STANLEY Assembly Technologies

Theta Controller User Manual

Software Version QC1-1.0.1

Important Safeguards

For your protection, please read these instructions completely, and keep this manual for future reference. Carefully observe and comply with all warnings, cautions and instructions placed on the equipment or described in this manual.

www.StanleyAssembly.com
ThetaUser091008

Contents

Getting Started

This manual is intended to promote proper and safe use and give guidance to owners, employers, supervisors, and others responsible for training and safe use by operators and maintainers. Please contact your Stanley Sales Engineer for further information or assistance on Stanley training or assembly tool operations.

1.1 EC Directives

The QPM tightening systems are designed and built, in whole or in part, using the following standards and or directives.

2006/42/EC Machinery Directive

Standard	Title / Description
EN292-1,2	*Safety of Machinery - Basic Concepts*
EN14121-1	*Safety of Machinery - Principles of Risk Assessment*
EN50178	*Electronic Equipment for Use in Power Installations*
EN60204-1	*Safety of Machinery, Part 1 - Electrical Equipment of Machines*
EN60745-1	*Hand-Held Motor-Operated Electric Tools - Safety*

89/336/EEC Electromagnetic Compatibility Directive

Standard	Title / Description
EN55011	*Conducted and Radiated Emissions*
EN61000-3-2	*Current Harmonics*
EN61000-3-3	*Voltage Fluctuation and Flicker*
EN61000-4-3	*Radiated Immunity*
EN61000-4-4	*Fast Burst Transients*
EN61000-4-5	*Surge*
EN61000-4-6	*Conducted Immunity*
EN61000-4-8	*Magnetic Immunity*
EN61000-4-11	*Voltage dips/interruptions*
EN61000-4-2	*Electrostatic Discharge Immunity* *Level 4: Contact Discharge 8 KV, Air Discharge 15 KV*

1.2 Warnings and Cautions

The safety notices and warnings for protection against loss of life (the users or service personnel) or for the protection against damage to property are highlighted in this document by the terms and pictograms defined here. The terms used in this document and marked on the equipment itself have the following significance:

Danger — Indicates that death or severe personal injury will result if proper precautions are not taken.

Indicates a general hazard. This icon appears as a part of a Danger, Warning, or Caution notice.

Warning — Indicates that death or severe personal injury **may** result if proper precautions are not taken.

Indicates that eye protection should be worn. This icon appears as a part of a Danger, Warning, or Caution notice.

Caution — Indicates that property damage may result if proper precautions are not taken.

Read and understand all the safety recommendations and all operating instructions before operating tools and controllers.

Indicates an electrical hazard. This icon appears as a part of a Danger, Warning, or Caution notice.

Indicates an item of special interest.

W A R N I N G

To Avoid Injury:

- Read and understand all the safety recommendations and all operating instructions before operating tools and controllers. Save these instructions for future reference.
- Train all operators in the safe and proper use of power tools. Operators should report any unsafe condition to their supervisor.
- Follow all safety recommendations in the manual that apply to the tools being used and the nature of the work being performed.
- Verify that all warning labels illustrated in this manual are readable. Replacement labels are available at no additional cost from **STANLEY ASSEMBLY TECHNOLOGIES**.

Qualified Personnel

W A R N I N G

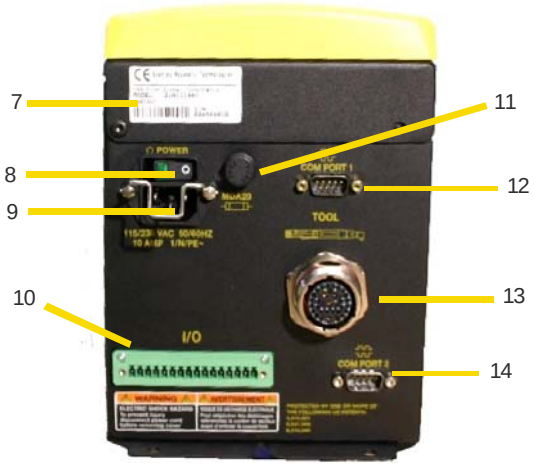
To Avoid Injury:

- Only allow suitably qualified personnel to install, program, or maintain this equipment and or system.
- These persons must be knowledgeable of any potential sources of danger and maintenance measures as set out in the Installation, Operations, and Maintenance manual.
- This product must be transported, stored, and installed as intended, and maintained and operated with care to ensure that the product functions correctly and safely.
- Persons responsible for system planning and design must be familiar with the safety concepts of automation equipment.

1.3 Specifications, Layout and Display

Dimensions	Width:	6.0 in	152 mm		
	Height:	14.2 in	361 mm		
	Depth:	8.2 in	208 mm		
Weight:		15 lb	7.0kg		
Operating Conditions:	Temperature:	32 to 122 ºF (0 to +50 ºC)			
	Humidity:	0 to 95 % non-condensing			
Power Source:	100 – 126 VAC, 50/60 Hz, 15 – 20A service or 207 – 253 VAC, 50/60 Hz, 10 – 16A service				
Power Consumption:	Stand by:		0.2 A (amperes)		
	Continuous:		1-2.5 kVA		
Tool Motor Power:	Service Rating:	EC02/EC22	EC33/EC34	EC44/E45	EC55
Consumption	@ 115 VAC:	15A	15A	20A	---
	@ 230 VAC:	10A	10A	10A	16A
	Continuous kVA:	0.3	0.7	1	1.7

Theta Controller



Item	Functional Description
1	Red, Green, Yellow LED's for Limits Evaluation
2	Display
3	Function Keys with Active Label Above
4	Cursor Keys with Center Button to Expand Lists
5	Maintenance Due and ATC Active LED's
6	Numeric Keypad to Enter Numbers or Select Options
7	Controller Label and Serial Number
8	Power Switch
9	Power Input
10	24 VDC Input/Output Connector
11	20A Fuse MDA-20 (P/N 21R201007)
12	Serial Connector for Laptop
13	Tool Connector
14	Serial Connector for Network Protocols

1.4 Installation Instructions

W A R N I N G

To Avoid Injury:

- Always wear eye and foot protection when installing equipment.
- Only use equipment and accessories specifically designed to operate with Stanley assembly tools and use them only in the manner for which they are intended.
- Do not install worn, damaged, or modified equipment that may be unsuitable for safe use.
- Train all operators in the safe and proper use of power tools. Operators should report any unsafe condition.
- Store idle tools and accessories in a safe location accessible only by trained persons.
- Disconnect power source (air, electricity, etc.) from tool prior to making adjustments, changing accessories, or storing.
- Prior to operation, always check and test tools and accessories for damage, misalignment, binding or any other condition that may affect operation. Maintenance and repair should be performed by qualified personnel.
- Do not operate tools in or near explosive environments or in the presence of flammable liquids, gases, dust, rain or other wet conditions.
- Keep the work area clean, well lit and uncluttered.
- Keep unauthorized personnel out of the work area.

DC Electric Tools & Controllers:

- Install tools in dry, indoor, non-flammable, and non-explosive environments only – Humidity: 0 to 95% non-condensing and Temperature: 32 to 122 ºF (0 to +50 ºC).
- Installation, maintenance and programming should be performed by qualified personnel. Follow all manufacturer installation instructions and applicable regulatory electrical codes and safety codes.
- Tool and controller plugs must match the outlet. This equipment must be earth grounded. Never modify a plug in any way or use any adaptor plugs.
- Avoid body contact with electrically energized surfaces when holding a grounded tool**.**
- Prior to connecting a power source, always ensure the tool or controller is turned off.
- Limit controller access to trained and qualified personnel. Lock controller cabinets.

W A R N I N G

To Avoid Injury:

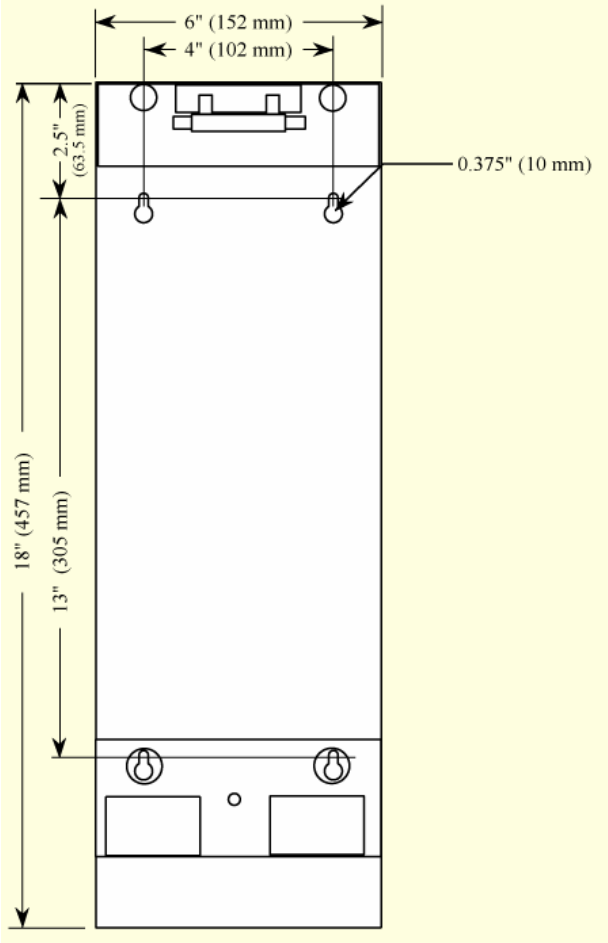
- Install modules in dry, indoor, non-flammable, and non-explosive environments only.
- Qualified personnel should perform installation and programming. Follow all manufacturer installation instructions, applicable regulatory electrical codes, and safety codes.
- Limit module access to trained and qualified personnel. Lock module cabinets.

W A R N I N G

ELECTRICAL HAZARD

To Avoid Injury:

- Install modules in dry, indoor, non-flammable, and non-explosive environments only.
- Do not use this product near water, for example near a washbowl, wet basement, or the like.
- This product should be located away from heat sources such as radiators or other devices that produce heat.
- This product should not be subjected to vibration or shock or in close contact with water or other liquids.
- To minimize electrical interference, place the module as far away from possible sources of electrical noise, such as arc welding equipment.



Plinths connect to each other with four 10-32 machine screws through openings on the top and right side to threaded openings on the bottom and left side. When mounting plinths are placed next to each other the center to center distance between the mounting holes in different plinths is 2" (50.8 mm). When mounting plinths are place one above another the center to center distance between the mounting holds in different plinths is 6" (152.4 mm).

1. Install the Theta Controller either directly to the wall or to an optional mounting plinth.

2. Fasteners through four mounting holes secure plinths to a wall or surface. Plinths can be connected using 10-32 threaded holes on the bottom and left side and through holes on the top and right side.

3. Make sure the bolts of the barrel-latches [**5**] on the plinth are retracted. Place the lower flange of the Theta controller [**1**] into the lip [**2**] on the plinth.

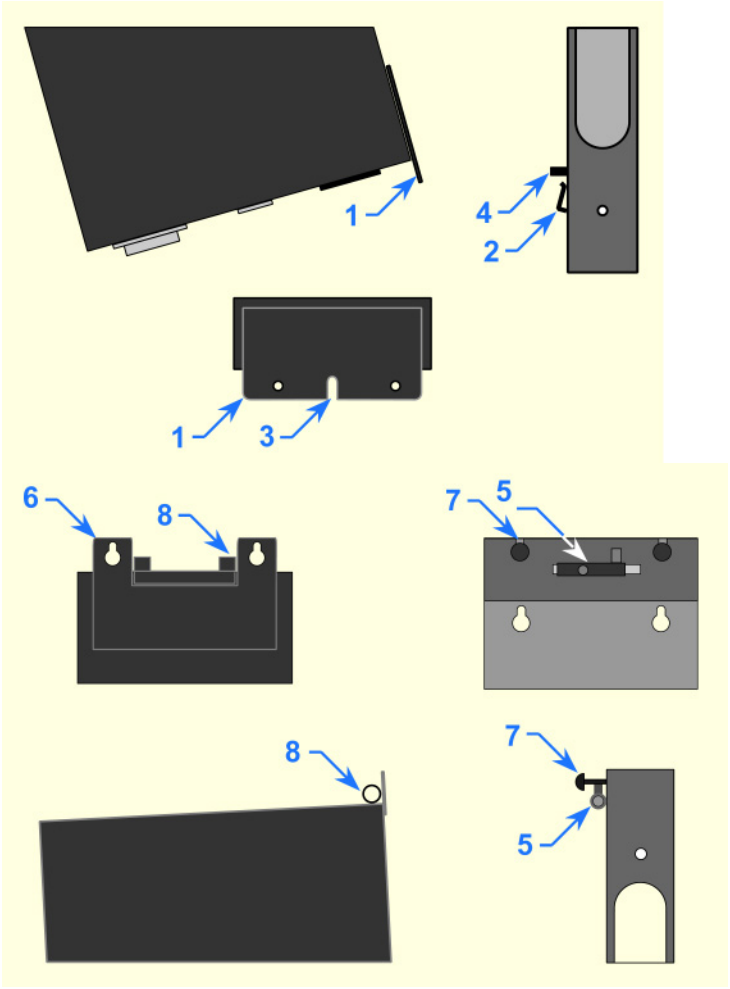
4. Align the slot [**3**] in the flange with the lower mounting-pin [**4**] on the plinth while placing. Rotate the top of the controller back towards the plinth.

5. Place the openings on the upper flange of the controller [**6**] over the upper mounting pins [**7**] on the plinth. Release the bolts on the barrel-latches [**5**] making sure the bolts enter the two barrels [**8**] on the controller.

6. Connect the Theta Controller to a power source.

7. Connect the tool cable to the Theta controller and press the power switch on the controller.

8. The controller will display a list of languages after the first boot up from the factory. Press the up or down arrows to select the appropriate language for the region, then press the Enter key to save the selection. The controller will display its run screen, indicating it is ready for programming and operation.

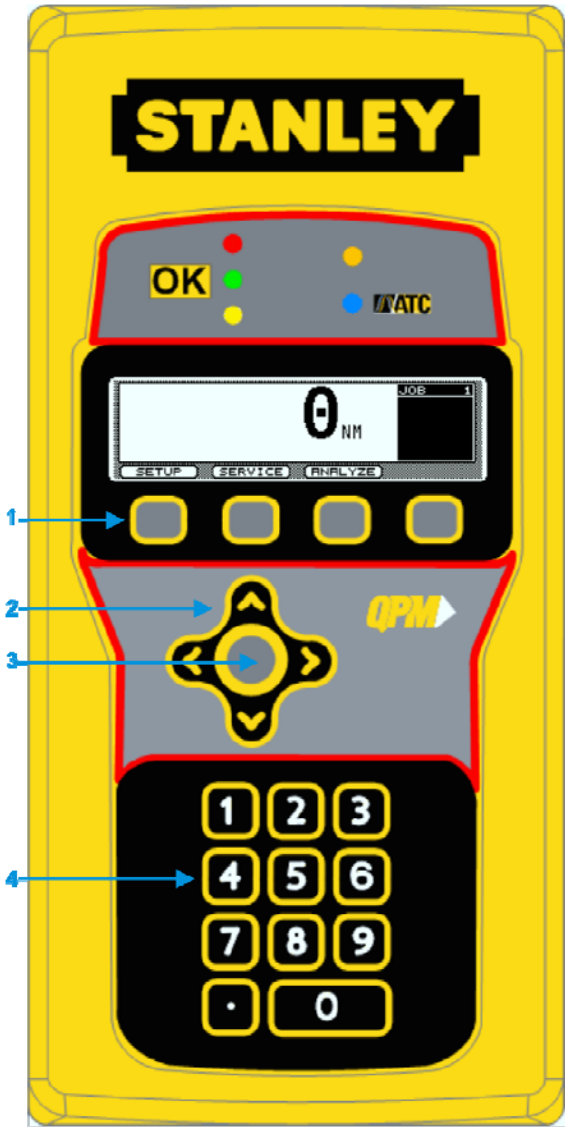


1.4.1 Theta Controller E-Stop Precaution

W A R N I N G
INTEGRATED E-STOP CIRCUIT NOT PRESENT **To Avoid Injury:** When a Theta controller connects to a tool where a fault can result in personal injury or substantial damage to property, an E-stop circuit is required. An E-stop circuit must be created in the external power supply line.

Programming

2.1 QA Theta Controller Navigation and Programming



The Theta controller's three navigation and input areas facilitate menu navigation, selection and data input:

- Menu buttons
- Arrows and Toggle button
- Keypad

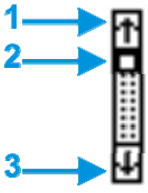
Labels for the four interactive menu buttons [**1**] change with menu selection. If the label is blank, the button has no function for the current display.

The up/down arrows [**2**] navigate menu and character selections; the left/right arrows enable backspace and space, as well as navigate between tabs. The toggle button [**3**] switches between modes and selects/accepts choices (synonymous with ***OK*** menu button).

The numeric keypad [**4**] facilitates data input and menu selection (where applicable) and job/step selection when enabled.

2.2 Display

2.2.1 Scroll Bar



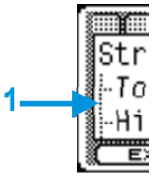
A scroll bar appears when more items are available than space within the display allows. The up arrow [**1**] and down arrow [**3**] direct scrolling. The black/white scroll bar [**2**] indicates which list items are currently displayed. No scroll bar means all items are currently displayed.

To navigate between menu items, use the up/down arrows or, if available, use the keypad to identify the corresponding menu item number.

2.2.2 Dropdown

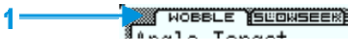
A dropdown [1] arrow appears to the right of menu items with multiple choices. To view these choices, first select the menu item using the up/down arrows or use the keypad to identify the corresponding menu item number. Then, use the toggle button to expand the dropdown. The up/down arrows scroll through the choices and the toggle button selects/accepts the highlighted choice.

2.2.3 Menu Tree



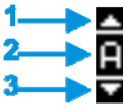
A menu tree [1] appears beside related menu items.

2.2.4 Tabs



Tabs [1] appear at the top when multiple menu selections exist. To navigate between tabs, use the left/right arrows. The active tab is white; inactive tabs are grey.

2.2.5 Character Scrollbar



This scrollbar enables adding: a-z, A-Z, 0-9, space, _, -, &, *, $, #, @, !, and a period (language and/or field determines character availability). The up arrow [1] and down arrow [3] direct scrolling with the active character [2] displayed between. Use the Theta Controller's up/down arrows to scroll through character choices. The left arrow backspaces. The right arrow moves one position to the right to input next character. Push toggle button or OK menu button to accept entry.

The following screens contain the character scrollbar option: Job (Name), Step (Name), System Name (General), and System (Users).

2.2.6 Run Display

Displays last torque reading and units [2] when a tool is connected. Icons [1] identify controller events (see list below). Specifies target bolt count in active job [3]. The run screen displays unless other programming functions [4] are in use. The active job [5].

The display background color in normal operation is white. After an OK fastening cycle, the display background color will change to green for 2 seconds, then revert back to white for the next cycle. After a NOK fastening cycle, the display background color will change to red for 2 seconds, then revert back to white for the next cycle. The display background color will turn red in the event of a fault; see section 2.3

If the keypad mode is set to Job Select, press a number key corresponding to a programmed Job. A Job window will pop up and allow you to enter a number. Press the OK button to switch the controller operation to the selected Job number. See section 2.5.3 to select keypad mode.

Shutoff Codes on the display indicate why a tightening cycle shutoffs other than upon completion of tool strategy.

Run Display Code	Description
TIME	Tightening time exceeds programmed Cycle Abort time value
STOP	Spindle stopped by either the operator or other device
125%	Spindle stopped due to torque achieving greater than 125% torque limit for the spindle
FAULT	Precedes a fault described in section 2.3
STALL	Spindle in stall status
CAN	Can occur during a tightening cycle when a spindle firmware update is in progress

Theta Controller Icons

Icon	Status	Description
	Locked	Password required to make changes
	Unlocked	Changes possible, automatically re-locks in time
	Busy/working	Wait
	Fault, system not operable	Check the run screen for Fault message
	Force on or off	Identifies an input/output forced on or off
	User Entered Password	This icon appears next to the user, in the User list, that has entered their password and unlocked the box.
	Stop Tool Operation, (press the trigger for an indication of what is causing the tool Stop)	Undefined Job – The selected Job is not programmed to run a tool, select another Job or program the currently selected Job. Network Protocol – The plant control system is issuing a Stop via a network protocol. Wait for the protocol to remove the Stop command. Error Proofing - Bolt count has been met, reset with a Job Reset input. Stop Issued - An Input is disabling the tool, remove the Stop input. Reset Reject - is enabled and active, reset the reject by pressing the MFB. Invalid Job – The selected Job is wrong based on the validation inputs. System Initializing – the controller is booting up, please wait. Cycle Lock-out – The Cycle Lockout timer is active, wait for it to reset.

2.3 Faults

The display background color in normal operation is white. In the event of a fault, the display background becomes red and the fault description appears on screen. The background color reverts to white only when the fault is cleared.

Overcurrent Fault!	There are two things that can cause this hardware fault: a) GFI – the Ground Fault Interrupter has exceeded its current trip point. A current detector monitors the current through the 3 phases of the motor and asserts this fault when the total current applied to the tool does not equal the total current returned from the tool. All phases are turned of immediately to protect the controller from shorts at the tool end. b) Total Current – the controller software limits the current applied to any tool based on what the tool can handle. This fault is asserted if there is a short at the tool end and the total current applied is greater than allowed.
Logic Voltage Fault!	The controller monitors the +5VDC, -5VDC and +12VDC of its onboard Power Supply. This fault is asserted when those voltages fall outside of nominal range.
Position Feedback Fault!	The controller is constantly monitoring the "resolver" zero and span points and asserts this fault if they go outside specification.
Transducer Span Fault!	This fault is asserted when the transducer zero point has shifted far enough to prevent a full scale reading from the transducer.
Temperature Fault!	This fault is asserted when the tool temperature detector has reached the temperature limit set by the Temperature Limit parameter. It resets after detected temperature has dropped by 5°C
Unrecognized Tool!	The controller is communicating to the tool but does not recognize the model number written in the tool memory board.
Tool Communications!	The controller is not communicating to a tool.
Transducer Current Fault	Transducer current has fallen outside nominal values. For "EC" series tools that is 4.16 mA +/- 75% (1 to 7mA).
Transducer Zero Fault!	The transducer zero point has shifted too far for the controller to compensate. These points are visible on the controller diagnostics screen under Analyze.
Unsupported Tool!	The wrong tool type has been connected to the controller. The Theta controller cannot run the tool that is connected.

2.4 Messages

Messages appear on the screen when certain non-critical conditions exist that asserts the warning. They may appear on any screen at any time.

Communication Fault	Used for Toyota Protocol only. Controller has lost communications to the PI box.
Count Fault	Used for Toyota Protocol only. Controller and PI box have a bolt count mismatch.
Program Fault	Used for Toyota Protocol only. More tightening cycles were performed than the PI box expected.
Tool Update Failed	Controller failed to update the tool configuration.
Nothing to Configure!	The parameter selected has nothing to configure.

2.5 Theta Controller Programming

W A R N I N G

EXCESSIVE TORQUE CONDITION
To Avoid Injury:

- Only trained and qualified personnel should program controllers.
- Never set control limits above the maximum rating of the tool.
- Setting control limits above the maximum rating of the tool can cause high reaction torque.
- Always test for proper tool operation after programming the controller.

The controller uses three main menus to display information and enable programming:

- ***Setup*** menu
- ***Service*** menu
- ***Analyze*** menu

To begin programming a tool strategy on the Theta, press the SETUP menu button. The list of setup functions will appear.

1. Jobs – this is where the tool strategy programming is performed, such as torque and speed parameters.
2. Communications – this area is where the Serial port options are programmed.
3. Other – this area has the parameters for all other features on the Theta. They include setting up system level parameters, users and passwords, assigning I/O, and tool functions.
4. Restore Factory Defaults – this area deletes all prior programming, stored fastening cycle data, and statistics and sets the controller back to factory defaults.

To enter an area, simply press the corresponding numbers on the keypad or us the up and down buttons to highlight the area and press the Enter key.

Icon Legend	Icon Description	Navigation
	Menu Buttons	Press to activate menu option noted above button.
	Left/Right Arrow Keys	Navigate tabs as well as backspace and space.
	Up/Down Arrow Keys	Scroll through menu selection and character selection.
	Toggle Button	Selects option for data input, accepts changes.
	Numeric Keypad	Data input and, when applicable, menu selection. Can be used for job selection when enabled to do so.

The left column shows the currently defined Theta Controller settings and menu choices. The Options Screen column shows options for each selection. Screen navigation options appear above each screen.

Default Screens	Options Screen
	

NOTE:
Programming changes are stored after exiting current menu and returning to run screen.

Job Reset resets bolt count back to zero.

2.5.1 Setup Menu: 1. Jobs

The ***Setup*** menu programs the controller to operate a spindle or tool. Jobs control tool operation for tightening a fastener and consist of one TC/AM (Torque Control, Angle Monitor) Step, with up to three optional Smart Steps. Most controllers will operate with a single Job and Step. Users must have ADMINISTRATOR or SETUP access in order to modify Job settings. This includes Wizard, Manage and Step parameters.

If a tool is attached and no jobs are programmed the ***Wizard*** automatically appears after selecting Jobs. The ***Wizard*** can setup a Job for simple or complex tightening cycles using the optional Smart Steps.

If no tool is attached, or if at least one Job exists already, the Job menu will appear.

The Wizard will be discussed first and then the Job setup afterwards.

2.5.1.1 Wizard Screens

Wizard Screens	Options Screen

The ***Wizard*** assists with programming the controller to assign a Job which consists of one Audit Step with optional Smart Steps. To function, the ***Wizard*** requires a tool to be connected. The ***Wizard*** automatically appears when there are no configured Jobs or when Jobs are added. The ***Wizard*** presents programming parameters about the FINAL strategy desired, and then it will give a list of modifiers for that strategy. These modifiers are explained further down in this section.

Strategy – TORQUE (TC/AM) is the only strategy the Theta controller supports. There are no other options for this parameter.

Units – the Theta supports the following operating units:

NM, Newton Meters

FTLB, Foot Pounds

INLB, Inch Pounds

INOZ, Inch Ounces

KGM, Kilogram Meters

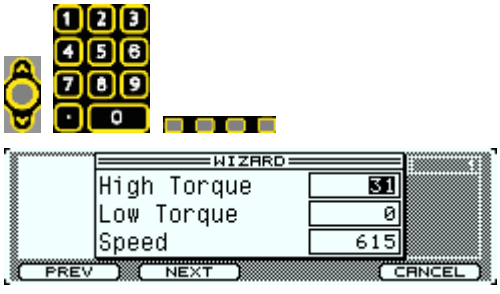
KGCM, Kilogram Centimeters

NCM, Newton Centimeters

Thread Direction – for tightening a right hand fastener use CW, clockwise. Use CCW, counter-clockwise for left hand fasteners.

To modify, select using the up/down arrow keys then press the Toggle button. After all parameters/ selections / options are finished, press the NEXT interactive menu button to advance through the ***Wizard***. Repeat for subsequent windows.

Pressing the CANCEL interactive menu button at any time to stop ***Wizard*** operation.



Use the keypad to enter the desired values for High Torque, Low Torque and Speed.

High Torque – By default, the ***Wizard*** uses the maximum torque for the connected tool.

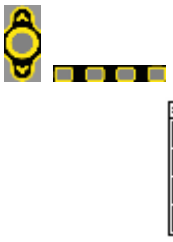
Low Torque – The ***Wizard*** uses zero as the low torque limit of the strategy.

Speed – The ***Wizard*** uses the maximum speed of the connected tool.

Press the Prev button to move back to previously programmed screens within the Wizard.

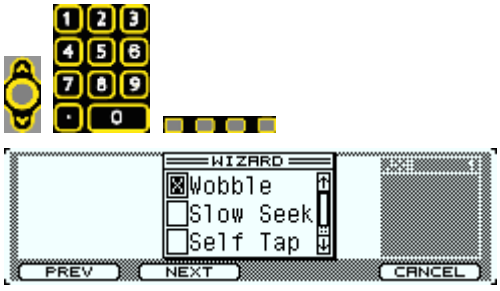
The final TC/AM step is now defined. The Wizard uses the median value, between the High and Low Torque parameters, as the Target Torque. It also calculates and programs other parameters automatically, including Snug Torque, Threshold Torque, Statistical Torque, and High Angle Bailout. Change these values after saving your Wizard programming if desired.

Next, select the modifiers specific to your application. Option screens appear for each specific modifier chosen. The ***Wizard*** makes assumptions and calculates specific values, modify these values if necessary..



Wobble, Slow Seek and Self Tap are Smart Steps that can be added to the beginning of the tool strategy. These modifiers only exist when an audit step exists; they cannot be programmed as steps unto themselves.

ATC (Adaptive Tightening Control) controls tool inertia toward the end of the tightening cycle. This allows for more consistent fastening.



Wobble is an Angle Control / Torque Monitoring strategy in the opposite direction for which the final tool strategy is programmed. This allows the fastener threads to align with the locking device threads before a standard forward rotation and high speed are applied, thereby preventing cross-threads. If selected, this will be the first step in the tool strategy.

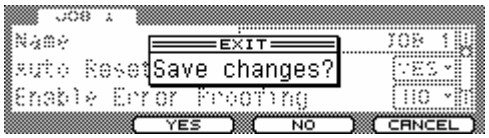
Wobble Options include:

Angle Target – The number of degrees of rotation the socket will turn during this step.

Speed – The speed of the tool during this step.

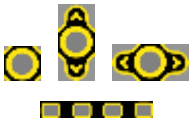
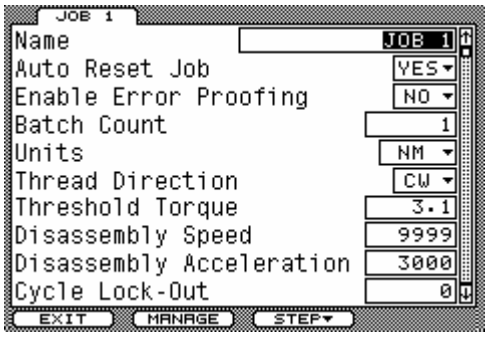
Max Torque – The maximum allowed torque during this step. A low value is calculated by the Wizard to detect cross-threads.

Slow Seek is an Angle Control / Torque Monitoring strategy in the same direction for which the final tool strategy is programmed. This allows the flats of the socket to align with the flats on the fastener before a standard forward rotation and high speed are applied. Using Slow Seek as a first step also allows for cross-thread detection. If selected, this is the first step AFTER Wobble. If Wobble is not selected, this is the first step in the tool strategy.

Wizard Screens	Options Screen
	Angle Target – The number of degrees of rotation the socket will turn during this step. Speed – The speed of the tool during this step. Max Torque – The maximum allowed torque during this step. A low value is calculated by the Wizard to detect cross-threads.
	Self Tap is an Angle Control / Torque Monitoring strategy in the same direction for which the final tool strategy is programmed. This Smart Step allows the tool to compensate for a high prevailing torque application. If selected, this step follows the Slow Seek step and just prior to the audit step.  Angle Target – The number of degrees of rotation the socket turns during this step. Snug Torque – Angle measurement, for the target angle, starts at this torque. Speed – The speed of the tool during this step. Max Torque – The maximum allowed torque during this step.
	ATC (Adaptive Tightening Control) is not a strategy or a step. It is an algorithm that modifies the tool's speed as the torque rises. Select this, instead of a downshift, as an option to increase tool capability. There are no options with this selection. The values are calculated automatically.
  	Press the Finish button to complete the Wizard. The Job Tab screen appears. This allows parameter changes to be made prior to saving ***Wizard*** programming. To save, press the EXIT interactive menu button. Press the YES interactive menu button to save changes. This saves the parameters and opens the Run screen.

2.5.1.2 Setup: Job Tab

Jobs are required to setup a tool strategy. Inputs and Triggers are used to select specific Jobs with different tool strategies including Error Proofing (bolt counting). Program the Job parameters according to the integration strategy desired; then program the Step(s) to create the desired tool strategy.

Job Tab Screens	Options Screens
Tool settings apply to all Steps.	
	Select Jobs by pressing the SETUP button on the run screen.
	Press 1 or with the Jobs menu item highlighted, press the Enter key.
	 or 
	Name – Name Job to define the operation performed (15 character limit). Use the up/down arrows to spell with letters or use the numeric keypad. Auto Reset Job – Yes resets the Job automatically after the fastener count has been met. The tool will not disable with Error Proofing enabled. No requires an Input or Trigger to Reset the Job. The tool disables with Error Proofing enabled. If Error Proofing is disabled, the tool is always enabled but will not count higher than the target value.

Enable Error Proofing – Yes causes the tool to disable after the accumulated fastener count equals the target fastener count for the job, unless Auto Reset Job is set to Yes. A Trigger or Input is required to Reset the Job and set the accumulated count to zero.

No keeps the tool enabled even after the Job's target count is met. The count will not increase beyond the Batch Count value.

Batch Count – This is the number of fasteners the Job is required to count. Zero is not allowed. The maximum is 99.

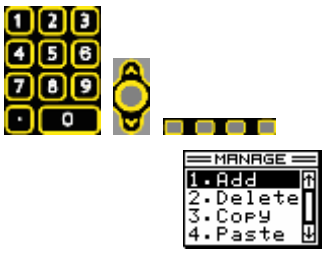
Units – the Theta supports the following operating torque units:

- NM, Newton Meters
- FTLB, Foot Pounds
- INLB, Inch Pounds
- INOZ, Inch Ounces
- KGM, Kilogram Meters
- KGCM, Kilogram Centimeters
- NCM, Newton Centimeters

Each Job does not have to use the same operating torque units as the other Jobs.

Job Tab Screens	Options Screens
Thread Direction – for tightening a right hand fastener use CW, clockwise. Use CCW, counter-clockwise for left hand fasteners. Threshold Torque – The torque level during the tightening cycle when the In Cycle Output transitions high. Data is not printed, stored or available to eTB, unless Threshold Torque is exceeded during the tightening cycle. A good starting point is 20% of Target Torque. Disassembly Speed – The speed of the tool during (Reverse) operation in RPM (revolutions per minute). Disassembly Acceleration – The rate the tool gets up to Disassembly Speed in RPM/s (revolutions per minute per second). Cycle Lock-Out – This is a timer, in seconds, that activates after the tool has reached its target. While active it disables the tool.	
Press Exit to save changes and return to the Run screen. Press Manage to Add, Delete, Copy or Paste Jobs. See section 2.5.1.3 for further information. Press Step to setup the parameters of the step(s) inside the selected Job. See section 2.5.1.4 for further information.	

2.5.1.3 Setup: Manage Button (Job)

Manage Button (Job) Screens	Options Screen
Manage enables active job settings to be added, deleted, and/or copied to the clipboard and pasted.	
 	 Add – Adds a Job to the controller. If a tool is attached the Wizard will begin for easy setup of the Job parameters. If a tool is not attached the Jobs tab will appear for manual parameter setup.  Jobs do not have to be added sequentially. A Job can be added before, or after, the one that is selected. Jobs will be renumbered automatically after being added. Make a selection and press OK to add a Job, or Cancel to not add a Job. Delete – Deletes the selected Job from the controller. This cannot be recovered once deleted. Copy – This will copy the selected Job and its associated Steps to the Clipboard.

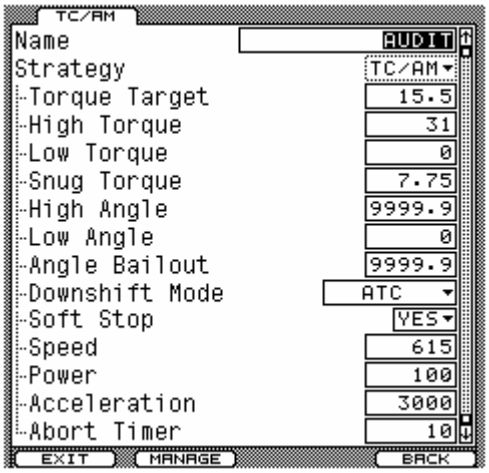
	Paste – Overwrites the selected Job with the values of the Job residing in the Clipboard.

2.5.1.4 Setup: Step Button

Step Button Screens	Options Screens

Step settings only affect the selected Job. There can be only one audit step per Job. In the Theta, that audit step is a Torque Control / Angle Monitor (TC / AM) strategy. The audit step can have Smart Steps associated with it. Without the audit step the Smart Steps are deleted.

Each step is represented by its own tab. Use the left or right arrow keys to select the tabs/steps to modify them.



Name – Provides an identifier for the step. Use the up and down arrows to write a name using the alphabet. Use the number keypad for numbers.

Torque Target – The torque at which the controller shuts off the tool (required for this step). Should be greater than Low Torque and lower than High Torque.

High Torque – The maximum peak torque for an acceptable tightening cycle. If the actual torque exceeds this limit the tightening cycle will be flagged as NOK and the RED LED on the front panel and the tool will illuminate. Required for this step. Must be greater than Torque Target and less than or equal to the rated torque marked on the tool.

Low Torque – The minimum peak torque for an acceptable tightening cycle. If the actual torque does not reach this limit the tightening cycle is flagged as NOK and the YELLOW LED on the front panel and the tool will illuminate. Required for this step. Must be less than the Torque Target.

Snug Torque – The point in this step when the controller begins to monitor the tool's output angle. Should be greater than 0 and less than Low Torque. A value of 50% of Torque Target is a good starting point.

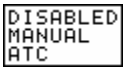
High Angle – The maximum peak angle for an acceptable tightening cycle. If the actual angle exceeds this limit the tightening cycle is flagged as NOK and the RED LED on the front panel, and the tool, will illuminate. Required for this step. Must be greater than Low Angle. Units are degrees of rotation.

Low Angle – The minimum peak angle for an acceptable tightening cycle. If the actual angle does not reach this limit the tightening cycle is flagged as a NOK and the YELLOW LED on the front panel and the tool will illuminate. Must be less than High Angle. Units are degrees of rotation.

Angle Bailout – Determines when to stop the tool on angle. Should be set equal to or above High Angle. Units are degrees of rotation.

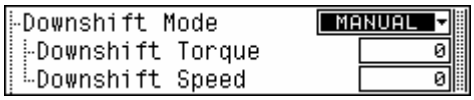
Downshift Mode – Selects the type of spindle inertia control toward the end of a tightening

cycle.

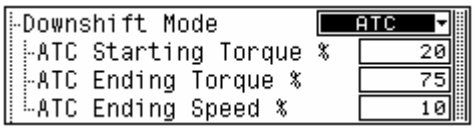


Disabled – Does not reduce the speed of the motor.

Manual – Reduces the tool speed to a specific value (Downshift Speed) when a specific torque value (Downshift Torque) is achieved during the tightening cycle. Speed units are RPM, Torque is in torque units.



ATC – Enables the Adaptive Tightening Control algorithm to slow the tool speed as the torque rises.



The default values can be modified for when the algorithm starts (ATC Starting Torque), when it ends (ATC Ending Torque) and what the tool speed is after the algorithm ends (ATC Ending Speed). The torque units are percent of Target Torque. The speed values are percent of Speed.

Soft Stop – This controls how the tool is turned off AFTER reaching target torque. This is designed as an ergonomic benefit to ease operator discomfort with direct-drive tools. If No is selected the tool will simply de-energize and coast to a stop.

If Yes is selected, the tools current will be removed for the time specified in Current Off Time, then reapplied for the time specified in the Current Hold Time, then it will ramp to zero over the time specified in Current Ramp Time. Units are in seconds.

Speed – The velocity of the output of the tool during this step before any Downshift Mode activates. Units are RPM. Required for this step. Must be greater than 0.

Power – The maximum power available to the tool to perform the tightening cycle. Units are percent of maximum rated torque of the tool. Required for this step, should not be less than 100%.

Acceleration - The rate the tool gets up to Speed in RPM/s (revolutions per minute per second). Required for this step. Should be greater than 1000 RPM/s.

Abort Timer – Stops the tool when the time has elapsed from the start of the step. Required for this step. The value should be long enough to complete the tightening cycle during this step.

Once the audit step has been created, Smart Steps can be added. Smart Steps allow you to modify the tool strategy BEFORE the audit step. See section 2.5.1.5 for adding Smart Steps.

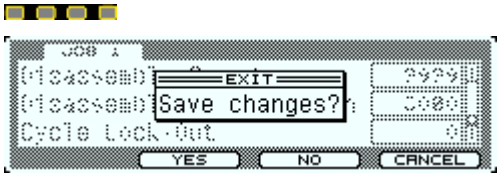
When finished modifying the tool strategy step(s), press the EXIT key, save the changes and return to the run screen. See Section 2.5.1.6.

Step Button Screens	Options Screens
	
 	

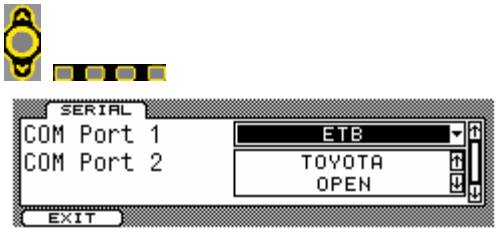
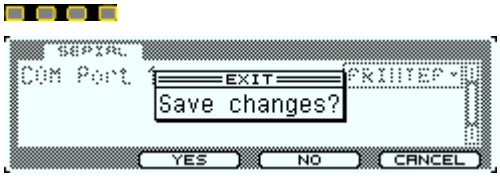
2.5.1.5 Setup: Manage Button (Step)

Manage Button (Step) Screens	Options Screen
Manage enables step settings to be added, deleted, and/or copied to the clipboard and pasted.	
 	  Add – Allows the addition of Smart Steps. The Smart Step choices are Wobble, Slow Seek and Self Tap. When added, they are inserted into the correct position before the audit step (Smart Step sequencing cannot be altered). Wobble always occurs first followed by Slow Seek and Self Tap, then the audit step. Smart Steps are not required to run a tool strategy, however, they may help. Add and modify the appropriate Smart Step(s) for the application. See section 2.5.1.1 for a description of the Smart Steps.  Delete – Allows the deletion of the selected step from the tool strategy. Copy – Copies the selected step to the clipboard. Paste – Overwrites the selected step with the values in the clipboard. The type of information in the clipboard must match the step into which it will be pasted. Smart Step values cannot be pasted into audit steps and vice versa.

2.5.1.6 Setup: Exit

Exit Screens	Options Screen
Programming changes are stored after exiting the current menu.	
	

2.5.2 Setup Menu: 2. Communications

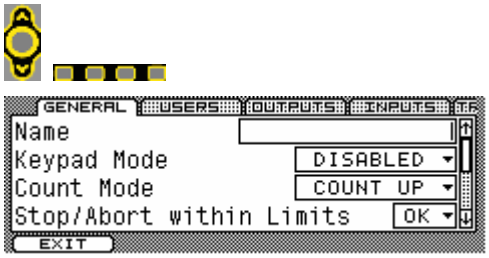
Communication Screens	Options Screen
This area changes the setting of the serial Communications ports on the bottom of the Theta. Users must have COMMUNICATIONS, SETUP or ADMINISTRATOR access level to modify values in this area.	
	
 ETB – This selection allows the controller to communicate to the Controller Gateway software on a PC. See Appendix A.	The Theta controller has two serial communication ports. COM Port 1 must be used for ETB. COM Port 2 can be used for error proofing or data collection protocols. Toyota – an error proofing protocol used in handheld tool applications in Toyota facilities. OPEN – an error proofing / data collection protocol used in tool applications in Ford and Honda facilities. This protocol can be used by others as it does not take special equipment like the Toyota protocol.
	

2.5.3 Setup Menu: 3. Other

Other Screens	Options Screen

This area has the parameters for all other features on the Theta. They include setting up system level parameters, users and passwords, assigning I/O, and tool functions. Each category is represented by its own tab. Use the left or right arrow keys to select the tabs/category to modify them.

Users must have ADMINISTRATOR or SETUP access level to modify values in this area.

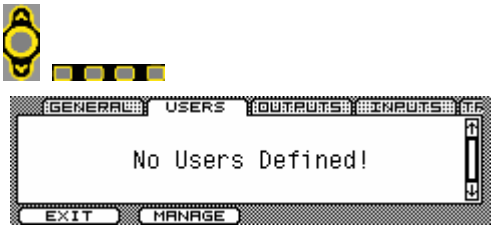


General Tab

Name – This gives a name to the controller so it can be distinguished from other Theta controllers on the same plant floor.

Keypad Mode – The keypad on the face of the controller can be used to select Jobs (Job Select) to run while in the run screen. Or this function can be (Disabled).

Use the right arrow to move to the next tab or press the EXIT key, save the changes and return to the run screen. See Section 2.5.1.6.



The Theta controller can have 8 users assigned, each with unique passwords. The passwords can be any length up to 16 characters and can be made up of any characters that can be created using the up and down arrows and numbers on the keypad.

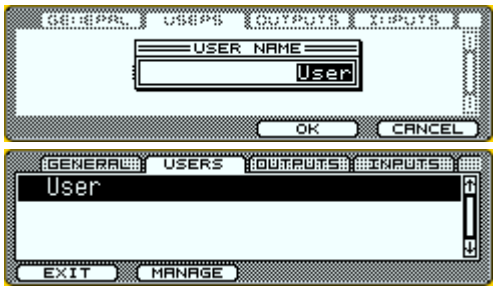
If users are assigned, one of them must be an Administrator.

If the lock icon appears, the controller is password protected. The controller automatically re-locks the system after 15 minutes.

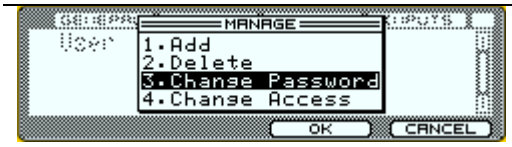
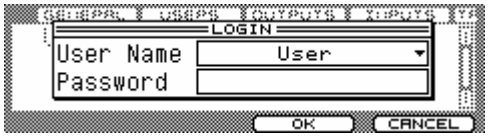
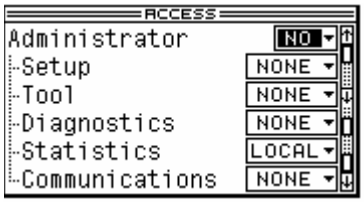
Users Tab

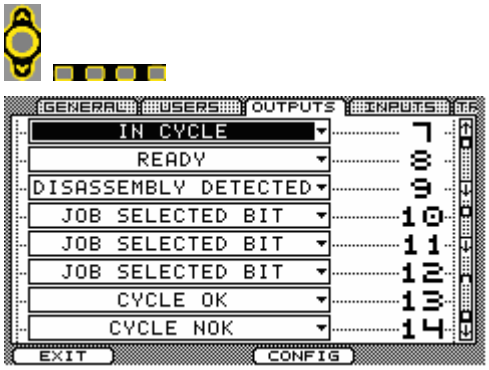
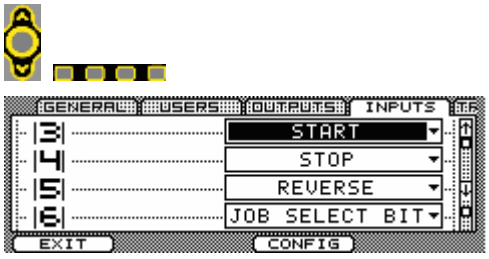
To add a user, press the Manage button.

Adding users is a 3 step process. First add the user and give them a User Name. Press OK.



Then select the user you just added in the list,

Other Screens	Options Screen
	press the Manage key then Change Password. If this is the first time adding a password leave the Old password blank, otherwise key in the old password, scroll down and create a New password and Verify you have the correct password by typing a second time. Press OK.
	Now change the access level of the user you just created by pressing the Manage button again, then Change Access.
	One user has to be an Administrator. If other users added are not, then select NO.
	The Administrator has to log in to change access for a user. Once the Administrator has logged into the controller it is unlocked. The unlocked icon will appear in the upper left hand corner of the screen. Select the Access level you wish to give to the selected user. NONE does not allow them access to the level; LOCAL will allow them access, on the keypad, to that level. Each access is exclusive of the other. You must assign to users each access level that applies to them.
	Administrator gives the user full access to the controller. They can do anything the other access levels can do plus restore factory defaults and add users. Setup - Users at this level can modify all parameters in the Job and Communications areas. They may modify parameters under the Input, Output and Trigger tabs in the Other area.
	Tool – Users at this level can modify parameters under the Tool tab in the Other area, as well as set Preventive Maintenance Threshold and reset the PM and Cycle counters in the SERVICE menu. Diagnostics. – Users at this level can force Inputs or Outputs ON or OFF and REMOVE forces in the I/O tab of ANALYZE. Communications – Users at this level can modify the serial port settings. Press OK. To Delete a user press the Manage key and then Delete. You will be asked “Are You Sure?” If you are, press OK. It will ask for the Administrator password. Once entered the user will be deleted. Press Ok,

Other Screens	Options Screen
Use the right or left arrow to move to the next tab or press the EXIT key, save the changes and return to the run screen. See Section 2.5.1.6.	
	OUTPUTS tab The 24 VDC connector has pins 7 through 14 designated as Outputs from the controller. The pin assignments are selectable on this tab. Use the up or down arrows to select the pin you wish to assign, then press the Enter key. A list of available output elements will display. See Section 4.2 for the complete list and their descriptions. Scroll the list and choose the element you wish to assign to the selected pin. Press the Enter key An Output element can be assigned to more than one pin. The selected Output element must then be configured. See section 4.2 for configuration options and their descriptions. Press the CONFIG button to configure the selected output element. After modifying press the BACK button. 
Use the right or left arrow to move to the next tab or press the EXIT key, save the changes and return to the run screen. See Section 2.5.1.6.	
	INPUTS tab The 24 VDC Connector has pins 3 through 6 designated as Inputs to the controller. The pin assignments are selectable on this tab. Use the up or down arrows to select the required pin, then press the Enter key. A list of available Input elements displays. See Section 4.2 for the complete list and their descriptions. Scroll the list and select the element to assign to the selected pin. Press the Enter key An Input element can be assigned to more than one pin. The selected Input element must then be configured. See section 4.2 for configuration options and their descriptions. Press the CONFIG button to configure the selected Input element. After modifying press the BACK button.

Other Screens	Options Screen
	

Use the right or left arrow to move to the next tab or press the EXIT key, save the changes and return to the run screen. See Section 2.5.1.6.

TRIGGERS tab

See Section 3.4.2 for an explanation of the selectable items.

Tap Action – Defines the operation when the MFB on the tool is tapped (pressed quickly).

Hold Action – Defines the operation when the MFB on the tool is held for 1 second.

Start Input – Defines which inputs are required to start the tool. In all cases, the 24 VDC Start input is always available to start the tool.

Any – Either the tool trigger or tool push-to-start switch will start the tool.

All – Requires that both the tool trigger and the tool push-to-start switch must be activated to start the tool.

Lever – Only the trigger on the tool will start the tool.

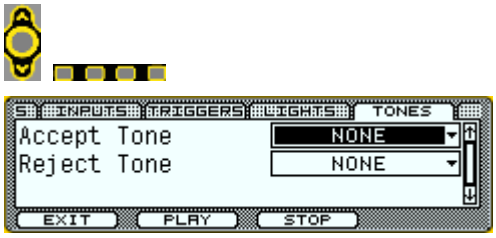
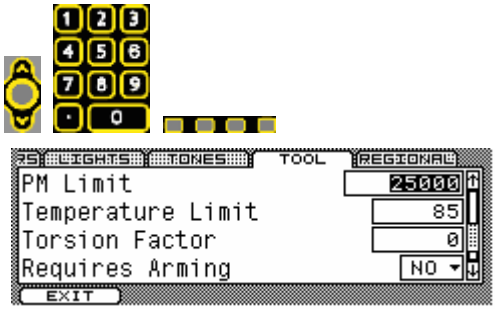
PTS – Only the push-to-start switch on the tool will start the tool.

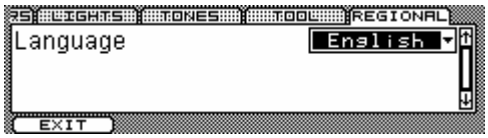
None – Neither the tool trigger nor the tool push-to-start switch will start the tool.

Use the right or left arrow to move to the next tab or press the EXIT key, save the changes and return to the run screen. See Section 2.5.1.6.

LIGHTS tab

Sets the time the pistol tool headlights remain on, in seconds, after the trigger is pressed.

Other Screens	Options Screen
Use the right or left arrow to move to the next tab or press the EXIT key, save the changes and return to the run screen. See Section 2.5.1.6.	
	TONES tab The alarm in the tool handle can emit different tones based on the status of the tightening cycle. Choose an Accept Tone for an OK tightening cycle and a Reject Tone for a NOK tightening cycle.  Play – previews the tone selected. Stop – stops playing the tone selected.
Use the right or left arrow to move to the next tab or press the EXIT key, save the changes and return to the run screen. See Section 2.5.1.6.	
	TOOL tab Values modified under this tab are saved to the tool not the controller. Users must have TOOL or ADMINISTRATOR access level to modify values here. PM Limit – When the PM Counter in the tool exceeds this threshold, the preventive maintenance LED on the front panel illuminates indicating it is time to perform maintenance on the attached tool. Temperature Limit – The threshold, in degrees Celsius, when the tool will shut off. This is caused by excessive duty cycle on the tool. Torsion Factor – See Appendix B for an explanation of this parameter and how to determine a correct value. Otherwise leave at the default of zero. Requires Arming – Forces the Tap Action on the MFB to Arm. See section 3.4.2. Tubenut tools require arming as a factory setting.

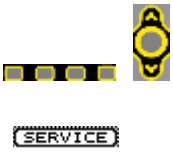
Other Screens	Options Screen
Use the right or left arrow to move to the next tab or press the EXIT key, save the changes and return to the run screen. See Section 2.5.1.6.	
	REGIONAL tab
	Select the language for your region of the world. 
Use the right or left arrow to move to the next tab or press the EXIT key, save the changes and return to the run screen. See Section 2.5.1.6.	
	Clock tab
	The Theta has a real time clock which must be set manually. Time – format is hh:mm;ss, where h is hour, m is minute and s is seconds. The format for hour is military or 24 hour clock, rather than 12 hour clock with a.m. and p.m. Date – format is mm / dd / yyyy, where m is for month, d is for day and y is for year.
Use the left arrow to move to the next tab or press the EXIT key, save the changes and return to the run screen. See Section 2.5.1.6.	

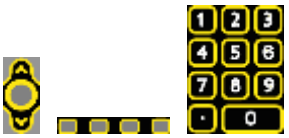
2.5.4 Setup Menu: 4. Restore Factory Defaults

Restore Factory Defaults Screens	Options Screen
	
	Restores all values for all parameters to their factory default settings. This is good for starting fresh with a controller that is in an unknown programmed state. Users must have the ADMINISTRATOR access level to restore factory defaults. 

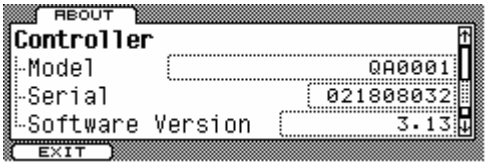
2.5.5 Service

2.5.5.1 Tool

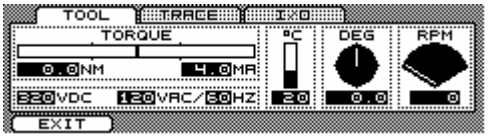
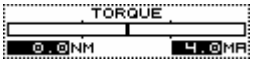
Tool Tab Screens	Options Screen
The Service area presents information about the tool and controller. Users must have TOOL or ADMINISTRATOR access level to modify any parameters here.	
	TOOL All of the tool's parameters are stored in the tool memory board in the handle of the tool. This area reads or writes those values on the tool memory board, not in the controller. 
 	ABOUT tab This tab displays information about the tool currently attached to the controller. None of the fields are editable except the Serial value. IF there is no serial number in the tool, you are allowed to enter one into the tool, one time only.
Use the right or left arrow to move to the next tab or press the EXIT key, save the changes and return to the run screen. See Section 2.5.1.6.	
  	COUNTERS tab All three counters count up at the same time after each OK tightening cycle. Odometer – Cannot be reset. Indicates the total number of OK tightening cycles the attached tool has performed over its lifetime. PM Counter – Causes the preventive maintenance LED on the front panel, and the tool, to illuminate when this value exceeds the PM Threshold value. Trip Counter – This counter can be used to count the number of OK tightening cycles between resets. Use the RESET button to reset, back to zero, either the PM Counter or the Trip Counter.

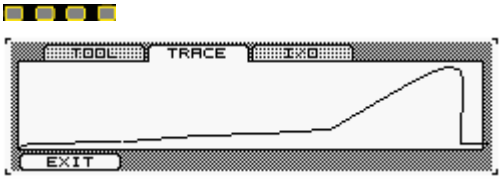
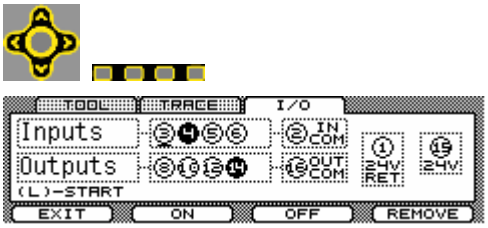
Tool Tab Screens	Options Screen
Use the right or left arrow to move to the next tab or press the EXIT key, save the changes and return to the run screen. See Section 2.5.1.6.	
 	CAL tab Nominal Cal – This is a calculated value based on the torque output of the motor, the gear ratios and efficiencies. This is a reference value only, it can not be modified. Torque Cal – This is the specific torque calibration value for the tool. Enter the new calibration value for the tool after performing a lab certification. This value should not deviate from the Nominal Cal value by more than 20%. Press EXIT when finished modifying the value.
 	

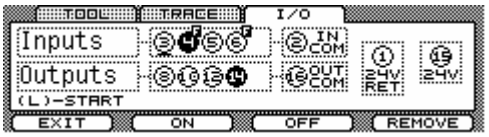
2.5.5.2 Controller

Controller Tab Screens	Options Screen
 	CONTROLLER 
 	ABOUT tab This tab displays information about the controller. These values are read only unless blank. The Model and Serial fields can be written to once.

2.5.6 Analyze

Analyze Screens	Options Screen
ANALYZE displays tool and controller diagnostic information, traces and I/O status.	
  ANALYZE	
  	TOOL tab This tab shows live status of the following events. It is updated every millisecond. Use this tab to perform diagnostics during troubleshooting operations.  Transducer Health – The thickness of the vertical line within the horizontal bar indicates transducer health. The thicker the line the less healthy. Once the line reaches the tick mark, on either side of center, the transducer zero shift can no longer be compensated for and the transducer needs to be replaced. Transducer Torque – Provides a live transducer torque value during the tightening cycle. Transducer Current – The transducer is powered with a constant current value. This current should be present and not varying. See section 2.3 for limits.  Controller DC Bus voltage – The bus should always be around 320 VDC. Controller AC Supply Voltage / Frequency – See section 1.3 for controller AC volts specification.  Tool Temperature – Temperature is not measured during tool operation. Interacts with the Temperature Limit parameter. See section 2.5.3/TOOL tab.  Tool Output Angle – number of circular degrees of rotation on the output of the tool. Resets at each start.  Tool Output Speed – Real time speed of the output of the tool.

Analyze Screens	Options Screen
Use the right arrow to move to the next tab or press the EXIT key, save the changes and return to the run screen. See Section 2.5.1.6.	
	TRACE tab This tab will plot a torque vs. time curve after every tightening cycle. The Y-axis is scaled from 0 to rated torque of the attached tool. The X-axis has a variable scale to include the entire tightening cycle.
Use the right or left arrow to move to the next tab or press the EXIT key, save the changes and return to the run screen. See Section 2.5.1.6.	
	I/O tab This tab indicates the live status of the 24VDC Inputs and Outputs. Forcing the I/O on or off is also performed here. Users must have the DIAGNOSTICS or ADMINISTRATOR access level to force I/O. Each pin, of the 24VDC connector, is represented. Pin A is for supplying 24VDC to the I/O elements. Pin V is the 24VDC Return to complete the current loop. Pin B is the bus for the Outputs. See section 4.1.4 for a schematic. Pins L through U are for Inputs. Pins C through K are for Outputs. See section 2.5.3 to assign elements to the pins. If an Input or Output pin icon is Clear, that means it is OFF, If the pin icon is Dark this means the pin is ON. There is a horizontal cursor under the pins. Use the cursor keys to move the cursor. The bottom left hand corner of the screen will indicate which pin the cursor is at and what element has been assigned to that particular pin. You can take manual control of the I/O by using forcing. Pins can be force ON or OFF. Applying a force means the pin will always be in that forced state and will not toggle to the opposite state; even though the system requires it to toggle. This is useful for troubleshooting signals that integrate with other equipment. Use the horizontal cursor under the pins to select the pin to be forced. Press the ON button to force it On, press the OFF button to force it Off. When the force is no longer required, press the REMOVE button to remove the force and return the pin to system control. When forcing I/O changes during an operation, the system provides a warning first.

Analyze Screens	Options Screen
	 If the pin icon is Clear with a small 'F' icon, that means it is forced OFF, If the pin icon is Dark, with a small 'F' icon, this means the pin is forced ON.  If a force is active when the EXIT button is pressed you will be asked to remove the force.  Yes will remove the forces and return to the run screen. No will NOT remove the forces and return to the run screen. The system will run with the forces applied until they are removed or until the next power cycle on the controller.

QPM DC Electric Tools

This chapter is intended to promote proper and safe use and give guidance to owners, employers, supervisors and others responsible for training and safe use by operators. DC Electric tools from STANLEY ASSEMBLY TECHNOLOGIES are intended for use in industrial threaded fastening or precision position and or adjustment applications only. Some instructions may not apply to all tools. Please contact your Stanley Sales Engineer for information or assistance on Stanley training for assembly tool operation.

3.1 Tool Specifications

Operating Conditions	Temperature	32 to 122 ºF (0 to +50 ºC)
	Humidity	0 to 95 % non-condensing

Noise Level: A-weighted emission sound pressure level at the work station < 70dBA (ref 20µPa) as determined according to ISO 15744-2002.

Vibration Level: Weighted root mean square acceleration value at the handle < 2.5 m/s^2 as determined according to ISO 8662.

STANLEY ASSEMBLY TECHNOLOGIES hereby declares the following sound and vibration emission levels as required by the Machinery Directive 98/37/EC.

Product	A-weighted emission sound pressure level at the work station L_{pA} (ref 20µPa). Value determined according to ISO 15744-2002 * using as basic standards ISO 3744 and ISO 11203	Weighted emission root mean square acceleration level at the handle. Value determined according to ISO 8662 * (single axis)
EC0, EC1, EC2, EC3, EC4 and EC5 electric tools	< 70dBA	< 2.5 m/s^2

* Operating conditions for all measurements: full rated speed, no load, rated supply voltage or pressure.

A-weighted emission sound power level L_{WA}: not required, declared sound pressure emission levels are below 85dBA.

C-weighted peak emission sound pressure level L_{pCpeak}: not applicable to these products.

Uncertainty K_{pA}, K_{WA}, K_{pCpeak}: not relevant, declared levels are maximum values.

W A R N I N G

To Avoid Injury:
This information is provided to assist in making rough estimates of sound and vibration exposure levels in the workplace. The declared emission values were obtained by laboratory type testing in accordance with the stated standards. **Levels measured in individual workplaces may be higher.**
The actual exposure levels and risk of harm experienced by an individual user depends upon the work piece, workstation design, duration of exposure, and the physical condition and work habits of the user. To help prevent physical impairment, a program of health surveillance is highly recommended to detect early symptoms which may relate to sound and/or vibration exposure, such that appropriate preventive measures may be taken.

3.2 Operator Protection

W A R N I N G

ROTATING EQUIPMENT
To Avoid Injury:

- Always wear eye and foot protection when operating, installing, or maintaining power tools, and when in areas where power tools are being used, maintained, or installed. Some applications may require the use of safety glasses and face shields. Use eye protection that conforms to ANSI Z87.1.[3] and ANSI Z41-PT99M I/75 C/75.
- Always stay alert when operating tools and/or their accessories. Do no operate tools and/or their accessories while tired, under the influence of drugs, alcohol or any other mind-altering substance.
- Repetitive work motions or vibration may be harmful to your hands, arms, shoulders or back.
- Use suitable protective equipment and work methods whenever an application presents a hazard.

Repetitive Motion

The use of power tools may involve highly repetitive motions of the fingers, hands, wrists, and shoulders. These repetitive motions can lead to cumulative trauma disorders (CTD). Many personal and workplace factors can contribute to these disorders.

Currently available data have identified the following risk factors. These risk factors are not necessarily causation factors of CTDs. The mere presence of a risk factor does not necessarily mean there is excessive risk of injury. Generally, the greater the exposure to a single risk factor or combination of factors the greater the risk for CTDs.

- Forceful exertions and motions
- Extreme postures and motions
- Repetitive exertions and motions
- Intended duration of exertion, postures, motions, vibration, and cold
- Insufficient rest or pauses
- Work organization risk factors
- Environmental risk factors

These risk factors span job design and content, operator training, work method, work pace, work environment, proper tool selection and other work place factors beyond the control of the tool manufacturer. Tool owners and employers should analyze jobs for all of the risk factors identified above and take appropriate action.

Some measures which may reduce the risk of CTDs:

- Use minimum hand grip force consistent with proper control and safe operation.
- Keep wrists as straight as possible.
- Avoid repetitive movements of the hands and wrists.
- If wrist pain, hand tingling, numbness, or other disorders of the shoulders, arm, wrist or finger occur; notify supervisor, discontinue operation, reassign user to a different job; if relief is not found contact experts skilled in treating such disorders.

Wrist supports, torque reaction devices, and balancers should be used if it can be determined that such devices can reduce the risk of repetitive motion disorders.

3.2.1 Hearing Protection

Power tool operators and adjacent personnel may be exposed to excessive sound levels. The tool in use is generally only one of many sources of noise that an operator experiences. Other tools and machines in the area, joint assembly noise, work processes, and other ambient noise sources all contribute to the sound level operators are exposed to.

The actual sound level an individual is exposed to and the individual's exposure time over the work day are important factors in determining hearing protection requirements. Worker sound level exposure can only be determined at the job site and is the responsibility of tool owners and employers.

Measure worker sound level exposure and identify high-risk noise areas where hearing protection is required.

Follow federal (OSHA), state or local sound level statues, ordinances and or regulations.

3.2.2 Vibration

Power tools can vibrate during use. To minimize the possible effects of vibration:

- Keep hands and body dry.
- Avoid anything that inhibits blood circulation such as tobacco, cold temperatures and certain drugs.
- Operators should notify their employer when experiencing prolonged symptoms of pain, tingling, numbness or blanching of the fingers.
- Wear vibration damping gloves if it can be determined that they reduce the risk of vibration disorders without introducing other hazards.

3.2.3 Breathing Protection

Respirators shall be used where contaminants in the work area present a hazard.

3.3 Tool Installation

W A R N I N G

To Avoid Injury:

- Always wear eye and foot protection when installing equipment.
- Only use equipment and accessories specifically designed to operate with Stanley assembly tools and use them only in the manner for which they are intended.
- Do not install worn, damaged, or modified equipment that may be unsuitable for safe use.
- Train all operators in the safe and proper use of power tools. Operators should report any unsafe condition.
- Store idle tools and accessories in a safe location accessible only by trained persons.
- Disconnect power source (air, electricity, etc.) from tool prior to making adjustments, changing accessories, or storing.
- Prior to operation, always check and test tools and accessories for damage, misalignment, binding or any other condition that may affect operation. Maintenance and repair should be performed by qualified personnel.
- Do not operate tools in or near explosive environments or in the presence of flammable liquids, gases, dust, rain or other wet conditions.
- Keep the work area clean, well lit and uncluttered.
- Keep unauthorized personnel out of the work area.

DC Electric Tools & Controllers:

- Install tools in dry, indoor, non-flammable, and non-explosive environments only – Humidity: 0 to 95% non-condensing and Temperature: 32 to 122 ºF (0 to +50 ºC).
- Installation, maintenance and programming should be performed by qualified personnel. Follow all manufacturer installation instructions and applicable regulatory electrical codes and safety codes.
- Tool and controller plugs must match the outlet. This equipment must be earth grounded. Never modify a plug in any way or use any adaptor plugs.
- Avoid body contact with electrically energized surfaces when holding a grounded tool**.**
- Prior to connecting a power source, always ensure the tool or controller is turned off.
- Limit controller access to trained and qualified personnel. Lock controller cabinets.

Turn controllers off when attaching tools.

Stanley electric tools must be connected to a controller to operate. To ensure superior performance and safe operation, use a Stanley controller specifically designed for each tool. These instructions are specific to Stanley Electric Tools when used with Stanley Electric Tool Controllers and accessories. Some features may not be applicable, performance may be degraded and some safety systems may not be available when tools are connected to non-Stanley controllers and accessories.

3.3.1 Sockets and Adapters

Use only industrial grade sockets and adapters (power bit and power or impact socket type).

Replace worn or damaged sockets that are unsuitable for safe operation immediately.

Always ensure drive socket is fully seated and locked into position before connecting power to tool.

3.3.2 Suspension Devices

Tool suspension devices or bails help support the weight of the tool during tightening operations. Attach these devices securely and periodically inspect them for damage or loosening.

3.3.3 Cable Installation

WARNING
ELECTRICAL HAZARD **To Avoid Injury:** • Never use a tool with a damaged cable. • Never abuse a cable, carry a tool by its cable, hang a tool by its cable, or pull on a cable to disconnect it from the tool or the controller.

To ensure superior performance and safe operation, use the Stanley cables specifically designed to operate these tools.

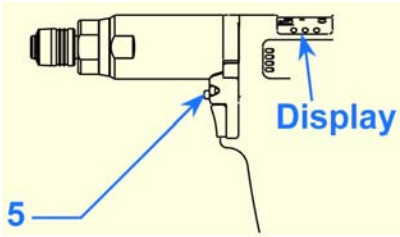
Never use a tool with a damaged cable. Never abuse a cable, carry a tool by its cable or pull a cable to disconnect it. Also, keep the cord away from heat, sharp edges, or moving parts.

Use cables of appropriate length (60M maximum) for each application; position and or suspend them in such a way as to prevent tripping and cable damage, and to provide good work area maneuverability.

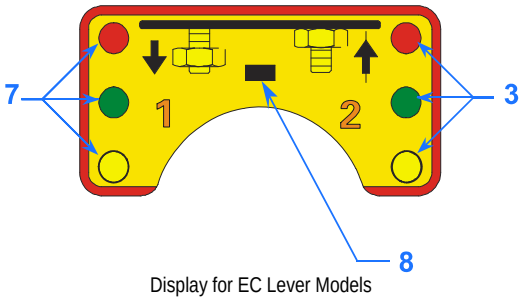
3.4 QPM Tools

3.4.1 Display and Multiple Function Button for Hand Held Tools

Handheld QPM tools have a display and a multiple function button (MFB). Two sets of lights [**3** and **7**] indicate tightening cycle status. Two blue lights indicate tool rotation direction, disassembly [**1**] or assembly [**2**]. A single multiple function button [**5**] can change tool direction and or parameter sets. When the button is used to select the Job, one of two orange indicators [**4** or **6**] illuminates to show the active Job. EA tools have four sets of lights [**3** and **7**] and an LED [**8**] that indicates when the tightening cycle count exceeds the PM limit.



Display and MFB
for EC02P to EC34P (pistol) Models



Display for EC Lever Models

3.4.2 MFB Mode

The *MFB Mode* configures the multiple function button for handheld QPM tools. The button can be configured to operate-in any of the following modes: These functions can be assigned to a tapping or holding (for 1 second) operation.

Disable (default)	The button does nothing. Pressing the button causes the tool alarm to "beep" once. Only the assembly blue light [**2**] illuminates.
Reverse (Disassembly)	Pressing the button toggles between assembly and disassembly and illuminates the appropriate blue light [**1**] or [**2**]. All tool status lights, [**3**] and [**7**], flash when the tool is in disassembly mode.
Job Select	Pressing the button toggles between Job 1 and Job 2 and illuminates the appropriate orange light [**6**] or [**4**].
Arm	Pressing the button arms (activates) the trigger but does not start the tool. The blue assembly light [**2**] comes on to show that the tool is armed.
Reset Reject	This function, when selected, will cause the tool to disable after a NOK tightening cycle. The Reject Tone, when enabled, will sound continuously. Pressing the button re-enables the tool and stops the reject tone indicating the operator acknowledges the rejected tightening cycle and wishes to repair it.
Job Reset	Pressing the button will cause the selected Job to be reset, meaning the fastener count will be set to zero and the tool will be re-enabled if disabled due to Error Proofing requirements.

3.4.3 Tool Memory

QPM tools have an onboard tool memory that stores tool identification, calibration factors and tightening cycle counters. Memory parameters include:

- *Model Number*
- *Serial Number*
- *Torque Cal* (calibration) factor

- *Angle Cal* (calibration) factor
- Tightening cycle counters

3.4.4 Tightening Cycle Counters

QPM tools have onboard counters that record the number of tightening cycles completed by the tool.

- *Odometer Counter.* Records the total number of tightening cycle completed.
- *Trip Counter.* Records the number of tightening cycles completed since the last time it was reset.
- *PM Counter*. Records the number of tightening cycles completed since the last time it was reset.
- *PM Threshold*. A static value set by the end user. When the PM Counter exceeds the PM Threshold (Limit), the controller provides a maintenance alert. The alert is an orange LED on the front panel and the tool.

The controller reads the tightening cycle counters from the tool on each power up.

3.5 Tool Operation

WARNING
ROTATING SPINDLE **To Avoid Injury:** • Always wear eye and foot protection when operating and when in areas where power tools are being used. • Keep all body parts and clothing away from the rotating end of the tool. Dress properly. Do not wear loose-fitted clothing or jewelry. **TORQUE REACTION FORCE** **To Avoid Injury:** • Be alert and maintain good balance, footing, and posture at all times in anticipation of the tool's torque reaction. Do not over-extend or over-reach. • Be prepared for the change in direction and or a higher reaction force when a tool is in reverse. • The start lever should be positioned to avoid trapping the operator's hand between the tool and the work piece. **TOOL MAY NOT SHUT OFF** **To Avoid Injury:** • If the tool does not shut off at the end of the tightening cycle, contact the person responsible for tool installation or repair. Note: When the tool does not shut off, a stall condition occurs. A stall condition can cause a higher than expected torque reaction impulse. • Ensure tool is properly installed, adjusted and in good working order. • Do not use the power tool if the switch does not turn it on and off. • Apply the tool to the joint following all recommendations in this manual. • Check to ensure the drive socket is fully seated and locked into position before connecting power to the tool.

Prepare to resist the tool's torque reaction:

Start the tool by depressing the start lever or trigger.

Release start lever after the cycle is complete.

3.5.1 Directional Control

W A R N I N G

UNEXPECTED REACTION FORCES
To Avoid Injury:

- Be prepared – when a tool operates in reverse, the tool's torque reaction is opposite to the reaction produced when the tool operates in forward direction.
- The tool can have a higher initial reaction force when loosening a fastener.
- Always stop the tool before changing direction of spindle rotation.

3.5.2 Torque Reaction Devices

W A R N I N G

PINCH POINT BETWEEN TORQUE REACTION BAR AND WORK PIECE
To Avoid Injury:

- Never place any body part between a reaction bar and the work piece.
- Before starting the tool, position the reaction bar firmly against a stationary rigid member that is opposite to the spindle rotation.

Torque reaction devices absorb tool torque reaction forces. Always use reaction devices when high reaction force could injure an operator.

Some reaction devices may require modification to fit the application. Follow all appropriate installation instructions.

3.5.3 Tool Temperature

W A R N I N G

POTENTIAL BURN HAZARD
Fixtured tools have higher operating temperatures and do not have additional thermal protection.
To Avoid Injury:
Wear thermal protective gloves when handling fixtured tools.

Stanley electric tools are thermally protected to prevent damage due to overheating. The thermal protection does not allow the tool to operate if the tool temperature rises abnormally – the thermal protector resets automatically when the tool cools down.

Controller parameter settings can have a significant effect on tool operating temperatures.

3.5.4 Tool Status Lights

Handheld tools from STANLEY ASSEMBLY TECHNOLOGIES have three (green, yellow, and red) status lights. The status light mirror or copy the status lights on the controller or control panel.

Green	Tightened to specified limits	The tightening cycle meets all of the specified parameters.
Yellow	Low torque or angle	The tightening cycle was rejected for not achieving either low torque or low angle.
Red	High torque or angle	The tightening cycle was rejected for exceeding either high torque or high angle.
All lights	Reverse	The next time the start trigger is engaged the tool will remove the fastener.

3.5.5 Setting Torque, Angle, and Other Operating Parameters

W A R N I N G

EXCESSIVE TORQUE CONDITION
To Avoid Injury:
- Only trained and qualified personnel should program controllers.
- Never set control limits above the maximum rating of the tool.
- Setting control limits above the maximum rating of the tool can cause high reaction torque.
- Always test for proper tool operation after programming the controller.

The Theta controller can be setup to change tightening Jobs from the tool.

3.6 Special Application Tools

3.6.1 Exposed Gear Socket Tools

W A R N I N G

PINCH POINT AT THE EXPOSED GEARS OR TEETH
To Avoid Injury:
Keep body parts and clothing away from the exposed gear sockets. Dress properly. Do not wear loose-fitted clothing or jewelry.

Exposed gear socket tools are designed to fit into tight spaces where other tools do not fit. These tools have exposed gears or ratchet teeth.

3.6.2 Tubenut Nutrunners

W A R N I N G

PINCH POINT AT THE EXPOSED GEARS OR TEETH
To Avoid Injury:
- Never place body parts or clothing, near the socket opening. Dress properly. Do not wear loose-fitted clothing or jewelry.
- Follow the Tubenut Nutrunner Sequence of Operation

Tubenut nutrunners are used for installing tube fittings.

Tubenut Sequence of Operation (QPM Tools)
- Place nutrunner socket on fastener
- Press the MFB to “arm” the start function
- Depress start lever, the tool will run the selected Job.
- The tool stops after reaching torque
- Release the lever and lift the tool from the fastener, all tool status lights flash to indicate the tool will now run in reverse to open the socket
- Depress the start lever until the socket returns to the open position
- Release the lever
- Remove the tool

Theta Controller Connections

Each controller or Theta Controller has a different combination of connectors. These connectors serve several purposes, such as:

- Power
- Tool Connections
- Discrete inputs and outputs

C A U T I O N
POTENTIAL ELECTROSTATIC DISCHARGE HAZARD AND WATER AND DIRT INGESTION **To Avoid Damage:** If not using a connector, keep the connector securely covered with the provided cap. This reduces the opportunity for transfer of static electricity and prevents dirt and water from entering the controller.

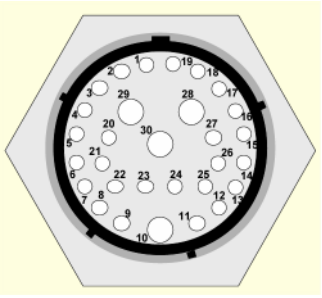
4.1 Theta Controller Connections

4.1.1 Theta Controller Power Cord

Theta Controllers use an IEC 60320 style connector. The power source connector for the power cord is based on customer requirements. The power cord should be rated at either 15A/125V for 115 V or 10A/250V for 230 V use of the controller.

4.1.2 Theta Controller Tool Connector

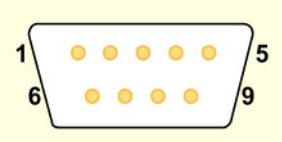
Theta controllers use a single 30 pin connector to connect the EC series QPM DC electric tool cables. QPM EC DC electric tool cables use a MIL-C-38999 Series III connector. The connector is a 17-30S with the insert having a B clocking position (30-pin Tool Connector).



30-pin Tool Connector

4.1.3 Theta Controller Serial Connector

Theta Controllers have two male DB-9 connector. The function of COM port 2 serial connector is assignable, see section 3. COM port 1 allows a connection to a laptop computer for access to Embedded Toolbox software. The connection between the computer and the controller is a simple null-modem cable. Only pins 2, 3 and 5 are active on this connector.



DB-9 Connector Pins

Pin	Function
2	Receive Data
3	Transmit Data
5	Signal Ground

4.1.4 Theta Controller Input and Output Connector

All four inputs and four outputs are optically isolated 24VDC. The Theta has an internal 24VDC power supply that can be used to provide the I/O signals. An external 24VDC power supply may be used instead. The following are the amperage ratings depending on the power supply used:

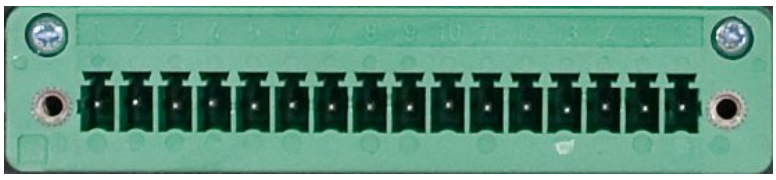
- Internal 24VDC supply: Maximum = 1 ampere total
- External 24VDC supply: Maximum = 1 ampere per output

The Theta controller's Input circuits conform to the IEC 61131-2 standard for PLCs.

LIMITS per IEC 61131-2

Rated Voltage	Type Of Limit	Type 2 limits					
		State 0		Transition		State 1	
		V low (v)	I low (ma)	V trans (v)	I trans (ma)	V high (v)	I high (ma)
24 volt	Max	5	30	11	30	30	30
	Min	-3	ND	5	2	11	6

The Theta controller has a terminal block connector for error proofing. Error proofing in the Theta controller is based on simple bolt counting with Poki-Oki.



NOTE:
One I/O mating connector (P/N 21C104800) is included with each Theta controller

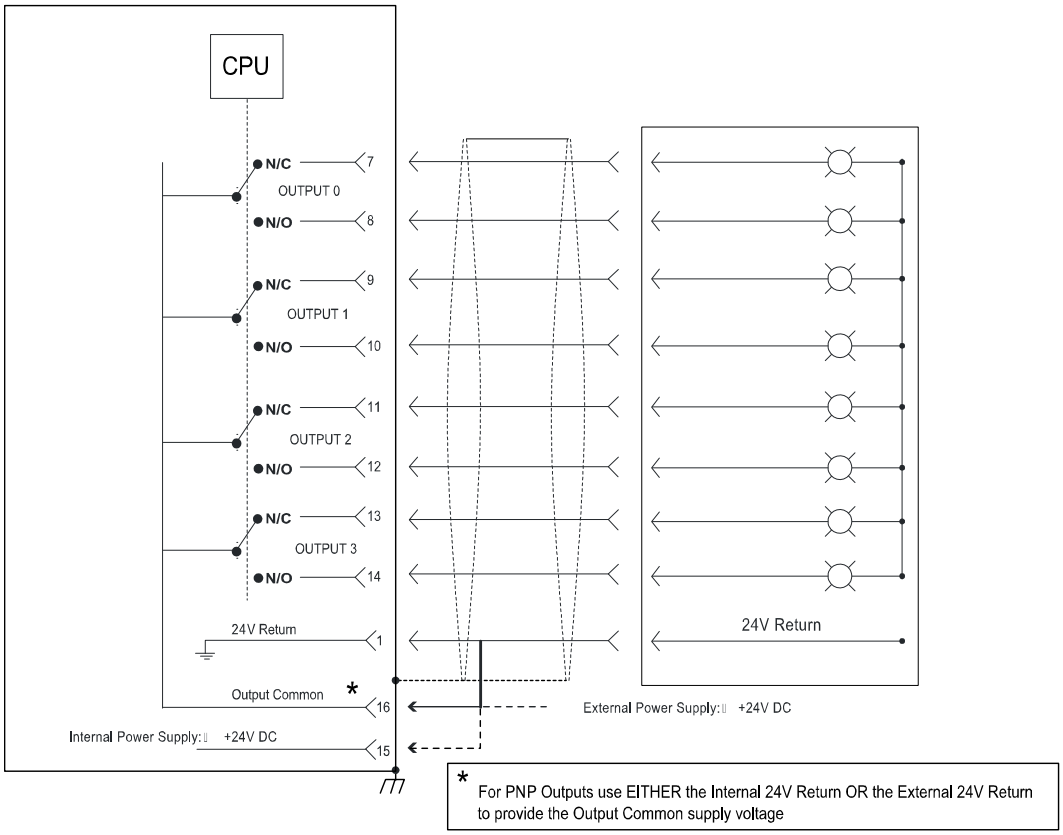
Theta Controller

When the Theta controller is used with fixtured tools, it must use a Remote Start/Stop/Reverse pendent to the controller to provide basic switching control for the tool.

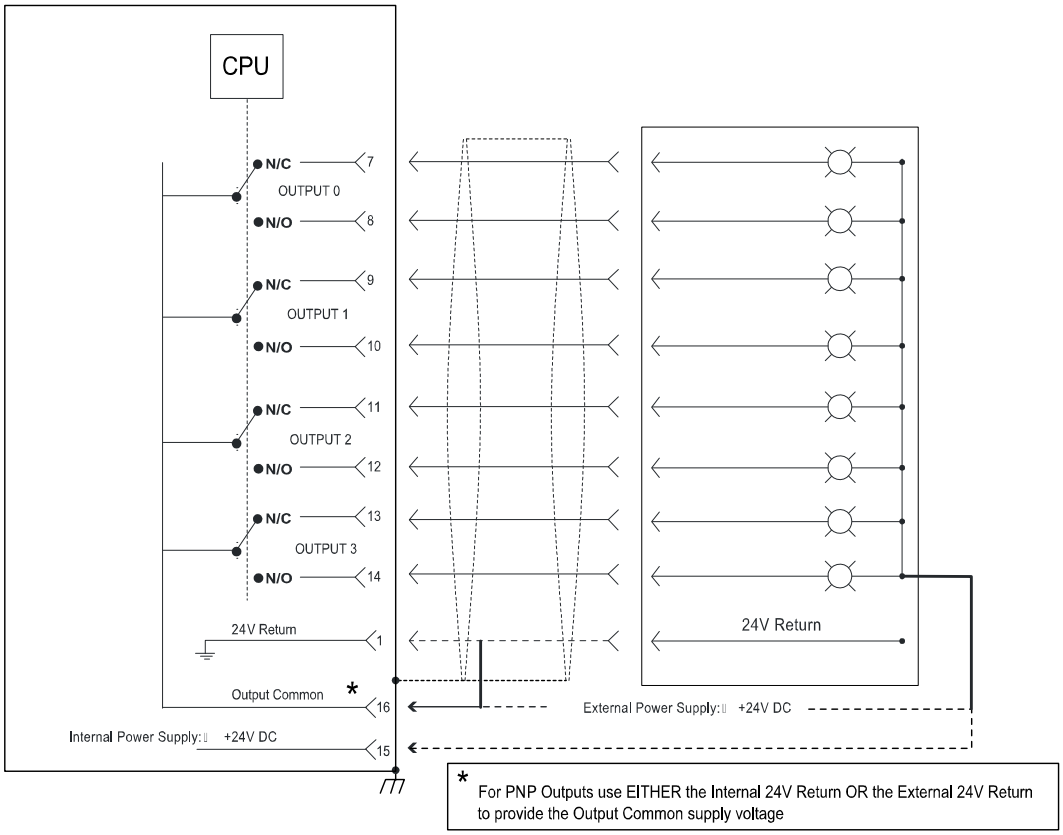
Inputs

Graphic to be added

Outputs: Sourcing



Outputs: Sinking



4.2 Assignable Input/Output Functions

The following Input/Output (I/O) functions apply to the 24 VDC I/O connector. There is a maximum of eight inputs and eight outputs for the 24 VDC I/O connector.

It is important to understand the controller responds to the rising and falling edges of input functions as they are asserted or removed, not while the levels are high or low. The STOP bit is an exception: it is a true "OR" function rather than working off the transition.

The table below lists the available input and output functions, gives a brief description and indicates the configuration options for each. The configuration options are an important aspect of the I/O functions, as they add powerful, multiple dimensions to each function not previously seen in Stanley tool controllers. These new dimensions allow integration of these controllers in unique ways, providing an amazing amount of flexibility.

Please see the full description of each function in the section following this table.

See Appendix A for assigning of inputs and outputs using Embedded Tool Box.

Inputs	Description	Configuration Options
IGNORE	Input is ignored	Input is not assigned
START	Start the tool	Contact Type, Latch
STOP	Stop the tool	Contact Type
RESET JOB	Reset a job	Contact Type
JOB SELECT BIT	One bit in a series to select the Job	Contact Type., Bit, Mode
REVERSE	Put the tool in reverse	Contact Type

Outputs	Description	Configuration Options
OFF	Output is turned off	Output is not assigned
IN CYCLE	The tool is in cycle	Contact Type, Output Type
DISASSEMBLY DETECTED	A tightened fastener removed has been loosened	Contact Type, Output Type
CYCLE OK	Tightening cycle was OK	Contact Type, Output Type
CYCLE NOK	Tightening cycle was NOK	Contact Type, Output Type
JOB SELECTED BIT	A bit, in a series of bits, to indicate the selected Job	Contact Type, Bit, Mode
READY	The tool is ready to run	Contact Type, Output Type

4.2.1 Input Descriptions

Each of the input elements has Configuration settings of Contact types and others. It is recommended to configure them immediately once the input elements are assigned to a pin.

Contact Type

The Contact Type can be Normally Open (N.O.) or Normally Closed (N.C.).

Normally Open - the input is asserted when 24 VDC is applied to the 24 VDC connector input pin.

Normally Closed - the input is asserted when the 24 VDC is removed from the 24 VDC connector input pin.

Inputs	Description
IGNORE	The pin that is assigned as IGNORE means the input will do nothing when asserted. This is essentially a spare input.
START	When asserted, the tool will start and run the currently selected job. This input is overridden by the STOP input. If STOP is used and a tool restart is required, remove the STOP, remove the START, then re-assert the START. If the tool is required to operate in Disassembly mode, remove the START, assert the REVERSE input, and then re-assert the START. When removed the tool will stop. Even if a second START input is active, the tool will stop when any START is removed. The size of this input function is 1 bit. Configuration: Contact Type Latch: This is applicable to external inputs only. This is not applicable to the trigger on the tool handle. Yes – when selected causes the START input to latch internally after a time period has elapsed. This means the physical START input can be removed without stopping the tool. The tool will run until the currently active Job is complete or times out. A TIME parameter becomes available to set how long the START input must be applied, in seconds, before the Latch becomes active. No – when selected turns the Latch function off.
STOP	When asserted, the controller will stop the tool. It will also keep the tool from running while it is applied. When removed nothing will happen other than the tool will be allowed to run. The size of this input function is 1 bit. Configuration: Contact Type

Inputs	Description
RESET JOB	When asserted the controller will reset the accumulated fastener count back to zero for the active job and act as a Part Entry to re-enable the tool if disabled. If "Error Proofing" is enabled, the tool will disable when the accumulated count equals target count. When removed nothing will happen. The size of this input function is 1 bit. Configuration: Contact Type
JOB SELECT BIT	When asserted or removed the controller will select a Job. This is one bit of a binary number created by several of these bits. The size of this input function is 1 bit. Configuration: Contact Type Bit: The number you wish this bit to be in your binary number scheme to select jobs. Mode: All JOB SELECT BITs must be the same mode, no mixing of modes allowed. Binary – Will create a decimal number equivalent to the weighted value of this binary bit(s). Binary + 1 – Will create a number equivalent to the weighted value of this binary bit(s) and add the value of one (1) to that number.
REVERSE	When asserted the controller will place the tool in Reverse (disassembly) mode. This will NOT run the tool in Reverse; it simply changes the tool mode from Forward to Reverse. When removed the controller will place the tool into Forward (assembly) mode. The size of this input function is 1 bit. Configuration: Contact Type

4.2.2 Output Descriptions

Each of the output elements has Configuration settings of Contact types, Output types, and others. It is recommended to configure them immediately once the output elements are assigned to a pin.

Contact Type

The Contact Type can be Normally Open (N.O.) or Normally Closed (N.C.).

Sourcing Outputs (PNP type)

If an output's contact type is normally open and the output is asserted, the output pin will transition from 0VDC to 24VDC. If an output's contact type is normally closed and the output is asserted, the output pin will transition from 24VDC to 0VDC.

Sinking Outputs (NPN type)

If an output's contact type is normally open and the output is asserted, the output pin will transition from 24VDC to 0VDC. If an output's contact type is normally closed and the output is asserted, the output pin will transition from 0VDC to 24VDC.

Output Type

The Output Type defines the behavior of the output signal.

Normal – The output asserts and stays asserted until a reset condition occurs.

Minimum On Time – Keeps the output asserted for this minimum time, in seconds, even though a reset condition occurs. After the timer is finished the output will reset if a reset condition has occurred otherwise it will remain asserted until a reset condition occurs.

Timed – The output asserts for this period of time then resets on its own without waiting for the reset condition to occur.

Time – Units are in seconds.

Flash – The output flashes for as long as it is asserted.

Period – Sets the flashing On and Off times, which are equal. Units are in seconds

Outputs	Description
OFF	The pin that is assigned as OFF means the output will do nothing when asserted. This is essentially a spare output. The size of this output function is 1 bit.
IN CYCLE	This output asserts when the tool torque level, during the tightening cycle, exceeds the Threshold Torque value. It resets when the tool is shutoff either by reaching target, a fault, a Stop input, a Start input removed or by the operator. The size of this output function is 1 bit. Configuration: Contact Type Output Type
DISASSEMBLY DETECTED	This output asserts when Error Proofing is enabled and the accumulated count is greater than one and the tool mode is Disassembly and Threshold Torque is achieved. It resets when the tool lever or Start input is removed. The size of this output function is 1 bit. Configuration: Contact Type Output Type
CYCLE OK	Asserts when a tightening cycle that exceeds the Threshold Torque is completed and the achieved torque and angle are audited within the limits of the audit step. Resets when the tool exceeds Threshold Torque on the next tightening cycle. The size of this output function is 1 bit. Configuration: Contact Type Output Type
CYCLE NOK	Asserts when a tightening cycle that exceeds the Threshold Torque is completed and the achieved torque and angle are audited outside the limits of the audit step. Resets when the tool exceeds Threshold Torque on the next tightening cycle. The size of this output function is 1 bit. Configuration: Contact Type Output Type
JOB SELECTED BIT	Asserts or resets according to the binary value of the selected Job. This is one bit of a binary number created by several of these bits. The size of this output function is 1 bit. Configuration: Contact Type Bit: Bit defines the number you wish this bit to be in your binary number scheme of the selected job. Mode: All JOB SELECTED BITs must be the same mode, no mixing of modes allowed. Binary – Will create a decimal number equivalent to the weighted value of this binary bit(s). Binary + 1 – Will create a number equivalent to the weighted value of this binary bit(s) and add the value of one (1) to that number.
READY	Asserts when the controller is energized and there are no faults and there is nothing disabling the tool, such as Error Proofing or a Stop input. See section 2.2.6 for the conditions that can Stop Tool Operation. Resets when the controller is turned off or there is anything stopping the tool from operating. The size of this output function is 1 bit. Configuration: Contact Type Output Type

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Glossary

Abort Timer	The tightening cycle aborts if the tool does not shutoff on target before this pre-selected time.
Acceleration	The rate at which the controller increases tool speed from 0 (stopped) to the Speed value.
Accept Tone	Controls the tone made from the handle of handheld QPM tools for accepted tightening cycles. Allows distinct tones for tools in adjacent workstations.
ATC	Adaptive Tightening Control allows a consistent achieved torque to be maintained over a wide range of joints. Manual downshift should be used when: • High Prevailing Torques – Prevailing Torque > 20% of the Torque Set Point (TSP). • High Starting Torque –Starting Torque > 20% of TSP.
Batch Count	The number of OK tightening cycles to complete a job. The Run display shows the accumulated and target counts for the selected job.
Downshift Mode	Disable: no downshift; Manual: Occurs at specified torque; ATC automatically adapts to the joint.
Downshift Speed	Once the tool reaches the Downshift Torque point, the controller changes the operating speed of the tool from the initial tool Speed to the Downshift Speed.
Downshift Torque	The controller changes the operating speed of the tool from the initial Tool Speed to the Downshift Speed at the Downshift Torque level.
High Angle	Anytime the peak angle recorded exceeds the High Angle, the tightening cycle is recorded as a reject for high angle, the red light illuminates and the tightening cycle is given an overall status of NOK.
High Torque	Anytime the peak torque recorded exceeds the High Torque, the tightening cycle is recorded as a reject for high torque, the red light illuminates and the tightening cycle is given an overall status of NOK.
Low Angle	Anytime the peak angle recorded during the Angle Audit Step fails to reach the Low Angle, the tightening cycle is recorded as a reject for low angle, the yellow light illuminates and the tightening cycle is given an overall status of NOK.
Low Torque	When the peak torque recorded fails to reach the Low Torque, the tightening cycle is recorded as a reject for low torque, the yellow light illuminates and the tightening cycle is given an overall status of NOK.
MFB Mode	Controls the operation of the multiple-function button (MFB) on QPM tools. The choices for handheld tools are Disable, Reverse (Disassembly), Parameter Select, Arming and Reset Reject. The default value is Reverse.
PM Counter	Records the number of tightening cycles completed since the last time it was reset for Planned Maintenance.
PM Limit	When the PM Counter exceeds the PM Limit, the controller provides a maintenance alert.
Parameter Set	A Parameter Set is a collection of instructions that define how the tool should perform the tightening process. It may be selected from the keypad or 24V device such as a socket tray.
Reject Tone	Controls the tone made from the handle of handheld QPM tools for rejected tightening cycles. Allows distinct tones for tools in adjacent workstations.
Slow Seek	Slow Seek helps engage the socket or fastener at a pre-selected speed, torque level and angular rotation. Once engaged, the tightening cycle completes at a higher speed. Slow Seek prevents cross-threaded fasteners and previously secured fasteners from being counted in a batch.
Snug Torque	The controller begins to monitor the tool output for angle at this torque. Any

	increase in angle after the snug point results in a corresponding increase in the tension or clamp load within the joint.
Soft Stop	Soft stop minimizes the torque impulse to the operator during tool shutoff at the end of the tightening cycle.
Speed	The speed at which the tool operates during the initial portion of the tightening cycle prior to ATC or downshift.
Spindle	A spindle represents the tool, its cable and connected controller.
Strategy	Identifies what variables will be used to control the tool during a tightening cycle.
Thread Direction	Sets assembly direction to clockwise (CW) or counter clockwise (CCW).
Threshold Torque	Sets the point at which the tool is considered to be "performing work", the tool and controller tightening cycle status lights turn off, the controller displays dashes (----) for data, and the "In Cycle" output is turned on.
Tool Tones	Distinctive sounds assigned to tool functions.
Torque Calibration	Determines how torque values are assigned to the electrical signals from the torque transducer on the tool. This value is unique to each tool and changes over time.
Torque Target	When the tool is being controlled for torque, the torque target instructs the controller when to shut the tool off. The torque target should be greater than Low Torque and less than High Torque, and is required for torque control.
Trace	A display plot of torque vs. time (or angle) of a tightening cycle.
Trip Counter	Records the number of tightening cycles completed since the last time it was reset. It is usually used as a supplementary count of the PM Counter.
Units	The following torque units and associated labels are used with Stanley controllers and tools. The labels are derived from SP811, *SI Unit rules and style conventions* from the National Institute of Standards and Technology

Abbreviation	**Common Term**	**= 1 lbfft**	**= 1 Nm**
Nm	Newton meter	1.355817	1
Ncm	Newton centimeter	135.5817	100
Ndm	Newton Decimeter	13.55817	10
kgm	Kilogram meter	0.138 255 2	0.101 971 6
kgcm	Kilogram centimeter	13.825 52	10.197 16
ft lb	Foot pound	1	0.737 562 1
in lb	Inch pound	12	8.850 745
in oz	inch ounce	192	141.611 9

Appendix A – Controller Gateway

Requirements for Theta Controllers Using the Controller Gateway (Serial Connection):

- Computer with Microsoft Windows XP and one serial port (can be a USB to serial adapter)
- QA1001 Theta Controller v1.0 or above
- Javascript enabled browser and Adobe Flash Player

The Controller Gateway is a Windows based software program that provides a web based interface to a Theta controller connected via a serial link.

Installing the Controller Gateway

Using the provided installation media, run the setup program and follow the on-screen instructions. During installation, TCP/IP ports for the web interface and the live event interface can be set. Leave the default values unless you understand their meaning and require a port change for your specific environment.

Running the Controller Gateway?

The installer sets the Controller Gateway to automatically launch each time the computer is started. When Controller Gateway is running, a small icon appears on the system tray or Windows Task bar (typically at the bottom right corner of the screen).

Right-clicking on the Controller Gateway icon displays its menu. From the menu, select the Auto-Connect option. Note that Auto-Connect is the default option; this means that double-clicking the Controller Gateway icon also starts the auto-connection process.

The auto-connection process launches the default web browser and examines the computers available serial ports. The Controller Gateway seeks each port for a compatible Stanley controller connection. When one is found, the browser displays the main menu. From the main menu, setup, maintenance and analysis functions can be performed.

If a compatible controller is not found, the auto-connect mechanism offers to try again. If you choose to not try again, the browser is redirected to an “Offline Mode” menu. In offline mode, setups and configuration file exports can be created. These files can be imported to a connected controller in the future.

Appendix B – Torsion Compensation

Torsion Factor:

For all Stanley electric assembly tools the angle information is based on the rotation of the resolver, which is directly attached to the rotor. This information is used for motor commutation, and it also serves as an angle encoder. The rotation of the tool output can be determined by dividing the rotor angle by the total gear ratio for the tool.

All things can deflect when loaded. Just as a long steel bar attached to a socket to produce high torque will deflect, likewise the gears within an assembly tool will deflect when subjected to the torque loads. In effect, the gears act as a torsion spring between the rotor and the socket, and it is the deflection of this spring that can give false angle data. In addition to the angular deflection within the gears of the tool, there can also be deflection of the parts of the joint .

Whenever this deflection is present in the tool, or the joint, or the tool mounting device, the angle information derived from the resolver will indicate a larger angle than the tool output actually rotates. This error is directly proportional to the torque level. That is, the deflection at 40 NM will be twice that at 20 NM.

In a torque vs. angle curve of a fastening cycle, at the end when the torque reaches its maximum value, the angle will also be at its maximum value. After shut-off, as the torque falls to zero, the angle should remain at its maximum value. But in the typical torque vs. angle curve, as the torque falls to zero, the angle also appears to fall some amount. This is not because the fastener is being loosened. It is actually the resolver indicating that the angular deflection of the gears is relaxing to the neutral position. In this case, the maximum angle indicated at the maximum torque was incorrect. The resolver indicated more angle than the tool output actually rotated.

To correct for this slight error in angle data, the Theta controller has a **Stanley-exclusive solution**. The Torsion Factor allows the user to input a value that compensates for the torsional spring rate of any part of the fastening system (the gears of the tool, the joint components, or the tool mounting device), and this factor is used to correct the angle reading throughout the fastening cycle. This factor is entered as **Degrees per NM**, and its default value is zero. If the default value is used, there will be no angular correction. If a value of 0.1 is used, each angle data point (every millisecond) will be modified by subtracting 0.1 times the torque value. For example, at 15 NM, the controller will subtract 1.5 degrees from the angle reading for that sample. At 30 NM, the controller will subtract 3 degrees for that sample.

The easiest way to determine the correct value for the Torsion Factor is to look at a torque vs. angle trace with Torsion Factor set to zero. The amount of degrees that the socket appears to loosen after the maximum torque, divided by that maximum torque is the Torsion Factor. For example, consider a torque vs. angle trace that indicates a maximum torque of 40 NM, and the maximum angle at this torque of 50 degrees. But the angle appears to loosen by 4 degrees as the torque drops to zero. The Torsion Factor can be determined by dividing 4 degrees by 40 NM to arrive at a Torsion Factor of 0.1 degrees per NM. When this value is entered into the Torsion Factor parameter, each angle reading will be corrected by this factor. When this factor is set correctly, any torque vs. angle trace will now indicate no apparent loosening of the fastener as the torque drops to zero after shut-off; which is exactly as it should be.

Angle Validation:

Now that the angle can be indicated with great precision, the other challenge is to validate these results against a master torque/angle transducer with monitor. This is not as simple as setting both the controller and the monitor to the same snug torque and comparing the resulting angle.

It has been found that a tool's torque trace will never track **exactly** the same as the external. The calibration is only the average of a number of readings, generally at a high torque near the maximum capacity of the tool. When any individual torque reading from the tool's controller is compared to a torque reading from the external torque monitor, you can easily have several percent difference higher or lower. This means that the tool's controller will start counting angle at a different point than the external torque/angle monitor starts counting. This could be 5 to 10 degrees different depending of the hardness of the joint.

The only way to get consistent results when validating an angle reading against an external monitor, is to **pretorque the joint slightly higher than the snug torque**. Run the tool on this already-tightened joint, with the snug torque set to the same value in both the controller and the monitor, even if the tool's transducer and the external transducer do not exactly agree near the snug torque, they will both start counting angle just before the fastener starts to rotate, so their zero angle will be synchronized exactly.

For example, if a brake line fitting requires 6 NM plus 40 degrees, pre-torque the joint to 7 NM first. Then change to an Angle Control strategy, with 6 NM snug torque, plus 40 degrees angle target, and reset the external torque/angle monitor. Then as the tool is run in this angle control mode, the tool will start counting angle as soon as it has 6 NM (which might have been 5 or 7 NM according to the external transducer), which is before the joint actually starts to rotate. And the external monitor will start counting angle as soon as it has 6 NM which is also before the joint starts to rotate. This way, both meters are reading angle from the same point, even though the torque readings may differ slightly because of the allowable tolerances in the torque calibration.

Warranty

Mechanical Products Limited Warranty:

STANLEY ASSEMBLY TECHNOLOGIES ("Stanley") warrants its Assembly Technologies mechanical products to the original purchaser to be free from deficiencies in material or workmanship for the useful life of the product.

Under this lifetime limited warranty Stanley will, at its discretion, repair or replace any product which, upon inspection, is acknowledged by Stanley to be defective.

This limited lifetime warranty shall apply to products which have been used under normal operating conditions for their intended use and shall not apply to products which have been subjected to: abnormal wear and tear, abuse, misuse, improper maintenance, negligence, continued use after partial failure, accident, alterations or repairs with non-genuine Stanley replacement parts.

Electronic Products Limited Warranty:

Stanley warrants its Assembly Technologies electronic products to the original purchaser to be free from deficiencies in material or workmanship for a period of one year after the date of shipment.

Under this limited warranty Stanley will, at its discretion, repair or replace any product which, upon inspection, is acknowledged by Stanley to be defective.

This warranty shall apply to products which have been used under normal operating conditions for their intended use and shall not apply to products which have been subjected to: abnormal wear and tear, neglect, component degradation, improper handling, overload, abuse, misuse, improper maintenance, use with improper accessories, or where alterations have been made.

Software Products Limited Warranty:

Stanley warrants its Assembly Technologies software products to the original purchaser to be free from deficiencies in material or workmanship for a period of one year after the date of shipment.

Under this limited warranty Stanley will, at its discretion, make available replacement software or an upgrade for any product which, upon inspection, is acknowledged by Stanley to be defective. Installation of the software shall be the responsibility of the requestor.

This warranty shall apply to products which have been used with specified, compatible hardware under normal operating conditions for their intended use and shall not apply to products which have been: modified, misused, improperly handled, improperly maintained, or used with non-compatible hardware or accessories.

OEM Products Limited Warranty:

Some Stanley Assembly Technologies custom engineered systems include components manufactured by others. The limited warranties of each individual manufacturer shall apply to these components and Stanley makes no representation or warranty of any kind, expressed or implied, with respect to such components.

General Terms:

This limited warranty gives you specific legal rights and is in lieu of all other warranties, expressed or implied, including the implied warranties of merchantability and fitness for a particular purpose. Some states and countries do not allow limitations on implied warranties, so the above may not apply to you. You may also have other rights which vary by state or country.

Stanley shall not be responsible for incidental or consequential damages or the inability to use its products for any purpose whatsoever. Stanley's maximum liability shall not in any case exceed the contract price for the products claimed to be defective. Some states and countries do not allow the exclusion or limitation of incidental or consequential damages, so this specific limitation or exclusion may not apply to you.

Specification Changes:

Stanley retains the right to discontinue and/or change specifications of any Assembly Technologies products without responsibility for incorporating changes in products already sold.

Warranty Claims:

To apply for warranty consideration, the original purchaser should take the following action:

Contact the Stanley Assembly Technologies customer service department to obtain a "Return Authorization Number" and "Warranty Claim Report Form."

Package the product including proof of purchase and the completed warranty claim form.

Note the Return Authorization Number on the exterior of the package and return freight to:

Stanley Assembly Technologies
5335 Avion Park Drive
Cleveland, Ohio 44143-2328

In the event that a product is repaired or replaced under the terms of the warranty, the warranty period of the repaired or replacement product shall be limited to the remaining portion of the original warranty period.

Product Services

Stanley provides full services for design, modification, service, repair, and training on Stanley products.

Contact STANLEY ASSEMBLY TECHNOLOGIES or their agents for information on training courses to aid users in becoming familiar with operations, maintenance, or programming of the Stanley DC electric tools and controllers.

No modification of Stanley tools and controllers can be made without the express permission of STANLEY ASSEMBLY TECHNOLOGIES. Refer all service to STANLEY ASSEMBLY TECHNOLOGIES, or their representatives.

Return Material Authorization (RMA) Procedures

A Return Material Authorization or RMA is required before returning any material for warranty or repair service.

- Contact STANLEY ASSEMBLY TECHNOLOGIES or their agents.
- Request Customer Service or Repair Services.

NOTE:
An RMA can be given without a purchase order. However, non-warranty repairs cannot be performed until a written purchase order or credit card authorization is received.

- Have the following information available for the person answering the telephone to obtain an RMA:
  - Company name and address.
  - A contact name and telephone number. If possible, have facsimile and pager numbers (if any) available.
  - The Stanley model number, serial number, and description for the item
  - A short description of the problem.

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