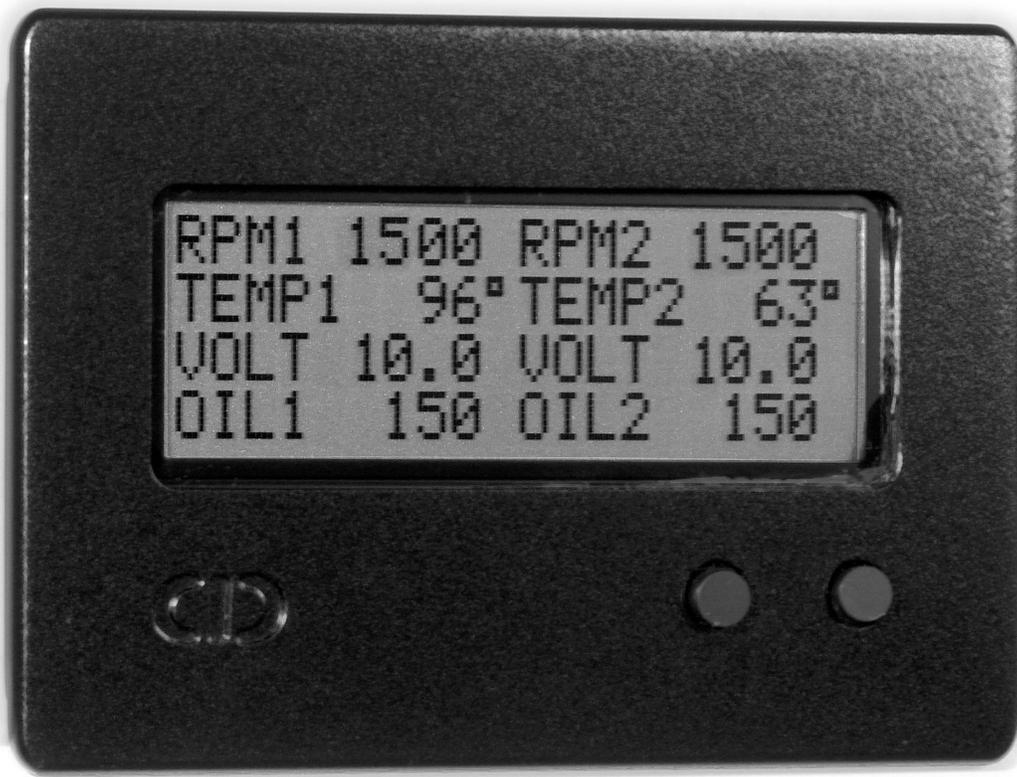


---

# SeaGauge-X4

---

## User's Manual



**Chetco Digital Instruments**

Copyright © 2005 Chetco Digital Instruments, Inc.

All rights reserved.

SeaGauge™ is a trademark of Chetco Digital Instruments, Inc.

SeaSwitch™ is a trademark of Chetco Digital Instruments, Inc.

## **WARNING!**

**USE THIS UNIT ONLY AS AN AID TO MONITORING ENGINE PERFORMANCE INFORMATION.**

## **CAUTION**

When showing sensor data, this unit will only show information based on the sender used and its installed position.

The operating and storage temperature for your unit is from -4 degrees to +167 degrees Fahrenheit (-20 to +75 degrees Celsius). Extended storage temperatures higher or lower than specified will cause the liquid crystal display to fail. Neither this type of failure nor its consequences are covered by the warranty. For more information, consult the factory customer service department.

All features and specifications subject to change without notice.

Chetco Digital Instruments may find it necessary to change or end our policies, regulations, and special offers at any time. We reserve the right to do so without notice.

All screens in this manual are simulated.

## **NOTICE!**

Free software upgrades will be available on our website at [http:// www.seagauge.com](http://www.seagauge.com) as they are released. Please check our website periodically for these and other information as they become available.

Thank you for choosing Chetco Digital Instruments

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

**Note:**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the factory customer service department for help.

## SPECIFICATIONS

CASE Dimensions:.....7" W x 5" H x 2.3" D

MODULE Dimensions: .....5.75" W x 2.6" H x 1.7" D

Input Voltage:..... 10 - 15 vDC, 12-volt Nominal

Processor Frequency: ..... 18.432 MHz

Maximum Current:.....800 mA

Display: ..... 4.5"W x 2.5"H LCD 4 char H x 20 char W

Operating and Storage Temperature ... -4 to +167 degrees Fahrenheit  
20 to +75 degrees Celsius

Analog Conversion Accuracy :..... 10 bits

Analog update rate :..... 2 per second (10 point average)

Sender voltage range:..... 0 -3.3 volts

Sender voltage resolution:..... 0.0128 volts

Pulse Count update rate:..... 1 per second

Maximum Pulse Count:..... 500 per second

Firmware Revision: ..... 1.98

NMEA 2.0 Instrumentation Sentences \$IIXDR,A \$IIXDR,C \$IIXDR,D \$IIXDR,F  
\$IIXDR,G \$IIXDR,I \$IIXDR,P \$IIXDR,R \$IIXDR,S \$IIXDR,T \$IIXDR,U \$IIXDR,V  
\$SDDBT, \$SDMTW, \$GPVTG,S \$GPVTG,H

# Table of Contents

---

Table of Contents .....	5
Introduction.....	8
Welcome .....	8
Anti-reflective faceplate.....	8
What You Get .....	9
Unit.....	9
Cables .....	9
Software .....	9
Operation .....	10
Scroll.....	11
Setup modes .....	11
Normal Operation.....	11
Graphic Modes .....	13
System Configuration .....	18
Configuration Button.....	18
Setup Modes.....	19
Set Options.....	19
Port Select Sub-mode.....	19
Data In Sub-mode .....	20
Data Out Select Sub-mode.....	20
Command In Select Sub-mode.....	21
Command Out Select Sub-mode.....	21
Max Groups Sub-mode.....	22
NMEA Groups Sub-mode.....	22
Pulse 0 Input Sub-mode .....	23
Pulse0Scale Sub-mode.....	24
Pulse0Time Sub-mode .....	24
Pulse1Input Sub-mode.....	25
Pulse1Scale Sub-mode.....	26
Pulse1Time Sub-mode .....	26
Port Baud Rate Sub-mode.....	27
Alarm Sub-mode .....	27
Histogram TC Sub-mode.....	28
Save Options Sub-mode .....	28
Set Alarms.....	28
Save Alarms Sub-mode .....	30
Set Display.....	31
Save Display sub-mode .....	33
Set NMEA TAGS.....	33
Save NMEA TAG sub-mode.....	36
Set Groups.....	36
Save Groups sub-mode.....	38
Set Position.....	<b>Error! Bookmark not defined.</b>

Save Positions sub-mode .....	<b>Error! Bookmark not defined.</b>
Set Channel.....	39
Save Channels sub-mode –.....	41
Connectors.....	42
System Power.....	42
Sensors .....	43
Ports .....	45
Installation.....	47
Cutout .....	47
Power .....	49
Alarm.....	49
Pulse input.....	50
Reference Voltage .....	50
Signals.....	51
Calibration Tables .....	52
Serial Port Protocols .....	55
NEXT MENU.....	56
SET Function.....	56
Real-time data .....	56
STOP Function .....	56
Program Mode.....	56
NMEA INPUT .....	58
Flash Programming.....	60
Unit Dimensions Seagauge-X4 Case.....	61
Unit Dimensions Seagauge-X4 Module.....	62
One Year Warranty.....	64

# SeaGauge-X4 User's Manual

## **Introduction**

---

### ***Welcome***

Thank you for purchasing a Chetco Digital Instruments product. SeaGauge™ provides custom instrumentation in a rugged compact design. Its menu driven functions allow it adapt to and monitor many different sensors from a single location. Optional built-in wireless capability allows display of real-time data from remote locations

### ***Anti-reflective faceplate***

The SeaGauge™ is shipped with a protective film to prevent damage to the faceplate during shipping. Keep the protective film in place until finished with installation. It is easily removed by peeling off when ready for use.

The special anti-reflective coating should only be cleaned with soap and water. **NEVER USE WINDOW CLEANER** on the display. A mild dish soap woks well and then rinse with clean water. Do not wipe surface with a paper towel as it will mar the finish. A lens cleaning tissue used for eye glasses works best. Be sure it is safe for plastic lenses and anti-glare coatings.

# What You Get

---

## **Unit**

Seagauge-X4 head unit with power and sensor input. Unit constantly monitors the sensor inputs and updates the graphic VFD display two times per second. A 10-bit analog converter samples sensor data and then performs a real-time average. The built-in microprocessor takes the averaged value for each sensor and looks up the display value from a 256 point table that is user modifiable. Once a sensor value is determined it is paired with a corresponding text label and sent to the integrated 256 X 128 Graphic VFD display. Two sealed silicone buttons provide control of display pages and unit setup.

## **Cables**

Seagauge-X4 is supplied with three water resist cables for installation. The power and sensor cable are un-terminated and will need to be modified for you installation. The serial interface cable will connect directly to any RS232 computer interface.

**Power cable** – 6 pin female cable. Never connect power without supplying 3 amp fuse protection.

**Sensor cable** – 9 pin female cable. Resistive loads do not need to be fused (temperature/oil pressure/fuel level). Voltage loads need to be protected with a 500 mA fuse to prevent damage. Always connect the sensor cable ground to solid ground bus.

**Serial cable** – 9 pin RS232 DSUB female cable. Connected directly to serial port of computer or laptop. Cable provides 5 volts on pin 9 for powering external Bluetooth module.

**Flash Programming cable** – 9 pin RS232 DSUB male cable. Connected to serial port of computer or laptop with a NULL MODEM adaptor. This cable is only used to reprogram the unit.

## **Software**

Flash programming utility (FPU) – The flashutil.exe and associated flash file is used to perform firmware updates of the unit. This utility can only be used with the supplied Flash programming cable.

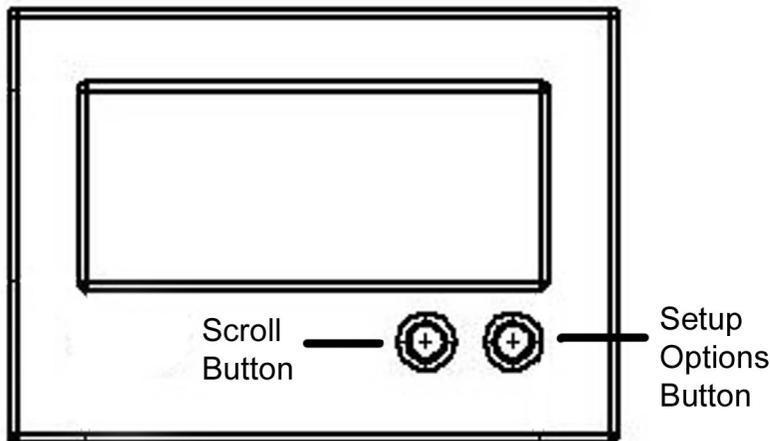
# Operation

---

This manual covers operation for Seagauge-X4 Dash unit and the Seagauge-X4 OEM Module. Both units feature a 20X4 graphic LCD display. Operation of both units is the same with the exception of the location of the control buttons. On the Seagauge-X4 Dash unit, the two sealed buttons are located on the front of the case while the Seagauge-X4 OEM module has a rear connector for attachment of two control buttons. Throughout the manual reference will be made to both buttons as:

- **Menu Scroll – (Left) Button**
- **Option Set – (Right) Button**

Control of the Seagauge-X4 unit is done using two sealed membrane pushbuttons. The **Scroll** button is used to scroll through different display options. The **Option Set** button is used to select/toggle unit functions.



When you receive your unit it has been programmed to display gauge reading in groups with a maximum of eight groups. On power-up the unit will start to display the first group of gauge functions. Additional gauge display groups can be viewed by using the **Scroll** menu select button. Once the unit has shown all display groups it cycles over again from the first group.

The **Option Set** button is used to put the unit into a special setup mode. This mode allows control over Alarms, backlight, and port settings. Once you press the **Option Set** button the unit will enter SETUP mode. To enter a new programming mode you press the **Scroll** menu select button to cycle to the next option.

Once all options are viewed the unit reverts back to gauge display starting from the first page.

## SeaGauge-X4 User's Manual

### **Scroll**

The **Scroll** button is used for group and menu selection. Pressing the button for 0.5 seconds will select the next group or menu item. Continuing to hold the button down will automatically scroll to the next group or menu.

### **Option Setup modes**

The **Option Set** button used to enter setup mode or change a setup setting. Pressing the bottom button for 0.5 seconds while viewing gauge display information will enter setup mode. Once in setup mode – you must **Scroll** through all menu choices using the top menu select button to exit setup and return to normal display. In setup mode this button is used to change various settings.

### **Normal Operation**

When the unit is powered up it will display the first group of display values. The Seagauge-X4 can display from 1 to 16 values per group and up to 8 groups. The total number of groups displayed is an option that can be changed in setup mode. For example if the number of groups is set to four – pressing the **Scroll** button will take you through the following displays.

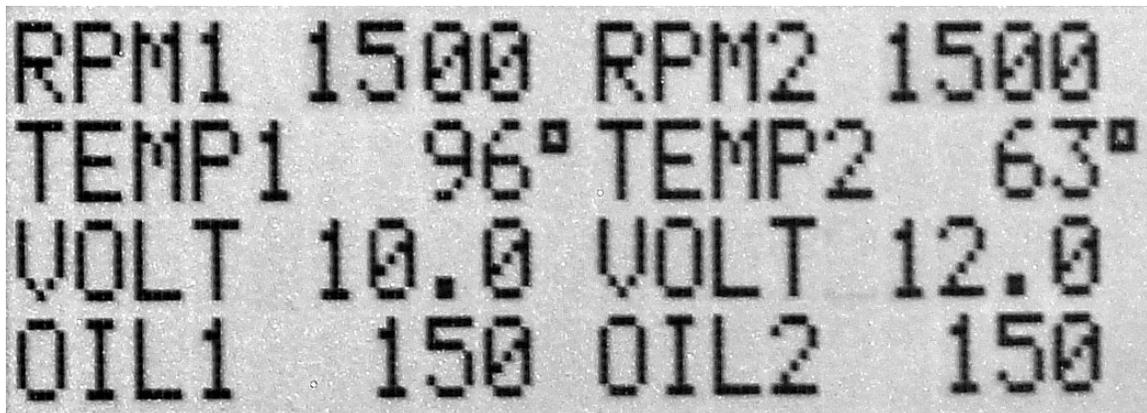


Figure 1 Display Group 1

## SeaGauge-X4 User's Manual

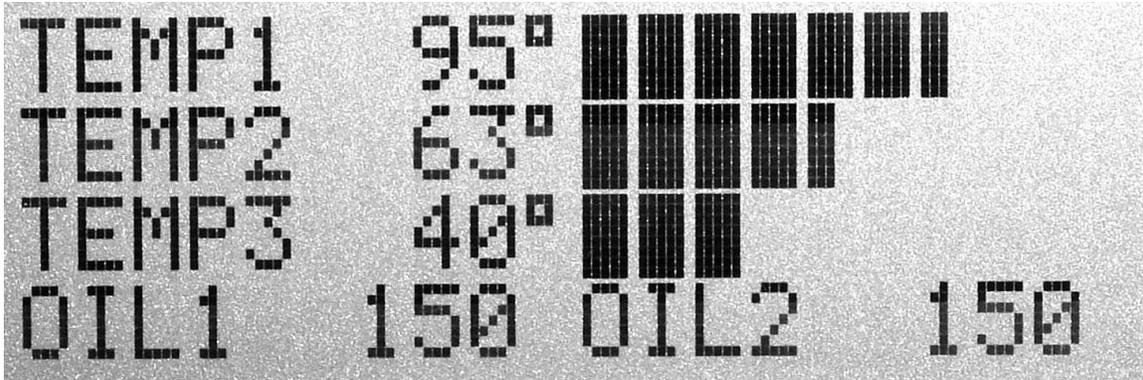


Figure 2 Display Group 2

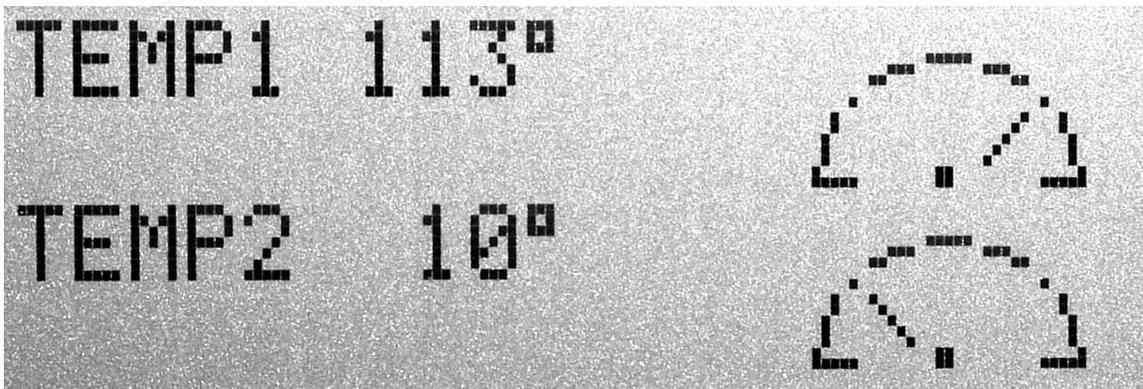


Figure 3 Display Group 3

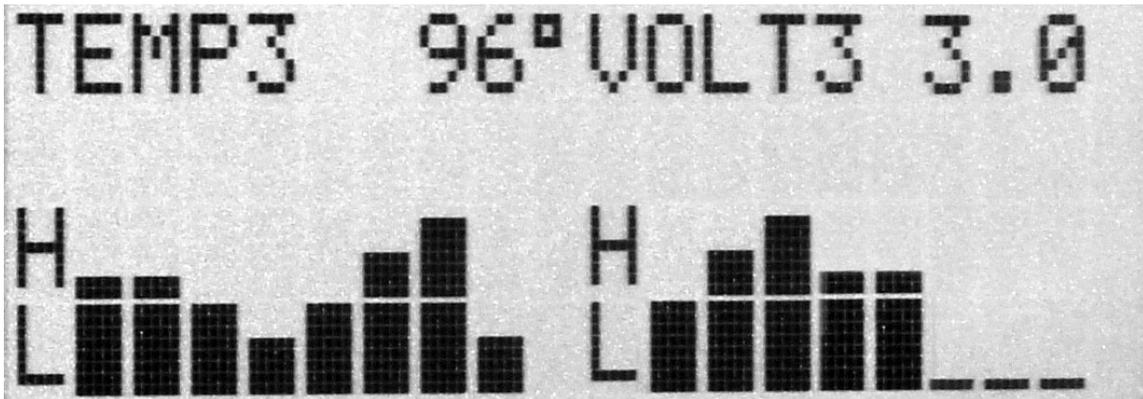


Figure 4 Display Group 4.

Once you cycle through all display groups they start over. You can change the group assignment and position for any of the display values using the setup modes.

## **SeaGauge-X4 User's Manual**

### ***Graphic Modes***

Seagauge-X4 supports four graphics modes to display digital data. The modes can be selected dependent on the type of desired display format.

- **Digital Data Display (D)**
- **Bar Graph (B)**
- **Histogram (H)**
- **Small Gauge Dial (G)**

Graphic display modes can be combined with digital data display in each display group. Graphic display modes are only available for the eight analog inputs and are not available for NMEA inputs. NMEA data can be displayed using Digital Data Display (D) only.

Graphic display modes are assigned during group configuration. As specific gauge values are being assigned to each of the eight possible groups there is an option to choose which display mode to use for that sensor input.

## SeaGauge-X4 User's Manual

**Digital Data** – An 8 character text label followed by a 6 character digital readout. The characters are 16 X 8 for a total of 16 readouts (8 rows by 2 columns) per display page. Digital data display modes can be mixed with other graphic display modes

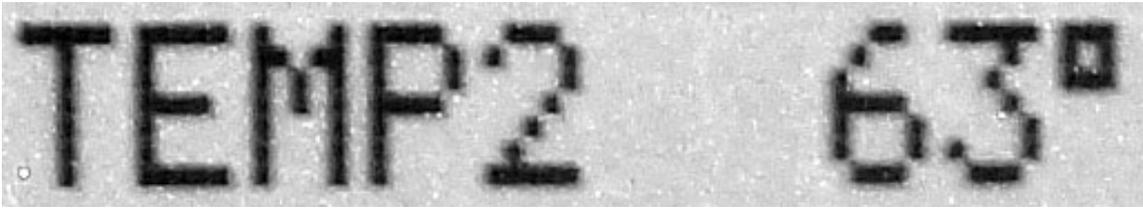


Figure 5 Digital Data Element

**Bar Graph** – 128 segment Bar graph used to show relative signal level with low values to the left and high values to the right. Each segment contains represents 1/128th of full scale value. As sensor signal increases, the graph will grow to the right in real time.

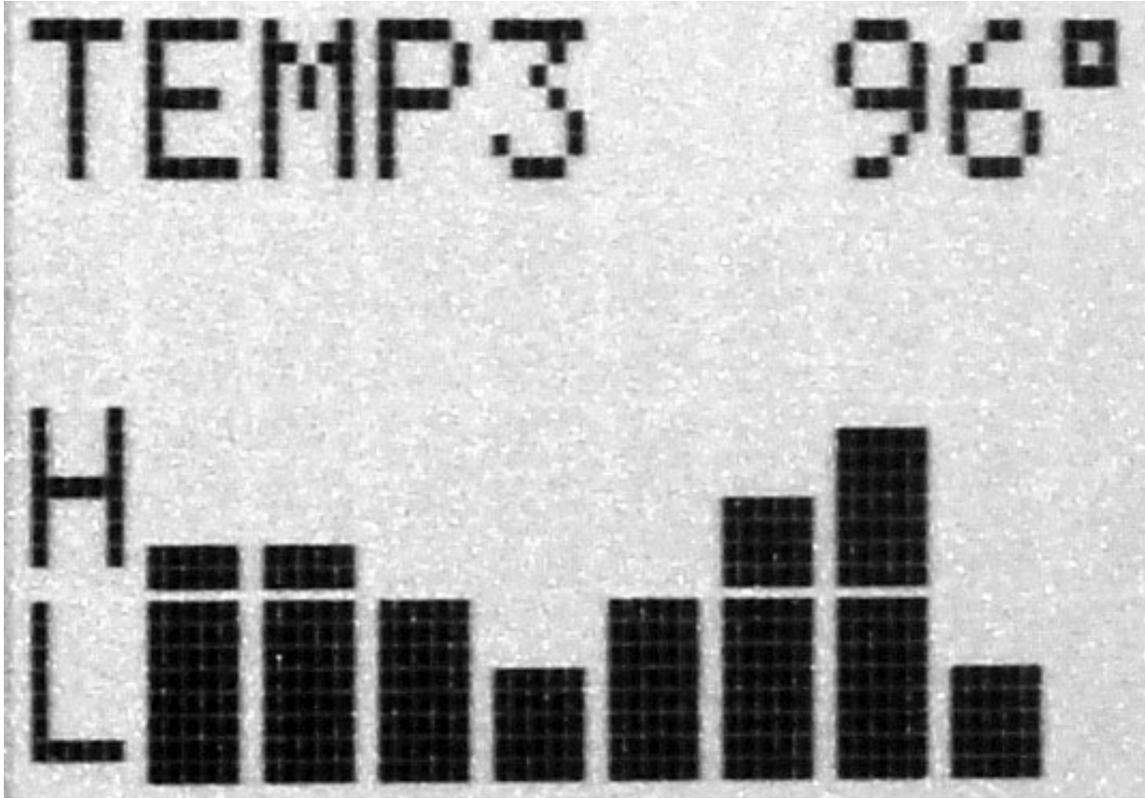


Figure 6 Bar Graph Element

Sensor text label and digital value are displayed on the left of the graph. One Bar Graph can be assigned to each row of the display for a total of 8 per display page.

### **NO OTHER GRAPHIC ELEMENTS CAN BE ASSIGNED TO THE SAME ROW WITH THE BAR GRAPH**

**Histogram Graph** – A 128 bar Histogram graph shows the relative strength of sensor input over a user configured time interval. Recent time values are on the left and oldest time values on the right. As new values arrive - the graph scrolls to the right adding the newest value and dropping the oldest. Signal strength is depicted by a 64 segment bar with lowest strength at the bottom and highest at the top. Histograms show signal trends over time.

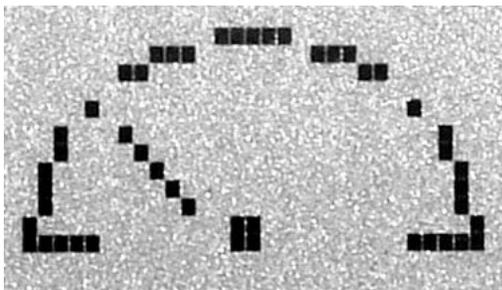


**Figure 7 Histogram Graphic Element**

Sensor text label and digital value are displayed on the left of the graph. One Histogram Graph uses 8 rows of the display. There can be two Histograms per group.

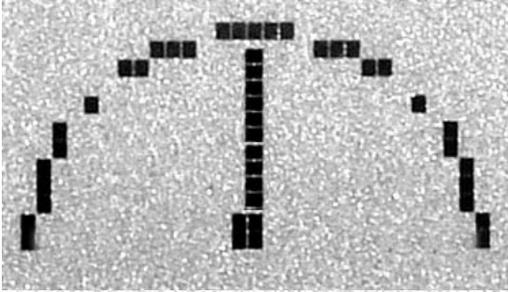
**NO OTHER GRAPHIC ELEMENTS CAN BE ASSIGNED TO THE SAME ROWS WITH THE HISTOGRAM**

**Digital Gauge Dial Graph** – A 5 segment digital dial shows the relative signal strength using an analog style gauge display.

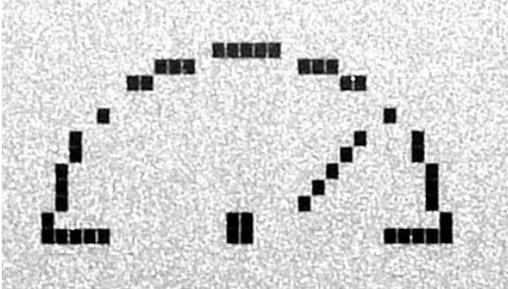


The needle at the 10:00 O'clock position represents low signal

## SeaGauge-X4 User's Manual



The needle at the 12:00 O'clock represent Mid-strength



The needle at the 2:00 O'clock represents Max strength

The needle moves in real-time in a clockwise direction to represent the relative strength of the analog signal.

Sensor text label is displayed in small text under the dial and digital sensor readout is display in center of dial using larger text.

Each display page can have up to 8 digital dial elements arranged as 2 rows of 4 elements. Other graphic elements can be mixed with digital dial displays.

## SeaGauge-X4 User's Manual

All Display pages are configurable to use any of the graphic display formats for each sensor input. It is possible to mix some graphic display formats on the same page. For example –

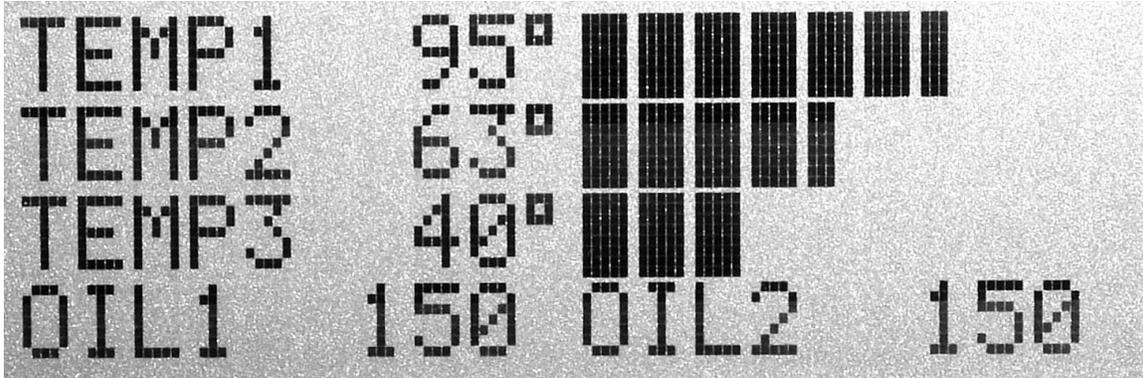


Figure 8 Mixed Display modes

These can be configured by using the display setup options in the SETUP MODE entered by pressing the **Option Set** button

# SeaGauge-X4 User's Manual

## System Configuration

System configuration consists of:

- **Disable Alarms**
- **Turn Backlight ON/OFF (LCD ONLY)**
- **Enter Set Up Options Modes**
- **Enter Display Labels**
- **Enter Display Positions**
- **Select Display Graphics Modes**
- **Select Display Groups**
- **Select NMEA TAGS**

These functions can be performed by using a combination of the two buttons provided on the front of the unit.

The most common task is configuration of display labels and choosing display graphics modes. It is always important to set Display Labels first as other operations use them. Having incorrect display labels will make other steps confusing and difficult. There are 8 analog sensor inputs, 6-8 NMEA inputs, and 0-2 Pulse Inputs for a total of 16 possible Display Labels

Once Display Labels are chosen the next step is to decide where to place them on the display. Most graphic modes have only a few options while Digital Data can be placed almost anywhere. The most common problem is placing two or more values on the same location or on overlapping locations. Take care to map out all possible combinations to avoid overlap.

The final step is assigning gauge readings to groups and picking the graphic display modes to best view the data. A group is collection of information presented on the main display. Seagauge-X4 can have up to 8 groups or pages. Any Display Label and associated sensor can be assigned to any of the 8 groups. Most groups hold from 1 to 8 gauge readings depending on the chosen graphics display format.

## Configuration Button

The **Option Set** button has three functions.

- **Disable Alarms**
- **Turn Backlight ON/OFF (for LCD displays only)**
- **Enter Set Up Modes**

Pressing the **Option Set** button for less than one second will momentarily disable any alarms. Alarms will be deactivated for 30 seconds and then resume if the alarm condition continues.



## SeaGauge-X4 User's Manual

S	E	T	O	P	T	I	O	N	S										
P	O	R	T	M	A	S	T	E	R										

S	E	T	O	P	T	I	O	N	S										
P	O	R	T	S	L	A	V	E											

To exit this mode press the **Scroll** button to take you to the next Options sub-mode

### Data In Sub-mode

This sub-mode is used to determine which port serial data is received from. Seagauge-X4 units equipped with two port options. The unit will listen for serial data on one of two ports. Choosing an alternate serial port is useful if listening for NMEA data on one port while communicating with a PC (data logging) on another port. Pressing the **Option Set** button while in this sub-mode will toggle which port data is input.

S	E	T	O	P	T	I	O	N	S										
P	O	R	T	S	E	R	I	A	L	0									

S	E	T	O	P	T	I	O	N	S										
P	O	R	T	S	E	R	I	A	L	1									

To exit this mode press the **Scroll** button to take you to the next Options sub-mode

### Data Out Select Sub-mode

This sub-mode is used to determine which port data is transmitted from. Seagauge-X4 units equipped with two port options. The unit will send serial data out one of two ports. Choosing an alternate serial port is useful if listening for NMEA data on one port while communicating with a PC (data logging) on another port. Pressing the **Option Set** button while in this sub-mode will toggle which port data is sent out of.

S	E	T	O	P	T	I	O	N	S										
P	O	R	T	S	E	R	I	A	L	0									

S	E	T	O	P	T	I	O	N	S										
P	O	R	T	S	E	R	I	A	L	1									





## SeaGauge-X4 User's Manual

### Pulse 0 Input Sub-mode

This sub-mode is used to enable or disable the pulse count option of the unit. The Seagauge-X4 can display eight analog sensor inputs and up to 2 pulse inputs (PULSE0 & PULSE1) for a total of ten display functions. The pulse input is usually assigned to RPM functions but can be used for any other function such as MPH calculations off a paddle wheel sender.

The unit counts the number of pulses per second and applies a scale factor before displaying the value. The formula used for the calculation is:

$$\text{DisplayValue} = (\text{Averaged Pulses per second}) * \text{Scale Factor}$$

The interval used to count pulses is approximately 0.5 seconds at 1X. To increase resolution at slower pulse rates, you can increase the interval by increasing from 1X on up to 8X by using the **Option Set** button.

To enable Pulse 0 input active High (Low to High edge) 0.5 second count interval

S	E	T	O	P	T	I	O	N	S										
P	U	L	S	E	0	I	N			1	X		R	I	S	E			

To enable Pulse 0 input active Low (High to Low edge) 0.5 second count interval

S	E	T	O	P	T	I	O	N	S										
P	U	L	S	E	0	I	N			1	X		L	O	W				

To enable Pulse 0 input active High (Low to High edge) 1 second count interval

S	E	T	O	P	T	I	O	N	S										
P	U	L	S	E	0	I	N			2	X		R	I	S	E			

If you do not wish to display any pulse information you can disable the input by using the **Option Set** button to toggle off.

S	E	T	O	P	T	I	O	N	S										
P	U	L	S	E	0	I	N						O	F	F				

To exit this mode press the **Scroll** button to take you to the next Options sub-mode



# SeaGauge-X4 User's Manual

## Pulse1Input Sub-mode

This sub-mode is used to enable or disable the pulse count option of the unit. The Seagauge-X4 can display eight analog sensor inputs and up to 2 pulse inputs (PULSE0 & PULSE1) for a total of ten display functions. The pulse input is usually assigned to RPM functions but can be used for any other function such as MPH calculations off a paddle wheel sender.

The unit counts the number of pulses per second and applies a scale factor before displaying the value. The formula used for the calculation is:

$$\text{DisplayValue} = (\text{Averaged Pulses per second}) * \text{Scale Factor}$$

The interval used to count pulses is approximately 0.5 seconds at 1X. To increase resolution at slower pulse rates, you can increase the interval by increasing from 1X on up to 8X by using the **Option Set** button.

To enable Pulse 1 input active High (Low to High edge) 0.5 second count interval

S	E	T	O	P	T	I	O	N	S										
P	U	L	S	E	1	I	N			1	X		R	I	S	E			

To enable Pulse 1 input active Low (High to Low edge) 0.5 second count interval

S	E	T	O	P	T	I	O	N	S										
P	U	L	S	E	1	I	N			1	X		L	O	W				

To enable Pulse 0 input active High (Low to High edge) 1 second count interval

S	E	T	O	P	T	I	O	N	S										
P	U	L	S	E	1	I	N			2	X		R	I	S	E			

If you do not wish to display any pulse information you can disable the input by using the **Option Set** button to toggle off. **To use the HOUR TACOMETER function Pulse 1 must be disabled – THE POSITION CONVERTS TO HOUR TAC FUNCTION.**

S	E	T	O	P	T	I	O	N	S										
P	U	L	S	E	1	I	N						O	F	F				

To exit this mode press the **Scroll** button to take you to the next Options sub-mode



## SeaGauge-X4 User's Manual

### Port Baud Rate Sub-mode

This sub-mode to set the baud rate for the serial ports. Normal operation is 9600 but some NMEA equipment requires 4800. Setting to the slower baud rate will affect the display update rate of the remote viewing software.

S	E	T	O	P	T	I	O	N	S										
B	A	U	D	R	A	T	E			9	6	0	0						

Press the **Option Set** button to toggle between the two options

S	E	T	O	P	T	I	O	N	S										
B	A	U	D	R	A	T	E			4	8	0	0						

To exit this mode press the **Scroll** button to take you to the next Options sub-menu

### Alarm Sub-mode

This sub-mode mode is used to set the power-up state of the alarm functions. If alarms are set off here they will not be active each time the unit is powered up and must be manually activated.

This mode is also used to set the state of the alarm output signal. Some alarms such as 3-5 volt Piezo Buzzers can be driven directly from the units alarm output signal. When using these types of alarms set this option to HIGH. and connect the hot lead directly to the alarm signal. **CAUTION – the unit can not drive more than 20 mA and never connect a alarm without a fuse.**

If you wish to use an alarm that requires more current you may have to use a external relay to drive the alarm. If this is the case the active low alarm function can be used to ground the relay.

S	E	T	O	P	T	I	O	N	S										
A	L	A	R	M						O	N	L	O	W					

S	E	T	O	P	T	I	O	N	S										
A	L	A	R	M						O	F	F	H	I	G	H			

## SeaGauge-X4 User's Manual

Press the **Option Set** button to toggle between the two options

S	E	T	O	P	T	I	O	N	S											
A	L	A	R	M					O	N	H	I	G	H						

S	E	T	O	P	T	I	O	N	S										
A	L	A	R	M					O	F	F	L	O	W					

To exit this mode press the **Scroll** button to take you to the next menu.

### *Histogram TC Sub-mode*

This sub-mode to set the time constant used for the Histogram Graphic Display mode. Lower numbers result in faster update rates. A value of 1 creates a histogram covering approximately 20 seconds while a value of 2 equals 40 seconds. The maximum setting is 255 which covers approximately 90 minutes. The value is incremented by pressing the **Option Set** button while in this sub-mode.

S	E	T	O	P	T	I	O	N	S										
H	I	S	T	T	C				1										

### **Save Options Sub-mode**

This sub-mode to save any changes made in any of the sub-modes. Any changes made up to this point have not been permanently saved and will be lost if the unit is reset or if you exit this sub-mode. Pressing the **Scroll** button (NO) will erase all changes and exit the SET OPTIONS setup mode.

S	A	V	E	O	P	T	I	O	N	S									N	O	>	
																			Y	E	S	>

Pressing the **Option Set** button (YES) will save the changes and reset the unit..

### **Set Alarms**

This setup mode is used to set the min and max alarm values for each of the eight sensor inputs. . You can skip this mode by pressing the **Scroll** button (NO) or enter the 16 alarm sub-modes by pressing the **Option Set** button (YES). Once you enter the sub-modes you must go through all of them before you exit though you do not need to make any changes.



## SeaGauge-X4 User's Manual

Pressing the upper right button will take you to the next alarm setting

S	E	T	A	L	A	R	M	S	[	O	I	L	]						
M	A	X	=	1					V	A	L	U	E	>	9	8			

Pressing the **Option Set** button will increment/decrement the current alarm setting

### Save Alarms Sub-mode

This sub-mode to save any changes made in any of the alarm sub-modes. Any changes made up to this point have not been permanently saved and will be lost if the unit is reset or if you exit this sub-mode. Pressing the **Scroll** button (NO) will erase all changes and exit the SET ALARMS setup mode.

S	A	V	E	A	L	A	R	M	S										N	O	>	
																			Y	E	S	>

Pressing the **Option Set** button (YES) will save the changes and reset the unit.



## SeaGauge-X4 User's Manual

S	E	T		D	I	S	P	L	A	Y	(	D	0	)					
R	P	M	#	#	#	#													

In this example the cursor is in the “R” position. Pressing the **Scroll** button would advance the cursor to the “P” position. Pressing the **Scroll** button again would advance to the “M” position and so on.

Once you advance through all eight positions for a selected label the display will change to the next label.

S	E	T		D	I	S	P	L	A	Y	(	D	1	)					
O	I	L	#	#	#														

To change a character for any position (flashing cursor) press the **Option Set** button to select the next character from the character set.

S	E	T		D	I	S	P	L	A	Y	(	D	0	)					
*	P	M	#	#	#	#													

In this example the bottom button was pressed once to select the “#” character. This is a special character since it used to indicate that this position is not to be displayed. By using the “#” character in the correct position you can shorten any display string to less than 8 characters. In this example the last 4 characters will not be displayed which will create room for additional display labels. By using the “#” character you can control exactly how long each label is on the display.

S	E	T		D	I	S	P	L	A	Y	(	D	0	)					
	P	M	#	#	#	#													

Pressing the **Option Set** button again increments to the space character.

S	E	T		D	I	S	P	L	A	Y	(	D	0	)					
A	P	M	#	#	#	#													

Pressing the bottom button again increments to the “A” character and so-on.

There are 86 possible characters to choose from in the following order:





## SeaGauge-X4 User's Manual

In this example the tag for NMEA data position 0 was changed to look for Sonar depth information but the display label still will read "SPEED" on the display. It is important to always pair the selected NMEA tags with the correct Display Labels. This flexibility allows freedom to choose any text label for selected NMEA data.

If the same NMEA Tag is used in more than one display location, both locations will receive random updates.

For example, here are two NMEA display positions (NMEA0 and NMEA1) with two different Display Labels (SPEED1 and SPEED2) looking for the same NMEA TAG (\$GPVTG).

S	E	T		N	M	E	A	0	S	P	E	E	D	1					
\$	G	P	V	T	G	,		5											

S	E	T		N	M	E	A	1	S	P	E	E	D	2					
\$	G	P	V	T	G	,		5											

In this case both NMEA positions will receive random updates since it is impossible to determine which location to assign the incoming data to. It is important to avoid using the same NMEA TAG in multiple display location with the exception of \$IIXDR, G tags.

The unit handles \$IIXDR,G tags differently to allow multiple display positions. For example, here are two NMEA display positions (NMEA0 and NMEA1) with two different Display Labels (TEMP1 and TEMP2) looking for the same NMEA TAG (\$IIXDR).

S	E	T		N	M	E	A	0	T	E	M	P	1						
\$	I	I	X	D	R	,	G												

S	E	T		N	M	E	A	1	T	E	M	P	2						
\$	I	I	X	D	R	,	G												

In the case of \$IIXDR,G tags, display positions are determined by looking at the last character of the Data Label field of the incoming NMEA sentence.

### \$IIXDR,X,DATA,U,LABEL,CHECKSUM

- X = sensor type (G,P,C,..)



## SeaGauge-X4 User's Manual

group has a letter D,B,H,G, then the sensor label is assigned to that group based on the position index value

The five display mode symbols are:

- | \_ | - not assigned to the group
- | D | - Digital Data Display Mode
- | H | - Histogram Graph
- | B | - Bar Graph
- | G | - Digital Gauge

The Position Index determines the display location of the selected sensor value on the 20X4 character display matrix as outlined below.

0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6	7	7	7	7	7	7	7	7	7	7

Pressing the **Option Scroll** button will step the cursor from left to right through the group assignment pairs. If the cursor is on a display mode field - Pressing the **Option Set** button will cycle through the five display mode choices. If the cursor is on the display position index field - Pressing the **Option Set** button will cycle through the eight index values.

For example the following figure shows the TEMP label assigned to the first, third, fourth, and sixth groups and not assigned to the second, fifth, seventh, and eighth groups.

- The first group will be a Digital Data display.
- The third and fourth groups will be a Bar Graph Display
- The sixth group will be a Histogram Display
- Groups 2,5,7,8 do not display TEMP

S	E	T			G	R	O	U	P	S									
(	D	0	)		T	E	M	P											
G	0	G	1	G	2	G	3	G	4	G	5	G	6	G	7				
D	0	_	#	B	0	B	1	_	#	H	0	_	#	_	#				

The flashing cursor indicates the currently selected value. Pressing the **Scroll** button advances to the next group while pressing the **Option Set** button toggles the assignment of the label to the selected group.

## SeaGauge-X4 User's Manual

In this example the “TEMP” label was removed from the first group by pressing the **Option Set** button until the letters were cleared. Pressing the **Option Set** button again would toggle the display mode to the next letter in the list. Using the **Scroll** button would advance to the next group.

S	E	T			G	R	O	U	P	S									
(	D	0	)		T	E	M	P											
G	0	G	1	G	2	G	3	G	4	G	5	G	6	G	7				
_	#	_	#	B	0	B	1	_	#	H	0	_	#	_	#				

Once you have advanced through all 8 groups the next label will appear with its group assignments. You must advance through all 8 groups for all 16 labels before you can save any changes.

S	E	T			G	R	O	U	P	S									
(	D	1	)		O	I	L												
G	0	G	1	G	2	G	3	G	4	G	5	G	6	G	7				
D	2	D	1	B	2	G	1	_	#	_	#	_	#	_	#				

This setup mode is only used to assign labels to groups. Just because they assigned here does not mean they will display. If a label is assigned to group 5 but the Max Groups value is set to 3 the only the first 3 groups will display regardless of settings in this mode.

Not all labels will need to be assigned to groups – It will be common to have only the first 8 labels and the last label assigned to groups. NMEA groups and Pulse groups can only display Digital Data and therefore the other display options (H,B,G,L) will not be available for those modes.

### Save Groups sub-mode

This sub-mode to save any changes made in any of the groups sub-modes. Any changes made up to this point have not been permanently saved and will be lost if the unit is reset or if you exit this sub-mode. Pressing the **Scroll** button (NO) will erase all changes and exit the SET GROUPS setup mode.

S	A	V	E		G	R	O	U	P	S										N	O	>	
																				Y	E	S	>

Pressing the **Option Set** button (YES) will save the changes and reset the unit.



## SeaGauge-X4 User's Manual

Once you enter channel assignment sub-mode you see the first sensor label and the channel it is assigned to. The pin out diagram for your unit will show how channels are mapped to specific pins on the connector. Changing a channel changes the lookup table used for that sensor label. Pressing the top button changes the label while the bottom button increments the channel assignment. Channels are numbered 0 to 15 and start over when you increment past the maximum.

S	E	T		C	H	A	N	N	E	L										
O	I	L					I	N	>		0		C	A	L					

In this example the “OIL” sensor channel was changed from 0 to 1 by pressing the bottom button one time.

S	E	T		C	H	A	N	N	E	L										
O	I	L					I	N	>		1		C	A	L					

Pressing the **Scroll** button displays the next sensor label. Pulse inputs do not use a lookup table and therefore do not appear in the channel assignments.

S	E	T		C	H	A	N	N	E	L										
T	E	M	P					I	N	>		4		C	A	L				

Once you cycle through all the input channel assignments, the unit will continue with assignments for the output channels.

S	E	T		C	H	A	N	N	E	L										
T	E	M	P				O	U	T	>		0		C	A	L				

Output channels can be assigned a Hexadecimal number from 0x0-0xF (0-15) and a flag indicating the output is from a calibration table (**CAL**) or analog converter index (**RAW**). The raw analog index (0-255) is useful in designing customized calibration tables as they provide the actual table index for each sensor input. Once you cycle through all 16 values for the **CAL** output, the flag will switch to **RAW** for another 16 values.

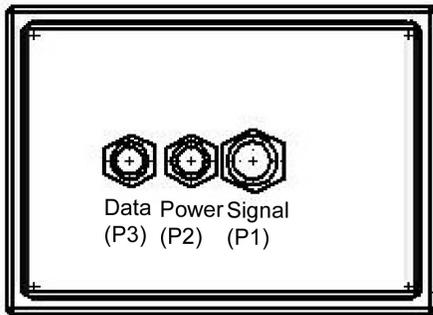
You must cycle through all 16 labels for both INPUT and OUTPUT before you can exit and save changes.



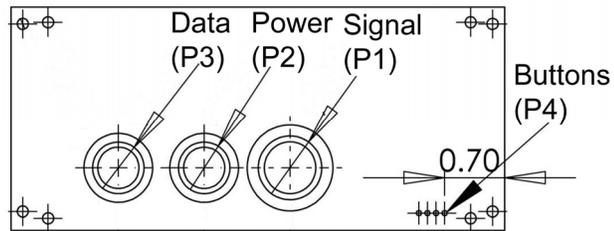
## Connectors

The Seagauge-X4 unit has three water-resist quick-connect connectors on the rear panel. Each connector is keyed to ensure proper alignment when attaching the supplied cables. Never force a cable in. Rotate the cable until the keys align and it should smoothly insert.

The serial cable (P3) can be left disconnected under normal operation. Only connect the serial cable when programming the unit or attachment to a computer for remote display. The optional Bluetooth serial adaptor can also be attached to this interface.



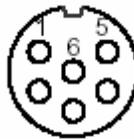
Rear View Seagauge-X4 Case



Rear Seagauge-X4 View Module

## System Power

System power is supplied via the 6-pin power connector. The connector also provides the reference voltage used for some sensors and the alarm signal



6-#20

<b>POWER (P2)</b>					
<b>Pin</b>	<b>Color</b>	<b>Function</b>	<b>Direction</b>	<b>Volt</b>	
1	Black	Ground	IN	0	
2	White	Alarm	OUT	-	
3	Orange	PULSE1	IN	0-3.3	
4	Green	PULSE0	IN	0-3.3	
5	Red	Power	IN	12-14	
6	-	VREF	OUT	3.3	

## SeaGauge-X4 User's Manual

The Power wire is connected to battery (+12 volts) via a switched 3 Amp fuse circuit. Never connect directly without providing a fused circuit. Circuit should be powered when key is on and power removed when key is off.

The ground wire should be connected to a solid ground bus located near the unit. The case is grounded and can be connected to system ground. Be sure to connect the ground wire from the cable and never rely on the case for ground.

The alarm signal provides the ground for a 2-wire pizo-electric alarm or buzzer. The hot lead of the alarm is connected via fuse to power source and ground connected directly to alarm signal. The alarm should draw no more then 25 mA. Never connect the alarm without a fuse.

The reference voltage is used to supply senders that require a regulated 3.3 volt source. Some senders like pressure, position, and fuel level may require fixed reference voltage. Never connect the reference without a 500mA fuse. Maximum current supplied by the reference is 500 mAmps.

The Pulse signal is used for RPM or other rotational senders that output a pulse stream of 12 volts maximum. The circuit is normally connected to the tach output of the ignition system to calculate RPM but can be used for other senders.

## Sensors

The sensor connector is used to interface with various senders to provide information to the unit. The supplied color-coded cable will have to be terminated to the appropriate senders dependent on your application. The information supplied in the following table is typical but may be different dependent on your application.

There are two basic classes of senders – those that provide a resistive load to ground and those that provide a voltage.

Senders that provide a resistance to ground (temperature/pressure) are easily interfaced by using a pull-up resistance. This resistance should be set to the mid-range resistance of the selected sender.

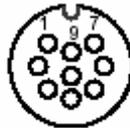
Senders that produce a voltage need to limit the full range voltage to no more then 3.3 volts. These senders will require a voltage divider (series/pull-down) to scale the range down to 3.3 volt max. For example – to support a voltage reading of 0-20 volts requires a scale down of  $3.3/20 = 0.165$  Using the voltage divider calculation of  $V_{out} = V_{in} (R_{pd}/(R_{pd} + R_s))$  if we set  $R_{pd}$  to 1000 and  $R_s$  to 5000, the resulting divider is  $1/6 = 0.166$ .

The standard Seagauge-X4 configuration it to provide three temperature sender inputs, three voltage inputs and two pressure inputs.

## SeaGauge-X4 User's Manual

- **Temperature Inputs** – These inputs are designed to be used with standard coolant senders with a resistance of 1000 ohms at 70 degrees F. Most VDO and GM style senders fit into this range.
- **Voltage Inputs** – These inputs use a voltage divider ratio of 1/6 and can accept input voltages up to 19.8 volts. Do not connect to a voltage source greater than 20 volts or damage to the unit will result.
- **Pressure Inputs** – These inputs are designed to be used with standard oil pressure senders of 0-45 PSI and an resistance range of 0 – 200 ohms. Most VDO and GM style senders fit into this range.

The Seagauge-X4 can be ordered with any combination of Rpu, Rpd, and Rs for each of the eight sensor inputs that match your application. Contact Chetco Digital Instruments for your custom application.



9-#20

<i>SIGNAL (P1)</i>									
<i>Pin</i>	<i>Color</i>	<i>Channel</i>	<i>Function</i>		<i>Pull-Up Ω</i>		<i>Pull-Down Ω</i>		<i>Series Ω</i>
<b>1</b>	Red/Black	A6	TEMP1	R36	300	R26	-	R16	-
<b>2</b>	Red	A5	TEMP2	R35	300	R25	-	R15	-
<b>3</b>	Green	A4	TEMP3	R34	300	R24	-	R14	-
<b>4</b>	White/Black	A3	VOLT1	R33	-	R23	1000	R13	5000
<b>5</b>	Blue	A2	VOLT2	R32	-	R22	1000	R12	5000
<b>6</b>	Orange	A1	PSI1	R31	150	R21	1000	R11	5000
<b>7</b>	Orange/Black	A0	PSI2	R30	150	R20	-	R10	-
<b>8</b>	Black	A7	FUEL	R37	150	R27	-	R17	-
<b>9</b>	Green/Black		Ground		-		-		-

# SeaGauge-X4 User's Manual

## Ports

The serial port connector provides the interface to a computer RS232 interface for command and status control of the unit. The unit can be remotely controlled via this interface using ASCII command sequences or the optional software utilities. Status information is transmitted out this interface using NMEA 0185 \$IIXDR sentences. Status information includes current gauge readings and display labels.

Cables are supplied for connection to this interface and there should be no need to interface directly. A serial interface cable is normally used to remotely control the unit or to collect status information in NMEA 0185 format. A separate reprogramming (FLASH) cable is used if the unit need to be reprogrammed. This cable is compatible with RS232 protocols but requires special software to provide this function. This cable is supplied only with the purchase of the development kit.



8-#20\*

<i>SERIAL (P3)</i>				
<i>Pin</i>	<i>Color</i>	<i>Function</i>	<i>Direction</i>	<i>Volt</i>
1	Grey	Serial2 TX	OUT	3.3
2	Brown	Flash RX	IN	0-3.3
3	Brown	Serial 1 TX	OUT	0-3.3
4	Yellow	+ 5 Volts	OUT	5 V
5	Red	Serial 1 RX	IN	0-3.3
6	Red	Flash TX	OUT	0-3.3
7	Green	Serial 2 RX	IN	0-3.3
8	Yellow	Serial Ground	IN	0

**5VPOWER** is a 5.0 volt regulated output to provide power for the optional BLUETOOTH serial adapter. This signal should not be used for any other purpose. Maximum output is 200 mA and is not fuse protected.

**FLASH TX** is the serial transmit line for reprogramming the unit. It is compatible with standard RS232 transmit protocols

**FLASH RX** is the serial receive line for reprogramming the unit. It is compatible with standard RS232 receive protocols

## SeaGauge-X4 User's Manual

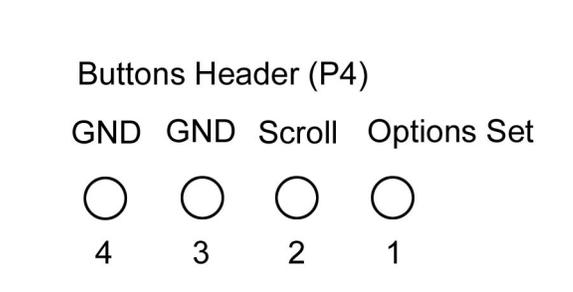
**SERIAL1TX** is the serial transmit line for status information from the unit. It is compatible with standard RS232 transmit protocols

**SERIAL1RX** is the serial receive line for control information to the unit. It is compatible with standard RS232 receive protocols

**SERIAL2TX** is the serial transmit line for status information from the unit. It is compatible with standard RS232 transmit protocols

**SERIAL2RX** is the serial receive line for control information to the unit. It is compatible with standard RS232 receive protocols

**SERIALGND** is the serial ground. It is compatible with standard RS232 transmit protocols.



<i>Buttons Header (P4)</i>				
<i>Pin</i>	<i>Color</i>	<i>Function</i>	<i>Direction</i>	<i>Volt</i>
<b>1</b>	Red	Options Set	IN	3.3
<b>2</b>	Green	Menu Scroll	IN	0-3.3
<b>3</b>	Black	Ground	OUT	0-3.3
<b>4</b>	Black	Ground	OUT	5 V

**Options Set** - is used to enter Setup Mode and to set various configuration options. It is a momentary to ground contact and is typically connected to a push button.

**Menu Scroll** - is used to select display pages and to scroll through various Setup Menus when in Set Options Mode. It is a momentary to ground contact and is typically connected to a push button. If continually grounded, the unit will scroll through all display pages at a rate of one page per second.

**Ground** – System ground provided for push buttons.

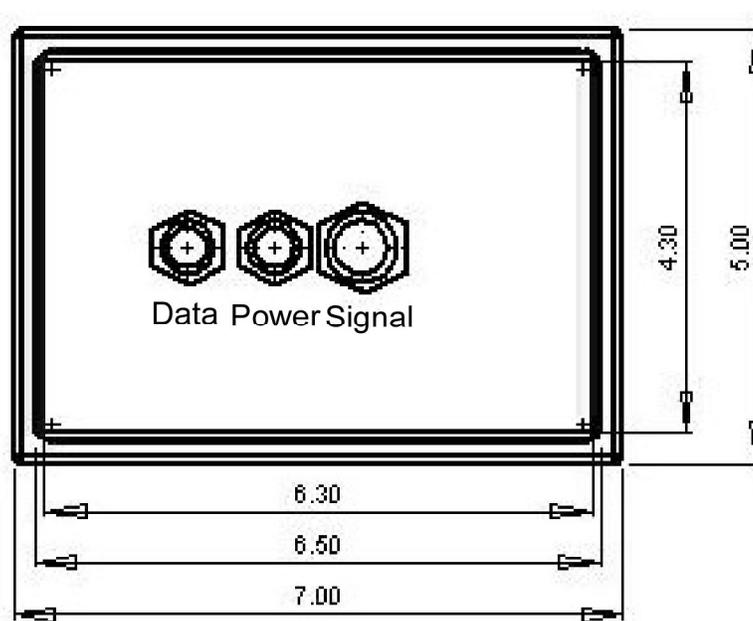
## **Installation**

---

### ***Cutout***

Seagauge-X4 can be mounted directly in the dash by performing a rectangular cut out as shown in the figure. The bezel lip is 0.5" from the cutout dimensions so care must be taken to not to make the cutout any larger then specified. It is a good idea to practice on scrap material before cutting into the panel. You must allow for the 1.5" depth of the unit plus another 4" to support the cables for a total of 6" behind the dash.

The cutout dimensions are 6.5" X 4.5"

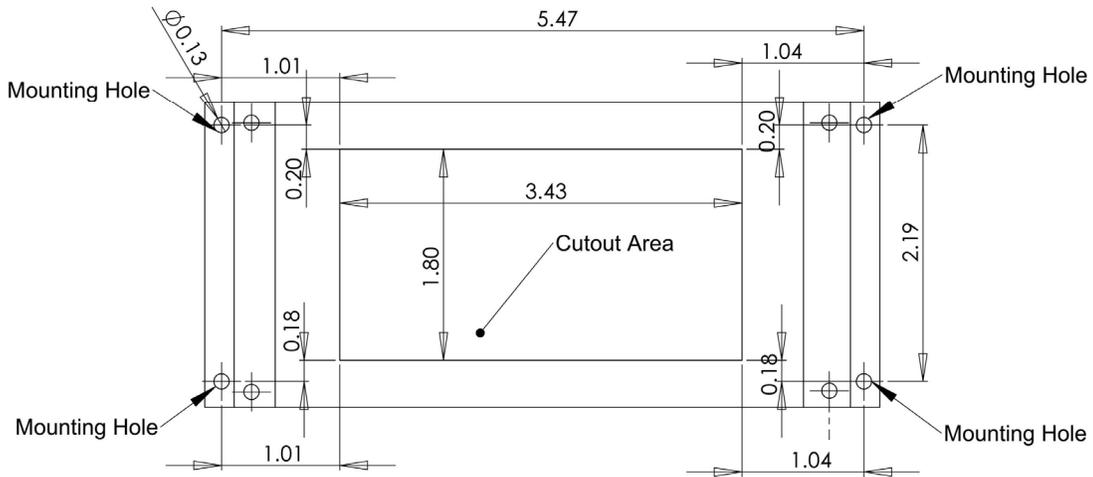


The unit can be secured in place by using slotted "L" brackets in the threaded gimbal holes on either side of the unit. Be careful not to tighten down the supplied screws into the holes with out a washer or "L" bracket - else damage to the internal seal will result.

## SeaGauge-X4 User's Manual

Seagauge-X4 OEM MODULE can be mounted directly in the dash by performing a rectangular cut out as shown in the figure. You must allow for the 1.5" depth of the unit plus another 3.5" to support the cables for a total of 5" behind the dash.

The cutout dimensions are 3.5" X 2" to allow for the display area. Four mounting holes are required as shown in the diagram.



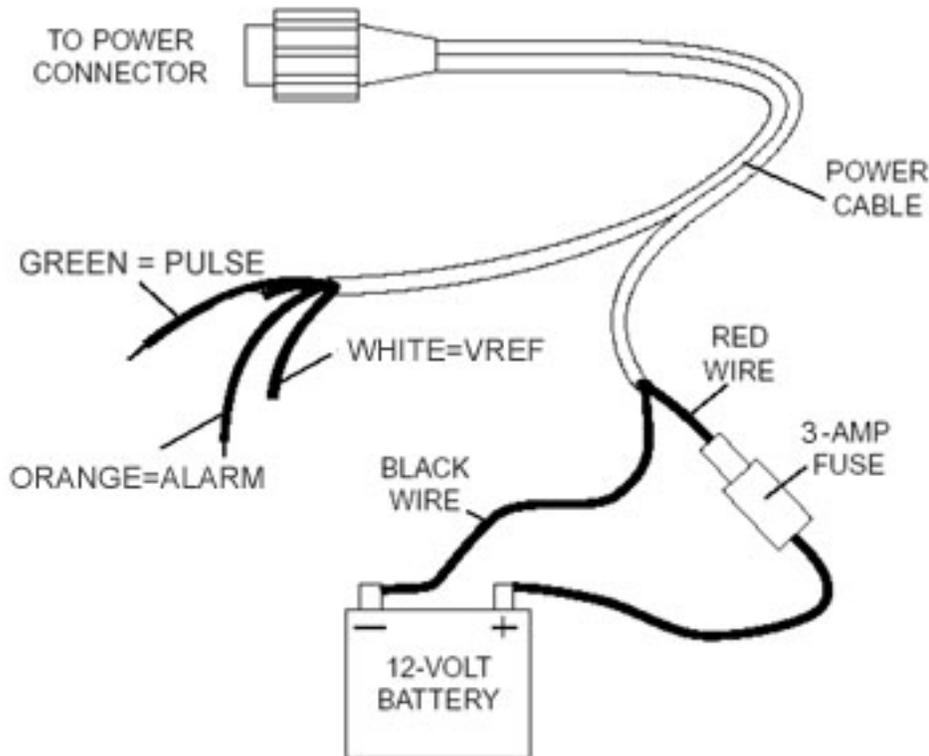
The unit can be secured in place by using bolts through the mounting holes. **Do not let the glass of the display touch the dash.** Use standoffs and foam tape to insulate the glass from the rear of the dash. The module should be suspended by the mounting bolts only.

## SeaGauge-X4 User's Manual

### Power

Power is supplied from the accessory bus via a 3 amp fuse. Never attempt to connect power without providing a fused input or serious damage may result. Unit should have power applied when key is in the accessory or run position and power removed when key is off.

Be sure to attach ground lead to a solid ground bus for proper operation. All sensor/sender grounds should be attached to the same ground buss.



### Alarm

The alarm signal can be attached directly to a 3-12 volt pizo buzzer. The ground lead of the pizo buzzer should be attached to the ground buss. Be sure the set the SeaGauge alarm function be active HIGH when driving a pizo buzzer directly.

An alternate configuration is required for applications where alarms require more then 25 mA or more then 3.3 volts to operate. In this case the unit can be set to active LOW and provide the ground to a relay circuit to drive a high power alarm. The relay should not require more then 25 mA to close but can be hooked to a 12 volt source. When an alarm occurs the unit will ground the relay which is used to drive the alarm

## **SeaGauge-X4 User's Manual**

### ***Pulse input***

The unit can detect and count voltage pulses. This is typically used for RPM or MPH calculations. Signals feed into the pulse input should be 5 – 12 volts referenced to ground and not exceed 14 volts. This input is normally attached to the tachometer signal and can be run in parallel with existing gauges. Be careful that the supplied signal does not contain large voltage transients or permanent damage may result. Use caution when connecting directly to the negative terminal of the ignition coil as large voltage spikes may occur if not properly filtered.

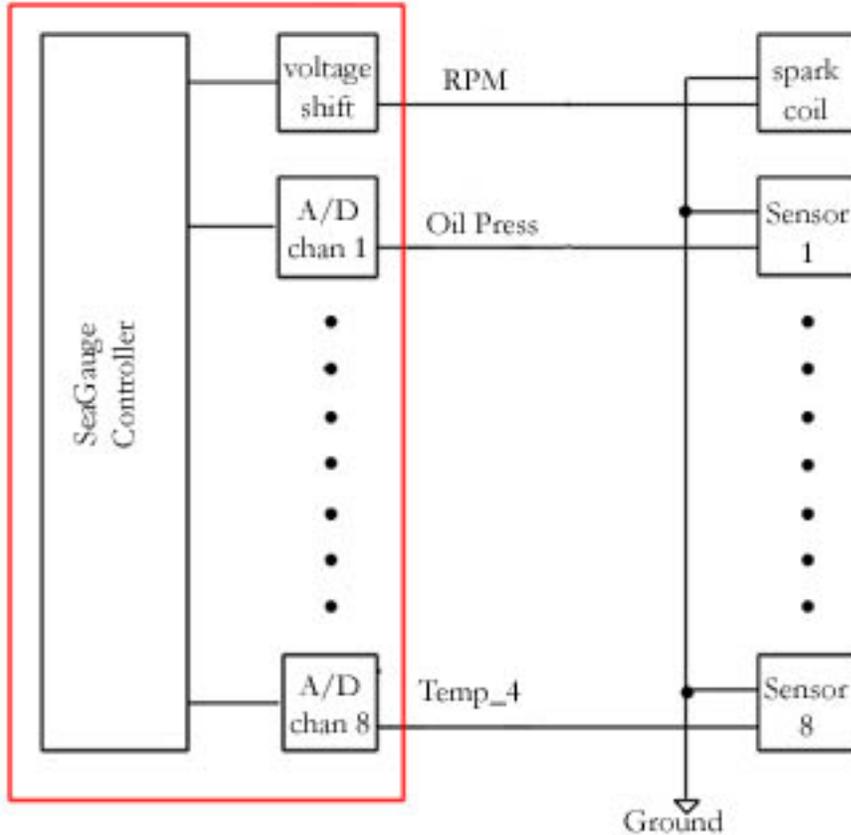
### ***Reference Voltage***

The reference voltage output can be used with senders which require a 3.3 volt source such as many pressure senders. This is a low current output not to exceed 500 mA and must be fused to avoid damage to the unit. The reference voltage is the same as used by the sensor conditioning circuit.

## SeaGauge-X4 User's Manual

### Signals

The unit supports up to 10 sensor inputs (8 analog and 2 pulse). Refer to the connector diagrams for the proper connection for each type of sender. Any unused sensors should be connected to ground to avoid unwanted noise. Never connect any resistive sensor input (temperature/pressure) directly to a voltage source or damage to the unit may result.



## **Calibration Tables**

---

Seagauge-X4 utilizes eight modifiable calibration tables to convert sensor data into user readable display information. The internal Analog-to-Digital converter converts sensor voltages to 10-bit values. The converter can resolve voltages to  $3.3/1024 = 3$  mVolts. These values are averaged and then used to lookup 8 character values form a 256 point lookup table. The use of a lookup table allows for accurate readings from non-linear sensors like temperature senders. The lookup table also allows for easy modification of display values to suit individual preferences and senders.

Following is an example of a partial table used to display battery voltage. The actual table has 256 indexed values. The measured voltage has a range from 0 to 3.3 volts. In this example it is desired to measure battery voltage from 0 to 18 volts so the input voltage from the battery is scaled down using a voltage divider ratio of  $3.3/18 = 0.1833$ . The scaled down voltage is converted to an averaged digital value and then used as an index lookup in the table. For example an Input voltage of 1.178 volts becomes index value 18 in the table which corresponds to the 8 character display value of 1.1 vdc. Using this method allows the Seagauge-X4 to display just about any range of values form a large variety of sensors/senders.

<i>Index</i>	<i>Input Voltage</i>	<i>Measured Voltage</i>	<i>Display value</i>
1	0.065	0.012968	0 vdc
2	0.131	0.025936	0.1 vdc
3	0.196	0.038904	0.1 vdc
4	0.262	0.051872	0.2 vdc
5	0.327	0.06484	0.3 vdc
6	0.393	0.077808	0.3 vdc
7	0.458	0.090776	0.4 vdc
8	0.523	0.103744	0.5 vdc
9	0.589	0.116712	0.5 vdc
10	0.654	0.12968	0.6 vdc
11	0.720	0.142649	0.7 vdc
12	0.785	0.155617	0.7 vdc
13	0.851	0.168585	0.8 vdc
14	0.916	0.181553	0.9 vdc
15	0.981	0.194521	0.9 vdc
16	1.047	0.207489	1.0 vdc
17	1.112	0.220457	1.1 vdc
18	1.178	0.233425	1.1 vdc
19	1.243	0.246393	1.2 vdc
20	1.309	0.259361	1.3 vdc
21	1.374	0.272329	1.3 vdc
22	1.439	0.285297	1.4 vdc
23	1.505	0.298265	1.5 vdc
24	1.570	0.311233	1.5 vdc
25	1.636	0.324201	1.6 vdc
26	1.701	0.337169	1.7 vdc
27	1.767	0.350137	1.7 vdc
28	1.832	0.363105	1.8 vdc

## SeaGauge-X4 User's Manual

The calibration table must conform to a strict format to be loaded. The first row of the text file must start with "[TABLE] [Table Address] [Num of Characters per line = 8] [Number of lines = 256]" to indicate to the download program it is a text file. The remaining 256 lines are the display lookup values corresponding to each of 256 table indexes. No extra spaces or other symbols can be inserted as the file is parsed by position.

Following is an example of a partial table used to display battery voltage. The actual table has 256 indexed values.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	17
[	T	A	B	L	E	]	[	C	0	0	0	]	[	8	]	[	2	5	6	]	
d	b		'			0	.	0		0	0	'	;	0	0	0					
d	b		'			0	.	1		0	0	'	;	0	0	1					
d	b		'			0	.	1		0	0	'	;	0	0	2					
d	b		'			0	.	2		0	0	'	;	0	0	3					
d	b		'			0	.	3		0	1	'	;	0	0	4					
d	b		'			0	.	3		0	1	'	;	0	0	5					
d	b		'			0	.	4		0	1	'	;	0	0	6					
d	b		'			0	.	5		0	1	'	;	0	0	7					
d	b		'			0	.	5		0	2	'	;	0	0	8					
d	b		'			0	.	6		0	2	'	;	0	0	9					
d	b		'			0	.	7		0	2	'	;	0	1	0					
d	b		'			0	.	7		0	2	'	;	0	1	1					
d	b		'			0	.	8		0	3	'	;	0	1	2					
d	b		'			0	.	9		0	3	'	;	0	1	3					
d	b		'			0	.	9		0	3	'	;	0	1	4					
d	b		'			1	.	0		0	3	'	;	0	1	5					
d	b		'			1	.	1		0	4	'	;	0	1	6					
d	b		'			1	.	1		0	4	'	;	0	1	7					
d	b		'			1	.	2		0	4	'	;	0	1	8					
d	b		'			1	.	3		0	4	'	;	0	1	9					

- Column 0-3 must be "db "' to indicate start of data field
- Column 4-9 is the 6 character display value associated with the table index
- Column 10-11 is two character (HEX) used for graphic display lookup
- Column 12-13 must be ";" to indicate end of display values
- Column 14 – is a comment and usually is the table row index number for reference

The 6 character display value can be any alpha-numeric value but usually is a numeric sequence representing the desired readout for the given table index. The "\*" character is reserved to skip the space when displaying the sequence. For example '1.3\*\*04' will only display the 4 character value "1.3". Most display values will only be 4 characters long.

The 2 character HEX Graphic Display Lookup value is used to calibrate the graphic displays. The values range for 0x00 Hex to 0x3F Hex (63 decimal) were 0x3F represents the

## SeaGauge-X4 User's Manual

maximum range for the graphic display. Normally these values can increase in a linear fashion from 0x00 to 0x3F. However, they can be adjusted in a non-linear sequence to give graphic displays more resolution in a desired operating range. For example if it is desired to have more sensitivity at vehicle operating temperature of 180 F, these values can be adjusted so graphic displays ramp quickly and then level off.

<b>Less sensitive graphic display</b>	<b>More sensitive graphic display</b>
db ' 55F 20' ; 164	db '155F 31' ; 229
db ' 60F 20' ; 165	db '160F 32' ; 230
db ' 65F 20' ; 166	db '165F 33' ; 231
db ' 70F 20' ; 167	db '170F 34' ; 232
db ' 75F 21' ; 168	db '175F 35' ; 233
db ' 80F 21' ; 169	db '180F 36' ; 234
db ' 85F 21' ; 170	db '185F 37' ; 235
db ' 90F 21' ; 171	db '190F 38' ; 236
db ' 95F 22' ; 172	db '195F 39' ; 237
db '100F 22' ; 173	db '200F 3A' ; 238
db '105F 22' ; 174	db '205F 3B' ; 239
db '110F 22' ; 175	db '210F 3C' ; 240

Each table has 2048 characters to modify and there are 88 choices for each character for a total of over 18,000 character choices for each table. For this reason the tables are much too large to be modified directly from the Setup Mode. However table files can be obtained and downloaded to the unit to allow for modification of any table. All that is needed is a computer interface (RS232 or Bluetooth) and a communication program such as HyperTerminal or the SeaView utility.

Contact Checto Digital Instruments or <http://www.seagauge.com/support.htm> for more information on obtaining additional table files to match particular senders/sensors.

# Serial Port Protocols

---

The serial port interface of the Seagauge-X4 unit can be used for real-time status and reprogramming. The status information is sent in NMEA 0183 format using the \$IIXDR sentence format. Custom NMEA control sentences are used to control the unit via the serial port interface.

To access the serial port information – connect the supplied cable to computer RS232 port. Set the baud rate of the computer interface to match the baud rate of the unit (4800 or 9600). Use the standard 8 bits, no parity, and 1 stop bit (8-N-1). Start a serial interface program such as HyperTerminal with these settings then power up the unit. If the connection is correct you will status message from the unit –

SeaGauge Version 1.02. This indicates the settings are correct.

NMEA 0183 support custom message formats for command and control of propriety equipment. SeaGauge uses the sentence structures:

\$PCDIC,X - for control were X is the control command

- **N** = Next menu. Same as pressing the top button
- **S** = Set function. Same as pressing the bottom button
- **G** = Start dumping NMEA \$IIXDR sentences in real-time at two updates per second
- **P** = Initiate programming the unit
- **B** = Initialize the Bluetooth module.

\$PCDIS,YYYYY – for status where YYYYY is the returned status information

- \$PCDIS,SEAGAUGE,0001.100,,\*79 = Model Name and Firmware revision

Instrumentation data is returned using the standard NMEA \$IIXDR sentence structure:

\$IIXDR,X,DATA,U,LABEL\*CHECKSUM

- **X** = sensor type (G,P,C,..)
- **DATA** = 8 character sensor data value returned from the lookup table
- **U** = unit of measurement specifier
- **LABEL** = 8 character sensor label and a 1 character number representing the channel
- **CHECKSUM** = NEMA check sum calculation on the string

## **SeaGauge-X4 User's Manual**

### ***NEXT MENU***

The **\$PCDIC,N** command is used to command the unit to display the next menu or group. It functions exactly the same as pressing the top button on the unit

### ***SET Function***

The **\$PCDIC,S** command is used to enter Set-up mode or increment a setting. It operates the same as pressing the bottom button on the unit.

### ***Real-time data***

The **\$PCDIC,G** command is used to view real-time instrumentation from the serial port. When the unit is first powered up it will start listening to the default serial port (RS232 or Bluetooth) for commands. It will not dump data until it receives the **\$PCDIC,G** command. To view real-time data type this command in HyperTerminal after you see the prompt. Data for each of the sensors will immediately begin to be displayed in NMEA 0183 \$IIXDR sentence format. The unit will dump data for all 8 sensors every 0.5 seconds.

HyperTerminal allows capture of real-time data to a text file. First enable the Capture Text command under the Transfer menu. Select the file name and location to capture to. Next enter the **\$PCDIC,G** command string to start dumping data to the specified file.

### ***STOP Function***

The **\$PCDIC,X** command is used to stop real-time display out the serial ports..

### ***Program Mode***

The **\$PCDIC,P** command is used to put the unit into reprogramming mode. Once in this mode a programming file can be sent to the unit to update Lookup Tables, Sensor labels, Display Groups, Label positions, or channel assignments.

**Use caution when using this command as improper use will erase the unit and it will have to be sent back for reprogramming.**

Programming files can be obtained from Chetco Digital Instruments for use in this mode. These are in a special propriety format and can not be constructed or edited in the field. Contact Chetco Digital Instruments for more information on this option.

Download of new table information requires three steps:

- Enter program mode
- Erase existing table
- Load new table

## SeaGauge-X4 User's Manual

Program mode is entered by using the \$PCDIC,P command from HyperTerminal. If this command is successful the unit will display:

- **READY->**

At this point the unit will wait to receive the starting and ending pages to erase. Page numbers are 512 bytes and can be calculated by dividing the starting page memory location by 512. The following table will help you determine the table page numbers.

<i>Table</i>	<i>Address</i>	<i>Start Page</i>	<i>End Page</i>	<i>Erase Command</i>
<b>Sensor Labels</b>	E000	70	70	*7070
<b>Groups</b>	E200	71	71	*7171
<b>Custom Graphics</b>	E400	72	72	*7272
<b>Alarms</b>	E600	73	73	*7373
<b>Channels</b>	E800	74	74	*7474
<b>Parameters</b>	EA00	75	75	*7575
<b>Lookup Table 0</b>	A000	50	53	*5053
<b>Lookup Table 1</b>	A800	54	57	*5457
<b>Lookup Table 2</b>	B000	58	5B	*585B
<b>Lookup Table 3</b>	B800	5C	5F	*5C5F
<b>Lookup Table 4</b>	C000	60	63	*6063
<b>Lookup Table 5</b>	C800	64	67	*6467
<b>Lookup Table 6</b>	D000	68	6B	*686B
<b>Lookup Table 7</b>	D800	6C	6F	*6C6F

To erase the memory you must enter a "\*" symbol followed by the start and end page values with no spaces. For example to erase the Alarms table enter:

- **\*7373**

To erase Lookup Table 3 enter:

- **\*5C5F**

Once you have entered the 5 characters the unit will erase the memory and respond with

- **ERASED->**

At this point the unit will wait to receive the data to reprogram the unit. Use the HyperTerminal Send Text File function to transfer the appropriate file to reprogram the memory. As the file is transferring data the unit will display the memory address for each update. The display should increment till it reaches the end of file and then reset if no errors occur.

# NMEA INPUT

---

The serial port interface of the SeaGauge unit can be used to receive information in NMEA 0183 format using the \$IIXDR sentence format.

The following table shows the currently available tags that can be captured and displayed. Once a selected tag is detected for the designated display label, the data is decoded and displayed if that label is assigned to a Display Group. NMEA data can only be displayed in Digital Data format.

NMEA TAG	Function
\$IIXDR,G	Instrumentation Data
\$GPGGA	UTC TIME, Position, Sat info
\$GPVTG	Track and ground speed
\$SDDBT	depth below transducer
\$SDMTW	water temperature
\$GPRMC	Position, ground speed, true heading
\$GPRMB	Destination WP position, Bearing to WP, Closing speed to WP, Distance to WP
\$YXMTW	water temperature
\$VWVHW	Speed and heading
\$VWVLW	Water traveled distance
\$SDDPT	depth below transducer
\$GPGLL	Basic position
\$SDVHW	Sonar Water Speed and heading
\$SDVLW	Sonar Water traveled distance
\$GPVHW	GPS Water Speed and heading
\$GPRMC	Used for adjusted UTC time to local time

To receive NMEA 0183 input, the following set-up conditions must be met.

- SeaGauge put into slave mode
- NMEA tags set to value other than 0
- NMEA display positions set to desired locations
- NMEA data assigned to 1 of 8 display groups
- Display text labels for desired NMEA position set to match incoming \$IIXDR label

Please refer to unit Setup sections of this manual for proper information on how to set these modes.

NMEA \$IIXDR tags are filtered based on the first 7 characters of the label portion of the sentence. This label must match one of (6-8) the NMEA Display Labels stored in the unit to be displayed. The data value will be displayed in the position assigned to the matching label.

## SeaGauge-X4 User's Manual

\$IIXDR,X,DATA,U,LABEL,CHECKSUM

- **X** = sensor type (G,P,C,..)
- **DATA** = 8 character sensor data value returned from the lookup table
- **U** = unit of measurement
- **LABEL** = 8 character sensor label and a 1 character number representing the channel
- **CHECKSUM** = NEMA check sum calculation on the string

By matching NMEA Display Labels with labels from incoming NMEA \$IIXDR sentences, Seagauge-X4 can decode and display a large variety of NMEA data.

All SeaGauge and SeaSwitch units output NMEA \$IIXDR data with a number in the last position on the label field so that multiple \$IIXDR sentences can be displayed on one screen.

When an incoming NMEA \$IIXDR label matches one of the 6-8 stored in the unit, the first 4 characters of the data field are extracted for display in the chosen position. NMEA data can only be displayed in Digital Data format. None of the Graphic Display modes can be used with NMEA data since it arrives as a TEXT stream and is not numerical data.

Seagauge-X4 will format any received NMEA data into a \$IIXDR sentence for output and data logging. This means that SONAR and GPS sentences will be converted into \$IIXDR sentences and output via the serial port. The resulting output stream can be cascaded to other NMEA equipment that is capable of decoding \$IIXDR sentences like the SeaView display and logging utility which is available for all units.

In this fashion, NMEA data from one SeaGauge unit can be feed into another to increase the number of sensors being monitored or to provide remote viewing of the same sensor. For example, one SeaGauge can be located at the helm and then resend data to another unit located in a flying bridge.

# Flash Programming

---

The firmware of the Seagauge-X4 unit can be upgraded using the supplied flash programming cable and software utility. To perform this function you will need a WINDOWS compatible computer or laptop and a NULL MODEM adapter to connect the supplied cable.

Updating the firmware requires a binary image and flash programming utility. If you do not have these or are not sure on version is required – PLEASE CONTACT THE FACTORY before proceeding.

The flashutil.exe file is started from the DOS command prompt. Before proceeding - copy the flashutil.exe and SeaGauge binary image file to a directory on your computer.

Next – start the DOS command prompt by going to START -> RUN and type “command” This will bring up the DOS command window.

Change the default directory to the folder you copied the files to – for example if the folder is C:\SEAGAUGE then type - **cd c:\seagauge**

Verify you have a valid connection to the unit and the cable is properly attached by typing **flashutil -i** at the prompt. This will display information about which com port you are connected to and verify communication with the unit. You can not proceed if this test does not pass. If there is problem here it is probably due to improper com port or a bad NULL MODEM cable.

After verifying communications you should proceed to save the current binary image from the SeaGauge to a file in case you need to replace it later. At the command prompt type **flashutil -s oldseagauge.hex** This will backup the current firmware to a file on your computer.

To update the firmware type **flashutil -m seagauge001071.hex** (or whatever filename is appropriate) You will be prompted to hit any key or “q” to quit. Proceed to hit the spacebar and your unit will be reprogrammed.

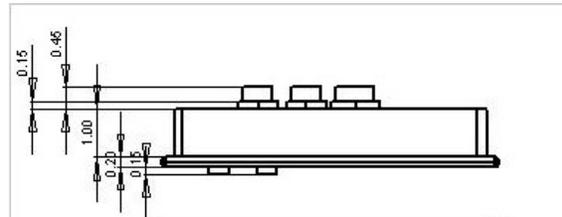
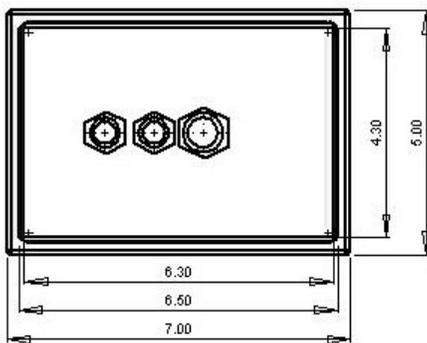
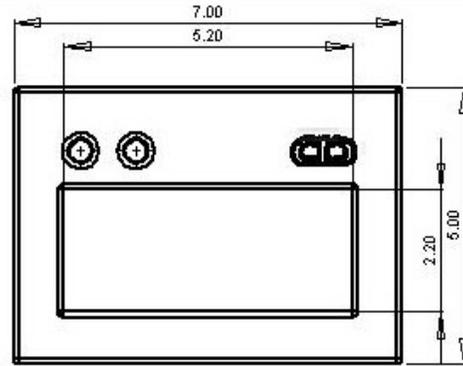
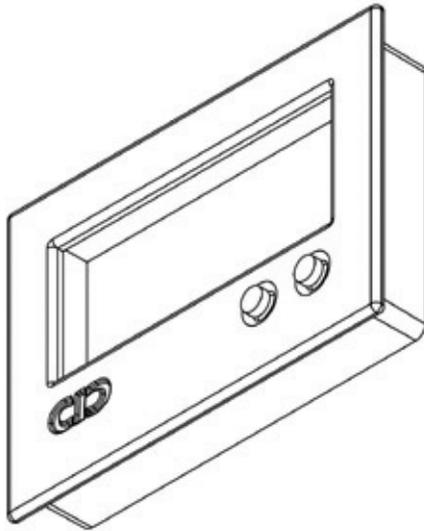
In summary the following sequence should be used to program your unit.

- C:\seagauge>**flashutil - i**
- C:\seagauge>**flashutil - s oldseagauge.hex**
- C:\seagauge>**flashutil - m seagauge001071.hex**

If you have any questions/problems with this procedure – contact the factory for assistance.

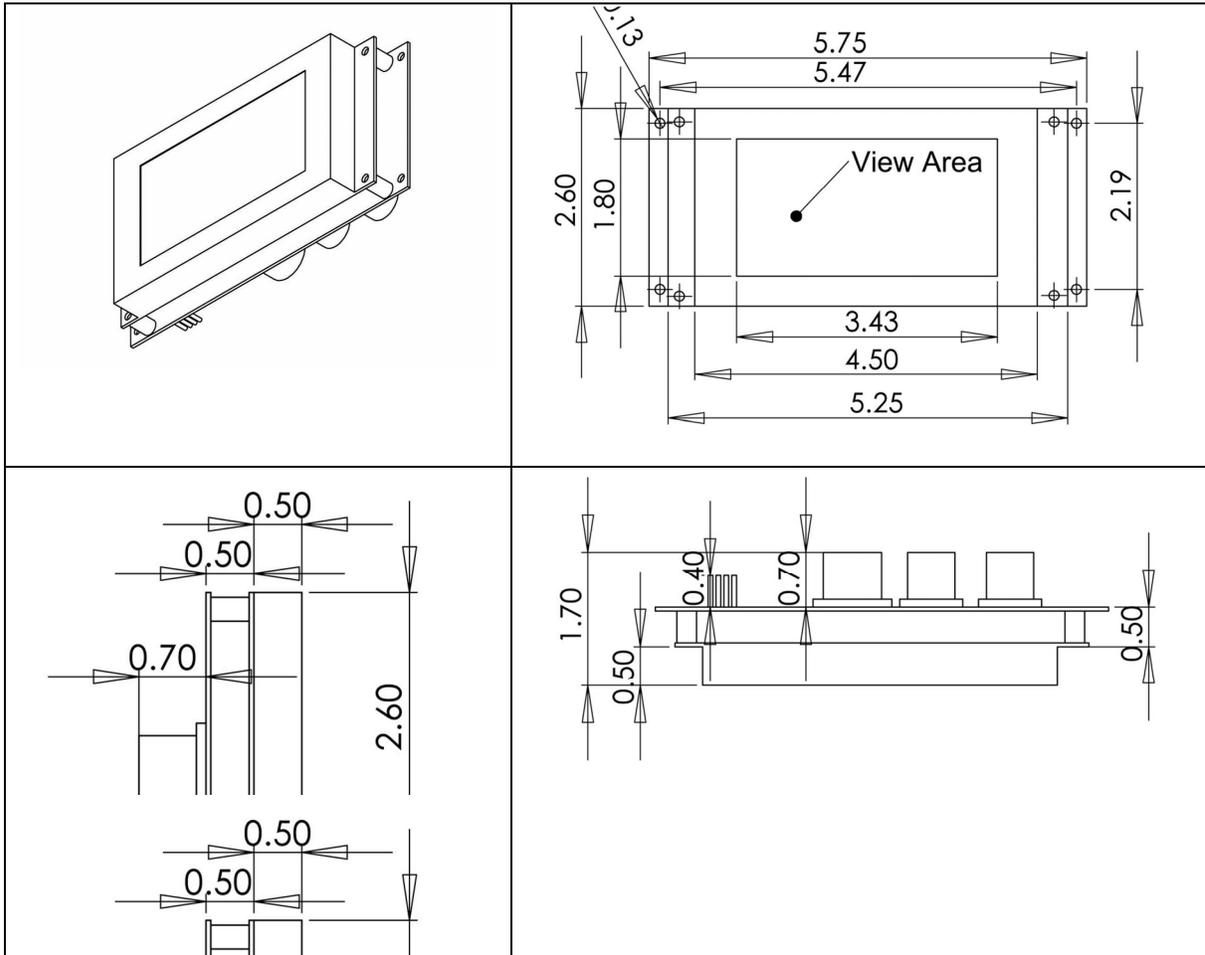
## Unit Dimensions Seagauge-X4 Case

The following table provides dimension information for the Seagauge-X4 case unit with 20X4 LCD display. All dimensions are in inches.

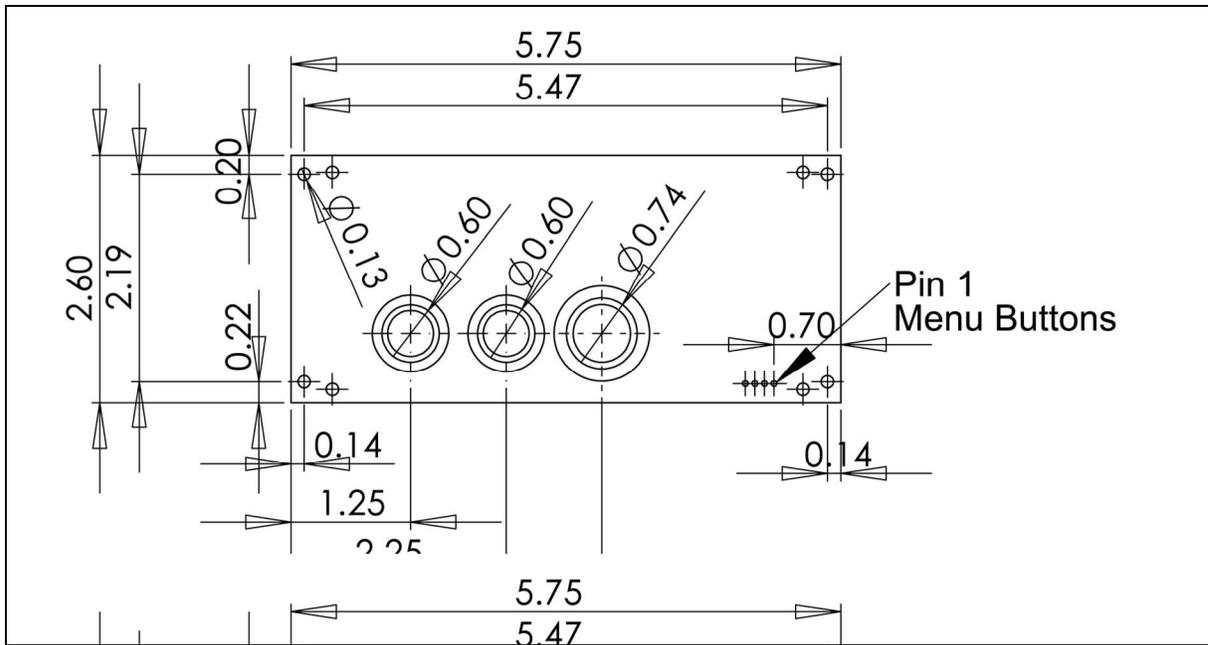


## Unit Dimensions Seagauge-X4 Module

The following table provides dimension information for the Seagauge-X4 module with 20X4 LCD display. All dimensions are in inches..



# SeaGauge-X4 User's Manual



## **90 day Warranty**

---

“We”, “our”, or “us” refers to **Chetco Digital Instruments**, the manufacturer of this product. “You” or “your” refers to the first person who purchases this product as a consumer item for personal, family, or household use.

We warrant this product against defects or malfunctions in materials and workmanship, and against failure to conform to this product's written specifications, all for 90 days from the date of original purchase by you. WE MAKE NO OTHER EXPRESS WARRANTY OR REPRESENTATION OF ANY KIND WHATSOEVER CONCERNING THIS PRODUCT. Your remedies under this warranty will be available so long as you can show in a reasonable manner that any defect or malfunction in materials or workmanship, or any nonconformity with the product's written specifications, occurred within 90 days from the date of your original purchase, which must be substantiated by a dated sales receipt or sales slip. Any such defect, malfunction, or non-conformity which occurs within 90 days from your original purchase date will either be repaired without charge or be replaced with a new product identical or reasonably equivalent to this product, at our option, within a reasonable time after our receipt of the product. If such defect, malfunction, or non-conformity remains after a reasonable number of attempts to repair by us, you may elect to obtain without charge a replacement of the product or a refund for the product. THIS REPAIR, REPLACEMENT, OR REFUND (AS JUST DESCRIBED) IS THE EXCLUSIVE REMEDY AVAILABLE TO YOU AGAINST US FOR ANY DEFECT, MALFUNCTION, OR NON-CONFORMITY CONCERNING THE PRODUCT OR FOR ANY LOSS OR DAMAGE RESULTING FROM ANY OTHER CAUSE WHATSOEVER. WE WILL NOT UNDER ANY CIRCUMSTANCES BE LIABLE TO ANYONE FOR ANY SPECIAL, CONSEQUENTIAL, INCIDENTAL, OR OTHER INDIRECT DAMAGE OF ANY KIND.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you.

This warranty does NOT apply in the following circumstances: (1) when the product has been serviced or repaired by anyone other than us, (2) when the product has been connected, installed, combined, altered, adjusted, or handled in a manner other than according to the instructions furnished with the product, (3) when any serial number has been effaced, altered, or removed, or (4) when any defect, problem, loss, or damage has resulted from any accident, misuse, negligence, or carelessness, or from any failure to provide reasonable and necessary maintenance in accordance with the instructions of the owner's manual for the product.

We reserve the right to make changes or improvements in our products from time to time without incurring the obligation to install such improvements or changes on equipment or items previously manufactured.

This warranty gives you specific legal rights and you may also have other rights which may vary from state to state.

REMINDER: You must retain the sales slip or sales receipt proving the date of your original purchase in case warranty service is ever required.

**Chetco Digital Instruments, INC.**  
**14377 Highway 101 South Unit C**  
**Harbor, OREGON 97415**  
**541-661-2051**

## SeaGauge-X4 User's Manual

### SEAGAUGE FIRMWARE LICENSE AGREEMENT

THIS IS A LEGAL AGREEMENT BETWEEN THE END-USER WHO FIRST PURCHASES THIS PRODUCT AS A CONSUMER ITEM FOR PERSONAL, FAMILY, OR HOUSEHOLD USE (“YOU”) AND CHETCO DIGITAL INSTRUMENTS, INC., THE MANUFACTURER OF THIS PRODUCT. (“WE”, “OUR”, OR “US”). USING THE PRODUCT ACCOMPANIED BY THIS LICENSE AGREEMENT CONSTITUTES ACCEPTANCE OF THESE TERMS AND CONDITIONS.

1. This License Agreement applies to the microcode and one or more lookup tables that your product may contain. We refer to these singly as a “FIRMWARE”.
2. The FIRMWARE that your product may contain are licensed, not sold. We grant to you the nonexclusive, non-assignable right to use these FIRMWARE for monitoring sensor/sender data, but only as long as you comply with the terms and conditions of this License Agreement. We reserve the right to terminate this license if you violate any aspect of this License Agreement.
3. The FIRMWARE housed in your product are protected by the copyright notices appearing on the product or its screen(s). You may NOT modify, adapt, translate, reverse engineer, decompile, disassemble, rent, lease, or resell any FIRMWARE, and you may NOT create derivative works based upon any FIRMWARE or its contents.. Any unauthorized reproduction, use, or transfer of a FIRMWARE may be a crime and may subject you to damages and attorney fees.
4. This License Agreement will terminate immediately without prior notice from us if you fail to comply with or violate any of the provisions of this Agreement. Upon termination, you will promptly return all products containing one or more FIRMWARE to us.
5. Prices and programs are subject to change without notice.
6. This License Agreement shall be governed by the laws of the State of Oregon and comprises the complete and exclusive understanding between you and us concerning the above subject matter.

## **SeaGauge-X4 User's Manual**

### **How to Obtain Service**

We back your investment in quality products with quick, expert service and genuine replacement parts. If you're in the United States and you have questions, please contact the Factory Customer Service Department using our number listed below. You must send the unit to the factory for warranty service or repair. Please call the factory before sending the unit. You will be asked for your unit's serial number (shown above). Use the following number:

**541-661-2051**

U.S.A. only. Monday through Friday, except holidays.

Your unit is covered by a full one-year warranty. (See inside for complete warranty details.) If your unit fails and the failure is not covered by the original warranty, Chetco Digital Instruments has a flat-rate repair policy that covers your unit and accessories packed with the unit at the factory. There is a 180-day warranty on all non-warranty repairs from the factory, which is similar to the original warranty, but is for 180 days rather than one year. For further details, please call us at the above number.

Remember, non-warranty repairs are subject to Chetco Digital Instruments published flat rate charges and 180-day warranty.

CHETCO DIGITAL INSTRUMENTS, INC

14377 Highway 101 South Unit C

HARBOR, OR 97415

541-661-2051

<http://www.seagauge.com>