

ZENER 8000

SW08020 Application Guide

Pump PID 2: Advanced Pump PID Control

Important Warnings:

- ALL PROTECTION PROVIDED BY THE ZENER 8000 IS FOR OPERATIONAL PURPOSES ONLY. SEPARATE INDEPENDENT METHODS MUST BE EMPLOYED TO PREVENT ECONOMIC LOSS.
- THIS EQUIPMENT CONTAINS HIGH VOLTAGE AND REMAINS CHARGED FOR A PERIOD AFTER POWER IS REMOVED. ALWAYS ALLOW 15 MINUTES FOR COMPLETE DISCHARGE AND CHECK FOR THE PRESENCE OF AC OR DC VOLTAGE BEFORE ACCESSING MOTOR PHASE TERMINALS, WIRING OR INTERNAL COMPONENTS.

Check List: What information you need to know

1. What is the motor nameplate Full Load Current ? _____ Amps
2. What is the motor nameplate RPM ? _____ rpm
3. What is the desired operating pressure (in kPa) ? _____ kPa
4. What is the maximum system pressure allowable (in kPa) ? _____ kPa
5. What is the transducer's pressure rating (ie. @ 20mA) ? _____ kPa
6. What is the minimum operating speed of the pump (= X% of 50Hz) ? _____ Hz
7. What is the maximum starts per hour rating of the pump/motor? _____



Product Support
www.zener.com.au/support-8r.php



Reference Manual
www.zener.com.au/images/im00140.pdf



Pump PID 2 Application Guide (this document)
www.zener.com.au/images/im00127.pdf

Commissioning Overview

Each step must be completed in order shown before proceeding to the next. Before proceeding to power the ZENER 8000 and operating the pump, check all wiring is correct and that the pump and plumbing system is in a state fit for operation. If any parameters are changed it is important to 'save changes' when prompted exiting the menu.

Preparation:

1. Read all safety instructions & warnings

Refer to the installation manual

2. Install as per instruction manual and this 'Application' guide

Refer to the installation manual and Page 4 of this guide

3. Read this application guide carefully and ensure it meets your requirements

Go to page 3

4. Familiarise yourself with operating the ZENER 8000 and application menus

Go to page 5 to 10

Preliminary Checks:

5. Load the application & adjust initial parameters

Go to Page 6

6. Operate in local mode to check direction

Go to Page 10

7. Check pressure transducer feedback

Go to Page 10

Operational Check & Fine Tuning:

8. Operate in remote mode and check PID. Calibrate PID if required.

Go to Page 11

9. Check & calibrate 'IDLE' function

Go to Page 13

10. Check & calibrate 'PIPE FILL' if required

Go to Page 15

11. Check overall operation and protection

12. Save 'Custom Defaults' and/or record settings

Application Overview

Part Number:	SW08020
App Group:	Standard
Description:	Advanced PID Pressure Control System No.2
Menu Text:	Pump PID 2
Compatibility:	ZENER 8000 Firmware 5.2.6ZO or later
Application Guide:	IM00127

What is a ZENER ‘Application’

An ‘Application’ is firmware that aims to simplify wiring, programming and the commissioning of a Variable Speed Drive. An ‘Application’ programs the drive and creates new user friendly menus with the essential settings. This eliminates timely setups, the reading & interpretation of complex manuals and ensures all critical protection is installed & set up correctly.

Since the ‘Application’ programs all the parameters required and custom ‘User menus’ created there is generally no reason to program additional parameters unless there is a variation to the intended operation of this ‘Application’.

Application Summary:

This application provides an advanced PID Pressure Control System (PCS) using an external pressure transducer. The ZENER 8000 will maintain a constant pressure with changing water consumption requirements. This is a pressure control system with an automatic turn off function (idle or sleep) when there is no demand (or flow). An optional ‘No flow switch’ can also be used to trigger idle mode.

A user configured set point provides the pressure for the system to maintain. As the pressure changes the ZENER 8000 automatically adjusts the speed to ensure constant pressure is maintained.

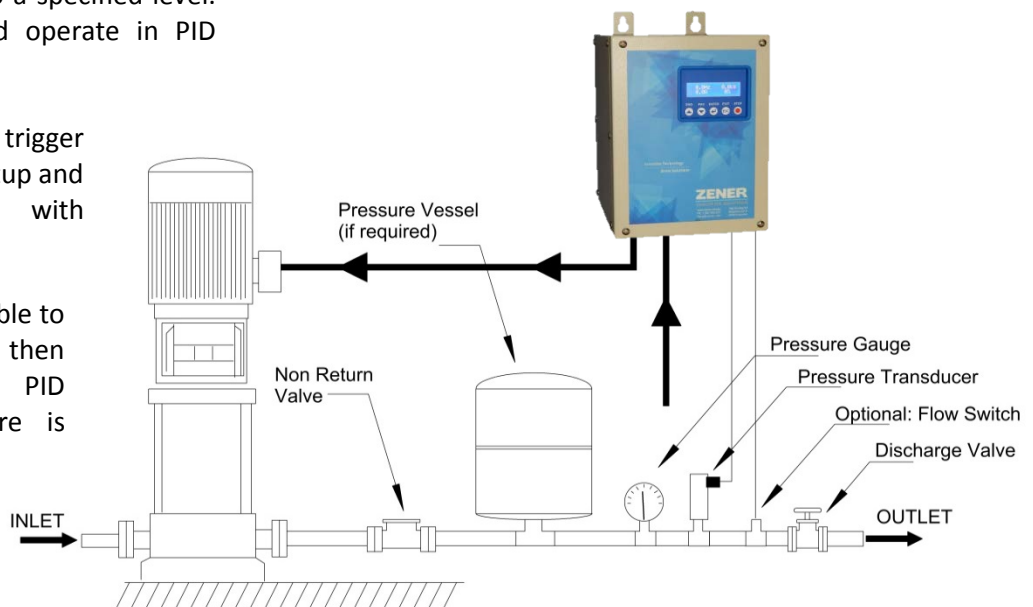
When demand decreases the drive will reduce in speed to reduce pressure accordingly. As the flow & speed reduces the load (current) also reduces. When the Load reaches the ‘idle threshold’ for the ‘idle delay’ period, the drive goes into idle mode. In idle mode the PID & output turns off until it is told to wake. The ZENER 8000 will automatically wake when the pressure falls to a specified level. Pumping will recommence and operate in PID mode.

A flow switch can be used to trigger idle mode. This simplifies the setup and provides a better solution with multiple or a variable set point.

A ‘Pipe Fill’ feature is also available to run at a set speed during filling then automatically changeover to PID mode when the set pressure is reached.

This also provides protection for the pump & motor:

- i. Motor Overload protection
- ii. Output Short Circuit protection
- iii. Loss of transducer signal
- iv. High & Low pressure Protection
- v. Optional Low Bore level protection

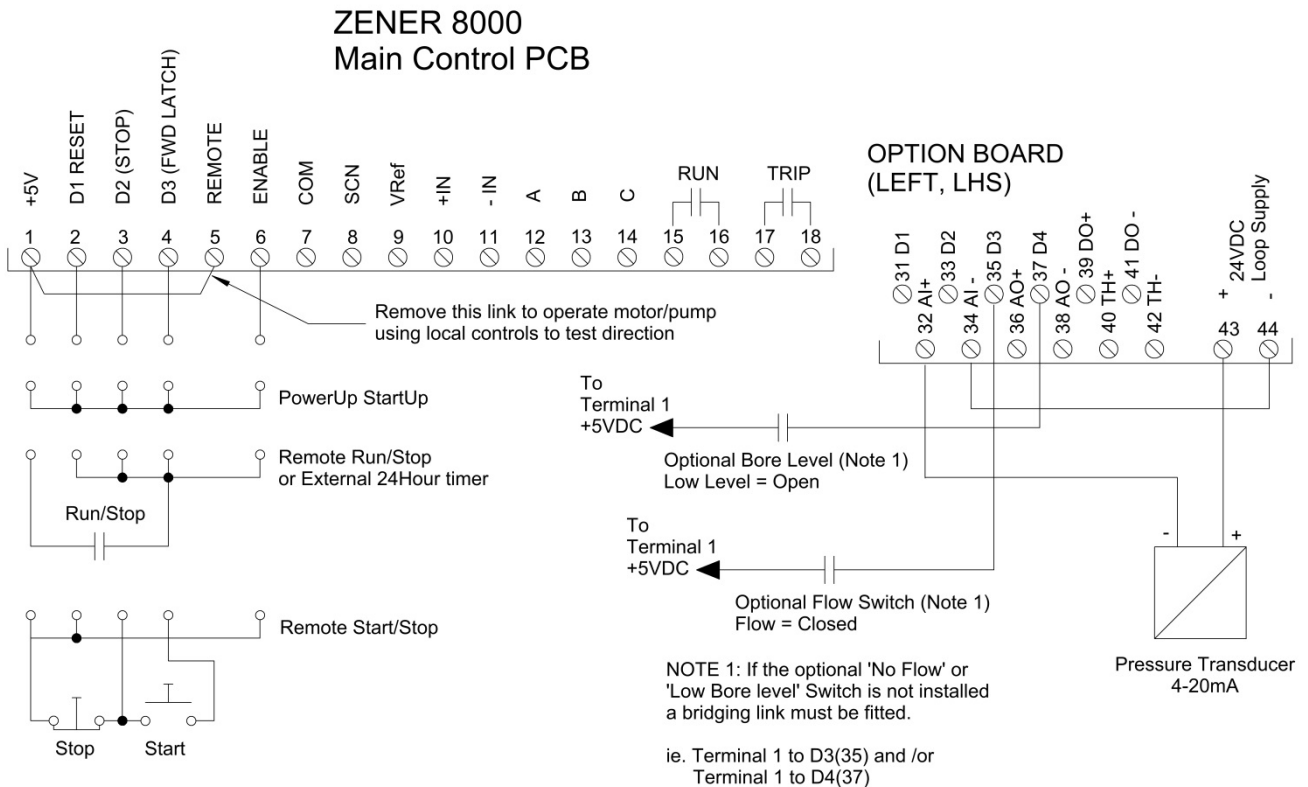


System Requirements:

1. ZENER 8000 with the Application: Pump PID 2 and an option board (AQ/AF08001) fitted.
2. A pressure transducer and a pressure gauge (for calibration purposes) located between the pump and any discharge valves.
3. A 4-20mA pressure transducer. However different devices can be used by varying the appropriate parameters.
4. Non return valve required on the suction side of the pump. All non-return valves are functioning correctly and there are no leaks in the pipework. With all field taps and valves turned off the pressure holds.
5. The motor & pump are in good working order.
6. Any non-return valve on the discharge side of the pump must be located between the pump and the transducer.
7. The internal high & low pressure trips are for operational purposes only. Separate and independent methods must be employed to prevent economic loss. A pressure relief valve is recommended.
8. Optional control input available for 'Bore level'. External level sensing device required.
9. Optional control input available for 'Flow Switch'. This provides a more direct idle control. A flow switch may be required with multiple set points or a variable set point.

Control Wiring:

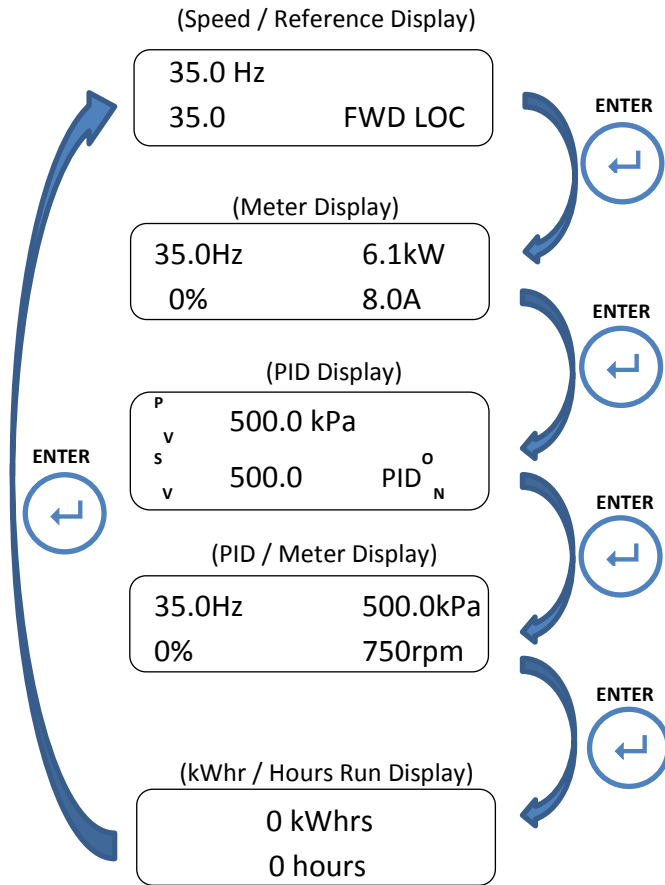
Note: All control wiring should be screened.



Ensure the ZENER 8000 is in local mode (remove link in terminal 5) to prevent operation while programming and performing preliminary checks..

Operation Displays

The operational displays show the operating state of the ZENER 8000. The six operational displays are: Speed / Reference Display, Meter Display, PID Display, PID / Meter Display and kWhr / Hours Run Display. Press **ENTER** (ENTER) to step through each display.



Speed / Reference Display

The top line displays the operating output frequency and the second line displays the speed reference and the drive status

Meter Display

The top line displays the operating output frequency and power and the second line displays motor load and output current.

PID Display

The top line displays the process variable (PV) with its units and the second line displays set-point variable (SV) expressed with the same units.

PID / Meter Display

The top line displays the operating output frequency and process variable (PV) and the second line displays output current and motor speed.

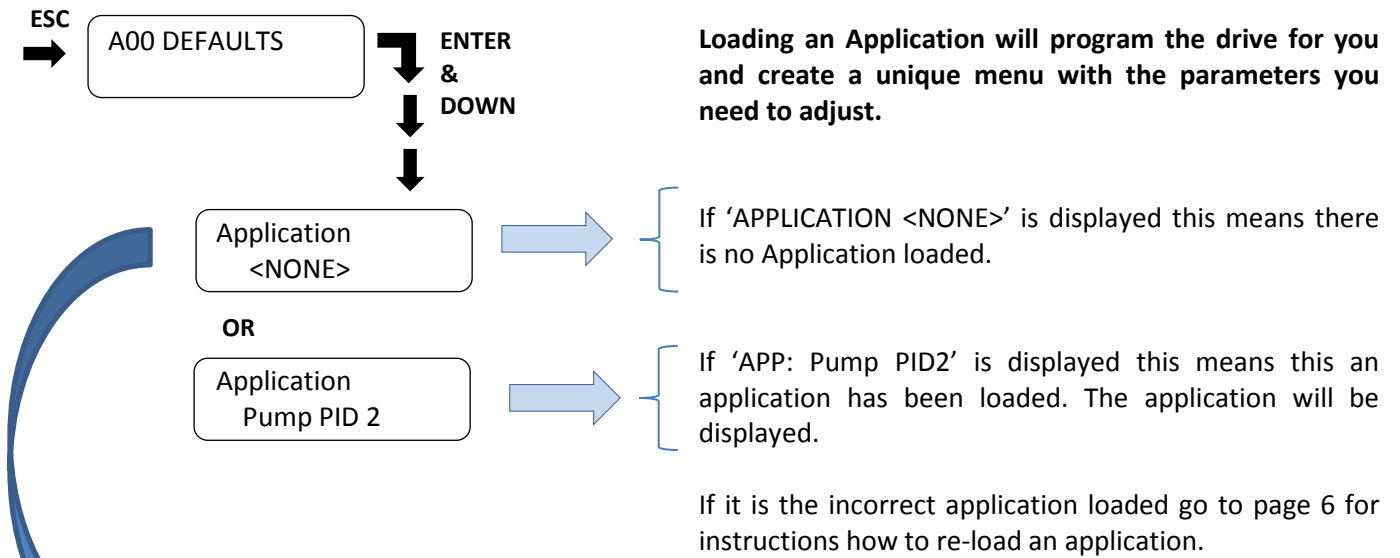
kWhr / Hours Run Display

The top line displays the kWhrs consumed by the motor and the second line displays accumulated running time of the motor

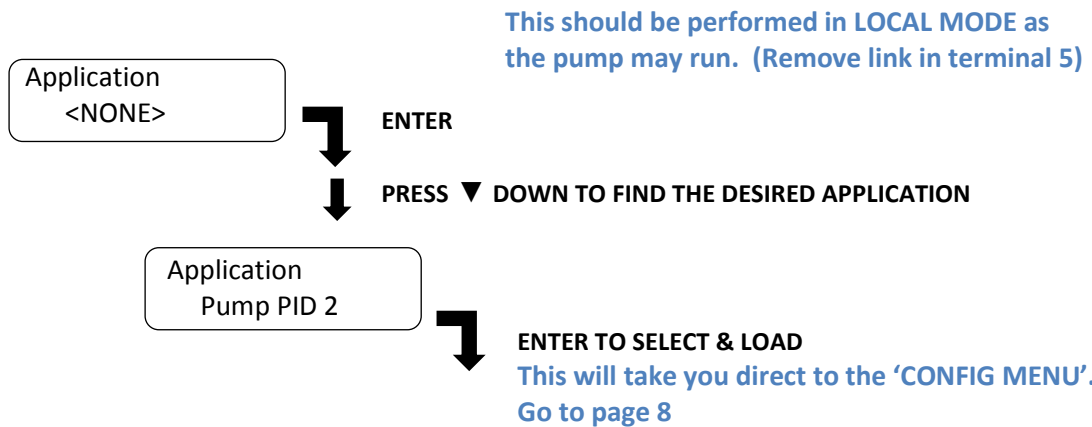
Display Messages

Message	Meaning
REM	REMOTE MODE: Start/stop control from digital inputs.
LOC	LOCAL MODE: Start/stop control from local console.
PID-A ON (OFF)	PID ON (or OFF): PID controller is operating or not.
FWD or REV	Forward or Reverse direction selected from local console or Digital inputs or internal
PV-A OOR	'Out of Regulation': A warning that PID is operating and the PV is not equal to the SV.
-DRY-	Bore level switch is indicating a low bore and/or in the timeout period before
Idle	PID is active and currently in Idle Mode and will wake based on pressure level set.
Filling	Pipe Fill Mode is active. When set pressure is reached will switch to PID mode.
Fill T/out	Alarm: The fill time has lapsed and pressure has not reach required level

Loading an Application:



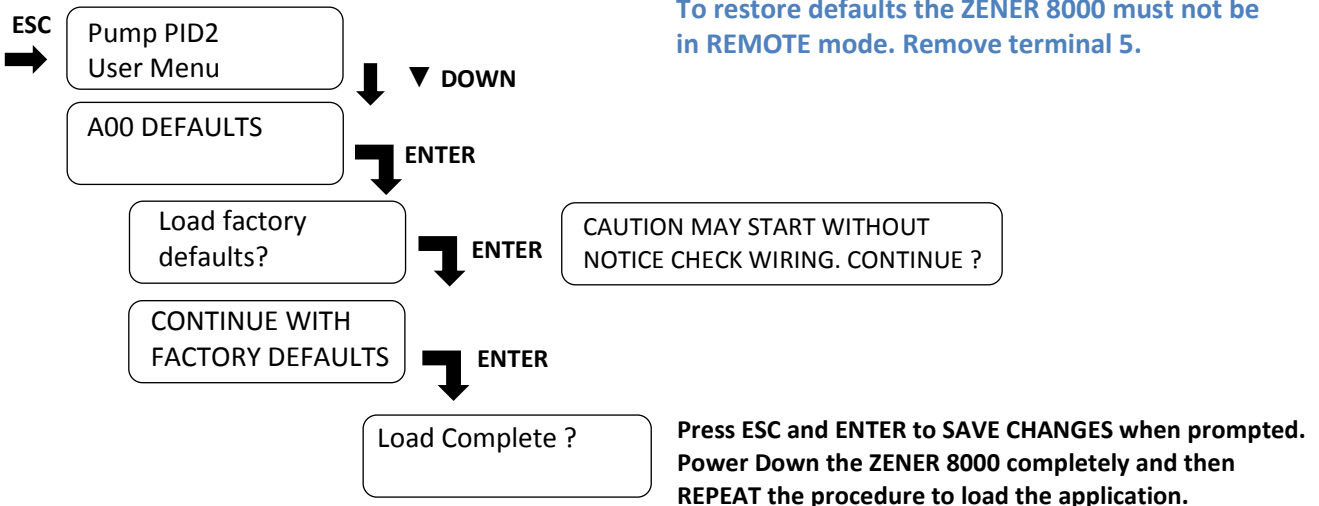
To load the application:



Reloading and Application:

Factory defaults must be restored and the application reloaded. To restore defaults follow the procedure below.

NOTE:
To restore defaults the ZENER 8000 must not be in REMOTE mode. Remove terminal 5.

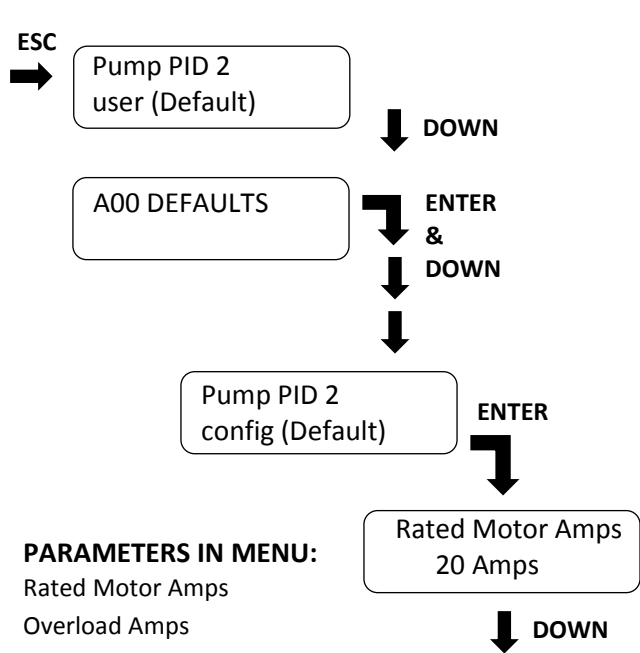


Application 'CONFIG' & 'USER' Menu:

There are now 2 additional menu's created with this application, a 'CONFIG MENU' and a 'USER MENU'.

CONFIG MENU

The 'CONFIG MENU' is created for initial setup. This can be found in the A00 DEFAULT' Menu and has all the parameters required. General access to this menu can be locked out.

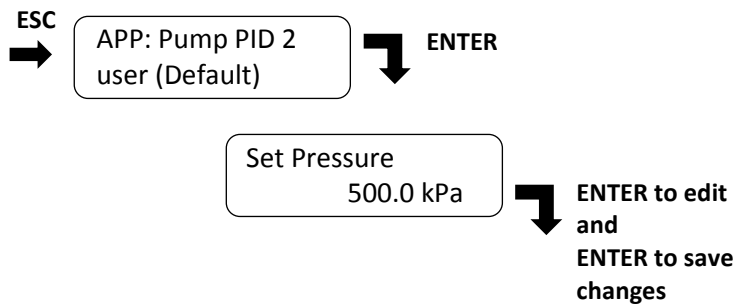


PARAMETERS IN MENU:

- Rated Motor Amps
- Overload Amps
- Motor RPM
- Transducer Scale
- Set Pressure
- Minimum Speed (Hz)
- Idle Threshold %
- Time before Idle
- Resume @ PV
- Low Trip Level
- Low Trip time
- High Trip Level
- Pipe Fill
- Pipe Fill Speed (Hz)
- Fill Level
- Fill time (s)
- Low Bore timeout

USER MENU

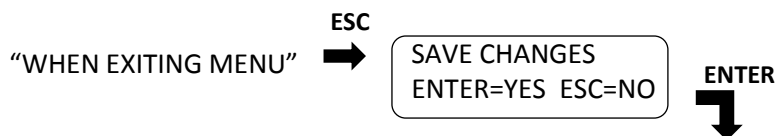
The 'USER MENU' is created for the operator. In this application it provides access to the 'Set pressure' only. Access to other settings can be locked out.



PARAMETERS IN MENU:

- Set Pressure

Always remember to press 'ENTER' when prompted to save changes.



Do not remove power while saving!!

CONFIG MENU Parameters:

After loading the application the CONFIG MENU will appear. Modify the following parameters. If the CONFIG menu does not appear read page 7.



Ensure the ZENER 8000 is in local mode (remove terminal 5) or will not operate.

Initial parameters to adjust:

	<u>Parameter</u>	<u>Default</u>	<u>Explanation</u>
1.	Rated Motor Amps	?? Amps.	Enter Motor nameplate full load current.
2.	Overload Current	?? Amps.	Enter Motor nameplate full load current.
3.	Rated Motor rpm	1470 rpm	Enter Motor nameplate speed in rpm.
4.	Transducer Scale	1000.0	Enter the rating of the pressure transducer at 20mA, in kPa.
5.	Set Pressure	500.0kPa	Enter the desired operating pressure.

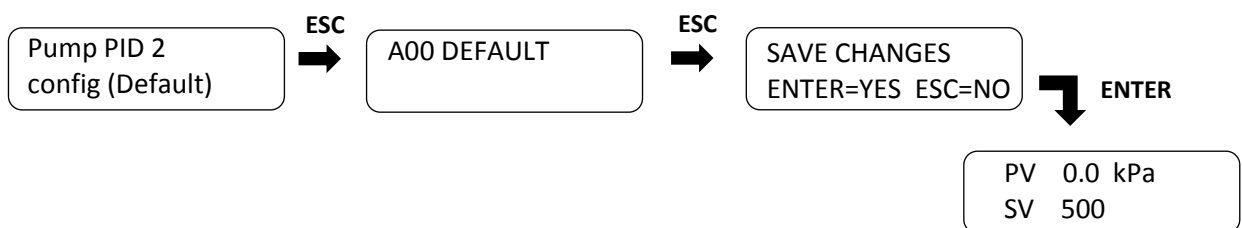
IDLE MODE Adjustments

Adjust later. Go to page 13 for an explanation on Idle Mode

6.	MIN Speed (Hz)	0 Hz	Leave at 0Hz (or minimum pump speed) to check pump rotation. This should be at least the minimum operating speed for the pump. Eg. 30Hz. When started the pump will run to this speed.
7.	Idle Threshold %	20%	Leave at 20% (or 0% for OFF) and adjust later. Enter the Load% under 'No flow' or 'dead head' condition which the ZENER 8000 must go into idle.
8.	Time before Idle	5sec	5 seconds is a good starting point. Enter the time period at the 'Idle Threshold %' before going into idle Mode.
9.	Resume @ PV	25% below SV	Leave at 25% for moment. Enter the pressure to wake from idle mode. This is entered as a value in % below the set pressure.

<u>Parameter</u>	<u>Default</u>	<u>Explanation</u>
10. Low Trip Level	250.0 kPa	Adjust if required. Adjust the level for 'low pressure' trip (in kPa)
11. Low Trip time	30 sec	Adjust if required. Adjust the low pressure trip time to allow the pipes to fill and pressure to increase above the trip level.
12. High Trip Level	800.0 kPa	Adjust if required . Adjust level for 'high pressure' trip (in kPa). The trip time (default 0 seconds) can be adjusted in another menu if required (Refer to User Alarm 1).
13. Pipe Fill	OFF	Leave OFF for the moment. Pipe fill mode runs the pump at a fixed speed until the pipes fill and the pressure begins to build. When the 'Fill to Level' pressure is reached it automatically switches to PID mode. Select 'PV Threshold' for pipe fill based on pressure.
14. Pipe Fill Speed (Hz)	40 Hz	Leave for the moment. This is the operating speed for pipe fill mode
15. Fill to Level	300.0 kPa	Leave for the moment. This is the pressure level to change from Pipe Fill to PID mode
16. Fill Time	40 sec	Leave for the moment. This is the time period for the pipe fill to reach pressure before an alarm occurs.
17. Low Bore timeout	0 sec	Leave at 0 sec for moment. This feature requires an external bore level switch. Link terminal 1 to Terminal D1(31) if no bore level switch installed. Enter the time to restart after the 'Low Bore' switch contact returns to the closed position. "- DRY-" is displayed during the timeout period." Link terminal 1 to Terminal D1(31) if no bore level switch available.

When back to the beginning (first parameter 'Set Pressure'), press ESC until:

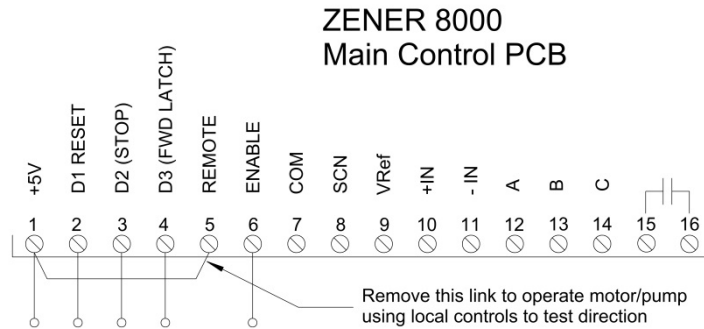


Preliminary Checks

The following should be performed with the ZENER 8000 in local mode to provide better control to carry out the checks. Ensure the motor and pump is ready and safe to operate.

To operate in local mode:

Remove the link in terminal 5, this selects local or remote/PID mode.



REM= REMOTE OR PID MODE [Control using terminal inputs]

LOC = LOCAL MODE [Control using push buttons]

Top display: Actual Speed in Hz (50Hz = full speed)

Bottom Display: Set speed

Press **FWD/▲** to start

Press **FWD/▲** to increase the speed

Press **STOP** to stop the pump

Note: If there is a minimum speed set it will go straight to that speed. To increase above this speed you will need to hold down the UP button until it goes above the minimum speed setting.

Check motor/pump direction:

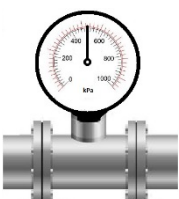
Press **FWD/▲** to start and increase the motor speed sufficient to test the direction. If a minimum speed is set it will go to that speed. Use the **▲** to increase the speed above the minimum speed level.

If the motor shaft or pump rotates in the wrong direction remove the input power, wait for the ZENER 8000 to discharge and swap any two motor phase wires. Re-apply input power and recheck direction

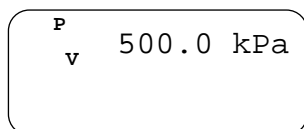
Check pressure transducer feedback:

Close the discharge valve and press **FWD/▲** to start & increase the motor speed until the desired operating pressure is indicated on the pressure gauge. Press **STOP** to stop the pump and check that the pressure holds. If the pressure does not hold there is a problem and must be rectified to operate correctly. If there is a small drop this must be allowed for in the wake control. ie. 'resume @PV' or implement an 'Idle Boost'

Press **↵** (ENTER) to scroll through the operator displays (see page 5) to the PID display shown below.



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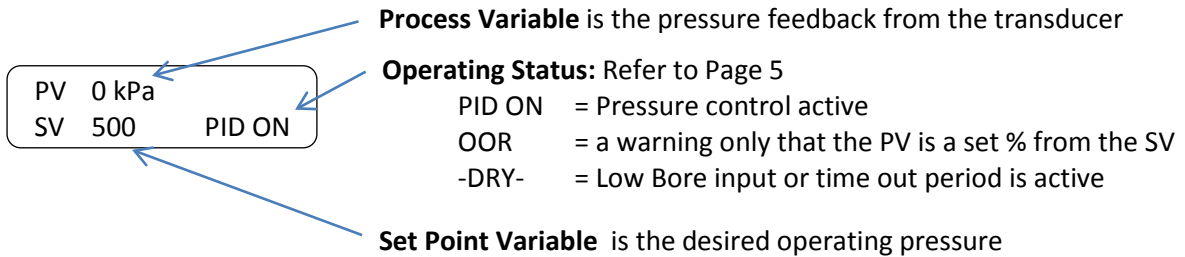


Check that the top display (PV) is displaying the correct pressure as per the pressure gauge. If this is not correct (within acceptable tolerance) than investigate and rectify. The service menu can be used to display the mA being received from the transducer.

Checking the PID operation

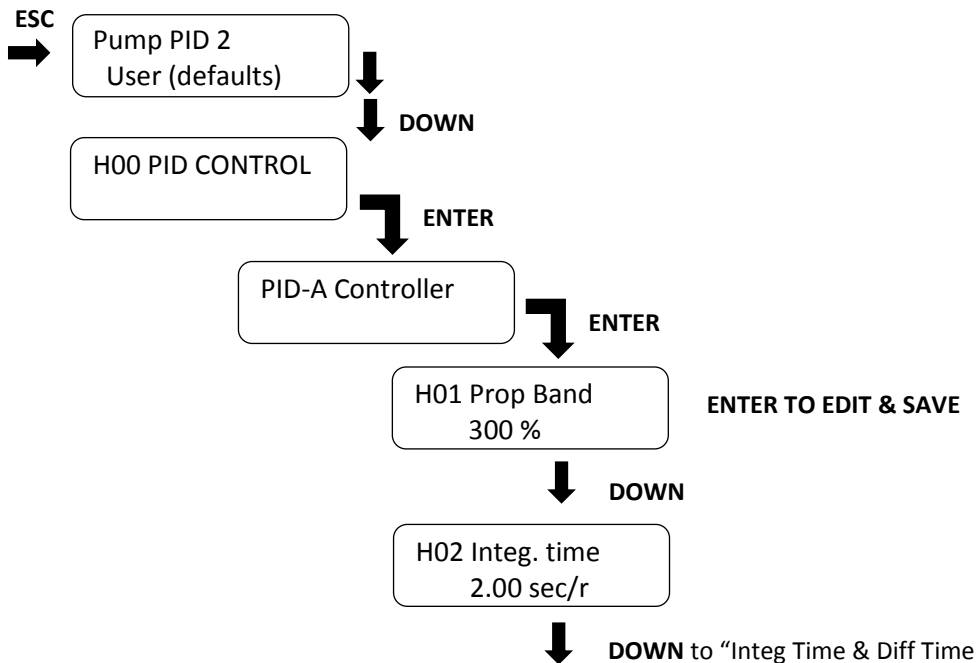
Ensure the system is ready to pump and discharge valve is open for flow required. Re-install the wire in terminal 5 to operate in Remote/PID Mode and apply power to the ZENER 8000.

Find the PID display to monitor the performance:



Check the following:

1. The ZENER 8000 operates and stabilises at a speed where the PV = SV.
2. The pressure (ie. PV) indicated on the ZENER 8000 is correct. If not correct turn the pump off and investigate.
3. Check that the control is stable and responds to changes. Refer to PID tuning guide if unstable. These parameters are found in the following menu:



4. Open & close additional taps/valves to check pressure is maintained and the system respond sufficiently. Refer to tuning guide if response is slow or over shooting occurs.
5. Progress to next step and enable 'Idle Mode' if this feature is required.

PID Tuning Guide

The Proportional gain: amplifies the difference between the set point reference and feedback signals. The **H01 Prop. Band** value is the proportion of input required to generate 100% at the output of the PID control. For example **H01 Prop. Band** is 300.0%, the proportional gain is $100/300 = 0.333$. That is 3 units of input will generate 1 unit of output. The higher the % value, the lower the 'proportional gain'.

The integral time: The integral action adds a corrective component to reduce a constant error difference between set point and feedback signals. The greater the error, the quicker the gain increases. The **H02 Integ. time** value sets the time to 'repeat' the error difference between set point and feedback signals - This assumes the Proportional gain is equal to 1.

A low **H02 Integ. time** value attempts to regulate the process variable quickly. However if excessively low, over shooting and under shooting will be more prominent.

A high **H02 Integ. time** value diminishes over shooting and under shooting. However regulation takes longer to achieve.

Guide to PID Tuning:

Step	Problem	Action
1.	The plumbing is set for typical flow but the system responds too slowly	1.1 Stop the ZENER 8000 & pump 1.2 Halve the value of H01 Proportional band (avoid adjustments below 10%) 1.3 Stop & restart the ZENER 8000 & pump. 1.4 Observe the time it takes to reach pressure (or reacts to changes) 1.5 Repeat if the response is slow. Keep halving H01 Proportional band until overshoots or starts to oscillate then proceed to step 2.
2.	The system starts to overshoot or oscillate	2.1 Stop the ZENER 8000 2.2 Double the value H01 Proportional band 2.3 Observe the time it takes to reach pressure (or reacts to changes) 2.4 Repeat if the system still overshoots or oscillates proceed to step 3.
3.	The system still responds slowly (after adjusting H01 Proportional band)	3.1 Halve the H02 Integral Time 3.2 Observe the time it takes to reach the pressure (or reacts to changes) 3.3 Repeat if the response is still slow (half Again) otherwise proceed to step 4."
4.	The system starts to overshoot or oscillate (after adjusting H01 Proportional band)	4.1 Double the H02 Integral Time 4.2 Observe the time it takes to reach the pressure (or reacts to changes) 4.3 Repeat if the system still overshoots or oscillates (half Again)

Implementing 'Idle mode'

What is Idle Mode ?

Idle mode is a feature that automatically switches the pump off when a 'no flow' condition is detected. The pump will then restart based on pressure ('% below SV') or PID output ('output frequency').

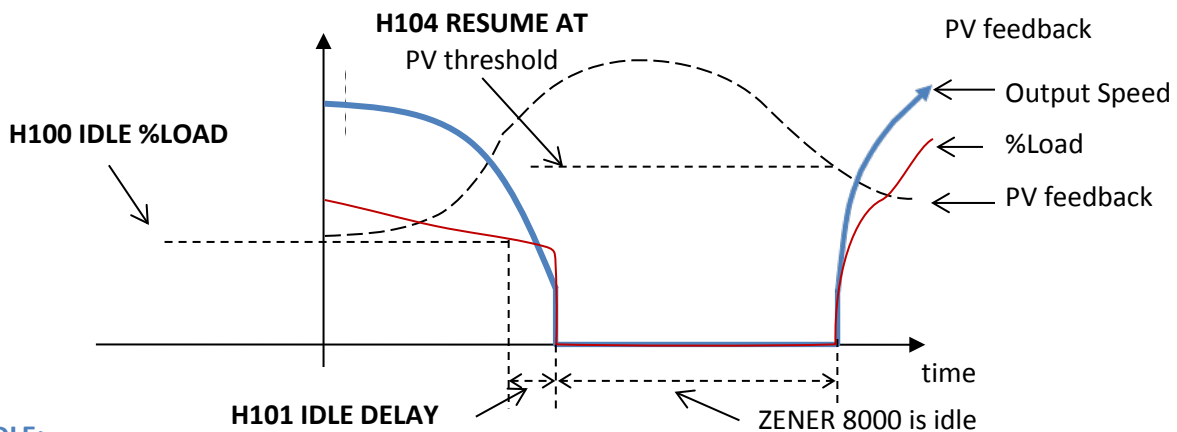
There are 2 methods in which the 'Idle Mode' can be configured.

1. **"LOAD %" [DEFAULT]** Monitoring the 'load %' to indicate when the pump load represents a no flow situation. Idle mode is triggered when the load drops to the preset level for the preset time. Depending on the pump performance and operating conditions a flow switch may be required. Eg. Multiple set points.
2. **FLOW SWITCH [DEFAULT]** Connect an external flow switch that triggers 'idle mode' when no flow for the preset 'idle delay'. The switch is connected to digital input on the option board D3(35). The default setting requires a contact that opens on 'no flow'. This input is always active so a link is required when a flow switch is not fitted. A flow switch is the best method to use when operated with a variable or multiple set point. The flow switch provides a more simple setup process as the 'load % threshold' is not used.
3. **OTHER [CUSTOM]** Use an internal logic function or other external device to trigger idle mode.

NOTE: Both the 'load %' and the 'flow switch' methods can be used simultaneously, with the same 'idle delay'.

Idle based on '% Load'

This is detected by a drop in 'Load%' for a set period of time. For this to operate it is important to find the % load under a 'No Flow' or 'Dead head' condition. Pumping will resume when the pressure falls below a specified % below the Set point. A flow switch can also be installed to trigger the idle mode.



IDLE:

%Load decreases with reduced flow to a level for a period of time 'Idle Delay' and then goes into 'Idle Mode' (sleep). Or ; The input from the optional Flow Switch indicating 'No Flow' for the 'Idle Delay'.

WAKE:

When the pressure drops due to returned demand the ZENER 8000 wakes automatically and operates in PID mode.

To ensure correct operation the 'Idle' function must be checked and configured for all possible conditions. For installations where multiple or variable set points the load% method may not operate under all conditions and require a flow switch to be installed.

Idle Mode based on Flow Switch Input

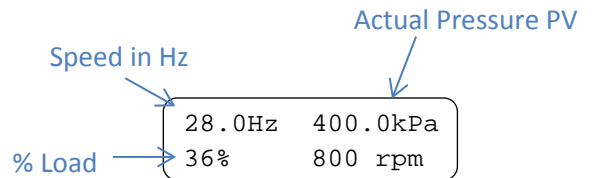
This application configures a digital input D3(35) for a flow switch input. The flow switch provides a more simple setup process ('load % threshold' is not used). When the flow switch provides an 'open contact' (no flow) into D3 (terminal 35) for the 'Idle delay' period, the ZENER 8000 will enter idle mode. It will operate in conjunction with the above 'load %' method if configured.

NOTE: If there is no switch available or installed a link must be fitted between terminal 1 & 35.

Idle Mode Adjustments

The following steps will help find the settings for Idle Mode.

STEP 1. Select the operator display that displays the following
 [Press ENTER to step through the displays]

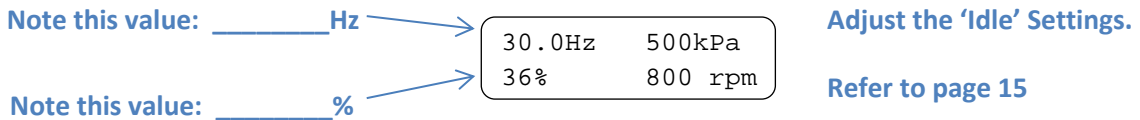


Note: You may also need to set the minimum speed to 30Hz or less to do the following test

STEP 2. Select one of the following methods to determine the initial idle settings.

Method 1: Operate the ZENER 8000 in PID Mode and close the discharge valve. The speed should decrease and the pressure should remain at the set point. Take the Load % and the speed reading. Stop the Pump or open the discharge valve.

Method 2: Operate the ZENER 8000 in local mode. Close the discharge valve. Press the **FWD/▲** button to start and increase the speed until the set pressure is reached. Take the Load % and the speed reading. Stop the pump.



MIN Speed (Hz)	0 (default)	Adjust to value equal to or higher than the minimum operating speed for the pump. This must be less than the Speed (Hz) value recorded in step 2 for "idle" to operate. This must be set to a level which will allow a 'no flow' condition (eg. Flow switch operation').
Idle Threshold %	20% (default)	Set at approximately 2-3% higher than the above recorded 'load%' value. Eg. Load % = 32% at dead head, set to 35% This is not required if using a flow switch. To turn Idle operation OFF adjust this to 0%.
Time before Idle	5 sec (default)	Increase / decrease if required This must be longer than the time for the 'idle trigger' to indicate a flow. ie. flow switch or 'Load %'
Resume Pumping @	25% below SV	Adjust if required. Reduce the value if required to 'wake' at a higher pressure. Increase the value if required to 'wake' at a lower pressure.

Check the Idle function:

Operate the ZENER 8000 in PID mode and while pumping turn various valves or taps on and off to check that it goes in and out of idle as required.

Make adjustment as required. If the 'Load %' method does not provide the desired 'idle mode' operation a flow switch will need to be installed.

Continual Idle cycling: Check if the pressure drops when the pump stops investigate reason and/or increase the 'Resume @ PV: X % below SV' setting. A pressure tank may be required if not fitted or adjust the parameter 'pre-idle boost'. This will increase the pressure before switching off. Refer to page 16.

Ensure the idle delay is adequate and flow switch (if fitted) is operating correctly.

Important Note:

Since the dynamics of the system can vary at different operating pressures and conditions, the system should be tested under all foreseeable conditions to ensure proper operation and operation within the pump manufacturers specification.

Remaining Parameters:

The remaining parameters to implement & adjust if required are:

Pipe Fill:

The pipe fill option allows the ZENER 8000 to operate at a reduced speed to fill the pipes on start. Pipe fill is only activated when a start/run command is first given.

Pipe Fill	DISABLED	To Enable, set to 'PV Threshold'. This will provide an automatic changeover to PID when a pressure level is reached.
Pipe Fill Speed (Hz)	40	Adjust the speed to operate during pipe fill mode
Pipe Fill Level	400 kPa	Adjust the level to switch from 'Pipe Fill Mode' to 'PID mode'
Pipe Fill time (s)	40	Adjust to the time required to reach the 'Pipe Fill Level' pressure before an alarm occurs

Bore Level Timeout:

Low Bore timeout	0	Enter a time period to restart after a 'Low Bore' is detected or install link if a 'Bore level switch' is not installed.
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This feature requires a bore level switch to be installed. When an 'open contact' is present on input D1(terminal 31) the ZENER 8000 stops and displays the warning '-DRY-'. When the contact closes there is a delay before the pump restarts.

The bore level timeout should be set to limit the number of starts per hour within the pump/motor specifications.

Note:

- 1. If no 'Bore Level switch' is installed fit a bridging link between terminal 1 and 31.**
- 2. If operated with a start/stop switch the low bore switch will stop the pump and not allow a restart until the time-out period has lapsed.**

Variations & Other Adjustments:

Other parameters may need to be adjusted because:

- The setup may vary from the intended application Eg. Use different set point source/reference such as a potentiometer.
- Additional requirements which the application does not include. Eg. An additional alarm for over current.

Parameters that you may want adjustment include:

Idle Boost:

Idle Boost provides a boost in pressure before the ZENER 8000 goes into 'Idle' mode. There are 2 parameters:

Idle Boost:

Set the pressure to 'boost to' in the current units (eg. Kpa)

*ESC to Menu> <DOWN>>> **H00 PID PARAMETER** <ENTER>**PID-A Controller**<ENTER><DOWN>>>
H10 Idle Function><ENTER>><<UP/DOWN>> <H105 Idle Boost><ENTER to edit><UP/DOWN to adjust> and<ENTER to save><ESC>*

Boost Time:

Set the time period to operate at the boost pressure

<H105 Idle Boost><DOWN><Boost time><ENTER to edit><UP/DOWN to adjust> and<ENTER to save><ESC>

Change Ramp Times:

Ramp types: C030 Accel Time & C031 Decel time = ramp time above minimum speed
C032 S-time = ramp time to minimum speed

*ESC to Menu> <DOWN>>> **C00 PERFORMANCE** <ENTER><DOWN>>>**C03 RAMP**<ENTER to edit><UP/DOWN to select ramp type>>>and<ENTER to save><ESC> ('ramp time' is time taken from 0 to 50Hz)*

Note: The time entered is the time from 0 – Max Hz.

Thermistor Input:

Allows a thermistor input for motor protection into terminals 40 and 42 on the option board. This function needs to be enabled if required.

*ESC to Menu> <DOWN>>> **G00 INPUT/OUTPUT** <ENTER><DOWN>>>**G09 Thermistor**<ENTER to edit><<UP/DOWN to select enable>>>and<ENTER to save><ESC>*

Set point Variable:

The set point in this application is a preset value. It is possible to alter this to another source such as;

- Potentiometer
- Multiple speed
- Analogue reference signal (0-5V, 0-10V, 4-20mA)
- Or other

ESC to Menu <DOWN>>> **H00 PID PARAMETER** <ENTER>**PID-A Controller**<ENTER><DOWN>>>**H06 SV Choice**<ENTER to edit><<UP/DOWN>> and <ENTER to save><ESC>

Potentiometer:

To select Analogue input for SV Choice:

ESC to Menu <DOWN>>> **H00 PID PARAMETER** <ENTER>**PID-A Controller**<ENTER><DOWN>>>**H06 SV Choice**<ENTER to edit><<Select AI(10,11)>> and <ENTER to save><ESC>

To configure Potentiometer input for 0-5Vdc:

ESC to Menu <DOWN>>> **G00 INPUT/OUTPUT** <ENTER> <DOWN>>>**Analogue Inputs**<ENTER to edit><<Select AI(10,11)>><ENTER><Select 0-5V><ENTER>. <ESC>

Others:

For other Set point variable sources refer to the reference manual for details on connection, wiring and the input parameters required.

Max Hz:

To reduce or increase the maximum speed output. The Motor volts may also be required to ensure the correct Volts per Hz.

- To operate higher than the motors rated speed.
- To operate a 60Hz motor
- To limit the maximum speed

ESC to Menu <DOWN>>> **C00 PERFORMANCE** <ENTER><DOWN>>>**C02 MAX Hz**<ENTER to edit><<UP/DOWN>>and<ENTER to save><ESC>

Motor Volts & Hz:

Adjust the output voltage and frequency to suit the motor and ensure the correct volts/Hz ratio is applied.

ESC to Menu <DOWN>>> **B00 MOTOR** <ENTER><DOWN>>>**B01 MOTOR VOLTS** <ENTER to edit><<UP/DOWN>>and<ENTER to save><ESC>

ESC to Menu <DOWN>>> **B00 MOTOR** <ENTER><DOWN>>>**B03 MOTOR HZ** <ENTER to edit><<UP/DOWN>>and<ENTER to save><ESC>

Adjust Transducer feedback Zero/Span:

If there is a slight error in the PV reading it may be necessary to make minor adjustment to the input signal for the transducer feedback. Adjust the 'Ref @ MIN in' and/or 'Ref @ MAX in'.

ESC to Menu <DOWN>>> **G00 INPUT/OUTPUT** <ENTER> <DOWN>>>**Analogue Inputs**<ENTER to edit><<Select AI(32,34)>><ENTER><DOWN>>**G103 ref @ MIN in**<ENTER><UP/DOWN to adjust><ENTER to save><ESC>

<DOWN>>**G104 ref @ MAX in**<ENTER><UP/DOWN to adjust><ENTER to save><ESC>

Parameters programmed by the Application:

The following parameters are automatically programmed by the 'Application' when it is loaded. They are listed below for reference purposes only.

Application Menu:

1. "Rated Motor Amps"
B02 = ?
2. " Overload current"
D020 = ?
3. "Rated Motor RPM"
B04 = 1470
4. "Transducer Scale" = 1000 (default)
H09 = 1000
5. "Set Pressure" = 500 kPa
F100 = 50.0
6. "Min. Speed (Hz)" = 0
C01 = 0Hz
7. "Idle Threshold %" = 20
H100 = 20
8. "Time before Idle" = 5
H101 = 5
9. "Resume @ PV" = 25% "Below SV"
H104 = 25%
10. "Low Trip Level" = 250.0 kPa
H110 = 250.0
11. "Low Trip time" = 30Sec
G252 = 30
12. "High Trip Level" = 800 kPa
H111 = 800
13. "Pipe Fill" = DISABLED
H120 = 0
14. " Fill Speed (Hz)" = 40
H123 = 40Hz
15. "Fill to Level" = 300kPa
H122 = 300
16. "Fill Time (s)" = 40
H121 = 40
17. "Low Bore Timeout" = 0 secs
G070 = 0

Other Preset Parameters

C030 [Accel] = 1 Sec
 C031 [Decel] = 1 sec
 C032 [S time] = 0.5 Sec
 C033 [Dual Ramp] = Enabled
 F010 [Remote Ref] = PID-A Opt
 F1001 [PRESET 1 units] = PID A

-High Pressure Trip Config.-
 G108 [AI 32,33,Config] = 4-20mA
 G230 = [UA1 trip] Always active
 G231 = [UA1 Signal] PVA-Over
 G233 = [UA1 msge] HI PRESSURE

-Signal Loss Trip-
 G106 [AI 32,34, cmp lo thres] = 2.0 mA
 G240 [UA2 Trip] = active with Run cmd
 G241 [UA2 Signal] = Lo AI(32,34)
 G243 [UA2 msge] = SIGNAL LOST

-Low Pressure trip-
 G250 = [UA3 Trip] Active with loop control
 G251 = [UA3 Signal] PVA -Under
 G253 = [UA3 msge] : LO PRESSURE

-Fill time out trip-
 G260 = [UA4 Trip] Run command
 G261 = [UA4 Signal] pipe fill timer
 G262 = [UA4 Delay] 1 sec
 G263 = [UA4 msge] FILL T/O

-Low Bore Customer-
 G271 = `TMR 1
 G272 = -DRY-
 G01 Digital Input Config = CUSTOM
 I02 = Logic Block 1
 I201 = D2(3)
 I202 = TMR 1
 I203 = LB1 Logic LLLHLLLH
 G071 = [TMR 1 Mode] Delay ON Init.
 G0720 = TMR 1 IN2 = ON
 G0721 = TMR 1 IN1 = D4(37)

-PID Config.-
 H01 [Proportional Band] =200%
 H02 = [Integrator time] = 2.00
 H06 = [PID-A SV] = PRESET 1
 H07 = [PID-A PV] = AI(32,34)
 H08 = PID-A units] = kPa
 H102 = Resume by PV threshold
 H107 [No Flow Sw] = ~D3(35)
 J02 = [Display] = PID Display

Trouble Shooting Guide:

The following assumes all standard configurations programmed by the Application without any changes.

Symptom	Checks/Remedy
No Application 'Pump PID 2' Menu is present	<ol style="list-style-type: none"> 1. If you have not loaded the 'Application' following the instructions on page 6 2. If you have loaded the Application and no menu, restore defaults and reload following the instructions on page 6
Pump running wrong direction	<ol style="list-style-type: none"> 3. Swap two motor cables on the ZENER 8000 output or at the motor
PV display is 0 when gauge indicates pressure	<ol style="list-style-type: none"> 4. Check the application has been loaded. Refer to page 6 5. Check transducer scale has been entered and is correct. 6. In the service menu, check analogue input AI(32,34) is reading correct mA 7. If not reading correct mA, check transducer wiring & polarity 8. Measure DC mA in transducer wiring
PV reading is not correct	<ol style="list-style-type: none"> 9. Check transducer scale has been entered and is correct. 10. In the service menu, check analogue input AI(32,34) is reading the correct mA 11. Measure & check DC mA in transducer wiring is correct and transducer is operating correctly 12. If only a small error may need to adjust AI(32,34) to read correctly
Pump does not start	<ol style="list-style-type: none"> 13. In the service menu, check digital inputs have '1' on terminals 2,3,4,5 & 6. If a start push button is used, check it provides a '1' on terminal 4 when pushed. If not, check input wiring. 14. Is the 'SV' on the display indicating the 'Set pressure' entered in the 'Application' Menu. Eg. 500Kpa. 15. Is the PV reading the correct pressure (as per pressure gauge) 16. If a trip is displayed investigate & rectify. Will need to reset trip. 17. If pipe fill is enabled, check 'Pipe Fill Speed' entered is not 0Hz. 18. If Idle is displayed, see below.
-DRY- is displayed and will not start	<ol style="list-style-type: none"> 19. Bore level is low 20. Check Bore level switch operating correctly and connections. 21. If no bore level switch, check bridging link is fitted between terminal 1 and 37.
'Idle' displayed and will not start	<ol style="list-style-type: none"> 22. Check optional 'no flow switch' operation and connections. If no switch installed ensure bridging link is in fitted between terminal 1 and 35. 23. Pressure not dropping to 'Resume Pumping @ % below SV' or set too low.
Cycles between 'run' and 'idle'	<ol style="list-style-type: none"> 24. Check 'Idle' settings, 'idle time' too short or idle % load to high 25. If flow switch is fitted, check correct logic and operation.
Pressure does not build up to the 'Set Pressure'.	<ol style="list-style-type: none"> 26. Ensure PV display is correct 27. Motor/Pump rotating wrong direction. Check & rectify. 28. If Pipe fill is enabled check 'Fill speed (Hz)' is not too low. Disable Pipe fill and check again 29. If the drive is not running at 50Hz, check motor current in all 3 phases and drive is not indicating 'current limit' 30. If running at 50Hz check pump and plumbing.
PID/ pressure control is unstable	<ol style="list-style-type: none"> 31. Ensure Pressure Transducer is operating correctly and the feedback (PV) is stable when the pump is not running and also running in local mode at a fixed speed. 32. Tune the PID using the parameters and guide on page 11
Current limit is displayed	<ol style="list-style-type: none"> 33. Check the motor current and the drive is correctly matched to the motor & pump. 34. Check the current in each motor phase to ensure balanced
Continually in Pipe Fill Mode	<ol style="list-style-type: none"> 35. Pipe Fill Speed too low, insufficient flow and pressure not reaching pipe fill level. 36. Problem with pump/motor not increasing pressure to pipe fill level. Check Pump/motor
Will not go into idle, when discharge valve closed or no flow	<ol style="list-style-type: none"> 37. Minimum speed too high and unable to reach Idle % Load or flow switch to operate (if fitted) 38. Load % set too low. Repeat procedure 'Idle Mode Adjustments' on page 14 39. Set point changed so incorrect 'Load %' setting. 'Load %' will need checking/adjustment if set point is changed. May need a flow switch fitted.

More Information or Assistance:

For details on all the features and parameters available refer to the ZENER 8000 Reference Manual available on the ZENER website: www.zener.com.au



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