

1.3 Attaching Peripheral I/O Devices

1.3.1 Activating an Input

All input signals operate at 24VDC. The Return for the 24V signal must be connected to COM IN for each input bank. It is recommended that you use the internal 24VDC located at the terminals marked 24VDC OUT +/- . Switch the 24VDC back to the desired input signal (FORWARD, REVERSE, FREE SPEED, etc.).

To use the internal 24VDC, you must connect a jumper wire from 24VDC OUT (-) to COM IN of each input bank. To activate an input you would then provide a contact closure between the desired inputs signals and 24VDC OUT (+). You can daisy chain the COM IN signal to the next input terminal bank as shown in the Input Signal drawing.

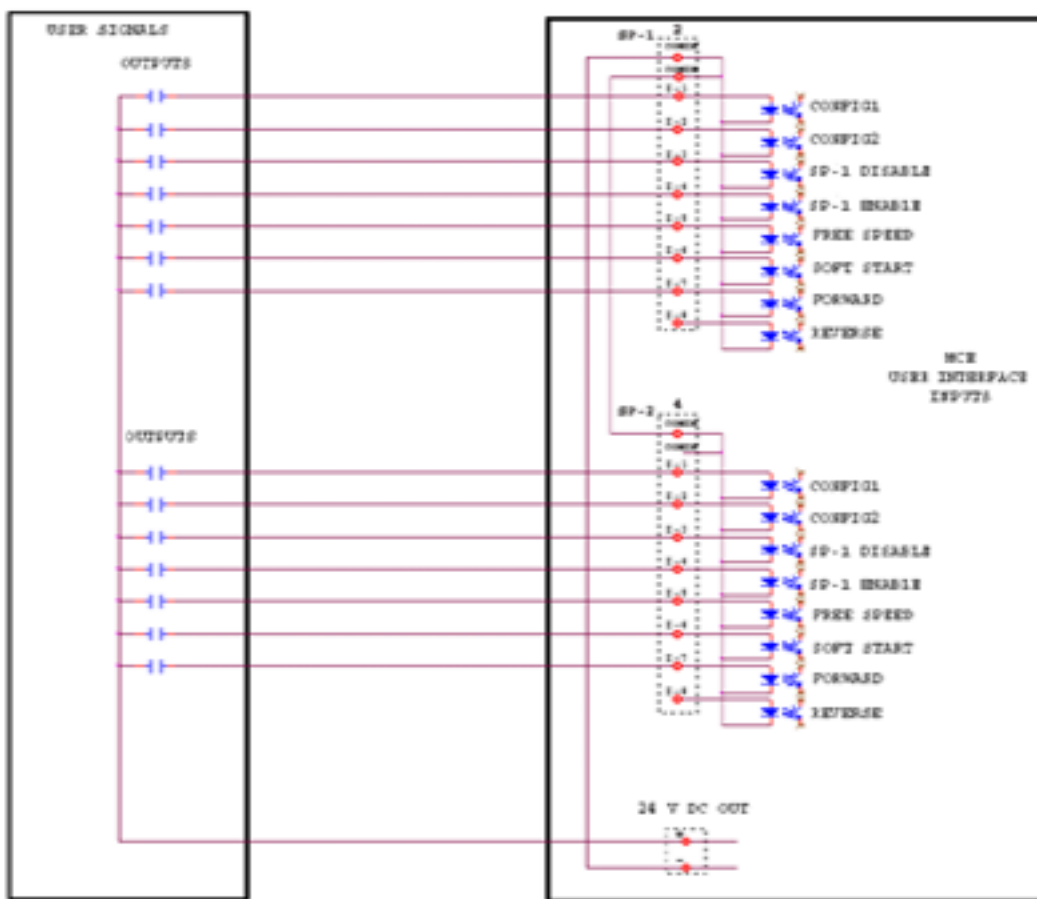


Figure 8 – Input Signal Drawing

1.3.2 Receiving an Output

All output signals operate at 24VDC. The 24V signal and its return must be connected to the terminal blocks labeled +/- 24VDC EXT on each output connector bank. **It is recommended that you use an external 24VDC supply.** The output signals will be switched back to you from the appropriate output signal (ACCEPT, REJECT, HIGH

TORQUE, etc.). See the Output Signal drawing. You can daisy chain the +/- 24VDC to the next output bank.

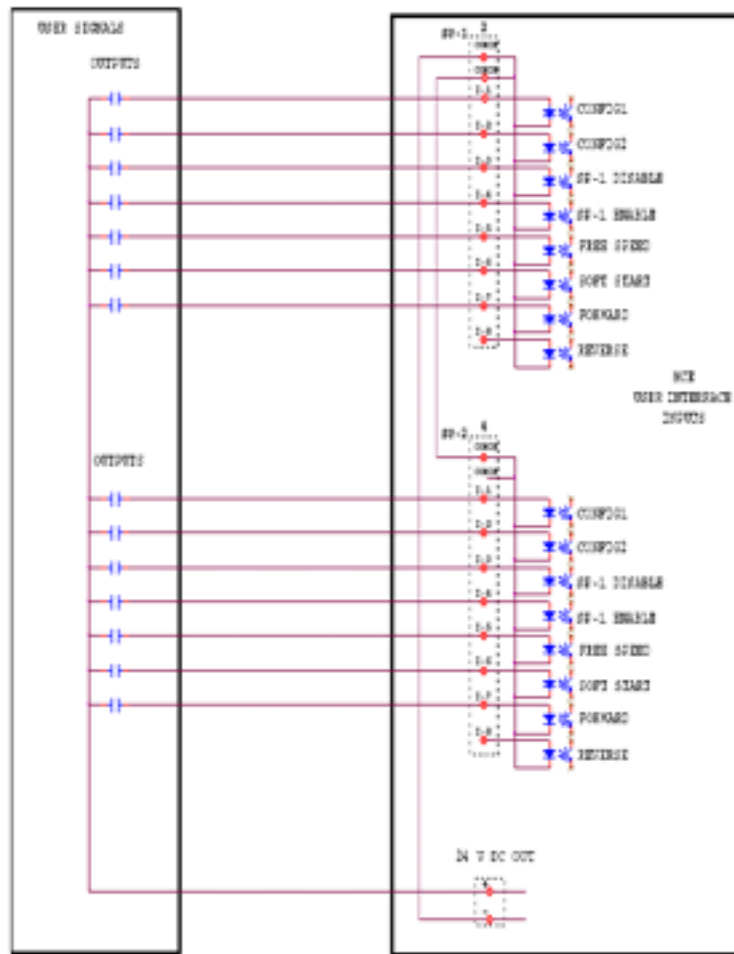


Figure 9 – Output Signal Drawing

1.3.3 Default Assignments of I/O

See [Pinout Tables](#) on page 60 for the default assignments.

1.3.4 Timing Diagrams

Content to be provided.

1.3.5 PLC Connection and Setup

NOTE: All connections to a PLC are made via the Insight's terminal blocks, except data collection. Data collection is done via the serial and/or Ethernet ports. For data collection, follow the procedures for setup via the serial or Ethernet port. To connect a PLC to the terminal blocks, see the procedure above.

Through the terminal blocks, a PLC can send and receive a variety of outputs to and from the Insight controller. It is important to always use a shielded cable for all PLC signals to

the Insight controller, and the shield should only be terminated at the controller end. All inputs and outputs are activated/received in the same way, as discussed above.

1.3.6 Socket Tray and Configuration Switch Connection and Setup

1. Connect the socket tray to the Insight controller's terminal blocks Connect Config 1 wire to the input assigned to Behavior Config 1, and so forth through Config 8.

NOTE: The Behavior (i.e., the assignment of function) for inputs and outputs is accomplished through the PC software.

2. Attach a tool to the Insight controller and turn the controller on using power switch on the front panel.
3. Go to the **Setup** menu and the **Spindle Setup** sub-menu screen.
4. If your socket tray has *more* than eight positions, select External Binary from the Config Select drop box.

If your socket tray has *eight* or *fewer* positions, select External Discrete from the Config Select drop box.

How to Test a Socket Tray

1. After you have connected and setup the device, go to the **Diagnostics** menu and the Discrete Inputs sub-menu screen.
2. As you lift each socket you should see the appropriate indicator light up on the screen, indicating activity on the configuration lines. (Note: If you selected External Binary in the Config Select drop box on the **Setup** menu's **Spindle Setup** screen, then the first four configuration lines will indicate the binary encoded number for the configuration selection, with 0000 indicating configuration 1 is selected.)

1.3.7 Light Box Connection and Setup

1. Locate the active wire colors for light boxes.
2. Connect the light box to the Insight controller's terminal blocks on the controller's left side with the appropriate accessory cable.
3. Ensure a tool is attached to the Insight controller and turn it on using the controller's power switch.

In a standard setup, the colored lamps indicate the following:

Red	Torque Hi and/or Angle Hi.
Green	Acceptable output.
Yellow	Torque Lo and/or Angle Lo.

1.4 Attaching Other Peripheral Devices

1.4.1 Printer Connections and Setup

NOTE: The Insight supports serial printers for printing E.O.R. (End of Run) data.

Serial Printer

1. Connect your printer via a standard 9-pin serial cable to a serial port located on the left side of the Insight controller labeled IOIOI.
2. On the **Setup** menu's **Serial Setup** sub-menu screen, select **EOR Data Out** from the **Protocol** dropdown.
3. Check that the settings for **Baud Rate**, **Parity**, **Bits Per Character**, and **# of Stop Bits** match those settings on the serial printer. Change the settings as necessary.
4. Turn on the printer and make sure it is on line.
5. Run a tightening and ensure that the tightening result is printed.

1.4.2 Bar Code Connection and Setup

Description

The bar code function allows the Insight IC controller to be connected to any serial ASCII bar code scanner. Each spindle can be equipped with its own scanner or, in the case of a powerhead, one scanner can be assigned to the powerhead. The bar code function has two main operating modes, Passive and Active. The choice of bar code mode, along with all bar code operational settings, is made in the PC software. See the PC software manual for more information on selecting this option.

Passive Bar Code Mode

In this mode bar code data is attached to EOR data and stored in the cycle log, but configurations are not selected via the bar code scan data.

Active Bar Code Mode

In this mode configurations are selected via the bar code scan data. The scan data is also attached to the EOR data.

Bar Code Setup

To setup the controller for bar code operation, follow the directions below.

1. Go to the **Setup** menu and select **Serial Setup**.
2. Go to the Protocol drop box and select "Bar Code."
3. Set the Baud Rate, Parity, # of Data Bits and # of Stop Bits to the same values as the Bar Code Scanner.

Bar Code Operation

When the bar code function is activated for a spindle, wherever the cycle data is sent (either field bus, cycle log report, EOR data or host data out), the bar code data is sent

with it. Upon bootup, if a cycle is run before a barcode is scanned then the bar code data is recorded as "No Bcode". When a barcode is scanned and is the valid length, then the scan data is recorded to all subsequent cycles until a new scan is initiated. If an invalid barcode is scanned, then "Invalid BC" is recorded as the scan data.

Removing Bar Code Operation

To remove bar code operation from a spindle, first go to the **Serial Setup** screen. Go to the drop box labeled **Protocol** and select **None**.

Bar Code Compatibility With Other Functions

Gang Count

Bar code operation functions fully with gang count. The scan data is attached to all cycles in the gang count. If ***Disable tool until scan*** is selected via programming in the PC software, the tool is disabled once the gang is complete. If a gang count needs to be reset, this must be performed through the Gang Reset Input or the **Run Main** screen. On the **Run Main** screen, press 0 (zero) and then **Enter**. A re-scan of a part does not reset the gang count.

Auto Increment

Auto increment operation does not function when ***Disable tool until scan*** has been selected. In all other cases both bar code and auto increment will operate together. One bar code scan allows all configurations in auto increment to operate when in active mode. The scan should be set up to select the first configuration in the auto increment chain.

Powerhead

For the barcode function to be used with a powerhead, the powerhead must be created first. Once the powerhead has been created, set up bar code operation for spindle number 1 in the powerhead. This assigns barcode operation to all the spindles in the powerhead. The scan data is added to all spindles in the powerhead.

Field Bus

A bar code scan can be added to tightening data on a DeviceNet or Profibus equipped Insight IC-D or IC-M. Use the PC software's field bus settings to specify where the scan data will come from. You have the option of sending the scan data to the controller via the field bus or via a serial port on the controller through a regular scanner. With a field bus equipped controller, the bar code always functions in the Passive mode (i.e., no configuration selection via bar code) and the "Disable tool until scan" option is not functional. This is because the field bus has control of the configuration selection and enable/disable tool functions.

1.5 E-Stop Connection

The Emergency Stop feature allows for a rapid tool shutdown (by the tool user) in an emergency situation.

An emergency stop switch may be wired to the connectors provided at the bottom of the connector panel. An E-stop for a single unit is connected to the controller's internal 24V power supply. When multiple controllers are wired together in a multiple-configuration cabinet, an external power supply is used to run the E-stop so that the power for the entire system is shut off when the E-stop is pressed.

E-stop is implemented via the Emergency Stop relay. The relay is normally energized. De-energizing it initiates E-stop. The relay has two outputs: 1, 24 VDC which is used by the MCE for controlling other relays that allow AC input voltage to be routed to the tool's bus voltage rectifier and 2, a voltage signal that is routed to the MCEs Control board processor to indicate that an emergency stop has occurred.

The E-stop relay coil terminals (+) and (-) are routed to jumper JP21 behind the I/O panel door. JP21 also has the module's internal 24 VDC power supply routed to it. The relay is energized by supply 24 VDC to the coil terminals at JP21. The 24 VDC can be supplied by an external power supply or the internal 24-volt power supply.

1.5.1 Single Spindle Operation

If the E-stop is being used, JP21 pin 2 (relay coil (-)) is routed to one contact of a remote (normally closed) SPST push button switch (PBS). The switch's other contact is routed back to JP21 pin 4. JP21 pin 1 remains connected to JP21 pin 3. If an emergency occurs the tool operator can depress the switch and the relay coil's low side voltage path will be interrupted. The E-stop can also be implemented by routing JP21 pins 1 and 3 to the remote switch. In this case, the relay coil's high side would be interrupted (JP21 pin 2 would have to be connected to JP21 pin 4).

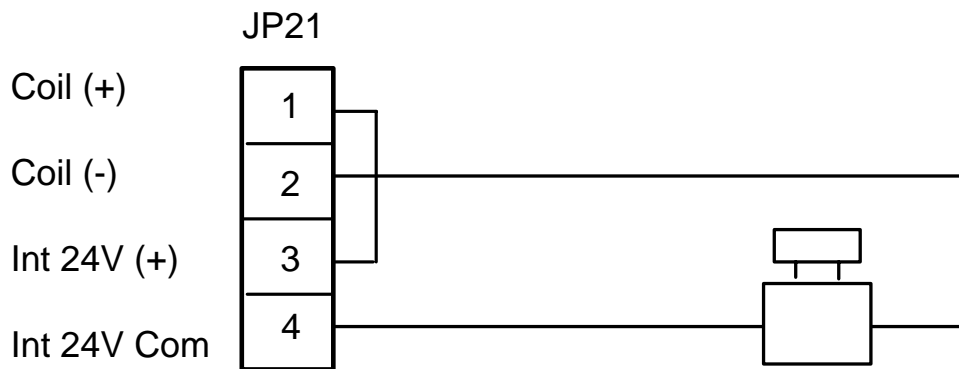


Figure 10 – E-Stop Connection, Single Spindle

1.5.2 Multi-Spindle Operation

If an E-stop is being used, an external 24-volt power supply is used to energize each of the module's Emergency Stop relays. Depressing the PBS (Palm Button Switch) now interrupts the current flow to the E-stop relay on all modules.

NOTE: Each relay coil requires 25 mA (nominal) of power supply current.

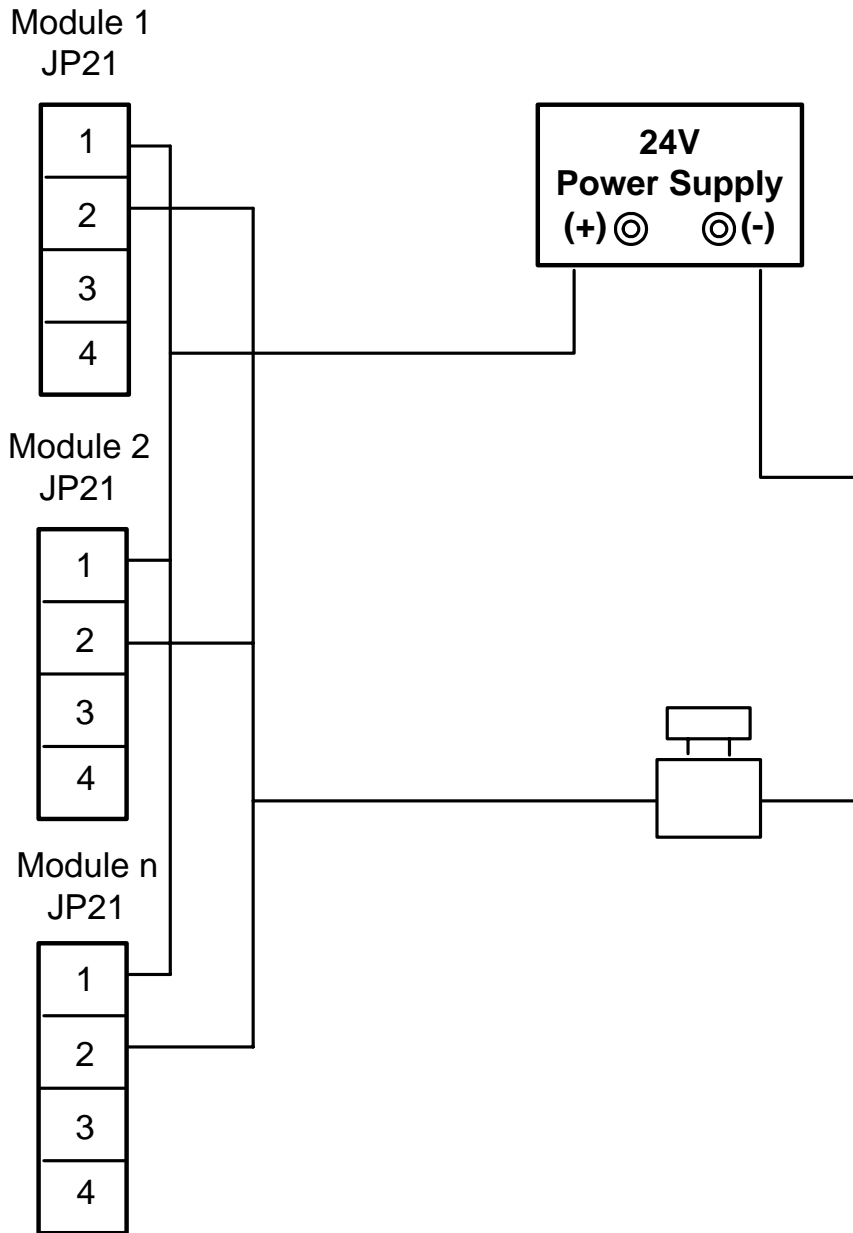


Figure 11 – E-Stop Connection, Multi-Spindle

1.5.3 E-Stop Not Present

If E-stop is not being used, the E-stop relay must still be energized to permit normal operation. This is accomplished by connecting JP21 pin 1 to JP21 pin 3 and JP21 pin 2 to JP21 pin 4. This allows the module's internal 24 VDC to energize the relay. The wiring is the same regardless of single or multi-spindle operation.

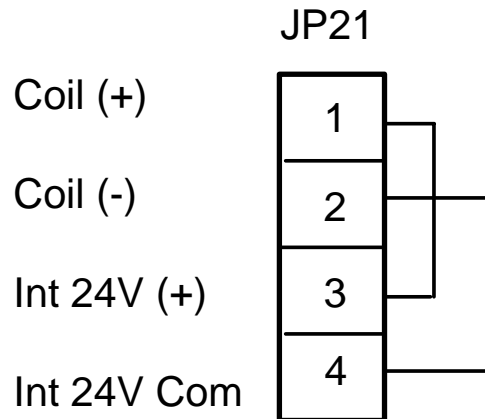


Figure 12 – E-Stop Not Present

1.6 Making Network Connections

1.6.1 Ethernet Connection

An **Ethernet** port can be found on the connector panel of the Insight unit. This port can be used to connect a PC to the unit so that programming changes can be made. When the PC is connected, this Ethernet connection can also be programmed to send data strings at the end of every tightening.

For changing local Ethernet settings on the unit, go to the **Setup** menu's **Ethernet Setup** sub-menu screen. On that screen, you can check that the settings for **IP Address**, **Subnet Mask**, and **Gateway** are correct. You can also turn Dynamic Host Communications Protocol (**DHCP**) On or Off on this screen. When DHCP is turned On, it allows the network server to set IP addresses for this unit.

1.6.2 Computer Connection and Setup via the Ethernet Port

NOTE: To connect a computer to the Insight controller you need the PC software.

1. Connect the controller to the PC via an Ethernet cable.
2. On the **Setup** menu's **Ethernet Settings** sub-menu screen, check that the settings for **IP Address**, **Subnet Mask**, and **Gateway** are correct.
3. If any settings need to be changed, press Enter on the Settings button to reach the Ethernet settings screen and make all required changes.

NOTE: The system must be re-booted before Ethernet set-up changes take effect.

1.6.3 Field Bus Card Connection

If equipped with the available optional card, the Insight can connect to a field bus network using either a Profibus or a DeviceNet card. Determine which, if any, of these field bus cards is installed in your system.


If you have DeviceNet attached, use the following table to arrange your field bus connectors:

Pluggable Connector	Screw Terminal	Description
1	1	V-
2	2	CAN_L
3	3	SHIELD
4	4	CAN_H
5	5	V+

If you are using Profibus, simply plug in the DB-9 cable connector to the Insight unit.

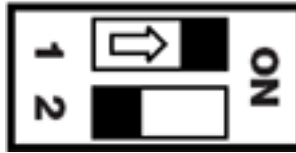
1.7 Powerhead Setup

A group of Insight units synchronized together to perform a multiple bolt tightening task is called a **Powerhead**. If you are arranging a series of Insight controllers together in this way, you must link them in a “daisy chain” fashion to create a **Powerhead Synchronization Bus**. These can comprise up to 40 Insight controllers. You must also set each controller’s two rotary address switches depending on its location in the chain.

1. On the first Insight controller in the powerhead, the top rotary switch must be set to 0, while the bottom switch is set to 1.
2. Connect a powerhead synchronization cable to the bottom powerhead connector on the first controller. 
3. Connect the other end of the same cable to the top powerhead connector on the second unit in the chain.
4. On the second controller, set the top rotary switch on the second unit to 0, with the bottom switch set to 2.
5. Continue using this same pattern of cabling and rotary settings up to 40 units.

NOTE: The top rotary switch is set to 1 for units 10-19, 2 for units 20-29, 3 for units 30-39, and 4 for unit 40.

6. Set the terminal block for the last unit in the chain to 1 **On** and 2 **Off**, as shown below.



NOTE: All other units in the powerhead should be set to 1 **Off** and 2 **Off**.

1.8 Initial Startup

Before starting the Insight 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 checklist, contact Ingersoll-Rand.

- The Insight controller enclosure is vertical, level, and securely mounted.
- Ensure that the spindle is attached, and that the spindle connector is locked down.
- If the Insight is equipped for attaching external devices (printers, computers, etc.), the proper devices have been attached to the appropriate ports in the connector panel (located on the controller's left side).
- The AC power cord is plugged into a properly rated electrical circuit. (See the Precautionary Information at the beginning of this manual.)

1.8.1 Startup Procedures

Once the above checklist is verified, you are ready to power-up the Insight Fastening System.

1. Turn the Insight **Circuit Breaker Switch** to **Off**.
2. Ensure the unit is plugged into the appropriate power outlet: 120V, 16A or 230V, 8A; 50-60Hz.
3. Ensure the **GFI** (Ground Fault Interrupt) is switched to the On (up) position.
4. Switch the Insight **Circuit Breaker** switch up to the **On** position. This switch sends power to the internal Motor Controllers, the graphics display, the keypads, and to the spindle(s) or powerhead.
5. The **Run Main** screen is displayed on the graphics display panel, indicating the startup was successful and the Insight IC is ready to operate.
 - If you need to turn the entire Insight system on or off use the **Circuit Breaker Switch**.
 - After powering down, wait at least five seconds before powering up again.

Section 2 – Programming

2.1 Setup Menu

The **Setup** menu and its sub-menus are used to program tightening strategies and to set a broad variety of important system parameters. Basic tightening strategies are created in the **Setup** menu. In addition to strategies, you can use the **Setup** menu to set many basic system parameters, such as time, display language, measurement units, and communications protocols. The **Setup** menu is also used to create passwords for controlling access to Insight's software and data records. There are five different sub-menus under the **Setup** menu: **1. Quick Setup**, **2. System Setup**, **3. Spindle Setup**, **4. Serial Setup**, and **5. Ethernet Setup**. The following sections covers each of these sub-menus in detail.

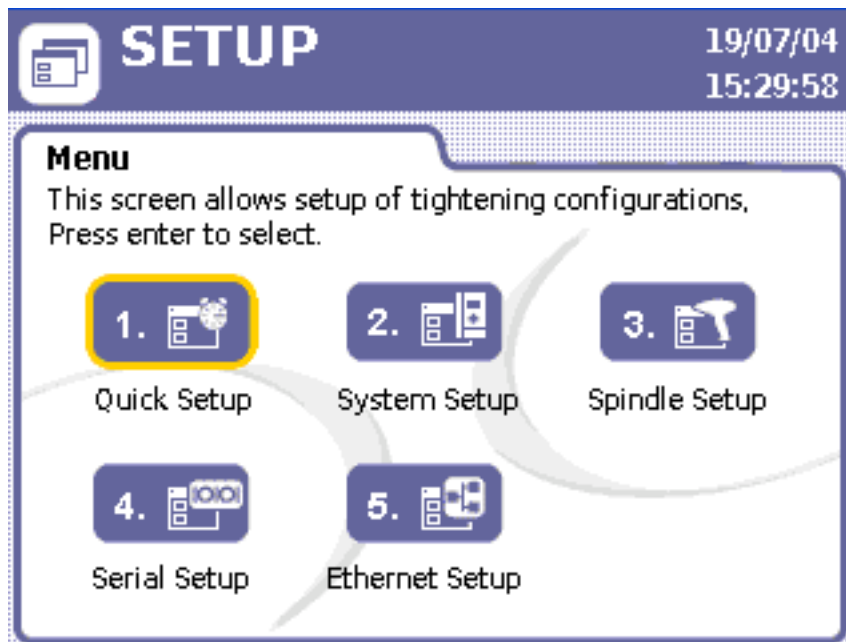


Figure 13 – Setup Menu

2.2 Quick Setup Procedure

2.2.1 Select Language

The first step in programming the Insight to operate for your requirements, is to select the language that is used in the graphical display. Language is selected by going to the **Setup** menu's **System Setup** screen. The **Language** parameter is the eighth item listed on this screen. Push the expand button to select the language you wish to use while operating the Insight IC-D. The default language is English.

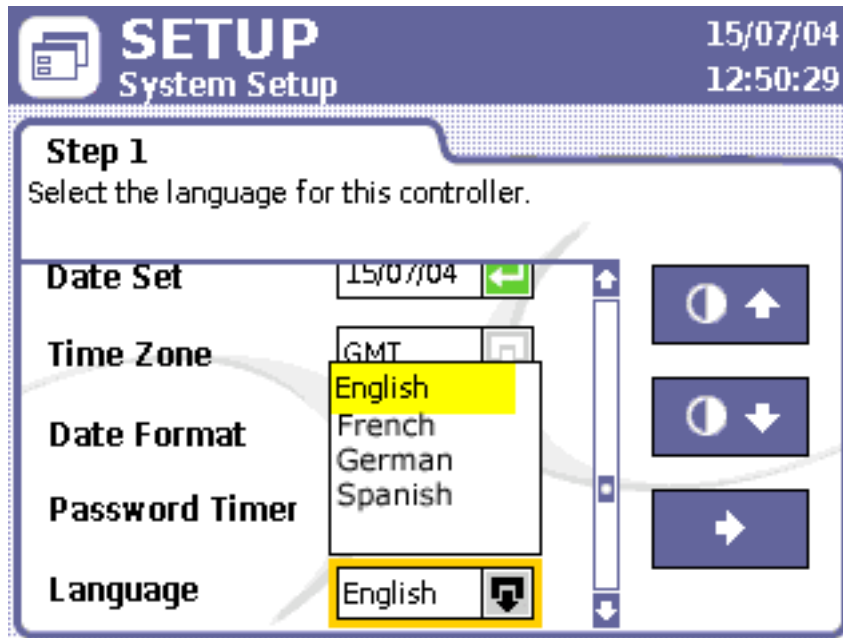


Figure 14 – Language Selection

2.2.2 Quick Setup Programming

This menu screen is used to get you up and running quickly. Single-step torque control and angle control fastening strategies can be set up from this screen. Only basic fastening parameters are displayed with this screen. If a more complex, multi-step strategy or other strategies are needed--such as yield or drag torque--they can be programmed through the PC software. Only the first eight configurations can be viewed and programmed from the controller. The PC software allows you set up a maximum of 256 configurations.

The **Quick Setup** screen allows you to set key parameters for your tightening strategy. You may pre-program up to eight separate tightening operations. These are called Configurations. The parameters displayed on the screen vary, depending upon the fastening strategy selected.

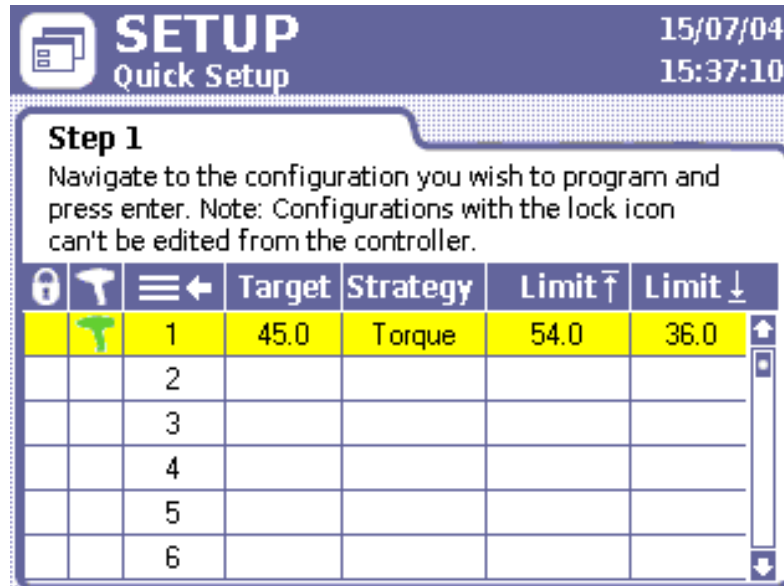



Figure 15 – Quick Setup Screen

To complete the parameters in the **Quick Setup** sub-menu:

1. Press the **Setup** menu button, then press enter to choose the first sub-menu, **Quick Setup**.
2. Use the arrow keys to move to one of the eight lines representing configurations 1 through 8.
3. Press Enter to bring up the Step 2, the first of two data entry screens used for setting up a configuration.
4. Move to the **Strategy** parameter and select either **Torque Control** or **Angle Control**.
5. Select a direction **CW** (Clockwise) or **CCW**.(Counter-clockwise).
6. Move to the next parameter on the screen and choose **Torque Units: Nm, Ft-lbs, In-lbs, or Kg-m**.
7. Choose the button with the right arrow and hit **Enter** to move to the second page of the configuration setup process.
 
8. Using the numeric keypad, enter the desired target value for your fastening operation into the **Torque Target** or **Angle Target** data entry box, depending on which of the two strategies you selected for a particular configuration.
9. The Insight software automatically assigns values within target limits to the other torque or angle control parameters displayed on this screen. If you want to edit any

of these values, navigate to the data entry box and enter a new value using the numeric keypad. These parameters include:

Torque High Limit	The maximum acceptable torque value for a fastening.
Torque Low Limit	The minimum acceptable torque value for a fastening.
Angle High Limit	The maximum acceptable angle through which the fastener may turn.
Angle Low Limit	The minimum angle through which the fastener must turn.
Torque Threshold	The torque required to seat components in the joint; also the torque point at which angle begins to be measured.
Free Speed	The maximum speed the tool can turn during fastening.
Shiftdown Point	The point during the final stage of tightening at which the tool shifts to a lower speed to improve accuracy.
Shiftdown Speed	The tool speed during the shiftdown phase.

10. If the assembly requires that multiple bolts are fastened in sequence, enter a **Gang Count** in the applicable data entry box. See below for more information on Gang Count.
11. If you wish to setup the Insight to move through a specific sequence of fastening configurations, use the **Auto Increment** parameter. Enter the number of the configuration you wish the Insight to use upon completion of the current configuration. See below for more information on Auto Increment.
12. Enter an **Increment Reset** parameter to indicate which configuration the Insight should use after a Configuration Reset Signal is received.
13. After you have completed entering all the parameters for your configuration, you must go the Save button and hit Enter to store the settings you just entered.



Save Button

Gang Count

Some assemblies have multiple bolts that must be fastened in sequence (called a "Gang"). For example, if you have a four-bolt assembly you can set the Gang Count to 4. The controller then keeps track of each fastening and, when all four fastenings have been completed within specification, a "Gang Complete" message appears on the display screen.

If the Gang Count is successfully completed, in addition to displaying "Gang Complete" on the screen, the controller provides a gang complete output signal on the spindle's I/O connector. There are two ways to reset the Gang Count.

1. Use the dedicated reset palm switch on the Gang Reset Input.
2. While on the **Run Main** screen, press 0 (zero) and then the **Enter** key to reset the Gang Count for the spindle.

Auto Increment

Auto Increment allows the Insight to move through a specific sequence of fastening configurations. For example, if you have programmed six different configurations

numbered 1 – 6, you can instruct the Insight to perform fastening in the sequence 1-4-6 and 2-3-5. By using this parameter to tell the Insight which configuration to go to next, the system continues to step through all programmed configurations in the Auto Increment chain. The **Increment Reset** parameter tells the Insight which configuration to use when the Configuration Reset Input is activated.

2.2.3 Start Mode and Config Select

The final two steps in the quick setup procedure are done on the **Spindle Setup** screen, where you must set the **Start Mode** and **Config Select** parameters before you begin to operate the Insight controller. For information on setting these parameters, see [Spindle Setup Screen](#) on page 31.