

**OPERATION AND
INSTALLATION GUIDE
FOR
990-SM10
PORTABLE SMART
MANUFACTURING
LEARNING SYSTEM
(Allen-Bradley Micro820)**



D19405-AA00UEN

INTRODUCTION

The purpose of this operation and installation manual is to provide you with the steps necessary to set up, test, and operate the Amatrol 990-SM10 Portable Smart Manufacturing Learning System.

This process is outlined in the following sections of this manual:

1. Parts Inventory/Identification
2. Hardware Setup
3. Software Installation/Configuration
4. Operation and Testing Procedures

FIRST EDITION, REV. A

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SECTION 1

Parts Inventory/Identification

The first step in setting up your learning system is to inventory each component and make sure everything is present.

OVERVIEW

This section has two parts. Part 1 is the inventory procedure to use to check out your equipment. Part 2 includes the pictures and descriptions of each component.

PART 1 INVENTORY PROCEDURE

1. Use the purchase order to determine the product(s) that your organization has purchased.
2. Locate, in the appendix of this manual, the installer checklist(s) for the 990-SM10 Smart Manufacturing Learning System.
3. Verify that all items were received.

NOTE

Please report any missing items or damaged components within 10 days. Save cartons if components are damaged. Amatrol will not be responsible after this period.

4. In addition to the equipment provided by Amatrol, the 990-SM10 Portable Smart Manufacturing Learning System requires these user-supplied items:

USER-SUPPLIED ITEMS	
ITEM	DESCRIPTION
Power	110-240 VAC, 50/60 Hz, single-phase power outlet
Computer	Recommended System Requirements: <ul style="list-style-type: none"> ▪ Intel Core i5 2.4 GHz Processor ▪ 8 GB RAM ▪ 20 GB free hard drive space ▪ Windows Operating System (Windows 10 64-Bit or above) ▪ Sound card (or onboard sound) ▪ DirectX 9 graphics device with WDDM 1.0 or higher driver ▪ Windows Media Player 10 ▪ CD-ROM drive for installing curriculum if locally installed ▪ Three USB ports (2.0, 3.0, or 4.0) ▪ Wi-Fi capability ▪ Internet access
Computer Monitor	Recommended Requirement: <ul style="list-style-type: none"> ▪ One HDMI port
Keyboard	Must be able to connect through USB port
Computer Mouse	Must be able to connect through USB port

PART 2 DESCRIPTION OF SYSTEM COMPONENTS

The 990-SM10 Portable Smart Manufacturing Learning System includes the major components listed in the following chart.

990-SM10 SMART MANUFACTURING LEARNING SYSTEM		
PART NUMBER	DESCRIPTION	QTY.
A220121	990-SM10 Final Assembly	1
43101	USB Bluetooth Adapter	1
43100	Bluetooth Scanner, 990-SM10	1
43105	Wi-Fi Temp Sensor and Power Supply, 990-SM10	1
43130	Fastener, 20 mm Bolts, 15 pcs	1
43131	Fastener, 25 mm Bolts, 15 pcs	1
43132	Fastener, 30 mm Bolts, 15 pcs	1
20704	Cable, Cat 5E, 14 ft. (4.3 m), Gray	1
25102	IEC Power Cord, 14/3, 15 A	1
K19405-AA00UEN	Print CD	1
D19405-AA00UEN	Operation and Installation Guide, 990-SM10	1
S19405-AA00UEN	Supplemental Disk, 990-SM10	1

OTHER REQUIRED ITEMS	
PART NUMBER	DESCRIPTION
25185	CCW – Connected Components Workbench Version 13
82-711	FactoryTalk View Studio – Machine Edition Version 11

OPTIONAL ITEMS	
PART NUMBER	DESCRIPTION
43110	Remote Current Sensor, 990-SM10

A220121 990-SM10 FINAL ASSEMBLY

The A220121 990-SM10 Final Assembly includes a workstation console and one Rockwell Micro820 PLC, shown in figure 1.



Figure 1. Portable Smart Manufacturing Assembly

43101 USB BLUETOOTH ADAPTER

The 43101 USB Bluetooth Adapter plugs into an open USB port on the PC. The USB Bluetooth Adapter allows the PC to make Bluetooth a connection with the Bluetooth scanner. The 43101 USB Bluetooth Adapter is pictured below and is identified in figure 2.



Figure 2. USB Bluetooth Adapter

43100 BLUETOOTH SCANNER

The 43100 Bluetooth Scanner is paired with the PC via a Bluetooth connection to the USB Bluetooth Adapter. The Bluetooth scanner is the tool used to change part types in the Production Quantity Application. The 43100 Bluetooth Scanner is pictured below and is identified in figure 3.



Figure 3. Bluetooth Scanner

43105 WI-FI TEMP SENSOR AND POWER SUPPLY

The 43105 Wi-Fi Temp Sensor, shown in figure 4, is attached to the workstation panel but is a removeable sensor. The Wi-Fi Temp Sensor pairs with the BorgConnect Hub via a wireless connection. The Wi-Fi temperature/humidity sensor transmits temperature and humidity data for the BorgConnect Dashboard MQTT Sensor Application. The Wi-Fi temperature/humidity sensor also comes with a power supply for remote setup.



Figure 4. Wi-Fi Temp Sensor

43130 FASTENER PACKAGE

The 43130 Fastener package contains (15) 20 mm bolts. The package provides common fasteners for the purpose of counting through weight measurement activities. The 43130 Fastener package is shown in figure 5.



Figure 5. 43130 Fastener Package

43131 FASTENER PACKAGE

The 43131 Fastener package contains (15) 20 mm bolts. The package provides common fasteners for the purpose of counting through weight measurement activities. The 43131 Fastener package is shown in figure 6.



Figure 6. 43131 Fastener Package

43132 FASTENER PACKAGE

The 43132 Fastener package contains (15) 30 mm bolts. The package provides common fasteners for the purpose of counting through weight measurement activities. The 43132 Fastener package is shown in figure 7.



Figure 7. 43132 Fastener Package

20704 CAT 5E CABLE

The 20704 Cat 5E Cable provides a communication interface between the unmanaged Ethernet switch and your local network. The 20704 Cat 5E Cable is shown in figure 8.



Figure 8. 20704 Cat 5E Cable

25102 IEC POWER CORD

The 25102 IEC Power Cord provides power to the Portable Smart Manufacturing System. The 25102 Power Cord is listed below and identified in figure 9.



Figure 9. 25102 IEC Power Cord

K19405-AA00UEN PORTABLE SMART MANUFACTURING INSTRUCTOR'S RESOURCE PRINT CD

The K19405-AA00UEN Portable Smart Manufacturing Instructor's Resource Print CD is shown in figure 10. The instructor's resource print CD contains printable versions of the nine hands-on activities for this unit (L19405-AA01UEN) and the operation and installation guide (D19405-AA00UEN).



Figure 10. The K19405-AA00UEN Instructor's Resource Print CD

D19405-AA00UEN PORTABLE SMART MANUFACTURING OPERATION AND INSTALLATION GUIDE

The D19405-AA00UEN Portable Smart Manufacturing Operation and Installation Guide is the manual that you are now reading.

S19405-AA00UEN PORTABLE SMART MANUFACTURING SUPPLEMENTAL DISK

The S19405-AA00UEN Portable Smart Manufacturing Supplemental Disk is shown in figure 11. The supplemental disk provides PLC and HMI files to install on the PC to supplement the curriculum.

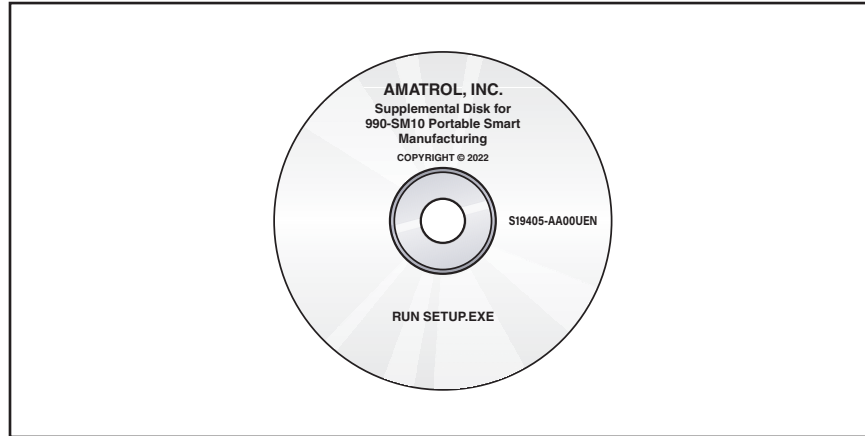


Figure 11. S19405-AA00UEN Portable Smart Manufacturing Supplemental Disk

43110 OPTIONAL REMOTE CURRENT SENSOR

The optional 43110 Remote Current Sensor connects between a separate device/machine and its power source to enable the 990-SM10 workstation to monitor power use of devices/machines not mounted to the workstation. The optional Remote Current Sensor is connected by an analog signal cable to the 990-SM10 workstation. The remote current sensor sends an analog signal to the workstation that represents the current draw of the device/machine. The 43110 optional Remote Current Sensor is pictured below and is identified in figure 12.



Figure 12. Optional Remote Current Sensor

SECTION 2

Hardware Setup

OVERVIEW

In this section, you will install and set up the hardware required for the 990-SM10.

NOTE

This hardware setup requires no tools.

HARDWARE SETUP	
Section	Hardware
2.1	Portable Smart Manufacturing Assembly Setup
2.2	Portable Smart Manufacturing Assembly Familiarization
2.3	BorgConnect Hub Setup
2.4	Wi-Fi Temperature/Humidity Sensor Setup
2.5	USB Bluetooth Adapter Setup
2.6	Bluetooth Scanner Setup

SECTION 2.1

Workstation Setup

1. Place the Portable Smart Manufacturing Workstation on a table near the PC that will serve as the workstation's programming terminal.
2. Perform the following substeps to remove the protective cover from the 990-SM10. It is typically useful to have an assistant for this step.
 - A. Lay the portable workstation on its back so that the wheels and handle are resting on the tabletop.



Figure 13. Portable Smart Manufacturing Assembly in Shipping Setup

- B. Locate the workstation's keyed latches, also shown in figure 13.
There are a total of six latches.
- C. Lift one of the keys from its recessed/protected position and turn it counterclockwise to unfasten. Repeat this step as necessary to free the workstation's cover.



Figure 14. Portable Smart Manufacturing Assembly Latch Unfastening

- D. Open the cover and locate the workstation's removable hinge pin.
- E. Locate the hinge pin's pull/lock and turn it to make it accessible.



Figure 15. Portable Smart Manufacturing Assembly Hinge Pin Pull/Lock

- F. Pull the pin along its axis, and away from the case to remove. It may be difficult to remove the pin. This is where an assistant comes in handy.
- G. Place workstation in position for use next to PC to prepare it for connections.



Figure 16. Portable Smart Manufacturing Assembly and PC

- H. Once removed, store the cover and hinge pin for later use.

3. Perform the following substeps to connect the PC to the workstation.
 - A. Connect the 20704 Cat 5E Cable to the PC's Ethernet NIC card and to an open port on the unmanaged Ethernet switch, as shown in figure 17.

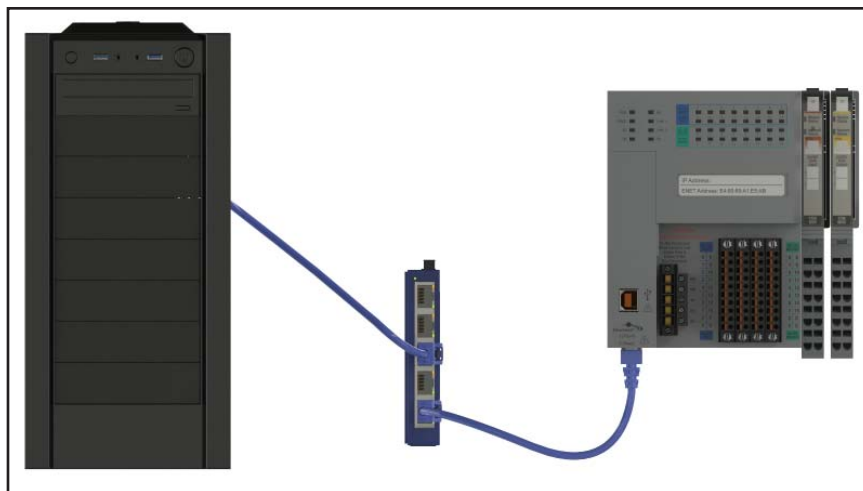


Figure 17. PC to PLC Connection Diagram

- B. Verify that a CAT 5E cable is connected to the PLC and the switch, as shown in figure 17.
- C. Verify that a CAT 5E cable is connected to the BorgConnect Hub and the switch, as shown in figure 18.

The unmanaged Ethernet switch provides connections between the PC, PLC, and if desired, network, as shown in figure 18. Connecting to the network, however, requires the user to allocate and set up static IP addresses for their control hardware.



Figure 18. PC, PLC, and the Workstation Connected to Local Area Network

- 4. Perform the following substeps to connect the power cord for the 990-SM10 workstation.
 - A. Verify that the workstation's main power switch is in the OFF position.



Figure 19. Workstation Main Power Switch

- B. Plug the 25102 IEC Power Cord into the workstation's IEC connection and to an AC wall outlet, as shown in figure 20. Do not power up the workstation yet.



Figure 20. Power Connections

5. Proceed to section 2.2 to continue setup.

SECTION 2.2

Portable Smart Manufacturing Learning System Familiarization

1. Position yourself in front of the 990-SM10 Smart Manufacturing system shown in Figure 21.

The 990-SM10 Workstation has five main components for learning smart manufacturing systems: load cell, AC current sensor, heater/cooling fan, vibration motor, and Wi-Fi temperature/humidity sensor. These five components will help you learn how technology-driven sensors help to observe and automate manufacturing performance through data collection and analytics.

The load cell measures fastener weight for calculating quantity. The AC current sensor measures the power used by the workstation. The heater and cooling fan are used to simulate heating and cooling systems. The vibration motor is used to simulate motor alignment or mechanical problems that is monitored by a vibration sensor. The Wi-Fi temperature/humidity sensor is used to measure ambient air on the workstation or remotely.



Figure 21. 990-SM10 Smart Manufacturing System

2. Perform the following substeps to locate the system components of the 990-SM10 Workstation.

- A. Locate the Unmanaged Ethernet Switch.

The unmanaged Ethernet switch is used to connect Ethernet ports of multiple devices, such as the PLC and BorgConnect Hub, through one network connection. The network is the pathway between two or more computers to share data, files, resources, or communications.



Figure 22. Unmanaged Ethernet Switch Network

- B. Locate the programmable logic controller (PLC).

A programmable logic controller (PLC) is an industrial computer control system that monitors analog and/or digital input signals and uses a custom program to make decisions to change the state of output devices.

C. Locate the BorgConnect Hub.

The BorgConnect Hub is being used here to collect data, store data short term, and to display data on a PC using the BorgConnect Dashboard software.

The BorgConnect Hub is a computer system that communicates through wired Ethernet, Bluetooth, and Wi-Fi connections. On the 990-SM10 workstation, the BorgConnect Hub uses a wired Ethernet connection with the PLC and PC, a Bluetooth connection with the Bluetooth scanner, and a Wi-Fi connection with the BorgConnect Node, and Wi-Fi temperature/humidity sensor.

D. Locate the BorgConnect Node.

The BorgConnect Node collects data from wired analog sensors, converts the data to digital signals and transmits the data to the BorgConnect Hub. The Node can connect to up to six analog input sensors, three current inputs and three voltage inputs. The three current inputs operate in a range 0 mA to 50 mA and the three voltage inputs operate in a range of 0 V to 5 V. The BorgConnect Node provides wireless or wired Ethernet communications to the BorgConnect Hub.

On this Workstation, the BorgConnect Node is wired to the load cell, AC current sensor, vibration sensor, and User inputs 1, 2, and 3, as shown in figure 23.

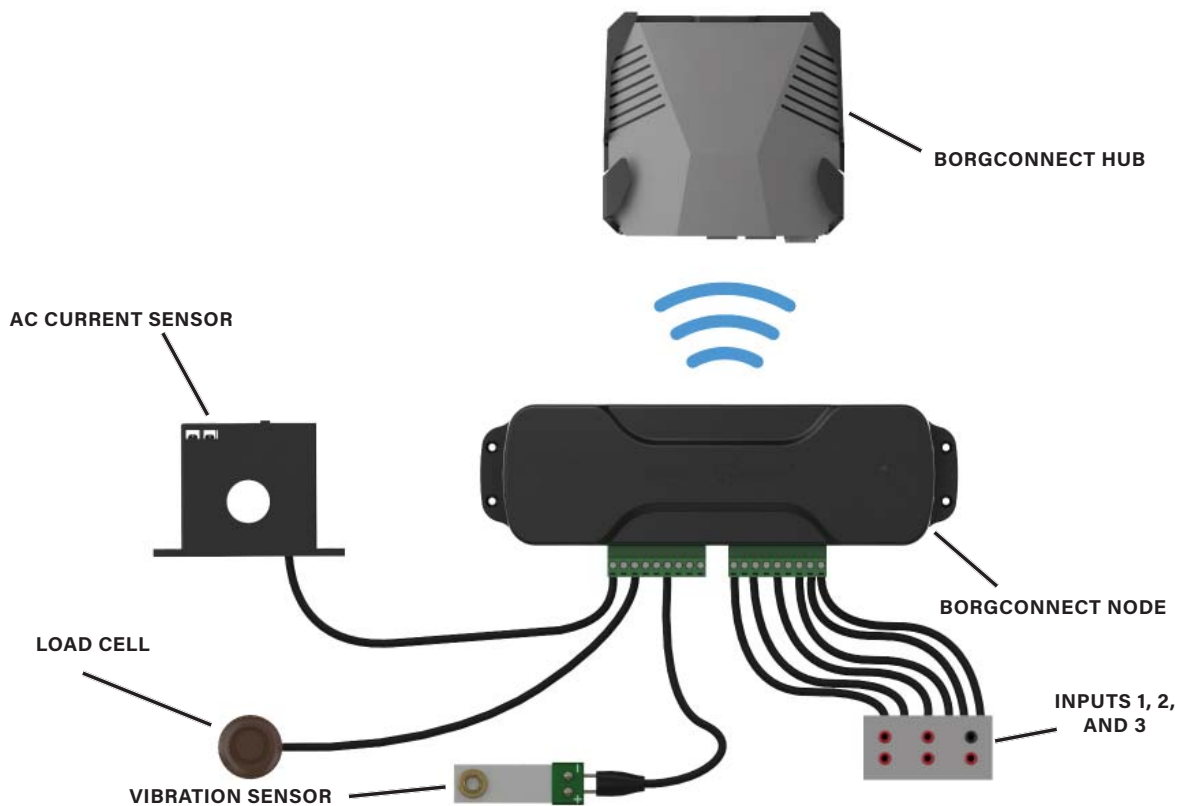


Figure 23. BorgConnect Node Connections

E. Locate the Vibration Motor.

The vibration motor is used to demonstrate vibration sensor data. Vibration monitoring can help to identify mechanical failures before they become mechanical breakdowns. The strength of the vibrations experienced by the vibration sensor is monitored in the BorgConnect Dashboard software using the Motor Vibration Monitoring application.

F. Locate the Interlock Door.

The interlock door works as a safety door to protect people around the motor. When the door is opened, the door switch sends a signal to the PLC, causing the motor to stop. While the interlock door is open, the motor cannot be started. Once the interlock door is closed, the door switch will signal the PLC to allow the motor to be started again.

This door uses an inductive sensor, which is wired to a 24 V digital input of the PLC.

G. Locate the Wi-Fi Temperature/Humidity Transmitter.

The Wi-Fi Temperature/Humidity Transmitter connects through a single cable on the side of the transmitter to wired analog temperature and humidity sensors. This transmitter uses an MQ Telemetry Transport (MQTT) protocol to stream ambient air temperature and humidity sensor data to the BorgConnect Hub through a wireless connection. The MQTT protocol is an efficient and lightweight messaging/data transport between Internet of Things (IoT) devices like the temperature transmitter. The sensor data can be viewed on the BorgConnect Dashboard software.

The Transmitter panel mounting is designed so it can easily be removed and moved to a different location than the Workstation. Its Wi-Fi communications allow it to stream data to the hub from a remote location.



Figure 24. Wi-Fi Temperature/Humidity Transmitter and Sensor Setup

H. Locate the wired Temperature / Humidity Sensors, which measure the ambient air temperature and humidity at the workstation, shown in figure 24.

These sensors are combined in a single unit and connected to the Wi-Fi Temperature Transmitter through a cable.

I. Locate the AC Current Sensor.

The current sensor uses a current transformer to measure the power consumed by the system. This current sensor measures incoming power to the entire 990-SM10 Workstation.

The transformer outputs an analog voltage signal that is measured to determine the current that passes through the system.

Amatrol also offers an optional 43110 remote current sensor that can be used to measure the current of devices outside of the workstation.

J. Locate the Load Cell / Parts Counter.

The load cell uses strain gauges to measure force. For this workstation, the voltage signal from the load cell is converted into weight in grams. By determining the weight of one fastener, a larger quantity can be weighed, and a quantity can be calculated.

$$\text{Total Quantity} = \frac{\text{Total Weight}}{\text{Fastener Weight}}$$



Figure 25. Load Cell Setup for Measurement

K. Locate the Bluetooth Scanner as shown in figure 26. This is a loose item, not attached to the system.

The Production Quantity App in the BorgConnect Dashboard software uses the Bluetooth scanner to scan a barcode printed on a sheet of paper that identifies the type of fasteners being counted. The Bluetooth scanner transmits the data of the barcode scanned of a given fastener to the BorgConnect Hub via a wireless Bluetooth communication.

To count parts, fasteners are added to the parts counter hopper. The Production Quantity App then uses the scanned data and the unit weight of the given fastener to calculate parts count.



Figure 26. Bluetooth Scanner

L. Locate the Indicator Lights.

There are five indicators, each a different color: red, yellow, green, blue, and white. These indicators are wired to 24 VDC PLC digital outputs and can be controlled by the PLC logic program. They are used for different applications to indicate the status of the application.

M. Locate the Operator Controls.

These operator controls allow the user to send inputs to the PLC for user designed activities. Switch 1 (SS1), Switch 2 (SS2), Push Button 1 (PB1), and Push Button 2 (PB2) are wired to 24 VDC digital PLC inputs. The potentiometer 1 (POT 1) is wired to an analog PLC input.

N. Locate the User Inputs IN 1, 2, and 3.

These user inputs are wired to the BorgConnect Node to collect analog data from external analog input devices. External devices are connected to these inputs through pairs of jacks on the front of the panel. IN 1 and IN 2 are current inputs, with a range 0 to 50 mA. IN 3 is a voltage input with a range of 0 to 5 V. IN 3 is also the designated connection for the optional Amatrol Current Sensor 43110.

O. Locate the Cooling Fan and Heater.

The cooling fan motor and heater are all controlled by the PLC 24V digital outputs. The heater and cooling fan are used to raise and lower the internal temperature of the workstation.

The heater uses a resistor that is built into a metal block mounted behind the panel and is in line with the flow of air from the fan.

A thermistor temperature sensor is also attached to the heater assembly and wired to the PLC analog input. The PLC uses the signal from the thermistor to determine the temperature and when to turn the fan and heater on.

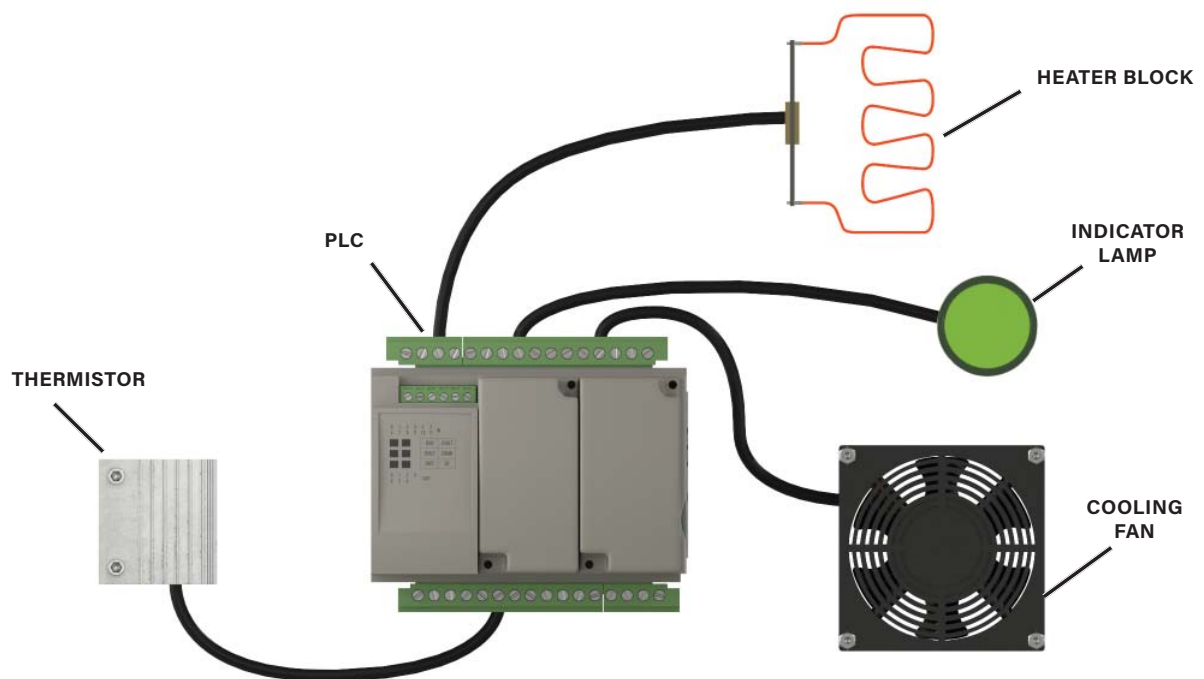


Figure 27. Network Connection Diagram

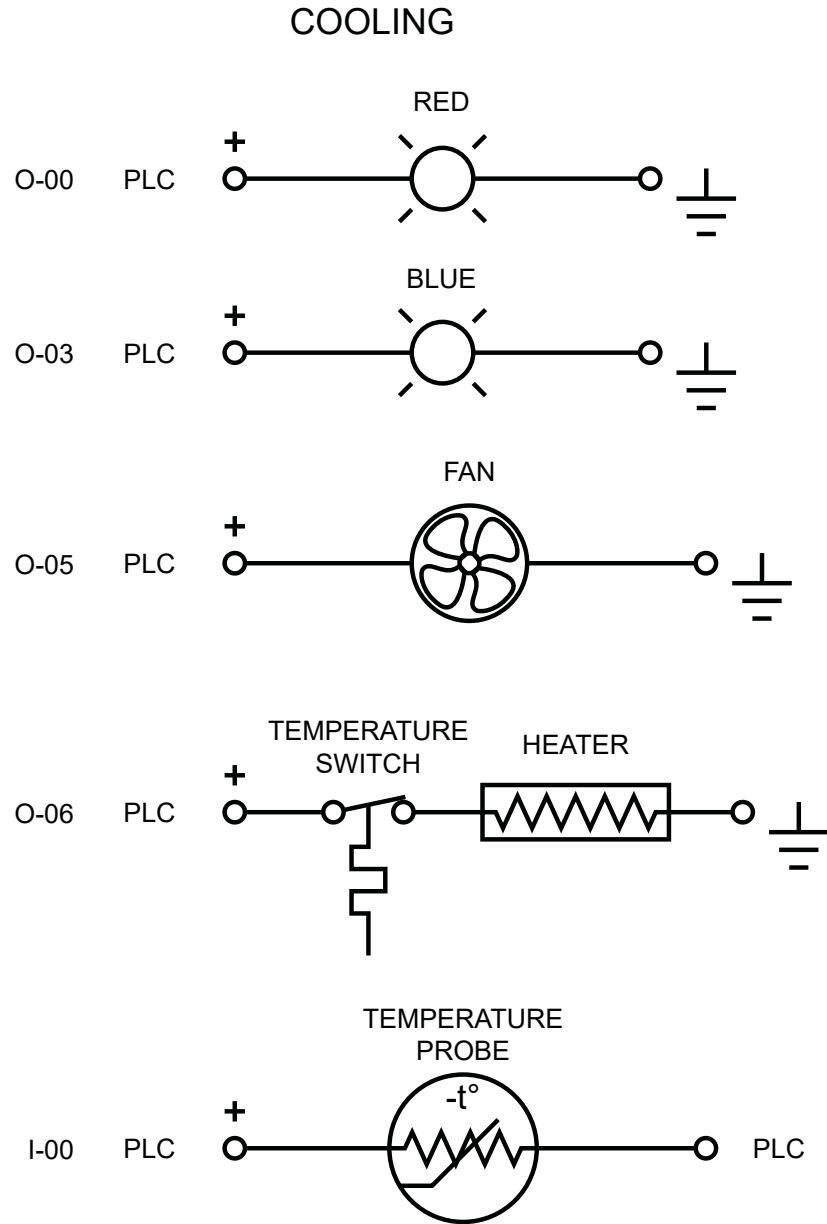


Figure 28. IO Wiring Diagram

3. Proceed to section 2.3 to continue setup.

SECTION 2.3

BorgConnect Hub Setup

OVERVIEW

The BorgConnect Hub is the central computing device that collects data via wired and wireless methods from sensors, the PLC, and the BorgConnect Node. The BorgConnect Hub converts the data into a usable format that can be displayed to users via the BorgConnect Dashboard. In this section, you will be connecting the hub to the PC with a Wi-Fi connection. After establishing the connection, you will connect to the BorgConnect Dashboard that will be used in the hands-on activities 5 through 9.

1. Turn on the workstation power switch, as shown in figure 29.



Figure 29. Workstation Power Switch ON

2. Perform the following substeps to connect the PC to the BorgConnect Hub using a Wi-Fi connection.



Figure 30. BorgConnect Hub

- A. Press the power button on the BorgConnect Hub to turn the device ON.



Figure 31. BorgConnect Hub Power Button

- B. In the Window search bar of the PC, enter Show Available Networks. This will cause a search window, similar to what is shown in figure 32. From that window, select the matching result similar to figure 32.

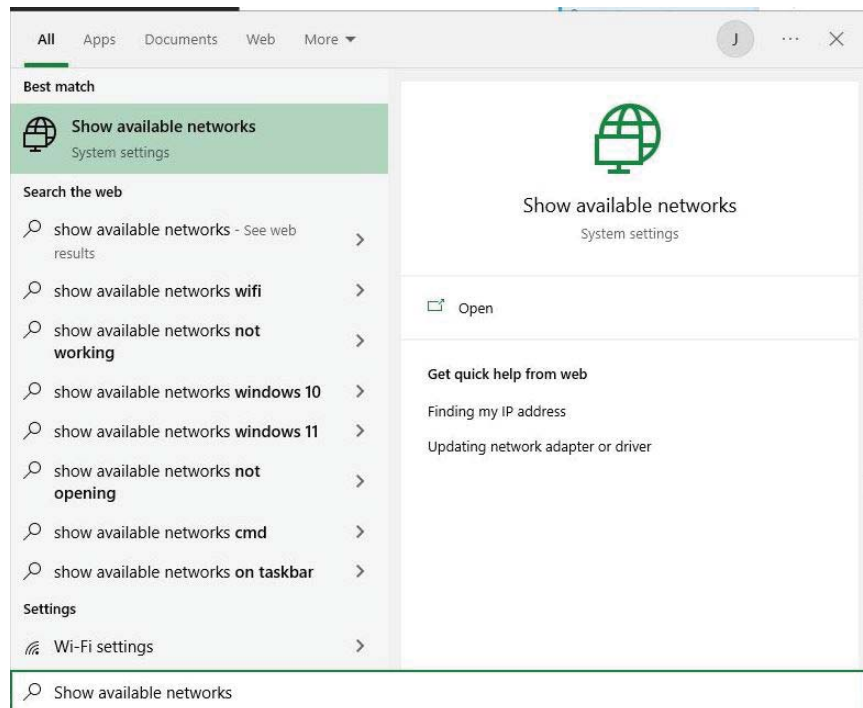


Figure 32. Show Available Networks

- C. On the Settings window that opens, similar to figure 33, click on *Show available networks*.

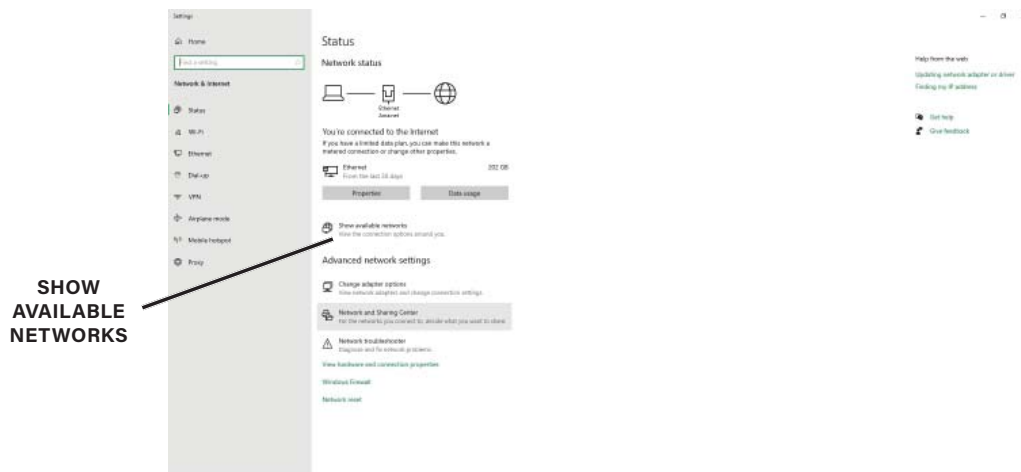


Figure 33. Settings – Status

A window will open in the bottom right of the screen showing available networks similar to figure 34.

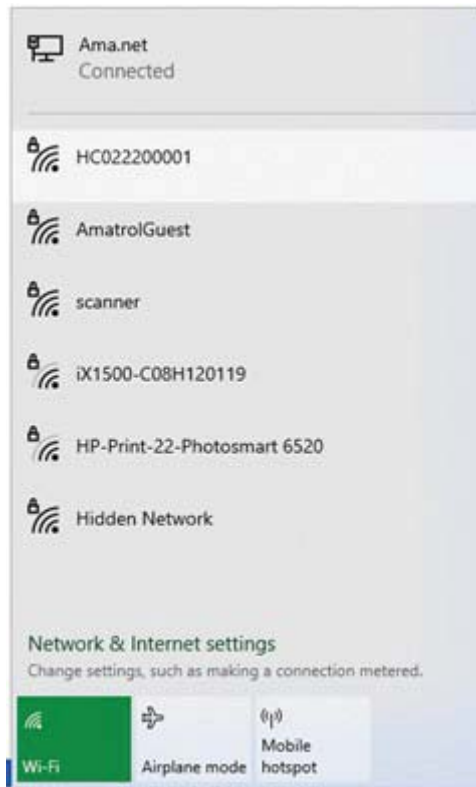


Figure 34. Example of Available Networks

- D. Look for a Wi-Fi connection that starts with HC02220 and click on it.
The last digits will vary from workstation to workstation, but a Wi-Fi option should appear similar to figure 35.



Figure 35. Example of Wi-Fi HC02220

- E. Click the Connect automatically box shown in figure 35.
F. Click **Connect**.
G. At the "Enter the network security key" prompt, enter: **B0rgC0nnec1**.
The window will then change to "Connected, secured" or "no Internet, secured".
H. Click anywhere outside of the window to minimize this window.

- I. Open the Internet browser and enter **http://10.3.141.1/** in the search bar.
This will display the BorgConnect Login page after a short connection period similar to figure 36 below.



Figure 36. BorgConnect Login

- J. Enter your login credentials, as shown below.
Username: **admin**
Enter Password: **Welcome2BC**
- K. Click **Submit**.
The BorgConnect Dashboard home screen will open, similar to figure 37.



Figure 37. BorgConnect Dashboard Home Screen

3. Press the power button on the hub to turn OFF the hub.
4. Turn off the main power switch on the workstation.
After turning off the power on the workstation, the Dashboard will lose its wireless connection with the hub. Leave the Internet browser open for the next section.
5. Proceed to section 2.4 to continue setup.

SECTION 2.4

Wi-Fi Temperature/Humidity Sensor Setup

OVERVIEW

The Wi-Fi Temperature/Humidity Sensor is used to remotely measure the temperature and humidity of the area around the workstation. The sensor transmits the data collected wirelessly to the BorgConnect Hub so that the data can be displayed by the BorgConnect Dashboard.

1. Connect the Wi-Fi temperature/humidity sensor to the Wi-Fi temperature/humidity transmitter, as shown in figure 38.



Figure 38. Wi-Fi Temperature/Humidity Sensor Attachment

NOTE

The Wi-Fi temperature/humidity sensor is not for outdoor use or use in extreme temperatures. Avoid extreme humidity and smoky environments to prevent sensor damage.

2. Turn on the main power switch on the workstation.

The Wi-Fi temperature/humidity sensor will turn on a solid red indicator to indicate that it has power. A second indicator light will begin to flash white, indicating that it is searching for a connection. The Wi-Fi temperature/humidity sensor is linked to the BorgConnect Hub at the Amatrol factory.

3. Press the power button on the BorgConnect Hub.

After a short period, the front of the BorgConnect Hub will turn on a red indicator to display that it is on. A short time after the BorgConnect Hub powers up, the Wi-Fi temperature/humidity sensor will change from a flashing white indicator to a flashing green indicator to indicate that there is a connection between the Wi-Fi temperature/humidity sensor and the BorgConnect Hub.

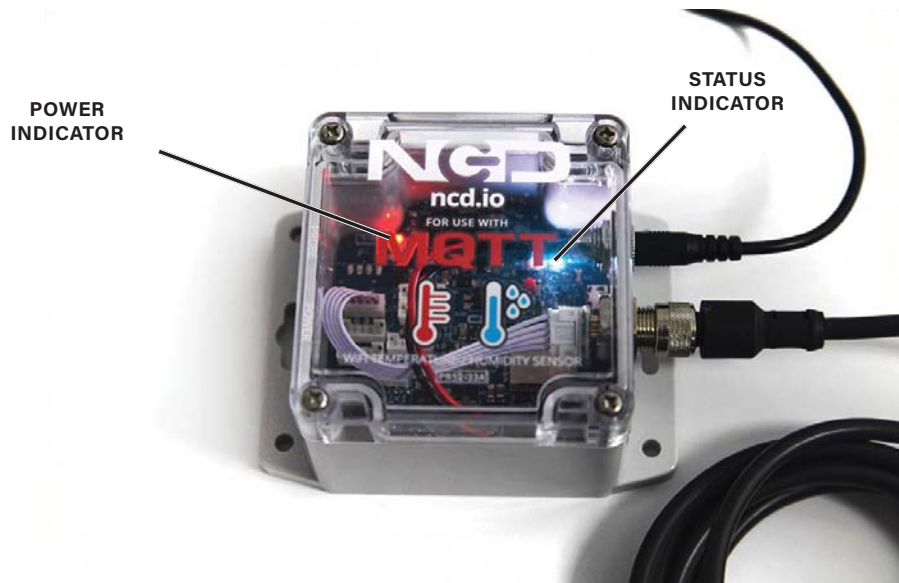


Figure 39. Green Indicator on Wi-Fi Temperature/Humidity Sensor

4. Perform the following substeps to connect and observe the Wi-Fi temperature/humidity sensor data in Dashboard.

- A. On the PC, refresh the Internet browser.

- B. Enter the following login information into the BorgConnect Dashboard.

Username: **admin**

Enter Password: **Welcome2BC**

- C. Click **Submit**.

- D. Click **MQTT Sensor**.

This opens the MQTT sensor application. Current, minimum, maximum, and temperature and humidity trends will all start populating approximately every 10 seconds.

5. If the Wi-Fi temperature/humidity sensor and BorgConnect Hub connection is made, leave the PC and workstation ON and continue to Section 2.5. If a connection is not made, contact your IT department.

SECTION 2.5

USB Bluetooth Adapter Setup

OVERVIEW

The USB Bluetooth Adapter is inserted into an open USB port on the PC and wirelessly connects devices via a Bluetooth connection. The USB Bluetooth adapter connects the PC with the Bluetooth scanner.

1. Perform the following substeps to install the USB Bluetooth adapter.
 - A. Insert the USB Bluetooth adapter into an open USB port on the PC.



Figure 40. USB Bluetooth Adapter in PC USB Port

- B. Follow the instructions provided with the USB Bluetooth adapter to install the Bluetooth driver.

The USB Bluetooth adapter should be plug-and-play for Windows 10 users, meaning that once the device is inserted into the USB port no drivers or downloads are required to make it function. If the USB Bluetooth adapter is not recognized, instructions will be provided with the adapter for installing the necessary driver for the PC. Once driver installation is complete, place the instructions with the documentation for the workstation.

2. Proceed to section 2.6 to continue setup.

SECTION 2.6

Bluetooth Scanner Setup

OVERVIEW

The Bluetooth scanner is a tool that is used with the Load Cell for the purpose of counting fasteners for the Production Quantity Application. The scanner reads a barcode and transmits the barcode data to the PC. This barcode data is used by the BorgConnect Hub to set the unit weight and part type of the fasteners to be counted.

1. Perform the following substeps to connect and charge your Bluetooth scanner.
 - A. Lift the rubber cover to gain access to the mini-USB port on the Bluetooth scanner.
 - B. Connect the mini-USB connector to the mini-USB port on the Bluetooth scanner and to an open USB port on the PC, similar to figure 41.

Once connected, the scanner will beep once to signal that it has powered on. The scanner indicator will be red and remain on while the scanner is charging. Allow the Bluetooth scanner to charge for a minimum of 5 hours for a full charge.



Figure 41. Bluetooth Scanner Charging Setup

- C. After the Bluetooth scanner has charged, unplug the USB cable from the Bluetooth scanner.

When charging is completed, the scanner indicator will turn off.

2. Perform the following substeps to pair the Bluetooth scanner with the PC.
 - A. With the Bluetooth scanner in hand, press the scanner's button to enable the device, similar to figure 42.

The Bluetooth scanner will output a long beep and the indicator will flash green to indicate that the scanner has turned ON.

The Bluetooth scanner has a power-saving setting that will shut down the scanner after a period of inactivity to preserve the battery charge. To turn the scanner back on, simply press the button to enable the device.

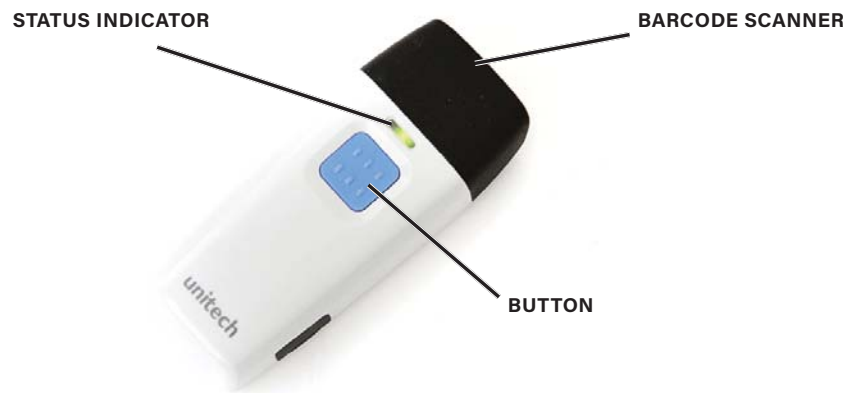


Figure 42. Bluetooth Scanner Enabled

- B. To begin the pairing process, scan the Default barcode shown in figure 43. This will stop the scanner from reporting/recording barcode scans and place the scanner in menu mode.

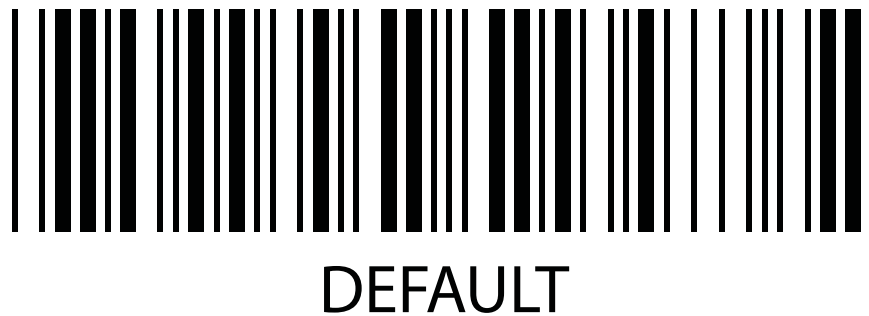


Figure 43. Default Barcode

- C. Scan the Disconnect barcode in figure 44.

This will disconnect the scanner from its previous Bluetooth connection. Once disconnected, the scanner will make itself discoverable for a new Bluetooth connection.



Figure 44. Disconnect Barcode

- D. Scan the Bluetooth: HID barcode in figure 45.

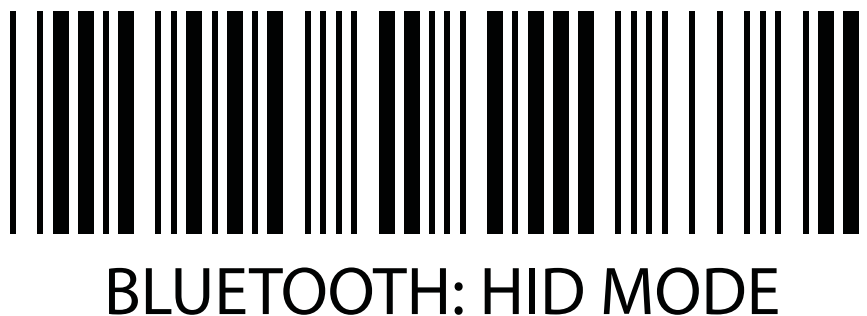


Figure 45. Bluetooth: HID Barcode

- E. On the PC, click **Search**, similar to figure 46.



Figure 46. Windows Search Icon

- F. Type **Bluetooth** into the search bar.
- G. Click **Bluetooth and other devices settings**, similar to figure 47.

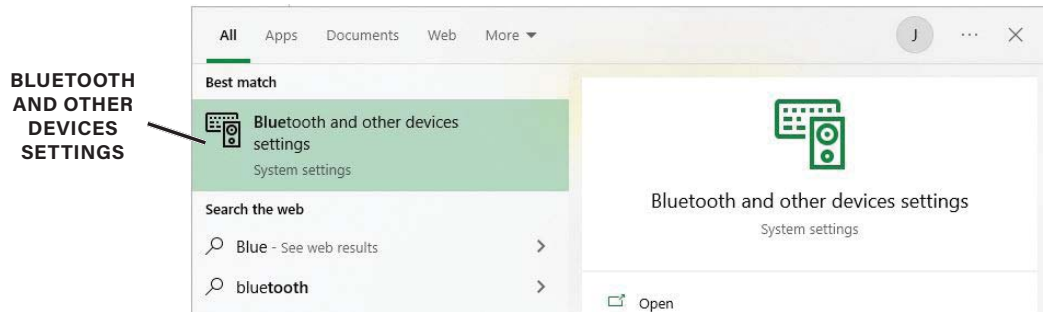


Figure 47. Bluetooth and Other Devices Settings

- H. Click **Add Bluetooth or other device**.
- I. Click **Bluetooth**.
- J. Click **Wireless Scanner**.

After a short time, the Bluetooth adapter and scanner will connect. The scanner will output a quick double beep and flash a green indicator. The PC will display "Your device is ready to go!" as shown in figure 48.

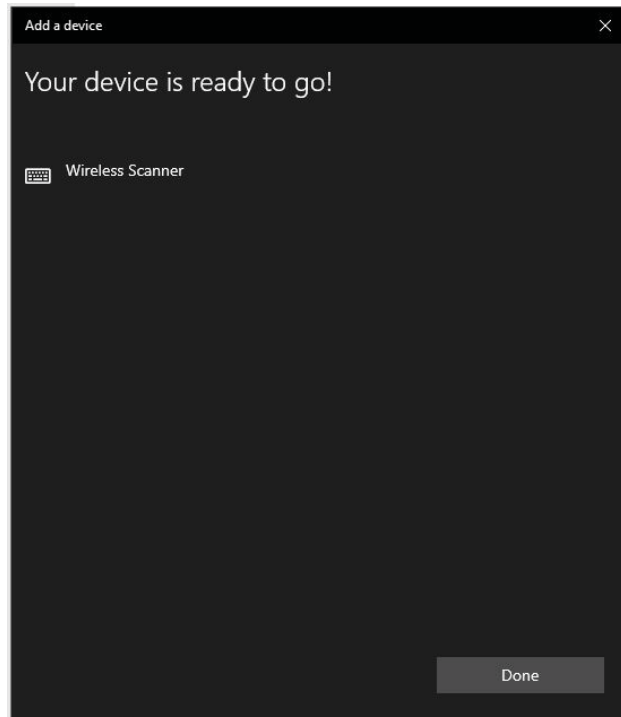


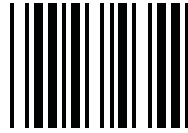
Figure 48. Your Device is Ready to Go!

- K. Click **Done**.

3. Perform the following substeps to test the Bluetooth scanner.

- A. On the PC, click **Search**.
- B. Type **Notepad** into the search bar.
- C. Click **Notepad** to open.
- D. Scan the barcode in figure 49.

When the barcode is scanned, the number 1 will appear in the Notepad application.



1

Figure 49. Barcode - 1

4. If connection is complete, continue to section 3 for software installation and configuration or return to step 2 to establish the connection.

SECTION 3

Software Setup

OVERVIEW

In this section, you will download and install Connected Components Workbench, FactoryTalk View Studio for ME, and FactoryTalk View Activation Client software packages. You will also install the supplemental disk provided with the 990-SM10. The table below identifies the software packages and the subsection in which the download/install instructions can be found.

SOFTWARE DOWNLOAD AND INSTALLATION	
Section	Software
3.1	Connected Components Workbench (CCW)
3.2	82-711 FactoryTalk View Studio
3.3	S19405-AA00UEN Supplemental Disk

SECTION 3.1

Connected Components Workbench (CCW) Software/Installation

In this procedure, you will install the Connected Components Workbench software. This software can be used to monitor the PLC logic program or create new PLC projects with different logic programs.

1. On the PC, open the Internet browser.

NOTE

You must have administrative privileges to correctly install the software.

2. In the address bar, type in **<https://www.rockwellautomation.com>** and press Enter.
The first time visiting the Rockwell-Automation site may prompt you to select your country and language, do so now if prompted. If not, continue to step 3.
3. Sign in if an account has been created.
If an account has not been created, please do so at this time. An account is needed to download software from Rockwell Automation.
4. Return to the Rockwell Automation homepage.
5. Click **Downloads**.
6. Click **Downloads by Product**.
7. In the Download Center search bar, type in **CCW**.
8. Click on **Connected Components Workbench**.
This will open the options for all the CCW versions to choose from.
9. Click on Version **13.00.00**.
This will add Connected Components Workbench 13.00.00 to the download queue.
10. Click **Downloads**.
11. Click the **Select Files** box.
12. Click all boxes necessary for download.
Necessary downloads include, but are not limited to: Connected Components Workbench, any drivers, patches, firmware tools, and/or manuals.
13. Click **Download Now**.
Selected items could take a long time to download, depending on Internet speeds, so plan accordingly.
14. After downloading complete, open the download file.

15. Locate the **setup.exe** file, and then double-click it.
A dialog will appear prompting "Do you want to allow the following program to make changes to your computer?"
16. Click **Yes**.
17. Follow the on-screen instructions to install the CCW software. Be sure to select the typical installation option during the installation process, being sure to use the software's default settings.
Also be sure to accept the End User License Agreement, or EULA. Failure to do so will end the installation procedure.
18. Perform the following substeps to pin a copy of the Connected Components Workbench software icon to the start menu. Doing this will make it easier for students to start the CCW software.
 - A. Click **Start**, scroll down then click **Rockwell Automation**, and then **Connected Components Workbench** to open the CCW folder and display its contents.
 - B. Right-click the **CCW** Icon to display a context menu.
 - C. Click **Pin to Start** menu to pin a copy of the program icon to the Start Menu.
19. Proceed to section 3.2 to install and configure FactoryTalk View Studio.

FactoryTalk View Studio Installation and Configuration

OVERVIEW

In this procedure, you will install the FactoryTalk View Studio – Machine Edition software. FactoryTalk View Studio is required to view and operate the HMI for the Portable Smart Manufacturing Learning System.

1. Close all Rockwell Software applications.

The installation closes all Rockwell software applications that are open, possibly causing loss of data.

NOTE

You must have administrative privileges to correctly install the software.

2. Perform the following substeps to locate the setup.exe file for the FactoryTalk View Studio – Machine Edition software.
 - A. Locate the FactoryTalk View Studio – Machine Edition DVD, identified earlier.
 - B. Place the DVD in the appropriate drive.
 - C. Use Windows Explorer to navigate to the appropriate drive and locate the X:\11.00.00-FTView-DVD folder (where X represents the appropriate drive).
 - D. Locate the **setup.exe** file and then double-click it.

A dialog will appear prompting “Do you want to allow the following program to make changes to your computer?”
 - E. Click **Yes**.

3. Perform the following substeps to install the FactoryTalk View Studio software. Be sure to use the setup wizard to select the typical installation option during the installation process, being sure to use the software's default settings.
 - A. Click the **drop arrow** to the right of the selection window.

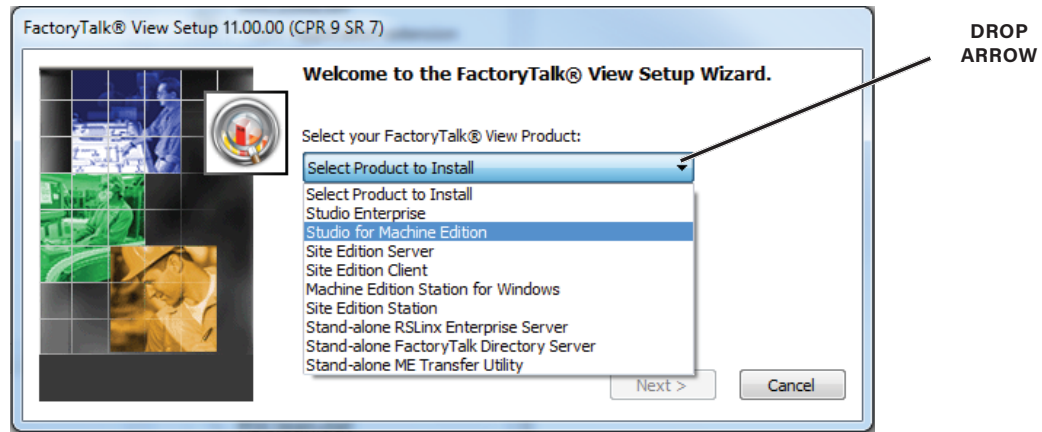


Figure 50. FactoryTalk View Setup Wizard

- B. Select the **Studio for Machine Edition** option and click the **Install now** button. The License agreement screen will open similar to figure 51.



Figure 51. License Agreement Screen

- C. Click **Accept All** to continue the installation.

After a few seconds, the installation will begin. A progress bar and messages are displayed to show the components being installed. The installation will take several minutes to complete.

When installation is complete, the summary dialog in figure 52 is displayed.

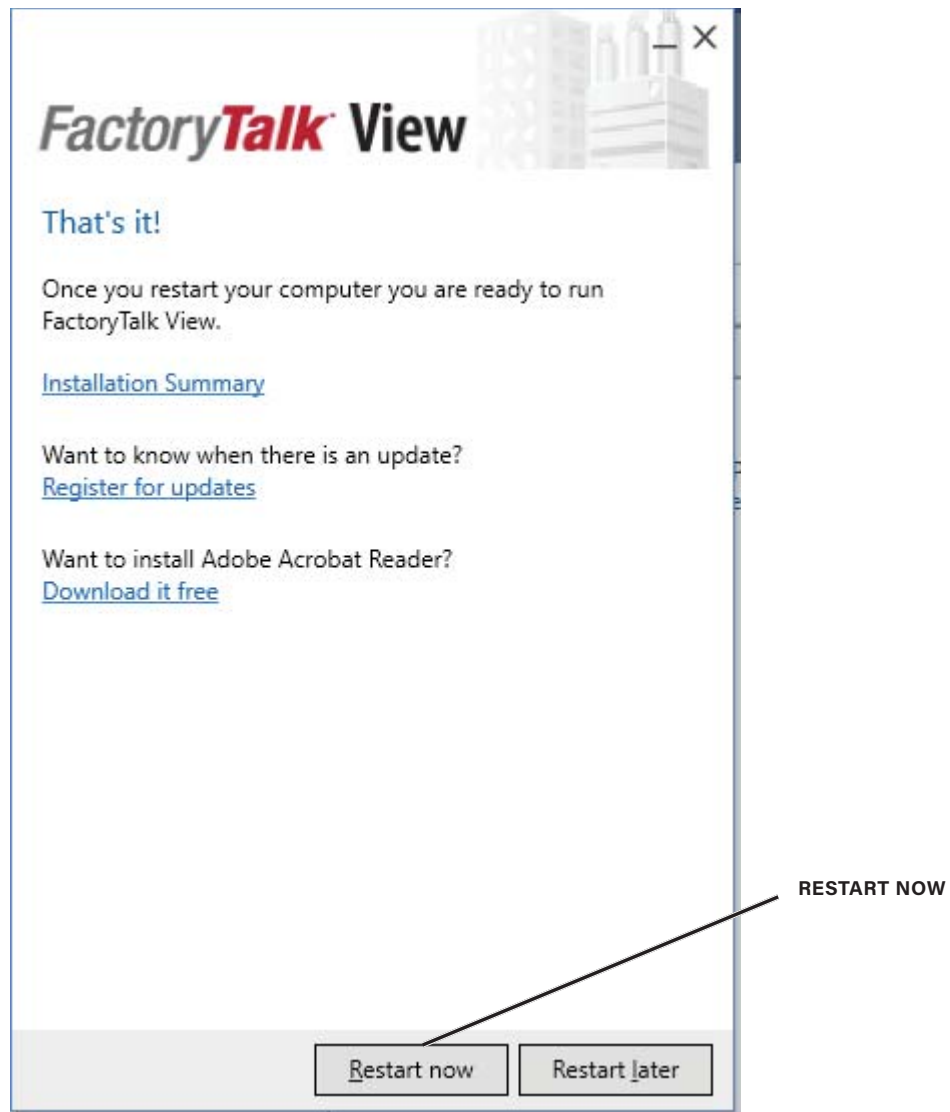


Figure 52. Installation Summary

- D. Click the Restart now button to re-start the PC.
E. After the PC reboots, log onto Windows as a user with Administrator privileges.

4. Perform the following substeps to activate the FactoryTalk View Studio – Machine Edition software.

Although the installation is complete, the software must still be activated.

- A. Click **Start** on the Windows toolbar.
- B. Locate and open the **Rockwell Software** folder.

The folder will open similar to figure 53. Your Start menu may be different than the figure below.

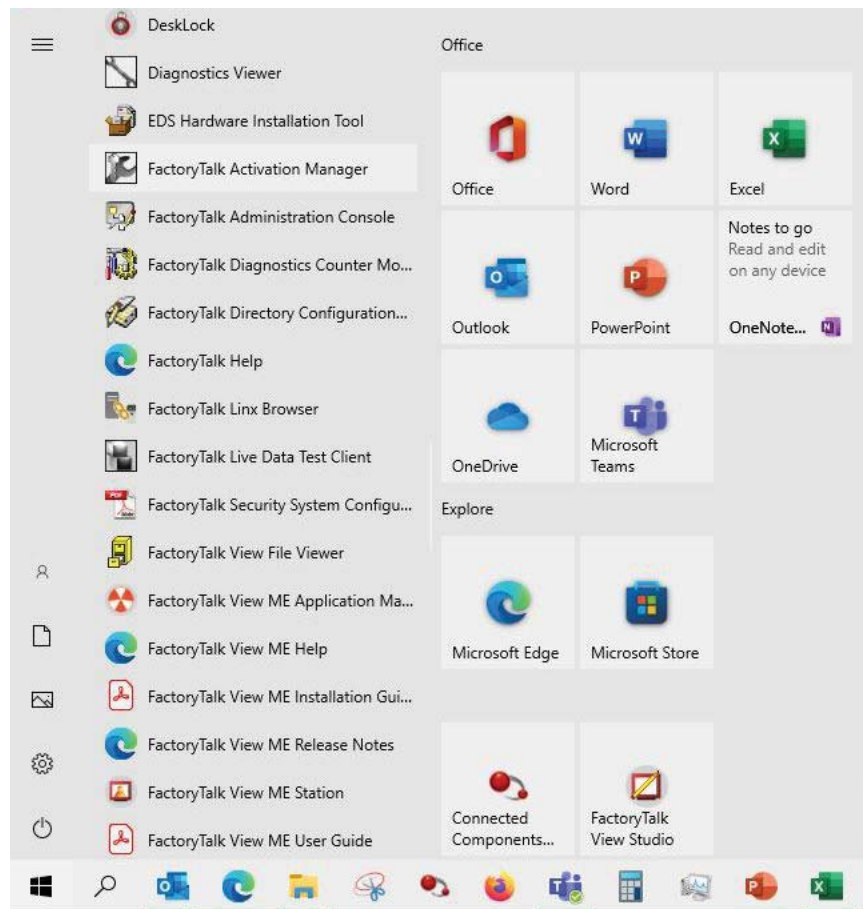


Figure 53. Rockwell Software Menu

- C. Click on **FactoryTalk Activation Manager** to open the Activation Dialog shown in figure 54.

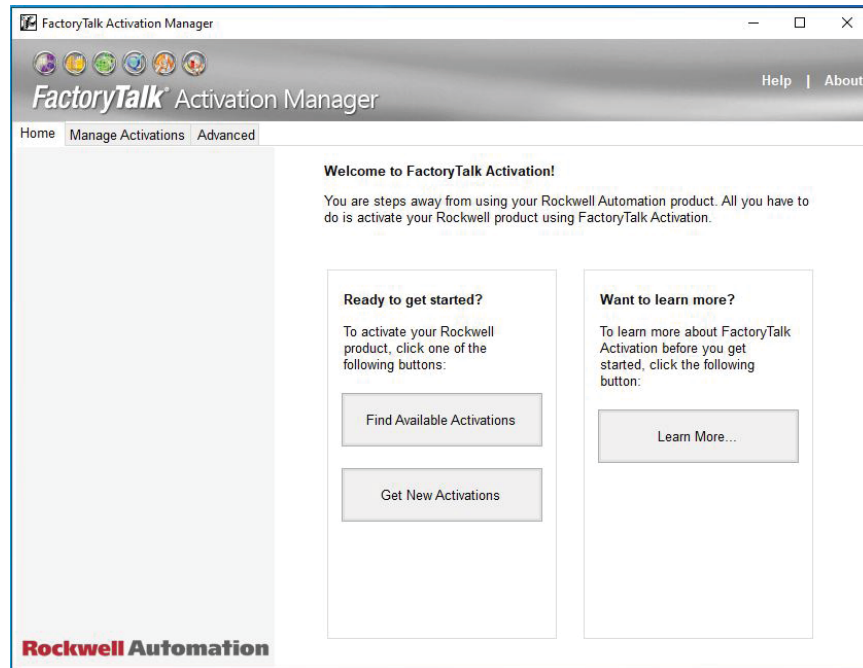


Figure 54. FactoryTalk Activation Dialog

- D. Click the Get **New Activations** button.
The dialog prompting you to select the activation method, shown in figure 55, will open.

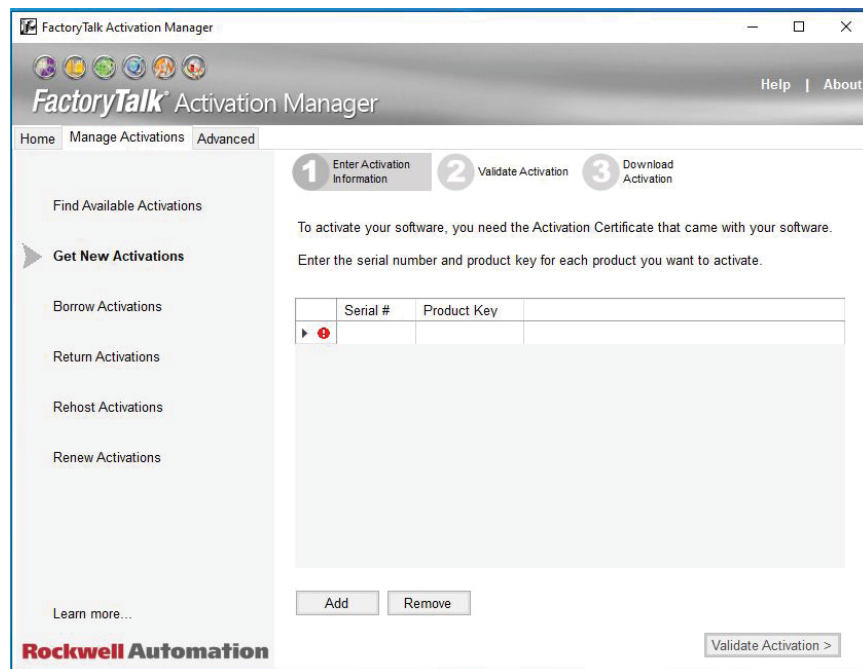


Figure 55. FactoryTalk Activation Method

- E. In the **Enter Activation Information** section, enter in the Serial # and Product Key from the paperwork provided with the DVD, then select **Add**.

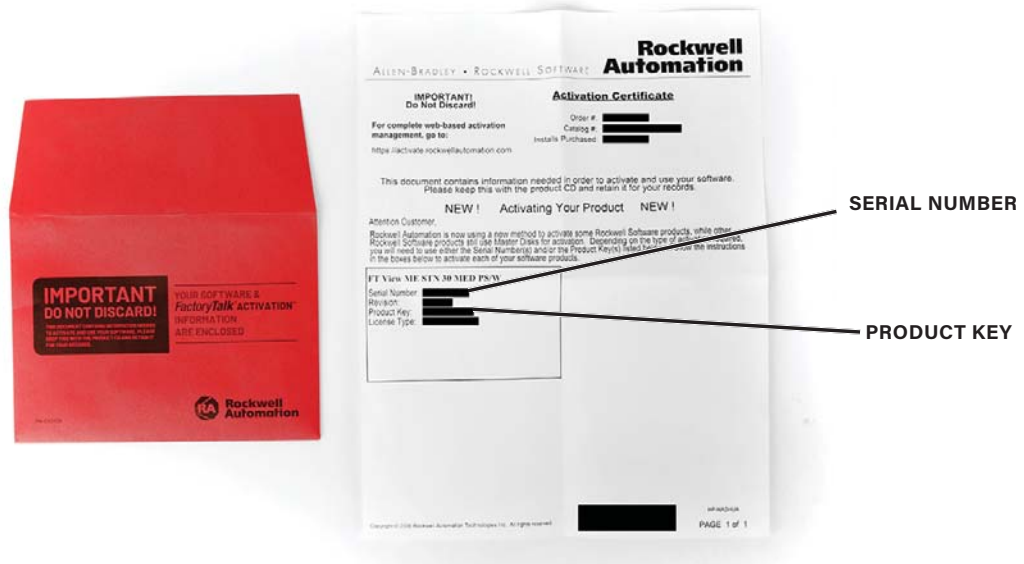


Figure 56. FactoryTalk View Product Activation Paperwork

- F. Follow the on-screen instructions to activate your software.
- G. After activation, remove DVD and store the installation material in a safe space.

5. Perform the following substeps to create a desktop icon for the FactoryTalk View Studio – Machine Edition software.
 - A. From the **Start** menu locate the **FactoryTalk View Studio** icon.

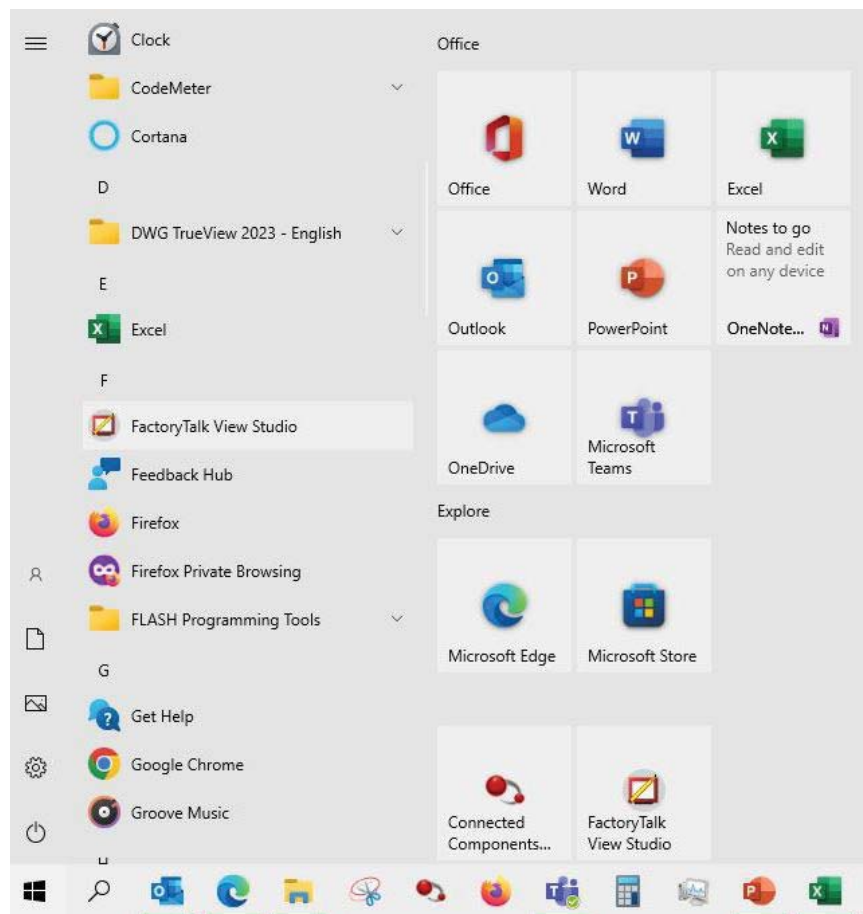


Figure 57. Program Path to FactoryTalk View Studio

- B. Click, hold, and drag the icon onto the desktop.
A new icon, FactoryTalk View Studio, is created on the desktop.
 - C. Click on the FactoryTalk View Studio desktop icon to launch FactoryTalk View Studio.
 - D. Click **Cancel** on the New/Open Machine Edition Application window that will popup.
Closing this window will allow you to minimize FactoryTalk View Studio.
 - E. Minimize FactoryTalk View Studio by clicking the - in the upper right-hand side of the screen.
6. Proceed to section 3.3 to install and configure the supplemental disk files.

SECTION 3.3

Supplemental Disk Installation and Configuration

OVERVIEW

In this section, you will install the S19405-AA00UEN Supplemental Disk files. The disk contains the Micro820 PLC project, the FactoryTalk View Studio application, and a shortcut for launching the HMI. While the PLC project comes pre-loaded on the PLC on the Smart Manufacturing workstation from Amatrol, the HMI application must be loaded to the PC to operate the workstation.

1. Perform the following substeps to install the S19405-AA00UEN Print CD files.
 - A. Locate the Supplemental Disk, part number S19405-AA00UEN.



Figure 58. S19405-AA00UEN Supplemental Disk

- B. Insert the disk into the DVD drive of the PC.

The installation process should begin automatically. If not, use Windows Explorer to view the contents of the disk and click Setup.exe.

- C. Follow the instructions provided by the installation program to install the files.

NOTE

If the Supplemental Disk has already been installed on your machine, a Program Maintenance dialog will appear on your screen. Select the Repair option and then click Next> to repair the previous installation files.

- D. Once the installation is complete, remove the disk from the drive and store it for future use.
2. Perform the following substeps to copy the FactoryTalk View ME Station shortcut, for starting the HMI program, from the supplemental disk install to the desktop.
- A. Click to open **File Explorer**.
 - B. Click the **(C:)** drive to expand its contents.
 - C. Click **Users**.
 - D. Click **Public**.
 - E. Click **Public Documents**.
 - F. Click **Amatrol**.
 - G. Click **S19405-AA00UEN**.
 - H. Copy the **FactoryTalk View ME Station** shortcut file.
 - I. Right click on the desktop and select **Paste** to place a copy of the FactoryTalk View ME Station shortcut for opening the HMI program for the Portable Smart Manufacturing Learning System.
3. Continue to Section 4 to test the operation of the 990-SM10.

SECTION 4

990-SM10 Smart Manufacturing Workstation Operation And Testing Procedures

OVERVIEW

In this section, you will power up and test the 990-SM10. This will allow you to verify that the 990-SM10 Smart Manufacturing Workstation is operating correctly.

This table identifies each procedure and its corresponding subsection.

SMART MANUFACTURING WORKSTATION CHECKOUT	
Section	Procedure
4.1	General Setup
4.2	Temperature Control – Cooling
4.3	Temperature Control – Heating
4.4	Motor Control
4.5	Vibration Monitoring
4.6	Temperature/Humidity Monitoring
4.7	Power Monitoring
4.8	Optional Remote Power Monitoring
4.9	Production Counting

SECTION 4.1

General Setup

1. Perform the following substeps to connect the CCW software with the PLC.
 - A. Open CCW from the taskbar at the bottom of the screen.
 - B. Click on **File**, highlight and click on **Discover**, similar to figure 59.
The Connection Browser window will then open.

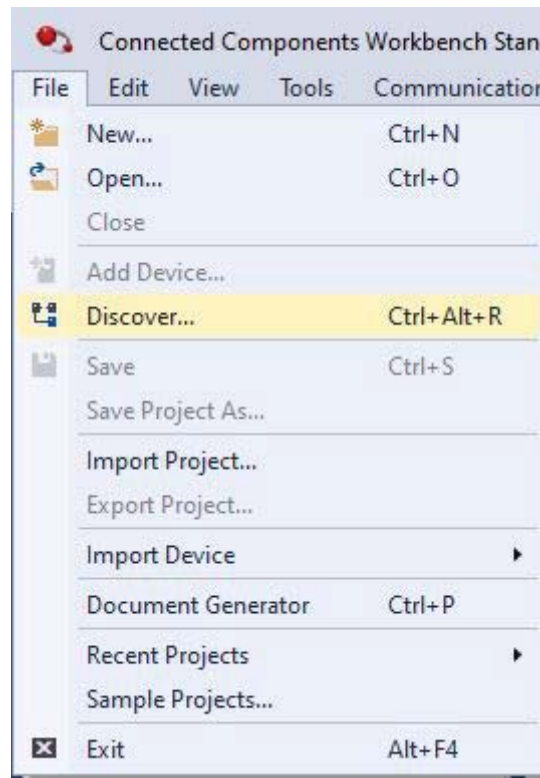


Figure 59. CCW File Tab

- C. Click the + symbol next to **AB_ETHIP-1, Ethernet** to expand the tree, as shown in figure 60.

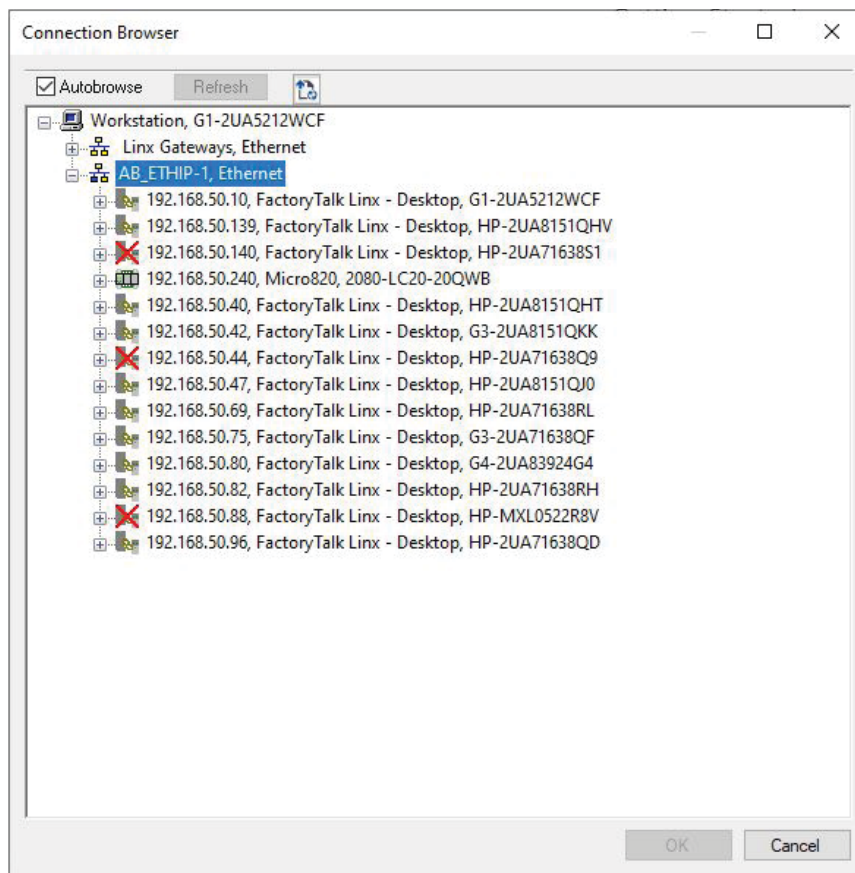


Figure 60. CCW Connection Browser

- D. Locate the Micro820, 2080-LC20-20QWB and highlight it.

This is the PLC used on the 990-SM10 Portable Smart Manufacturing System.

Depending on RSLinx drivers, Micro820 may not display in AB_ETHIP-1. If other options are available such as AB_ETHIP-2, expand its tree and locate Micro820, 2080-LC20-20QWB and highlight it. Then continue to substep E.

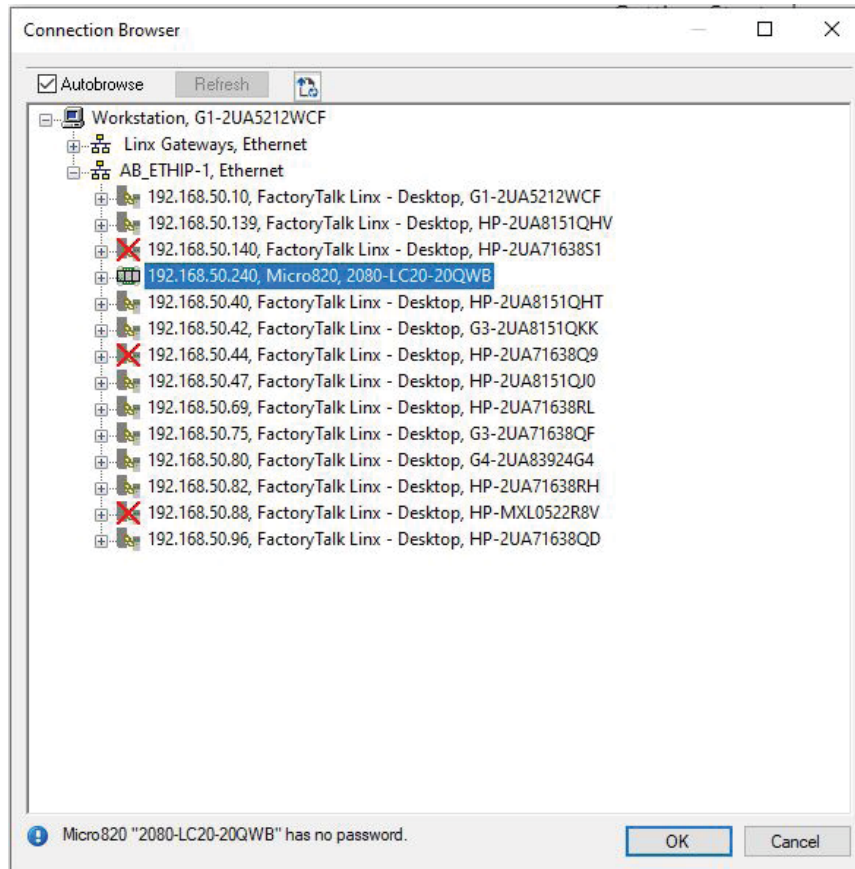


Figure 61. CCW Micro820 Connection

E. Click the **OK** button.

CCW will connect with the PLC and open a Project Organizer tab on the left side similar to figure 62. All of the PLC programs will be displayed.

If Project Organizer does not open automatically, click **View** and select **Project Organizer** to open.

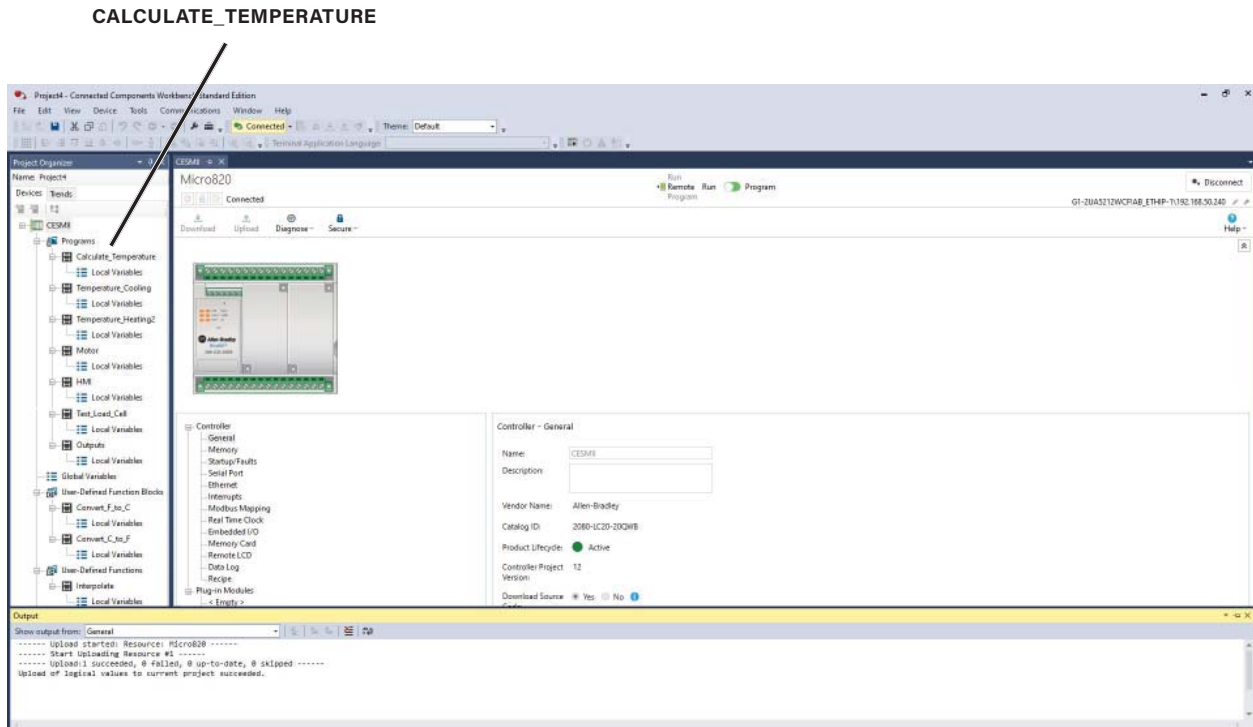


Figure 62. CCW Connected with the PLC

- F. Double-click on **Calculate_Temperature** program, as seen in figure 63, to view the ladder logic for that PLC program.

NOTE

To view the ladder logic for any of the other PLC programs, double-click on any of the other programs from the tree in the project organizer window. The PLC programs come preloaded on the PLC for the 990-SM10 Portable Smart Manufacturing Learning System from Amatrol.

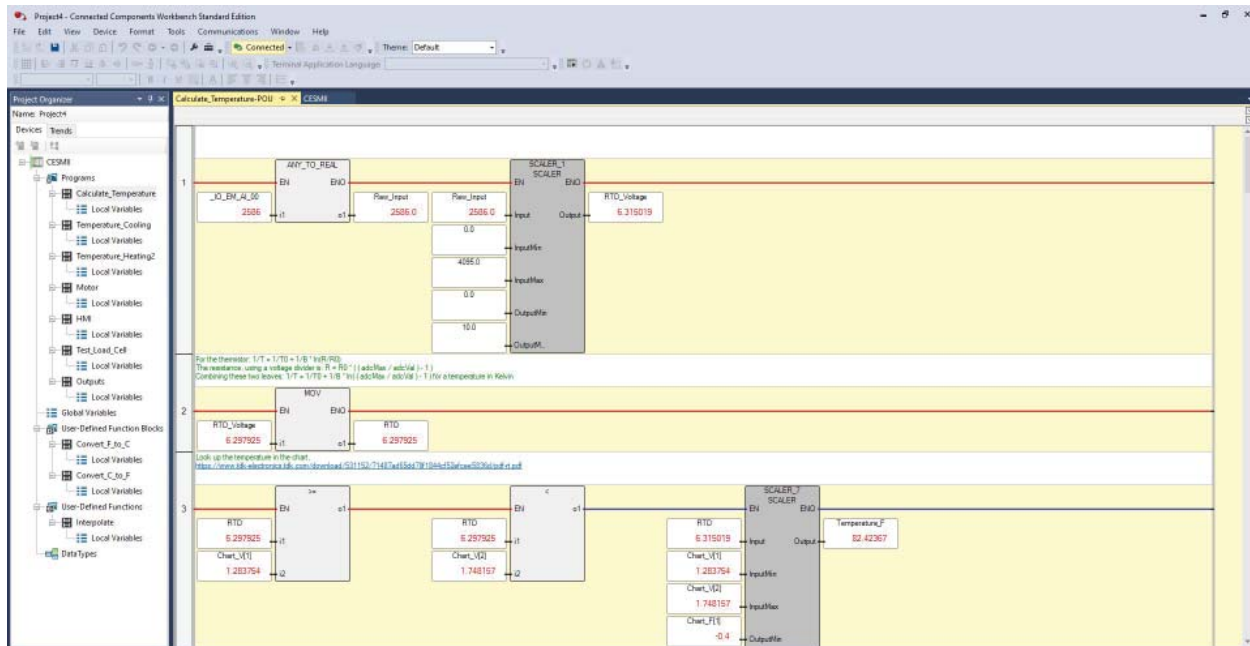


Figure 63. CCW Ladder Logic Open

2. Perform the following substeps to access and operate the HMI screen.
 - A. Click the **FactoryTalk View ME Station** shortcut on the desktop.



Figure 64. FactoryTalk View ME Station Shortcut

A User Account Control window will open asking "Do you want to allow this app to make changes to your device?"

- B. Click the **Yes** button.

After a short time, the HMI screen will pop up, similar to figure 65.

NOTE

If you only have one monitor with your designated PC, you can move between screens by pressing the Windows key + Tab key on the keyboard. This will allow you to choose which window that you want to view.

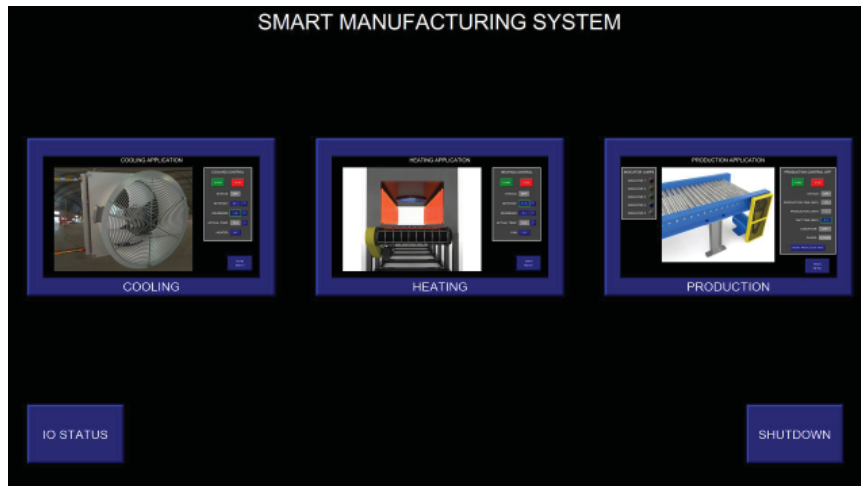


Figure 65. Smart Manufacturing System HMI Main Screen

3. Continue to section 4.2 to test the cooling temperature control application.

SECTION 4.2

Temperature Control – Cooling

OVERVIEW

In this section, you will test the operation of the cooling temperature control application.

1. From the Main Screen, press on the **Cooling Application** to open. The screen shown in figure 66 will open.

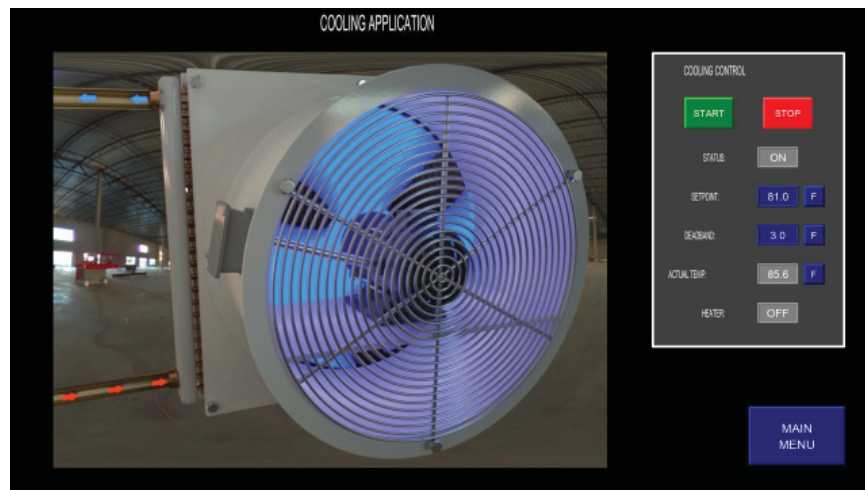


Figure 66. Cooling Application

2. Press on the blue box to the right of setpoint.
3. Enter **81.0** using the keypad that opens.

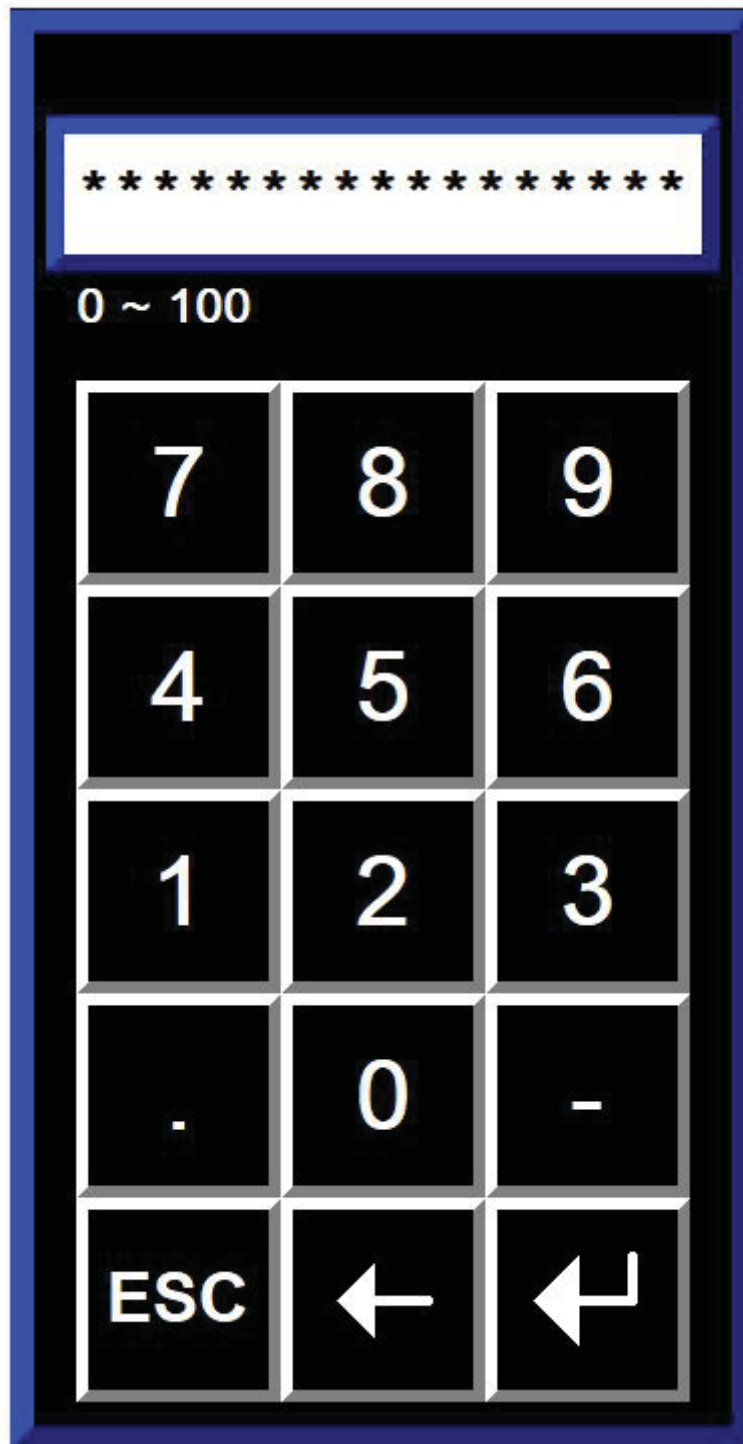


Figure 67. Numerical Window for Temperature

4. Press **Enter** to set the setpoint and close the window.
5. Press **START** to initiate the cooling application.

The status box will change from OFF to ON. The fan blades on the screen will also turn blue in the graphic to the left of the cooling control box. If the actual temperature is below the setpoint (81 °F), the red indicator and heater will turn ON. Once the temperature goes above the setpoint plus the deadband ($81+3=84$ °F), the red indicator and heater will turn OFF.

Then the blue indicator and fan will turn ON, initiating the cooling cycle. The fan cools by pulling room temperature air in, so cooling will not be a rapid process. Once the temperature falls below the setpoint (81 °F), the blue indicator and fan will turn OFF and the red indicator and heater will turn ON.

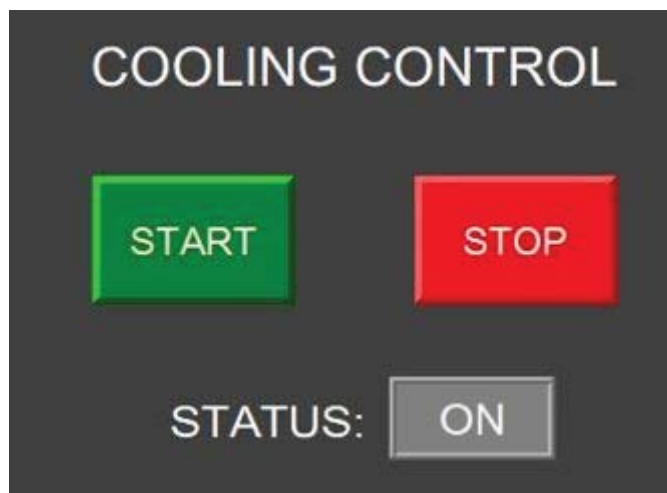


Figure 68. Cooling Control with Status

6. Press on the box to the right of deadband to change the deadband value.



Figure 69. Deadband Value Box

7. Enter **5.0** in the keypad.

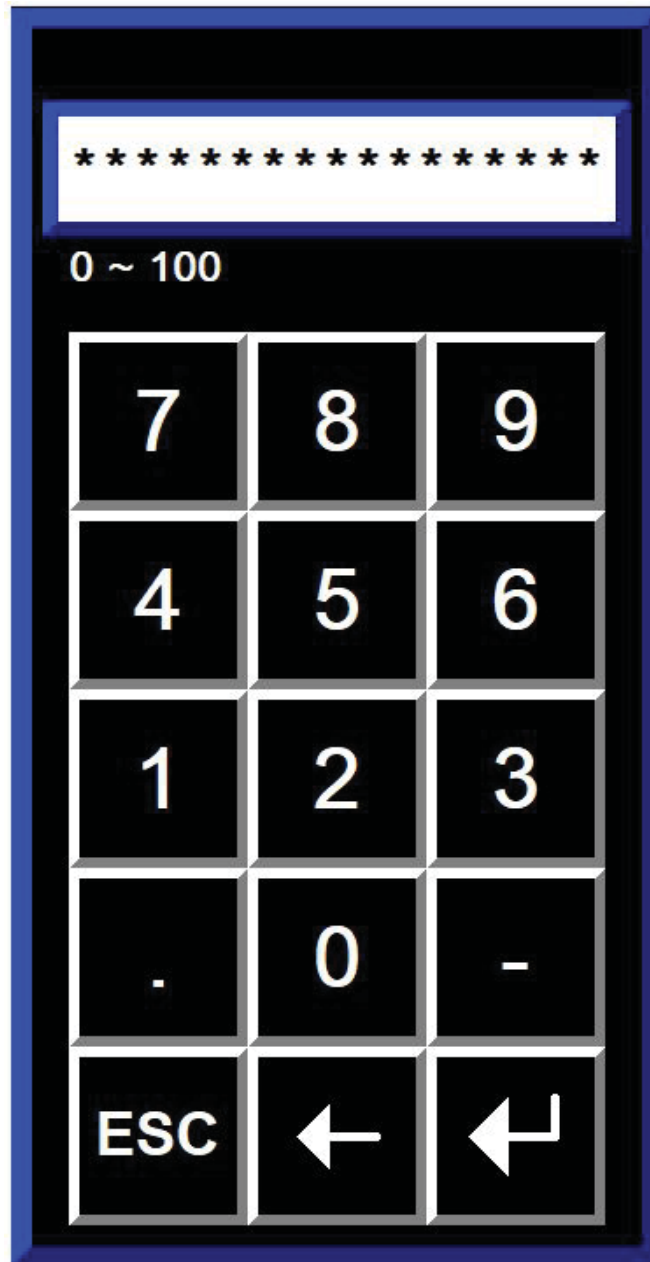


Figure 70. Numerical Window for Deadband

8. Press the **Enter** key.
This will change the deadband value from 3.0 to 5.0. Observe the actual temperature and workstation to see the temperature rise to 86 °F before starting the cooling process.
9. Change deadband value back to **3.0** using steps 6 through 8, then continue on to step 10.
10. Press **STOP** to end the cooling application program. The HMI fan blades will return to silver and status will change to OFF.
11. Press the **Main Menu** in the bottom right to return to the main menu and continue to section 4.3.

SECTION 4.3

Temperature Control – Heating

OVERVIEW

In this section, you will test the operation of the heating temperature control application

1. Press the **Heating Application** to open.

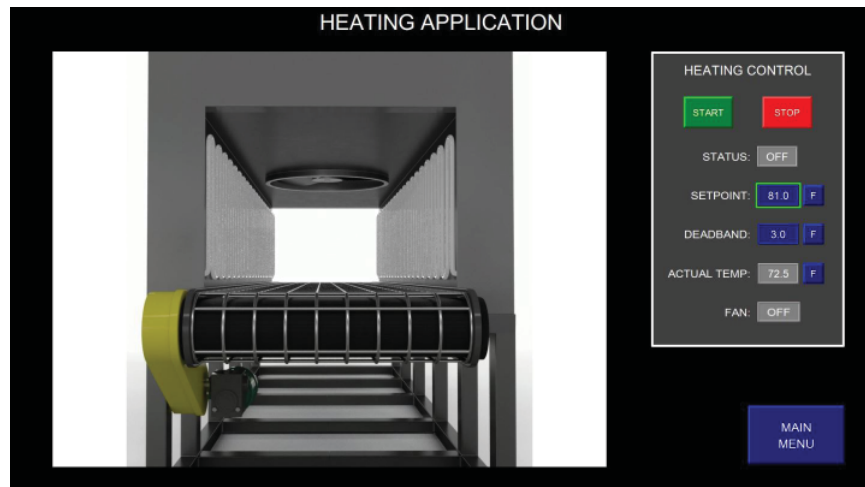


Figure 71. Heating Application

2. Press the blue box to the right of setpoint to open the keypad and use it to change the setpoint.
3. When the keypad opens, enter the new temperature of **83.0**.
4. Press **Enter**.
5. Press **START** to initiate the heating application.

The status box will change from OFF to ON. The heater coils will also turn red in the graphic on the HMI.



Figure 72. Heating Control with Status

6. Notice that when the actual temperature is below the setpoint temperature, less the deadband, the heater will turn on and the red indicator lamp will illuminate.
Setpoint – Deadband = Temperature that the heater will turn on
7. Observe as the actual temperature goes above the setpoint, the red indicator and heater will turn off, ending the heating portion of the cycle. The fan and blue indicator will then turn on as the cooling portion of the cycle runs. When the temperature falls below the setpoint less the deadband, the cooling portion of the cycle will end and start the heating portion of the cycle.
8. Press the box to the right of Deadband to change the deadband value.
9. Enter **5.0** in the keypad and press **Enter**.
This will change the deadband value from 3.0 to 5.0.
10. Repeat steps 6 and 7 to verify that the deadband changes. Then proceed to step 11.
11. Change the deadband value back to 3.0.
12. Press **STOP** to end the heating application program. The heating coils will return to silver and status will change to OFF.
13. Press the **Main Menu** in the bottom right to return to the main menu and continue to section 4.4.

SECTION 4.4

Motor Control

OVERVIEW

In this section, you will test the operation of the Production application, which controls a motor-driven conveyor.

1. Press the Production application to open, similar to figure 73.

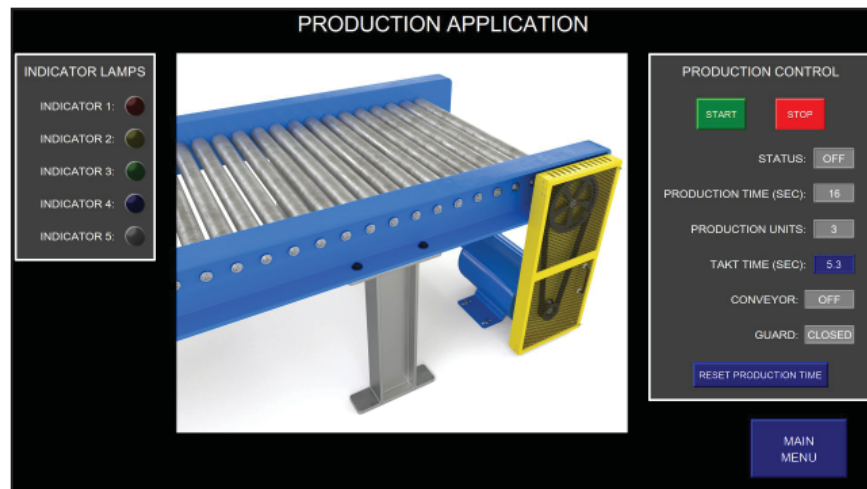


Figure 73. Production Application

2. On the workstation, rotate the **Motor Power** switch clockwise to the **ON** position, as shown in figure 74.

The white indicator lamp will turn ON.

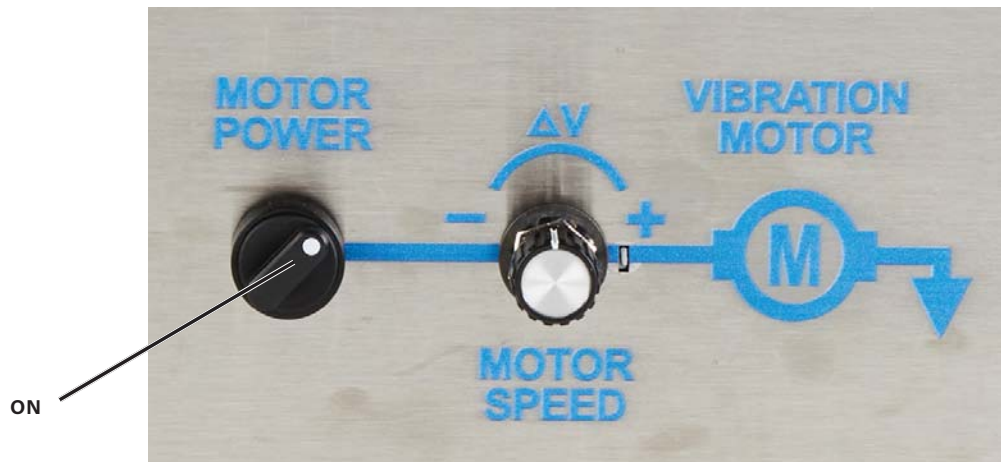


Figure 74. Motor Power Switch ON

3. Press START on the HMI to initiate the production application.

This will change the status from OFF to ON, the conveyor from OFF to ON, and the green indicator lamp will turn ON.



Figure 75. Production Control Start

4. Observe the motor speed as the motor speed potentiometer is rotated clockwise to midpoint (white line at the top of the potentiometer knob).

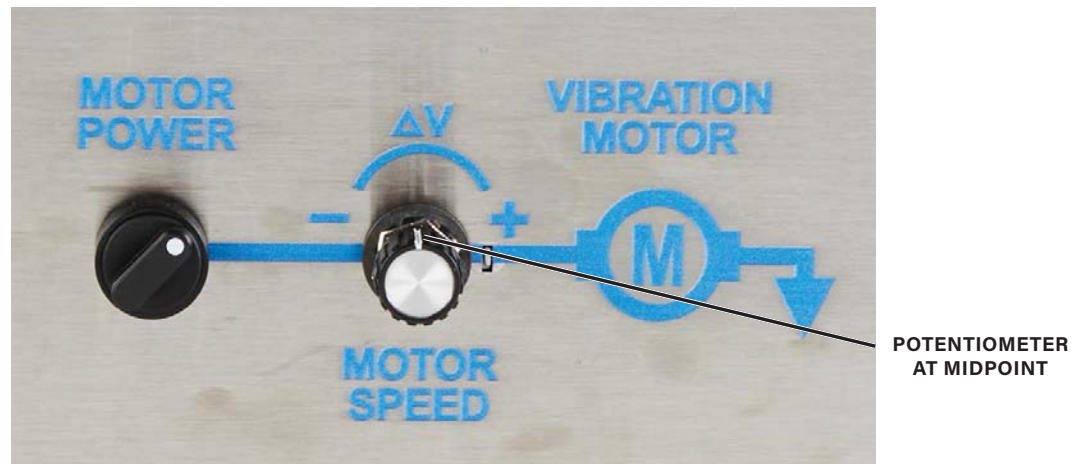


Figure 76. Motor Speed Knob and Vibration Motor

5. With the vibration motor running, open the Interlocked Door.
The motor will quickly stop turning, the Green Indicator Lamp will turn OFF, and the Yellow Indicator Lamp will turn ON.

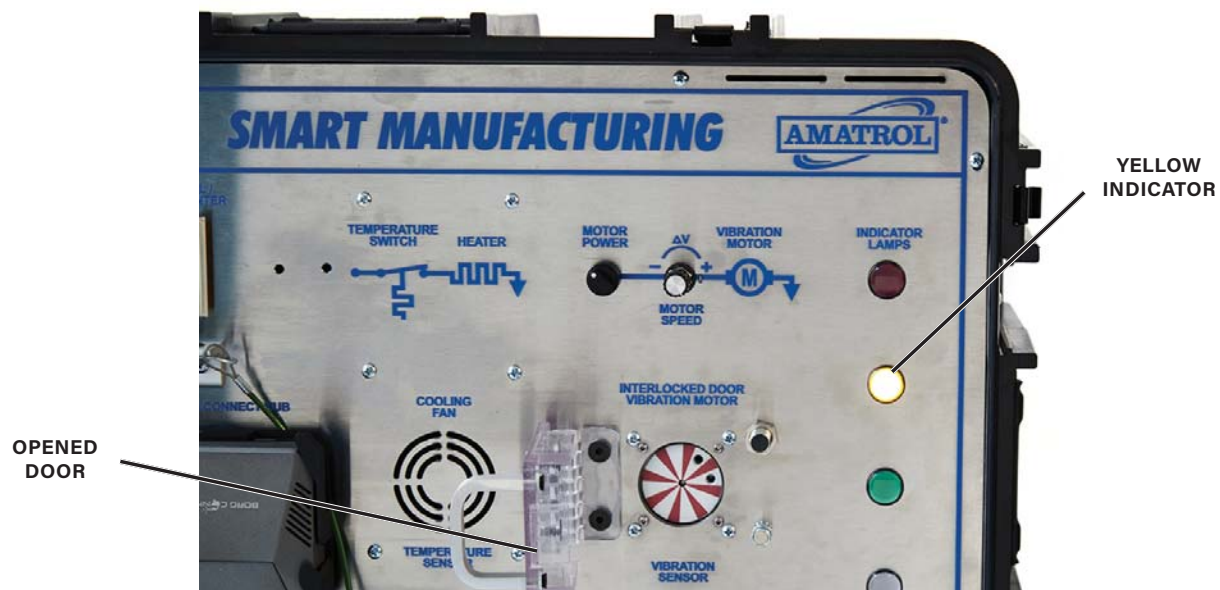


Figure 77. Opened Interlock Door

6. Close the Interlocked Door and observe that the Yellow Indicator Lamp turns OFF.
7. To start the motor turning again, press START on the HMI screen.
8. Press the Takt Time blue box to change the takt time.

Takt time is the time needed to build a product to meet customer demand.

$$\text{Takt Time} = \frac{\text{Workable Production Hours}}{\text{Customer Demand}}$$

9. Enter **5.5** using the keypad and press **Enter**.
This will change the takt time to 5.5 seconds.
10. Press **RESET PRODUCTION TIME** to reset the production time and production units to zero.
11. Press **STOP**, the status and conveyor will change to OFF, the production time and units will pause counting.
12. Press **MAIN MENU** in the bottom right to return to the main menu and continue to section 4.5.

SECTION 4.5

Vibration Monitoring

OVERVIEW

In this section, you will use the vibration motor to test the operation of the Motor Vibration Monitoring application.

1. Press the Windows key on the keyboard to open the taskbar at the bottom of the screen.
2. Click on your Internet browser icon **to open the BorgConnect Dashboard**.
3. **Click on** Motor Vibration Monitoring to view the piezo vibration sensor results.

A piezo vibration sensor is attached to the motor to measure vibration during operation. The motor vibration monitoring application, while open in the BorgConnect Dashboard, keeps a short record of maximum, minimum, and a current trend graph of recent vibration measurements. The motor vibration monitoring application values and graph will extract new data approximately every 10 seconds.

4. Click on the FactoryTalk View ME Station icon in the taskbar to maximize the HMI window.

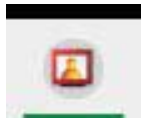


Figure 78. FactoryTalk View ME Station Icon

5. Press the **Production** application to open.
6. Press **START** to initiate the production application.
7. Press the **Windows** key to show the taskbar.
8. Click on the Internet browser to bring up the Dashboard.
9. Observe the current g-force value.
The g-force will remain at or close to 1 g.
10. On the workstation, turn the motor speed potentiometer clockwise to full turn.
This will cause the motor to rotate faster than when initially turned on.
11. Observe the current g-force value.
The g-force will spike above 1 g but remain below 2 g.
12. Press **STOP** on the HMI, the motor will stop turning.
13. Turn the motor power switch OFF.
14. Rotate the motor speed potentiometer counterclockwise to a full stop.
15. Press **Main Menu** on the HMI and continue to section 4.6.

SECTION 4.6

Temperature/Humidity Monitoring

OVERVIEW

In this section, you will use the Wi-Fi Temperature/Humidity Sensor to monitor ambient temperature and humidity.

1. Click on the Internet browser icon in the taskbar to open the BorgConnect Dashboard.
2. In BorgConnect Dashboard, open the MQTT Sensor application similar to figure 79.



Figure 79. MQTT Sensor Application

3. Notice that the current temperature and current humidity are displayed, as well as maximum and minimums.
The trend graphs will initially be empty but will begin populating after a few seconds.



Figure 80. Wi-Fi Temperature/Humidity Sensor

4. Observe how the temperature and humidity graphs record your local environment for the next 5 minutes.
During this time, notice how much or how little, your local environment changes regarding the relative temperature and humidity. If the temperature and humidity remain constant, your graph will remain flatter to show little change. Should the temperature or humidity have large changes, your graph will show large changes.
5. Click the Dashboard **Back** arrow to return to the main screen.
6. Continue to section 4.7 for power monitoring operation and testing.

Power Monitoring

OVERVIEW

In this section, you will test the power monitoring application.

1. In Dashboard on the Internet browser on the PC, click the **Incoming Power Consumption** tab and observe the values that appear.
The internal current sensor will measure the current passing through the main feed wire after the main power switch. The current sensor is connected to the BorgConnect Node, which converts the analog signal to a digital value that is shared with the BorgConnect Hub. The hub uses these measurements to calculate power, which is also displayed by the BorgConnect Dashboard software.
2. Click the **FactoryTalk View Studio** icon in the taskbar to open the Smart Manufacturing System HMI screen.
For this section, you will be using the HMI to turn the motor, fan, and heater on to observe how they affect the current draw, max power, and the kWh trend graph.
3. Press the **HEATING** application to open.
4. Press **START** to start the heating program.
5. Press the Windows key on the keyboard and click the Internet browser from the taskbar to observe the changes from starting the heater in the incoming power consumption application.
6. Turn the motor power switch clockwise to the ON position on the workstation.
7. Rotate the motor speed potentiometer to the midpoint.
8. Click the **FactoryTalk View Station** to return to the HMI screen.
9. Press **MAIN MENU** to return to the main screen.
10. Press **PRODUCTION** to open.
11. Press **START** to start the vibration motor program.
12. Return to the Internet browser to observe the changes from starting the motor.
13. Observe any changes to the values in the incoming power consumption application for 30 seconds.
14. Observe if the motor, the fan, and the heater are all on and observe the current power draw and the kWh trend graph.
The heater will turn off when it reaches the setpoint, so observe with the heater on and off. Compare with the readings when the fan turns on when the heater cycles off.
15. Rotate the motor speed potentiometer fully clockwise until the full turn point is reached.
16. Observe any changes to the values in the incoming power consumption application for a cycle of the heating application.

17. Click the **FactoryTalk View Station** to return to the HMI screen.
18. Press **STOP** to end the motor program.
19. Switch the motor power switch **OFF**.
20. Rotate the motor speed potentiometer fully counterclockwise.
21. Press **MAIN MENU** to return to the main screen.
22. Press **HEATING** to return to the heating application.
23. Press **STOP** to end the heating application.
24. Press the power button on the hub to power down the hub.
25. Switch the workstation main power OFF.
26. Continue to section 4.8 if you have the optional remote AC current sensor. Otherwise, continue to section 4.9.

SECTION 4.8

Optional Remote Power Monitoring

OVERVIEW

The optional Remote Current Sensor is used with the BorgConnect Hub to measure and the current of other machines or devices not mounted on the workstation. and display the results on the BorgConnect Dashboard. Using the remote current sensor, you can observe the power used by remote electrical devices.

1. Perform the following substeps to connect the remote current sensor for measurement.
 - A. Connect the remote current sensor leads to the IN 3 jacks on the workstation panel, as shown in figure 81.



Figure 81. 43110 Remote Current Sensor Connection to Workstation

- B. Plug the remote power cord into an AC wall outlet.
- C. Plug the sample device to be measured into the remote current sensor as shown in figure 82.

Examples of devices that can be measured:

- Computer
- Desk fan
- Cell phone charger
- Hand tools
- Any AC device that does not exceed 15 amps



Figure 82. Power Connection into Remote Current Sensor

NOTE

If the selected device uses a motor, it must use less than 15 amps to function. Exceeding 15 amps will trip the circuit breaker in the remote sensor enclosure because of the elevated inrush current of the motor.

2. On the designated PC, open the Internet browser and login to BorgConnect Dashboard.
3. Click on the External Power Consumption tab.
4. Turn the power switch on the workstation to the ON position.
5. Press the power button on the BorgConnect Hub.
6. If necessary, power on the device being measured or continue to step 7.
7. Wait 30 seconds and observe the current draw.

The Current Amps will change from zero, indicating that it is reading the amperage from the workstation.

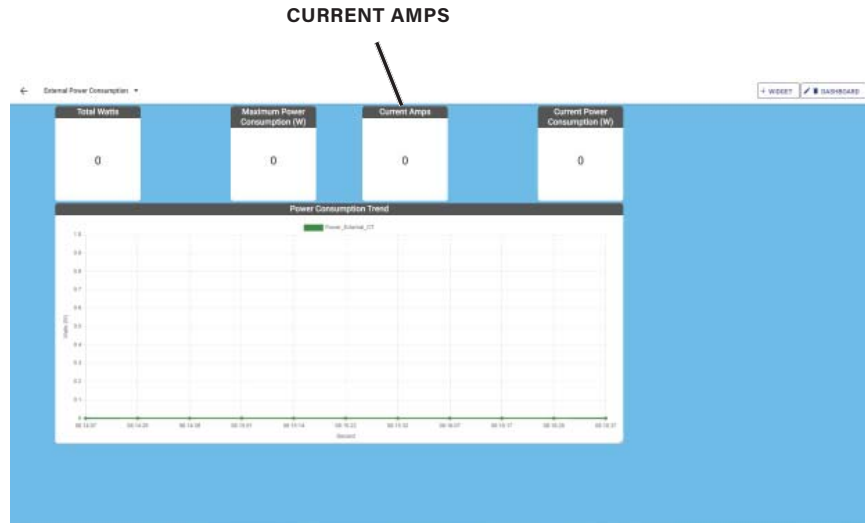


Figure 83. Current Amps

8. Press the power button on the hub to power down the hub.
9. Switch the workstation power main power OFF.
10. Unplug the remote current sensor from the outlet.
11. Unplug the remote current sensor leads from the workstation.
12. Proceed to section 4.9.

SECTION 4.9

Production Counting

OVERVIEW

In this section, you will test the operation of the production counting application. This application uses a load cell for weight measurement and a barcode scanner for part type selection.

1. Switch the workstation's main power switch to the **ON** position.
2. Press the power button to turn on the BorgConnect Hub.
3. Perform the following substeps to prepare the load cell for measurement.
 - A. Grasp the load cell hopper with one hand to hold it in position.

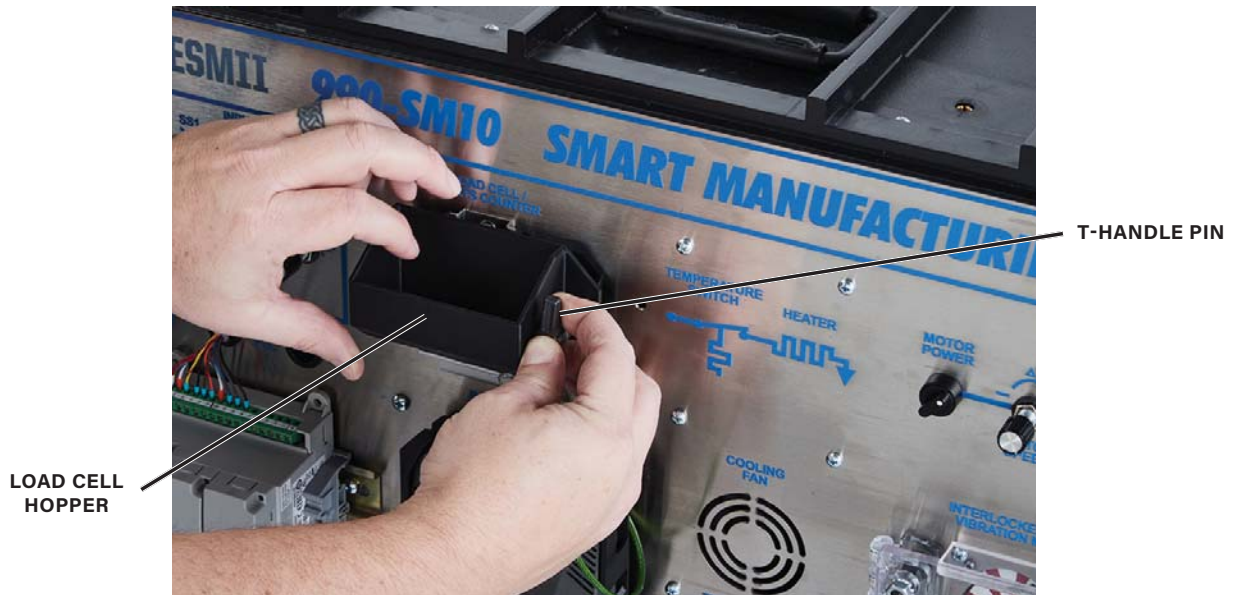


Figure 84. Load Cell Hopper

- B. Press the button of the t-handle and remove the quick-release pin from the load cell hopper so it can be moved from the shipping position.

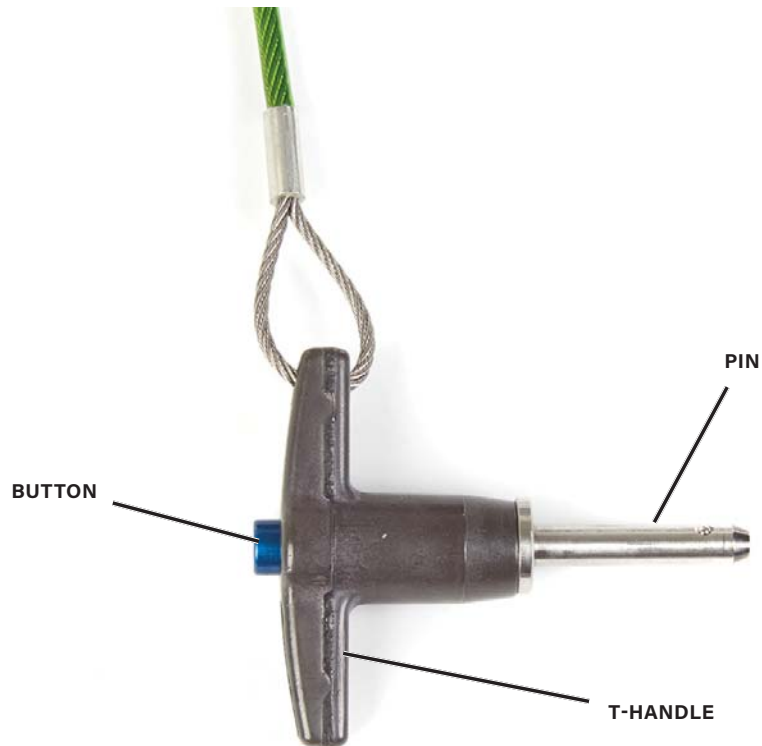


Figure 85. T-Handle Quick-Release Pin

- C. Insert the quick-release pin into the pin storage location.



Figure 86. Quick-Release Pin Storage

- D. Slowly lower the load cell hopper down onto the load cell and release the hopper.

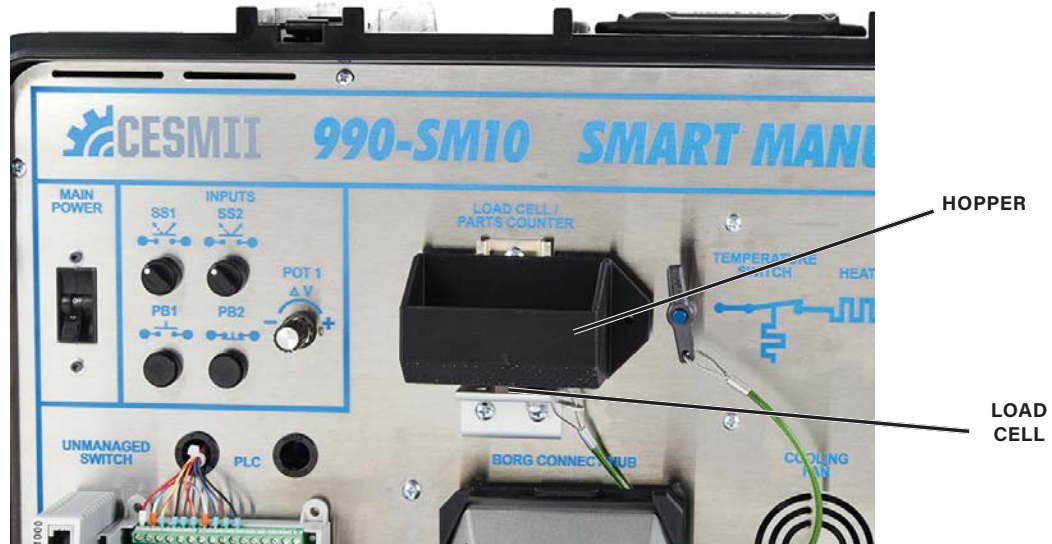


Figure 87. Load Cell Hopper Ready Position

4. Perform the following substeps to connect to the BorgConnect Dashboard from the PC.
 - A. Enter **http://10.3.141.1/** into the address bar of the Internet browser.
 - B. Press the Enter key on the keyboard.
 - C. Enter the login credentials in the space provided.
 Username: admin
 Password: Welcome2BC
 - D. Open a second tab in the Internet browser.
 - E. Repeat the process starting with substep B to open a second Dashboard main screen, as two Dashboard tabs will be needed for this activity.
5. Click on **Production Quantity App**.

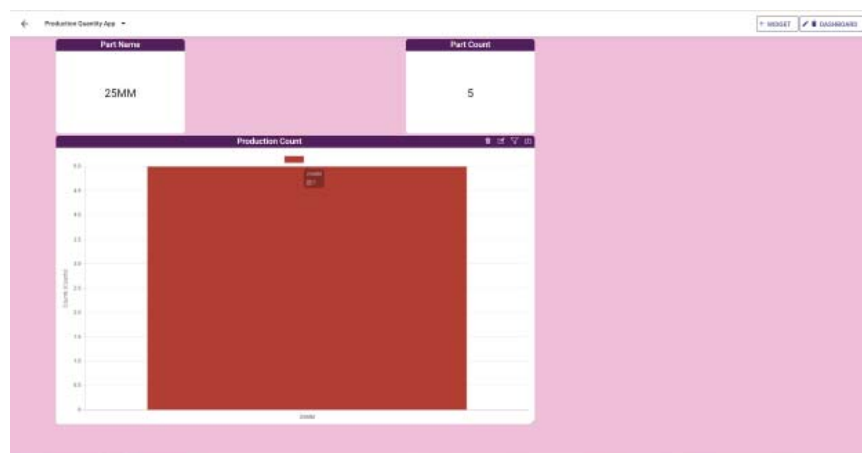


Figure 88. Production Quantity Application

6. Perform the following substeps to familiarize yourself with the Production Quantity application in the BorgConnect Dashboard.
 - A. Locate the Part Name widget and observe the displayed name.
Initially, the part name may be displayed as Not Connected if a part type has not been linked. After linking, the part type to be counted will be named here.
 - B. Locate the Part Count widget and observe the displayed count.
Initially, the part count may be displayed as Not Connected if a part type has not been linked. After linking, the quantity of parts will be displayed here.
 - C. Locate the Production Count widget and observe the displayed graph.
Initially, the graph may be void of information until a part type and count has been provided. Once the graph populates a result, it will retain the last count from each part type until the screen is refreshed.
7. Select the second web browser tab to set up the part type for measurement.

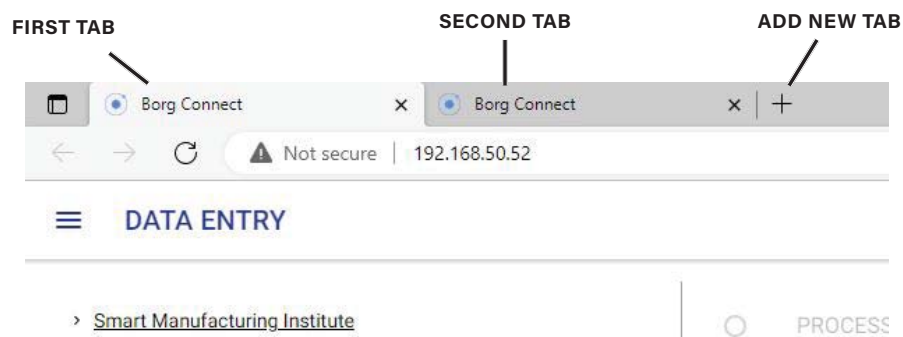


Figure 89. Internet Second Browser Example

8. Perform the following substeps to reset or zero the load cell through Dashboard to prepare for measurement.
The weight of the hopper must be subtracted from the calculation for determining the number of bolts in the hopper. Otherwise, the count would be incorrect. By zeroing out the load cell with the empty hopper resting on it, the hopper weight does not affect the calculation.
 - A. Click **Menu** to open the menu.
 - B. Click **DATA ENTRY**.

- C. Click **ASSOCIATED ATTRIBUTES**.
- D. Click **HOW MANY** as shown in figure 90.

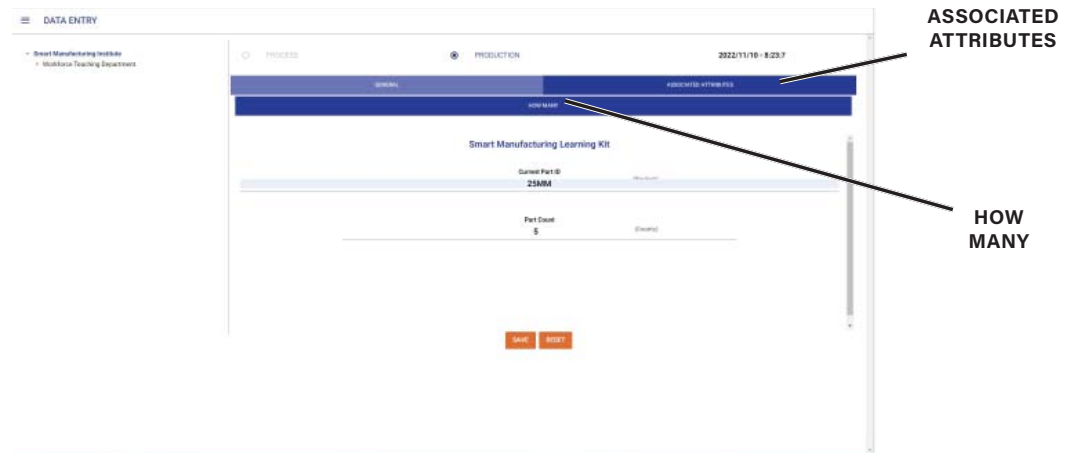


Figure 90. BorgConnect Dashboard Data Entry Main

- E. With an empty load cell hopper and after waiting for 5 seconds, click **RESET** to zero, or tare, the part count.
 Allow 5 seconds after emptying or replacing the load cell hopper onto the load cell before clicking reset. This will give the load cell time to stabilize after changes. Failure to do so may result in the displayed part count varying from the actual count.
- 9. Perform the following substeps to refresh the Dashboard page to prepare for counting.
 - A. Click **Menu** to begin refreshing the page after reset.
 - B. Click **Dashboard** to change from the data entry page.
 - C. Click **Menu**.
 - D. Click **Data Entry**.
 - E. Click **Associated Attributes**.
 - F. Click **How Many**.
 - G. Click **Current Part ID**.
 This will allow you to enter the part ID with the Bluetooth scanner.
 - H. Press the button on the Bluetooth scanner, shown in figure 91, to power up the scanner and prepare for the next step.
 The scanner will beep one long beep when initializing, followed by a quick double beep to signal that it is ready to scan.

After a period of inactivity, the scanner will power down to conserve battery life. Repeat this substep to power up the scanner as necessary.



Figure 91. Bluetooth Scanner Button

10. Scan the 20MM barcode, shown in figure 92, with the Bluetooth scanner to set the production quantity application for weighing the 20 mm bolt.

This inserts 20MM in the current part ID and sets the unit weight to 11 gm, which is the weight of the 20 mm bolt. The 25 mm bolt, when selected, is set to 20 gm and the 30 mm bolt, when selected, is set to 34 gm. These weights have been measured by the load cell and adjusted for count accuracy.

NOTE

Due to the manufacturing process of the hardware, the individual weights between parts can vary. As the quantity of hardware increases, so does the chance that the quantity can become over or under counted.

20MM

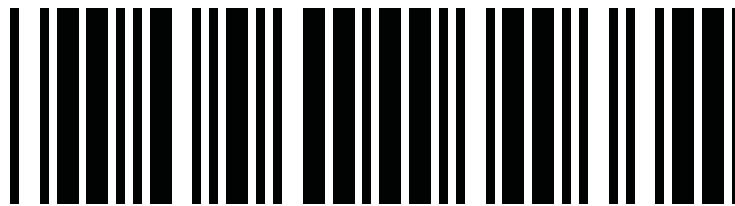


Figure 92. Barcode – 20MM

11. Add 5 of the 20 mm bolts to the load cell hopper.
12. Press **Tab** on the PC keyboard.

After approximately 5 seconds, the part count line should display a part count of 5. This allows time for the load cell to stabilize and for the hub to receive the latest data.
13. Click **SAVE** to save the part ID and part count to the production quantity application for display.
14. Click the Dashboard web browser tab to view the production quantity application.

The part name should display 20MM to show that the 20 mm bolts are being counted. The part count should display 5 to show that there are 5 bolts in the hopper. The production count graph should show that the 20 mm bolts have a quantity of 5.

15. Perform the following substeps to view the part description, part ID, and part type unit weights.
 - A. Click the Data Entry browser tab.
 - B. Click the greater-than symbol (>) to expand the tree for Smart Manufacturing Institute.

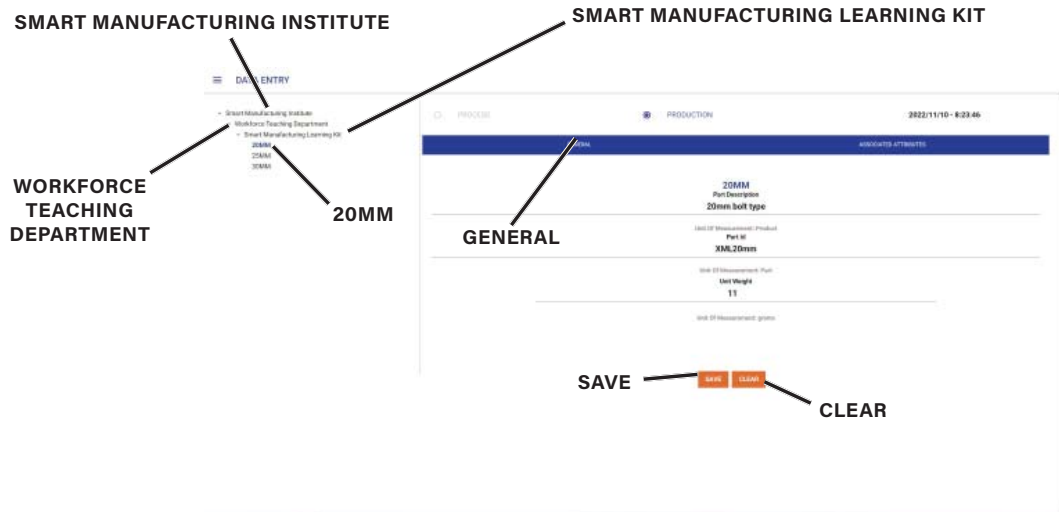


Figure 93. Data Entry Tree

- C. Click the greater-than symbol (>) to expand the tree for Workforce Teaching Department.
- D. Click the greater-than symbol (>) to expand the tree for Smart Manufacturing Learning Kit.
- E. Select **20MM** to choose the 20 mm bolt setup.
- F. Click **GENERAL** to display the 20 mm bolt page.

This page displays the part name, part description, part ID, unit weight, and unit of measurement.

This process can be performed for the 25 mm bolts (25MM), the 30 mm bolts (30MM), and any other parts configured by the instructor.

16. Empty the load cell hopper.
17. Perform the following to shut down the workstation.
 - A. Raise the load cell hopper into shipping position.
 - B. Push the button on the T-handle and remove the quick-release pin.
 - C. Insert the quick-release pin into the hopper and the panel to secure the hopper in shipping position.
 - D. Close the BorgConnect Dashboard and the Internet browsers by clicking the (X) in the top right-hand corner of the screen.
 - E. Press the power button on the hub to power down.
 - F. Switch the workstation's main power switch to the **OFF** position.
 - G. Turn off the PC and monitor.

Bluetooth Scanner Additional Information

This appendix includes the following Bluetooth Scanner additional information:

- Beeper Indication
- LED Indication
- Product Barcodes

Beeper Indication

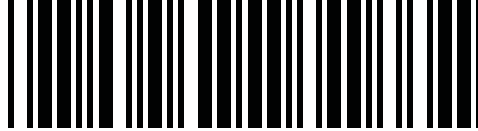
Single long beep	Power up
Single beep	Good read
Single short beep	The scanner reads a Code39 of ASCII in configuration procedure
Two beeps	1. Wireless Connection
	2. The scanner successfully reads a configuration barcode
Two short beeps	Good read (Auto mode)
Four beeps (Hi-Lo-Hi-Lo)	Out of range/Poor connection
Five beeps	Low power
Three beeps	Wireless disconnection
Three short beeps	1. The scanner reads a barcode while disconnected
	2. The scanner reads an unexpected barcode during configuration procedure
Several short beeps	The scanner switches from one communication mode to another

LED Indication

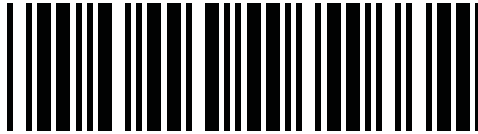
Off	Standby or Power off
Flashing Green	Disconnected or Discoverable
Green for 2 seconds	Good read
Flashing Red	Low Power
Solid Red	Charging

Product Barcodes

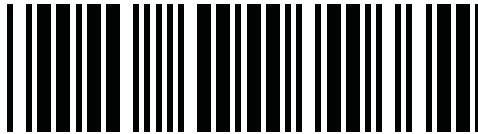
20MM



25MM



30MM



Installer Checklists

This appendix includes the following installer checklists:

Smart Manufacturing Learning System Checklists

990-SM10 Portable Smart Manufacturing Learning System

Optional Remote Current Sensor

43110 Remote Current Sensor, 990-SM10



CUSTOMER _____

CUSTOMER P.O. _____

ASO _____

SERIAL NUMBER _____

SHIPPING CHECKLIST

12/20/2022

PLEASE REPORT ANY MISSING ITEMS/DAMAGED COMPONENTS WITHIN 10 DAYS.

SAVE DAMAGED CARTONS IF COMPONENTS ARE DAMAGED.

AMATROL WILL NOT BE RESPONSIBLE AFTER THIS PERIOD.

990-SM10-AAU SMART MANUFACTURING LEARNING SYSTEM

Office Use	Item Number	Check Off	Qty.	Part Number	Description
	1.	_____	1	A220121	990-SM10 Final Assembly
	2.	_____	1	43100	Bluetooth Scanner, 990-SM10
	3.	_____	1	43105	Wi-Fi Temp Sensor and Power Supply, 990-SM10
	4.	_____	1	43130	Fastener, 20 mm Bolts, 15 pcs.
	5.	_____	1	43131	Fastener, 25 mm Bolts, 15 pcs.
	6.	_____	1	43132	Fastener 30 mm Bolts, 15 pcs.
	7.	_____	1	20704	Cable, Cat 5E, 14Ft, Gray
	8.	_____	1	43101	USB Bluetooth Adapter
	9.	_____	1	25102	IEC Power Cord, 14/3, 15 A
	10.	_____	1	K19405-AA00UEN	Print CD,990-SM10
	11.	_____	1	D19405-AA00UEN	Operation and Installation Guide,990-SM10
	12.	_____	1	S19405-AA00UEN	Supplemental Disk, 990-SM10

PREPARED BY _____ DATE _____

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SHIPPING CHECKLIST

12/6/2022

CUSTOMER _____

CUSTOMER P.O. _____

ASO _____

SERIAL NUMBER _____

PLEASE REPORT ANY MISSING ITEMS/DAMAGED
COMPONENTS WITHIN 10 DAYS.

SAVE DAMAGED CARTONS IF COMPONENTS ARE
DAMAGED.

AMATROL WILL NOT BE RESPONSIBLE AFTER
THIS PERIOD.

43110 CURRENT SENSOR

Office Use	Item Number	Check Off	Qty.	Part Number	Description
	1.	_____	1	A220121-0-10	External Current Monitor
	2.	_____	1	25102	IEC Power Cord, 14/3, 15 A
	3.	_____	1	43111	Power Cord IEC To NEMA 2FT.

PREPARED BY _____ DATE _____

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