



DeZURIK ECB (CP & CEM) PUMP & CONTROL VALVE INTERFACE FOR SOLENOID CONTROLLED VALVES AND ELECTRIC MOTOR OPERATED



Instruction D10504

October 2018

Instructions

These instructions provide information about ECB Pump & Control Valve Interface. They are for use by personnel who are responsible for installation, operation and maintenance of the ECB Pump & Control Valve Interface.

Safety Messages

All safety messages in the instructions are flagged with an exclamation symbol and the word Caution, Warning or Danger. These messages indicate procedures that must be followed exactly to avoid equipment damage, personal injury or death.

Safety label(s) on the product indicate hazards that can cause equipment damage, personal injury or death. If a safety label becomes difficult to see or read, or if a label has been removed, please contact DeZURIK for replacement label(s).



WARNING!

Personnel involved in the installation or maintenance of valves should be constantly alert to potential emission of pipeline material and take appropriate safety precautions. Always wear suitable protection when dealing with hazardous pipeline materials. Handle valves, which have been removed from service with suitable protection for any potential pipeline material in the valve.

Inspection

Your ECB Pump & Control Valve Interface has been packaged to provide protection during shipment; however, it can be damaged in transport. Carefully inspect the unit for damage upon arrival and file a claim with the carrier if damage is apparent.

Parts

Recommended spare parts are listed on the assembly drawing. These parts should be stocked to minimize downtime.

Order parts from your DeZURIK sales representative, or directly from DeZURIK. When ordering parts, please include the serial number located on the data label attached to the inside door of the control box. Also include the part name, the assembly drawing number, the balloon number and the quantity stated on the assembly drawing.

DeZURIK Service

DeZURIK service personnel are available to install, maintain and repair all DeZURIK products. DeZURIK also offers customized training programs and consultation services.

For more information, contact your local DeZURIK sales representative or visit our website at www.dezurik.com.

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1 Notes about this Documentation

Note



Keep this documentation!

The operating instructions are part of the product and should be kept for the entire lifetime of the device. They must be transferred to each subsequent owner or user of the device. Care must also be taken to ensure that any supplement to these instructions are included, if applicable.

1.1 Validity of this Document

This documentation is only applicable to the device:
“ECB Pump & Control Valve Interface”.

The ECB Pump & Control Valve Interface must only be installed and operated according to the instructions in this manual and the system description.

1.2 Copyright

This Manual, including all figures and illustrations, is copyright-protected. Any further use of this Manual by third parties that violate pertinent copyright provisions is prohibited. Reproduction, translation, electronic and photo technical filing/archiving (e.g., photocopying) as well as any amendments require the written consent of DeZURIK, Inc. Non-observance will involve the right to assert damage claims.

1.3 Symbols

DANGER

Personal Injury!

Indicates a high-risk, imminently hazardous situation which, if not avoided, can result in death or serious injury.

DANGER



Personal Injury Caused by Electric Current!

Indicates a high-risk, imminently hazardous situation which, if not avoided, can result in death or serious injury.

WARNING

Personal Injury!

Indicates a moderate-risk, potentially hazardous situation which, if not avoided, could result in death or serious injury.

2 Important Notes

This section includes an overall summary of the most important safety requirements and notes that are mentioned in each individual section. To protect your health and prevent damage to devices as well, it is imperative to read and carefully follow the safety guidelines.

2.1 Legal Base

2.1.1 Subject to Changes

DeZURIK, Inc. reserves the right to provide for any alterations or modifications that serve to increase the efficiency of technical progress.

2.1.2 Personnel Qualifications

All sequences implemented on the ECB Pump & Control Valve Interface may only be carried out by electrical specialist with sufficient knowledge in automation. The specialists must be familiar with the current norms and guidelines for the devices and automated environments.

All changes to the controller should always be carried out by qualified personnel with sufficient skills in programmable logic controller (PLC) programming.

2.2 Safety Advice (Precautions)

For installing and operating purposes of the relevant device to your system the following safety precautions must be observed:

DANGER

Do not work on components while energized!

All power sources to the device must be switched off prior to performing any installation, repair or maintenance work.

DANGER

Installation only in appropriate housing cabinets or in electrical operation rooms!

The ECB is an open system. As such install the system and its components exclusively in appropriate housings cabinets or in electrical operation rooms. Allow access to such equipment and fixtures to authorized qualified staff only by means of specific keys or tools.



NOTICE**Replace defective or damaged devices!**

Replace defective or damaged controllers, since the long-term functionality of the device can no longer be ensured.

NOTICE**Protect the components against materials having seeping and insulating properties!**

The components are not resistant to materials having seeping and insulating properties such as: aerosols, silicones and triglycerides (found in some hand creams). If you cannot exclude that such materials will appear in the component environment, then install the components in an enclosure being resistant to the above-mentioned materials. Clean tools and materials are imperative for handling the controller.

NOTICE**Cleaning only with permitted materials!**

Clean the ECB Pump & Control Valve Interface using oil-free compressed air or with ethyl alcohol and leather cloths. Do not use any contact spray.

NOTICE**Do not reverse the polarity of connection lines!**

Avoid reverse polarity of data and power supply lines, as this may damage the devices involved.

NOTICE**Avoid electrostatic discharge!**

The controller is equipped with electronic components that may be destroyed by electrostatic discharge when you touch. Pay attention while handling the devices to good grounding of the environment (person, job and packing).



3 Important Notes

The ECB Pump & Control Valve Interface provides control between the pump control valve and the pump, to prevent surges in the system when the pump starts or stops. The control panel properly sequences and controls the pump start-up and pump shut-down procedure, providing both visual and electronic status outputs for operating personnel. Panel protects the pumping system from damage due to mechanical, hydraulic or power failure. Panel is pre-wired and includes an integral programmable valve controller to sequence the pump and pump control valve during all modes of operation. Controller is pre-programmed for most common pump control applications. Controller is easy to wire and adjust. Controller includes the following features:

- Sequence timers
- Local visual indication of pump and control valve status.
- Displays time for system to build pressure and for valve to open
- Contacts for remote or automatic start signal
- Local pump start & pump stop buttons
- Local emergency stop button
- Automatic shutdown of pump in emergency situations
- Terminal block connections for solenoid controls, valve limit switch, pump starter relay, remote automatic contact, pressure switch
- 3 position switch for remote or local operation

The control panel includes automatic recognition of common fault conditions and provides proper fault response sequencing to the pump control valve and pump starter as well as visual and electronic fault notification to operating personnel.

The integral programmable valve controller is housed in a NEMA 4X fiberglass enclosure with polycarbonate window, gasketed door, continuous stainless steel hinge, stainless steel twist/latch door fasteners, and pad lockable door hasp.



Figure 1: ECB Pump & Control Valve Interface

ECB Pump & Control Valve Interface**Specifications**

Material Specification for the Pump & Control Valve Interface as follows:

Panel Enclosure

Material Flame retardant UL rated PC/ABS plastic
 Enclosure Panel Dimensions 20.0" (508 mm) H x 18.0" (457 mm) W x 9.0" (228 mm) D
 The enclosure panel is provided with all necessary mounting brackets.

Panel Integral Controller

Display Type 4.3" Color TFT-LCD, 480 x 272 pixels
 Display Update Rate 100ms
 Programming Method Mechanical Push Button VNC
 Password 6 digit

Enclosure Environmental

NEMA 4X

Controller Mass Data Storage

Type 4GB SD Card
 Language English
 Temperature Range 14°F to 158°F (-10°C to 70° C)
 Humidity 90% RH, non-condensing
 Memory Protection 10 year life lithium battery

Power Requirement

Power 120VAC @ 60Hz protected with 5 Amp Fuse & Circuit Breaker
 Motor Starter Contacts: 10 amp maximum
 Valve Solenoid Contacts: 10 amp maximum
 Remote Alarm: 1 amp maximum

Controller Inputs

Analog 4-20mA; (6) Inputs Available (0-5 V / 0-10 V)
 Resolution 10 bit
 Digital (6) digital inputs (Dry contact)
 Units Configurable
 Decimal Point 0 / 0.0 / 0.00 / 0.000
 Signal Filter Configurable 1 to 60 seconds
 Totalizer Configurable Input and Units
 Totalizer Reset Yes
 I/O Connection Screw Terminals

Controller Outputs

Pump Relay 10 Amp Max
 Control Valve Relays 120VAC @ 60Hz Output
 Alarm Relay (2) Available and Configurable
 Analog 4-20mA; (4) Outputs available
 Resolution 10 bit
 Solenoid (2) Solid State Relay, Zero Switching Voltage
 Relay (2) Mechanical Relay, Rated Voltage 250VAC, Rated Current 6A

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Controller Input Logging

Configurable	Yes
Logging Speed	1 minute
Event Memory	128 Mbytes rolling memory up to 80,000,000 values capacity
Output	CSV format suitable for exporting to MS Excel

Controller Parameters

Control Input	4-20mA full scale / 0-5 V / 0-10V / digital (dry contact)
Proportional Band	0-100% (50% default) adjustable in 1% increments Independently for opening and closing
Dead band	Adjustable 0 to full scale of set-point signal
Cycle Time	0 to 60 seconds in 1 sec. increments
Integral Band	Adjustable 0 to 60 seconds
Derivative Band	Adjustable 0 to 60 seconds
Loop Zoning	Adjustable up to (4) zones
PID Loops	4 Configurable
Control Curves	4
Retransmission	4 Analog (4-20mA signal)
Actions (Alarms)	Triggering conditions

Controller Communication

Local	Mechanical Push Button
Remote	VNC Server
Interfaces	GPRS Modem Quad Band / Ethernet / RJ-45 / RS-232 / RS-485
Protocols	Modbus TCP / ModbusRTU / VNC

Controller Approvals

Conformity Marking	CE marking
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Controller Optional

Features /Accessories Heater with integral thermostat

4 Installation

For Installation in USA: The DeZURIK ECB must be installed in accordance with the National Electrical Code (NEC) NFPA 70.

For Installation in Canada: The DeZURIK ECB must be installed in accordance with the Canadian Electrical Code CSA 22.1. All input circuits must be derived from a CSA approved Class 2 source.

For European Community: The DeZURIK ECB must be installed in accordance with the ATEX directive 94/9/EC.

4.1 Unpacking

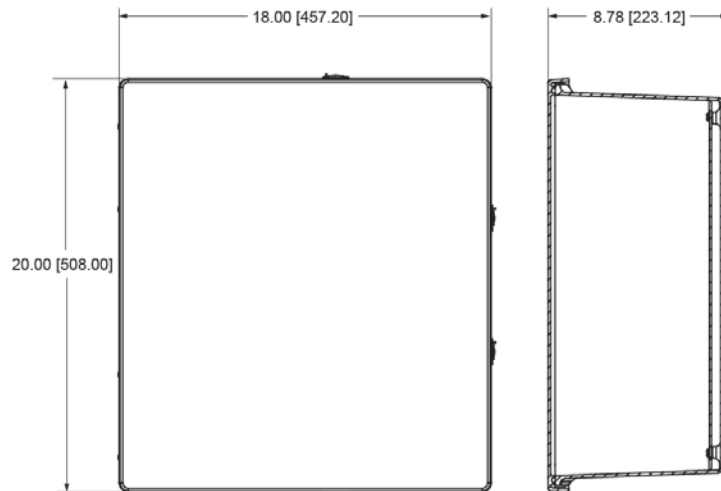
Remove enclosure from box. Inspect the packaging and contents for damage. Report damages, if any, to the carrier.

If any part is missing or the control malfunctions, please contact your representative or the factory for assistance.

4.2 Mounting the Enclosure

The DeZURIK ECB Pump & Control Valve Interface is NEMA 4X rated. Molded fiberglass polyester with enhanced UV inhibitors protect against outdoor weathering. Stainless steel mounting brackets and hardware are provided for mounting to the rear of the enclosure.

1. ECB Enclosure Physical Dimensions:



**Figure 2: ECB Enclosure Footprint Dimensions.
(Dimensions in IN[MM])**

2. ECB Enclosure Mounting Dimensions:

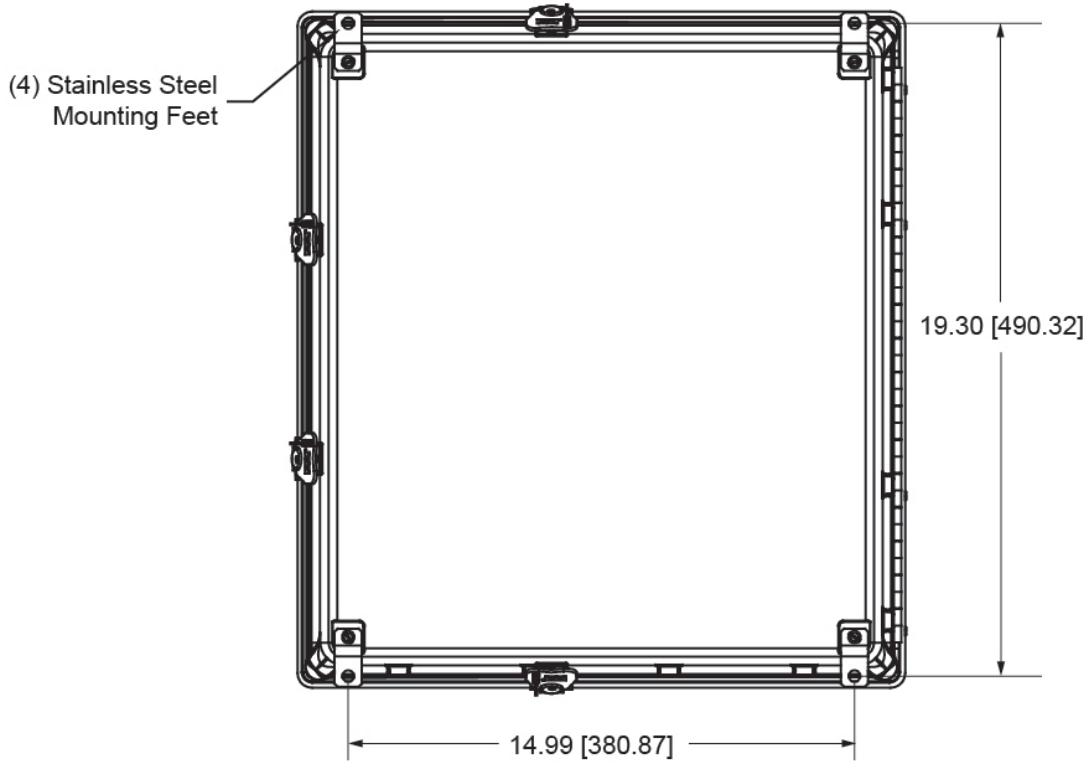


Figure 3: ECB Enclosure Mounting Dimensions.
(Dimensions in IN[MM])

ECB Pump & Control Valve Interface

4.3 Component Layout

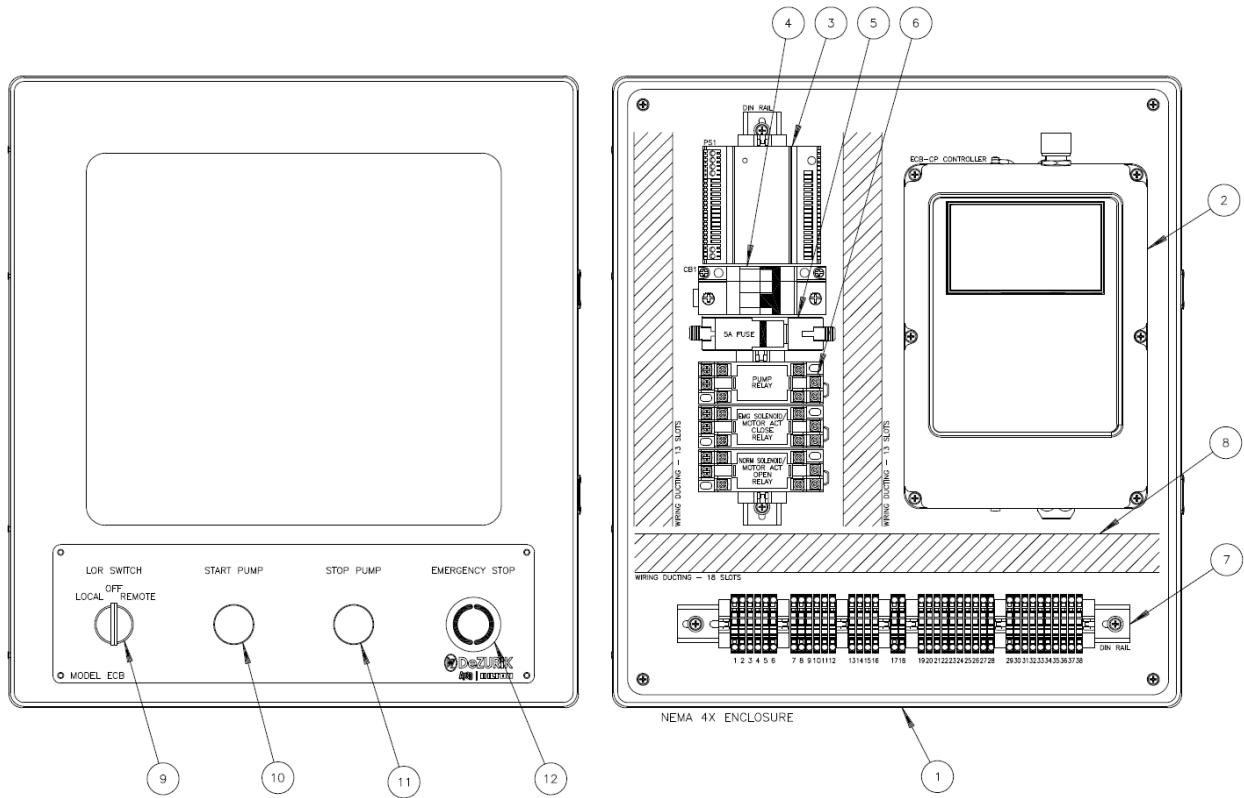


Figure 4: ECB Component Layout

List of Components:

- | | |
|---------------------------------|---------------------------------|
| 1. NEMA 4X Enclosure | 7. Din Rail |
| 2. ECB Controller | 8. Wiring Ducting |
| 3. Power Supply 24VDC @ 40Watts | 9. 3-Position Switch |
| 4. 5A Circuit Breaker | 10. Start Pump Switch – Green |
| 5. 5A Fuse Protection | 11. Stop Pump Switch – Red |
| 6. (3) Mechanical Relay | 12. Emergency Stop Button - Red |

4.4 Wiring Connections

Customer connections are made to the provided numbered terminal blocks located near the bottom portion of the enclosure.

Stripped solid conductors, stranded conductors, or ultrasonically “bonded” conductors are easily connected using a screwdriver.

Wire Removal
The conductor is removed using a screwdriver.

Maximum Conductor Size: 12 AWG

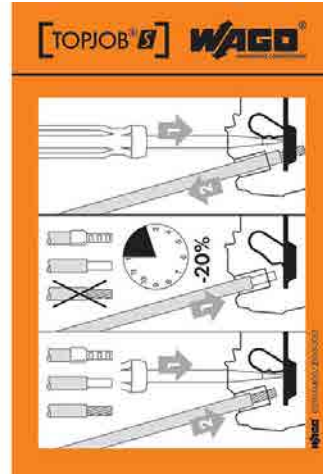


Figure 5: Terminal Block installation & removal.

4.4.1 System Supply

The ECB requires 110VAC @ 60Hz alternating current supplied to the enclosure. The product is powered via terminal block 5 & 6 with CAGE CLAMP connections. The provided power supply generates the necessary voltage to power the integral controller and valve solenoid/s.

NOTICE

Do not use an incorrect voltage/frequency!

The use of an incorrect supply voltage or frequency can cause severe damage to the product.

The 110V AC supplies power to system controller and valve solenoids.



**110V
AC**

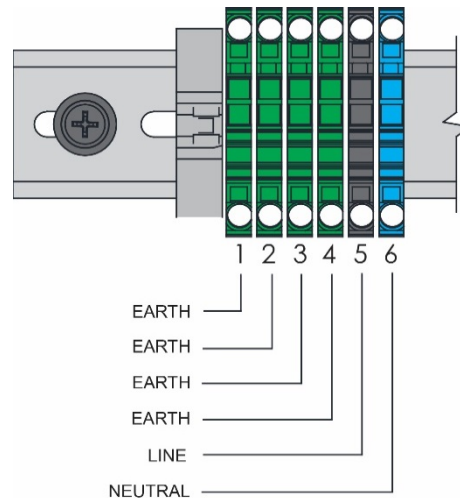


Figure 6: Supply Voltage Connections.

ECB Pump & Control Valve Interface

4.4.2 Valve Connections

If the valve is solenoid controlled (model ECB-CP) refer to Section 4.4.2A for connections.

If the valve is electric motor operated (model ECB-CEM) refer to Section 4.4.2B for connections.

4.4.2A Valve Solenoid Connections

The control valve emergency solenoids are terminated on terminal block **7, 8, 9 & 10**. This contact is pre-wired with an output of 110VAC. Typically, when wiring AC solenoids, polarity is irrelevant.

The control valve normal solenoid is terminated on terminal block **11 & 12**. This contact is pre-wired with an output of 110VAC.

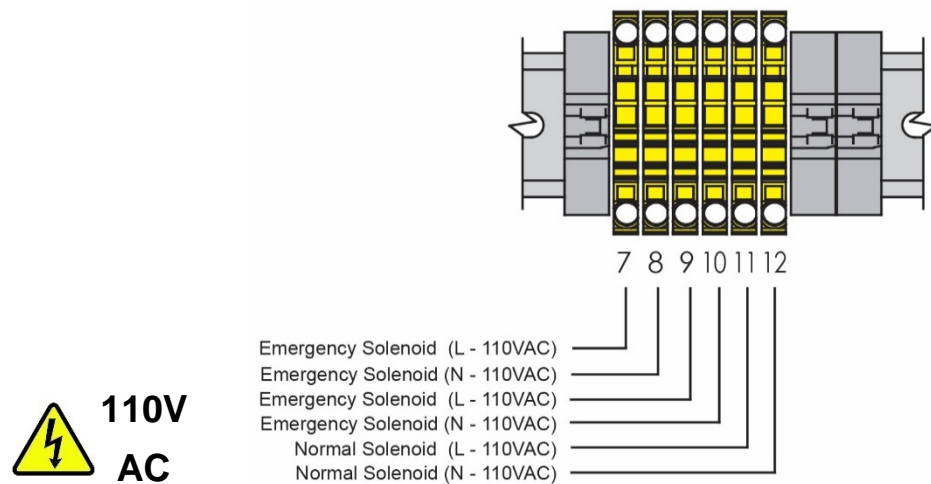


Figure 7A: Solenoid Connection Terminals

4.4.2B Electric Motor Operator Opening & Closing Connections

The control valve motor actuator is terminated on terminal block 13, 14, 15 and 16. These contacts are pre-wired as dry contact output. If the contact requires power, the maximum current is 10 amps.

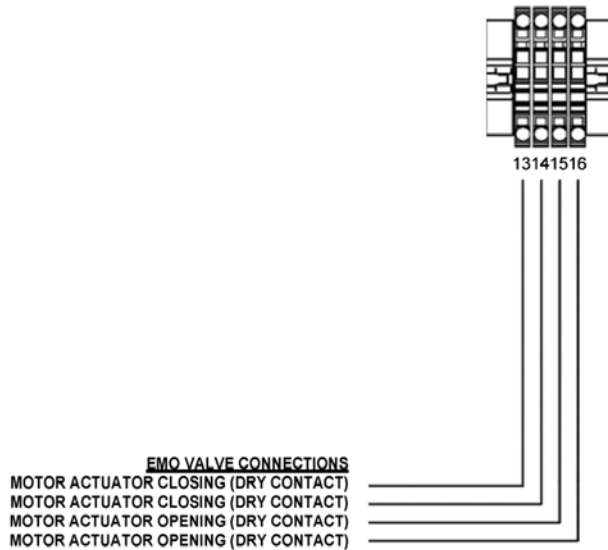


Figure 7B: Electric Motor Operator Connections

4.4.3 Pump Start Connections

The pump start signal are terminated on terminal block **17 & 18**. This contact is pre-wired as a dry-contact output. If the contact requires power, the maximum current is 10 amps.

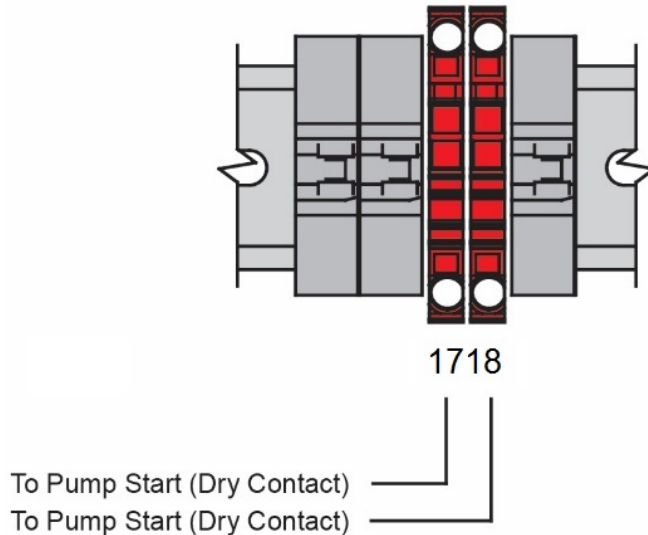


Figure 8: Pump Start Connection Terminals

4.4.4 Remote Pump Start, Pressure & Valve Limit Switch Connections

The remote start signal from SCADA is terminated on terminal block **19 & 20**. This contact is pre-wired as a dry-contact input. When the contact is closed and the 3-position switch is set to remote, the controller interprets this as a pump run command.

The valve limit switch is terminated on terminal block **25 & 26**. This contact is pre-wired as a dry-contact input. When the contact is open, the controller interprets this as “valve open”. When the contact is closed, the controller interprets this as “valve closed”.

ECB Pump & Control Valve Interface

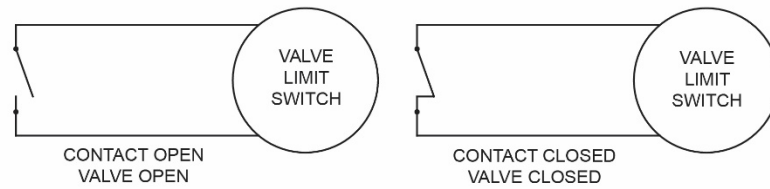


Figure 9: Valve Limit Switch Connections.

The pressure switch signal is terminated on terminal block **27 & 28**. This contact is pre-wired as a dry-contact input. When the contact is open, the controller interprets this as “minimum pressure **not** met”. When the contact is closed, the controller interprets this as “minimum pressure met”.

NOTICE

If a pressure switch is not used!

If a pressure switch is not used, a jumper must be inserted across terminal block 27 & 28.

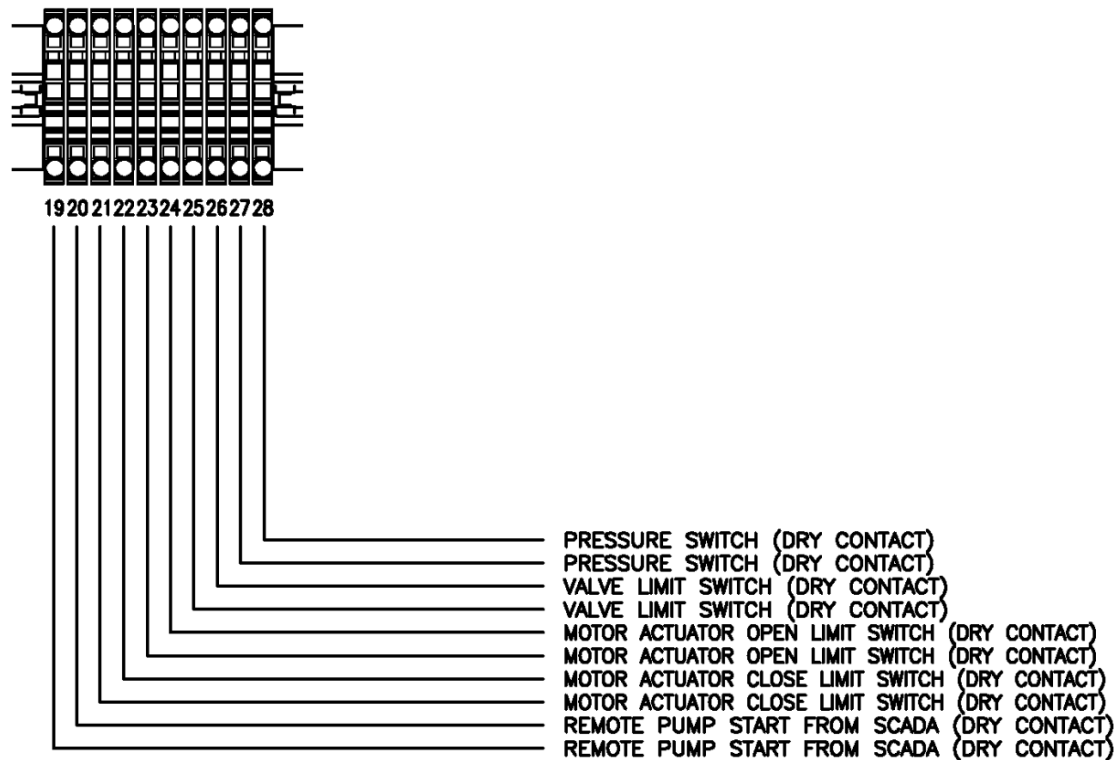


Figure 10: Remote Start, Valve Limit Switch, & Pressure Switch Connections.

4.4.4.1 Electric Motor Actuator Limit Switch Connections

If the valve is electric motor operated, connections must be made to the limit switches integral to the motor actuator on terminal block 21, 22, 23 and 24 (Refer to Figure 10, Page 15). These contacts are prewired as a dry contact input.

4.4.5 Alarm Connections

The ECB comes standard with 5 built in alarms. If either power, pump or valve failure occur, the appropriate alarm is flagged and the following output are given to the terminals:

Terminal **29 & 30**: Failure Mode 1 – Insufficient Pump Pressure
Alarm OFF = 4mA
Alarm ON = 20mA

Terminal **31 & 32**: Failure Mode 2 – Valve Did Not Open on Start-up
Alarm OFF = 4mA
Alarm ON = 20mA

Terminal **33 & 34**: Failure Mode 3 – Loss of Pressure to Pressure Switch
Alarm OFF = 4mA
Alarm ON = 20mA

Terminal **35 & 36**: Failure Mode 4 – Valve Closed without Command
Alarm OFF = 4mA
Alarm ON = 20mA

Terminal **37 & 38**: Failure Mode 5 – Power Failure Delay
Alarm OFF = Dry Contact Closed
Alarm ON = Dry Contact Open

Further explanation is given on alarms in the software section of this manual.

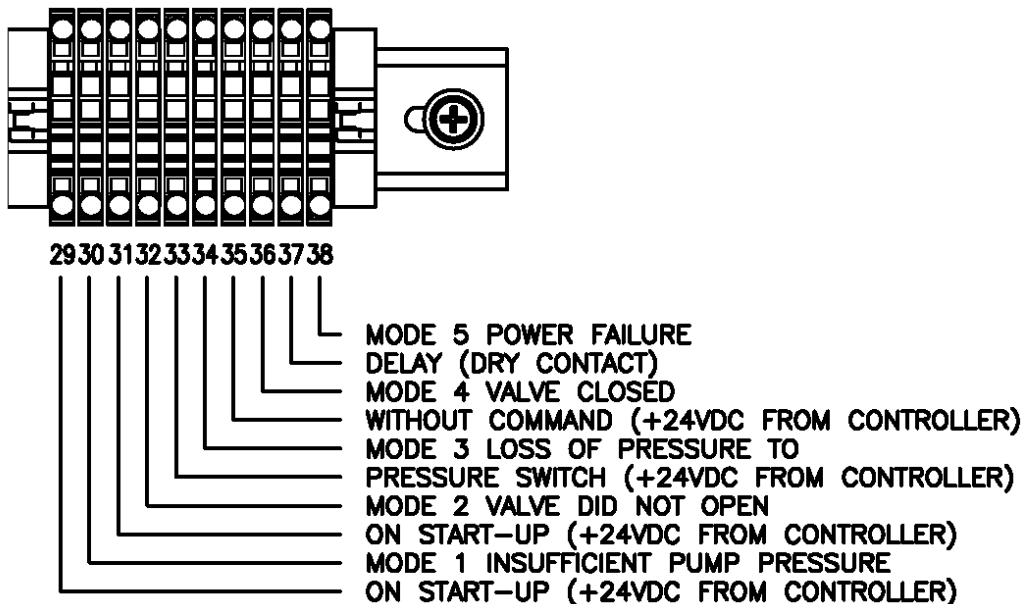


Figure 11: Alarm Output Connections.

4.5 Grounding & Shielding Function

Grounding increases the resistance against disturbances from electromagnetic interferences. From the field side, the ground wire must be connected to any ground potential (green terminal block). The terminal block is internally connect to the carrier rail.



Figure 12: Grounding Connection Terminal Block.

The use of shielded cables reduces electromagnetic interference and thus increases signal quality. Measurement errors, data transmission errors and interference due to excessive voltage can be prevented.

Shielded signal lines only *required* for analog signals connected to the ECB Controller.

NOTE

Connect the cable shield to the ground potential!

Integrated shielding is mandatory to meet the technical specifications in regards to measuring accuracy. Connect the cable shield to the ground potential (green terminal block). This allows induced interference to dissipate and to be kept away from devices in the cabinet.

NOTE

Improve shielding performance by placing the shield over a large area!

Higher shielding performance is achieved via low-impedance connection between shield and ground. For this purpose, connect the shield over a large surface area.

NOTE

Keep data and signal lines away from sources of interference!

Route data and signal lines separately from all high voltage cables and other sources of high electromagnetic emission (e.g. power supplies).

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4.6 Cabinet Wiring

Provided wiring diagrams are intended to be used as reference only.

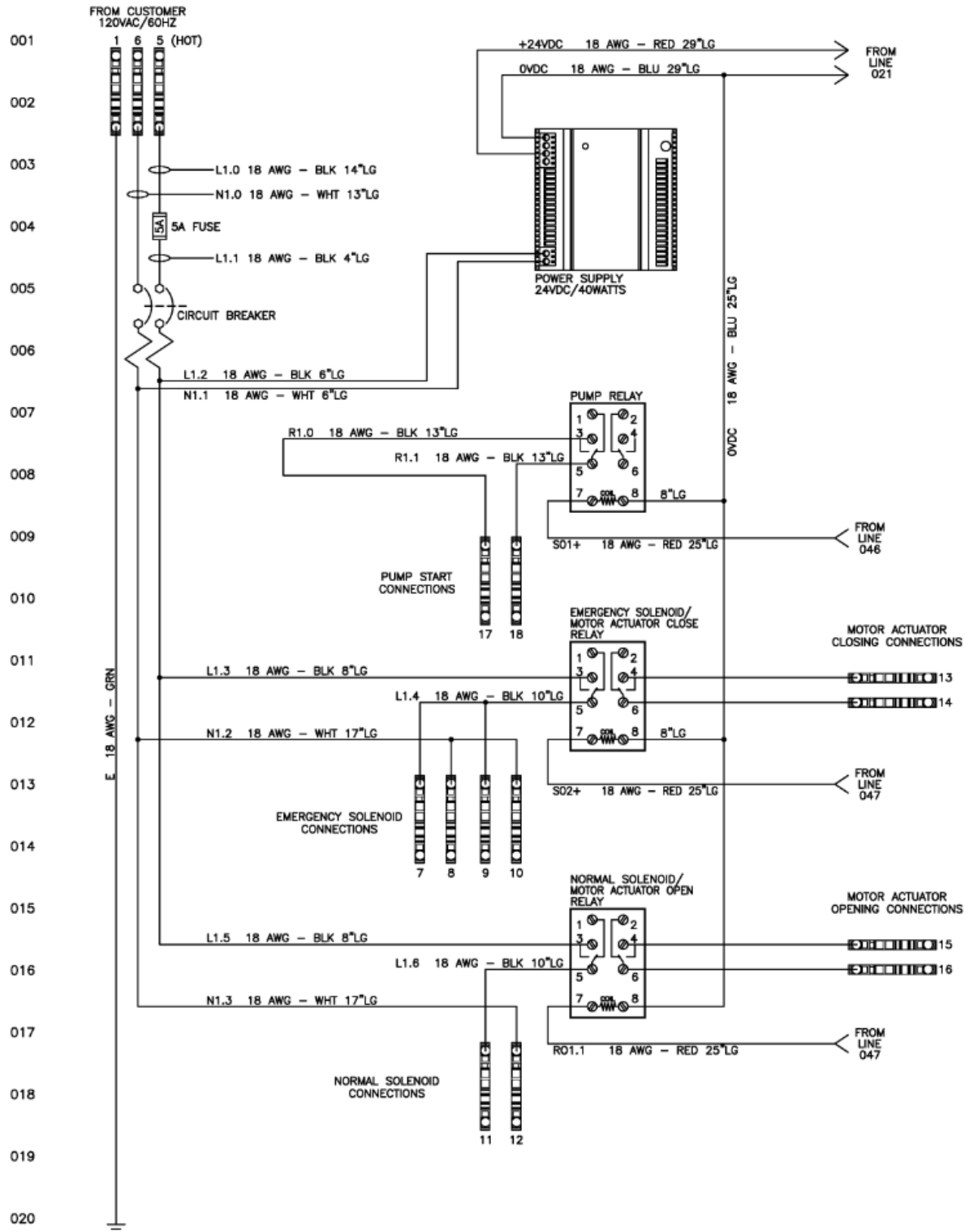


Figure 13. Panel Wiring Diagram.

ECB Pump & Control Valve Interface

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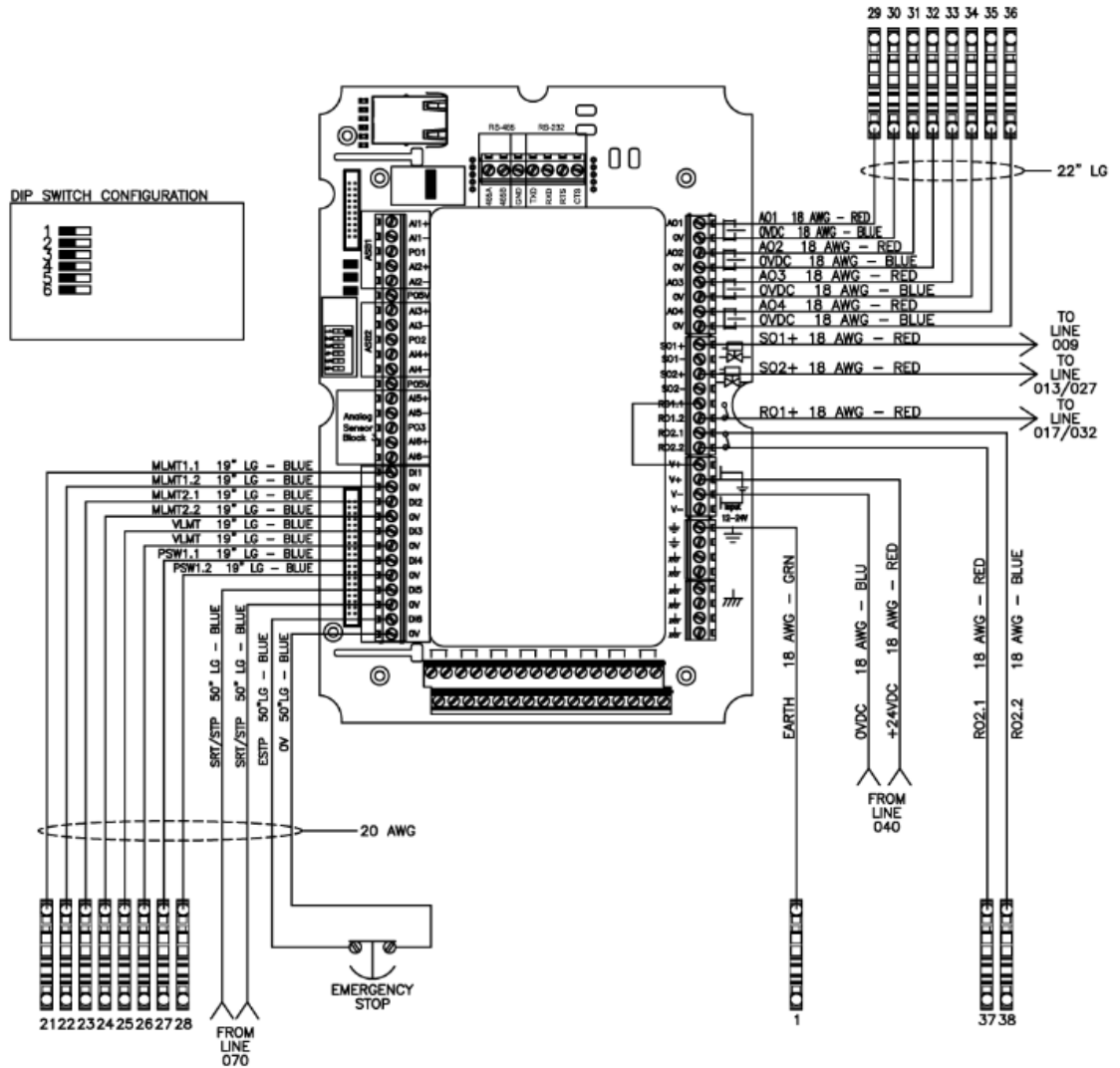


Figure 14: Panel Wiring Diagram.

5 Software Setup and Operation

The DeZURIK ECB is pre-programmed at the factory for solenoid valve operation (model ECB-CP) or electric motor operator (model ECB-CEM).

The DeZURIK ECB Pump & Control Valve Interface powers on after switching the circuit breaker to the “On” position. An indicator light illuminates on the power supply indicating power to controller and accessory components. It takes approximately 40 seconds for the controller to complete its boot up procedure.

Once the controller has completed the boot up process, the home screen appears with system indicators and status.

5A. Solenoid Controlled Valve Home Screen and Indicators (Figure 15A)

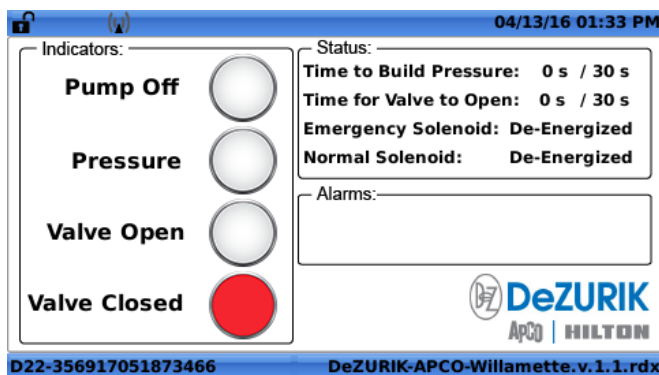


Figure 15A. ECB-CP Solenoid Valve Controller Home Screen

Solenoid Valve Controller Home Screen Visual Indicators/Status:

1. Pump Status - White = Pump Off, Amber = Pump On, Indicator Section “Pump Off”
2. Pressure Switch Status – Flashing Blue = Below Minimum, Steady Blue = Pressure OK, Indicator Section “Pressure”
3. Valve Status - Red = Valve Closed, Flashing Green = Normal Solenoid Energized, Valve Opening, Steady Green = Normal Solenoid Energized, Valve Fully Open, Indicator Section “Valve Open”, “Valve Closed”, Flashing Red = Normal Solenoid De-Energized, Valve Closing
4. Emergency Stop Status - Emergency stop enabled when displayed in alarms section
5. System Failure Status - Indicates a system failure when displayed in alarms section
 - a. Failure Mode 1 = Insufficient Pump Pressure on Start-up
 - b. Failure Mode 2 = Valve did not Open on Start-up
 - c. Failure Mode 3 = Loss of Pressure to Pressure Switch
 - d. Failure Mode 4 = Valve Closed Without Command
 - e. Failure Mode 5 = Power Failure Delay
6. Time for Pump to build Pressure - Displays setting and countdown time in seconds in status section
7. Time for Valve to Open - Displays setting and countdown time in seconds in status section

5B. Electric Motor Operator Controlled Valve Home Screen and Indicators (Figure 15B)

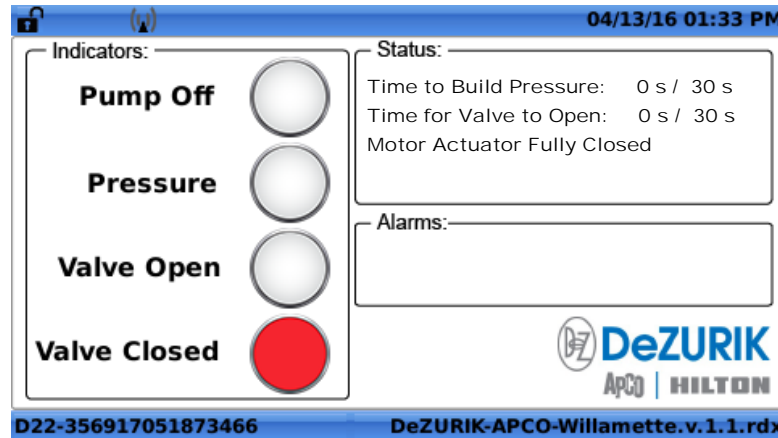


Figure 15B. ECB-CEM Electric Motor Operator Controller Home Screen


Electric Motor Operator Controller Home Screen Visual Indicators/Status:

1. Pump Status - White = Pump Off, Amber = Pump On, Indicator Section "Pump Off"
2. Pressure Switch Status – Flashing Blue = Below Minimum, Steady Blue = Pressure OK, Indicator Section "Pressure"
3. Valve Status - Red = Valve Closed, Flashing Green = Electric Motor Operator Energized, Valve Opening, Steady Green = Valve Fully Open, Indicator Section "Valve Open", "Valve Closed", Flashing Red = Electric Motor Operator Energized, Valve Closing
4. Emergency Stop Status - Emergency stop enabled when displayed in alarms section
5. System Failure Status - Indicates a system failure when displayed in alarms section
 - a. Failure Mode 1 = Insufficient Pump Pressure on Start-up
 - b. Failure Mode 2 = Valve did not Open on Start-up
 - c. Failure Mode 3 = Loss of Pressure to Pressure Switch
 - d. Failure Mode 4 = Valve Closed Without Command
 - e. Failure Mode 5 = Power Failure Delay
6. Time for Pump to build Pressure - Displays setting and countdown time in seconds in status section
7. Time for Valve to Open - Displays setting and countdown time in seconds in status section.

5.1 Security Passcode


The EBC controller can be password protected to prevent unauthorized users from accessing important configuration menus. When a password is configured, protected menus include input, output, alarm, and retransmission configuration menus.

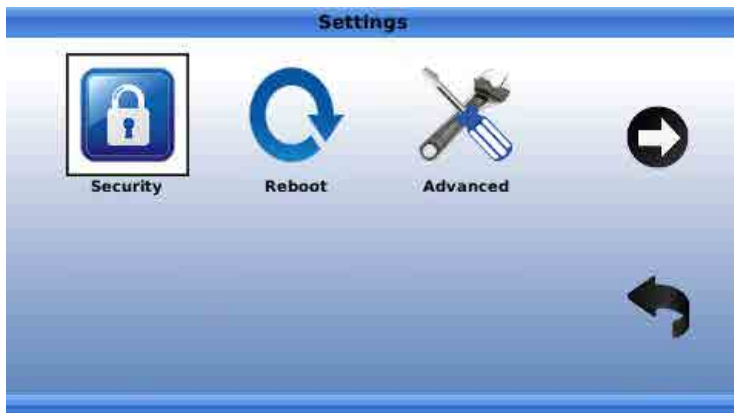
The password configuration menu is accessed using the 5 button keypad on the controller.

1. From the "Home" screen, hold the down arrow  for greater than 2 seconds.



2. Select the right arrow icon using the  button.

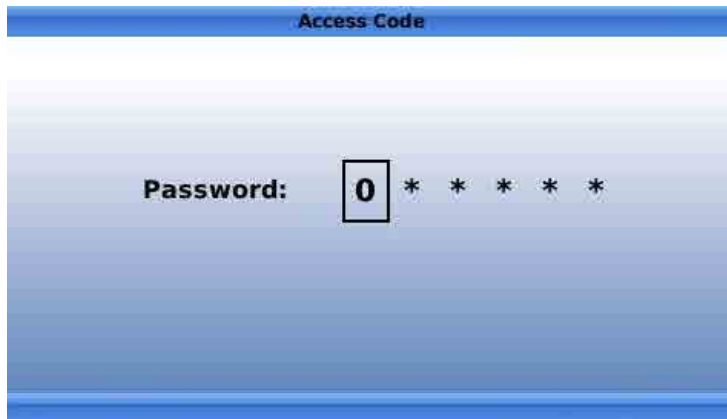


3. Select the security icon using the  button.



ECB Pump & Control Valve Interface

4. Enter a 6 digit password using the   buttons.



Note: To remove a password and allow free access to all menus, set password to “000000”.

5.2 System Timers

The ECB includes the following timers and settings, programmable from a set-up screen on the integral controller:

1. Pressure Timer - Allowable time for pump to build pressure.

The Pressure Timer is configurable from 0 to 60 seconds. After the pump has been started, the system has the configurable amount of time to build pressure. If the timer has expired and the pressure switch contacts has not closed, the pump is shut off, emergency solenoid pilot is de-energized, and “Failure Mode 1: Insufficient Pump Pressure on Start-up” is displayed. A manual reset of the Emergency Stop Button is required to reset the fault.


2. Valve Open Timer - Allowable time for control valve to open.

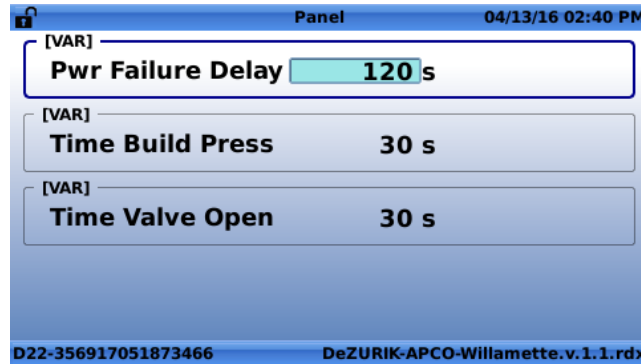
The Valve Open timer is configurable from 0 to 60 seconds. After the normal solenoid valve has been energized, the valve has the configurable amount of time for the valve to open. If the timer has expired and the limit switch contact does not change state, the pump is shut off, both normal and emergency solenoids de-energize, and “Failure Mode 2: Valve Did Not Open On Start-up” is displayed. A manual reset of the Emergency Stop Button is required to reset the fault.

3. Power Failure Pump Restart Timer - Delay time for automatic pump re-start following power failure.

The Power Failure Delay Timer is configurable from 0 to 1000 Seconds. Upon a loss of power, when the power is restored, and “Failure Mode 5: Power failure Delay” is displayed. The pump cannot be restarted until the timer expires.

The system timers are accessed using the 5 button keypad on the controller.

From the home screen, click the down arrow  to access the timer menu.



To toggle between timers, use the   buttons on the keypad.


Timers are selected using the  button. The text box is highlight red and the value can be changed.

Figure 16. ECB Controller Timer Menu.

5.3 Normal Pump Start (Local or Remote)

5.3A For Solenoid Controlled Valves Model ECB-CP (Figure 17A)

A pump start command is initiated by turning the LOR switch to the "Local" position and pressing the "Start Pump" button; or by a remote contact closure with the LOR switch in the "Remote" position. Either of these operations immediately turns on the pump which can be seen by the **Steady Amber** light indicator on the display screen. Simultaneously the Pressure Timer is activated with its setting and count up displayed. A **Flashing Blue** light indicates the pump is building pressure. The emergency solenoid pilot is energized with indication shown on the display screen.

The valve does not start to open until sufficient pressure is established within the time set on the Pressure Timer. Once pressure is established, indicated by a Steady Blue light, the opening sequence starts.

A **Flashing Green** light indicates the Valve Open Timer has been activated. Its setting and count up is indicated on the display screen. The normal solenoid pilot is energized and indicated on the display screen. The valve opens at the rate set on the speed control valve (opening speed). Once the valve is open and the limit switch has been tripped within the Valve Open Timer's setting, the status indication is change to **Steady Green**.

With the valve open, pump running, and producing sufficient pressure; display screen indication consists of **Steady Amber**, **Steady Blue**, and **Steady Green** lights along with indication that both the normal solenoid and emergency solenoid pilots are "energized".

ECB Pump & Control Valve Interface



Figure 17A. ECB-CP Controller Home Screen, Normal Operation

5.3B For Electric Motor Operated Valves Model ECB-CEM (Figure 17B)

A pump start command is initiated by turning the LOR switch to the "Local" position and pressing the "Start Pump" button; or by a remote contact closure with the LOR switch in the "Remote" position. Either of these operations immediately turns on the pump which can be seen by the **Steady Amber** light indicator on the display screen. Simultaneously the Pressure Timer is activated with its setting and count up displayed. A **Flashing Blue** light indicates the pump is building pressure.

The valve does not start to open until sufficient pressure is established within the time set on the Pressure Timer. Once pressure is established, indicated by a Steady Blue light, the opening sequence starts.

A **Flashing Green** light indicates the Valve Open Timer has been activated. Its setting and count up is indicated on the display screen. The electric motor operator is energized and opening as indicated on the display screen. The valve opens at the rate set by the electric motor operator (opening speed). Once the valve is open and the valve limit switch has been tripped within the Valve Open Timer's setting, the status indication is change to **Steady Green**. The electric motor actuator will continue to open until the EMO's internal open limit switch is tripped.

With the valve open, pump running, and producing sufficient pressure; display screen indication consists of **Steady Amber**, **Steady Blue**, and **Steady Green** lights along with indication that the electric motor operator is opening or fully open.

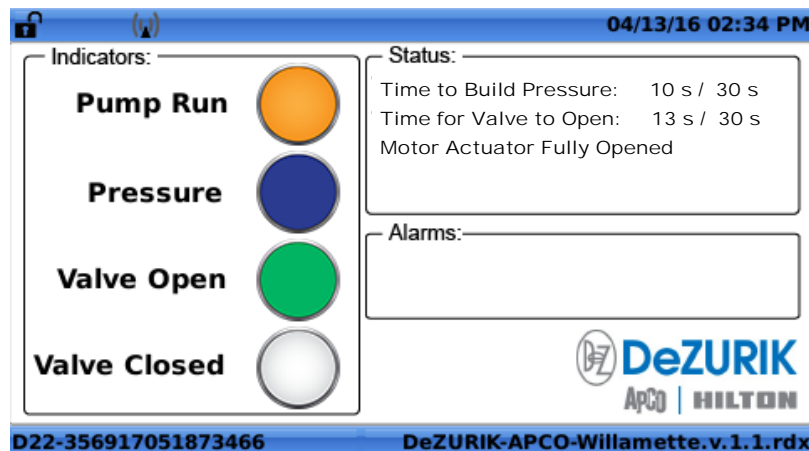


Figure 17B. ECB-CEM Controller Home Screen, Normal Operation

5.4 Pump Malfunction

5.4A For Solenoid Controlled Valves Model ECB-CP (Figure 18A)

At any time during the pumping operation, if the pump discharge pressure is not capable of satisfying the pressure switch setting, the **Steady Blue** visual indicator for pressure turns **White**, indicating a loss of pressure. The pump contact opens turning the pump off and de-energizing both the normal and emergency solenoids. The valve fails closed at the rate set by the hydraulic emergency closing speed control. A screen indicator “Failure Mode 3: Loss of Pressure to Pressure Switch” is displayed. A manual reset of the Emergency Stop Button is required to clear the fault and reset the system.

NOTE

To Reset a System Fault!

A system fault must be cleared using the emergency stop button. If the fault is not cleared, the pump is not able to start.

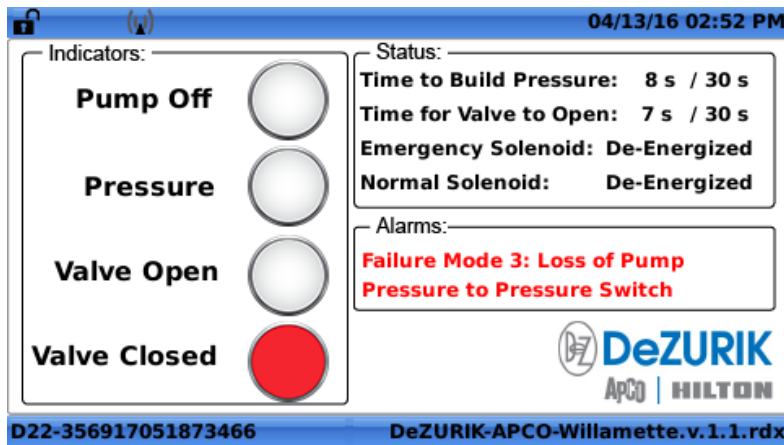


Figure 18A: ECB-CP Controller Home Screen, Failure Mode #3.

5.4B For Electric Motor Operated Valves Model ECB-CEM (Figure 18B)

At any time during the pumping operation, if the pump discharge pressure is not capable of satisfying the pressure switch setting, the **Steady Blue** visual indicator for pressure turns **White**, indicating a loss of pressure. The pump contact opens turning the pump off and the electric motor actuator will be energized to run to the closed position. The valve fails closed mechanically. A screen indicator “Failure Mode 3: Loss of Pressure to Pressure Switch” is displayed. A manual reset of the Emergency Stop Button is required to clear the fault and reset the system.

NOTE

To Reset a System Fault!

A system fault must be cleared using the emergency stop button. If the fault is not cleared, the pump is not able to start.

ECB Pump & Control Valve Interface

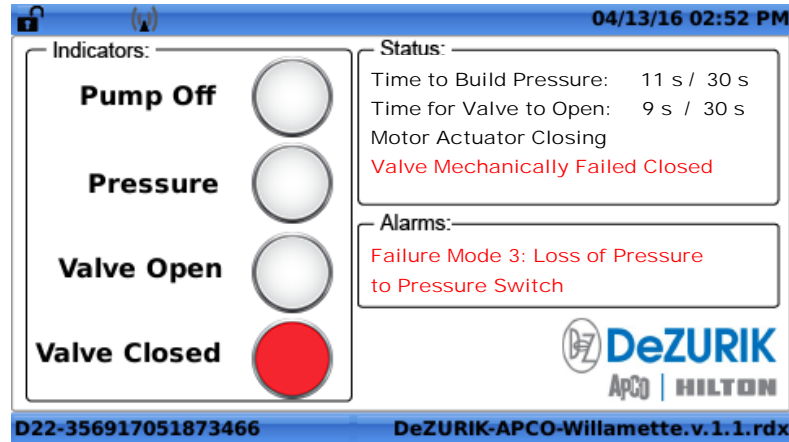


Figure 18B: ECB-CEM Controller Home Screen, Failure Mode #3.

5.5 Valve Malfunction

5.5A For Solenoid Controlled Valves Model ECB-CP (Figure 19A)

If either of the solenoids of the pump control valve fail, or if any other event should cause the valve to close without a normal pump shutdown command, the pump contact opens, turning the pump off and de-energizing both the normal and emergency solenoids. The valve fails closed at the rate set by the hydraulic emergency closing speed control. A screen indicator “Failure Mode 4: Valve Closed Without Command” is displayed. A manual reset of the Emergency Stop Button is required to clear the fault and reset the system.

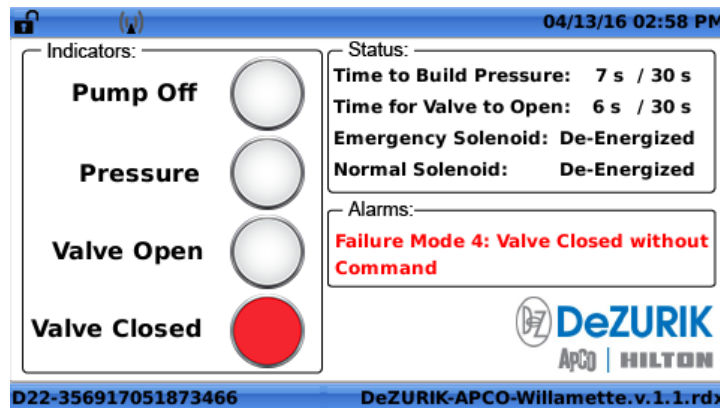


Figure 19A: ECB-CP Controller Home Screen, Failure Mode #4.

5.5B For Electric Motor Operated Valves Model ECB-CEM (Figure 19B)

If any event should cause the valve to close without a normal pump shutdown command, the pump contact opens, turning the pump off, energizing the electric motor actuator to run to the closed position. The valve fails closed mechanically. A screen indicator “Failure Mode 4: Valve Closed Without Command” is displayed. A manual reset of the Emergency Stop Button is required to clear the fault and reset the system.

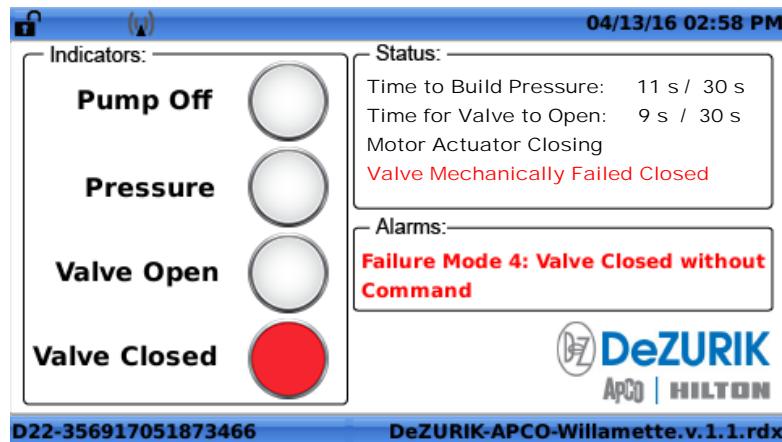


Figure 19B: ECB-CEM Controller Home Screen, Failure Mode #4.

5.6 Normal Stopping of Pump (Local and Remote)

5.6A For Solenoid Controlled Valves Model ECB-CP

A normal pump shutdown sequence is initiated by either depressing the “Pump Stop” button if in the “Local” mode; or by remotely breaking contacts of the remote start circuit with the LOR switch in the “Remote” position. This command de-energizes the normal solenoid pilot to initiate a normal valve closure.

A **Flashing Red** light indicates that the valve is closing, and the display indicates the normal solenoid pilot is de-energized. Once the valve’s limit switch is tripped, the pump motor starter contacts open, turning off the pump, and de-energizing the emergency solenoid pilot.

With the valve closed and the pump off, pump status is displayed in **Steady White**, and the valve closed indicator is displayed in **Steady Red**. The display screen also indicates both solenoid pilots are “de-energized”.

5.6B For Electric Motor Operated Valves Model ECB-CEM

A normal pump shutdown sequence is initiated by either depressing the “Pump Stop” button if in the “Local” mode; or by remotely breaking contacts of the remote start circuit with the LOR switch in the “Remote” position. This command energizes the electric motor actuator to run to the closed position to initiate a normal valve closure.

A **Flashing Red** light indicates that the valve is closing, and the display indicates the electric motor actuator is closing. Once the valve’s limit switch is tripped, the pump motor starter contacts open, turning off the pump.

With the valve closed and the pump off, pump status is displayed in **Steady White**, and the valve closed indicator is displayed in **Steady Red**. The display screen also indicates the electric motor actuator is closed.

5.7 Power Failure

5.7A For Solenoid Controlled Valves Model ECB-CP (Figure 20A)

In the event of a power failure, even momentary, the pump contact opens, turning the pump off and de-energizing both the normal and emergency solenoids. The valve fails closed at the rate set by the hydraulic emergency closing speed control.

A pre-set time delay period is initiated as soon as power is restored. A screen indicator “Failure Mode 5: Power failure Delay” is displayed. The adjustable time delay period ranges from 0 to 1000 seconds. During the power failure delay period, it is not possible to have a pump restart. After the delay period has expired, a normal pump start sequence can be initiated if a local or remote pump start command exists.

ECB Pump & Control Valve Interface

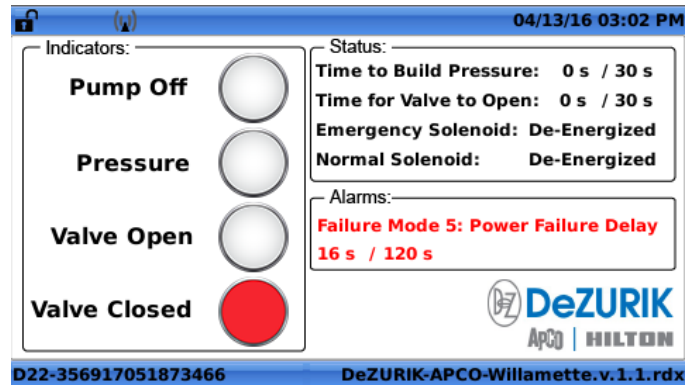


Figure 20A: ECB-CP Controller Home Screen, Failure Mode #5.

WARNING

Valve Must be closed prior to Pump Start!

A local or remote pump start cannot be initiated unless the control valve is closed.

5.7B For Electric Motor Operated Valves Model ECB-CEM (Figure 20B)

In the event of a power failure, even momentary, the pump contact opens, turning the pump off. The valve fails closed mechanically.

A pre-set time delay period is initiated as soon as power is restored. A screen indicator “Failure Mode 5: Power failure Delay” is displayed. The adjustable time delay period ranges from 0 to 1000 seconds. During the power failure delay period the electric motor actuator will be energized to run to the closed position. It is not possible to have a pump restart until the electric motor actuator is fully closed. After the delay period has expired the electric motor actuator will be run to the closed position and trip the closed limit switch, Then a normal pump start sequence can be initiated if a local or remote pump start command exists.

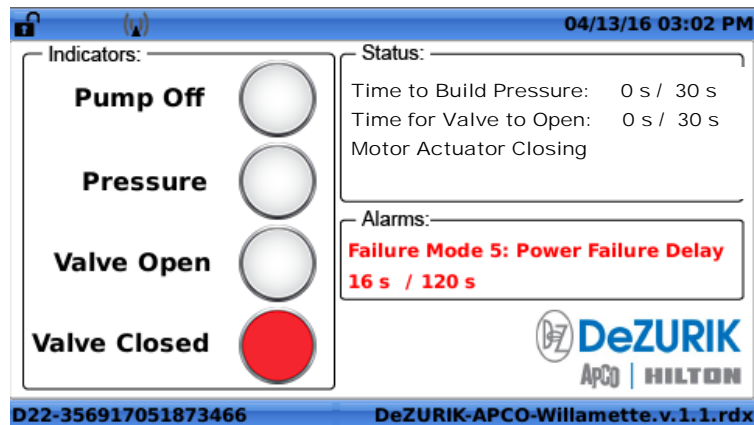


Figure 20B: ECB-CEM Controller Home Screen, Failure Mode #5.

WARNING

Valve and Electric Motor Actuator Must be closed prior to Pump Start!

A local or remote pump start cannot be initiated unless the control and electric motor actuator valve is closed.

5.8 Software Logic Diagrams

5.8A For Solenoid Operator Valves Model ECB-CP

TIMERS:

PFD - POWER FAILURE DELAY TIMER
 TPD - TIME TO BUILD PRESSURE
 TVD - TIME FOR VALVE TO OPEN

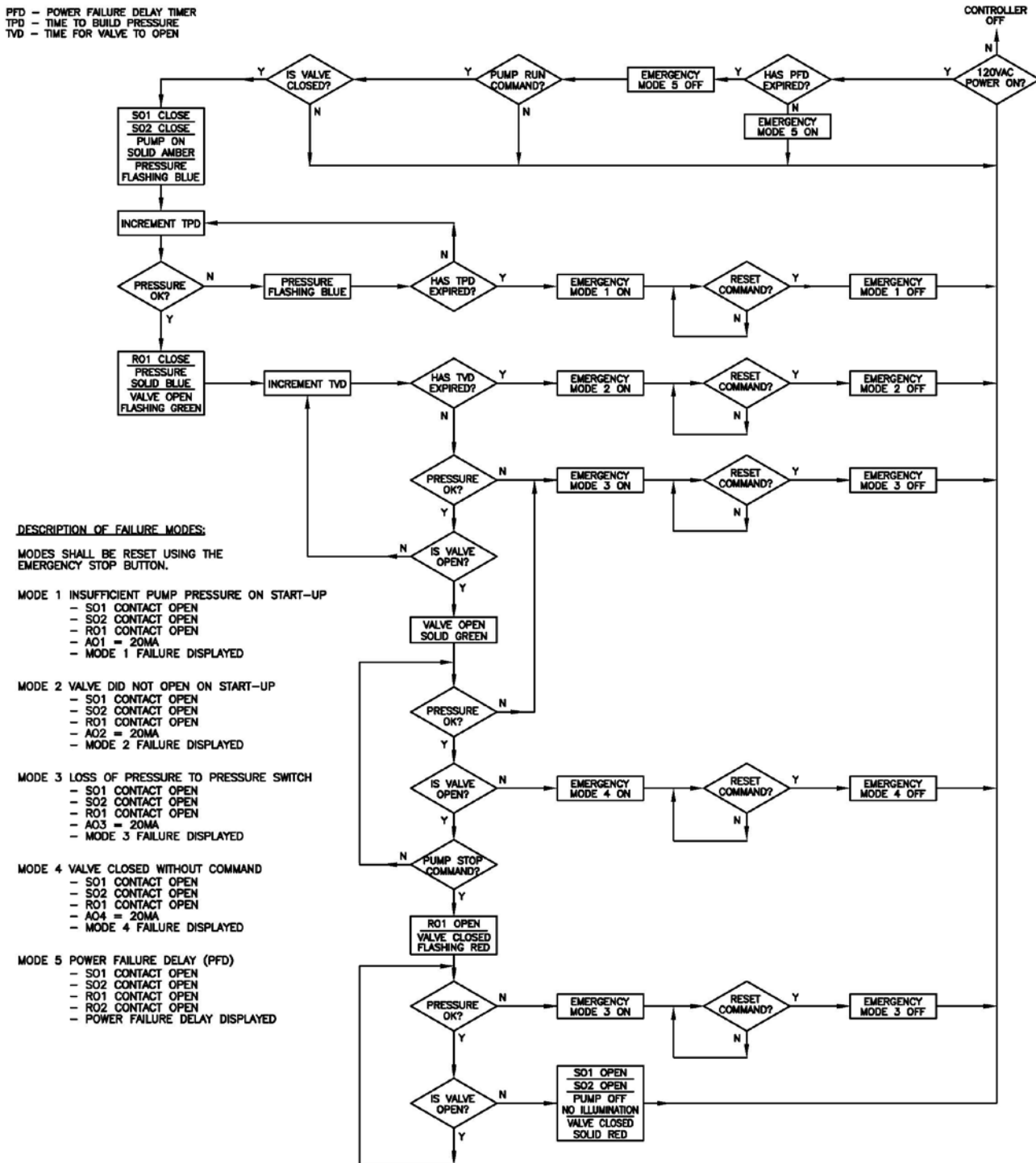


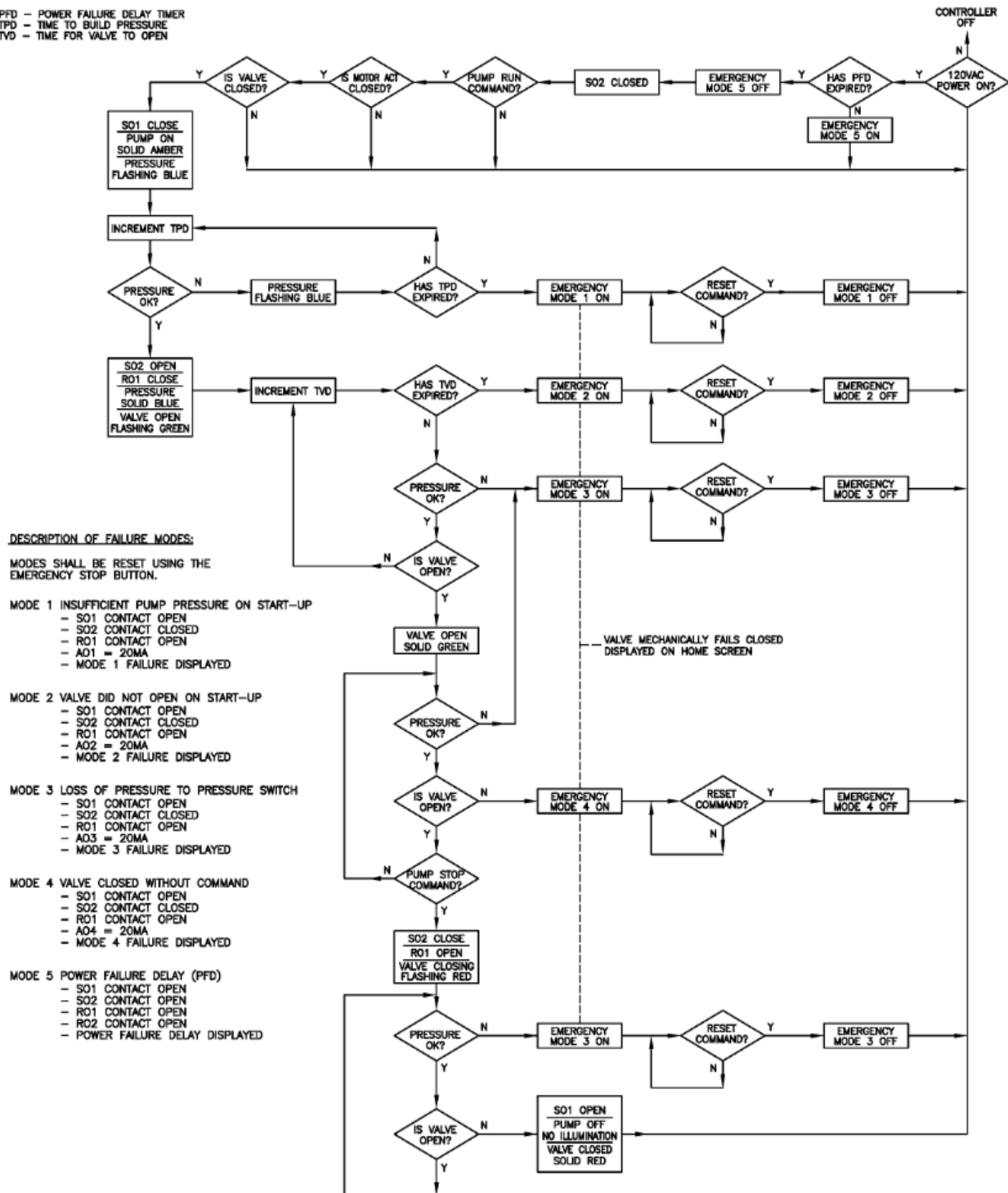
Figure 21A: ECB Logic Diagram.

ECB Pump & Control Valve Interface

5.8B For Electric Motor Operated Valves Model ECB-CEM

TIMER ABBREVIATIONS:

PFD - POWER FAILURE DELAY TIMER
 TPD - TIME TO BUILD PRESSURE
 TVD - TIME FOR VALVE TO OPEN



DESCRIPTION OF FAILURE MODES:

MODES SHALL BE RESET USING THE EMERGENCY STOP BUTTON.

MODE 1 INSUFFICIENT PUMP PRESSURE ON START-UP
 - S01 CONTACT OPEN
 - S02 CONTACT CLOSED
 - R01 CONTACT OPEN
 - A01 = 20MA
 - MODE 1 FAILURE DISPLAYED

MODE 2 VALVE DID NOT OPEN ON START-UP
 - S01 CONTACT OPEN
 - S02 CONTACT CLOSED
 - R01 CONTACT OPEN
 - A02 = 20MA
 - MODE 2 FAILURE DISPLAYED

MODE 3 LOSS OF PRESSURE TO PRESSURE SWITCH
 - S01 CONTACT OPEN
 - S02 CONTACT CLOSED
 - R01 CONTACT OPEN
 - A03 = 20MA
 - MODE 3 FAILURE DISPLAYED

MODE 4 VALVE CLOSED WITHOUT COMMAND
 - S01 CONTACT OPEN
 - S02 CONTACT CLOSED
 - R01 CONTACT OPEN
 - A04 = 20MA
 - MODE 4 FAILURE DISPLAYED

MODE 5 POWER FAILURE DELAY (PFD)
 - S01 CONTACT OPEN
 - S02 CONTACT OPEN
 - R01 CONTACT OPEN
 - R02 CONTACT OPEN
 - POWER FAILURE DELAY DISPLAYED

Figure 21B: ECB Logic Diagram.

6 Modbus Communication

The ECB comes standard with Modbus protocol. This protocol defines a message structure that PLC's recognizes and uses, regardless of the type of networks over which they communicate. The pump controller can be configured to communicate on standard Modbus networks using either of two transmission modes: TCP/IP or RTU. Users have the ability to select the desired mode, along with communication parameters (IP address, subnet mask, baud rate, etc.). The electronic valve controller has a built in VNC server. A viewer/operator uses TCP port 5900 to connect to a server (or 5800 for browser access), but can also be set to use any other port.

Supports Modbus TCP/IP and Modbus RTU simultaneously, as a server (slave) only.

Modbus RTU: requires UID (Modbus address, 1-255) and baud rate.

Modbus TCP/IP: requires allowed operator IP address range (for access control) and IP port number (default 502)

All data accessible with Modbus requests is mapped into the Holding Register address space (40000 to 65535). The commands supported are

- 03 – read multiple holding registers
- 16 – write multiple holding registers

Initially, only the physical inputs and outputs are available to a operator. All share a common format, in which an input or output is accessible as three consecutive 16-bit words. Remember that Modbus word data is transmitted in Motorola format i.e. high-order byte: low-order byte.

Each input/output is represented as follows:

- Status/control word
- Input/output value (IEEE 32-bit float, high-order word:low-order word)

The status of the status/control word is common to all, but certain bits may never be set if they are not applicable. Unused bits are read as zeros.

b0 signal lost/out of range (AIx and DIx_F only) read-only

b1 local override applied read-only

b2 alarm active (AOx, DOx only) read-only

b3 recopy active (AOx, DOx only) read-only

b14 clear Modbus override write-only, always reads as 0

b15 Modbus override active/set Modbus override read/write

Input/output values are expressed as natural units, so that if a 4-20 mA analog input is configured as flow, where 4 mA = 10 l/s and 20 mA = 200 l/s, for an input value of 12 mA the operator reads 95.

Space is reserved for 32 each of the analog inputs, digital inputs, analog outputs and digital outputs. Reading an input/output which does not physically exist, returns all zeros: writing has no effect. Note that input values are supplied after any filtering, scaling and special handling. So reading the value of a 4-20 mA input which has no signal (defined as input < 3.6 mA) may return

- an out-of-range value
- the last-known good value
- a default value

depending on the configuration of the input. An input/output with a local override applied returns the override value, **not** the current physical value.

ECB Pump & Control Valve Interface

Address mapping is as follows:

Analog Inputs		
40000	AI1	Status/control word
40001		input value, high-order word
40002		Input value, low-order word
40003	AI2	Status/control word
40004		input value, high-order word
40005		Input value, low-order word
40006	AI3	
.		.
.		.
40015	AI6	Status/control word
40016		input value, high-order word
40017		Input value, low-order word
40018-40099		Read as zeros

Digital Inputs		
40100	DI1 (digital state 1/0)	Status/control word
40101		input value, high-order word
40102		Input value, low-order word
40103	DI1_C (counter value)	Status/control word
40104		input value, high-order word
40105		Input value, low-order word
40106	DI1_F (flow value i.e. counter value over time)	Status/control word
40107		input value, high-order word
40108		Input value, low-order word
40109	DI2	
.		.
.		.
40145-40147	DI6	
40148-40150	DI6_C	
40151-40153	DI6_F	
40154-40199		Read as zeros

Analog Outputs		
40200	AO1	Status/control word
40201		input value, high-order word
40202		Input value, low-order word
40203	AO2	Status/control word
40204		input value, high-order word
40205		Input value, low-order word
40206	AO3	
.		.
.		.
40209	AO4	Status/control word
40210		input value, high-order word
40211		Input value, low-order word
40212-40299		Read as zeros

Digital Outputs		
40300	DO1	Status/control word
40301		input value, high-order word
40302		Input value, low-order word
40303	DO2	Status/control word
40304		input value, high-order word
40305		Input value, low-order word
40306	DO3	
.		.
.		.
40309	DO4	Status/control word
40310		input value, high-order word
40311		Input value, low-order word
40312-40399		Read as zeros

To override an input/output value, the operator must perform a single write operation to all three words of the input(s)/output(s) concerned. Any number of inputs/outputs may be overridden in the same write operation, but the above condition must be respected.

To override a value the operator must write

- status/control word, with b15 set to 1 (other bits will NOT be changed)
- high-order word of the new value
- low-order word of the new value

To clear an override the operator must write at least the status/control word for the input/output concerned, with b14 set to 1.

This means that with a single 18-word (6 x 3) write operation the operator can override the values of selected analog inputs (by setting b15 of the status/control word to 1), clear an override on others (set b14 to 1), and leave the state of the rest unchanged (b14, b15 = 0).

NOTE that an override does not have an effect if

- the write operation is incomplete (writing only 5 words to address 40200, for example, may override AO1 but has no effect on AO2)
- the supplied value is outside the permitted range
- a local override, an alarm, or a recopy is active
- if an override is applied and subsequently a local override, an alarm or a recopy become active, the override is removed.

7 Troubleshooting

1. Verify Input Connections

Note: All digital inputs are dry contact, 0 = Open Contact, 1 = Closed Contact

- a. Before checks are made, remove both ice cube relays from socket to disconnect outputs.
- b. From the home screen, click the “left arrow” button to view the input status.



Figure 22: PC-22D Controller, input status.

- c. Verify Local Start is recognized by controller – Put the LOA switch in “local” mode & press the “Start Pump” button. When pressed, DI4 (Start Pump) should change from 0 to 1. This is a momentary switch, when the “Start Pump” button is released, the input changes back to 0.
 - d. Verify Local Stop is recognized by controller – Put the LOA switch in “local” mode & press the “Stop Pump” button. When pressed, DI5 (Stop Pump) should change from 0 to 1. This is a momentary switch, when the “Stop Pump” button is released, the input changes back to 0.
 - e. Verify Pressure Switch Contact is Closed – Since a pressure switch is not being used, a jumper is required across the contact. Verify the controller recognizes the closed contact (DI3 = 1).
 - f. Verify Limit Switch Contact Closure is Working Correctly – When the valve is closed, DI2 should read 0 (open contact). When the valve is open, DI2 should read 1 (closed contact). Using a jumper, verify the controller interprets a closed & open contact correctly.
 - g. Verify Emergency Stop is Working Correctly – Press in and out the emergency stop button & verify DI6 is responding to each change.
 - h. Verify Remote Start is Working Correctly – Put the LOA switch in “remote” mode & close the remote start contact. Verify DI1 (Pump Start) switches from 0 to 1.
- ### 2. Verify Output Connections
- i. Insert both ice cube relays back into sockets.
 - j. When the pump starts, verify there is a contact closure between 10 & 11. This is a non-powered output from the factory.
 - k. When the valve solenoid energizes there should be 120VAC across 12 & 13.

8 Technical Support

For technical support, please contact DeZURIK, 250 Riverside Ave N, Sartell, MN 56377, 320-259-2000.