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.
**Table of Contents**

1 Notes about this Documentation ................................................................. 5
   1.1 Validity of this Document ................................................................. 5
   1.2 Copyright ......................................................................................... 5
   1.3 Symbols .......................................................................................... 5

2 Important Notes ..................................................................................... 6
   2.1 Legal Base ...................................................................................... 6
      2.1.1 Subject to Changes .............................................................. 6
      2.1.2 Personnel Qualifications ...................................................... 6
   2.2 Safety Advice (Precautions) ........................................................... 6

3 Important Notes ..................................................................................... 8

4 Installation ............................................................................................ 11
   4.1 Unpacking ...................................................................................... 11
   4.2 Mounting the Enclosure .................................................................. 11
   4.3 Component Layout ......................................................................... 13
   4.4 Wiring Connections ........................................................................ 14
      4.4.1 System Supply ....................................................................... 14
      4.4.2 Valve Connections .................................................................. 15
         4.4.2A Valve Solenoid Connections ........................................... 15
         4.4.2B Electric Motor Operator Opening & Closing Connections .......................................................................................................................................................... 15
      4.4.3 Pump Start Connections ......................................................... 16
      4.4.4 Remote Pump Start, Pressure & Valve Limit Switch Connections ................................................................. 16
      4.4.5 Alarm Connections ................................................................. 18
   4.5 Grounding & Shielding Function ..................................................... 19
   4.6 Cabinet Wiring .............................................................................. 20

5 Software Setup and Operation ................................................................ 22
   5A. Solenoid Controlled Valve Home Screen and Indicators (Figure 15A) ................................................................. 22
   5B. Electric Motor Operator Controlled Valve Home Screen and Indicators (Figure 15B) ........................................... 23
   5.1 Security Passcode .......................................................................... 24
   5.2 System Timers ............................................................................... 25
   5.3 Normal Pump Start (Local or Remote) ........................................... 26
      5.3A For Solenoid Controlled Valves Model ECB-CP (Figure 17A) ........................................................................ 26
      5.3B For Electric Motor Operated Valves Model ECB-CEM (Figure 17B) ............................................................. 27
   5.4 Pump Malfunction ......................................................................... 28
      5.4A For Solenoid Controlled Valves Model ECB-CP (Figure 18A) ........................................................................ 28
      5.4B For Electric Motor Operated Valves Model ECB-CEM (Figure 18B) ............................................................. 28
DeZURIK
ECB Pump & Control Valve Interface

5.5 Valve Malfunction ............................................................................................................................................. 29
5.5A For Solenoid Controlled Valves Model ECB-CP (Figure 19A) ................................................................. 29
5.5B For Electric Motor Operated Valves Model ECB-CEM (Figure 19B) ......................................................... 29
5.6 Normal Stopping of Pump (Local and Remote) ......................................................................................... 30
5.6A For Solenoid Controlled Valves Model ECB-CP .................................................................................... 30
5.6B For Electric Motor Operated Valves Model ECB-CEM ......................................................................... 30
5.7 Power Failure ............................................................................................................................................... 30
5.7A For Solenoid Controlled Valves Model ECB-CP (Figure 20A) ................................................................. 30
5.7B For Electric Motor Operated Valves Model ECB-CEM (Figure 20B) ....................................................... 31
5.8 Software Logic Diagrams ............................................................................................................................ 32
5.8A For Solenoid Operator Valves Model ECB-CP ....................................................................................... 32
5.8B For Electric Motor Operated Valves Model ECB-CEM ......................................................................... 33
6 Modbus Communication .................................................................................................................................... 34
7 Troubleshooting ............................................................................................................................................... 37
8 Technical Support ........................................................................................................................................... 37
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
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
**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
- 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**

**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:

![ECB Enclosure Footprint Dimensions](image)

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])
4.3 Component Layout

Figure 4: ECB Component Layout

List of Components:

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

---

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 5: Terminal Block installation & removal.**

**Figure 6: Supply Voltage Connections.**
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.
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.

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”.
**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.
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.

![Grounding Connection Terminal Block.](image)

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).
4.6 Cabinet Wiring

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

Figure 13. Panel Wiring Diagram.
Figure 14: Panel Wiring Diagram.
Software Setup and Operation

The DeZURIK ECB in 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)

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”
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”
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.
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.

![Timer Menu](image)

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".
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.
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.

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.
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.

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.
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.
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.

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

Figure 21A: ECB Logic Diagram.
5.8B For Electric Motor Operated Valves Model ECB-CEM

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 an 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.
Address mapping is as follows:

<table>
<thead>
<tr>
<th>Analog Inputs</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>40000</td>
<td>AI1</td>
<td>Status/control word</td>
</tr>
<tr>
<td>40001</td>
<td></td>
<td>input value, high-order word</td>
</tr>
<tr>
<td>40002</td>
<td></td>
<td>Input value, low-order word</td>
</tr>
<tr>
<td>40003</td>
<td>AI2</td>
<td>Status/control word</td>
</tr>
<tr>
<td>40004</td>
<td></td>
<td>input value, high-order word</td>
</tr>
<tr>
<td>40005</td>
<td></td>
<td>Input value, low-order word</td>
</tr>
<tr>
<td>40006</td>
<td>AI3</td>
<td></td>
</tr>
<tr>
<td>40015</td>
<td>AI6</td>
<td>Status/control word</td>
</tr>
<tr>
<td>40016</td>
<td></td>
<td>input value, high-order word</td>
</tr>
<tr>
<td>40017</td>
<td></td>
<td>Input value, low-order word</td>
</tr>
<tr>
<td>40018-40099</td>
<td></td>
<td>Read as zeros</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Analog Outputs</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>40200</td>
<td>AO1</td>
<td>Status/control word</td>
</tr>
<tr>
<td>40201</td>
<td></td>
<td>input value, high-order word</td>
</tr>
<tr>
<td>40202</td>
<td></td>
<td>Input value, low-order word</td>
</tr>
<tr>
<td>40203</td>
<td>AO2</td>
<td>Status/control word</td>
</tr>
<tr>
<td>40204</td>
<td></td>
<td>input value, high-order word</td>
</tr>
<tr>
<td>40205</td>
<td></td>
<td>Input value, low-order word</td>
</tr>
<tr>
<td>40206</td>
<td>AO3</td>
<td></td>
</tr>
<tr>
<td>40209</td>
<td>AO4</td>
<td>Status/control word</td>
</tr>
<tr>
<td>40210</td>
<td></td>
<td>input value, high-order word</td>
</tr>
<tr>
<td>40211</td>
<td></td>
<td>Input value, low-order word</td>
</tr>
<tr>
<td>40212-40299</td>
<td></td>
<td>Read as zeros</td>
</tr>
</tbody>
</table>
Digital Outputs

<table>
<thead>
<tr>
<th>Digital Outputs</th>
<th>40300</th>
<th>DO1</th>
<th>Status/control word</th>
</tr>
</thead>
<tbody>
<tr>
<td>40301</td>
<td></td>
<td></td>
<td>input value, high-order word</td>
</tr>
<tr>
<td>40302</td>
<td></td>
<td></td>
<td>Input value, low-order word</td>
</tr>
<tr>
<td>40303</td>
<td></td>
<td>DO2</td>
<td>Status/control word</td>
</tr>
<tr>
<td>40304</td>
<td></td>
<td></td>
<td>input value, high-order word</td>
</tr>
<tr>
<td>40305</td>
<td></td>
<td></td>
<td>Input value, low-order word</td>
</tr>
<tr>
<td>40306</td>
<td></td>
<td></td>
<td>DO3</td>
</tr>
<tr>
<td>40309</td>
<td></td>
<td>DO4</td>
<td>Status/control word</td>
</tr>
<tr>
<td>40310</td>
<td></td>
<td></td>
<td>input value, high-order word</td>
</tr>
<tr>
<td>40311</td>
<td></td>
<td></td>
<td>Input value, low-order word</td>
</tr>
<tr>
<td>40312-40399</td>
<td></td>
<td></td>
<td>Read as zeros</td>
</tr>
</tbody>
</table>

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.

   ![Image of input status](image)
   
   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.