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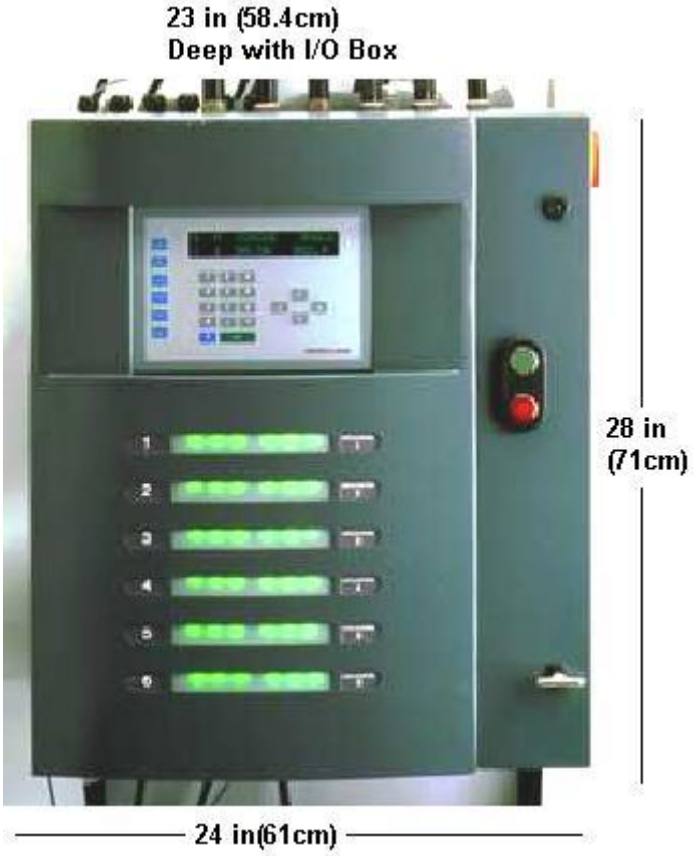
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INSIGHT 6 Torque Management System (PFS6)

WARNING YOU MUST READ THIS MANUAL BEFORE OPERATING THE SYSTEM



The Insight PFS6 is used in multi-spindle applications,. This controller can control individual separate tools or multi-spindles in any combination up to a maximum of six in total.
The Insight 6 controller features an easy to install back-plane which can be mounted in place to accept incoming power and control lines.

It has the same tightening algorithms available in the Insight IC controllers. The compact two-line display allows programming from the front panel keypad. Downloading saved programs via PC is also available.
Large tightening cycle status lights make for easy viewing by the operator.

Tightening Strategies
A control and monitoring process developed so that a tool can accurately perform the a fastening application

The DC Electric fastening systems described offer many advanced tightening strategies and customized multi-step configurations.

These include:

- Torque control
- Torque control with angle inspection
- Angle control with torque inspection
- Yield control with torque and angle inspection
- Yield over-ride
- Prevailing torque algorithm
- Drag torque

These tightening strategies are described in the Mobile Module on Fastening Strategies and Applications.

THE SPINDLE CONTROL MODULE

The Spindle Control Module (SCM) is the heart of the INSIGHT 6 Torque Management system. The SCM is a computer mated to several specialized circuit boards, that work together to control each DC motor spindle. It will monitor the spindle's performance during fasterner tightening, and signal the operator if the fastening has been performed correctly. Each SCM in the INSIGHT 6 controls one spindle.



Ingersoll Rand
Assembly Solutions
Ingersoll-Rand
North American Solutions Center
1872 Enterprise Drive Phone (248)293-5700
Rochester Hills MI, 48309 Tech Support (866)284-5509

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OPERATION AND MAINTENANCE MANUAL for INSIGHT DC ELECTRIC TORQUE MANAGEMENT SYSTEM

⚠ WARNING This symbol is to alert the user and service personnel to the presence of uninsulated dangerous voltage that will cause a risk of electrical shock.

⚠ CAUTION This symbol is to alert the user and service personnel to the presence of important operating instructions that must be read and understood to prevent personal injury, electrical shock or damage to the equipment.



⚠ WARNING

YOU MUST READ THIS MANUAL BEFORE OPERATING THE SYSTEM.

Electrical repairs should be attempted only by authorized trained repairmen. Consult your service center listing for your nearest Ingersoll-Rand authorized service center.

For safe operation the following procedure must be followed.

- **Keep work area Clean.**
  Cluttered areas and benches invite injuries.
- **Consider work area environment.**
  Don't expose the Controller to water or moisture.
  Keep work area well lit.
- **Guard against electric shock.**
  Prevent bocy contact with grounded surfaces, such as pipes, metal structures or other electrical products.
- **Keep bystander away.**
  Do not permit unauthorized personnel to operate this Controller.
- **Store idle Controllers.**
  When not in use, the Controllers should be stored in a dry, and secure area.
- **Keep cord from heat, oil, solvent and sharp edges.**
- **Maintain Controller with care.**
  Inspect Controller cord periodically and if damaged, have repaired by an authorized service facility.
- **This apparatus must be earth grounded.**
- **Should the earth fault disconnect the system,** be sure to find the primary reason before you resume operation.
- **Always disconnect the apparatus from the mains by first rotating the rotary disconnect switch to the off position and locking,** then release the cabinet from the mounting plate by truning the screw and disconnect and power plug on the bac plate, before opening the instrument for installation, service, etc.
- **There are no user serviceable parts inside this unit.** Refer all servicing to qualified service personnel.
- **If the main cable to this apparatus is damaged** it must be replaced with a cable that meets the local electrical safety standards for this type of product.
- **Do not use this product near water** or on other liquids, for example near a washbowl, wet basement or the like.
- **Install Mounting Plate and Controller to a structure capable of safely supporting total weight of system.** Failure to follow installation instruction properly can result in structure collapse and personal injury.
- **Disconnect power and lockout/tagout machine prior to removal, insertion or servicing any component or module within the system.** Failure to follow instructions can result in contact with high voltage and cause sever injury or death.
- The product should be located so that its location is away from heat sources such a radiators or other products that produce heat.
- For minimum electrical interference, place the instrument as far away as possible from sources of electrical noise, e.q. arc welding equipment, etc.
- Do not attach or place external loads on any part of the Controller. Failure to follow instructions can cause hinge failure and result in personal injury an damage to controller.
- Keep body parts from in-between Front Door, enclosure and Mounting Plate during closing and latching to avoid risk of pinching.
- Install Mounting Plate and Controller on vertical support structure only. Failure to follow installation instructions properly will cause unexpected motion of unlatched Controller and result in personal injury.
- Keep fingers away from rotating fan blades to avoid personal injury.
- When tool/spindle is to be idle for extended periods of time, disable tool/spindle though software selection to avoid unintended operation by nonusers.
- Use proper lifting techniques and/or mechanical lifting aids to handle Power Distribution Module during install or removal due to weight of module. Failure to follow instructions may result in personal injury. (See specification for module weight).
- The Power distribution Module is heavy (~90 Lbs (40Kg)). Use tow people and/or mechanical lifting aid for installation and removal of module. Failure to follow instructions can result in personal injury.

SAVE THESE INSTRUCTIONS

NOTICE

The use of other than genuine Ingersoll-Rand replacement parts may result in safety hazards, decreased tool performance, and increased maintenance, and may invalidate all warranties.

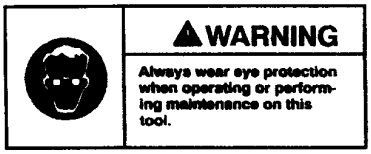
Refer All Communications to the Nearest Ingersoll-Rand Office or Distributor.

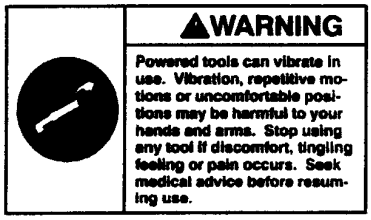
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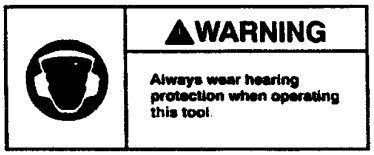
⚠ WARNING

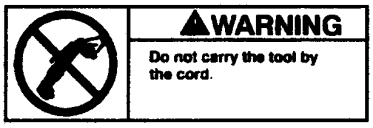
FAILURE TO OBSERVE THE FOLLOWING WARNING COULD RESULT IN INJURY

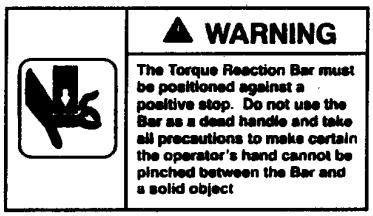


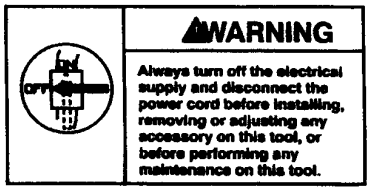


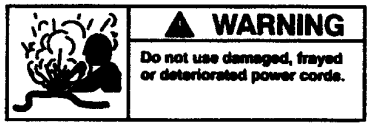


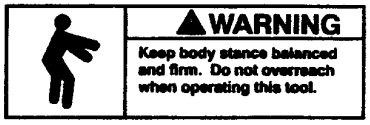


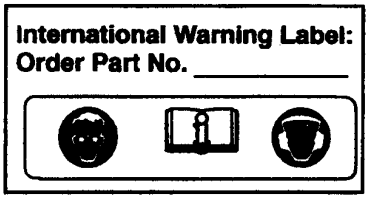












⚠ WARNING

GROUNDING INSTRUCTIONS

THE CONTROLLER MUST BE EARTH GROUNDED WHILE IN USE TO PROTECT THE OPERATOR FROM ELECTRIC SHOCK. The controller requires a 3 phase drop and must be wired by qualified personnel to meet local electrical safety standards for connecting 3 phase power to the system receptacle. The unit is to be used with 380-500VAC, 50/60 Hz, 20A, 3 phase circuit. Always verify that the ground is operating properly by a qualified electrician before using the unit.

WIRING

⚠ WARNING

THIS APPARATUS MUST BE EARCH GROUNDED

The three conductors of the
Main leads must be attached
To the correct terminal as indicated.

3 PHASE CONDUCTOR	CONTROLLER TERMINAL
L1	X
L2	Y
L3	Z
Earth	Green

WIRING MUST BE INSTALLED BY QUALIFIED ELECTRICIAN

1. Do not drop or abuse the Controller
2. Whenever a Controller is not being used, position the rotary disconnect switch to the “OFF” position and lock.

NOTICE

Ingersoll-Rand Company makes no warranty or implies any warranty or liabilities due to the misuse or damage resulting from the application of the information supplied by this manual. Liabilities due to errors in the manual are only limited to replacement of the manual. Ingersoll-Rand reserves the right to change information contained in this manual or the program without notice at anytime.

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INSIGHT 6 SPECIFICATIONS:

The specifications for the INSIGHT 6 Torque Management System are shown below.

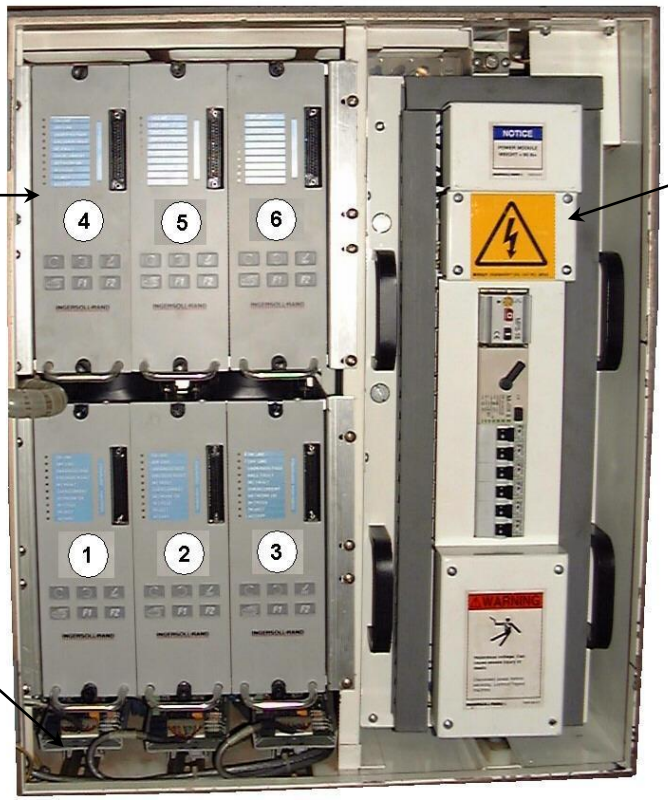
Specifications Table

Measurement Accuracy	t 0.2% of monitor torque full scale. t 1 count of angle.
Measurement Resolution	0.05% of monitor torque full scale.
Torque Transducer Bridge Excitation	t 5 VDC standard.
Torque Transducer Zero Offset/ Drift Compensation	10.4% of full scale.
Calibration	Values entered from front panel or tool table. Automatic digital correction.
Frequency Response	Selectable: 15 Hz, 150 Hz, 500 Hz, 700 Hz.
Keypad	User-friendly, menu-driven interface for all readings and commands. Six hot keys.
Display	Vacuum fluorescent. Two lines of 20 characters per line. 3/8" character height. 15' visibility. Horizontal (floor) viewing angle >200°. Vertical viewing angle +25° to -50°.
Parameter Sets	16 per spindle.
Statistics Data Memory	5,000 per spindle.
Communications	Serial: RS-232-C, 7-bit word, 1 stop bit, even or odd parity, or 8-bit word, 1 stop bit, no parity. Programmable baud rates of 1,200 - 115,200. Parallel port for printer.
Control Inputs	Free Speed, Soft Start, Forward, Reverse, Reset Configuration, Tool Disable, Tool Re-enable, Configuration 1-8. Through contact closure switching internal 24 VDC.
Control Outputs	Accept, Reject, In-Cycle (Busy), Cycle Complete, Motor Stop. Through opto-relays switching external 24V source.
Indicators	High-intensity LED indicators for: Torque High, Torque Low, Angle High, Angle Low, and Pass. Incandescent lamps for: Spindle Power, Statistics Alarm, Torque Label, and Angle Label.
Input/Output Consumption	AC 3 phase, 380-500 Volts, 50/60 Hz, 20 Amp.
Input Signal	2.0 MV/V
Ambient Operating Conditions	0-50° C temperature, 20-90% non-condensing humidity.
Enclosure	NEMA-12 type.
System Weight	230 pounds (105 kg).
Power Distribution Module Weight	95 pounds (43 kg).

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CONTROL BOX LAYOUT





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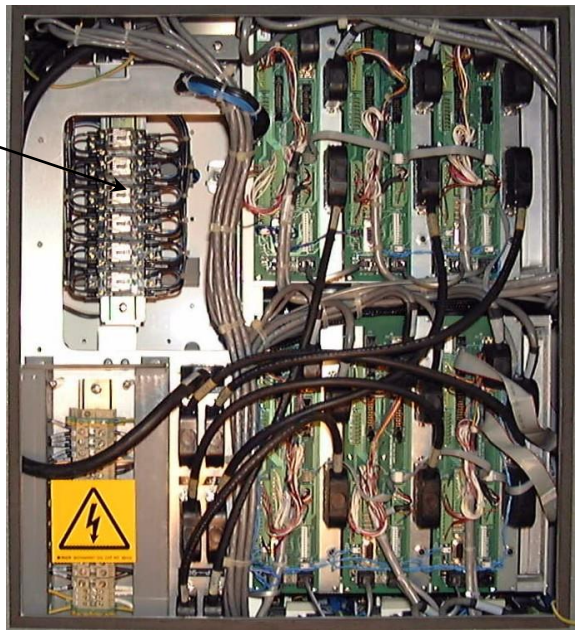
SPINDLE POWER ON
LIGHT/PUSHBUTTON
T51286-01

SPINDLE POWER OFF
LIGHT/PUSHBUTTON
T51171-07

SPINDLE INDICATOR
BOARDS
T21600-01



SPINDLE
RECONGINITION
RELAYS



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1. Mounting and Pre-Wiring

The INSIGHT 6 enclosure consists of two parts: the mounting plate and the main enclosure (see Figure 4). Typically the mounting plate will be mounted during pre-installation. This allows the electronics and other sensitive components to remain in storage until ready for use. There is a hole in each corner of the mounting plate that may be used for either wall or rail mounting. Use 3/8" (9.5 mm) or larger hardware, with both flat washers and lock washers, to attach the mounting plate to wall or rails. Make sure the mounting plate is stable, secure, and level.

⚠ WARNING Attach the mounting plate to a structure capable of safely supporting the total weight of the system (~230 pounds, 105 kg). Failure to follow installation instructions properly can result in structure collapse and personal injury.

⚠ CAUTION CAUTION! Install the mounting plate on a vertical support structure only. Failure to follow installation instructions properly can cause unexpected motion of the unlatched INSIGHT 6 controller and result in personal injury.

Once the mounting plate is securely attached it is ready for wiring. INSIGHT 6 is supplied ready for either U.S. or international installation. Input power is:

- 3 phase at 380 VAC, 415 VAC, 460 VAC, or 500 VAC
- 50 or 60 Hz
- 20 A recommended

There is a basic wiring decal on the inside of the mounting plate for the external (Harting) connectors. Wire the mounting plate as illustrated on this decal. Detailed wiring instructions, schematics, and power distribution drawings are available from Ingersoll-Rand.

⚠ WARNING It is the user's responsibility to ensure that INSIGHT 6 is installed and wired by a qualified electrician.

⚠ CAUTION Do not attach or place external loads on any part of the INSIGHT 6 controller. Failure to follow instructions can cause hinge failure and result in personal injury and damage to the controller.

2. Attaching and Wiring the Main Enclosure

Once the mounting plate is attached and pre-wired, the INSIGHT 6 main enclosure can be attached to the mounting plate. Simply lift the main enclosure and slide it down onto the mounting plate, making sure that the hinge pins engage the hinges. Next, verify that the Main Power Switch is Off. (This is the rotating switch located on the right-hand side of the main enclosure.) This switch is off when the rotating handle pointer is pointing to the left as you face the switch. The switch is on when the rotating handle pointer is pointing up. If the Main Power Switch is not in the Off position, turn it to the Off position.

⚠ CAUTION Keep body parts from between the front door, the enclosure, and the mounting plate during closing and latching to avoid risk of pinching.

Unlock the main enclosure from the mounting plate (if necessary) and swing it open. Ingersoll-Rand supplies the main enclosure largely pre-wired. However, there are interface connection cables (numbered I/O-1 through I/O-6) that must be attached to the correspondingly numbered connectors on the mounting panel. Also, the main AC power cable plug on the back of the controller must be plugged into the AC power receptacle in the mounting panel. Unlock the front door and swing it open. You can now close the main enclosure and lock it onto the mounting plate.

⚠ WARNING Disconnect power and lockout/tagout the INSIGHT 6 prior to removing, inserting, or servicing any component or module. Failure to follow instructions can result in contact with high voltage and cause severe injury or death.

2.1 The SCM

⚠ CAUTION Keep fingers away from rotating fan blades to avoid personal injury.

Your INSIGHT 6 main enclosure will have up to six individual racks for holding the Spindle Control Modules (SCMs). Unless otherwise marked, all of the SCMs are interchangeable. That is, any SCM may be installed in any rack. Install the SCMs by

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sliding each one into one of the SCM racks and pushing firmly, so they engage their electrical connectors. Tighten the top and bottom attachment screws to lock the SCM in place.

The front panel of each SCM has diagnostic LEDs , a cable connection port for performing additional diagnostics and six function buttons. Accessing the SCM is not necessary during normal operation, but can be done in the event of a problem or fault.



The Lights indicate the status of the SCM When three LED – ONLINE –

NETWORK OK – ACCEPT – the tool is ready.

When RED LED for ENCODER FAULT – Is on switch the SCM, Tool or Tool Cable.

When RED LED is on for OVER CURRENT check incoming Voltage or change SCM



2.2 The Power Distribution Module.

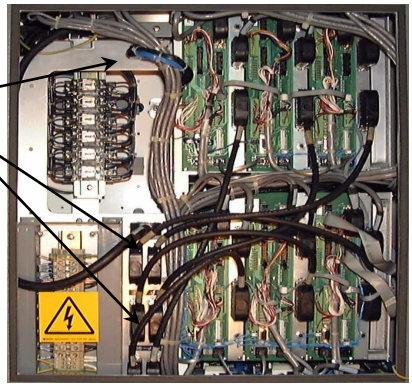
⚠ CAUTION The Power Distribution Module is heavy (-95 pounds, 43 kg). Use two people and/or a mechanical lifting aid to insert or remove the module. Failure to follow instructions can result in personal injury.

Next you will insert the Power Distribution Module. The Power Distribution Module has four handles. Lift the module by the handles, and slide it into its location on the right-hand side of the INSIGHT 6 chassis, engaging the channel on the bottom of the module onto the nylon rail in the chassis. Slide the module all the way into the chassis until it is firmly against the stops. There are two holes on the lefthand side of the Power Distribution Module for inserting mounting screws. Insert the two mounting screws provided and tighten them to lock the module in place. The INSIGHT 6 front door may now be closed and (key) locked.
The Ingersoll-Rand tools (spindles or powerheads) may now be attached to the INSIGHT 6 connector panel. In general, any spindle may be plugged into any connector, since the SCMs serving the spindles are identical. However, the user may have preferred locations for the spindles based on the fastening applications. At the end of each spindle's cable is a twist-to-lock 24-pin connector.

Tighten 2 screws



Attach Cables



Plug each tool into the appropriate connector and lock it in place. There should be a tool attached to each connector. If no tool is present, when the unit is subsequently powered up, no power will be delivered to the SCM wired to the empty connector. This is a safety feature. The INSIGHT 6 interprets the lack of a tool as a tool with a possible ground fault. and does not energize that circuit. If tools are added at a later time to empty connectors, then turn the INSIGHT 6 Main Power Switch off and back on, or press the green button on the front door Start/Stop switch. This will allow the INSIGHT 6 to recognize the new tools.

⚠ CAUTION When a tool/spindle is to be idle for extended periods, disable the tool/spindle through software selection to avoid unintended operation by giving it a 24V signal (by PLC).

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The connector panel where the spindles attach may also have other connectors, such as a 25-pin D connector (parallel port) for an external printer or an RS-232 port for an external computer. If present, attach the appropriate external devices to these ports as necessary for your fastening application.

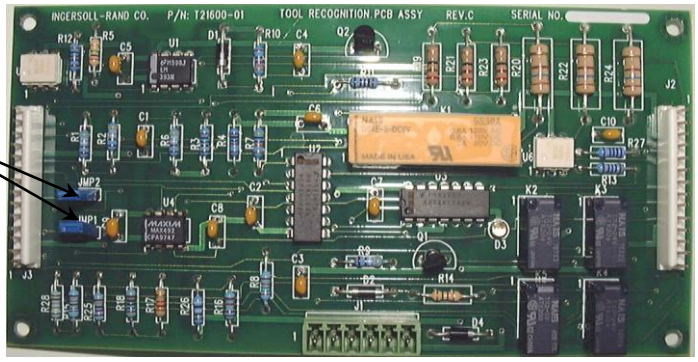
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3. Setting the Jumpers

There are several jumpers that must be set or the spindles will not work

3.1 The Tool Recognition Board has two jumpers JMP-1 & JMP-2.
The Tool Recognition Board is located at the bottom of the panel.
If the spindle is a Hand tool both jumpers should be installed
If the spindle is a Machine tool the jumpers should be removed.

Jumpers
JMP-1
JMP-2



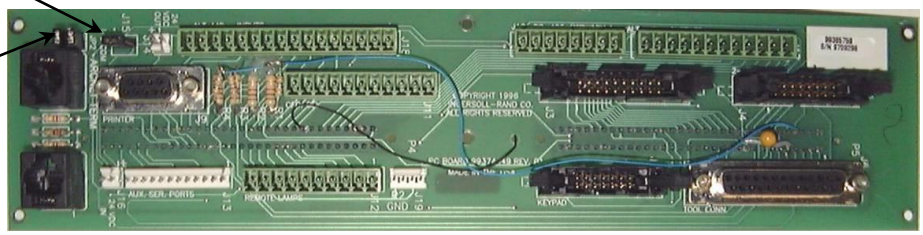
NOTE:
New Boards have a Slide switch instead of a JMP-1&2 Move the switch to the Right position for Hand Held and Left Position for Machine Mount.

3.2 The Back Plane Board has three jumpers.
JP1 & JP2 Must be installed on the first and last rack. If several power-heads are used they should be installed on the first and last rack of the power head group.

J15 determines whether the spindle is hand or machine mount.
If the spindle is a Hand tool jumper J15 1&2 should be made.
If the spindle is a Machine tool jumper J15 2&3 should be made.

Jumper J15

Jumper JP1
& JP2

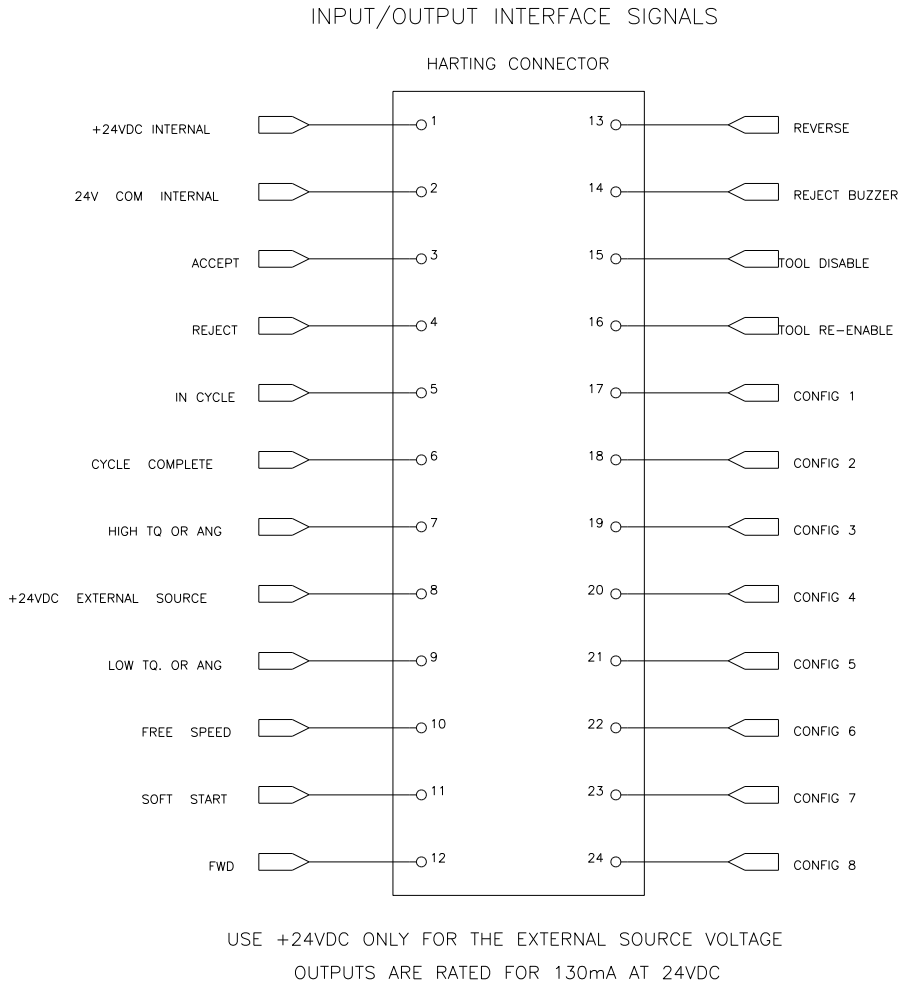


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4. SETTING UP THE I/0:

There are six Connectors (Harting) that can be wired in a multitude of different arrangements depending on the users specifications. If the internal 24vdc is used terminal 1 must be jumpered to terminal 8.

PLC Sequence Run Example: Configuration Input/ delay 250ms/ Forward or Reverse input/ Free Speed or Soft Start input.



Pin 1	+24vdc internal voltage	Pin 13	Reverse Input
Pin 2	-24vdc common internal voltage	Pin 14	Reject Buzzer Output
Pin 3	Accept Output	Pin 15	Tool Disable Input
Pin 4	Reject Output	Pin 16	Tool Re-Enable Input
Pin 5	In Cycle Output	Pin 17	Configuration 1 Input
Pin 6	Cycle Complete Output	Pin 18	Configuration 2 Input
Pin 7	High Fault Output	Pin 19	Configuration 3 Input
Pin 8	+24vdc external source	Pin 20	Configuration 4 Input
Pin 9	Low fault Output	Pin 21	Configuration 5 Input
Pin 10	Free Speed Input	Pin 22	Configuration 6 Input
Pin 11	Soft Start Input	Pin 23	Configuration 7 Input
Pin 12	Forward Input	Pin 24	Configuration 8 Input

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5. Initial Startup

Before starting the INSIGHT 6 Torque Management System for the first time, you must go through the following checklist and verify that all of the steps have been completed. If in doubt about any aspect of this check list, contact Ingersoll-Rand.

- ☐ The mounting plate is securely mounted.
- ☐ The main enclosure is correctly attached to the mounting plate.
- ☐ The power input box has been wired with the appropriate AC power.
- ☐ The numbered modular connector coming from each Spindle Control Module (SCM) has been attached to the correct mating connector in the mounting plate.
- ☐ Every SCM rack has an SCM that is fully inserted and locked in place.
- ☐ The Power Distribution Module has been fully inserted and locked in place.
- ☐ There is a spindle attached to every spindle location in the connector panel, and each spindle connector is locked down.
- ☐ If the INSIGHT 6 is equipped for attaching external devices (printers, computers, etc.), the proper devices have been attached to the appropriate ports in the connector panel.
- ☐ The main enclosure is closed and locked.
- ☐ The front door is closed and locked.

Once the above checklist is verified, you are ready to power-up the INSIGHT 6 Torque Management System. The rotating switch on the right-hand side of the INSIGHT 6 case is the Main Power Switch. Turn this switch on by turning the handle clockwise 90° so that it points up. This switch sends power to the Power Distribution Module inside the INSIGHT 6, but does not send power to the:

- Spindle Control Modules
- keyboard and display
- the spindles or powerhead(s).

The red light on the INSIGHT 6 Start/Stop switch located on the front door will be on, indicating the main power is on but the above systems are not powered.

Push the green button on the Start/Stop switch located on the front door and observe the two-line display.

You will see:
INGERSOLL-RAND COPYRIGHT 1996
then
PROGRAM VERSION (a number)
then
INITIALIZATION IN PROGRESS ...
then
INTELLECT (Note, INTELLECT is the name of the INSIGHT 6 software.) SETUP

* *Throughout this document we indicate what the two-line display shows by using the format:*
TEXT ON TOP LINE / TEXT ON BOTTOM LINE.

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6. CYCLE STATUS LIGHTS AND OPERATOR ACTIONS

This sequence indicates the INSIGHT 6 startup was successful, and the system is now ready to be programmed for its fastening tasks. (SETUP is one of the four INSIGHT 6 operating modes, and the one in which basic programming is performed.) If INSIGHT 6 does not show the above INTELLECT / SETUP* display, contact Ingersoll-Rand for instructions.
Turning on the Start/Stop switch powers the SCMs and spindles (or powerheads). You may confirm the spindles are powered by manually starting them to verify they operate.
The Main Power Switch can generally remain on. Use the Start/Stop switch on the front door for turning the INSIGHT 6 system on and off. Also, if you ever have to reset INSIGHT 6, use the front door Start/Stop switch. In that case, press the red stop button, wait five seconds, then press the green start button. If it is necessary to open the INSIGHT 6 front door or main enclosure, for safety turn the Main Power Switch off before opening.

6.1 Cycle Status Lights and Operator Actions

The six large horizontal lights on the INSIGHT- 6 front door are called cycle status lights. There is one light for each of the six spindles. After every fastening, each numbered light will display the status of that fastening. The cycle status lights remain off until the first fastening begins. Thereafter the lights are off during fastening, come on at the end of the fastening cycle, and remain on until the start of the next cycle.

If a fastening operation is within specification, the entire light will be green. If a fastening operation is out of specification the light bar will show red or yellow as follows:

- torque value too high - red light on left side
- torque value too low - yellow light on left side
- angle value too high - red light on right side
- angle value too low - yellow light on right side.

If there is a general system fault (that is, a fault not associated with a fastening operation) then the entire light bar will be red. This indicates a problem with the electronics, a cable, or a tool (spindle). Operators may use these lights to assess the quality of each fastening, and may want to take specific actions based on these indicators. For a fastening fault the operator should follow established plant procedures (try again, reject that part, etc.). For a system fault the operator should contact the line supervisor for assistance.
Each Ingersoll-Rand hand-held spindle also has an indicating light on the tool itself. If the fastening is within specification the tool light will be green. If either the torque or angle value is too high the light will be red. If either the torque or angle value is too low the tight will be yellow.



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7. KEYBOARD AND DISPLAY

The keyboard and display are the INSIGHT's operator interface. From here all of the fastener tightening functions can be programmed, the performance and status of each spindle or powerhead can be viewed, and total fastening statistics (for up to 5,000 fastening cycles) can be printed or downloaded.
Figure 6 shows the INSIGHT 6 keyboard and display. This operator interface consists of a two-line display, keypads for data entry and navigation, four operating mode keys, and two selection keys.
The operating mode keys include:



- MONITOR — For monitoring (displaying) up to 12 user-selected fastener tightening parameters (out of a total of 22 possible parameters).
- SETUP — For setting up (programming) different functions, parameters, or values. Ranging from the basic (date, time of day, password access), to the technical (spindle speed, torque values, peak angle, backout speed), to the specialized (Plant ID number, job number, display language*).
- DIAGN — For diagnosing system and spindle performance. Thirteen parameters can be measured, such as spindle motor current, motor temperature, excitation voltages, and RAM backup battery voltage.
- REPORT — For printing a variety of fixed-format fastening data reports.

The selection keys include:

- SPINDLE — To select which spindle (or powerhead) is being programmed, or whose parameters are being shown on the two line display.
- ASS'Y — To select which assembly is being programmed or displayed. Assembly refers to different tightening programs. For example, the user might program two different fastening strategies for two different operations (Assembly 1 and Assembly 2).

* *INSIGHT 6 can be set to display information in English, French, Spanish, Italian, or German.*

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8. SOFTWARE SETUP

8.1 Introduction

Before you can program INSIGHT 6 to perform specific fastener tightening strategies, you must do some initial setup. This section describes that setup process. After completing the setup you will be directed to Section 4, where the steps for programming the five standard fastening strategies* are described. To use this section you should have a general knowledge of fastening techniques, as well as a basic knowledge of your particular fastening application(s).
Before we describe the initial setup there are a few things you should know.

- To program INSIGHT 6 you will need to insert a four digit PIN, or personal identification number. INSIGHT 6 comes from the factory with four levels of security access the owner may access. The factory default PINs are: 1111, 2222, 3333, and 4444. PIN 1111 allows the lowest level of owner security access and 4444 allows the highest level. Before putting INSIGHT 6 in formal service in your application, be sure to set your own PINs for each of the four owner access levels to ensure system security. Setting PIN values is addressed in Section 10. In the steps below, when asked to enter a PIN use your highest level access number or-if the factory default settings have not yet been changed-use 4444.

- You navigate through the INSIGHT 6 menu options using the ↑↓←→ keys. Generally the ↑↓ keys take you to the previous or next menu option, respectively. For some menu options you will have to enter information (such as a number). Enter the value using the numeric keypad and press the Enter key ↵
- For other menu options you select the value from a pre-established list (such as Enable/Disable). In those cases you use the ←→ keys to cycle through the options until the one you want is displayed, then press ↵.

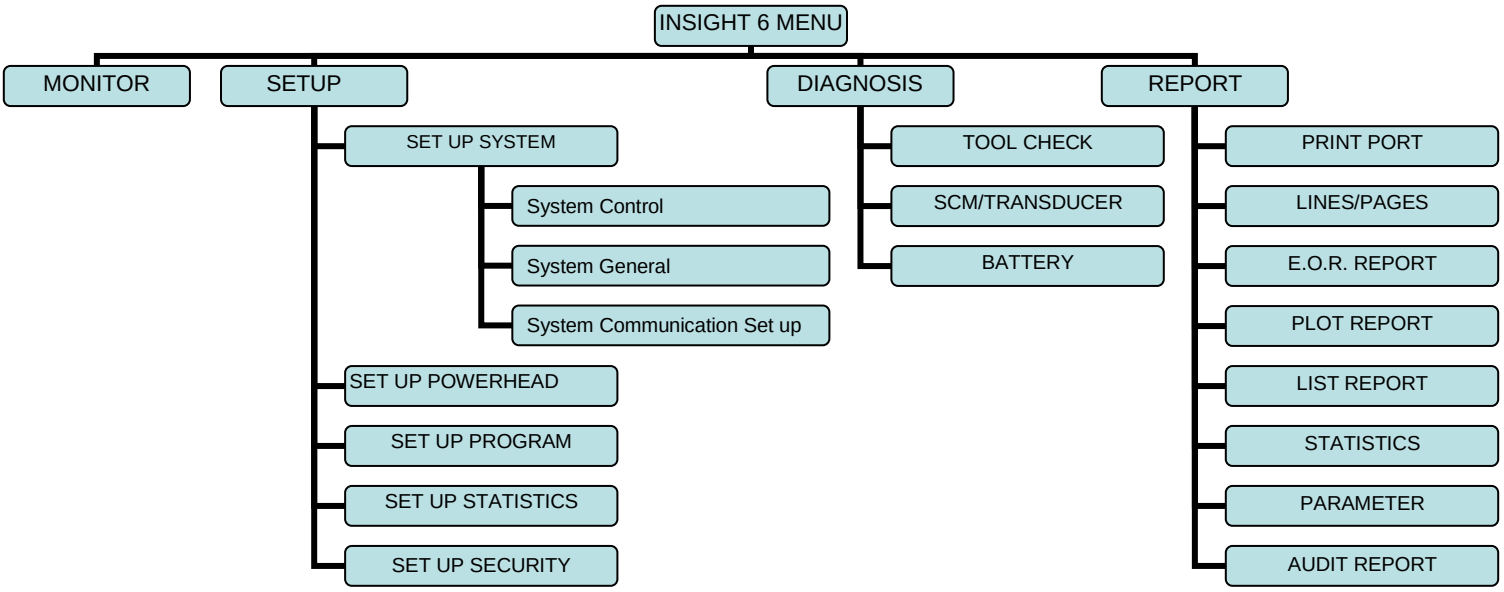
- Many menu options allow you to enter data or view information for each individual spindle on your INSIGHT 6. In those cases, you will see the spindle number indicated in the display as the letter S followed by a number (such as S1 or S6). If you want the same value to be applied to all the spindles without setting each spindle separately. Simply enter the data when the spindle display shows S_ (rather than a specific spindle number). To move from one spindle setting to another press the blue SPINDLE selection key.

As noted earlier, INSIGHT 6 has four operating modes identified by the four function keys:

- MONITOR For monitoring (displaying) fastener tightening parameters
- SETUP For setting up (programming) how INSIGHT 6 operates
- DIAGN For diagnosing system hardware performance
- REPORT For generating fastening reports.

* *The five fastening strategies: torque control, angle control, pre-torque torque control, repeat, and yield control.*

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8.2 Establishing Basic System Parameters

In this section we describe how to use the SETUP mode to set initial parameters. This involves three steps or phases:

1. Establishing INSIGHT's basic system parameters
2. Telling INSIGHT 6 what kinds of torque wrenches (spindles) you are using
3. Setting ENGAGE parameters. (Every fastening strategy requires that certain simple parameters be set, such as direction of rotation, maximum speed, etc. These are called ENGAGE parameters.)

In this section you set various INSIGHT 6 basic parameters, such as the units of torque, the language information is displayed in, date, time, name of your fastening operation, etc.

Verify the INSIGHT 6 two-line display shows INTELLECT / SETUP.

a. Press the ↵ key. Enter the PIN for your highest security access level. Press ↵.
b. Press ↓ to display SETUP / SYSTEM.
c. Press ↵ to display SYSTEM / CONTROL.
d. Press ↵ to display CONTROL / ALL VARS = Press ← or → to cycle through the two options: ENABLE or DISABLE. When ENABLE is selected all variables will be shown. When DISABLE is selected only an essential subset of the variables will be shown. For basic programming you want to have only essential variables displayed. Accordingly, when DISABLE is displayed, press ↵.

NOTE: In the steps that follow, press ← or → to cycle through the options or use the keypad to enter values. When the option or value you want is displayed, press ↵. Remember, the parameters for each spindle can be set individually (S1, S2, etc.), or the same parameters can be assigned to all the spindles (S_). Press the blue SPINDLE key until the spindle number you want is displayed then set the parameters. Press ↓ to display the next variable. We will not repeat these instructions for each step.

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8.3 Programming SETUP/SYSTEM/CONTROL

a. CONTROL S_ / TOR UNITS =. Select the desired torque units (None, N-m, Ft-lb, In-lb, Kg-m).
NOTE: Ingersoll-Rand tool are calibrated in N-m.

b. CONTROL S_/RDNDNCY FAULT=. 0 is ON and 1 is OFF.

c. CONTROL S_/TOOL DSBL SW=. Each spindle can be enable or disabled. This allows the spindle to run.

d. CONTROL / ASY SEL =. Each spindle can be programmed to perform different sequences of tightening operations (called assemblies). This parameter determines how the different assemblies will be selected. Select the desired option.
BINARY - receives an external binary coded signal
SEQUENTIAL - system increments through all the assemblies in numerical order
DISCRETE - a contact closure signals which assembly is selected, e.g., from a rotary switch, a socket tray, or PLC.

e. CONTROL / ST. MODE =. This parameter determines the method INSIGHT 6 uses for a start signal. Select the desired option.
MOMENTARY - looks for a pulse (e.g., from an external PLC)
MAINTAINED- start signal is switch closure (e.g., from a hand-held tool)
DUAL - requires that two switches must be closed. (Some tools require that the operator activate two switches simultaneously in order to ensure that the operator's hands are safely out of the way of the machinery.)

f. CONTROL S_ / TOOL TYPE _. Select HANDHELD or MCH. TYPE (fixture).

g. CONTROL S_ / SHUNT CAL =. The normal setting is ENABLE. This will check and compensate shunt calibration before running the tool.

h. CONTROL S_ / CYC. OVERTIIME. This sets the number of seconds after a fastening cycle has begun that the system will shut off the tool if the cycle has not been completed. Generally, this should be set to 15 seconds. The allowable rang is 0 - 255 seconds

i. CONTROL S_/ PM OUTPUT TIME=. This determines how long the paint marker will stay on.

j. CONTROL S_/ PM OUTPUT ON=. Accept or Reject. This determine if the paint marker is trigger with an accept or reject signal.

k. CONTROL / SPINDLE(S) _. The system automatically recognizes the number of spindles attached. This is a display-only parameter.

l. CONTROL / PH CONFIG =. PH stands for Powerhead. There are two options: ALL SPN or INDV SPN. Select ALL SPN if you want to operate in synchronized mode where all spindles start at the same time and run through the same tightening sequence. Select INDV SPN for unsynchronized mode, meaning that each spindle may be programmed independently (used when the spindles are hand-held).

m. CONTROL S_ / ASY OVERRIDE _. This parameter allows the operator to override the assembly selection (ASSY SEL) and run only the assembly number selected. Set a value from 0 to 16. Note: If ASSY SEL is set to DISCRETE and there is no external method of selecting assemblies, do not set this parameter to 0, as INSIGHT 6 will not operate.

n. CONTROL S_/PRESET ABORT=. Set to 0 not used at present time.

o. CONTROL S_/ALTERNATE 1/O =. Used to define i/o to an external source (example light tower, panel view, etc).

p. Setting the CONTROL parameters is now complete.

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8.4 Programming SETUP/SYSTEM/GENERAL

GENERAL parameters will now be set. Press ↓ to display SYSTEM / GENERAL. Press ↵. If you are asked for your PIN, enter the number for your highest security access level and press ↵.

a. GENERAL / LANGUAGE = will be displayed. Select the language for displaying information on the two-line display. Options include: English, French, German, Italian, and Spanish.

b. GENERAL/LOCK TMOUT=. This parameter sets the lockout time in minutes. If you have entered a pin and are changing parameters and do not press a key before the lockout time has transpired the INSIGHT system will reset itself. You will then be prompted to re-enter the PIN in order to continue.

c. GENERAL / SYSTEM=. An alphanumeric name of up to 12 characters can be entered (e.g., ACME CORP). Use the ↑↓ keys to select a character. Press the → key to enter the character into the name. If you wish to delete a character press the ← key.

d. GENERAL / PLANT =. An alphanumeric name of up to 12 characters can be entered (e.g., DETROIT#1). Use the ↑↓ keys to select a character. Press the → key to enter the character into the name. If you wish to delete a character press the ← key.

e. GENERAL / JOB =. An alphanumeric name of up to 12 characters can be entered (e.g., ACME JOB#1A). Use the ↑↓ keys to select a character. Press the → key to enter the character into the name. If you wish to delete a character press the ← key.

f. GENERAL / DATE FMT =. Select one of the two date format options, M/D/Y OR D/M/Y.

g. GENERAL / DAYLIGHT =. Select ENABLE or DISABLE to activate or de-activate automatic recognition of daylight savings time.

h. GENERAL S_ /DATE =. If incorrect enter today's date as M/D/Y OR D/M/Y.

i. GENERAL / TIME =. If incorrect enter the current time as HHMMSS using a 24 hour clock.

j. GENERAL / REV =. This a display only parameter showing the system revision number.

NOTE: If using multiple SCM all of the software revision numbers must be the same. Otherwise the communication can fail.

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8.5 Programming - SET UP THE POWERHEAD

In this section you will tell the INSIGHT 6 software what Ingersoll-Rand spindles you are using. Once the software has this information, spindle parameters will be set automatically. You will need to know the specific model number of each spindle. Every Ingersoll-Rand spindle has the model number on the tool, either embossed into the housing or on a permanent label. (The model number will be alphanumeric, for example: DEA55N558TL.)

Select spindles as follows.

a. Press the blue SETUP key to display SETUP / SYSTEM.
b. Press ↓ to display SETUP / POWERHEAD. Press ↵. If you are asked for your PIN, enter the number for your highest security access level. Press ↵.
c. Press ↵ to display POWERHEAD S_ / TOOL SEL=. Press ← or → to cycle through the extensive list of Ingersoll-Rand tool model numbers. When the correct tool model number is displayed, press ↵. If you have multiple spindles, select each spindle in turn by pressing the blue SPINDLE key and repeating this model number selection process. (DEA tools are hand held tools and DEF tools are Machine Mount)
    i. An ASC value is located on the Green & White calibration sticker on the tool. Verify that the ASC value matches the controller display. If not change the value using the alpha numeric keypad.

8.6 Setting the ENGAGE Parameters

Setting ENGAGE parameters is a prerequisite for every fastener tightening strategy, and the setup is the same regardless of the fastening strategy you use.

Set the ENGAGE parameters as follows.

a. Press the blue SETUP key to display SETUP / SYSTEM.
b. Press ↓ several times to display SETUP / PROGRAM. Press ↵. If you are asked for your PIN, enter the number for your highest security access level. Press ↵.

c. Press ↵ to display PROGRAM S_ / LEARN MODE=. This mode is reserved for future software versions, so skip past it by pressing ↓ to display PROGRAM S_ / SEQUENCE=. Set the sequence to one of the five fastening modes: TORQUE CTL (torque control), ANGLE CTL (angle control), PRETQ/TQCTL (pre-torque torque control), TORQ-REPEAT (repeat or backout control), or YIELD CTL (yield control). Press ↵.

NOTE: In the steps that follow, press ← or → to cycle through the options or use the keypad to enter values. When the option or value you want is displayed, press J. Remember, the parameters for each spindle can be set individually (S1, S2, etc.), or the same parameters can be assigned to all the spindles (S_). Press the blue SPINDLE key until the spindle number you want is displayed then set the parameters. We will not repeat these instructions for each step below.

d. Press ↓ to enter the actual ENGAGE sequence. Depending upon which fastening strategy you have set, you will see displayed one of the following: TORQUE CTL / ENGAGE or ANGLE CTL / ENGAGE or PRETQ/TQCTL / ENGAGE or TORQ-REPEAT / ENGAGE or YIELD CTL /ENGAGE.

e. ENGAGE S_ / ENGAGE ANGLE=. Set the engage angle to 0.

f. ENGAGE S_ / DIRECTION=. Set the direction to CW (clockwise) or CCW (counter clockwise).

g. ENGAGE S_ / ENGAGE SPEED=. The engage speed is the speed the tool will run (in rpm) when the first speed of the two-speed throttle on hand-held tools is depressed (also called soft start speed). Enter the engage speed value for the fastening operation.

h. ENGAGE S_ / FREE SPEED=. The free speed is the free speed of the tool (in rpm). Enter the desired free speed value for the fastening operation.

i. ENGAGE S_ / DOWNSHIFT SPD=. The downshift speed is the tool speed (in rpm) when the downshift point is reached during fastening. Enter the desired downshift speed value for the fastening operation.

i. ENGAGE S_ / BACKOUT SPEED=. The backout speed is the reverse speed of the tool (in rpm). Enter the desired backout speed value for the fastening operation.

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k. Press ↓. The fastening algorithm selected previously (in step d above) will now be displayed. Specifically, the top line of the display will show: TORQUE CTL or ANGLE CTL or PRETQ/TQCTL or YIELD CTL. Depending upon which of these is displayed.

8.7 Programming – TORQUE CONTROL FASTENING

Torque control fastening turns the fastener to a pre-determined torque setting to achieve the proper clamp load. The values you will need to know for your particular torque control fastening operation(s) are:

Control torque	**The target (desired) final torque.**
Torque low limit	**The lower limit of acceptable torque.**
Torque high limit	**The upper limit of acceptable torque.**
Threshold torque	**The torque at which INSIGHT 6 begins measuring the angle through which the fastener is turning. Sometimes called snug torque**

Two additional values may also be specified, though they are optional in this fastening mode.

Angle low limit	**The minimum angle through which the fastener must turn. Used for cross-thread detection**
Angle high limit	**The maximum angle through which the fastener may turn. Used for broken part or stripped bolt detection**

NOTE: In the steps that follow use the keypad to enter values. When the value you want is displayed, press ↵. Remember, the parameters for each spindle can be set individually (S1, S2, etc.), or the same parameters can be assigned to all the spindles (S_). Press the blue SPINDLE key until the spindle number you want is displayed, then set the parameters.

a. With TORQUE CTL / TORQUE CTL displayed on the screen, press ↵ to display TORQUE CTL S_ / CNTL. TORQUE=. Set the desired control torque value, making sure the numerical value is consistent with the torque units you specified in Section 3.2, step e.

b. TORQUE CTL S_ / TORQUE LL=. Enter the desired torque low limit value, making sure the numerical value is consistent with the specified torque units.

c. TORQUE CTL S_ / TORQUE HL=. Enter the desired torque high limit value, making sure the numerical value is consistent with the specified torque units.

d. TORQUE CTL S_ / ANGLE LL=. Enter the desired angle low limit value (in degrees).

e. TORQUE CTL S_ / ANGLE HL=. Enter the desired angle high limit value (in degrees).

f. TORQUE CTL S_ / THR. TORQUE=. Enter the desired threshold torque value, making sure the numerical value is consistent with the specified torque units

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8.8 Programming – ANGLE CONTROL FASTENING

Angle control fastening turns the fastener through a pre-determined angle. Actually this is a two-step process. First a torque is applied to consolidate (called "snug") the fastener. Then the fastener is turned through the specified angle. The values you will need to know for your particular angle control fastening operation(s) are:

Threshold torque	The torque at which INSIGHT 6 begins measuring the angle through which the fastener is turning. Sometimes called snug torque.
Control angle	The angle through which the fastener should turn.
Angle low limit	The minimum angle through which the fastener must turn.
Angle high limit	The maximum angle through which the fastener may turn.
Torque low limit	The lower limit of acceptable torque.
Torque high limit	The upper limit of acceptable torque.

NOTE: In the steps that follow use the keypad to enter values. When the value you want is displayed, press ↵. Remember, the parameters for each spindle can be set individually (S1, S2, etc.), or the same parameters can be assigned to all the spindles (S_). Press the blue SPINDLE key until the spindle number you want is displayed, then set the parameters.

a. With ANGLE CTL / ANGLE CTL displayed on the screen, press J to display ANGLE CTL S_ / CNTRL. ANGLE=. Enter the desired control angle (in degrees).

b. ANGLE CTL S_ / ANGLE LL=. Enter the desired angle low limit (in degrees).

c. ANGLE CTL S_ / ANGLE HL=. Enter the desired angle high limit (in degrees).

d. ANGLE CTL S_ / THR. TORQUE=. Enter the desired threshold torque value, making sure the numerical value is consistent with the torque units you defined in Section 3.2, step

e. ANGLE CTL S_ / TORQUE LL=. Enter the desired torque low limit value, making sure the numerical value is consistent with the specified torque units.

f. Press u once to display ANGLE CTL S_ / TORQUE HL=. Enter the desired torque high limit value, making sure the numerical value is consistent with the specified torque units.

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8.9 Programming – PRE-TORQUE CONTROL FASTENING

Pre-torque torque control mode allows the user to set torque values for the first portion of the tightening sequence, as well as the main tightening step in which the clamp load is applied. This mode consists of two steps: a pre-torque step and a torque control step. The values you will need to know for your particular pre-torque torque control fastening operation(s) are:

Pre-torque	The target (desired) torque for the pre-torque step.
Pre-torque low limit	The lower limit of acceptable torque for the pre-torque step.
Pre-torque high limit	The upper limit of acceptable torque for the pre-torque step.
Control torque	The target (desired) final torque.
Torque low limit	The lower limit of acceptable final torque.
Torque high limit	The upper limit of acceptable final torque.
Threshold torque	Following the pre-torque step, the torque at which INSIGHT 6 begins measuring the angle through which the fastener is turning.
Angle low limit	The minimum angle through which the fastener must turn.
Angle high limit	The maximum angle through which the fastener may turn.

NOTE: In the steps that follow use the keypad to enter values. When the value you want is displayed, press ↵. Remember, the parameters for each spindle can be set individually (S 1, S2, etc.), or the same parameters can be assigned to all the spindles (S_). Press the blue SPINDLE key until the spindle number you want is displayed, then set the parameters.

a. With PRETQ/TQCTL / PRE-TORQUE displayed on the screen, press ↵ to display PRETORQUE S_ / PRE-TORQUE=. Set the desired torque value for the pre-torque step, making sure the numerical value is consistent with the torque units you specified in Section 3.2, step e.

b. PRE-TORQUE S_ / PRE-TORQUE LL=. Enter the desired torque low limit value for the pre-torque step, making sure the numerical value is consistent with the specified torque units.

c. PRE-TORQUE S_ / TORQUE HL--. Enter the desired torque high limit value for the pre-torque step, making sure the numerical value is consistent with the specified torque units.

d. PRETQ/TQCTL / TORQUE CTL. Press ↵ to display TORQUE CTL S_ / CNTRL. TORQUE=. Set the desired torque value for the torque control step, making sure the numerical value is consistent with the specified torque units.

e. TORQUE CTL $_ / TORQUE LL=. Enter the desired torque low limit value for the torque control step, making sure the numerical value is consistent with the specified torque units.

f. TORQUE CTL S_ / TORQUE HL=. Enter the desired torque high limit value for the torque control step, making sure the numerical value is consistent with the specified torque units.

g. TORQUE CTL S_ / THR. TORQUE=. Enter the desired threshold torque value, making sure the numerical value is consistent with the specified torque units.

h. TORQUE CTL S_ / ANGLE LL=. Enter the desired angle low limit value (in degrees) for the torque control step.

i. TORQUE CTL S_ / ANGLE HL=. Enter the desired angle high limit value (in degrees) for the torque control step.

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8.10 Programming – REPEAT FASTENING

Repeat (also called backout or torque repeat) fastening applies an initial torque, then backs out the fastener, then applies the final (clamping) torque. Though this process consists of three steps, both the initial torque and final torque steps are identical. The values you will need to know for your particular repeat fastening operation(s) are:

Control torque	The target (desired) final torque.
Torque low limit	The lower limit of acceptable final torque.
Torque high limit	The upper limit of acceptable final torque.
Threshold torque	Following the initial torquing step, the torque at which INSIGHT 6 begins measuring the angle through which the fastener is turning.
Angle low limit	The minimum angle through which the fastener must turn for the clamping step.
Angle high limit	The maximum angle through which the fastener may turn for the clamping step.
Backout angle	The angle through which the fastener must be turned to achieve the desired amount of backout.
Backout time	The time (in seconds) that the fastener must be turned to achieve the desired amount of backout.

NOTE: In the steps that follow use the keypad to enter values. When the value you want is displayed, press ↵. Remember, the parameters for each spindle can be set individually (S1, S2, etc.), or the same parameters can be assigned to all the spindles (S_). Press the blue SPINDLE key until the spindle number you want is displayed, then set the parameters.

a. With TORQ-REPEAT / TORQUE CTL displayed on the screen, press ↵ to display TORQUE CTL S_ / CNTL. TORQUE=. Set the desired final torque value, making sure the numerical value is consistent with the torque units you specified in Section 3.2, step e.

b. TORQUE CTL S_ / TORQUE LL=. Enter the desired torque low limit value, making sure the numerical value is consistent with the specified torque units.

c. TORQUE CTL S_ / TORQUE HL=. Enter the desired torque high limit value, making sure the numerical value is consistent with the specified torque units.

d. TORQUE CTL S_ / THR. TORQUE=. Enter the desired threshold torque value, making sure the numerical value is consistent with the specified torque units.

e. TORQUE CTL S_ / ANGLE LL=. Enter the desired angle low limit value (in degrees)..

f. TORQUE CTL S_ / ANGLE HL=. Enter the desired angle high limit value (in degrees).

g. TORQ-REPEAT / OBO. Press ↵ to display BACKOUT S_ / BACKOUT ANG=. Enter the desired backout angle (in degrees). See Note below.

h. BACKOUT S_ / BACKOUT TIME--. Enter the desired backout time (in seconds) See Note below.

NOTE: Only the BACKOUT ANG or the BACKOUT TIME must be set. If both are set the system ignores the time.

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8.11 Programming – YIELD CONTROL FASTENING

Yield control achieves the proper clamp load by tightening the fastener to the point of yield, where permanent bolt stretch occurs. The values you will need to know for your particular yield control fastening operation(s) are:

Yield point %	The percentage decrease in the torque/angle gradient that determines the onset of yield.
Angle into yield	The number of degrees the spindle rotates beyond the yield point.
Torque low limit	The lower limit of acceptable final torque.
Torque high limit	The upper limit of acceptable final torque.
Angle low limit	The minimum angle through which the fastener must turn.
Angle high limit	The maximum angle through which the fastener may turn.
Threshold torque	The torque at which INSIGHT 6 begins measuring the angle through which the fastener is turning.
Slope low limit	The minimum acceptable slope for the torque/angle curve.
Slope high limit	The maximum acceptable slope for the torque/angle curve.

NOTE: In the steps that follow use the keypad to enter values. When the value you want is displayed, press .J. Remember, the parameters for each spindle can be set individually (S 1, S2, etc.), or the same parameters can be assigned to all the spindles (S_). Press the blue SPINDLE key until the spindle number you want is displayed, then set the parameters.

a. With YIELD CTL / YIELD CTL displayed on the screen, press ↵ to display YIELD CTL S_ / YIELD STPT %_. Enter the desired percent value.

b. Press 4 to display YIELD CTL S_ / ANGLE INTO=. Enter the desired angle into yield value (in degrees).

c. Press 4 to display YIELD CTL S_ / TORQUE LL=. Enter the desired torque low limit value, making sure the numerical value is consistent with the torque units you specified in Section 3.2, step e.

d Press 4 to display YIELD CTL S_ (TORQUE HL=. Enter the desired torque high limit value, making sure the numerical value is consistent with the specified torque units.

e. Press ~ to display YIELD CTL S_ / ANGLE LL--. Enter the desired angle low limit value (in degrees).

f. Press ~ to display YIELD CTL S_ / ANGLE HL=. Enter the desired angle high limit value (in degrees).

g. Press u to display YIELD CTL S_ / THR. TORQUE=. Enter the desired threshold torque value, making sure the numerical value is consistent with the specified torque units.

h. Press u to display YIELD CTL S_ / SLOPE LL=. Enter the minimum acceptable slope value for the torque/angle curve.

i. Press u to display YIELD CTL S_ / SLOPE HL=. Enter the maximum acceptable slope value for the torque/angle curve.

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9.0 SYSTEM DIAGNOSTICS

The INSIGHT 6 software can measure a variety of system hardware parameters during operation, and self-assess overall system performance. To access this capability press the blue DIAGN key, displaying DIAGN / TOOL CHECK on the two-line display. You can then perform a series of three diagnostics checks, as described in the sub-sections below.

9.1 Tool Check

a. With DIAGN / TOOL CHECK displayed on the screen, pressing the ↵ key will automatically measure six tool parameters for the first spindle. If the parameters are within specification, TOOL TEST / PASS will be displayed. If not, TOOL TEST / FAIL will be displayed. The parameters measured include:

FWDCUR	Motor current with the spindle motor turning in the forward direction (amps)
REVCUR	Motor current with the spindle motor turning in the reverse direction (amps)
HALLS	The condition of the Halls effects switches in the motor (UNITS?)
MTRKT	A measure of motor efficiency (torque/amp)
HTSNK	The temperature of the Spindle Control Module (° C)
MTRTMP	The temperature of the spindle motor (° C)

b. Press ←→to display each of these parameters in turn. You will see the parameter name on the top line of the display and the measured value on the bottom line. If the parameter is above maximum allowable limits an **H** will be displayed after the measured value. If the parameter is below minimum acceptable limits an **L** will be displayed.

c. Press the blue SPINDLE key to perform the tool check for the next spindle. Repeat this process to check the condition of each spindle.

9.2 Spindle Control Module and Transducers Check

a. After the tool checks are complete, press ↵ to display DIAGN / TOOL CHECK. Press↓ to display DIAGN / SC1VI/XDUCERS. Pressing the ↵ key will automatically measure six Spindle Control Module parameters and spindle transducer parameters for the first spindle. If the parameters are within specification, EQUIP TEST / PASS will be displayed. If not, EQUIP TEST / FAIL will be displayed. The parameters measured include:

AMPOFF	Amplifier offset. A measure of the total offset attributable to the input circuitry, expressed as a percentage of full scale input range. Shows "Warning" if it reaches 68%, "Fail" if it reaches 610%.
BRGOFF	Bridge offset. A measure of the total offset attributable to the torque transducer, expressed as a percentage of full scale input range. Shows "Warning" if it reaches 68, "Fail" if it reaches 610%.
SNTCAL	Shunt calibration. A measure of the gain calibration of the total input circuitry (transducer + circuitry), expressed as a percentage of expected reading. Shows "Warning" if it reaches 64%, "Fail" if it reaches 65%.
+EXCTT	Positive excitation voltage applied to the torque transducer (nominally +SVDC). It is displayed as a voltage with two decimal places.
-EXCTT	Negative excitation voltage applied to the torque transducer (nominally -SVDC). It is displayed as a voltage with two decimal places.
VREF	Voltage reference. A measure of the analog/digital converter's internally generated reference voltage (nominally -2.5 VDC). It is displayed as a voltage with two decimal places.

b. Press ←→to display each of these parameters in turn. The parameter name will be on the top line of the display and the measured value on the bottom line. If the parameter is above maximum allowable limits an **H** will be displayed after the measured value. If the parameter is below minimum acceptable limits an **L** will be displayed.

c. Press the blue SPINDLE key to perform the SCM/transducers check for the next spindle. Repeat this process to check the condition of each spindle.

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9.3 Battery Check

a. With DIAGN / TOOL CHECK displayed on the screen, press ↓ twice to display DIAGN / BATTERY Pressing the ↵ key will automatically measure the voltage of the battery within the Spindle Control Module. This battery maintains the data stored in RAM within each SCM. If the battery voltage is within specification, BATTERY TEST / PASS will be displayed. If not, BATTERY TEST / FAIL will be displayed.

b. Press → to display the battery voltage. If the voltage is less than 2.8 volts a W (for warning) will be displayed after the measured value. If the voltage is less than 2.7 volts an F (for failure) will be displayed.

c. Press the blue SPINDLE key to perform the battery test check for the next Spindle Control Module. Repeat this process to check the condition of each SCM.

10.0 COMMUNICATIONS SETUP

In order to attach a printer to the INSIGHT 6 system, or incorporate the system into a facility's computer network, various communications parameters must be set. Follow these steps to establish INSIGHT 6 communications.

a. Press the blue SETUP function key and press ↵. If you are asked for your PIN, enter the number for your highest security access level and press ↵. SETUP / SYSTEM will be shown on the two-line display.

b. Press ↵ to display SYSTEM / CONTROL.

c. Press ↓several times until SYSTEM / COM SETUP is displayed.

d. Press ↵ to display COM SETUP / COM PORT =. Press ← or → to cycle through the four options for the communications port: COM1 through COM4. This is the communications port for attaching an external printer. COM1 is the default parameter and is generally the one used for printers.

NOTE: In the steps that follow, press ← or → to cycle through the options or use the keypad to enter values. When the option or value you want is displayed, press ↵. We will not repeat these instructions for each step below.

e. COM SETUP / BAUDRATE =. Select the speed for the communications port selected in step d above from the available options: 1,200, 4,800, 9,600, 19,200, 38,400, 57,600, and 115,200 baud.

f. COM SETUP / COMPORT MODE =. Select the configuration parameters for the communications port selected in step d above from the following options:
N, 8, 1 (no parity, 8 data bits, 1 stop bit)
E, 7, 1 (even parity, 7 data bits, 1 stop bit) O, 7,
1 (odd parity, 7 data bits, 1 stop bit).

g. COM SETUP /,NW PORT =. If you are attaching the INSIGHT 6 to a network, select the communications port for the network. The four options include COM1 through COM4. COM2 (an RS-485 port) is the default parameter.

h. COM SETUP / MULTIIDROP =. You can enter a numeric drop address for the network communications port selected above. This will allow the network to address a particular Spindle Control Module within the INSIGHT 6.

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11. SETTING THE SECURITY ACCESS

The INSIGHT 6 software has four levels of security that the user can control, each accessed by a separate four-digit personal identification number (PIN). These levels of access are designated Ll through L4. As one goes up the access levels from L1 to L4, one has increasing access to software parameters and greater ability to make software configuration changes.
The default PINs set by Ingersoll-Rand and typical job descriptions for security level access are shown below.

Security Level	Default PIN	Tvoical Access
L1	1111	Operator, Electrician
L2	2222	Process Engineer
L3	3333	Quality Control Engineer
L4	4444	Factory or Line Supervisor

Before putting INSIGHT 6 in formal service in your application, be sure to set your own PINs for each of the four owner access levels to ensure system security. To change the default PINs or to create new PINs at any time, follow the steps below.

a. With INTELLECT / SETUP displayed on the screen, press ↵. You will be asked to enter a PIN. Enter the highest level user-controlled PIN (or 4444 if the default PINs are still active).

b. Press ↓ four times until SETUP / SECURITY is shown on the two-line display.

c. Press ↵. SECURITY L1* / ENTER USER PIN will be displayed. Press ↵ to display ENTER USER PIN /____. Enter the Level 1 PIN using the numeric keypad and press ↵.

d. Press u to display SECURITY L1 / CHANGE USER PIN. Press J to display CHANGE USER PIN /____ Enter a new Level 1 PIN using the numeric keypad and press ↵.

e. To change PINs for the other security levels, log in at that level and repeat steps c and d.

* *LI to L4 will be displayed depending upon the security level of the current user.*

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12. ADVANCED PROGRAMMING

There are a number of INSIGHT 6 advanced programming features that may be used in certain specialized fastening situations. In this section we review those features and explain their use.

12.1 Adjusting Spindle Parameters

INSIGHT 6 automatically sets a variety of spindle parameters when you perform basic system programming. However, the software also has the ability to adjust many other parameters in order to give you the flexibility you need for specialized situations. In this section we identify the parameters that you can adjust, explain their functions, and describe how to set them. Unlike other sections of this manual where we took you through a series of sequential steps, in this section we simply describe each advanced programming parameter. In this way you are free to choose which, if any, parameters to adjust based on your individual circumstances.

You must be in the SETUP / POWERHEAD mode to adjust the spindle parameters, and must have told the INSIGHT 6 software what Ingersoll-Rand model number spindle(s) you are using.

To get in the SETUP / POWERHEAD mode you:

a. Press the blue SETUP key to display SETUP / SYSTEM.

b. Press → to display SETUP / POWERHEAD. Press ↵. If you are asked for your PIN, enter the number for your highest security access level. Press ↵.

You can now cycle through the spindle parameters, resetting values if necessary for your fastening operations. As usual, use the ↑ ↓ keys to cycle through the parameters, the blue SPINDLE key to select individual spindles (S1, S2, etc.) or all spindles at once (S_), the ←→ keys or the numeric keypad to select parameter options or enter values, and the ↵ key to set the option or value. In the explanations below, the parameter name will be on the bottom line of the two-line display while POWERHEAD S_ will be on the top line.

a. SPN. BYPASS (spindle bypass)
This parameter is sometimes used with multi-spindle tightening fixtures.
If a spindle fails on such a fixture and you still want to continue fastening operations with the remaining spindles, you can bypass the defective spindle using this parameter. To bypass a spindle set this parameter to ENABLE for the defective spindle. To operate the spindle, set the parameter to DISABLE.

b. GBOX LOSS (gearbox loss)
A value may be entered which compensates for loss of spindle gearbox efficiency (for example as gears wear over time). In general, set this value to 1, which represents an ideal (completely efficient) gearbox. For a 90% efficient gearbox the parameter would be set to 0.9. The allowable range is 0.1 to 1.0.

c. FILTER
One of four values may be entered which will filter high frequency noise (ripple) from the torque signal, leading to a "cleaner" signal and a better measure of actual torque.
0 - sets a 15 Hz cutoff frequency
1 - sets a 150 Hz cutoff frequency
3 - sets a 350 Hz cutoff frequency
7 - sets a 500 Hz cutoff frequency
The filter is used primarily for soft (gasketed) joints. Don't set the value to 0 for hard joints, or the low cutoff frequency may cause the software to misjudge the applied torque.

d. FREE SPEED H (free speed high)
This parameter sets the maximum free speed of the tool (in rpm) when the tool is operating in its high range. Setting this parameter is somewhat more involved, therefore it is addressed in a separate sub-section; see Section 12.2.

e. FREE SPEED L (free speed low)
Set this free speed low parameter to the lowest speed (in rpm) desired from the tool. Do not set the value to less than 50; tool life and performance could be affected.

f. TOR DECPT (torque decimal point)
This parameter is the number of places shown to the right of the decimal point when torque values are displayed. Set this parameter as 0, l, or 2.

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12.2 Adjusting The Free Speed High Parameter

The free speed high parameter (FREE SPEED H) sets the maximum free speed of the tool (in rpm) when the tool is operating in its high range. You must be in the SETUP / POWERHEAD mode to adjust the free speed high parameter, and you must have told the INSIGHT 6 software what Ingersoll-Rand model number spindle(s) you are using. Select your spindle(s) from the INSIGHT 6 tool list using the TOOL SEL= parameter. To get in the SETUP / POWERHEAD mode you:

a. Press the blue SETUP key to display SETUP / SYSTEM.

b. Press ↓ to display SETUP / POWERHEAD. Press ↵. If you are asked for your PIN, enter the number for your highest security access level. Press ↵.

Use the ↑↓ keys to cycle through the parameters until POWERHEAD S_ / FREE SPEED H is displayed. Use the blue SPINDLE key to select individual spindles (S1, S2, etc.) or all spindles at once (S_). Set this free speed high parameter as follows.

a. The nominal free speed value for the spindle is shown as the rpm value on the permanent label attached to the spindle. Enter this value.

b. At this point the nominal free speed value must also be entered into the ENGAGE step of the SETUP / PROGRAM mode. Go to Section 3.4 step h to display ENGAGE S_ / FREE SPEED=. Set this parameter to the same nominal free speed value. Return to the step below.

c. Run the tool and measure the free speed with a tachometer.

d. Enter the measured value back into this FREE SPEED H= parameter.

12.3 Applying Advanced Programming to the Fastener Tightening Strategy

In Section 4 we explained how to program the spindles for the various fastener tightening strategies (torque control, angle control, pre-torque torque control, repeat, and yield control). Section 3 described necessary prerequisites to actually setting the tightening strategies, in particular (in Section 3.4) setting the ENGAGE parameters. Section 3.4 described how to cycle through and set five basic ENGAGE parameters, including: DIRECTION, ENGAGE SPEED, FREE SPEED, DOWNSHIFT SPD, and BACKOUT SPEED. INSIGHT 6 can actually display an additional five ENGAGE parameters to "fine tune" the tightening strategies.
To adjust these additional parameters you must enter the ENGAGE mode, as described below.

a Press the blue SETUP key to display SETUP / SYSTEM, and press the ↵ key. If asked to enter a PIN, enter the PIN for your highest security access level. Press ↵.

b. Go to SETUP / SYSTEM/ CONTROL.

c. CONTROL / ALL VARS =. Press ← or → to cycle through the two options: ENABLE or DISABLE. For advanced programming you want to display all the possible variables. Accordingly, when ENABLE is displayed, press ↵.

d. Press the blue SETUP key and press ↓ several times until SETUP / PROGRAM is displayed. If asked to enter a PIN, enter the PIN for your highest security access level. Press ↵.

e. PROGRAM S_ / LEARN MODE=. This mode is reserved for future software versions, so skip past it by pressing ↵.

f. PROGRAM S_ / SEQUENCE=. The fastener tightening strategy you previously set (in Section 3.4, step c) will be shown to the right of the = sign.

g. ENGAGE sequence=. Depending upon which fastening strategy you have set, you will see displayed one of the following: TORQUE CTL / ENGAGE or ANGLE CTL / ENGAGE or PRETQ/TQCTL / ENGAGE or TORQ-REPEAT / ENGAGE or YIELD CTL /ENGAGE.

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12.3 Applying Advanced Programming to the Fastener Tightening Strategy (continued)

You are now ready to adjust or reset any of the ENGAGE parameters. The five parameters description (DIRECTION, ENGAGE SPEED, FREE SPEED, DOWNSHIFT SPD, and BACKOUT SPEED) will not be repeated.. The advanced ENGAGE parameters that can be adjusted to "fine tune" your tightening strategies are as follows.

ENGAGE ANGLE

The engage angle is the angle through which the fastener must turn in order for the ENGAGE step to be completed. This angle may be set at any value in the range 0 to 9999 degrees.

AUTOBKOUT ANG (auto back-out angle)

If the INSIGHT 6 detects a fault during fastening (for example, the fastener is cross threaded), it can be programmed to back-out a certain number of degrees. The angle through which the fastener will back-out can be set using this parameter. This angle may be set at any value in the range 0 to 9999 degrees.

AUTO B/O TIME (auto back-out time)

If the INSIGHT 6 detects a fault during fastening it can be programmed to back-out for a certain time period. The time in seconds for back-out can be set using this parameter. This parameter may be set at any value in the range 0 to 9999 seconds. Note that whichever limit is reached first (auto back-out angle or auto back-out time) will determine the end of the back-out step.

ENGAGE TQ END (engage torque end)

The engage torque end parameter is the target torque for the ENGAGE step of the fastening. Set the engage torque end to any value from 0 to 9999, making sure the numerical value is consistent with the defined torque units.

ENGAGE TQ HI (engage torque high)

The engage torque high parameter is the maximum torque permitted before back-out is initiated. If a back-out step has been programmed (see AUTOBKOUT ANG and AUTO B/O TIME parameters above), then back-out will occur if the applied torque exceeds the engage torque high value. Set the engage torque high to any value from 0 to 9999, making sure the numerical value is consistent with the defined torque units.

TRACE ZOOM

This parameter sets how frequently the INSIGHT 6 samples and stores the torque value during the early stages of tightening (prior to reaching the threshold torque). The more frequent the sampling the greater the resolution possible when plotting the torque vs. angle tightening curve. Setting the trace zoom value to 1 will result in sampling every 10° of rotation, while setting the value to 2 will sample every 20°.

This completes the description of the advanced programming ENGAGE parameters. Press the blue SETUP key, or any other mode key, to exit ENGAGE.

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13. GENERATING REPORTS – FASTENING REPORTS.

Within the REPORT mode a variety of fixed-format reports on fastening results can be created. There are six types of reports that the INSIGHT 6 software can print for the user:

1. End-of-Run Report — A report arranged in columns that lists all of the EOR parameters selected by the user. (Selecting these EOR parameters was described in Section 6.2.) The EOR parameters are printed after every fastening.

2. Plot Report — A report of the data points that, when plotted, create the tightening curve (torque vs. angle) for a fastening.

3. List Report — Identical to an EOR Report, but not generated in real time after each fastening. It is generated later from data stored in memory.

4. Statistics Report — A report on the statistical variations for a particular batch of fastenings.

5. Parameter Report — A report of the parameters that the user has set for a particular fastening program.

6. Audit Report — A time and date report of important system events (program changes, power failures, system faults, security code changes, etc.).

Prior to creating a report some basic printer settings must be set. The subsections that follow show how to interface a printer to the INSIGHT 6, present examples of these reports, and explain how the reports are created.

13.1 Printer Interface

Two simple parameter settings are necessary to set up the printer. The user must identify the communications port to which the printer is attached, and must format the printout, as follows.

a. Press the blue REPORT function key. REPORT / PRN PORT=COM1 will be displayed (communications port #1 is the default value for the printer port). Press ← or →. to cycle through the four options (COM1, COM2, COM3, COM4). (If you are asked for your PIN, enter the number for your highest security access level and press ↵.) Press ↵ when the correct communications port is displayed.

b. REPORT / LINES/PAGE=. Using the numeric keypad, enter the number of lines to be printed on each page and press ↵. Setting this correctly will prevent printing on the tear lines if fan-fold paper is used.

13.2 GENERATING REPORTS- End-of-Run Report

An End-of-Run (EOR) report prints out one line of data (final torque, final angle, plus other parameters you select) after every tightening operation. The steps below explain how to generate an EOR report. However, before following these steps the user must select the fastening parameters that the EOR report will print. Setting the parameters is described in Section 6.2 (Setting the End-of-Run Filter).
A typical EOR report is shown in Figure 8. Follow the steps below to turn the EOR report option either on or off.

a. Press the blue REPORT function key. Press ↓ twice to display REPORT / EOR REPORT. (If you are asked for your PIN, enter the number for your highest security access level and press ↵.)

NOTE: In the steps that follow, press ← or → to cycle through the options or use the keypad to enter values. When the option or value you want is displayed, press ↵.

b. EOR REPORT / SPINDLE(S)=. Cycle through the options (all spindles or a selected spindle and enter the desired value.

c. EOR REPORT / ASSEMBLY=. Cycle through the options (all assemblies 1 to 16) and enter the desired value.

d. EOR REPORT / DATA=. Cycle through the two options (all fastenings or only rejected fastenings) and enter the desired value.

e. Press u to display EOR REPORT / PRINT EOR=. Cycle through the two options (disable or enable) and enter the desired value. ENABLE turns EOR reporting on, DISABLE turns it off.

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13.3 GENERATING REPORTS- Plot Report

A Plot report is a printout of the torque versus angle data for a single fastening operation. The data, when plotted, show the complete tightening curve for that fastening. Follow the steps below to generate a Plot report.

a. REPORT function key. Press ↓ three times to display REPORT / PLOT REPORT. (If you are asked for your PIN, enter the number for your highest security access level and press ↵.)

NOTE: In the steps that follow, press ↑ or ↓ to cycle through the options or use the keypad to enter values. When the option or value you want is displayed, press ↵.

b. PLOT REPORT / SPINDLE(S)=. Cycle through the options (all spindles or a selected spindle) and enter the desired value.

c. PLOT REPORT / PLOT SEL=. Cycle through the options and enter the desired value. Options include:

- LAST GOOD data from the last acceptable fastening
- LAST BAD data from the last rejected fastening
- LAST RUN data from the last fastening (accepted or rejected)
- LAST BAD PH data from the last rejected powerhead fastening

d. PLOT REPORT / PRINT PLOT. Press ↵ to start printing the Plot report. Press any key to cancel the printing.

13.4 GENERATING REPORTS- List Report

A List report is identical to an End-of-Run (EOR) report, that is, it is a one-line printout of selected fastening parameters that is generated for every fastening operation. However, unlike an EOR report which prints the one line of data after every fastening, a List report is created after a series of fastening operations. That is, the user selects data stored in INSIGHT 6 buffers for a series of past fastenings and generates an EOR-type printout. Follow the steps below to generate a List report.

a. Press the blue REPORT function key. Press ↓ four times to display REPORT / LIST REPORT. (If you are asked for your PIN, enter the number for your highest security access level and press ↵.)

b.

NOTE: In the steps that follow, press ← or → to cycle through the options or use the keypad to enter values. When the option or value you want is displayed, press ↵.

b. LIST REPORT / NUM OF RUNS=. The number of runs is the number of fastenings you want the List report to include. Enter a number from 0 to 5,000.

c. LIST REPORT / SPINDLE(S)=. Cycle through the options (all spindles or a selected spindle) and enter the desired value.

d. LIST REPORT /ASSEMBLY=. Cycle through the options (all assemblies or a selected one from assemblies 1 to 16) and enter the desired value.

e. LIST REPORT / DATA=. Cycle through the two options (all fastenings or only rejected fastenings) and enter the desired value.

f. LIST REPORT / PRINT LIST. Press ↵ to start printing the List report. Press any key to cancel the printing.

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13.5 GENERATING REPORTS- Statistics Report

A Statistics report is a printout of basic statistics for a series of fastenings. Basic statistics on peak torque and peak angle are included, such as target value, mean, range, number of rejects, σ, 6σ, etc. Follow the steps below to generate a Statistics report.

a. Press the blue REPORT function key. Press ↓ five times to display REPORT / STATISTICS. (If you are asked for your PIN, enter the number for your highest security access level and press ↵)

NOTE: In the steps that follow, press ← or → to cycle through the options or use the keypad to enter values. When the option or value you want is displayed, press ↵.

b. STATISTICS / SPINDLE(S)=. Cycle through the options (all spindles or a selected spindle) and enter the desired value.

c. STATISTICS /ASSEMBLY=. Cycle through the options (all assemblies or a selected one from assemblies 1 to 16) and enter the desired value.

d. STATISTICS / LOT SEL=. Lot select will determine which group of fastenings will be selected for the STATISTICS report. Cycle through the four options and enter the desired value. The options include current or previous sublot and current or previous lot. The sublot and lot values are the same as selected earlier in Section 6.1 (Collecting Statistics.)

e. STATISTICS / PRINT STAT. Press ↵ to start printing the Statistics report. Press any key to cancel the printing.

13.6 GENERATING REPORTS- Parameter Report

A Parameter report is a summary printout of the parameters that are set for the fastening strategies for which INSIGHT 6 has been programmed. For example, for an angle control strategy the parameters would include: direction, engage angle, engage speed, control angle, angle low limit, angle high limit, and many others. A Parameter report is a convenient way to keep a record of all the details of a particular tightening strategy. Follow the steps below to generate a Parameter report.

a. Press the blue REPORT function key. Press ↓ six times to display REPORT / PARAM REPORT. (If you are asked for your PIN, enter the number for your highest security access level and press ↵.)

NOTE: In the steps that follow, press ← or → to cycle through the options or use the keypad to enter values. When the option or value you want is displayed, press ↵.

b. PARAM REPORT / SPINDLE(S)=. Cycle through the options (all spindles or a selected spindle) and enter the desired value.

c. PARAM REPORT /ASSEMBLY=. Cycle through the options (all assemblies or a selected one from assemblies 1 to 16) and enter the desired value.

d. PARAM REPORT/ PRINT PARAM. Press ↵ to start printing the Parameter report. Press any key to cancel the printing.

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13.7 GENERATING REPORTS- Audit Report

An Audit report is a summary printout of important INSIGHT 6 events. It is a chronological record (from most current to most distant) showing the date and time that certain software files internal to the Spindle Control Modules were saved. Follow the steps below to generate an Audit report.

a. Press the blue REPORT function key. Press ↓ seven times to display REPORT / AUDIT REPORT. (If you are asked for your PIN, enter the number for your highest security access level and press ↵.)

NOTE: In the steps that follow, press ← or → to cycle through the options or use the keypad to enter values. When the option or value you want is displayed, press ↵.

b. AUDIT REPORT / SPINDLE(S)=. Cycle through the options (a11 spindles or a selected spindle) and enter the desired value.

c. AUDIT REPORT/ PRINT AUDIT. Press ↵ to start printing the Audit report. Press any key to cancel the printing.

14. DISPLAYING FASTENING PARAMETERS

The INSIGHT 6 two-line display can be used to display important information on each fastening. In Section 6.2 you learned how to program a function called the End-of-Run (EOR) filter, which captures specific information on every fastening operation. The EOR filter always captures peak torque and peak angle, and up to ten additional fastening parameters can also be captured. This section describes how to use the MONITOR mode to display all of the EOR filter parameters you have selected. This can be useful for visually observing fastening quality during tightening operations.

a. Press the blue MONITOR key to display the spindle and assembly numbers and the EOR filter parameters. The spindle and assembly and the first two EOR parameters will be displayed as shown on the example below.

S	A	TORQUE	ANGLE
1	1	10.5	27.1

b. Press the ↑or ↓ keys to cycle through the other EOR filter parameters. Pressing the ← key shifts the display to the left and pressing the → key shifts the display to the right, exposing the next parameter. For example, let's assume the third and fourth EOR filter parameters you selected were Slope Minimum and Cycle Count. Pressing the → key once would change the display to:

S	A	ANGLE	SLOPMN
1	1	27.1	21.4

Pressing the → key a second time would change the display to:

S	A	SLOPMN	CYCCNT
1	1	21.4	205

Simply repeat this process to display the spindle number, assembly number, and any two EOR filter parameters on the two-line display.

c. Note that the spindle number and assembly number do not change. To display EOR filter parameters for other spindles or assemblies, simply press the blue SPINDLE or ASS'Y key repeatedly until the ones you want are shown.

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15.0 INSIGHT SERVICE AND TROUBLE SHOOTING CHECKLIST

If problem indicates it could be with the Arcnet check or do the following:	**OK**	**N/OK**
1) Check Arcnet Cable (Phone cord, Both ends)		
2) Check Arcnet board settings (Red switch bank, 4,6,7 are down)		
3) Reseat the Arcnet card		
4) Re-boot the controller		

If the screen is blank check or do the following:		
1) Check to see if the backlight is on		
2) Adjust contrast		
3) Check LCD connector (Colored wires, lower right hand side)		
4) Confirm computer is on by checking yellow light next to the Ethernet connector		
5) If you can hear a constant beeping, remove and re-insert RAM card. (Vertically mounted)		

If the SCM will not power up check or do the following:		
1) Make sure the tool is connected properly		
2) Check that the circuit breaker is in the up position		
3) Check that cube relays above the SCM are seated properly		
4) Check wires on the back of green power button		
5) Reseat SCM		

If the tool will not run check or do the following:	**OK**	**N/OK**
15.1 Quick Reference Programming/ Setup System/Control		
1) Check if tool is selected in tool table(Symptom: Christmas lights red and yellow)		
2) Check configuration is programmed(Symptom: Christmas lights red and yellow)		
3) Check that Spindle Status is not disabled(Setup Spindle Initialization)		
4) Check “Rem.Tool En/Dis” has not been set to on if no external disable is required. (Set-Up Spindle Initialization)		
5) Check for any fault messages		
6) Check on backplane board that the switch for handheld (toward you) or fixture		

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(away from you) is in the correct position.

7) If using external device to select configurations. Make sure that “Config Select” In “Set-Up Spindle Initialization Screen” is set to external.

8) Check that an actual config has been selected if using an external device (socket tray, remote switch PLC) in diagnostic screen.

If c:\twister appears instead of the run screen check or do the following:

1) Check green I/0 connector located in bottom left side of display computer is secure.

2) At the c:\twister prompt type “855” and press Enter. All data will be lost. Re-boot system and re-program

3) Check that UPS system is working correctly. Make sure yellow light next to Ethernet connector stays on for 4-6 seconds.

If the computer tries to re-boot on its own check or do the following:

1) Check and confirm connections between 24V-power supply, UPS board and main processor board. White or black connectors with red, black, and yellow wires.

If screen will not update check or do the following:

1) Check clock in left-hand corner did not stop. If it did software locked up. Re- Boot the controller.

2)Check all the steps that form the Arcnet test.

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15.1 Insight 6 Troubleshooting Guide

Problem	Cause	Solution
SCM loses its program after a while	The Battery that holds the program is not ON	The Battery Switch on the top of the SCM should be in the ON position (pushed toward the front of the SCM)
Handheld tool does not operate	System is set up for Machine Mount tool	1. Set tool to Handheld in the Setup/ System/ Control menu 2. Insure that the switch or jumpers on the Tool Recognition Board are set to Handheld
	Tool, Cable, or SCM problem	Validate the tool using Tool Check in the Diagnostics menu. Use the "Spindle" key to select the correct spindle to test.
Machine Mount tool does not operate	System is set up for Handheld tool	1. Set tool to Machine Mount in the Setup/ System/ Control menu 2. Insure that the switch or jumpers on the Tool Recognition Board are set to Machine Mount
	Tool, Cable, or SCM problem	Validate the tool using Tool Check in the Diagnostics menu. Use the "Spindle" key to select the correct spindle to test.
System runs but the 2-Line Display is not ON.	2-Line Power Supply is not functioning correctly	Check wires to the 2-Line Display Replace SCM #1 If this does not fix the problem, replace the 2-Line Display
Pushing the green Start Button does not turn the system ON.	Tool #1or SCM #1 not connected	Make sure that a tool is connected to the Tool #1 connector Replace SCM #1
The End of Run Report is not printing after each cycle	The EOR is disabled.	Make sure that the EOR is enabled in the Reports menu. Running any other report automatically disables the EOR.
	The port settings are incorrect.	Make sure the communication port you are using is set up with the correct parameters in the Setup/System/Comm Setup menu

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15.2 Insight 6 Shutdown Codes

Code

#	Fault Type	Description
1	TORQUE CYCLE STARTED EVENT	
2	TORQUE CONTROL	TORQUE SETPOINT BACKGROUND
3	TORQUE CONTROL	TIMEOUT BACKGROUND SHUTDOWN
4	ANGLE CONTROL	TORQUE HIGH LIMIT BACKGROUND
7	TORQUE THRESHOLD EVENT	
8	PRETORQUE CONTROL	PRETORQUE SETPOINT INTERRUPT
9	PRETORQUE CONTROL	PRETORQUE SETPOINT BACKGROUND
10	TORQUE CONTROL	TORQUE SETPOINT INTERRUPT SHUTDOWN
11	NEGATIVE TORQUE HIGH LIMIT INTERRUPT	
13	ANGLE CONTROL	ANGLE SETPOINT INTERRUPT SHUTDOWN
14	BACKOUT CONTROL	ANGLE SETPOINT INTERRUPT SHUTDOWN
15	BACKOUT CONTROL	TORQUE HIGH LIMIT INTERRUPT
20	CYCLE ABORTED	
22	SLOPE MONITOR	SLOPE LOW LIMIT REGION A BACKGROUND
23	SLOPE MONITOR	SLOPE HIGH LIMIT REGION A BACKGROUND
24	SLOPE MONITOR	SLOPE LOW LIMIT REGION B BACKGROUND
25	SLOPE MONITOR	SLOPE HIGH LIMIT REGION B BACKGROUND
26	SLOPE MONITOR	SLOPE LOW LIMIT REGION C BACKGROUND
27	SLOPE MONITOR	SLOPE HIGH LIMIT REGION C BACKGROUND
31	YIELD CONTROL	YIELD ANGLE SETPOINT INTERRUPT
32	YIELD CONTROL	TORQUE HIGH LIMIT BACKGROUND
35	YIELD CONTROL	MEASUREMENT ERROR BACKGROUND
36	YIELD CONTROL	ANGLE INTO YIELD BACKGROUND
37	MOTOR CONTROLLER	UNDERVOLTAGE FAULT SHUTDOWN
38	MOTOR CONTROLLER	HALL ENCODER FAULT SHUTDOWN
39	MOTOR CONTROLLER	WATCHDOG FAULT SHUTDOWN
40	MOTOR CONTROLLER	OVERCURRENT FAULT SHUTDOWN
41	TORQUE HIGH LIMIT INTERRUPT	
42	ANGLE HIGH LIMIT INTERRUPT SHUTDOWN	
44	PRETHRESHOLD MONITOR	ANGLE HIGH LIMIT INTERRUPT SHUTDOWN
45	PRETHRESHOLD MONITOR	ANGLE LOW LIMIT INTERRUPT SHUTDOWN
47	NO CYCLE	MOTOR OVERTEMPERATURE FAULT
48	NO CYCLE	MODULE OVERTEMPERATURE FAULT
49	NO CYCLE	TORQUE TRANSDUCER BRIDGE OFFSET
50	NO CYCLE	MODULE TORQUE AMPLIFIER OFFSET
51	NO CYCLE	TORQUE TRANSDUCER SHUNT
52	NO CYCLE	MODULE POSITIVE EXCITATION VOLTAGE
	NO CYCLE	MODULE NEGATIVE EXCITATION VOLTAGE
54	RETORQUE CONTROL	TORQUE HIGH LIMIT BACKGROUND
55	RETORQUE CONTROL	TORQUE SETPOINT INTERRUPT SHUTDOWN
56	MOTOR STOPPED AT START OF RETORQUE	
57	MOTOR CONTROLLER	INITIALIZATION FAILURE
58	NO CYCLE	INVALID STEP SELECTED
59	NO CYCLE	TOOL NOT SELECTED
60	NO CYCLE	TORQUE UNITS NOT SELECTED
61	SLOPE MONITOR	OTHER BACKGROUND SHUTDOWN
62	NO CYCLE	ASSEMBLY NOT PROGRAMMED OR INVALID
63	PREVAILING TORQUE	ANGLE HIGH LIMIT BACKGROUND
64	PREVAILING TORQUE	ANGLE LOW LIMIT BACKGROUND
65	PREVAILING TORQUE	TORQUE HIGH LIMIT BACKGROUND
66	PREVAILING TORQUE	TORQUE LOW LIMIT BACKGROUND

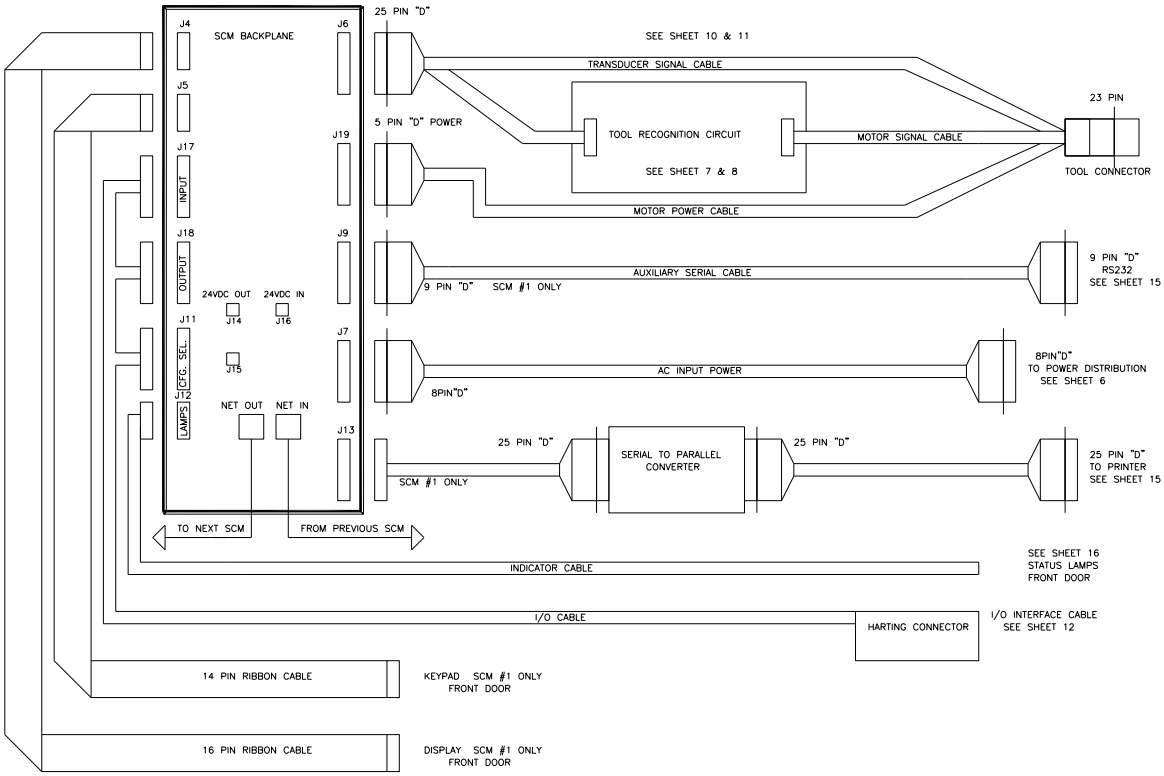
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Code

#	Fault Type	Description
67	LOW THRESHOLD ANGLE LIMIT INTERRUPT	
68	HIGH THRESHOLD ANGLE LIMIT INTERRUPT	
69	NO CYCLE	INVALID TRANSDUCER LOSS CONSTANT
70	NO CYCLE	CONTACT CLOSURE INPUT SPINDLE
71	NO CYCLE	LADDER LOGIC SPINDLE BYPASS
72	NO CYCLE	DATA ENTRY SPINDLE BYPASS
73	NO CYCLE	CURRENT CONTROL UNAVAILABLE (IN
74	MACHINE FORWARD ABORT TIMEOUT	
75	MACHINE REVERSE ABORT TIMEOUT	
76	FAULT BACKOUT RETRY STARTED	
77	FAULT BACKOUT	TIMEOUT OR ABORT
78	CURRENT REDUNDANCY REJECT	
79	NO CYCLE	INVALID STEP SELECTED
100	CYCLE TIMEOUT (ADDED TO THE STATUS CODE 1 XX)	

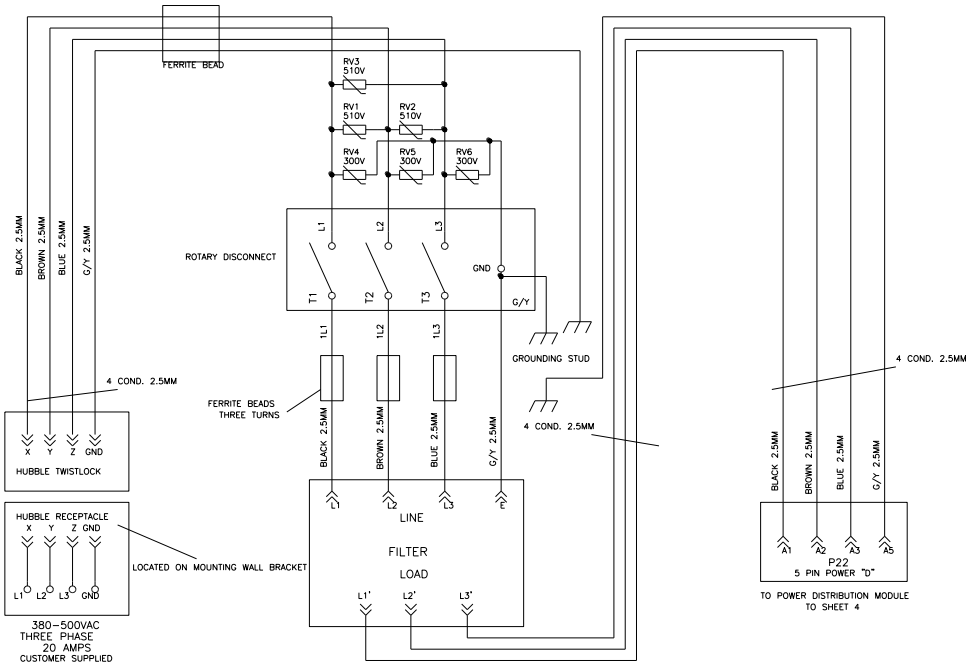
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16.0 REFERENCE DRAWINGS



J14 24VDC OUT TO NEXT SCM.
J16 24VDC IN FROM PREVIOUS SCM
J15– CONNECT 1 AND 2 FOR HANDHELD TOOL
J15– CONNECT 2 AND 3 FOR MACHINE MOUNT
JP1 AND JP2 BOTH ARE JUMPERED FOR THE FIRST AND LAST SCM

AC Input Power Wiring Diagram



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17.0 Quick Reference Programming/Control

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SETUP		DEFAULT	OPTIONAL		ALL	SECURITY LEVEL	
SYSTEM		SETTING	SETTINGS	DESCRIPTION / COMMENT	VAR'S	VIEW	EDIT
CONTROL							
AVAR	ALL VARS =	DISABLE	ENABLE	**Enable to view speeds and powerhead variables**		1	2
TQU	TORQUE UNITS =	NONE	N-M, FT-LB, IN-LB, KG-M	**Select before viewing individual spindles**		1	2
PHRD	RDNDNCY FAULT		N/A	Not used at present, redundancy fault parameter	Y	1	2
TLDS	TL DISABL =	DISABLE	ENABLE	**Enable for remote spindle stop switch, if present**	Y	1	2
ASMM	ASSY SEL =	DISCRETE	BINARY, SEQUENTIAL	Mode for remote assembly selection		1	3 (not 4)
STCM	STRT MODE =	MAINTAINED	MOMENTARY, DUAL	Spindle start switch operation (for MCH. MOUNT only)		1	3 (not 4)
TTYP	TOOL TYPE =	MCH. MOUNT	HANDHELD	**Select tool type or mode of operation**			
SCD	SHUNT CAL =	ENABLE	DISABLE	Automatic shunt calibration, leave ENABLED		1	1
RTO	CYCLE OVRTIME	15.00	0.00 - 327.67 sec.	Cycle run out timer, set appropriately for missing bolt condition		1	3 (not 4)
JT	JOG TIMER =	0.00	0.01 - 327.67 sec.	System ignores throttle jog unless this duration, 0 = disabled		1	3 (not 4)
PMOT	PM OUTPT TIME =	0.0	0.1 - 3276.7 sec.	On time for paint marker or audible alarm	Y	1	2
SELO	OUTPUT ON =	ACCEPT	REJECT, NONE	Condition to energize paint marker or audible alarm	Y	1	2
SCNT	SPINDLE =	(# of spindles)	N/A	Display only, total number of spindles in system		1	N/A
MCFG	PH CONFIG =	ALL SPN	INDIV. SPN	**INDIV. SPN unless single powerhead system**		1	3 (not 4)
CFO	ASSY OVERRIDE		1-16	**Set to 1 for single configuration, 0 = remote selection**		1	2
PSPA	PRESETPT ABRT =			1 = cycle is hardware reject if throttle released pre shutdown		1	2
AIOD	ALTERNATE I/O =		1	**Set to 1 for remote status lights outputs**		1	2
GENERAL							
QUIT	QUIT =		1, 2	1 = Terminate operating system, 2 = RAM clear and reboot		7	7
LANG	LANGUAGE =	ENGLISH	FR, GR, IT, SP, SYMBOLS	Display language		1	1
TLK	LOCK TIMEOUT=	200.0	0.0 - 3276.7 sec.	Automatic security lock out time if no keypad activity		1	2
SYSN	SYSTEM =	MY SYST. NAME	(User defined)	Appears in report headings		1	2
PLNT	PLANT =	MY PLANT NAME	(User defined)	Appears in report headings		1	2
JNUM	JOB# =	IR JOB #1234	(User defined)	Appears in report headings		1	5
DTF	DATE FMT =	M/D/Y	D/M/Y	Format of date fields		1	2
DLS	DAYLIGHT =	DISABLE	ENABLE	Auto daylight savings time update, requires date entry below		1	2
DLSF	SPRING FWD =	(Standard date)	(Date)	Required only when DLS enabled		1	2
DLFB	FALL BACK =	(Standard date)	(Date)	Required only when DLS enabled		1	2
DT	DATE =	(Present date)	(Present date)	Enter current date if incorrect		1	2
TM	TIME =	(Present time)	(Present time)	Enter current time if incorrect		1	2
PAN	REV.=	(Software rev)	N/A	Display only, operating system software revision		1	N/A

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17.1 Quick Reference Programming/ Communication Setup

COMM SETUP		DEFAULT	OPTIONAL		ALL	SECURITY LEVEL	
		SETTING	SETTINGS	DESCRIPTION / COMMENT	VAR'S	VIEW	EDIT
PORT	COMM PORT =	COM1	COM2, COM3, COM4	Select communications port and adjust baudrate and mode		1	2
BAUD	BAUDRATE =		1200 - 115,200	Communications port baud rate		1	2
PMOD	COMM MODE =	N,8,1	E,7,1 - O,7,1	Parity (Even / Odd / None), # of data bits, # of stop bits		1	2
CNSA	NETW PORT =	COM3	COM1, COM2, COM4	Port selection for network, must not be same as printer port		1	2
NADR	MULTIDROP =		1 - 64	Module ID number for networked systems		1	2
NPRO	NW PROTO =	NONE	RDA60, FTSNET, PFCS	Network protocol		1	2
NW PROTO							
PFCS							
NMFM	NUM FORMAT=	INT	REAL	Numbering Format		2	2
NMRT	# OF RETRIES=	5	1-10	Communication failure retries		2	2
RTIV	RETRY INTRVL=	10	5-60	Delay interval between each retry in seconds		2	2
TXOK	TRANSMIT OK ONLY=	OFF	ON	Transmits Oks or ALL		2	2
TXMD	TRANS MODE=	COMPLETE	GANG,INDV,COMPLETE	Data transmission mode after 1 or more tightenings based on selection		2	2
GNCV	GANG COUNT=	0	0, 1-26, 99	COMP. BUTTON=0, GANG COUNT=1-26, INDV. RUNDN=99		2	2

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17.2 Quick Reference Programming/Power Head

		DEFAULT	OPTIONAL		ALL	SECURITY LEVEL	
POWER HEAD		**SETTING**	**SETTINGS**	**DESCRIPTION / COMMENT**	**VAR'S**	**VIEW**	**EDIT**
TOOL PARAMS							
TOOL	TOOL SEL =	NONE	(Tool model # from list)	**Select tool model before setting program**		1	2
BYP	SP BYPASS =	DISABLE	ENABLE	Enable to bypass spindle in multi-spindle unit		1	2
TRK	GEARBX LOSS %		0.800 - 1.200	Compensation for gear box efficiency losses, used as multiplier		1	2
FLTR	INPUT FILTER =	150 Hz	35 Hz, 350 Hz, 500 Hz	Transducer signal low pass filter frequency		1	2
GAIN	INPUT GAIN =		N/A	Amplifier gain	Y	5	7
SPFH	FREE SPEED HI =	(Value from table)	N/A	Maximum rated tool speed	Y	1	7
ASC	ANGLE CONST =	(Value from table)	N/A	Gear ratio conversion factor for revolutions per motor encoder	Y	1	7
SPFL	FREE SPEED LO =	(Value from table)	N/A	Minimum rated tool speed	Y	1	7
MTID	MOTOR ID =	(Value from table)	N/A	Tool table 7 = 2, tool table 8 (40 Series, 120 Series) = 2,3	Y	5	7
NMP	MOTOR POLES =		N/A	Number of motor poles	Y	5	7
OFFS	OFFSET =		N/A	Torque signal offset, 3 = 0V	Y	5	7
SCV	SHUNT CAL mV =		N/A	Transducer ideal shunt calibration voltage	Y	5	7
TRUU	XDUCER RANGE =	Value from table	N/A	Calculated from transducer constant in selected units	Y	1	N/A
TD	TORQUE DEC PT	(Calculated)	N/A	Calculated from system and tool variables		1	7
TR	XDUCER CONST =	(Calculated)	N/A	**Full scale transducer range in Ft-lbs, adjust for calibration**	Y	1	7
TCHL	RATED TORQUE =	Value from table	N/A	Tool rated torque in ft-lbs	Y	1	7
ANDV	ANGLE DIVISOR		N/A	Reduction factor for free speed angle monitoring	Y	5	7
MTEN	MTR TEMP =	ENABLE	DISABLE	Motor temperature fault sensing	Y	5	4
MTHL	MTR TEMP LIM =	75.0	N/A	Motor temperature high limit	Y	1	7
TRAD	VOLTS@A/D@TR		N/A	A/D converter voltage at transducer full scale	Y	5	7
XDTD	XDUCER DEC PT	(Calculated)	0, 1, 2	**Set as desired for application**	Y	1	7
SPOM	SPEED OUT MAX	Value from table	N/A	D/A converter voltage at maximum speed	Y	1	7
MKT	MOTOR KT VAL =	Value from table	N/A	Nominal motor torque constant, in ft-lbs / Amps	Y	1	7
IOFF	CURRNT OFFSET	1.00	N/A	Current offset value for current per torque calculation	Y	5	7
ITDS	CURR DOWNSHFT		N/A	Downshift setpoint in ft-lbs for current control	Y	2	2
ACCL	ACCELERATION =		N/A	Nominal acceleration rate of 0.5 seconds to target speed	Y	5	7
TGIF	TQ GAIN FACTR =	45.0	N/A	Torque gain interpolation factor for low frequency filter	Y	1	7
ICCP	CUR CAPABILITY	(Value table)	N/A	Current control capability, 1 = disabled, 2 = enabled	Y	5	7

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17.3 Quick Reference Programming/ Custom tool

		DEFAULT	OPTIONAL		ALL	SECURITY LEVEL	
		SETTING	SETTINGS	DESCRIPTION / COMMENT	VAR'S	VIEW	EDIT
CUSTM TOOL1							
CND1	TOOL1 END=	DISABLE	ENABLE	Selects Custom tool #1		1	2
SRS1	TOOL1 SERIES=	1616	(Motor model # from list)	Selects a motor type for custom tool #1			
TR1	XDUCER CONST1=	0.0	0 - 32676	Torque transducer constant for custom tool #1			
ASC1	ANGLE CONST1=	0.000	0 - 32676	Angle constant for custom tool #1			
CN1	TOOL1 NAME=			User defined tool name for custom tool #1			
CUSTM TOOL2							
CND2	TOOL2 END=	DISABLE	ENABLE	Selects Custom tool #2		1	2
SRS2	TOO21 SERIES=	1616	(Motor model # from list)	Selects a motor type for custom tool #2			
TR2	XDUCER CONST2=	0.0	0 - 32676	Torque transducer constant for custom tool #2			
ASC2	ANGLE CONST2=	0.000	0 - 32676	Angle constant for custom tool #2			
CN2	TOOL2 NAME=			User defined tool name for custom tool #2			
TUBENUT CNTL							
TNE	TUBENUT ENBL	DISABLE	ENABLE	Selected tubenut operation		1	2

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17.4 Quick Reference Programming/ Torque control

		DEFAULT	OPTIONAL		ALL	SECURITY LEVEL	
PROGRAM		**SETTING**	**SETTINGS**	**DESCRIPTION / COMMENT**	**VAR'S**	**VIEW**	**EDIT**
CM	SEQNCE =	TORQUE CTL	(See below)	Engage, Prevail, Pre-Thresh, Torque Control, End		1	3
			ANGLE CTL	Engage, Prevail, Pre-Thresh, Angle Control, End			
			PRETQ/TQCTL	Engage, Prevail, Pre-Thresh, Pretorque, Torque Control, End			
			PRETQ/ANCTL	Engage, Prevail, Pre-Thresh, Pretorque, Angle Control, End			
			PRETQ/YIELD	Engage, Prevail, Pre-Thresh, Pretorque, Yield Control, End			
			BACKOUT	Engage, Prevail, Pre-Thresh, Backout, End			
			YIELD	Engage, Prevail, Pre-Thresh, Yield, End			
			PTQ/BO/TQ	Engage Prevail Pre-Thresh, Pretorque, Backout, Torque, End			
			PTQ/BO/ANG	Engage, Prevail, Pre-Thresh, Pretorque, Backout, Angle, End			
			PTQB/TQ/B	Eng., Prevail, Pre-Thresh, Pretorque, BackO, Torque, BackO,End			
			PTQ/B/ANG/B	Eng., Prevail Pre-Thresh Pretorque BackO Angle, BackO, End			
ENGAGE							
AEN	ENGAGE ANGLE =	0.0	0.1 - 3276.7 deg.	Degrees until the end of the engage step, MCH MOUNT only		1	2
AFAB	REVERSE ANGLE =	0.0	0.1 - 3276.7 deg.	Maximum degrees for reverse rotation, 0 = No limit	Y	1	2
TFAB	REVERSE TIME =	0.00	0.01 - 327.67 sec.	Maximum time for reverse rotation in seconds, 0 = No limit	Y	1	2
DIR	DIRECTION =	CW	CCW	Forward direction of spindle rotation	Y	1	2
SPEN	ENGAGE SPEED =		(SPFL - SPFH RPM)	**Entry required**,engage speed for selected spindle assembly	Y	1	2
SPFR	FREE SPEED =		(SPFL - SPFH RPM)	**Entry required**,free speed for selected spindle/ assembly	Y	1	2
SPTH	DOWNSHIFT SPD		(SPFL - SPFH RPM)	**Entry required**,final tightening speed for spindle / assy	Y	1	2
SPBO	BACKOUT SPEED		(SPFL - SPFH RPM)	**Entry required**,backout speed for selected spindle assy.	Y	1	2
TZMF	TRACE ZOOM =		N/A	Not used at present, pre-threshold slope sample rate, 1=2x	Y	1	2
ATHL	REVS TO TT LO =	0.0	0.1 - 3276.7	Minimum revolutions to torque threshold, 0.0 = No limit	Y	1	2
ATHH	REVS TO TT HI =	0.0	0.1 - 3276.7	Maximum revolutions to torque threshold, 0.0 = No limit	Y	1	2
DDS	DOWNSHIFT =	ENABLE	DISABLE	Enables slow down and increased sample rate at threshold	Y	1	2
TDS	TORQUE DNSHFT	0	0-32767	Torque setpoint for downshift	Y	1	2
CLD	CUR LIMIT =	DISABLE	ENABLE	Enable to allow current limit sensing	Y	1	2
TNRS	TNREV SPEED	10% of SPFH	10-30% of SPFH	Tubenut Reverse speed is related to Tool free speed	Y	1	2
TNRT	TNREV THRSH	10% of TCHL	10-25% of TCHL	Tubenut Reverse Threshold is related to max torque of tool	Y	1	2
END							
ERD	EOR DATA DISA =			1 = Disables end of run data update for selected step	Y	1	2

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JMPA	JUMP TO ASSY#		1 - 16	Assembly number to jump to if multiple step operation	Y	1	2

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17.5 Quick Reference Programming/ Torque Control

		DEFAULT	OPTIONAL		ALL	SECURITY LEVEL	
TORQUE CNTROL		**SETTING**	**SETTINGS**	**DESCRIPTION / COMMENT**	**VAR'S**	**VIEW**	**EDIT**
TC	CNTROL TORQUE =		(TR * 115% max)	**Entry required, target or setpoint torque**		1	2
TL	TORQUE LO LIM =		(TT min - TH max)	Low torque limit		1	2
TH	TORQUE HI LIM =		(TL min - TR * 115% max)	**Entry required, high torque limit**		1	2
AL	ANGLE LO LIM =	0.0	0.1 - 3276.7 deg.	Low angle limit		1	2
AH	ANGLE HI LIM =	0.0	0.1 - 3276.7 deg.	**Entry required, high angle limit**		1	2
TT	THRESH TORQUE =	(TC * 40%)	(TC max)	Torque threshold for angle count and downshift speed		1	2
SAVG	AVG INTERVAL =	0.0	0.1 - 3276.7 deg	Interval for slope calculations, 0.0 = disable slope monitoring	Y	1	2
SL	SLOPE LO LIM =	0.00	0.01 - 327.67	Slope low limit, from threshold to shutdown or first slope	Y	1	2
SH	SLOPE HI LIM =	0.00	0.01 - 327.67	Slope high limit, from threshold to shutdown or first slope	Y	1	2
TX	TRQ CROSSOVER =	0	(TR * 115% max)	Torque cross over point for dual slope monitoring	Y	1	2
AX	ANG CROSSOVER =	0.0	0.1 - 3276.7 deg	Angle cross over point for dual slope monitoring	Y	1	2
SLB	SLOPE B LO LIM =	0.00	0.01 - 327.67	Optional second slope low limit, for dual slope only	Y	1	2
SHB	SLOPE B HI LIM =	0.00	0.01 - 327.67	Optional second slope high limit, for dual slope only	Y	1	2
SLC	SLOPE C LO LIM =	0.00	0.01 - 327.67	Optional final slope low limit, from last interval	Y	1	2
SHC	SLOPE C HI LIM =	0.00	0.01 - 327.67	Optional final slope high limit, from last interval	Y	1	2
TOM	TQ OVRSHT MAX =	0	(TR * 115% max)	Torque overshoot, move shutdown point by entered amount	Y	1	2
RRLL	REDUND HI LIM =	0.000	N/A	Not used at present, current redundancy low limit	Y	1	2
RRHL	REDUND LO LIM =	0.000	N/A	Not used at present, current redundancy high limit	Y	1	2
RMO	REDUN MONITOR =		N/A	Not used at present, 1 = enables redundancy reject fault	Y	1	2
PHDS	REDN FLT DISA =		N/A	Not used at present, 1 = redundancy fault disables powerhead	Y	1	2

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17.6 Quick Reference Programming/ Torque Control

		DEFAULT	OPTIONAL		ALL	SECURITY LEVEL	
ANGLE CONTROL		**SETTING**	**SETTINGS**	**DESCRIPTION / COMMENT**	**VAR'S**	**VIEW**	**EDIT**
AC	CONTROL ANGLE =	0.0	0.1 - 3276.7 deg	**Entry required, target or setpoint angle**		1	2
AL	ANGLE LO LIM =	0.0	0.1 - 3276.7 deg.	Low angle limit		1	2
AH	ANGLE HI LIM =	0.0	0.1 - 3276.7 deg.	**Entry required, high angle limit**		1	2
TT	THRESH TORQUE =	(TC * 40%)	(TR * 115% max)	Torque threshold for angle count and downshift speed		1	2
TL	TORQUE LO LIM =	0	(TT min - TH max)	Low torque limit		1	2
TH	TORQUE HI LIM =	0	(TL min - TR * 115% max)	**Entry required, high torque limit**		1	2
SAVG	AVG INTERVAL =	0.0	0.1 - 3276.7 deg	Interval for slope calculations, 0.0 = disable slope monitoring	Y	1	2
SL	SLOPE LO LIM =	0.00	0.01 - 327.67	Slope low limit, from threshold to shutdown or first slope	Y	1	2
SH	SLOPE HI LIM =	0.00	0.01 - 327.67	Slope high limit, from threshold to shutdown or first slope	Y	1	2
TX	TRQ CROSSOVER =	0	(TR * 115% max)	Torque cross over point for dual slope monitoring	Y	1	2
AX	ANG CROSSOVER =	0.0	0.1 - 3276.7 deg	Angle cross over point for dual slope monitoring	Y	1	2
SLB	SLOPE B LO LIM =	0.00	0.01 - 327.67	Optional second slope low limit, for dual slope only	Y	1	2
SHB	SLOPE B HI LIM =	0.00	0.01 - 327.67	Optional second slope high limit, for dual slope only	Y	1	2
SLC	SLOPE C LO LIM =	0.00	0.01 - 327.67	Optional final slope low limit, from last interval	Y	1	2
SHC	SLOPE C HI LIM =	0.00	0.01 - 327.67	Optional final slope high limit, from last interval	Y	1	2
AOM	AN OVRSHT MAX =	0.0	0.1 - 3276.7 deg	Angle overshoot, move shutdown point by entered amount	Y	1	2
RRLL	REDUND HI LIM =	0.000	N/A	Not used at present, current redundancy low limit	Y	1	2
RRHL	REDUND LO LIM =	0.000	N/A	Not used at present, current redundancy high limit	Y	1	2
RMO	REDUN MONITOR =		N/A	Not used at present, 1 = enables redundancy reject fault	Y	1	2
PHDS	REDN FLT DISA =		N/A	Not used at present, 1 = redundancy fault disables powerhead	Y	1	2

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17.7 Quick Reference Programming/ PreTorque & PreThresh

		DEFAULT	OPTIONAL		ALL	SECURITY LEVEL	
PRETORQUE		**SETTING**	**SETTINGS**	**DESCRIPTION / COMMENT**	**VAR'S**	**VIEW**	**EDIT**
TP	PRETORQUE =	0	(TR * 115% max)	**Entry required, target or setpoint torque**		1	2
TPL	PRETRQ LO LIM =	0	(TT min - TPH max)	Low torque limit		1	2
TPH	PRETRQ HI LIM =	0	(TPL min - TR * 115% max)	**Entry required, high torque limit**		1	2
						1	2
PREVAILING TORQUE							
PEN	PV TQ ENA=	DISABLED	ENABLED	Enables/Disables Prevailing Torque for a strategy		1	2
PVDR	PV OR DRAG=	PREV	DRAG	Selects between Prevailing Torque & Drag Torque		1	2
CTHL	CUTIN TQ LIM=	0	0 - 32767	Cut-in Torque High Limit		1	2
CTAN	CUTIN ANGLE=	0	0 - 32767 deg.	Cut-in Angle Setpoint		1	2
SNTQ	SNUG TQ=	0	0 - 32767	Snug Torque before counting Cut-in Angle		1	2
APH	PRV AN HI LIM=	0	0 - 32767 deg.	Prevailing Angle High Limit		1	2
APL	PRV AN LO LIM=	0	0 - 32767 deg.	Prevailing Angle Low Limit		1	2
APT	ANG PREV END=	0	0 - 32767 deg.	Target Prevailing Angle		1	2
TPVH	PRV TQ HI LIM=	0	0 - 32767	Prevailing Torque High Limit		1	2
TPVL	PRV TQ LO LIM=	0	0 - 32767	Prevailing Torque Low Limit		1	2
DVLM	DEVIA LIMIT=	0.0	0 - 3276	Slope Deviation		1	2
CDLN	CHORD LENGTH=	20	0 - 100	Chord Length		1	2
NMCD	NUM CHORDS=	4	0 - 10	Number of Chords		1	2
TPC	PREV TRQ MODE=	Avg. Prev. Torque	0-1	Offset Compensation(0=Avg. Prevailing Torque, 1= zero offset)		1	2
TRGA	TARG INSP ANG=	0	0 - 32767	Target Inspection Angle for Drag Torque		1	2
PRETHRESH MON							
PTME	PRE MON ENA	DISABLED	ENABLED	Enables/Disables Pre-Threshold Monitoring for a strategy		1	2
TTO	PRETHRSH TORQ =	0	(TP min - TT max)	**Entry required, torque to begin monitoring**		1	2
AHB	PRETHR ANG HI =	0.0	0.1 - 3276.7 deg.	**Entry required, high angle limit**		1	2
ALB	PRETHR ANG LO =	0.0	0.1 - 3276.7 deg.	Low angle limit		1	2

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17.8 Quick Reference Programming/ Yield Control

YIELD CONTROL							
AY	YIELD ANGLE =	0.0	0.1 - 3276.7 deg.	**Entry required, angle into yield**		1	2
YP	YIELD SETPT % =	0	1-32676	**Entry required, yield detection setpoint**		1	2
TT	THRESH TORQUE =	0	(TR * 115% max)	**Entry required, torque threshold for angle count and downshift**		1	2
AYRF	REF SLOPE INT =	0	1-32676	**Entry required, reference slope intervals**		1	1
AL	ANGLE LO LIM =	0.0	0.1 - 3276.7 deg.	Low angle limit		1	2
AH	ANGLE HI LIM =	0.0	0.1 - 3276.7 deg.	**Entry required, high angle limit**		1	2
TL	TORQUE LO LIM =		(TT min - TR * 115% max)	Low torque limit		1	2
TH	TORQUE HI LIM =	0	(TT min - TR * 115% max)	**Entry required, high torque limit**		1	2
SAVG	AVG INTERVAL =	0.0	0.1 - 3276.7 deg	Interval for slope calculations, 0.0 = disable slope monitoring	Y	1	2
SL	SLOPE LO LIM =	0.00	0.01 - 327.67	Slope low limit, from threshold to shutdown or first slope	Y	1	2
SH	SLOPE HI LIM =	0.00	0.01 - 327.67	Slope high limit, from threshold to shutdown or first slope	Y	1	2
YPL	YPL =	0.0	0.1 - 3276.7 deg.	Not used at present, learned yield detection point	Y	1	2
AYO	YLD AN OVRSHT =	0.0	0.1 - 3276.7 deg.	Angle into yield overshoot	Y	1	2
TZMF	TRACE ZOOM =		N/A	Not used at present, pre-threshold slope sample rate, 1=2x	Y	1	2
SLC	SLOPE C LO LIM =	0.00	0.01 - 327.67	Optional final slope low limit, from last interval	Y	1	2
SHC	SLOPE C HI LIM =	0.00	0.01 - 327.67	Optional final slope high limit, from last interval	Y	1	2
RRLL	REDUND HI LIM =	0.000	N/A	Not used at present, current redundancy low limit	Y	1	2
RRHL	REDUND LO LIM =	0.000	N/A	Not used at present, current redundancy high limit	Y	1	2
RMO	REDUN MONITOR =		N/A	Not used at present, 1 = enables redundancy reject fault	Y	1	2
PHDS	REDN FLT DISA =		N/A	Not used at present, 1 = redundancy fault disables powerhead	Y	1	2

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17.9 Quick Reference Programming/ Backout Control

		DEFAULT	OPTIONAL		ALL	SECURITY LEVEL	
		SETTING	SETTINGS	DESCRIPTION / COMMENT	VAR'S	VIEW	EDIT
BACKOUT							
AFB	BACKOUT ANGLE =	0	1 - 32767 deg.	**Entry required, target or setpoint angle**		1	2
TTB	B/O THRESH TQ =	0	(TR * 115% max)	Torque to begin counting backout angle	Y	1	2
ABL	B/O ANGLE LOW =	0	1 - 32767 deg.	Low angle limit		1	2
ABH	B/O ANGLE HI =	0	1 - 32767 deg.	**Entry required, high angle limit**		1	2
TLB	B/O TORQ LOW =	0	(TTB min - THB max)	Low torque limit		1	2
THB	B/O TORQ HI =	0	(TLB min - TR * 115% max)	**Entry required, high torque limit**		1	2
FLT B/O/RETRY							
AFB	BACKOUT ANGLE =	0	1 - 32767 deg.	**Entry required, target or setpoint angle**		1	2
AFFB	FLT B/O ANGLE =	0	1 - 32767 deg.	**Entry required, target or setpoint angle if retry exhausted**		1	2
RTRY	RETRY COUNT =	0	1-32767	**Entry required, number of attempts to be made**		1	2
SPLT	SPLT =	0	(Spindle bitmap)	**Entry required, spindles that can cause this spindle to retry**	Y	1	2
SPLF	SPLF =	0	(Spindle bitmap)	**Entry required, spindles to be backed out if retry exhausted**	Y	1	2
STATISTICS							
CSUB	CLOSE SUBLOT =	0	1	1 = close current sublot and reset to 0 with next cycle		1	3
CLOT	CLOSE LOT =	0	1	1 = close current sublot/lot and reset to 0 with next cycle		1	3
ENST	STATS =	DISABLE	ENABLE	Enable allows statistical calculations		1	2
SIG	STATS =	ALL	GOOD	Statistics performed on all cycles or only good cycles		1	3
SLU	SUBLOT UNITS =	COUNT	SHIFT	Sublot determined by number of cycles or end of a shift		1	3
SSZ	SUBLOT SIZE =	0	1-32767	Number of cycles in a sample group		1	3
LMLT	LOT MLTIPLIER =	0	1-32767	Number of sample groups in a lot		1	3

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17.10 Quick Reference Programming/ EOR FILTER

		DEFAULT	OPTIONAL		ALL	SECURITY	
		SETTING	SETTINGS	DESCRIPTION / COMMENT	VAR'S	VIEW	EDIT
EOR FILTER		Selects and arranges information displayed on Monitor screen and printed by EOR report, use <> arrow keys to (de)select					
TPK	PEAK TORQUE	< 1 >		Peak torque during any step in the sequence, always first		1	N/A
APK	PEAK ANGLE	< 2 >		Peak angle during any step in the sequence, always second		1	N/A
TPPK	PEAK PRETORQ	-	< 3 - 12 >	Peak torque at end of pretorque step		1	2
XG	SHUTDOWN CODE	-	< 3 - 12 >	See listing of shutdown codes for descriptions		1	2
IPK	CUR PK	-	< 3 - 12 >	Peak current during any step in the sequence		1	2
LS	FIRST SLOPE	-	< 3 - 12 >	Slope over first SAVG samples		1	2
MS	MEAN SLOPE	-	< 3 - 12 >	Slope between first and last SAVG samples		1	2
FS	LAST SLOPE	-	< 3 - 12 >	Slope over last SAVG samples		1	2
XSH	MAXIMUM SLOPE	-	< 3 - 12 >	Highest calculated slope		1	2
XSL	MINIMUM SLOPE	-	< 3 - 12 >	Lowest calculated slope		1	2
SFA	REG A SLOPE	-	< 3 - 12 >	Slope over region A		1	2
SFB	REG B SLOPE	-	< 3 - 12 >	Slope over region B		1	2
APTH	ANG PRE THRSH	-	< 3 - 12 >	Angle from TTO to TT		1	2
APP	ANG AT SEAT	-	< 3 - 12 >	Angle from TTP to TFS		1	2
TFS	TORQ AT SEAT	-	< 3 - 12 >	Torque value when fastener seats		1	2
TPA	AVG PREV TORQ	-	< 3 - 12 >	Average torque over last 360 degrees		1	2
TPP	PEAK PREV TRQ	-	< 3 - 12 >	Peak prevailing torque		1	2
TRE	PREV TQ COMP	-	< 3 - 12 >	Prevailing torque compensation value		1	2
STTQM	SLOPE AT SEAT	-	< 3 - 12 >	Prevailing torque slope at fastener seating		1	2
AYLD	ANG AT YIELD	-	< 3 - 12 >	Angle at onset of yield		1	2
TN0	PK TORQ ARRAY	-	< 3 - 12 >	Not used at present, peak torque for initial pulse		1	2
TN1	PK TORQ ARY 1	-	< 3 - 12 >	Not used at present, peak torque for first retorque pulse		1	2
TN2	PK TORQ ARY 2	-	< 3 - 12 >	Not used at present, peak torque for second retorque pulse		1	2
TNL	PK TORQ ARY L	-	< 3 - 12 >	Not used at present, peak torque for last retorque pulse		1	2
AN0	ANGLE ARRAY	-	< 3 - 12 >	Not used at present, angle over initial torque pulse		1	2
AN1	ANGLE ARRAY 0	-	< 3 - 12 >	Not used at present, angle over first retorque pulse		1	2
AN2	ANGLE ARRAY 1	-	< 3 - 12 >	Not used at present, angle over second retorque pulse		1	2
ANL	ANGLE ARRAY L	-	< 3 - 12 >	Not used at present, angle over last retorque pulse		1	2
ASD	ANG AT SHUTDN	-	< 3 - 12 >	Angle when shutdown was issued		1	2
TPSD	PK TQ AFT SDN	-	< 3 - 12 >	Peak torque after shutdown use only if pretorque > final torque		1	2
RVTT	REVS TO THRSH	-	< 3 - 12 >	Number of revolutions until threshold reached		1	2

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APBO	B/O ANG PEAK	-	< 3 - 12 >	Angle at end of backout step		1	2

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17.10 Quick Reference Programming/ EOR FILTER continued

		DEFAULT	OPTIONAL		ALL	SECURITY LEVEL	
		SETTING	SETTINGS	DESCRIPTION / COMMENT	VAR'S	VIEW	EDIT
TDSA	ACCTTQ DNSHFT	-	< 3 - 12 >	Torque Downshift Point as measured		1	2
PKRD	PEAK DRAG TQ	-	< 3 - 12 >	Peak Drag Torque		1	2
ANCT	ANGLE COUNT	-	< 3 - 12 >	Angle Count at Exit of Drag Torque		1	2
MDTQ	MIN DRAG TQ	-	< 3 - 12 >	Minimum Drag Torque		1	2
PKCI	PEAK CUTIN TQ	-	< 3 - 12 >	Peak Cut-in Torque		1	2
FTT	TIME TO SHUTD	-	< 3 - 12 >	Time from Cycle Start to Shutdown		1	2
ATT	ANG AT THRESH	-	< 3 - 12 >	Angle from Cycle Start to Threshold		1	2
RR	RDNDNCY RATIO	-	< 3 - 12 >	Redundancy Ratio		1	2
RRFC	RED FLT COUNT	-	< 3 - 12 >	Redundancy Fault Count		1	2
RT	TRQ RISE TIME	-	< 3 - 12 >	Torque Rise Time from Threshold to Shutdown		1	2
TASD	TQ AT SHUTDOWN	-	< 3 - 12 >	Torque at Shutdown		1	2
ISD	CUR AT SHUTDOWN	-	< 3 - 12 >	Current at Shutdown		1	2
APPK	ANG AT PEAKTQ	-	< 3 - 12 >	Angle for Pretorque at Peak Pretorque		1	2
PTT	TIME TO PRETQ	-	< 3 - 12 >	Time from Cycle Start to Pretorque		1	2
YLDF	FINAL YLD CAL	-	< 3 - 12 >	Final Yield Calculation		1	2
TPBO	BACKOUT TORQ	-	< 3 - 12 >	Peak Torque during Backout		1	2
ICL	CURRENT LIMIT	-	< 3 - 12 >	Current Limit (Fixed or Based on Motor Constant)		1	2
TAOS	AMPOFF	-	< 3 - 12 >	Amplifieer Offset		1	2
TBEX	EXCERR	-	< 3 - 12 >	Excitation Voltage Error		1	2
TBOS	BRGOFF	-	< 3 - 12 >	Bridge Offset		1	2
TBSC	SNTCAL	-	< 3 - 12 >	Bridge Shunt Calibration Error (% of Actual from Ideal)		1	2
TBXN	MINUS EXCIT	-	< 3 - 12 >	Negative Excitation Voltage		1	2
TBXP	PLUS EXCIT	-	< 3 - 12 >	Positive Excitation Voltage		1	2
THST	HT SNK	-	< 3 - 12 >	Heat Sink Temperature		1	2
TMKT	MTR KT	-	< 3 - 12 >	Motor Constant		1	2
TMRT	MTRTMP	-	< 3 - 12 >	Motor Temperature		1	2
FEND	FEND	N/A	< ENTER >	Saves selections made above		1	2
SECURITY		Level 1 = 0001, level 2 = 1111, level 3 = 2222, level 4 = 3333, level 5 = 4444, level 7 = IR personnel only					
KEY	ENTER USER PIN	N/A	XXXX	Used to change access levels		1	1
PIN	CHANGE USER	N/A	XXXX	New PIN for selected access level		1	1

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	PIN						

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17.11 Quick Reference Programming/DIAGNOSTICS

DIAGNOSTICS		PASS	FAIL	DESCRIPTION / COMMENT			
TOOL CHECK		Initiates motor and controller tests, use < > arrow keys to scroll through results below					
TAP	CURFWD =	< Limit	N/A	40 Series limit = 20.0 Amps, 120 Series limit = 40.0 Amps			
TAN	CURREV =	< Limit	N/A	40 Series limit = 20.0 Amps, 120 Series limit = 40.0 Amps			
THLS	MOTOR HALLS =	1,10,11,100,101,110	000, 111	Motor encoder bits			
TMKT	MTR KT =	N/A	N/A	Not used at present, motor torque constant limits			
THST	HT SNK =	< 80.0 deg C	> 120 deg C	SCM heat sink temperature			
TMRT	MTRTMP =	< 55.0 deg C	> 75.0 deg C	Motor temperature			
SCM/XDUCERS		Initiates transducer, A/D and power supply tests, use < > arrow keys to scroll through results below					
TAOS	AMPOFF =	0.0% +/- 8.0 %	0.0% +/- > 10.0 %	Amplifier offset for A/D			
TBOS	BRGOFF =	0.0% +/- 8.0 %	0.0% +/- > 10.0 %	Transducer bridge offset			
TBSC	SNTCAL =	100.0 % +/- 8.0 %	100.0 % +/- > 10.0 %	Shunt calibration			
TBXP	+EXCIT =	+ 5.0 V +/- 0.3 V	+ 5.0 V +/- > 0.5 V	Positive excitation supply			
TBXN	-EXCIT	- 5.0 V +/- 0.3 V	- 5.0 V +/- > 0.5 V	Negative excitation supply			
TADR	V REF =	- 2.50 V +/- 0.10 V	- 2.50 V +/- > 0.20 V	Voltage reference for A/D			
BATTERY		Initiates battery voltage test					
TBAT	V BATT =	> 2.80 V	<= 2.70 V	Battery voltage			

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17.12 Quick Reference Programming/ Reports

		DEFAULT	OPTIONAL		ALL	SECURITY LEVEL	
REPORT		**SETTING**	**SETTINGS**	**DESCRIPTION / COMMENT**	**VAR'S**	**VIEW**	**EDIT**
CPRN	PRN PORT =	COM1	COM2, COM3, COM4	Select output port for report printing		1	2
PSIZ	LINES/PAGE =		1 - 99	Lines to print on a page, 60 for standard 8 1/2" X 11" page		1	2
EOR REPRT		Outputs real time End Of Run data					
SPRQ	SPINDLE =	ALL	1 - 6	Spindle(s) included in report		1	1
ASRQ	ASSEMBLY =		2 - 16, ALL	Assemblies included in report		1	1
DTRQ	DATA =	ALL	REJECTS	Report on all cycles or only reject cycles		1	1
EORE	PRINT EOR =	DISABLE	ENABLE	Automatically disabled when different report selected		1	1
PLOT REPORT		Outputs stored data points for plotting					
SPRQ	SPINDLE =	ALL	1 - 6	Spindle(s) included in report		1	1
PLTS	PLOT SELECTED =	LAST RUN	GOOD,BAD,POWERHEAD	Cycle to be plotted		1	1
PRPT	PRINT PLOT	N/A	< ENTER >	Starts report		1	1
LIST REPORT		Outputs list of stored cycle data					
NOR	NUM. OF RUNS =		1 - 3000	Number of runs per spindle and assembly in report		1	1
SPRQ	SPINDLE =	ALL	1 - 6	Spindle(s) included in report		1	1
ASRQ	ASSEMBLY =		2 - 16, ALL	Assemblies included in report		1	1
DTRQ	DATA =	ALL	REJECTS	Report on all cycles or only reject cycles		1	1
LRPT	PRINT LIST	N/A	< ENTER >	Starts report		1	1
STATISTICS		Outputs statistics for selected data					
SPRQ	SPINDLE =	ALL	1 - 6	Spindle(s) included in report		1	1
ASRQ	ASSEMBLY =		2 - 16, ALL	Assemblies included in report		1	1
LOTS	LOT SEL. =	CUR. LOT	CUR./PRE. LOT/SUBLOT	Select group for calculations		1	1
SRPT	PRINT STAT	N/A	< ENTER >	Starts report		1	1
PARAM REPORT		Outputs system setup parameters					
SPRQ	SPINDLE =	ALL	1 - 6	Spindle(s) included in report		1	1
ASRQ	ASSEMBLY =		2 - 16, ALL	Assemblies included in report		1	1
DRPT	PRINT PARAM	N/A	< ENTER >	Starts report		1	1
AUDIT REPORT		Outputs audit history					
SPRQ	SPINDLE =	ALL	1 - 6	Spindle(s) included in report		1	1
ARPT	PRINT AUDIT	N/A	< ENTER >	Starts report		1	1

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