



SWORDFISH +

LEVEL OPERATION MANUAL



MULTIPLE PUMP

FIXED SPEED PUMP
LEVEL CONTROL SYSTEM

Version 1.3

INTRODUCTION

SWORDFISH + Pump Controller

The SWORDFISH + pump control system is a fully integrated pump controller for single or multiple pumps required to operate via either single, multi level control or switched inputs.

SWORDFISH + is suitable for up to 6 pumps of any type plus a jockey pump. The unique electronic - hydraulic control allows each pump to operate at the maximum performance level.

Easy access menu items and in-built pump and system protection allows simple adjustment for any pump application.

SWORDFISH + also offers a full complement of telemetry outputs for simple integration into central control applications.

Swordfish+ Level control is suitable for both Tank Fill & Tank Empty applications therefore some logic will reverse in this manual pending upon the intended use.

The SWORDFISH + Pump Control system is part of the Techsys Pump Control range. Pump Controllers are available in a range of options to suit particular applications and user requirements.

Additional manuals available for:-

- Temperature control
- Pressure control
- Flow control
- Vacuum

Version History

This manual covers the software applications for Version No. 12.07v01 or later. Please contact Techsys Corporation to obtain any verification of the currency of this manual for your application.

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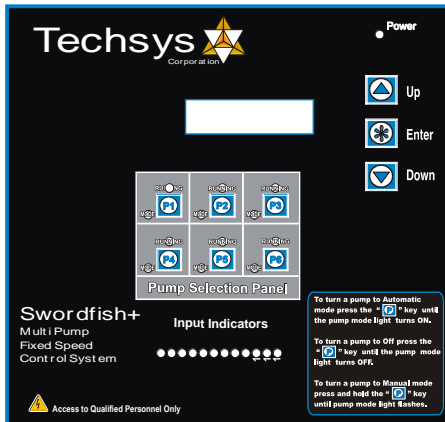
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QUICKSTART

The following procedures are the minimum required to start and operate the SWORDFISH+. If you are concerned regarding the Commissioning of the unit please read the complete manual or call your closest Techsys Corporation representative.

The following test confirms the operational directions of all pumps in both Manual and Automatic Modes



ROTATION CHECK

This is a most important procedure and should be completed prior to any other commissioning procedure. Only Qualified Personnel should be allowed to complete this procedure as there is High Voltage wiring within the switchboard.

1. Switch OFF all motor circuit breakers in the cabinet.
 2. Turn ON power to Sowrdfish controller.
 3. Make sure all Pump Mode indicators are OFF. If not press the “P” key to turn pump off (All pumps should be off)
 4. Adjust Overloads to to suit motor ratings. Switch ON all circuit breakers in the cabinet.
 5. Press “P1” to turn on Pump 1. The Running indicator will light up.
 (If the message “ Key Pad Locked” appears, scroll up to the Access Code using the up key and input the number 21)
- Check Rotation against the pump manufacturer’s direction arrow. After checking turn Pump1 to OFF by pressing “P1” again.
6. Check the balance of the pumps for direction as described above. If any of the other pumps have the wrong direction of rotation change two of the wires on the wiring connected to the motor in question.
 - Re-check direction
 7. Rotation check complete.

KEY SETTINGS.

This sets the Operating Level of the System.

1. Press the Up Key until the Message **Access Code** is displayed.
2. Press the "Enter Key" once, the display should start to flash, now press the "UP Key" until the number 21 appears in the lower part of the screen, now press the "Enter Key" again, the display should stop flashing. The correct Access code is now set.
3. Then press the "DOWN Key" once more. The Main Menu Marked **SETTINGS** will appear.
4. Press the "Enter Key" to access the **SETTINGS** Sub Menu.
5. Press the "DOWN Key" Until the **Cut In Level** screen is reached.
6. Adjust the **Cut In Level** by pressing the "Enter Key" once, the display should then start to flash, now press the "UP or DOWN Key" to alter the **Cut In Level** If when increasing any setting you are prevented from further adjustment you may also need to adjust the parameter above or below the current setting being adjusted. Eg. Increasing the **Cut In Level** and trying to make it greater / Smaller than the **Cut Out Level** (pending logic function - Note Cut In Level 1 /2 etc will appear in Multi Level mode)
7. Press the "DOWN Key" Until the **Cut Out Level** screen is reached.
8. Adjust the **Cut Out Level** by pressing the "Enter Key" once, the display should then start to flash, now press the "UP or DOWN Key" to alter the **Cut Out Level** (The same sequence of key presses is used to adjust all settings on the SWORDFISH +)
9. After the adjustments have been made, press the "DOWN Key" until the sub menu is exited and the "SETTINGS" main screen appears.

CALIBRATING PRESSURE TRANSDUCER

For a full explanation go to the section marked - CALIBRATION OF ANALOGUE SENSORS.

1. Press the "DOWN Key" until you reach the Main Menu Marked "CONFIGURE"
2. Enter the submenu by pressing the "Enter Key"
3. Press the "DOWN Key" until the "**Transducer Zero**" screen is displayed. (At this point there should be NO level in the system)
4. Adjust the value in the bottom screen until the reading is "0" – Use the same key sequence to adjust zero. (If "**Value too Low**" appears, increase the Zero offset level slowly until a zero value is obtained by pressing the key).
5. Press the "DOWN key" until you reach "ADJUST LEVEL". (At this point a constant level needs to be introduced into the system).
6. Adjust the value in the "**Adjust Level**" screen until the system height level (scaled as required i.e. 100 = 100cm or 10cm) reads the same as the screen level.
7. The System is now Calibrated. Press the DOWN key until the main system level screen (Status Screen) returns.

Rotation

******* IMPORTANT *******

**Failure to follow this procedure will void
Warranty and cause failure of the pump
station**

The rotation of each pump is checked prior to shipment on packaged units, however it is essential to check the rotation of each pump. To do this select *MANUAL* for each pump individually and check the rotation. If the rotation is not correct swap two of the phases coming into the main isolation switch to reverse the rotation.

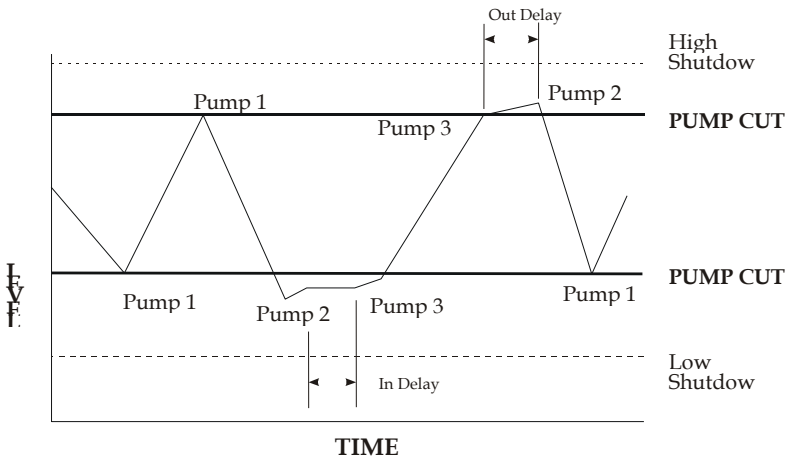
Note:- any wiring changes done within the switchboard should be done with the ***approval of the service agent*** and by ***qualified personnel only***.

In models with phase failure relays the mains phase orientation must be set to the correct orientation. If only one light (either green or red) is showing then swap any two wires on the main isolation switch. This orientates the main's power to the correct rotation.

System Operation

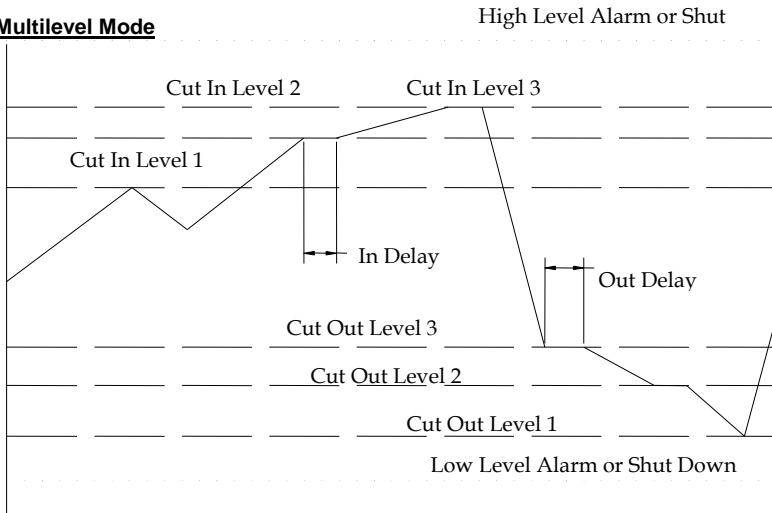
The operating constraints for the system are detailed below.

Single Level Mode



When the system level rises above the System Cut In Level the controller will start the first pump. If one pump cannot satisfy the level requirement another pump will start after the IN delay timer has timed out (Single Level Mode) and the system level remains above the Cut Out level. More pumps will be started until there are no further pumps available or the system level drops below the Cut Out Level. If at any time the level drops below the Cut Out Level then the OUT delay timer (Single Level Mode) is started and when it times out a pump will be turned off (Providing the minimum run time for that pump has also timed out). Multilevel Mode utilises individual cut in / out level for each pump.

Multilevel Mode



Pump Control Panel

The interface for SWORDFISH + Control Panel allows access for the operator to edit values throughout the menus.

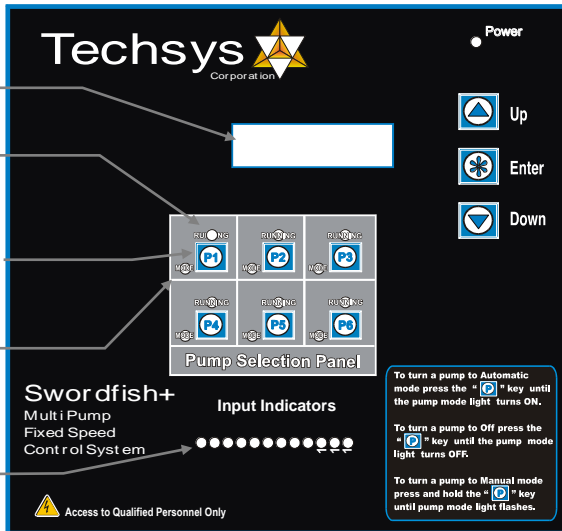
Two line LCD Display

Pump RUN Indicator (One for each pump)

Pump ON/OFF/Manual Switch (Mode) (One for each pump)

ON/OFF Indicator (One for each pump)

Input Activation Indicators



Each pump is controlled by an individual Auto / Off / Manual Switch.

To enable a pump for operation

Press the ON/OFF/Manual Mode switch and the associated mode indicator will light up. The selected pump is now available for operation in Automatic mode.

To disable a pump in Automatic Mode

Press the Mode switch until the Mode indicator light turns off.

To operate a pump on Manual

In order to operate a pump in manual mode, press and hold the mode select switch for the relevant pump, after 3 seconds the system will start this pump in manual mode. The mode indicator led will now start flashing at 2 times per second and the RUN indicator will be on. To turn a manual pump off, press and release the switch when the RUN led turns off. The pump is now disabled and to return it to Automatic press the Mode switch again and the Mode indicator should turn on.

In order for this mode to be selected the Access Code must be entered.

MANUAL MODE PROTECTION

Pump protection settings apply to all pumps including those in manual mode.

NB: By default all pumps will be off when system is powered.

To edit menu data

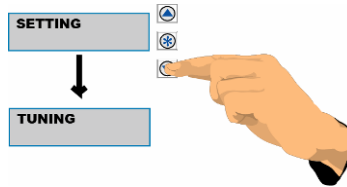
Press the ENTER key to edit data in the required menu, the top line will flash if the current menu is an editable screen. Use the UP and DOWN buttons to change the selection, then press ENTER again to confirm the change.

Moving Around & Editing Menu Items

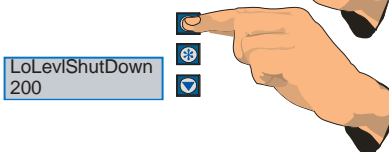
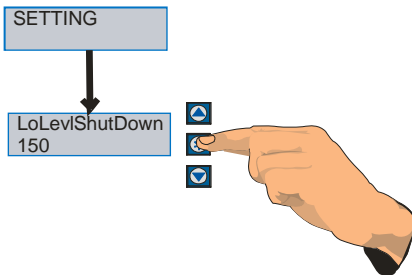
To move between the Main Menu screens press the UP or DOWN key.

To Enter an adjustable sub menu press the ENTER key. Access to these menus is controlled by an Access Code, which needs to be entered prior to accessing the editable section of the menus. If the Access Code is not inserted correctly the system will disable entry into the Submenus and the use of any pump select or enable keys.

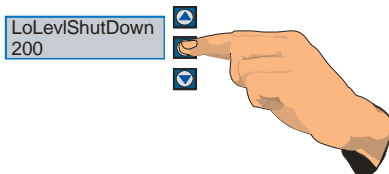
To scroll through the menus select the UP or DOWN keys



Once the required Menu is selected press the ENTER Key to enter the specific menu

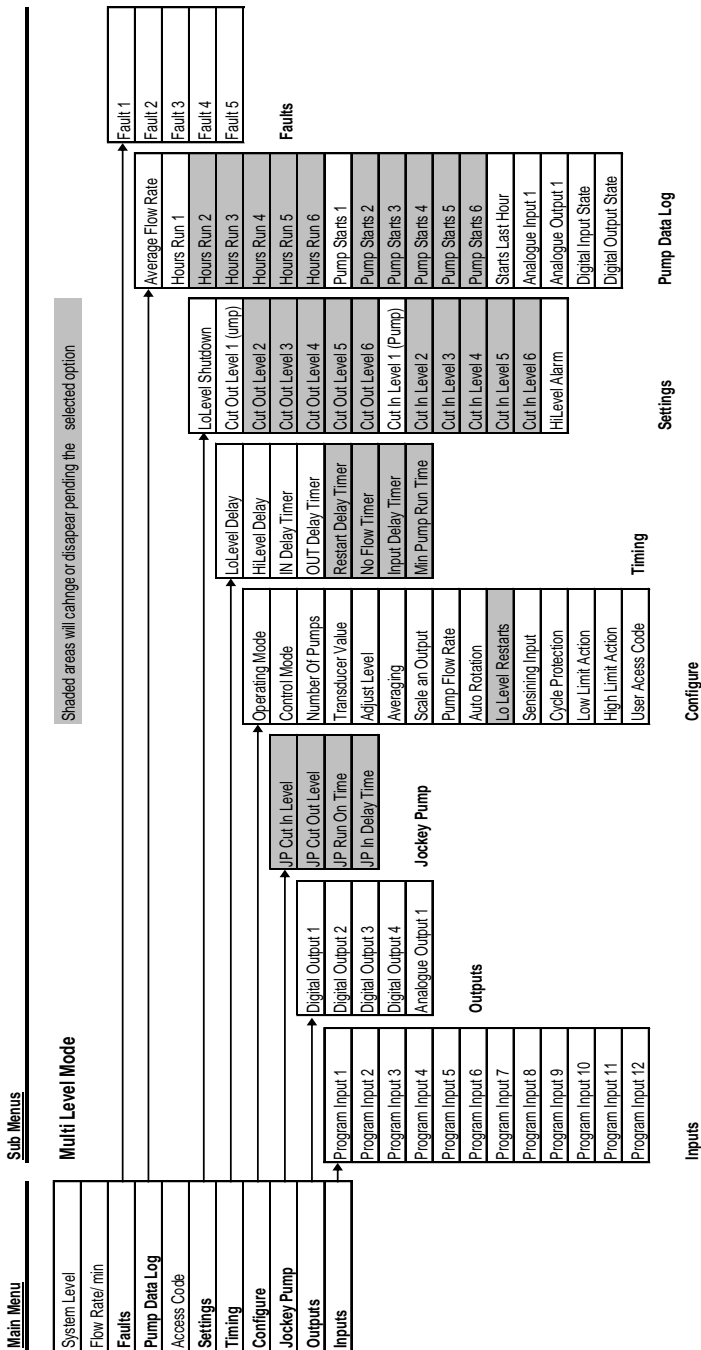


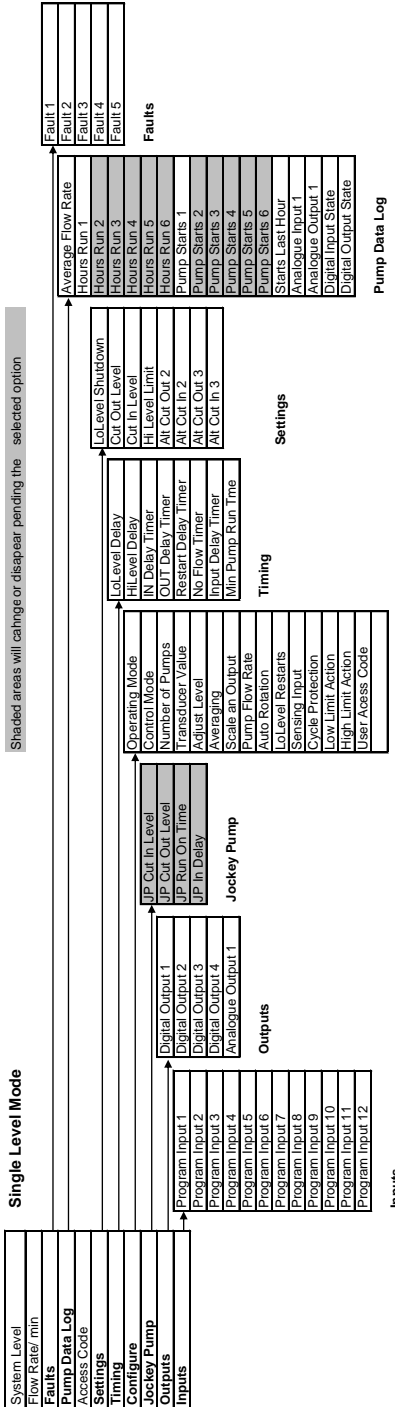
To edit a value press the ENTER key once, the display should now flash, now press the UP or DOWN key until the desired value is displayed.



Press the ENTER Key again to save the value selected.

To move out of a submenu press the up or down key to scroll to the top or bottom of the submenu and the display will return to the main menu area.





MENUS

The SWORDFISH + controller has numerous adjustment menus to allow the system to be tuned to suit each application. These are listed below and explained throughout this manual and differ between single or multilevel settings.

Menus throughout this manual show the complete range of options available. If a menu is not needed because the option is disabled then these screens will not appear. For example if only 3 pumps are implemented, then screens with options for pumps 4 to 6 will be hidden.

Main Menu	Units	Defaults	Range
System Pressure	number	display	0 - 9999
Flow Rate /Min	number	display	0 - 9999

Main Menu	Sub Menu	Units	Defaults	Range
FAULTS	Fault 1	selection	None Logged	None Logged Lo Press Shutdwn, Hi Press Shutdwn, No Flow Shutdwn,
	Fault 2	selection	None Logged	*Pump 1 - 6 Shutdown *Pump 1 - 6 No Flow
	Fault 3	selection	None Logged	Power Off Power Glitch Auto Reboot
	Fault 4	selection	None Logged	
	Fault 5	selection	None Logged	

* Pump 2-6 Shutdown are only displayed if "Number of pumps" is set accordingly

* Pump 2-6 No Flow are only displayed if "Number of pumps" is set accordingly

Main Menu	Sub Menu	Units	Defaults	Range
PUMP DATA LOG				
	Hours Run 1	hours	display	0 - 65535
	*Hours Run 2	hours	display	0 - 65535
	*Hours Run 3	hours	display	0 - 65535
	*Hours Run 4	hours	display	0 - 65535
	*Hours Run 5	hours	display	0 - 65535
	*Hours Run 6	hours	display	0 - 65535
	Pump Starts 1	number	display	0 - 65535
	*Pump Starts 2	number	display	0 - 65535
	*Pump Starts 3	number	display	0 - 65535
	*Pump Starts 4	number	display	0 - 65535
	*Pump Starts 5	number	display	0 - 65535
	*Pump Starts 6	number	display	0 - 65535
	Pump Starts Last Hr	number	display	0 - 65535
	Analogue Input 1	%	display	0.00 - 100.00
	Analogue Output 1	%	display	0.00 - 100.00
	Digital Input State	1 - 12	display	X for Active
	Digital Output State	1 - 4	display	X for Active
	Curr & max retry	number	display	0 - 50 0 - 50
	Temperature	degrees C	display	0 - 999

* Hours Run 2-6 are only visible if "Number of pumps" is set accordingly

* Pump Start 2-6 are only visible if "Number of pumps" is set accordingly

Main Menu	Units	Defaults	Range
Access Code	number	21	0 - 250

Main Menu	Sub Menu	Units	Defaults	Range
SETTINGS				
	*LoLevel Shutdown		*150	0 - 9999
	*LoLevel Alarm		*150	0 - 9999
	*Low Limit		*OFF	*OFF
	*Cut In Level (1,2,3)		200	0 - 9999
	*Cut Out Level (1/2/3)		450	0 - 9999
	*HiLevel Shutdown		650	0 - 9999
	*HiLevel Alarm		650	0 - 9999
	*High Limit		*OFF	*OFF
	Alt Cut In 2		250	0 - 9999
	Alt Cut Out 2		500	0 - 9999
	Alt Cut In 3		300	0 - 9999
	Alt Cut Out 3		600	0 - 9999
	*Trip Point Low		300	0 - 9999
	*Trip Point High		400	0 - 9999

* LoLevel Shutdown is displayed when "Low Level Action" is set to "Shutdown"

* LoLevel Alarm is displayed when "Low Limit Action" is set to "Alarm"

* Low Limit "OFF" is displayed when "Low Limit Action" is set to "OFF"

* HiLevel Shutdown is displayed when "HighLimit Action: is set to "Shutdown"

* HiLevel Alarm is displayed when "HighLimit Action: is set to "Alarm"

* High Limit "OFF" is displayed when "High Limit Action" is set to "OFF"

*Trip Point Low & High are displayed when a "Digital Output" is set to "Trip Point"

*Cut In Level is start level for all pumps when "Operation Mode" set to "Single Level"

*Cut Out Level is stop level for all pumps when "Operating Mode" set to "Single Level"

*Cut Out Level 1 /2 /3 etc is individual pump stop level when "Operating Mode" set to "Multi Level"

*Cut In Level 1/2/3 etc is start level for all pumps when "Operation Mode" set to "Single Level"

Main Menu	Sub Menu	Units	Defaults	Range
TIMING				
	*Lo Press Delay	seconds	120	*OFF, 0 - 250
	*High Press Delay	seconds	4	*OFF, 0 - 250
	In Delay Timer	seconds	4	0 - 999
	Out Delay Timer	seconds	1	0 - 999
	Restart Delay	seconds	0	0 - 999
	No Flow Timer	seconds	0	0 - 250
	Input Delay Timer	seconds	120	0 - 999
	*Press Trip Low Delay	seconds	0	0 - 999
	*Press Trip High Delay	seconds	0	0 - 999
	*Min Pump Runtime	seconds	60	0 - 240
	*Max Pump Starts	per Hour	60	0 - 240

* Press Trip delays are only visible if an OUTPUT is set to "Pressure Trip"

* "Min Pump Runtime" Is displayed when "ExcessRun Prot'n" is set to "Minimum Run Time"

* "Max Pump Starts" Is displayed when "ExcessRun Prot'n" is set to "Max Starts PerHr"

* OFF is displayed in the "Lo Press Delay" screen when "Low Limit Action" is set to "OFF"

* OFF is displayed in the "Hi Press Delay" screen when "HighLimit Action" is set to "OFF"

Main Menu	Sub Menu	Units	Defaults	Range
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CONFIGURE

Operating Mode	selection	MultiLevel	Pressure, Flowrate, Temperature, Single Level Multi Level.
*Control Mode		Tank Empty	Tank Fill
Number of pumps	number	3	0 - 6
*Transducer Zero	unitless		0 - 9999
*Adjust Level	unitless		0 - 9999
*Averaging	number	20	0 - 50
Scale An Output	number	1000	
Pump Flow Rate	per Min	5	1-9999 /Min
Auto Rotation	selection	Full	Full, *Pump 1 - Pump 6, Every 24 Hours, Low Hours.
LoLevel Restarts	selection	0	0 - 250
Sensing Input	selection	Analogue	Analogue, Switched
Cycle Protection	selection	Minimum Run Time	Minimum Run Time, Max Starts PerHr
Low Limit Action	selection	OFF	OFF, Alarm, Shutdown
HighLimit Action	selection	OFF	OFF, Alarm, Shutdown
User Access Code	number	21	0 - 250

- * "Transducer Zero", "Adjust Pressure" & "Averaging" are hidden when in "Switched" mode
- * Pumps 2 - 6 are only visible if "Number of pumps" is set accordingly
- * Pending Tank Fill or Tank Empty selection will reverse some logic . i.e Cut in level nowCut Out level etc

Main Menu

Sub Menu	Units	Defaults	Range
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JOCKEY PUMP

Jockey Pump	selection	---Off---	---Off---, ===On===
*JP Cut In Level		250	0 - 9999
*JP Cut Out Level		400	0 - 9999
*JP Run On Time	seconds	2	0 - 999
*JP In Delay Time	seconds	0	0 - 999

- * JP Screens are only visible is "Jockey Pump" is set to " ===ON=== "

Sub Menu	Units	Defaults	Range
OUTPUTS			
Digital Output 1	selection	Shutdown Fault	Shutdown Fault, Lo Level Fault, Hi Level Fault, *Pump 1 - 6 Run,
Digital Output 2	selection	Any Pump Shutdown	*Pump 1 - 6 Fault, System Paused, Low Alarm, High Alarm, Any Alarm,
Digital Output 3	selection	Any Alarm	Any Pump Shutdwn, Any Pump Running, Trip Point
*Digital Output 4	selection	Any Pump Running,	Alternate Trip, Aux Output 1, Aux Output 2, Aux Output 3, Shutdown Fault
Analogue Output 1	selection	System Level	System Level

* If the Jockey Pump is set to "ON" then Digital Output 4 will not be available for other functions.

* Pump Run 2 - 6 are only visible if "Number of pumps" is set accordingly

* Pump Fault 2 - 6 are only visible if "Number of pumps" is set accordingly

INPUTS

Program Input 1	selection	System Pause,	*Alt 2 Settings
Program Input 2	selection	Pump 1 Protection,	*Alt 3 Settings
Program Input 3	selection	Pump 2 Protection,	*Cut In,
Program Input 4	selection	Pump 3 Protection,	*Cut Out,
Program Input 5	selection	High Limit,	Low Limit,
Program Input 6	selection	Low Limit,	High Limit,
Program Input 7	selection	No Flow,	System Pause,
Program Input 8	selection	*Alt 2 Settings	*Pump 1 - 6 Protection,
Program Input 9	selection	*Alt 3 Settings	*Pump 1 - 6 Stop,
Program Input 10	selection	Reset,	*Pump 1 - 6 Manual Run,
Program Input 11	selection	Cycle Pumps,	Fire Mode,
Program Input 12	selection	Aux Input 1	Cycle Pumps,
			Reset,
			No Flow,
			Aux 1, Aux 2, Aux 3,
			*Pump 1 - 6 No Flow Prot,
			*Level Cut In 1,
			*Level Cut In 2,
			*Level Cut In 3,
			*Level Cut In 4,
			*Level Cut In 5,
			*Level Cut In 6,
			*Level Cut Out 1,
			*Level Cut Out 2,
			*Level Cut Out 3,
			*Level Cut Out 4,
			*Level Cut Out 5,
			*Level Cut Out 6,

* Alternate 2&3 settings only apply when operating in "Pressure", "Temperature", "Flow" or "Single Level" mode:

* "Cut In" and "Cut Out" are only visible when operating in "Switched" Mode

NOTE: Also not visible when "Switched" "Multi level" is in operation but are available in Single Level Operation

* Pump Protection 2 - 6 are only visible if "Number of pumps" is set accordingly

* Pump Stop 2 - 6 are only visible if "Number of pumps" is set accordingly

* Pump Manual Run 2 - 6 are only visible if "Number of pumps" is set accordingly

* Pump NoFlowProt 2 - 6 are only visible if "Number of pumps" is set accordingly

* Level Cut In 1-6 & Cut Out 1-6 are only visible when operating "Switched" "Multi level"

SYSTEM STATUS

System Level		number	display	0 - 9999
Flow Rate /Min		number	display	0 - 9999

System Level

The System Level is the direct measurement of the level in the tank / sump of the system. It is read from the level transducer and is displayed on the Level Screen on the front of the switchboard.

System Level
XXXX

This is the default display screen. It will display appropriate messages describing current conditions. These include in order of priority: Emergency Stop, Hi Level Alarm, Lo Level Shutdown, Fault, Pause Activated, etc.

After 25 minutes from the last key press the SWORDFISH + will revert to this screen automatically.

Flow Rate

The SWORDFISH + can operate on a calculated flow rate.

Flow-Rate /Min
XXXXX*

The Calculated flow rate uses information that is input into the Pump Flow rate screen to provide an estimation of the flow rate at any time. This calculation automatically compensates for the number of pumps operating - it is useful in determining the system capacity. This is a calculated flow and must be treated as such. The time base for this flow is in flow per **MINUTES** and is not adjustable.

FAULT HISTORY

FAULTS				
Fault 1	selection	None Logged	None Logged	None Logged Lo Press Shutdwn, Hi Press Shutdwn, No Flow Shutdwn,
Fault 2	selection	None Logged	None Logged	*Pump 1 - 6 Shutdown *Pump 1 - 6 No Flow
Fault 3	selection	None Logged	None Logged	Power Off Power Glitch
Fault 4	selection	None Logged	None Logged	Auto Reboot
Fault 5	selection	None Logged	None Logged	

When a system fault is registered a "NEW FAULT" message will appear on the main screen. It will also be logged in the FAULT HISTORY menu. There is space for up to 5 faults to be logged which scroll down as new faults are received.

In the event of a new fault, which has been automatically reset, the default screen will display the message “New Fault”. Go to the FAULT HISTORY to view this fault. Faults that are active will remain live on the screen until the ENTER Key is pressed to clear the fault.

**** NEW FAULT ****

Faults will appear in the Fault sub menu in the following format with the most recent fault being Fault 1.

**Last Fault (No.1
Lo Level Shutdown**

Note: The FAULT HISTORY menu is cleared when the system is first powered up.

**Fault 2
Auto Reboot**

“Pump 1 - 6 Shutdown” signifies that the corresponding “Pump protect 1-6” input has been activated for the period of the input delay time.

“Auto Reboot” denotes that the SWORDFISH + has automatically restarted due to an internal reset, whereas “Power Failure” records that the SWORDFISH + has recovered from a power supply disconnection. A very short disconnection of power will record a “Power Glitch” message, typically around 0.1seconds.

The FAULT HISTORY menu is always visible regardless of whether the Access Code is correct.

To reset the complete FAULT HISTORY by pressing ENTER then DOWN and then ENTER again when at Fault 1. Individual Faults can be reset by completing the same action while displaying the Fault screen to be reset.

PUMP DATA LOG

Main Menu	Sub Menu	Units	Defaults	Range
PUMP DATA LOG				
	Hours Run 1	hours	display	0 - 65535
	*Hours Run 2	hours	display	0 - 65535
	*Hours Run 3	hours	display	0 - 65535
	*Hours Run 4	hours	display	0 - 65535
	*Hours Run 5	hours	display	0 - 65535
	*Hours Run 6	hours	display	0 - 65535
	Pump Starts 1	number	display	0 - 65535
	*Pump Starts 2	number	display	0 - 65535
	*Pump Starts 3	number	display	0 - 65535
	*Pump Starts 4	number	display	0 - 65535
	*Pump Starts 5	number	display	0 - 65535
	*Pump Starts 6	number	display	0 - 65535
	Pump Starts Last Hr	number	display	0 - 65535
	Analogue Input 1	%	display	0.00 - 100.00
	Analogue Output 1	%	display	0.00 - 100.00
	Digital Input State	1 - 12	display	X for Active
	Digital Output State	1 - 4	display	X for Active
	Curr & max retry	number	display	0 - 50 0 - 50
	Temperature	degrees C	display	0 - 999

* Hours Run 2-6 are only visible if "Number of pumps" is set accordingly
 * Pump Start 2-6 are only visible if "Number of pumps" is set accordingly

Hours Run Pump 1-6

Each pump has an hour run meter attached to record the actual run time for each pump. The hour log will accumulate all of the operation time for each pump in both AUTOMATIC and MANUAL modes.

To reset the time press ENTER then DOWN and then ENTER again.

**Hours Run Pump1
XXXXX**

Pump 1-6 Starts

The SWORDFISH + registers the number of starts that each pump accumulates to assist in the tuning of the system. This number can assist in the selection of the Cut In and Cut Out levels and the run time settings. The starts do not increment when selected in MANUAL as this is considered to be an override function.

To reset press ENTER then DOWN and then ENTER again.

**Pump Starts 1
XXXXX**

Starts Last Hour

This registers the numbers of starts that the *TOTAL SYSTEM* had over the past hour. This is the accumulation of all of the Starts for all of the pumps and is designed to assist in trouble shooting. The new number is accumulated over a 10-min period and is updated at 10-minute intervals. To get a true hourly reading the system must have been running for at least 1 hour. After the first hour the last 6 previous 10-minute readings are added together to get the Starts last hour reading. To reset press ENTER then DOWN and then ENTER again.

**Starts Last Hour
XXXXX**

Analogue Input

This screen displays the actual Analogue Input reading in percentage.

It shows the actual possible full scale reading and is not zeroed or scaled to level. It is used to determine input functionality.

Analogue Input 1
XXX.XX%

Analogue Output

This screen displays the actual Analogue Output reading in percentage. This output mimics the Analogue 1 Input and can be re-scaled in the configuration settings.

Analogue Output 1
XXX.XX%

Digital Input State

This screen displays the state of the Digital inputs
X = energized

- = de-energized

See INPUTS for configurable options for this item.

Dig Input State
X - - X - - - X - - X

Digital Output State

This screen displays the state of the Digital outputs
X = energized

- = de-energized

See OUTPUTS for configurable options for this item.

Dig Output State
X - - -

Curr & Max Retry

The number under "Curr" is the current number of times the main processor has not been able to communicate with the analogue system. If it is not at Zero it indicates that the analogue system has been subject to noise and may have had to restart itself. If this number continues to increment up to 20, then resets to 0, and continues incrementing again it indicates a major malfunction with the analogue system

Curr & Max Retry
XX XX

The number under "Max Retry" is the maximum number of times the main processor has not been able to communicate with the analogue circuitry. If it is at 20 there may have been a major disruption in the analogue system and was unable to restart itself and the main processor has more than likely forced it to restart.

Temperature

Displayed is the current temperature in degrees C, read via the temperature sensor on the circuit board.

Temperature
XXX degrees C

ACCESS CODE

Access Code	number	21	0 - 250
-------------	--------	----	---------

Press ENTER to edit the Access Code at this location. If correct this will then allow access to the "Sub Menus". Once the Access Code is input it will remain active for 25 minutes after the last key press. Standard security will then resume and access into the submenus will require re-entering of the Access Code.

Access Code
XXX

The system will then automatically lock the use of the keys which control the ON/OFF and AUTOMATIC and MANUAL Functions. This is designed to protect the system from tampering.

KEY PAD LOCKED
Enter Access Code

If a message KEPAD LOCKED appears on the screen enter the ACCESS CODE to allow access.

SETTINGS

SETTINGS			
*LoLevel Shutdown		*150	0 - 9999
*LoLevel Alarm		*150	0 - 9999
*Low Limit		*OFF	*OFF
*Cut In Level (1,2,3)		200	0 - 9999
*Cut Out Level (1/2/3)		450	0 - 9999
*HiLevel Shutdown		650	0 - 9999
*HiLevel Alarm		650	0 - 9999
*High Limit		*OFF	*OFF
Alt Cut In 2		250	0 - 9999
Alt Cut Out 2		500	0 - 9999
Alt Cut In 3		300	0 - 9999
Alt Cut Out 3		600	0 - 9999
*Trip Point Low		300	0 - 9999
*Trip Point High		400	0 - 9999

Low Level Shutdown
Low Level Alarm
Low Limit

LoLevel Shutdown
XXXX

This is the alarm level point for low liquid level. If any pump is running and the system falls below this level and remains there for the period of the "LoLevel Delay" time the system will act according to the setting in the "Low Limit Action" Sub menu.

- If Low Limit Action is set to OFF, then no action is taken.
- If Low Limit Action is set to Alarm, then an alarm is only logged.
- If Low Limit Action is set to Shutdown, then a shutdown is initiated.

For alarm and shutdown actions, an output relay can be set to the appropriate mode to turn it on.

An alarm message will show on the main screen showing that there is a low level shutdown fault. The fault will also be recorded in the FAULT HISTORY sub menu. To clear the fault and restart the system press the ENTER key.

LO LEVEL SHUTDWN

Note: All pumps will be shutdown including manual pumps (key pad control only). If Low Limit Action is set to OFF the Low Limit and then the Low Level Delay screens will then display -----OFF----- and can be not altered.

Cut In Level

The Cut In Level is the level at which the system will restart or the next pump will start. This Level must be higher than the Low Level Shutdown. If the system is re-starting, then the restart timer must have timed out before the first pump will start. If there is a pump is already running, then the Cut In timer must have timed out before the next pump will start. Pumps may also be prevented from starting if the Max starts per hour setting has been exceeded.

A message will appear on the status screen letting you know that it has occurred.

Cut In Level (1/2/3)
XXXX

PUMP/S REACHED
MAX Starts PerHr

(This option is set in- Configuration -> Excess Run Protection. Note in Multilevel Mode Cut In Level 1 / Cut In Level 2 etc will be displayed pending number of pumps selected)

Cut Out Level

The Cut Out Level is the level at which the system will start to turn off pumps. This Level must be lower than the Cut In Level. The Cut Out timer must have timed out before the next pump will be turned off. Pumps may also be prevented from stopping if the Minimum run time for all pumps that are currently running, and have not yet timed out.

Cut Out Level
XXXX

Min Run Time ON
Pump Stop X Secs

(This option is set in- Configuration -> Excess Run Protection, Note in Multilevel Mode Cut Out Level 1 / Cut Out Level 2 etc will be displayed pending number of pumps selected)

High Level Shutdown

This is the alarm level point for High Level . If any pump is running and the system rises above this Level and remains there for the period of the "HiLevel Delay" time the system will act according to the setting in the "High Limit Action" Sub menu.

- If High Limit Action is set to OFF, then no action is taken.
- If High Limit Action is set to Alarm, then an alarm is only logged.
- If High Limit Action is set to Shutdown, then a shutdown is initiated.

HiLevel Shutdown
XXXX

For alarm and shutdown actions, an output relay can be set to the appropriate mode to turn it on.

If the High Limit Action is set to “Shutdown” then another option becomes available to automatically restart the system after a High Level (or Lo Level pending tank fill / empty mode selection) shutdown. This is called “High Level Restarts” (or Lo Level Restarts) and is located in the Configuration menu. It can be set at any value between 0 and 250 to suit the application.

Note: All pumps will be shutdown including manual pumps.

If High Limit Action is set to OFF then the High Limit and the High Level Delay screens will then display -----OFF----- and can be not altered.

Alt Cut In 2 / Alt Cut Out 2

In cases where the Cut In and Cut Out settings need to be changed via a remote control signal, activating the Alternate 2 settings will force the Swordfish+ to operate on “Alt Cut In 2” & “Alt Cut Out 2” setting.

- Primary settings (Cut In - Cut Out)
- 2nd Settings (Alt Cut In 2 - Alt Cut Out 2)
- 3rd Settings (Alt Cut In 3 - Alt Cut Out 3)

Alt Cut In 2
XXXX

Alt Cut Out 2
XXXX

In order to run the alternate settings program one of the inputs to Alt Setting 2 and activate the relevant input.

See Inputs for detailed description

Eg: If the standard systems has

Cut In.....400kPa
Cut Out.....800kPa

Alt Cut In 2.....600kPa
Alt Cut Out 2.....1000kPa

When the Alt Settings 2 input is activated the actual system Cut In will go to 600kPa and Cut Out to 1000kPa.

Alt Cut In 3 / Alt Cut Out 3

In cases where the Cut In and Cut Out settings need to be changed via a remote control signal, activating the Alternate 3 settings will force the Swordfish+ to operate on “Alt Cut In 3” & “Alt Cut Out 3” setting.

- Primary settings (Cut In - Cut Out)
- 2nd Settings (Alt Cut In 2 - Alt Cut Out 2)
- 3rd Settings (Alt Cut In 3 - Alt Cut Out 3)

Alt Cut In 3
XXXX

Alt Cut Out 3
XXXX

In order to run the alternate settings program one of the inputs to Alt Setting 3 and activate the relevant input.

See Inputs for detailed description

NOTE: These settings will also limit the adjustment of the High level and Low level settings. If Alt Cut In & Alt Cut Out 2 or 3 are not used, adjust these settings to be close to the "standard" CUT OUT, this should prevent them from limiting adjustment to the High Level and Low Level settings.

Trip Point Low

SWORDFISH + has the ability to energize an output relay based on specific level points. This can be useful for monitoring other functions through out the system that are not directly affected by the SWORDFISH + control. Trip Point High also has to be set, see below. See Output Relays section for more information on how to set this feature.

Trip Point Low
XXXX

Note: The “Trip Point Low” and “Trip Point High” screens will only appear if an output is set to “Trip Point ” within the OUTPUTS menu.

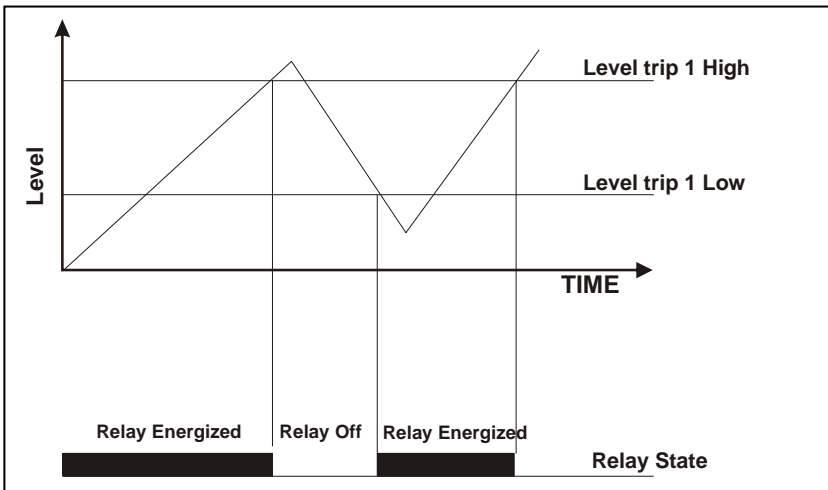
Trip Point High

Trip Point High
XXXX

The Trip Point High is the mating pair to the Trip Point low. If a single trip point is required set the High and Low trip points to the same value.

Note: The settings of Trip Point High must be greater or equal to Trip Point Low. The system constrains settings outside this range.

Note: The “Trip Point Low” and “Trip Point High” screens will only appear if an output is set to “Trip Point ” within the OUTPUTS menu.



TIMING

TIMING				
*Lo Level Delay	seconds	120		*OFF, 0 - 250
*High Level Delay	seconds	4		*OFF, 0 - 250
In Delay Timer	seconds	4		0 - 999
Out Delay Timer	seconds	1		0 - 999
Restart Delay	seconds	0		0 - 999
No Flow Timer	seconds	0		0 - 250
Input Delay Timer	seconds	120		0 - 999
*Press Trip Low Delay	seconds	0		0 - 999
*Press Trip High Delay	seconds	0		0 - 999
*Min Pump Runtime	seconds	60		0 - 240
*Max Pump Starts	per Hour	60		0 - 240

Low Level Shutdown Delay

Set this time to delay a Low Level Shutdown. It must time out before the system will shut down in Low Level mode. The range for this is "0-250 sec".

If the Low level shutdown needs to be turned OFF it can be done by accessing the "Low Limit Action" sub menu in the Configuration menu. If Low Limit Action is set to OFF the Low Limit and the Low level Delay screens will then display -----OFF---- and can not be altered. If OFF is selected then the system will ignore any low-level shutdown commands. Be sure that you fully understand the repercussions of this setting as the Shutdown settings are designed to protect both the pump and the system from damage. The Low & High level delay timers are independent of each other and can be set to suit individual needs.

**LoLevel Delay
XXX seconds**

High Level Shutdown Delay

Set this time to delay the High Level Shutdown. It must time out before the system will shut down in High Level mode. The range for this is "0-250 sec".

If the High level shutdown needs to be turned OFF it can be done by accessing the "High Limit Action" sub menu in the Configuration menu. If High Limit Action is set to OFF the High Limit and the High level Delay screens will then display -----OFF---- and can not be altered. If OFF is selected then the system will ignore any high-level shutdown commands. Be sure that you fully understand the repercussions of this setting as the Shutdown settings are designed to protect both the pump and the system from damage.

**HiLevel Delay
XXX seconds**

In Delay Timer

The IN DELAY TIMER is used to delay the starting of additional pumps. When the system level increases above the Cut In Level the system starts the first pump according to the "restart" timer. Any additional pumps required will be started if the level remains above the Cut In Level in single level mode (Multiple Level Mode will Display Cut In Level 1 /2 etc for individual pump start levels) after the In Delay Timer has timed out. The In delay timer is used to start every pump apart from the first pump after a restart. This timer is designed to assist in the reduction of Short Cycling and allowing the system to stabilise before additional pumps are started.

**In Delay Timer
XXX seconds**

Out Delay Timer

When the pumps are called to turn off the delay for this is governed by the OUT DELAYTIMER. It delays the shutting down of additional pumps when the system level is above the Cut In and pumps are attempting to shut down.

**Out Delay Timer
XXX seconds**

Restart Delay

When the system level rises above the Cut In Level the first auto pump to start will be delayed by the RESTART DELAY

**Restart Delay
XXX seconds**

No Flow Timer

If a flow switch is fitted and connected to a programmable input which is programmed to “No Flow” and pumps are running there should be flow detected by the Flow Switch. If there is No flow the flow switch input is closed this timer delays a no flow shutdown by the given amount.

**No Flow Prot Dly
XXX seconds**

Input Delay Timer

The SWORDFISH + has the capacity to accept input signals for various processes. This timer sets the delay for reaction to those inputs. The specific inputs that are controlled by this timer are:- Outlined in the “Programmable Input Options”

**I/P Delay Timer
XXX seconds**

Level Trip Low Delay

This setting delays the activation of the relevant Output relay if programmed for Level Trip.

**Lvl Trip Lo Dly
XXX seconds**

Level Trip High Delay

This setting delays the deactivation of the relevant Output relay if programmed for Level Trip..

**Lvl Trip Hi Dly
XXX seconds**

Note: The screens “Level Trip Low Delay” and “Level Trip High Delay” are only visible if at least one output is set to “Trip point” in the OUTPUTS menu.

Min Pump Runtime

This setting is used to prevent switchgear and pumps from failing due to excessive cycling. Each pump is prevented from stopping until its own Minimum run timer expires.

**Min Pump Runtime
XXX seconds**

A message will appear on the status screen letting you know that it has occurred.

**Min Run Time ON
Pump Stop X Secs**

This method of protection should only be used if the reticulation system can withstand maximum pump head.

Maximum Pump Starts

This setting is used to prevent switchgear and pumps from failing due to excessive cycling. Each pump is prevented from starting if the Max starts per hour setting has been exceeded.

**Max Pump Starts
XXX per Hr**

A message will appear on the status screen letting you know that it has occurred.

**PUMP/S REACHED
MAX Starts PerHr**

Note: The “Min Pump Runtime” and “Max Pumps Starts” screens are visible according to the setting of “Excess Run Prot’n” sub menu in the “Configuration” Menu.

CONFIGURE

CONFIGURE			
Operating Mode	selection	MultiLevel	Pressure, Flowrate, Temperature, Single Level Multi Level.
*Control Mode		Tank Empty	Tank Fill
Number of pumps	number	3	0 - 6
*Transducer Zero	unitless		0 - 9999
*Adjust Level	unitless		0 - 9999
*Averaging	number	20	0 - 50
Scale An Output	number	1000	
Pump Flow Rate	per Min	5	1-9999 /Min
Auto Rotation	selection	Full	Full, *Pump 1 - Pump 6, Every 24 Hours, Low Hours.
LoLevel Restarts	selection	0	0 - 250
Sensing Input	selection	Analogue	Analogue, Switched
Cycle Protection	selection	Minimum Run Time	Minimum Run Time, Max Starts PerHr
Low Limit Action	selection	OFF	OFF, Alarm, Shutdown
HighLimit Action	selection	OFF	OFF, Alarm, Shutdown
User Access Code	number	21	0 - 250

* "Transducer Zero", "Adjust Pressure" & "Averaging" are hidden when in "Switched" mode

* Pumps 2 - 6 are only visible if "Number of pumps" is set accordingly

* Pending Tank Fill or Tank Empty selection will reverse some logic . i.e Cut in level nowCut Out level etc

Operating Mode

Select the Control Parameter relevant to the operation.
The options are:

Operating Mode
MultiLevel

- Pressure Control
- Flowrate Control
- Temperature Control
- **Single Level Control**
- **Multi Level Control**

When the relevant selection is made the menu screens will change to reflect the control parameters. This manual only covers the Level control option, therefore no other options will be discussed.

Control Mode

Select the Control Parameter relevant to the operation.
The options are:

Control Mode
Tank Emptying

- Tank Emptying
- Tank Filling

Pending selection of the above will cause several settings to be reversed in mode of operation or menu listing i.e. Cut In Level for tank empty now becomes Cut Out Level for tank filling application etc.

Number of Pumps

Select the number of pumps in the system. The menus will change to suit the selection.

Number of Pumps
X

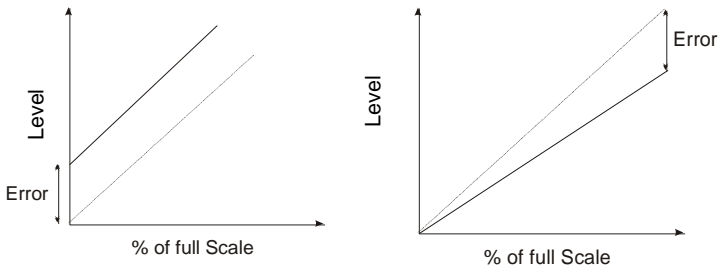
Note: Do not include the Jockey Pump when entering the number of pumps as Output Relay 4 controls the jockey pump

Transducer Zero

The Transducer Zero adjusts the zero offset in the Level sensor. Remove all level in the system and then trim the display by pressing ENTER and then the UP or DOWN keys to set the reading to "0". There are buffers in the system so the transition to the new reading may take some time to settle, wait at least 5 seconds before accepting the adjustment.

Transducer Zero
XXXXX kPa

If SWORDFISH + senses that the adjusted zero input is lower than can be accepted, a message will come up on the screen stating "VALUE TOO LOW". If this message appears, increase the setting slowly by pressing ENTER and then UP, press ENTER again to confirm. Exit out of the menu to store the value.



Note: This screen will not be displayed if the SWORDFISH + is running in switched mode.

Adjust Level

The calibration of the analogue sensor is achieved by adjusting the level reading on this screen to match a reading from a level gauge (or tape measure to scale pit / tank etc IE 100cm in vertical height= 100 on the Swordfish+ display screen)

Adjust Level
XXXXX

Enter fluid into the reservoir, Once the system Level has stabilised, press the ENTER key and then either UP or DOWN keys to match the reading on this screen to suit a Level gauge / measurement reading. Once the readings are matched the system level is now calibrated. Press ENTER again and then exit out of the menu to store the data.

There are buffers in the system so the transition to the new reading may take some time to settle, wait for 5 seconds before accepting the adjustment.

Note: This screen will not be displayed if the SWORDFISH + is running in switched mode

Averaging

To allow the system level to be displayed without significant level bouncing, the SWORDFISH + averages the readings taken.
To damp the Level Reading insert a high number.

Averaging
XX

Note: The “Transducer Zero”, “Adjust Level” and “Averaging” screens are not visible if the “Sensing Input” sub menu in the “Configuration” Menu is set to Switched.

Note: This screen will not be displayed if the SWORDFISH + is running in switched mode

Scale An Output

This allows the analogue input to be re-scaled and sent to other devices. 1000 = 1:1 2000 = 2:1 (Output twice the input value)

Scale An Output
XXXX

Pump Flow Rate

This figure is the flow rate of the pump at a nominated pressure. It is read from a manufacturers pump curve and input as a flow rate / minute. Any units can be used for this figure however the time units are fixed at MINUTES.

Pump Flow Rate
XXXX /min

Each time the operating range of the controller is changed this figure must be modified to maintain a more accurate figure.

Auto-Rotation

This menu allows SWORDFISH + to call on one pump to be the lead pump or to allow for a new pump to be the lead pump after each time all of the pumps have shutdown.

Note: The lead pump is the name given to the first auto pump to start (if available). The options are Full, 1, 2, 3, 4, 5, 6, Every 24 Hours and Low Hours. If a number is selected then that pump will always be the lead pump. If Full is selected then the lead pump will cycle after system shutdowns or PAUSE events.

If set to “Every 24 Hours”, once every 24 hours the system will shutdown all auto pumps (including jockey) and force a cycle of the lead pump.

Auto Rotation
FULL

Selecting “Low Hours” will start the next available pump with the lowest hours according to the individual Hours Run meters as seen in PUMP DATA LOG. The aim of the setting is to get an even wear through all of your pumps.

Note: A forced rotation can be activated by setting one of the programmable inputs to “Cycle Pumps” and closing the relevant input terminals- see Programmable Inputs.

High / Lo Level Restarts .

This setting allows the operator to set the number of times that the system can shutdown and then automatically restart after a High (or Lo) Level Shutdown.

Hi (Lo) Level Restarts

The range is from 0-250. Select 0 to make the system shut down immediately after the High Level delay timer trips. This is the safest setting and the default for the system. After each automatic restart the fault is logged in FAULT HISTORY and the message "New Fault" appears on the main screen.

The restart number is based on a 1 hour time period. i.e. if the Restarts number is 5 then the system will allow 5 restarts in the 1 hour time frame starting from the time of the first High Level Fault.

Sensing Input

The SWORDFISH + can accommodate a variety of inputs. It is divided in to two categories.

Sensing Input Analogue

- **Analogue-** These are signals which change proportionally over time. Most sensors and transducer have an analogue output. Analogue is also divided in to two categories.
 - **Standard Analogue-** This is where a level rise will cause a rise in the output of the transducer.
 - **Reverse Analogue-** This is where a level rise will cause a fall in the output of the transducer. (These are very rare in level control applications and will depend if tank filling or emptying selected)
- **Switched-** These are signals which change instantaneously. Typical switched products are: Floats, level switches and toggle switches.

Excess Run / Cycle Protection

There are two options to prevent excessive pump cycling or starting.

ExcessRun Prot'n Min Run Time

- **Min Run Time-** If this setting is used then each pump is prevented from stopping until the it's own Minimum run timer times out. This method of protection should only be used if the reticulation system can withstand maximum pump head. A message will appear on the status screen letting you know that it has occurred.
- **Max Starts perHr-** If this setting is used then each pump from starting if the Max starts per hour setting has been exceeded. The down side of this is that if all pumps have exceeded the number of starts per hour then the reticulation pressure will fall to zero. A message will appear on the status screen letting you know that it has

Min Run Time ON Pump Stop X Secs

PUMP/S REACHED MAX Starts PerHr

Low Limit Action

The Low limit action allows the user to select an appropriate action in the event of a sustained low Level condition. There are three possible settings:

- **OFF**- This setting completely turns OFF the Low level. Be aware that if set to OFF there would be no Low level protection for the system.
- **Alarm**- This setting turns OFF the Low level protection but will generate an alarm which can be used for telemetry . Be aware that if set to Alarm there would be no Low level protection for the system
- **Shutdown**- This setting turns ON the Low level protection and also generates a fault alarm which can be used for telemetry. This is the safest option.

Low Limit Action Shutdown

High Limit Action

The High limit action allows the user to select an appropriate action in the event of a sustained high level condition. There are three possible settings:

- **OFF**- This setting completely turns OFF the High level. Be aware that if set to OFF there would be no High level protection for the system.
- **Alarm**- This setting turns OFF the High level protection but will generate an alarm which can be used for telemetry . Be aware that if set to Alarm there would be no High level protection for the system
- **Shutdown**- This setting turns ON the High level protection and also generates a fault alarm which can be used for telemetry.

HighLimit Action Shutdown

User Access Code

The access code is used to limit access to the settings menus.

The user access code has the range “off, 0 – 250”. Off will disable the access code and allow unlimited access. Once a number is selected then access to the settings screens or any other editable screen will require the inputting of this number to progress. To edit press enter and then up or down keys to edit the new number. Press enter again and exit the menu to store the changes.

Access Code XXX

JOCKEY PUMP

JOCKEY PUMP

Jockey Pump	selection	----Off----	----Off----, ==On==
*JP Cut In Level		250	0 - 9999
*JP Cut Out Level		400	0 - 9999
*JP Run On Time	seconds	2	0 - 999
*JP In Delay Time	seconds	0	0 - 999

The Jockey pump is typically a smaller auxiliary pump that is outside the flow range of the main pumps. The jockey pump will turn on when there are no main pumps on and the level is below Jockey Cut In Level. If the jockey pump is enabled it automatically takes over Output relay 4 for its operation, therefore making the system capable of 1 Jockey pump plus 6 main pumps.

To enable the jockey pump and allow viewing of the rest of the jockey pumps screens change to Jockey Pump ON.

Jockey Pump
-----Off-----

Jockey Pump
=====On=====

JP Cut In Level

The JP Cut In Level is the Level at which the pump defined as Jockey pump will restart.

JP Cut In Level
XXXX

JP Cut Out Level

The Level Point is the system that the Jockey Pump will be turned off.

JP Cut Out Level
XXXX

JP Run On Time

The Jockey pump can be forced to run on after the main system has started by the time detailed in this screen.

JP Run On Time
XXX seconds

JP In Delay

When the system level reaches the JP Cut In Level and remains there the Jockey pump will start after this period. Given that no main pumps have started.

JP Restart Delay
XXX seconds

NOTE: IF THE JOCKEY PUMP IS TURNED “ON”, RELAY 4 IS NO LONGER AVAILABLE FOR ANY OTHER FUNCTION.

OUTPUTS

OUTPUTS

Digital Output 1	selection	Shutdown Fault	Shutdown Fault, Lo Level Fault, Hi Level Fault, *Pump 1 - 6 Run,
Digital Output 2	selection	Any Pump Shutdown	*Pump 1 - 6 Fault, System Paused, Low Alarm, High Alarm, Any Alarm,
Digital Output 3	selection	Any Alarm	Any Pump Shutdwn, Any Pump Running, Trip Point
*Digital Output 4	selection	Any Pump Running,	Alternate Trip, Aux Output 1, Aux Output 2, Aux Output 3, Shutdown Fault
Analogue Output 1	selection	System Level	System Level

* If the Jockey Pump is set to "ON" then Digital Output 4 will not be available for other functions.

* Pump Run 2 - 6 are only visible if "Number of pumps" is set accordingly

* Pump Fault 2 - 6 are only visible if "Number of pumps" is set accordingly

SWORDFISH + has four main programmable outputs that can be used to communicate with external sources such as Telemetry or Building Management Systems (BMS). As each system requires different combinations of information all output relays are configurable in software. All outputs are Voltage Free - Change Over contact outputs and capable of 5 amps 240 VAC.

You can view which outputs are currently activated within the PUMP DATA LOG menu, under Digital Output State. The status of the analogue outputs is also available within this menu.

Digital Output Options

No.	Option	Delay
1	Shutdown Fault,	As per delay timer
2	Lo Level Fault,	As per delay timer
3	Hi Level Fault,	As per delay timer
4	Pump 1 Run,	Instantaneously
5	Pump 2 Run,	Instantaneously
6	Pump 3 Run,	Instantaneously
7	Pump 4 Run,	Instantaneously
8	Pump 5 Run,	Instantaneously
9	Pump 6 Run,	Instantaneously
10	Pump 1 Fault,	As per delay timer
11	Pump 2 Fault,	As per delay timer
12	Pump 3 Fault,	As per delay timer
13	Pump 4 Fault,	As per delay timer
14	Pump 5 Fault,	As per delay timer
15	Pump 6 Fault,	As per delay timer
16	System Paused,	Instantaneously
17	Low Alarm,	As per delay timer
18	High Alarm,	As per delay timer
19	Any Alarm,	As per delay timer
20	Any Pump Shutdwn,	As per delay timer
21	Any Pump Running,	Instantaneously
22	Trip Point	As per delay timer
23	Alternate Trip,	Instantaneously
24	Aux Output 1	Instantaneously
25	Aux Output 2	Instantaneously
26	Aux Output 3	Instantaneously

- **Shutdown Fault**

This output is used to indicate that there has been an event that has shut down the system. This can be a High or Low-Level Shutdown, No Flow Shutdown.

- **Low Level Fault**

A shutdown based on a Low Level Shutdown.

- **High Level Fault**

A shutdown based on a High Level Shutdown.

- **Pump 1-6 Run**

Pump 1-6 running.

- **Pump 1-6 Shutdown**

Pump 1-6 shutdown on individual pump protection.

- **System Paused**

The “system pause” input is activated

- **Low Alarm**

If a Low Level circumstance has occurred then the output will turn on.

- **High Alarm**

If a High Level circumstance has occurred then the output will turn on.

- **Any Alarm**

If there are any Fault Re-starts active or general alarm that do not cause a system shutdown this output will activate.

- **Any Pump Shutdown**

If any pump is shutdown this will then will activate the relay.

- **Any Pump Running**

Any pump running will activate the relay.

- **Trip Point**

When the system level reaches the nominated Trip Point Low and High, this relay will energize or de-energize. See level Trip in SETTINGS.

- **Alternate Trip**

Each time the system shuts down the energized state of the relay will change. E.g. If the relay on one cycle is closed during operation then the next cycle this relay will be open. The relay will change on the following: - Low level Shutdown, High level Shutdown, No Flow Shutdown and Pause.

- **Aux Outputs 1 - 3**

Any output can be set to be an auxiliary output. Setting an output to become an auxiliary output allows the SWORDFISH + to use an input to turn on a Digital Output. To do this the input has to be set up to be an Auxiliary input. There are three auxiliary functions available.

Aux Input 1 operates Aux Output 1

Aux Input 2 operates Aux Output 2

Aux Input 3 operates Aux Output 3

*** RELAY RATINGS**

The relays are rated at 5 amp 250VAC. Consideration of inrush current, inductive loads and cycling must be taken into account when applying current to these relays.

INPUTS

INPUTS			
Program Input 1	selection	System Pause,	*Alt 2 Settings
Program Input 2	selection	Pump 1 Protection,	*Alt 3 Settings
Program Input 3	selection	Pump 2 Protection,	*Cut In,
Program Input 4	selection	Pump 3 Protection,	*Cut Out,
Program Input 5	selection	High Limit,	Low Limit,
Program Input 6	selection	Low Limit,	High Limit,
Program Input 7	selection	No Flow,	System Pause,
Program Input 8	selection	*Alt 2 Settings	*Pump 1 - 6 Protection,
Program Input 9	selection	*Alt 3 Settings	*Pump 1 - 6 Stop,
Program Input 10	selection	Reset,	*Pump 1 - 6 Manual Run,
Program Input 11	selection	Cycle Pumps,	Fire Mode,
Program Input 12	selection	Aux Input 1	Cycle Pumps,
			Reset,
			No Flow,
			Aux 1, Aux 2, Aux 3,
			*Pump 1 - 6 No Flow Prot,

There are 12 main inputs with the SWORDFISH + that control the external sensing functions.

They all require **VOLTAGE FREE** contacts and as such should **NOT HAVE ANY VOLTAGE APPLIED**.

- All inputs operate on a **CLOSED CONTACT** for registration. This contact needs to be made between the input common and the relevant input. There are three terminals for the input Common to allow for multiple connections.

You can view which inputs are activated by the leds on the front of the unit and also within the PUMP DATA LOG menu under the "Digital Input State" screens. See PUMP DATA LOG for more information.

PROGRAMMABLE INPUT OPTIONS

	Description Option	Delay time	Duration
0	Not selected		
1	Alt 2 Setting	1 second	Continuous
2	Alt 3 Setting	1 second	Continuous
3	Cut In	Cut In delay	Continuous
4	Cut Out	Cut Out delay	Continuous
5	Low Limit	Low Level dly	Continuous
6	High Limit	High Level dly	Continuous
7	System Pause	1 second	Continuous
8	Pump 1 Protection	Input delay	Continuous
9	Pump 2 Protection	Input delay	Continuous
10	Pump 3 Protection	Input delay	Continuous
11	Pump 4 Protection	Input delay	Continuous
12	Pump 5 Protection	Input delay	Continuous
13	Pump 6 Protection	Input delay	Continuous
14	Pump 1 Stop	Instantaneous	Continuous
15	Pump 2 Stop	Instantaneous	Continuous
16	Pump 3 Stop	Instantaneous	Continuous
17	Pump 4 Stop	Instantaneous	Continuous
18	Pump 5 Stop	Instantaneous	Continuous
19	Pump 6 Stop	Instantaneous	Continuous
20	Pump 1 Manual Run	Instantaneous	Continuous
21	Pump 2 Manual Run	Instantaneous	Continuous
22	Pump 3 Manual Run	Instantaneous	Continuous
23	Pump 4 Manual Run	Instantaneous	Continuous
24	Pump 5 Manual Run	Instantaneous	Continuous
25	Pump 6 Manual Run	Instantaneous	Continuous
26	Fire Mode	1 second	Continuous
27	Cycle pumps	1 second	Rising edge
28	Reset	1 second	Rising edge
29	No Flow	No Flow Prot Dly	Continuous
30	Aux Input 1	Instantaneous	Continuous
31	Aux Input 2	Instantaneous	Continuous
32	Aux Input 3	Instantaneous	Continuous
33	Pump 1 NoFlowProt	No Flow Prot Dly	Continuous
34	Pump 2 NoFlowProt	No Flow Prot Dly	Continuous
35	Pump 3 NoFlowProt	No Flow Prot Dly	Continuous
36	Pump 4 NoFlowProt	No Flow Prot Dly	Continuous
37	Pump 5 NoFlowProt	No Flow Prot Dly	Continuous
38	Pump 6 NoFlowProt	No Flow Prot Dly	Continuous

Not Selected

When this is selected the input will not respond to any activation.

Alt Setting 2 & 3

If an input is programmed as a means of selecting the Alternate Setting, then closing of the contact to either of these inputs will activate an alternate cut in and cut out Levels. If two inputs are activated at the same time, then Alternate Setting 3 will be the selected option.

**Program Input XX
Alt 2 Setting**

Low Limit

An input can be programmed to function as a switched low limit even when the system is operating in Analogue mode. Closing of the contact on this input will start the action programmed for the low limit as set in the Configuration menu.

**Program Input XX
Low Limit**

High Limit

An input can be programmed to function as a switched high limit even when the system is operating in Analogue mode. Closing of the contact on this input will start the action programmed for the high limit as set in the Configuration menu.

**Program Input XX
High Limit**

System Pause

An external sensor can be used to PAUSE the system. When the system receives a PAUSE command the system will shut down. The system turns off all running pumps, and a message will be shown on the main screen.

**Program Input XX
System Pause**

After the PAUSE input has been deactivated the system will restart under normal operations. If the Auto-rotation is selected to FULL the lead pump will rotate.

PAUSE ACTIVATED

Pump 1-6 Protection

SWORDFISH + has inputs for each pump to allow for individual pump protection. In the event of a pump going into a fault condition the input for that pump should close. This will shut down the pump after the time set by the Input Delay Timer.

**Program Input XX
PumpX Protection**

Note: The pump will become available again when the Input contact is opened.

This protection is ideal for the following pump protection sensors:

- Temperature probes
- Thermal Overloads
- Moisture sensor for oil bath pump seals
- Any individual pump protection device.

Pump 1-6 Stop

Activation of this input will instantly stop the operation of the relevant pump. This can be used as an Off override switch in the system or if the remote control of a pump is required.

Note: This input will override the relevant “Pump 1-6 Manual Run” input if both are active.

**Program Input XX
Pump X Stop**

Pump 1-6 Manual Run

Activation of this input will instantly start the relevant pump. All automatic control of the pump is ceased at this stage.

This action can cause an alarm or shutdown condition. (See Manual operation)

**Program Input XX
PumpX Manual Run**

Fire Mode

The FIRE MODE allows the system to ignore all shutdown protection features so the pump will continue running under all conditions.

The system will still operate as per normal turning on pumps when below the Cut In setting and Turning off pumps when above the Cut Out setting. The following protection features are disabled:

- High Level Shutdown
- Low Level Shutdown
- System Pause
- No Flow
- Individual Pump Protection
- Pump 1-6 Stop
- Pump 1-6 No Flow Protection

**Program Input XX
Fire Mode**

The operational consequences for activating Fire Mode are substantial so be sure to understand the repercussions of activating this input.

It should only be used if the risk of the pump stopping is greater than letting it run to destruction.

Hardware items such as circuit breakers, Thermal Overloads and any other switchgear protection is not effected by this mode and will continue to provide switchgear protection.

Cycle pumps

Activation of this input will shutdown and then cycle the pumps to the next available pump as the lead pump. If pump 1 started first on the last start-up, the toggling of this input will switch the lead pump to pump 2 instantly on receipt of this signal.

**Program Input XX
Cycle Pumps**

Reset

The reset input allows remote resetting of SWORDFISH + after a shutdown fault. If SWORDFISH + has shutdown due to a fault - for any reason - closing the reset contact will reset all current faults and restart the system.

**Program Input XX
Reset**

No Flow

An input can be set up to monitor a flow switch. If the system detects that there is a No Flow signal from an external flow switch and there are pumps running, then the SWORDFISH + will display the message "Low Flow Detected". If this input remains on for the period of the No flow delay timer then the SWORDFISH + shut down all pumps.

This is optional and requires a flow switch to feedback into the No Flow Input and will only operate if there is at least 1 pump selected to AUTO.

Once the No Flow Delay Timer has expired then the screen message changes to:

**Program Input XX
No Flow**

**Low Flow Detected
XXXXX**

**No Flow Shutdown
XXXXX**

Aux Inputs 1- 3

Any input can be set to be an auxiliary input. Setting an input to become an auxiliary input allows the SWORDFISH + to use this input to turn on a Digital Output. To do this the output has to be set up to be an Auxiliary output. There are three auxiliary functions available.

Aux Input 1 operates Aux Output 1

Aux Input 2 operates Aux Output 2

Aux Input 3 operates Aux Output 3

**Program Input XX
Aux Input X**

Pump 1-6 No Flow Protection

SWORDFISH + has inputs for each pump to allow for individual pump no flow protection. In the event of a individual pump loosing prime or flow for some reason, the No Flow Protection input for that pump should close. This will shut down the pump after the time set by the No Flow Protection Delay Timer.

The pump will permanently disabled until reset by the operator or remotely via the reset input.

This protection is ideal for the following pump protection sensors.

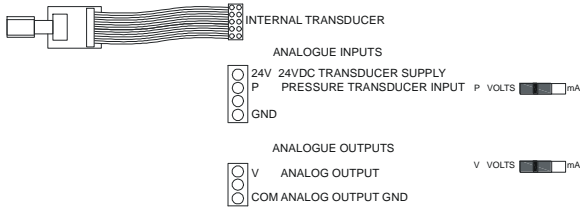
- Temperature probes
- Individual Loss of prime pressure switches
- Any individual pump protection device.

External contacts must be VOLTAGE FREE - any applied voltage can cause damage to the system.

**Program Input XX
PumpX No FlowProt**

ANALOGUE INPUTS

(The use of any other transducer apart from the standard one requires the disconnection of the ribbon cable connected to the standard transducer)



External Analogue Input



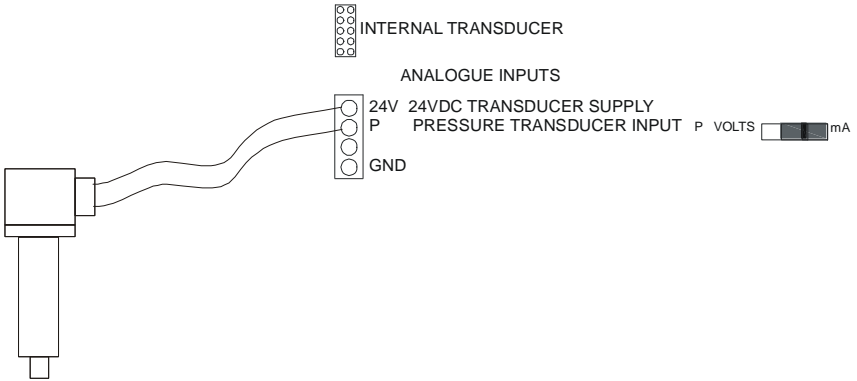
The analogue terminals are located on the left hand side of the PCB near the top.

The use of 4 – 20mA and 0-10V transducers require the slide switches to be placed to match the input. This allows the system to read the correct input from the transducers.



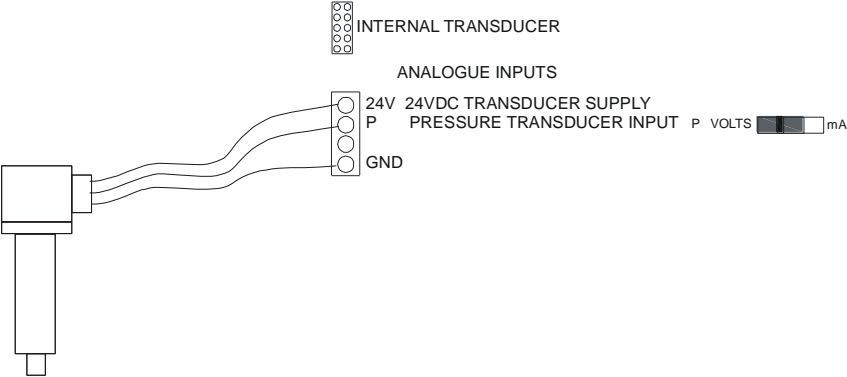
Volts = 0-5VDC, 0-10VDC etc
mA = 0-20mA, 4-20mA etc

4-20 mA is a standard analogue signal from a level transducer.



To use this input, note the wiring requirements on the PCB. A regulated 24VDC power supply is available on board for 2-wire configuration.

0-10 V transducers are set up for standard 3-wire operation.



PUMP PROTECTION

The SWORDFISH + has numerous safety features built into the system to protect the pumps from damage. Some of these shut down all operation and some are designed to halt operations until the system can stabilise. The user determines the selection of each of these.

Description	Screen Message	Action
High level Shutdown	HiLevel Shutdown	Shutdown - Restart Automatically or Manually (pending tank fill / empty option setting)
Low level Shutdown	LoLevel Shutdown	Shutdown - Restart Automatically or Manual pending tank fill / empty option setting)
No Flow Shutdown	Low Flow Detected No Flow Shutdown	On first detecting a "No Flow Input" Shutdown- Manual Restart
Pause	Pause Activated	Halts the system until contacts opened again.
Individual pump shutdown	Pump X protection Logged as a Fault in the Fault Record	Pump 1-6 shutdown

High Level Shutdown

If the system level goes over the High Level setting for a period of time, the SWORDFISH + will shutdown the system until manually reset.

There is the option to allow a number of automatic restarts after this shutdown.

There are 0-250 restarts possible and are set in the "High level Restarts" screen within the TUNING menu pending tank fill / empty option setting.

Low Level Shutdown

If the system level drops under the specified Low Level setting for a period of time the SWORDFISH + will shutdown the system until manually reset.

There is the option to allow a number of automatic restarts after this shutdown.

There are 0-250 restarts possible and are set in the "Lo Level Restarts" screen within the TUNING menu pending tank fill / empty option setting.

Individual Pump Protection

SWORDFISH + has inputs for each pump to allow for individual pump protection. In the event of a pump going into a fault condition the input for that pump should close. This will shut down the pump after the time set by the Input Delay Timer.

The pump will automatically restart when the Input contact is opened.

This protection is ideal for the following pump protection sensors:

- Temperature probes
- Loss of prime pressure switches
- Thermal Overload
- Thermistor

ALL FAULTS CAN BE REMOTELY RESET FROM THE "RESET INPUT"

CALIBRATION OF ANALOGUE SENSORS

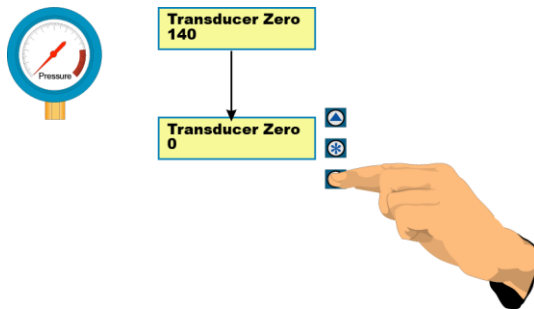
SWORDFISH + can accept most analogue signals from sensors and requires that a calibration routine be run to set both SCALING and ZERO OFFSET of these sensors. Go to the CONFIGURE Menu and press the Enter Key.

ZERO ERROR

The Zero Error routine should be done *BEFORE* using the “Adjust Level” screen.

The zero error offset is trimmed out on the “Transducer Zero” screen. Make sure that there is no level in the system or in the tube leading to the transducer.

On the “Transducer Zero” screen press ENTER to edit the data and then DOWN to make the reading go to “0”. Wait for 5 seconds for the reading to stabilise. Take care when running this procedure to reduce to the “zero” value slowly as the possibility of running past is high.

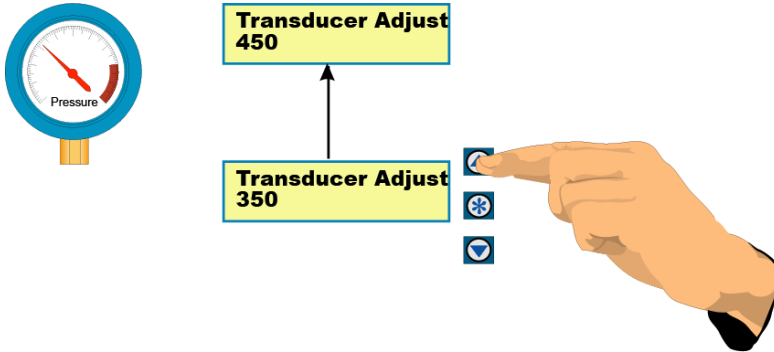


The level readings are averaged so the readings can lag behind the key presses. Always allow the system to stabilise prior to completing this procedure. If the value input is lower than Zero a message stating, “VALUE TOO LOW” will appear on the screen. Press the UP key until a “zero” value appears. Once completed press ENTER again and back out of the menu to initiate a store of the “zero” value.

LEVEL ADJUSTMENT

For this routine it is necessary to have a reference level that can be used to compare the systems top level that the SWORDFISH + senses.

To calibrate the scaling for the analogue sensor apply a level to the system and allow it to stabilise. This can be done by manually filling the reservoir or via compressed air to simulate level. This should hold system level evenly and remove any fluctuations that are prevalent without any pumps are running.



This level should be as close as possible to the normal system level, as the calibration routine works best with an end of scale reading.

Go to the “Adjust Level” screen. The level on this screen should match the level on a gauge in the system or scaled to suit reservoir / pit tank (i e 100 = 100cm of vertical height). If it does not press ENTER and then either UP or DOWN to move the displayed level to match the gauge or measured level.

There is a buffer that takes approximately 5 seconds to stabilise so wait for this period to make sure that the reading is stable before accepting or editing the settings.

Once the readings match and are steady then the scaling is calibrated. Press ENTER again and back out of the menu to initiate a store of the “Adjust level” value.

GENERAL

The basis for these calibrations is that the sensor used has a linear error if the instrument that is being used has a non-linear error then the system readings will be inaccurate. The standard transducer used with SWORDFISH + has these characteristics and also is fitted with temperature compensation to eliminate possible transducer drift with temperature.

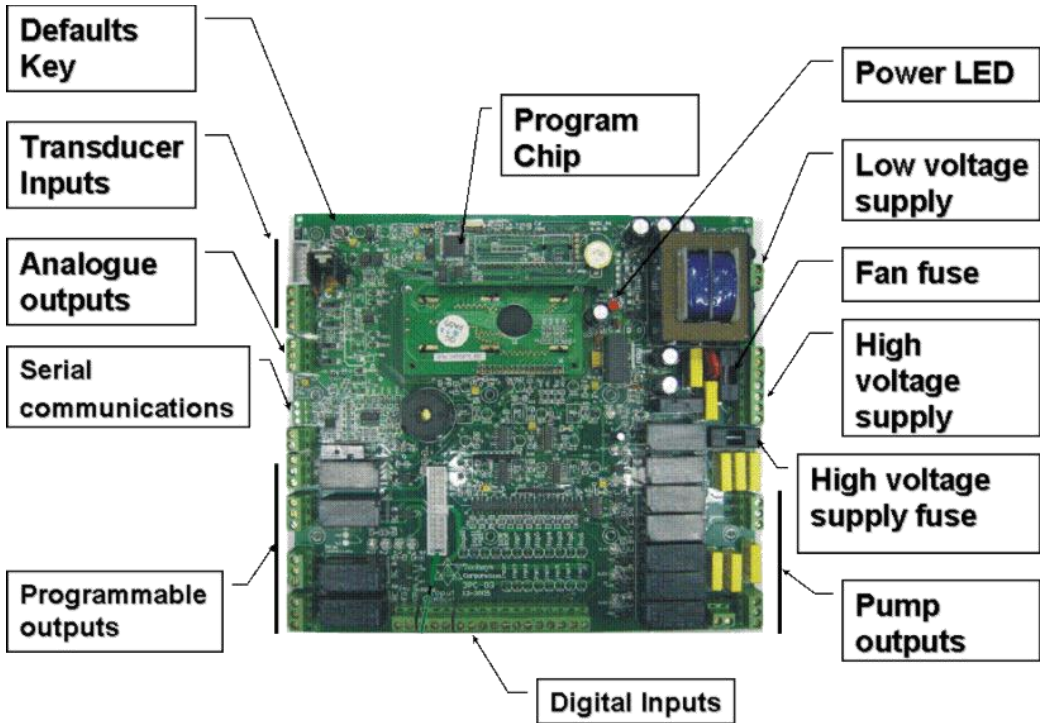
With standard transducers you will be able to read level to an accuracy of $\pm 4\%$ under normal conditions..

SPECIFICATIONS

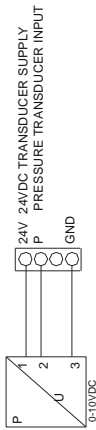
Item	Description
Power supply	Control - 240VAC 50-60Hz single phase 2 amp Single pole circuit breaker protected Optional Supply. - 24 VDC- 200mA min 500mA max (3pumps) 750mA max (6pumps). - 24 VAC- 200mA min 500mA max (3pumps) 750mA max (6pumps).
External transducer power supply	24 VDC- 100mA max. Auto reset fuse protected
EMC/ EMI filtering	Designed to minimize conducted and radiated emissions.
Standard Transducer	0-250mV \pm 4% accuracy uncompensated. 0-250 psi operating range Temp max 50 degC 500 psi burst pressure Temperature compensated
Time based functions	\pm 5% of real time
Output Relays	5 amp 250VAC changeover software configurable
Switched inputs	Voltage free - internal supply 24VDC - read threshold - 2mA
Operating temperature	0 to 50 degC
Over voltage protection	Varistor protection Clamp voltage 275V - 4500 amps 1 amp - IEC127-2/3
Enclosure	IP54 not certified
Contactors	Rated voltage - 690Vac Coil - as per control Voltage cycles mech. - 10×10^6 elec. - 2×10^6 cycles/hr - 3600 auxiliary contacts - 1 x NO Standard - IEC947
Motor circuit breakers	Standard - IEC947 – Start current 10x FLC
Wiring	Standard - AS3000
Input supply Voltage - 3 phase	230 - 440V
Input supply tolerance - 3 phase	-20% + 10%
Input frequency range	48 to 62 Hz

PCB HARDWARE & SPECIFICATIONS

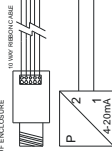
The figure below shows the terminal configurations for the SWORDFISH +.



Detailed above are the locations for the components for the Swordfish+ Printed Circuit Board (PCB)



MODEL 24PC ON BOARD
PRESSURE TRANSDUCER
250PSI MAX
1.4 PSI @ 1.1 THRESHOLD
1.4 PSI @ 1.1 THRESHOLD
OF ENCLOSURE



INTERNAL TRANSDUCER

24V 24VDC TRANSDUCER SUPPLY
EXTERNAL TRANSDUCER INPUT

Analogue input type
SELECTOR SWITCHES

Volts mA
Volts mA

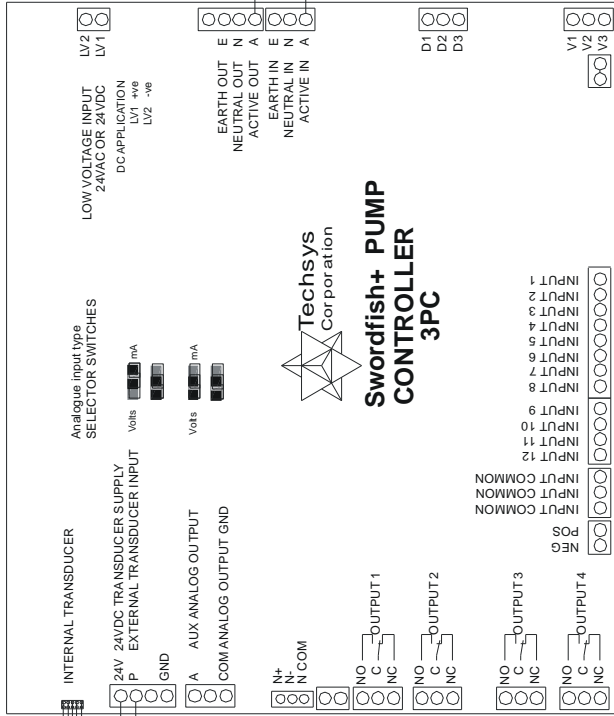
AUX ANALOG OUTPUT
COM ANALOG OUTPUT GND

N+
N-
N COM

OUTPUT 1
C NC
OUTPUT 2
C NC
OUTPUT 3
C NC
OUTPUT 4
C NC

SERIAL COMMS TERMINALS

OUTPUT TERMINALS
5 amp max. 250VAC changeover
software config. only



LOW VOLTAGE POWER SUPPLY
18-28VAC
20-30VDC

LOW VOLTAGE INPUT
24VAC OR 24VDC
DC APPLICATION
LV2 +ve
LV2 -ve

EARTH OUT
NEUTRAL OUT
ACTIVE OUT
EARTH IN
NEUTRAL IN
ACTIVE IN

POWER SUPPLY 240VAC max 1 amp
POWER SUPPLY 240VAC ± 10%

CONTACTOR OUTPUT
TERMINALS (Pumps 1 to 3)
Voltage IS/AC or DC
Output max 5 amp ON SUPPLY.
Max 5 amp

CONTACTOR OUTPUT
TERMINALS (Pumps 4 to 6)
Voltage IS/AC or DC
Output max 5 amp ON SUPPLY.
Max 5 amp

Swordfish+ PUMP CONTROLLER 3PC

Techsys Corporation

INPUT 1
INPUT 2
INPUT 3
INPUT 4
INPUT 5
INPUT 6
INPUT 7
INPUT 8
INPUT 9
INPUT 10
INPUT 11
INPUT 12
INPUT COMMON
INPUT COMMON
INPUT COMMON
NEG
POS

24VDC POWER SUPPLY
100mA MAX CURRENT
AUTO RESET FUSE PROTECTED

INPUT TERMINALS
VOLT FREE
INPUT COMMON IS NEGATIVE 24VDC
DO NOT COMMON TO ANY EXTERNAL
VOLTAGE

SPARE PARTS

The typical spare parts required for SWORDFISH + are detailed in the table below.

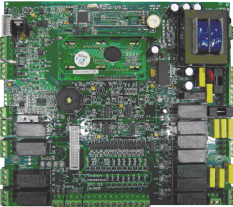
Please refer to Techsys Corporation for confirmation of parts type and suitability for use with specific projects.

Part	Code
0-250mV Standard pressure transducer	24P-Trans
PCB Board	3PC
Retrofit panel	SW+-RF
Manual	SWORDFISH + Manual
Lexan	SWORDFISH + Lexan
SWORDFISH + PCB mounted on retrofit panel*	SWORDFISH+_RF-Kit

*Use the Swordfish+ retrofitting kit when upgrading an existing system or for fitting to new switchboard.

Includes:

- SWORDFISH + Base PCB mounted to panel
- Stainless Steel Retrofit panel
- SWORDFISH + Lexan



SWORDFISH + PCB BOARD




SWORDFISH + RETROFIT KIT



TROUBLESHOOTING

PROBLEM	CAUSE	SOLUTION
Can't enable pumps	<ul style="list-style-type: none"> • Screen Stated – “KEY PAD LOCKED” • One of the Inputs is set to Pump STOP. 	<ul style="list-style-type: none"> • Input Access Code- typically 21 • Check Input LED's for activation. • Check Input Menu for Pump Stop setting.
Pump won't start	<ul style="list-style-type: none"> • Pump not enabled. (Turned OFF) • Motor circuit breaker tripped or off • Control circuit breaker tripped or off • System level below Cut In Level • System Pause Active 	<ul style="list-style-type: none"> • Press pump mode switch for at least 1 second. • Reset circuit breaker. • Reset Circuit breaker • De-power and re-power the system. • Allow the system level to increase • Reset Input
Pump won't turn off	<ul style="list-style-type: none"> • Manual selected for that pump (Running LED flashing) • Pump Manual Run input active • Cut Out level set too high 	<ul style="list-style-type: none"> • Press pump mode switch once to turn OFF. • Remove input • Adjust Cut Out level
No display screen	<ul style="list-style-type: none"> • Control circuit breaker tripped • High voltage has tripped the surge protection fuse • Temperature within the enclosure in excess of 60degC 	<ul style="list-style-type: none"> • Reset Circuit breaker • Replace fuse on the PCB • Lower internal temperature
No Level or wrong Level displayed	<ul style="list-style-type: none"> • Incorrect Sensing Input selected • Calibration incorrect for sensor 	<ul style="list-style-type: none"> • Change Sensing Input to suit sensor used • Calibrate sensor
Pumps cycling excessively	<ul style="list-style-type: none"> • IN delay too low • Pause Input tripping • Voltage being applied to the Inputs. • Cut In & Cut Out are incorrect. 	<ul style="list-style-type: none"> • Adjust IN Delay timer • Check Pause input • Make sure that the Inputs are Voltage Free • Adjust Cut In lower or Cut Out higher

Pump shutting down on Pump Protection	<ul style="list-style-type: none"> • Fault in protection sensor 	<ul style="list-style-type: none"> • Replace or adjust sensor
Controller powers on and off continuously	<ul style="list-style-type: none"> • Voltage being applied to the Inputs. • Excessive current being drawn from the external level sensor 	<ul style="list-style-type: none"> • Make sure that the Inputs are Voltage Free • Check external sensor current 100mA max.
<p>System Displays wont initialise</p> <p>Loading Data message cycles continuously</p>	<ul style="list-style-type: none"> • System needs to be initialised. 	<ul style="list-style-type: none"> • Press the "Commissioning Button" on the PCB whilst powering up the system to initialise the program 
System Level not displaying	<ul style="list-style-type: none"> • Transducer not connected properly. • Transducer type selection switch set incorrectly. • Analogue circuits not functional 	<ul style="list-style-type: none"> • Check transducer connections. Refer to Analogue Input section. • Change switch to suit transducer type. • There are 2 LED's located on the front top right of the PCB. One is for Power which should be flashing – the other is for indication that the analogue circuit is operational, it should also be flashing. A SOLID light or NO light on either means the SWORDFISH + is inoperative.

INSTALLATION NOTES

General Installation information can be obtained from Techsys Corporation regarding the site-specific requirements however there are some "GOLDEN RULES" in site installation that should be followed.

Site Installation

- Standard SWORDFISH + requires a NEUTRAL
- Select the site most shaded and out of direct sunlight.
- Allow the airflow from the fans to be unimpeded.
- The earth needs to be close and not laid parallel with High Voltage cables

Inputs

- Use shielded wire for all inputs
- Connect the shield to EARTH and one end only
- Never apply voltage to the Inputs
- Take care in running inputs for long distances
- The inputs use a 24VDC signal as the carrier voltage- use compliant sensors.

Outputs

- 5 amp maximum switching load
- Check the programming on each output before trying to troubleshoot

Start-up

- CHECK ROTATION
- Calibrate transducer
- Input level settings

All these items are site related.

Site Record

Main Menu	Sub Menu		Date	
		//	//	//
System Level & Actual Level				
Flow Rate /Min				
FAULT HISTORY	Fault 1			
	Fault 2			
	Fault 3			
	Fault 4			
	Fault 5			

PUMP DATA LOG				
	Flow Total			
	Hours Run 1			
	Hours Run 2			
	Hours Run 3			
	Hours Run 4			
	Hours Run 5			
	Hours Run 6			
	Pump Starts 1			
	Pump Starts 2			
	Pump Starts 3			
	Pump Starts 4			
	Pump Starts 5			
	Pump Starts 6			
	Pump Starts Last Hr			
	Curr & max retry			
	Temperature			
Access Code	21			

SETTINGS				
	LoLevel			
	Cut Out Level 1			
	Cut Out Level 2			
	Cut In Level 1			
	Cut In Level 2			
	HiLevel			
	Alt Cut In 2			
	Alt Cut Out 2			
	Alt Cut In 3			
	Alt Cut Out 3			
	Trip Point Low			
	Trip Point High			

TIMING				
	LoLevel Delay			
	HiLevel Delay			

Main Menu	Sub Menu		Date	
	IN Delay Timer			
	OUT Delay Timer			
	Restart Delay			
	No Flow Timer			
	Input Delay Timer			
	Levl Trip Low Delay			
	Levl Trip High Delay			
	Min Pump Runtime			
	Max Pump Start			

CONFIGURE				
	Operating Mode			
	Control Mode			
	Number of pumps			
	Transducer Zero			
	Adjust Level			
	Averaging			
	Scale An Output			
	Pump Flow Rate			
	Auto Rotation			
	Lo Level Restart			
	Sensing Input			
	Cycle Protection			
	Low Limit Action			
	High Limit Action			
	User Access Code			

JOCKEY PUMP				
	Jockey Pump			
	JP Cut In Level			
	JP Cut Out Level			
	JP Run On Time			
	JP In Delay Time			

OUTPUTS				
	Digital Output 1			
	Digital Output 2			
	Digital Output 3			
	Digital Output 4			

INPUTS	Program Input 1			
	Program Input 2			
	Program Input 3			
	Program Input 4			
	Program Input 5			
	Program Input 6			
	Program Input 7			
	Program Input 8			
	Program Input 9			
	Program Input 10			
	Program Input 11			
	Program Input 12			

Commissioned by.....Date.....

Agent.....

Contact details.....

Panel Serial Number

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