII character string packet that is sent out of the controller via the RS232 Port.

### **a) Standard Output :**

Format:

**O P HHHHH LLLLL TTTTT P HHHHH LLLLL AAAAA CR CR**

O: Overall Pass/Fail  
P: Tq Pass/Fail  
HHHHH: Tq High Limit  
LLLLL: Tq Low Limit  
TTTTT: Tq Result  
P: Angle Pass/Fail  
HHHHH: Angle High Limit  
LLLLL: Angle Low Limit  
AAAAA: Angle Result  
CR  
CR

### **b) Profibus Output:**

Format:

**%CAN 1 O P HHHHH LLLLL TTTTT P HHHHH LLLLL AAAAA NAC% CRLF**

%CAN: Msg Start  
1: Pset  
O: Overall Pass/Fail  
P: Tq Pass/Fail  
HHHHH: Tq High Limit  
LLLLL: Tq Low Limit  
TTTTT: Tq Result  
P: Angle Pass/Fail  
HHHHH: Angle High Limit  
LLLLL: Angle Low Limit  
AAAAA: Angle Result  
NAC%: Msg End  
CR  
LF

**c) Standard Output with CR/LF**

Format:

**O P HHHHH LLLLL TTTTT P HHHHH LLLLL AAAAA 1 CR LF**

O: Overall Pass/Fail  
P: Tq Pass/Fail  
HHHHH: Tq High Limit  
LLLLL: Tq Low Limit  
TTTTT: Tq Result  
P: Angle Pass/Fail  
HHHHH: Angle High Limit  
LLLLL: Angle Low Limit  
AAAAA: Angle Result  
1: Pset  
CR  
LF

**d) UEC Serial**

Format:

**# P 1 BB TTT.T AAAA 0000 0000 J**

(Notice that there is a decimal point next to the least significant T)

P: parameter set  
B: batch count  
T: torque result  
A: angle result  
J: judgment (@=overall pass, H=low torque, I (eye)=hi torque, J=low angle, K=hi angle)

**Statistics**

**Minimum Stats** - Number of rundowns that need to be preformed before the statistics will be calculated and displayed on the controller.

**Stat Samples** - Maximum number of rundowns used for calculating and displaying statistical data on the iEC controller.

**Statistical Outliers** - The statistical outliers' parameter is a code that is used to determine if the data from a rundown will be excluded from the data set being used in the static calculations that are displayed on the iEC controller. The exclusions are based on the results of the rundowns.

The following are the codes for each exclusion type:

- 2 - Final Torque Result Above High Limit
- 4 - Final Torque Result Below Low Limit
- 8 - Final Angle Result Above High Limit
- 16 - Final Angle Result Below High Limit
- 128 - Re-Hit

To exclude any combination of the above list add up the code values.

Example: To exclude all rundowns where the final torque was above the high limit (2) or the angle was below the low limit (16), Set the value for statistical outliers to 2 +16 = 18

### **Lock on Reject**

When enabled, this prevents the tool from starting a new rundown if the result of the last rundown was a reject.

The tool remains locked until reverse is selected on the tool or from the Logic IO Reverse Input.

The Default setting is off.

### **Batch Hold Reset**

Batch Control Reset Options for: “Disable Tool – Hold Count & Output Batch Complete”

The following are options to re-enable the tool after it has been disabled in batch control:

- Option 1: Re-enable the tool by toggling the RESET\_BATCH Logic I/O input (default).
- Option 2: Re-enable the tool by selecting a new PSET or by toggling the RESET\_BATCH input. (This option gives the operator that ability to manually re-enable the tool from the Controller front panel by pressing the CHANGE PSET button.)

### **Low Speed Control Mode:**

Low Speed Control mode is designed to allow a tool to apply torque energy more consistently to a joint at lower RPM's. The feature precisely manages power delivery to the tool motor from the servo insuring the rotation of the fastener is done at a constant velocity even when the desired RPM is extremely slow.

IEC controllers are able to run this feature assuming the servo in the controller is REVB or higher and SCC code is 1.16 or higher. SCC installed code and Servo REV level is indicated each time the controller is powered on. This information is visible on the LED display.

Controllers capable of Low Speed Control mode default to standard control unless selection of Low Speed Control is consciously made. Confirmation of Low Speed Control being in effect is shown in red type on the Parameter Set screen whenever it is in use.

Low Speed Control is a feature that applies across all PSETs globally. Selection of Low Speed Control ON or OFF requires a Power Cycling of the IEC control for the change to

become effective. Prompts will indicate to the user this requirement and the LED on the IEC controller will change to OFF indicating that a Power Cycle is required.

While Low Speed Control has many benefits and is not inherently negative to tool performance when left in use, it does apply slightly higher power levels to the tool motor and in high duty cycle applications where it is not necessary, this feature should be turned off.

Specific Information Related to Low Speed Control:

- RPM range of tools when used with Low Speed Control activated is 4%-100% of the tool's normal speed rating
- TubeNut tools are unable to take advantage of Low Speed Control and will not function if activated
- Ergo Mode is not usable when using Low Speed Control
- Low Speed Control is effective on all 1000 Series, 2000 Series and 3000 Series tools up to 90NM (larger tools are unable to use this feature)

#### **Disable Tool when SVC/CAL Due**

- Option to select(Default) – Disable tool in preset Service or Calibration period exceeded (date or time) LED warning appears on IEC Tool re-enabling accomplished by (to be determined)
- Option de-selected – Tool remains enabled, LED warning appears on IEC

#### **Angle Count on Trigger:**

When this option is selected the angle count is started at the beginning of the rundown when the trigger is pulled.

- Start angle count at threshold (default)
- Start angle count on throttle.

Power must be cycled for the selection to take effect.

#### **Gen 3 / 4 Buzzer and Headlight**

Buzzer ON -When enabled, the Buzzer serves two purposes:

- In disassembly mode, the buzzer beeps. When a rundown is rejected the buzzer also beeps.
- If a rundown is rejected, the beeping can be stopped by making a successful rundown or using the MFB option "Stop Reject Tone".

Headlight ON - Enables or Disables the Headlight.

### **2.7.3 View/Edit Date Time**

Sets the date and time in the Controller

### **2.7.4 Reset Controller to Defaults**

This option resets the Controller configuration to its factory default state.

## **2.8 Tool**

### **2.8.1 View**

#### **Tool Parameters**

Reads all the tool parameters and displays on the screen

#### **Torque Cal Value**

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

#### **RPM's**

Performing this test will determine the actual RPM of the tool.

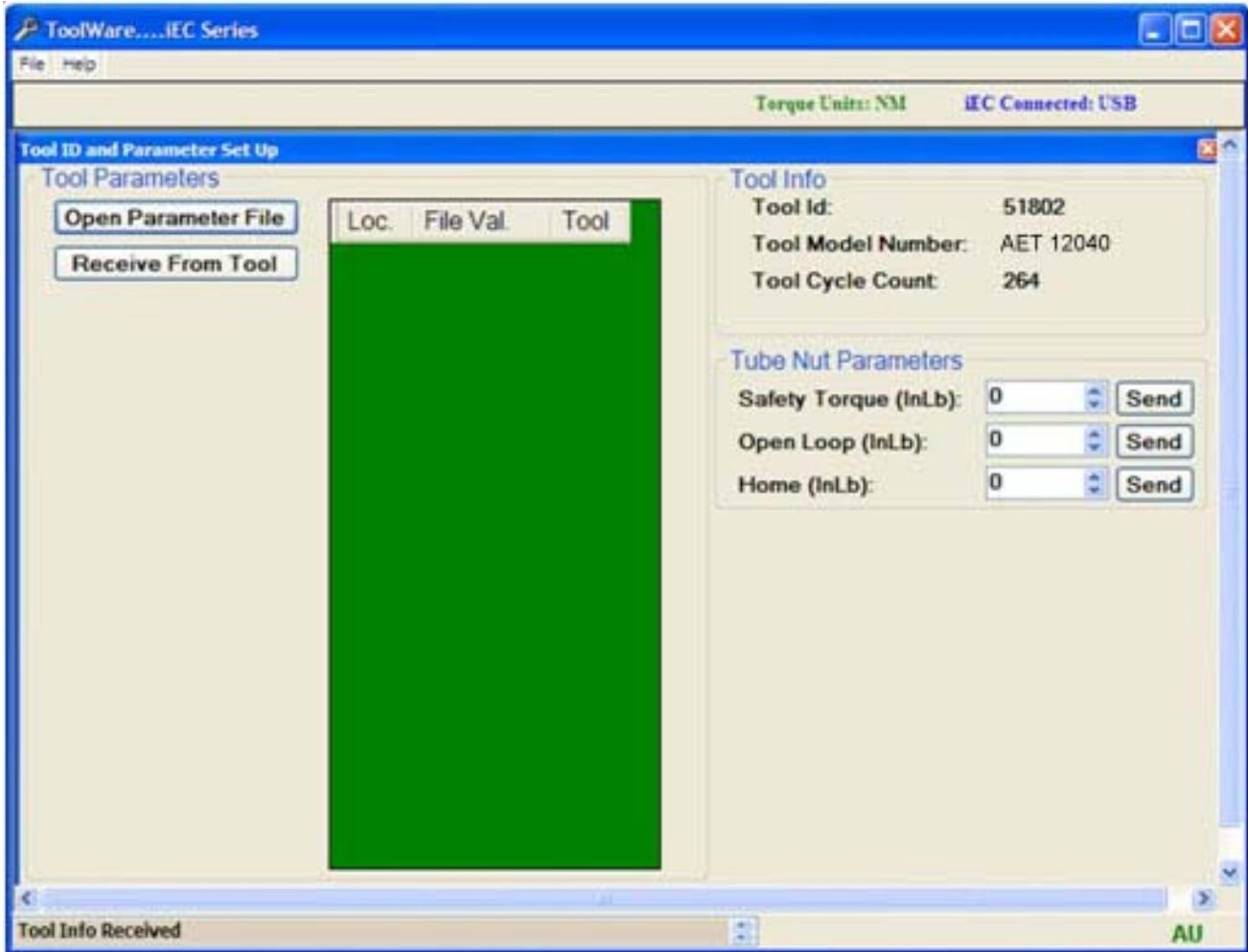
#### **Cycle Count**

Displays the total number of rundowns on the tool good or bad

### **2.8.2 Edit**

#### **Tool Setup**

Each tool has a special parameter file that defines the tool. You can view the parameter file for that tool and how it differs from what is in the tool. The tool Information such as Tool Id, Tool Model number, Tool cycle count and Tool Multiplier value are displayed. The User can change the Tube nut Parameters according to their application need and send it to the tool.



**Figure 2.8.2 Tool Configuration and tubenut tool setup**

**Safety Torque** - In 1st 90° degrees of rotation in the tightening direction cycle will be aborted if this torque is exceeded. If the tool rotates 90° degrees and stops without any obstruction, the value is too low.

**Open Loop** - After reaching the open position, this open loop torque prevents the socket from bouncing to a partially closed position. This torque should be set to a value slightly less than the tube nut home torque.

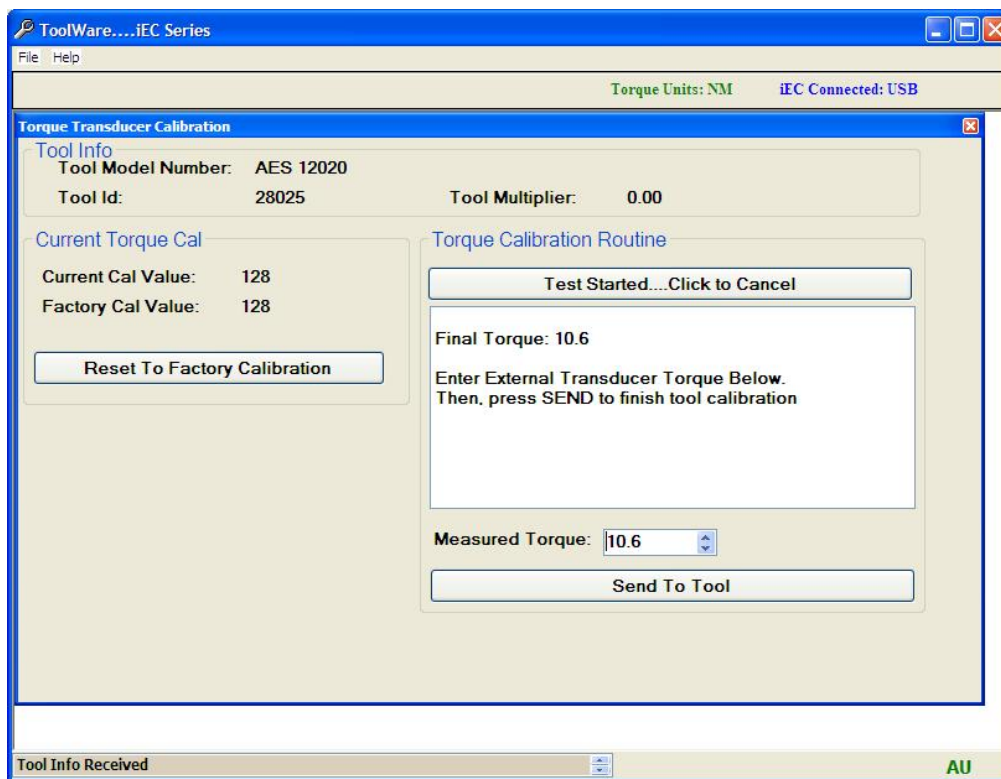
**Home** - In the reverse direction, reaching this torque indicates to the controller the socket is in the open position. If the socket does not attempt to return to the open position or returns at an extremely fast rate this value is too low. AcraDyne recommends starting at about 12 in-lbs.

## 2.8.3 Calibrate

### Torque

This is used to calibrate the tool. Following are the steps that need to be followed to calibrate the Tool

1. Press the “Start To Test” Button
2. Run the Tool to Final Torque
3. Put the External transducer value in the Measured Torque box.
4. Press “Send to Tool” Button.
5. The new Cal value is calculated automatically and assigned to the tool.

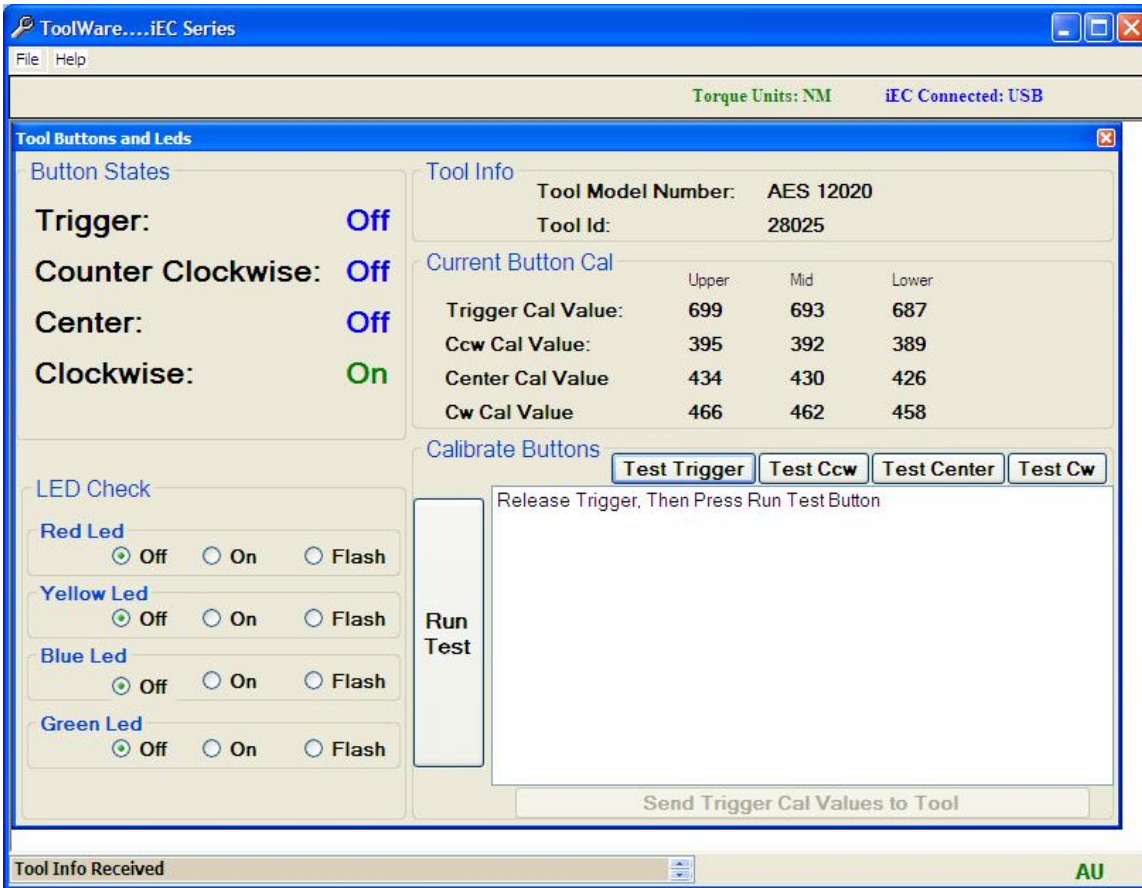


**Figure 2.8.3** Tool calibration screen

### Buttons and LED's

**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 between the two. Test Trigger, Ccw, Center and Cw positions and send the values to the Tool.

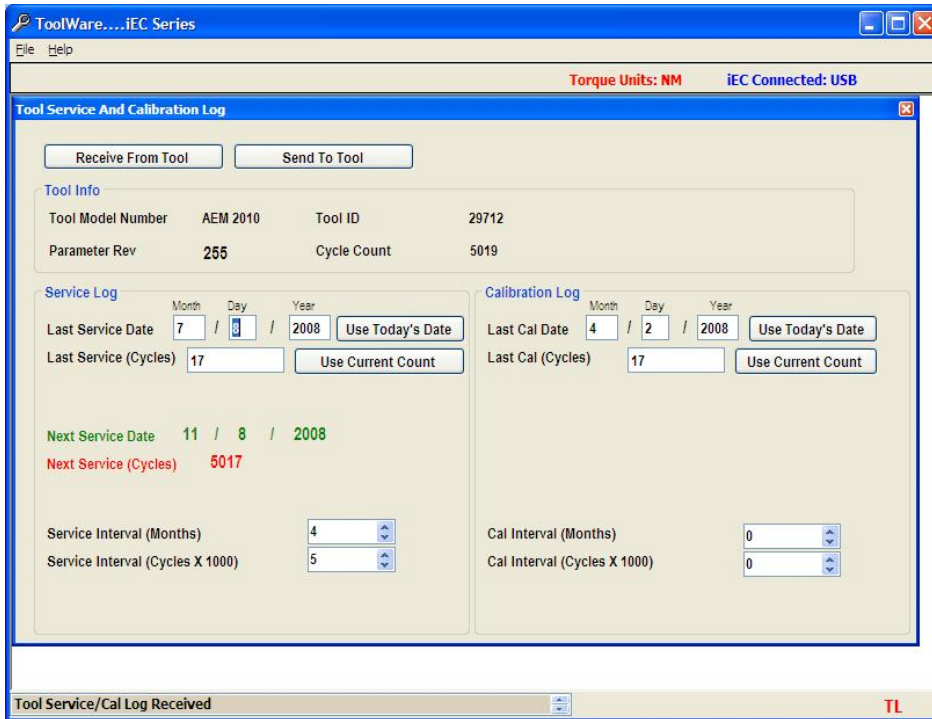
**LED States** - Turns the tool lights on, off, or flashes. Used for testing of the Tool



**Figure 2.8.4 LED programming and button calibration**

## Service and Calibration Log

The Service Parameters are stored in the memory of the Tool and they can be viewed in this screen. The Next Service cycle or Next Service date in this screen will turn red if they exceed the value the service is due.



## 2.8.5 Tool Service and Calibration Log

## 2.9 Rundowns

Data for rundowns in all or selected Parameter Sets can be displayed in a tabular format. This information can then be saved as a "Ms.csv" File.

- You can print the rundown results by using File ->Print in the menu.
- Rundowns must be saved to a file before the statistics function can be used to evaluate the data.
- Controller memory can be cleared by clicking the "Clear iEC Rundown Memory" button

### 2.9.1 Download Data

- If rundown data is to be analyzed with the Statistics function, select **All Data**
- If no statistical analysis is to be applied, select **Results Only**. This will significantly decrease the time taken to download the data from the controller to the PC.

## 2.9.2 Select Parameter Set

- To view results of all saved rundowns, regardless of Parameter Set, select zero (0)
- To view results of rundowns for a specific Parameter Set, select the appropriate Parameter Set number

To begin rundown data download, click “Start Rundown Receive”

No	Day	Date	Time	Torque	Angle	Status	PSet	Units	Strategy	TqHi	TqTarg
1	Mon	1/ 26/ 9	16: 41: 0	18	260	Accept-ReRun	2	NM	Tc	21	18
2	Mon	1/ 26/ 9	16: 41: 4	20	268	Accept-ReRun	2	NM	Tc	21	18
3	Mon	1/ 26/ 9	16: 41: 8	19	250	Accept-ReRun	2	NM	Tc	21	18
4	Mon	1/ 26/ 9	16: 41: 12	20	265	Accept-ReRun	2	NM	Tc	21	18
5	Mon	1/ 26/ 9	16: 41: 16	18.3	253	Accept-ReRun	2	NM	Tc	21	18
6	Mon	1/ 26/ 9	16: 41: 20	18.5	252	Accept-ReRun	2	NM	Tc	21	18
7	Mon	1/ 26/ 9	16: 41: 24	19.3	246	Accept-ReRun	2	NM	Tc	21	18
8	Mon	1/ 26/ 9	16: 41: 28	20.4	266	Accept-ReRun	2	NM	Tc	21	18
9	Mon	1/ 26/ 9	16: 41: 32	18.1	252	Accept-ReRun	2	NM	Tc	21	18
10	Mon	1/ 26/ 9	16: 41: 36	18	253	Accept-ReRun	2	NM	Tc	21	18
11	Mon	1/ 26/ 9	16: 41: 40	18	253	Accept-ReRun	2	NM	Tc	21	18
12	Mon	1/ 26/ 9	16: 41: 44	18.1	253	Accept-ReRun	2	NM	Tc	21	18
13	Mon	1/ 26/ 9	16: 41: 48	18.5	250	Accept-ReRun	2	NM	Tc	21	18

Figure 2.9 Rundown Log example

## 2.10 Log Info

Log info describes the usage of the Controller and the tools that have been used with that controller.

**POR Counts** - Number of times the controller power has been cycled.

**Controller Cycles** - Number of rundown the controller has completed.

**Tool Log** - Displays history of tools that have been previously connected to the controller.

**Monthly Usage** - Displays history of the number of rundowns the controller has preformed divided in to months and years.



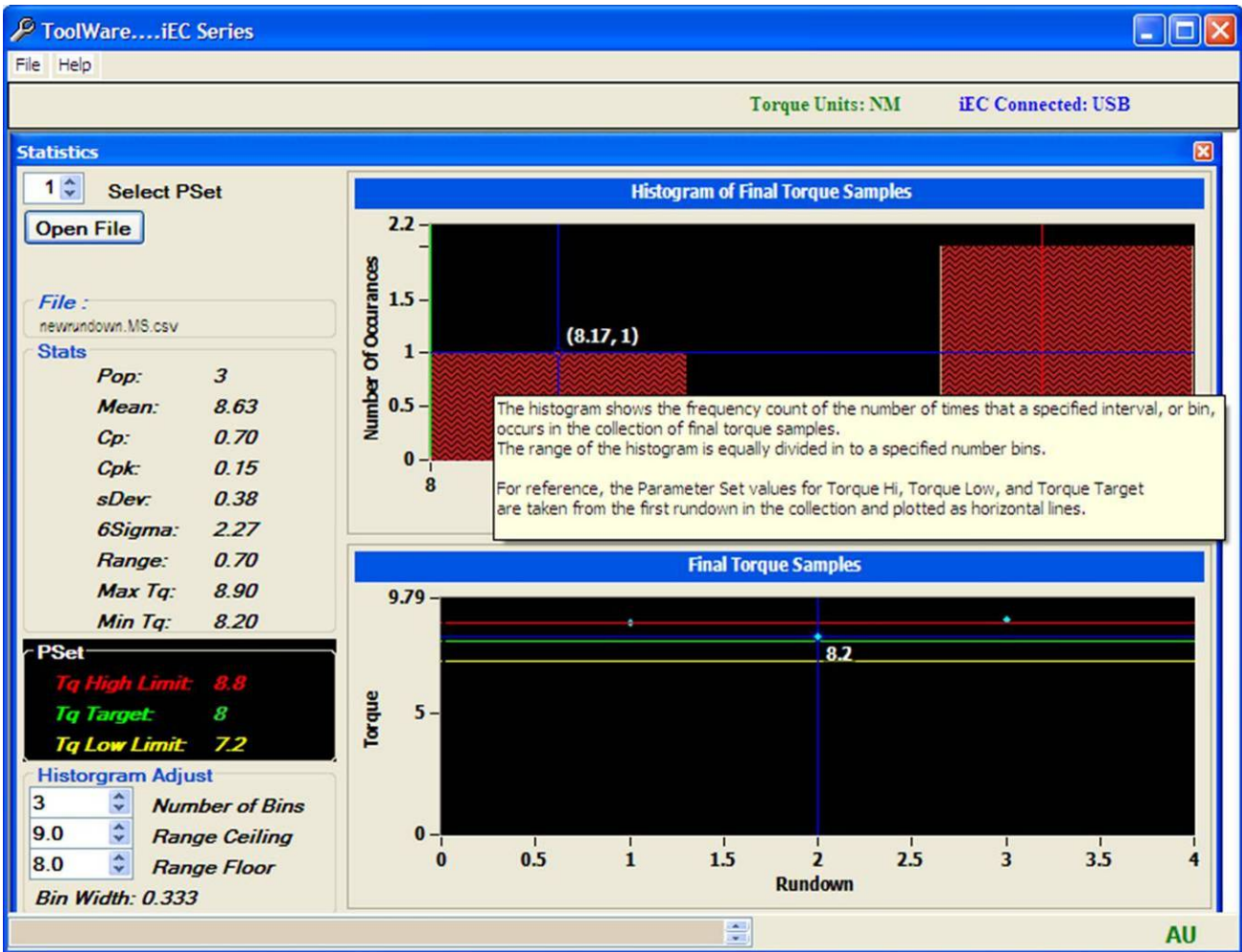


Figure 2.11 Statistics screen example

**PSet Selection (Parameter Set):**

- a. Only rundowns with the Pset selected are used in the collection. In addition, Only Rundowns with settings for Torque High Limit, Torque Low Limit, and Target that match the first rundown are used in the collection.
- b. If 0 is selected for the Pset, all rundowns in the file will be used in the collection.

**Stats:**

- **POP:** Population; The total number of observations used to calculate the statistical data.
- **Mean:** (Sum of All Readings) / (Number of Readings)
- **CP:** Overall capability, which is the ratio of 6 sigma to the tolerance. The equation for CP is:  $(\text{Torque High Limit} - \text{Torque Low Limit}) / 6 \text{ Sigma}$
- **CPK:** Process capability, which takes both sigma and mean into account. The equation for CPK is the smaller of:  $(\text{Torque High Limit} - \text{Mean}) / 3 \text{ Sigma}$  or  $(\text{Mean} - \text{Torque Low Limit}) / 3 \text{ Sigma}$
- **6 Sigma:** The standard deviation multiplied by 6. A total range of 6 sigma will include 99.7% of all data. The equation for six sigma is as follows:

$$6\sigma = 6 X$$

- **Range:** The difference between the maximum and minimum reading.
- **Min Tq:** The maximum torque reading.
- **Max Tq:** The minimum torque reading.

## Histogram of Final Torque Samples

The histogram shows the frequency count of the number of times that a specified interval, or bin, occurs in the collection of final torque samples. The range of the histogram is equally divided in to a specified number bins using the following equations:

- The width
- of the frequency bin is
  - $\Delta x = \frac{\text{max} - \text{min}}{m}$
  - Where:
    - $m$  is the selected *Number of Bins*.
    - max is the upper ceiling for the torque range to be evaluated (*Range Ceiling*)
    - min is the lower floor for the torque range to be evaluated (*Range Floor*)
- The *center points* of each bin are set according to the following equation:
  - $\text{center}_i = \text{min} + \frac{\Delta x}{2} + \Delta x i$

For reference, the Parameter Set values for Torque Hi, Torque Low, and Torque Target are taken from the first rundown in the collection and plotted as horizontal lines.

### Histogram adjustment:

The width, center point, and number of bins can be adjusted by selecting different values for Range Ceiling, Range Floor and the Number of Bins.

- **Number of Bins Selection:** The histogram initially uses the number of rundowns in the collection for the number of bins. If there are more than 200 rundowns, then the number of bins is set to 200. The number of bins can be adjusted from 2 to the number of rundowns + 1.
- **Range Ceiling Adjustment:** This value is initially set to the maximum torque sample rounded up to the next higher integer. This can be adjusted in increments of 0.1
- **Range Floor Adjustment:** This value is initially set to the minimum torque sample rounded down to the next lower integer. This can be adjusted in increments of 0.1

Bin width and center points will be updated on a change to these values.

## Final Torque Sample Graph

The Final Torque Sample graph shows the final torque of each rundown in the collection. For reference, the Parameter Set values for Torque Hi, Torque Low, and Torque Target are taken from the first rundown in the collection and plotted as vertical lines.

## 2.12 AcraVision

AcraVision displays the current rundown information in an easy to read screen. If there is a failure in the tightening the Torque/Angle is displayed in red.

Use *Record Rundowns* to save the Rundown information straight to the Computer memory. You can use *View saved rundowns* to see the saved rundowns.

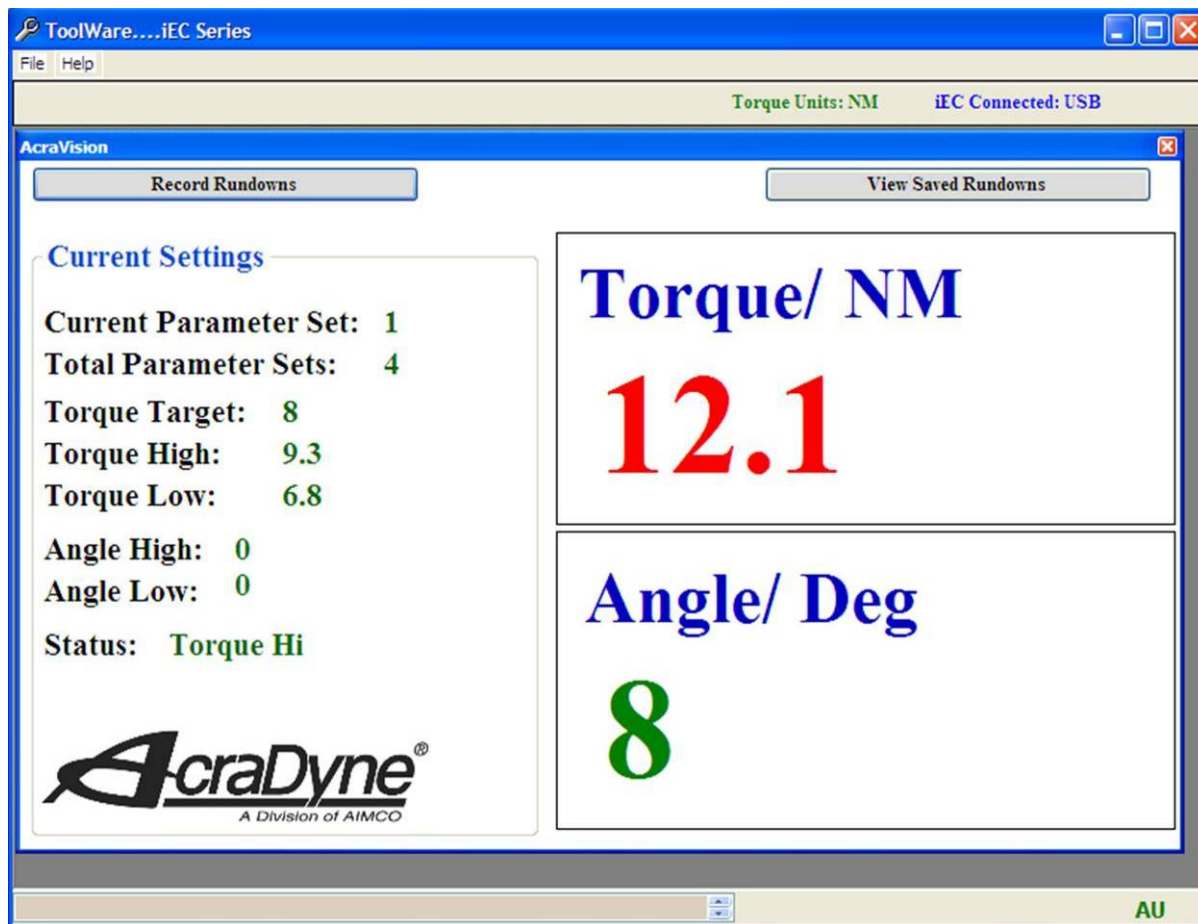


Figure 2.12 AcraVision Screen example

## 2.13 System

### 2.13.1 Socket Tray Monitor

Allows operator to see sockets are pulled from socket tray

### 2.13.2 Serial Test

Hyper-terminal like screen that can be used to monitor the serial output messages from the iEC controller

## 3. Addendum

### 3.1 Fault codes

Fault codes are displayed to inform the operator about what is happening in the Controller and why something doesn't behave as expected.

Auto Reset Faults			
AUT1	Fault	Description	Possible Causes
1	TID Timeout	tool id board communication timeout	faulty tool id board or tool cable
32	Tool GND	ground circuit problem between controller and tool	faulty tool cable, faulty tool connector, faulty ground connection within tool
64	Power On Throttle	run command on power up	tool laying on throttle lever on power up, tool buttons out of calibration
128	Button Timeout	button (run, fwd, rev) communication timeout	faulty tool id board
256	Button State	illegal button state (example fwd and rev)	tool buttons out of calibration,
512	Undefined Voltage	tool or controller voltage parameter is undefined	corrupt communication message from drive, corrupt tool id memory location
1024	UNUSED		
2048	Tool Update Req	tool parameter file is not compatible with controller	corrupt tool id memory location, outdated tool id parameters
4096	Illegal Tool	tool type is not compatible with controller	controller does not recognize tool type, Tool type not compatible with low speed control
Cycle Reset Faults			
CYC1	Fault	Description	Possible Causes
1	Free Run Timeout	tool has run no load too long	tool has run w/o crossing threshold for 5 seconds
2	Load Run Timeout	tool has run under load too long	tool has run after crossing threshold for 15 seconds
4	Hall Error	motor commutation signal error	faulty tool cable, faulty tool motor, obsolete tool cable used - probably with extension cable
8	Tool Offset	tool cannot reach target torque	tool significantly out of calibration, tool exposed to magnetic parts, faulty transducer
64	Tool Level	tool transducer output beyond electrical limits	tool exposed to magnetic parts, faulty transducer, faulty tool cable
512	Locked Rotor	motor has stalled for more than 100 msec	poor parameter settings for the application
1024	Drive Fault	motor drive shut down or not responding	tool stall detected by drive, faulty controller components
External Reset Faults			
EXT1	Fault	Description	Possible Causes
1	Param Value	illegal parameter set value	communication problem,
8	TID Param Value	illegal tool parameter value	corrupt tool id memory location, tool id communication problem
32	TID Param Timeout	communication timeout when reading tool parameter	tool id communication problem
4096	Target Value Fault	target out of range of tool	parameter set not correct for tool range, tool parameter corrupt
EXT2	Fault	Description	Possible Causes
1	TID EE Write	communication timeout when writing to tool memory	tool id communication problem
2	Drive Comm	communication timeout reading / writing to motor drive	motor drive communication problem
4	Vbus	measured controller voltage is not within required limits	corrupt message from motor drive to controller, controller plugged into illegal voltage
8	Drive Update Req	Drive firmware not compatible with low speed control	Low speed speed mode controller parameter selection requires drive firmware update

\* Fault codes that are displayed represent the sum of the fault codes indicated in the table  
 Example: Fault code AUT1: 129 represents code 128 and code 1  
 In this example there would be a Tool ID board timeout and a Button timeout

Figure Add.3.1 Fault Codes

## 3.2 Trouble Shooting

### 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 or tool. Try the tool and cable on another controller. The fault can be intermittent.

**Power on Throttle:** The System thinks that the 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 completely returning home completely after being released.

**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).

**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.

**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.

**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.

**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.

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