

- 1. Operation:** The controller will vary the output frequency of the VFD or VFDs to maintain a local or remote set point. If another pump is available and the lead pump is at full speed and unable to maintain the set point minus a lower dead band, then a lag pump will start after an adjustable delay. If the output frequency of the lag VFD falls below an adjustable lag off set point, the lag pump will stop after an adjustable delay.

The system will operate with one or two transducers. The system will maintain the set point with the greatest error. The lead pump will run at min speed if there is a transducer failure.

Optional Boost Mode (Requires storage tank)

The system will operate continuously. At least one pump will operate at all times unless there is no demand. If there is no demand for an initial time of 6 minutes and a secondary time of 3 minutes, the pressure is increased 10 PSI above the set point and the VFD is stopped. The VFD is started when the pressure falls to 1.5 PSI above the set point. Only one VFD can be running for this process to be initiated, and an expansion tank must be calibrated. Tying pin 16 to ground activates this feature. The 3-minute timer is reset to 6 if the tank does not hold a pressure greater than the set point for a minimum time of 10 seconds. The 3rd line of the main screen will display "BOOST ACTIVE" when the routine is initiated.

- 2. Pump Alternation:** The pumps will alternate every 13 hours. The alternation is based upon pump availability and the order they are made available. The lead pump is stored in EEPROM. If the controller is reset, the stored lead VFD will start if it is available.
- 3. Alarm Annunciation:** The system will generate alarms for the following conditions: high-pressure, low pressure, and low suction. Output 1 is the high-pressure alarm, output 2 is the low-pressure alarm, and output 3 is the low-suction alarm. The outputs are open collector type rated @ 250mA @ 24Vdc. A relay with a 24Vdc coil can be connected to these outputs. The coil must draw less than 200 mA continuous. One side of the coil is connected to the output and the other side is connected to +24Vdc. A diode must be placed across the coil to ensure operation. An optional relay panel is avail-

able from Metropolitan for this purpose. Reference your schematic to see if your system includes the relay option. The high-pressure alarm and low suction alarm will cause a system shutdown. The pumps will auto restart after the alarm clears. All alarms are displayed on the 3rd line of the main screen.

- 4. Auto/Manual Mode (ABB VFD):** When the HAND key is pressed, the drive starts and the reference frequency can be modified by pressing the UP/DOWN keys. The HAND (keypad) control mode is indicated. When the OFF key is pressed, the drive stops and the OFF control mode is indicated. When the AUTO key is pressed, the AUTO mode is indicated. The drive can be started and stopped via a serial communication command. The drive speed is controlled by the external speed reference input. If the HAND key is pressed while the drive is running in the AUTO control mode, the drive continues to run without changing speed, but ceases to respond to external input or PID speed reference changes (Bumpless transfer). The reference frequency can be modified by pressing the UP/DOWN keys. If the AUTO key is pressed while the drive is running in the HAND control mode, the drive continues to run and follows the acceleration or deceleration control ramp to the speed set by the external input or PID speed reference (Bumpless transfer).

Auto/Manual Mode (AC Tech VFD): The PLC reads parameter #4 "SPEED#4" to check for Auto/Manual status. If "SPEED#4" is equal to 1999 then the drive is in auto. If "SPEED#4" is any other value, then the drive is in manual. The local/remote button located on the AC Tech VFD keypad can also be used to run the drive in manual mode. Remote would allow control from the PLC and local will allow from the drive keypad. Serial communication should be disabled at the drive when running from the keypad.

- 5. Display/Operator Interface:** The interface is a 4 line by 20-character liquid crystal display. The display and 3 buttons allow for both changing system set points and monitoring. The display main screen is used to monitor the system pressure, drive speed, pressure set point and alarms. An alarm is displayed only when active. It is displayed on line 3 of the main screen.



6. Changing Set Points: Set point adjustment will be accomplished via a series of menus. By pressing mode while the main screen is being displayed, the password screen will appear. The correct password has to be entered to access the set point screens. Pressing the INC and DEC buttons changes the password. The default password is "1" for the user mode and "2" for the integrator mode. If the user password is entered, a limited set of set points is available. If the integrator password is entered, a full set of set points is available. Once the password is entered there will be a screen with

one blinking set point. The blinking set point is the active changeable set point. It can be adjusted by using the INC and DEC buttons. To go to the next set point or screen, press the mode button. Refer to the *screens and set points* section for a description of each screen. Refer to the *set point definitions* for a complete description of each changeable set point. Upon start up you may write actual set point values in the table list of *default and actual set points*.



7. Set Point Definitions:

SP1= XXX.X	Desired pressure set point.
Hi Pres= XXX.X	This triggers the high-pressure shutoff and the high-pressure alarm output if the pressure exceeds this value.
Lo Pres= XXX.X	This triggers an alarm output when the pressure falls below this value.
Min Spd= XX.X	The minimum speed at which the drive will run.
P DB= XX	The band around the set point in which the proportional error is used to trigger a constant drive speed. This # is a % of the local set point. If the set point is 100 PSI and the P DB is 1 then the dead band will be 1 PSI or ½ PSI above and below the set point.
P Gain= XX.X	The multiple used to calculate the time it takes for the proportional error to go from a minimum value to a maximum value.
D Gain= XX.X	The multiple used to calculate the time it takes for the derivative error to go from a minimum value to a maximum value.
D DB= XX.X1	The band around the set point in which the differential error is used to trigger a constant drive speed.
User Password= XX	The password used to enter the user mode. The user mode allows access to only the essential changeable parameters.
Intgr Password= XX	The password used to enter the Integrator mode. The integrator mode allows access to all changeable parameters.
Max Inc.= XX.X	The max changes for each given write cycle.
Max Spd= XX.X	The maximum speed in which the drive will run.
Lag On= XX.X	When the speed of the drives reaches 95% and the pressure drops below the desired pressure minus this value the lag drive will turn on. Each drive has an inter-step off delay.
Start Delay= XX.X	The delay before a pump will start. This is also used as the inter-step on delay.
Stop Delay= XX.X	The delay before a pump will turn off. This is also used as an inter-step off delay.
Lag Off= XX.X	The speed at which the lag drives turn off. Each drive has an inter-step on delay.
SP2= XX.X	The remote transducer desired pressure set point. This is only used if there are two transducers.



8. Screens and Set Points:

PSI1 = XXX.X
SP1 = XXX.X
Speed
Press Mode = Change set point

Screen 1
One Transducer

PSI1 = XXX.X PSI2 = XX.X
SP1 = XXX.X SP2 = XX.0
Speed
Press Mode= Change set point

Screen 1 (Main Screen)
Two Transducers

Password = XX
Enter Password
Then Press Mode

Screen 2 (Password Screen)

SP1 = XXX.X PSI
Hi Pres = XXX.X PSI
Lo Pres = XXX.X PSI
Min Spd = XX.X HZ

Screen 3
Integrator Mode Screen

P DB = XX %
P Gain = XX.X Mult.
D Gain = XX.X Mult.
D DB = XX.X1 PSI

Screen 4
Integrator Mode Screen

User Password = XX
Intgr Password = XX
Max Inc = XX.X HZ
Max Spd = XX.X HZ

Screen 5
Integrator Mode Screen

Lag On = XX.X PSI
Start Delay = XX.X Sec
Stop Delay = XX.X Sec
Lag Off = XX.X PSI

Screen 6
Integrator Mode Screen

SP2 = XX.X
Pumps Available = X
Exit = Yes/No

Screen 7
Integrator Mode Screen

SP1 = XXX.X PSI
Hi Pres = XXX.X PSI
Lo Pres = XXX.X PSI
Min Spd = XX.X PSI

Screen 1
User Mode Screen

Lag Off = XXX.X PSI
Max Spd = XX.X PSI
Lag On = XX.X PSI
Exit =

Screen 2
User Mode Screen

Mode: By pressing mode while in the Main screen the password screen will appear. If the integrator password is entered a full set of set points are adjustable. If the user password is entered a limited set of set points are adjustable. The blinking line is the active changeable variable. To change lines press mode.

9. List of Default & Actual Set Points:

Parameter	Default Value	Actual Value	Scale	Screen #	Notes
PSI1= XXX.X				Screen 1	One Transducer
SP1= XXX.X				Screen 1	One Transducer
Rotating Line				Screen 1	One Transducer
Press Mode=Change setpoint				Screen 1	One Transducer
PSI1= XXX.X PSI2= XX.X				Screen 1	Two Transducer
SP1= XXX.X SP2= XX.0				Screen 1	Two Transducer
Rotating Line				Screen 1	Two Transducer
Press Mode=Change setpoint				Screen 1	Two Transducer
Password= XX				Screen 2	All Applications
Enter Password				Screen 2	All Applications
Then Press Mode*				Screen 2	All Applications
SP1= XXX.X	38.5		PSI	Screen 3	Integrator Mode Only
Hi Pres= XXX.X	175		PSI	Screen 3	Integrator Mode Only
Lo Pres= XXX.X	45		PSI	Screen 3	Integrator Mode Only
Min Spd= XX.X	51		HZ	Screen 3	Integrator Mode Only
P DB= XX.X	1		PSI	Screen 4	Integrator Mode Only
P Gain= XX.X	0.2		Mult.	Screen 4	Integrator Mode Only
D Gain= XX.X	0		Mult.	Screen 4	Integrator Mode Only
D DB= XX.X1	0		PSI	Screen 4	Integrator Mode Only
User Password= XX	1			Screen 5	Integrator Mode Only
Intgr Password= XX	2			Screen 5	Integrator Mode Only
Max Inc.= XX.X	5		HZ	Screen 5	Integrator Mode Only
Max Spd= XX.X	60		HZ	Screen 5	Integrator Mode Only
Lag On= XX.X	2.5		PSI	Screen 6	Integrator Mode Only
On Delay= XX.X	6		Sec	Screen 6	Integrator Mode Only
Off Delay= XX.X	5		Sec	Screen 6	Integrator Mode Only
Lag Off= XX.X	53.5		HZ	Screen 6	Integrator Mode Only
SP2= XX.X	0.1		PSI	Screen 7	Integrator Mode Only
Pumps Available= X	1			Screen 7	Integrator Mode Only
Exit= Yes/No				Screen 7	Integrator Mode Only
SP1= XXX.X	38.5		PSI	Screen 1	User Mode Only
Hi Pres= XXX.X	175		PSI	Screen 1	User Mode Only
Lo Pres= XXX.X	45		PSI	Screen 1	User Mode Only
Min Spd= XX.X	51		HZ	Screen 1	User Mode Only
Lag Off= XXX.X	53.5		HZ	Screen 2	User Mode Only
Max Spd= XX.X	60		PSI	Screen 2	User Mode Only
Lag On= XX.X	2.5		PSI	Screen 2	User Mode Only
Exit= Yes/No				Screen 2	User Mode Only



Startup Procedure for New Installs

1. Inspect the pump package for damage. Inspect the plumbing connections and electrical connections. Turn pump shafts manually if possible. Measure for grounds on the motor leads and any other equipment wired in the field.
2. Pressurize the pump package if it has not been done and check for leaks. Bleed the air out of the pumps if necessary.
3. Measure incoming power with a meter and verify it is correct for panel design.
4. Power up pump package but do not turn on variable speed drive disconnects yet.
5. Verify the desired pressure setting on the display is low enough to not cause an overpressure situation. Change any setpoints as desired at this time.
6. Set Low Suction switch to desired setpoint. The low suction switch can be used to detect low suction or low fluid level in a tank. It is recommended for most applications. A standard value is about 20 psi for potable water and 10 psi or lower for tank supplies. Low suction lockouts for tank applications should be set according to elevation or the lowest setting without tripping. If the application uses a Honeywell low suction switch, the gauge is adjusted by turning the screw on top of the unit.
7. Adjust thermal dumps to protect the pumps. Set per pump specs. Typically 80-110 degrees. Honeywell thermals are adjusted using the dial in the front of the unit.
8. If a bladder tank is not on the system or if boost off mode is not desired disconnect the terminal strip for input 16 from the plc.
9. Check the suction and discharge valve positions for each pump. Open or close as necessary for application and testing.
10. Turn the disconnects to the drives on. One pump should start and bring the pressure up to the desired setpoint. Verify the pump rotation is correct. If the pressure cannot reach the desired setpoint the lag pumps should time on.
11. If pumps do not come on and run properly the parameters in the drives need to be confirmed for proper communications. Refer to drive setup sheet.
12. Flow some water and tune the proportional and derivative setpoints for smooth pressure control.
13. Test each pump for proper operation. To cause lag pumps to come on close or choke the discharge valve on the lead pump and let the pressure fall below the lag on setpoint. Pumps should stage on. Test the stage off by opening all the discharge valves again. Lag off speed setpoint may need to be adjusted at this time.
14. If boost mode is to be used adjust the air in the bladder tanks so the tank is half full of water. Typically air charge of bladder should be 10-20 psi less than water pressure at tank.
15. Wait for the boost timer to timeout and test boost mode several times. If pump speed is more than 2% above the minimum speed setpoint the boost mode will not time out. You need to set the minimum speed setpoint with no flow on the system.
16. Set all other setpoints per application.



Metro-Tech

Variable Speed Pump Controller

OPERATION MANUAL

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Drive Parameters to Change for Metro-Tech Control

AC Tech Drives

Parameter No.	Factory Default	New Setting
4	20.00 Hz	19.99 Hz
Auto: Parameter # 4 "SPEED#4" in the VFD is 1999.Hand/OFF: Parameter # 4 "SPEED#4" is any value other than 1999. This allows you to run from the keypad.		
8	30.0 sec.	3-10 sec.
9	30.0 sec.	3-10 sec.
26	coast	ramp
54	none	fault
57	disable	w timer
58	30	Pump No. 1-4:1=pump 1:2=pump 2

Default password is 19 to get into menu.

VFD Parameter to Change from HVAC Default for ACH550

Parameter No.	Name	Factory Default	New Setting
1001	EXT1 COMMAND	DI1	KEYPAD
1002	EXT2 COMMAND	NOT SEL	COM
1102	EXT1/EXT2 SEL	EXT1	EXT2
1103	REF 1 SEL	AI1	KEYPAD
1106	REF 2 SEL	KEYPAD	COM
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2003	MAX CURRENT		SET TO SF
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2102	STOP FUNCTION	COAST	RAMP
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2202	ACCEL TIME 1	30S	3-10S
2203	DECEL TIME 1	30S	3-10S
2205	ACCEL TIME 2	60S	3-10S
2206	DECEL TIME 2	60S	3-10S
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3005	MOT THERM PROT	FAULT	NOT SEL
3010	STALL FUNCTION	NOT SEL	FAULT
3011	STALL FREQUENCY	20HZ	30HZ
3104	AR OVERCURRENT	DISABLE	ENABLE
3415	SIGNAL 3 PARAM	120	RUN TIME
5201	STATION ID	1	PUMP#
5302	EFB STATION OD	1	PUMP #
9802	COMM PROT SEL	NOT SEL	STD MODBUS

*PROGRAM GROUP 99 WITH MOTOR DATA, IF AVAILABLE.