PROGRAMMING INPUTS AND OUTPUTS ON A NXF4000 OR A PPC4000

PR-00-2-0500-0-015-A

Inputs and Outputs

NXF4000

The NXF4000 has the following inputs and outputs:

- 15 programmable line voltage digital inputs
- 3 programmable line voltage digital outputs
- 5 programmable 4-20mA analog inputs
- 1 programmable 4-20mA analog outputs (3 if NXCESVFD card is fitted)

Applies to: NXF4000

Inputs and Outputs

PPC4000

The PPC4000 has the following inputs and outputs:

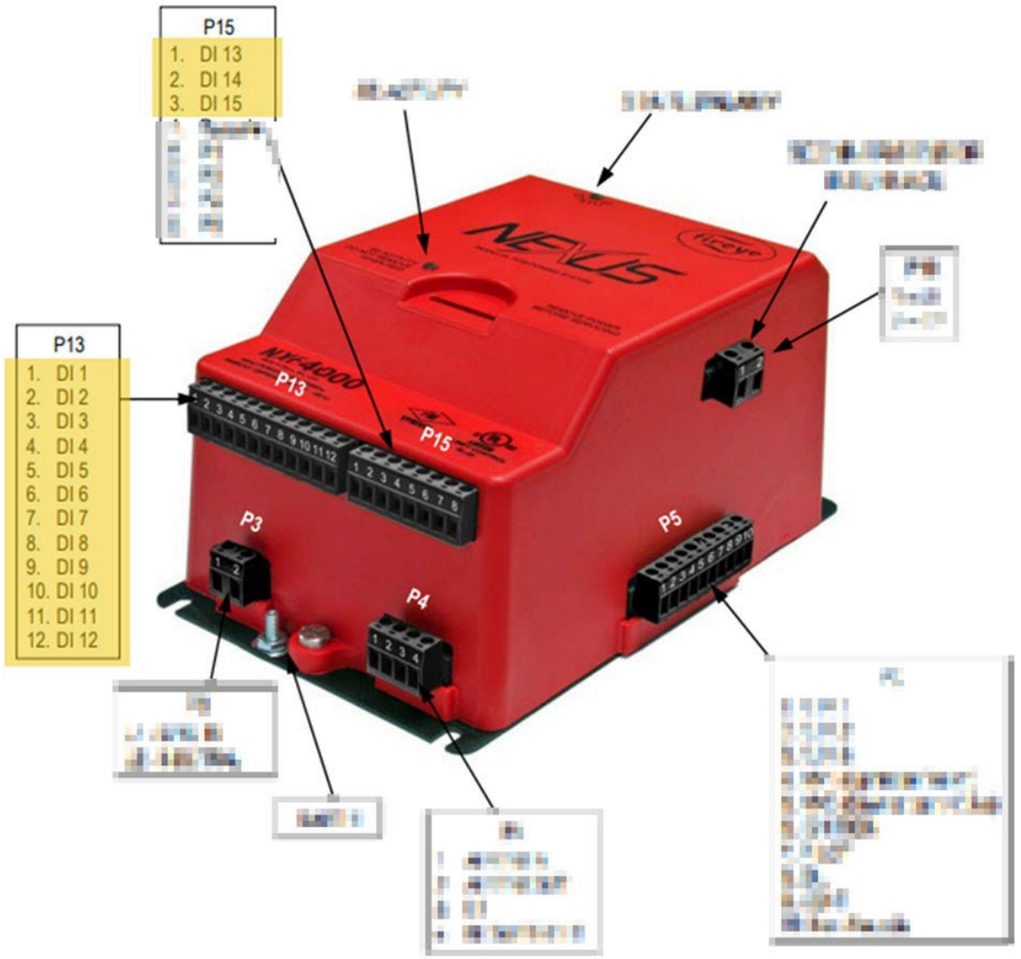
- 10 programmable line voltage digital inputs
- 5 programmable 4-20mA analog inputs
- 1 programmable 4-20mA analog outputs (3 if NXCESVFD card is fitted)

Applies to: PPC4000

Physical Wiring

NXF4000 digital inputs

These inputs are rated for the line voltage at 1mA of current. These are only intended to monitor a voltage (switches or status). The terminals are on both the P13 and P15 connectors and reference the neutral on terminal (P3) L2.

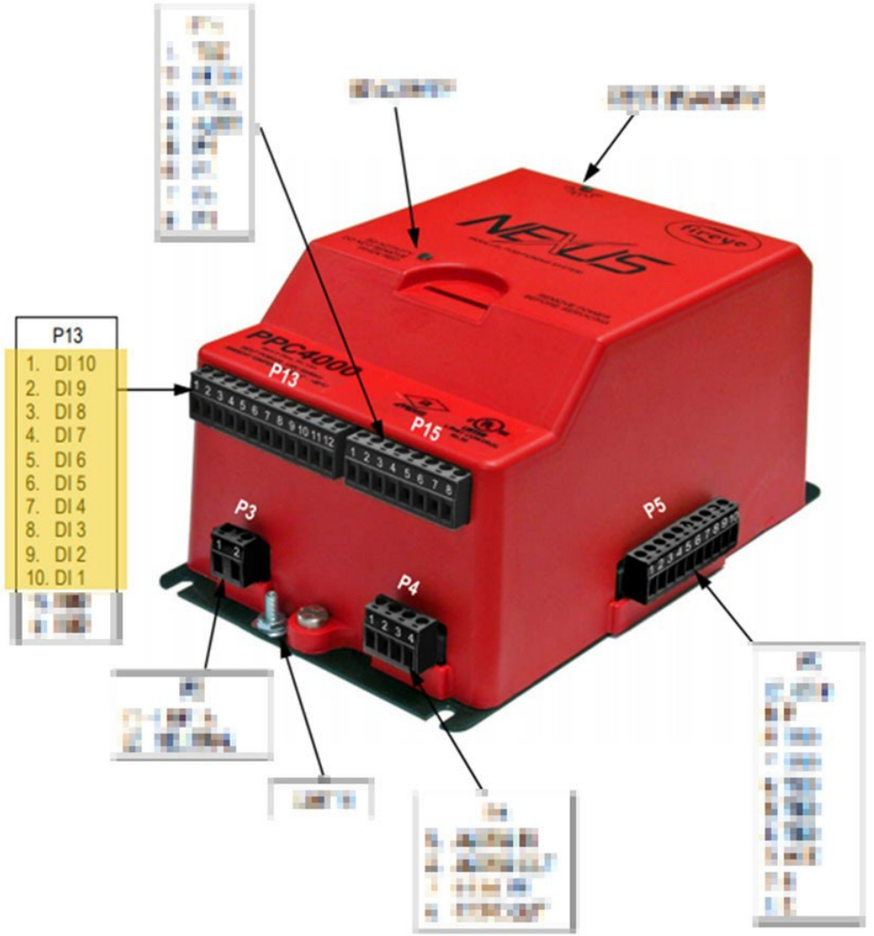


Applies to: NXF4000

Physical Wiring

PPC4000 digital inputs

These inputs are rated for the line voltage at 1mA of current. These are only intended to monitor a voltage (switches or status). The terminals are all on the P13 connector and reference the neutral on terminal (P3) L2. Although the terminals are similar, note that the digital inputs on the PPC4000 are arranged in a different order than on the NXF4000.

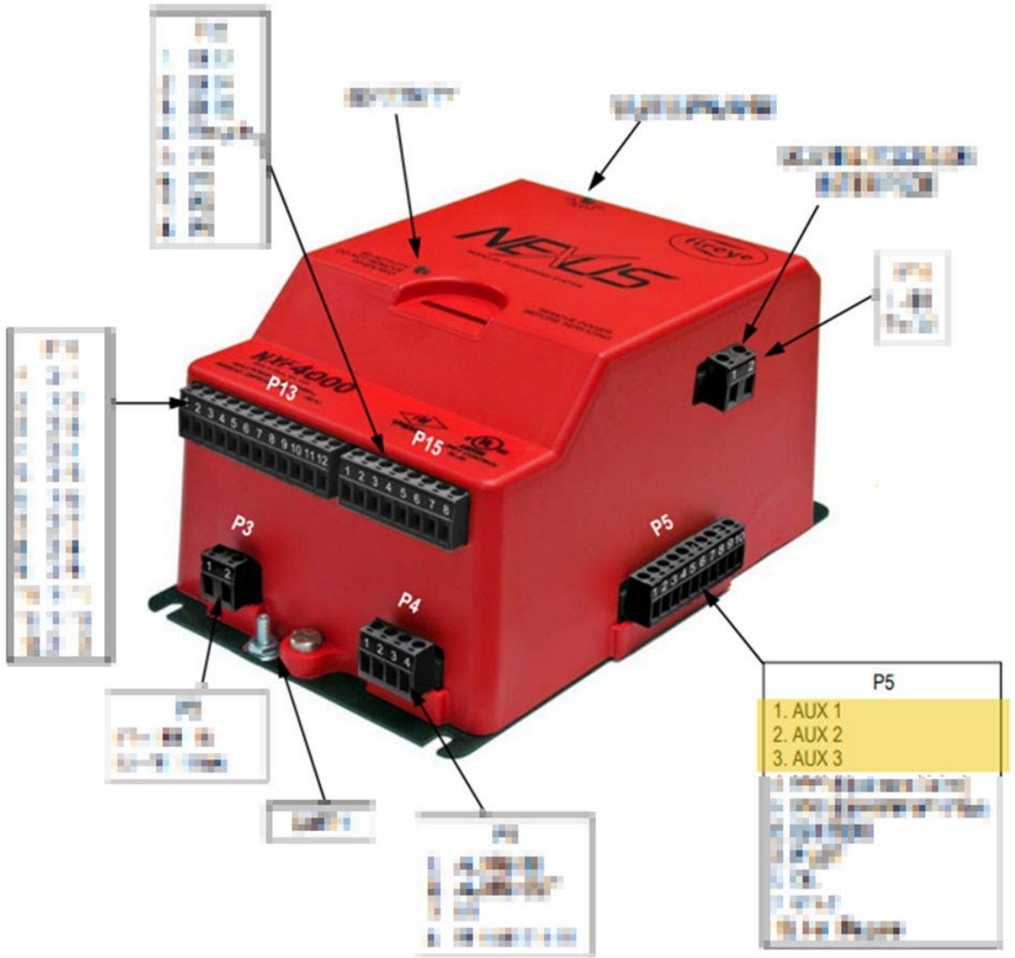


Applies to: PPC4000

Physical Wiring

NXF4000 digital outputs

These outputs are rated for the line voltage with a load of 480VA. These outputs are not safety rated and are intended for use to monitor or provide any function that is not critical to operation. The terminals are all on the P5 connector and reference the neutral on terminal (P3) L2. A relay must be added if dry contacts are required.



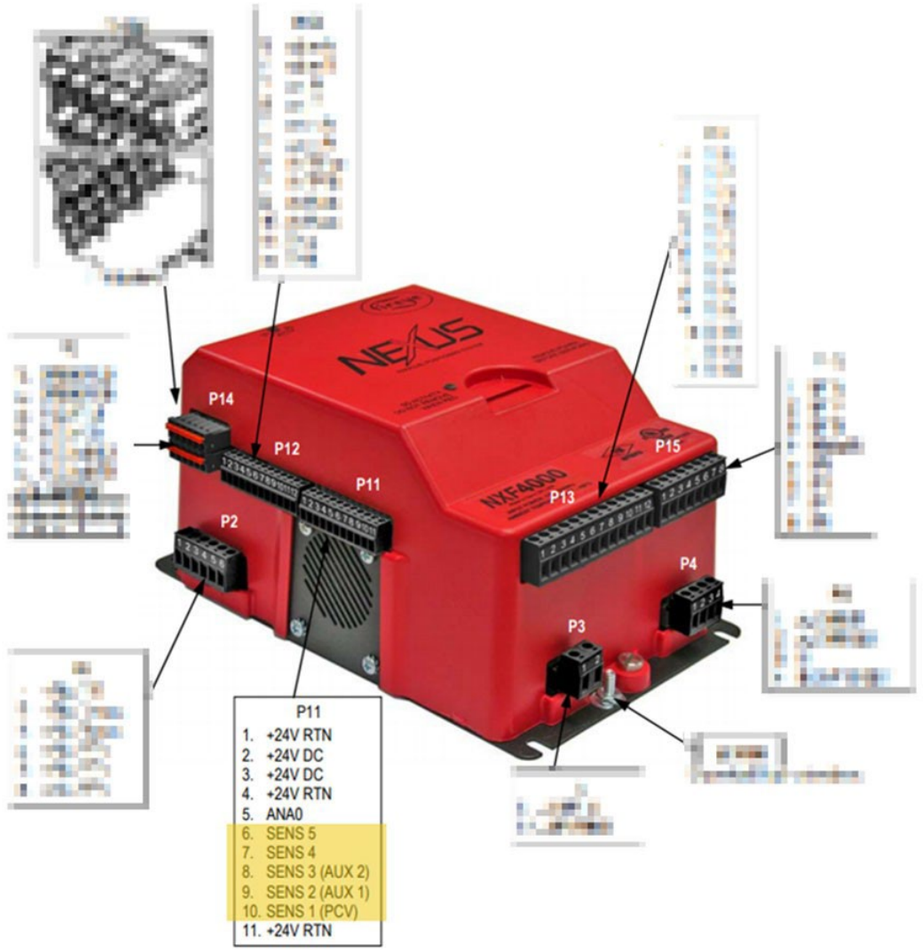
Applies to: NXF4000

Physical Wiring

NXF4000/PPC4000 analog inputs

These inputs are all 4-20mA and can work with either sinking or sourcing transmitters. This means that either the NXF4000/PPC4000 can supply the loop power or it can come from an external source. If the NXF4000 is to supply the power (sourcing) the two wires of the transmitter would connect to **+24V DC** and to the applicable sensor input (receives the 4-20mA signal). This is how the Fireye- supplied transmitters are wired. If the power is from an external source (sinking), the 4-20mA signal is connected to the applicable sensor input, and the common of the external power supply is connected to **+24V RTN**.

Multiple **+24V DC** and **+24V RTN** terminals are provided to connect multiple sensors. The terminals are all on the P11 connector.

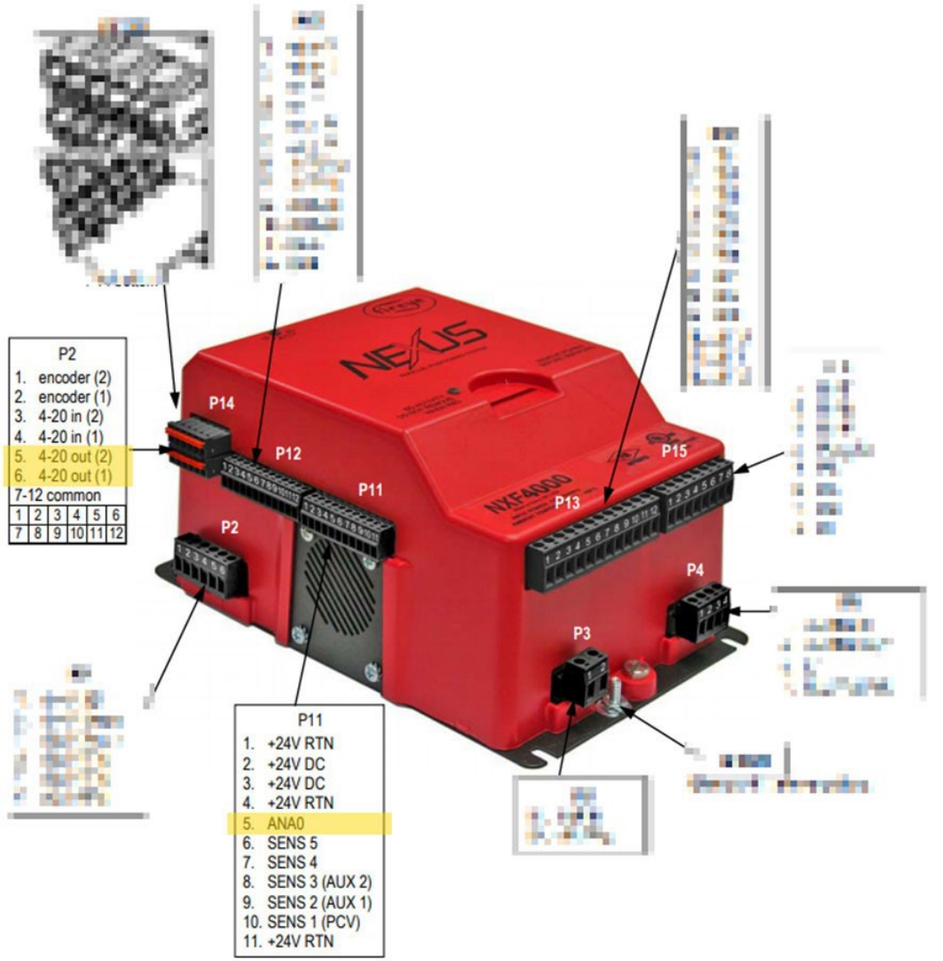


Applies to: NXF4000, PPC4000

Physical Wiring

NXF4000/PPC4000 analog outputs

These outputs are all 4-20mA. There is one output provided on the P11 terminal block that references **+24V RTN** when connecting to an external device. There are two outputs on the P2 terminal block that reference one of the common terminals 7-12 on that terminal block when connecting to an external device. The outputs on P2 are only available if the NXCESVFD card is fitted and when those outputs are not being used to connect to a VFD.

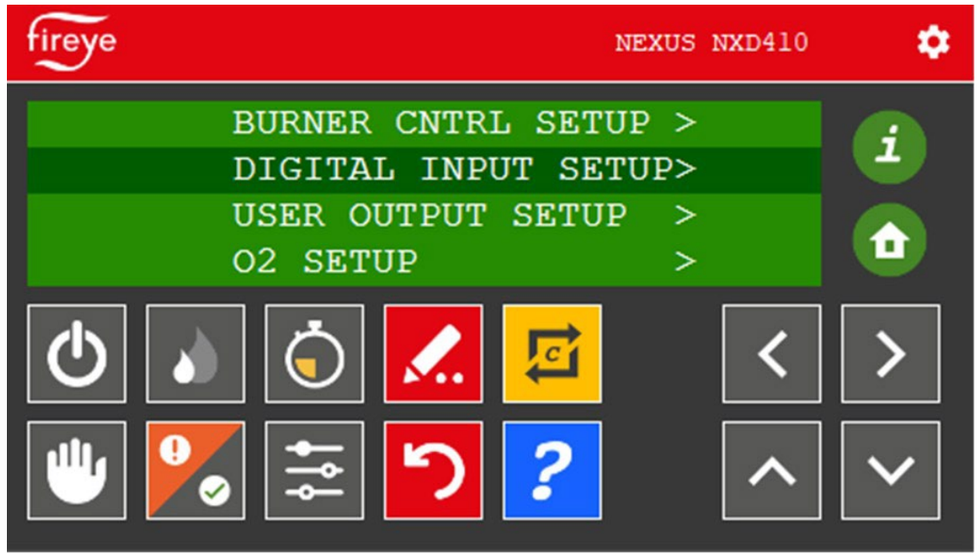


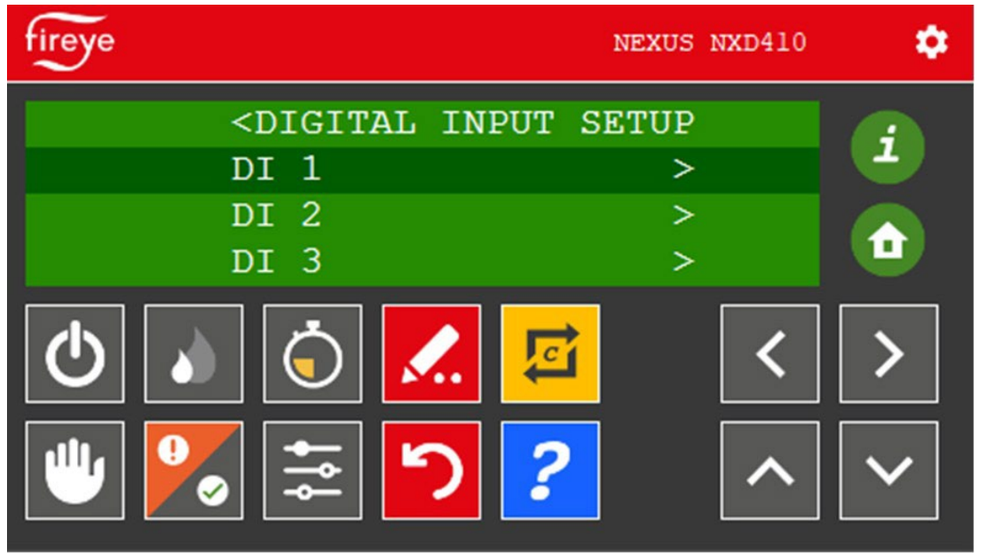
Applies to: NXF4000, PPC4000

Digital Inputs

Programming

There is a menu called **DIGITAL INPUT SETUP** for both the NXF4000 and PPC4000. Press the right arrow or NEXT key to enter the menu. Each digital input will then have a separate sub menu.





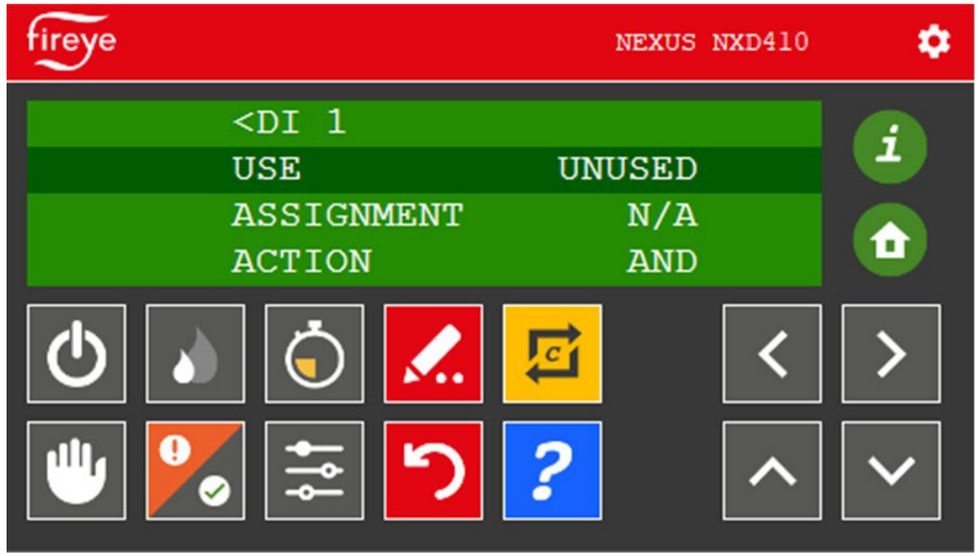
Applies to: NXF4000, PPC4000

Digital Inputs

Setting function

USE refers to the assignment of the digital input. Pressing the MODIFY/SAVE key (pencil icon) allows editing of the assignment using the up/down arrows. MODIFY/SAVE is also used to confirm the changes.

Other parameters such as *ASSIGNMENT* or *ACTION* will be explained with each individual function.

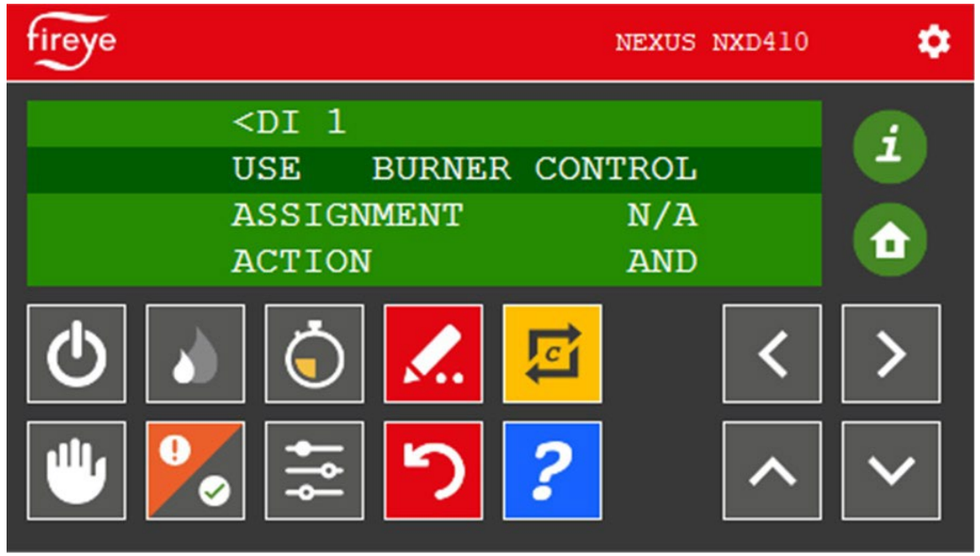


Applies to: NXF4000, PPC4000

Digital Inputs

Burner control

Setting *USE* to **BURNER CONTROL** allows that digital input to be used to start/stop the control in the same manner as the keypad on/off key. *ASSIGNMENT* is set to **N/A** since this is a global setting not affected by profile selection. *ACTION* can be set to **AND** or **OR**. Setting to **AND** means that this input has to be on along with any others set for the same function. This includes the keypad **BURNER ON KEY** setting. Setting to **OR** means that any assigned input or key can be on. Another way to think of it is that **AND** is like putting multiple switches in series and **OR** is like putting multiple switches in parallel.



Applies to: NXF4000, PPC4000

Digital Inputs

Global inputs

There are many other input choices that work in the same manner as BURNER CONTROL. For each of these, *ASSIGNMENT* is not applicable, and *ACTION* must be set.

- SETPOINT 2 SLCT – Uses setpoint 2 instead of setpoint 1 (setpoint 2 must be properly configured).
- LOW FIRE HOLD – Forces modulation to low fire. Can also be done using LOW FIRE KEY option on the keypad.
- ALARM RESET – Allows a remote reset. Note that this should only be done within sight and sound of the burner.
- MANUAL MODULATE – Forces manual modulation. The rate is then set using the keypad. Can also be done using AUTO MAN KEY option on the keypad.

Applies to: NXF4000, PPC4000

Digital Inputs

Global inputs

There are many other input choices that work in the same manner as **BURNER CONTROL**. For each of these, *ASSIGNMENT* is not applicable, and *ACTION* must be set.

- **O2 TRIM DISABLE –** Forces O_2 trim control to be disabled by temporarily overriding the permanent settings.
- **FORCED SETBACK** – Forces the setback setpoint to be used when outside of the scheduled time.
- **SETBACK OVERRIDE –** Forces the setback setpoint to be overridden when within the scheduled time.
- **FORCE SEQ. MSTR** – Forces selection as the master when sequencing is used. Normally if this method is used the other units also have this connection and they will be turned off (only one master). Can also be done using **LEAD LAG KEY** option on the keypad.
- **SEQUENCING OFF** – Forces sequencing to be disabled by temporarily overriding the permanent settings.

Applies to: NXF4000, PPC4000

Digital Inputs

Global inputs

There are many other input choices that work in the same manner as **BURNER CONTROL**. For each of these, *ASSIGNMENT* is not applicable and *ACTION* must be set.

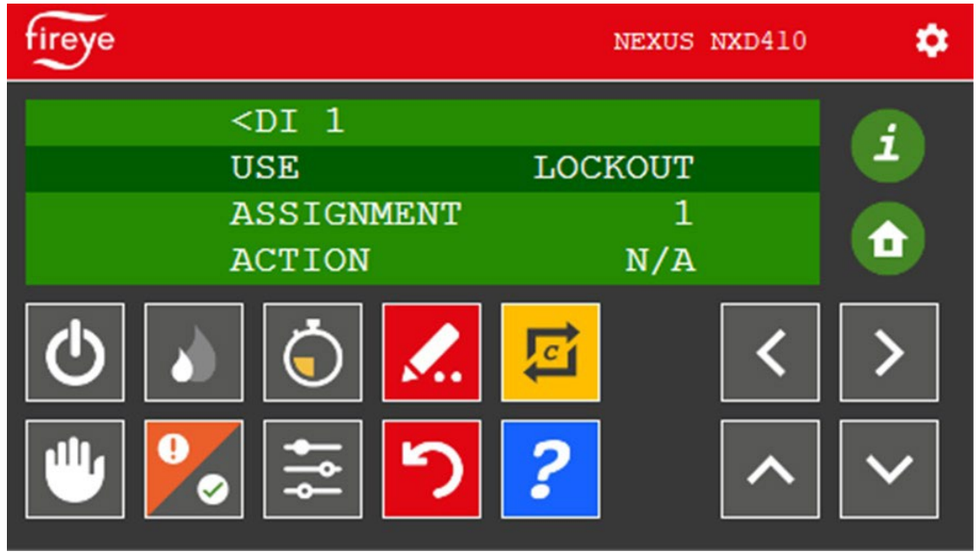
- **TRACK ON –** When track modulation is used, this input allows the burner to start. In the absence of this input the control can run to maintain the standby setpoint if enabled. This input is normally connected to a control system of some kind.
- **FORCED BLOWER ON –** This input forces the blower output to turn on. This can be used to provide a purge separately from the programmed prepurge or postpurge.

Applies to: NXF4000

Digital Inputs

Lockout

- A lockout can be forced by applying line voltage to an input. This can happen at any time in the sequence or in standby. *ASSIGNMENT* must be used for this selection to specify which profiles this will apply to so situations that only apply to one fuel could be used. *ACTION* is not applicable. The lockout generated will read “FORCED i01” (substitute actual digital input number) and will require a reset to clear.

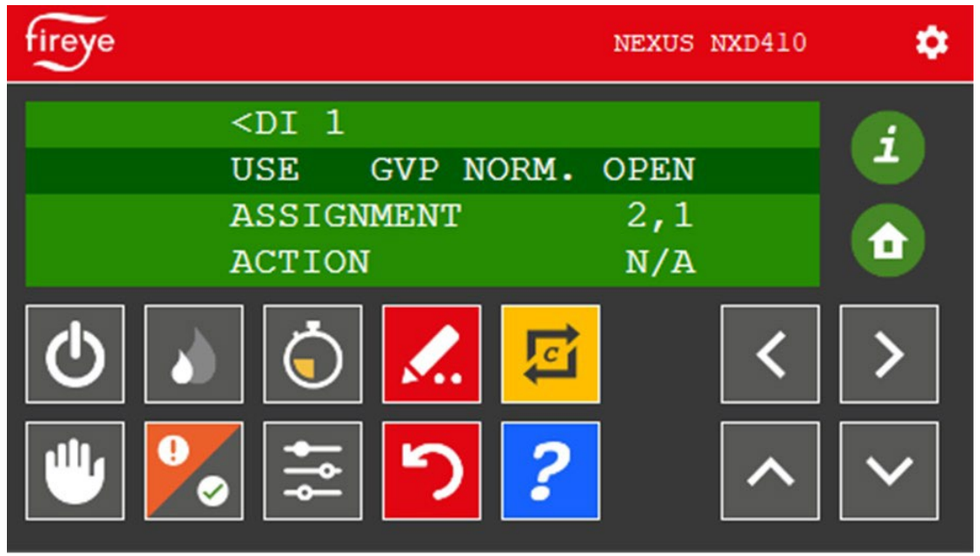


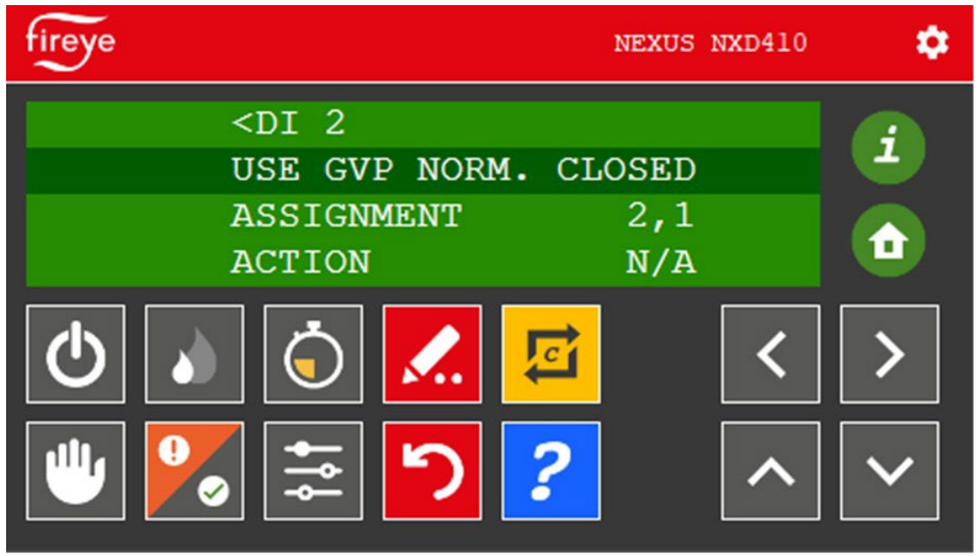
Applies to: NXF4000

Digital Inputs

Valve proving inputs

To use valve proving, two different inputs must be assigned to monitor both the normally open and normally closed positions of the switch. *ASSIGNMENT* must be used for this selection to specify which profiles this will apply to so situations that only apply to one fuel could be used. *ACTION* is not applicable.



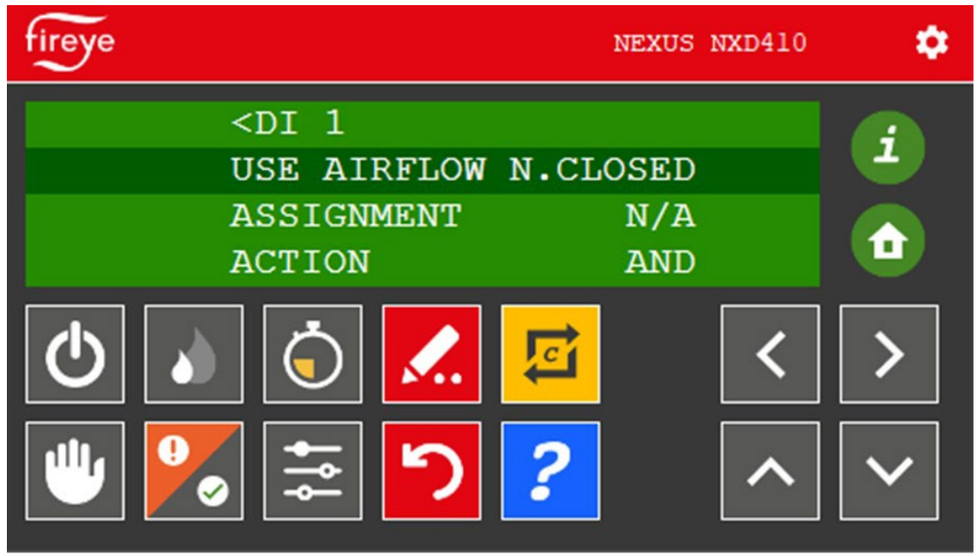


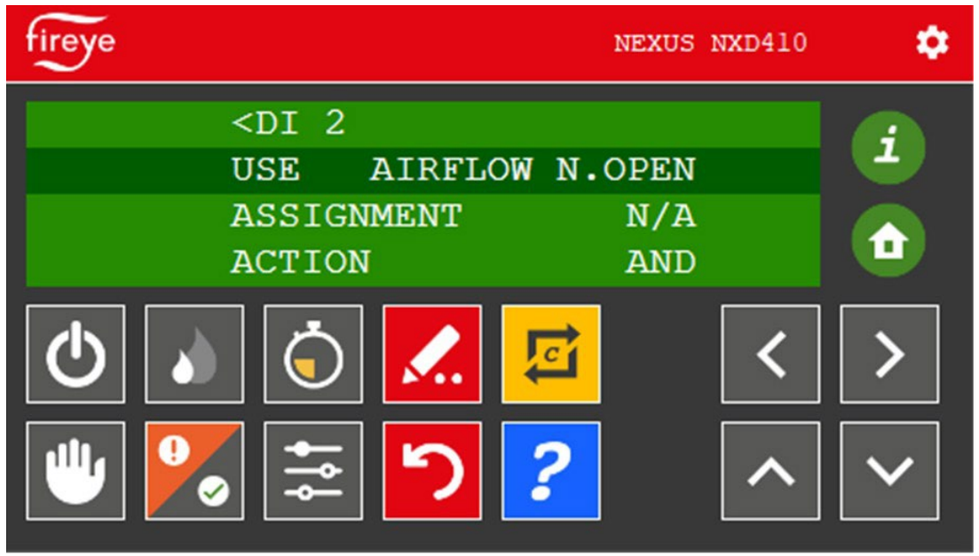
Applies to: NXF4000

Digital Inputs

Airflow proving inputs

The airflow switch can be connected to dedicated inputs to provide both a specific lockout message as well as an airflow switch check that the state changes. If used, two different inputs must be assigned to monitor both the normally open and normally closed positions of the switch. This is optional as the airflow switch can also be connected in the safety limit string. *ASSIGNMENT* is not applicable. *ACTION* can be **AND** or **OR** and only applies if more than one input is used for this function.



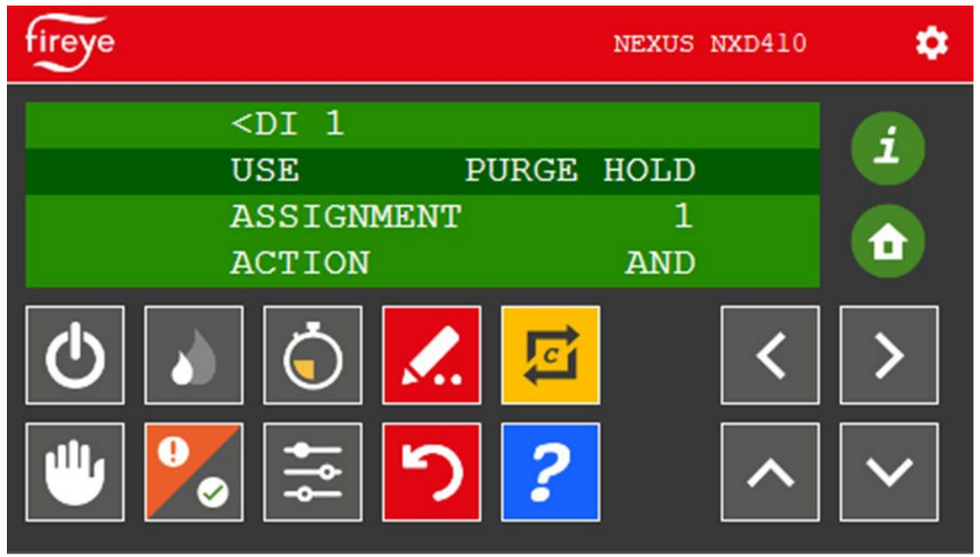


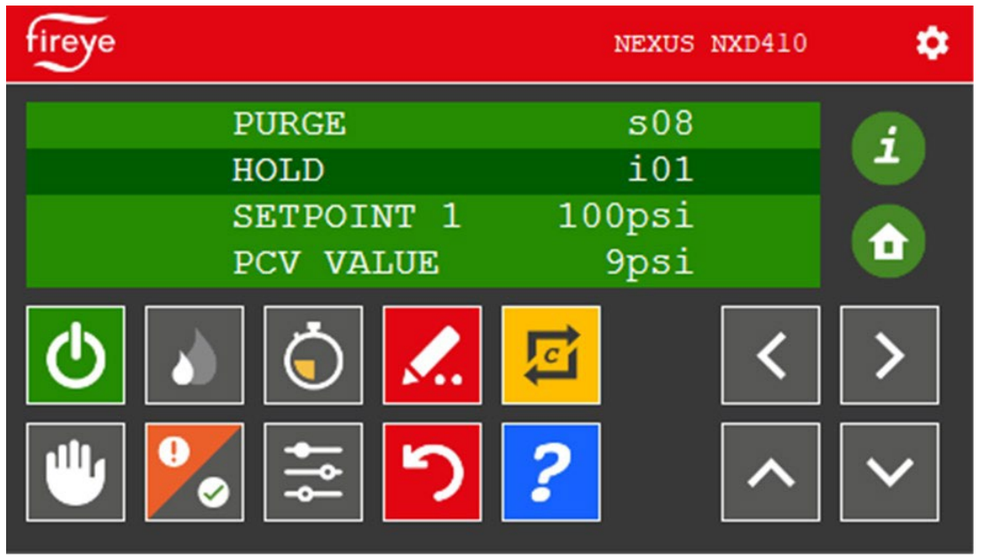
Applies to: NXF4000

Digital Inputs

Purge hold

An input can be used to hold the control in purge indefinitely. *ASSIGNMENT* must be used for this selection to specify which profiles this will apply to so situations that only apply to one fuel could be used. *ACTION* can be **AND** or **OR** and only applies if more than one input is used for this function.



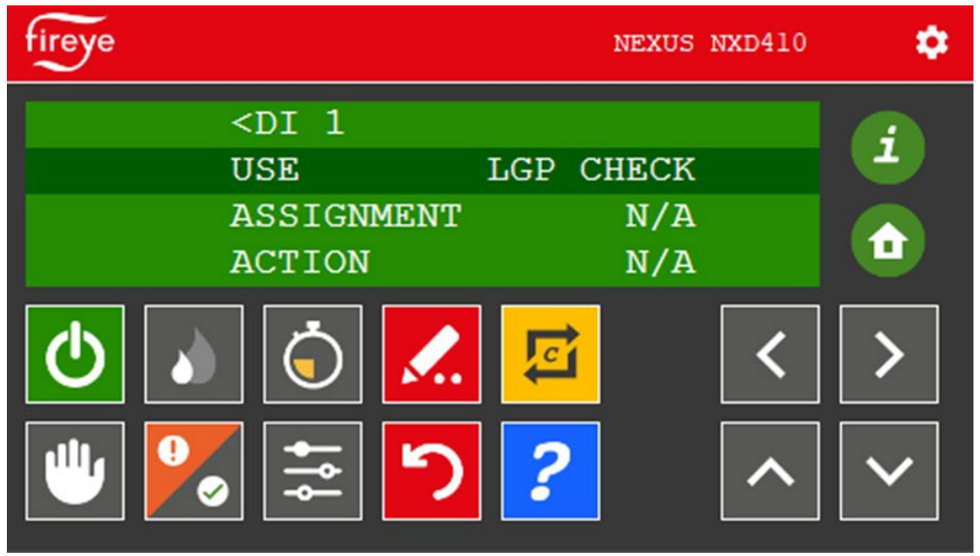


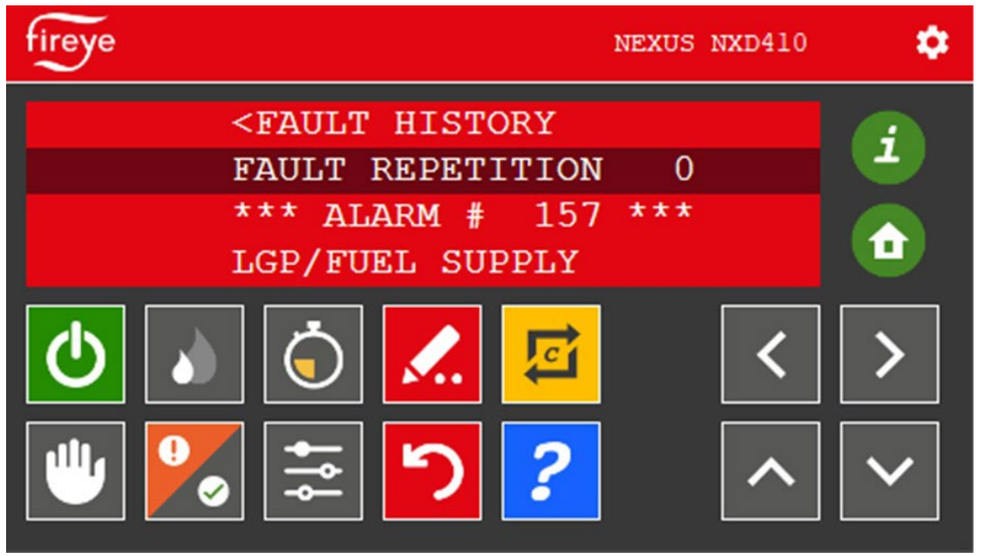
Applies to: NXF4000

Digital inputs

LGP check

An input can be used to monitor that the fuel pressure or supply is sufficient. This input must have voltage during and after MTFI (s13) or a lockout will occur. *ASSIGNMENT* and *ACTION* are not applicable.



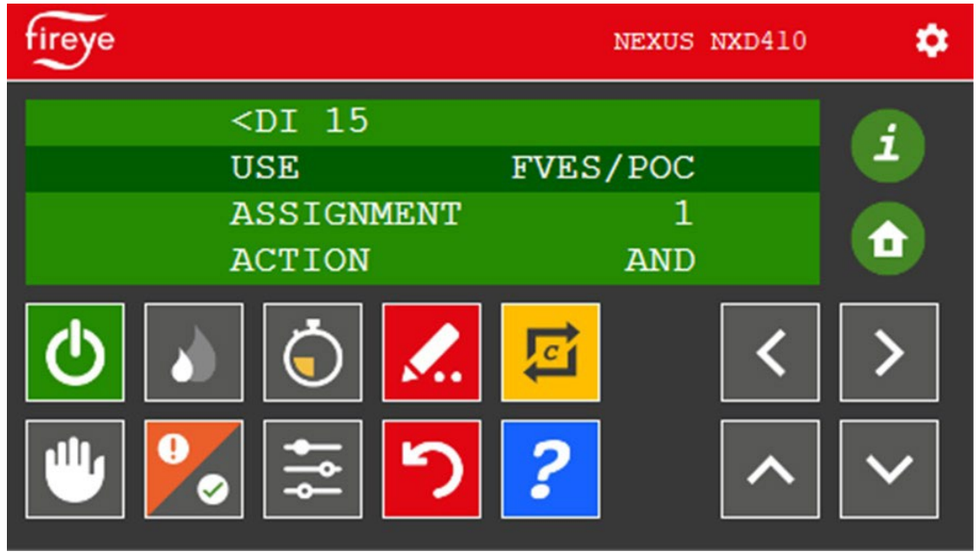


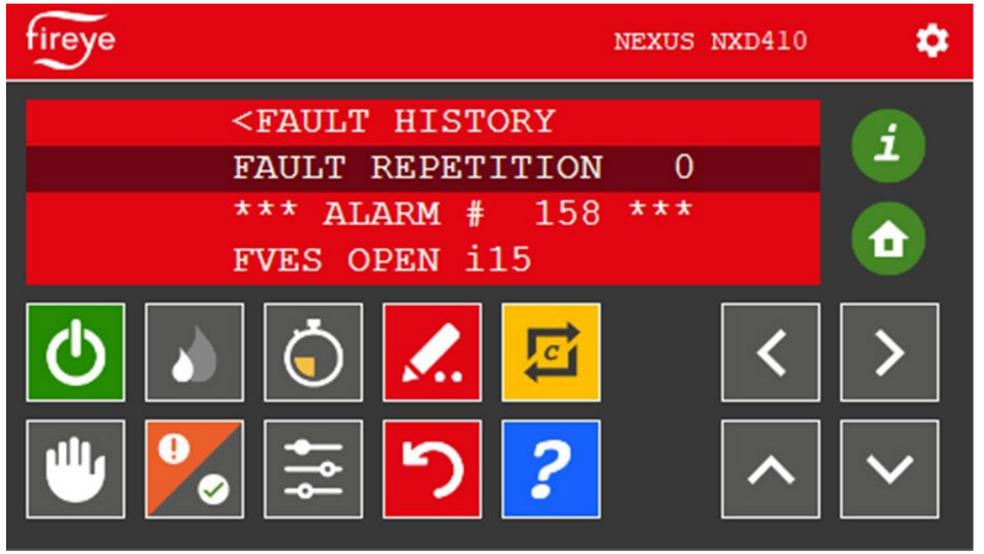
Applies to: NXF4000

Digital Inputs

FVES/POC input

An input can be used to monitor the position of the fuel valve end switch (proof of closure). This input must have voltage during and after MTFI (s13) or a lockout will occur. *ASSIGNMENT* must be used for this selection to specify which profiles this will apply to so situations that only apply to one fuel could be used. *ACTION* can be **AND** or **OR** and only applies if more than one input is used for this function. NOTE: DI15 is set for this function by default.



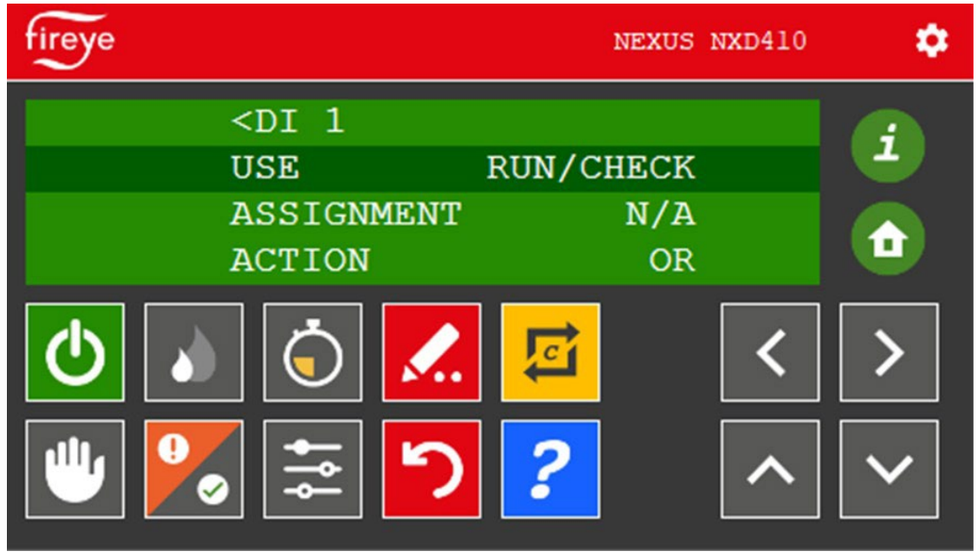


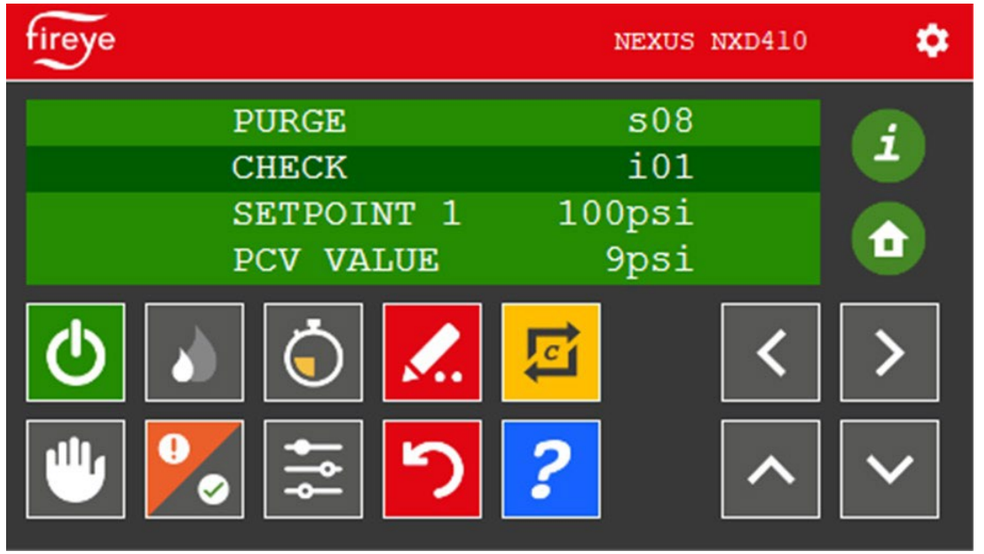
Applies to: NXF4000

Digital Inputs

Run/check input

- An input can be used put the control into “check” mode. This can also be done with the RUN/CHECK key on the keypad. The feature must first be enabled from the BURNER CNTRL SETUP menu (ENABLE RUN/CHECK). This will enable the function for two hours. *ASSIGNMENT* is not applicable. *ACTION* can be AND or OR and only applies if more than one input is used for this function. The keypad key is always active so if AND is chosen this key must also be pressed.



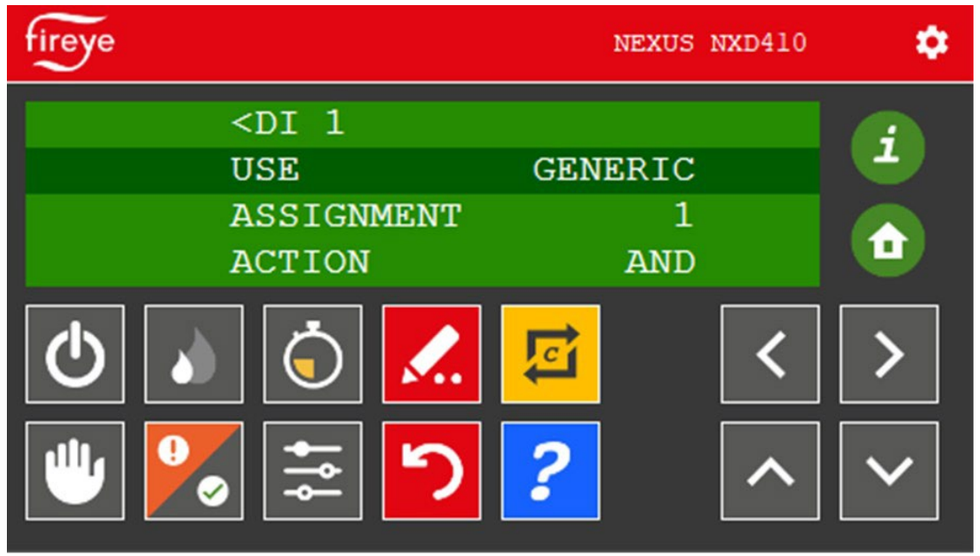


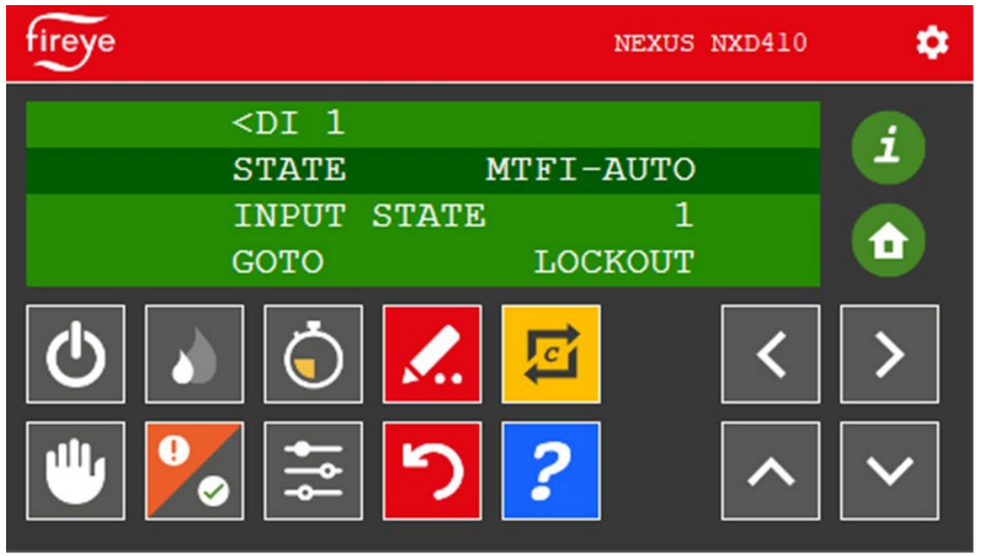
Applies to: NXF4000

Digital Inputs

Generic

Generic inputs allow a condition to be monitored and for different actions to be taken. *ASSIGNMENT* must be used for this selection to specify which profiles this will apply to so situations that only apply to one fuel could be used. *ACTION* can be **AND** or **OR** and only applies if more than one input is used for this function. *STATE* indicates the state at which monitoring of this input begins. *INPUT STATE* determines if the input should normally be on or off. Finally, *GOTO* indicates the action that should occur when the condition is true.





Applies to: NXF4000

Digital Inputs

Generic state choices

- **ALL –** The input is monitored in all states.
- **AFTER PREPURGE** – The input is only monitored after prepurge has completed.
- **HF PURGE ONLY** – The input is only monitored during the high fire purge.
- **AFTER HF PURGE** – The input is only monitored after high fire purge has completed.
- **AFTER LF PURGE** – The input is only monitored after low fire purge has completed.
- **PTFI-MTFI** – The input is only monitored during the PTFI and MTFI states.
- **MTFI-AUTO** – The input is only monitored during the MTFI and AUTO states.

Applies to: NXF4000

Digital Inputs

Generic goto choices

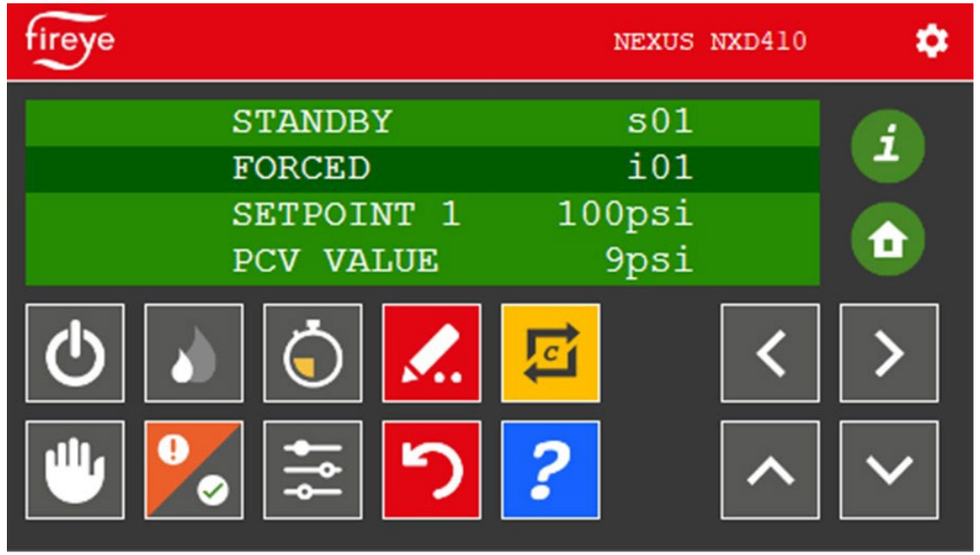
- LOCKOUT – There will be a lockout when the condition is true.
- STANDBY 1S – The control will return to standby if the condition is true for more than one second.
- STANDBY 3S – The control will return to standby if the condition is true for more than three seconds.
- ALARM – There will be an alarm when the condition is true. The alarm output will be energized and there will be a message on the display.

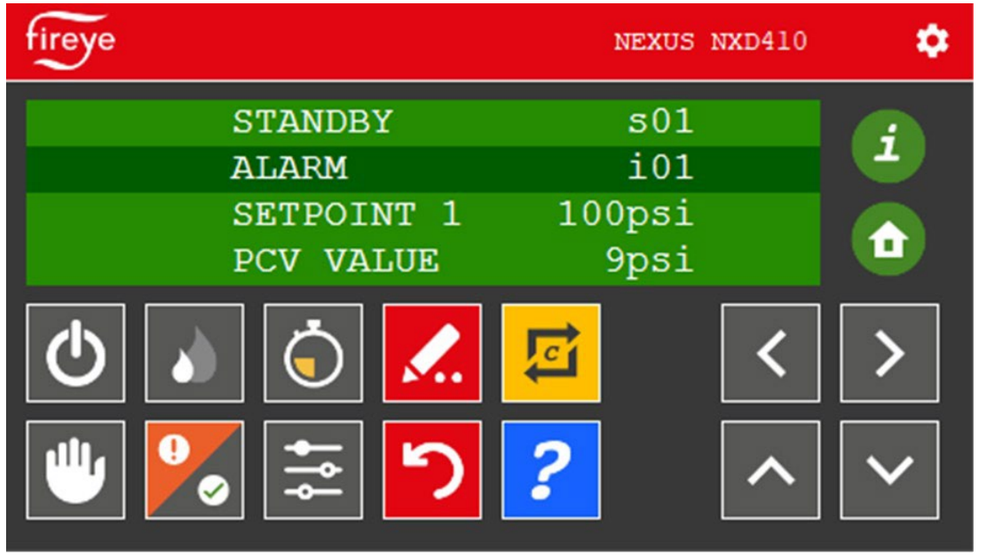
Applies to: NXF4000

Digital Inputs

Generic display messages

Shown here are the displays when the generic input is active and the **GOTO** action is set for standby or alarm.



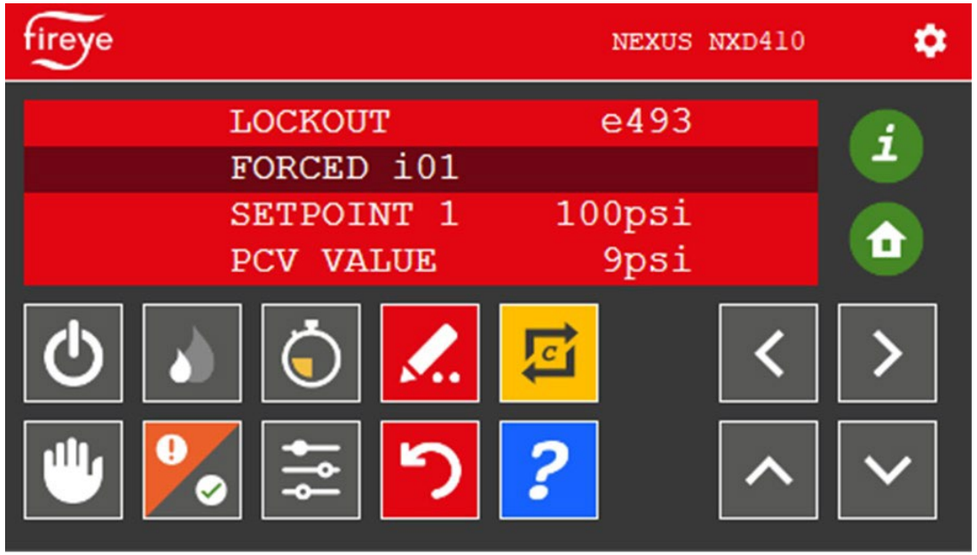


Applies to: NXF4000

Digital Inputs

Generic display messages

Shown here is the display when the generic input is active and the **GOTO** action is set for lockout.



Applies to: NXF4000

Digital Inputs

Using generic inputs for annunciation

The digital inputs can be used for annunciation if desired and enough are available. The typical way to configure would be as follows:

- **USE** – **GENERIC**
- **ASSIGNMENT** – (profiles to apply to)
- **ACTION** – (it can be set to either **AND** or **OR** – it has no effect for GENERIC)
- **STATE** – **AFTER PREPURGE**
- **INPUT STATE** – **0** (lockout will occur if there is no voltage)
- **GOTO** – **LOCKOUT**

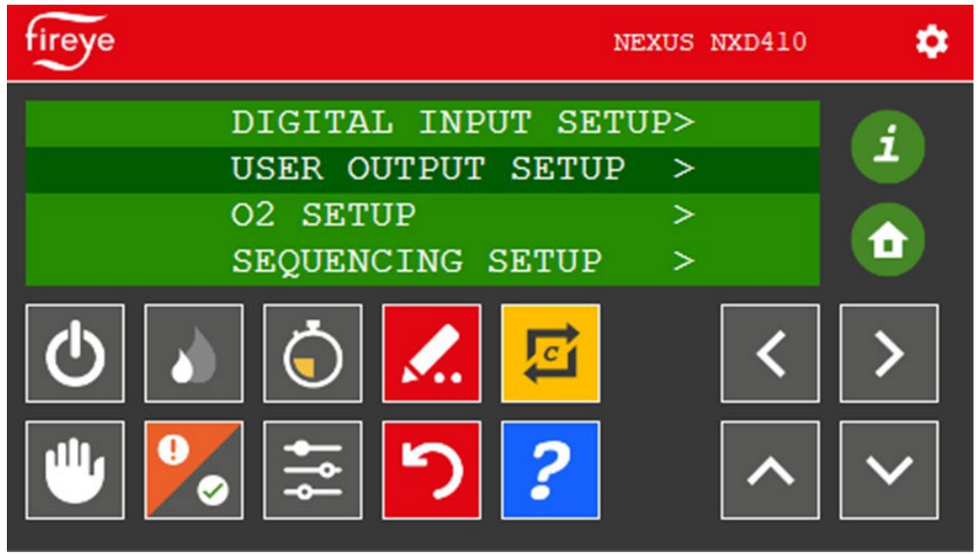
Limits should be wired so that the entire limit string still connects to the recycle or safety limit input, but the status of each connection is monitored at the digital input. The lockout for the generic input will occur before the lockout for the safety limit input. The lockout messages will read “FORCED i01” (or whichever input is applicable). This helps to determine which limit input has caused a lockout.

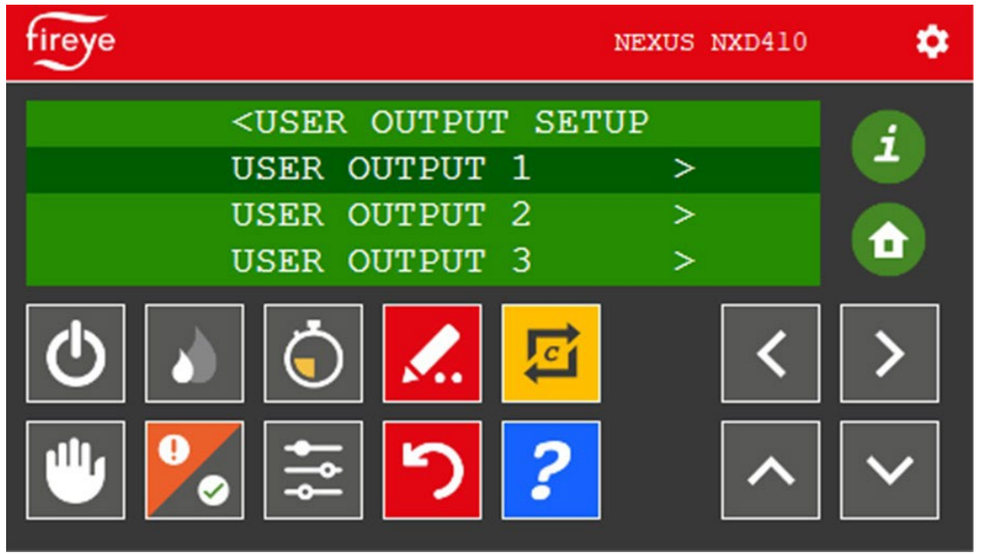
Applies to: NXF4000

Digital Outputs

Programming

There is a menu called **USER OUTPUT SETUP** for the NXF4000. Press the right arrow or NEXT key to enter the menu. Each user output will then have a separate sub menu.





Applies to: NXF4000

Digital Outputs

Status uses

There are multiple choices that reflect different statuses. For some of these, *ASSIGNMENT* is used to select which profiles that this output will apply to.

- **ALWAYS ON** – The output is energized whenever the selected profile(s) is active.
- **MIRROR INPUT 1-15** – The output is energized whenever the corresponding input and selected profile(s) are active.
- **FLAME ON** – The output is energized whenever there is any flame signal and the selected profile(s) are active.
- **LOCKOUT** – The output is energized whenever the control is in lockout, regardless of any profile selection.
- **LOW FIRE** – The output is energized when the modulation rate is below 6% and de-energized when the modulation rate is above 11%. The selected profile(s) must also be active.
- **HIGH FIRE** – The output is energized when the modulation rate is above 93% and de-energized when the modulation rate is below 88%. The selected profile(s) must also be active.

Applies to: NXF4000

Digital Outputs

Alarm uses

The alarm relay is energized whenever any alarm is active. Certain alarms can be decoupled from the general alarm relay and tied to a dedicated output by assigning to a user output. *ASSIGNMENT* is used to select which profiles that this output will apply to.

- **MARGINAL 1,2,3,ALL** – The output is energized whenever the marginal input for the selected sensor (or any sensor if **ALL** is selected) and the selected profile(s) are active.
- **O2 TRIM LIMIT** – The output is energized whenever the programmed O_2 trim limit is reached and the selected profile(s) are active.
- **HIGH FLUE TEMP** – The output is energized whenever the programmed O_2 system flue temperature limit is reached and the selected profile(s) are active.
- **O2 PROBE LIMITS** – The output is energized whenever the programmed O_2 probe limit is reached and the selected profile(s) are active.
- **ALL LIMITS** – The output is energized whenever any of the above limits are reached and the selected profile(s) are active.

Applies to: NXF4000

Digital outputs

State On/Off

The relay is energized whenever the **ON** state is reached and is de-energized whenever the **OFF** state is reached. Each are assigned individually and they cannot be assigned to the same state. *ASSIGNMENT* is used to select which profiles that this output will apply to.

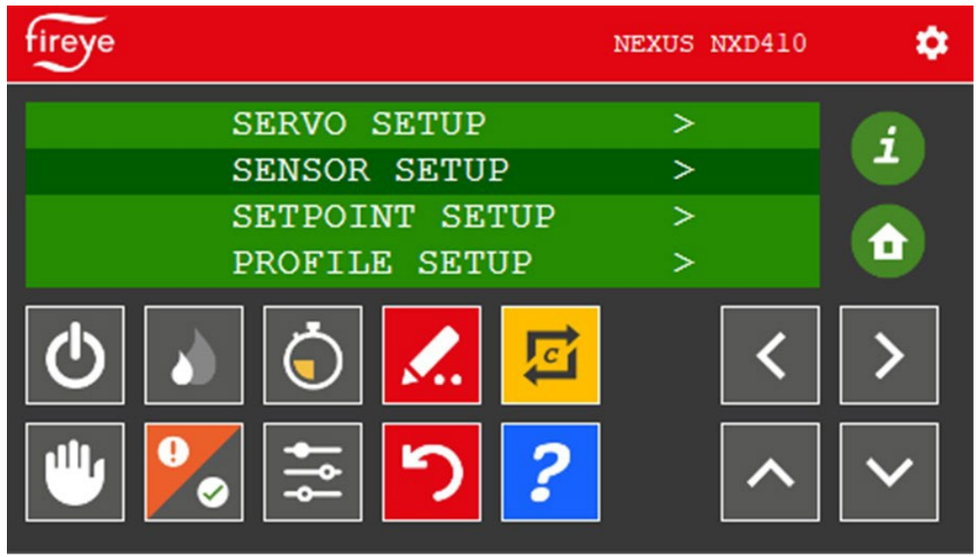
- **STANDBY**
- **WAIT FOR PROFILE**
- **GAS VALVE PROVE1-4**
- **MOVE TO PURGE**
- **PURGE**
- **MOVE TO IGNITION**
- **PTFI**
- **PILOT**
- **MTFI**
- **MFEP**
- **MOVE TO LOW FIRE**
- **AUTO**
- **POSTPURGE**
- **LOCKOUT**

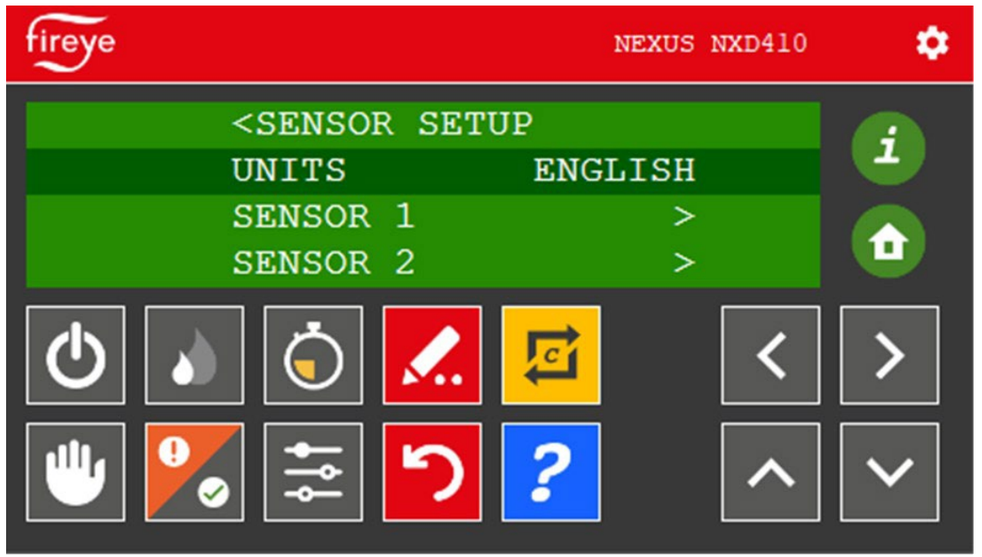
Applies to: NXF4000

Analog Inputs

Sensors

There are five sensor inputs. Each accepts 4-20mA and can be used for different specific functions. There is a menu called **SENSOR SETUP** for the NXF4000 and PPC4000. Press the right arrow or NEXT key to enter the menu. Each sensor will then have a separate sub menu.





Applies to: NXF4000, PPC4000

Analog Inputs

Units of measurement

- The first menu option in the SENSOR SETUP menu is to select the units of measurement. The two choices are ENGLISH and METRIC. In order to change this selection, all of the sensors must be set to UNUSED as this setting is global (applies to all sensors).
- ENGLISH uses PSI for pressure and °F for temperatures. METRIC uses mB (millibar) or B (bar) for pressure (depending upon resolution) and °C for temperatures.

Applies to: NXF4000, PPC4000

Analog Inputs

Sensor 1 options

Sensor 1 is used for the primary control variable (PCV). It is used for setpoint 1 and can also be assigned to setpoint 2 using a digital input to quickly swap between two setpoints. Sensor 1 can be set to one of three options:

- **STEAM** – Uses a steam pressure sensor in one of the defined ranges:

  o-1013 mB to 1720 mB (-14.7 PSI to 25 PSI)

  - 0 mB to 1030 mB (0 PSI to 15 PSI)
  - 0 mB to 2070 mB (0 PSI to 30 PSI)
  - 0 B to 13.8 B (0 PSI to 200 PSI)
  - 0 B to 20.7 B (0 PSI to 300 PSI)

Applies to: NXF4000, PPC4000

Analog Inputs

Sensor 1 options

Sensor 1 is used for the primary control variable (PCV) and can be set to one of three options:

- **WATER** – Uses a water temperature transmitter in one of the defined ranges:

  o0 °C to 176 °C (32 °F to 350 °F)

  o0 °C to 400 °C (32 °F to 752 °F)
- **TRACK** – Uses an external 4-20mA firing rate signal. *RANGE* is unused for **TRACK**.

Applies to: NXF4000, PPC4000

Analog Inputs

Sensors 2, 3 options

- Sensor 2 is used for hot standby with track modulation or sequencing. It can also be used to monitor a temperature or pressure and a marginal alarm value can be assigned. Sensor 2 can be set to STEAM (same choices as with sensor 1), WATER (same choices as with sensor 1) or STANDBY (same choices as WATER).

- Sensor 3 is used to monitor a temperature or pressure and a marginal alarm value can be assigned. Sensor 3 can be set to STEAM (same choices as with sensor 1), WATER (same choices as with sensor 1), OUTDOOR (same choices as WATER), STACK (same choices as WATER) or INLET (same choices as WATER).

Applies to: NXF4000, PPC4000

Analog Inputs

Sensors 4, 5 options

Sensors 4 and 5 are used to monitor a temperature. Either sensor 4 or sensor 5 can be set to **INLET** with the following range choices:

- 0 °C to 176 °C (32 °F to 350 °F)
- -40 °C to 60 °C (-40 °F to 140 °F)
- -45 °C to 149 °C (-50 °F to 300 °F)

If the control is being connected to a supervisory system such as a BMS or PLC, the raw data can be read using Modbus and converted using a formula provided in the MOD-4001 bulletin. Any type of 4-20mA sensor can be connected this way as the raw analog data is available whether the sensor is configured or not and can be parsed in the supervisory system into a meaningful format.

Applies to: NXF4000, PPC4000

Analog Inputs

Enhanced capabilities using Modbus

If the control is being connected to a supervisory system such as a BMS or PLC, the raw data can be read using Modbus and converted using a formula provided in the MOD-4001 bulletin. Any type of 4-20mA sensor can be connected this way. For sensors 1, 2 and 3, the raw analog data is available via Modbus even if the sensor does not have a **TYPE** assigned. For sensors 4 and 5, the raw data is available as long as the sensor has a **TYPE** assigned (**RANGE** is left UNUSED).

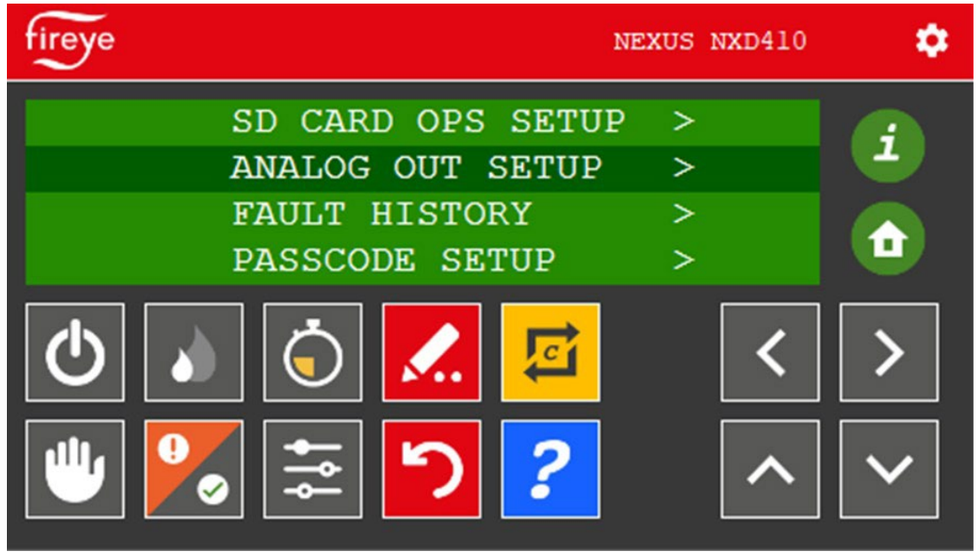
Once read, the raw data can then be parsed in the supervisory system into a meaningful format.

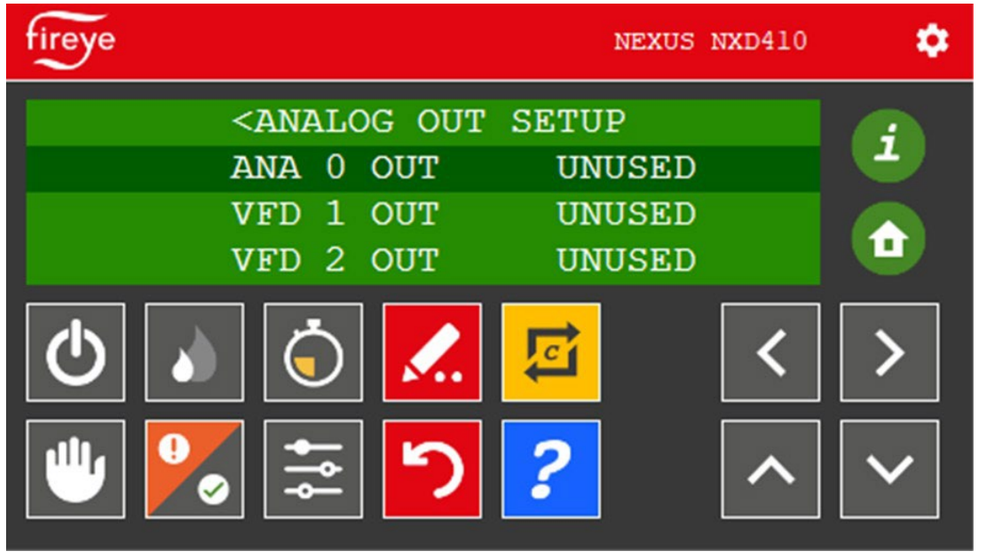
Applies to: NXF4000, PPC4000

Analog Outputs

Status

There is one analog output available on the control, as well as two additional when fitted with the NXCESVFD card. Each puts out 4-20mA and can be used to represent different data. The availability of the outputs on the NXCESVFD depends upon whether they are being used for VFD feedback. There is a menu called **ANALOG OUT SETUP** for the NXF4000 and PPC4000. Press the right arrow or NEXT key to enter the menu. Each output will then have a separate sub menu.





Applies to: NXF4000, PPC4000

Analog Outputs

Choices

Each of the analog outputs can be set to represent one of the following in the specified range:

- **MOD RATE** (0-100%)
- **SETPOINT** (current setpoint, same range as **SENSOR**)
- **SENSOR 1-5** (same range as **SENSOR**)
- **SERVO 1-10** (0°-100°)
- **O2** (0%-20.9%)

Applies to: NXF4000, PPC4000

Conclusion

Improve your installation

- With all of the programmable inputs and outputs available, it is often possible to improve the customer experience at only the cost of the time and wiring involved. Using the inputs can help with troubleshooting no-start issues and using the outputs can help with interconnecting devices as well as supervisory systems. When also considering what is available via Modbus, a way can usually be found to connect a device or get information when needed.

Applies to: NXF4000, PPC4000

THANK YOU