ToolWare

Operations Manual for PC Software Package to Interact with iEC AcraDyne Tool Control Systems

Version 3

Introduction

ToolWare Version 3 is the software package designed for communicating with AcraDyne DC Electric Tool Controllers.

ToolWare provides an easy-to-use, Windows-based platform that can be used for:

- Tightening strategy programming
- Collection and viewing of rundown data
- Statistical analysis
- Rundown curve analysis
- I/O monitoring and configuration

- Maintenance and calibration alert programming
- Controller configuration programming
- Tool calibration
- Batch programming
- Network communication configuration

This version of ToolWare is designed to be fully compatible with all iEC series AcraDyne Tool Controllers and the iControl AcraDyne Tool Systems. In addition, this software compliments and enhances features and benefits of AcraDyne 1000, 2000, 3000 and 8000 (HT) series tools that are connected to and used with AcraDyne controllers.

While past versions of AcraDyne's ToolWare software have been completely backwards compatible, version 2.1.0.0 marks the first version that is no longer compatible with the discontinued Evolution series controllers. Should you require software to run the older Evolution or iControl controllers, please visit www.aimco-global.com and look to the "Downloads" tab. There you will find older versions of ToolWare that will function with the Evolution or iControl controllers and are downloadable free of charge.

Contents

1. <u>Getting Started with ToolWare</u>

1.1 Terminology and Abbreviations

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

Table 1.1 Terminology and Abbreviations

Term/Abbreviation	Explanation
Tool	AcraDyne Nut runners including Pistol, Straight and Tubenut wrench
Controller	AcraDyne iEC 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
3.x.x.x	3.x.x	6.xx

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 1GB or higher RAM and Windows XP 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.

It is recommended to have your ToolWare CD files or Download files stored on your Hard Drive.

1.4 Introduction to ToolWare User Interface

When ToolWare is initially opened, the selection box shown in Figure 1.4.1 will appear, if not connected to the controller.
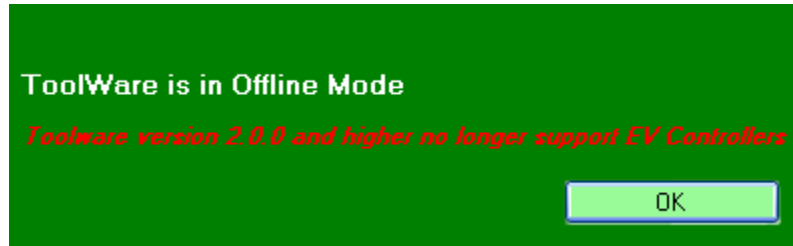

Figure 1.4.1 Dialog box for selection of controller platform being used

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.
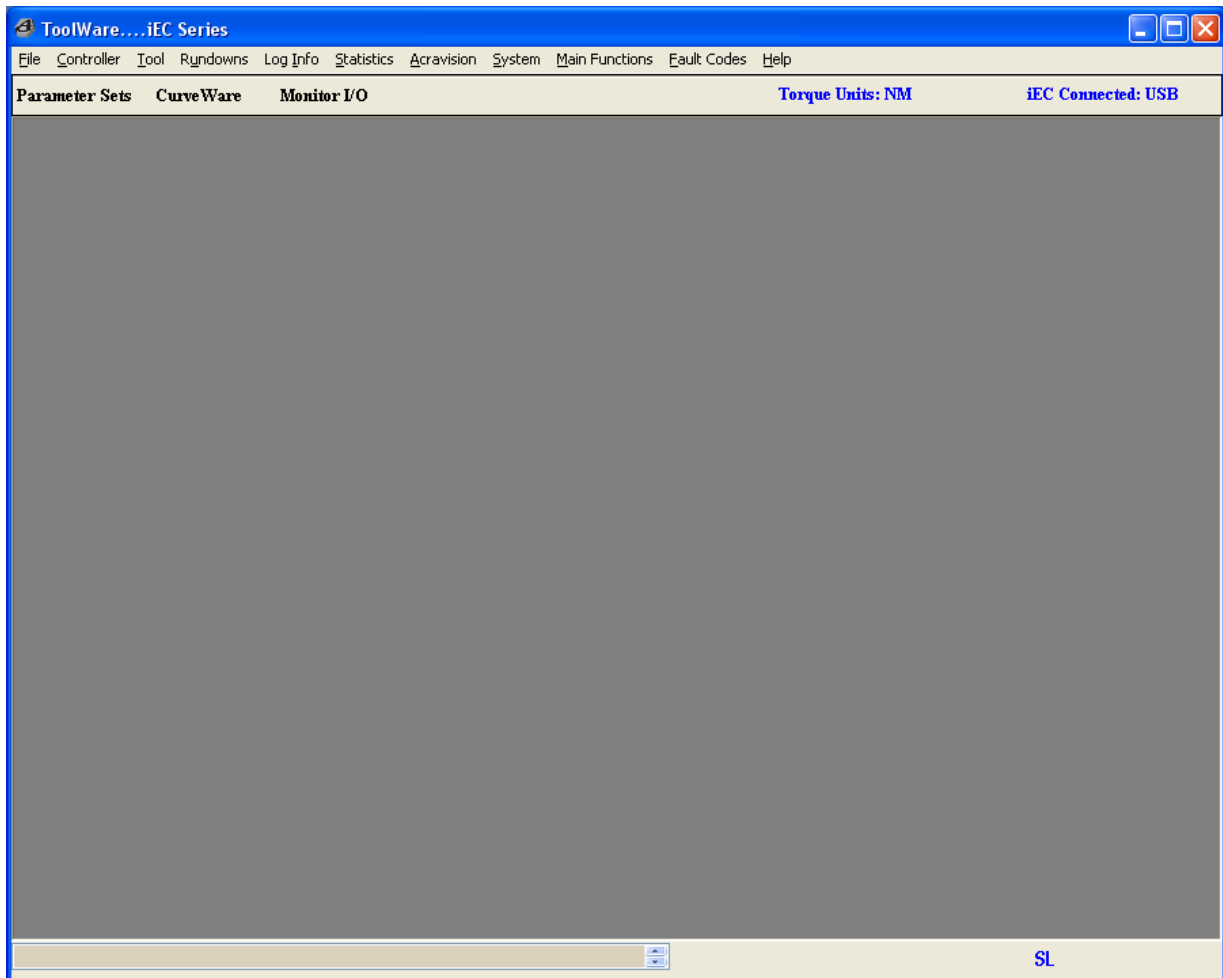

Figure 1.4.2 Main Screen of ToolWare

1.4.1 ToolWare Menu Structure

Menu Level			Supported Functionality
File	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
	LANGUAGE		Switch Language Locale
	LogOff		Program remains open, some menu items not accessible
	Exit		Close the program
Controller	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
Tool	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
Rundowns			Display rundown data in a tabular format
Log Info	Usage		View tool and controller usage information
Statistics			Performs statistical analysis of a previously saved rundown-data file
AcraVision			Displays real-time rundown information in full-screen view
System	Serial Test		Used for testing of serial data string information.
	Fault Codes		Displays a list of fault codes for the controller and tool.
Main Functions	Parameter Sets		Opens the parameter set programming window.
	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
Fault Codes			Displays a list of fault codes of the controller and tool.
Help	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
- 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

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

1.5 Connecting IEC Controller with PC

ToolWare supports –2 options of connecting Controller to PC depending on the interface and the model of AcraDyne Controller:

- USB port through the CIM adapter (P/N # AEC-CIM)
- Ethernet port through the Ethernet crossover cable or standard cable

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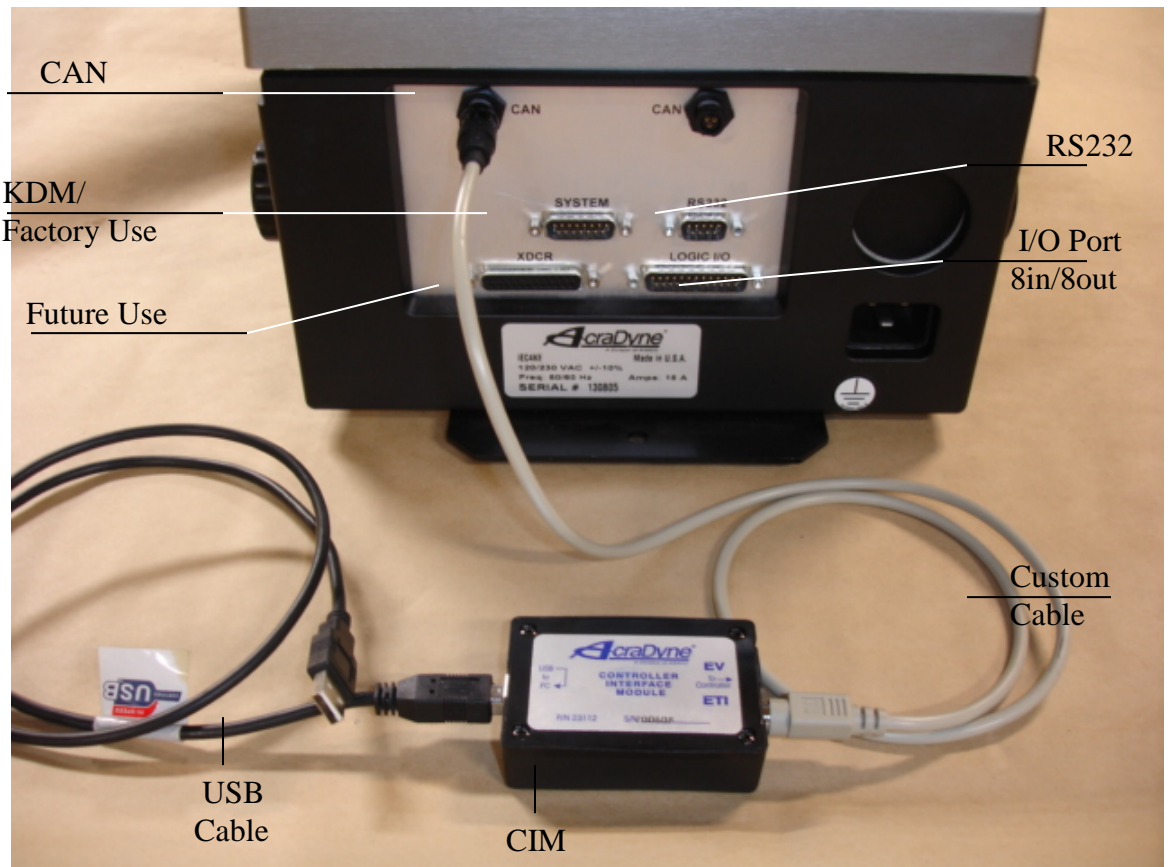
Figure 1.5.1 iEC Controller Bottom panel

Tool Cable

COM1
RS232

Ethernet Port2

COM2
Bar Code Scanner

Ethernet Port1

RJ45 CAT 5E
Regular Cable
Straight
through pin out
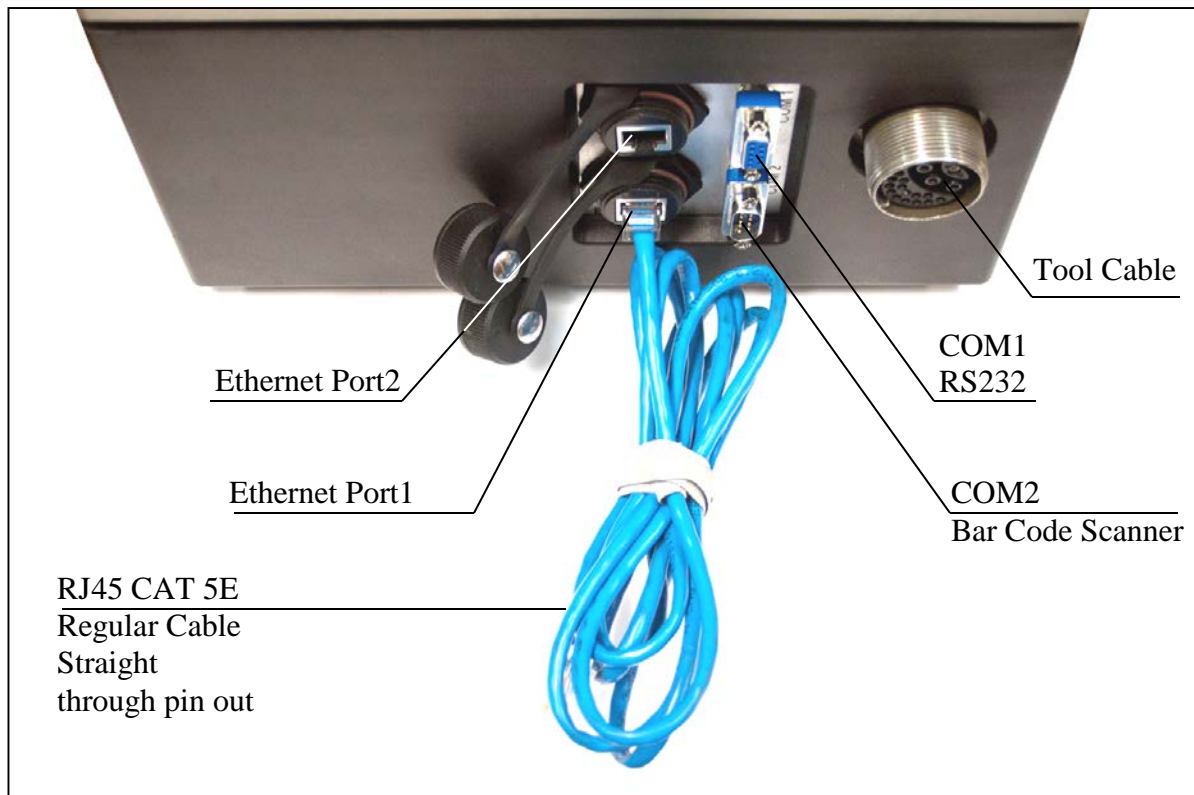
Figure 1.5.2 iEC controller electrical interface, top panel (Some connections available on iEC3 and iEC4 models only

1.5.1 Connecting to USB port

IEC Controller		AEC-CIM P/N 23112 (Includes P/N 23217/22940)		PC	
CAN port	←→		←→	USB port	

Cable PN: 23217

Cable PN: 22940
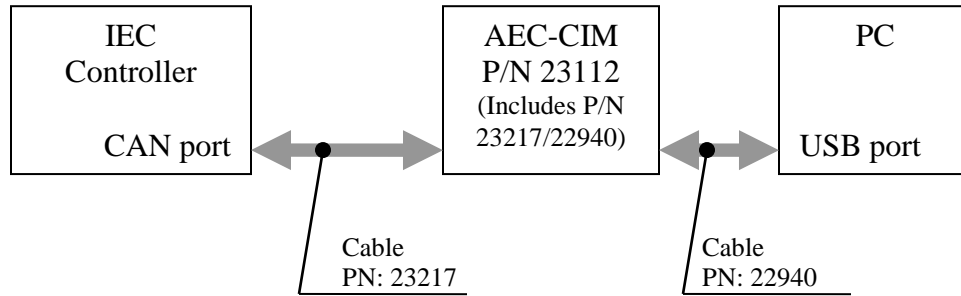
1.5.2 Connecting to Ethernet Port

IEC Controller		PC	
Ethernet port	←→	Ethernet port	

RJ45 cable /cross over
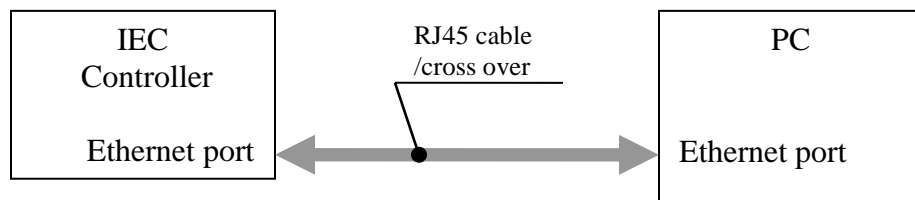
1.5.3 Connecting to the network

IEC Controller		Network Router	
Ethernet port	←→	Ethernet port	

Cable PN: 20403

RJ45 CAT5E
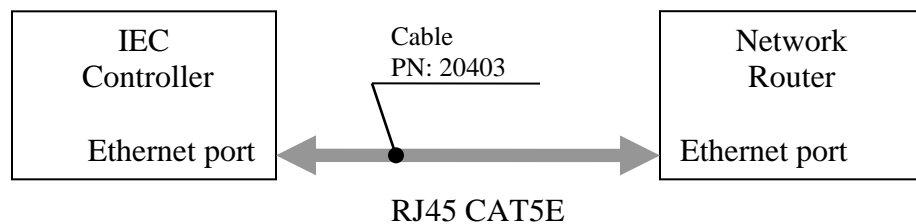
2. Working with ToolWare

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

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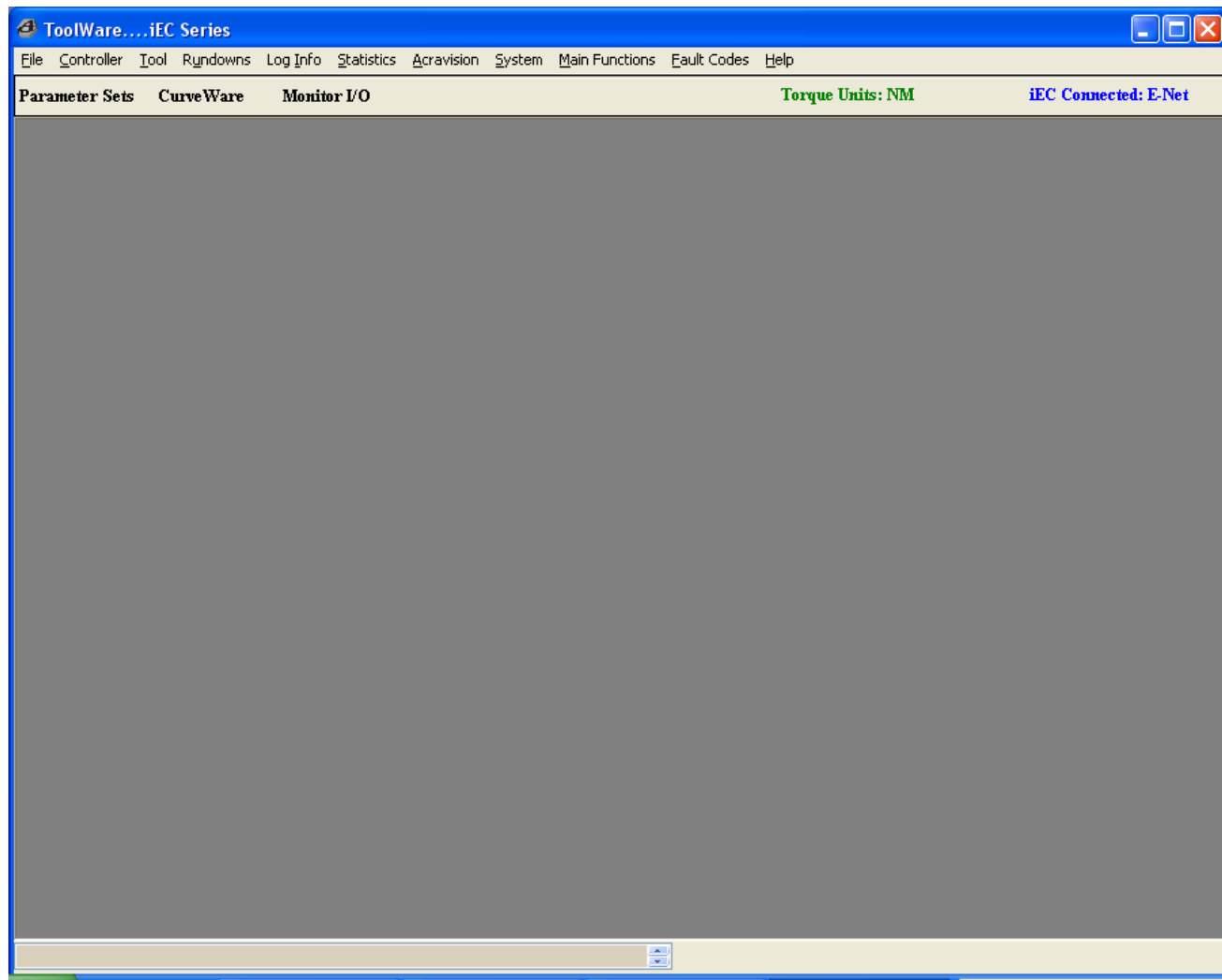
2.2 Setting Parameters

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 2.2. ToolWare can send and receive up to 32 Parameter sets to the controller.

Figure 2.2 Parameter Sets View/Edit Window

2.2.1 Parameter Entry Fields

Strategy - Select one of four fastening strategy options.

- o **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.
- o **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.
- o **Tm-Ac -** *Torque Monitoring / Angle Contro*l 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.
- o **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.

Linked PSets – creates a group of sequential Parameter Sets actuated by a single trigger pull. To define the last Parameter Set in the group, unselect "Link PSet" by placing a 0 in the field.

Link Delay - used to add a delay time between the linked steps.

Running a Linked PSet rundown:

- To run a Linked PSet group, select the first PSet in the group as the "Current PSet". (Via the CHANGE PSET button on the controller, or using Logic IO, or using the "Current" PSet selection in Toolware)
- Link the PSets by selecting the next PSet in the Current PSet's "Link PSet" Drop down. If you want to have a delay between the rundowns enter that in   the "Link Delay" Drop Down box. If you want to link more PSets then repeat this step.
- Run the tool as usual by pressing and holding the throttle.
- The tool will sequence thru each PSet in the Linked PSet group.
- At the completion of last the PSet of the group, the controller will signify the Linked PSet rundown is complete by lighting the cycle accept (or reject) led and turning off the blue In-cycle led.
- The current PSet will automatically reset to the first PSet in the group to ready for the next rundown.
- A release and repress of the trigger is necessary to start the next Linked PSet rundown.

Linked PSet Results Reporting:

The angle count is reset to 0 at the end of each linked step of a Linked PSet rundown.

RBR Combined with a Linked PSet Rundown Note:

The RBR, RB, and RBsp, options are only preformed at the end of the last step of a Linked PSet rundown

Results Reporting:

The results of the last PSet Step in the group are used to report.

If the trigger is released before the rundown sequence is complete, the results from the step that the controller was currently running, before being interrupted, are reported.

The controller reports curve data from the last rundown step and any linked previous steps if not separated by a delay time.

Batch Processing:

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. When PSets are linked only the last PSet has batch settings.

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:
- Act1 - Reset count and output batch complete
- Act2 - Hold count and output batch complete
- Act3 - Disable tool – Hold count and output batch complete
- Act4 - Go to next PSet & do not output batch complete
- Act5 - 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

2.2.2 Parameter Sets

Parameter Enable - check boxes allow the user to generate up to 32 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 30%, 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 or Low Speed Control 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.
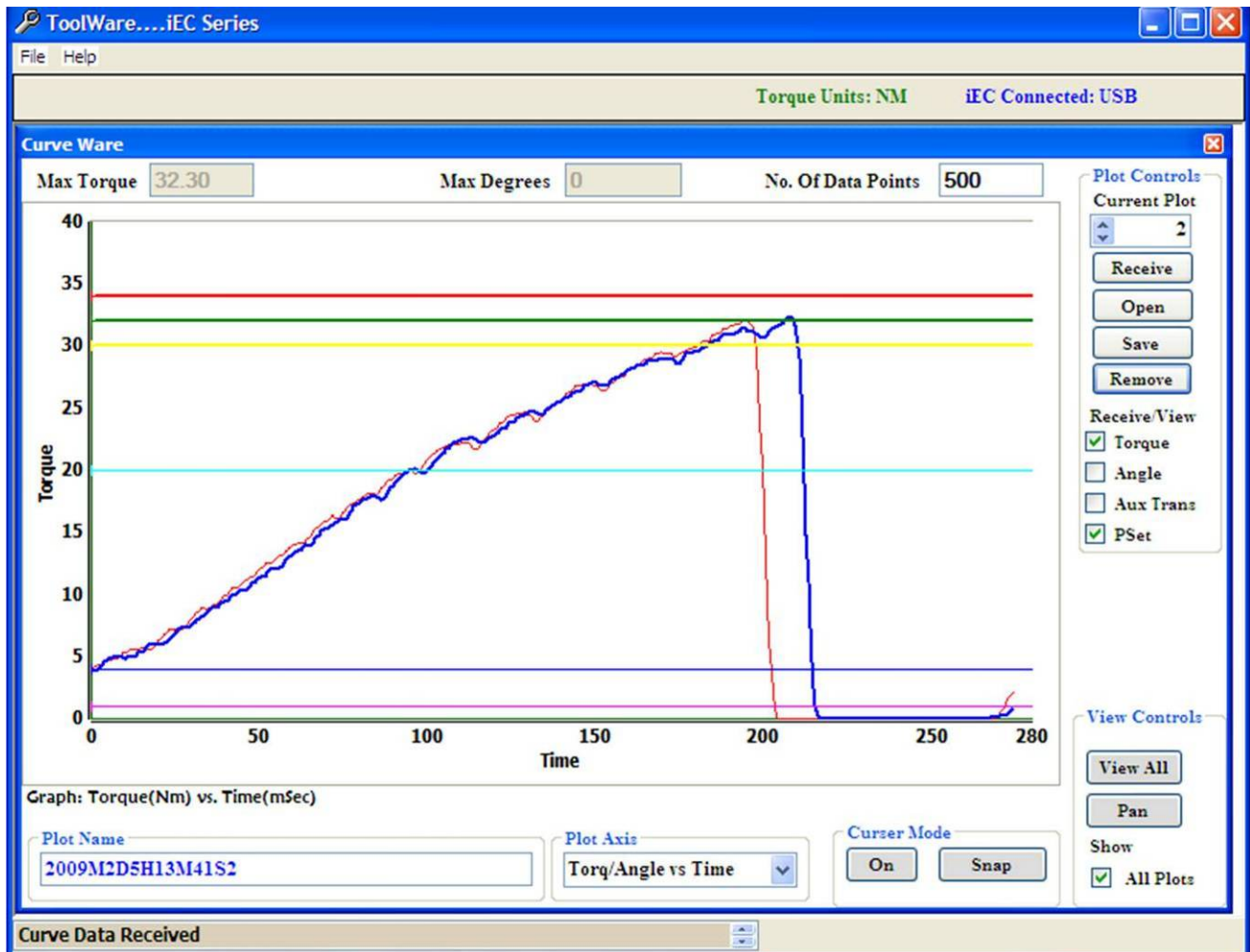
Figure 2.3 CurveWare example

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 Nth rundown that has been recorded is highlighted in the graph.

Receive – downloads last rundown data from the Controller.

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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 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 2.4.

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 temporally. This screen also shows the state of the physical I/O. We can temporally change the control source between Tool buttons and Logic I/O port.
Selection of PSets through IO is limited to PSets 1-8. Selection of entire 32 PSets library requires network connectivity.
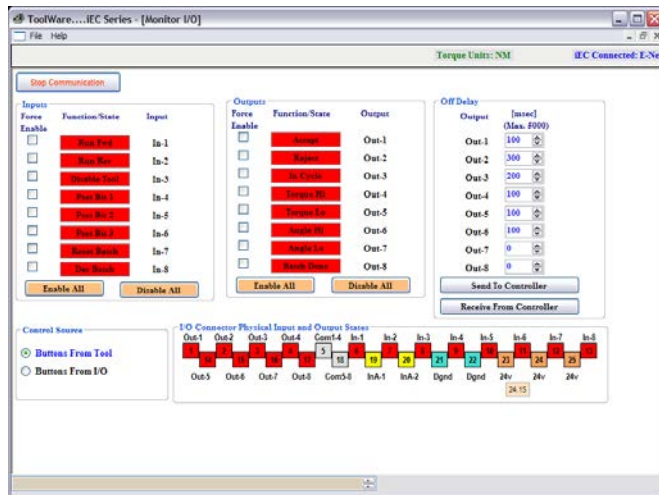
Figure 2.4 Monitor I/O screen

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-ridden 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.

2.5 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.

2.5.1 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 -edit parameter files and configuration files to save without being connected to the controller

2.5.2 Open

Enables the user to select the file to open

2.5.3 Save

Saves the file to the PC in the specified directory

2.5.4 Print

Print the Screen or the Data.

2.5.5 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.

2.5.6 Language

User can change language and locale either for the particular session or set it as default for the system. The application switches to the language the User selects.

2.5.7 Logoff

Log out of the user level the user is in.

2.5.8 Exit

Exits ToolWare

2.6 Controller

2.6.1 View Firmware Rev

Displays the current DSP revision and Servo Rev

2.6.2 Edit Configuration Parameters

The user can Edit the controller configuration from this screen. The screen is shown in Figure 2.6.2.
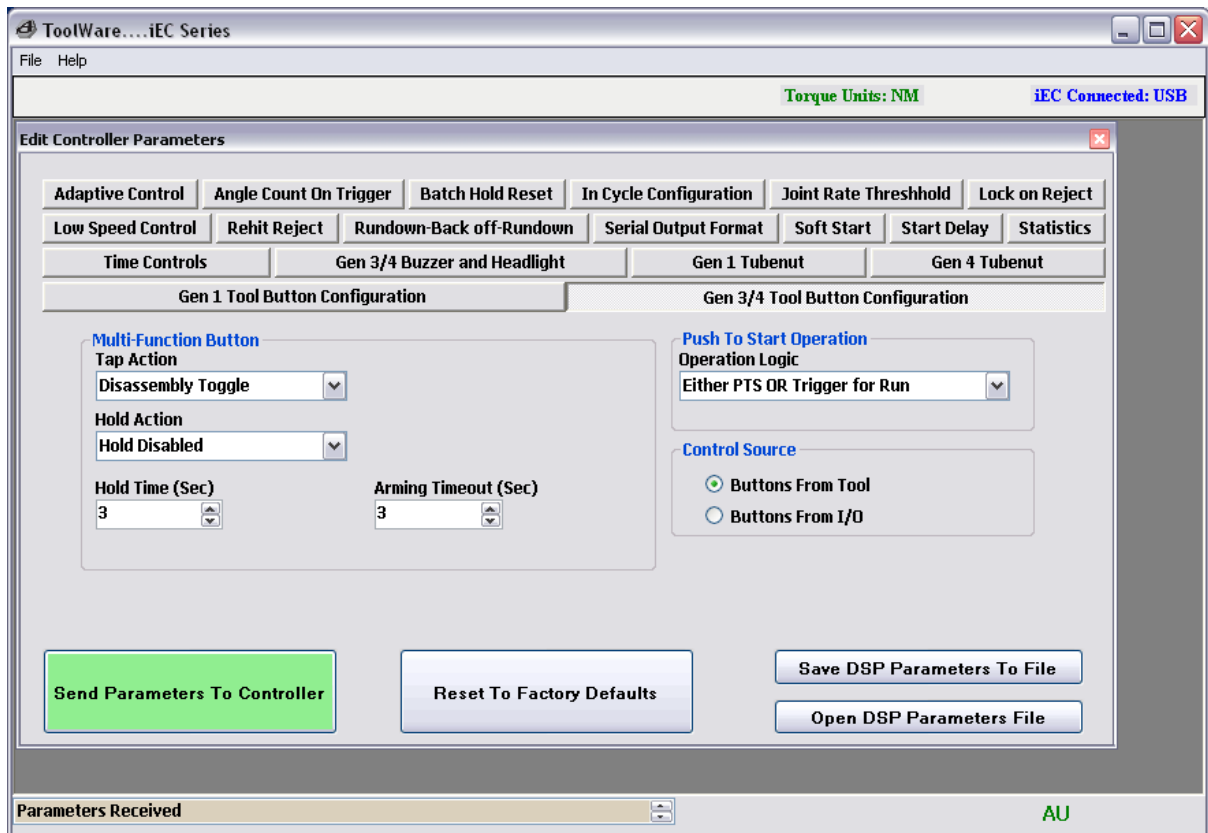
Figure 2.6.2 Edit Controller Parameter screen

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.

Note: In Cycle Configuration "At Throttle" and Rehit Reject are mutually exclusive selections.

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.

Note: Rehit Reject and In Cycle Configuration "At Throttle" are mutually exclusive selections.

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

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

- **Rundown Backoff SP** - Tool will rundown to selected PSet torque, reverse the fastener a set number of degrees defined by Back Off Degrees. Reports the Torque and Angle from the rundown.

- **Rundown-Backoff-Rundown** – Rundown to the 1st 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. Reports the Torque and Angle at end of cycle.

- **Rundown-Backoff** - Tool will rundown to 1st Rundown Torque, reverse the fastener a set number of degrees. Reports the Torque and Angle at end of cycle.

- **Off** - Switches the Rundown-Backoff or Rundown-Backoff-Rundown to off mode

1st Rundown (in-lbs) - The initial rundown torque, measured in (in-lbs).

Dwell Time before Back Off - Dwell time [ms] between first rundown and the start of back off.

Back Off Degree - The amount of rotational degrees the fastener is backed off after reaching 1st rundown torque.
Back Off Torque Limit – This is the backoff torque limit, measured in (in-lbs)
Dwell Time before Second Rundown - Dwell time [ms] between back off and the start of second rundown.

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 A and PSET B. Status lights flash indicating PSET A is selected or twice if PSET B 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 A and PSET B. Status lights flash indicating PSET A is selected or twice if PSET B 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

Homing Type - There are three options
- No Home
- Home on release and repress of main trigger
- Auto Home on release of Main trigger

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).
WARNING: If Latching Throttle is Enabled and Tubenut Homing Option is set to "Auto Home on Release of Main Trigger", the Tubenut will attempt to home prematurely.

Gen 4 Tubenut

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

- Home Retry: Tapping the MFB button puts the tool into homing mode. All LEDs will flash and the horn will beep to signal the tool is in homing mode. Pressing the throttle(s) will start the homing move. After the homing is complete and the throttle(s) released, the tool will return to fastening mode. LEDs and horn will return to the previous state. 'Tool disable' will be ignored during the retry homing cycle.
- 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 A and PSET B. Status lights flash indicating PSET A is selected or twice if PSET B 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.

- Home Retry: Holding the MFB button puts the tool into homing mode. All LEDs will flash and the horn will beep to signal the tool is in homing mode. Pressing the throttle(s) will start the homing move. After the homing is complete and the throttle(s) released, the tool will return to fastening mode. LEDs and horn will return to the previous state. 'Tool disable' will be ignored during the retry homing cycle.
- 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 A and PSET B. Status lights flash indicating PSET A is selected or twice if PSET B is selected
- Reset Reject Tone: Holding MFB button silences reject tone
- Hold Disabled (Default): Holding MFB button has no effect on tool

Homing Type - There are three options
- No Home
- Home on release and repress of main trigger
- Auto Home on release of Main trigger

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).

Note: If Latching Throttle is Enabled and Tubenut Homing Option is set to "Auto Home on Release of Main Trigger" the Tubenut will attempt to home prematurely.

Latching Throttle
Pull trigger and tool finishes cycle automatically.
A second trigger tap stops tool.
Tool will unlatch automatically at the end of the rundown.

Latching Throttle Options:
- Latch by Using the MFB Option

1. Press and hold trigger
2. Press and hold MFB
3. Release trigger
4. Release MFB
- Press and Hold Option
  1. Hold trigger down for x seconds to latch throttle.
- No Latch Option (Default)

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 ("1" – "9") for PSets 1-9, ("A" – "W") for PSets 10-32
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 ("1" – "9") for PSets 1-9, ("A" – "W") for PSets 10-32
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 ("1" – "9") for PSets 1-9, ("A" – "W") for PSets 10-32
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 performed 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 may not home accurately in Low Speed Control Mode.
- 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 Configuration
- This option determines when the angle count is started. Start angle count at threshold (default): The angle count is started when the tool crosses threshold torque,
- Start angle count on throttle.: The angle count is started when the tool is activated.

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.

2.6.3   Angle Offset Calibration

Angle Calibration Value:

- The value for this will determine how much to add or subtract to the angle measured and reported by the iEC controller.
- The offset is added at the start of threshold.
- The default value for this is 100. The range is 1 to 200.
- The units are (value - 100) = degrees of correction.
- Examples:
  - A value of 100 = No correction. This is the default value.
  - A value of 90 = 10 degrees added to iEC angle measurement.
  - A value of 110 = 10 degrees subtracted from iEC angle measurement.

Reset to Factory Calibration: The angle calibration value will be set to 100 = No correction.

Angle Offset Calibration Routine: Toolware will automaticity calculate and send the angle
offset calibration value to the controller.

2.6.4 View/Edit Date Time

Sets the date and time in the Controller

2.6.5 Reset Controller to Defaults

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

2.7 Tool

2.7.1 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

2.7.2 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 Tubenut Parameters according to their application need and send it to the tool.

Figure 2.7.2 Tool Configuration and tubenut tool setup

Multiplier - Configures the tool to include gearing added to the base model.
Units: Gear Ratio * 100.
a. Example: Adding a multiplier with a gear ratio of 5:1, Multiplier setting = 5.

Obstruction 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.

2.7.3 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.
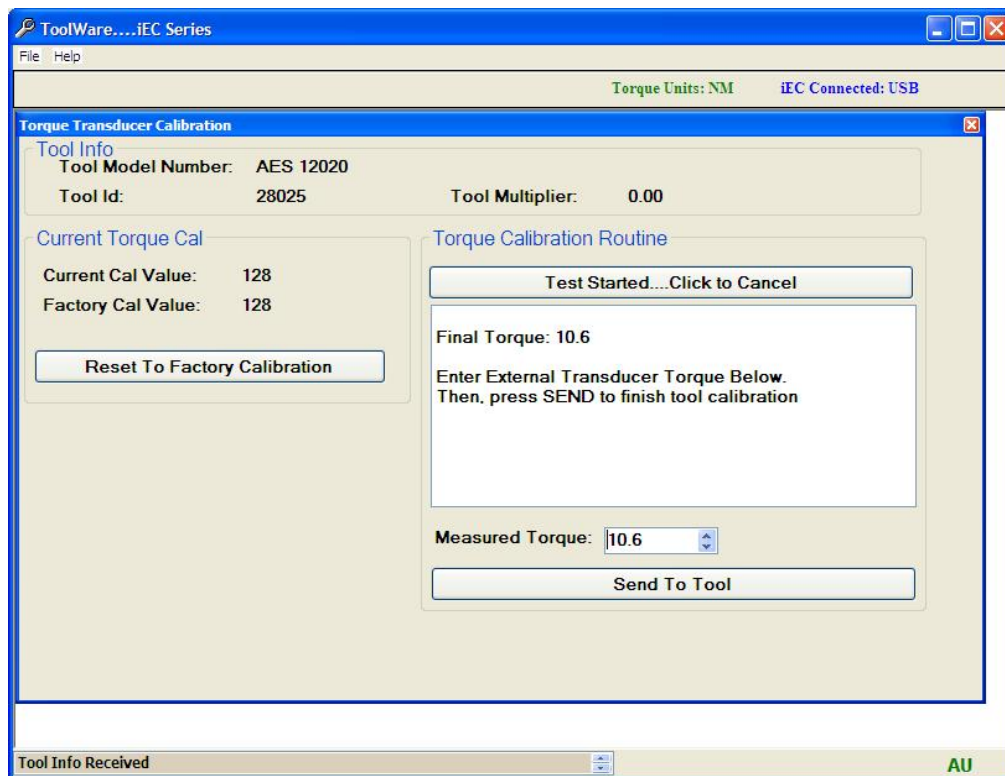
Figure 2.7.3 Tool calibration screen

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
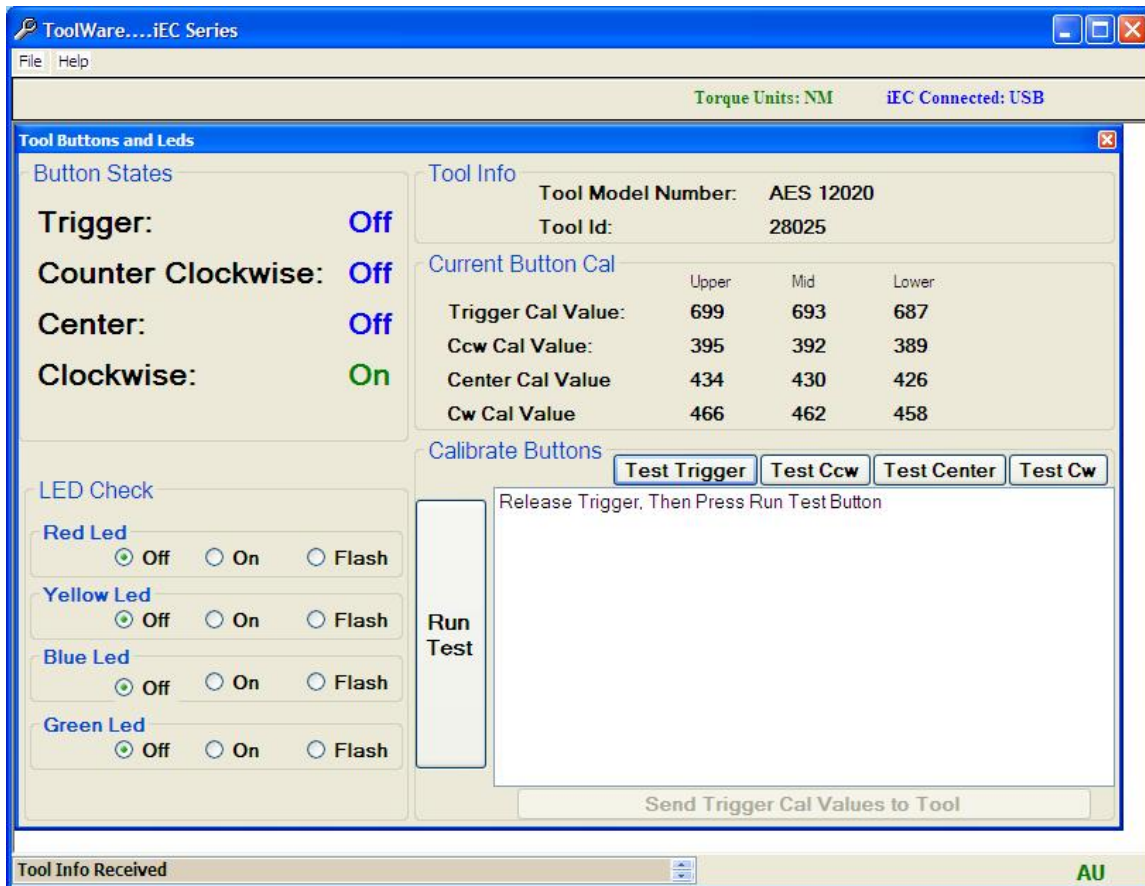
Figure 2.7.4 LED programming and button calibration

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.

2.7.5 Tool Service and Calibration Log

2.8 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

2.8.1 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.

2.8.2 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 select the columns you want to see, select custom and choose the columns from the selection menu
- You can restrict the number of rundowns you want to see by selecting the Max. Rows (0 means all)
- The Rundowns are ordered by latest first. So the Recent Rundown will be the first record to be downloaded. You can stop download at any time and analyze the records that are downloaded.

To begin rundown data download, click "Start Rundown Receive"

Note: Statistics functionality requires "All Data" to be selected.
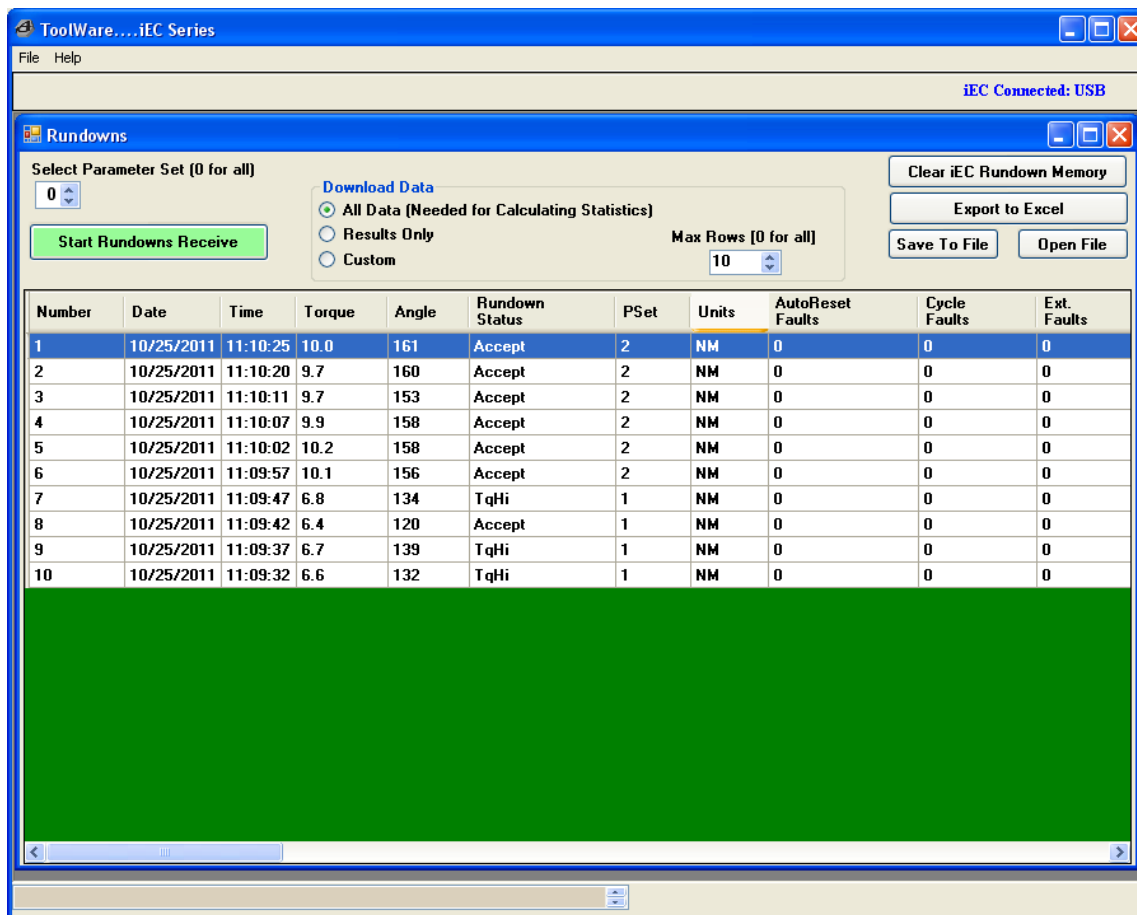
Figure 2.8 Rundown Log example

2.9 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.

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Monthly Usage - Displays history of the number of rundowns the controller has performed divided into months and years.

Note: Serial/Model number entries in usage log are abbreviated for functionality will legacy tools.
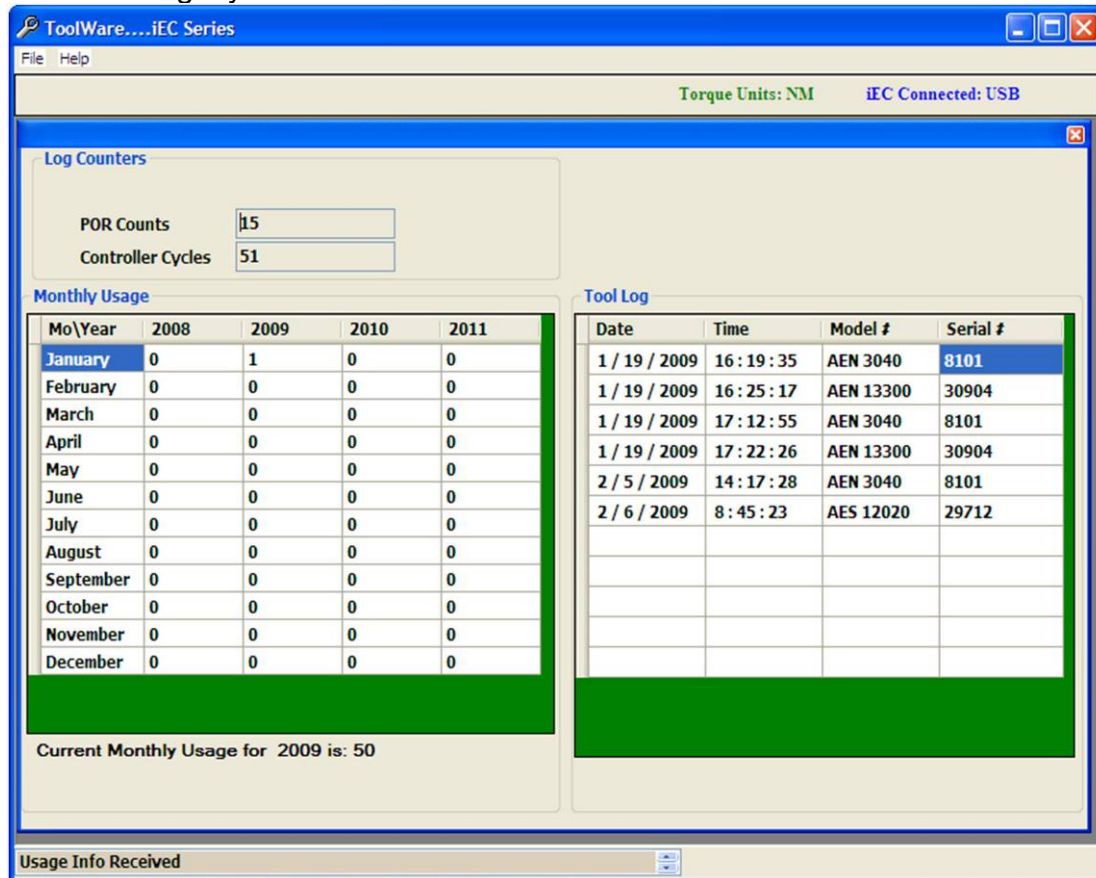
Figure 2.9 Tool / controller Log Info example

2.10   Statistics

The statistics page takes a collection of final torque samples from a rundown file then calculates and displays statistical information about the collection. In addition, a histogram is plotted, and the final torque for each rundown is displayed graphically. The maximum number of rundowns that can be evaluated is 2048. If more data is stored in the file, then data for only first 2048 rundowns are used. Torque values are displayed in the units shown on the Main Window toolbar. Rundown Files are saved using Toolware with *.MS.csv extension. This file type can be generated in the Rundowns page by receiving rundown data, then saving the data to a type *.MS.csv file. We can open this using the File -> Open option.
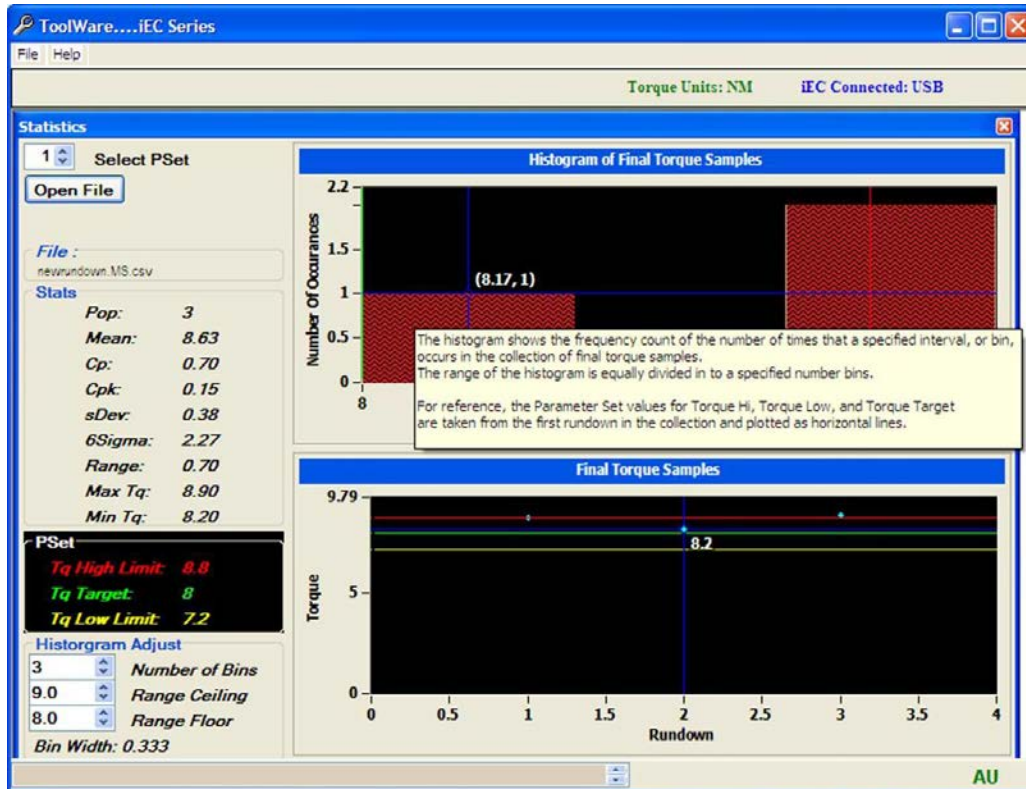
Figure 2.10 Statistics screen example

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: (Torque High Limit – Torque Low Limit) / 6 Sigma

- **CPK:** Process capability, which takes both sigma and mean into account. The equation for CPK is the smaller of: (Torque High Limit – Mean) / 3 Sigma or (Mean – Torque Low Limit) / 3 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:

$$6\sigma = 6 \text{ X}$$

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- **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
  - $$\Delta x = \frac{max - min}{m}$$
  - 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:
  - $$center_i = min + \frac{\Delta x}{2} + \Delta xi$$

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.

2.11 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 2.11 AcraVision Screen example

2.12 System

2.12.1 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.

FAULT CODE DETAILS

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
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 compatable 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	Pset 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**		
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 compatable 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

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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 or Trigger and MFB button

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 in 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 factory defaults.

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.

3.3 Tubenut Tool Setup Details

Overview

The following describes the setup required for tube-nut tool operation. This includes determining the values for tube-nut specific TID parameters (parameters residing in the tool memory) and iEC Controller parameters.

3.3.1 Tube-Nut Homing

Tube-Nut Home TID parameters:

The tube-nut TID parameters can be viewed and modified from the Tool-> Edit->Tool Setup screen in ToolWare. The tool to be configured must be connected to the controller.

- Home Detection Torque - **Home (in*Lb)**
    - When the tool is homing, reaching this torque indicates to the controller the tool output socket has reached the home stop and is in the open position.
    - If the tool output does not attempt to return or does not completely reach the home position, this value is too low

- o **Attention: Setting this value too high can potentially damage the tool.**
- o Units: lbf-in
- o TID memory location: 53
- Hold at Home Torque - **Open Loop (in*Lb)**
  - o After reaching the home position, this torque is applied against the home stop to prevent the socket from bouncing to a partially closed position.
  - o This value is typically set to a value slightly lower than the home detection torque.
  - o If the socket is bouncing back to a partially closed position after reaching the home stop, this value is too low.
  - o **Attention: Setting this value too high can cause the socket to snap back to the home stop too quickly and potentially damage the tool.**
  - o Units: lbf-in (approximation)
  - o TID memory location: 54

Typical Procedure for setting the tool's Tubenut Home TID Parameters
- Set the Hold at Home Torque = 0
- Set the Home Detection Torque = 1
- Free run the tool and watch the homing routine while making the adjustments below.
- Gradually increase the value for the Home Detection Torque until the tool reliably returns to the home position.
- Once a good value for the Home Detection Torque is found, if the tool is bouncing back to a partially closed position after hitting the home stop.
  - o Gradually increase the value for the Hold at Home Torque until bounce back is eliminated.

Controller parameters affecting tube-nut homing:
Controller parameters for tube-nut operation can be viewed and modified from the Controller->Edit Controller Parameter->Tube-nut screen in ToolWare.
- Tube-Nut Backoff Speed:
  - o This is the speed the tool output socket travels when returning to the home position.
  - o Decreasing this can reduce the impact force when hitting the home stop.
  - o **Attention: Care must be taken, increasing the speed above the default value. Too high of a value can greatly increase how hard the output will hit the home stop and potentially damage the tool.**
  - o Units: RPM of the tool output socket in the homing direction
  - o Default value: 100 RPM**.**
  - o Range: 10 to 500 RPM
- Tube-Nut Homing Reverse Dwell Time:
  - o The amount of time before the output is allowed to home, after the rundown is complete and the tool lever is released.
  - o Units: Seconds
  - o Default value: 0.5 Seconds
  - o Range: 0 to 2 Seconds

- Tube-Nut Home Dwell time:
  - The amount of time the tool holds at home to prevent bounce back
  - Too short of home dwell time can increase the occurrence of bounce back. However, decreasing the homing speed can decrease the severity of bounce back after the home stop is reached and allow for a shorter dwell time.
  - Units: Seconds
  - Default value: 0.5 Seconds
  - Range: 0 to 2 Seconds

3.3.2 Tube Nut Pinch Detection

Tube-Nut Home TID parameters:

The tube-nut TID parameters can be viewed and modified from the Tool-> Edit->Tool Setup screen in ToolWare. The tool to be configured must be connected to the controller.
- Obstruction Detection Torque - **(in*Lb)**
  - At the start of rundown before the output rotation has passed though the Obstruction Check Zone (where the output is open at the start of the fasting cycle), the tool will stop and fastening cycle will be aborted if this torque is exceeded.
  - If the tool stops, when the output is open during this first part of the rundown, without any obstruction, the value is too low.
  - Units: lbf-in
  - TID memory location: 53

Typical Procedure for setting the tool's Tubenut obstruction detection parameters:
- Set the value for the obstruction torque just high enough so the tool will reliably overcome gear friction and make it past the obstruction checking zone.
- Check the torque of the stop on obstruction feature by measuring the actual "pinch" torque the tube nut produces at the start of the rundown when the jaws are open (within the obstruction detection angle range). This can be done on a semi-tightened joint simulator set for a hard joint, while auditing the torque.
- Note: Gear friction in the tube-nut head can greatly affect the ability to reliably detect an obstruction.

Controller parameters affecting tube nut pinch detection.

Controller parameters for soft-start operation can be viewed and modified from the Controller->Edit Controller Parameter->Soft Start in ToolWare.
- Soft Start Dwell Speed
  - The Soft Start Dwell Speed is used during the check for obstructions.
  - Decreasing this can reduce the impact force when hitting an obstruction.
  - <u>**Attention:**</u> **Care must be taken, increasing the speed above the default value. Too high of a value can greatly increase how hard the output will hit the obstruction.**

- Units: RPM of the tool output
- Default: 90 RPM
- Range: 1 to 500 RPM

3.3.3 Tube-Nut Homing Start Input Logic Selection

The controller parameters for tube- operation can be viewed and modified from the Controller->Edit Controller Parameter->Tube-nut screen in ToolWare.

- Tube-nut Home Strategy:
  - Lever action required to start the home sequence.
  - Options:
    - Home on release and repress of the lever (default)
    - Home on release of the lever

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