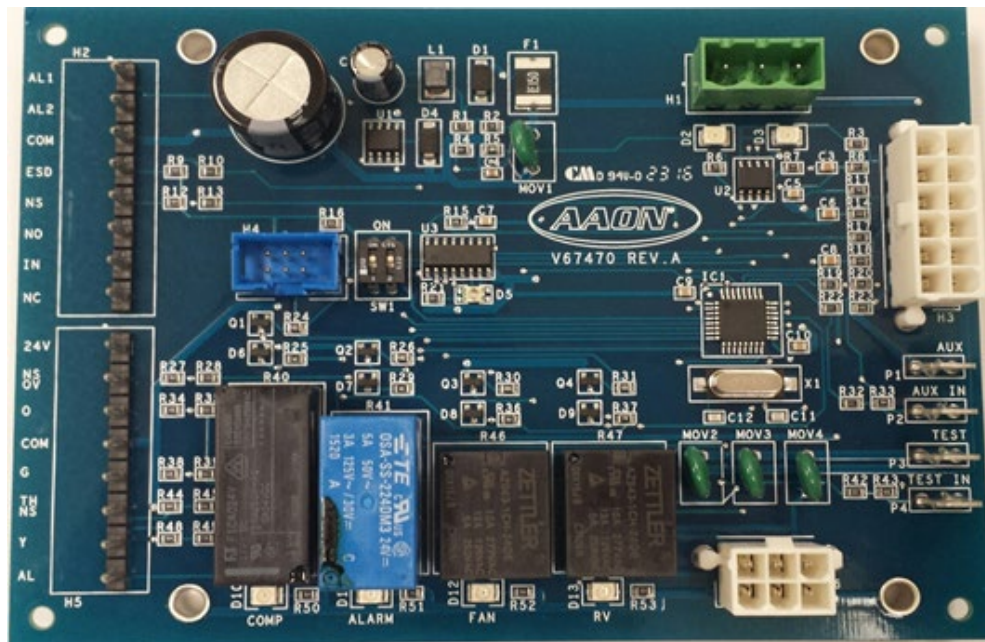




Pioneer Silver Controller Technical Guide

Pioneer Silver Controller Code: Version 1.7
Pioneer Silver Expansion Board Code: Version 1.5
Modular Service Tool: Version 1.13
Used with AAON WSHP WV Series Vertical and WH Series Horizontal





WARNING

QUALIFIED INSTALLER

IMPROPER INSTALLATION, ADJUSTMENT, ALTERATION, SERVICE, OR MAINTENANCE CAN CAUSE PROPERTY DAMAGE, PERSONAL INJURY, OR LOSS OF LIFE. INSTALLATION AND SERVICE MUST BE PERFORMED BY A TRAINED, QUALIFIED INSTALLER. A COPY OF THIS MANUAL SHOULD BE KEPT WITH THE UNIT AT ALL TIMES.



www.aaon.com

This manual is also available for download from our website—www.aaon.com/controlsmanuals under **Current HVAC Unit Controllers where you can always find the latest literature updates.**

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Factory Technical Support Phone: 918-382-6450
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PIONEER SILVER CONTROLLER TECHNICAL GUIDE

REVISION & DATE	CHANGE
Rev. 01D, March 17, 2020	Revised temperatures values in Glycol Setpoints Table, p.17.
Rev. 01D, March 17, 2020	Revision to leaving water temperature alarm verbage, p.17.
Rev. 01D, March 17, 2020	Revision to entering water temperature and low suction pressure alarm verbage, p.18.
Rev. 01D, April 28, 2020	Changed names of (2) sensors. The LWT (Leaving Water Temperature) Sensor became the RTH (Refrigerant Saturated Suction Temperature during Heating) Sensor and the ECT (Entering Coil Temperature) Sensor became the RTC (Refrigerant Saturated Suction Temperature during Cooling) Sensor.
Rev. 01D, June 15, 2020	Information added for Y1 to Y2 input jumper wiring, p.19, 23.
Rev. 01E, July 29, 2020	Revision to leaving water temperature alarm, p.17.
Rev. 01E, July 29, 2020	Revisions to high discharge pressure & low suction pressure alarms, p.18.

AAON Factory Technical Support: 918-382-6450
techsupport@aaon.com

NOTE: Before calling Technical Support, please have the model and serial number of the unit available.

PARTS: For replacement parts, please contact your local AAON Representative. When ordering parts, reference the unit serial number and part number located on the external or internal nameplate of the unit.

AAON, Inc.
 Warranty, Service, and Parts Department
 2425 S. Yukon Ave.
 Tulsa, OK 74107
 Ph: 918-382-6450
 techsupport@aaon.com
 www.aaon.com

PART NUMBER CROSS REFERENCE TABLE

PART DESCRIPTION	PART NO.
Pioneer Silver Controller	V67470
Pioneer Silver Electric Heat Board	V75410
Heat Pump Thermostat	By Others
Modular Service Tool (for ECM Programming)	ASM01895
ECM Programming Cable	G045460
Horizontal Water-Source Heat Pump Unit	WHA-XXX
Vertical Water-Source Heat Pump Unit	WVA-XXX

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OVERVIEW

Safety

Safety

Attention should be paid to the following statements:

NOTE—Notes are intended to clarify the unit installation, operation and maintenance.

CAUTION—Caution statements are given to prevent actions that may result in equipment damage, property damage, or personal injury.

WARNING—Warning statements are given to prevent actions that could result in equipment damage, property damage, personal injury or death.

DANGER—Danger statements are given to prevent actions that will result in equipment damage, property damage, severe personal injury or death.

WARNING

ELECTRIC SHOCK, FIRE, OR EXPLOSION HAZARD

Failure to follow safety warnings exactly could result in dangerous operation, serious injury, death, or property damage.

Improper servicing of HVAC equipment could result in dangerous operation, serious injury, death, or property damage.

- **Before servicing, disconnect all electrical power to the equipment. More than one disconnect may be provided.**
- **When servicing controls, label all wires prior to disconnecting. Reconnect wires correctly.**
- **Verify proper operation after servicing. Secure all doors with key-lock or nut and bolt.**

WARNING

Electric shock hazard. Before servicing, disconnect all electrical power to the equipment, including remote disconnects, to avoid shock hazard or injury from rotating parts. Follow proper Lockout-Tagout procedures.

WARNING

GROUNDING REQUIRED

All field installed wiring must be completed by qualified personnel. Field installed wiring must comply with NEC/CEC, local and state electrical code requirements. Failure to follow code requirements could result in serious injury or death. Provide proper unit ground in accordance with these code requirements.

WARNING

During installation, testing, servicing and troubleshooting of the equipment it may be necessary to work with live electrical components. Only a qualified licensed electrician or individual properly trained in handling live electrical components shall perform these tasks.

Standard NFPA-70E, an OSHA regulation requiring an Arc Flash Boundary to be field established and marked for identification of where appropriate Personal Protective Equipment (PPE) be worn, should be followed.

Pioneer Silver System Overview

Applications

The V67470 AAON® Water-Source Heat Pump Pioneer Silver Controller is designed for AAON® horizontal water-source heat pump units—WH & WV series. All of the energy saving features and options available on AAON® WH & WV series water-source pumps can be controlled with the Pioneer Silver Controller.

The Pioneer Silver controller is the standard controller configuration for basic water-source heat pump systems with terminals for connection to a heat pump thermostat. All AAON stocked water-source heat pumps include the Pioneer Silver.

The Pioneer Silver Controller contains all the functionality required to operate the basic configuration of AAON WH & WV Series units. The controller requires commands from a standard heat pump room thermostat and has outputs to control a supply fan, compressor, and reversing valve.

The controller also contains a terminal block for communication to the V75410 Water Source Heat Pump Pioneer Silver Expansion Board for additional functionality, allowing for control of premium options, such as hot gas reheat and waterside economizer.

NOTE: When the expansion board is connected to the main controller, the H5 terminals on the main controller will not be used. The H4 terminals on the expansion board must be used instead to connect to the thermostat.

NOTE: If the application currently uses an obsolete mercury bulb type thermostat, it must be upgraded to an electronic thermostat. The unit will not function properly when controlled via a mercury bulb thermostat.

Pioneer Silver Controller Applications

- Terminals to Connect to a DDC System or Heat Pump Thermostat
- Heating, Cooling, and Dehumidification Modes of Operation

Pioneer Silver + Thermostat Advantages

- PSC or ECM Fan Control
- Rotary or Scroll Compressor Control
- Night Setback
- High Condensate Level Sensor
- Status and Alarm LEDs
- Test Mode for Startup and Maintenance
- Emergency Shutdown Input

Pioneer Silver + Thermostat + Expansion Board Advantages

- PSC or ECM Fan Control
- Rotary or Scroll Compressor Control
- Night Setback
- High Condensate Level Sensor
- Status and Alarm LEDs
- Test Mode for Startup and Maintenance
- Emergency Shutdown Input
- Hot Gas Reheat Dehumidification Control
- Waterside Economizer Control
- Two Stage Fan Control
- Two Stage Compressor Control
- Two Stage Auxiliary Heat Control

OVERVIEW

Pioneer Silver Features and Options

Features and Options

Refer to **Table 1** for a list of Pioneer Silver features and options.

PIONEER SILVER FEATURES & OPTIONS			
UNIT CAPACITY CONTROL	½ to 30 ton WSHPs	ADVANCED FEATURES	<ul style="list-style-type: none"> Waterside Economizer Operation Two-Speed EC Fan Operation Hot Gas Reheat Two-Step Compressor Operation Constant Airflow EC Motor
SERVICE AND RELIABILITY FEATURES	<ul style="list-style-type: none"> Service Test Mode Factory Wiring Harness Connectors High/Low Control Voltage Lockout (Auto Reset) Alarm and Relay Status LEDs Removable Field Low Voltage Connector 	BASIC ALARMS	<ul style="list-style-type: none"> High/Low Control Voltage Alarms (24 VAC) Air Coil Low Refrigerant Temperature Alarm Low Leaving Water Temperature Alarm Dry Alarm Contacts Emergency Shutdown Input Night Setback Mode Night Setback Override Thermostat Input Auxiliary Alarm Input I/O Status LEDs Constant Torque EC Motor
USER INTERFACE	<ul style="list-style-type: none"> Thermostat Control Terminals to Heat Pump Thermostat Status & Alarm LEDs 		
NETWORKING CAPABILITY	Thermostat Terminals to DDC System		
BASIC FEATURES	<ul style="list-style-type: none"> Random Start Delay Compressor Minimum On/Off Timers High Condensate Level Sensor High Refrigerant Pressure Protection Loss of Refrigerant Charge Protection Reversing Valve Default to Heating Mode 		

Table 1: Pioneer Silver Features & Options

Pioneer Silver Controller Part Number Tables

Pioneer Silver Part Numbers

Refer to **Table 2** for a list of Pioneer Silver part numbers and **Tables 3 & 4** for WH & WV series harness part numbers.

PIONEER SILVER PART DESCRIPTION	PART NUMBER
Pioneer Silver Controller	V67470
Pioneer Silver Electric Heat Board	V75410
Heat Pump Thermostat	By Others
Modular Service Tool (for ECM Programming)	ASM01895
ECM Programming Cable	G045460
Horizontal Water-Source Heat Pump Unit	WHA-XXX
Vertical Water-Source Heat Pump Unit	WVA-XXX
H3 Water Harness	See Tables 3 & 4 below

Table 2: Pioneer Silver Part Numbers

WHA SERIES PIONEER SILVER HARNESS PART NUMBERS			
HARNESS #	BOX SIZES	TONNAGE	PART NUMBER
H3	A Box	½ Ton - 1 Ton	V84380
	B Box	1¼ Ton - 1½ Ton	V84500
	C,D,E Boxes	2 Ton - 5 Ton	V85150
H6	A Box	½ Ton - 1 Ton	V84510
	B Box	1¼ Ton - 1½ Ton	V84370
	C,D,E Boxes	2 Ton - 5 Ton	V85160

Table 3: WSHP WHA Unit Harness Part Numbers

WVA SERIES PIONEER SILVER HARNESS PART NUMBERS			
HARNESS #	BOX SIZES	TONNAGE	PART NUMBER
H3	A, B Boxes	½ Ton - 1½ Ton	G006680
	C,D,E Boxes	2 Ton - 5 Ton	V94500
H6	A Box	½ Ton - 1 Ton	V97840
	B,C,D,E Boxes	1½ Ton - 5 Ton	V85160

Table 4: WSHP WVA Unit Harness Part Numbers

Pioneer Silver Controller & Expansion Board Wiring Considerations

Wiring Overview

Correct wiring of the Pioneer Silver Controller and its Expansion Board, if applicable, is the most important factor in the overall success of the controller installation process. In general, most Pioneer Silver Controllers and Expansion Boards are factory installed and wired at the AAON® factory. Some of the following information pertains to field wiring and may not apply to your installation if it was pre-wired at the factory. However, if troubleshooting of the controller or Expansion Board is required, it is a good idea to be familiar with the system wiring, no matter if it was factory or field wired.

Controller & Expansion Board Mounting & Dimensions

When the controller and expansion board are to be field mounted, it is important to mount them in a location that is free from extreme high or low temperatures, moisture, dust, and dirt. See **Table 5** for a list of the required operating conditions for the Pioneer Silver Controller and its Expansion Board.

The Pioneer Silver Controller and the Expansion Board are designed to be mounted via the 4 shoulder eyelets located on the corners of each circuit board. Be careful not to damage the electronic components when mounting the controller and expansion board.

The Pioneer Silver Controller dimensions are 5.5" x 4.0". The Pioneer Silver Controller Expansion Board dimensions are 6.5" x 4.0".

Electrical & Environmental Requirements

The Pioneer Silver Controller and electric heat expansion module must be connected to a 24 VAC power source of the proper size for the calculated VA load requirements. All transformer sizing should be based on the VA rating listed in **Table 5**.

Control Device	Voltage	VA Load	Operating Temperature	Humidity (Non-Condensing)	Storage Temperature
Pioneer Silver Controller	24VAC (25%/-15%), Class 2	15*	32°F to 158°F (0°C to 70°C)	0-95% RH	-4°F to 158°F (-20°C to 70°C)
	Inputs		Resistive Inputs require 10K Type 3 Thermistor		
	Outputs		Relay Outputs: 1 Amp maximum per output.		
	*Note: Controller uses 15VA. Output Relays are rated at 55VA combined.				
Pioneer Silver Expansion Board	24VAC (25%/-15%), Class 2	10*	32°F to 158°F (0°C to 70°C)	0-95% RH	-4°F to 158°F (-20°C to 70°C)
	Inputs		Resistive Inputs require 10K Type 3 Thermistor		
	Outputs		Relay Outputs: 1 Amp maximum per output.		
	*NOTE: Combined System VA Load for Controller & Expansion Module is 75 VA. Relay outputs combined 2.3 Amps maximum.				

Table 5: Electrical and Environmental Requirements

Important Wiring Considerations

WARNING: When using a single transformer to power more than one controller or expansion module, the correct polarity must always be maintained between the boards. Failure to observe correct polarity will result in damage to the Pioneer Silver Controller and expansion module.

Please carefully read and apply the following information when wiring the Controller and the Expansion Module.

1. All wiring is to be in accordance with local and national electrical codes and specifications.
2. All 24 VAC wiring must be connected so that all ground wires remain common. Failure to follow this procedure can result in damage to the controller and connected devices.
3. Minimum wire size for 24 VAC wiring should be 18-gauge.
4. Minimum wire size for all sensors should be 24-gauge. Some sensors require 2-conductor wire and some require 3-or 4-conductor wire.
5. Minimum wire size for 24 VAC thermostat wiring should be 22 gauge.
6. Be sure that all wiring connections are properly inserted and tightened into the terminal blocks. Do not allow wire strands to stick out and touch adjoining terminals which could potentially cause a short circuit.

7. When communication wiring is to be used to connect to other communication devices, all wiring must be plenum-rated, minimum 18-gauge, 2-conductor, twisted pair with shield. AAON can supply communication wire that meets this specification and is color coded for the network or local loop. Please consult your AAON distributor for information. If desired, Belden #82760 or equivalent wire may also be used.
8. Before applying power to the Pioneer Silver Controller, be sure to recheck all wiring connections and terminations thoroughly.

Powering Up

When the Controller is first powered up, the D5 LED in the center of the board should light up green, indicating 24 VAC power to the board and stay green to indicate normal operation. If it does not light up, make sure that you have 24 VAC connected to the controller, that the wiring connections are tight, and that they are wired for the correct polarity. The 24 VAC power must be connected so that all ground wires remain common.

When the Expansion Board is properly connected to the controller, the D5 LED, located directly beneath the “R” disconnect tab at the top of the board, should light up green, indicating that 24 VAC power to the board and stay green to indicate normal operation.

If after making all these checks, the D5 LED(s) does not light up, please contact AAON Technical Support for assistance— 918-382-6450; techsupport@aaon.com.

PIONEER SILVER WIRING

Pioneer Silver Controller Input/Output Maps

Input/Output Map

See Table 6 for Pioneer Silver Controller Input/Outputs. See Figure 1, page 13 for location.

PIONEER SILVER CONTROLLER	
PLUGGABLE SCREW TERMINAL BLOCK H2	
AL1	Dry, normally open contact with terminal AL2 Contact closes when controller is in alarm.
AL2	Dry, normally open contact with terminal AL1 Contact closes when controller is in alarm.
COM	24VAC Common
ESD	Emergency shutdown Input. 24VAC or common must be used as input for unit operation. Jumper to COM is factory installed.
NS	Night setback mode enable. 24VAC or common may be used as inputs.
NO	Dry, normally open contact with terminal IN. Contact closes when compressor is active.
IN	Common input for terminals NO and NC.
NC	Dry, normally closed contact with terminal IN. Contact opens when compressor is active.
PLUGGABLE SCREW TERMINAL BLOCK H5	
24V	24VAC power output for thermostat
NS_OV	Night setback override input. Input requires 24VAC to activate.
O	Thermostat input for reversing valve operation Input requires 24VAC to activate
COM	24VAC common for thermostat power
G	Thermostat input for fan operation. Input requires 24VAC to activate.
NS_TH	Night setback compressor enable. Input requires 24VAC to activate
Y	Thermostat input for compressor operation. Input requires 24VAC to activate
AL	24VAC wet alarm output
PLUGGABLE SCREW TERMINAL BLOCK H1	
S	Shield
-	Network terminal used for communication with the Expansion Board
+	Network terminal used for communication with the Expansion Board

Table 6: Pioneer Silver Controller Inputs & Outputs

QUICK DISCONNECT TERMINALS		
P1	AUX	Auxiliary alarm terminal. Dry contact with AUX IN enables alarm.
P2	AUX IN	Auxiliary alarm terminal. Dry contact with AUX enables alarm.
P3	TEST	Delay override terminal. Dry contact with TEST IN enables the delay override function.
P4	TEST IN	Delay override terminal. Dry contact with TEST enables the delay override function.
WIRING HARNESS H3		
PURPLE		Refrigerant Saturated Suction Temperature during Cooling Sensor (RTC). To be used with 10k Type III thermistors.
WHITE		Refrigerant Saturated Suction Temperature during Cooling Sensor (RTC). To be used with 10k Type III thermistors.
TAN		Refrigerant Saturated Suction Temperature during Heating Sensor (RTH). To be used with 10k Type III thermistors.
GRAY		Refrigerant Saturated Suction Temperature during Heating Sensor (RTH). To be used with 10k Type III thermistors.
PINK		Not used
BROWN		Condensate drain pan sensor input
GREEN		Low pressure switch. Input requires a normally closed switch.
ORANGE		Low pressure switch. Input requires a normally closed switch.
BLACK		High pressure switch. Input requires a normally closed switch.
YELLOW		High pressure switch. Input requires a normally closed switch.
RED		24VAC Power
BLUE		24VAC Common
WIRING HARNESS H6		
BLACK		Reversing valve 24VAC output
RED		Reversing valve common wire
BLUE		Fan 24VAC output.
BROWN		Fan common wire
GREEN		Compressor contactor 24VAC output
WHITE		Compressor contactor common wire

Table 6, cont.: Pioneer Silver Controller Inputs & Outputs

Pioneer Silver Controller Components

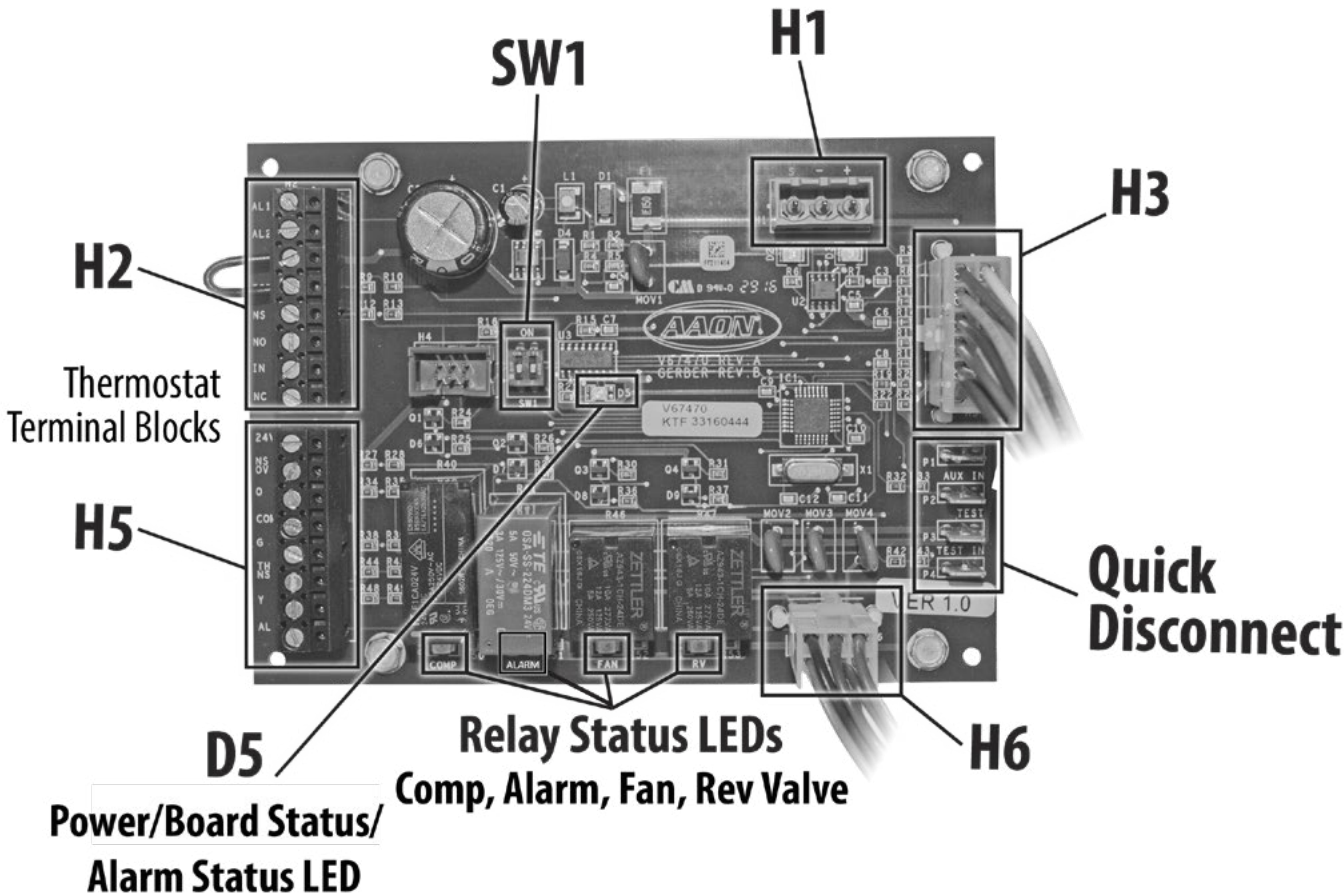


Figure 1: Pioneer Silver Controller Components

PIONEER SILVER WIRING

Expansion Module Input/Output Maps

Input/Output Map

See Table 7 for Expansion Module Inputs/Outputs. See Figure 2, page 15 for locations.

NOTE: When the expansion board is connected to the main controller, the H5 terminals on the main controller will not be used. The H4 terminals on the expansion board must be used instead to connect to the thermostat.

PIONEER SILVER EXPANSION MODULE	
PLUGGABLE SCREW TERMINAL BLOCK H4	
G	Thermostat input for fan operation. Input requires 24VAC to activate.
Y1	Thermostat input for compressor stage 1 operation. Input requires 24VAC to activate
Y2	Thermostat input for compressor stage 2 operation. Input requires 24VAC to activate
O	Thermostat input for reversing valve operation Input requires 24VAC to activate
DH	Dehumidistat input for dehumidification operation. Input requires 24VAC to activate
W1	Thermostat input for Auxiliary Heat 1 operation
W2	Thermostat input for Auxiliary Heat 2 operation
AL	24VAC wet alarm output
R	24VAC power output for thermostat
NS_TH	Night setback compressor enable. Input requires 24VAC to activate
NS_OV	Night setback override input. Input requires 24VAC to activate.
COM	24VAC common for thermostat power
PLUGGABLE SCREW TERMINAL BLOCK H1	
S	Shield
-	Network terminal used for communication with the controller
+	Network terminal used for communication with the controller

Table 7: Expansion Module Inputs & Outputs

QUICK DISCONNECT TERMINALS		
P1	FAN ENABLE	Future Use
P2	R	24VAC power
P3	COM	24VAC common
P4	HEAT 2	24VAC output Heat 2 enable
P5	COM	Heat 2 24VAC common
P6	HEAT 1	24VAC output Heat 1 enable
P7	COM	Heat 1 24VAC common
P8	WATER INPUT TEMP	Entering Water Temperature Sensor (EWT Sensor). To be used with 10k Type III thermistors.
P9	WATER INPUT TEMP	Common for Entering Water Temperature Sensor (EWT Sensor).
P12	AO1	EC Supply Speed (+VDC), 0-10VDC
P13	COM	EC Supply Speed (-VDC)
P14	FAN HIGH	24VAC Fan High Speed Output
P15	WTR ECON	24V Waterside Economizer output
P16	COM	Fan High Common
P17	COM	WTR ECON Common
P18	COMP2	24VAC Compressor Stage 2 output
P19	COM	Compressor Stage 2 Common
P20	REHEAT	24VAC Reheat output
P21	COM	Common

Table 7, cont.: Expansion Module Inputs & Outputs

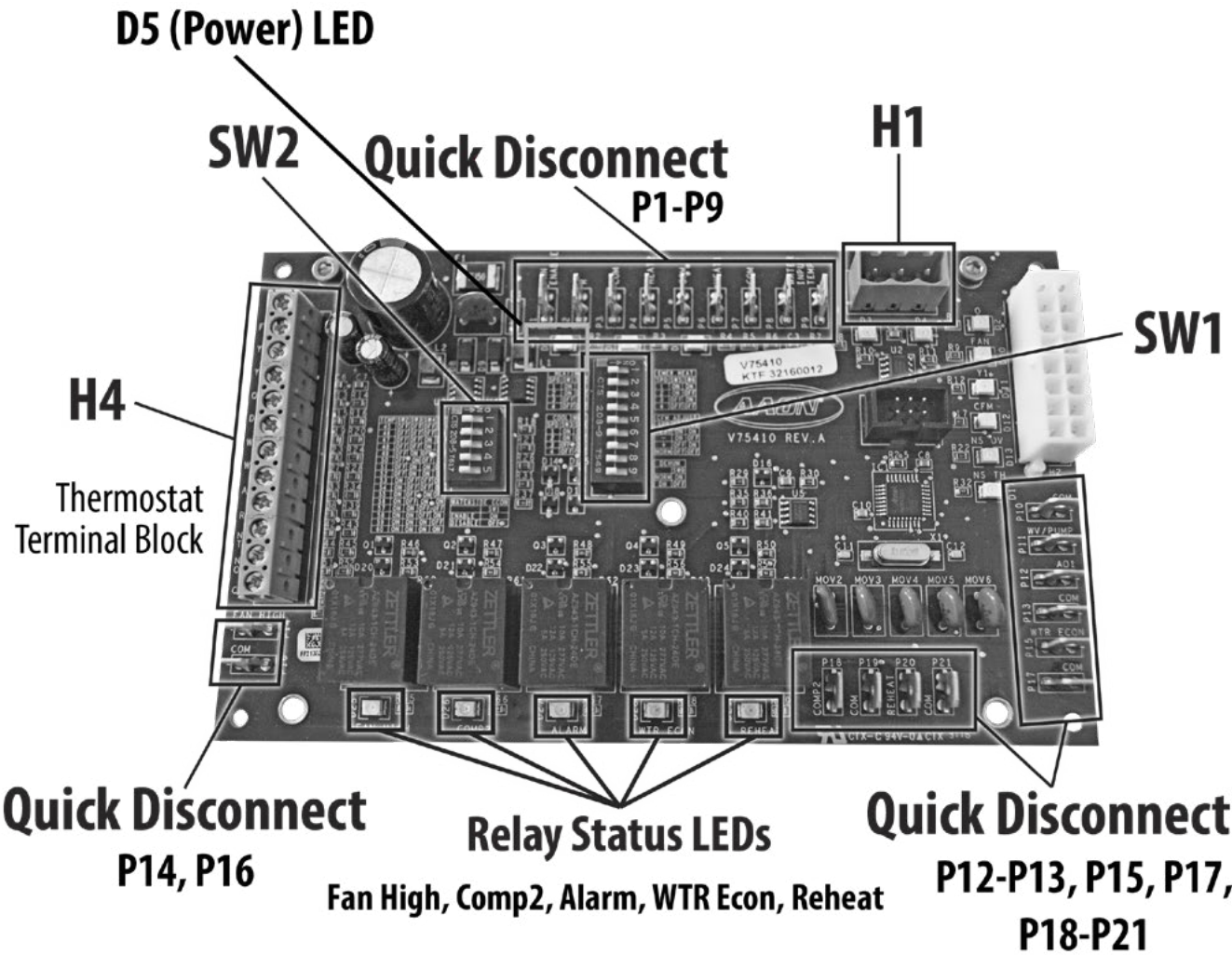


Figure 2: Pioneer Silver Expansion Module Components

SEQUENCE OF OPERATIONS

Pioneer Silver Controller Sequence

Supply Fan Operation

The Supply Fan will enable upon receiving a 24VAC input on the “G” terminal or a call for Compressor operation unless an alarm prevents the fan from operating.

There is a 30 second minimum off timer for the fan. The Supply Fan is enabled for 15 seconds after the last stage of Cooling, Heating, or Dehumidification stages off.

Not all alarms will prevent Supply Fan operation. The alarms that disable the fan are:

- 1.) Emergency Shutdown
- 2.) Condensate Overflow
- 3.) Low Voltage
- 4.) High Voltage

Compressor Operation

The Compressor will enable upon receiving a 24VAC input on the “Y” terminal or a 24VAC input on the “TH_NS” terminal if in Night Setback mode unless an alarm is active. If the Supply Fan was not enabled prior to the Compressor call, then the Supply Fan will enable for 5 seconds before the Compressor is started.

The Compressor has a minimum on time of 3 minutes and a minimum off time of 2 minutes to prevent short cycling. These delays can be shortened to 5 seconds if the controller is in test mode. If the unit goes into an alarm then the minimum on time will be ignored and the compressor will disable. All alarms will disable the compressor except the Entering Water Temperature Alarm.

Reversing Valve Operation

The Reversing Valve will enable if the controller receives a 24VAC input on the “O” terminal and the Compressor has been operational for a minimum of 5 seconds.

The default Reversing Valve position is for Heating operation, no 24VAC input on the “O” terminal. Therefore, in Compressor Cooling operation, 24VAC must be applied to the “O” terminal. To minimize noise, the Reversing Valve will remain energized after having satisfied a call for Cooling mode. The Reversing Valve will then only be commanded to shift back to default position (de-energized) if a call for Heating mode is detected on the thermostat terminal block, i.e. 24VAC present on the “Y1” terminal and no 24VAC present on the “O” terminal.

Random Start Delay

The controller will enter a Random Start Delay in these situations:

- 1.) The unit powers up
- 2.) Recovery from Emergency Shutdown alarm
- 3.) Recovery from High Voltage alarm
- 4.) Recovery from Low Voltage alarm
- 5.) Night Setback mode is disabled

The Random Start Delay will be between 3 and 60 seconds. The Fan and Compressor will not be operational during this time. The Random Start Delay will be ignored if the unit is in test mode.

Building Occupancy Status

Occupied Mode

The controller will operate according to the thermostat inputs.

Night Setback Mode

Night Setback mode is enabled upon receiving a 24VAC or a 24VAC common input on the “NS” terminal. While in Night Setback mode, the controller will ignore the normal thermostat signals. Instead, the controller will use the “NS_TH” input as the Fan and Compressor enable signal operating at full Compressor capacity. When the unit is taken out of Night Setback mode, the controller will execute a Random Start Delay.

The Night Setback mode can be overridden with a 24VAC input to the Night Setback override terminal “NS_OV”. Once the override signal is received, Night Setback will be overridden for 2 hours even if the signal is removed. While Night Setback is overridden, the controller will respond to the normal thermostat signals.

Test Mode

Test mode is enabled by connecting the two quick disconnect terminals “TEST” and “TEST IN” together. The controller will remain in “Test Mode” as long as the terminals are connected to each other. The controller will exit “Test Mode” immediately upon removal of the jumper. While in “Test Mode” there will be no Random Start Delay, and the Compressor Minimum On and Minimum Off Times are reduced to 5 seconds each. The 5 second delay between Compressor and Reversing Valve operation is still present as well as the 5 second delay between the Supply Fan and Compressor.

Controller Alarms

LED Fault Codes

All alarms will be monitored and displayed through the Pioneer Silver Controller, unless otherwise specified.

The controller provides a status LED (D5) in the center of the board to indicate the unit status. A green status light indicates that the unit is powered up and that the controller is not detecting any fault conditions. A flashing red status light indicates that the controller has detected a fault condition and is now in alarm mode. The number of flashes indicates what alarm is present. **Table 8** describes the meaning of the flash codes.

Alarm Status (D5 LED) Blinks	Blink Code Description
1	High Discharge Pressure
2	Emergency Shutdown
3	Auxiliary Alarm
4	High Condensate Level Alarm
5	Low Control Voltage Alarm
6	High Control Voltage Alarm
7	Low Suction Pressure
8	Leaving Water Temperature Alarm
9	Air Coil Low Temperature Alarm
10	Entering Water Temperature Alarm

Table 8: Alarm Status LED Diagnostic Codes

Automatic Reset Alarms

The following alarms will automatically reset themselves once the fault condition clears.

Low Control Voltage Alarm

The Low Control Voltage Alarm will activate when the 24VAC control voltage drops to 20VAC +/-5%. Below this voltage, the onboard normally open relays are not guaranteed to close. This alarm will disable the compressor, the supply fan, and the reversing valve. The low voltage alarm will release when the voltage rises above 22VAC +/-5%. Once the fault is cleared, the controller will activate a random start delay.

High Control Voltage Alarm

The High Control Voltage Alarm will activate when the 24VAC control voltage increases to 32VAC +/-5%. Any voltage higher than this risks damaging components on the control board. This alarm will disable the compressor, the supply fan, and the reversing valve. The alarm will release when the control voltage decreases to 30VAC +/-5%. Once the fault is cleared, the controller will activate a random start delay.

Leaving Water Temperature Alarm

The Leaving Water Temperature Alarm will monitor the Refrigeration Saturated Suction Temperature during Heating (RTH). The alarm will activate if the Refrigeration Saturated Suction Temperature drops below the freeze protection temperature. This alarm will release when both of these conditions occur: 10 minutes has expired and the refrigeration line temperature has risen 5° above the freeze protection temperature. If the alarm is activated again within 2 hours, the alarm will be active until the unit is power cycled or the Leaving Water Temperature has risen above the release point (5° above the freeze protection temperature) and the call for compressor operation is removed. The glycol percentage Dipswitch SW1 located in the center of the control board will determine what temperature will trigger the alarm and what temperature will release the alarm. See **Figure 1, page 13** for SW1 Dipswitch location. Changes to the glycol settings are permanently recorded. This alarm will disable the compressor but will allow operation of the supply fan. **Table 9** shows what glycol percentages the different switch positions represent and at what temperatures the alarm will trigger and release.

SW1 Dipswitch Glycol Setpoints				
Switch 1 Position	Switch 2 Position	Glycol %	Trigger Temp	Release Temp
OFF	OFF	0%	35°F	40°F
OFF	ON	10%*	30°F	35°F
ON	OFF	20%	23°F	28°F
ON	ON	30%	15°F	20°F

*Setting not recommended. 20% or more glycol solution is required if ambient temperatures are expected to fall below freezing or if the loop water temperature is below 50°F while operating in the heating mode.

Table 9: Glycol Setpoints

SEQUENCE OF OPERATIONS

Pioneer Silver Controller Alarms

Entering Water Temperature Alarm

The Entering Water Temperature Alarm will be monitored by the expansion board, only if included and if the WSE option is allowed per DIP SWITCH SW2 setting. The alarm will be displayed through the Pioneer Silver Controller alarm LED (D5). For Pioneer Silver Expansion v.1.4 and later, the alarm will trigger if the Entering Water Temperature drops below 30°F for 2 minutes. This alarm will disable Waterside Economizer operation but will allow operation of the compressor and supply fan. The alarm will release when the Entering Water Temperature rises above 35°F. **NOTE:** For Pioneer Silver Expansion v.1.5 and later, the trigger and release values are increased to 35°F and 40°F, respectively.

Air Coil Low Temperature Alarm

The Air Coil Low Temperature Alarm will monitor the Refrigeration Saturated Suction Temperature during Cooling (RTC). The Air Coil Low Temperature Alarm will trigger if the Refrigeration Saturated Suction Temperature drops below 30°F. The alarm will release when the Refrigeration Saturated Suction Temperature increases to 35°F. This alarm will disable the compressor but will allow operation of the supply fan.

Emergency Shutdown Alarm

The Emergency Shutdown input requires a constant connection to either 24VAC or 24VAC common for normal operation. If the 24VAC or 24VAC common signal is removed, the controller will enter emergency shutdown mode. This alarm will disable the compressor and the supply fan. This alarm will release when the 24 VAC input is restored.

Lock-Out Alarms

The lock-out alarms will not automatically reset themselves once the fault condition clears. For these alarms to clear, one of the following conditions must be met:

- 1.) Controller is power cycled.
- 2.) Fault condition is corrected and the Compressor call is removed.

Auxiliary Input Alarm

The Auxiliary Input Alarm will enable if the compressor has been operational for at least 2 minutes and a dry contact has been made between the “AUX” and “AUX IN” quick disconnect terminals for 10 seconds. This alarm will disable the compressor but will allow the supply fan to operate. If a secondary drain pan is to be used, the secondary drain pan overflow switch should be wired into the Auxiliary Input Alarm.

High Condensate Level Alarm

The High Condensate Level Alarm will enable if the resistance between the condensate level sensor and 24VAC common is less than 100k Ω for more than 30 seconds. This alarm will disable both the compressor and the supply fan.

High Discharge Pressure Alarm

The High Discharge Pressure Alarm will enable if the high pressure switch opens. This alarm will immediately disable the compressor but will continue to allow the supply fan to operate. **For versions 1.7 and higher only**, the High Discharge Pressure Alarm will remain active for a minimum of 15 minutes. The compressor will restart after 15 minutes if the high pressure switch is closed. A second High Discharge Pressure alarm within 2 hours will cause a soft lockout.

Low Suction Pressure Alarm

The Low Suction Pressure Alarm will enable if the low pressure switch opens for more than 10 seconds. This alarm will disable if both of these conditions occur: 15 minutes has expired and the low pressure switch has closed. The compressor will not start if the switch is open. If the alarm is enabled again within 2 hours, there will be a hard lockout and require a power cycle to reset. Removal of the compressor call will not reset the alarm while in hard lock out. **For versions 1.7 and higher only**, there will be a delay of 30 seconds after the compressor starts before the alarm will enable.

Pioneer Silver Expansion Board Sequence

Expansion Board Supply Fan Operation

The Supply Fan will enable upon receiving a 24VAC input on the “G” terminal or a call for Compressor operation unless an alarm prevents the fan from operating.

There is a 30 second minimum off timer for the fan. The Supply Fan is enabled for 15 seconds after the last stage of Cooling, Heating, or Dehumidification stages off.

Two-Speed Electronically Commutated Motor (ECM) if equipped with EC motor and Fan-Speed Dehumidification or Hot Gas Reheat

With a two-speed ECM, the Supply Fan will have (2) speed operations—low speed and high speed.

The Supply Fan speeds will correspond to the below listed operating functions.

Supply Fan “G” Call Only – Low Speed

Compressor Low Capacity “Y1” – Low Speed

Compressor Full Capacity “Y2” – High Speed

Supplementary Heating – High Speed

Dehumidification – Low Speed

Waterside Economizer – High Speed

With a “Y1” enable, the Supply Fan will run at low speed, and with a “Y2” enable (concurrent with/in addition to a Y1 enable call), the Supply Fan will run at high speed. If there is only one compressor capacity, the “Y1” call from the thermostat must be wired to the “Y1” input terminal of the unit control board, and additionally the adjacent/nearby “Y2” input terminal on the control board must also be connected (jumped) to the Y1 input terminal on the unit control board. Please see **Figure 3, page 23** for a wiring diagram.

Expansion Board Compressor Operation

Unless an alarm is active, the Compressor will enable upon receiving a 24VAC input on the “Y1” or “Y2” terminals or upon receiving a 24VAC input on the “TH_NS” terminal if in Night Setback mode. If the Supply Fan was not enabled prior to the Compressor call, then the Supply Fan will enable for 5 seconds before the Compressor is started.

The Compressor has a minimum on time of 3 minutes and a minimum off time 2 minutes to prevent short cycling. These delays are shortened to 5 seconds if the controller is in test mode. If the unit goes into an alarm, the minimum on time will be ignored and the Compressor will disable. The controller includes built-in compressor inter-stage delays.

All alarms will disable the Compressor except the Entering Water Temperature Alarm.

Expansion Board Auxiliary Heating Operation

Staged Heating

The Heating stages will enable according to thermostat inputs.

SEQUENCE OF OPERATIONS

Expansion Board Dehumidification Operation

Expansion Board Dehumidification Operation

Fan Speed Dehumidification (requires EC Motor)

For Fan Speed Dehumidification, Dipswitch 1, position 9, must be set to “ON”.

DIPSWITCH SW1	
SW1 Position 9	Fan Speed Operation
ON	Fan Speed Dehumidification Enabled

Table 10: Fan Speed Dehumidification Dipswitch Setting

Fan Speed Dehumidification mode is enabled based on a 24VAC input to the “DH” terminal and a 24VAC input to the “Y1” or “Y2” terminals.

The Unit operates according to the Cooling sequence of operation, with the exception that during Dehumidification, the Supply Fan Low Speed output is enabled instead of High Speed. The Compressor operates at full capacity during Dehumidification.

If a Waterside Economizer is included and the Entering Water Temperature falls below the Entering Water Temperature Setpoint, the Waterside Economizer Coil will be enabled and operate as described in the *Waterside Economizer Operation* section.

Hot Gas Reheat Dehumidification

For Hot Gas Reheat Dehumidification, switch 1, position 9 must be set to “OFF”.

DIPSWITCH SW1	
SW1 Position 9	Hot Gas Reheat Operation
OFF	Fan Speed Dehumidification Disabled

Table 11: Hot Gas Reheat Dipswitch Setting

Hot Gas Reheat Dehumidification mode is enabled based on a 24VAC input to the “DH” terminal.

Cooling and Heating modes are always priority over Dehumidification. Hot Gas Reheat Dehumidification is only available when the Cooling and Heating demands are satisfied.

The Compressor is enabled at full capacity “Y2” when Dehumidification mode is enabled. The Supply Fan Low Speed (if using EC Motor) and reheat valve “RH” 24VAC outputs are enabled. If the unit is equipped with Waterside Economizer, the Entering Water Temperature Setpoint will be ignored, and freeze protection will be monitored.

Expansion Board Waterside Economizer Operation

Expansion Board Waterside Economizer Operation

On/Off Waterside Economizer (WSE) Coil Operation

If the Compressor is enabled, as the Entering Water Temperature drops below the Entering Water Temperature Setpoint, the call for the Compressor will be removed once the minimum on time has been satisfied, and the WSE 24VAC output will be enabled, sending the cold loop water through the air coil to utilize “free cooling”.

The WSE will act as the unit’s only stage of Cooling. If the Cooling call has not been satisfied within 10 minutes of operation, the WSE valve will disable. Following a delay, the unit will resume normal Compressor Cooling operation until the Cooling input is removed. When this happens, the Pioneer Silver Controller green D5 LED will flash, signifying the WSE was unable to satisfy the Cooling call.

If the Entering Water Temperature rises above the Entering Water Temperature Setpoint plus the Deadband, the WSE will be disabled, and Compressor Cooling will be utilized.

DIPSWITCH SW2	
SW2 Position 1	WSE Operation
OFF	Waterside Economizer Disabled
ON	Waterside Economizer Enabled

Table 12: WSE Operation Dipswitch Setting

DIPSWITCH SW2				
Temp	SW2 Position 2	SW2 Position 3	SW2 Position 4	SW2 Position 5
45°F	OFF	OFF	OFF	OFF
46°F	OFF	OFF	OFF	ON
47°F	OFF	OFF	ON	OFF
48°F	OFF	OFF	ON	ON
49°F	OFF	ON	OFF	OFF
50°F	OFF	ON	OFF	ON
51°F	OFF	ON	ON	OFF
52°F	OFF	ON	ON	ON
53°F	ON	OFF	OFF	OFF
54°F	ON	OFF	OFF	ON
55°F	ON	OFF	ON	OFF
56°F	ON	OFF	ON	ON
57°F	ON	ON	OFF	OFF
58°F	ON	ON	OFF	ON
59°F	ON	ON	ON	OFF
60°F	ON	ON	ON	ON

Table 13: WSE Temperature Enable Setpoint Selection Dipswitch Settings

Using LEDs to Verify Operation

The Pioneer Silver Controller and its Expansion Board are equipped with LEDs that can be used to verify operation and perform troubleshooting. See **Figures 1 & 2, pages 13 & 15** for the LED locations. The LEDs associated with these outputs allow you to see what is active without using a voltmeter. The LEDs and their uses are as follows:

D5 LEDs

POWER - The D5 LED on the controller and expansion board will light up green to indicate that 24 VAC power has been applied to the controller and that both boards are powered up.

STATUS - A solid green light on the controller D5 LED indicates there are no alarms present. A flashing green LED indicates the WSE was unable to satisfy cooling and compressor operation was resumed. If the LED is solid red or flashing red, the ALARMS paragraph below gives a description of those codes.

ALARMS - A flashing red status light on the controller D5 LED indicates that the controller has detected a fault condition and is now in alarm mode. The number of flashes indicates what alarm is present. **Table 8, page 17** describes the meaning of the flash codes. If the LED turns solid red, then communication has been lost between the boards.

Controller Relay LEDs

COMP - Compressor Stage 1 LED—This green LED will light up when the Compressor Stage 1 relay is active.

ALARM - Alarm LED—This red LED will light up when there is an active alarm.

FAN - Supply Fan LED—This green LED will light up when the Supply Fan relay is active.

RV - Reversing Valve LED—This green LED will light up when the Reversing Valve relay is active.

Expansion Board Relay LEDs

FAN HIGH - Supply Fan High Speed LED—This green LED will light up when the High Speed Supply Fan relay is active.

COMP2 - Compressor Stage 2 LED—This green LED will light up when the Compressor Stage 2 relay is active.

ALARM - Alarm LED—This red LED will light up when there is an active alarm.

WTR ECON - Waterside Economizer LED—This green LED will light up when the Waterside Economizer is active.

REHEAT - Hot Gas Reheat Valve LED—This green LED will light up when the Reheat Valve relay is active.

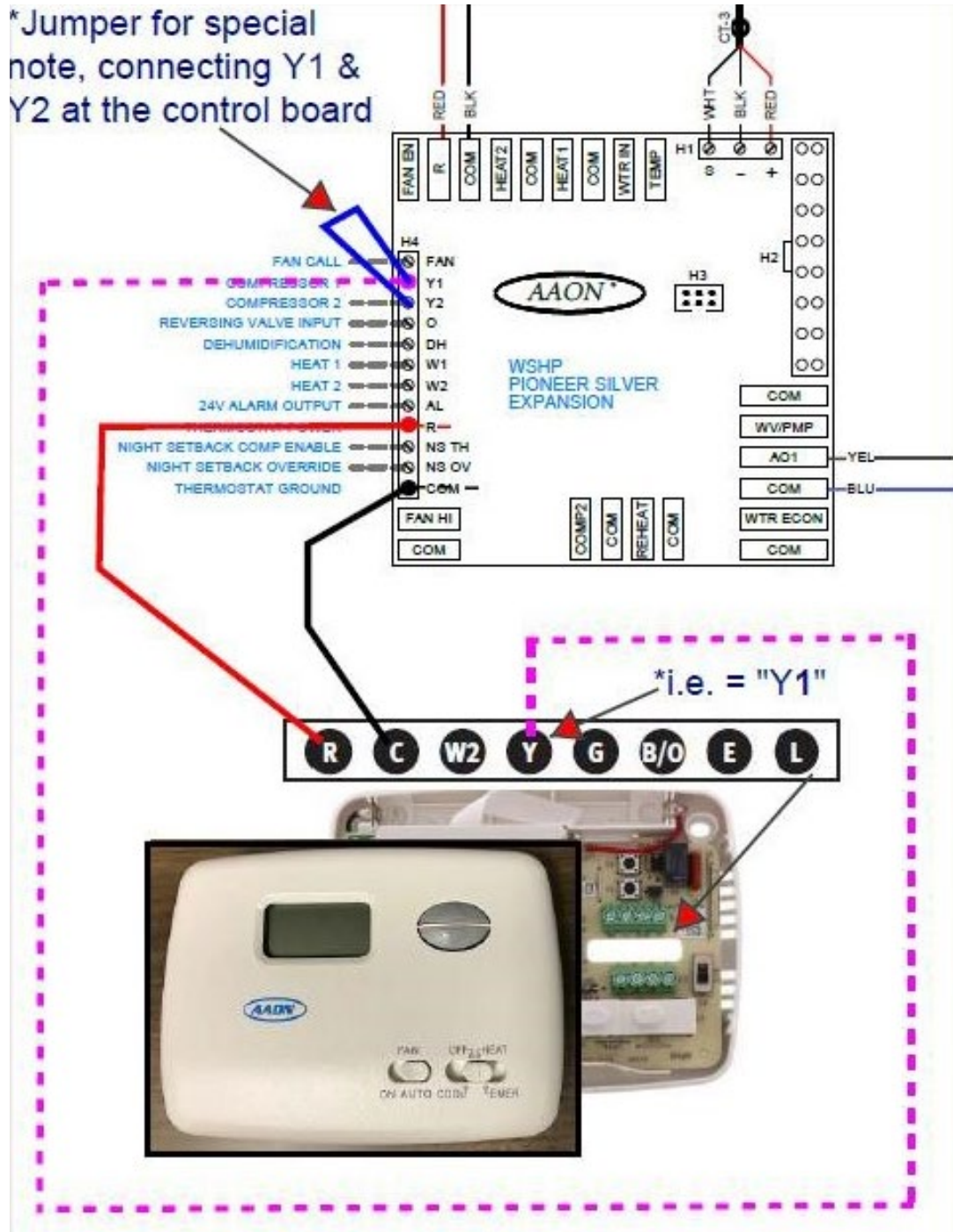


Figure 3: Y1 /Y2 Jumper Setting Wiring

APPENDIX A: ECM PROGRAMMING

Modular Service Tool Connection

Overview

To program the ECM settings for your Pioneer Silver Electric Heat Expansion Board, you will need a Modular Service Tool SD with internal software version 1.13 or higher and the ECM programming cable (P/N: G045460, not supplied). Contact AAON Controls Support to order both items, if needed.

The Modular Service Tool connects to the Pioneer Silver Expansion Board via the 10 foot ECM programming cable. The cable is terminated on one end with an EBC E-BUS connector and on the other end has a 3-pin terminal that connects to the Pioneer Silver Expansion Board's H1 terminal block.

Be sure that the Modular Service Tool has fresh batteries installed or that it is connected to a power source using the supplied power pack before attempting any programming of the controller. See **Figure 4** for connection details.

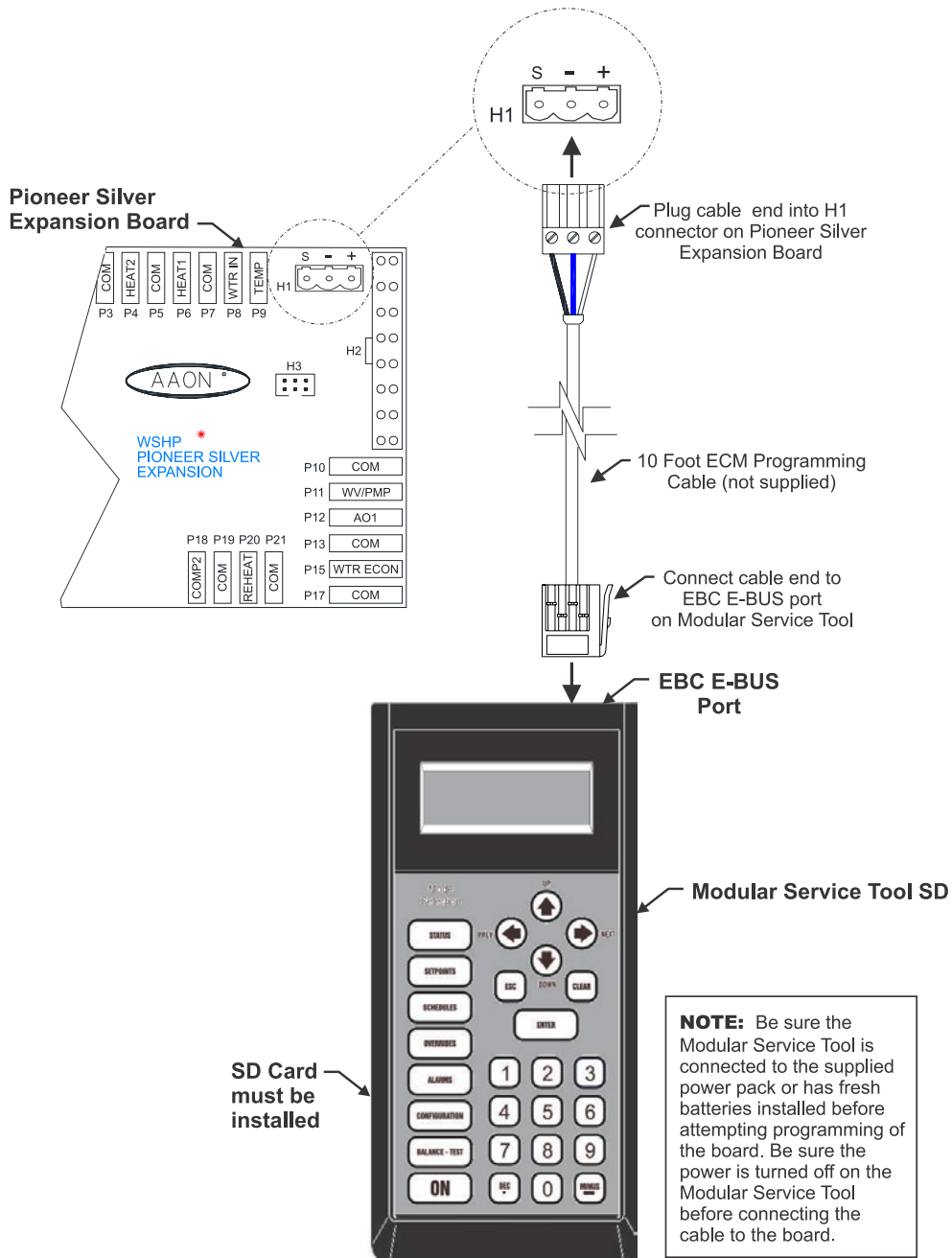


Figure 4: Modular Service Tool Connection

Modular Service Tool Instructions

Service Tool Initialization

Modular Service Tool Initialization Screen and Setup Screens

After connecting the Service Tool to the expansion board with the ECM programming cable, press **<ON>**. The *Initialization Screen* will appear followed by the *Setup Screens* as shown below. If there is no SD card installed, the second screen will display, "No SD Card Connected! Powering Down!"

NOTE: Once you press **<ESC>** while at any of the *Setup Screens* shown below, you can access them again by pressing **<NEXT>** or cycling power.

```
INITIALIZING
Service Tool SD 1.13
AAON
```

Keep pressing **<NEXT>** until you get to the last screen.

```
1) Set Time & Date
2) Communications
NEXT) More Options
ESC) Exit Menu
```

```
3) Energy Saving
4) Update Software
NEXT) More Options
ESC) Exit Menu
```

```
5) Pioneer Silver
NEXT) More Options
ESC) Exit Menu
```

Press **<5>** for Pioneer Silver. The following screen will display:

```
View Current Status
Change Fan Speed
Manual/Test
ESC) Exit Menu
```

Pioneer Silver Expansion Programming

To scroll through the fields on the *Pioneer Silver Expansion Screen*, move the cursor to a selection using the **<DOWN>** and **<UP>** keys and then press **<ENTER>**.

```
View Current Status
Change Fan Speed
Manual/Test
ESC) Exit Menu
```

View Current Status

```
Pioneer Silver Exp
Firmware Ver = 1.4
Fan Lo Vdc = 1.0
Fan Hi Vdc = 5.0
```

The *Pioneer Silver Expansion Status Screen* displays the current firmware version, the Low Fan Speed, and the High Fan Speed. Press **<ESC>** to return to the previous screen.

Change Fan Speed

```
Change Fan Speeds
New Lo Vdc = 1.0
New Hi Vdc = 5.0
Push ENTER to Commit
```

Use the number keypad to type in a new Low Fan Speed and/or new High Fan Speed. Low Speed Fan range is 0.0 to 10.0 and High Speed Fan range is 0.0 to 10.0. Press **<ENTER>** to save the value(s). Press **<ESC>** to return to the previous screen.

Manual / Test Mode

```
Manual/Test Mode
Forced Value = 0.0
Change & Push ENTER
ESC) Exit Menu
```

The default Forced Value is the current High Fan Speed value. Voltages between 0.0 to 10.0 are valid entries. Press **<ENTER>** after making a setting change and test the voltage at the analog output. Press **<ESC>** to return to the previous screen.

Pioneer Silver Controller Technical Guide
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AAON Factory Technical Support: 918-382-6450
techsupport@aaon.com

AAON Controls Support: 866-918-1100
Monday through Friday, 7:00 AM to 5:00 PM
central standard time.

NOTE: Before calling Technical Support, please have the model and serial number of the unit available.

PARTS: For replacement parts please contact your local AAON Representative.



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