



PHASE CONNECT™

Installation & Operation Manual

<http://www.phasetechnologies.com/downloads>

REMOTE EQUIPMENT MANAGEMENT

- Stay informed from anywhere
- Intuitive web & mobile portal
- Programmable e-mail and text alerts
- Accepts 100 – 480 VAC





REMOTE EQUIPMENT MANAGEMENT



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V1.0_06012021


SAFETY MESSAGES AND WARNINGS

To ensure safe and reliable operation of the Phase Connect system, it is important to carefully read this manual and to observe all warning labels attached to the unit before installing. Please follow all instructions exactly and keep this manual with the unit for quick and easy reference.


Definitions of Warning Signs and Symbols


 **CAUTION:** Indicates a potentially hazardous situation that could result in injury or damage to the product.


 **WARNING:** Indicates a potentially hazardous situation that could result in serious injury or death.


 **HIGH VOLTAGE:** The voltage associated with the procedures referenced could result in serious injury or death. Use caution and follow instructions carefully.


READ THESE WARNINGS BEFORE INSTALLING OR OPERATING EQUIPMENT!


 **WARNING:** Risk of electric shock. De-energize the unit by disconnecting all incoming sources of power, before servicing the equipment.

 **HIGH VOLTAGE:** This equipment is connected to line voltages that can create a potentially hazardous situation. Electric shock could result in serious injury or death. This device should be installed only by trained, licensed, and qualified personnel. Follow instructions carefully and observe all warnings.

 **WARNING:** Installation of this equipment must comply with the National Electrical Code (NEC) and all applicable local codes. Failure to observe and comply with these codes could result in risk of electric shock, fire, or damage to the equipment.

 **CAUTION:** Circuit breakers, fuses, proper ground circuits, and other safety equipment and their proper installation are not provided by Phase Technologies, LLC, and are the responsibility of the end user.

 **WARNING:** Input power connections should be made by a qualified electrician into circuit with adequate voltage and current carrying capacity for the model.

 **CAUTION:** Use 600 V vinyl-sheathed wire or equivalent. The voltage drop of the leads needs to be considered in determining wire size. Voltage drop is dependent on wire length and gauge. Use only copper conductors.

 **CAUTION:** Secure wires to terminal blocks and torque to value be listed in **Table 1**.


 **CAUTION:** Never allow bare wire to contact metal surfaces.

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1 INTRODUCTION

Phase Connect is a remote management system designed to monitor and control variable frequency drives (VFDs). Although designed for use with Phase Technologies VFDs, Phase Connect can be tailored to manage a variety of equipment. Data is transferred between the device and an online portal, which is accessible from any PC or smart phone. From the portal, users can monitor three inputs (one analog, two digital) and control three outputs (one analog, two digital). Alerts can be customized to send text and/or email notifications to one or multiple contacts. One account can manage unlimited Phase Connect devices. See **Figure 1** for an overview of Phase Connect components.

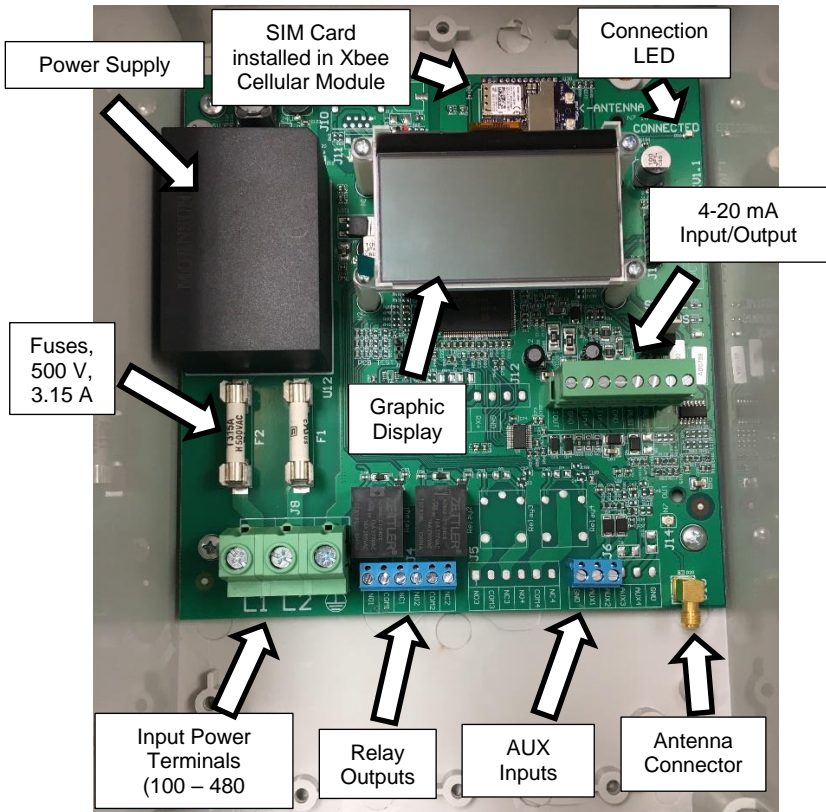
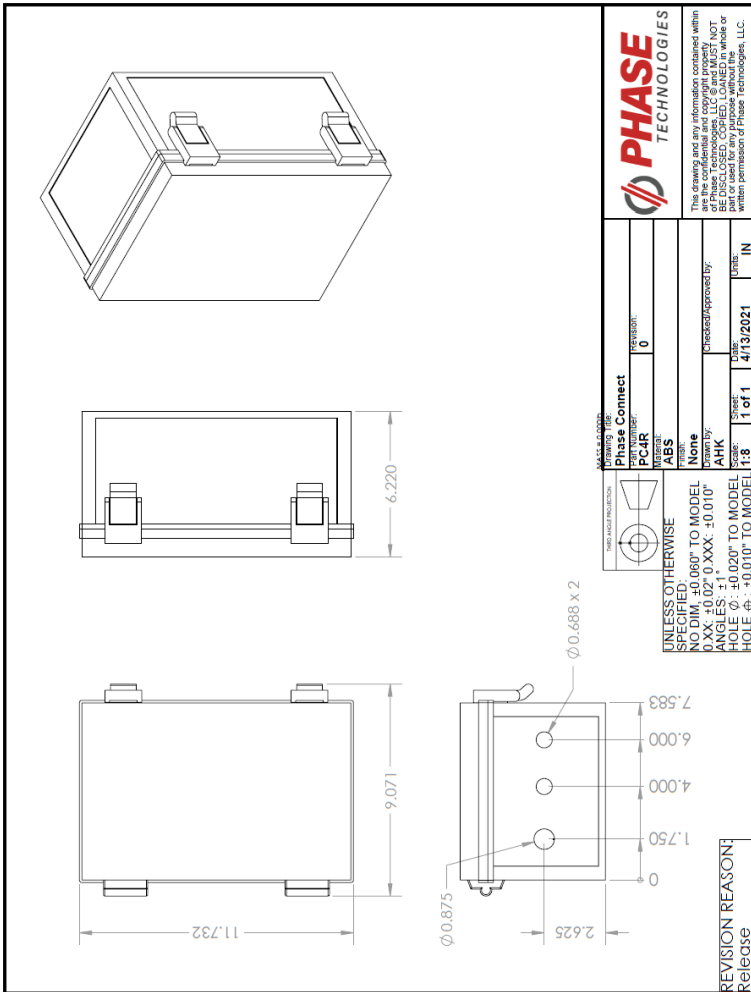


Figure 1 – Internal Components of Phase Connect

1.1 Specifications

Model Number	PC4R
Input Voltage	90 VAC – 528 VAC
Input Current	3 A
Operating Temperature Range	-10 °C to 50 °C (-14 °F to 122 °F)
Storage Temperature	-20 °C to 60 °C (-4 °F to 140 °F)
Dimensions (H x W x D)	11.73" x 9.07" x 6.22"
Enclosure Type	NEMA 3R
Weight	4 lbs

1.2 Enclosure Drawing



2 INSTALLATION



Install Tip Devices must be activated through the online portal before device will connect. Go to connect.phasetechnologies.com to activate new devices.

2.1 Mounting the Enclosure

Each Phase Connect device comes with external mounting brackets and two sets of screws. Use the larger screws to fasten the mounting brackets to the enclosure as shown below.

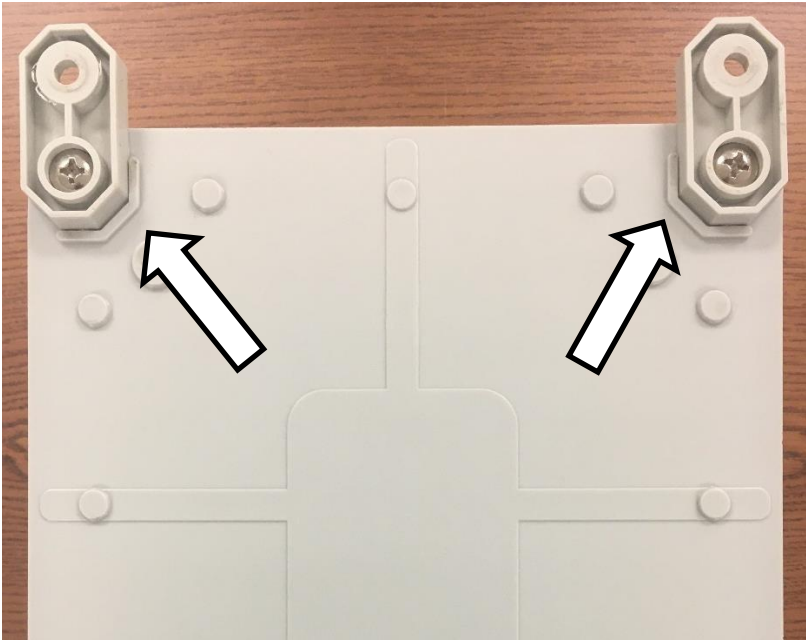


Figure 2 – Mounting Brackets on Enclosure

The Phase Connect enclosure should be mounted to a solid, non-flammable surface using the mounting brackets provided. It should be installed in a location free from:

- Corrosive gases or liquids
- Excessive vibration
- Airborne metallic particles

2.2 Antenna

Screw the antenna to the magnetic base and connect the antenna cable to the connector at the bottom right corner of the device circuit board (see **Figure 1** on next page). The antenna should be mounted upright, to a magnetic surface, in open air. Do not mounting the antenna inside a metallic enclosure. Metal will reflect radio frequency signals and reduce signal strength. Antenna wire should be routed separately from power cables.

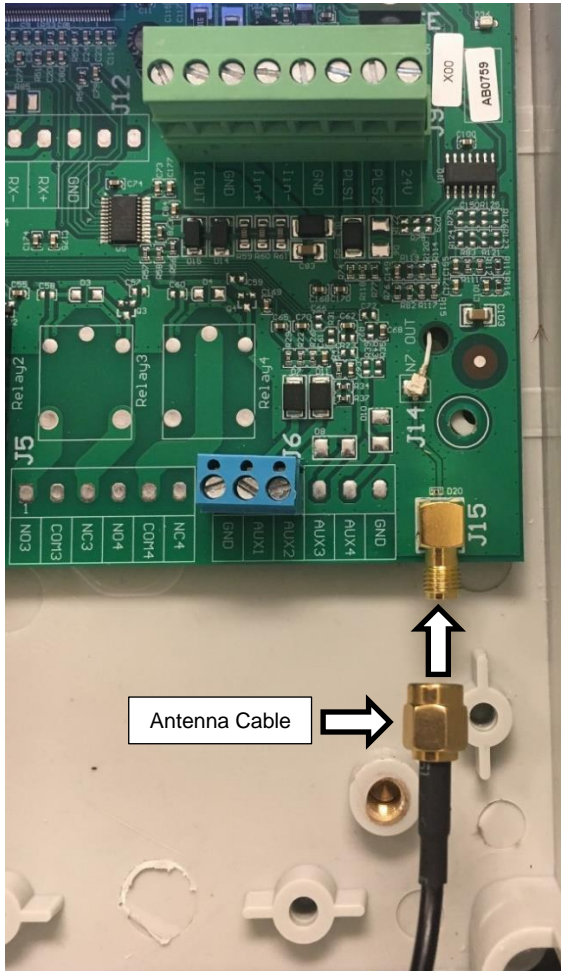


Figure 3 – Antenna Connection



Install Tip

A cell phone signal booster may be used to increase reception in remote areas.

2.3 Grounding the Device

- Properly ground the system according to local electrical code.
- Connect the ground terminal to the branch circuit or service ground conductor with an adequately sized conductor according to local electrical code.
- Ground terminal location is shown in **Figure 4**.

Recommended Min. Ground Wire	Max Wire Size	Torque
14 AWG	6 AWG	10.5 lb-in.

2.4 Field Wiring Terminals

The Phase Connect will accept an incoming voltage range of 100 VAC – 480 VAC. Connect incoming power cables to L1 and L2, shown in **Figure 4**, and tighten to 10.5 lb-in, as shown in **Table 1**.

⚠ CAUTION: Installations must comply with NEC and local electrical code requirements. Failure to do so can lead to hazardous situations and may void manufacturer's warranty.

Table 1 – Input Power Terminal Specifications

	Rating	Wire Size	Torque
Input Power (L1, L2)	480 V, 3 A	18 – 6 AWG	10.5 lb-in.



Figure 4 – Input Power Terminal Locations

2.5 Cable and Wire Routing

All cables should enter the bottom of the enclosure through the conduit openings provided. Do not route power cables and control wires in the same conduit. If control cables must intersect power cables, they should cross at right angles to minimize electromagnetic interference (EMI). See enclosure drawing on page 2 for conduit sizes and locations.

3 CONTROL WIRING

The Phase Connect is equipped with two AUX inputs and an analog input for monitoring equipment status. The device also contains two Normally Open/Normally Closed (NO/NC) relay outputs and an analog output for controlling equipment with a manual 4-20 mA signal. Refer to **Table 2** for wire sizes and torque values. This section details common wiring setups for monitoring and controlling Phase Technologies VFDs.

Table 2 – Control Terminal Wire Range and Torque Values

	Wire Range	Torque
AUX1 and AUX2	26 – 18 AWG	3.5 lb-in.
Relay 1 and Relay 2		
I in and I out	24 – 18 AWG	3.5 lb-in.

Phase Connect control terminal ratings and functions are described in **Table 3** below.

Table 3 – Control Terminal Ratings and Descriptions

Terminal	Description	Rating	Comments
NO1	Normally Open Relay 1	24 VDC or 277 VAC, 12 A	Normally open relay controlled via online portal.
COM1	Common 1		Common terminal for NC1 and NO1 terminals.
NC1	Normally Closed Relay 1		Normally closed relay controlled via online portal.
NO2	Normally Open Relay 2		Normally open relay controlled via online portal.
COM2	Common 2		Common terminal for NC2 and NO2 terminals.
NC2	Normally Closed Relay 2		Normally closed relay controlled via online portal.
I out	4-20 mA Output	4-20 mA	Analog transducer connection for controlling a 4-20 mA signal via online portal. Accurate within 1%.
GND	Ground for I out		
I in+	4-20 mA Positive		Analog transducer connection for monitoring a 4-20 mA signal via online portal. Accurate within 1%.
I in-	4-20 mA Negative		
COM	Common	< 5 V, galvanically isolated	Common terminal for AUX1 and AUX2
AUX1	Auxiliary 1		Digital input used to monitor relay status via online portal.
AUX2	Auxiliary 2		Digital input used to monitor relay status via online portal.
GND	Ground		Ground terminal for AUX1 and AUX2

3.1 Detect VFD Fault

To set up the device to detect a VFD fault on a Phase Technologies drive, connect wires as shown in **Figure 5** and set **PROGRAM RELAY 1** to “**0 = SYSTEM FAULT**” on VFD.

When the VFD has a fault, **AUX 1** will be shown in the **CLOSED** position on the portal **Dashboard**. The label of **AUX 1** can be changed on the **Config** page of the portal.

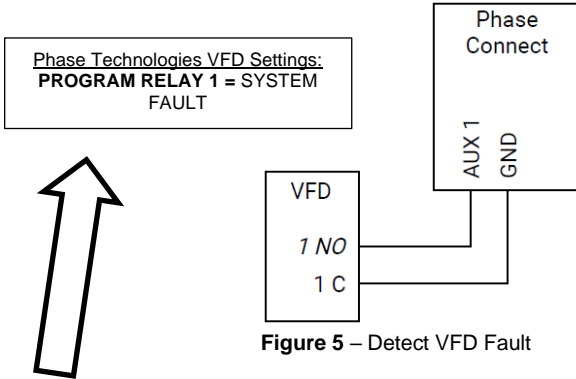


Figure 5 – Detect VFD Fault



Install Tip

Be sure to make sure your VFD settings are set up properly for the chosen operation.

3.2 Monitor VFD Run Status

To set up the device to detect when a Phase Technologies VFD is running a load, connect wires as shown in **Figure 6** and set **PROGRAM RELAY 2** to “**5 = MINIMUM FREQUENCY**” on VFD.

When the VFD is running, **AUX2** will be shown in the **CLOSED** position on the portal **Dashboard**. The label of **AUX 2** can be changed on the **Config** page of the portal.

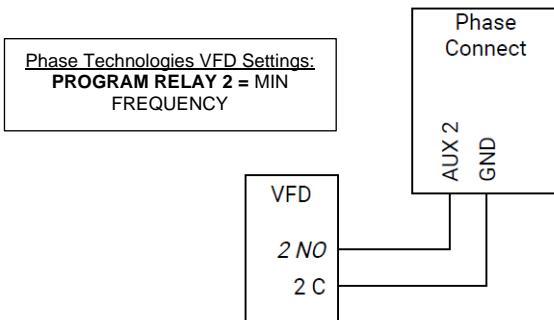


Figure 6 – Detect When Drive is Running

3.3 Monitor 4-20 mA Transducer Input

To view the reading of a 4-20 mA transducer, connect wires from a 4-20 mA transducer to the device as shown in **Figure 7**. In the portal, this reading will be displayed under the **4-20 mA Input**. Use the **Config** page to select the proper sensor range and units for the transducer being used. If the value shown for **4-20 mA Input** does not match a manual reading, use **4-20 mA Input Offset**, on the web portal, to calibrate.

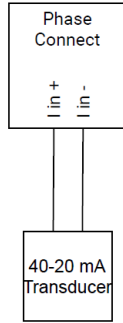


Figure 7 – Monitor 4-20 mA Input

If your 4-20 mA transducer isn't reading correctly wired as shown in **Figure 7**, it may provide a voltage, which interferes with the board voltage. If your transducer provides a voltage, you will need to connect the wires as shown below.

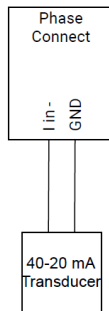


Figure 8 – 4-20 mA Transducer Wiring with External Source

3.4 VFD Run/Stop Control

To give a Phase Technologies VFD a **RUN/STOP** command remotely, connect wires as shown and make sure the VFD settings match those shown in **Figure 9**. These are default settings, so no changes should need to be made. On the portal dashboard, toggle **Relay 1** and hit **Send Commands** button. The relay icon next to **Relay 1** will now show that the NO terminal is connected to C. The label of **Relay 1** can be changed on the **Config** page of the portal.

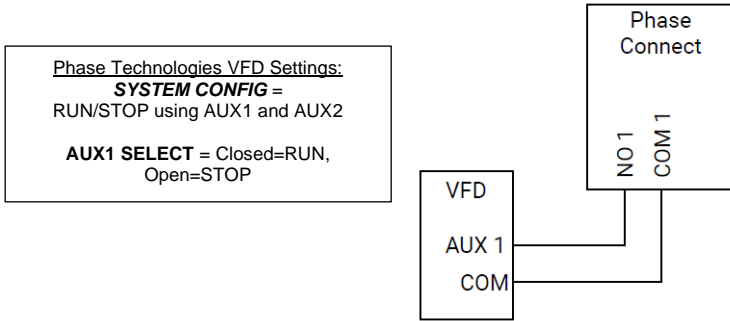


Figure 9 – Run/Stop Commands

3.5 Reset VFD Fault



Install Tip

Not all Phase Technologies drives have this feature. Navigate to the **AUX SELECT** parameters in your drive to ensure it has this ability.

Some faults on Phase Technologies VFDs require manually cycling incoming power to reset. To do this remotely, connect wires as shown in **Figure 10** and set **AUX 2 SELECT** on the VFD to **5 (Reset Drive Fault)**. If a Phase Technologies VFD encounters a non-resettable fault, use the portal to turn Relay 2 **ON**, which will cycle power to the VFD and reset the fault. If the drive encounters another fault, Relay 2 will need to be cycled **OFF** then back **ON** to reset the fault.

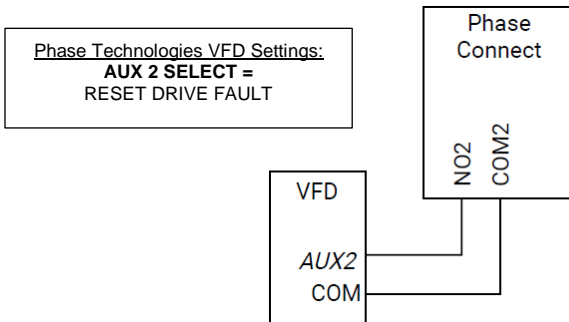


Figure 10 – Reset VFD Fault

3.6 4-20 mA Output Control

⚠ CAUTION: If sending a 4-20 mA signal from a Phase Connect to a Phase Technologies VFD, wires must be connected to I1- and COM in VFD. Wiring to I1+ and I1- can damage the VFD control board and void warranty.

To manually control the speed of a Phase Technologies VFD relative to a 4-20 mA signal, connect wires as shown in **Figure 11**. The wires connected to I_{out} and GND of the Phase Connect are used to send a manual 4-20 mA signal from the portal to the VFD 4-20 mA input. The wires connected to AUX 1 and COM of the VFD are used to provide **RUN/STOP** commands from the portal. If the VFD is in AUTO mode and the proper settings are selected, a RUN command will prompt the drive to ramp to the frequency corresponding with the **4-20 mA Output** signal from the portal. Use the **Config** page to select units and the range of the analog output.

When controlling a **4-20 mA Output** signal from the portal, the user will select a value in their chosen units (psi, GPM, or feet). This value will be converted to a 4-20 mA signal before being sent to the device.

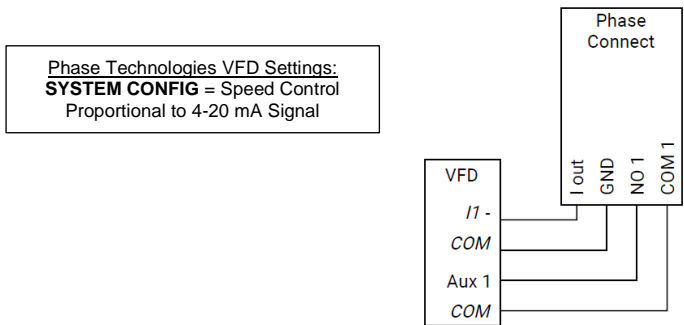


Figure 11 – 4-20 mA Output Control

3.7 Repeat 4-20 mA Input Signal

⚠ CAUTION: If sending a 4-20 mA signal from a Phase Connect to a Phase Technologies VFD, wires must be connected to I1- and COM in VFD. Wiring to I1+ and I1- can damage the VFD control board and void warranty.

Phase Connect allows users to control a VFD and monitor the input from the portal using a single transducer. To do this, wire the transducer, VFD, and Phase Connect as shown in **Figure 12**. On the portal dashboard, check the box under the 4-20 mA Output that says, "Match Input" and hit **Send Commands**. Now both the portal and the VFD will read the 4-20 mA transducer signal. When turning the **Match Input** command **OFF**, the 4-20 mA Output will be reset to 0.

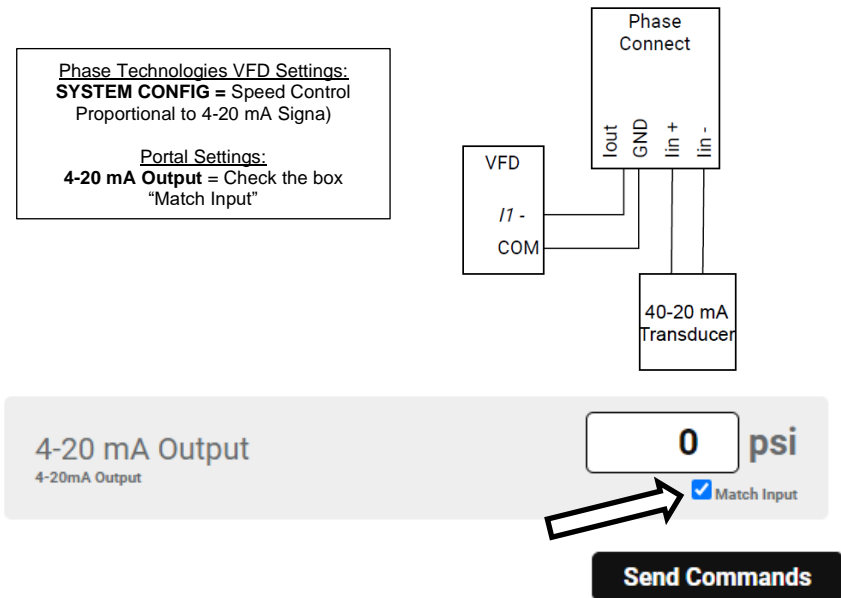


Figure 12 – Repeat 4-20 mA Signal

💡 Install Tip

Be sure to hit SEND COMMANDS after selecting MATCH INPUT to enable this feature.

4 OPERATION



Install Tip Devices must be activated through the online portal before device will connect. Go to connect.phasetechnologies.com to activate new devices. The first connection process should take about 20 minutes but can take longer depending on cellular reception.

4.1 Initialization

After power and control connections are made, turn power to the device **ON** so device can begin the connection procedure. While connecting, the display will show “Waiting Conn:” with a counter showing the number of seconds the device has been trying to connect. The activation process usually takes 20 minutes but can take longer in areas with poor cellular service. The **Connection LED**, in the top right corner of the circuit board, will blink when connected and be always on when unconnected.

4.2 Device Parameters

After device is connected, parameters and their values will scroll across the display. See **Figure 13** and **Table 4**, to understand the information being shown. The **IMEI** (International Mobile Equipment Identity) number is a unique identifier for mobile devices. This can be used to verify which device you are controlling through the portal.



Figure 13 – Understanding the Display

Table 4 – Scrolling Parameters


Parameter	Description
Iin	4-20 mA Input value
Iout	4-20 mA Output value
T	Temperature in °C and °F
R1 R2	Status of Relay 1 and Relay 2
X1 X2	Status of Aux 1 and Aux 2
X1 Cycles	Number of times Aux 1 has been cycled
X2 Cycles	Number of times Aux 2 has been cycled
X1 On	Total time Aux 1 has been closed
X2 On	Total time Aux 2 has been closed
Next Msg	Countdown until next update is sent to portal

5 PHASE CONNECT PORTAL

5.1 Creating An Account

A Phase Connect Portal account is required to view and manage Phase Connect devices. To create a portal account, go to connect.phasetechnologies.com and click “Sign up for an Account.” Enter your information and click “Accept Terms and Submit.” If you already have an account, you will need to log in to access your devices.

5.2 Activating A New Device

 **Install Tip** The first connection process should take about 20 minutes but can take longer depending on cellular reception.

If you have not activated a device before, you will be prompted to do so after creating a portal account. If you already have active devices, you will need to click on the **Activate New Device** button on the **View Devices** page and follow the steps. You will need to enter the device **Serial Number** and **Activation Code**, which can be found on a sticker inside the device or on a card included in the device packaging. You may also scan the QR code on the serial number sticker, which will take you to the online portal **Device Activation** page. See **Figure 14** for the location of this information.

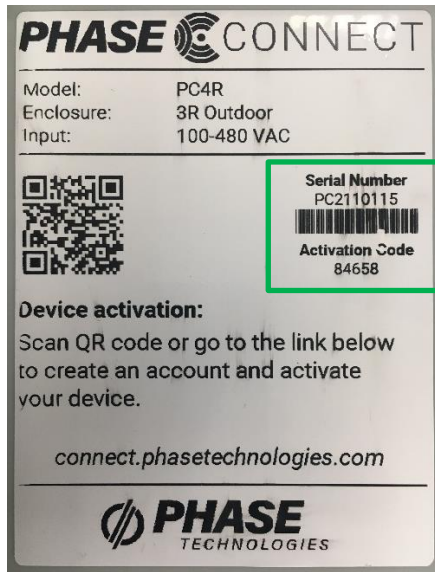


Figure 14 – Device Serial Number and Activation Code

5.3 Navigating the Portal

To manage a device, go to the **View Devices** page, found in the **Portal Navigation Pane** on the left side of the window, and then click on the device you wish to manage. This will bring you to the **Device Dashboard**. The Device Dashboard will be the main page for monitoring and control. Other pages are found in the **Device Navigation Pane**. To change

AUX and relay labels, as well as to configure 4-20 mA Input and Output, see the **Config** page. Use the **Alerts** page to set up text and email notifications. The **Records** page can be used to keep a log of device history. The **Settings** page is used to manage subscription plans and billing information.

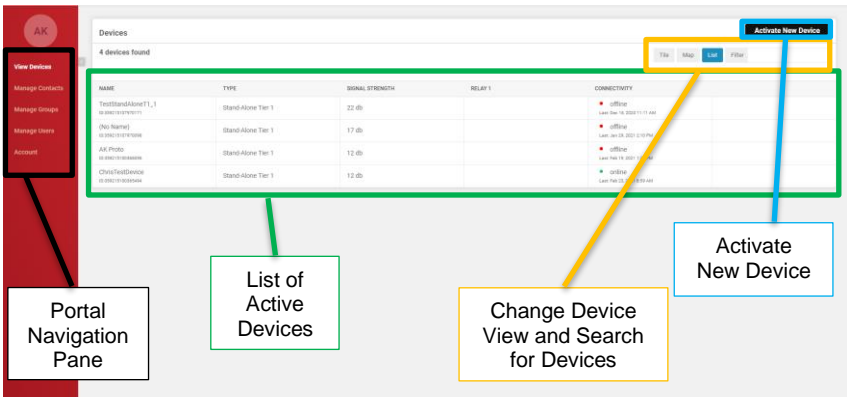


Figure 15 – View Devices Page

5.4 Device Dashboard

Active devices will appear on the **View Devices** page. Devices can be viewed by clicking on them. This will open the **Device Dashboard** for the selected device, where settings can be monitored and controlled. Use the **Device Navigation Pane** to navigate through the settings of the current device. The **Device Status Bar**, in the top right corner of the **Device Dashboard**, can be used to view critical device information quickly.

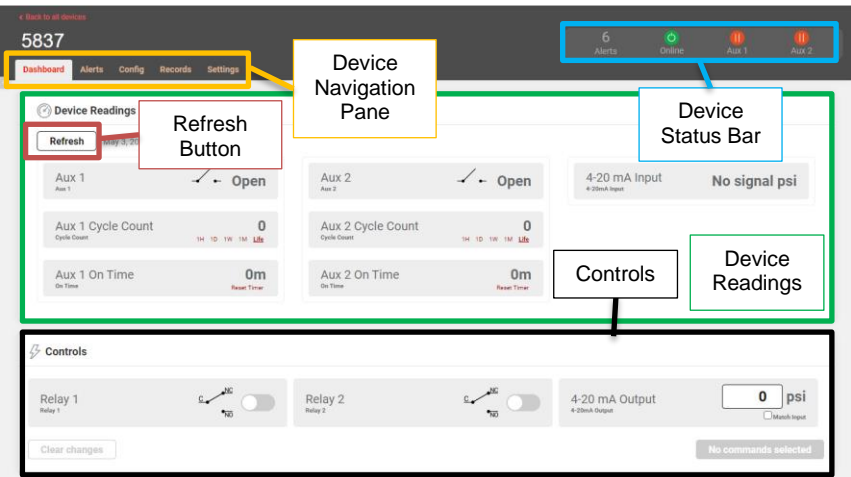


Figure 16 – Device Dashboard

5.5 Device Readings

The Device Readings box section is where you will see Aux 1, Aux 2, and 4-20 mA Input readings. Readings are sent from the device to the portal hourly and can be requested at any time by clicking the **Refresh** button. Refreshing the device readings will request new readings from the device and display them once received.

Cycle Count displays the number of times each Aux switch has cycled, **ON** and back **OFF** is one cycle. The time period of this count can be changed by selecting from the list of time frames below the Cycle Count. Time periods are shown for the last hour, the last day, the last week, the last month, and the life of the Phase Connect device. Aux **On Time** refers to the amount of time each Aux switch has been in the closed, or **ON**, position. The **On Time** counts can be reset to 0 by clicking **Reset Time** below each count.

5.6 Controls

In the **Controls** section of the **Dashboard**, you have the ability to control two relays and one 4-20 mA Output. To change the state of relays, click on the toggle next to the relay you'd like to change then hit the **Send Commands** button. Likewise, to change the **4-20 mA Output**, type in the value you want the device to give and hit **Send Commands**. You may send multiple commands at once. After sending commands to the device, a 20 second countdown will begin, after which the portal will auto-refresh. This 20 second delay allows the analog readings to reach or move toward their setpoint before updating the portal readings.

5.7 Configuring Your Device

The **Config** page allows you to customize the **Dashboard** labels and the 4-20 mA settings. For accurate 4-20 mA readings, you must set the range and the units of the transducer in the **Analog Control Settings** box. Units can be psi (pounds per square inch), ft (feet), or gpm (gallons per minute). To save configuration changes, you must click "Save" or "Save and Deploy" before leaving the Config page.

Device location can be set on the Config page by scrolling down to the map and clicking on the desired device location then clicking Save.

5.8 Programming Alerts

Alerts can be set up to monitor the status of Aux switches, 4-20 mA Input, and Online Status. Alerts will be triggered when the portal receives hourly updates from the device or upon manual refreshes of the **Dashboard**. After clicking on the **Alerts** tab, you will be taken to the Alerts page, where you will see a list of previous alerts that have been triggered.

The Alerts page is where you can Acknowledge alerts by clicking on the **Acknowledge** button on the right side of the list. Acknowledging an alert will remove it from the alert counter in the **Device Status Bar**.

To view current alert rules or set up a new alert, click on the **Manage Alerts** button. This will bring up a list of alert rules. To edit an alert rule, click on the rule you would like to edit. To create a new alert rule, click the **Add Alert** button. Contacts can be notified via text or email by clicking the **Add Contact** button and selecting the Contact or Group you would like to be notified.

5.9 Manage Contacts

Alerts can be customized to text or email contacts when an event of interest occurs. **Manage Contacts** is found in the Portal Navigation Pane. Contacts can be arranged into groups that can receive alert notifications. Use this to save time when setting up alert notifications if multiple contacts need to be notified.

5.10 Adding New Users to Account

Additional users can be added to accounts from the **Manage Users** page, found in the Portal Navigation Pane, on the left edge of the screen. Click "Add User" in the top right corner, enter the new user's name and email, and then select their **Role**. Their Role will determine their permission structure. Administrators are the only users that can view and update billing information. See **Table 5**, below for a description of each Role.

Table 5 – User Roles

Role	Description
Administrator	Has all the same permissions as User with Control. Can view and edit payment information and add device users.
User with Control	Can view device readings, make changes, acknowledge alerts, and create new alerts.
View Only	Can view device readings but cannot make changes. Can acknowledge alerts.

5.11 Removing Users from Account


To remove a user from an account, go to the **Manage Users** page, in the Portal Navigation Pane, and click on the user that you wish to remove from the account. Click **Unlink User** to revoke their portal access. The user will then receive an email notification that they have been removed from the account.

5.12 Transferring Account

To transfer ownership of the account to another user, go to the **Manage Users** page in the Portal Navigation Pane. Click the **Add User** button and enter the new owner's name and email address, ensure the **Role** is set to Administrator and click the **Add** button.

The new user will receive an email with their login credentials. Once the new user is logged in, they can go to the **Manage Users** page, click on the old owner's name, and select **Unlink User**. If the original device owner cannot be reached to transfer device ownership, contact Phase Technologies for assistance.

5.13 Pausing Device Communication

 **Helpful Tip** Pausing device communication will still incur subscription charges.

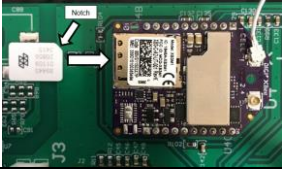
Pausing a device will stop all communication between the device and the online portal, but subscription costs will still be charged. If a device has been paused through the portal,

incoming power to the device will need to be manually cycled **OFF/ON** before device will resume communication. To pause device communication, go to the Settings page of the device you would like to pause, and hit the **Pause** button at the bottom of the screen. Likewise, to un-pause device communication, click the **Un-Pause** button at the bottom of the settings page for the paused device. After the device has been un-paused on the portal AND power has been cycled OFF and back ON, the device will resume communication.

5.14 Deactivating Device

Deactivating a device will permanently deactivate the SIM card after the current pay period expires. Deactivating a device is permanent and cannot be reversed without the purchase of a new SIM card. To deactivate a device, go to **Device Settings** and click **Deactivate** and follow the steps to complete the process.

6 TROUBLESHOOTING

PROBLEM	POTENTIAL CAUSE	SOLUTION
Device not powering on	Incorrect source voltage	Ensure incoming power is 100 VAC – 480 VAC.
	Blown fuses	Check fuses, located above L1 and L2 terminals. If damaged, replace with 500 V, 3.15 A fuses.
Device not communicating with web portal	Temporary interruption	Wait for at least one hour and check communication again. If device is still offline after one hour, go on site and check incoming power, Xbee module, and antenna.
	SIM card not installed properly	Ensure that SIM card has been properly installed into Xbee. 
	Antenna disconnected	Check antenna connection.
	Poor cellular signal	Check antenna for damage and good connection.
		Install signal booster to increase signal strength.
Xbee communication	Check that the wire between Xbee module and antenna connector is properly seated.	
	Remove Xbee module, clean pins, and re-install.	
Relays not changing states	Damaged relay	Use the portal to change relay states, use multimeter to check if relay is open or closed. If not functioning, contact Phase Technologies.
4-20 mA readings not accurate	4-20 mA	Ensure that transducer is wired correctly. Connect I_out to I_in-, change the 4-20 mA Output on the portal and check the 4-20 mA Input reading. If they are more than 5% off, contact Phase Technologies for replacement.



LIMITED WARRANTY

This Limited Warranty applies to the following
Phase Technologies' product lines:

Phase Connect One Year Warranty

Phase Connect devices are warranted against defects in material and workmanship. This warranty covers both parts and labor from the date of purchase from Phase Technologies. Phase Technologies will repair or replace (at our option), at no charge, any part(s) found to be faulty during the warranty period specified. The warranty repairs must be performed by/at a Phase Technologies Authorized Service Center or at Phase Technologies LLC, Rapid City, SD.

Obligations of Customer

1. The original Bill of Sale must be presented to obtain "in-warranty" service. Transportation to Phase Technologies or an Authorized Service Center is the responsibility of the purchaser. Return transportation is provided by Phase Technologies.
2. Installations must comply with all national and local electrical codes.

Exclusions of the Warranty

This warranty does not cover any of the following: accident, misuse, fire, flood, and other acts of God. Nor does this warranty cover any contingencies beyond the control of Phase Technologies, LLC, including: water damage, incorrect line voltage, improper installation, missing or altered serial numbers, and service performed by an unauthorized facility.

Phase Technologies' liability for any damages caused in association with the use of Phase Technologies' equipment shall be limited to the repair or replacement only of the Phase Technologies' equipment. No person, agent, distributor, dealer, or company is authorized to modify, alter, or change the design of this merchandise without express written approval of Phase Technologies, LLC.



Scan to download product information



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