# NE 250 Duplex Pump Controller

Installation and Operation Manual

Rev 0.9


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# NE250 Duplex VFD Pump Controller

Installation and Operation Manual

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# Overview

The NE250 controller is intended for controlling two pump VFDs or motor starters using an analog level signal. It can operate as a stand-alone controller or as part of a system control panel. The NE250 can be used for well pump stations, booster pump stations, or stormwater lift stations.

The NE250 is packaged as a single module that mounts in the panel face (cut-out is identical to the U.S. Filter D152 and Siemens LC150 for retrofitting). It does not require any space on the subpanel, allowing for use in compact designs.

The operator interface is a color touchscreen (3.5” 256-Color, QVGA TFT display) that provides easy viewing of level and pump status, as well as easy adjustment of setpoints. All configuration settings can be plainly viewed and adjusted on just a handful of screens, without requiring a long series of menus.

The NE250 can be paired with a variety of level sensing instruments. It requires a linear analog signal proportional to water level that can be 0-5V, 1-5V, or 4-20mA. The sensing device can be a pressure sensor, an ultrasonic transmitter, radar, or other type of device. The signal type and scaling are easily configurable from the setup screen.

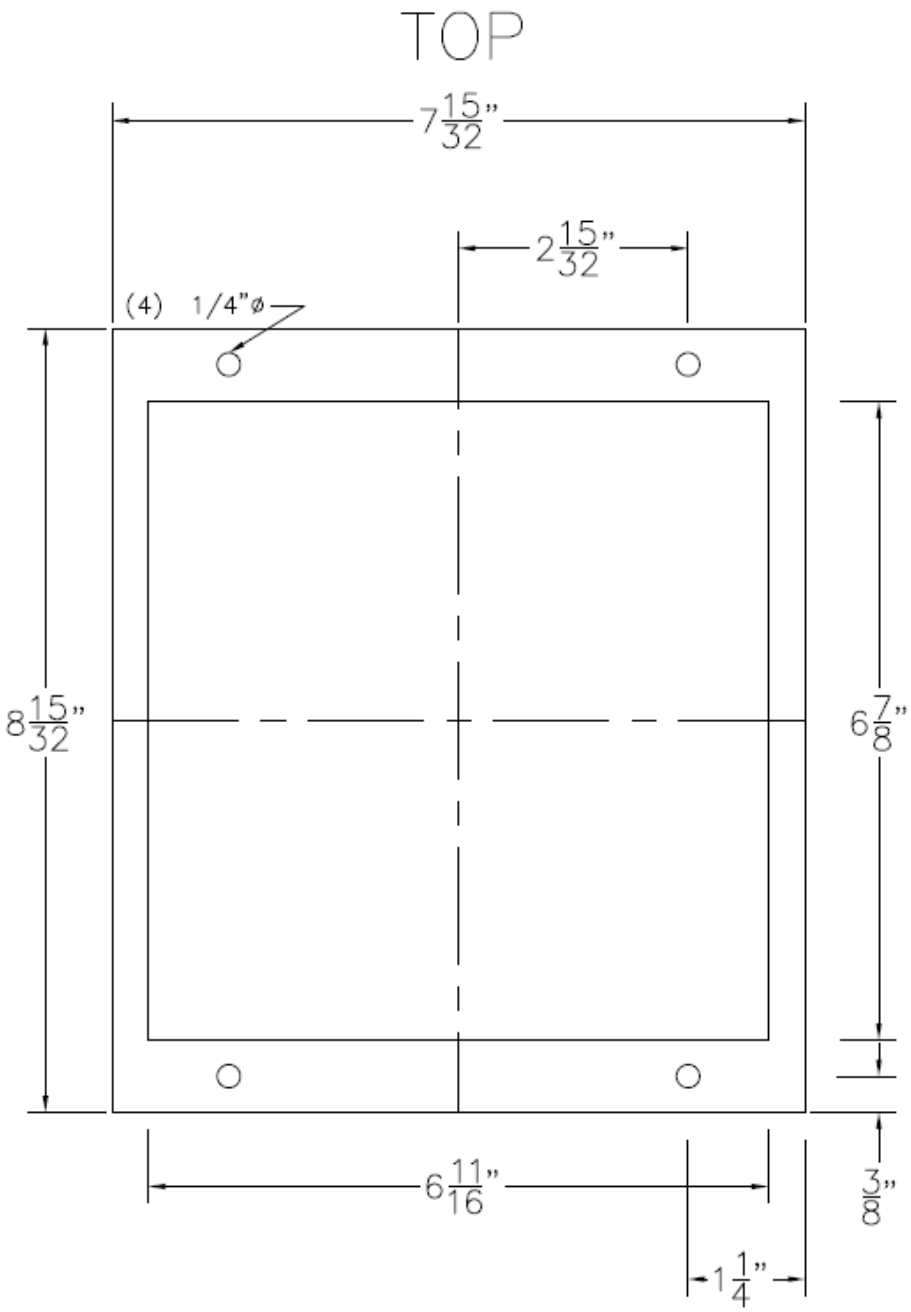
The NE250 can control VFDs by varying a 4-20 mA output (second analog output is available for added capacity). The relationship of the speed of the pump to the water level can be configured independent of the pump on/off setpoints, allowing for a variety of control strategies.

The NE250 displays the well level, pump speeds, pump run hours, and pump starts, enabling the user to collect valuable information easily.

There is no need for special mode selections. Programming changes can be made without interrupting control of the pumps. Simulation of various liquid levels can be done on the fly with the press of a single button.

# Installation

The NE250 mounts on a control panel door or inner swing panel. Secure the mounting studs with the included washers and nuts. See dimensions below:




**Not To Scale**

# Electrical Connections

The NE250 comes with removable terminal strips for ease of wiring. A list of wiring connections is shown on the back of the device housing for additional assistance.

## Step 1 - Connecting power (Required)

The NE250 requires 120VAC power wired to terminals 1 and 2. Ground the NE250 to a panel ground using the G terminal.

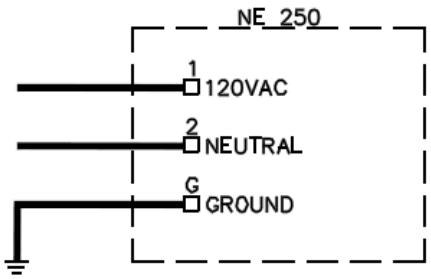



Figure 1- Power Connection

## Step 2 – Connecting the pump motor starters/VFDs (Required)

The control voltage calling each pump to run will be switched on and off. For across the line starters, this will be switching control voltage to the starter coil. For VFDs, this will switch the control voltage to a digital input programmed for run on the drive. These are dry contacts on the NE250 and can be used with 120VAC or 24VDC circuits depending on the control voltage of the starters or VFDs. The start circuit for Pump 1 connects to terminals 6 and 7. The start circuit for Pump 2 connects to terminals 8 and 9.

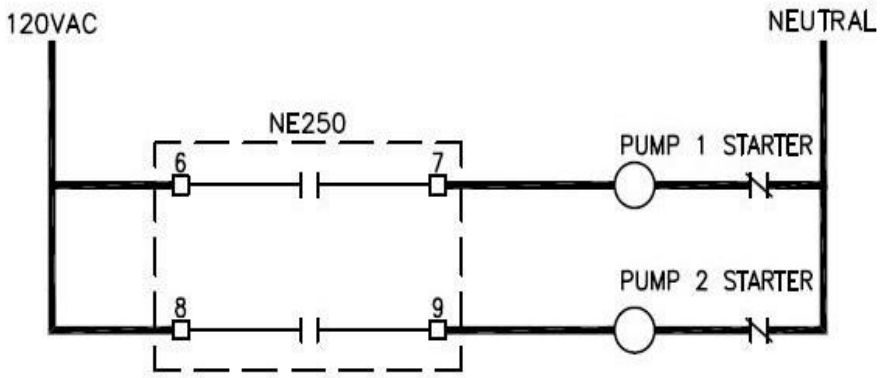



Figure 2-Starter Connection

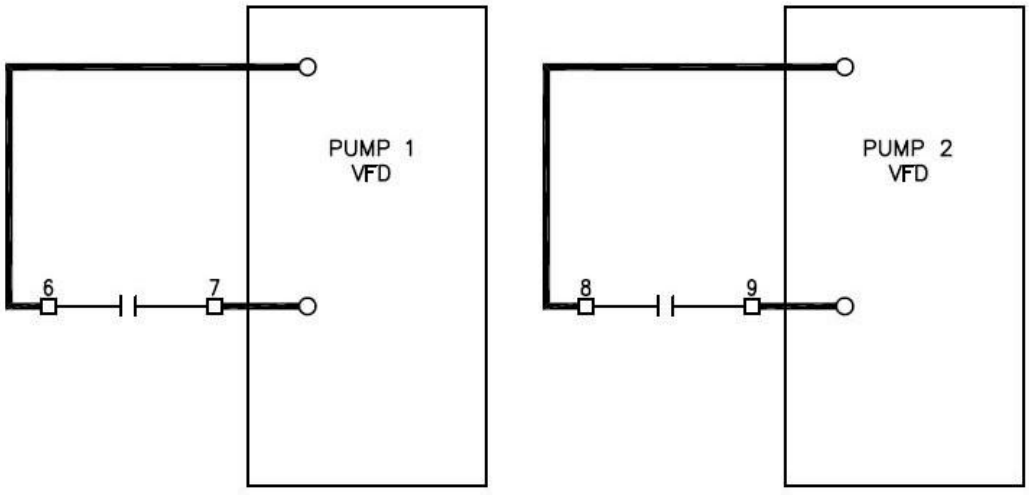



Figure 3-VFD Connection

## Step 3 – Connecting the common alarm output (Optional)

The NE250's alarm outputs can be monitored externally (e.g., PLC input, Auto-Dialer, etc.) using terminals 12, 13, and 14. These alarm outputs can be configured for either low or high alarms and configured as NO or NC.

Terminal 12 is factory set for Low, NO. Terminal 13 is factory set for High, NO. Terminal 14 is the common supply for both outputs. An external relay should be connected to each output if dry isolated contacts are needed.

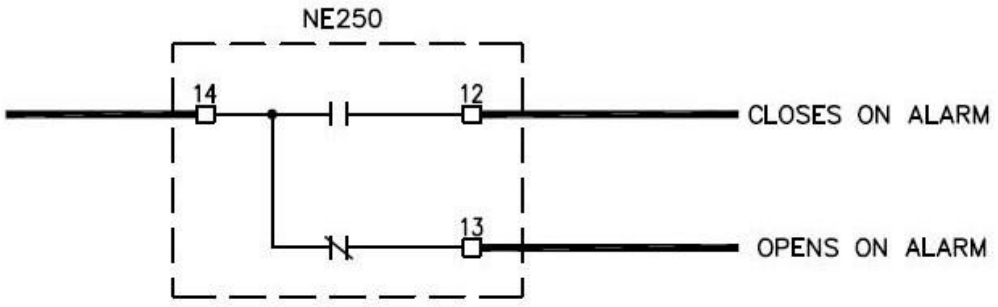



Figure 4-Common Alarm Connection

## Step 4 – Connecting the external audible alarm & silence (Optional)

If using an external horn, buzzer, and/or beacon, a dry contact is provided between terminals 15 and 16 to control it. Connect the appropriate voltage for the device to terminal 15 and connect terminal 16 to the device.

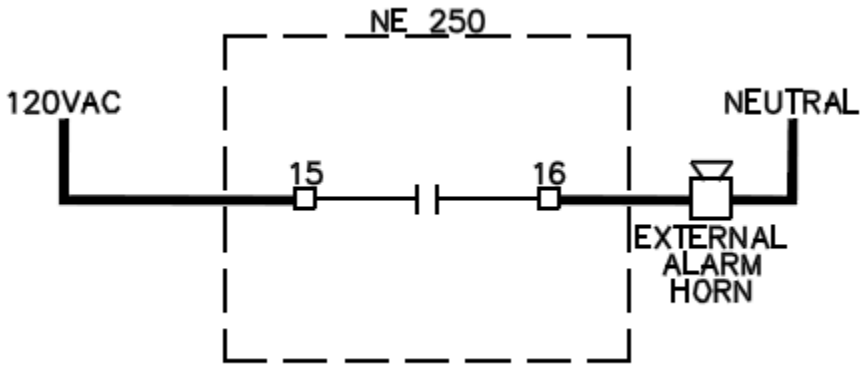



Figure 5-External Alarm

An external silence button can be used with the horn to turn the horn output off while the alarm condition persists. The external silence button must be a normally open momentary contact, wired to terminals 28 and 33. The horn silence circuit runs on 24VDC.

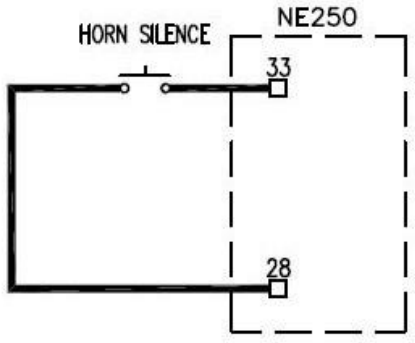



Figure 6-Alarm Silence

## Step 5 – Connecting backup floats (Optional)

If backup floats are to be used, they can be wired into the NE250, or they can be wired around the NE250. Wiring the floats into the NE250 will protect against a level signal failure and does not require additional programming of the VFDs. Wiring the floats around the NE250 will protect against a level signal failure and the failure of the NE250 but requires additional wiring and/or programming of the VFDs. To wire the floats into the NE250, terminal 33 will supply the common side of both the low and high floats with 24VDC power. The high float will then be wired to terminal 26 (closes on high level), and the low float will be wired to terminal 27 (opens on low level).

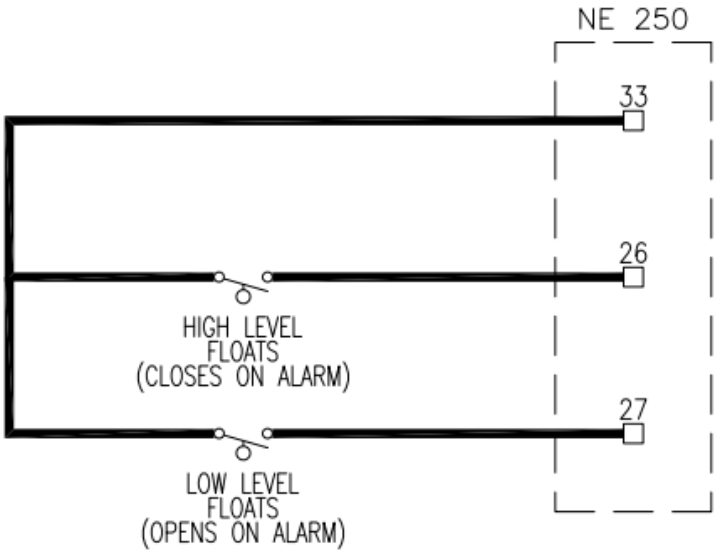



Figure 7-Backup Float Connection

# Step 6 – Connecting the level signal input (Required)

Option 1 – Voltage Input

When using a voltage signal for a level input, the transducer will need to be connected to terminals 38, 41, and 42. Terminal 42 supplies +5 Volts to power the signal. Terminal 41 is the 0 Volt common. Terminal 38 carries the voltage level signal. If an intrinsic barrier is required, consult the wiring instructions from the manufacturer.

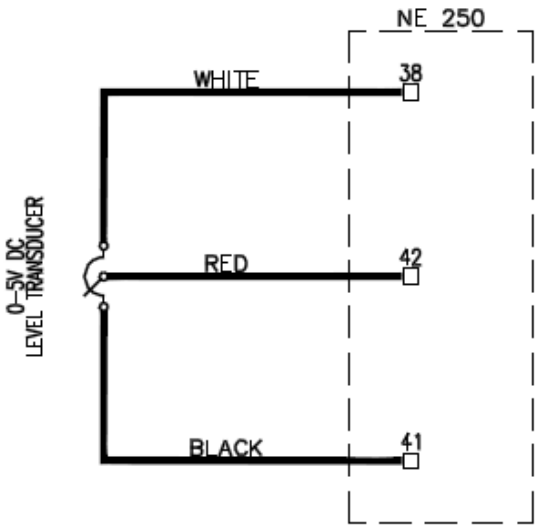



Figure 8-Voltage Input Connection

Option 2 – Current Input

When using a current signal (0-20 mA or 4-20mA) for a level input, the transducer will need to be connected to terminals 39 and 40. The positive side of the current loop is wired to terminal 39. The negative side of the loop is wired to terminal 40. If an intrinsic barrier is required, consult the wiring instructions from the manufacturer.

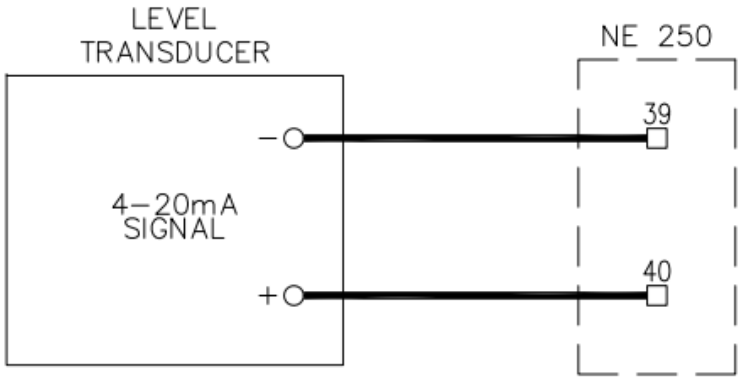



Figure 9-Current Input Connection

# Step 7 – Connecting the Speed Command(s) (Required for VFDs)

When using a VFD, the speed command output must be wired to the drives' analog inputs. The NE250 provides two analog outputs for speed command, but two drives can be run off one so long as the loop impedance is less than 250 ohms for each drive. NOTE: Be sure to confirm that the VFDs are configured for a 4-20mA speed reference input. It is preferred to scale the speed reference in the drive from 0 Hz to 60 Hz and set the minimum and maximum frequencies at 0 Hz and 60 Hz respectively. The NE250 has minimum and maximum speed setpoints in its configuration that will work best with those settings programmed in the drive.

Option 1 – Single Speed Command Output

To connect two drives to one speed command output, connect terminal 34 to the positive terminal of the first drive's analog input. Then connect the negative terminal of the first drive's analog input to the positive terminal on the second drive's analog input. The loop is then completed by connecting the negative terminal of the second drive's analog input to terminal 35.

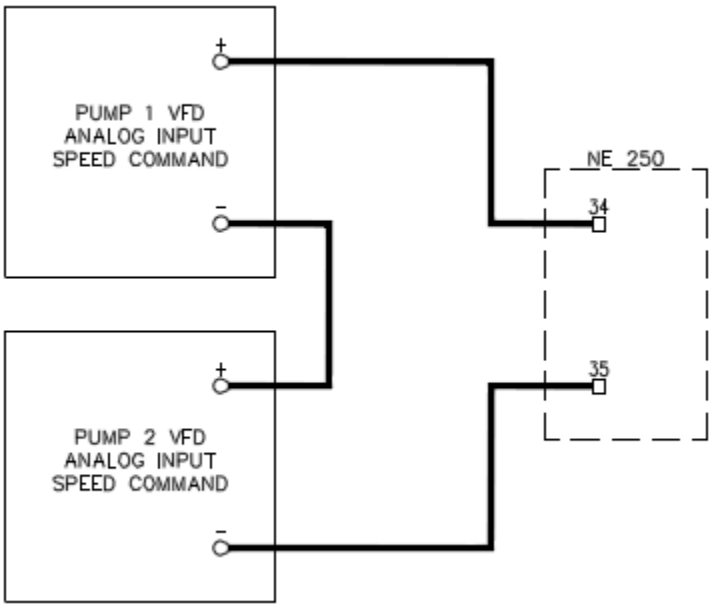



Figure 10-Single Speed Connection

Option 2 – Individual Speed Command Output

To connect each drive to individual speed command outputs, connect terminal 34 to the positive terminal of the first drive's analog input. Connect terminal 35 to the negative terminal of the first drive's analog input. Connect terminal 43 to the positive terminal of second drive's analog input. Connect terminal 44 to the negative terminal of the second drive's analog input.

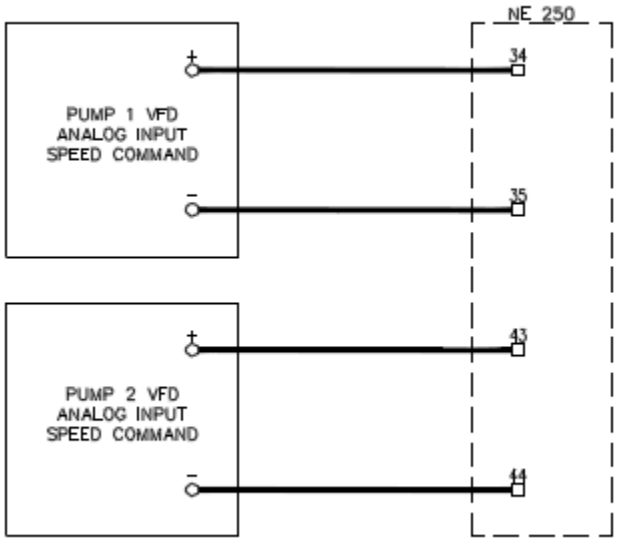



Figure 11-Individual Speed Connection

# Operation

Main Screen

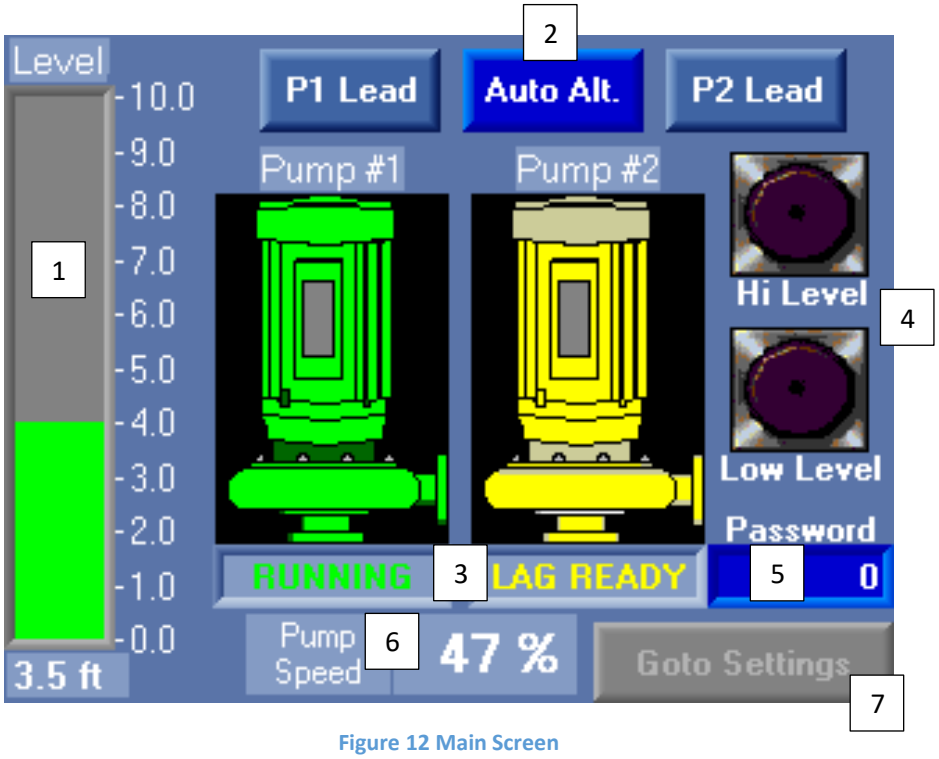



Figure 12 Main Screen

The Main Screen displays the status of the system.

1. Level Graph – The bar graph displays the current level from the transmitter and can be scaled by going to the Settings Screen.
2. Control Sequence - The user can select a lead/lag sequence for the pumps. If “P1 Lead” is selected, then pump 1 will always come on first. If “P2 Lead” is selected, then pump 2 will always come on first. If “Auto Alt.” is selected, then pumps will alternate after each pump cycle. The on/off setpoints for the pump can be changed on the settings page.
3. Pump Status – Displays the status of each pump. The display has four states, “Lead Ready”, “Lag Ready”, “Running”, and “Alarmed”.
4. Alarm Level Indicators – If a high-level or low-level alarm is present then the corresponding light will illuminate.
5. Password – Enter the correct password to access the “Settings” screens.
6. Pump Speed – The pump speed increases and decreases based on the level in the well. The current speed is displayed in percent.
7. Goto Settings – Navigates to the Settings Screen.

Simulation

To simulate levels, press and hold either the “Lower Level” or “Raise Level” buttons on the controller faceplate as shown in Figure 12. While either button is held, the liquid level displayed on the screen will gradually increase or decrease. The pumps will turn on and off based on the simulated level, and alarms will set appropriately. When the button is released, the liquid level displayed will gradually return to the actual level.

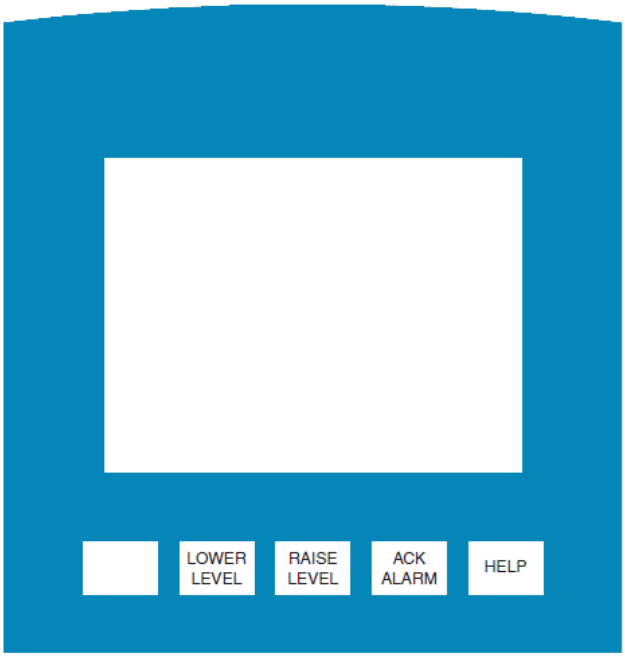



Figure 13- Faceplate Buttons

# Programming & Setpoints

## Settings Screen 1

The settings screens of the NE250 are locked to protect them from unauthorized editing. To unlock them, press the box immediately below “Password” on the lower right of the Main Screen. A pop-up keypad will appear. Type “911” on the keypad and press enter. The Goto Settings button in the bottom right corner of the screen should turn blue. Press the Goto Settings button.

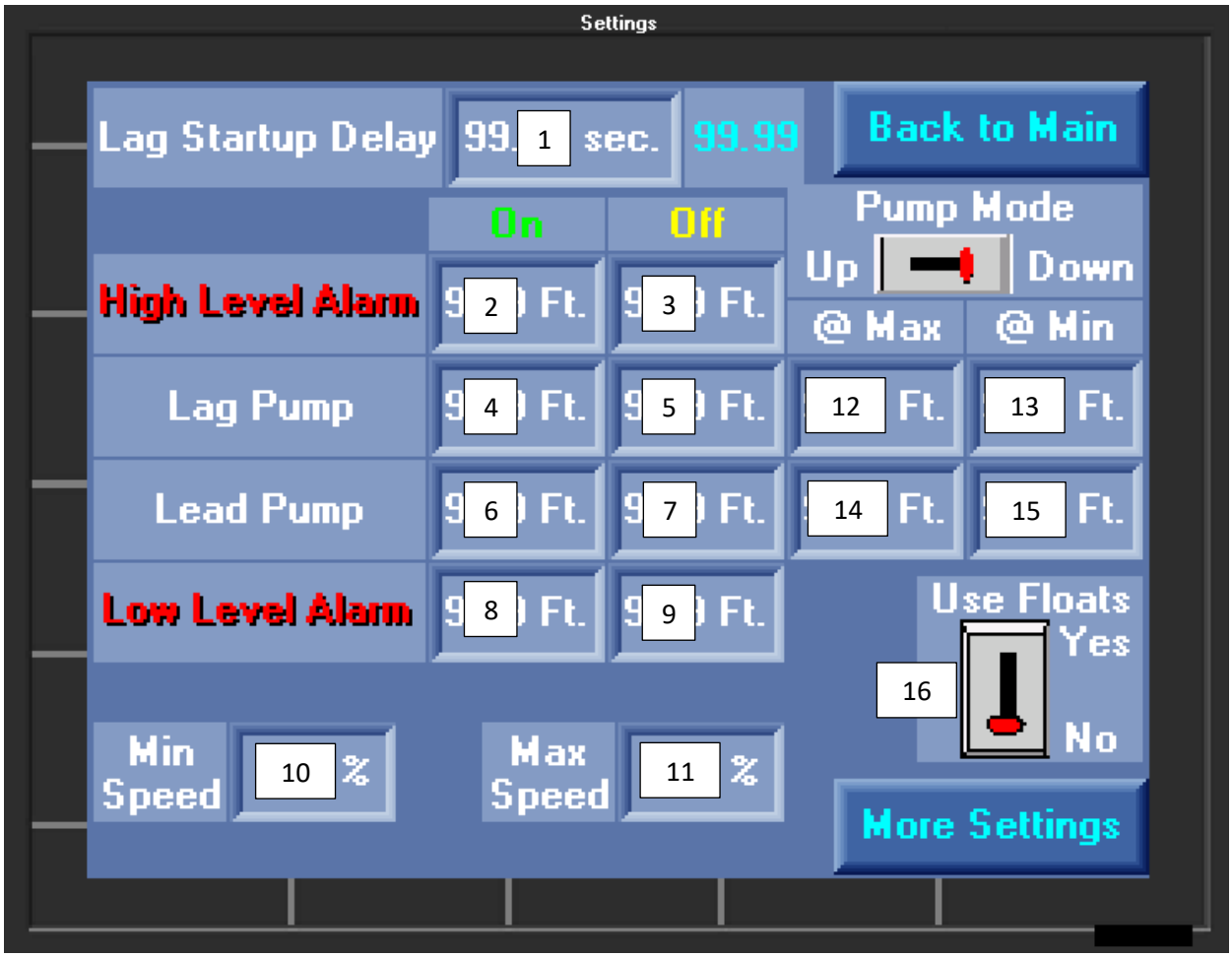



Figure 14 – Settings 1 Screen

Settings Screen 1 contains common setpoints used for controlling the pumps.

1) Lag Startup Delay – If both the lead and lag pumps are called to start at the same time, such as after a power outage and a level that calls both pumps, the lag pump will delay startup for this amount of time to prevent overloading the incoming power supply. The factory default for this parameter is 15 seconds.

2) Pump Mode Toggle Switch – Touch this switch to select between “Pump Down” mode where pumps drain vessel and “Pump Up” mode where pumps fill vessel. In “Pump Down” mode, pumps will turn on when level gets above “On” setpoint and turn off when level gets below “Off” setpoint. A float cycle is triggered by a high float and will pump down to clear the low float. In “Pump Up” mode, pumps will turn on when level gets below “On” setpoint and turn off when level rises above “Off” setpoint. A float cycle will be triggered by clearing the low float and then pump up until reaching the high float.

   **NOTE**: ensure “On” and “Off” levels are set in the appropriate “direction” for pump mode selected or unexpected operation can result.

3) High-Level Alarm: On – This is the level above which a high-level alarm will turn on. This will turn on the common alarm relay and trigger the external alarm contact.

4) High-Level Alarm: Off – This is the level below which a high-level alarm will reset. If the high-level alarm is active, it will remain active until the water level drops below this value.

5) Lag Pump: On – This is the level where the lag pump will turn on. In pump-down applications, this value is typically between the Lead On and High Level Alarm setpoints. In pump-up applications, this is typically between the Lead On and the Low Level Alarm setpoints.

6) Lag Pump: Off – This is the level where the lag pump will turn off if it is running. For pump-down applications, this value should be less than the lag pump on setpoint. For pump-up applications this value should be greater than the lag pump on setpoint.

7) Lead Pump: On – This is the level where the lead pump will turn on. In pump-down applications, this value is typically between the Lag On and Low Level Alarm setpoints. In pump-up applications, this is typically between the Lag On and the High Level Alarm setpoints.

8) Lead Pump: Off – This is the level where the lead pump will turn off if it is running. For pump-down applications, this value should be less than the lead pump on setpoint. For pump-up applications this value should be greater than the lead pump on setpoint.

9) Low Level Alarm: On – This is the level below which the low-level alarm will turn on. This will turn on the common alarm relay and trigger the external alarm contact.

10) Low Level Alarm: Off – This is the level above which the low-level alarm will reset. If a low-level alarm is active, it will remain active until the water level rises above this value.

11) Min Speed – This is the minimum speed that the VFDs will run at when turned on. This speed should be set high enough to generate flow (overcome the system head & open check valve)

12) Max Speed – This is the maximum speed that the VFDs will run at when turned on. This speed will typically be 100% unless that speed produces too much flow for the downstream system.

Note: Pump Speed Response

The pump speed responds to the level in the vessel. In pump-down applications, typically pump speed will decrease as level goes down and increase as level goes up. Hence Pump@Max levels will be greater than Pump@Min levels. In pump-up applications, typically pump speed will increase as level goes down and decrease as level goes up. Hence, Pump@Max levels will be less than Pump@Min levels.

13) Lead Pump: @ Max – This is the level at which the lead pump will reach maximum speed when it is the only pump running. The lead pump will continue to run at maximum speed beyond this setpoint until the lag pump on level is reached. Between these levels, the lead pump will ramp down smoothly toward the lead pump @ min level.

14) Lead Pump: @ Min – This is the level at which the lead pump will reach minimum speed when it is the only pump running. The lead pump will continue to run at minimum speed beyond this setpoint until the lead pump off level is reached. Between these levels, the lead pump will ramp up smoothly toward the lead pump @ max level.

15) Lag Pump: @ Max – This level at which the lead and lag pumps will reach maximum speed when both pumps are running. Both pumps will continue to run at maximum speed beyond this setpoint. When both pumps are running, they will always run at the same speed.

16) Lag Pump: @ Min – This is the level at which the lead and lag pumps will reach minimum speed when both pumps are running. Both pumps will continue to run at minimum speed beyond this setpoint until the lag pump off setpoint is reached. Between these levels, the pumps will ramp up smoothly toward the lag pump @ max level.

17) Use Floats Toggle Switch: If backup floats are wired into terminals 26, 27, and 33 of the NE250, press the “Use Floats” toggle switch to change it to the “Yes” position. Press the toggle switch again to turn off the use of floats. Backup floats will override the level transducer signal, running both pumps at maximum speed when the float is tripped (high in pump-down application and low in pump-up applications) until both pumps are shut off upon tripping the opposite float.

## Settings Screen 2

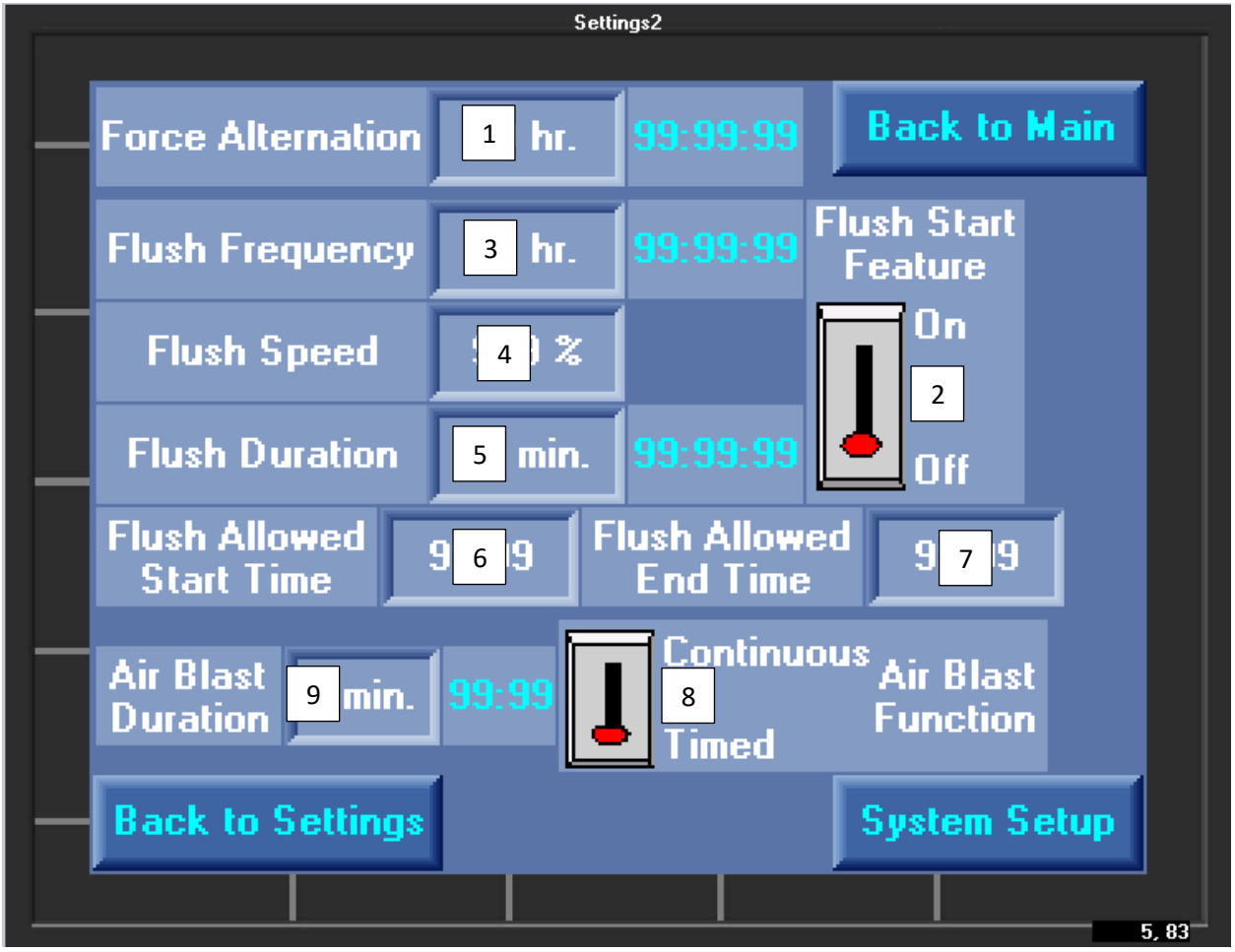



Figure 15 -Settings 2 Screen

Settings Screen 2 contains additional setpoints for advanced features of the NE250. The flush feature will increase the pump speed momentarily after starting to clear sediment out of the well and piping. The air blast feature is used to pump air into the well to suspend sediment when the flush feature is used and requires additional equipment.

1) Force Alternation – When the pumps are in auto alternation mode, they will alternate lead and lag status upon each shutdown. If one pump remains running as lead for a prolonged period, the lead and lag status will be alternated based on this time.

2) Flush Start Switch – When turned on, the pumps will periodically ramp up to a higher speed to flush sediment out of the well. This is useful for systems that run steadily at low speeds.

3) Flush Frequency – This is the time in hours between flush cycles.

4) Flush Speed – This is the speed that the pump(s) will ramp up to during a flush cycle. This should be set as high as possible without disrupting downstream conditions to remove as much sediment as possible.

5) Flush Duration – This is the length of time in minutes that the pump(s) will flush before resuming normal operation.

6) Flush Allowed Start Time – This is the time of day after which a flush cycle is allowed to occur. This parameter along with the Flush Allowed End Time allow the flush cycle to be restricted to a time of day where overall system flow is low so that the system is not overloaded downstream (e.g., between 1AM and 4AM). If the Flush Frequency timer completes timing before this time, it will wait until this time to start a flush cycle.

7) Flush Allowed End Time – This is the time of day before which a flush cycle is allowed to occur. This parameter along with the Flush Allowed Start Time allow the flush cycle to be restricted to a time of day where overall system flow is low so that the system is not overloaded downstream (e.g., between 1AM and 4AM). If the Flush Frequency timer completes timing after this time, it will wait until after the next Flush Allowed Start Time to start a flush cycle.

8) Air Blast Mode – This toggle switch is used to define how the air blast function operates. “Timed Air Blast” will turn the air blast on for the duration set in the “Air Blast Duration” input. The flush sequence will not start until the timed air blast function is complete. If the toggle switch is set to “Continuous Air Blast”, then the air blast will run continuously when the pumps are not running.

9) Air Blast Duration – This is the amount of time that the pressurized air will remain on at the start of a flush cycle.

## System Setup 1

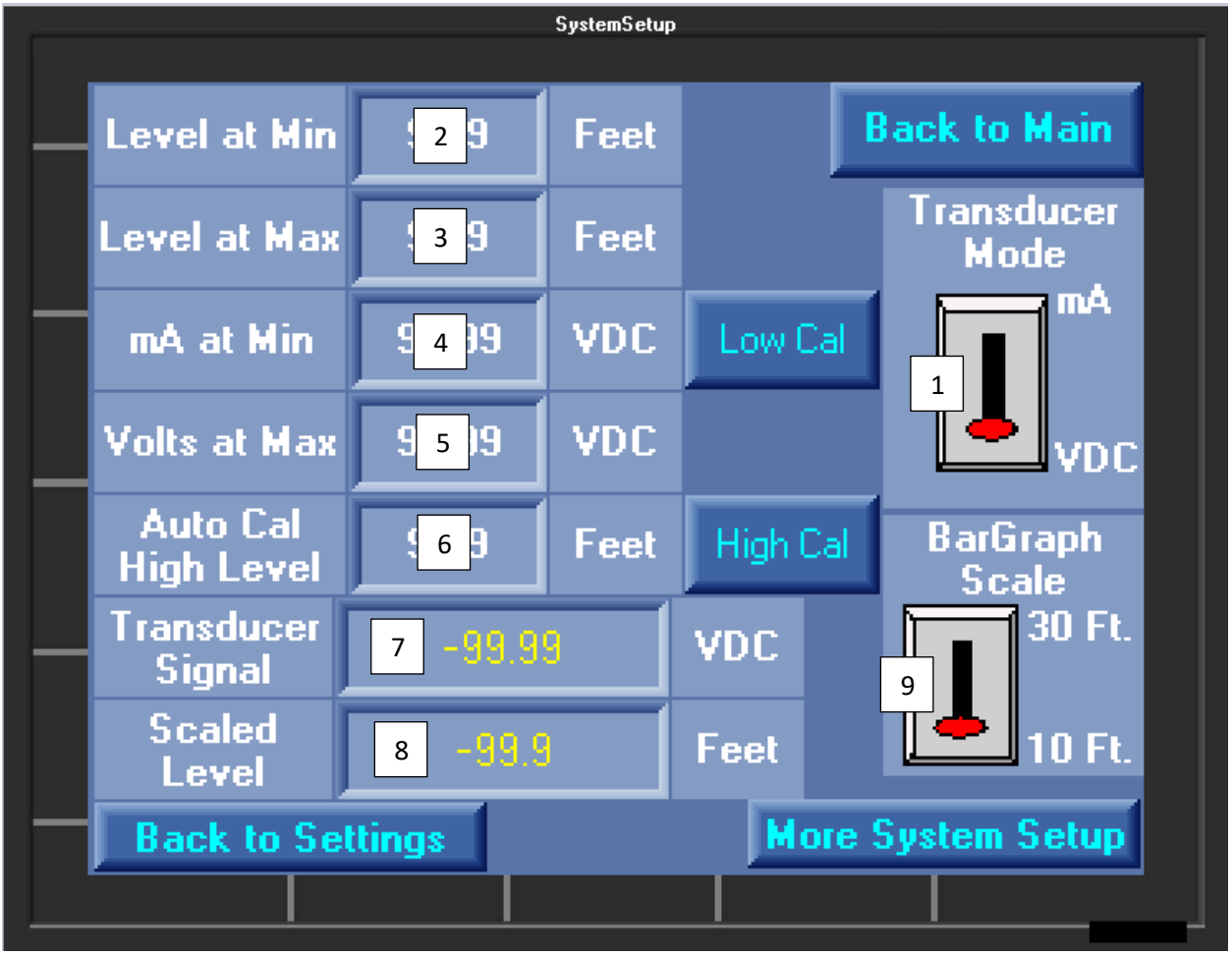



Figure 16 – System Setup Screen

System Setup 1 contains scaling parameters for the transducer. These settings are typically set during commissioning and are not modified again for the life of the equipment unless the transducer is replaced with a different model.

1) Transducer Mode – This switch allows the operator to select the type of signal being used. This is set based on the transducer type being used and is typically not changed after commissioning.

2) Level at Min – This is the level that the transducer will read when there is no liquid present (typically 0 Feet).

3) Level at Max – This is the maximum scaled level of the transducer. For a 5.0 psi transducer, this value is typically 11.5 feet. For a 15.0 psi transducer, the value would be 34.6 feet.

4) mA/Volts at Min – This is the signal when the liquid level is at its minimum. It is dependent on the transducer type, and will typically be 4 mA, 0 volts, or 1 volt.

5) mA/Volts at Max – This is the signal when the liquid level is at its maximum. It will typically be 20 mA or 5 Volts.

6) Auto Cal High Level – This is the level that the transducer is submerged to while performing an auto calibration. To auto calibrate, remove the transducer from the well and suspend it in air, then press the “Low Cal” button on the screen. Next, submerge the transducer to a known level and enter that level into the “Auto Cal High Level” box and then press the “High Cal” button. This will automatically scale the input from the transducer.

7) Transducer Signal – This displays the raw signal being received from the transducer. If this value does not read in the range of your transducer’s output (i.e., between 0 – 5 volts or 4 – 20 mA), check the transducer wiring.

8) Scaled Level – This displays the scaled level reading based on the scaling parameters listed above.

9) Bar Graph Scale – This allows the operator to select the range of the bar graph on the main page. It does not affect the scaling of the signal.

## System Setup 2

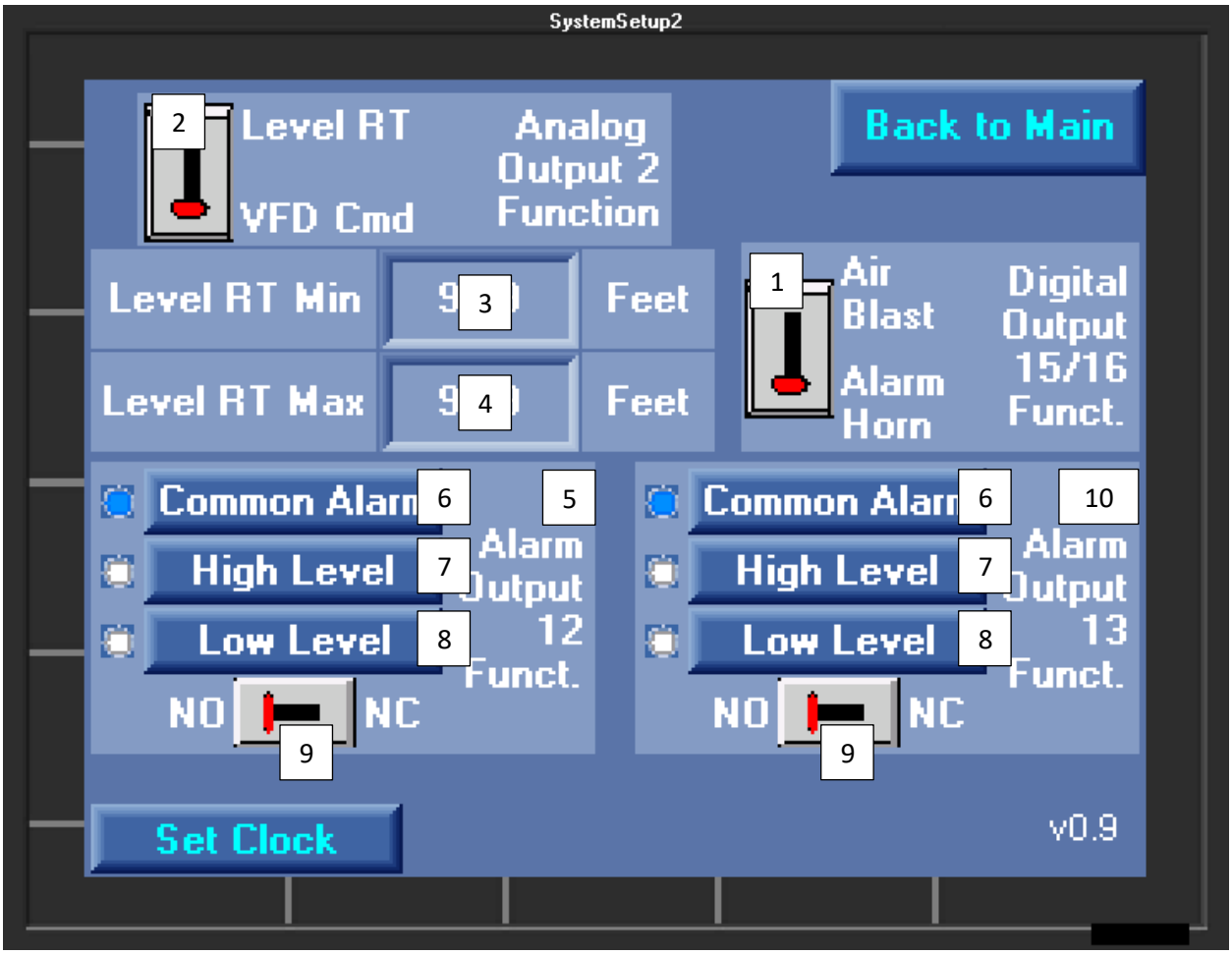



Figure 17 - SystemSetup2 Screen

1) Digital Output 15/16 Mode – This switch allows the operator to choose between using an external alarm horn or incorporating an air blast as part of the flushing cycle. When “Alarm Horn” is selected, output 15/16 will close on level alarms and can be deactivated by closing the Horn Silence circuit (terminals 28 and 33). When “Air Blast” is selected, output 15/16 will close at the start of a flush cycle to trigger the release of pressurized air into the well. The air will help to suspend sediment and other solids prior to the flushing.

2) Analog Output 2 Mode – This switch allows the operator to choose between retransmitting the level signal or duplicating the speed command. This signal will be transmitted from the Analog Output 2 (terminals 43 and 44). If Level RT is selected, use “Level RT Min” and “Level RT Max” values to set the 4-20mA output signal range.

3) Level RT Min – Sets the 4mA value for the analog output. (e.g., if “Level RT Min” is set to 0 ft, analog output 2 will output 4mA when the level in the well reaches 0 ft. This value will increase linearly to 20mA as the level increases to the “Level RT Max” setpoint.)

4) Level RT Max – Sets the 20mA value for the analog output. (e.g., if “Level RT Max” is set to 12 ft, analog output 2 will output 20mA when the level in the well reaches 12 ft.)

5) Alarm Output 1 – This area allows the operator to configure alarm output 1 (terminal 12).

6) Common Alarm – When selected, this sets associated alarm output to change state for both level alarms.

7) High Level – When selected, this sets the associated alarm output to change state when a high-level alarm is active.

8) Low Level – When selected, this sets associated alarm output to change state when a low-level alarm is active.

9) NO/NC Mode – Allows the user to configure the associated alarm output as normally open or normally closed. When NO is selected, the alarm contact will close when the alarm condition is met. When NC is selected, the alarm contact will open when the alarm condition is met.

10) Alarm Output 2 – This area allows the operator to configure alarm output 2 (terminal 13).

# Troubleshooting

The Level Signal is Wrong or Does Not Appear

If the level signal is wrong or does not appear, go to the “System Setup” screen and check the transducer signal to make sure that the NE250 is receiving a transducer signal. If the NE250 is not receiving a signal, check the wiring of the transducer. If the NE250 is receiving a signal, but the scaled value is incorrect, ensure that the correct mode is selected for the transducer and adjust setpoints 2-5 on “System Setup 1” to match the transducer range.

The Pumps Have Difficulty Starting

If one pump has difficulty starting up, check the incoming power and pump starting equipment. If the pumps have difficulty starting when both pumps are commanded to run, check the lag startup delay. The factory default value is set at 15 seconds but may need to be increased.

The Pumps Turn On and Off Too Frequently

If the pumps are turning on and off too frequently, go to the “Settings 1” screen and adjust the ON and OFF setpoints appropriately. Increasing the difference between the ON setpoint and OFF setpoint will result in longer run times. Increasing the “Level @Min” setpoints will slow the pump down earlier and run at a low speed longer before reaching the OFF setpoint.

# Factory Settings

Below is a list of all the factory default settings:

| | |
|---|---|
| Lag Startup Delay | 15 sec |
| Pump Mode | Pump Down |
| High Level Alarm On | 9 ft |
| High Level Alarm Off | 8.5 ft |
| Lead Pump On | 7 ft |
| Lead Pump Off | 4 ft |
| Lead Pump @Max | 8 ft |
| Lead Pump @Min | 6 ft |
| Lag Pump On | 6 ft |
| Lag Pump Off | 3 ft |
| Lag Pump @Max | 6.5 ft |
| Lag Pump @Min | 3.5 ft |
| Low Level Alarm On | 1 ft |
| Low Level Alarm Off | 1.5 ft |
| Force Alternation | 24 hr |
| Flush Frequency | 48 hr |
| Flush Speed | 100% |
| Flush Duration | 3 min |
| Flush Allowed Start Time | 01:00 |
| Flush Allowed End Time | 04:00 |
| Air Blast Duration | 1 min |
| Air Blast Function | Timed |
| Level at Min | 0 ft |
| Level at Max | 11.7 ft |

| | |
|---|---|
| Volts at Min- | 0.54 V |
| Volts at Max- | 4.53 V |
| Transducer Mode- | VDC |
| Bar Graph Scale- | 10 ft |
| Analog Output 2 Function- | VFD CMD |
| Level RT Min- | 0 ft |
| Level RT Max- | 12 ft |
| Digital Output 2 Function- | Alarm Horn |
| Config. Alarm Output 1[12] - | Low Level, NO |
| Config. Alarm Output 2[13] - | High Level, NO |

# Table of Figures

| REVISIONS | | | | |
|---|---|---|---|---|
| REV. | DATE | BY | CHKD | DESCRIPTION |
| 0 | 3/19/14 | EGW | | FOR MANUFACTURE |
| 1 | 7/30/14 | EGW | | ADDED FACTORY SETTINGS |
| 2 | 9/9/25 | RAP | | ADDED PUMP MODE GRAPHICS |
| | | | | |

## FACTORY SETTINGS

Lag Startup Delay: 15 SEC

PUMP MODE: UP / DOWN

| | On | Off | @ Max | @ Min |
|---|---|---|---|---|
| High Level Alarm | 9 | 8.5 | | |
| Lag Pump | 7 | 4 | 8 | 6 |
| Lead Pump | 6 | 3 | 6.5 | 3.5 |
| Low Level Alarm | 1 | 1.5 | | |

Use Floats: Yes / No

Min Speed: 50%

Max Speed: 100%

Force Alternation: 24 hr.

Flush Frequency: 48 hr.

Flush Speed: 100 %

Flush Duration: 3 min.

Flush Allowed Start Time: 01:00

Flush Allowed End Time: 04:00

Air Blast Duration: 1 min.

Air Blast Function: Continuous / Timed

| | |
|---|---|
| Level at Min | 0 |
| Level at Max | 11.7 |
| Volts at Min | 0.54 |
| Volts at Max | 4.53 |
| Auto Cal High Level | 0 |
| Transducer Signal | 0 |
| Signal Level | 0 |

Transducer Mode: mA / VDC

BarGraph Scale: 30 Ft. / 10 Ft.

Level RT Analog Output 2 Function: VFD Cmd

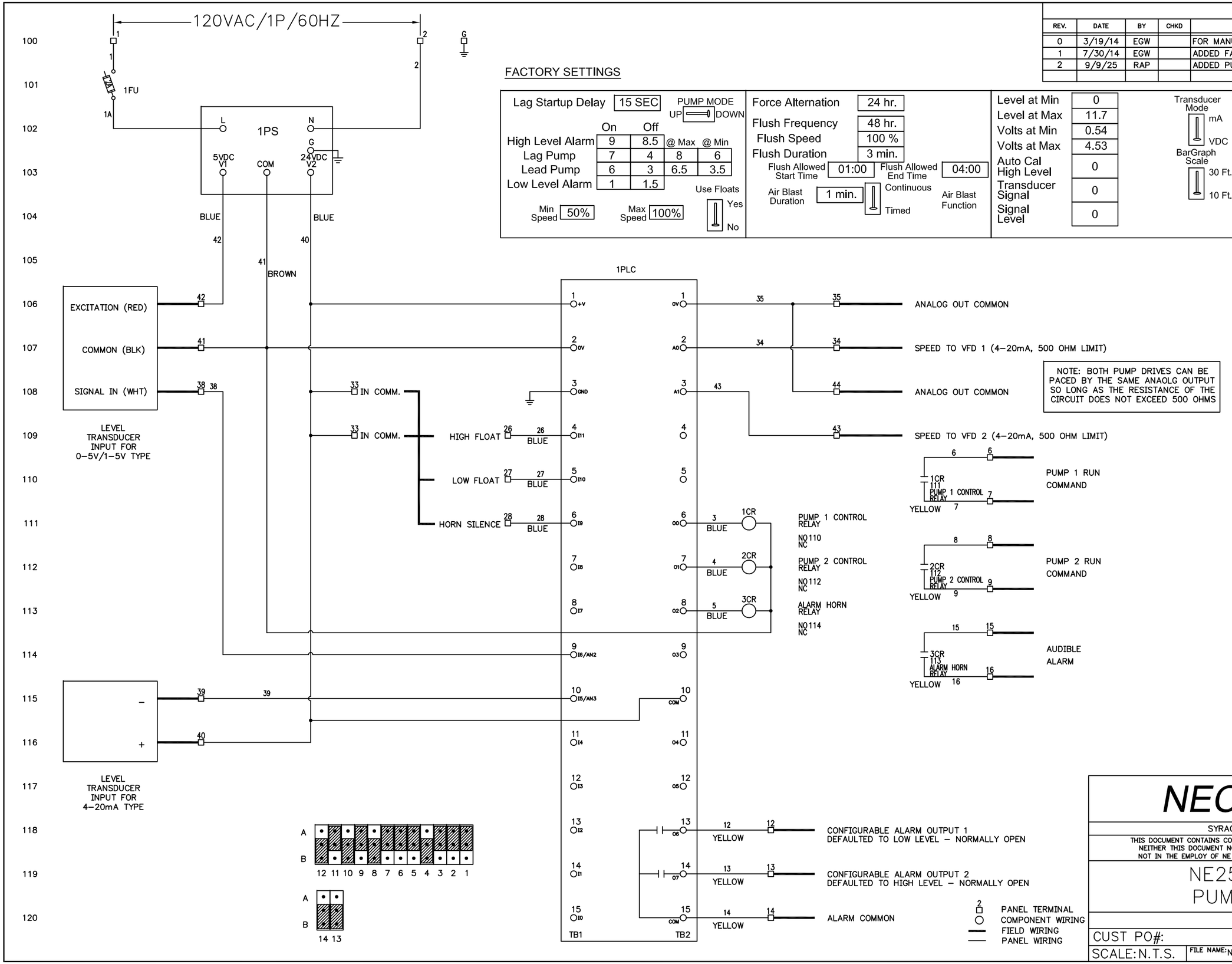
Level RT Min: 0

Level RT Max: 12

Air Blast / Alarm Horn — Digital Output 2 Function

Common Alarm — High Level / Low Level — Alarm Output 12 Function — NO / NC

Common Alarm — High Level / Low Level — Alarm Output 13 Function — NO / NC




NOTE: BOTH PUMP DRIVES CAN BE PACED BY THE SAME ANAOLG OUTPUT SO LONG AS THE RESISTANCE OF THE CIRCUIT DOES NOT EXCEED 500 OHMS

### 1TB

| |
|---|
| 1 |
| 2 |
| 6 |
| 7 |
| 8 |
| 9 |
| 12 |
| 13 |
| 14 |
| 15 |
| 16 |
| 26 |
| 27 |
| 28 |
| 33 |
| 33 |

### 2TB

| |
|---|
| 34 |
| 35 |
| 38 |
| 39 |
| 40 |
| 41 |
| 42 |
| 43 |
| 44 |
| G |

NE CONTROLS–SYRACUSE,NY–315–626–2480

# NECONTROLS

SYRACUSE, NEW YORK 315–299–5161



## NE250 DUPLEX VFD PUMP CONTROLLER

PAGE: PAGE 1 OF 1

CUST PO#:

SCALE: N.T.S.

FILE NAME: NE250

SIZE: D

NE250

REV.: 2