GREENSPAN

PR-7100

LIQUID LEVEL SENSOR

PRODUCT USER MANUAL

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Quality Assurance Statement

ISO9001 accreditation

ESS Earth Sciences is currently an AS/NZS ISO9001:2015 certified organisation.

This certification is evidence that sound practices are used to get high quality instrumentation to your organization within a reasonable time interval. Standard practices are used for all areas of manufacture, beginning with the efficient procurement of incoming orders, right through to shipment.

Stringent quality assurance procedures are applied to all aspects of manufacturing, including the calibration of scientific instruments against NATA traceable references. Every sensor is accompanied by a test and calibration certificate that can be used as reference information as well as evidence of sensor accuracy.

Terms of Warranty

The warranty covers part or complete replacement, repair or substitution of new instrumentation that has failed in part or completely within the warranty period. While every effort has been made to supply robust and user-friendly instrumentation, the warranty does not cover instruments incorrectly installed, misused or operated in conditions outside those specified. The warranty does not cover shipment costs for instrumentation, installation or removal and, under no circumstances whatsoever, indirect or consequential losses caused by the failed instrumentation.

ESS Earth Sciences believes the warranty conditions to be fair and just and in accordance with standard business practices worldwide. ESS Earth Sciences reserves the right to arbitrate any warranty issues and will ensure that warranty issues are treated with the highest standards of professional conduct.

At ESS Earth Sciences we believe your investment in our products and services is a good decision and we will therefore ensure all your requirements are met at all times, both now and in the future.

Background information

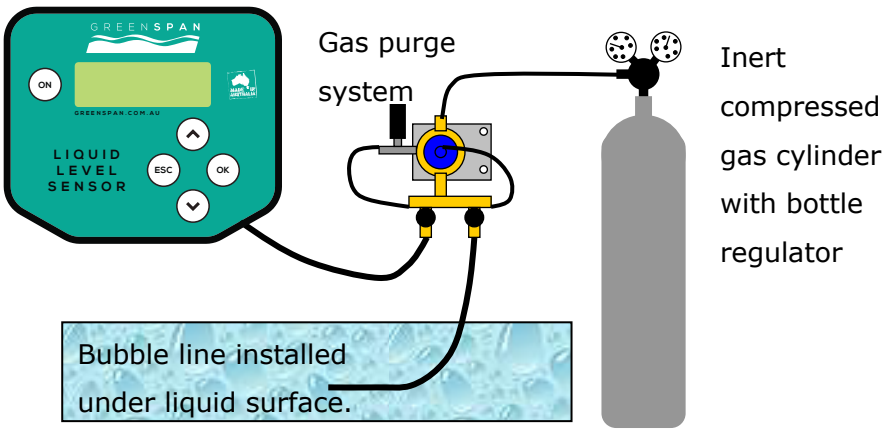
Level measurement using a gas purge system

Gas purge systems have been used for many years in the hydrographic industry, well before electronic pressure sensors were introduced. They provide a convenient method to measure water levels accurately without having to install sensitive instruments in water.

The principle of operation is simple. A gas purge system provides a close to static pressure condition inside a capillary tube. One end of the tube is installed under water, while the other is connected to the gas purge system and pressure sensing instrument, out of the water. To ensure water does not enter the submerged tube end (when the level increases), an inert gas (typically nitrogen) is pumped into the tube by the gas purge system. The flow rate is maintained extremely low, just enough to prevent water from entering the tube, while providing a static pressure condition. The pressure required to overcome the hydrostatic (head of water) pressure is therefore same at both ends of the tube. By measuring the pressure at the dry end, the pressure at the submersed end is determined. A simple calculation using pressure to head of water conversion is then made to determine water level.

A practical gas purge system consists of several components. Firstly a compressed gas is required for which low cost dry nitrogen is typically used. Nitrogen bottles are filled are at high pressure, around 15-20MPa (2000psi) hence a bottle regulator is used to reduce the pressure to around 400kPa (60psi). Gas is fed into a gas purge regulator also called a constant differential flow regulator as it regulates the flow with varying backpressure. Next, a capillary tube is required to carry the gas to below the water surface. One end is connected to the flow regulator output, while the other is installed under the water surface to be measured. The gas purge regulator is adjusted to produce a very low flow rate of approximately 50 cc/hour. The flow of gas is so low that it is always laminar producing only negligible friction effects. This is important as it results in almost zero pressure difference between tube ends, even if small internal diameter tube is used. Lastly, a pressure sensor is connected to the dry tube end for measuring the pressure in the system. Pressure is converted to level using liquid density and a standard for kPa to level conversion.

The PR-7100 is designe d to operate with all types of gas purge systems. A typical layout configuration is shown below.

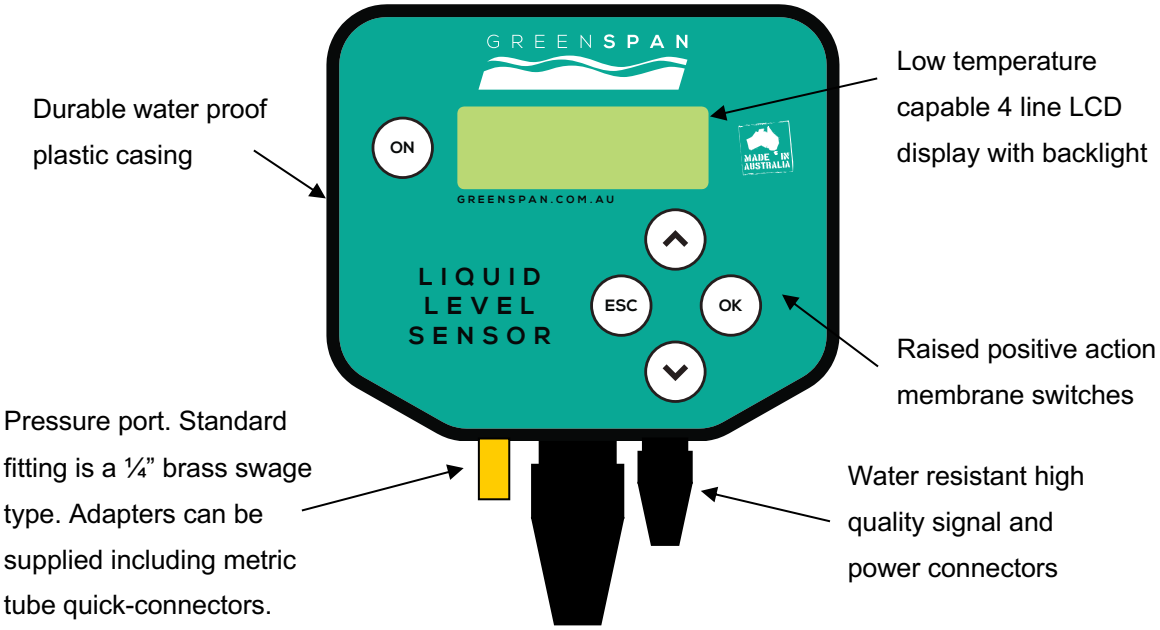


Sensor Description

The PR-7100 sensor is a microprocessor based pressure sensor, calibrated in kilopascals (kPa). Measurement is converted to a number of units including linear distance (metres and feet) of liquid head, volume and flow. A four line LCD display (dot matrix type) shows measurements, short messages and instructions for in-built functions. Configuration is via a keypad on the front display panel. Two multi-pole connector sockets are available for electrical connection and a ¼" tube fitting for pneumatic connection to the gas purge system.

The sensor enclosure houses all electronic and electromechanical components and provides IP67 protection. A 0.2µm hydrophobic filter is fitted on the bottom of the sensor to allow atmospheric pressure regulation inside the enclosure, thereby eliminating barometric pressure variations.

Every PR-7100 sensor is supplied with a signal cable, power cable and stainless steel wall mounting bracket, conveniently packaged in a sturdy, recycled cardboard carton. The figure shown below shows the basic sensor layout and major components.



Installation

Sensor installation

The PR-7100 must be wall mounted using the supplied stainless steel wall mounting bracket. Screws are supplied for fitting the bracket to the sensor. You must provide 2 wall mounting screws suitable for the wall material being used.

Equipment required:

- PR-7100
- Signal and power cables
- Connecting tube, ¼" nylon
- Wall mounting bracket and screws

} supplied with new sensor

- 2 screws for mounting to wall – to suit wall material
- Phillips head screwdriver, medium size
- 2 x adjustable spanners, 150mm minimum

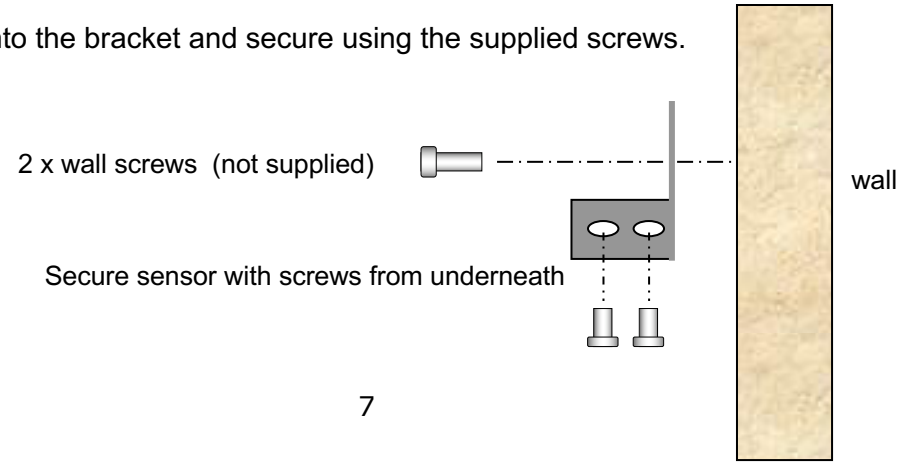
Some points to consider:

- The sensor must be installed out of rain, snow and direct sunlight. Air borne moisture and dust will not affect the sensor operation.
- A gas purge system must be installed according to the manufacturer's installation instructions. The system should ideally be installed close to where the sensor will be installed (within 1.5 meters (60").
- Single or dual line gas purge systems can be used, provided they operate according to specifications and there is one available ¼" tube port.
- The gas purge system sensor port must be fitted with an isolation valve to ensure the sensor can be isolated during gas purge system maintenance (capillary line purging).

Typically, a site shelter that offers protection from at least the above should be provided. Choose a suitable vertical wall section within, no more than 1.5 m (60") from the gas purge system. Also ensure that the display can be read easily without staff having to strain to achieve a suitable viewing position.

Fit the sensor bracket to the wall section using appropriate screws as shown below. If mounting the bracket onto a metal wall section, pilot holes should be pre drilled before fitting the bracket. Use plastic wall plugs and appropriate screws when fitting brackets to masonry walls.

Place the sensor onto the bracket and secure using the supplied screws.



Tube connection

The ¼" black nylon tube included with the PR-7100 is used to connect to the gas purge system. It must be fitted to the sensor pressure port and appropriate connection point on the gas purge system.

You MUST use two spanners to connect the ¼" tube to pressure port to prevent the mating tube fitting from rotating. The tube nut size is 9/16" and bulkhead fitting nut size, located at the bottom of the PR-7100, is 5/8".

To prevent damage to the PR-7100 always install an isolation valve in the connecting tube or at the purge system. Use the valve to isolation the sensor during capillary tube purge cycles.

The ¼" tube may be shortened or extended. Doing so has no significant effect on sensor performance as the pressure inside is static only (no flow).

- Connect the ¼" brass nut to the PR-7100 pressure port by hand until tight.
- Using two adjustable spanners, tighten the nut half a turn further.
- Connect the other end of the tube to the gas purge system. A fitting must be provided that accepts ¼" OD tubing. It is recommended to use a compression ferrule type fitting where the ferrule is crimped onto the tube end when the nut is tightened. Either brass or plastic fittings can be used. Using a spanner matching the nut size, tighten the nut onto the fully inserted tube. Typically only one and a half turns are required to crimp the ferrule.

Tightening the nut more than the recommended amount will result in eventual leaking of pressure. Do not tighten the nut more than necessary.

Crimp ferrule type fittings do not require the use of a sealing compound, unless specified in instructions. The fitting used must be suitable for the ¼" nylon tube as any variation in size will result in possible leaks. Please refer to your fitting supplier's instructions before proceeding.

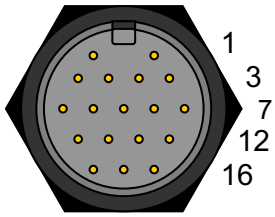
The ¼" tube can be extended using a ¼" tube union (or adapter for another size tube) and a length of suitable tube. Ensure any fittings are installed to the manufacturer's recommendations to ensure gas tight seals are formed. The quality of gas seals on fittings can be checked with a detergent and water solution. When applied to the outside of fittings, any leaks will result in the formation of many small bubbles around the area of the leak. Off the shelf leak test solutions are available from your gas fitting shop.

Sensor electrical connection

The PR-7100 sensor is supplied with 2 cables with connectors fitted to match the sensor sockets on the bottom of the sensor. The larger connector is used for connection of all signal lines while the smaller connector and cable is used only for providing 12VDC power. The following tables provide details of all signal and power connections.

Cable Conductor Designation – multi-pole connector

1	RED	Battery power +
2	BLACK	Battery power -
3	BLUE	Ground
4	BROWN	RS232 Rx (receive data)
5	WHITE	RS232 Tx (transmit data)
6	DARK GREEN	RS232 handshaking
7	YELLOW	SDI-12 data
8	VIOLET	High Level alarm output
9	GREY	Low Level alarm output
10	PINK	Analogue enable
11	ORANGE	Not used
12	RED-WHITE	Not used
13	BLACK-WHITE	Not used
14	ORANGE-WHITE	Not used
15	BROWN -WHITE	Not used
16	GREEN-WHITE	Not used – do not connect
17	LIGHT GREEN	Analogue output (voltage)
18	BLUE -WHITE	Analogue output (current)



Plug with cable

Front View

Battery Power +

Use this connection to supply power to the sensor. Power must be between +10 and +15V DC. Supply is reverse bias protected using a diode. When power is applied, the sensor switches on briefly to indicate power connection. Thereafter the ON button must be pressed to obtain readings or configure the sensor for operation. To automatically output measurements on analogue output, you must connect Switched Power Enable (PINK pin 10) to power supply +ve.

Battery Power -

Use this connection to supply power return (-ve) to the sensor. This input is directly connected to sensor analogue and digital ground.

Ground

Connected directly to sensor analogue and digital ground.

RS232 Rx

This connection is an input that allows the sensor to accept RS232 commands from a controlling device (DTE). All RS232 parameters are fixed except the baud rate. Input must be via a true RS232 driver that can provide the correct signal levels.

RS232 Tx

The PR-7100 sensor outputs RS232 data at 5.0V EIA/TIA-232 levels. All RS232 parameters are fixed except the baud rate. Select the desired baud rate through the Settings menu. Only one digital output can be selected at any one time.

SDI-12 data

The SDI-12 data line is used exclusively for SDI-12 bi-directional communication. This line remains at high impedance until the sensor responds to a correctly addressed command at which time a 0-5V logic data signal is transmitted to the

SDI-12 controller in accordance with SDI-12 protocol version 1.3.

High Level Alarm Output

This connection is will be driven from 0V to 5V when the preset threshold for the "high" level alarm is exceeded. See page 28 for alarm setup instructions.

Low Level Alarm Output

This connection is will be driven from 0V to 5V when the preset threshold for the "low" level alarm is exceeded. See page 28 for alarm setup instructions.

Analogue Enable

Connect this line to supply +ve (RED). It effectively forces analogue output whenever power is applied to the sensor. This feature is required for data loggers and recorders that provide a switched power output whenever measurements are taken. When power is removed the sensor turns off completely.

Analogue Output - Voltage

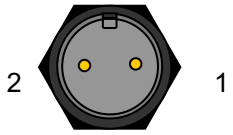
This connection will output voltage (0-1V or 0-2.5V) in proportion to measurements with reference to ground. A high impedance voltage input equipped recorder can be used to measure the output on this connection. Select voltage output by configuring the sensor through the Settings menu. Only one analogue output can be selected.

Analogue Output - Current

Use this connection if 4-20mA output signal is desired. It is a ground referenced current *source* that can be connected to current measuring devices. For 12 volt operation, the load resistance must not exceed 450ohms (900 ohms for 24 volt). Select current output by configuring the sensor through the Settings menu.

Cable Conductor Designation – 2 pin power connector

1	RED	Battery power +
2	BLACK	Battery power -



Battery +12Vdc - RED

The red wire is used for +12Vdc battery supply and is protected by a reverse protection diode to prevent sensor damage if the polarity is accidentally reversed.

Ground 0Vdc – BLACK

Power supply ground connection.

7100 Sensor Output Configuration

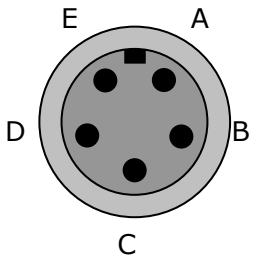
The following details show sensor electrical connections for interface to specific recorder/ controllers (using appropriate sensor configuration settings).

Digital (SDI-12) Mode Electrical Connection

To operate the PR-7100 sensor in SDI-12 mode, only 3 connections are required. The DC power cable is not required as the SDI-12 recorder/ controller will provide continuous power to the sensor. While power is supplied, the sensor is in a sleep state that causes very little power draw. Incoming commands will be processed only if the sensor address programmed during configuration matches the command address character. In SDI-12 mode the sensor will only respond to fully compliant SDI-12 commands that include the “break” character.

The table below shows the pin-out for an ESS SDI-12 connector used for connecting sensors to SDI-12 enabled recorder/ controllers.

7100	**Colour**	**Designation**	**5-pin male plug**
1	RED	Supply +ve	A
3	BLUE	Ground	C
7	YELLOW	SDI-12 data	B

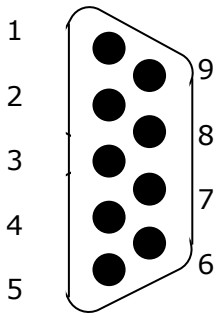


Digital (RS232) Mode Electrical Connection

To operate the PR-7100 sensor in RS232 mode, 3 terminations are required. The DC power cable is required as the RS232 DTE does not provide continuous power to the sensor. While power is supplied, the sensor is in sleep mode where very little power is drawn. An incoming, correctly addressed RS232 command will cause the sensor to wake and process the command. No handshaking is required as the PR-7100 sensor wakes upon an incoming RS232 command. During command processing the sensor display remains off.

The table below shows connection to a 9 pin female “D” connector that connects directly to a computer serial port.

7100	**Colour**	**Designation**	**RS232**	**9-pin D female**
5	WHITE	RS232 Tx	RxD	2
4	BROWN	RS232 Rx	TxD	3
3	BLUE	Ground	Ground	5



2 pin power cable

1	RED	Supply +ve
2	BLACK	Ground

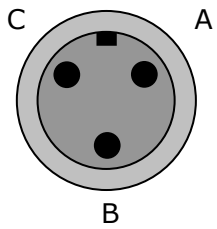
Analogue Power Mode Electrical Connection - Voltage

The PR-7100 sensor can be configured to output analogue signals in two modes, continuous and switched. For continuous mode the sensor is powered (and ON) continuously and remains in this state indefinitely. Use this mode to connect to recorders/ controllers that require a continuous signal such as PLCs. You must connect the PINK (pin 10) wire to supply + (RED, pin1) to force continuous output.

For switched power mode, connect the sensor the same way (as shown below). The recorder must be able to switch sensor power on and off as required. While switched on, the sensor operates as a continuously powered sensor. While switched off, the sensor draws zero power. Configure the sensor to output either 0-1V or 0-2.5V.

The table includes pin-out for an ESS analogue connector used for connecting sensors to analogue input equipped devices.

7100	**Colour**	**Designation**	**3 pin male plug**
1	RED	Supply +ve	A
3	BLUE	Ground	C
17	LIGHT GREEN	Voltage signal output	B
10	PINK	Analogue Enable Connect to Supply +ve	A



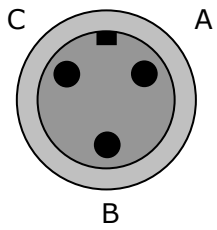
Analogue Mode Electrical Connection – 4-20mA Current Loop

The PR-7100 sensor can be configured to output analogue signals in two modes, continuous and switched. For continuous mode the sensor is powered (and ON) continuously and remains in this state indefinitely. Use this mode to connect to recorders/ controllers that require a continuous signal such as PLCs. You must connect the PINK (pin 10) wire to supply + (RED, pin1) to force continuous output.

For switched power mode, connect the sensor the same way (as shown below). The recorder must be able to switch sensor power on and off which provides the power switching control. While switched on, the sensor operates as a continuously powered sensor. While switched off, the sensor draws zero power.

The table includes pin-out for an ESS analogue connector used for connecting sensors to analogue input equipped devices.

7100	**Colour**	**Designation**	**3 pin male plug**
1	RED	Supply +ve	A
3	BLUE	Ground	C
18	BLUE-WHITE	Current signal output	B
10	PINK	Analogue Enable Connect to Supply +ve	A



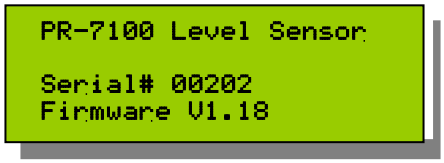
Operation

Manual Mode

In manual power mode the sensor will take a level measurement and display it on the LCD display. Connect the 2 pin DC power cable to a 12V battery and sensor DC power socket.

Once power is connected to the sensor

display shows (serial no. example only)



To obtain a measurement from the sensor:

Press ON Display shows

To switch off, do not press any keys for 25 seconds. The sensor will automatically switch off thereafter or revert to another power mode.

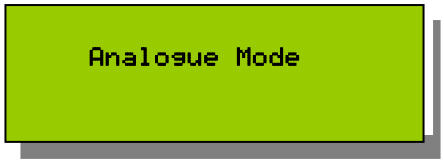
You may also press ESC twice to switch the sensor off.

Display shows

Or the sensor will revert to another power mode

If the sensor is configured to continuous

Analogue power mode, display shows:

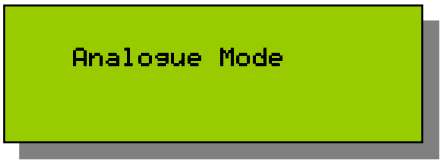


Analogue Output Mode

In analogue output mode the sensor will take a level measurement and output a corresponding analogue voltage or current signal (depending on configuration). While switched or continuous power is applied with the Analogue Enable terminal connected to supply +ve, analogue output will be active continuously and updated as level changes occur.

While switched DC power is applied,

the display will show:

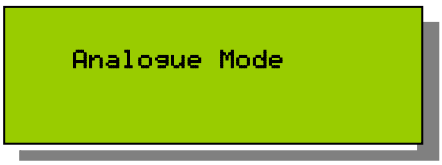


To display the current measurement:

Press ON Display shows

To switch off displayed value and revert back to Analogue Output Mode:

Press ESC twice. Display shows



Or simply wait for around 25 seconds. The unit will automatically switch back to Analogue Power Mode, as this is the prevailing mode.

Analogue Output Mode always takes preference over Manual Mode. If the display is activated to show a reading while in Analogue Output Mode, the analogue output will not be interrupted.

Analogue output is available and stable after one second from the time switched power is applied. Switched power is typically removed after a reading has been attained. However it may be permanently applied to allow continuous analogue output used for devices requiring continuous signal such as PLCs. In doing so, continuous power consumption will result (see Specifications).

Any incoming SDI-12 or RS232 commands with an address matching the sensor address will be processed as highest priority. This ensures digital sensor data is unaffected while users are configuring the sensor or viewing measurements on the display.

Digital Output Mode

The PR-7100 provides digital output as either SDI-12 or user configurable RS232.

SDI-12 Output

To obtain a reading from the PR-7100 sensor in SDI-12 mode, it must be connected to a fully compliant SDI-12 controller device (SDI-12 protocol version 1.3).

In SDI-12 mode the sensor is permanently powered by the 12Vdc supply from the recorder/ controller or through the dc battery power cable. Incoming SDI-12 commands will only be processed if the preceding address matches the set sensor address. A correct SDI-12 command received will invoke a sensor response according to the protocol as summarized below.

The SDI-12 command/ response sequence causes the sensor to switch on, respond to the command and switch off. As the sequence takes less than 1 second, there is no visible activity on the display.

☞ **If the sensor was started in manual or analogue power mode, a correctly addressed SDI-12 command will be processed as priority and override all other modes.**

SDI-12 Command Set

Command	Response	Description
?!	a	reveals sensor address
Eg: **?**!	1 <CR><LF>	sensor address is "1"
a**I**!	a13ccccccmmmmmmvvvsssss	sensor identification
Eg. 1**I**!	118ESSearth PR-7100 11220202	
a**M**!	atttn	buffers new measurement
Eg. 1**M**!	10301<cr><lf>	address 1, 030s measurement
	1	time, 1 data field, service
request (1)	sent when reading is available	
a**D0**!	apd.ddd	returns buffer contents or
Eg. 1**D0**!	1+1.234	measurement.
	1+0001.234	leading zeros ON
a**R**!	apd.ddd not implemented	returns new measurement
Eg. 1**R**!	1+1.234 in version 1.21	without D0! Command
	1+0001.234	leading zeros ON
a**A**b!	ar	change sensor address
Eg. 1**A**2!	21	from 1 to 2

a	= sensor address	1 character	
b	= new sensor address	1 character	
ttt	= measurement time (secs)	3 characters	%
n	= number of data fields	1 character	
p	= polarity (+ or -)	1 character	#
r	= return code (1 = all ok)	1 character	
dd.ddd	= measured data	variable	*
cccccccc	= Vendor ID	8 characters	
mmmmmm	= sensor model	6 characters	
vvv	= sensor firmware version	3 characters	
sssss	= sensor serial number	5 characters	

Leading zeros can be switched off and on through the *Settings – Communications – SDI-12* menu (see examples above). When switched on, the response from the PR-7100 sensor is always of fixed length, no matter the value. When leading zeros are off, the string length can vary according to the actual sensor output

1+0001.234	leading zeros ON
1+1.234	leading zeros OFF

Polarity sign, whether + or – will always be included in response.

% The PR-7100 sensor has a variable measurement time depending on the measurement sequence parameters programmed in *Settings – Pump Settings* and if averaging is used (averaging implemented in version 1.21).

RS232 Output

Every PR-7100 sensor has an RS232 interface fitted as standard and is accessible using the designated wires in the signal cable. A 9 pin “D” connector, suitable for direct connection to most RS232 equipped communication equipment, can be factory fitted to allow easy connection. The PR-7100 sensor is a Data Communication Equipment (DCE) device and can be directly connected to Data Terminal Equipment (DTE) which includes modems, computers and telemetry systems.

Communication parameters:

To communicate to the PR-7100 sensor via RS232, the DTE must be configured with the parameters shown below. No handshaking is required as the PR-7100 wakes upon incoming commands. The sensor baud rate is adjustable through the Settings menu.

Baud rate = 1200 to 115000 bps
Parity = none
Data bits= 8
Stop bits= 1

When sending RS232 commands, you must send the <carriage return> character at end of command strings.

Menu Functions

When the sensor is switched on and a reading is being displayed, pressing any button (except ON) will enter the menu mode. In this mode the configuration of the sensor can be adjusted.

To obtain a measurement from the sensor:

Press ON

Display shows

Press any other key to enter the menu mode

To navigate through the menus, use the following:

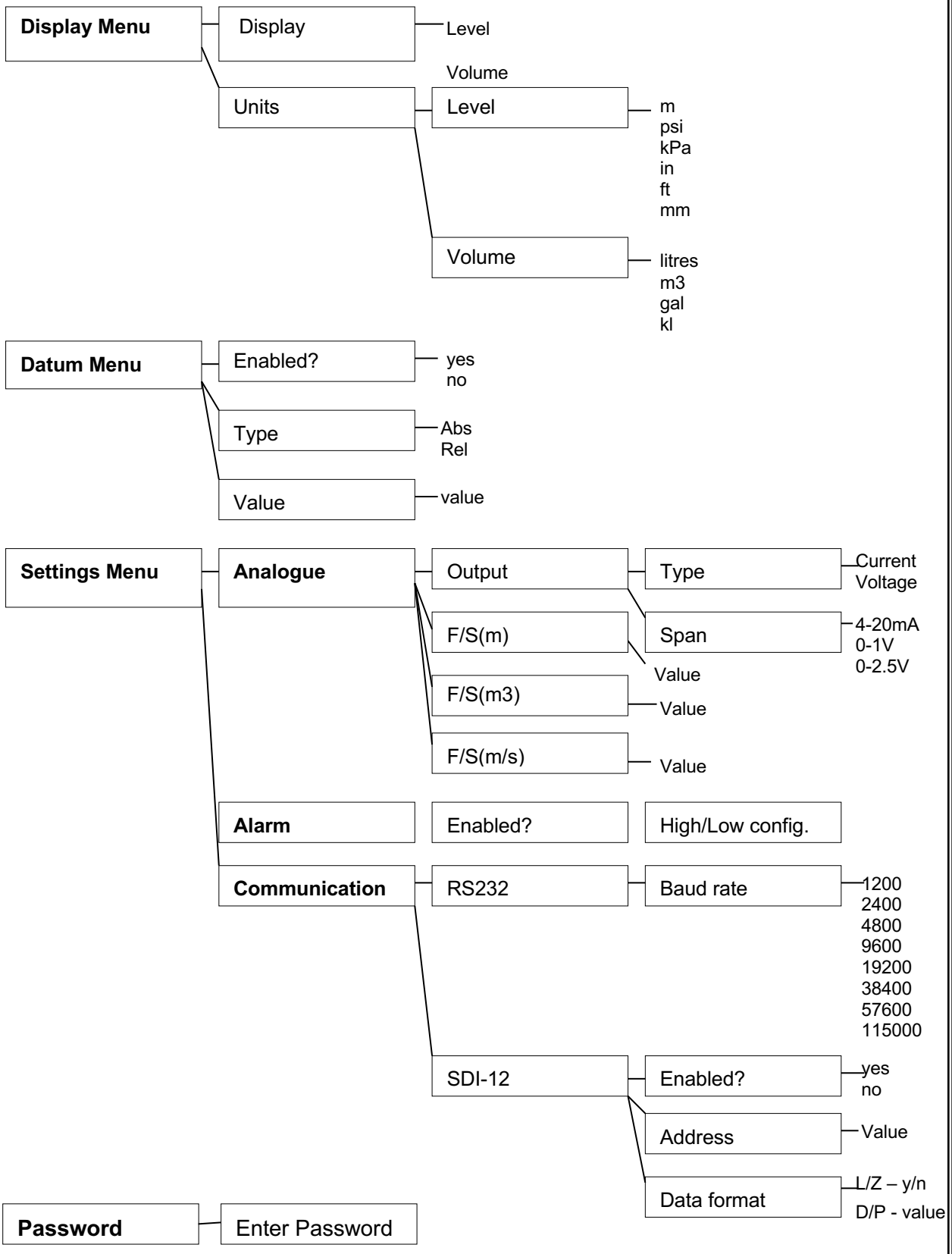
Use ^ and v keys to scroll through menu items.

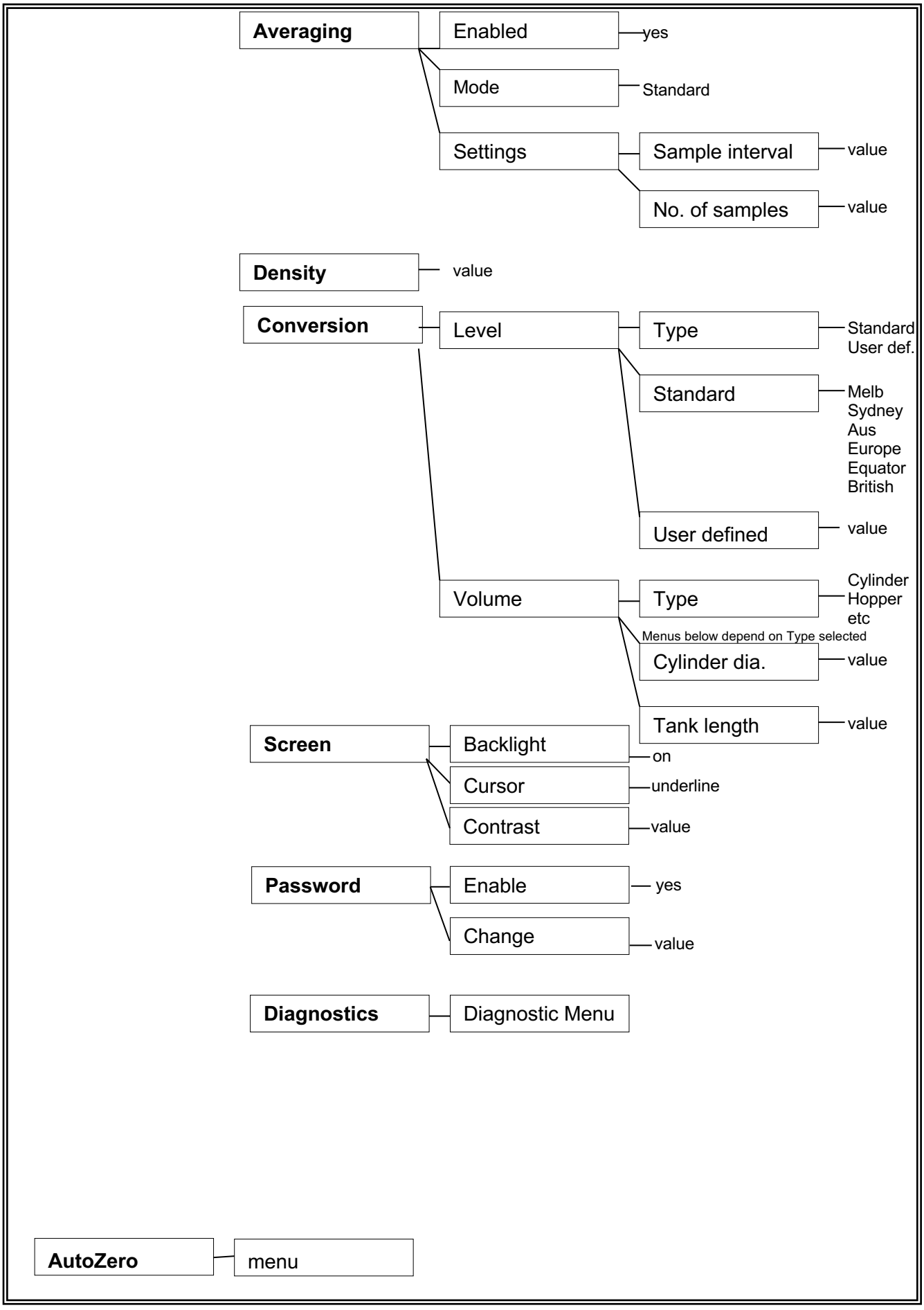
Use OK to enter into a sub-menu item or confirm and save a change.

Use ESC to revert back to the previous menu level or cancel an operation.

Pressing ESC while in the highest menu level will cause the sensor to switch off completely or revert to the previous power mode.

Main Menu Structure

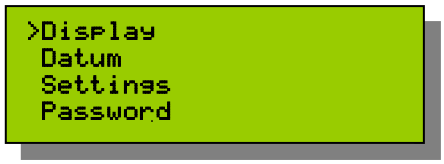



Averaging
Enabled
yes
Mode
Standard
Settings
Sample interval
value
No. of samples
value
Density
value
Conversion
Level
Type
Standard
User def.
Standard
Melb
Sydney
Aus
Europe
Equator
British
User defined
value
Volume
Type
Cylinder
Hopper
etc
Menus below depend on Type selected
Cylinder dia.
value
Tank length
value
Screen
Backlight
on
Cursor
underline
Contrast
value
Password
Enable
yes
Change
value
Diagnostics
Diagnostic Menu
AutoZero
menu

Display Menu

Access the display menu by pressing any button except ON while the sensor is showing measurements.

Display will show



Press OK to enter submenu

or

Press ⌄ to move cursor

Display: shows the currently displayed parameters when readings are taken.

Units: shows the currently displayed unit when readings are taken.

Display menu - Display

Press OK to enter

Press ⌄ or ⌃

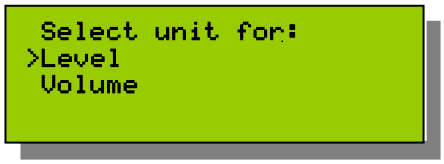
Level: Selecting this parameter outputs a linear distance of liquid level

Volume: Selecting this parameter outputs a volume of liquid in accordance with a particular vessel shape.

Press OK on the selected parameter to save the setting

Display menu - Units

Press OK to set parameter

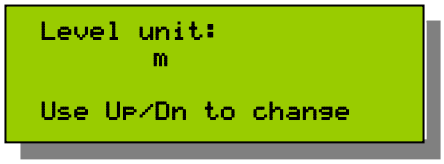


Press ⌄ or ⌃

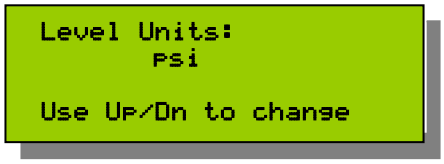
Each parameter has different units. Use this menu to select which parameter you want to change the units of measurement for.

Display menu – Units – Level

Press OK to set units



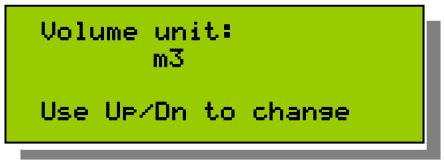
Press ⌄ or ⌃



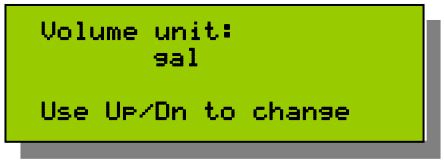
mm	all measurements are in millimeters using kPa to meters conversion
m	all measurements are in meters using kPa to meters conversion
psi	raw pressure output in pounds per square inch
kPa	raw pressure output in kilo Pascals
in	all measurements are in inches using kPa to feet conversion
ft	all measurements are in feet using kPa to feet conversion

Display menu – Units – Volume

Press OK to set units

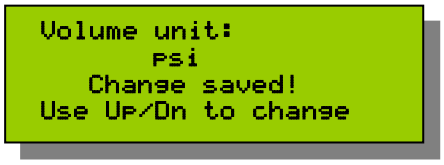


Press ⌄ or ⌃



lit	all measurements are converted to liters using selected tank shape
m3	all measurements are converted to cubic meters using selected tank shape
gal	all measurements are converted to imperial gallons using selected tank shape
kl	all measurements are converted to kiloliters using selected tank shape

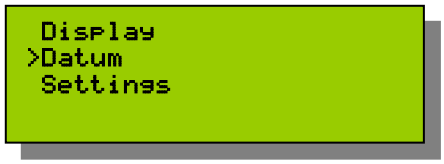
To save press OK



Datum Menu

Sensor measurements can be referenced to a known level called datum offset. Two types of datum offset calculations are available as shown below. Access the datum menu by pressing any button except ON while the sensor is showing measurements.

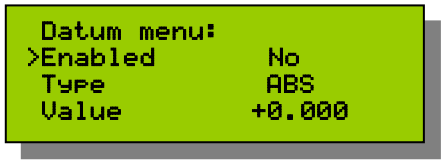
Display will show



Press OK to enter submenu

or

Press ⌄ to move cursor



Enabled: set to YES to add datum value to reading.

Type: shows the type of datum used.

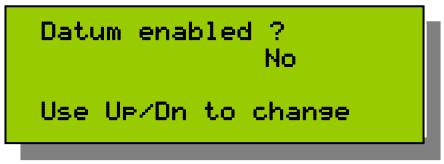
ABS Datum offset value is added to all readings.

REL Reading is taken. Datum is subtracted from reading and result is added to reading. This has the effect of forcing the current reading to be the same as the datum offset. Use this when entering exact staff gauge reading for water level measurement

Value: This is the datum offset value to be used in the calculation.

Datum menu - Enabled

Press OK to enter



Press ⌄ or ⌃

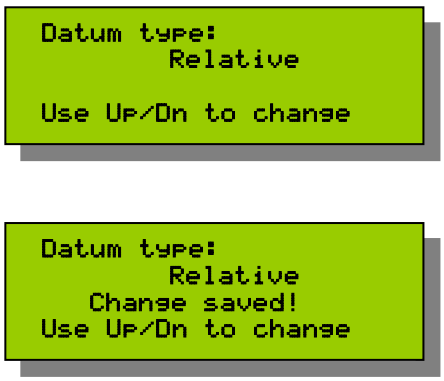
Press OK to save parameter setting

Datum menu - Type

Press OK to enter

Press ⌄ or ⌃

Press OK to save



Datum menu - Value

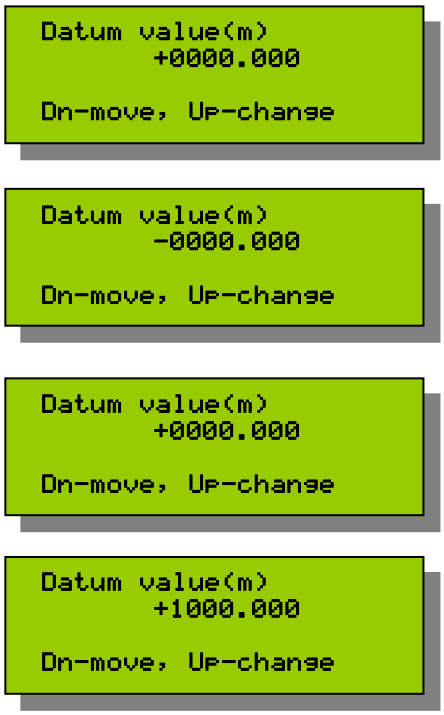
Press OK to enter

Press ⌃ to change sign

or

Press ⌄ to move one character to the right

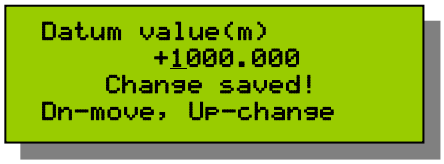
Press ⌃ to increase digit



Example only.

Continue this process to adjust all digits. Once finished,

press OK to save the new value.



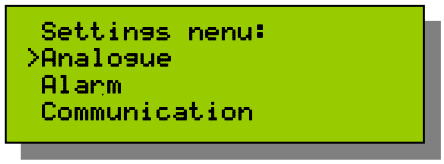
Note: Datum values only apply to digital output (SDI-12 or RS232). Analogue output (voltage or current) is not affected by the datum value. Datum for analogue output is typically applied within the recorder/ controller to which the sensor is connected.

Settings Menu

The Settings menu is used to configure the sensor for the desired operation and includes functions to set up analogue and digital output as well as housekeeping functions. Each Setting menu item is described in detail in the following sections.

To access the Settings menu it must be unlocked first by entering a password (see Main Password, page 31). By default, the Settings menu is unlocked.

Press OK to enter submenu



Analogue

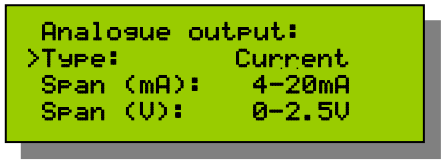
Use the analogue menu to set the type and range of analogue output. Two types are available, current and voltage. The full scale analogue output can be adjusted, effectively re-ranging the sensor. Full scale adjustment must be set for level, volume and discharge separately.

Press OK to enter submenu

Settings – Analogue – Output

Use this menu to select either current (4-20mA only) or voltage output. Select the span for the type of analogue output by entering the respective submenus.

Press OK to enter submenus



Use ^ to change to Voltage output and press to save OK

Settings – Analogue – F/S(m)

Use this parameter to assign the full scale level, pressure, volume or flow for analogue output. The value selected here will be that represented by 20mA (current) or 1V/ 2.5V (voltage). Enter the value desired in the next submenu.

Press OK to enter submenu

Press ^ to change to sign/ value

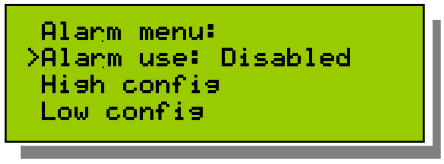
Press v to move one digit to the right. Press OK to save.

Change the volume full scale (F/S(m3)) and discharge full scale (F/S(m3/s)) in the same way. Please note that discharge is not implemented in version 1.22.

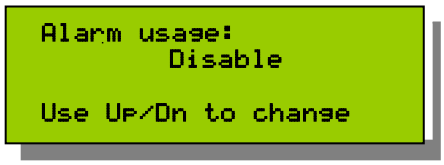
Alarm

A digital output provides alarm control for external devices. Output is at 0V when off and at 5V when active. This is a low current driver capable of driving high impedance external circuitry only.

Press OK to enter submenu



Enable or disable the alarm as required



Set the high alarm trigger level

and reset level in the next menu

Set the low alarm trigger level

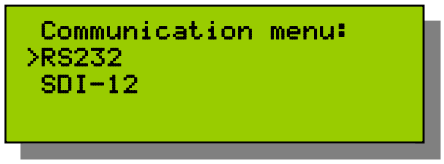
and reset level in the next menu

Use both high and low alarms to set an alarm window. You must however ensure the high trigger and reset values are always higher than the low alarm values or the alarm may never trigger and/or reset.

Communication

The Communication menu is used to configure digital output. Both RS232 and SDI-12 settings can be adjusted as shown in the following menus.

Press OK to enter submenu



Settings – Communication – RS232

Only the baud rate can be adjusted for RS232 communications. All other parameters remain fixed as shown below:

No. of data bits: **8**
No of stop bits: **1**
Parity: **none**

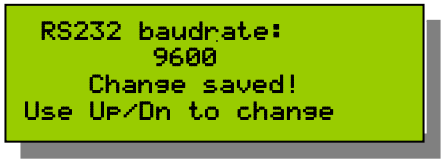
To set RS232 baud rate:

Press OK to enter submenus

Set the baud rate compatible with the DTE device to which the sensor is connected. The possible baud rates are shown below:

1200
2400
4800
9600
19200
38400
57600
115000

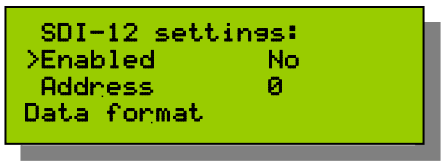
Use ⌄ or ⌃ to change baud rate, press OK to save



Settings – Communications – SDI-12

The SDI-12 settings menu can be used to enable SDI-12, set sensor address and configure the output data format.

Press OK to enter submenus



Change the status to "Yes" to activate SDI-12 communications. You cannot use RS232 output in this mode, however, this does not affect analogue output which can be used simultaneously, as previously configured.

Address

Press OK to enter submenus

Use or to change

Data Format

Use this menu to change the SDI-12 output data format. This feature is particularly useful when recorders require a particular format to ensure data is received correctly at all times. Leading zeros ensures the data string is always of a fixed length while the number of decimal points can be changed to allow output of very large or very small numbers.

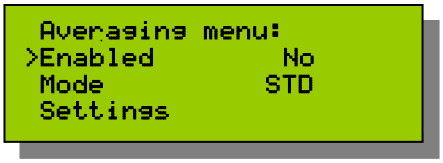
Use the respective menus to set leading zeros off or on and set the number of decimal points between 0 and 4.

Note: The PR-7100 is able to output numbers up to 8 digits. When outputting large numbers (level in mm or inches, volume in litres etc), set the number of decimal places to 0 or 1. Similarly, set the number of decimal places to 2,3 or 4 when outputting small numbers.

Averaging

The Averaging menu allows users to configure the sensor to take several readings that are averaged. The averaging process outputs the average reading of a pre-programmed number of readings.

Press OK to enter submenus



Averaging – Enabled

Select YES to enable averaging output.

Averaging – Mode

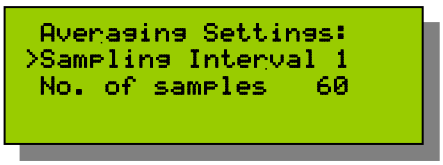
Select standard averaging (STD) for typical averaging whereby a number of readings are added then divided by number of readings at the end of the process. Select Running (RUN) for producing running average that takes the last number of readings to produce an averaged reading every consecutive reading. This function is only available for PR-7100 sensors, not PR-7200 sensors.

Press OK to enter submenu and ⌄ to change

Averaging – Settings

This menu allows users to change the averaging parameters as required. There are two parameters, sample interval and number of samples. The total averaging time is the product of sample interval (in seconds) and no. of samples. For running averaging the averaging time is the same as the sample interval (7100 only).

Press OK to enter submenu



Sample Interval

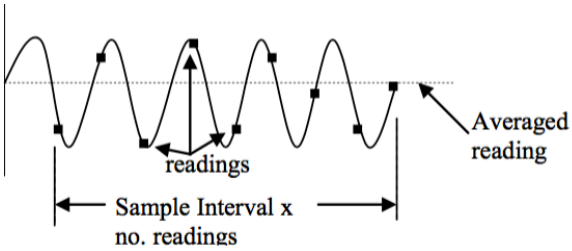
Change the sample interval between 1 and 60 seconds. The sample interval is the time between readings in seconds. When selected, the averaging process forces the sensor to take level readings at this interval. The number of readings taken depends on the programmed number of readings (see No. of Samples).

No. of Samples

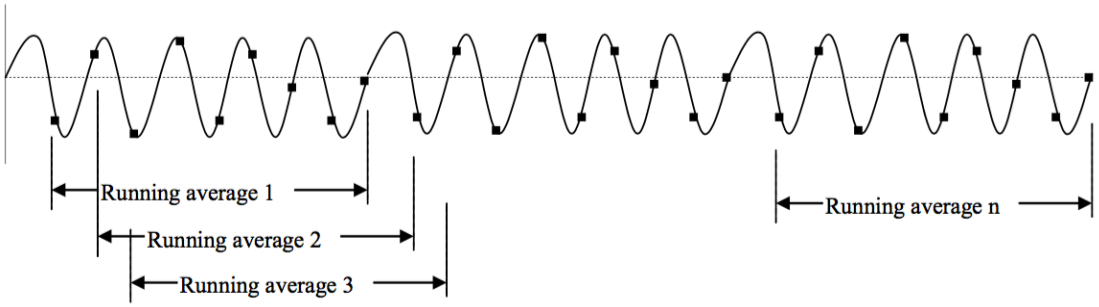
Select the number of samples for averaging between 2 and 60. Number of samples is the number of individual level readings the sensor will take before outputting an averaged reading. Total averaging time is the number of samples x sample interval (minimum 2 seconds, maximum 3600 seconds).

Standard Averaging – sensor takes a number of readings, adds all readings together and divides total by number of readings. This produces an averaged reading even if some or all readings vary substantially. Use this setting to measure tidal levels with waves superimposed onto desired sea level reading. Once reading is output, a new averaging interval begins.

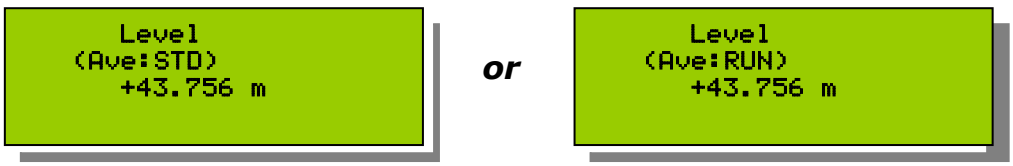
$$\text{Averaged reading} = \frac{\text{Sum } \{ \text{reading}_1 + \text{reading}_2 + \text{reading}_n \}}{\text{No. of readings}}$$



Running Averaging – sensor takes a number of readings, adds all readings together and divides total by number of readings as per Standard Averaging. In standard averaging the process begins anew once the averaged reading is output for the first time. For running averaging and output is generated after each sample interval using the latest no. of samples. This way an averaged reading is output much faster after every sample interval (1 to 30 seconds). The sensor remains on continuously in this mode as this is a continuous output.



When averaging is enabled the main display will show that the reading is averaged. Running average is only available for PR-7100. For example:



Density

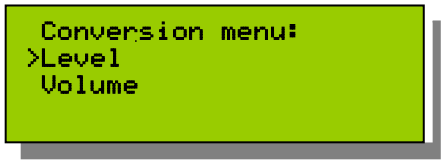
When measuring level in liquids of density other than fresh water, a density factor can be programmed into the sensor to ensure pressure to level conversion remains accurate. For this sensor a relative density is assumed whereby freshwater (ultrapure) has a density of 1.0000.

Liquid density is the ratio of weight to volume. Fresh water is lighter than seawater, therefore seawater has a higher density. Some liquids other than water have a density less than 1. Simply enter the density of the liquid in the above menu. The readings taken thereafter will be automatically converted to the correct level.

Conversion

The conversions menu is used to set the type of conversion used by the sensor to provide a calculated output.

Setting – Conversion – Level



Use the level conversion menu to select kPa to distance conversion factor. All conversions are based on mm/kPa units.

Type: Select between a Standard and user defined conversion

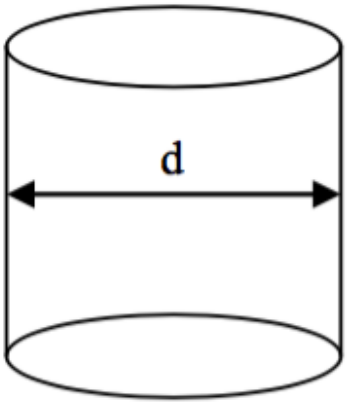
Standard: If a STD conversion type is used, this submenu allows selection the standard used to convert kPa to millimeters water.

Standards:	Australian	102.15mm/kPa	British:	101.97 mm/kPa
	Sydney:	102.07 mm/kPa	Europe:	101.85 mm/kPa
	Melbourne:	102.04 mm/kPa	Equator:	102.25 mm/kPa

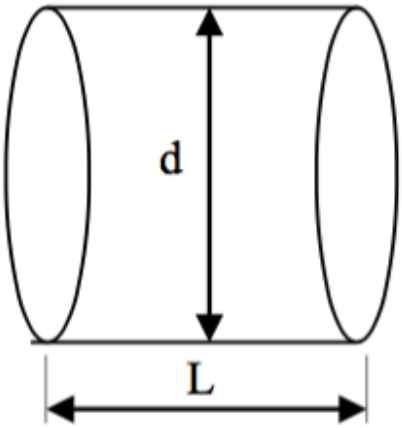
User defined: If a user defined type is used, this submenu allows entry of a non standard conversion in mm/kPa.

Settings – Conversion – Volume - Cylinder

Vertical cylinder (tank) is oriented as shown. Enter diameter (d) of the tank only. Level sensor will calculate tank volume based on measured height of liquid. For bubble tubes installed with end fitting above tank floor, use Datum menu to adjust volume.

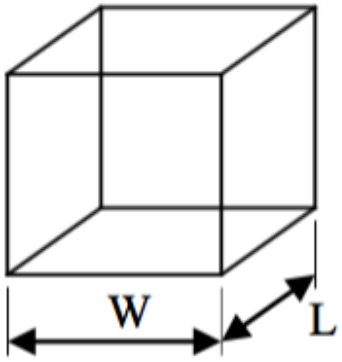


For horizontally oriented cylindrical tank, enter diameter (d) and length (L) as shown. Ensure internal dimensions are used only. For bubble tubes installed with end fitting above tank floor, use Datum menu to adjust volume.



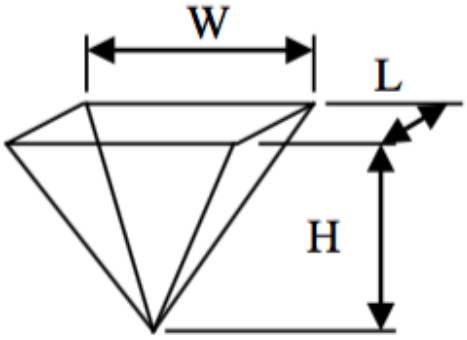
Settings – Conversion – Volume - Box

Box shaped tanks have vertical sides as shown. Enter length (L) and width (W) of the tank only. Level sensor will calculate tank volume based on measured height of liquid. For bubble tubes installed with end fitting above tank floor, use Datum menu to adjust volume.



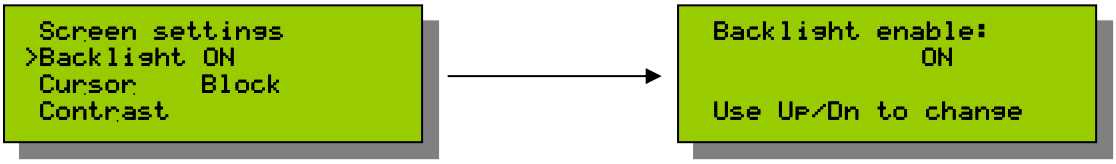
Settings – Conversion – Volume - Hopper

This is an inverted pyramid shape commonly used in the process industry. Enter length and width dimensions in reference to height (H) . Level sensor will calculate tank volume based on measured height of liquid. For bubble tubes installed with end fitting above tank floor, use Datum menu to adjust volume.

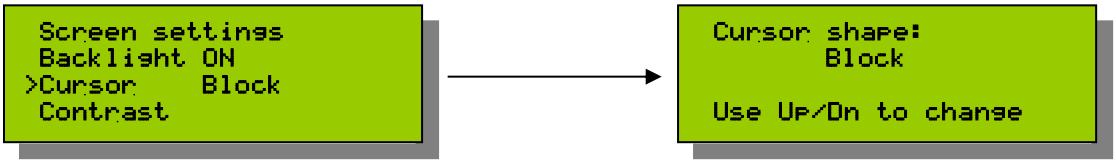


Screen

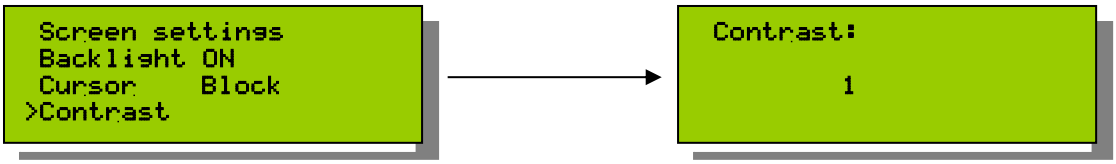
Use this menu to adjust screen settings.



The display backlight can be switch on an off using this menu.



By default the cursor is a flashing block. Use this menu to change it to underline if desired.

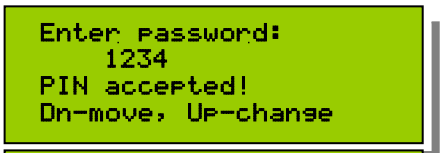


Display contrast can be adjusted in this menu between 1 and 7.

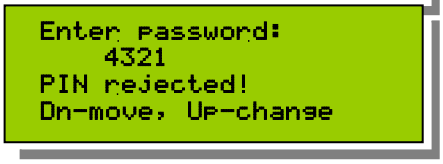
Password

By default the settings menu can be accessed at all times. However users have the facility to password protect the settings menu to prevent unauthorized access. Once a password has been enabled in the settings menu, this menu is only available after the password is entered to unlock it. To unlock the Settings menu you must enter the correct password consisting of 4 numbers between 0 and 9. This must be done in the main menu.

Once password is entered press OK. If correct:

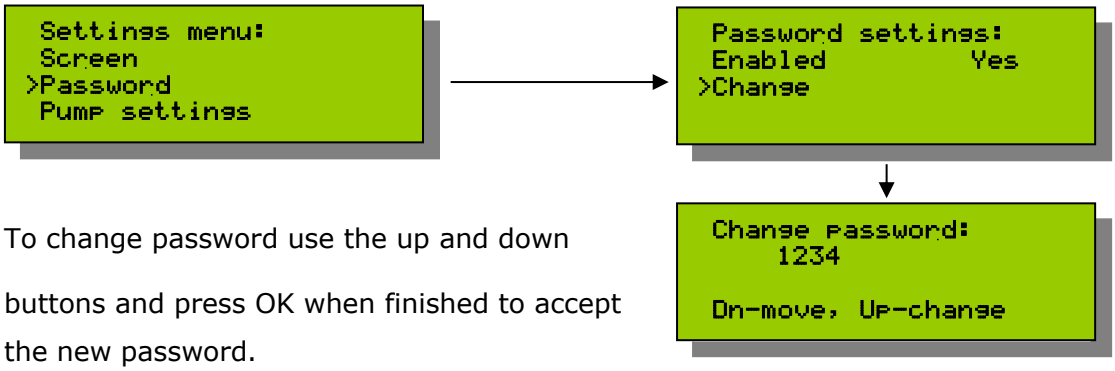


or if incorrect:



To lock the Settings menu again, enter the password again until it is accepted.

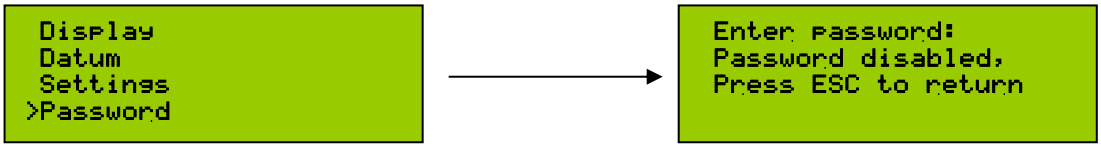
To change the password and enable/ disable you must get access to the Settings menu.



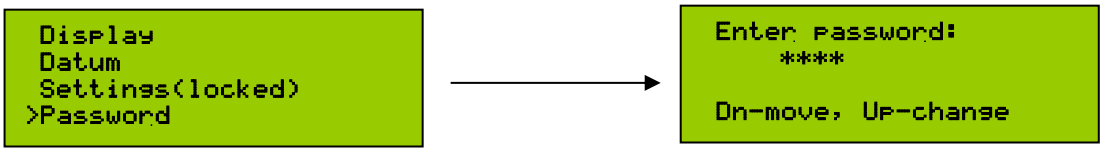
To change password use the up and down buttons and press OK when finished to accept the new password.

The password menu allows you to enable or disable a password used to protect the sensor settings from unauthorized access. When in the Main Menu, the password must be entered to allow access to the Settings menu only. All other menus are freely accessible.

If password is disabled:

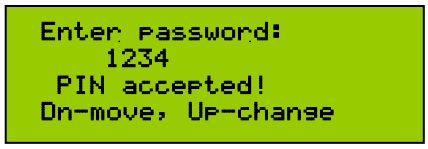


If password is enabled:

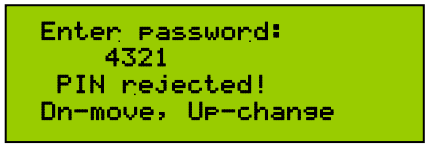


To unlock the Settings menu you must enter the correct password consisting of 4 numbers between 0 and 9.

Once password is entered press OK. If correct:



or if incorrect:

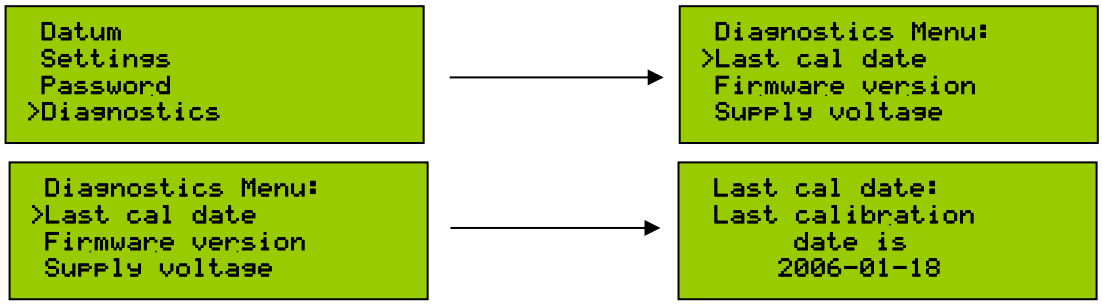


To lock the Settings menu again, enter the password again until it is accepted.

Diagnostics

The diagnostics menu provides details of basic internal sensor parameters. While these provide information only, they are very useful while diagnosing technical difficulties when setting up the sensor. The calibration date parameter provides the date of last factory calibration.

Press OK to enter diagnostics menu



Shows date of last calibration (yyyy-mm-dd)

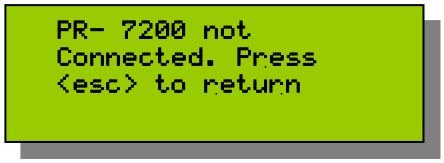
Shows currently loaded sensor firmware version

Shows current supply voltage available to sensor.

Shows current internal sensor temperature

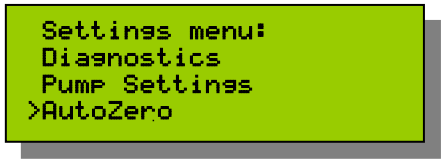
Pump Settings

The PR-7100 does not have a pump system connected. This menu is only available when the PR-7100 is embedded in the PR-7200.

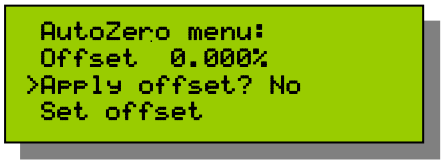


Settings - AutoZero

Autozero is used to counteract long term sensor drift due to sensor ageing. The expected drift Is typically very small and is due to thermal stress relief of silicon strain gauge components



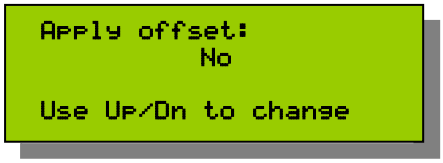
Press OK to enter submenu



Offset shows the amount of offset that was added to bring the atmospheric pressure reading back to zero. This value is automatically adjusted by the sensor after the Autozero is carried out.

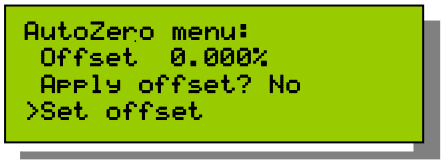
You are able to select whether or not to use the offset. If you select "No", any offset value will not be added to the sensor reading. Selecting "Yes" will added the offset shown above.

Press OK to enter submenu

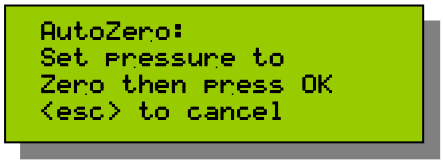


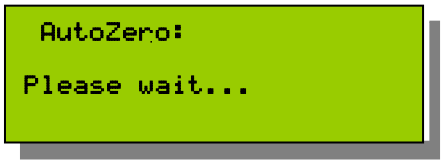
When back in previous menu,

Press OK to enter submenu



Press OK to AutoZero

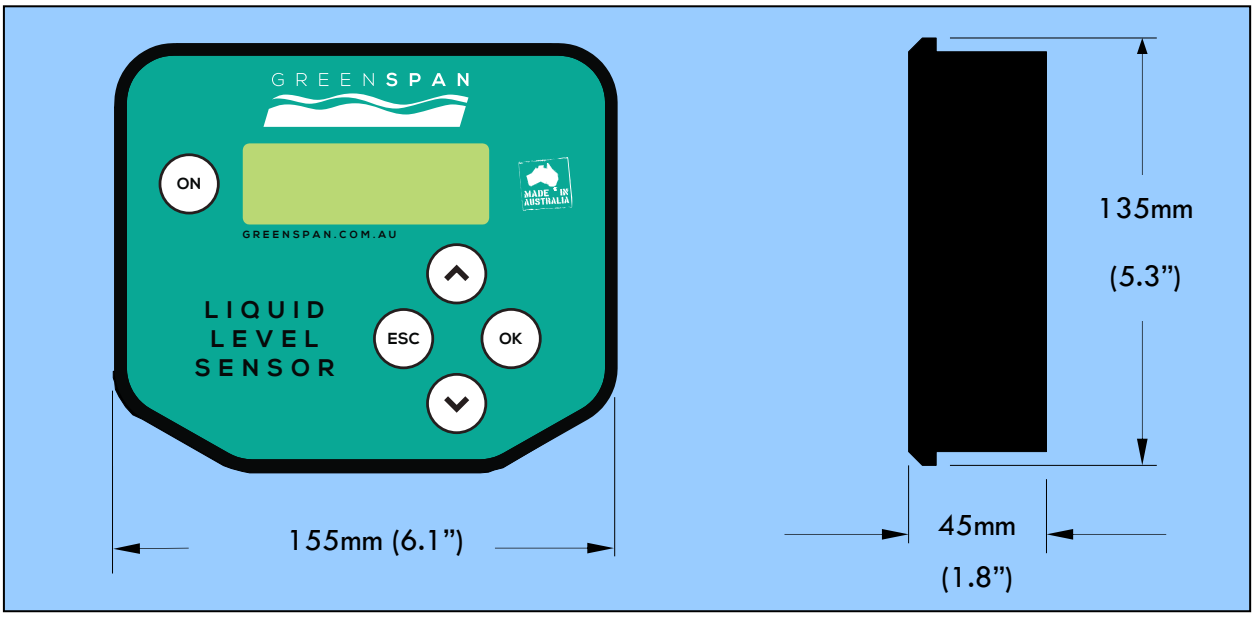




Ensure pressure is set to zero before performing AutoZero function.

Specifications

Range:	10, 20, 35, 70 meters freshwater (15, 30, 50 and 100psi) Non-standard ranges are available	
Units:	kPa, psi, feet, inches, meters, centimeters, flow and volume units based on above	
Accuracy:	Combined linearity/hysteresis/temperature compensation error over 0-50°C range:	
	< ±0.15% of full scale for standard ranges	
Resolution:	Analogue:	12 bit
	Digital:	16 bit
	Display	0.1mm water
Temperature range:	operating:	-5°C to +55°C
	Storage:	-20°C to +70°C
Response Time:	from standby:	0.25s to full accuracy
	from power up:	1s to full accuracy
Type:	Piezo resistive differential pressure sensor vented to atmosphere (gauge type)	
Output Options:	Analogue:	4-20mA current, 3 wire loop (up to 600 ohm load @12V DC) 0-1 Volt or 0-2.5 Volt, 100 ohm impedance
	Digital:	SDI-12 data protocol version 1.3 RS232C data
	Simultaneous digital and analogue output	
Tube Connection:	¼" BSP female fitting standard with a selection of other tube fittings available	
Power Supply:	10-15V DC unregulated	
	Standby @12V:	<10 mA
	Active @12V:	<120mA backlight on plus current loop if used <25mA backlight off plus current loop if used
Surge Protection:	Inputs/outputs protected against transients by a secondary protection circuit that can absorb up to 1.5kW for 1ms.	
Enclosure:	IP67 rated	
Display:	4 line x 20 character LCD (7 x 5 dot matrix) with backlight, extended temp. range	
Weight:	0.85kg	



Product Return Form

As part of our Quality Assurance initiative, and to improve response time, we request that the forms below are completed in as much detail as possible for product returns.

OPERATOR INFORMATION				
Name and contact details				
Company				
Date/Time				
Logger Site				
Location of product				
PRODUCT INFORMATION				
Model				
Serial number				
S/W version number(s)				
H/W version number(s)				
SOFTWARE USED				
Download program				
Remote or Local download				
Other software used				
CONFIGURATION				
Logger				
Length of tube				
Last logged values				
Measurement interval				
SITE - Describe site. Is unit in protective hut or enclosure? List any other sensors which are used at the site. Estimate cable length to sensors				
POWER SUPPLY				
Battery				
Voltage / Capacity				
Internal/External				
Solar/Mains charger				
Measured battery volts				
Solar Panel				
Voltage/Capacity				
Regulator make / model				
Switching/Linear regulator				
Mains supply				
COMM PORT		SDI-12 port		4-20mA
EARTHING -Describe any special earthing arrangements in place.				

DESCRIPTION OF PROBLEM How did the problem manifest itself? Weather conditions while fault occurred (especially temperature) What commands were being used (SDI-12 or serial)? *If possible, list the exact commands used, and the sequence. List the commands sent through the logger* What action was taken to get the unit going again? Have you noticed anything in common with the last time there was a fault? Was the unit permanently disabled, or is the fault intermittent? Is this the first time the fault occurred? Is there anything unusual about this site compared to other sites? Is there any other equipment or facilities (e.g. local power lines) which could cause interference? Please list any other issues relating to the site or the fault.	

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