

Fisher™ FIELDVUE™ DPC2K Digital Process Controller



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Section 1: Introduction

1.1 Installation, Pneumatic and Electrical Connections, and Initial Configuration

Refer to the DPC2K Quick Start Guide (D104559X012) for installation and connection information and the LoopConnect Software Quick Start Guide (D104558X012) for initial configuration and setup using LoopConnect Software. If a copy of these documents are needed, scan or click the QR code below, contact your [Emerson sales office](#) or visit our website at [Fisher.com](#).

NOTE

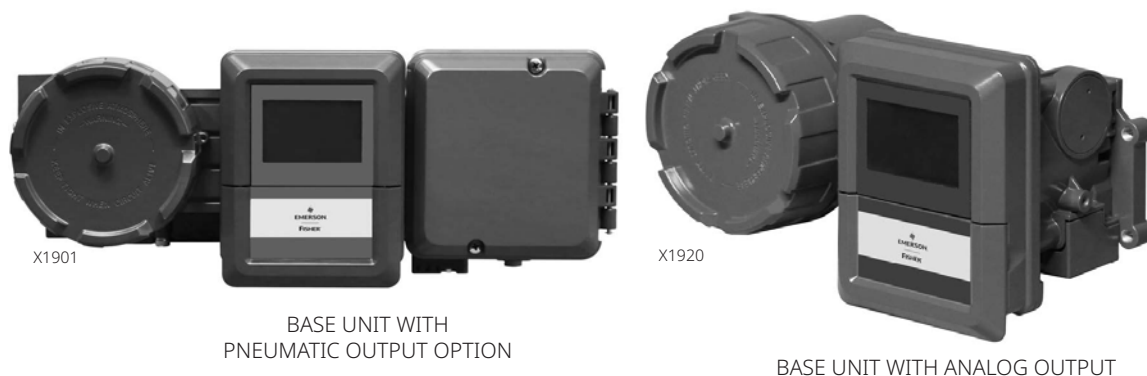
LoopConnect software is available for download on the Emerson website – Application Software Hub at <https://mysoftware.emerson.com/>. Ensure you have Administrator rights on the computer the software is being installed.



Click or scan for Installation
Documents & Field Support

emrson.co/FieldSupportDPC2K

Figure 1. DPC2K Digital Process Controller



1.2 Scope of the Manual

This instruction manual is a supplement to the DPC2K QSG (D104559X012) and the LoopConnect Software QSG (D104558X012). It includes product specifications, reference materials, detailed setup and calibration information, maintenance procedures and troubleshooting and replacement part details.

This instruction manual describes using LoopConnect Software to setup and calibrate the instrument.

NOTE

This manual also includes details for using the Local User Interface (LUI) to perform various operational tasks.

NOTE

This instruction manual may not be the latest version of the document. Scan the QR code on the previous page, contact your Emerson sales office, or visit our website at Fisher.com to access the latest version of D104786X012.



WARNING



Do not install, operate or maintain a DPC2K digital process controller without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

1.3 Description

The Fisher FIELDVUE DPC2K digital process controller is an electro-pneumatic PID controller to meet your single continuous PID loop needs.

NOTE

Single feedback PID loop control is achieved using internal PID digital intelligence executing every 50 milliseconds.

The PID algorithm requires tuning parameters to ensure good dynamic response and minimize process error. The tuning parameters consist of:

- Proportional (P): The output of the controller is adjusted proportionate to the difference between the setpoint and the process variable value. This is also known as setpoint error. Increasing the proportional gain will result in an increase in the loop response, however, introducing too large of a gain can result in a loop that oscillates.
- Integral (I): Integral accounts for the setpoint error created over time. It adjusts the output of the controller until the error is zero. The integral action tries to eliminate setpoint error, but when there is too much integral action, it can increase too quickly in relation to the process variable (or windup); this can also cause an oscillatory loop response.
- Derivative (D): The controller output decreases when the rate of change in the process variable is too rapid (or vice versa). While derivative adds stability, it is easily affected by noise. A loop can become unstable if too much derivative action is used in certain situations (e.g., when there is a noisy process variable or during a slow controller execution rate, etc.).

An easy-to-read display, either at the instrument using the local user interface or with LoopConnect software, provides quick access to process pressure and setpoint information as well as setup, operations and maintenance support.

The process variable (PV) input uses the integral process pressure sensor and the output uses the integrated pneumatic output. An external transmitter may be used as the process variable to support other loop types.

The controller output can be an analog output or a pneumatic signal that operates a final control element. Pressure control is provided with the following:

- Two analog inputs (4 to 20 mA) for receiving remote set point or process value from an external transmitter. When using an external transmitter, the integral process pressure sensor may not be needed.
- One analog output for use with electric actuators or positioners. In this configuration, the electric output is sent to the electric actuator to operate the final control element.

Optionally, the pneumatic output, used with single-acting valve actuators, produces a pneumatic signal that operates a final control element.

- Five pressure ranges: 0 to 2.1 bar / 0 to 30 psi, 0 to 6.9 bar / 0 to 100 psi, 0 to 20.7 bar / 0 to 300 psi, 0 to 41.4 bar / 0 to 600 psi, 0 to 103 bar / 0 to 1500 psi, and 0 to 344.7 bar / 5000 psi sealed gauge.

For standalone operations, DC power is required.

For remote control, an optional 4 to 20 mA input from a control system can be used. The remote set point can also be from a two-wire serial MODBUS host or Ethernet host/ LoopConnect software. In this configuration, the remote host can access all operating information using the digital communications.

1.4 Specifications

Specifications for DPC2K are listed in Table 1.

Table 1. Specifications

Base Unit (Analog Output) These specifications also apply to the Pneumatic Output Option The Base Unit may also include the Process Pressure Sensor Option	
Available Mounting	I/O Scan and PID Update Rate
■ Integral mounting to Fisher 657/667 actuators ■ Integral mounting to Fisher rotary actuators ■ Sliding-stem linear applications ■ 2 in. Pipestand Remote Mount	50 msec (20x/sec)
Actuator Compatibility	Communication Protocol
Stem Travel (Sliding-Stem Linear): Linear actuators with rated travel between 6.35 mm / 0.25 in. and 606 mm / 23.375 in. Shaft Rotation (Quarter-Turn Rotary) ⁽¹⁾ : Rotary actuators with rated travel between 45° and 180°	■ Serial (RS-485): Modbus RTU, Supports function codes Baud: Configured 9600 to 256,000 baud Default 115,200 ■ Ethernet: Modbus TCP, HART-IP (Common commands and Universal commands)
Instrument Power	Electromagnetic Compatibility
9 to 28 V DC Input Power Draw Base Unit: 1 W nominal with all I/O ⁽²⁾ : 2 W, max	Meets EN 61326-1:2013 Immunity — Industrial locations per Table 2 of the EN 61326 1 standard. Emissions — Class A ISM equipment rating: Group 1, Class A
Maximum Voltage	Vibration Testing Method
28 V DC, Reverse Polarity protected	Tested per ANSI/ISA-S75.13.01 Section 5.3.5
Operating Ambient Temperature Limits ⁽³⁾⁽⁴⁾	Humidity Testing Method
-40 to 80 °C / -40 to 176 °F	Tested per IEC 61514-2
Inputs ⁽⁵⁾	Hazardous Area Approvals
Analog Input 1: 4 to 20 mA, 250 ohm internal resistance Accuracy: ±0.25% Protected to ±30 V DC Analog Input 2: 4 to 20 mA with internal 28 V DC Source, 250 ohm internal resistance Accuracy: ±0.25% Internal 28 V supply, overcurrent protection Protected to ±30 V DC Current: 200 mA	cCSAus (Canada and United States) Class I Div 1 CD - Explosion-proof Class I Div 2 A, B, C, D - Non-incendive Class I Zone 1 Ex db ia IIB T4 Gb Class I Zone 2 Ex ec ic IIB T4 Gc ATEX - Flameproof, Ex db ia IIB T4 Gb IECEx Flameproof - Ex db ia IIB T4 Gb Increased Safety - Ex ec ic IIB T4 Gc ECAS – Emirates Conformity Assessment Scheme (UAE)
Output ⁽⁵⁾	
Analog Output: 4 to 20 mA with internal 28 V DC Source, 1 K ohm maximum Accuracy: 0.35%	MOL - Ministry of Labor (Taiwan)

- continued -

Table 1. Specifications (continued)

Electrical Housing	Weight
cCSAus: Type 4X, IP66 ATEX and IECEx: IP66	Electric Only Without process pressure sensor: 3.3 kg / 7.4 lbs With process pressure sensor: 3.7 kg / 8.1 lbs
Electrical Connections	With Pneumatic Output Option
1/2 NPT internal, two conduit entries ⁽⁶⁾	Without process pressure sensor: 5.5 kg / 12.2 lbs With process pressure sensor: 5.9 kg / 12.9 lbs
General Electrical Safety - Environmental Conditions	Construction Materials
Use: Indoor and Outdoor Altitude: up to 2000m Temperature: see operating ambient temperature limits Relative Humidity: 5 - 95% Supply Voltage Fluctuations: N/A, not connected to Mains Wet Locations: Yes	Housing, module base and terminal box: A03600 low copper aluminum alloy

Pneumatic Output Option

The Base Unit specifications also apply to the Pneumatic Output Option

The Pneumatic Output Option may also include the Process Pressure Sensor Option

Supply Pressure	Connections
Minimum Recommended: 0.3 bar / 5 psig higher than maximum actuator requirements Maximum: 10.0 bar / 145 psig or maximum pressure rating of the actuator, whichever is lower Medium: Air or Natural Gas Supply medium must be clean, dry and noncorrosive	Supply Pressure: 1/4 NPT internal Output Pressure: 1/4 NPT internal Tubing: 3/8 in. recommended Vent: 3/8 NPT internal
Per ISA Standard 7.0.01 A maximum 40 micrometer particle size in the air system is acceptable. Further filtration down to 5 micrometer particle size is recommended. Lubricant content is not to exceed 1 ppm weight (w/w) or volume (v/v) basis. Condensation in the air supply should be minimized Pressure dew point: At least 10 °C less than the lowest ambient temperature expected	Output Signal Pneumatic signal, up to full supply pressure Minimum Span: 0.4 bar / 6 psig Maximum Span: 9.5 bar / 140 psig Action: Single
Per ISO 8573-1 Maximum particle density size: Class 7 Oil content: Class 3 Pressure dew point: Class 3	Low Bleed Steady-State Air Consumption⁽⁷⁾⁽⁸⁾⁽⁹⁾ At 1.4 bar / 20 psig supply pressure: 0.056 normal m ³ /hr / 2.1 scfh, average At 5.5 bar / 80 psig supply pressure: 0.184 normal m ³ /hr / 6.9 scfh, average
	Maximum Output Capacity⁽⁷⁾⁽⁸⁾ At 1.4 bar / 20 psig supply pressure: 10.0 normal m ³ /hr / 375 scfh At 5.5 bar / 80 psig supply pressure: 29.5 normal m ³ /hr / 1100 scfh

- continued -

Table 1. Specifications (continued)

Process Pressure Sensor Option	
The Process Pressure Sensor option can be used with either the Base Unit (Analog Output) or the Pneumatic Output Option	
Pressure Ranges	Construction
Sealed Gauge: 2.1, 6.9, 20.7, 41.4, 103, 344.7 bar / 30, 100, 300, 600, 1500, 5000 psi ranges available	316 stainless steel wetted parts
Compensated Temperature range⁽³⁾	Pressure Port
-20 to 80 °C / -4 to 176 °F	1/4 NPT
Total Accuracy	Canadian Registration (CRN)
Reference accuracy: $\pm 0.35\%$ Temperature Sensitivity: $< 0.3\%$ per 28 °C ⁽¹⁰⁾	Approved under CRN 0F24844.5
NOTE: Specialized instrument terms are defined in ANSI/ISA Standard 51.1 - Process Instrument Terminology. 1. NAMUR mounting is not supported on quarter-turn rotary actuators. 2. A fully loaded and communicating DPC2K adds 2 Watts plus safety factor for solar applications. 3. The pressure/temperature limits in this document and any other applicable code or standard should not be exceeded. 4. Temperature limits vary based on hazardous area approval. 5. Shielded cable is recommended in applications where high electromagnetic interference may be present. 6. 14 to 22 AWG recommended wire size. 7. Normal m³/hour - Normal cubic meters per hour at 0 °C and 1.01325 bar, absolute. Scfh - Standard cubic feet per hour at 60 °F and 14.7 psia. 8. Values at 1.4 bar / 20 psig based on a single-acting direct relay. 9. The Quad O steady-state consumption requirement of 6 scfh can be met by a DPC2K. The 6 scfh requirement can be met by low bleed relay C when used with up to 5.2 bar / 75 psi supply of Natural Gas at 16 °C / 60 °F. 10. Applicable from -20 °C to 85 °C. From -20 °C to -40 °C, allowed temperature drift is 1.5% per 20 °C. 11. Terminals should be torqued to 0.5 N•m / 4.4 lbf•in. 12. Solar power supply must be SELV Class 2 type.	

1.5 Related Documents

This section lists other documents containing information related to the DPC2K digital process controller. These documents include:

- Fisher FIELDVUE DPC2K Digital Process Controller Product Bulletin ([D104561X012](#))
- Fisher FIELDVUE DPC2K Digital Process Controller Quick Start Guide ([D104559X012](#))
- Fisher LoopConnect Software Quick Start Guide ([D104558X012](#))
- Fisher FIELDVUE DPC2K Instruction Manual — latest version ([D104786X012](#))

1.6 Education Services

Emerson Education Services
Phone: +1-800-338-8158
E-mail: education@emerson.com
emerson.com/my training

Section 2: Security

NOTICE

Physical security is an important part of any security program and is fundamental to protecting your system.

Unauthorized personnel may potentially cause significant damage to and/or misconfiguration of end users' equipment. This could be intentional or unintentional and must be protected against by restricting access of unauthorized personnel in your facility.

- The DPC2K Single Loop Controller has several security capabilities:
 - System stores configuration and log data.
 - DPC2K Signed Firmware prevents the downloading of corrupted or unauthorized firmware.
 - The DPC2K has the capability to enable or disable the provided communication channels as well as enabling or disabling various types of communication on those channels.
 - The Write Protect switch, located under the terminal cover, when enabled, helps prohibit unintentional configuration and calibration changes over all interfaces.
- If unsecured, any device in the field is vulnerable to a physical attack; safety and security procedures must include mitigation by physical security controls.
- By default, the instrument is shipped from the factory with all the communication channels disabled. The following are unsecured, unencrypted inputs and outputs used by the DPC2K single loop controller:
 - AI1: Analog input capable of reading a 4 to 20 mA signal and communicating HART FSK as a secondary device.
 - AI2: Analog input capable of reading a 4 to 20 mA signal.
 - AO: Analog output capable of driving a 4 to 20 mA signal.
 - Communication Channels:
 - RS-485 — In normal operation, this channel is used to communicate Modbus.
 - HART-FSK — The DPC2K will be a secondary HART communicating device on AI1.
 - LUI — Local user interface provides ethernet configuration options and monitoring.
 - LAN/TCP — Supports user defined HART-IP port and a Modbus defined TCP port.
 - LAN/UDP — Supports up to four UDP sessions over HART-IP.

- The DPC2K uses LoopConnect software for device configuration, including enabling communication protocols used and data monitoring. It is expected that LoopConnect software is installed and run on a computer that is configured and operated according to local security policies.
- Product Operation Best Practices:
 - Ensure that operation personnel are trained both on local security policies and the secure operation of the DPC2K and LoopConnect software.
 - It is recommended that you set the Write Lock switch in the enabled position after configuration is complete.
 - Operate the device within a controlled and secured physical environment.
 - When connected to a network, operate the DPC2K and LoopConnect software within a controlled and secured network environment.
 - Configure security settings of the DPC2K, providing access to only what is absolutely required to perform configuration and operational functions.
 - Apply security patches and updates as they are released.

NOTE

Work with your [Emerson sales office](#) to stay informed and obtain access to security patches and updates.

- Report security incidents and potential product vulnerabilities at:
https://go.emersonautomation.com/reportvulnerability_en
- Product Disposal Guidelines

When the device needs to be disposed of consider the following aspects of device removal:

- Identify whether the device can be reused in another part of the process or for testing or training purposes.
- Identify what data is stored on the device and sanitize this data with the latest industry recommended methods.

To restore the device back to factory defaults:

1. Using LoopConnect navigate to the Device Data Tab.
2. Select "Restore Factory Defaults" and follow on screen instructions.

If the device will not be reused, follow local disposal policy.

To uninstall LoopConnect software from your computer go to Start > Settings > Apps > Apps & features and select LoopConnect.

Section 3: Prestartup Checks

When performing the checks, open loop conditions must exist. An open loop exists when the controller output does not affect the input pressure or other control signal to another controller.

1. Provide a means of measuring the pneumatic supply pressure to the controller with a pressure gauge and be sure it is delivering the proper supply pressure.

NOTE

Supply pressure is recommended to be at least 0.3 bar / 5 psi higher than the highest pressure rating of actuator bench set (operating range).

2. Provide a means of measuring the controller output pressure by connecting the controller output to a pressure gauge.
3. While in MANUAL mode - change output to 100% and 0%.

NOTE

Output pressure should match the bench set values of the actuator's (operating range) and not exceed the operating range of the actuator.

4. Ensure the voltage and current rating of power supply is adequate.

NOTE

Voltage can be read from either LoopConnect software or the LUI. Voltage should be at least 9 V and able to provide a minimum of 120 mA.

5. If integral process pressure sensor is used, provide a means of measuring/verifying calibration (zero and span) using values from LoopConnect software or the LUI.
6. If remote setpoint is used (Analog Input #1) and while in LOCAL mode, verify zero and span (4 to 20 mA) values are correct.

7. If an external transmitter is used (Analog Input #2) and while the output is in MANUAL mode, verify the zero and span values are correct.
8. If optional output (Analog Output) is used and before the receiving device/instrument is put into operation; verify the zero and span values are correct.
9. Verify the PID control action is correct:
 - a. DIRECT acting, an increase in PV will result in increase in output.
 - b. REVERSE acting, an increase in PV will result in decrease in output.
10. Verify an INCREASING output value results in the valve opening or closing.

NOTE

The DPC2K default tuning parameters are: Proportional Gain = 1, Integral (seconds/repeat) = 0 and Derivative (seconds) = 0. Verification of tuning parameters is required before placing control loop into production.

Section 4: Tuning Tips

NOTE

When performing tuning procedures, keep in mind that the initial settings are guidelines. They will vary depending on the actual process being controlled.

Output Response

The response of the controlled parameter to a set point or load disturbance change may be classified in the following manner:

- Over-damped response: Controlled parameter is gradually restored without overshooting the set point value. In most cases, an over-damped response provides best response for varying operating conditions that impact process gain and response time.
- Critically damped response: Controlled parameter is restored in minimum time without overshooting the set point value. While minimizing response time, unstable control may be observed with changing operating conditions that impact process gain or response time.
- Under damped response: Controlled parameter overshoots the set point but eventually settles at the set point value. May minimize time to get back to set point but at the expense of stability and overshoot to set point and load disturbances.

Derivative

NOTE

The Derivative should be tuned only when necessary.

Most industrial control loops can be handled with P-I control alone. Derivative action should only be applied to loops when all of these conditions are true:

- There is little or no noise
- Fast-responding control is critical
- P-I alone is not good enough
- There is some (small) filtering of the PV (process value or process parameter)

Section 5: Setup and Configuration

Fisher LoopConnect software is used to configure and monitor the DPC2K. The software communicates with the DPC2K, allowing you to perform setup, commissioning, operating and troubleshooting tasks.

Figure 2. Local User Interface



from X2008

Additionally, you can use the Local User Interface (LUI) (Figure 2) to access operational information and view loop information.

See Appendix A for the Local User Interface flow chart.

Operational tasks available via the LUI include:

- Modifying the setpoint source (local or remote)
- Lockout remote setpoint operations
- Changing the setpoint value (local value)
- Modifying the Output variable (Auto or Manual)
- Lockout remote output changes
- Changing the Output value (Manual value)
- Tuning the PID algorithm

- Reading other Input and Output values
- Modifying Communication Settings
- Temporarily release write protect
- Calibrating the sensors
- Restart controller

5.1 Configuration Guidance

LoopConnect software is required to configure the DPC2K digital process controller.

The software features five dashboards: Control (main dashboard), Events, Loop, I/O and Instrument. The Control and Event dashboards are used for operation. The Loop, I/O and Instrument dashboards are used for configuration. The software provides visual assists used to update status, provide configuration guidance and highlight alert messages. The Now Viewing and Device Status panels (shown in Figure 3) are available on all five dashboards.

Cards located on the dashboards allow you to configure and monitor the system.

Click the pop up icon () to open any given card. The move icon () indicates a card can be moved via drag and drop for configuration. The icon shown on the Device Status panel () indicates communications activity.

The LUI can perform some of the same functions as LoopConnect.

Navigation, Now Viewing and Device Status

Color Key

Goldenrod indicates a change is pending.

Red indicates an error or important message. Red in configuration can be used to troubleshoot the cause of a configuration error.

Now Viewing

The Now Viewing panel, available on the left side of LoopConnect, provides information regarding configuring the DPC2K digital process controller.

CURRENT STATE — when highlighted, shows how the instrument is currently setup.

PENDING CHANGES — when highlighted, indicates that changes have been made but not yet APPLIED. Pending changes are detailed by dashboard.

The changes are indexed for quick navigation by the dashboard they appear on.

UNDO/REDO — click prior to applying the configuration changes to revert back.

APPLY the changes as you make them or queue them up and make them all at once.

NOTE

If bandwidth is limited, you may want to apply each change individually.

IMPORT allows you to import a saved configuration.

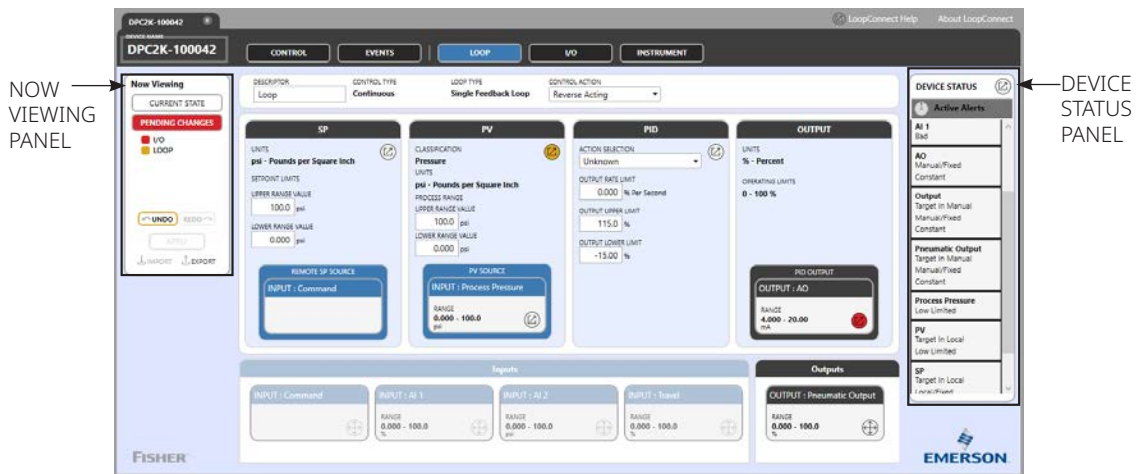
NOTICE

The configuration being imported must match the hardware configuration exactly for the import to be successful. If the configurations do not match, numerous checks may be required for your application to function as expected.

EXPORT allows you to save a configuration file as a text file.

Configuration Notices are visible on the Now Viewing panel when there are possible configuration errors or potential conflicts while configuring. They provide details about conditions required to complete configuration changes.

Figure 3. Example of How Colors and Notices Provide Configuration Guidance



Device Status

The Device Status panel available on the right side of LoopConnect provides the configuration of the DPC2K alerts. When open, alerts are configured according to the dashboard where the associated parameter is located.

Device Alerts

An alert is a notification that the instrument has detected a condition that has exceeded the alert conditions. Device Alerts show the specific reason for the alert condition; when multiple alerts are active, they are displayed in priority order. Active alerts will be displayed with their NE107 status and recommended action.

NOTE

In the event of multiple NE107 Alerts being active, the highest priority will be indicated as Device Status. Refer to Table 2 for NE107 priority.

Active alerts are cleared when the instrument is rebooted; however, alerts will be re-triggered if the condition that activated the alert is not cleared.

Setting Alerts

See Table 2 for DPC2K alerts and recommended actions.

Expand DEVICE STATUS (example screen shown in Figure 4) by clicking on the icon to the right of the wording to show the card for setting these alerts. The conditions are listed for each of the dashboards the variables appear on.

NOTE

Process Alarms, Device Alerts and Device Variable under Device Status may be collapsed if the device is operating properly and there are no active alerts or alarms. When using LoopConnect software, Device Status is best utilized as a troubleshooting tool.

Table 2. Available Alerts

Instrument Alert Name	Description	Recommended Action
RTC Time Lost	Real time clock may not be accurate	Check time and adjust as necessary.
Device Variable Limit Alarm	Value is outside alarm setting	Check value and make appropriate changes.
PID Fault State	PID is not executing	Determine source of fault-state and take appropriate actions.
Pneumatic Output Fault State	Pneumatic Output is not executing	Determine source of fault-state and take appropriate actions.
Analog Output Fault State	Analog Output is not executing	Determine source of fault-state and take appropriate actions.
Active Application Verification Error	Device is not operating	Check power and/or replace device.
Device Variable Alert	Value is outside alert setting	Check value and make appropriate changes.
Critical Power Failure	Incoming power is outside the normal operating range	Change incoming power to appropriate levels (9 to 28 V).
NVM Defect	Error with NVM memory	Replace device.
Watchdog Reset	Error with product operation	Check power levels and take appropriate actions (engineering to fill in).
Environmental Conditions Out of Range	Device temperature output range	Adjust temperature to operating range.
Electronic Defect	Product defect	Replace product.
PV Out of Limits	Process variable out of operating range	Verify process and potentially change sensor or transmitter (if used).
Non-PV Out of Limits	Input or output is out of range	Check input or output with issue, take appropriate actions.
Analog Input Saturated	Analog input is out of operating range	Change input to correct range.

Alert Priority and Color Key

The DPC2K allows these defaults to be modified in order to provide greater compatibility with existing systems, in accordance with NAMUR NE107.

NOTE

The NAMUR NE107 recommendation harmonizes the display of status for devices, and defines that detailed device-specific diagnostics are summarized as four simple status signals. This ensures that the plant operator is not inundated with device troubleshooting details and cryptic error codes.

See Table 3 for NE107 priority.

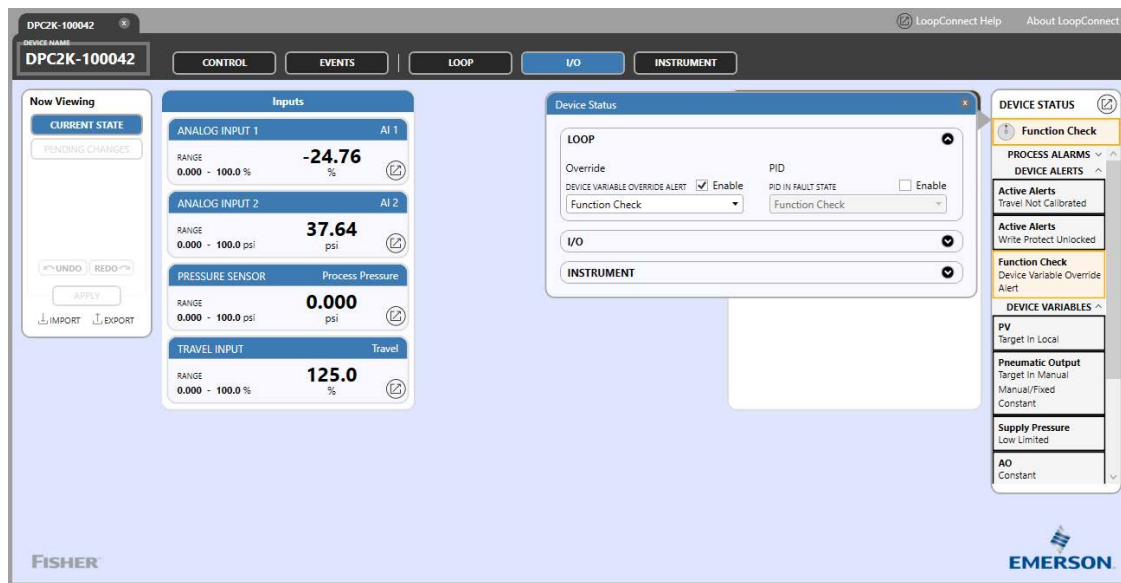
Table 3. NE107 Priority

NE107 Status	Priority
Failure	1
Function Check	2
Out of Specification	3
Maintenance Required	4
No NE107 Mapping	N/A

NE107 Status Messages

- Failure (Red): Output signal invalid due to malfunction in the field device or its sensors.
- Function Check (Orange): Output signal temporarily invalid (e.g., frozen) due to ongoing work on the device.
- Out of Specification (Yellow): Out of specification means that the device is operating outside its specified range or an internal diagnostic indicates deviations from measured or set values due to internal problems in the device or process characteristics.
- Maintenance Required (Blue): Although the output signal is valid, a function will soon be restricted due to operational conditions.
- Normal Operating (Green)

Figure 4. Device Status, Example



Process Alarms

Process Alarms are configured on the LOOP and I/O dashboards for the associated measurement or control point. While alerts are associated with the instrument, alarms are defined based upon operating parameters.

When an alarm is active, the Point Name and alarm type are displayed.

Expand the display to show the data value and status, and to access the alarm configuration for the I/O point.

Device Variables

Device Variables are internal parameters that can be configured to provide alerts for status monitoring and troubleshooting. They provide operating information about each variable displayed, including the Point Name and information regarding the status for troubleshooting assistance.

Each variable may be expanded to provide additional information; click on the variable to expand the card to view alarms and fault states.

Device Variable Terminology

Process Data Status indicates the overall status of the process variable. Possible values are Good: Operating normally; Poor: Data integrity may be suspect; or Bad: Data is not being read properly.

Limit Status indicates if the process variable is responding to changes. Possible values are Not Limited: Data is within range; Limited: May be High or Low Limited by design boundaries; or Constant: The Variable may be in Manual or within the configured deadband limits and not changing.

Process Alarm: There are four alarms which may be triggered based upon operating parameters for a given input; High, High-High, Low and Low-Low values.

Fault State: In order to provide an appropriate output action upon a loop fault or failure, the output may be configured to take a certain action.

Status States Terminology

Target provides information regarding internal software connections.

Local/Fixed indicates a target with a non-changing value has been entered either at the local user interface, the configuration software or by command protocol.

Manual/Fixed indicates the output from the loop is an entered value, not calculated.

5.2 Instrument Dashboard

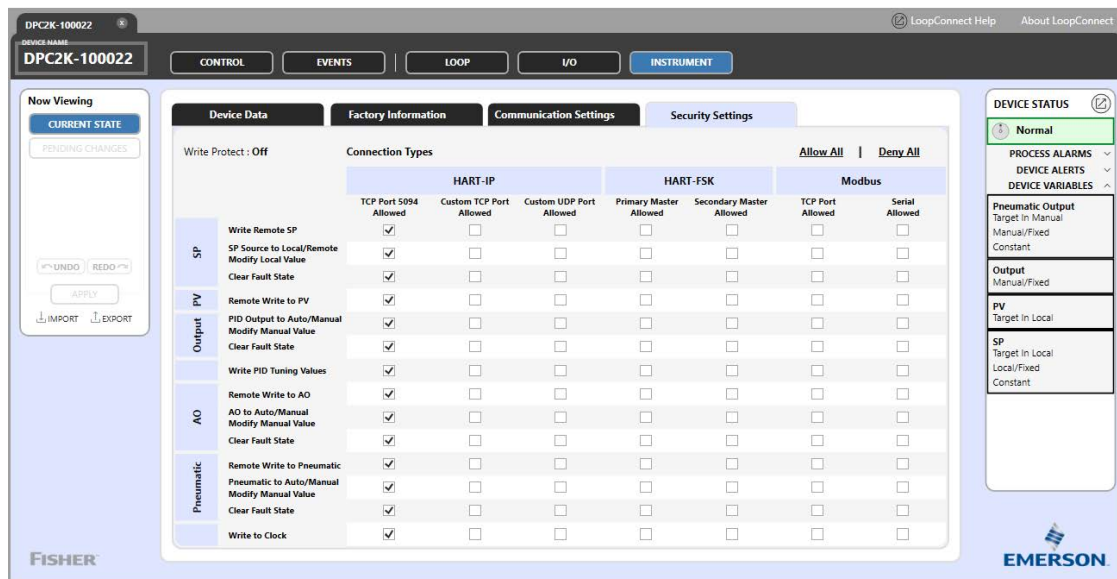
NOTE

Configuration tasks generally start with the Instrument dashboard on the right and move left to the Loop dashboard.

Security Settings

DPC2K security methods consist of hardware and firmware configuration limitations. The Security Settings tab allows you to set software configuration limits.

Figure 5. Security Settings



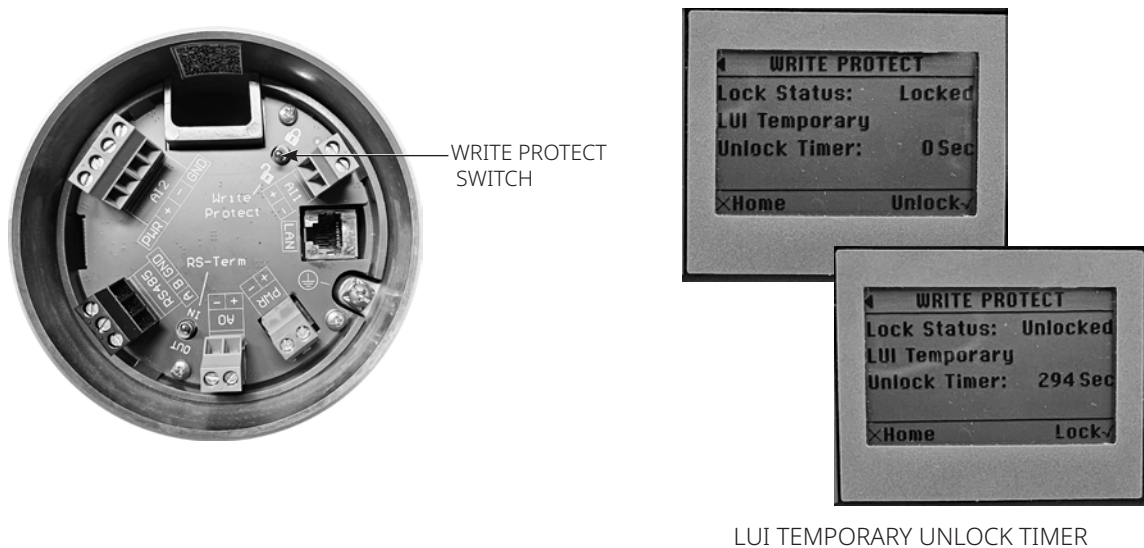
A Write Protect switch in the termination housing (Figure 6) is used to set the status.

When Write Protect is Off, the configuration may be modified via the software or local user interface.

NOTE

Unlock Timer, which is accessible through the LUI, allows you to initiate a 5-minute temporary bypass (see Figure 6). This allows quick changes to be made, such as closing a valve, without removing the termination cover.

Figure 6. Write Protection



Firmware can allow or deny many of the writable parameters used for control to be read/write or just read only. The deny state is to not allow the writing of the list of operational parameters. When a check mark is present, that parameter is read/write.

Connection Types refer to the supported protocols by the DPC2K security by protocol and by connection type. Each of the headers is a selectable button which can deny the columns below with a single click.

NOTE

It is recommended that if the port or protocol is not being used, the columns should be read only as a security measure; i.e., none of the items checked.

In addition, each heading under a protocol may be configured as read only by a single click on the column heading to further secure unused network ports or communication methods. When LoopConnect is the only tool being used for configuration, monitoring and troubleshooting, the HART-IP/TCP Port 5094 or a Custom Port are the only required protocol and port.

Each checkbox may be individually checked/unchecked to allow or deny specific items.

Communication Settings

The Communication Settings tab includes configuration information and allows for connecting to the instrument.

Figure 7. Communication Settings

The screenshot displays the 'Communication Settings' tab for a DPC2K-100042 instrument. The interface is divided into several sections:

- LAN Settings:** Includes a DHCP toggle (On), Hostname (DPC2K-100042), IP Address (10.208.35.193), Netmask (255.255.255.128), Default Gateway (10.208.35.129), and NTP Refresh Rate (15 Minutes). There are also options for NTP from DHCP and Static NTP.
- HART:** Includes Polling Address (0), HART-IP (5094), TCP Port (5094), and UDP Starting Port (5095).
- Modbus:** Includes Modbus TCP (502) and Modbus Serial (RS485) settings, along with Address, Baud Rate, Parity, Stop Bits, Byte Order, and Float Byte Order.
- Protocol Statistics:** A table showing connection counts for HART-IP, Modbus TCP, and Modbus RS-485.
- Device Status:** A sidebar on the right showing Active Alerts and Process Alarms.

LAN Settings

The LAN Settings card allows you to configure the Ethernet port for compatibility of access with your own network or peer to peer connection.

DHCP (Dynamic Host Configuration Protocol) — The DPC2K will obtain IP Address dynamically from a DHCP server instead of a static IP Address.

HOSTNAME is used to identify the DPC2K when DHCP is turned on and the DPC2K has received a dynamically assigned IP Address.

The factory default IP ADDRESS is 192.168.1.9 with a NETMASK of 255.255.255.0 and a DEFAULT GATEWAY of 192.168.1.1.

NTP from DHCP: Option (if given) to use the IP Address for NTP server given by the DHCP Server when DHCP is used. If not provided, NTP defaults to Static NTP is enabled.

Static NTP is the Static NTP address to use or fall back to if not provided from DHCP.

NTP REFRESH RATE is the rate in minutes at which the DPC2K will request time from NTP Server.

Each of these settings is configurable and will be retained over power cycles or a user-initiated Restart.

Although not used for configuration, this card also contains the device's MAC ADDRESS which is unique to each instrument.

HART

The HART card allows you to configure the POLLING ADDRESS for FSK and the ports for TCP and UDP connections.

The valid range of the polling address is 0 to 255, with 0 normally reserved for adding a new device on an FSK multidrop system.

NOTE

The ports must be compatible with your security policy and network settings.

DESCRIPTOR, SHORT TAG and MESSAGE allow you to enter information about the device or application. The DATE CODE field may be used for information or as a user entered date for notations.

The HART implementation supports Common and Universal Commands.

Modbus

The Modbus card allows you to configure the MODBUS TCP and the MODBUS SERIAL settings.

The MODBUS TCP default port is 502 and the TIMEOUT set to 60 seconds.

NOTE

Both the port and timeout settings may be edited for network compatibility.

MODBUS SERIAL supports Modbus RTU protocol and is accessible at the RS-485 serial port located in the termination area of the DPC2K. This port may be given a new name in the DESCRIPTOR field.

The ADDRESS, BAUD RATE, PARITY and STOP BITS are settings for Modbus RTU and must match the host settings in order to establish a proper connection.

In addition to the serial settings, the data order between the Modbus Host and the target (DPC2K) must be correct. The BYTE ORDER (16 bit) can be set to MSB (Most Significant Bit) as the leading bit in a response, or LSB (Least Significant Bit). A Modbus float is a 32-bit word and the Byte order is important for the Host to correctly interpret the floating-point value in the response from the target (DPC2K). Since the bit and byte orders must be used correctly, FLOAT BYTE ORDER allows you to select the correct method of forming the Modbus register based upon which bit order and which byte order the Host requires.

See Appendix B for DPC2K Modbus register information.

Protocol Statistics

The Protocol Statistics card provides statistics for messages and connection information.

The DPC2K supports up to four connection for each protocol on the LAN port simultaneously. There may also be up to five TCP connections (depending on configuration) and up to four UDP HART IP connections. At least one TCP connection is guaranteed for each protocol port.

The VALID COMMANDS value is an assist for troubleshooting the connections when the INVALID COMMAND counter has been incrementing.

NOTE

INVALID COMMANDS and messages from the Host could indicate an out of date revision, firmware incompatibility or some manner of software mismatch.

For Modbus protocol, there are packet counters to provide status updates on the message traffic to and from the DPC2K. The DPC2K is a Modbus server and each valid packet should have a valid response packet. When these values do not match, there may be interruptions in the communications. The cause could be messages cut off or dropped in transmission, messages being retried or delayed.

If the Host is sending unrecognized functions or bad data is being transmitted, the lower set of counters will help diagnose the cause of those counters incrementing.

Factory Information

The Factory Information tab, shown in Figure 8 and 9, contains information regarding the construction of the instrument. It includes the serial number, revision information, build date and other technical information needed for factory troubleshooting.

Figure 8. Instrument Dashboard, Factory Information

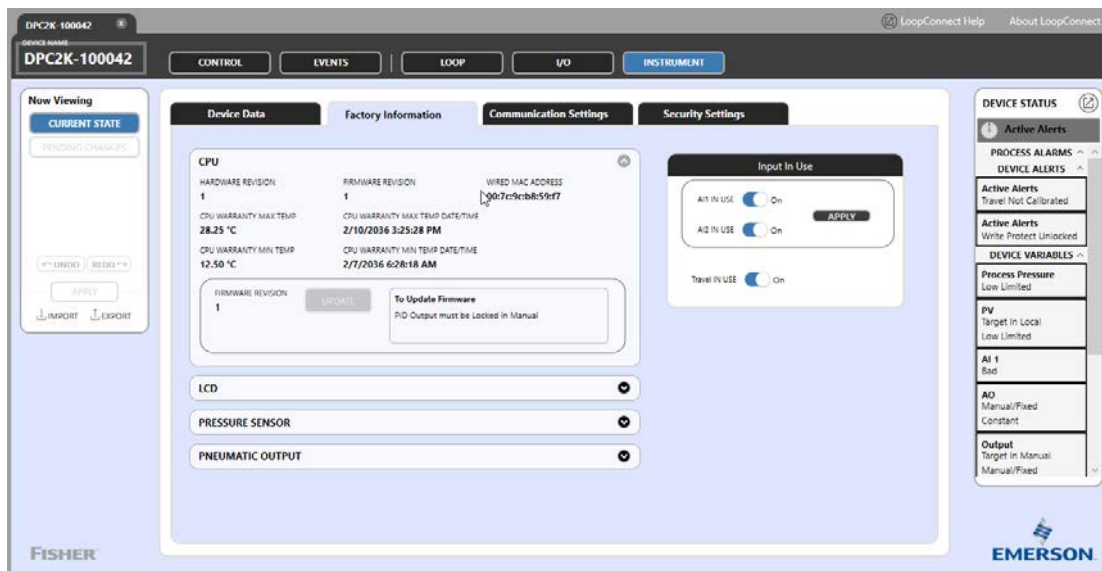
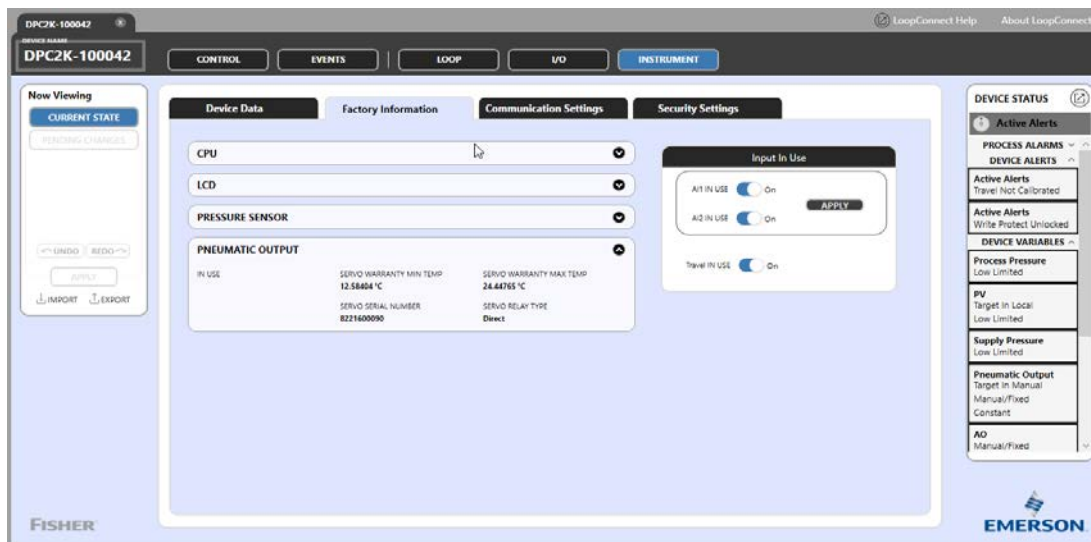


Figure 9. Instrument Dashboard, Factory Information, Pneumatic Module Installed

CPU includes firmware and hardware information and allows you to update the firmware.

LCD lets you configure the number of decimal places for the Local User Interface.

PRESSURE SENSOR is visible when an integral Process Pressure Sensor (PPS) is installed.

Expand this selection, shown in Figure 9, to view the serial number of the pressure sensor and an in use indication.

PNEUMATIC OUTPUT is visible when the Pneumatic Module is installed. Expand to view the build information.

NOTE

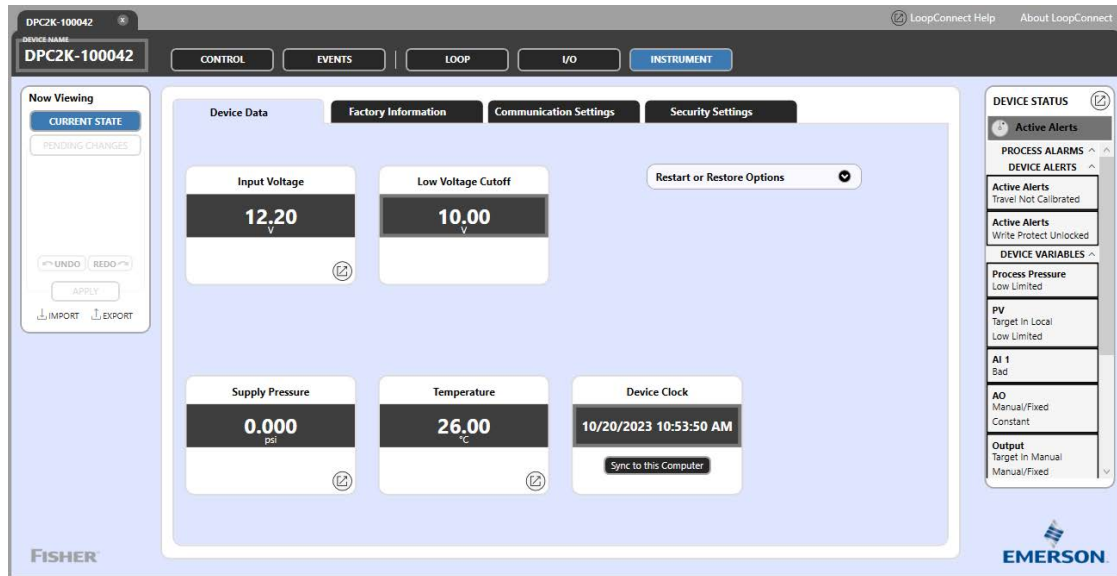
When a pressure sensor is installed, but is not being used for measurement, the toggle may be set to NOT IN USE. The not in use setting will suppress information on the main Control dashboard.

If the In Use/Not in Use toggle is set to Not in Use, the next time a connection is made, the Pneumatic Module will NOT show up in factory information. If there is a Pneumatic Module installed, a Device Restart will be required to make the card visible again.

Device Data

The Device Data tab, shown in Figure 10, includes internal measurements and time.

Figure 10. Instrument Dashboard, Device Data



Low Voltage Cutoff shows the value that sets the Low Voltage Cutoff Alert. The Low Voltage Cutoff Alert (when enabled) is active when the voltage is below the set value; an event will be written to the event log. This alert is especially useful with solar systems to indicate potential brown-out or solar system issues.

Input Voltage displays the current input voltage and allows you to configure input voltage alarms.

Supply Pressure provides the measurement of the pressure that is used to move a pneumatic actuator and allows you to configure Threshold Alerts and Alarms or run a Calibration.

NOTE

Supply Pressure is only visible when a pneumatic module is installed.

Units are set to the same engineering units as the Pneumatic Output (I/O > Outputs).

To calibrate the supply:



WARNING

During calibration the valve will move full stroke. To avoid personal injury and property damage caused by the release of pressure or process fluid, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

NOTE

Before starting this procedure, determine the actuator operating range (bench set).

1. Follow all safety cautions and warnings. Verify the output will not negatively affect the valve assembly or process.
2. Provide a means of measuring the controller output pressure by connecting the controller output to a pressure gauge.
3. Connect supply pressure to the supply pressure regulator and ensure it is delivering the proper supply pressure to the controller.
4. Do not exceed the normal operating pressure range of actuator.

LoopConnect Software

Expand the Supply Pressure card to access the calibration procedure.

Local User Interface (LUI)

Use the navigation buttons to access Input/Output > Calibrate > Supply Pressure.

NOTE

The Supply Pressure can also be calibrated during Auto Cal.

Temperature displays the instrument internal temperature and allows you to configure Temperature alarms.

Device Clock displays the current time. Write To Clock must be set to Allow in order to Sync to this Computer (see Security Settings).

Restart or Restore Options

RESTART DEVICE halts processing and comes back in the last known good state. Use this restart in the event of a modification, change or communication failure.

Local User Interface (LUI): Use the navigation buttons to access Setup > Reset - Reboot.

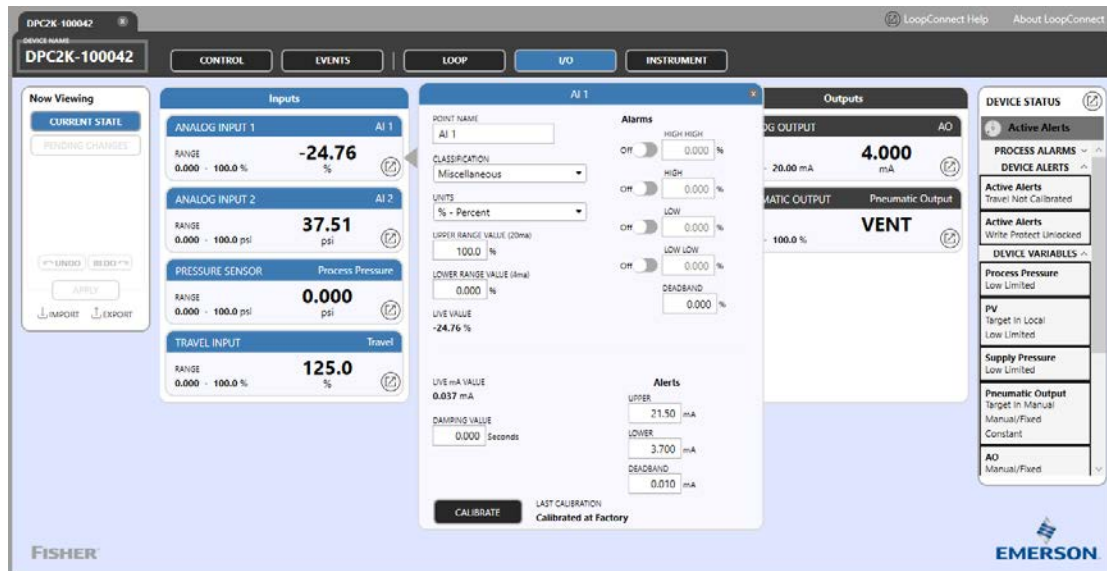
RESTORE FACTORY DEFAULTS erases all current configuration information and restores the instrument to the condition it was when it left the factory.

Local User Interface (LUI): Use the navigation buttons to access Setup > Reset - Factory Defaults.

5.3 I/O Dashboard

The I/O dashboard is used to configure the Inputs and Outputs that are used in the PID control loop, including a remote setpoint, additional measurement or a possible manual control output.

Figure 11. I/O Dashboard



The dashboard features the available installed I/O. Internally to the DPC2K are two analog 4 to 20 mA inputs and an analog 4 to 20 mA output. In addition, there can be an optional pressure sensor input and an optional pneumatic output module.

Inputs

Analog Inputs

Each I/O point is shown as a card that includes the POINT NAME, RANGE VALUE(S) and LIVE VALUE. Expand the cards to show the configuration settings and an entry into the calibration routine.

On the expanded card, the upper left portion allows you to provide a descriptive name to the I/O. In addition, the engineering UNITS for the types of supported measurement are defined by the classification or group type; the measurement units may also be selected from the drop-down lists.

NOTE

If your specific measurement type is not on this list, select Other, None or Blank.

Once the LOWER and UPPER RANGE values are entered, the LIVE VALUE will display the engineering units value of the measurement point.

Below the engineering units value, the raw units are provided in mA for the 4 to 20 mA analog input.

NOTE

This value can be measured at the terminals by inserting a current meter.

The DAMPING VALUE can be used as a filter for a noisy input signal and may be entered in decimal values. Damping provides an average of the samples within the time indicated.

Input Calibrations

Analog Inputs #1 and #2 are calibrated at the factory and should not need to be recalibrated; however, if adjustments are required, perform the calibration procedure.



WARNING

During calibration, the valve will move full stroke. To avoid personal injury and property damage caused by the release of pressure or process fluid, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

1. Follow all safety cautions and warnings.
2. Provide a means of measuring the current input by connecting a calibrated source in series for current readings.
3. Connect a current source and ensure it is delivering the proper current to the controller. Verify minimum and maximum readings.
4. Do not exceed the normal operating pressure range of the process pressure sensor.

LoopConnect Software

Select CALIBRATE and follow the steps to calibrate the selected input.

Local User Interface (LUI)

Use the navigation buttons to access Input/Output > Calibrate > AI-1 or AI-2.

Process Alarms

When alarms are enabled, the active alarms will be visible on both the Local User Interface and in the right-hand navigation column of the software. To enable any of the four alarm conditions, move the slider to the On position and entering a value in the corresponding data field. Allowable alarm values must be within the measurement range of the input. Once triggered, an alarm will remain active until the measurement is within the boundary of the deadband.

NOTE

When engineering units are modified, all alarm setups are disabled and values reset to 0.0.

The exceptions are pressure and temperature units because the DPC2K firmware makes those conversions internally.

Devices

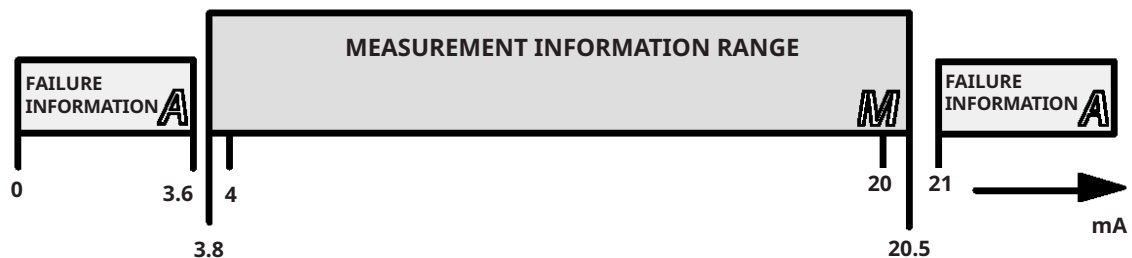
Expand DEVICE STATUS, located at the top of the right-hand navigation column, to enable and categorize alerts. The alert triggers for analog inputs are based upon the NE43 alert and default to common values used for 4 and 20 mA devices.

Alerts

The DPC2K allows these defaults to be modified in order to provide greater compatibility with existing systems.

Once triggered, an Alert will remain active until the measurement is outside the boundary of the deadband (see Figure 12).

Figure 12. NAMUR NE43 Alerts



NAMUR NE43 uses the 3.8 to 20.5 mA signal range for measure in information, with ≥ 21 mA or ≤ 3.6 mA to indicate diagnostic failures.

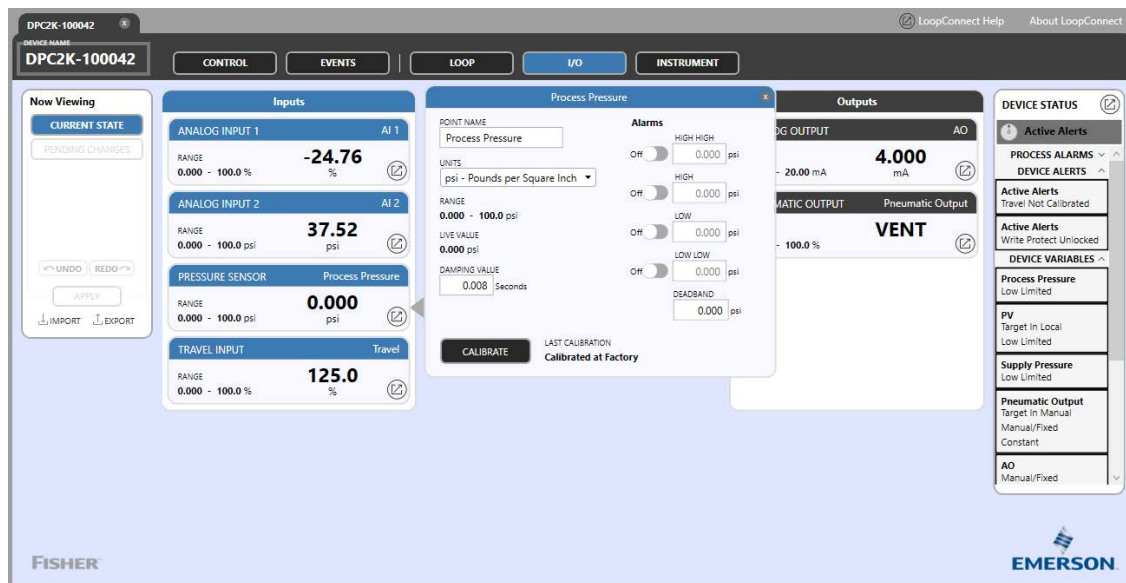
Pressure Sensor

PRESSURE SENSOR is shown as a card that includes the POINT NAME, RANGE VALUE and LIVE VALUE. Expand the card to show the configuration settings and an entry into the calibration routine.

The controller displays the integrated Pressure Sensor as an Input when one is installed. Expand PRESSURE SENSOR to give this input a descriptive name and select the Measurement Units. The Range is automatically read during power up or a reset. For noisy signals a damping value can be set to average the reading over a period of time to smooth spikes or dips in the readings.

Input Alarms can be enabled and configured from this card. The Alarm Deadband may be configured to ensure clean operation if working close to limits.

Figure 13. Process Pressure



Process Pressure Calibration

The process pressure sensor is a sealed gauge sensor; it is factory calibrated to have a base reference of 1 Atmosphere / 14.73 psi. Calibration may be required depending upon your process requirements/specifications, variations in altitude, measurement range or weather conditions.

The optional Process Pressure Sensor is calibrated at the factory and should not need to be recalibrated; however, if adjustment is required, perform the calibration procedure.

WARNING

During calibration, the valve will move full stroke. To avoid personal injury and property damage caused by the release of pressure or process fluid, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

NOTE

Before starting this procedure, provide a regulated process pressure to the controller and a means of measurement external to the controller. Ensure proper fittings are available. The calibration range should be the full range of the pressure sensor, but a subset span is allowed to allow a linear interpretation at the working range of the process.

Adjust calibrated pressure to the controller and set zero and span.

1. Follow all safety cautions and warnings.
2. Provide a means of measuring the current input pressure by connecting the controller input to a pressure gauge.
3. Connect a pressure source and ensure it is delivering the proper pressure to the controller. Verify minimum and maximum readings.
4. Do not exceed the normal operating pressure range of the process pressure sensor.

LoopConnect Software

The calibration information shown is the date of the last calibration. Click the Calibrate button to follow the steps of the Calibration procedure.

Local User Interface (LUI)

Use the navigation buttons to access Input/Output > Calibrate > Process Pressure.

NOTE

After multiple calibration cycles, you should return to the factory calibration as a known base line.

Travel Input

The Travel Input is available when the Pneumatic Output Module is not integral to the DPC2K or when remote travel feedback is connected to Analog Input 2. When the DPC2K is an Analog Output version, the I/O dashboard will have an input labeled Travel Input.

The TRAVEL INPUT card includes the POINT NAME, CLASSIFICATION, RANGE VALUES and LIVE VALUE. Expand the card to provide a descriptive name and engineering units as well as upper and lower range values.

Alarms are based upon the selected engineering units and can be enabled as required to support your configuration.

Figure 14. Travel Input



Travel Calibration

Travel Calibration is used to apply the end stops from non-contact magnetic array position.

1. Move the measured device from a zero position and use the 0% Calibration button.
2. Move the measured device to it fully extended position and use the 100% Calibration button.

There is no factory calibration stored in the instrument. Each application will require a calibration cycle prior to a measurement being used for monitoring or control.

LoopConnect Software

Calibrate using the Manual Travel Calibration 0% and 100% buttons located on the Travel card.

Local User Interface (LUI)

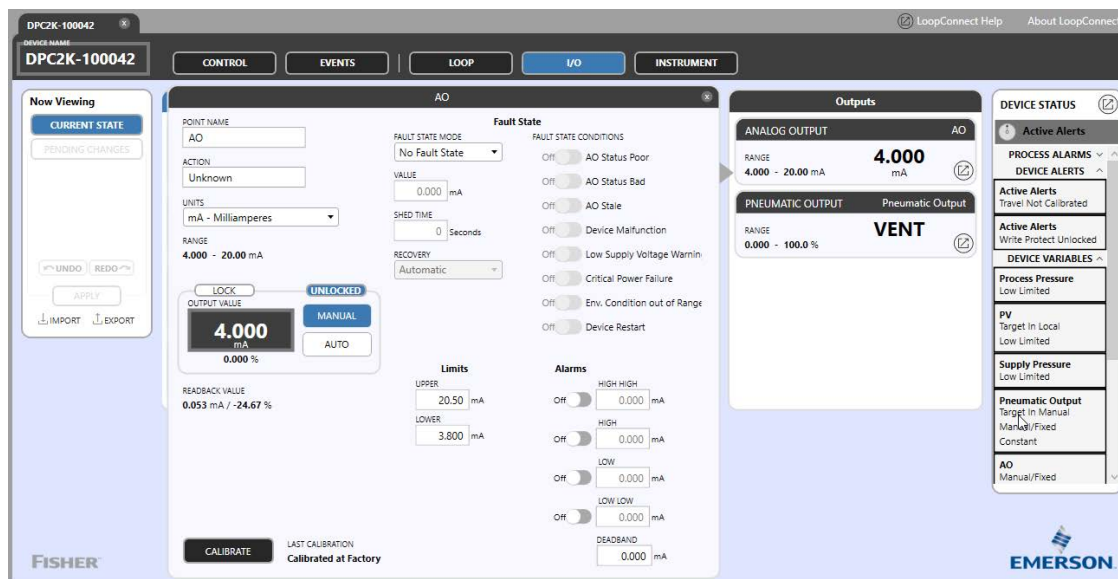
Use the navigation buttons to access Input/Output > Calibrate > Travel.

Outputs

Analog Output

Each I/O point is shown as a card with the POINT NAME, RANGE and LIVE VALUE. Expand these cards to show the configuration settings and an entry into the calibration routine. On the expanded card, the upper left portion lets you provide a descriptive name to the I/O.

Figure 15. I/O Dashboard



The ACTION field is a manually added note to the operator that can be used to describe the output control action. Including this information provides a better understanding of how the output responds to control signals. The description for air-operated valves may be: increase output to open or increase output to decrease flow.

NOTE

The output control action is dependent upon the device the output is connected to.

The AO supports two types of units, the measurable current in mA and the percentage of range with 4 mA equal to 0% and 20 mA equal to 100%.

The OUTPUT VALUE and READBACK VALUE show the measured value of the current being output. The live value may differ from the Readback Value due to the NAMUR NE43 alert messaging. The OUTPUT VALUE displays the NAMUR Limits value, while the READBACK VALUE displays the actual measurement. Within the limits, the values should closely resemble each other. If they vary significantly perform a calibration.

NOTE

To calibrate the output, remove the control element and block or bypass the system, as the output will change from 4 milliamps (zero) to 20 milliamps (full span).

To accurately measure the current being output by the DPC2K, using either LoopConnect software or the LUI, insert a calibration source in the output wiring and perform the following steps:

NOTE

The output needs to be in MANUAL and LOCKED to perform this procedure.

1. When asked to set zero, allow the signal to settle, then enter the meter reading in the data entry field.
2. Press SET ZERO.
3. Press CONTINUE to Set Span.
4. Repeat the previous process in order to SET SPAN at 20 mA.
5. Press CONTINUE to Review.
6. To Review
 - a. Enter values.
 - b. Press apply.
 - c. Verify the calibrated meter reading.
7. Once verified, press Close.

NOTE

If there seems to be a problem with either the output or the user entered values, there is also the option to Reset to Factory Calibration.

Analog Output Calibration

The Analog Output is calibrated at the factory and should not need to be recalibrated; however, if adjustment is required perform the calibration procedure.



WARNING

During calibration, the valve will move full stroke. To avoid personal injury and property damage caused by the release of pressure or process fluid, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

1. Follow all safety cautions and warnings. Verify the output will not negatively affect the valve assembly or process.
2. Provide a means of measuring the controller input pressure by connecting the controller input to a pressure gauge.
3. Connect a pressure source and ensure it is delivering the proper pressure value to the controller. Verify minimum and pressure readings.
4. Do not exceed the normal operating pressure range of the process pressure sensor.

LoopConnect Software

The calibration information shown is the date of the last calibration. Click the Calibrate button to follow the steps of the Calibration procedure.

Local User Interface (LUI)

Use the navigation buttons to access Input/Output > Calibrate > AO.

Fault State

A Fault State defines the behavior of the output when a trigger condition is Active. A DPC2K has three configuration options which control the behavior of the output when one of the trigger conditions exist.

Fault State Mode

1. No Fault State indicates no action is taken. When configured to Not Mapped, and no triggers are selected, the output will attempt to continue to operate normally. Check the AO and Readback Values to troubleshoot for a device problem.
2. Fail to Value allows a predetermined value to be forced as the output value. This is useful when a complete shutdown may be required or as an intermediate action taken to preserve some function of the process. Configure the Fail to Value to support these types of applications. The Shed time is the amount of time after the trigger clears for the output to update to the current value. If the Fault State is configured to Manual, the active trigger must clear and you must acknowledge the fault before the output is updated to the latest value. You can acknowledge the fault from any dashboard by using the right-hand navigation device status to clear the fault state.
3. Hold Last Value maintains the output in the last used value while any of the triggers are active. Enter a shed time for the fault to clear and update to the latest value. If the Fault State is configured to Manual, the active trigger must clear and you must acknowledge the fault prior to the output to be updated to the latest value. You can acknowledge the fault from any dashboard by using the right-hand navigation device status to clear the fault state.

Fault State Conditions

The following conditions can trigger the configured Fault State:

- AO Status Poor: Firmware can sporadically communicate with the AO or the AO is occasionally returning invalid information.
- AO Status Bad: Firmware can no longer control the AO or the AO is returning invalid information.
- AO Stale: Reserved for future use.
- Device Malfunction: There is an issue with the device. Troubleshoot or replace the device.
- Low Supply Voltage Warning: The instrument is nearing the shutdown threshold. Check for problem with power supply or battery.
- Critical Power Failure: The system has lost power and is ready to stop operating.
- Environmental Conditions out of Range: Temperature is outside of -40 to 85 °C / -40 to 185 °F.
- Device Restart: A manual restart from the LUI or by the software. During a restart, the memory is cleared and the current configuration is reloaded to retain the settings and begin operating from the last good configuration.

Limits

The limits on this Output are configurable and in line with the NAMUR NE 43 standard. These Limits are the triggers for the NE 107 DEVICE STATUS monitoring. The factory default settings fall within the commonly set parameters for NE 43.

Alerts

Alerts may be set to advise or annunciate situations where the output has either risen or fallen to levels which may impact the safety of the process. Four alert states are available and each may be set independently from others. Once an alert setting is exceeded and conditions change, the alert will only reset when the deadband threshold is met.

Pneumatic Output

NOTE

Upon first power up of a new DPC2K, a message on the LUI will direct you to calibrate the Travel sensor.

The DPC2K supports single-acting actuators only. The PID can be set as either reverse or direct-acting control.

NOTE

If a double-acting actuator is being used, it is recommended to use the analog output and a double-acting digital valve controller such as the Fisher FIELDVUE DVC7K digital valve controller or DVC6200 digital valve controller.

When the pneumatic output module is installed in a DPC2K, the configuration screen is as shown in Figure 16.

Expand the pneumatic output card to enter a more descriptive name up to 16 characters in the POINT NAME field.

Once AUTO CAL is run on the Pneumatic Output the ACTION (either Increase to Open or Increase to Close) will be determined and shown.

Select the OUTPUT/SUPPLY PRESSURE UNITS for the Supply and Output readings.

Control of the Pneumatic Output is either MANUAL or AUTO.

Figure 16. Pneumatic Output

When in MANUAL, a value can be entered into the OUTPUT VALUE field. You may also use VENT or SUPPLY in the OUTPUT VALUE field to move the valve to the travel endpoints.

NOTE

Manually entering a value in the OUTPUT VALUE field automatically locks the Output so no other session may take control.

If the Output is in AUTO, the Output will be adjusted by the Manipulated Variable (MV), which is the calculated value from the PID algorithm.

While the OUTPUT VALUE shows the current value, the READBACK value shows the actual travel value. The READBACK SOURCE is a dropdown which allows you to select the integral travel input when the DPC2K is mounted to an actuator or remote travel for cases where the instrument is pole mounted.

NOTE

Remote travel is only applicable for use with AI2.

When setting up the Pneumatic Output, use Manual Travel Calibration to set the travel endpoints. The endpoint will be set as zero and 100%. Zero normally means the valve is closed and 100% indicates the valve is open.

NOTE

Valve actuators can be air-to-open or air-to-close so it is important to check the connection to the actuator.

When the OUTPUT VALUE is set to MANUAL, you may enter a value into the number field.

Using the VENT and SUPPLY buttons, you may calibrate the travel with 0% at the closed valve position and 100% as the fully open position.

NOTE

To prepare for AUTO CAL, the output must be MANUAL and LOCKED.

Once the Travel endpoints are calibrated, it is recommended to run an AUTO CAL.

NOTE

To calibrate the travel endpoints using the Local User Interface (LUI), use the navigation buttons to access Input/Output > Calibrate > Travel.

Pneumatic Output Calibration

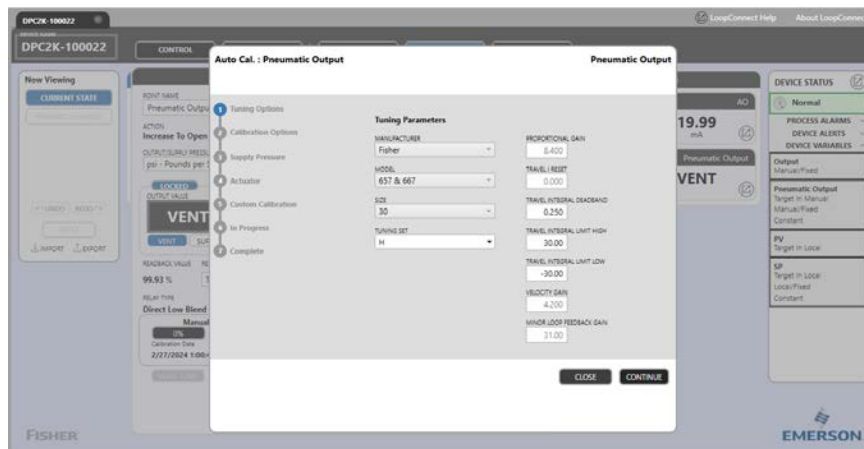
LoopConnect Software

Auto Cal

** WARNING**

During calibration, the valve will move full stroke. To avoid personal injury and property damage caused by the release of pressure or process fluid, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

Figure 17. Tuning Parameters



Once AUTO CAL is initiated, review the initial warning text:
The Auto Cal process will cause actuator movement. All safety precautions must be taken. To proceed, select "CONTINUE".

1. Tuning Options

MANUFACTURER, MODEL and SIZE may be selected from pull-down lists. If the actuator is not included, select a Fisher actuator that is the nearest size to its Fisher equivalent. Filling in these fields will automatically populate the TUNING SET from the internal data base. The Tuning Set parameters are viewable in the right hand column.

2. Calibration Options (see Figure 18)

- a. Select Calibrate Supply to calibrate the Supply Pressure Sensor.

NOTE

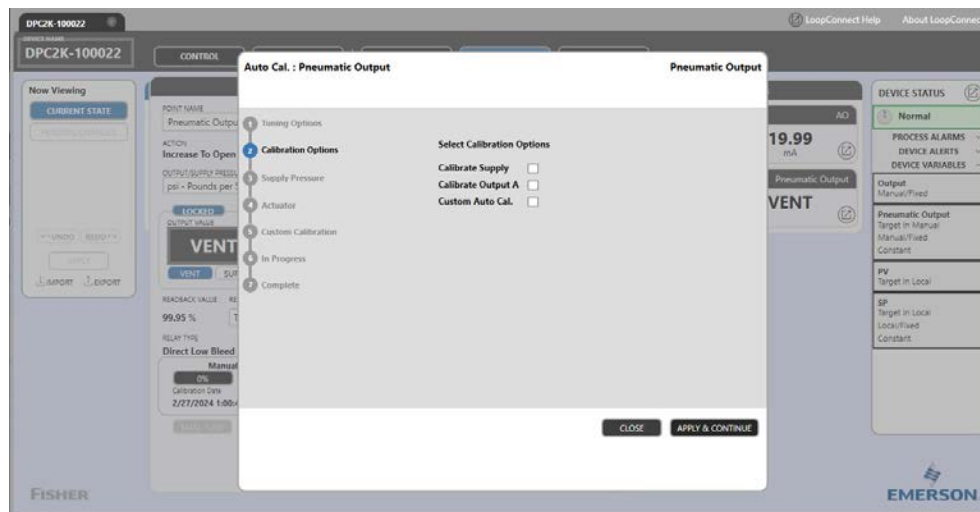
The Calibrate Supply procedure requires a calibrated gauge or source be placed upon the supply inlet to the pneumatic module. This option allows calibration of the supply pressure by following the prompts and entering the known value applied.

Calibration of the output pressure A uses the supply pressure for calibration. Vented = 0 %. Supply will be the same value as the supply pressure reading.

- b. Select Custom Auto Cal. if you want to make adjustments to the chosen tuning set.

NOTE

Custom Auto Cal. and the Custom Calibration option may be useful when the actuator is large or there are volume boosters connected to the actuator.

Figure 18. Calibration Options

3. Supply Pressure

To calibrate the supply pressure sensor, take the reading from the calibrated gauge or source and enter that value into the field.

Then select APPLY and CONTINUE.

NOTE

If Calibrate Supply or Calibrate Output A were not selected in Step 2, Supply Pressure will be skipped.

4. Actuator

This step requires an understanding of the valve position. Closed = 0.0%, Open = 100%. This information is shown on the VENT/ SUPPLY readback value to the left of this screen.

5. Custom Calibration allows you to enter custom values for Timeouts, End Point, MLFB Bias and IP Bias if desired.

NOTE

Review the CAUTION displayed by the software: *The following process should only be attempted by advanced users with an intimate knowledge of the pneumatic settings parameters. Failure to adhere may induce improper performance. Proceed cautiously.*

6. In Progress

While the actuator is going through the process of verifying the AUTO CAL parameters, the actuator will move through the complete stroke and then settle at a bias point of 50%.

7. Auto Cal is Complete, select Close.

Manual Tune

WARNING

During calibration, the valve will move full stroke. To avoid personal injury and property damage caused by the release of pressure or process fluid, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

MAN. TUNE allows the manipulation of a selected tuning set.

NOTE

Review the CAUTION displayed by the software: *The following process should only be attempted by advanced users with an intimate knowledge of the pneumatic settings parameters. Failure to adhere may induce improper performance. Proceed cautiously.*

NOTE

When AutoCal and/or Man. Tune is complete you will be taken back to the Pneumatic Output Card.

Fault State

A Fault State defines the behavior of the output when a trigger condition is Active. A DPC2K has three configuration options which control the behavior of the output when one of the trigger conditions exist.

Fault State Mode

1. No Fault State indicates no action is taken. When configured to Not Mapped, and no triggers are selected, the output will attempt to continue to operate normally. Check the Output and Readback Values to troubleshoot for a device problem.
2. Fail to Value allows a predetermined value to be forced as the output value. This is useful when a complete shutdown may be required or as an intermediate action taken to preserve some function of the process. Configure the Fail to Value to support these types of applications. The Shed time is the amount of time after the trigger clears for the output to update to the current value. If the Fault State is configured to Manual, the active trigger must clear and you must acknowledge the fault before the output is updated to the latest value. You can acknowledge the fault from any dashboard by using the right-hand navigation device status to clear the fault state.
3. Hold Last Value maintains the output at the last used value while any of the triggers are active. Enter a shed time for the fault to clear and update to the latest value. If the Fault State is configured to Manual, the active trigger must clear and you must acknowledge the fault before the output is updated to the latest value. You can acknowledge the fault from any dashboard by using the right-hand navigation device status to clear the fault state.

Fault State Conditions

The following conditions can trigger the configured Fault State:

- Pneumatic Status Poor: Firmware can sporadically communicate with the output module or the module is occasionally returning invalid information.
- Pneumatic Status Bad: Firmware can no longer control the output module or the module is returning invalid information.
- Pneumatic Stale: Reserved for future use.
- Device Malfunction: There is an issue with the device. Troubleshoot or replace the device.
- Low Supply Voltage Warning: The instrument is nearing the shutdown threshold. Check for problem with power supply or battery.
- Critical Power Failure: The system has lost power and is ready to stop operating.
- Environmental Conditions out of Range: Temperature is outside of -40 to 85 °C / -40 to 185 °F.
- Device Restart: A manual restart from the LUI or by the software. During a restart, the memory is cleared, and the current configuration is reloaded to retain the settings and begin operating from the last good configuration.

Cutoffs

UPPER — This is the point within the calibrated output range above which the Limit or Cutoff is in effect. When using cutoffs, a Cutoff Hi of 99.5% is recommended to ensure the valve goes fully open.

LOWER — This is the point within the calibrated output range below which the Limit or Cutoff is in effect. When using cutoffs, a Cutoff Lo of 0.5% is recommended to help ensure maximum shutoff seat loading.

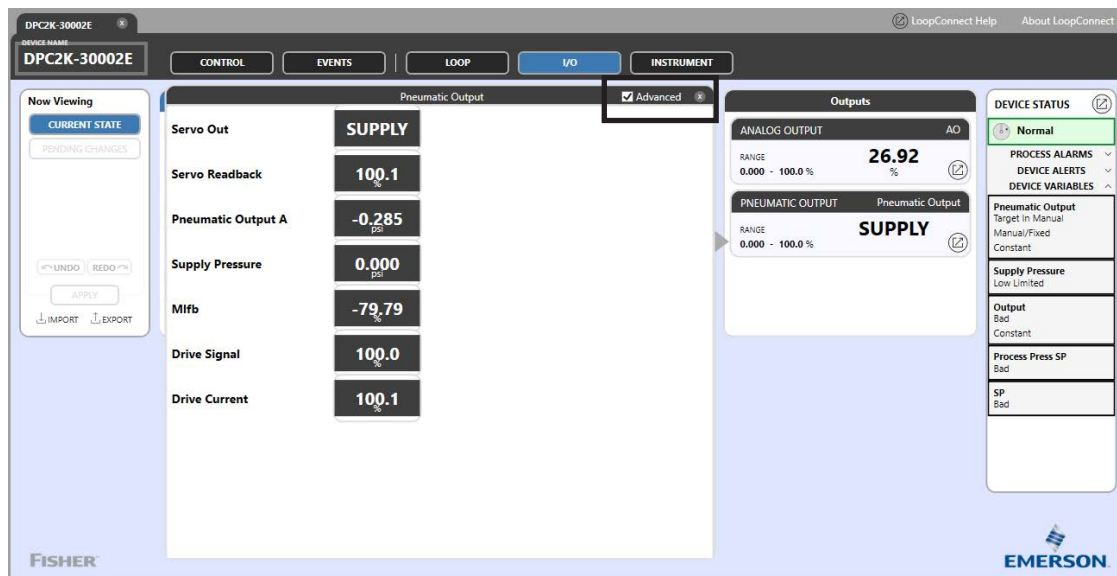
Alerts

Alerts may be set to advise or annunciate situations where the output has either risen or fallen to levels which may impact the safety of the process. Four alert states are available and each may be set independently from others. Once an alerts setting is exceeded and conditions change, the alerts will only reset when the deadband threshold is met.

Advanced

Advanced is an informational read-only screen, shown in Figure 19, to assist troubleshooting the pneumatic output. You access this by clicking the checkbox in the upper right corner of the Pneumatic Output card.

Figure 19. Pneumatic Output, Advanced



- Servo Out: This is the internal value of the input to the pneumatic module.
- Servo Readback: Is the value from the travel readback (shown on prior card as READBACK VALUE).
- Pneumatic Output A: Is the pressure reading to the actuator.
- Supply Pressure: The pressure to the input of the pneumatic module which is used as the pneumatic control valve movement.
- Mlfb: Minor Loop Feedback, indicates the position of the relay.
- Drive Signal: The signal to the I/P converter from the printed wiring board. It is the percentage of the total microprocessor effort needed to drive the valve fully open.
- Drive Current: The measured Drive Current actually flowing through the I/P converter in percent of maximum drive.

5.4 Loop Dashboard

The Loop dashboard provides configuration for the controller. It features a drag and drop interface to configure the I/O to the correct parameters of the process loop.

The top row of the dashboard provides information about the process loop. The DESCRIPTOR field can be updated with the loop name. CONTROL TYPE and LOOP TYPE provide information regarding the controller functions.

Figure 20. Loop Dashboard

CONTROL ACTION dictates the action of the controller output. Choices are direct- or reverse-acting. In direct-acting, the output of the controller output rises if the process variable increases. Reverse-acting means that the controller output drops when the process variable rises.

NOTE

CONTROL ACTION is dependent upon the control element configuration. The most common control action is reverse-acting.

SP (Setpoint)

The SP card shows the currently configured source of the setpoint value. A setpoint can be set locally on the LUI, via an analog input, through a remote digital setpoint from a Modbus register (40033), or a HART device variable. Any of the small cards from the Inputs row at the bottom of the dashboard can be dragged and dropped as the SP source.

SETPOINT LIMITS will initially default to the range of the process variable but may be configured as a subset of that range for operational or safety reasons. The setpoint limits only allow valid setpoint entries to be within the lower and upper values.

Expand the SP card to configure Alarms to provide notification of potential setpoint warnings. Once an alarm is active, it will remain on until it passes outside the deadband.

Figure 21. SP Card



Fault State

A Fault State defines the behavior of the setpoint when a trigger condition is Active. A DPC2K has three configuration options which control the behavior of the setpoint when one of the trigger conditions exist.

Fault State Mode

1. No Fault State indicates no action is taken. When configured to Not Mapped and no triggers are selected, the setpoint will attempt to continue to operate normally.
Fail to Value allows a predetermined value to be forced as the setpoint value. This is useful if a remote setpoint is set by an analog input and that connection fails. Setting to Fail to Value allows the controller to preserve some function of the process. The Shed time is the amount of time after the trigger clears for the output to update to the current value.
If the Fault State is configured to Manual, the active trigger must clear and you must acknowledge the fault before the output is updated to the latest value. You can acknowledge the fault from any dashboard by using the right-hand navigation device status to clear the fault state.
2. Hold Last Value will maintain the setpoint at the last used value while any of the triggers are active. Enter a shed time for the fault to clear and update to the latest value. If the Fault State is configured to Manual, the active trigger must clear and you must acknowledge the fault before the setpoint is updated to a new value. You can acknowledge the fault from any dashboard by using the right-hand navigation device status to clear the fault state.

Fault State Conditions

The following conditions can trigger the configured Fault State:

- SP Status Poor: Firmware can sporadically communicate with the SP, or the SP is occasionally returning invalid information.
- SP Status Bad: Firmware can no longer read the SP, or the SP is returning invalid information.
- SP Status Stale (reserved for future use).

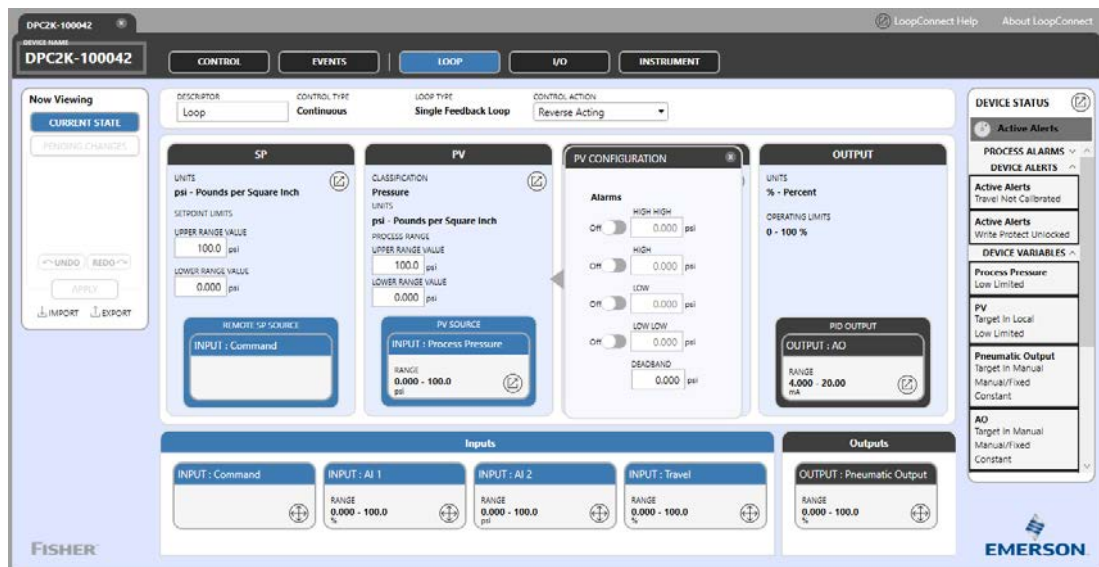
PV (Process Variable)

The Process Variable source may be configured from Input cards at the bottom of the dashboard by dragging the selected input card and dropping it in the PV source. In many cases if there is an integral pressure sensor installed, it will be the PV Source by default.

CLASSIFICATION and UNITS define the measurement and type of process being controlled. These can be modified in the actual I/O card used for the PV Source. PROCESS RANGE defines the allowable values for the process and can be a subset of the Range of the associated measurement point.

This allows for alternate ranges of I/O to be used if the measurement point needs to be changed. The measurement range is independent from the PROCESS RANGE to allow the controller to be tuned to the specific application.

Figure 22. Process Variable



NOTICE

Any time the **PROCESS RANGE** is changed, the PID control algorithm will require retuning. In addition, when the Process Range is modified, the setpoint limits will be updated to reflect the process range.

Once expanded, alarms can be set for the Process Variable. Only values within the process range are valid for Process alarms. Once an alarm is active it will remain on until it passes outside the deadband.

PID (Proportional, Integral, Derivative)

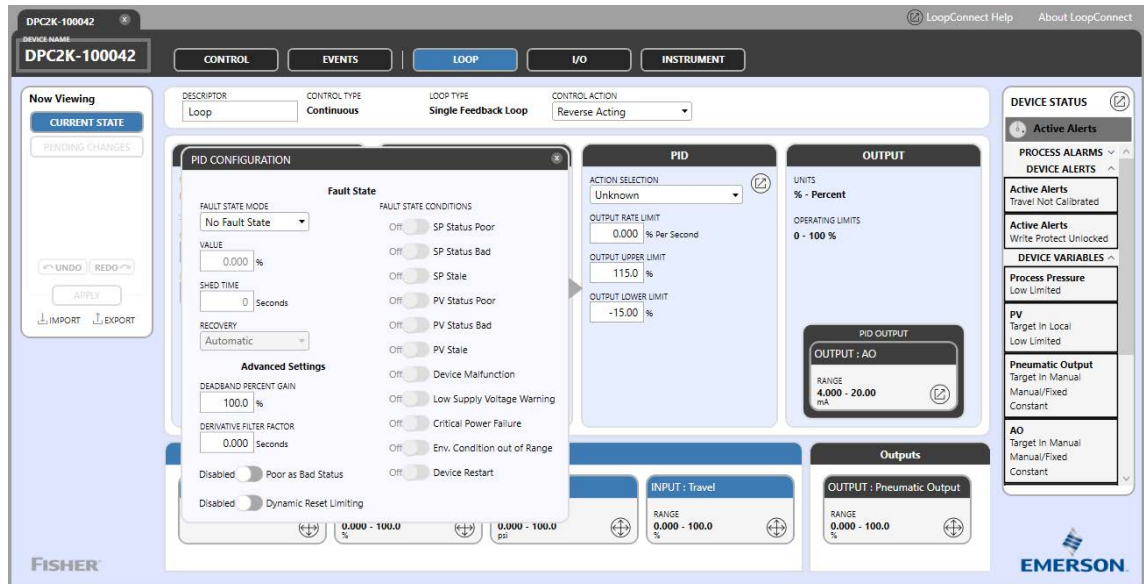
ACTION SELECTION is a user entered reminder of what will happen with manual entries for the Output. This setting is not used in the algorithm. It is useful when the output is in Manual or if you are questioning the loop behavior.

OUTPUT RATE LIMIT

When large step changes are expected to the output, configure a limit on the amount of change per second.

The default is 0.0% per second, which indicates the rate limit is disabled. To slow the rate of change to the control element configure a value greater than to 0.0%.

Figure 23. PID Configuration



Fault State

Expand the PID card to configure the Fault State Mode of the PID Output (Manipulated Variable).

1. No Fault State indicates no action is taken. When configured to Not Mapped and no triggers are selected, the output will attempt to continue to operate normally. Check the AO and Readback Values to troubleshoot for a device problem.
2. Fail to Value allows a predetermined value to be forced as the output value. This is useful when a complete shutdown is required or as an intermediate action taken to preserve some function of the process. Configure the Fail to Value to support these types of applications. The shed time is the amount of time after the trigger clears for the output to update to the current value. If the Fault State is configured to Manual, the active trigger must clear and you must acknowledge the fault before the output is updated to the latest value. You can acknowledge the fault from any dashboard by using the right-hand navigation device status to clear the fault state.

3. Hold Last Value will maintain the output in the last used value while any of the triggers are active. Enter a shed time for the fault to clear and update to the latest value. If the Fault State is configured to Manual, the active trigger must clear and you must acknowledge the fault before the output is updated to the latest value. You can acknowledge the fault from any dashboard by using the right-hand navigation device status to clear the fault state.

Fault State Conditions

The following conditions trigger the configured Fault State:

- SP Status Poor: Firmware can sporadically communicate with the SP or the SP is occasionally returning invalid information.
- SP Status Bad: Firmware can no longer read the SP or the SP is returning invalid information.
- SP Stale: Reserved for future use.
- PV Status Poor: Firmware can sporadically communicate with the PV or the PV is occasionally returning invalid information.
- PV Status Bad: Firmware can no longer read the PV or the PV is returning invalid information.
- PV Stale: Reserved for future use.
- Device Malfunction: There is an issue with the device. Troubleshoot or replace the device.
- Low Supply Voltage Warning: The instrument is nearing the shutdown threshold. Check for problem with power supply or battery.
- Critical Power Failure: The system has lost power and is ready to stop operating.
- Environmental Conditions out of Range: Temperature is outside of -40 to 85 °C / -40 to 185 °F.
- Device Restart: A manual restart from the LUI or by the software. During a restart, the memory is cleared and the current configuration is reloaded to retain the settings and begin operating from the last good configuration.

Advanced Settings

DEADBAND PERCENT GAIN: When in deadband, the percentage of proportional gain to use to react to error.

DERIVATIVE FILTER FACTOR: Configurable filter for the derivative term. Value of 0 is auto.

Poor as Bad Status is the configuration to treat device variables which have a poor status, to immediately show Bad status. This choice will affect the operation of fault states. When configured for "Poor as Bad Status", the frequency of fault states could increase.

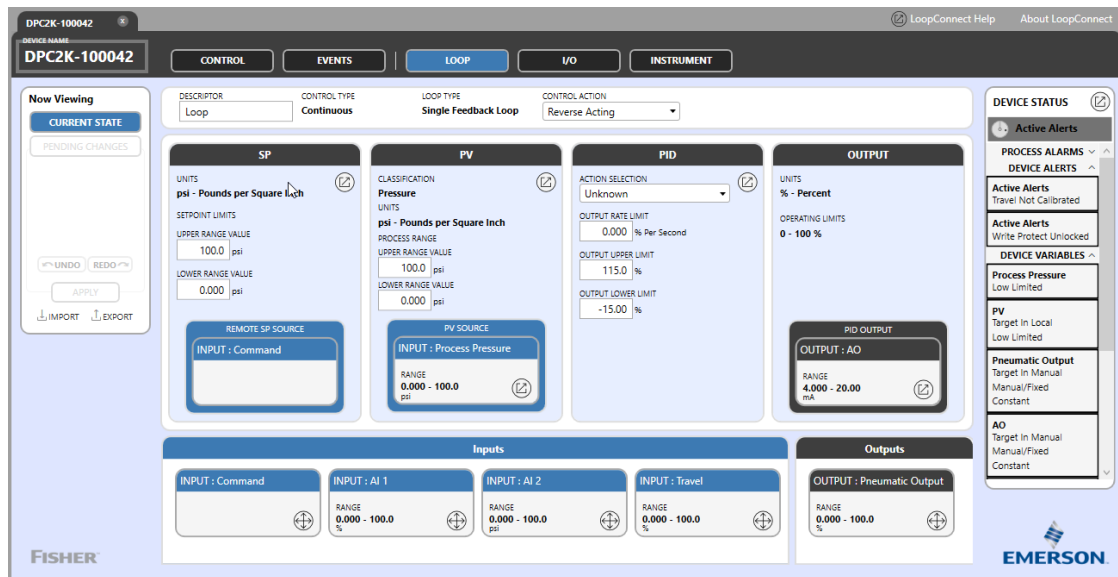
Dynamic Reset Limiting: When enabled, the measured output is fed back to the PID to be used as the integrator and will automatically limit the output when the feedback stops.

Output

The output can be configured to two potential outputs:

- The integral analog output which is a 4 to 20 mA current loop.
- The Pneumatic Module which provides a modulated air output in the range of 0-100% of the operating range for air operated actuators.

Figure 24. Output



To change the configured output, select the desired Output card and drag and drop into the PID OUTPUT.

NOTE

In order to change the PID configuration, the Output must be in MANUAL.

Expanding the selected Output will take you to the I/O screen for specific configuration of that Output.

NOTE

The output can be configured for digital output value (Modbus register 40033) for readback and retransmission by a Modbus Host.

Section 6: Operation and Monitoring

6.1 Control Dashboard

The Control dashboard is the main operations dashboard for the process loop. From this view, you can quickly discern how the loop is performing to the setpoint, the process variable itself and the condition of the final control element.

Figure 25. Control Dashboard



In addition, there is an I/O Monitor docked on the lower edge of the Control dashboard. Although normally minimized, it can be expanded to show all of the I/O points which are not directly connected to the Loop I/O. This allows you to quickly view device parameters or additional monitored points.

SP Source can be set to LOCAL (user entered) or REMOTE (Analog Input or digital value via Modbus). You can modify the SP (Setpoint) value by entering a new value in the number field and selecting APPLY.

NOTE

When you modify the setpoint using LoopConnect, the SP value is locked to ensure no other users are able to dynamically change the setpoint until you select UNLOCK or the communication session is disconnected.

NOTE

It is important to unlock and restore to remote configuration to ensure as found, as left conditions exist.

When SP is in REMOTE, the connector from the configured input will show up as a solid connector. When in LOCAL, the indicator is a dashed line.

PV (Process Variable) is the measurement which is being controlled. The PV should track the SP closely. The controller's PID algorithm drives the output signal to minimize the error between PV and SP. You can easily compare the SP and PV values on this display.

To the right of the PV value, there is a scrolling chart with SP and PV trending to provide some historical reference. You can expand this display by using the TUNE PID button.

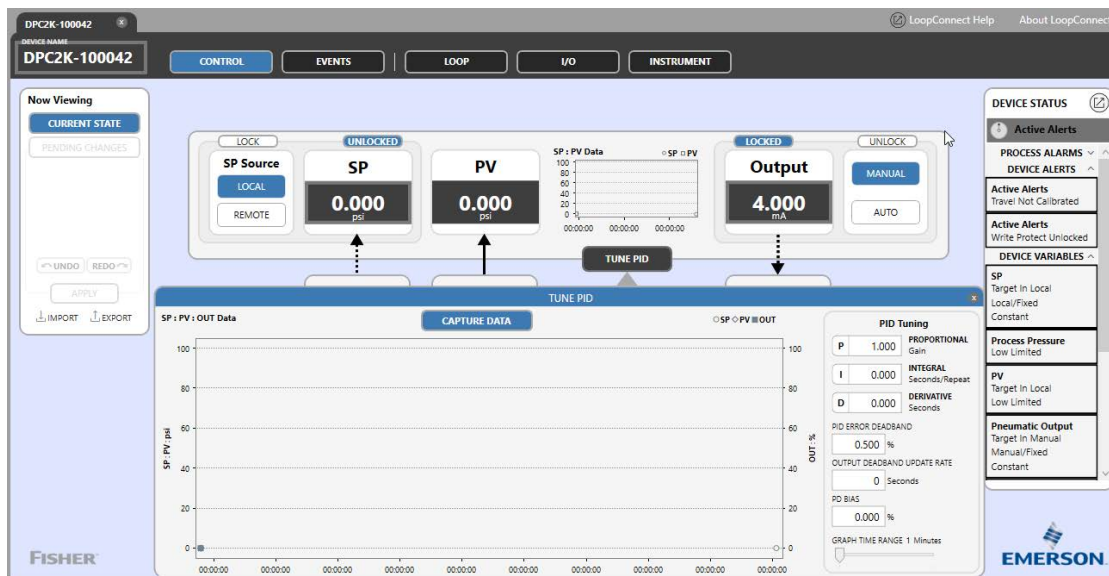
To the right of the trend is the Output value. The Output value is normally provided as a percentage output. The range is determined by the scaling of the configured output. In the case of an analog output, that scaling is 4 to 20 mA. When a pneumatic output is configured, the range of the output is the configured operating range of the pneumatic control element.

When the PID Output is in AUTO, the connecting line to the configured Output is solid. When the PID Output is in MANUAL, this connection is dotted. While in Manual, the Output value can be selected and a new value written to the Output value by entering a new value and hitting the APPLY button.

Tune PID

TUNE PID is a larger version of the trend that also includes the PID output. There are two axis to this trend, the SP and PV units on the left y axis and the Output percentage on the right y axis. This display is useful when tuning the PID to gauge the response to tuning parameter changes. The update rate is roughly 2 seconds per scan. During tuning also pay attention to the action of the control device for jitter or fast cycling.

Figure 26. Tune PID



PID Tuning

PROPORTIONAL GAIN is the gain applied to error to drive output.

INTEGRAL is the integration applied to drive output.

DERIVATIVE is the gain applied delta PV to drive output.

The PID ERROR DEADBAND sets boundaries during which the PID output does not change. Adding deadband is useful to minimize small output deviations which may cause mechanical wear to the control device.

DEADBAND ACTIVATION DELAY is the amount of time error needs to remain in deadband before the integrator is turned off.

The PD BIAS is applied such that the output will equal this term when Error = 0.

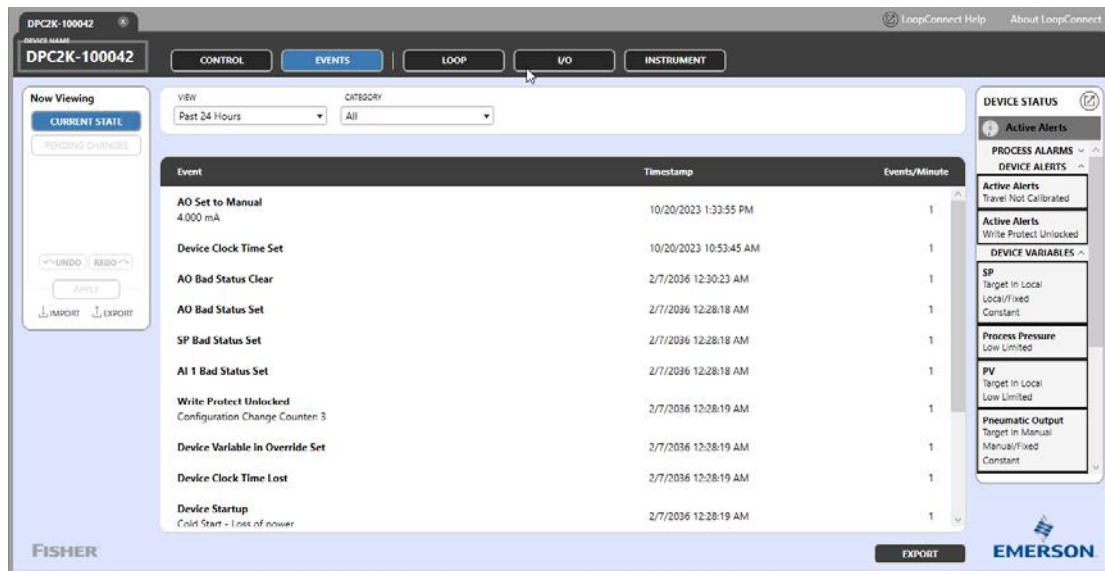
NOTE

The PD Bias used for proportional only controller (Integral = 0).

6.2 Events Dashboard

The DPC2K retains an event log in the internal memory. To view these events, open the Events dashboard. The list of events appear in chronological order with the latest at the top of the list. The internal log is updated every minute. LoopConnect allows you to select from predefined historical datasets, as the log may become large after years of operation. In addition, you may select events by type, such as calibration or security, for record keeping or troubleshooting.

Figure 27. Events Dashboard



The event details provide the type of event, the parameter and a value or status where applicable. Each event has a time and date stamp. There is a display of events/minute that may help troubleshoot noisy signals or intermittent connections.

Once the list of events has been returned, this log may be exported to a text based file. Once captured, these files may be examined or used for technical support purposes.

NOTE

An "Undecoded" event is used for firmware debug only.

Section 7: Maintenance and Troubleshooting

The DPC2K digital process controller enclosure is rated Type 4X and IP66, therefore periodic cleaning of internal components is not required. If the DPC2K is installed in an area where the exterior surfaces tend to get heavily coated or layered with industrial or atmospheric contaminants, it is recommended that the vent be periodically removed and inspected to ensure there is no partial or full obstruction. If the vent appears to be partially or fully obstructed, it must be cleaned or replaced. Refer to Cleaning the Vent procedure.

WARNING

To avoid static discharge when flammable gases or dust are present, do not rub or clean the instrument with solvents. To do so could result in a spark that may cause the flammable gases or dust to explode, resulting in personal injury or property damage. Clean with a mild detergent and water only.

WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance procedures on the DPC2K digital process controller:

- Always wear protective clothing, gloves and eyewear.
- Do not remove the actuator from the valve while the valve is still pressurized.
- Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
- Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression so the actuator is not applying force to the valve stem; this will allow for the safe removal of the stem connector.

** WARNING**

When using natural gas as the supply medium or for explosion proof applications, the following warnings also apply:

- Remove electrical power before removing the housing cap. Personal injury or property damage from fire or explosion may result if power is not disconnected before removing the cap.
- Remove electrical power before disconnecting any of the pneumatic connections.
- When disconnecting any of the pneumatic connections or any pressure retaining part, natural gas will seep from the unit and any connected equipment into the surrounding atmosphere. Personal injury or property damage may result from fire or explosion if natural gas is used as the supply medium and appropriate preventive measures are not taken. Preventive measures may include, but are not limited to, one or more of the following: ensuring adequate ventilation and the removal of any ignition sources.
- Ensure that the cover is correctly installed before putting this unit back into service. Failure to do so could result in personal injury or property damage from fire or explosion.

** WARNING**

Personal injury or property damage can occur from cover failure due to overpressure. Ensure that the housing vent opening is open and free of debris to prevent pressure buildup under the cover.

This unit vents the supply medium into the surrounding atmosphere. When installing this unit in a non-hazardous (non-classified) location in a confined area, with natural gas as the supply medium, you must remotely vent this unit to a safe location. Failure to do so could result in personal injury or property damage from fire or explosion and area reclassification.

When installing this unit in a hazardous (classified) location remote venting of the unit may be required, depending upon the area classification and as specified by the requirements of local, regional and national codes, rules and regulations. Failure to do so when necessary could result in personal injury or property damage from fire or explosion and area reclassification.

In addition to remote venting of the unit, ensure that all caps and covers are correctly installed. Failure to do so could result in personal injury or property damage from fire or explosion and area reclassification.

⚠ WARNING

When replacing components, use only components specified by the factory. Always use proper component replacement techniques, as presented in this manual. Improper techniques or component selection may invalidate the approvals and the product specifications, as indicated in Table 1 and may also impair operations and the intended function of the device and could cause personal injury and property damage.

⚠ WARNING

To avoid personal injury or property damage in Hazardous Area applications, do not attempt to repair any sealing surfaces, flameproof or explosion-proof joints.

⚠ WARNING

Select wiring and/or cable glands that are rated for the environment of use (such as hazardous area, ingress protection and temperature). Failure to use properly rated wiring and/or cable glands can result in personal injury or property damage from fire or explosion.

Wiring connections must be in accordance with local, regional and national codes for any given hazardous area approval. Failure to follow the local, regional and national codes could result in personal injury or property damage from fire or explosion.

To avoid personal injury resulting from electrical shock, do not exceed maximum input voltage specified on the product nameplate. If the input voltage specified differs, do not exceed the lowest specified maximum input voltage.

Personal injury or property damage caused by fire or explosion may occur if electrical connections are attempted in a potentially explosive atmosphere or in an area that has been classified as hazardous. Confirm that area classification and atmosphere conditions permit the safe removal of the terminal box cap before proceeding.

The valve may move in an unexpected direction when power is applied to the digital process controller. To avoid personal injury and property damage caused by moving parts, keep hands, tools and other objects away from the valve/actuator assembly when applying power to the instrument.

Insulation for wiring must be greater than 90 °C / 194 °F.

Select the appropriate maintenance procedure and perform the numbered steps. Each procedure requires that the supply pressure be shut off before beginning maintenance.

7.1 Removing the Magnetic Feedback Assembly

To remove the magnet assembly from the actuator stem, perform the following basic steps.

1. Make sure that the valve is isolated from the process.
2. Remove the instrument terminal box cover.
3. Disconnect the field wiring from the terminal board.
4. Shut off the instrument air supply.
5. Disconnect the pneumatic tubing and remove the DPC2K from the actuator.
6. Remove the screws holding the magnet assembly to the connector arm.

When replacing the instrument, be sure to follow the mounting guidelines in the DPC2K Quick Start Guide (D104559X012). Setup and calibrate the instrument prior to returning to service.

7.2 Part Replacement

When replacing any of the DPC2K assemblies, the maintenance should be performed in an instrument shop whenever possible. Make sure that the electrical wiring and pneumatic tubing is disconnected prior to disassembling the instrument.

WARNING

To avoid personal injury or property damage caused by the uncontrolled release of pressure, be sure any trapped process pressure is properly vented from the controller. Vent any supply pressure from the controller before disassembly.

I/P Converter

Refer to Figure 28, 29 and Figure 33 for part locations. The I/P converter is located on the front of the module base.

NOTE

The I/P converter procedures are only applicable to the DPC2K with Pneumatic Output option. After I/P converter submodule replacement, calibrate the digital process controller to maintain accuracy specifications.

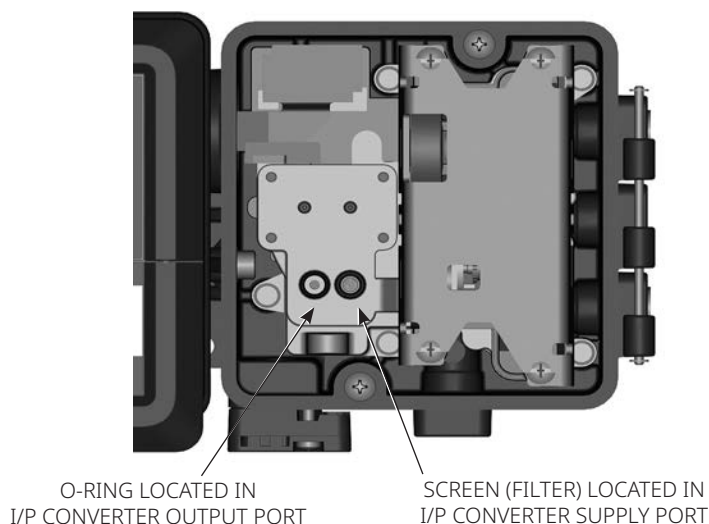
Replacing the I/P Filter

A screen in the supply port beneath the I/P converter serves as a secondary filter for the supply medium. To replace this filter, perform the following procedure:

1. Remove the front cover.

2. Remove the I/P converter and shroud as described in the Removing the I/P Converter procedure.
3. Remove the screen from the supply port.
4. Install a new screen in the supply port as shown in Figure 28.
5. Inspect the O-ring in the I/P output port and replace if necessary.
6. Reinstall the I/P converter and shroud as described in the Replacing the I/P Converter procedure.

Figure 28. I/P Converter and Filter Location



Removing the I/P Converter

1. Remove the front cover if needed.
2. Refer to Figure 29 and 33. Using a 2.5 mm hex socket wrench, remove the four socket-head screws that attach the shroud and I/P converter to the module base.
3. Remove the shroud, then pull the I/P converter straight out of the module base. Be careful not to damage the two electrical leads that come out of the base of the I/P converter.

NOTE

Ensure the feedthrough shroud is not displaced when the I/P convert is removed from the module base.

4. Ensure that the O-ring and screen stay in the module base and do not come out with the I/P converter.

Replacing the I/P Converter

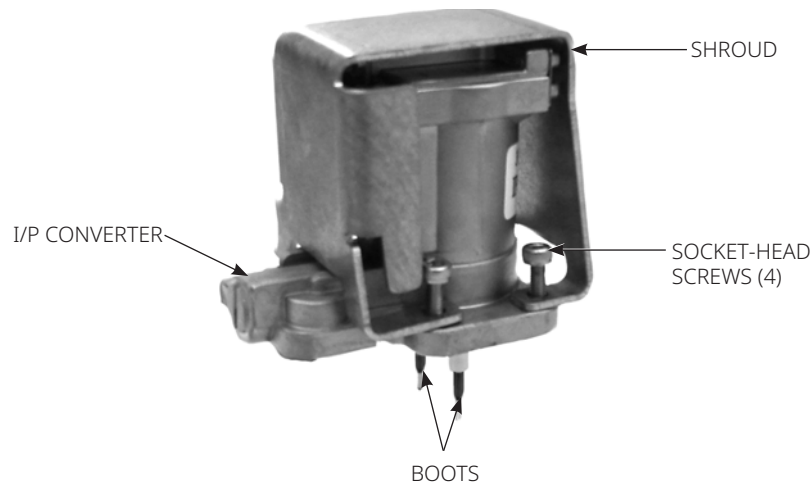
1. Inspect the condition of the O-ring and screen in the module base (see Figure 28). Replace them, if necessary. Apply silicone lubricant to the O-rings.
2. Apply silicone lubricant to the two boots shown in Figure 29 and ensure they are properly installed on the electrical leads.

NOTE

Before installing the I/P converter in the next step, ensure the feedthrough shroud (see Figure 33) is correctly positioned.

3. Install the I/P converter straight into the module base, taking care that the two electrical leads feed into the guides in the module base. These guides route the leads to the printed wiring board assembly submodule.
 4. Install the shroud over the I/P converter.
 5. Install the four socket-head screws and evenly tighten them in a crisscross pattern to a final torque of 1.6 N•m / 14 lbf•in.
 6. After replacing the I/P converter, calibrate travel or perform touch-up calibration to maintain accuracy specifications.
-

Figure 29. I/P Converter



W9328

Pneumatic Relay

Refer to Figure 30 and 33 for key number locations. The pneumatic relay is located on the front of the module base.

NOTE

This procedure is only applicable to the DPC2K with Pneumatic Output option.

After relay submodule replacement, calibrate the digital process controller to maintain accuracy specifications.

Removing the Pneumatic Relay

1. Remove the front cover if needed.
 2. Loosen the four screws that attach the relay to the module base. These screws are captive in the relay.
 3. Remove the relay.
-

Figure 30. Pneumatic Relay Assembly



W8074

Replacing the Pneumatic Relay

1. Visually inspect the holes in the module base to ensure they are clean and free of obstructions. If cleaning is necessary, do not enlarge the holes.
2. Apply silicone lubricant to the new relay seal and position it in the grooves on the bottom of the relay as shown in Figure 30. Press seal retaining tabs into retaining slots to hold relay seal in place.
3. Position the relay (with shroud) on the module base. Tighten the four screws, in a crisscross pattern, to a final torque of 2 N•m / 20.7 lbf•in.
4. After replacing the relay and verifying the relay type, calibrate travel or perform touch-up calibration to maintain accuracy specifications.

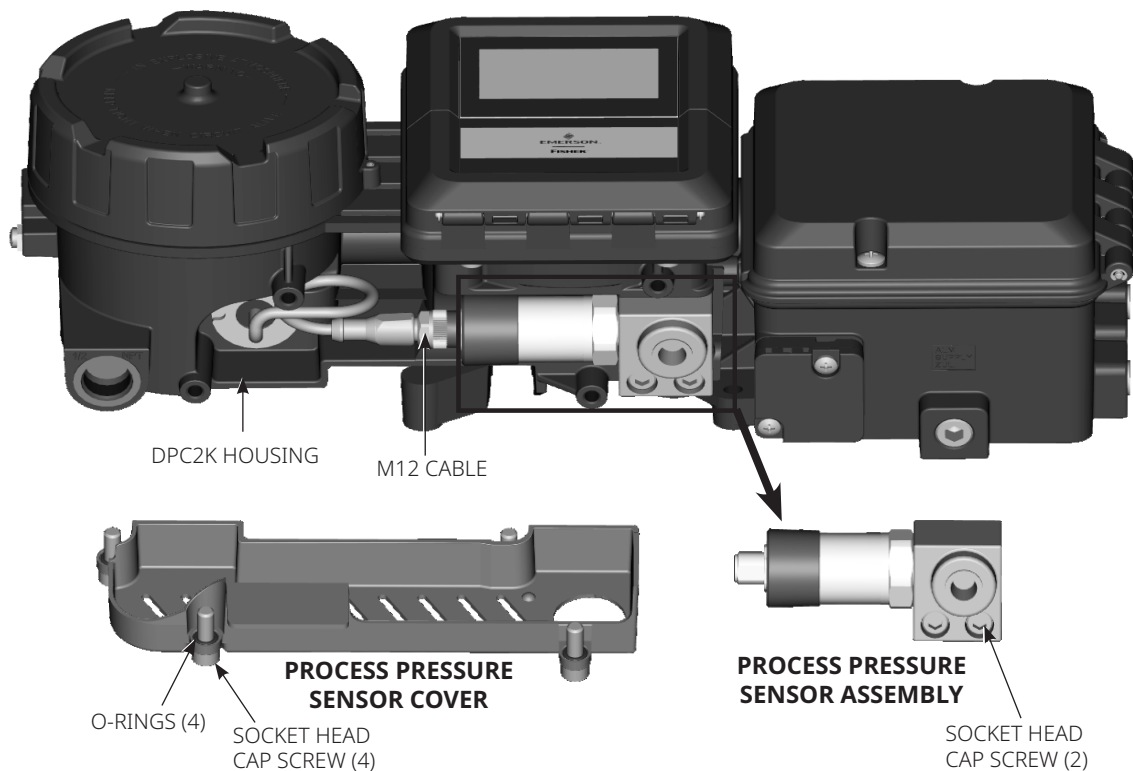
Process Pressure Sensor (PPS) Assembly

Refer to Figure 31 and 33.

Removing the PPS Assembly

1. Using a 3/16 mm hex socket wrench, remove the four socket head cap screws to remove the PPS cover.
2. Retain the PPS cover, screws and four O-rings from the recessed area on the inside cover. They will be reused when installing the new PPS assembly.
3. Unscrew the two socket head cap screws from the PPS assembly.
4. Disconnect the assembly from the M12 cable to remove it from the housing.

Figure 31. Process Pressure Sensor Assembly Removal



Replacing the PPS Assembly

NOTE

This procedure can be used to replace the PPS assembly or for first time installation of a PPS assembly. When replacing the PPS assembly, ensure that the pressure range of the new sensor is the same as the one removed.

For a first time installation, you will need to remove the existing process pressure sensor cover and punch out the knockout on the right front of it. Be sure to retain the screws and O-rings as they will be used to reattach the cover.

1. Connect the new PPS assembly to the M12 cable.
 2. Insert two socket head cap screws into the assembly.
 3. Install O-rings in the recessed area on the backside of the assembly.
-

NOTE

The O-rings on the backside of the PPS assembly and inside of the cover hold the socket head cap screws in place for ease of installation.

4. Position the assembly in the DPC2K housing and tighten the screws.
-

NOTE

Twist the cable as shown in Figure 31 to position the assembly for easy installation.

5. Insert the four socket head cap screws into the PPS cover.
 6. Install O-rings in the recessed area on inside of cover.
 7. Position cover over the PPS assembly and tighten the four socket head cap screws.
-

Vent

The vent is located on the bottom right of the instrument (see Figure 33).

NOTE

This procedure is only applicable to the DPC2K with Pneumatic Output option.

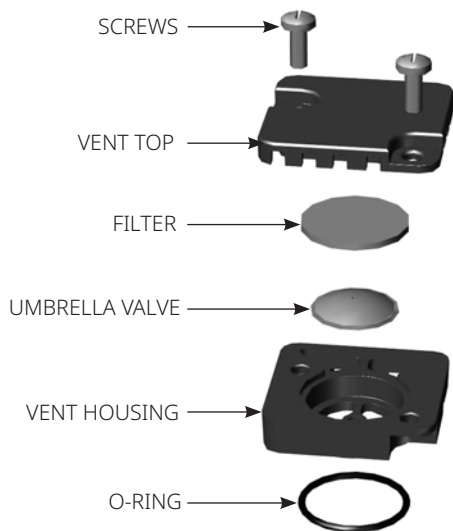
Cleaning the Vent

See Figure 32.

1. Before proceeding, place unit in MANUAL output and change output to 0% output.
2. Remove the vent by unscrewing the two screws and removing the O-ring.
3. Carefully disassemble the vent.

NOTE

There are three parts to the vent, two vent housing components and a filter; take care when disassembling the vent as it is loosely held together.

Figure 32. Vent Assembly

-
4. Clean each component with a mild water/detergent solution.
 5. Allow the components to dry before reinstalling.
 6. Reassemble the vent by inserting the filter and umbrella valve between the two vent housing components as shown in Figure 32.
 7. Insert the O-ring into the Pneumatic Module Housing Assembly.
 8. Align the vent so that the hardware holes are aligned.
 9. Insert and tighten the two screw to 1.3 N•m / 11.5 in•lbs removed in step 2 to secure the vent to the Pneumatic Module Housing Assembly.
-

NOTE

Be sure to tighten each screw such that the vent is evenly seated.

10. Perform the unit startup procedures before placing in production.

7.3 Troubleshooting

As an aid to troubleshooting, Table 4 lists some common operating faults, their probable cause and suggestions for correcting the faults.

Table 4. DPC2K Troubleshooting Chart

Fault	Possible Cause	Check	Correction
Process wanders or cycles about setpoint	Proportional, Integral, Derivative or Deadband settings	Refer to the startup procedures for controller settings.	If stable control cannot be attained, and all other elements of the loop are functionally correct, examine other possible causes related to the controller.
	Supply pressure varying	Monitor the supply pressure with an external gauge. Ensure that it is set correctly and does not fluctuate. Note the number of instruments being supplied by the regulator.	Correct as necessary. One regulator per instrument is recommended.
	Process input failure	Inspect the process pressure sensor connections for loose connections or leaks.	Repair or replace parts as necessary
	Transmitter input failure, Analog Input #2	Inspect analog input #2 wiring and screw terminations.	Verify power is being supplied to the transmitter. Then verify transmitter operating and calibration.
	Pneumatic output varying	Inspect tubing and fittings between controller and actuator.	Verify the output calibration matches the actuator range (bench set).
	Remote setpoint varying	Inspect analog input #1 wiring and screw terminations.	Verify current from control system's analog output. Then verify analog input#1 current and calibration. Recalibrate as appropriate.
Controller cannot attain full output range	Supply pressure not set correctly	Monitor the supply pressure with an external gauge. Ensure that it is set correctly and does not fluctuate. Note the number of instruments being supplied by the regulator.	Correct as necessary. One regulator per instrument is recommended.
	Pneumatic output calibration or issue	Monitor the output pressure with an external gauge. Check for leaks.	Fix leaks as necessary. (Repair or replace? Tighten?) Recalibrate the pneumatic output.

- continued -

Table 4. DPC2K Troubleshooting Chart (continued)

Fault	Possible Cause	Check	Correction
Controller cannot attain full output range	Analog output calibration or issue	Monitor the output current with an external calibrator. Inspect wiring.	Tighten screws as necessary. Recalibrate analog output.
	Actuator or valve issue	Verify output settings match actuator range (bench set).	Inspect or repair actuator or valve as necessary.
	- - -	Verify Output and/or Setpoint limits.	- - -
	- - -	Verify not in manual, fault state or servo fail condition (i.e., zero power condition).	- - -
	- - -	Verify status of inputs is not bad.	- - -
Controller remains at full output	Verify pneumatic output type	Monitor the output pressure with external gauge, place output in MANUAL and check 0 and 100% output pressure.	Replace pneumatic output as necessary.
	Verify analog output calibration	Monitor the output current with an external calibrator. Inspect wiring.	Tighten screws as necessary. Recalibrate analog output.
	Controller output	If in MANUAL, check to verify the output is not either 0 to 100%.	- - -
	Controller setpoint	Verify setpoint is not a full scale.	- - -
Controller remains at zero output	Verify pneumatic output type	Monitor the output pressure with external gauge, place output in MANUAL and check 0 and 100% output pressure.	Replace pneumatic output as necessary.
	Verify analog output calibration	Monitor the output current with an external calibrator. Inspect wiring.	Tighten screws as necessary. Recalibrate analog output.
	Remote setpoint failure - analog input #1	Inspect wiring and screw terminations with analog input #1.	Verify output current from control system is valid. Then verify analog input current is within range.
	Controller output	If in MANUAL, check to verify the output is not either 0 to 100%.	- - -
	Controller setpoint	Verify setpoint is not at minimum range.	- - -

Section 8: Parts

8.1 Parts Ordering

Whenever corresponding with your [Emerson sales office](#) about this equipment, always mention the controller serial number.



WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson, should not, under any circumstances, be used in any Fisher instrument. Use of components not supplied by Emerson may void your warranty, might adversely affect the performance of the instrument and could cause personal injury or property damage.

8.2 Parts Kits

Table 5. DPC2K Parts Kits

Kit	Description	Part Number
1*	I/P Converter Kit	38B6041X152
2*	Spare I/P Shroud Kit [kit contains shroud and hex socket cap screw, qty. 4]	GE29183X012
3*	Seal Screen Kit [kit contains 25 seal screens and 25 O-rings]	14B5072X182
4*	Relay Assembly [kit contains relay/shroud; relay seal; and mounting screws, qty. 4] Single-acting direct (relay C)	38B5786X952
5*	Process Pressure Sensor Assembly [kit contains process pressure sensor assembly, socket head screws, qty. 2; and O-rings, qty. 2] 0 to 2.1 bar / 0 to 30 psi 0 to 6.9 bar / 0 to 100 psi 0 to 20.7 bar / 0 to 300 psi 0 to 41.4 bar / 0 to 600 psi 0 to 103 bar / 0 to 1500 psi 0 to 344.7 bar / 0 to 5000 psi	 GK04999X012 GK05000X012 GK05000X022 GK05000X032 GK05000X042 GK05000X052

-continued-

Table 5. DPC2K Parts Kits (continued)

Kit	Description	Part Number
6*	Feedback Array Kit	
	Sliding Stem (Linear)	
	[kit contains • feedback array and hex socket cap screws, qty. 2, washer, plain, qty. 2, external tooth lock washer, qty. 2 (only with aluminum feedback array kit).	
	• 210 mm / 8-1/4 in. kit contains feedback array and hex socket cap screws, qty. 4, washer, plain, qty. 4, external tooth lock washer, qty. 4 (only with aluminum feedback array kit) and insert].	
	7 mm / 1/4-inch Aluminum	GG20240X012
	19 mm / 3/4 in. Aluminum	GG20240X022
	25 mm / 1 in. Aluminum	GG20240X032
	38 mm / 1-1/2 in. Aluminum	GG20240X042
	50 mm / 2 in. Aluminum	GG20240X052
	110 mm / 4-1/8 in. Aluminum	GG20240X082
	210 mm / 8-1/4 in. Aluminum	GG20243X012
	Rotary Array Kit with Pointer and Scale	
	[kit contains feedback assembly, pointer assembly, travel indicator scale and M3 machine pan head screws qty. 2].	
	Aluminum	GG10562X012
	Rotary Array Kit with Coupler	
	[kit contains feedback assembly, NAMUR coupler, M3 machine pan head screws qty. 2 and cap screw qt. 1]	
	Aluminum	GE71982X012
	Rotary Array Kit with Beacon	
	[Kit contains feedback assembly, beacon visual on/off indicator, indicator cover assembly, M3 machine pan head screws qty. 2 and M6 cap screws qty. 4]	
	Aluminum	GH19538X012
7	Alignment Template	
	For linear actuators (except GX)	GE43826X012
	For GX actuators	GE20586X012
8	Pipestand Mounting Kit (see Figure 34)	
	[kit contains hex nut, qty. 4; U-bolt strap, qty. 2; pipestand mount plate; U-bolt, qty. 2; and socket head cap screws qty. 4]	GK04788X012
* Recommended spare parts		

Figure 33. DPC2K Assembly Drawings

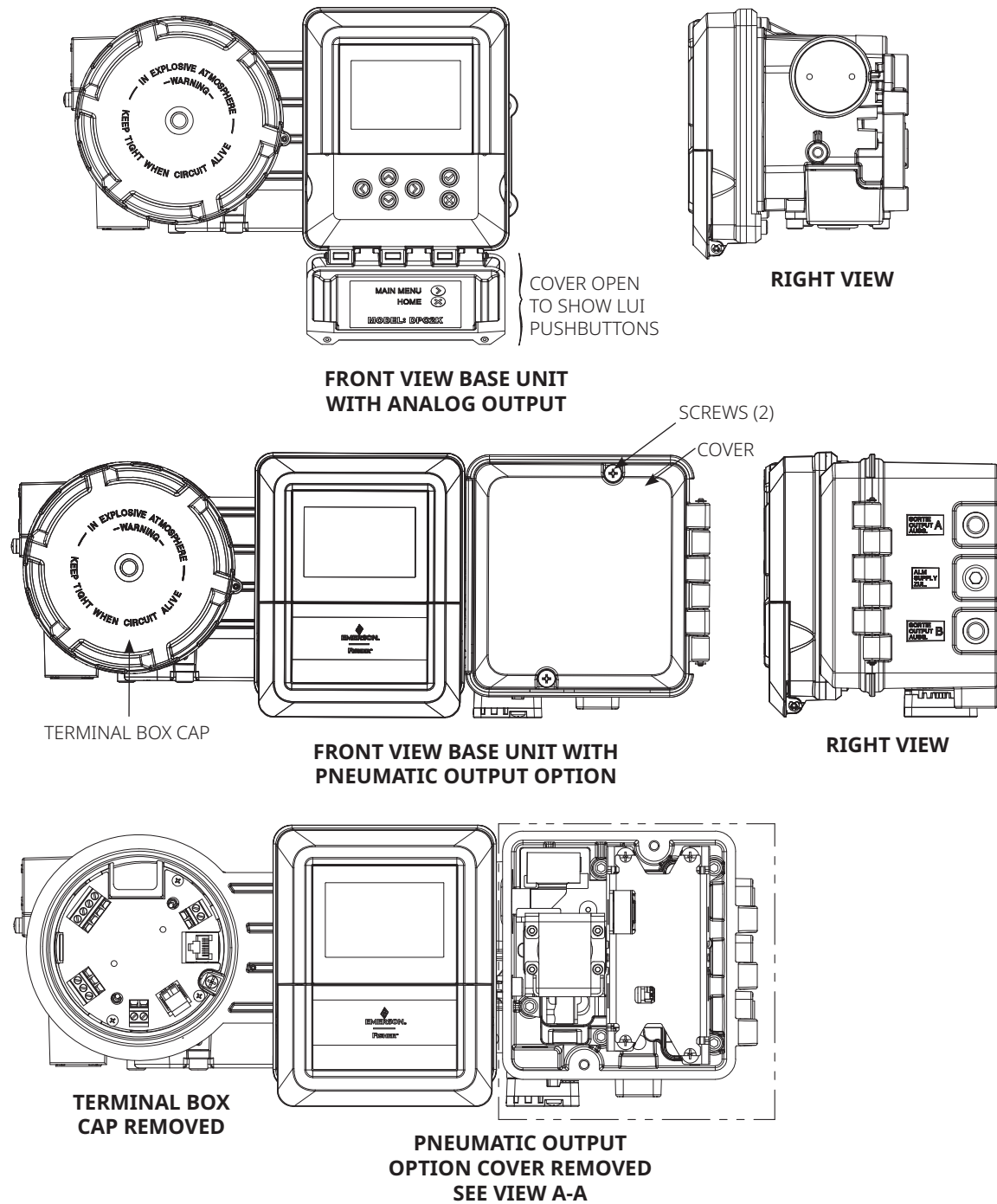
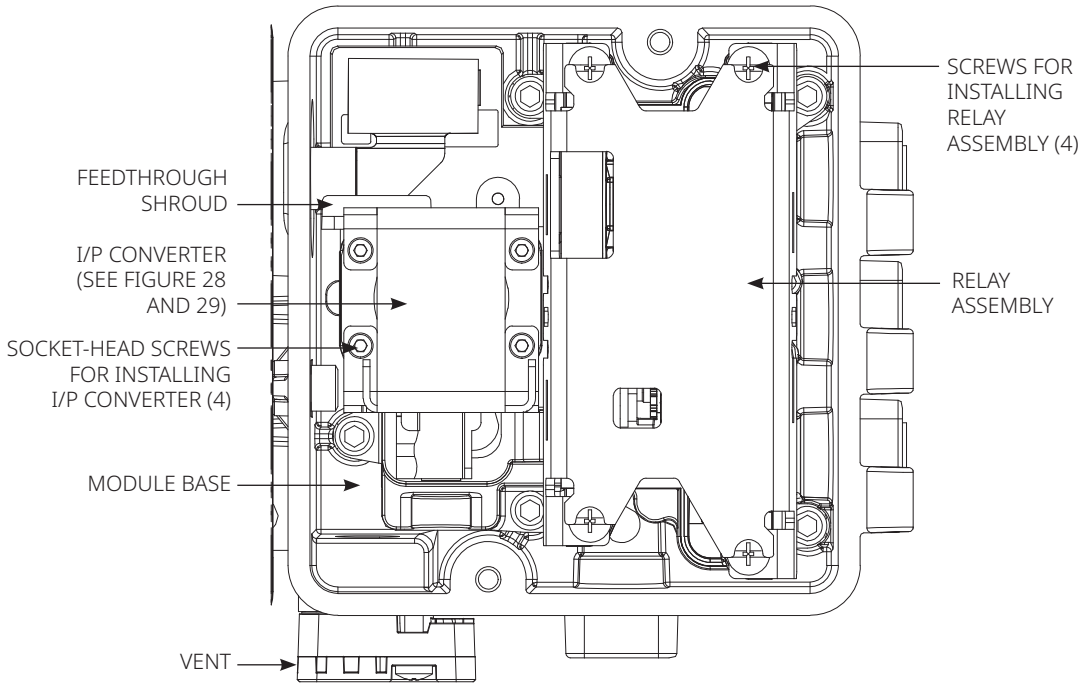


Figure 33. DPCP2K Assembly Drawings (continued)



VIEW A-A

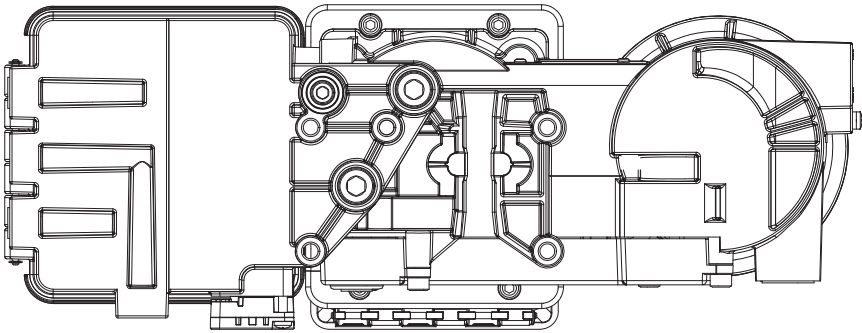
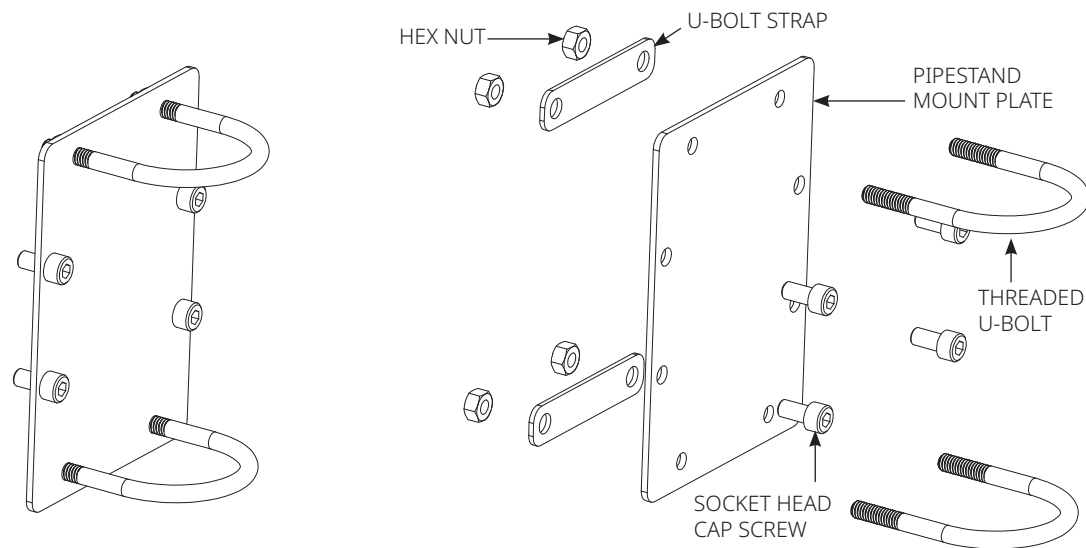
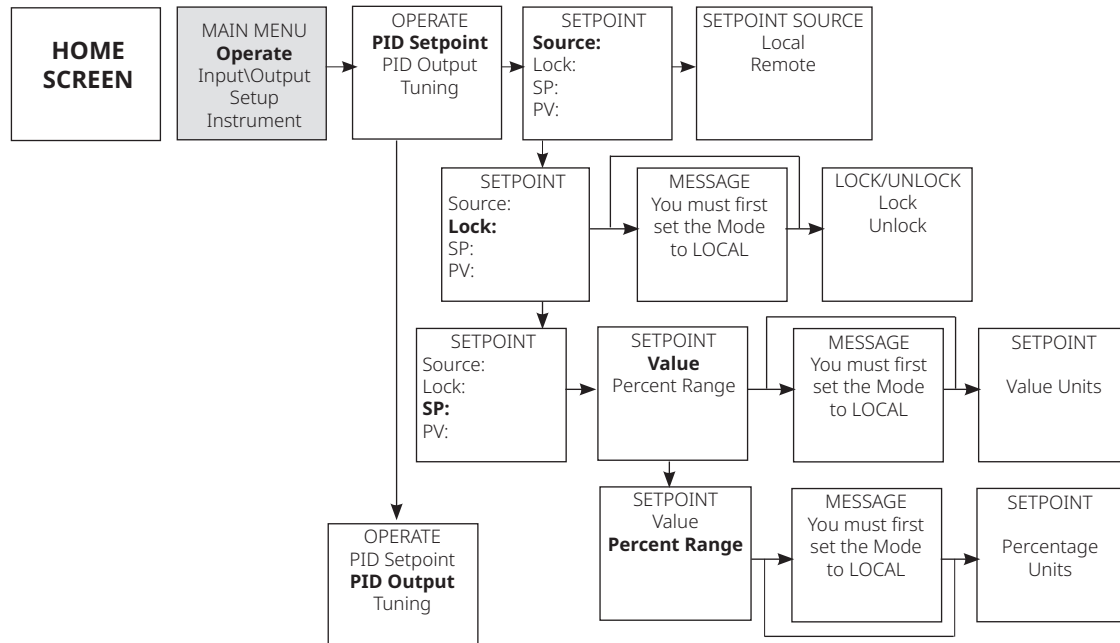


Figure 34. Pipestand Mounting Kit



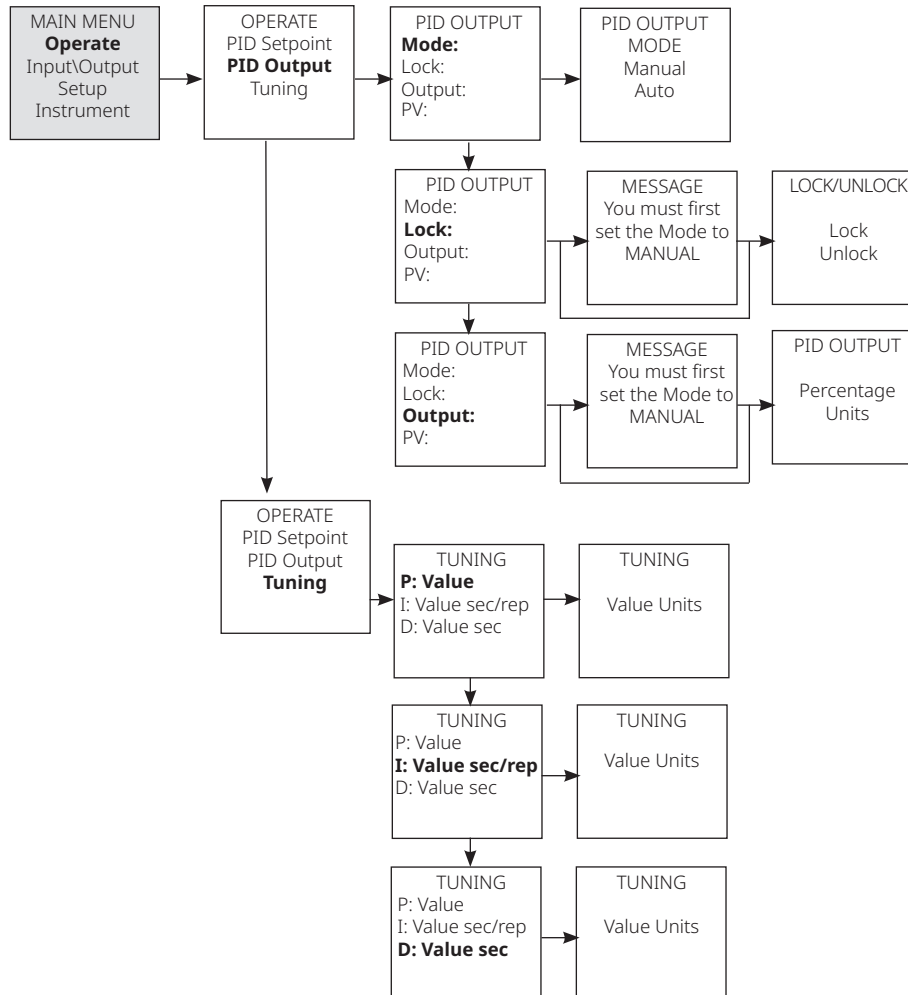
Appendix A: Local User Interface (LUI) Flow Chart

Operate

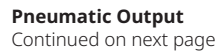


PID Output
continued on next page

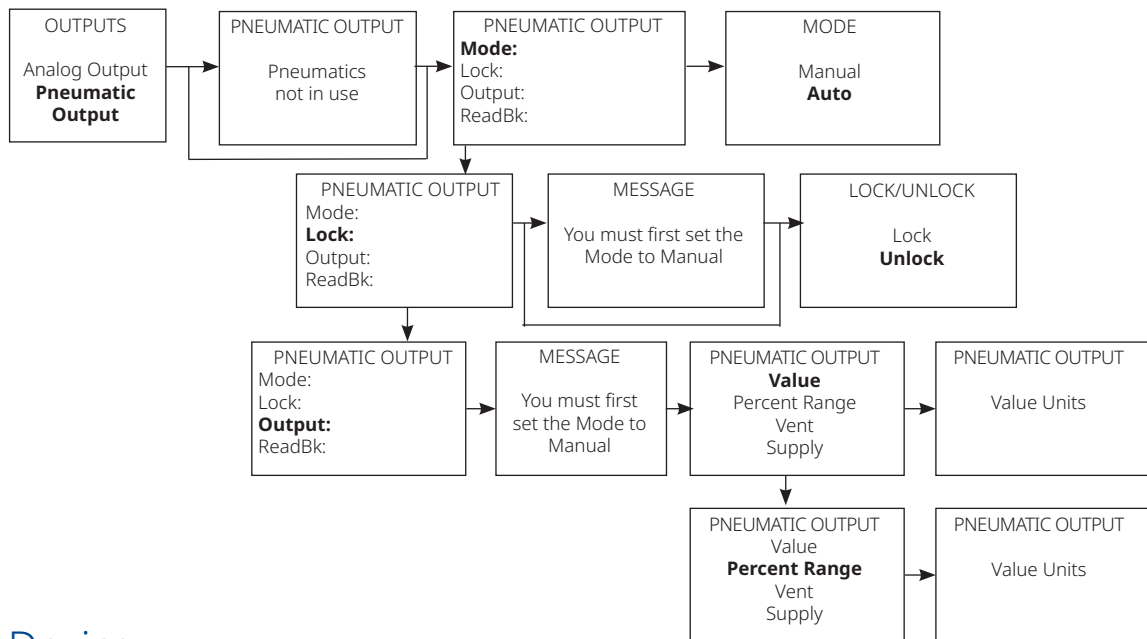
Operate (continued)



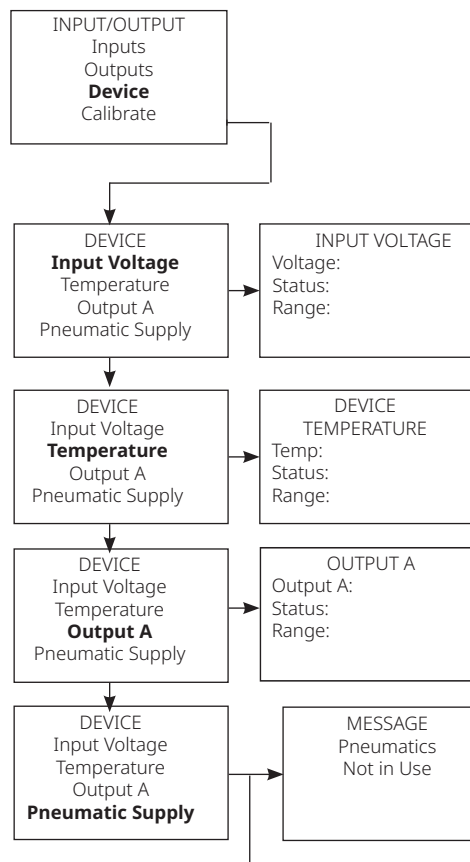
Inputs



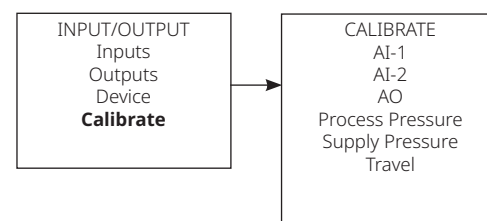
Outputs (continued)



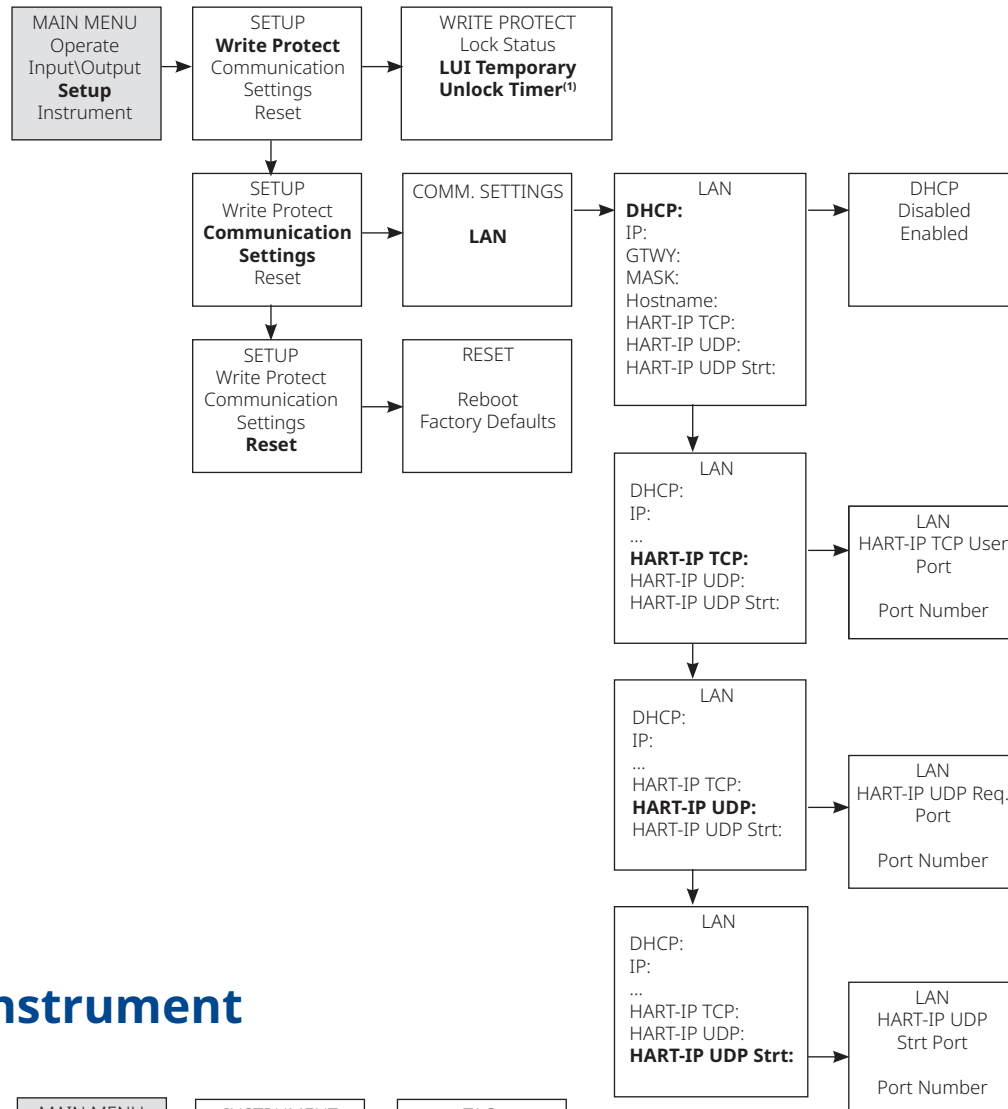
Device



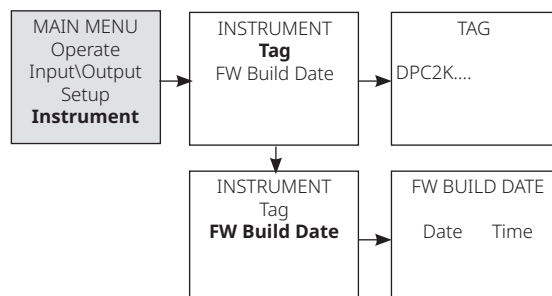
Calibrate



Setup



Instrument



1. LUI TEMPORARY UNLOCK TIMER ALLOWS YOU TO INITIATE A 5-MINUTE TEMPORARY BYPASS THROUGH THE LUI. THIS ALLOWS QUICK CHANGES TO BE MADE, SUCH AS CLOSING A VALVE, WITHOUT REMOVING THE TERMINATION COVER.

Appendix B: Modbus Register Information

Table B-1. DPC2K Modbus Register Information

Priority	Description	Type	Size	Read/Write	Coil Address	Modbus Address
1	PID_PV.Value	Float	4	R/W	---	6
1	PID_SP.Value	Float	4	R/W	---	19
1	PID_OUT.Value	Float	4		---	45
1	PID_MV.Value	Float	4	R/W	---	58
1	AI_1_ENG_VALUE.Value	Float	4	R	---	149
1	AO_CURRENT_ENG_VALUE.Value	Float	4	R	---	201
1	AI_2_ENG_VALUE.Value	Float	4	R	---	227
1	PROCESS_PRESSURE.Value	Float	4	R	---	240
1	PNEUMATIC_OUTPUT_A.Value	Float	4	R	---	292
1	PNEUMATIC_SUPPLY_PRESSURE.Value	Float	4	R	---	305
1	TRAVEL.Value	Float	4	R	---	318
2	PID_BK.Value	Float	4	R/W	---	71
2	PID_P.Value	Float	4	R/W	---	84
2	PID_I.Value	Float	4	R/W	---	97
2	PID_D.Value	Float	4	R/W	---	110
2	INPUT_VOLTAGE.Value	Float	4	R	---	123
2	ELECTRONIC_TEMPERATURE.Value	Float	4	R	---	136
2	AO_CURRENT.Value	Float	4	R/W	---	175
2	AO_READBACK.Value	Float	4	R	---	188
2	AI_2.Value	Float	4	R	---	214
2	SERVO_OUT.Value	Float	4	R/W	---	266
2	SERVO_READBACK.Value	Float	4	R	---	279
2	REMOTE_TRAVEL.Value	Float	4	R	---	331
2	PV_PERCENT_RANGE.Value	Float	4	R	---	409
2	AI_1.Value	Float	4	R	---	422
3	PID_SP.Override	Boolean	1	R/W	223	---
3	PID_SP.Manual	Boolean	1	R	228	---
3	PID_SP.Locked	Boolean	1	R/W	233	---
3	PID_SP_IN.Override	Boolean	1	R	239	---
3	PID_SP_IN.Fault State	Boolean	1	R/W	240	---
3	PID_OUT.Override	Boolean	1	R	255	---

- continued -

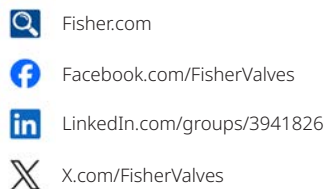
Table B-1. DPC2K Modbus Register Information (continued)

Priority	Description	Type	Size	Read/ Write	Coil Address	Modbus Address
3	PID_OUT.Fault State	Boolean	1	R/W	256	---
3	PID_OUT.Manual	Boolean	1	R	260	---
3	PID_OUT.Locked	Boolean	1	R	265	---
3	PID_MV.Override	Boolean	1	R/W	271	---
3	PID_MV.Fault State	Boolean	1	R	272	---
3	PID_MV.Manual	Boolean	1	R	276	---
3	PID_MV.Locked	Boolean	1	R/W	281	---
3	INPUT_VOLTAGE.High	Boolean	1	R	347	---
3	INPUT_VOLTAGE.Low	Boolean	1	R	348	---
3	ELECTRONIC_TEMPERATURE.High	Boolean	1	R	363	---
3	ELECTRONIC_TEMPERATURE.Low	Boolean	1	R	364	---
3	AI_1_ENG_VALUE.Override	Boolean	1	R	383	---
3	AI_1_ENG_VALUE.Manual	Boolean	1	R	388	---
3	AO_CURRENT.Override	Boolean	1	R/W	415	---
3	AO_CURRENT.Manual	Boolean	1	R	420	---
3	AO_CURRENT.Locked	Boolean	1	R/W	425	---
3	AI_2.Override	Boolean	1	R	463	---
3	AI_2.Manual	Boolean	1	R	468	---
3	AI_2_ENG_VALUE.Locked	Boolean	1	R	489	---
3	PROCESS_PRESSURE.Override	Boolean	1	R	495	---
3	SERVO_OUT.Override	Boolean	1	R/W	527	---
3	SERVO_OUT.Manual	Boolean	1	R	532	---
3	PNEUMATIC_OUTPUT_A.Override	Boolean	1	R	559	---
3	PNEUMATIC_OUTPUT_A.Manual	Boolean	1	R	564	---
3	PNEUMATIC_OUTPUT_A.Locked	Boolean	1	R	569	---
3	PNEUMATIC_SUPPLY_PRESSURE.High	Boolean	1	R	571	---
3	PNEUMATIC_SUPPLY_PRESSURE.Low	Boolean	1	R	572	---
3	NON_CONTACT_FEEDBACK.Bad	Boolean	1	R	673	---
3	AI_1.Override	Boolean	1	R	719	---
3	AI_1.Manual	Boolean	1	R	724	---
4	Device Malfunction	Boolean	1	R	0	---
4	Write Locked	Boolean	1	R	1	---
4	RTC Time Lost Alert	Boolean	1	R	2	---
4	Low Voltage Warning Alert	Boolean	1	R	3	---
4	Device Variable Limit Alarm Active Alert	Boolean	1	R	4	---

- continued -

Table B-1. DPC2K Modbus Register Information (continued)

Priority	Description	Type	Size	Read/ Write	Coil Address	Modbus Address
4	Device Variable Override Alert	Boolean	1	R	5	---
4	Active Application Verification Error Alert	Boolean	1	R	6	---
4	PID In Fault State Alert	Boolean	1	R	7	---
4	AO_IN Fault State Alert	Boolean	1	R	8	---
4	PPS Failure Alert	Boolean	1	R	9	---
4	AI-1 Bad Status Alert	Boolean	1	R	10	---
4	AI-2 Bad Status Alert	Boolean	1	R	11	---
4	AO_CURRENT Bad Status Alert	Boolean	1	R	12	---
4	Write Protect Unlocked	Boolean	1	R	13	---
4	Pneumatic Failure Alert	Boolean	1	R	14	---
4	Travel Not Calibrated Alert	Boolean	1	R	15	---
4	High Supply Pressure Alert	Boolean	1	R	16	---
4	Low Supply Pressure Alert	Boolean	1	R	17	---
4	Pneumatics In Fail Safe Alert	Boolean	1	R	18	---
4	SERVO_IN Fault State Alert	Boolean	1	R	19	---
4	SERVO_OUT Bad Status Alert	Boolean	1	R	20	---
4	Maintenance Required Alert (NE107)	Boolean	1	R	50	---
4	Device Variable Alert	Boolean	1	R	51	---
4	Critical Power Alert	Boolean	1	R	52	---
4	Failure Alert (NE107)	Boolean	1	R	53	---
4	Out Of Specification Alert (NE107)	Boolean	1	R	54	---
4	Function Check Alert (NE107)	Boolean	1	R	55	---
4	Device Variable Simulation Alert	Boolean	1	R	66	---
4	NVM Defect Alert	Boolean	1	R	67	---
4	Command 48 Byte 8, Bit 2	Boolean	1	R	68	---
4	Watchdog Reset Alert	Boolean	1	R	69	---
4	Command 48 Byte 8, Bit 4	Boolean	1	R	70	---
4	Environmental Conditions Alert	Boolean	1	R	71	---
4	Electric Defect Alert	Boolean	1	R	72	---
4	Device Configuration Locked Alert	Boolean	1	R	73	---
4	Status Simulation Alert	Boolean	1	R	74	---
4	Discrete Variable Simulation Active Alert	Boolean	1	R	75	---



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