

# EHPC210 Universal Controller

## Operation Manual



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## Associated Documentation

The following is a list of documentation associated with this manual. Any product specific documentation is generated by Bifold based on the part code selected.

- EHPC210 Part Code Selection Chart
- Product Specific Layout Drawing
- Product Specific Wiring Schematic
- ORM0012 – EHPC210 Installation and Maintenance Manual
- ORM0018 – BPS-30W-RELAY Operation and Maintenance Manual
- ORM0020 – BPS-150W Operation and Maintenance Manual
- ORM0021 – BPS-DCSS Operation and Maintenance Manual

## Electrical Interface

Please refer to the specific schematic for the ordered EHPC210 Universal Controller for more details on electrical connections. All connections to the EHPC210 Universal Controller are external to the Ex d enclosure.

The connections are either made via a close-coupled Exe enclosure, or via a flying lead which is connected to a remote enclosure, usually Exe also.

### Power Supply

Power Supply	24V dc $\pm$ 10%
Consumption (Controller Only)	50mA max
Total Current Out (max) (Solenoids and outputs)	2A

### Solenoid Outputs

Configurable Solenoids	Up to 3 – specified at order
Voltage	24V dc
Load Current (max)	1A

### ESD Interface Signal

ESD Valve monitoring	24V dc
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ESD Interrupt Relay	24V dc 2Amax
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### Digital Inputs

Configurable Inputs	Up to 7 – specified at order
Voltage	24V dc
Input Current	5mA
On Level	12V
Off Level	4V

### Digital Outputs

Configurable Outputs	Up to 10 – specified at order
Voltage	24V dc open drain, switching to ground
Load Current (max)	250mA

### Analogue Inputs

Configurable Inputs	Up to 5 – specified at order
Input Type	Current Voltage Potentiometer
Voltage Input Range	0-3V
Voltage Input Impedance	100Kohms
Current Input Range	4-20mA
Current Input Impedance	300 Ohms
Resolution	1 in 3600

### Analogue Outputs

Configurable Outputs	Up to 1 – specified at order
Output Type	Voltage
Voltage Output Range	0-3V
Resolution	1 in 3600

### Isolated Analogue Signals

Input Type	Current Loop Powered
Current Input Range	4-20mA Loop Powered
Current Input	5V effective load
Resolution	1 in 3600
Output Type	Current
Current Output Range	4-20mA sinking only
Resolution	1 in 3600

# Introduction

## Overview

The EHPC210 Universal Controller can be used to operate a hydraulic or pneumatic control system and is generally used for the control of linear or rotary actuators. It can also be used for hydraulic power pack control and has the ability to customise its inputs, outputs and its operation.

The key factor is the EHPC210 controller's flexibility in operating a wide variety of field devices, such as solenoid valves, pumps and field instrumentation.

The EHPC210 part number must be configured at selection using the EHPC210 Part Code Selection Chart. Here this will define the control switch location, any integral feedback, additional power supplies, motor control options and most importantly the available I/O provided.

The EHPC210 is either supplied close coupled to an Exe enclosure, or with a 3m flying lead for remote termination to an external enclosure or system.

## Actuator Control

Typically the EHPC210 Universal Controller is used to control either hydraulic or pneumatic actuators. It can either modulate or position the actuator to a desired command or demand 4-20mA signal, or it can open or close the actuator when required.

If the EHPC210 is selected with a command 4-20mA input signal and the user selects an actuator feedback signal, either as an integral sensor or an external analogue instrument, the EHPC210 can be set to automatically position the actuator based on these signals.

If any input actions override the standard positioning as above then the action will take precedence. For example if the actuator is opening to meet a desired command signal, but a digital input action is closing the actuator it will close.

A signal fault set within the EHPC210 overrides everything and takes priority. For example a loss of an analogue feedback signal can be set to close the actuator by default.

If there is no 4-20mA command signal or no analogue actuator feedback, then it is not possible to automatically position the actuator and the opening and closing actions will need to be defined by the user. For example a remote open signal can be set to drive the actuator open.

## Setup Overview

The user is fundamental in setting up the EHPC210 for use in the field. All the options are configurable and can be set up.

The key is to follow the below sequence when setting up a virgin EHPC210 unit, ignoring any sections which are not required:

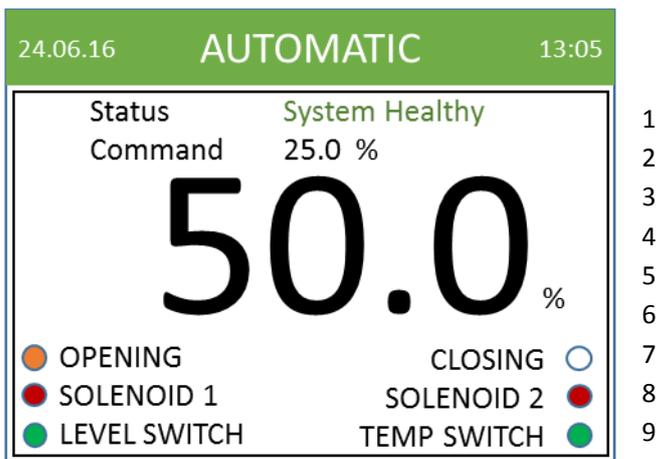
1. [Set up Solenoid Outputs](#)
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3. [Set up Digital Inputs](#)
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## Home Screen

The EHPC210 Universal Controller is fitted with a colour TFT display, used for monitoring, settings and calibration. Local operation and setup is via the control switch.

The first screen displayed is the Automatic screen. To switch to Manual operation, briefly press the control switch on the side of the EHPC210 Universal Controller. Pressing the control switch briefly will toggle between Automatic and Manual operation.

The screen is broken down into nine configurable lines, which are set up in the display settings menu explained later within this document.



The top of each screen contains the title bar which indicates which screen is currently displayed, the current time and the current date.

### Automatic Screen

The automatic screen is where the EHPC210 Universal Controller will operate the actuator, solenoid valves, pump or instrumentation via a remote automatic signal source.

This may be a 4-20mA command signal, digital inputs or other analogue instrumentation, such as pressure or level transmitters. This control is set within the menus.

As discussed previously, the EHPC210 is generally used to control or position a hydraulic or pneumatic actuator. The automatic screen can display the current position of the actuator as well as other variables, such as the command signal or pressure.

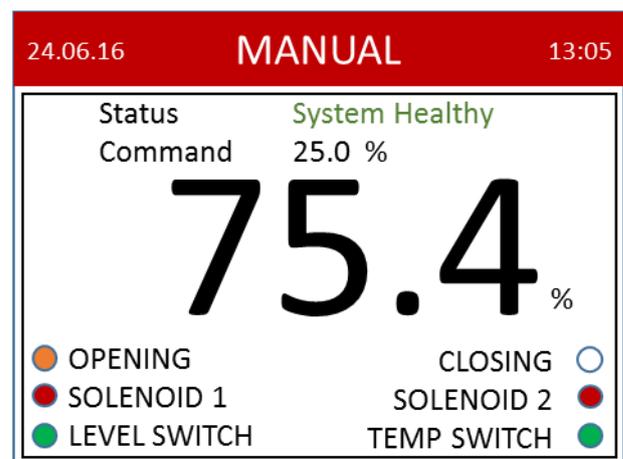
The status of the system can also be displayed here. If the system has no warnings or faults, System Healthy will be displayed in green. If a warning alarm is present, the Status description will be amber with details as to what has caused the warning.

Similarly if a fault alarm is present the Status description will be Red with details of what has caused the fault. If there is more than one fault or warning, these will cycle every second to give indication of all present faults or warnings.

There are up to ten configurable LEDs on the screen. These can be set to display a number of digital variables, such as whether the actuator is opening or closing, any limits or the status of any outputs such as solenoids or pumps.

For more information on the display read the display screen settings section.

### Manual Screen



If the control switch is pressed inwards briefly the screen will change to Manual Mode. The manual screen is used to control the EHPC210 manually using the control switch.

If set to automatically position an actuator, the EHPC210 will now ignore the current Command Signal and any actions that are set to operate in automatic only. The solenoids and pump outputs can be operated directly from the switch – away to Open and towards to Close. There is a software interlock to prevent over travel in manual mode with the limits set within the menus.

## Menus and Navigation

The main menu screen is used to navigate through the menus to setup the EHPC210 Universal Controller. If the control switch is held in for greater than 2 seconds within manual mode the full setup menu screen can be accessed.

The control switch is used for navigating all menus, selecting and changing choices, entering any selection windows and also modifying parameters.

Towards and away on the control switch moves the highlighted menu choice accordingly and pressing the control switch selects the highlighted choice.

In all menus or windows, holding away on the control switch for greater than 2 seconds will return to the previous menu level, exit any selected windows, or if at this top menu screen, will return to Manual Mode operation.

Within a selector box, holding back on the control switch for a prolonged period will remove the selection from this box. This can be used to turn off a selection, for example to remove a selected input or output. Removing any selection for an input or output will also remove any settings, rules or faults associated with that input or output.

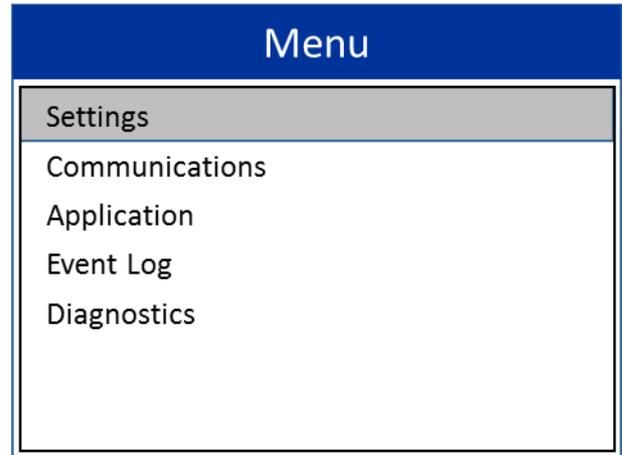
Please note that if a selector box is left without a selection made, the desired function will not be carried out. Therefore it is important to ensure all selector boxes have a selection made. To exit a selector box without removing all selections you must select one of the available choices from the drop down list.

Within a text box, holding away or towards will increase or decrease the numeric value. To exit a text box press the control switch briefly.

Holding towards on the control switch will cycle through all the available choices.

### Main Menu

The main menu displayed is as follows:



Use the control switch to navigate to the desired selection, then press to access that section. The following sections detail the setup and use of each menu section.

## Settings Menu

The settings menu displays as follows:

Settings	
Date and Time	
Display	
About	

### Date and Time

Date and Time	
Date	
Time	
Date Format	dd/mm/yy ▾
Time Format	24hr ▾
Time Zone	GMT ▾

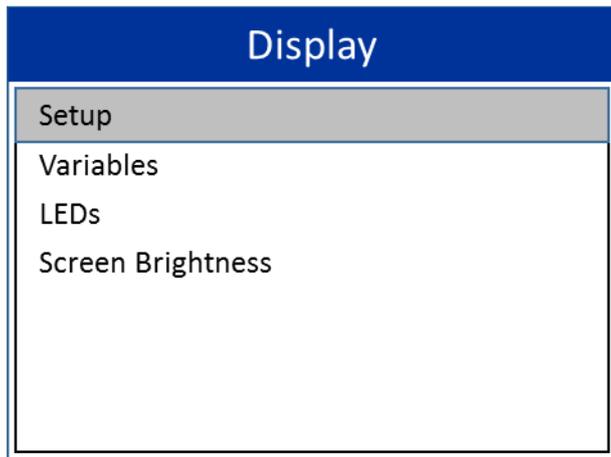
Here the date and time menus can be accessed as well as the date format, time format and time zone. Set the date within the date menu. The time will not change with daylight saving.

Date	
Day	31
Month	August ▾
Year	2016

Set the time within the time menu. AM and PM will be greyed out if 24hr format is selected.

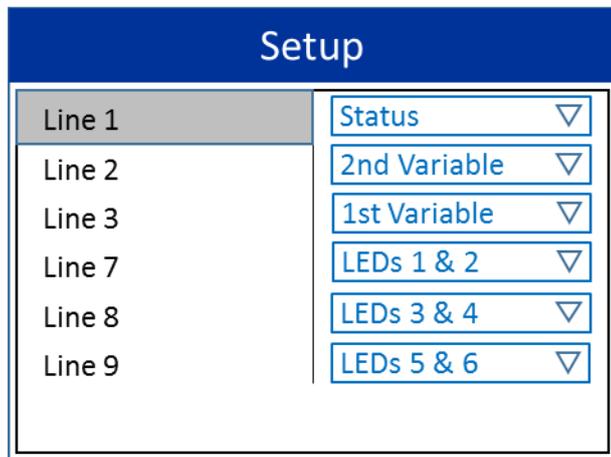
Time	
Hour	13
Minute	30
Period	<input type="checkbox"/> AM <input checked="" type="checkbox"/> PM

## Display



The display menu is used to setup the front screen display in both Automatic and Manual. The setup option is used to change the screen layout, variables sets which data is used on the screen, the LEDs option selections what to show with the selected LEDs, and screen brightness sets the brightness of the display.

## Setup

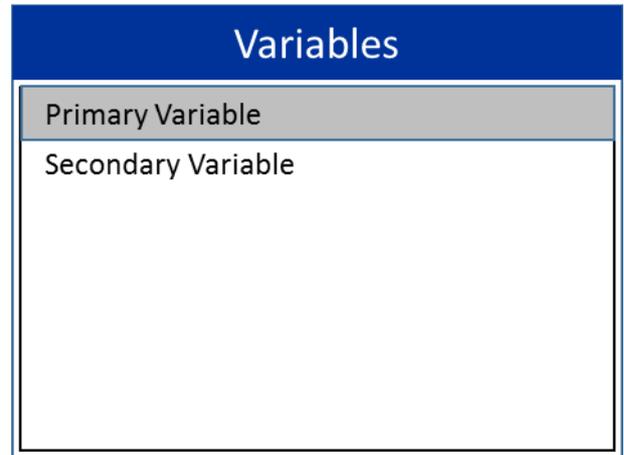


The display setup screen is used to select what is shown on the 9 available lines of the front display screen. Each line can be selected to show:

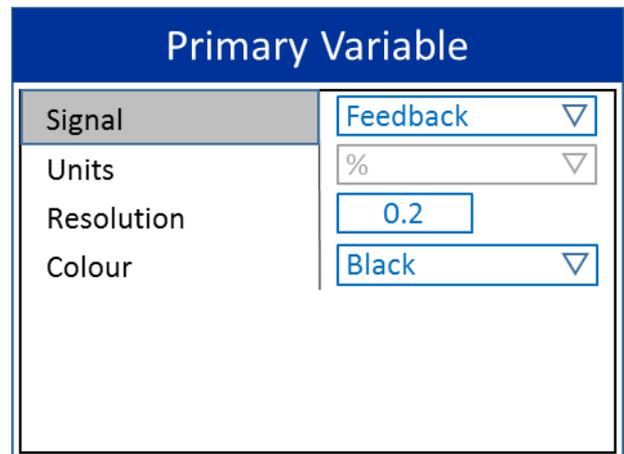
- Variables – up to five analogue variables
- Status – Any warnings or faults present
- Operations – Any operations present
- LEDs – Up to 10 LEDs shown in pairs
- Blank – An empty line on the display

## Variables

The primary variable is shown as a large text font and takes up four of the available lines. This is generally used for either actuator feedback or if another primary variable is driving the system, such as a hydraulic pressure.



The variables menu will show as many variables as have been selected in the settings menu. Above the primary and secondary variables have been selected.

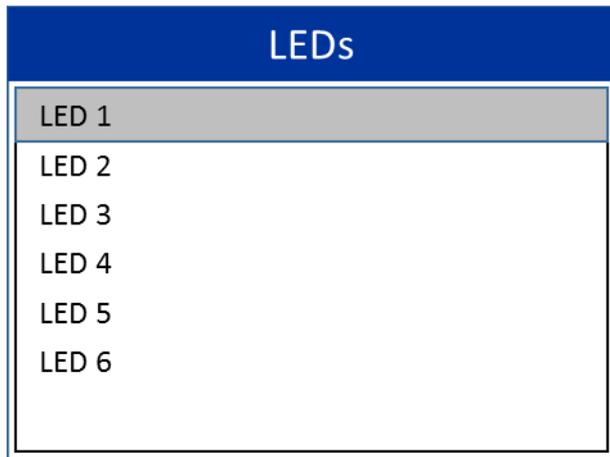


Selecting any of the variables will enter a further screen which is used to select what is set as each variable. Here a choice is made as to which signal is selected as the variable. This can be any of the analogue inputs or the integral feedback, either linear or rotary, if this has been selected as part of the EHPC210 part code.

The units will by default match the units that have been set for the selected signal, this is greyed out but shows as a reminder to the use.

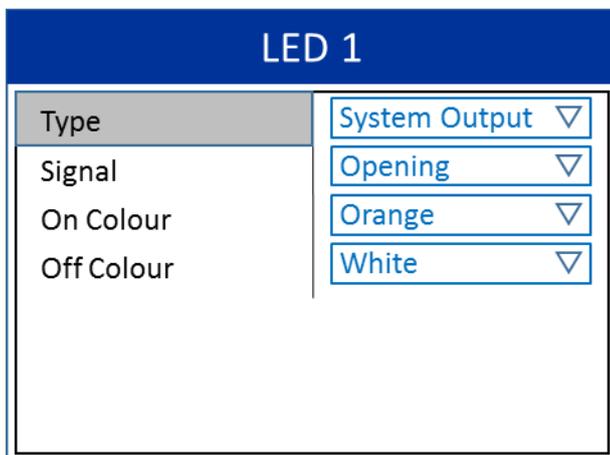
A resolution is set to avoid any fluctuations in the display setting, by default this is set to 0.2% of the variable range. The colour is selected as to how the variable will be displayed.

**LEDs**



The LEDs menu displays as many LEDs as have been selected in the display settings section. These are chosen in pairs and there are up to 10 LEDs available.

Selecting any of the LEDs will enter a further menu that is used to set on each LED.



The type selection is used to select what the LED is representing. This can be any one of the following:

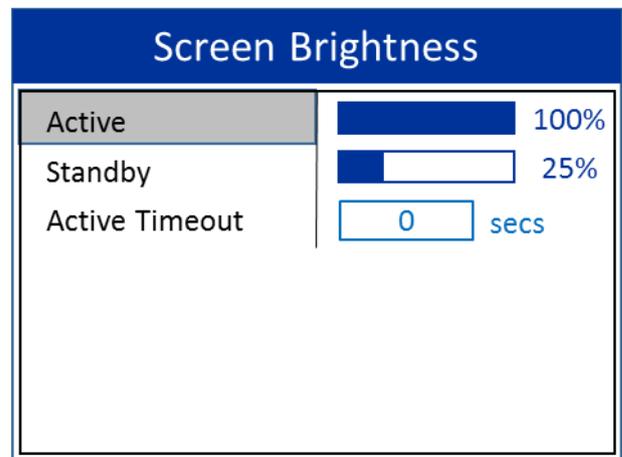
- Solenoid Outputs – any solenoid output
- Digital Input – any setup digital input
- Digital Output – any setup digital output
- System Output – any of the default system outputs
- Blank – No LED shown

For more information on the available inputs and outputs, along with system outputs please see the relevant section later within this document.

Once the type has been selected, the signal window will display all the available options from that type. For example if the digital input type has been selected, all the setup digital inputs will be shown.

Finally an On colour and an Off colour can be set for each LED. The on colour is displayed when the signal is on or high, the off colour when the signal is off or low.

**Screen Brightness**



The screen brightness menu sets the brightness of the display in both active and standby modes.

Active mode is present whenever the switch is operated and can be modified by selecting Active and using the control switch to vary the level. The display brightness will change as you modify the setting to give an indication of the selected brightness.

Similarly the standby mode brightness is set in the same method by selecting Standby and using the control switch to vary the level.

Standby mode will initiate a number of seconds after the control switch has been used. The number of seconds is set by the Active Timeout setting. By selection this as 0 seconds the standby brightness setting will never be reached.

## About

About	
Product Code	UC-FRSLIL
I/O Code	2033003
Serial Number	RG0716-0001
Software Release	V3.14
Date of Build	24.06.2016

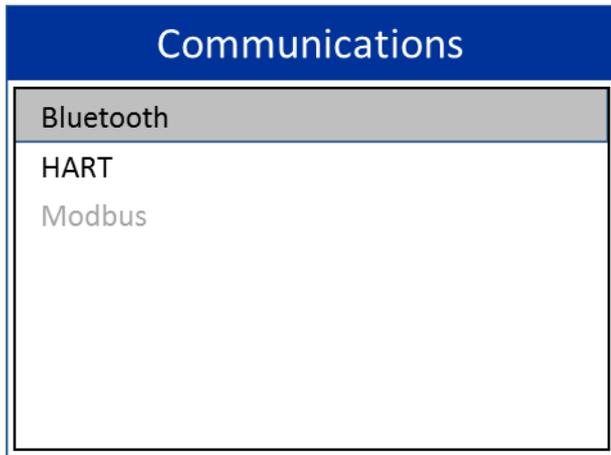
The about screen is used to display the information about the setup of the EHPC210 and is a read only screen. Here the information is displayed which is factory set at Bifold.

The product code is used to set up the EHPC210 control switch location and whether a linear or rotary integral feedback device is set. The I/O code defines the inputs and outputs that are present and can be set up on the unit. For more information please see the EHPC210 part code selector chart.

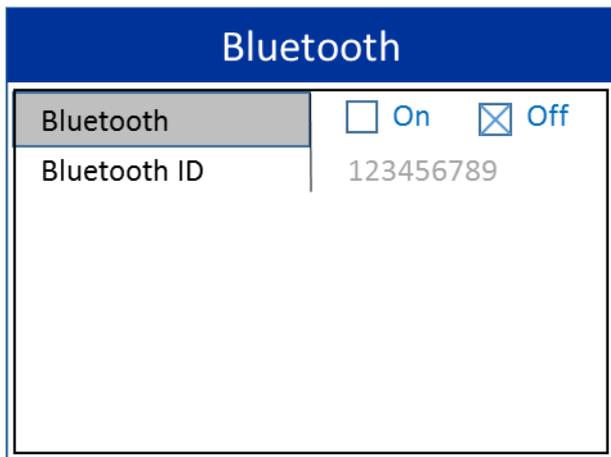
The serial number identifies the unit and can be used for any correspondence with Bifold as well as the software release and the date of build.

## Communications Menu

The communications menu will be displayed as follows:

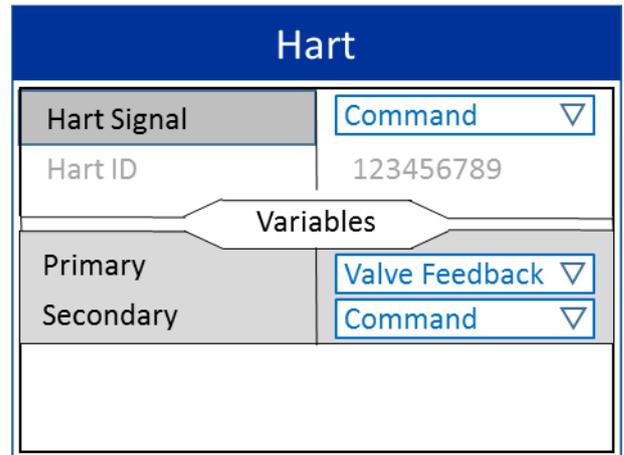


### Bluetooth



The Bluetooth screen is used to turn the Bluetooth communications on or off and displays the Bluetooth ID for reference, which is factory set at Bifold.

### Hart



The Hart menu is used to select if the Hart signal is present on the Command or Retransmission loops. Also displayed is the current Hart ID of the unit which is read only for information.

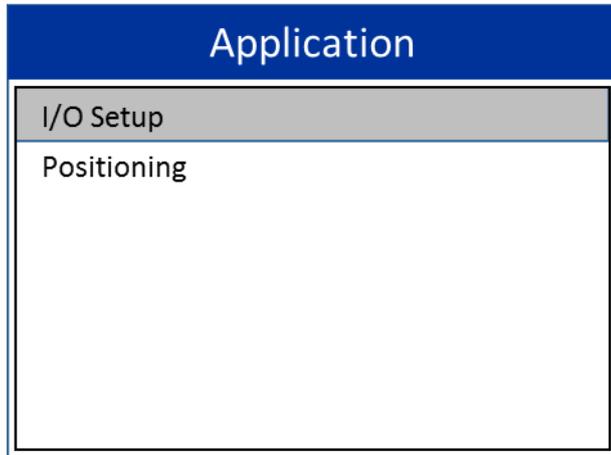
The variable window is used to select which two variables are available over the Hart signal as the primary and secondary variables.

### Modbus

Modbus selection will be added in a later software version.

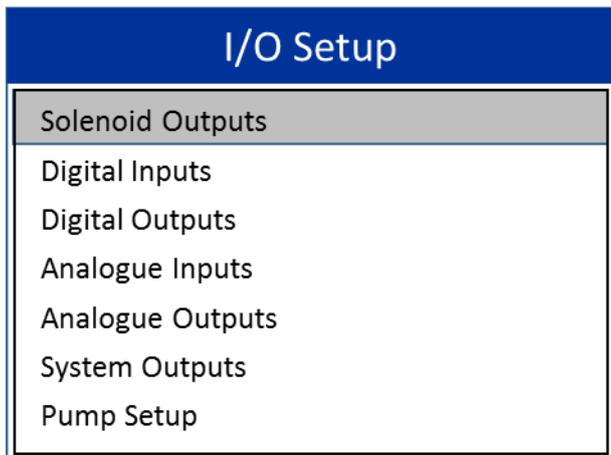
## Application Menu

The application menu will be displayed as follows:



### I/O Setup

The Input and Output (I/O) setup menu will be displayed as follows:

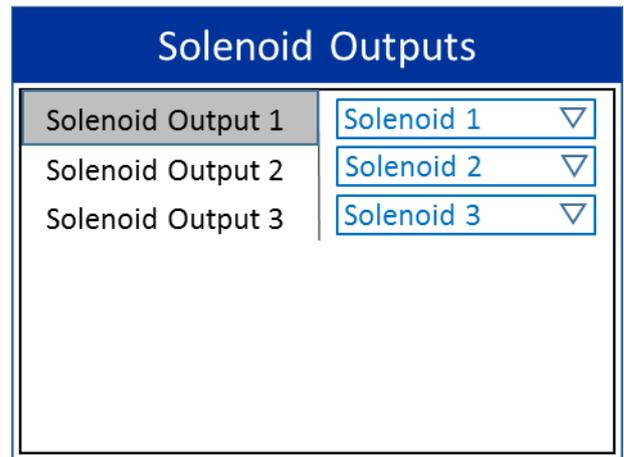


This menu is used to set all the available inputs and outputs as defined within the EHPC210 Universal Controller part code including the I/O code.

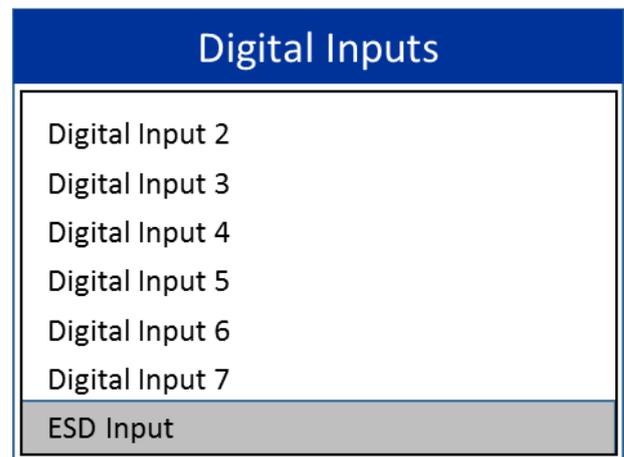
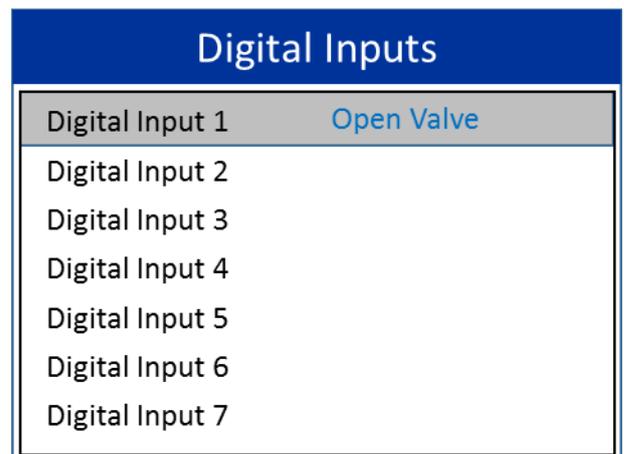
It is also used to set up the default system outputs and the pump setup, if a pump output has been selected in the digital outputs.

### Solenoid Outputs

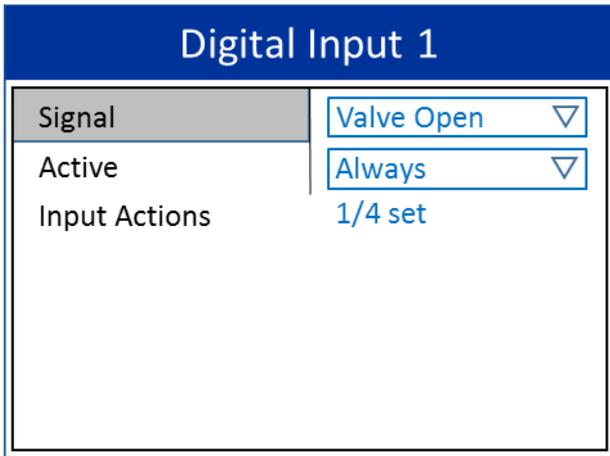
This menu is used to allocate names to the solenoid outputs. The number of solenoids shown will be determined by the EHPC210 part code selected.



### Digital Inputs



The digital inputs menu shows the number of digital inputs as selected by the EHPC210 part code. Any inputs that have been assigned already will show the selected name in the list. The ESD Input selection will also be shown if selected within the EHPC210 part code. Each digital input can be selected individually and the following screen is displayed:

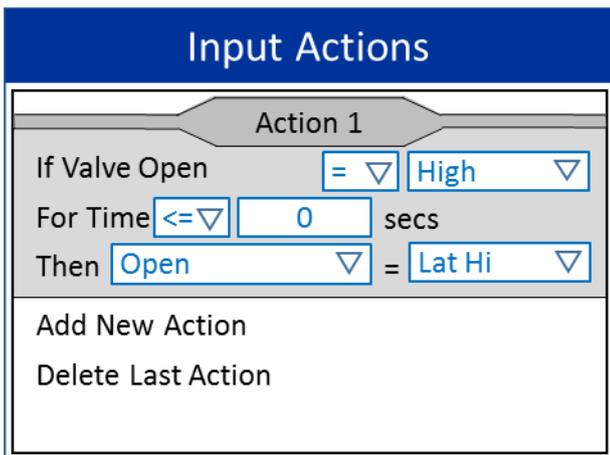


Select the signal type from the drop down list. The available signals are discussed later within this manual. This selection only defines the name of the digital input not its function. This is allocated within the input actions section.

The Active setting selects which mode the input actions work in for this digital input. The Input Actions selected will then only work when in the specified operating mode. The options are

- Always – automatic and manual modes
- Automatic – automatic mode only
- Manual – manual mode only

**Input Actions**



The final choice enters the Input Actions screen for the selected digital input. For each digital input up to 4 input actions can be defined, the number of actions currently set is displayed. The screen above is shown to set an Input Action.

Initially for each input no actions will be present. To add an input action, select Add New Action. This will display Action 1 window. This window can be selected to modify the rules of this input action. Delete last actions removes the last action for the selected digital input.

The digital input signal type will be set for each input. First select whether this input action will occur when the signal is either high, the digital input is present, or if the signal is low, the digital input is not present.

Next a time period can be set to delay the result of the action. Here the user can select either less than or equal to, or greater than or equal to. Then a number of seconds can be set. For example for a digital input action to occur after 2 seconds, this can be set to greater than or equal 2 seconds.

Finally the input action output can be set. Here any of the system outputs or selected digital outputs can be set. For more information on system outputs or digital outputs, please see the relevant section of this manual.

The input action output can then be set to either low, high, latched low (Lat Lo) or latched high (Lat Hi). A latched high or latched low action will maintain after the input action set has been removed.

For a momentary input, such as a push button, use either a latched low or high action to set the output accordingly. For a constant digital input, such as a switch, set either low or high, or latched if required.

A low or latched low output action will always over rule a high or latched high output action set for another input action.

For example if a Pressure Switch input is setting a Hydraulic Pump to run by setting this output to latched high, but a Level Switch input is interlocking the Hydraulic Pump by setting the output to low, then the Pump Output will always be pulled low by the Level Switch.

If no action is currently being set for an output it will revert to its default state.

If an input action is set to one of the system outputs that positions the actuator, this will take priority over the command signal positioning.

### ESD Input

The ESD Input menu is identical to each of the digital input menus, with the signal type greyed out as this will monitor the 24VDC ESD Solenoid Valve at all times.

This input is used to monitor the ESD Input 24VDC signal in order to perform an action based on its presence. For example on the presence of the ESD Input the actuator can be set to Open or Close depending on the type of ESD signal required.

### Digital Outputs

Digital Outputs	
Digital Output 1	Run Pump
Digital Output 2	System Fault
Digital Output 3	Manual Mode
Digital Output 4	
Digital Output 5	
Digital Output 6	
Digital Output 7	

The digital outputs menu shows the number of digital outputs as selected by the EHPC210 part code. Any outputs that have been assigned already will show the selected name in the list.

Each digital output can be selected individually and the following screen is displayed:

Digital Output 1	
Signal	Pump Run ▾
Type	Operation ▾
Default	Low ▾

Here the signal type can be selected from the drop down list. The available signals are discussed later within this manual. This selection only defines the name of the digital output not its function.

This function is allocated within the input actions section for either digital or analogue inputs. The exception for this are the default signal outputs signals and the pump run output that can be called from the positioning menu. For more information on the default signal output signals, see later in this manual

The next drop down box selects the type of digital output. This is whether the output type is an Operation Notification, Warning or Fault type. If the digital output is an alarm it can be set to a warning or a fault. If this output then occurs it will change the state of the System Warning or System Fault default system outputs accordingly.

The default for each output is also set here as either low (off), or high (on). This is used to set the default for this output when no actions are defined to change its status. For example a pump run output is always low unless called to run.

### Analogue Inputs

Analogue Inputs	
Analogue Input 1	Valve Feedback
Analogue Input 2	Pressure
Analogue Input 3	Temperature
Analogue Input 4	
Analogue Input 5	
Command	
Internal Feedback	

The analogue inputs menu displays the number of analogue inputs as selected by the EHPC210 part code. Any inputs that have been assigned already will show the selected name in the list. Also displayed here are the Command input and Internal Feedback if selected by the EHPC210 part code.

Each analogue input can be selected and shows the following screen. The second screen shown is the continuation of the screen and can be accessed by scrolling down the page.

Analogue Input 1	
Signal	Feedback ▾
Signal Type	Current ▾
Unit	% ▾
Active	Automatic ▾
Input Actions	2/8 set
Signal Faults	1/4 set
Calibration	

Analogue Input 1	
Active	Automatic ▾
Input Actions	2/8 set
Signal Faults	1/4 set
Calibration	
Actual Limits	
Minimum	0.0 %
Maximum	100.0 %

Here the signal can be selected from the drop down list. The available signals are discussed later within this manual. This selection only defines the name of the analogue input not its function. This is allocated within the input actions section.

The signal type defines if the analogue input is a current, 4-20mA, or voltage, 0-3V or potentiometer, input. The unit dropdown box selects the unit of measurement used for this analogue input.

The Active setting selects in which operating modes the analogue input is active. The Input Actions selected will then only work when in the specified operating mode.

The options are:

- Always – automatic and manual modes
- Automatic – automatic mode only
- Manual – manual mode only

The input actions section is used to set the actions for each analogue input and is discussed later in this section. The signal faults option selects the signal faults available for this analogue input. This screen is discussed later within this section. The number of current input actions and signal faults set is displayed also.

Calibration is also discussed later within this section and is used to calibrate the specific analogue input selected.

The actual limits window is used to set the range of the displayed calibrated value for the analogue input. For example 0 to 100% for actuator position, or 0-250 bar for a pressure transmitter.

### Input Actions

Input Actions	
Action 1	
If Valve Feedback	<= ▾ 0.5 %
For Time	>= ▾ 1 secs
Then	Close Limit ▾ = High ▾
Add New Action	
Delete Last Action	

For each analogue input up to 8 input actions can be defined. The screen above is shown to set an Input Action. Initially for each input no actions will be present. To add an input action, select Add New Action. This will display Action 1 window. This window can be selected to modify the rules of this input action.

The analogue input signal type will be set for each input. First select whether this input action will occur when the signal is either less than or equal to a value, or greater than or equal to a value.

The value is then set in the next box to allocate the value the analogue input value is compared to. The unit of measurement will be displayed according to the setup.

Next a time period can be set to delay the result of the action. Here the user can select either less than or equal to, or greater than or equal to. Then a number of seconds can be set. For example for an analogue input action to occur after 2 seconds, this can be set to greater than or equal 2 seconds.

Finally the input action output can be set. Here any of the system outputs or selected digital outputs can be set. For more information on system outputs or digital outputs, please see the relevant section of this manual.

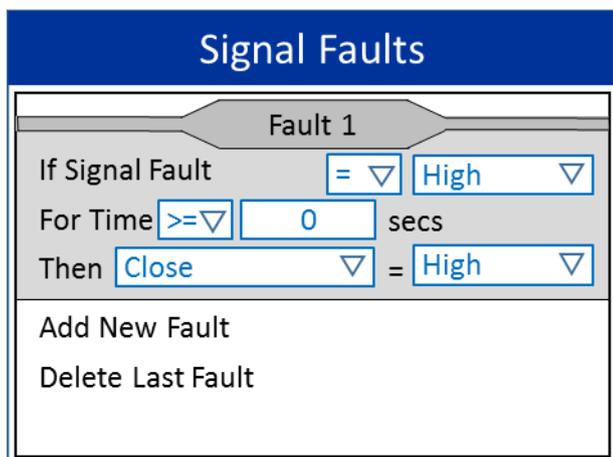
The input action output can then be set to either low, high, latched low (Lat Lo) or latched high (Lat Hi). For a momentary action, use either a low or high action to set the output accordingly. For a latched action, set either latched low or latched high.

A low or latched low output action will always over rule a high or latched high output action set for another input action.

For example if both a Pressure Transmitter input is setting a Hydraulic Pump to run by setting this output to latched high when below a certain pressure value, but a Level Transmitter input is interlocking the Hydraulic Pump by setting the output to low when below a set level, then the Pump Output will always be pulled low.

If an input action is set to one of the system outputs that positions the actuator, this will take priority over the command signal positioning.

**Signal Faults**

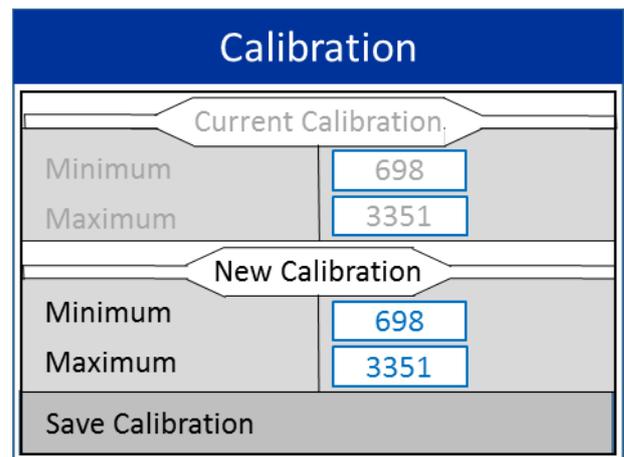


The signal faults menu is used to set any faults that occur if the analogue input falls out of measured range. There are up to 4 signal faults per analogue input and these are set in exactly the same way as the input actions, high meaning the signal is outside the analogue measurement range.

A signal fault will always override an input action. If an input action is setting an output low, but the signal fault is pulling this high the output will be pulled high by the signal fault.

A low signal fault output will also take precedence over a high signal fault output. Also if a signal fault is set to one of the system outputs that positions the actuator, this will take priority over the command signal auto positioning.

**Calibration**



Each analogue input must be calibrated against the actual raw value at both the minimum and maximum ends of its range.

To modify the calibration select the New Calibration window and select the minimum value. Now inject into the analogue input the exact value required for the minimum value. Do the same for the maximum valve.

If the analogue input is set to Valve Feedback then the open and closed actions set in the Positioning menu can be set by using towards and away on the control switch whilst setting minimum and maximum signals.

This can be used to calibrate the open and close positions of the actuator by moving to the correct point of the travel.

### Command

The command input is very similar to the analogue input selection. This is only available when the command signal has been selected in the EHPC210 part code. The following screen displays when command is selected. The second screen is the continuation of the command screen.

Command	
Signal	Command ▾
Signal Type	Current ▾
Unit	% ▾
Active	Always ▾
Input Actions	2/8 set
Signal Faults	1/4 set
Calibration	

Command	
Active	Automatic ▾
Input Actions	2/8 set
Signal Faults	1/4 set
Calibration	
Actual Limits	
Minimum	0.0 %
Maximum	100.0 %

The signal, signal type and unit selections are greyed out as these cannot be changed. All other options are identical to the analogue input screen. The command signal can be used to modulate or position an actuator as set up in the positioning menu.

### Internal Feedback

The internal feedback also very similar to the analogue input selection. This is only available when the internal feedback signal has been selected in the EHPC210 part code. The following screen displays when internal feedback is selected. The second screen is the continuation of the screen.

Internal Feedback	
Signal	Valve Feedback ▾
Signal Type	Linear ▾
Unit	% ▾
Active	Always ▾
Input Actions	2/8 set
Signal Faults	1/4 set
Calibration	

Internal Feedback	
Active	Always ▾
Input Actions	2/8 set
Signal Faults	1/4 set
Calibration	
Actual Limits	
Minimum	0.0 %
Maximum	100.0 %

The signal and unit selections are greyed out as these cannot be changed. The signal type is selected as either linear or rotary by the part code selected, so is greyed out. All other options are identical to the analogue input screen. The internal feedback can be used to modulate or position an actuator as set up in the positioning menu

### Analogue Outputs

Analogue Outputs	
Analogue Output 1	
Retransmission	

The analogue outputs menu displays one available analogue output if selected by the EHPC210 part code. Also displayed here is the retransmitted output signal if selected in the EHPC210 part code.

The analogue output can be selected and shows the following screen.

Analogue Output 1		
Signal	Pressure ▾	
Signal Limits		
Minimum	0.0	V
Maximum	3.0	V
Actual Limits		
Minimum	0.0	Bar
Maximum	100.0	Bar

Here the signal can be selected from the drop down list. The available signals are discussed later within this manual.

**Retransmission Signal**

If the retransmission signal has been selected in the EHPC210 part code it will be displayed in the analogue outputs menu. This displays the following screen.

Retransmission		
Signal	Valve Feedback ▾	
Raw Signal Limits		
Minimum	187	
Maximum	901	
Actual Limits		
Minimum	0.0	%
Maximum	100.0	%

The retransmission signal is a 4-20mA output that can be set to any of the analogue inputs. Normally the signal is set to valve feedback, but it can be set to any of the set analogue inputs, such as pressure or temperature.

This is normally ranged to 4-20mA to match the input selected. The raw signal limits can be adjusted by entering the window and modifying each end accordingly.

The actual limits window automatically matches the input range for the selected analogue input and as such is greyed out. It is displayed here as a guide to what the retransmitted 4-20mA signal represents.

**System Outputs**

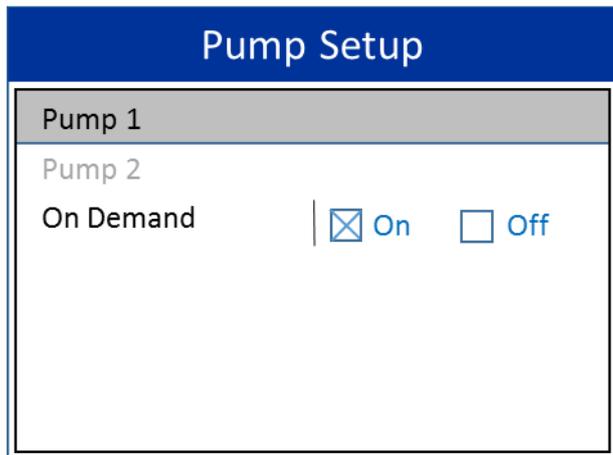
System Outputs	
System Warning	0/6 set
System Fault	1/6 set
Manual Mode	0/6 set
Opening	1/6 set
Closing	0/6 set
Stayput	0/6 set
Open Limit	0/6 set

The system outputs screen is used to set up the actions allocated to a system output, there are 6 available with the number set shown in the list. These default system outputs are detailed later in this document.

Opening	
Action 1	
If Opening	= ▾ High ▾
For Time	>= ▾ 30 secs
Then	System Fault ▾ = Lat Lo ▾
Add New Action	
Delete Last Action	

Select a system output to bring up the systems action screen for that output. Here the system actions can be defined in the same method as the digital input actions. This is used to set any actions required against a default operation of the EHPC210. See the system outputs section for more information.

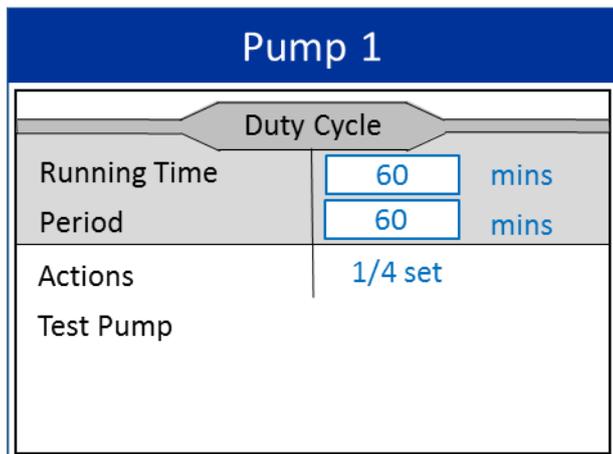
### Pump Setup



The pump setup screen is used to set up either of the two available pump outputs. These will be shown if the pump outputs are selected in the digital outputs section.

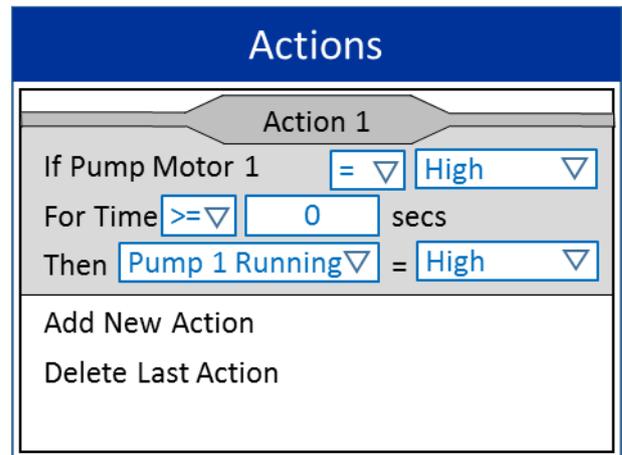
Pump control can be set to On Demand being on, with the pump set to run during the actuator moving valve actions section, or can be set to On Demand being off, with the pump set to run via input action rules. If a pump rule has been set, this rules must be removed before On Demand can be turned on.

Select a pump to see the following screen.



The duty cycle for the pump can be set here along with actions against the pump signal. The test pump can be pressed and the pump output will run whilst the switch is pressed down.

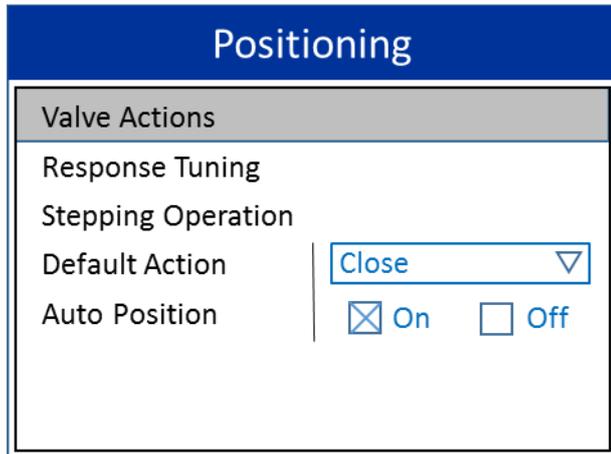
### Actions



The actions can be set against the pump output signal in the same way the actions are set against digital inputs.

## Positioning Menu

The positioning menu is used to set up how the EHPC210 controls an actuator for positioning or controlling a valve. The screen displayed is as follows.

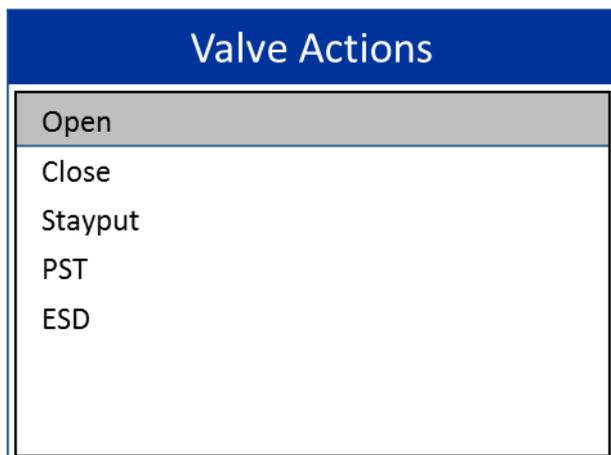


The Auto Position selection is used to toggle the automatic positioning of the actuator. This is only available if both a command and a valve feedback signal is present.

If this is turned on, the EHPC210 will position the actuator by comparing the command signal against the valve feedback signal. For more information please see the Response Tuning section.

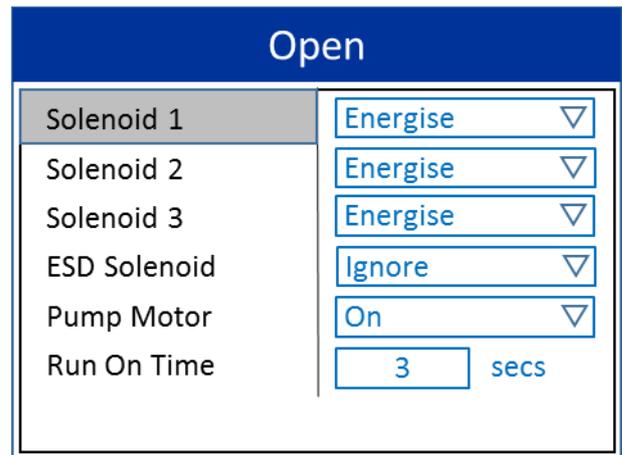
### Valve Actions

Select Valve actions option to enter this menu.



Here the control of the actuator is set. There are five choices, each one selects how the EHPC210 will control the available outputs to make the action happen.

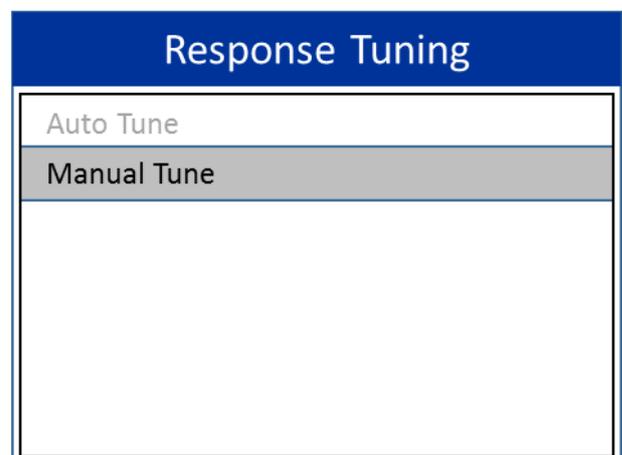
The open action menu is used to define how the EHPC210 will control the output devices to make the actuator open. Whenever the open action is called by the EHPC210 these output devices will follow these settings. The screen is as follows.



Here the solenoids and pump motor operation is defined for when the EHPC210 is opening the actuator. All options can be set in accordance to what is required on the actuator.

There are identical screens for Close, Stayput, PST and ESD actions. Here each actuator action can be set to define what the solenoids and pump, if the pump is set to On Demand, are doing during each action.

### Response Tuning



The Response Tuning menu gives one selection at present, Manual Tune. Auto Tune will be added at a later date. The Manual Tune screen is selected here and shown on the below screens, the second screen is accessed by scrolling down.

Manual tuning only affects the EHPC210 when the unit is positioning an actuator to a set command signal against the actuator feedback.

Manual Tune	
Dead Zone	
Open	1.0 %
Close	1.0 %
Hysteresis	
Open	0.5 %
Close	0.5 %
Manual Limits	

Manual Tune	
Close	1.0 %
Hysteresis	
Open	0.5 %
Close	0.5 %
Manual Limits	
Open	0.0 %
Close	100.0 %

Tuning improves the actuator stability when approaching and at the actuator balance point. The dead zone can be set in the range 0% - 10% with a default setting of 1%. This affects positioning accuracy as a response to the command 4-20mA signal. A smaller deadzone increases accuracy, however this may introduce instability.

The hysteresis can be set in the range 0% - 10% with a default setting of 0.5%. This also affects positioning accuracy as a response to the command 4-20mA signal. A larger hysteresis setting will increase accuracy but the value must be less than the deadzone.

The EHPC210 will control the actuator to run towards the command signal position until the actual feedback position is within the set dead zone minus the hysteresis setting. This has the effect of the actuator stopping nearer the command position.

The actuator will not restart unless it overshoots and runs outside the dead zone or a new command signal is received outside the dead zone. There are separate settings for the opening and closing direction for both dead zone and hysteresis.

The manual limits are set to restrict the opening and closing within manual mode.

### Stepping Operation

Stepping Operation	
Open	<input checked="" type="checkbox"/> On <input type="checkbox"/> Off
Close	<input type="checkbox"/> On <input checked="" type="checkbox"/> Off
Open	
Step Type	Time ▾
Time On	0.1 secs
Step Number	1
Time Off	0.1 secs

The EHPC210 positioner can operate the solenoids intermittently to cause a stepping movement. This can be used to slow the actuator stroke time or for mechanical stepping actuators.

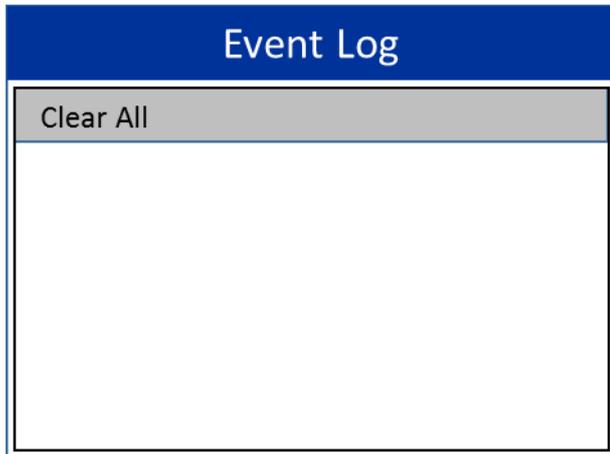
On the Stepping Operation screen, stepping mode can be toggled for both open and close directions. Once enabled for either open or close stepping mode, the type of stepping can be selected. Here the type of stepping mode can be set, either Time or Number of Steps.

Time mode is a set time for the valve action to be on and off during movement of the actuator. The Number of Steps option allows the full actuator travel to be broken down into a specific number of steps. On moving the actuator the steps are then a fixed % of the total travel.

The EHPC210 monitors the position of the actuator on each step instead of varying the on time of the valve action to remove the effects of hydraulic flow rate changes due to pressure, temperature or viscosity of the oil. The off time of each step can be also set. There are separate settings for the opening and closing direction.

## Event Log Menu

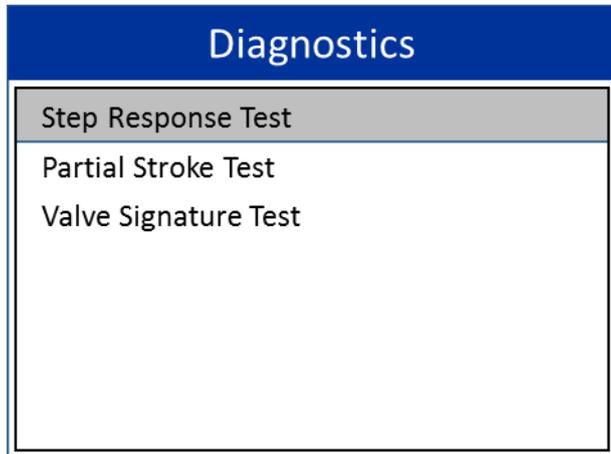
The event log screen is currently only used to clear all set latches within the actions and faults. Future software versions will have access to all events within the EHPC210 controller.



Any latches, such as warning or fault alarms, or any latched actions can be cleared here. For example if a pressure fault is latched when the pressure transmitter analogue input drops below a set point, use the clear all selection in the event log to clear this latch once above the set point.

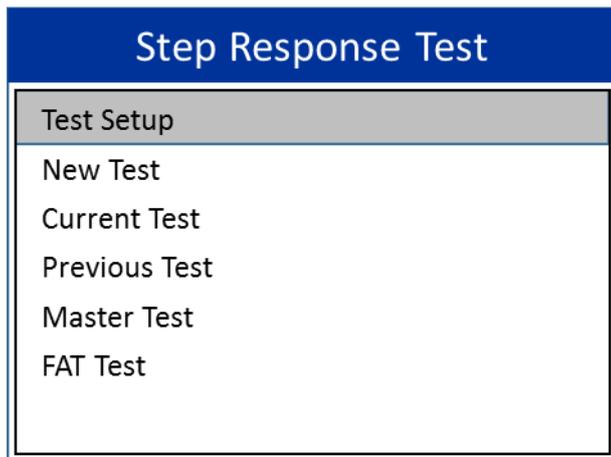
## Diagnostics Menu

The diagnostics menu is used to run actuator tests via the EHPC210 controller. There are three tests that can be run, a step response test, a partial stroke test and a valve signature test.



### Step Response Test

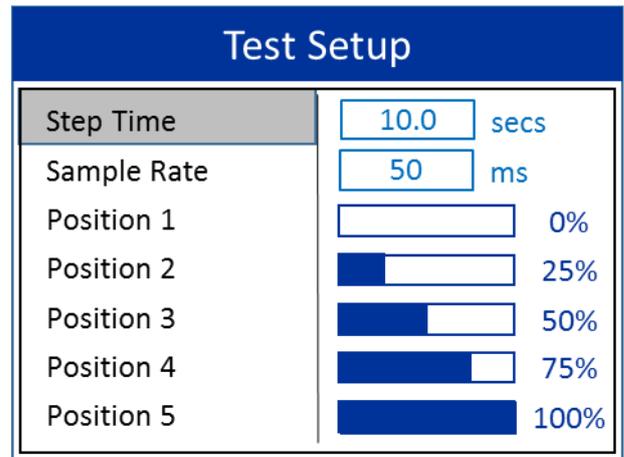
A step response test is used to operate the full stroke of the actuator, from closed to open and then back to closed. During each direction a number of step positions can be added. This checks movement and positioning in both directions and at various points of travel.



The step response test has a number of options. The first is Test Setup which is used to determine how the test will run. The next option for New Test will select the New Test menu for running and viewing a new test.

Also here is the option for viewing either the previous test carried out or viewing the master test or FAT test.

### Test Setup



The Test Setup screen is used to determine how the step response test will run. The first option is Step Time which is set in seconds. This is the time for each step position during the test to be reached by the actuator. Use the control switch to highlight this option, press the switch to edit and use towards and away to modify the value. Press the switch again to save this value.

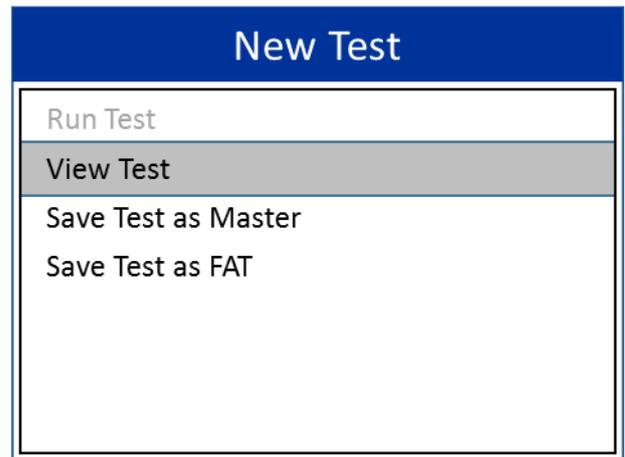
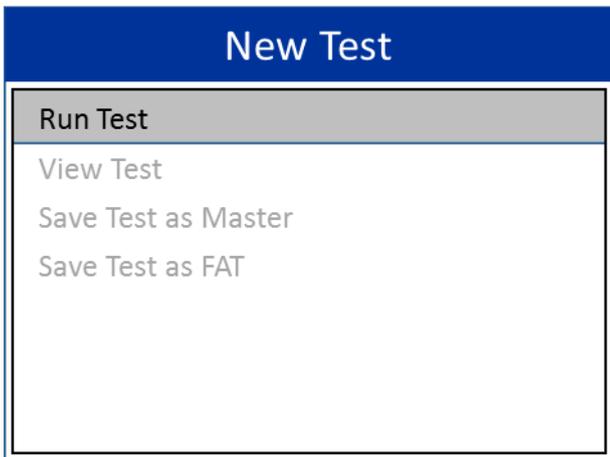
The Sample Rate is in milliseconds and is the rate at which the EHPC210 will record the data during the test. This is set in the same manner as Step Time.

All other options here are positions set on the test. These are edited by navigating to the position using the control switch, pressing the switch, then using away and towards to modify the setting. Press the switch again to save. Each position must be greater than the last with the final position being 100%.

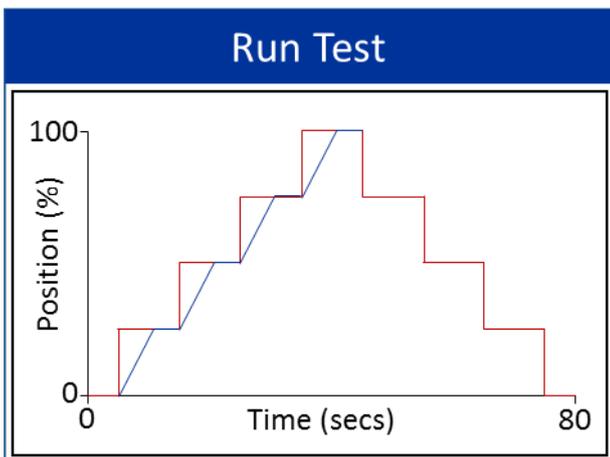
### New Test – Run Test

The New Test menu has a number of options that are greyed out until a test is run.

The only option available is to Run Test. Press the control switch to start a new test based on the settings in the Test Setup menu.



The screen below will be shown. The graph shown displays the test parameters and results. The red line indicates the command step positions as setup in the Test Setup menu and the blue line will be plotted during the test and indicates the actual feedback signal from the actuator.

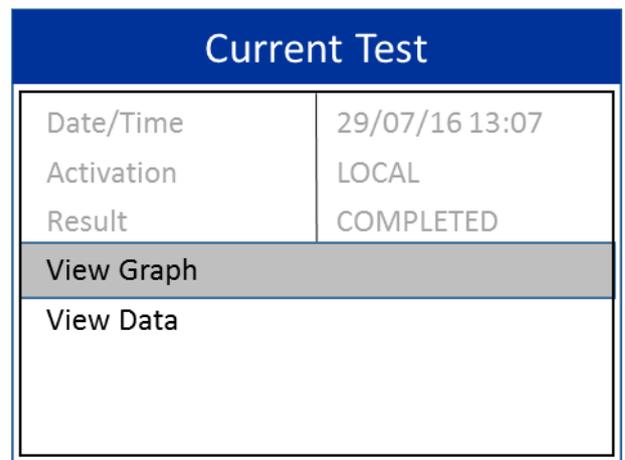


The test will first move the actuator to the closed 0% position, before moving the actuator to the first step position, in this example 25%. Each step will take the time as setup in the Test Setup Menu.

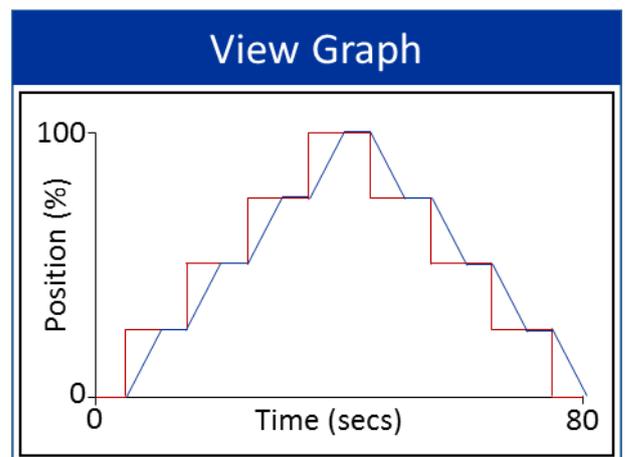
The EHPC210 will then move the actuator to each subsequent step position that has been set. Once 100% has been reached the test will be repeated on the downward stroke, stopping at the same step positions but in reverse. Again each step will take the time as setup.

Once the test is complete and the actuator has returned to 0% closed position the screen below will be shown. From here the test can be viewed, saved as the new master or saved as the new FAT

**View Test**



Both the View Previous Test, View Current Test, View Master Test and View FAT Test will display the result of the desired test as above. Here the graph can be shown with the same details as shown in the Run Test menu, with the menu bar displaying which test is shown.



Also the data can be shown from the test:

View Data		
Max Overshoot		
Increasing	0.5	%
Decreasing	0.4	%
Max Hysteresis	0.7	%

The data displayed shows the maximum overshoot in each direction during the test. This is the maximum value in which the actuator went past the desired test step position. This is shown for both directions of operation.

The maximum hysteresis is also displayed here. This is the largest value difference between the end point of a particular step position during the opening and closing directions.

**Partial Stroke Test**

A partial stroke test is used to operate only a portion of the actuator stroke, from its open position to a partially closed position. This is normally from 100% to around 85% of its full stroke.

The test exercises the solenoids and the valve to confirm they will operate in a shutdown situation. The EHPC210 performs a number of system tests during the operation of a partial test which can be set up during commissioning.

On receiving a momentary action to carry out a Partial Stroke Test system output, the EHPC210 will move the actuator to a pre-set position (typically 85% of open), a short pause, and then return to the fully open position. The EHPC210 will record the data during the test.

During the test the PST System output will be on or high. If the test is successful then PST Result output will be on or high. If the test fails the PST Result System output will be off or low. The acceptance or pass criteria during this test is detailed below.

During the partial test the actuator pressure is recorded during the breakaway. This will measure the static friction in the valve and present a safety factor as follows:

Pressure to fully open = 100 bar

Pressure to breakaway in closing direction = 60 Bar

Friction = (max-min)/2 = (100-60)/2

Safety Factor = average friction/difference = 80/20 = 4

Partial Stroke Test	
Test Setup	
New Test	
Current Test	
Previous Test	
Master Test	
FAT Test	

The partial stroke test menu is similar to the step response test menu. First the test setup must be defined before a new test can be run.

From there a new test can be run, the current and previous test results can be viewed, as well as the master and FAT tests.

**Test Setup**

The test setup menu is used to define how the test will run and looks as follows.

Test Setup	
PST Pressure	Pressure ▾
PST Position	85 %
Sample Rate	100 ms
Accept Criteria	

The PST Pressure selection displays all the analogue inputs available to use for the safety factor calculations. If pressure is unavailable then this can be left blank and the safety factory calculations are ignored.

The PST Position details which position the actuator will drive to during the partial stroke test and the sample rate defines how often the data is saved within the EHPC210 Controller. The final choice is accept criteria which enters another menu screen.

**Accept Criteria**

Accept Criteria		
Max Test Time	<input type="text" value="30"/>	secs
Max Pos Time	<input type="text" value="15"/>	secs
Min Safety Factor	<input type="text" value="1.5"/>	

This screen details how a partial stroke test will deem if the test is a pass or failure. The first choice is maximum test time, which is the overall time to complete the partial stroke test.

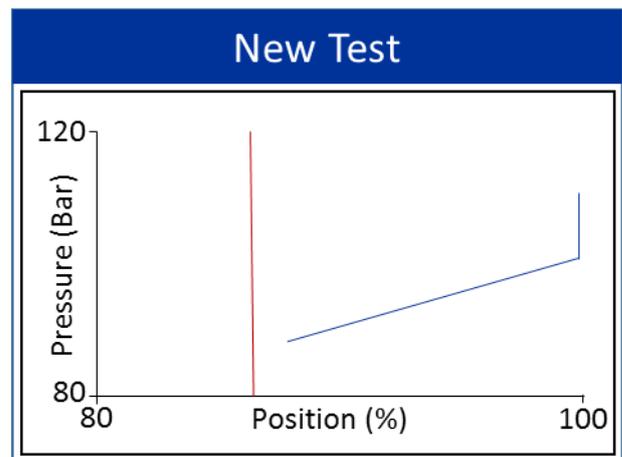
Maximum position time is the acceptable time to drive to the PST position and minimum safety factor is the minimum accepted calculated safety factor. This is ignored if a pressure input analogue signal is not present.

**New Test – Run Test**

The New Test menu has a number of options that are greyed out until a test is run. The only option available is to Run Test. Press the control switch to start a new test based on the settings in the Test Setup menu.

New Test	
Run Test	
View Test	
Save Test as Master	
Save Test as FAT	

The screen below will be shown. The EHPC210 will then plot position against pressure for the duration of the partial stroke test.



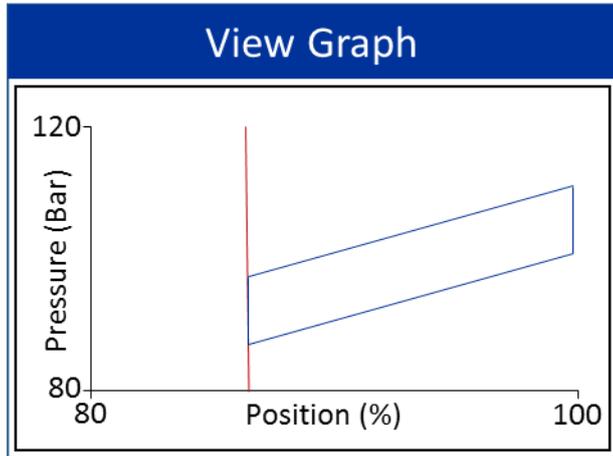
**View Test**

View Test	
Date/Time	29/07/16 13:43
Activation	LOCAL
Result	PASS
View Graph	
View Data	

Once complete the View Test screen can be selected and displayed as above, with the results and the ability to view

either the graph or the data. The result of the test is shown as well as the type of activation, whether this test has been started locally via the menus, or remotely via an input signal. See system outputs for more information on a remote partial stroke test.

The graph will display the same graph as was plotted during the test:



The data for the test can also be displayed:

View Data		
Break Away Time	0.55	secs
Time to Position	6.45	secs
Restore Time	8.55	secs
Total Time	15.55	secs
Safety Factor	2.5	

Here all the data collected during the test can be displayed.

### New Test

Run Test

View Test

Save Test as Master

Save Test as FAT

Once the data has been viewed, the test can be saved as either the master or FAT test. These can be viewed in the same method, seeing the test results and the graph.

There are only two ways to end a partial stroke test during its operation and that is to either hold away on the control switch or if an ESD action is called.

### Valve Signature Test

This test is used to fully close an actuator from the open position and then reopen. It can be used to check the full closing stroke of a valve and actuator. This test also runs in the background when the actuator goes through a normal ESD cycle, in this way the data is recorded.

This test works in a similar manner to the partial stroke test section although rather than stopping at an intermediate position, the actuator will instead run to the fully closed position. The main valve signature test screen is as below.

### Valve Signature Test

Test Setup

New Test

Current Test

Previous Test

Master Test

FAT Test

### Test Setup

The test setup menu is used to define how the test will run and looks as follows.

The ESD Pressure selection displays all the analogue inputs available to use for the safety factor calculations. If pressure is unavailable then this can be left blank and the safety factory calculations are ignored.

The ESD Position details which position the actuator will drive to during the valve signature test, normally set to 0%, and the sample rate defines how often the data is saved within the EHPC210 Controller. The final choice is accept criteria which enters another menu screen.

### Accept Criteria

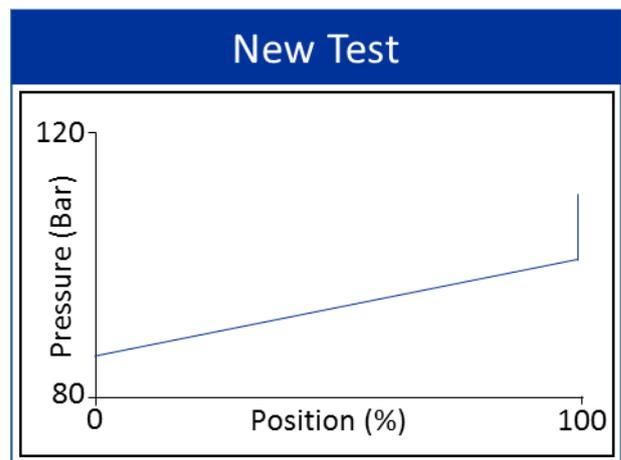
This screen details how a valve signature test will deem if the test is a pass or failure. The first choice is maximum test time, which is the overall time to complete the test.

Maximum ESD time is the acceptable time to drive to the ESD position and minimum safety factor is the minimum accepted calculated safety factor. This is ignored if a pressure input analogue signal is not present. The safety factor is calculated in the same manner as the partial stroke test data.

### New Test – Run Test

The New Test menu has a number of options that are greyed out until a test is run. The only option available is to Run Test. Press the control switch to start a new test based on the settings in the Test Setup menu.

The screen below will be shown. The EHPC210 will then plot position against pressure for the duration of the valve signature test.



**View Test**

View Test	
Date/Time	29/07/16 13:43
Activation	LOCAL
Result	PASS
View Graph	
View Data	

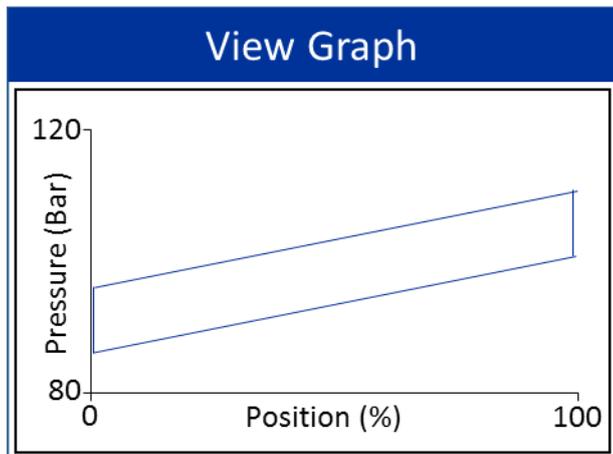
Once complete the View Test screen can be selected and displayed as above, with the results and the ability to view either the graph or the data.

The result of the test is shown as well as the type of activation, whether this test has been started locally via the menus, or remotely via an input signal.

A test will be started remotely whenever the ESD system output is called, for example when the actuator is triggered for an emergency shutdown. The EHPC210 will record the data during the closing cycle then wait until the opening action is called before recording the data for the opening cycle.

A remote test will be saved as the current test once complete and can be viewed from the menus.

The graph will display the same graph as was plotted during the test:



The data for the test can also be displayed. Here all the data collected during the test can be displayed.

View Data	
Break Away Time	0.55 secs
Time to ESD	3.50 secs
Restore Time	10.96 secs
Total Time	15.01 secs
Safety Factor	2.5

Once the data has been viewed, the test can be saved as either the master or FAT test. These can be viewed in the same method, seeing the test

## System Inputs and Outputs

### System Outputs including Alarms

There are a number of default system outputs that appear in all the output options for all Action choices. There are default states for each system output which can only be changed if the system output is selected as a digital output also. If this is done, the default state can be changed accordingly and this change must be taken into account when setting the actions.

All the System Outputs:

- System Warning
- System Fault
- Manual Mode
- Opening
- Closing
- Stayput
- Open Limit
- Close Limit
- Stepping Open
- Stepping Close
- PST
- PST Result
- ESD

System Warning and System Fault are the alarm outputs and are both defaulted high. They can be pulled low by any alarm condition from either an action or a signal fault. The only way to change this default state is to link the system alarm output to a digital output.

To activate either of the alarm conditions there must be an action or signal fault associated, or the alarm condition can be linked to another of the digital outputs. For example pressure low can be linked to a warning alarm in the digital outputs setup screen.

Any time the system warning is activated the status on the front screen, if selected on the display settings, will change to amber and will display which variable has created the warning.

Any time the system fault is activated the status on the front screen, if selected on the display settings, will

change to red and will display which variable has created the fault.

All other system outputs are defaulted to a low state. This means that if no rules are selected to change their states they will be in the low or off state. The only way to change this default state is to link the system output to a digital output.

Manual mode system output state is changed whenever the system changes from Automatic to Manual operation.

Opening, closing and stayput system outputs, if selected within an action or signal fault will activate the appropriate valve action set within the positioning menu.

Open limit and closed limit system outputs need to be set against either an actuator feedback signal or via a digital input.

Stepping open and stepping close system outputs will bring the stepping modes in either direction on if these are pulled high.

PST is the running of the partial stroke test sequence as detailed on the partial stroke test section screen. If this output is called from a momentary input, the partial stroke test sequence will start and only an ESD signal or holding away on the control switch can exit before the sequence is complete. The PST result is directly linked to the result from this sequence.

The ESD System output is used to call the ESD valve actions from the positioning menu. This system output if called overrides all other system outputs, positioning, actions and faults.

### Digital Inputs

The following is a list of the available digital input names:

- Open Valve
- Close Valve
- Stay Put
- PST Start
- Stepping Close
- Stepping Open
- Manual Mode

- Manual Enable
- Pump Run
- Pump Run 2
- Push Button
- Push Button 2
- Push Button 3
- Push Button 4
- Control Switch
- Control Switch 2
- Control Switch 3
- Control Switch 4
- External ESD
- Opened Limit
- Closed Limit
- Pressure Switch
- Pressure Switch 2
- Pressure Switch 3
- Pressure Switch 4
- Temp Switch
- Temp Switch 2
- Temp Switch 3
- Temp Switch 4
- Level Switch
- Level Switch 2
- Level Switch 3
- Level Switch 4
- Pump Running
- Pump Healthy
- Pump Running 2
- Pump Healthy 2
- Pressure Low Low
- Pressure Low
- Pressure High High
- Pressure High
- Temperature Low Low
- Temperature Low
- Temperature High High
- Temperature High
- Level Low Low
- Level Low
- Level High High
- Level High
- ESD Healthy
- Pump Running
- Pump Healthy
- Pump Running 2
- Pump Healthy 2
- Lamp Output
- Lamp Output 2
- Lamp Output 3
- Lamp Output 4
- Notification
- Notification 2
- Notification 3
- Notification 4
- Alarm
- Alarm 2
- Alarm 3
- Alarm 4
- Gen Operation
- Gen Operation 2
- Gen Operation 3
- Gen Operation 4
- Pump Run
- Pump Run 2

Each digital input defines its name only and not its function. This must be set with the input actions for the digital input. The name is used to allow for ease when setting rules and actions.

## Digital Outputs

A digital output can be linked to one of the above system outputs. This means that if any of the default system outputs change state so will the digital output. This method can also change the default state of the system output so care must be taken when defining the default state of such a digital/system output.

In addition to the system outputs the digital outputs can be named as any of the following:

Each of the above digital outputs defines its name only and not its function. This must be set with the input actions for the digital inputs and analogue inputs. The name is used to allow for ease when setting rules and actions.

## Analogue Inputs

The following is a list of the available analogue input names:

- Feedback
- Pressure
- Pressure 2
- Pressure 3
- Pressure 4
- Level
- Level 2
- Temperature
- Temperature 2
- Pump Speed
- Pump Current
- Pump Speed 2
- Pump Current 2

### **Analogue Outputs and Retransmission**

The analogue outputs can be set to any of the selected analogue inputs as can the retransmitted signal.