

WARNING:

Improper installation, setup, modification, operation or maintenance of the heating system can cause personal injury and property damage.

Follow each appliances' instructions precisely. For assistance or further information, contact a trained and certified installer or service provider.

Application drawings in this manual are conceptual only and do not purport to address all design, installation, code, or safety considerations.

The diagrams in this manual are for reference use by code officials, designers and licensed installers. It is expected that installers have adequate knowledge of national and local codes, as well as accepted industry practices, and are trained on equipment, procedures, and applications involved. Drawings are not to scale.

Universal Pump Controller (UPC-GEO) by Grundfos

BOSCH

Installation and Operating Manual



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Explanation of Symbols

Warnings



Warnings in this document are identified by a warning triangle printed against a grey background. Keywords at the start of a warning indicate the type and seriousness of the ensuing risk if measures to prevent the risk are not taken.

The following keywords are defined and can be used in this document:

- DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
- WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- CAUTION indicates a hazardous situation which, if not avoided, could result in minor to moderate injury.
- NOTICE is used to address practices not related to personal injury.

Important information

This symbol indicates important information where

_____ there is no risk to people or property.

Notes:

This guide provides the installer with instructions specific to Grundfos Universal Pump Controller (UPC-GEO). Please refer to your heat pump manufacturer's instructions or IGSHPA guidelines for additional detailed flushing, purging, and installation information. Please review the entire IOM document before proceeding with the installation.

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General Description

Overview

Flo-Link™ is a trademark of Geo-Flo Products Corporation, Bedford, IN, U.S.A. The Universal Pump Controller (UPC-GEO), designed in collaboration with Grundfos, is a 24VAC powered controller that operates a one- or two-pump variable speed flow center system to provide accurate pump control and feedback resulting in the lowest possible power consumption for the pump(s) and system (PWM output only; feedback not available for 0-10 VDC output). Instantaneous pump power in Watts is displayed on the back-lit LCD (PWM output only) along with other system parameters depending on which sensors are installed. The installation technician decides whether to control the pump speed based on flow rate set points or differential temperature (ΔT) set points. Installing a single Grundfos Vortex Flow Sensor (VFS) with the UPC- GEO allows the system to be controlled using a flow rate set point input into the controller based on the requirements of the heat pump. The controller allows separate flow rate inputs for two-speed heat pumps, which results in substantial energy savings due to lower flow rate requirements in first-stage heat pump operation. The Grundfos Vortex Flow Sensor provides both flow rate and temperature feedback which is displayed on the controller. Differential temperature (ΔT) control requires the addition of two immersion thermistors and allows separate ΔT inputs for heating and cooling modes. Installing both a VFS sensor and thermistors allows the UPC-GEO to display flow rate, ΔT, and heat of extraction/rejection in KBTU/H. Two lockout modes allow the installer to choose whether to lock the system parameters so they cannot be inadvertently changed or to lock the screen so the feedback (temperatures, flow rate, power, etc.) are not displayed. A Meter mode is included which allows the UPC-GEO to display temperature, flow, and MBtu parameters but does not control the pump(s).

Flow-rate based control (Grundfos VFS flow sensor required)

The UPC-GEO receives a 24VAC signal from the heat pump or thermostat for stage-one or stage-two heating or cooling. The UPC-GEO then provides a PWM signal to the variable speed Magna GEO 32-140 pump (or 0-10 VDC output for other pumps) and monitors the output signal from the Grundfos VFS flow sensor and pump. The UPC-GEO increases or decreases the pump speed based on the flow rate input into the controller and the actual flow rate of the system. For higher flow rate and/or head loss systems a two-pump variable speed flow center may be required. This flow center consists of a single variable speed Magna GEO 32-140 and a constant speed UPS26-99. The UPC-GEO attempts to satisfy the flow rate requirement by first using the more efficient Magna GEO 32-140 pump. If the Magna GEO reaches its maximum performance level before satisfying the flow rate set point requirement, the UPC-GEO energizes the UPS26-99 and ramps the Magna GEO down to match the requirement, thereby minimizing pumping power. The UPC-GEO saves the pump signal settings to allow it to quickly deliver the required flow rate on subsequent calls for heating or cooling. On two-pump variable speed flow center systems the UPC-GEO energizes the UP26-99 for 30 seconds every 72 hours if it has not run during that same period.

ΔT based control (Two immersion thermistors required)

The UPC-GEO receives a 24VAC signal from the heat pump or thermostat for heating or cooling. The UPC-GEO then provides a PWM signal to the Magna GEO 32-140 pump (or 0-10 VDC output for other pumps) and monitors the temperatures provided from the EWT and LWT thermistors and the return signal from the pump. The UPC-GEO drives the pump at 90% for two minutes before increasing or decreasing the pump speed based on the delta-T (Δ T) set point for heating or cooling mode and the actual Δ T of the system. The controller recognizes whether the heat pump is in heating or cooling mode by monitoring the EWT and LWT temperatures (i.e. heating mode: LWT<EWT; cooling mode: LWT>EWT). For higher flow rate and/or head loss systems a two-pump variable speed flow center system may be required. This flow center consists of a single variable speed Magna GEO 32-140 and a constant speed UPS26-99. The UPC-GEO attempts to satisfy the Δ T requirement by first using the more efficient Magna GEO 32-140 pump. If the Magna GEO reaches its maximum performance level before satisfying the Δ T set point requirement, the UPC-GEO energizes the UPS26-99 and ramps the Magna GEO down to match the requirement thereby minimizing pumping power.

Parameter	Rating	Tolerance (+/-)
Input Voltage	24 VAC, 200 mA Max	10%
Input Frequency	60 Hz	20%
PWM Input Frequency	75 Hz	10%
PWM Input Voltage	Open Collector	n/a
PWM Output Frequency	3.9 kHz	10%
PWM Output Voltage*	12 VDC	10%
0-10 VDC Output Voltage*	1 to 10 VDC	10%
Thermistor Input	NTC 10k	N/A
HP IN1	24 VAC or dry contact across terminals	10% (for 24 VAC Input)
HP IN2	24 VAC or dry contact across terminals	10% (for 24 VAC Input)
1-10 VDC input	Not currently used	N/A
GND	Earth Ground Connection	N/A
L1/N1 (input for second pump)	120/208-230 VAC	10%
L2/N2 (output for second pump)	120/208-230 VAC	10%
Relay for L1/N1 to L2/N2	4A Max	N/A
Display	128 x 64 pixels	N/A
DB9 connector (serial communication)	N/A	
Nominal power consumption	3.5 VA	N/A

Technical Specifications

*Default controller output is PWM. Alternate 0-10 VDC output may be selected in the controller menu for Flow mode or ΔT mode.

Agency Listings/Approvals



Certified to CSA C22.2 No 24 Conforms to UL Standard 873

Dimensional Data



	A	В	С	D	E	F	G	н	I	J	We	ight
Inches	5-1/8	6-11/16	1-7/8	3-3/8	5-5/8	3-3/8	1-11/16	Φ1/4	Ф3/16	1/2" standard	LBS	KG
СМ	13	17	4.7	8.6	14.3	8.6	4.3	Ф0.7	Ф0.4	conduit knockout	0.75	0.34

Installation

Location

The UPC-GEO can be mounted in any available indoor climate controlled location in or around the mechanical room near the variable speed pump or flow center. All UPC-GEO kits include mounting hardware and a ten foot cable that allows the controller to be connected to the Grundfos Magna pump. This equipment should be installed and serviced by qualified personnel only.

Please review the entire Installation Instructions document before proceeding with installation.

Tools Required

Legend of Abbreviations

EWT	Entering Water Temperature (from loop to heat pump)
LWT	Leaving Water Temperature (to loop from heat pump)
PWM	Pulse Width Modulation
BRN	Brown
BLK	Black
BLU	Blue
HP IN#	Heat Pump Input # (used for Stage # call)
THERMS	Thermistors
С	Common
GND	Earth Ground
L	Line
N	Neutral
KBTU/H	1000 BTU per hour

Mounting the Controller

- 1. Using the template included in Appendix C, mark the mounting hole locations and install the plastic wall anchors (if necessary).
- Remove the controller's wiring cover by releasing its tabs with a 3/16" flathead screwdriver as shown in Figure 1.
- Install the upper #6 screw and slide the controller into place. Install the second screw to secure the controller to the wall.



Figure 1: Mounting Controller

Wiring the Controller (Single Heat Pump -- Magna Geo Pump)

WARNING: Open the main power suppy disconnect switch and secure it in anopen position prior to performing electrical work. Verify that power has been disconnected prior to wiring the controller. Failing to secure the electrical supply could result in serious injury or death. This equipment should be installed and serviced by qualified

NOTE: The Magna GEO 32-140 motor requires no external protection. Wiring the Magna GEO directly to mains

power is recommended. See Appendix C for more information.

NOTE: Low voltage wiring will vary depending on the installation and sensors used.

- 1. Turn off power at the heating/cooling system or fuse/circuit breaker panel.
- 2. Decide on where wires will enter the controller housing and remove the appropriate knock-outs.
- 3. Figures 2a through 2d provide controller terminal descriptions and wiring for a single unit; Figure 3 shows wiring for two heat pumps. Complete wiring using appropriately sized wire and replace controller's cover.



NOTES:

A. HP IN1: Left terminal receives 24VAC input from heat pump accessory output (labeled "ACC" or "A" by some heat pump manufacturers). IMPORTANT: Some heat pump accessory relay contacts are not isolated from the 24 VAC heat pump transformer, and may create a "dirty" power signal, especially heat pumps with thermostat-controlled ECM fan motors (symptom includes variable speed pump not shutting off). An additional relay will be required for these heat pumps (see Figure 2b). If an accessory terminal is not available, Figures 2c and 2d illustrate connections. Alternatively, ΔT mode may be used, which will only require one relay (coil connected to Accessory and C; contacts connected to HP and IN1).

- B. HP IN2: Receives a contact closure from the relay connected to Y2, closing the circuit between the left and right terminals. <u>This connection is not required when operating the controller in ΔT mode</u>. Relay is a SPST N.O. general purpose relay (equivalent to 90-360 WR/RBM Type 184).
- **C.** 24VAC IN: Left terminal connected to "R" at heat pump; right terminal connected to "C" at heat pump.



Figure 2b: Wiring Diagram for heat pumps requiring an additional isolation relay -- see Notes A & B, above



*May require a "piggyback" spade connector.

Figure 2c: Wiring Diagram for heat pumps with an external compressor contactor, but without an accessory relay -- see Note A, previous page



** Relay #1 needed for temperature difference mode; both relays needed for flow mode.

Figure 2d: Wiring Diagram for heat pumps without an external compressor contactor (compressor relay is on the circuit board) and without an accessory relay -- see Note A, page 5





Bosch offers a panel mount flow center option for pressurized flow centers and a variable speed kit for non-pressurized flow centers. Both products provide factory-wired and mounted controllers, as well as factory wired thermistors and flow sensor (if equipped). Field low voltage wiring simply involves running 4 conductor thermostat wiring between the heat pump and the flow center terminal block, greatly reducing installation time. In addition, all components necessary for the installation, including the hose kit, are part of the panel mount or flow center variable speed kit.

Wiring the Controller (One Flow Center / Two Heat Pumps)



NOTE: The Magna GEO 32-140 motor requires no external protection. Wiring the Magna GEO directly to mains power is recommended. See Appendix C for more information.



INP	UTS	OUT	PUTS
HP-1	HP-2	HP IN1	HP IN2
ON	OFF	ON	OFF
OFF	ON	ON	OFF
ON	ON	ON	ON
OFF	OFF	OFF	OFF

ACC is accessory terminal (energized when compressor contactor coil is energized). If heat pump does not have an accessory terminal, consult Figures 2c and 2d.

Figure 3: Wiring Diagram for connecting two heat pumps to one variable speed flow center. See figures 4a and 4b for piping.

NOTES:

- **A.** Above wiring should be used with a flow sensor to avoid potential nuisance trips if one unit is in cooling and one is in heating or other temperature difference conditions (e.g. long runs of piping in the mechanical room, settling to room temp.).
- **B.** Set stage one flow between minimum and nominal full load flow rate of the larger unit. Set stage two flow between minimum and nominal flow for both units on full load. For example:
 - 4 ton and 3 ton heat pump
 - Minimum full load flow rates are 9 GPM (4 ton) and 7.5 GPM (3 ton); nominal flow rates are 12 GPM (4 ton) and 9 GPM (3 ton).
 - Stage one flow rate should be 9 to 12 GPM (between min. and nom. for 4 ton).
 - Stage two flow rate should be 16.5 to 21 GPM (between min. and nom. for both heat pumps).
 - A good compromise for this example would be 10 GPM on stage 1 and 19 GPM on stage 1.
- C. A zone valve is required at each unit to allow flow only through the heat pump running.



Figure 4b: Two Unit Piping Diagram: Non-Pressurized Flow Center

Wiring the Controller (0-10 VDC Output)



NOTE: The Grundfos Magna3 (or other pump receiving 0-10 VDC output from this controller) must be powered independently. This controller is not designed to power the pump.



NOTES:

- A. 0-10 VDC Output (labeled "PWM"): Connect 0-10 VDC output from the OUT (BRN) and REF (BLU) terminals to the pump being controlled (Grundfos Magna3 terminal connections shown above).
- B. HP IN1: Used for pump enable. Left terminal receives 24 VAC input to activate controller based upon controller setting, flow rate or ΔT. Controller will send 0-10 VDC output to the pump to maintain flow rate or ΔT when enabled. If the application requires constant pump operation (or a minimum flow rate), terminals HP and IN1 should be jumpered to enable controller/pump continuous operation. **IMPORTANT:** If using 24 VAC from a nearby heat pump, some heat pump accessory relay contacts are not isolated from the 24 VAC heat pump transformer, and may create a "dirty" power signal, especially heat pumps with thermostatcontrolled ECM fan motors (symptom includes variable speed pump not shutting off). An isolation relay as shown in Figure 5 will be required for these situations. Terminal E is 24 VAC; terminal C is common.
- C. 24VAC IN: Left terminal connected to "R"; right terminal connected to "C" from external transformer or heat pump.

Setup

Quick Start Procedure

- 1. Press and hold the center button to enter Setup Menu (Fig. 6).
- 2. Select desired control mode (Item 4 in menu).
- 3. Enter desired flow rates or ΔT (Item 1 in menu).
- 4. Select sensors that have been installed (Item 2 in menu).
- 5. Enter media/antifreeze type and concentration (Item 3 in menu).
- 6. Select desired Lockout mode (Item 5 in menu).
- 7. Select desired output signal (Item 6 in menu) -- version 3.0 and higher only.

General Navigation

The menu items are navigated by using the + (up), - (down), and OK (center) buttons. Pressing the + and - buttons moves a triangular cursor up and down through the menu items, switches between the two Main pages, or increases or decreases a particular parameter. Pressing and holding the OK button for one second while on either Main page changes the display to the Setup Menu screen (unless the controller has been locked). Pressing and holding the OK button for one second from any screen other than Main returns the display to the previous screen. Pressing and quickly releasing the OK button scrolls through the menu options next to the cursor, or changes the cursor to a filled triangle which allows the + and buttons to increase or decrease the parameter selected.

Main Page

The Main page provides information on the system (Figure 8). The screen shows whether there is a first or second stage call, pump operation ("Power Usage" for PWM controller output to pump or "Volts Output" for 0-10 VDC controller output), the control mode (Flow or ΔT), the flow rate or ΔT (depending on control method selected), and the system status. The System Status area provides information such as whether the system is running or stopped, whether one or two pumps are running, and any warnings or errors. Pressing the up or down arrow from the Main page changes the display to the Main-2 page which displays the EWT, LWT, Flow rate, and HE/HR. Note that parameters displayed depend on the sensors that are installed in the system. A VFS flow sensor and a thermistor must be installed to see all of the parameters.



Software version #

NOTE: Menu item 6 is only available for software version 3.0 and higher.



Figure 7: Navigation Buttons

	POWER
	USAGE (W)
STAGE1 OFF/ON	OR
STAGE2 OFF/ON	VOLTS OUTPUT
	LOW RATE (GPM)
CONTROL MODE	OR
SYSTEM STATUS	ΔT (°F)

Figure 8: Main Page

NOTE: "VOLTS OUTPUT" is only available for software version 3.0 and higher.

EWT	LWT
(°F)	(°F)
HE/HR (KBTU/H)	FLOW RATE (GPM)

Figure 9: Main-2 Page

System Status

SYSTEM STATUS	Description	
Display		
1 PUMP RUNNING	Magna GEO 32-140 is running	
2 PUMPS RUNNING	Magna GEO 32-140 is running and relay energizes L1/N1 output to UPS26-99 (i.e. both pumps should run)	
STOPPED	Neither pump is running	
Warnings displayed in the System Status area are discussed in the Troubleshooting section of this document.		

Setup Menu

The Setup Menu page is accessed by pressing and holding the OK button for one second while on the Main page. Item 1) in the Setup Menu changes depending on which mode is selected and will always match the Mode listed in item 4 (Figure 10).

Flow Configuration / Minimum Pump Speed %

The Flow Configuration menu (Figure 11) is accessed by selecting 1) FLOW from the Setup Menu when item 4) is set to FLOW. Separate flow rates for Stage 1 and Stage 2 operation can be specified. The flow rate specified for STAGE 1 will be applied when the controller receives a 24 VAC signal at the left HP IN1 terminal, or when a dry contact is made across the two HP IN1 terminals. The flow rate specified for STAGE 2 will be applied when the controller receives a 24 VAC signal at the left HP IN2 terminal, or when a dry contact is made across the two HP IN2 terminal, or when a dry contact is made across the two HP IN2 terminals. Press the OK button to select Item 1) STAGE 1 or Item 2) STAGE 2 and the +/- buttons to set the values.

Item 3) MIN% in the Flow Configuration menu allows for a minimum pump speed percentage set point. Although not typically used for residential applications, the pump speed may be set to remain above a certain percentage RPM regardless of the flow rate setting for STAGE 1. To change minimum %, press the arrow down (-) button to select item 3). Press the OK button to select the MIN % menu (the triangle cursor will turn solid), and use the +/- buttons to set the value. Once set, press the OK button again to lock in the value. **NOTE:** If system status display shows pump(s) running, but heat pump is not operating, check wiring vs. diagram on pages 5 to 7. Isolation may be required between ACC/Y2 and the controller.



Figure 10: Setup Menu (Item 1)

NOTE: Menu item 6 is only available for software version 3.0 and higher.

FLOW CONFIGURATION					
8.0 GPM					
12.0 GPM					
0%					

Figure 11: Flow Configuration

NOTE: Menu item 3 is only available for software version 3.0 and higher.

ΔT Configuration / Minimum Pump Speed %

The ΔT Configuration menu (Figure 12) is accessed by selecting 1) ΔT from the Setup Menu when item 4) is set to ΔT . Separate ΔT values for heating and cooling operation can be specified. The Heating ΔT will be applied when the controller receives a 24VAC signal at the left HP IN1 terminal or the left HP IN2 terminal AND the EWT > LWT (i.e. heat is extracted from loop). The Cooling ΔT will be applied when the controller receives a 24VAC signal at the left HP IN1 terminal or the left HP IN2 terminal AND the LWT > EWT (i.e. heat is rejected to loop). A dry contact across the two terminals of HP IN1 or HP IN2 can be used as an alternative to providing a 24VAC signal.

Item 3) MIN% in the ΔT Configuration menu allows for a minimum pump speed percentage set point. Although not typically used for residential applications, the pump speed may be set to remain above a certain percentage RPM regardless of the ΔT setting for heating or cooling. To change minimum %, press the arrow down (-) button to select item 3). Press the OK button to select the MIN % menu (the triangle cursor will turn solid), and use the +/- buttons to set the value. Once set, press the OK button again to lock in the value.

Sensor Configuration

NOTE: Selecting the actual sensors installed in the system is critical to proper controller performance.

The Sensor Configuration menu (Figure 13) is accessed by selecting SENSORS from the SETUP menu. Items 1) and 2) are provided for the various Grundfos Vortex Flow Sensors available including VFS 1-20, VFS 2-40, VFS 5-100, VFS 10-200, and VFS 20-400. Items 3) and 4) are provided for 10K thermistors. The mapping of the sensors to the location on the controller circuit board is shown on the Figure 13 in brackets. To change the type of sensor, press the OK button to select the item (cursor becomes filled) and use the + and – buttons to select the sensor. The UPC-GEO will automatically recognize when a thermistor is connected to the EWT or LWT thermistor terminals.

ΔT CONFIGURATION				
N 1) LIFATING AT	F °F			
$>$ 1) HEATING Δ 1	5 F			
COOLING ΔT	12 °F			
3) MIN % 0	%			
•				

Figure 12: ΔT Configuration

NOTE: Menu item 3 is only available for software version 3.0 and higher.

SE	ENSOR CONFIGURATION
▶1)	VFS 100-200 [EWT 4-pin connection]
2)	VFS 100-200 [LWT 4-pin connection]
3)	NONE [EWT Therm]
4)	NONE [LWT Therm]

Figure 13: Sensor Configuration

Media Configuration

The Media Configuration menu (Figure 14) is accessed by selecting MEDIA from the SETUP menu. The Media Configuration page allows setting the type and percentage of antifreeze used in the ground loop system. The TYPE choices are ethanol, methanol, glycol, and none. The Media inputs only affect the HE/HR calculation. **NOTE:** HE/HR is calculated as follows:

HE or HR = $\Delta T \times Flow$ Rate (U.S. GPM) x Fluid Factor where: ΔT = temperature difference between EWT and LWT Fluid factor = adjustment for antifreeze (see appendix F)

Mode Setup

The UPC-GEO's operating and control mode is set by moving the cursor to 4) MODE on the SETUP menu (Figure 15) and pressing the OK button until the desired mode is displayed. Item 1) in the menu will change to match the MODE. There are three modes available: 1) FLOW, 2) Δ T, and 3) METER. Flow mode provides pump control and feedback based on the desired flow rate for first and second stage operation. This mode requires the installation of a Grundfos VFS sensor. Δ T mode provides pump control and feedback based on desired differential temperature for heating and cooling operation, and requires the installation of thermistors. Meter mode provides a display of flow rate, entering and leaving fluid temperatures, and HE/HR depending on which sensors are installed. Meter mode **does not provide an output to control the pump(s)**, and only displays the Main-2 page.

Lockout Setup

There are three Lockout modes available that provide differing levels of security to the controller settings: 1) Screen, 2) Parameter, and 3) None. Screen lockout disables all display screen feedback. A controller in screen lockout mode will not respond to +, -, or OK button inputs and will display "PROTECTED" on the screen. Parameter lockout prevents access to the SETUP menu but the MAIN and MAIN-2 pages will be displayed as normal. The default lockout setting of NONE allows access to all the display screens and settings. The mode is selected by moving the cursor to Item 5) LOCKOUT in the Setup Menu and pressing the OK button unit the desired mode is displayed.



Figure 14: Media Configuration

S	ETUP MENU	3.000
1)	FLOW	
2)	SENSORS	
3)	MEDIA	
⊳4)	MODE: FLOW	
5)	LOCKOUT: NON	E
6)	SIGNAL: PWM	

Figure 15: Mode Setup

NOTE: Menu item 6 is only available for software version 3.0 and higher.

S	ETUP MENU	3.000
1)	FLOW	
2)	SENSORS	
3)	MEDIA	
4)	MODE: FLOW	
>5)	LOCKOUT: PARA	Μ
6)	SIGNAL: PWM	

Figure 16: Mode Setup

NOTES:

- To unlock the UPC-GEO, hold down the OK button for 10 seconds (software version 3.0 and later) or 30 seconds (previous versions).
- 2. Menu item 6 is only available for software version 3.0 and higher.

Controller Output Signal Setup

There are two controller output modes available that change the output based upon the variable speed pump connected: 1) PWM, and 2) 0-10 VDC. The default setting is PWM, which is used for the Grundfos Magna GEO variable speed pump. The 0-10 VDC setting is used for Grundfos Magna3 or other pumps that require a 0-10 VDC input signal. The mode is selected by moving the cursor to Item 6) SIGNAL in the Setup Menu and pressing the OK button unit the desired mode is displayed. Menu choice 6) is only available for controllers with software version 3.0 and higher.

<u>s</u>	ETUP MENU	3.000
1)	FLOW	
2)	SENSORS	
3)	MEDIA	
4)	MODE: FLOW	
5)	LOCKOUT: PARA	M
6)	SIGNAL: PWM	

Figure 17: Output Setup

NOTE: Menu item 6 is only available for software version 3.0 and higher.

Troubleshooting

Screen Color	Action / Display	Indication	Possible Cause / Solution	
Blue backlight	Any button is pressed	Blue backlight comes on for 30 seconds when a button is pressed.	N/A	
	Display = "RUNNING"			
No light or	Display = "1 PUMP"	Newsel energies	NI / A	
blue backlight	Display = "2 PUMPS"	Normal operation	N/A	
	Display = "STOPPED"			
Red	Display = "NO SENSOR"	No flow sensor connected when in flow mode; no thermistor connected when in ΔT mode.	 Flow sensor not plugged in. Plug in sensor; check installa- tion and wiring. Flow sensor not set up in sen- sor configuration menu. Select proper sensors and EWT/LWT location in sensor configura- tion menu. 	
			 Missing thermistors. Check thermistor wiring at EWT, LWT, and C terminals on UPC-GEO circuit board. 	
	Display = "NO PUMP"	Controller does not detect a Magna GEO (var. spd.) pump attached. Could also indicate no power to pump.	 PWM Cable not attached to pump or controller. Check PWM cable at pump and con- troller. 	
			 Magna GEO does not have power. Provide 230VAC power to Magna GEO. Check Line and Neutral connections on 230V power. If the pump is wired to the "T" side of the contactor, the pump should be rewired to the "L" side of the contactor. 	
	Display = "BLOCKED"	Magna GEO feedback signal "reports" to controller that rotor is blocked.	Debris is blocking pump rotor. Remove pump motor and clean debris. Replace pump if necessary.	
	Display = "LOVOLT F"	Magna GEO feedback signal "reports" to controller that voltage is not sufficient to run.	Incorrect power supplied to pump. Supply correct input to pump.	
	Display = "RPM SENSOR"	Magna GEO feedback signal "reports" to controller that motor has RPM sensor fault. Pump runs at reduced speed.	Failed RPM sensor. Replace pump.	

Troubleshooting (continued)

Screen Color	Action / Display	Indication	Possible Cause / Solution
	Display = "LOWVOLT W"	Magna GEO feedback signal "reports" to controller that motor has low voltage, but it is still able to running (yellow indicates a warn- ing). Pump performance is reduced.	Incorrect power supplied to pump. Supply correct input to pump.
Yellow	Display = "FLOW SET- POINT"	Displayed when the pump(s) are unable to deliver the flow rate neces- sary to achieve the set point (flow or ΔT) input into the UPC-GEO (i.e. the pumping system is running at full speed and cannot satisfy the user's request).	 Incorrect flow rate or ΔT value entered into UPC-GEO. Enter correct flow rate or ΔT values into UPC-GEO. Pump system undersized for installed piping/heat pump system. Reduce system head loss. Add an additional pump to the system.

Additional Troubleshooting

Problem	Possible Cause	Solution
Magna GEO var. speed pump runs continuously at full speed and does not respond to controller inputs.	Loss of communication with con- troller. Controller should report "No Pump" in Status area.	Check PWM cable connection at pump and at controller. Or, may require isolation relay.
	No 230V input power at L2/N2 IN (i.e. one leg of the 230V input is disconnected). No 230V output power at L1/N1 OUT (i.e. one leg of the 230V out- put is disconnected).	Correct input/output wiring. The relay L1/N1 and L2/N2 are rated for 120/208-230V. If a single leg (Line or Neutral) of the 230V power is connected to the L2/N2 IN, the relay will energize the L1/ N1 OUT terminals but the 230V UP26-99 will not run.
Control displays "2 PUMPS RUN- NING" but UPS26-99 will not run.	UPS26-99 failure.	Disconnect power. Isolate UPS26-99 by closing service/flush valves. Verify UPS26-99 impeller spins free by removing bleed screw with a large flathead screwdriver and attempt to rotate the pump's shaft with a small flathead screw- driver. Note that removing bleed screw will result in fluid/pressure loss in system so be prepared with a bucket and/or towels. If the impeller spins, replace bleed screw, open service/flush valves, re-pressurize system, and re-con- nect power. If pump then runs, loosen bleed screw and allow a few drops of water to seep out to ensure there is no air trapped in the pump. If impeller does not
	- continues -	replace pump motor.

Additional Troubleshooting (continued)

Problem	Possible Cause	Solution
	No 208-230V input power at L2/ N2 IN. No 208-230V output power at L1/ N1 OUT.	Correct input/output wiring.
Controller will not energize the UPS26-99.	UP26-99 not required to meet the demand (set point for flow or ΔT).	To check UPS26-99 operation, increase the demand (i.e. required flow rate) incrementally and moni- tor the display. When the pump is at or near its maximum perfor- mance level the power will read about 230W. A higher demand will result in the relay energizing L1/N1 OUT terminals (UPS26-99) and/or a "FLOW SETPOINT" warning.
	Bad relay on controller PCB.	Replace controller.
	Grundfos VFS Sensor/ Senor tube mounted incorrectly.	Check direction of flow arrow on sensor tube body and re-plumb if necessary.
Sporadic flow rate display on con- troller.	Plumbing disturbance in front of entrance to flow tube.	Re-plumb to remove disturbance.
	Air in loop.	Flush loop.
	Sensor dirty or defective.	Remove sensor and clear debris. Replace sensor if necessary.
Controller displays "PROTECTED" and will not respond to button inputs.	Controller Lockout mode has been set to SCREEN.	Change Lockout mode to None or Parameter. See Lockout Setup sec- tion for more information.
Controller will not respond to button inputs when trying to change flow rate, ΔT , etc.	Controller Lockout mode has been set to PARAM.	Change Lockout mode to None. See Lockout Setup section for more information.
Controller displays	Controller may be connected	
"1 PUMP RUNNING" or	directly to thermostat. In some	Wire controller as shown on pageS 5 & 6 with isolation between ACC and Y2.
"2 PUMPS RUNNING,"	cases, backfeed voltage could	
but heat pump is off.	cause pump(s) to run.	
Pump continually overshoots and undershoots set point in ΔT mode (i.e. pump ramps up and nearly stops).	Small pump speed changes result in large ΔT swings at low flow rates.	Increase MIN % to prevent pump from stopping.

Appendix A: Sensor Kit Descriptions

The following information provides descriptions of currently available controller kits. Although both kits work well, there is an advantage to installing the flow and temperature kit, as the ability to directly read heat of extraction and heat of rejection makes start up and troubleshooting much easier.

 Controller kit (P/N 3698 & 3766*), Flow and Temperature: This kit allows the installer to control pump speed based upon flow rate or temperature difference (ΔT). The display will show heat pump operating stage, EWT, LWT, ΔT, flow rate, pumping Watts, and heat of extraction/rejection (Figure 18).

(1)	Controller with wall anchor kit
(1)	PWM controller-to-pump cable, 10'
(1)	VFS10-200 Flow tube, sensor, cable, and seals
(2)	Brass adapters, 1" Hose Barb X 10- 200 Flow Tube
(2)	G1-1/4 Union nuts (for Flow Tube/ Adapters)
(4)	Hose clamps, stainless steel
(2)	10k Thermistors, 1/4" MPT brass connection
(2)	SPDT Isolation Relay (for ACC & Y2 input)

***Note:** P/N 3766 includes (2) 1" PVC glue adapters instead of 1" hose barb adapters. All other components are the same as P/N 3698).



Figure 18: Flow and Temperature Kit (P/N 3698)

2. Controller kit (P/N 3697), Temperature: This kit allows the installer to control pump speed based upon temperature difference (Δ T). The display will show heat pump ON/OFF, EWT, LWT, Δ T, and pumping Watts. Flow rate and heat of extraction/rejection will not be displayed (Figure 19).

(1)	Controller with wall anchor kit
(1)	PWM controller-to-pump cable, 10'
(4)	Hose clamps, stainless steel
(2)	10k Thermistors, 1/4" MPT brass connection
(1)	SPDT Isolation Relay (for ACC & Y2 input)



Figure 19: Temperature Kit (P/N 3697)

1" Hose Barb x

Flo-Llnk[™] double

1" Hose Barb x 1"

Flo-LInk[™] double MPT Elbow with

Appendix B: Installing Sensors

1" Hose Barb x

Thermistor Installation

Install thermistors in any 1/4" NPT Female port using a quality thread sealing compound (pipe dope). Be sure to insulate the entire fitting/pipe/ thermistor to prevent conductive heat transfer from affecting the thermistor reading. Adding additional wire to the thermistor leads is acceptable since the resistance of the thermistor is much greater than the resistance of the additional wiring. Figure 20 provides several examples of thermistor to fitting assemblies.

Grundfos VFS Sensor Installation

Install the VFS sensor and flow tube by utilizing the 1" hose barb transition fittings. Allow 6-10" of 1" rubber hose in front of and behind the flow tube. Be sure that there are no sharp bends/ elbows directly in front of or behind the sensor. **Verify that the arrow on the flow tube matches the pumping direction or the sensor will not perform correctly.** The sensor can be placed on the entering water or leaving water side of the heat pump. See Figure 21.

O-ring with 1/4" 1/4" FPT Port O-ring Elbow with FPT Port 1/4" FPT Port Figure 20: Thermistor Installation From Loop 1" Hose Barb x Flo-LInk™ double O-ring Hose Clamps VFS 10-200 Flow Tube with Sensor 1" Hose Barb Adapter Hose Clamps Figure 21: Flow Sensor Installation G1-1/4 Nut 1" Rubber Hose To Heat Pump

Appendix C: Important Power Considerations

Grundfos recommends that the Magna GEO pump be wired directly to the mains power supply.

NOTE: Connecting the pump high voltage to the "T" side of the heat pump compressor contactor could cause premature contactor failure due to contact pitting.

The Magna GEO motor is controlled by a small frequency converter, which converts the power supply to DC voltage. Therefore, the 230 VAC mains voltage must be converted to DC voltage before the frequency converter can control the motor. The conversion is accomplished with a rectifier and a capacitor. The load of an ECM pump behaves as a capacitive load and not as a motor load like a standard pump. When turning the power supply on, the capacitor will act as a short circuit (as it is "empty" – it has not been charged) and therefore the current is only limited by the sum of resistance in the NTC resistor and the resistance in the coil in the mains filter. If the power is turned on when the supply voltage is at its highest point, the in-rush current will become much higher than the rated current, but only for a very short period of time (less than 0.0015 seconds, 1.5 msec). After this period of time, the current will drop to the rated current.

If the pump is powered on and off by an external relay, the contact material of the relay must be capable of higher in-rush currents. Grundfos recommends using a minimum 16 Amp relay for 230 VAC switched voltage, and a minimum of 250,000 electrical operation cycles at 4.0 Amps. A typical example is the Omron G7L general purpose relay. *There is no advantage in switching the pump power on and off with a relay, since the UPC Geo controller turns the pump on and off with the low voltage connection*. However, if required, special attention should be given to selecting a relay that meets the Grundfos recommendations.

Appendix D: Controller Mounting Template



This document must be printed full-scale to properly mark the mounting-hole locations. The Page Scaling in the Print dialog box in Adobe Acrobat must be set to None. The 6-inch line can be used as reference to ensure the document has been printed full-scale.

Submittal Data			
	DUJUN	FLV Series Variable Speed Pres	surized Flow Center, Single Pump
		Project Name:	
		Contractor:	
	The second se	Engineer:	
	and the second	Order Number:	
		Additional Information:	
Technical D	Data		1
Circulator: Cabinet: Insulation: Valves:	Grundfos Magna GEO 32-144 High Impact Polystyrene plas CFC-free, polyurethane foam 1" Full-port, 3-Way, 4-Positic Brass body and spool, NBR s	D variable speed stic n n flushing and isolation/service valve, eals, stainless steel retaining ring.	Max. Fluid Temperature: 140°F [60°C] Min. Fluid Temperature: 20°F [-7°C] Max. Oper. Press.: 145 psi [1 Mpa] Min. Operating Press.: 1.3 psi [9 kPa] Max. Ambient Air Temp: 104°F [40°C]
Electrical a	nd Power Data		Approved Antifreeze
Motor: 208-230 ments), electroni	1, 50/60 Hz, single phase, 2-pole, ETI ically protected, insulation class F, 0. Grundfos Magna GEO 32-140 Power	_{-c/us} approved (meets UL and CSA require- 09 to 1.7 Amps (at 230V) NOTES: The Magna GEO (vari-	Propylene Glycol Ethanol Methanol
		able speed) pump adjusts speed	Mounting
(stite) 150		maintain flow rate or tem- perature difference.	Flow Center is designed for indoor installation only.
N) 100			Flow Center must be installed with the pump's motor shaft horizontal.
50			Do not install flow center with the pump's motor shaft vertical.
	10 20 30 [0.63 1.26 1.89 Flow (U.S. GPM) [I/s]	40 2.52]	
Pump Perf	Ormance Curves Grundfos Magna GEO 32-140 Perfor	mance Curves (Single Pump)	
50 [149.2] 45 [134.3]			The terminal box should be located in one of the following orientations:
40 (1194) 35 (1045) 430 (895) 49 (25) 49 (246) 49 (246) 49 (246) 49 (246) 49 (246) 49 (246) 49 (246) 49 (246) 49 (246) 40 (246) 4	Pump operates in between these curves		
(59.7) T 15 [44.8] 10 [29.8] 	to maintain flow rate		BOSCH
5 [14.9] 0 0	5 10 15 20 25 1032 063 095 136 159	30 35 40 45 50 189 21 22 264 3151	Bosch Thermotechnology Corp. 50 Wentworth Avenue Londonderry, NH 03053
	Flow (U.S. GPM)	[l/s]	Tel: 603-552-1100 Fax: 603-965-7581
Curves are manufa	cturer's reported averages using water a	t 68°F [20°F].	www.boschneatingandcooling.com



Fluid connections are Flo-Link[™] double O-ring style. Transition fittings are not included with the flow center packaging. Typically, PE fusion x Flo-Link[™] is used on the ground loop connections. A Bosch hose kit designed for Flo-Link[™] connections includes transition fittings for heat pump connections.



Bosch Thermotechnology Corp. 50 Wentworth Avenue Londonderry, NH 03053 Tel: 603-552-1100 Fax: 603-965-7581 www.boschheatingandcooling.com

	Submittal Data		
	FIV Series Variable Speed Press	irized Flow Center, Double Pump	
	Project Name:		
	Contractor:		
	Order Number:		
010.00 ¥	Additional Information:		
Technical Data			
Circulators: Cabinet: Insulation: Valves: Grundfos UPS26-99 & Mag High Impact Polystyrene pla CFC-free, polyurethane foa 1" Full-port, 3-Way, 4-Positi Brass body and spool, NBR	na GEO variable spd. (requires controller) astic m ion flushing and isolation/service valve, seals, stainless steel retaining ring.	Max. Fluid Temperature: 140°F [60°C] Min. Fluid Temperature: 20°F [-7°C] Max. Oper. Press.: 145 psi [1 Mpa] Min. Operating Press.: 1.3 psi [9 kPa] Max. Ambient Air Temp: 104°F [40°C]	
Electrical Data	as a little and CSA approved internal thermal	Approved Antifreeze	
<u>OPS26-99 motor</u> : 208-230V, 60 HZ, single phase, 2- overload protection, insulation class F, three speed <u>Magna GEO motor</u> : 208-230V, 50/60 Hz, single phase CSA requirements), electronically protected, insulat	se, 2-pole, ETL _{c/us} approved (meets UL and tion class F, variable speed	Propylene Glycol Ethanol Methanol	
Pump Nominal Amps	i @ Watts @ Housing	Mounting	
Motor Speed HP Volts 230V	* 230V* Capacitor (Volute)	Flow Center is designed for indoor installation only.	
UPS26-99 <u>Medium</u> 1/6 208-230 <u>0.8</u> Low 0.7	179 150 150	Flow Center must be installed with	
Magna GEO Variable 1/6 208-230 0.09 to *Data is maximum for UPS26-99: Magna GEO var	1.7 5 to 230 N/A Cast Iron	Do not install flow center with the	
Pump Performance Curves Grundfos Magna GEO 32-140 and Construction Grundfos Magna GEO 32-140 and Construction	d UPS26-99 (pumps in series) is a constant speed pump; Magna GEO is a variable p. When both pumps are running, the Magna GEO retween duty cycles shown below to maintain te or temperature difference. agna GEO + UPS26-99 (high speed) Magna GEO (lowest duty cycle – highest flow/head)	pump's motor shaft vertical.	
L 25 20 15 10 5 10 0 5 10 15 20 25 [0.32 0.63 0.95 1.26 1.58	est duty cycle lowest flow/head) 30 35 40 45 50 1.89 2.21 2.52 2.84 3.15]	Bosch Thermotechnology Corp. 50 Wentworth Avenue	
Flow (U.S. GP Curves are manufacturer's reported averages using water	2M) [I/s] at 68°F [20°F].	Londonderry, NH 03053 Tel: 603-552-1100 Fax: 603-965-7581 www.boschheatingandcooling.com	





Fluid connections are Flo-Link[™] double O-ring style. Transition fittings are not included with the flow center packaging. Typically, PE fusion x Flo-Link[™] is used on the ground loop connec tions. A Bosch hose kit designed for Flo-Link[™] connections includes transition fittings for heat pump connections.

Flow center may be field modified to a one pump flow center by replacing the constant speed pump with a blank plate kit.



		Submittal Data						
	BOSCH	NP V non-pressurized flow	v center variable speed nump					
	0.0							
	NP.	Contractor:						
	J.							
9								
	6							
Technical	Data							
Circulator:	Grundfos Magna GEO 32-140 (v	variable speedrequires controller)	Max. fluid temp.: 140°F [60°C]					
Cabinet:	Powder coated galvanized steel		Min. fluid temp.: 14°F [-10°C]					
Iank:	CEC-free polyurethane foam		Max. operating press.: 13 psig [89.6 kPa]					
Valves:	1", 3-way, 4-position flushing ar	nd isolation/service valve, composite	Max. ambient relative humidity: 80%					
	valve body and spool, NBR seals	s, stainless steel retaining ring	· · · · · · · · · · · · · · · · · · ·					
Electrical	and Power Data		Approved Antifreeze					
Motor: 208-230)V, 50/60 Hz, single phase, 2-pole	, $ETL_{C/US}$ approved (meets UL and CSA	Propylene Glycol					
requirements),	electronically protected, insulation	on class F, 0.09 to 1.7 Amps (at 230V)	Methanol					
250	Grundfos Magna GEO 32-140 Powe	r	Ethanol					
		NOTES: The Magna GEO	Mounting					
200		(variable speed) pump	Flow center is					
ts)		adjusts speed (when used	designed for indoor					
× 150		flow rate or temperature	installation only.					
Ver		difference.	· NP Stevens					
of 100			Flow center must					
50			upright position as					
50			shown to the right.					
0								
0	10 20 30 [0.63 1.26 1.89	40 2.52]						
	Flow (U.S. GPM) [l/s]		The pump terminal					
Pump Per	formance Curves		box should be					
50 -	Grundfos Magna GEO 32-140 Perform	mance Curves (Single Pump)	following orienta-					
[149.2]			tions:					
[134.3]								
[119.4]			and a standard and a standard a					
[104.5]								
¥ [89.5]			A CONTRACT CONTRACT					
U [74.6]	Pump operates in between these curves							
e [59.7] H 15	to maintain flow rate							
[44.8]			I ((=)) BOSCH					
[29.8]								
[14.9]	*		Bosch Thermotechnology Corp.					
c	0 5 10 15 20 25 [0.32 0.63 0.95 1.26 1.58	30 35 40 45 50 1.89 2.21 2.52 2.84 3.15]	Londonderry, NH 03053					
Flow (U.S. GPM) [I/s] Tel: 603-552-1100 Fax: 603-965-7581								
Curves are man	ufacturer's reported averages usin	www.boscnneatingandcooling.com						

Dimensional Data

			-						-			
	Α	В	С	D	E	F	G	н	I	J*	WEI	GHT
Inches	30-1/2	9	11-1/8	16	32	4	9-3/8	24-1/8	4-1/2	3/8" DRIVE	LBS	KG
СМ	77.4	22.8	28.3	40.7	81.1	10.2	23.9	61.4	11.4	SOCKET	51.0	23.1



*Requires two Flo-Link[™] (double O-ring) transition fittings. Typically, PE fusion or PVC glue fittings are used for the ground loop; a hose kit or PVC glue fitting is used for the heat pump connection.

Flow center may be upgraded to a two pump flow center by removing the blank plate, and adding a second constant speed pump (UPS26-99).



Bosch Thermotechnology Corp. 50 Wentworth Avenue Londonderry, NH 03053 Tel: 603-552-1100 Fax: 603-965-7581 www.boschheatingandcooling.com

BOSCH Submittal Data								enter variable speed, double pump				
	00	j.			Project Name:							
		Contractor:										
				Er	Engineer:							
				0	Order Number:							
Additional Information:												
Technical I	Data											
Circulators: Cabinet: Tank:	Circulators: Grundfos UPS26-99 & Magna GEO variable speed (requires controller Cabinet: Powder coated galvanized steel Tank: Polyvinyl chloride (PVC)								Min. fluid temp.: 20°F [-7°C] Max. operating press.: 13 psig [89.6 kPa]			
Insulation:	CFC-fre	e polyur av 4-nov	ethane	toam shing and	isolation/s	ervice valv	e compos	te	Max. ambient air temp.: 104°F [40°C] Max. ambient relative humidity: 80%			
	valve b	ody and	spool, N	IBR seals, s	tainless st	eel retaini	ng ring	i.C				
Electrical I	Data								Approved Antifreeze			
<u>UPS26-99 motor</u> : 230V, 60 Hz, single phase, 2-pole, UL and CSA approved, internal thermal over- load protection, insulation class F, three speed <u>Magna GEO motor</u> : 208-230V, 50/60 Hz, single phase, 2-pole, ETL _{c/uS} approved (meets UL and CSA requirements), electronically protected, insulation class F, variable speed								over- d	Propylene Glycol Methanol Ethanol			
							Pump		Mounting			
Pump	Spood	Nominal	Volte	Amnc*	Watts*	Capacitor	Housing		Flow center is			
UPS26-99	High Medium Low	1/6	230	0.9 0.8 0.7	196 179 150	5µF/400V	Cast Iron		designed for indoor installation only.			
Magna GEC *At 230V	Variable	1/6	208-230	0.09 to 1.7	5 to 230	N/A	Cast Iron		Flow center must be installed in an unright position as			
Pump Per	f <mark>orm</mark> a	nce (Curve	es					shown to the right.			
80 [239] 75	irundfos	Magna (GEO 32-1	40 and UP	S26-99 (pı	ımps in sei	ies)]	The pump terminal			
									box should be			
65 [194]	-		*	UPS26-99 is a co speed pump. Wi	nstant speed pu nen both pumps	ump; Magna GE are running, th	O is a variable e Magna GEO	-	located in one of the			
60 ^[179]				operates betwee set flow rate or t	en duty cycles si emperature difi	nown below to r ference.	naintain		tions:			
e 50								_				
土 [149]	perate i	1 series		Magna	GEO + UPS26-99	(high speed)		-	UPS26-99			
	n these c	urves*										
0 35 to mai	ntain flov	w rate			1agna GEO (low	est duty cycle	highest flow/he	ad)	Magna GEO			
	iperature	: am.	-									
20							_					
Imagina GEO (highest duty cycle lowest flow/head)												
0 + + + + + + + + + + + + + + + + + + +												
Curves are manufacturer's reported averages using water at 68°F [20°C].								IeI: 603-552-1100 Fax: 603-965-7581 www.boschheatingandcooling.com				



Appendix F: Antifreeze Fluid Factors

The UPC-GEO controller calculates Heat of Extraction (HE) and Heat of Rejection (HR) based upon the Media Configuration menu (Figure 14). The Media Configuration page allows setting the type and percentage of antifreeze used in the ground loop system. The type choices are ethanol, methanol, glycol, and none. The Media inputs only affect the HE/HR calculation. HE/HR is calculated as follows:

HE or HR = $\Delta T \times Flow$ Rate (U.S. GPM) x Fluid Factor where: ΔT = temperature difference between EWT and LWT Fluid factor = adjustment for antifreeze

It is possible that the calculation shown on the controller screen is different than a hand calculation. The reason that the calculation could be different is the use of fluid factor. The UPC-GEO calculation is based upon the weight of the fluid, specific heat, percentage of antifreeze, and fluid temperature. Some calculations in the geothermal heat pump industry use a fluid factor of 500 for water, and a fluid factor for all antifreezes of 485. While this will make the calculation easier, and allow the technician to be "in the ballpark", it may not match the controller display, which uses calculations specific to the current conditions.

NOTES

NOTES

Bosch Thermotechnology Corp. 50 Wentworth Avenue Londonderry, NH 03053

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For Technical Support: Tel: 866-642-3198