Startup Guide

MAGNA3 Insulated Pumps

This Startup Guide is designed to assist the installer when setting up a Geo-Flo insulated pump using a Grundfos Magna3. *Please read this guide in its entirety before attempting to install the pump.*

1. Verify package contents. Included in the package is the Magna3 insulated pump and two isolation valves.
2. Remove start/stop plug. Before attaching power, remove the Start/Stop jumper (remove the entire green plug with the jumper). This will prevent the pump from starting when eventually powered. See Figure 1.
3. Complete ground loop and heat pump piping.
4. Determine the pump control mode. The Magna3 has a number of control modes for a variety of applications. However, for geothermal installations there are only three control modes that are applicable, Constant Differential Pressure, Differential Temperature, and Constant Curve. Most of the other modes are for boiler applications, and are not recommended. There are four types of applications that utilize the three control modes, as follows:

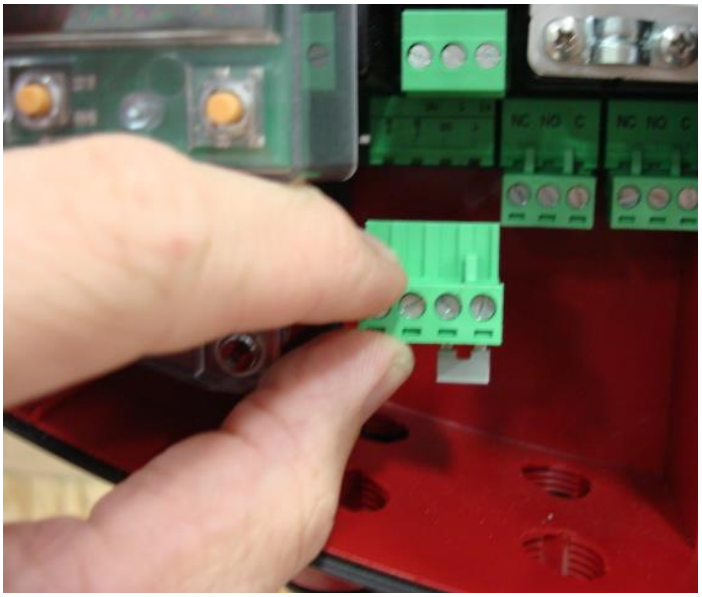


Figure 1: Remove Start/Stop jumper before wiring pump.

- **Uncontrolled Pump -- Constant Curve**: Because the Magna3 uses a very efficient motor, the pump may be used as a constant speed pump in applications where variable speed is not necessary or desired. This application is called an "Uncontrolled Pump", and uses the Constant Curve mode.

  ➔ ***See Option 1 (page 4) for pump setup in Constant Curve mode.***

- **Central Variable Speed Pump -- Constant Differential Pressure**: A central variable speed pump is common for geothermal applications of three or more heat pumps due to the opportunity for energy savings. Figure 2 provides an example piping diagram. The central pump is controlled based upon pressure differential. As the motorized ball valves (on/off or modulating) open and close based upon the operation of the heat pump, the system pressure changes, causing the pump to adjust speed to attain the water flow needed. For example, if only one of five heat pumps is running, the pump speed adjusts to the flow rate needed for the one heat pump, dramatically reducing pump Watts compared to when the pump is running at maximum flow.

  ➔ ***See Option 2 (page 4) for pump setup in Constant Differential Pressure mode.***

- **Primary (Ground Loop) Pump for Primary-Secondary Application -- Temperature Difference**: Primary-Secondary pumping allows for a smaller pump on the ground loop portion of the installation, since the piping arrangement (primary-secondary) effectively separates the piping into two pumping systems, the ground loop, and the inside piping. Figure 3 provides an example piping diagram. The primary pump is controlled based upon temperature difference (typically 6 to 10 deg F., depending upon climate and building load profile). The secondary pump(s) are energized only when the heat pumps are running. When the heat pumps are running, heat is extracted or rejected from the ground loop, causing the temperature difference to increase on the primary side, which causes the Magna3 to increase speed to provide additional flow.

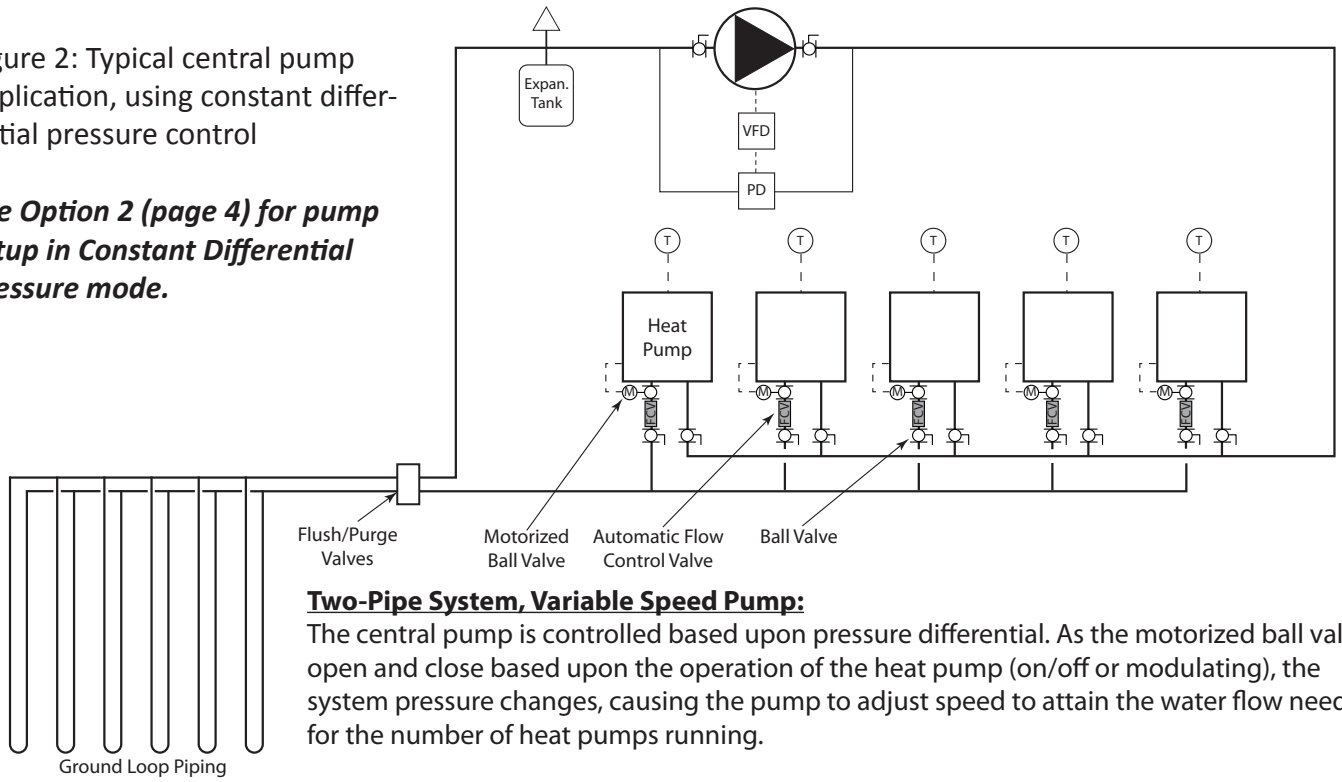
  ➔ ***See Option 3 (page 5) for pump setup in Temperature Difference mode.***

- **Secondary (Inside Piping) Pump for Primary-Secondary Application -- Constant Differential Pressure**: Primary-Secondary pumping allows for a smaller pump on the inside portion of the installation, since the piping arrangement (primary-secondary) effectively separates the piping into two pumping systems, the ground loop and the inside piping. Figure 4 provides an example piping diagram. The secondary pump is controlled based upon pressure differential. As the motorized ball valves (on/off or modulating) open and close based upon the operation of the heat pump, the system pressure changes, causing the pump to adjust speed to attain the water flow needed. For example, if only one of five heat pumps is running, the pump speed adjusts to the flow rate needed for the one heat pump, dramatically reducing pump Watts compared to when the pump is running at maximum flow.

  ➔ ***See Option 2 (page 3) for pump setup in Constant Differential Pressure mode.***

Figure 2: Typical central pump application, using constant differential pressure control

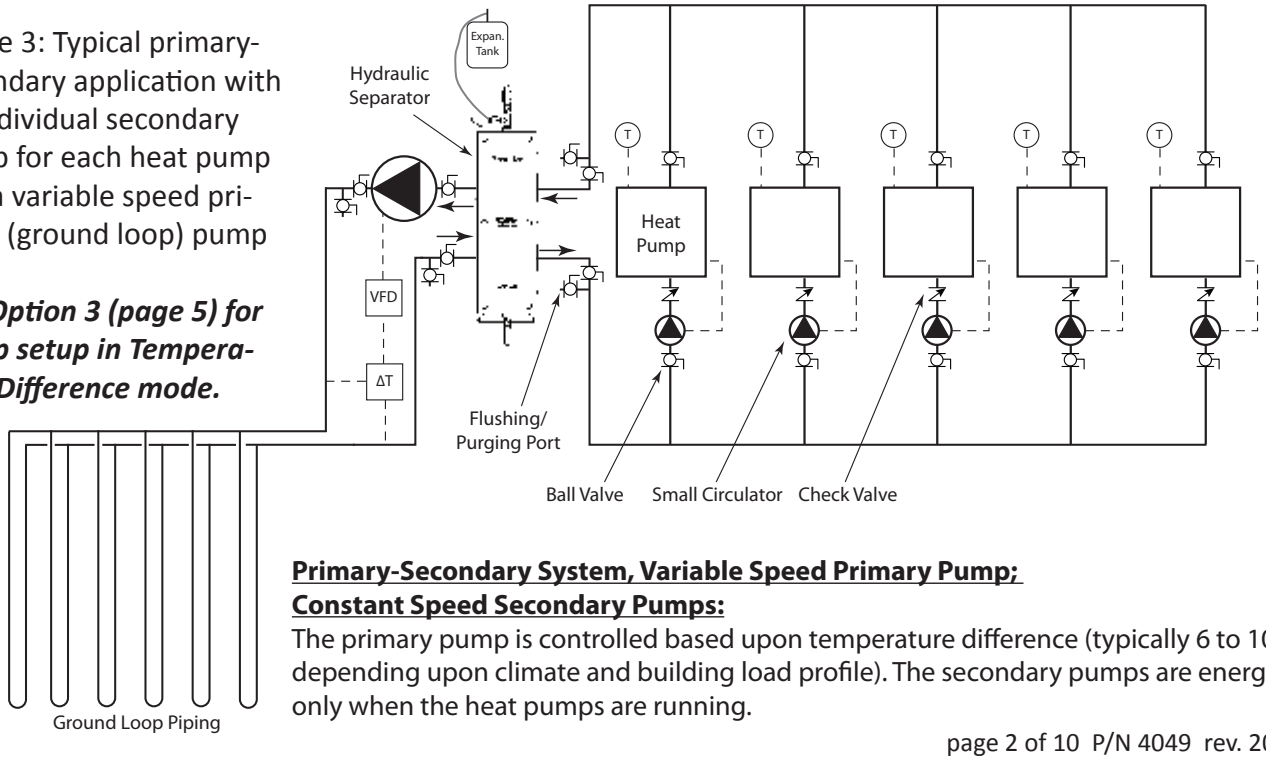
See Option 2 (page 4) for pump setup in Constant Differential Pressure mode.



<u>Two-Pipe System, Variable Speed Pump:</u>
The central pump is controlled based upon pressure differential. As the motorized ball valves open and close based upon the operation of the heat pump (on/off or modulating), the system pressure changes, causing the pump to adjust speed to attain the water flow needed for the number of heat pumps running.

Figure 3: Typical primary-secondary application with an individual secondary pump for each heat pump and a variable speed primary (ground loop) pump

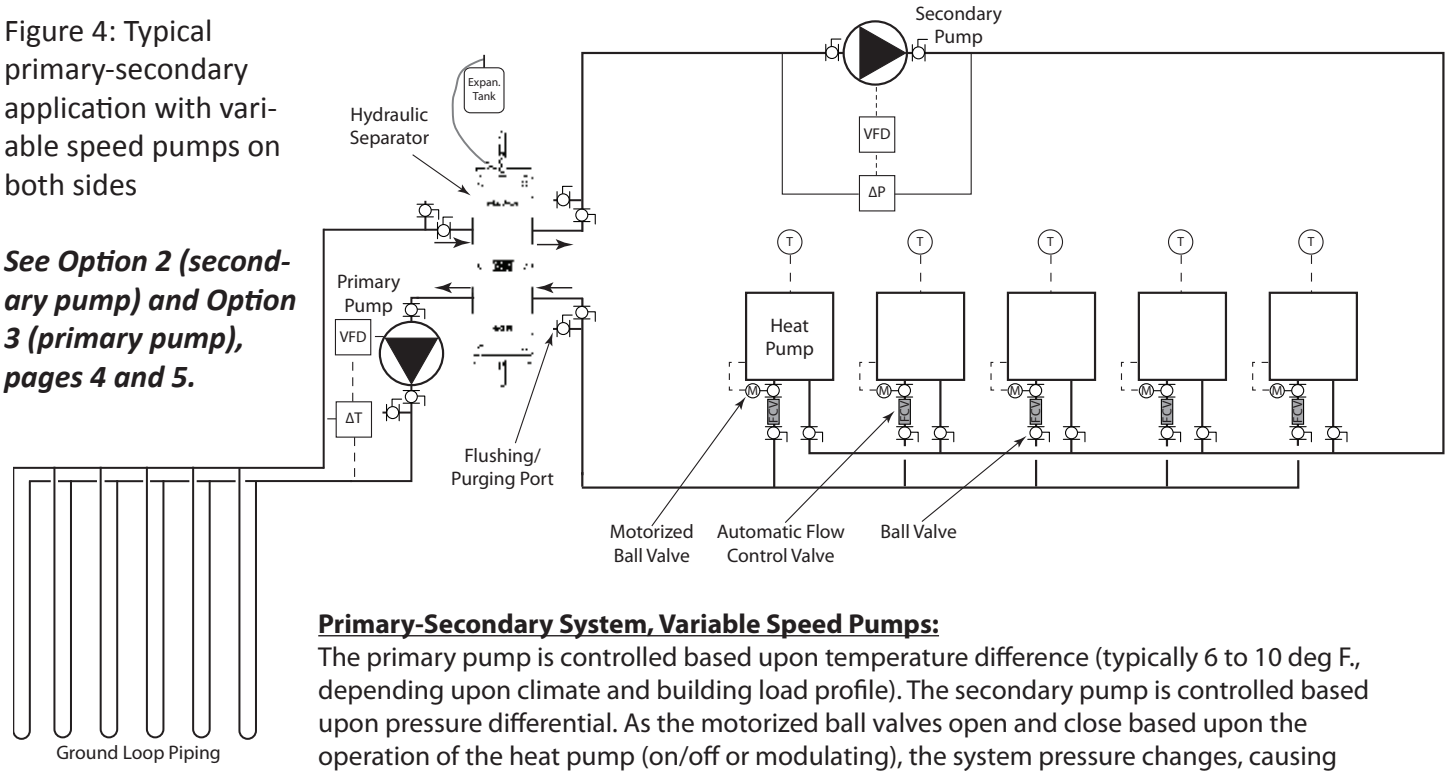
See Option 3 (page 5) for pump setup in Temperature Difference mode.



<u>Primary-Secondary System, Variable Speed Primary Pump;</u>
<u>Constant Speed Secondary Pumps:</u>
The primary pump is controlled based upon temperature difference (typically 6 to 10 deg F., depending upon climate and building load profile). The secondary pumps are energized only when the heat pumps are running.

Figure 4: Typical primary-secondary application with variable speed pumps on both sides

See Option 2 (secondary pump) and Option 3 (primary pump), pages 4 and 5.



Primary-Secondary System, Variable Speed Pumps:

The primary pump is controlled based upon temperature difference (typically 6 to 10 deg F., depending upon climate and building load profile). The secondary pump is controlled based upon pressure differential. As the motorized ball valves open and close based upon the operation of the heat pump (on/off or modulating), the system pressure changes, causing the pump to adjust speed to attain the water flow needed for the number of heat pumps running.

WARNING: MAKE SURE THAT POWER IS DISCONNECTED BEFORE PROCEEDING TO STEP #5.

5. Complete high voltage wiring to the pump. Locate the power supply plug and conduit adapter in the box supplied with the pump. Connect wiring from pump disconnect to the pump terminal block as shown in Figure 5. Pump terminals are labeled L, N, and ground (symbol) for both 208-230V and 115V pumps. For 208-230V pumps, connect L to L1 and N to L2; for 115V pumps, connect L to L and N to N. Wiring must meet all applicable code requirements, including requirements for wire protection, such as conduit. Wire and breaker/fuse size must be determined based upon pump nameplate ratings.

WARNING: MAGNA3 PUMPS ARE AVAILABLE IN 208-230V AND 115V. VERIFY PUMP NAMEPLATE VOLTAGE BEFORE CONNECTING HIGH VOLTAGE WIRING.

CAUTION: DO NOT DEAD-HEAD THE PUMP. USE A PUMP ENABLE RELAY (SEE FIGURE 10) OR PROVIDE A BYPASS ZONE TO AVOID DAMAGING THE PUMP AND/OR PIPING.

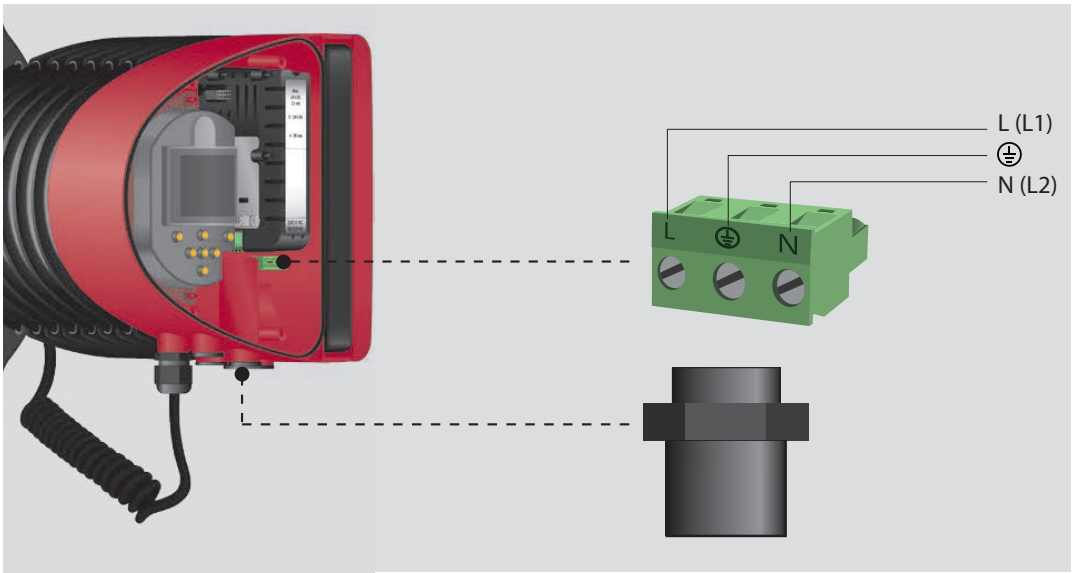


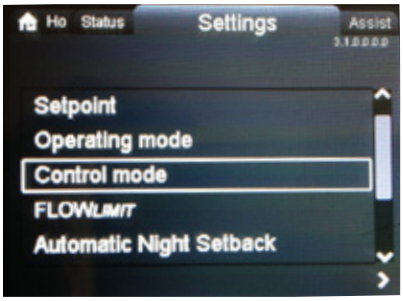
Figure 5: High voltage wiring

CAUTION: VERIFY THAT AIR HAS BEEN PURGED FROM THE PIPING SYSTEM, AND THAT THE SYSTEM HAS BEEN HAS BEEN PRESSURIZED (IF APPLICABLE) BEFORE PROCEEDING TO STEP #6. IF OPERATING IN TEMPERATURE DIFFERENCE MODE, VERIFY THAT THERMISTORS HAVE BEEN INSTALLED.

6. Replace start/stop jumper removed in Step #2, and apply power to the pump.
7. After a few seconds (if the pump has not been powered previously), the pump display will change to the home screen. The home screen shows control mode, operating mode, and additional information (see Figure 6).
8. All Geo-Flo Magna3 insulated pumps are set up at the factory for constant pressure mode and maximum head. The home screen is configured as shown in Figure 6.
9. Refer to Option 1, 2, or 3 below based upon application type from Step 4.

Figure 6: Startup screen

<u>Option 1</u>: Constant Curve Mode, Uncontrolled Pump
Follow Steps “a” through “g” to set up the pump as a high efficiency constant speed pump.



a. Select Settings.
b. Scroll down to Control mode and press OK.

c. Scroll down to Constant curve and press OK.

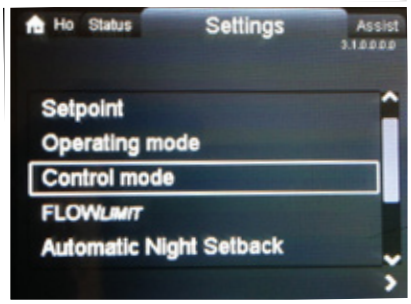
d. Press  to go back to the Settings menu.
e. Scroll down to Setpoint and press OK.

f. Press OK to select the pump % set point.
NOTE: For less than 100%, select the 1 and change it to 0. Then change the second digit, accordingly.

g. Disconnect power to the pump, and go to Step #10 (page 8).

<u>Option 2</u>: Central Pump Application, Constant Differential Pressure Mode, Zone Valve at Each Heat Pump (Fig. 3)
<u>OR</u>: Primary-Secondary Application, Constant Differential Pressure Mode, Magna3 on Inside Piping (Fig. 4)
Follow Steps “a” through “l” to set up the pump in Constant Differential Pressure mode.

a. Open all of the zone valves at the heat pumps for full flow (may need to energize valve at the heat pump).



b. Select Settings.
c. Scroll down to Control mode and press OK.

d. Scroll down to Const. press. and press OK.

e. Press  to go back to the Settings menu.

f. Scroll down to Setpoint and press OK.

g. Press OK to select the psi.

h. Before changing the setting, review Steps i through k, below.

i. Balance the flow if necessary. Larger applications may utilize flow control valves; smaller applications may simply have balancing or ball valves at each heat pump.

j. Once the system is balanced, the psi setting may be adjusted. If the flow rate at the heat pumps is higher than design flow rate, start to lower the psi setting, and recheck the flow rate at several heat pumps. Continue to adjust psi until the flow rate is within design specifications.

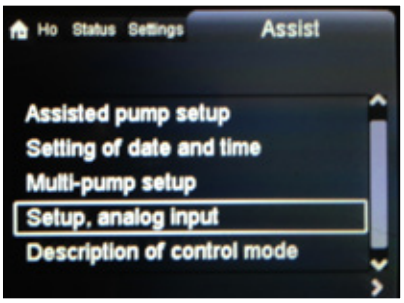
k. Close some of the zone valves, and recheck flow. The pump should slow down. If flow is within design specifications, press the Home key, and place the zone valves in normal operating mode. If flow rates are off, return to Step j. Depending upon how the system is balanced (i.e. with balancing valves or with flow control valves), this could be an iterative process.

l. Disconnect power to the pump, and go to Step #10 (page 8).

<u>Option 3</u>: Primary (Ground Loop) Pump for Primary-Secondary Application, Temperature Difference Mode

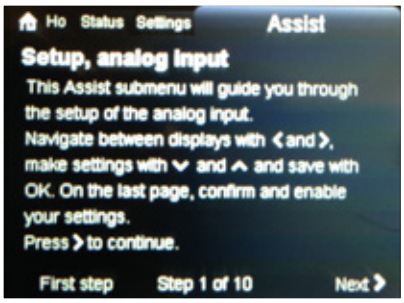
Follow Steps “a” through “ad” to set up the pump in Temperature Difference mode.

IMPORTANT NOTE: The Grundfos Magna3 pump has a built-in temperature difference mode. However, it does not allow for a separate heating and cooling temperature difference, which is important for geothermal heat pump applications, allowing the pump to operate at much lower flow rates (and use less Watts) based upon seasonal temperatures. Therefore, Option 3 uses an external controller, the UPC-GEO, to allow separate heating and cooling set points.

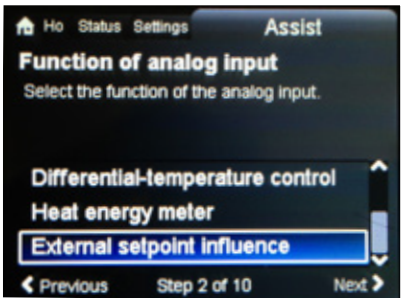


a. Select Assist.

b. Scroll down to Setup. analog input and press OK.



c. Press the right arrow button to go to the next screen.

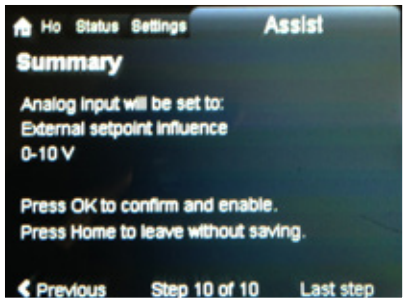


d. Scroll down to External setpoint influence, and press OK.

e. Press the right arrow button to go to the next screen.

f. Highlight (scroll up or down) to select 0-10 V, and press OK.

g. Press the right arrow button to go the next screen.



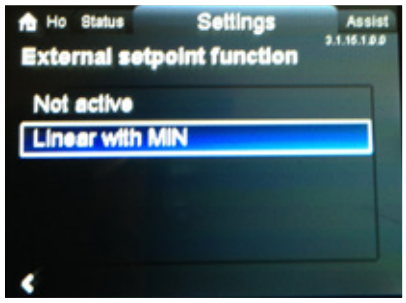
h. At the summary screen, press OK to confirm settings. A message will indicate that the settings have been saved, and the screen will return to the home screen.

i. Follow Steps “a” through “f” in Option 1 to set the pump to Constant Curve mode. This mode will allow the external temperature difference controller to use the full range of the pump.
NOTE: Ensure that the setpoint is at 100%.

j. Select Settings.

k. Scroll down to Setpoint influence and press OK.

l. Scroll up or down to External setpoint function, and press OK.



m. Scroll down to select Linear with MIN, and press OK.

n. Disconnect power to the pump.

WARNING: MAKE SURE THAT POWER IS DISCONNECTED FROM THE PUMP AND UPC-GEO CONTROLLER BEFORE PROCEEDING TO STEP “o”.

o. Mount the UPC-GEO controller (Figure 6) on the wall or in a location near the Magna3 pump.
NOTE: Thermistors should have been installed prior to flushing/purging.

p. Wire the UPC-GEO controller to the Magna3 analog input terminals as shown in Figure 8 using 18 AWG thermostat wire.

q. Once the controller is wired to the Magna3 pump, power the controller (leave the Magna3 pump disconnected from power for now).

Use the OK, +, and - keys to change settings

Figure 6: UPC-GEO controller

Figure 7: Optional 24 VAC wall transformer for UPC-GEO controller

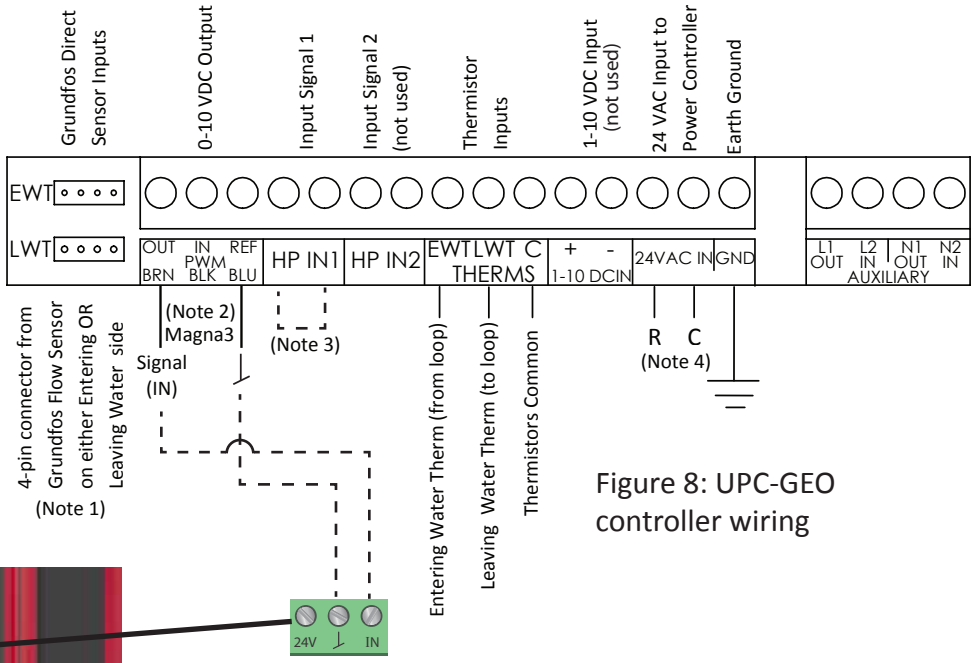
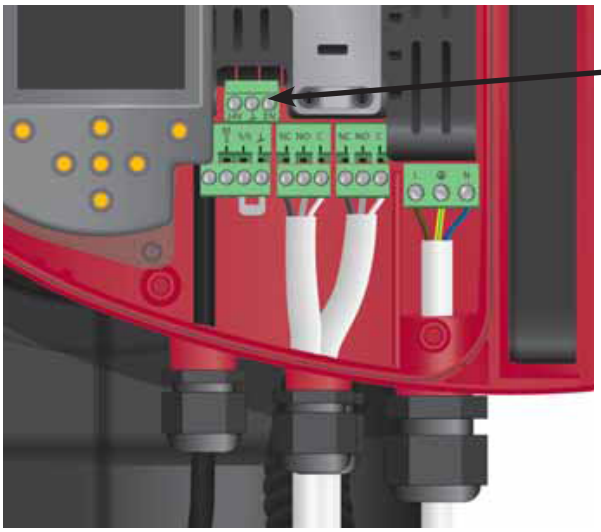
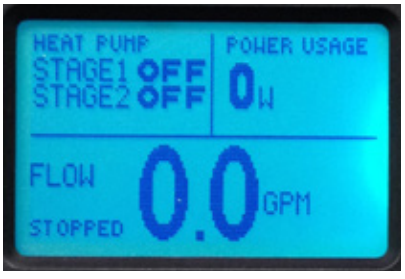


Figure 8: UPC-GEO controller wiring



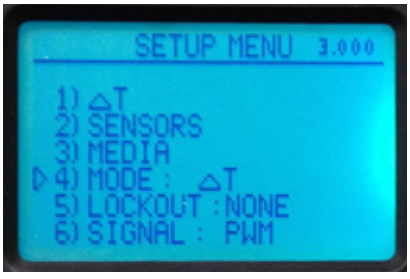
NOTES:

1. These sensor inputs are not used for temperature difference control.
2. The terminals labeled PWM are also used for 0-10 VDC output. Connect BRN to Signal IN and BLU to the ground symbol at the Magna3 analog input terminal strip (Figure 8).
3. Jumper terminals HP and IN1 to enable controller. When contoller is enabled, it will maintain either the minimum flow rate setting (see step "ac") or temperature difference settings, depending upon EWT and LWT temperatures.
4. Controller must be powered by 24 VAC. Pull 24 VAC from a nearby heat pump, or use the 24 VAC wall adapter as shown in Figure 7.



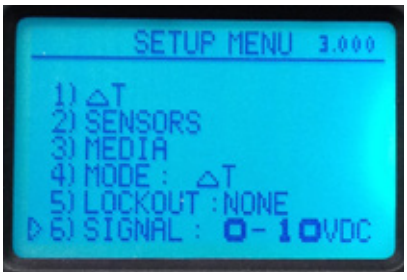
r. The factory default settings look like the screen to the left.

s. Hold down the OK button for about 1 sec. (the setup menu appears).



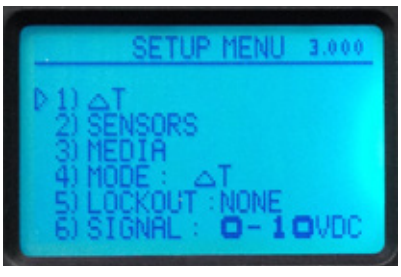
t. Use the arrow down key to move the cursor to item 4.

u. Press the OK key to change to ΔT mode.



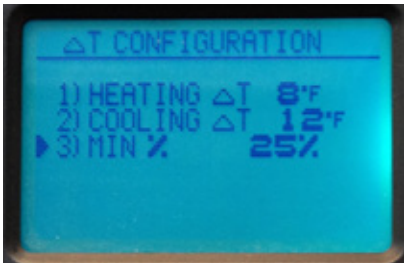
v. Use the arrow down key to move the cursor to item 6.

w. Press the OK key to change to 0-10 VDC

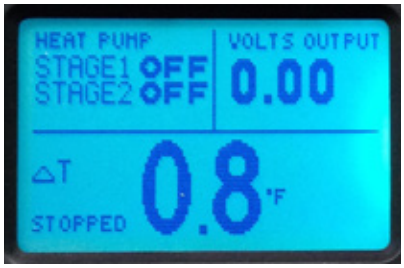


x. Use the arrow up key to move the cursor to item 1.

y. Press the OK key to select the ΔT menu.



z. Press the OK key to select heating ΔT (cursor turns blue).



aa. Use the arrow up/down keys to set ΔT. Press the OK key to lock in the ΔT set point.

ad. Verify that the screen looks like the one to the left (ΔT in the middle of the screen, and VOLTS OUTPUT in the upper right hand corner.

ab. Repeat process for setting cooling ΔT.

ac. Set the minimum %. **NOTE:** It is important to have a minimum pump speed for ΔT control. A small amount of flow is necessary to allow reading of the EWT and LWT thermistors, which are used to control pump speed based upon ΔT.
IMPORTANT: Table 1 (right) shows the minimum percentage for each model. Even if the MIN% in the ΔT configuration above is set lower than the value in the table, the pump can only operate as low as the listed setting in Table 1.

Size	MIN %
32-60	43%
32-100	34%
40-80	36%
40-120	29%
40-180	23%
50-80	35%
50-150	26%
65-120	29%
65-150	26%
80-100	29%
100-120	24%

Table 1: Magna3 minimum % for "Linear with MIN" setting

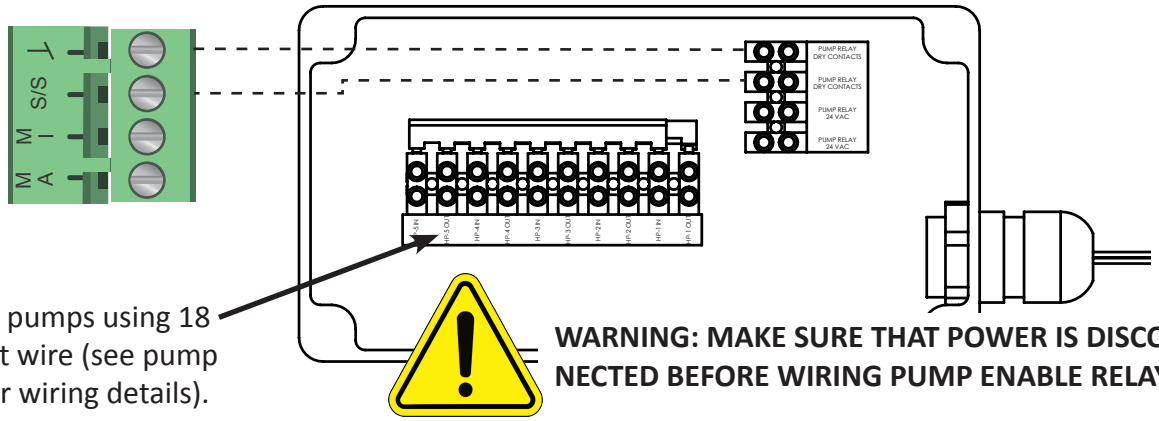
WARNING:
DISCONNECT PUMP POWER BEFORE PROCEEDING TO STEP #10.

10. Determine how the pump will be enabled. For temperature difference control (Option 3, above), the pump must run at a minimal flow rate in order to sense entering and leaving water temperatures. Skip to Step 12 if operating in temperature difference control. For constant curve (Option 1) and constant differential pressure (Option 2), continue to Step 11.
11. The Magna3 pump has an enable jumper that is factory installed (see Figure 9). With the jumper installed, the pump will run when it is powered. Depending upon the application (e.g. when all of the zone valves are closed with the pump operating in differential pressure mode), the pump could be in a dead-head condition if all of the heat pump zone valves are closed. There are two options to avoid dead-heading the pump, as follows:

Figure 9: Start/Stop jumper

    a. For systems operating in differential pressure mode, a small bypass will eliminate a dead-head condition. Typically, one heat pump zone valve can to set to a minimum position (the valve does not close all the way). The pump will run at its minimum curve (see submittal data) if all of the zone valves are closed. The bypass will avoid dead-heading the pump.
    b. For systems operating in constant differential pressure mode or constant curve mode, a pump enable relay will leave the pump off unless at least one heat pump is calling for heating or cooling. The pump enable relay (Geo-Flo P/N 3808) may be wired to up to five heat pumps, as shown in Figure 10. Remove the factory-installed jumper from terminal block (shown in Figure 9). Then, run two-conductor 18 AWG thermostat wire from the Magna3 pump to the Pump Relay Dry Contacts terminals at the pump enable relay.
    c. After the heat pumps and Magna3 pump have been wired to the pump enable relay, the wall transformer may be attached to the power connector.

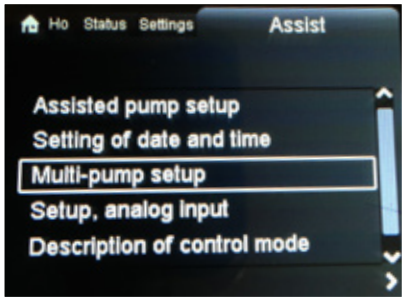
Figure 10:
Pump enable
wiring

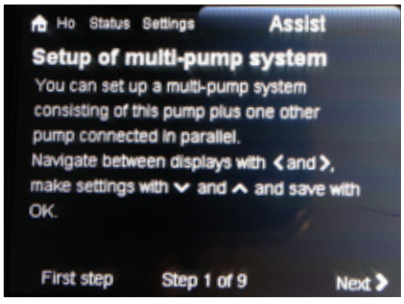


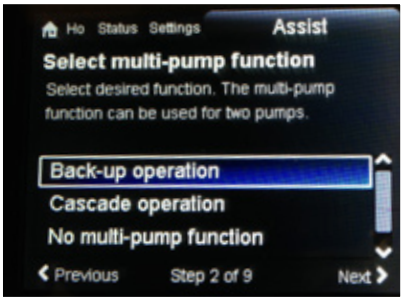
Connect to heat pumps using 18 AWG thermostat wire (see pump enable I.O.M. for wiring details).

WARNING: MAKE SURE THAT POWER IS DISCONNECTED BEFORE WIRING PUMP ENABLE RELAY.

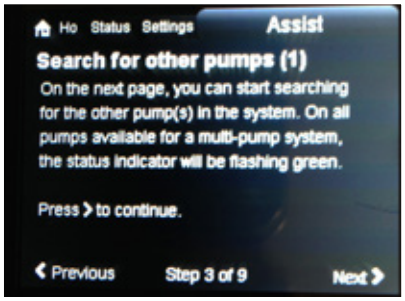
12. For single pump systems, skip to Step 16. For dual head pumps or two pumps in parallel with check valves, choose a mulit-pump control mode from the choices below. The multi-pump function enables the control of single-head pumps connected in parallel and twin-head pumps without the use of external controllers. The pumps in a multi-pump system communicate with each other via the wireless Grundfos GENIair connection. A multi-pump system is set up via a selected pump, i.e. the master pump (first selected pump).
    a. Alternating operation: Only one pump is operating at a time. The change from one pump to the other depends on time or energy. If a pump fails, the other pump will take over automatically.
        Pump system:
        • Twin-head pump.
        • Two single-head pumps connected in parallel. The pumps must be of same type and size.
    b. Back-up operation: One pump is operating continuously. The back-up pump is operated at intervals to prevent seizing up. If the duty pump stops due to a fault, the back-up pump will start automatically.
        Pump system:
        • Twin-head pump.
        • Two single-head pumps connected in parallel. The pumps must be of same type and size.
    c. Cascade operation: Cascade operation ensures that the pump performance is automatically adapted to the consumption by switching pumps on or off. The system thus runs as energy-efficiently as possible with a Constant Differential Pressure and a limited number of pumps. The back-up of a twin-head pump will start at 90% and stop at 50 % performance when operating in Constant Differential Pressure mode. All pumps in operation will run at equal speed. Pump changeover is automatic and depends on speed, operating hours and fault.
        Pump system:
        • Twin-head pump.
        • Two single-head pumps connected in parallel. The pumps must be of same type and size.
        • The control mode must be set to “Constant Pressure” or “Constant Curve”.
13. In the Assist menu, scroll down to Multi-pump setup, and follow the screens below to select pump operation. NOTE: This step must be completed for each pump (through Step 2 of 9) before continuing to the pump search screen on the next page.

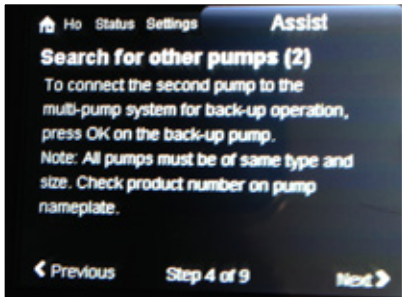


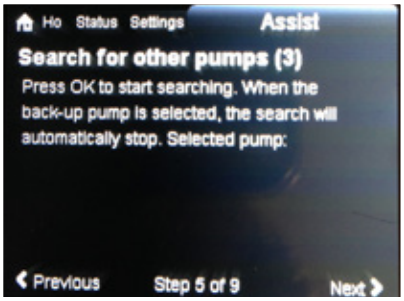




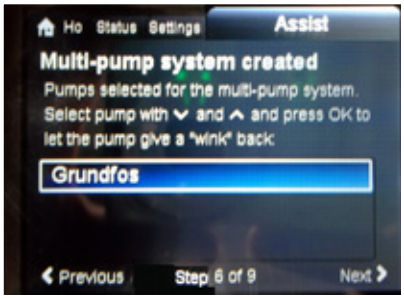
14. Go back to the Assist menu (after both pumps are set up as Alternating, Backup or Cascade), and follow the steps above (through Step 2 of 9). Then, continue with the screens below.

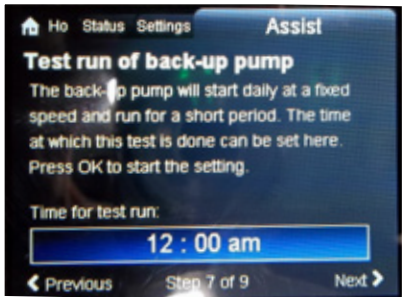




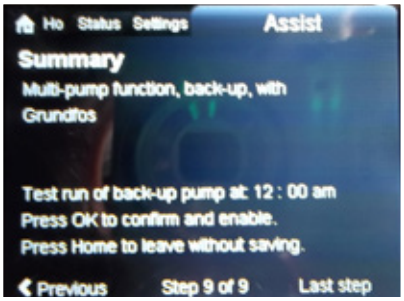


IMPORTANT: The assist menu will not go past this step if the second pump has not been set up for multi-pump operation.



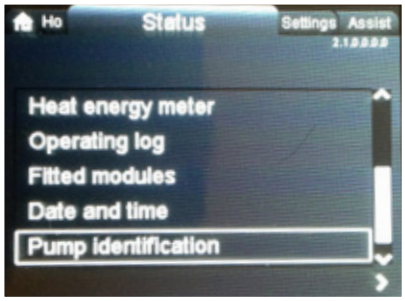


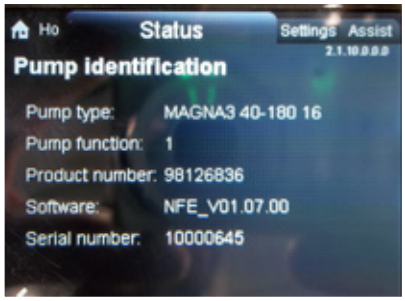
IMPORTANT: The correct day/time for the primary pump must first be completed before going to this screen. The settings automatically propagate to the second (backup) pump.



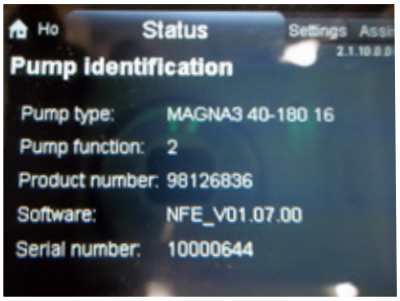
IMPORTANT: Step 8 (not shown) will start the pumps. If the start/stop jumper is removed, Step 8 will be skipped.

15. Verify the pump function by selecting Pump Identification from the Status menu. See examples below.





Example screen for pump 1



Example screen for pump 2

16. Replace the pump and UPC-GEO controller (if applicable) covers. Start the system, and check for proper operation. Record temperatures and flow rates as appropriate.

IMPORTANT NOTE: Figure 11 shows the home screen default data as setup at Geo-Flo. The home screen can show up to four panels of data. Geo-Flo does not recommend flow rate (in gpm) as one of the four panels. The Magna3 does not use a flow sensor; it "estimates" flow, which can be misleading, especially when setting up the pump for constant differential pressure mode. Verification of system flow rate should be done by checking flow rates at each of the heat pumps.

Figure 11: Default home screen for Geo-Flo Magna3 insulated pumps

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