PERDIX AI

PERDIX AI Operating Instructions

SHEARWATER

Powerful • Simple • Reliable

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DANGER

This computer is capable of calculating deco stop requirements. These calculations are at best a guess of the real physiological decompression requirements. Dives requiring staged decompression are substantially more risky than dives that stay well within no-stop limits.

Diving with rebreathers and/or diving mixed gases and/or performing staged decompression dives and/or diving in overhead environments greatly increases the risk of scuba diving.

You really are risking your life with this activity.

WARNING

This computer has bugs. Although we haven't found them all yet, they are there. It is certain that there are things that this computer does that either we didn't think about, or planned for it to do something different. Never risk your life on only one source of information. Use a second computer or tables. If you choose to make riskier dives, obtain the proper training and work up to them slowly to gain experience.

This computer will fail. It is not whether it will fail but when it will fail. Do not depend on it. Always have a plan on how to handle failures. Automatic systems are no substitute for knowledge and training.

No technology will keep you alive. Knowledge, skill, and practiced procedures are your best defense (except for not doing the dive, of course).

Conventions Used in this Manual

These conventions are used to highlight important information:

INFORMATION

Information boxes contain useful tips for getting the most out of your Perdix AI.

CAUTION

Caution boxes contain important instructions on operating the Perdix AI.

WARNING

Warning boxes contain critical information that may affect your personal safety.

1. Introduction

The Shearwater Perdix AI is an advanced dive computer for all types of diving. The Air Integration (AI) feature adds the ability to wireless monitor the pressure of one or two scuba tanks.

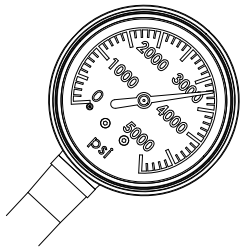
This manual only covers operation of the AI feature. Please see the Perdix manual for full operating instructions of the dive computer features.

Please take the time to read this manual. Your safety may depend on your ability to read and understand the AI displays.

Do not use this manual as a substitute for proper dive training and never dive beyond your training. What you don't know can hurt you.

Use a backup analog SPG

Always use a backup analog submersible pressure gauge as a redundant source of gas pressure information.



1.1. Features

- Wireless pressure monitoring of 1 or 2 scuba tanks.
- Units in PSI or Bar.
- Flexible display setup.
- Optional Gas Time Remaining (GTR) and Surface Air Consumption (SAC) rate based on one of the tanks.
- Logging of pressure, GTR, and SAC values at 10 second intervals.
- Average SAC of last dive displayed on surface.
- Warnings when reserve and critical pressures reached.
- Available in all modes (OC Rec, OC Tec, CC/BO, and Gauge)

FIGURE 1 ***The Perdix AI transmitter and handset***

2. Covered by this Manual

This manual only covers operation of the wireless air integration (AI) feature of the Perdix dive computer.

See the Perdix Manual

Refer to the regular Perdix manual for general dive computer setup and operation. This manual only covers the AI feature.

3. What is AI?

AI stands for Air Integration. On the Perdix AI, this refers to a system that uses wireless transmitters (FIGURE 3) to measure the gas pressure in a scuba tank and transmit this information to the Perdix AI handset (FIGURE 2) for display and logging.

Data is transmitted using low-frequency (38kHz) radio frequency communications. A receiver in the Perdix AI accepts this data and formats it for display.

The communication is one-way. The transmitter sends data to the Perdix AI handset, but the handset does not send any data to the transmitter.

Although the feature is named “Air” Integration, other gas mixtures can be used with the system as well. When using gas mixtures with oxygen content above 40%, be sure to have proper training on such mixtures, and follow proper cleaning and material compatibility guidelines.

Transmitter is not O_2 Clean

The transmitters sold with Shearwater branding are not shipped O_2 clean and may only be used with gas mixtures up to 40% O_2.

Compatible O_2 clean transmitters are sold by other vendors.

FIGURE 2 ***Perdix AI handset***

FIGURE 3 ***Wireless high-pressure (HP) transmitter***

4. Getting Started / Basic Setup

This section will get you started with the basics of AI on the Perdix. Advanced setup and detailed descriptions will be covered in later sections.

4.1. Install the Transmitter

Before using the AI system, you will need to install one or more transmitters on a scuba tank first stage regulator.

The transmitter must be installed on a first stage port labeled “HP” (high pressure). Use a first stage regulator with at least two HP ports, so that a backup analog submersible pressure gauge (SPG (FIGURE 4)) can be used.

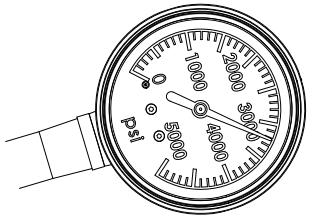


FIGURE 4 ***A backup SPG is recommended***

Position the transmitter such that it is on the same side of your body as you wear your Perdix AI handset (FIGURE 5). Range is limited to approximately 3 ft (1 m).

A high-pressure hose may be used to relocate the transmitter for better reception or convenience. Use hoses rated for a working pressure of 4500 PSI (300 Bar) or higher.

Use a wrench (11/16” or 17mm) to tighten or loosen the transmitter

Avoid hand tightening or loosening, as this can stress the body of the transmitter.

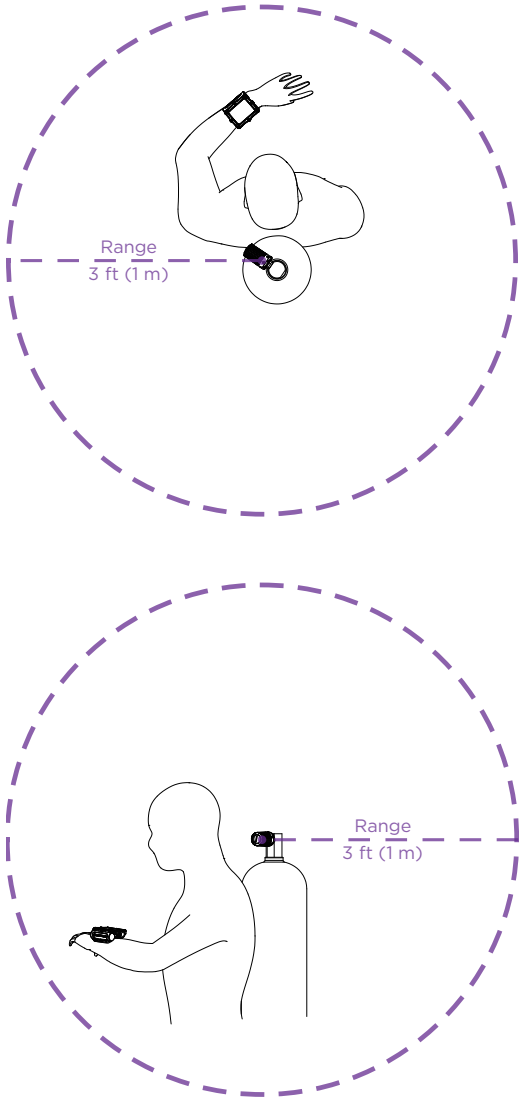


FIGURE 5 ***Install transmitter on 1st stage HP port***

Install transmitter on the same side of your body as the handset. Range is approximately 3 feet (1 m).

4.2. Turn On the Transmitter

Turn on the transmitter by opening the tank valve. The transmitter will automatically wake up when it detects pressure.

Pressure data is transmitted every 5 seconds.

4.3. Turn Off the Transmitter

To turn off the transmitter, close the tank valve and purge the second stage regulator to drain pressure from the hoses. The transmitter will automatically power down after 30 seconds of no applied pressure.

Leave the valve open and the transmitter on for now.

4.4. Enable AI on the Perdix

On the Perdix AI, navigate to the **System Setup⇨AI Setup** menu (FIGURE 6). Change the **AI Mode** setting to **T1** (Tank 1). The AI is now on.

When **AI Mode** is **Off**, the AI sub-system is completely powered down and does not consume any power. When on the AI system increases power consumption by approximately 10%. For example, an alkaline AA battery which lasts approximately 45 hours with AI off (on medium screen brightness), would last about 40 hours with AI on.

More information about settings in the **AI Setup** menu can be found in **Section 5.1. AI Setup**.

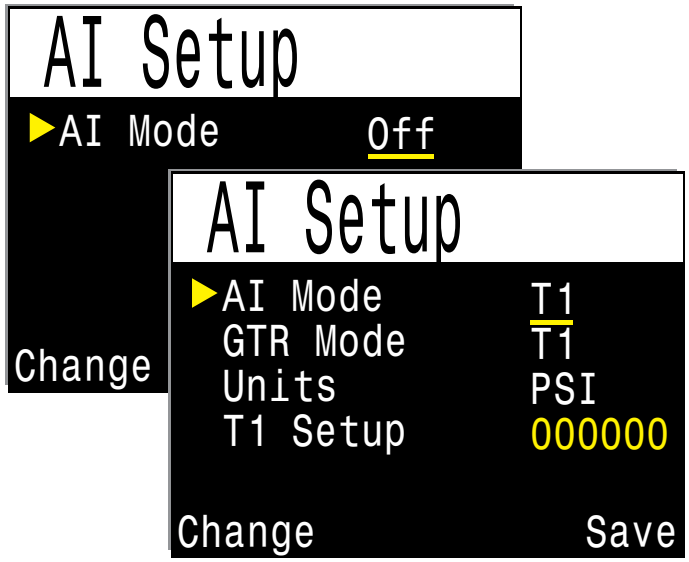


FIGURE 6 ***Enable AI by changing the AI Mode to T1***

The menu above can be found at System Setup⇨AI Setup

4.5. Pair the Transmitter

Each transmitter has a unique serial number etched on its body. All communications are coded with this number so that the source of each pressure reading can be identified.

Pairing the transmitter is done by going to the **T1 Setup** menu option, then selecting **Edit**. Enter the 6-digit serial number into the **T1 Serial #** setting (FIGURE 7). You only need to set this once, as it will be permanently saved in the settings memory.

More information about settings in the **T1/2 Setup** menu can be found in **Section 5.2. T1/T2 Setup**.

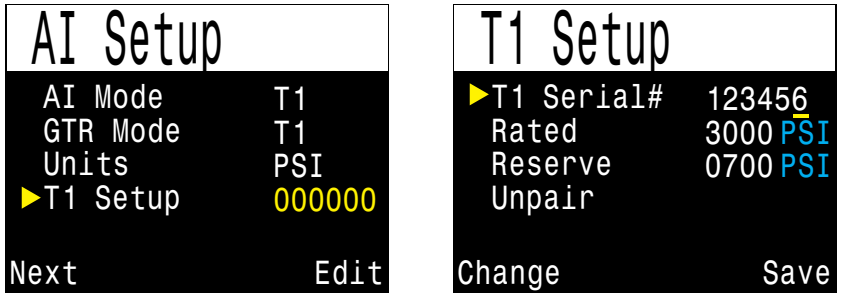


FIGURE 7 ***Pair the transmitter serial number***

Each transmitter has a unique serial number printed on its body.

4.6. Add an AI display to the main screen

The main screen will not show AI information until manually added.

In OC Rec mode, use the **System Setup⇨Bottom Row** menu (FIGURE 8). In OC Tec or CC/BO modes, use the **System Setup⇨Center Row** menu.

Alternatively, you can leave AI information off the main screen. Pressing the right button twice will change the bottom row of the screen to show AI information. This display does not time-out back to the main screen.

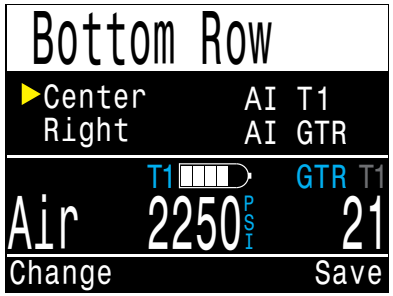


FIGURE 8 ***Add an AI display to the main screen (optional)***

If you choose not to put AI on the main screen you can access the AI information with two presses of the right button.

4.7. Ready to Dive

AI is now setup and ready to dive (FIGURE 9).

However, please continue to read the manual to fully understand the displays, warnings and operation of the AI feature.

Check that your tank valve is open

Always take a few breaths from your regulator or purge your regulator's second stage while monitoring your tank pressure for a full 10-15 seconds prior to entering the water to ensure your tank valve is turned on.

If the first stage regulator is charged but the tank valve has been closed the breathing gas available to the diver will decrease rapidly and within a few breaths, the diver will face an "out of air" situation. Unlike an analog gauge, the air pressure reported on the Perdix AI will only update every 5 seconds, so the pressure reported by the Perdix AI must be monitored for longer than that (we suggest 10-15 seconds) to ensure the tank valve is open.

Including a regulator purge test followed by 10-15 seconds of air pressure monitoring before entering the water as part of your pre-dive safety check is a good way to mitigate this risk.

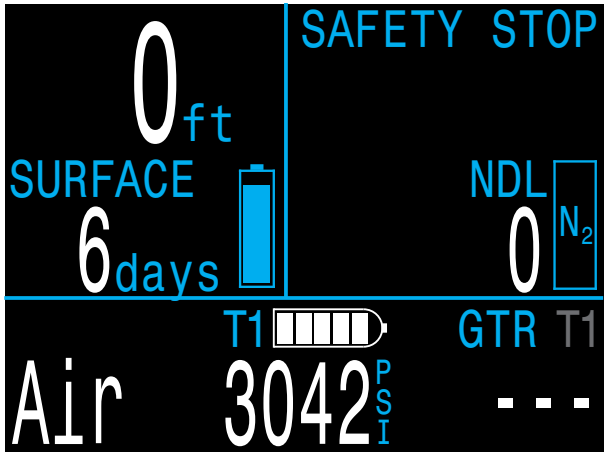


FIGURE 9 ***The main screen (OC Rec mode) on the surface***

4.8. Using Multiple Transmitters

When using mutliple transmitters, **best reception reliabilty will be attained when using transmitters of different colors** (FIGURE 10)**.**

The different colors have different transmit timing. This prevents communication collisions that could potentially cause a loss of connection.

When two transmitters of the same color are used, the potential exists for their communication timing to become synchronized. When this occurs, the transmitters will interfere with each other, resulting in data dropouts. These dropouts may resolve quickly or could last up to 20 minutes or more.

By using different colored transmitters, the transmit timing periods are different enough that collisions due to synchronized communications will resolve quickly.

Shearwater sells standard gray transmitters, and also yellow transmitters with alternate transmit timing.

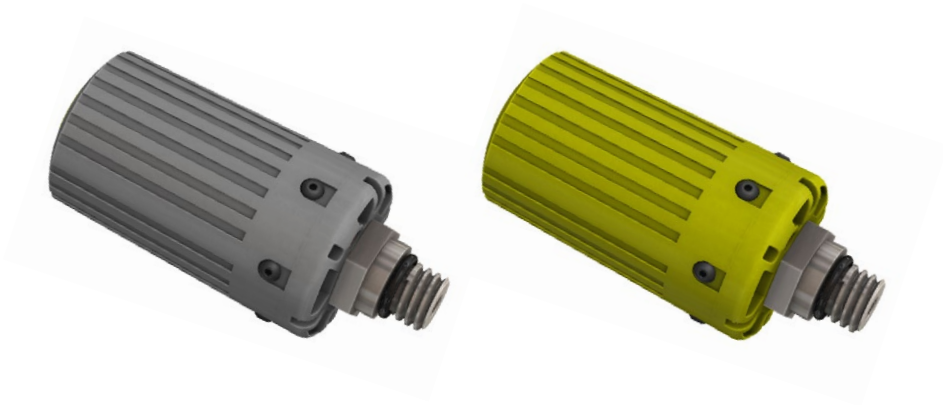


FIGURE 10 ***When using more than one transmitter, use one gray and one yellow for best reliability***

Using Multiple Transmitters of Same Color May Result in Lost Communications

Use different colored transmitters when using more than one transmitter (see above).

5. AI Menus

There are two AI related menu pages (FIGURE 10) that can be accessed in the **System Setup** menu.

All AI settings must be configured on the surface before a dive, since **System Setup** is not accessible during a dive.

5.1. AI Setup

The AI Setup menu page (FIGURE 11) contains settings that apply to all transmitters.

AI Mode

AI Mode is used to completely disable AI, or select which transmitters are active.

AI Mode Setting	Description
Off	AI sub-system is completely powered down and consumes no power. When on, AI increases power consumption by about 10%.
T1	Transmitter (tank) 1 is enabled.
T2	Transmitter (tank) 2 is enabled.
T1&T2	Both transmitters are enabled.

Set AI Mode to OFF when AI not in use

Leaving AI enabled when not in use will negatively impact battery life. When a paired transmitter is not communicating, the Perdix goes into a higher power scan state. This increases power consumption to about 25% higher than with AI off. Once communications are established, power drops to about 10% higher than with AI off.

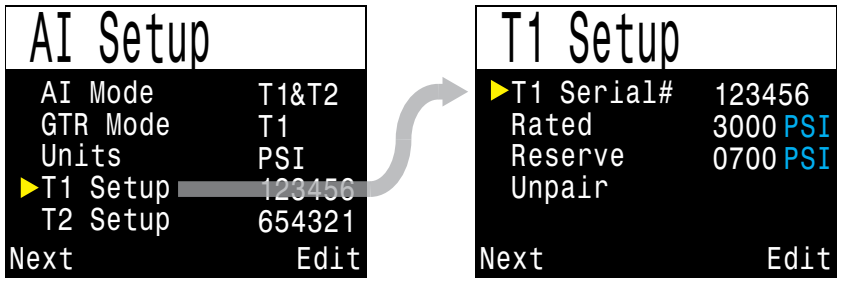


FIGURE 11 ***The two menu screens used to setup AI***

There is also a corresponding "T2 Setup" menu with the same settings as the "T1 Setup" menu.

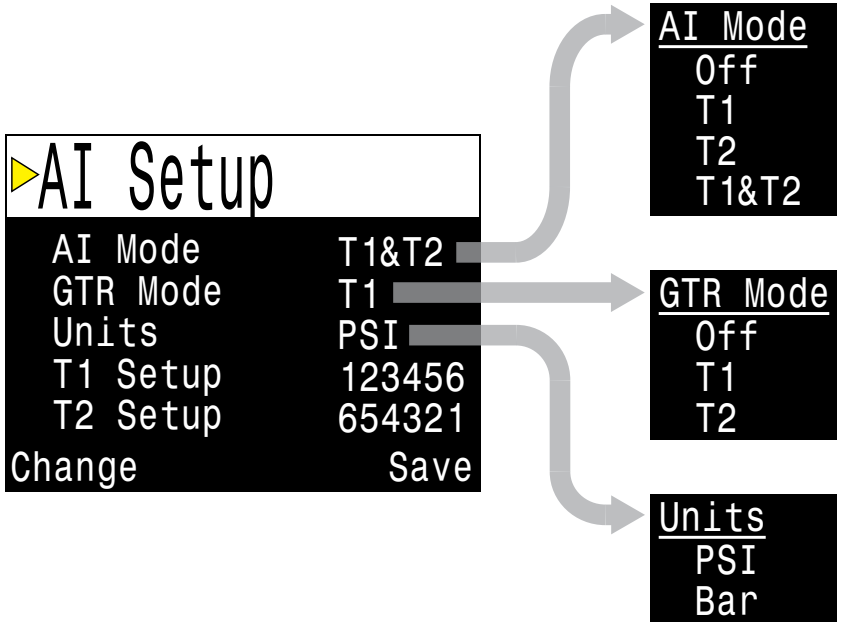


FIGURE 12 ***The AI Setup menu***

GTR Mode

Gas Time Remaining (GTR) is the time in minutes that can be spent at the current depth and SAC rate until a direct ascent to the surface at a rate of 33 feet/min (10 m/min) would result in surfacing with the reserve pressure. The SAC rate is averaged over the last two minutes of diving for calculating GTR.

GTR can only be based on one tank. The Surface Air Consumption (SAC) measurements are also based on the tank selected for GTR calculations.

GTR Mode Setting	Description
Off	GTR is disabled. SAC is also disabled.
T1	Transmitter (tank) 1 is used for GTR and SAC calculations.
T2	Transmitter (tank) 2 is used for GTR and SAC calculations.

The GTR display is described in **Section 6.4. GTR Display.**

Read more on how GTR is calculated in **Section 7.2. GTR calculations.**

Units

Units can be set to pounds per square inch (PSI) or Bar.

T1/T2 Setup

These menu items show the serial number of the currently paired transmitters.

Selecting edit (right button) while these menu items are selected will open the next menu page for T1/T2 Setup.

5.2. T1/T2 Setup

The T1/T2 Setup (FIGURE 12) menu pages allow setup that is individual to each transmitter/tank.

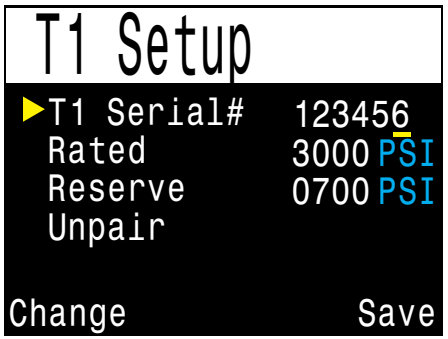


FIGURE 13 ***The T1/T2 Setup menu***

Serial

Every transmitter has a unique 6-digit serial number (FIGURE 13). This number is etched onto the side of the transmitter.

Enter the serial number to pair the transmitter to T1. This number only needs to be entered once. Like all settings, it is stored in permanent memory and will be retained across power cycles and battery changes.

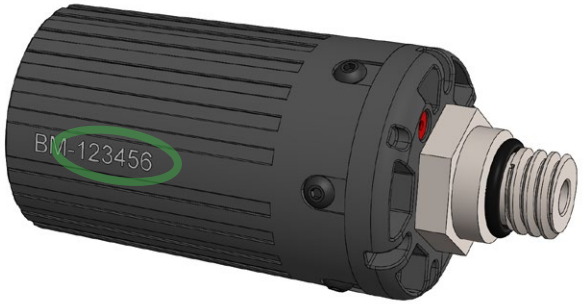


FIGURE 14 ***Each transmitter is marked with a unique serial number***

Rated Pressure

Enter the rated pressure of the tank on which the transmitter is installed.

The valid range is 1000 to 4350 PSI (69 to 300 bar).

The only use of this setting is to scale the full-scale range of the gas pressure bar graph (FIGURE 14).

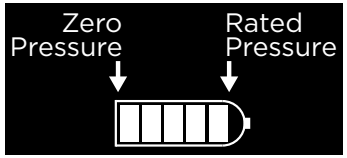


FIGURE 15 ***Rated pressure is only used to scale the pressure bar graph***

Reserve Pressure

Enter the reserve pressure (FIGURE 15).

The valid range is 400 to 2000 PSI (28 to 137 bar).

The reserve pressure setting is used for:
1) Low pressure warnings
2) Gas Time Remaining (GTR) calculations

A yellow **"Reserve Pressure"** warning will be generated when the tank pressure falls below this setting.

A red **"Critical Pressure"** warning will be generated when the tank pressure falls below the larger of 300 PSI (21 Bar) or half the reserve pressure.

For example, if reserve pressure is set to 700 PSI, the critical warning will occur at 350 PSI (700/2). If the reserve pressure is set to 400 PSI, the critical warning will occur at 300 PSI.

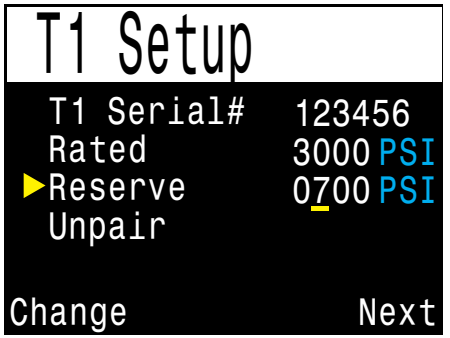


FIGURE 16 ***The reserve pressure is used for warnings and GTR***

The display of reserve and critical warnings can be seen in **Section 6.3. T1/T2 Pressure Display.**

Unpair

The unpair option is simply a shortcut to reset the serial number to 000000.

When not using T1 or T2, for lowest power consumption disable receiving completely by setting the **AI Mode** setting to **Off**.

6. AI Displays

There are four display fields (FIGURE 16) that are used to display AI information:

1) T1/T2 Pressure
2) GTR
3) SAC
4) Mini combination display

T1/T2 Pressure | *Gas Time Remaining* | *Surface Air Consumption* | *Mini-Combination*

FIGURE 17 ***There are four AI displays***

These displays can be viewed in two ways:

1) Added to a configurable location on the main screen.
2) Viewed on a bottom row info line by pressing the right button a few times.

6.1. Adding to a configurable location

To display AI information permanently on the main screen, a configurable location must be setup with an AI display.

In OC Rec mode, the configurable locations are on the bottom row (FIGURE 17).

In OC Tec mode or CC/BO mode, the configurable locations are on the center row (FIGURE 18).

Gauge mode does not have any configurable locations, so the AI information must be viewed on the bottom info line.

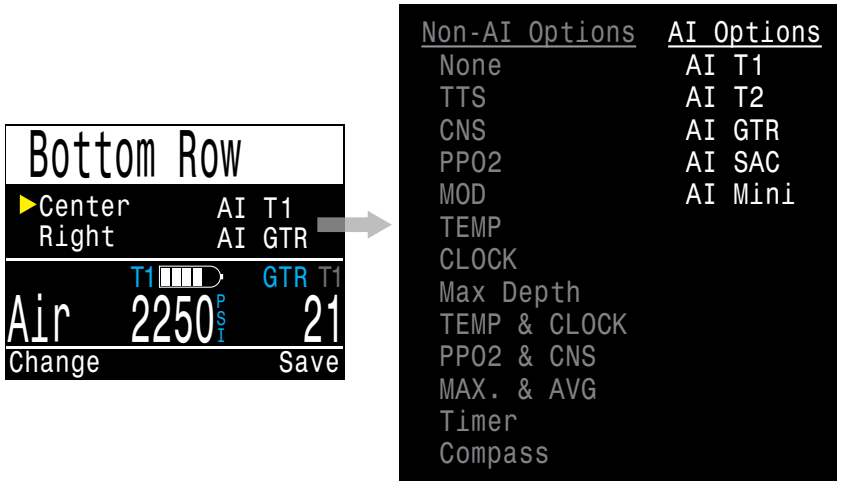


FIGURE 18 ***In OC Rec mode, AI displays may be added to the bottom row***

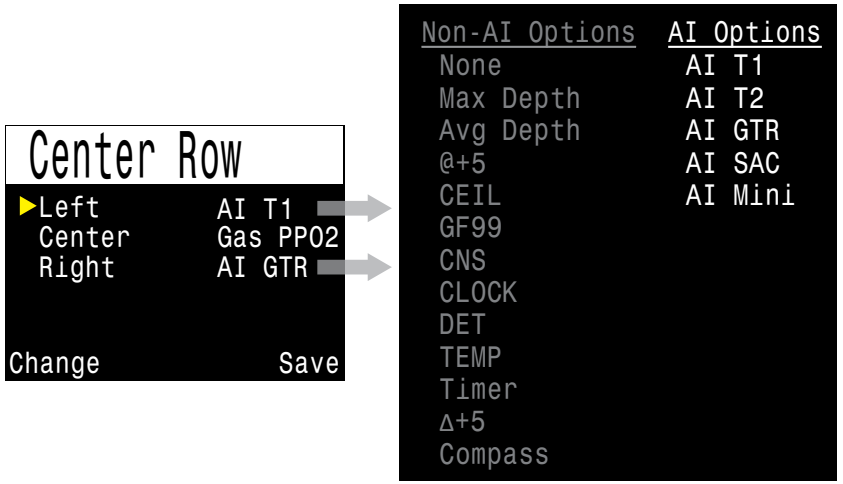


FIGURE 19 ***In OC Tec or CC/BO mode, AI displays may be added to the center row***

6.2. Viewing on the bottom info line

If it is not desired to use a configurable main screen location for AI, the AI information can be viewed on the bottom info line (FIGURE 19) by pressing the right button twice.

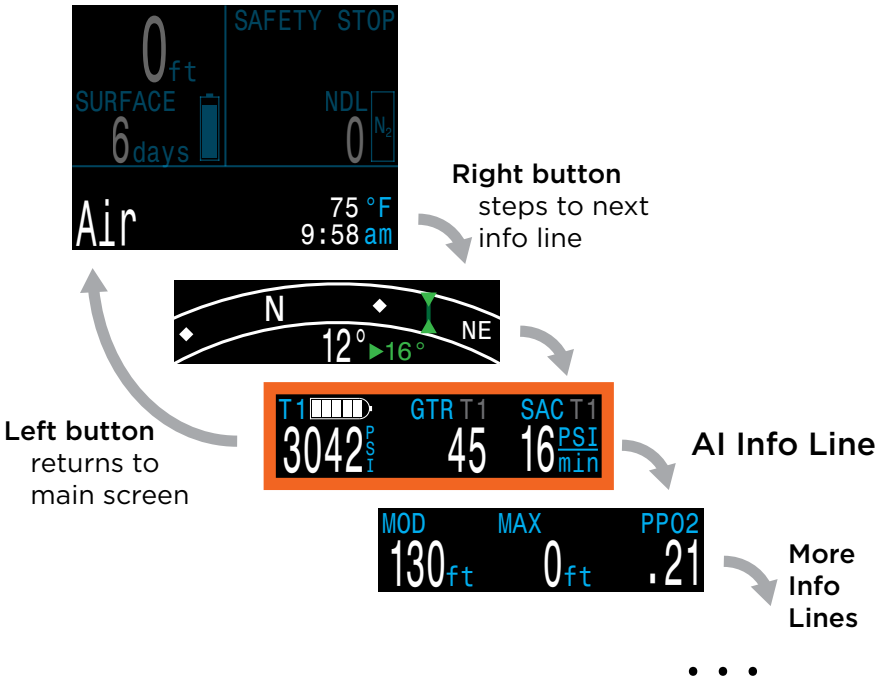


FIGURE 20 ***Access the AI info line with two right button presses***

The AI info line does not timeout back to the main screen.

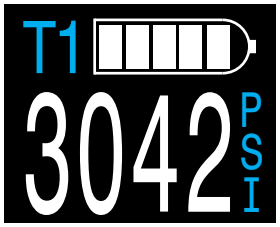
Most other info lines do timeout back to the main screen after 10 seconds, with the exception of the compass and tissues bar graph which also do not timeout.

The contents of the AI info line will automatically adapt to the current setup.

AI Setting	GTR Setting	AI Info Line Display
T1	Off	T1 3042 PSI
T2	Off	T2 1648 PSI
T1&T2	Off	T1 3042 PSI T2 1648 PSI
T1	T1	T1 3042 PSI GTR T1 45 SAC T1 16 PSI/min
T2	T2	GTR T2 23 SAC T2 17 PSI/min T2 1648 PSI
T1&T2	T1	T1 3042 PSI GTR 45 T1 SAC 16.2 T2 1648 PSI
T1&T2	T2	T1 3042 PSI GTR 23 T2 SAC 17.4 T2 1648 PSI

6.3. T1/T2 Pressure Display

The pressure displays (FIGURE 20) are the most fundamental AI displays, showing pressure in the current units (PSI or Bar).



Additionally, a bar graph represents the pressure graphically. This bar graph is scaled from zero pressure up to the **rated pressure** setting. This is NOT a battery level indicator.

FIGURE 21 ***The AI T1/T2 Pressure Display***

Low Pressure Warnings:

Reserve Pressure

Critical Pressure

No Communications Warnings:

No communications for 30 to 90 seconds

No communications for greater than 90 seconds

Low Battery Warnings:

Battery should be replaced soon

Battery should be replaced immediately

FIGURE 22 ***Warning displays***

6.4. GTR Display

The Gas Time Remaining display (FIGURE 22) shows the time, in minutes, that you could stay at the current depth until a direct ascent to the surface at a speed of 33 feet/min (10 m/min) would result in surfacing with the reserve gas pressure remaining.

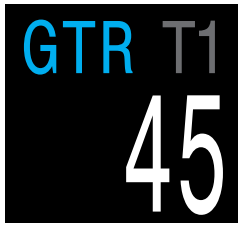


FIGURE 23 ***The GTR Display***

The value is displayed in yellow when less than or equal to 5 minutes. The value is displayed in red when less than or equal to 2 minutes.

GTR can only be based on a single tank. The title indicates which transmitter (T1 or T2) is being used for the GTR and SAC calculations in a dark gray font. When on the surface, the GTR displays "---". **GTR is not shown when decompression stops are needed, and will display "deco".**

SAC data from the first 30 seconds of each dive is discarded. It then takes an additional few minutes to calculate the average SAC. Therefore, for the first few minutes of each dive, the GTR will display "wait", until enough data has been collected to begin making GTR predictions (FIGURE 23).

More information on how GTR and SAC are calculated can be found in **Section 7. How SAC and GTR are calculated**.

No GTR on surface

At start of dive, wait for data to stabilize

FIGURE 24 ***GTR display when on surface and at start of dive***

6.5. SAC Display

The Surface Air Consumption (SAC) display shows the average rate of pressure change over the last two minutes, normalized to as if at 1 ATA pressure. Depending on the current units setting, SAC is either displayed in PSI/minute or Bar/minute.

Note that SAC is NOT transferable between tanks of different sizes.

On the surface, the average SAC from the last dive is displayed.

FIGURE 25 ***The SAC Display***

During the first few minutes of a dive the SAC value is not available, while the initial data is being collected for averaging calculations. The SAC display will show “wait” during this time.

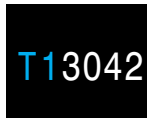
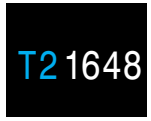
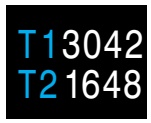
FIGURE 26 ***SAC is not displayed for the first few minutes of a dive***

On surface, SAC is average from last dive

The average SAC from your last dive is shown when on the surface. When a dive ends, you may notice the SAC value suddenly changes. This is because the SAC display changes from showing the SAC over the last two minutes (when in dive mode) to showing the average SAC for the whole dive.

6.6. Mini Combination Display

A miniature combination display is available that packs more information into a smaller space, at the expense of font size.
Like the AI info line, the mini display automatically changes its displayed contents based on the current settings:

AI Setting	GTR Setting	Mini Display
T1	Off	
T2	Off	
T1&T2	Off	
T1	T1	
T2	T2	
T1&T2	T1	
T1&T2	T2	

The gray bar indicates which tank is used for GTR/SAC calculations.

7. How SAC and GTR are calculated

Understanding the basis of SAC and GTR will help you get the best performance from your Perdix AI.

7.1. SAC calculations

Surface Air Consumption (SAC) is the **rate of change of tank pressure**, normalized as if at 1 atmosphere of pressure. The units are either PSI/minute or Bar/minute.

The Perdix AI calculates SAC averaged over the last two minutes. The data from the first 30 seconds of a dive are discarded to ignore the extra gas that is typically used during this time (inflating BCD, wing, or dry suit).

SAC vs RMV

Since SAC is simply based on rate of tank pressure change, the calculations do not need to know the tank size. However, this means that the SAC is NOT transferable to tanks of a different size.

Contrast this to respiratory minute volume (RMV) which is the volume of gas your lungs experience per minute, measured in Cuft/min or L/min. The RMV describes your personal breathing rate, and is therefore independent of tank size.

Why SAC instead of RMV?

Since RMV has the desirable property of being transferable between tanks of different sizes, it seems to be the better choice on which to base GTR calculations. However, the main drawback of using RMV is that it requires setting up tank size correctly for each tank. Such setup is easy to forget and is also easy to setup incorrectly.

SAC has the great property of not requiring any setup, making it the simplest and most reliable choice. The drawback is that it is not transferable between tanks of different sizes.

SAC Formula

The SAC is calculated as follows:

$$SAC = \frac{\frac{P_{tank}(t_1) - P_{tank}(t_2)}{t_2 - t_1}}{P_{amb,ATA}}$$

$P_{tank}(t) = Tank\ pressure\ at\ time\ t\ [PSI] or\ [Bar]$
$t = Time\ [minutes]$
$P_{amb,ATA} = Ambient\ pressure\ [ATA]$

The time samples are taken 2 minutes apart, and $P_{amb,ATA}$ is the average ambient pressure (i.e. depth) over this time frame.

Since the Perdix AI displays and logs SAC, the formula for calculating RMV from SAC is useful. Knowing your RMV can help with planning dives using tanks of various sizes.

Calculating RMV from SAC - Imperial units

In the imperial system, tank sizes are described using two values; capacity in Cuft at a rated pressure in PSI.

For example, a common tank size is 80 Cuft at 3000 PSI.

To convert SAC in [PSI/minute] to RMV in [Cuft/minute], calculate how many Cuft are stored per PSI, then multiply this by the SAC to get RMV.

For example, a SAC of 23 PSI/min with an 80 Cuft 3000 PSI tank would be an RMV of (23 x (80/3000)) = 0.61 Cuft/min.

Calculating RMV from SAC - Metric units

In the metric system, tank sizes are described using a single number, the tank's physical size in liters [L]. This is how much gas could be stored at a pressure of 1 Bar, so effectively the units of tank size are [L/Bar].

This makes converting SAC to RMV easy. When using metric units, simply multiply the SAC by tank size.

For example, a SAC of 2.1 Bar/min with a 10 L tank would be an RMV of (2.1 x 10) = 21 L/min.

7.2. GTR calculations

Gas Time Remaining (GTR) is the time in minutes that can be spent at the current depth until a direct ascent to the surface at a rate of 33 feet/min (10 m/min) would result in surfacing with the reserve pressure. This is calculated using the current SAC value.

Safety stops and decompression stops are not considered by the GTR calculations.

To calculate GTR, start with the known tank pressure, P_{tank}. The remaining gas pressure, $P_{remaining}$, is determined by subtracting off the reserve pressure and the pressure used for the ascent.

$$P_{remaining} = P_{tank} - P_{reserve} - P_{ascent} \quad \text{, all tank pressures in [PSI] or [Bar]}$$

Knowing $P_{remaining}$, divide this by the SAC adjusted to the current ambient pressure to get GTR in minutes.

$$GTR = P_{remaining} / (SAC \times P_{amb,ATA})$$

Why aren't safety stops included?

Safety stops aren't included to simplify the meaning of GTR, and make it consistent across operating modes that do not include safety stops.

Managing enough gas for a safety stop is quite simple, especially since they require a relatively small amount of gas. For example, consider if your SAC was 20 PSI/min (1.4 Bar/min). At a depth of 15ft/4.5m, the pressure is 1.45 ATA. So a 3 minute safety stop would use 20 x 1.45 x 3 = 87 PSI (6.1 Bar) of gas. This small amount of gas is easy to factor into the reserve pressure setting.

Why is GTR limited to one tank and no deco?

Currently, Shearwater does not believe that GTR is the proper tool for decompression dives, especially those involving multiple gases. This isn't to say AI in general is not a good fit for all technical diving, but the GTR function becomes increasingly complex to manage and understand when multiple gases are used. For one, if multiple gases are used, then tank sizes must be correctly entered. This is a very easy step to forget, and will lead to incorrect GTR values. Multiple gas diving also requires further setup of associating each transmitter to a specific gas mixture, which besides being another setup to forget, gets complicated with corner cases such as having multiple tanks containing the same mixture. Further handling other situations such as only a sub-set of the used tanks with transmitters add complexity and potential for user misunderstandings. Overall, the extra complexity of menus and setup burden on the user would result in a system prone to mistakes and accidental misuse, and not fitting with Shearwater's design philosophies.

Gas management is an incredibly important and also complex activity, especially for technical diving. Education, training, and planning are critical for proper gas management for technical dives. Shearwater feels that a convenience feature such as GTR is not a good application of technology in this case, as its complexity and potential for misuse would outweigh its utility.

No compensation for ideal gas law deviations

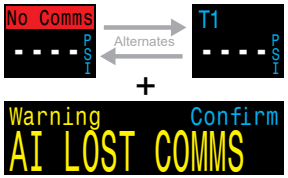
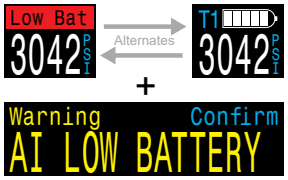
Note that all SAC and GTR calculations assume that the ideal gas law is valid. This is a good approximation up to about 3000 PSI (207 Bar). Above this pressure, the change in gas compressibility as pressure increases becomes a noticeable factor. This is mainly an issue for European divers using 300 Bar cylinders. The end result is early in the dive, when pressures are above 3000 PSI/207 bar, the SAC is over-estimated, resulting in under-estimation of GTR (although this is the good way to err, as it is more conservative). As the dive progresses and pressure drops, this problem rectifies itself and the numbers become more accurate.

8. Troubleshooting

Follow these guidelines to help solve problems with the Perdix AI.

8.1. Warning and error displays

The following table shows warnings and errors you may see, their meaning, and steps to take to solve any problems.

Display	Meaning	Action to take
	No communications for 30 to 90 seconds.	See **Section 8.2. Connection problems**
	No communications for 90+ seconds.	See **Section 8.2. Connection problems**
	Low transmitter battery.	Replace the transmitter battery. See **Section 9.1. Transmitter Battery Replacement**
	Tank pressure exceeds rated pressure by more than 10%.	Properly set the rated pressure in the AI Setup->Tx Setup menu.
	Tank pressure has fallen below the reserve pressure setting.	Be aware that gas is running low. Begin to end your dive and perform a controlled ascent to the surface.
	Tank pressure has fallen below the critical pressure.	Be aware that gas is running low. Begin to end your dive and perform a controlled ascent to the surface.
	GTR is not available when on the surface.	None. GTR will display during a dive.
	GTR (and SAC) are not available for the first few minutes of a dive.	None. After a few minutes, enough data has been collected for display.

8.2. Connection problems

If you are seeing “No Comms” errors, follow these steps:

If the “No Comms” is persistent:

- Check that the proper serial number is entered into the **AI Setup⇨T1/T2 Setup** menu.
- Ensure the transmitter is turned on, by connecting it to a first stage and turning on the tank valve. Applying high pressure > 50 PSI (3.5 Bar) is the only way to turn on the transmitter. The transmitter will power off after 2 minutes of no pressure.
- Bring the handset within range (3ft / 1m) of the transmitter. Having the transmitter too close (less than 2 inches / 5 cm) can also cause communication loss.

If the “No Comms” is intermittent:

- Search for sources of radio frequency (RF) interference, such as HID lights, scooters, or photo flashes. Try eliminating such sources to see if this solves the connection problem.

- Check the distance from transmitter to handset. If range related dropouts are occurring during diving, locating the transmitter on short length of high pressure hose is possible to decrease the transmitter to handset distance.

9. Storage and Maintenance

The Perdix AI dive computer and transmitter should be stored dry and clean.

Do not allow salt deposits to build up on your dive computer. Rinse your computer with fresh water to remove salt and other contaminants. **Do not use detergents or other cleaning chemicals** as they may damage the dive computer. Allow to dry naturally before storing.

Store the dive computer and transmitter out of direct sunlight in a cool, dry and dust free environment. Avoid exposure to direct ultra-violet radiation and radiant heat.

9.1. Transmitter Battery Replacement

Transmitter battery type is 3V Lithium CR2.

1. Loosen the cap by turning counter-clockwise with a coin.
2. Remove old battery and discard according to local regulations on lithium batteries.
3. Install the new battery, positive end first.
4. Replace the o-ring (size AS568-016, nitrile A70) and lightly lubricate it with a silicone grease. When installing the o-ring, roll it over the lip from the coin slot side. Do not roll it over the threads.
5. Install the battery cap by turning clockwise. Start slowly to avoid cross-threading the cap. The cap should be flush with the case when properly installed.

See the Perdix Operating Instructions for handset battery replacement instructions.

10. Servicing

There are no user serviceable parts inside the Perdix AI or transmitter. Do not tighten or remove the faceplate screws. Clean with water ONLY. Any solvents may damage the Perdix AI dive computer.

Service of the Perdix AI may only be done at Shearwater Research, or by any of our authorized service centers.

Your nearest service center can be found at www.shearwater.com/contact

Glossary

CC - Closed circuit. Scuba diving using a rebreather where exhaled gas is recirculated with carbon dioxide removed.
GTR - Gas Time Remaining. The time, in minutes, that can be spent at the current depth and SAC rate until a direct ascent to the surface would result in surfacing with the reserve tank pressure.
NDL - No Decompression Limit. The time, in minutes, that can be spent at the current depth until mandatory decompression stops will be required.
O_2 - Oxygen gas.
OC - Open circuit. Scuba diving where gas is exhaled into the water (i.e. most diving).
PPO_2 - Partial Pressure of Oxygen, sometimes PPO2.
RMV - Respiratory Minute Volume. Gas usage rate measured as the volume of gas consumed, adjusted as if at a pressure of one atmosphere. Units of Cuft/minute or L/minute.
SAC - Surface Air Consumption. Gas usage rate measured as the rate of tank pressure change, adjusted as if at a pressure of one atmosphere (i.e. surface pressure). Units of PSI/minute or Bar/minute.

Specifications

Specification	Transmitter
Wireless Range	3 ft (1 m)
Depth Rating	500 ft (150 m)
Pressure Range	0 to 4350 PSI (0 to 300 Bar)
Pressure Resolution	2 PSI (1 Bar)
Operating Temperature	22°F to 140°F (-6°C to 60°C)
Size	2.95” (V) x 1.38” (Diameter) 75mm (L) x 35mm (Diameter)
Weight	0.26 lbs (116g)
Packaged Size	3.74” (L) x 2.56” (W) x 2.17” (H) 95mm (L) x 65mm (W) x 55mm (H)
Packaged Weight	0.40 lbs (180g)
Battery Type	CR2 Lithium User replaceable
Battery Life	300 dive hours at two 1-hour dives per day Up to 5 year shelf life Annual replacement recommended
Battery Warning Levels	Warning (yellow) < 2.75V Critical (red) < 2.50V
Battery Cap O-ring	Size AS568-016, Nitrile (Buna-N) A70
High Pressure Fitting	7/16” UNF
High Pressure O-ring	Size AS568-012, Viton™ material
Turn-on conditions	Pressure > 120 PSI (8 Bar) Battery > 2.75 V
Turn-off conditions	Pressure < 50 PSI (4 Bar) for 2 minutes
Internal Over-Pressure Relief Valve	Yes

Please see the Perdix Operating Instructions Manual for handset specifications.

FCC Warning

a) USA-Federal Communications Commission (FCC)
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of 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. If not installed and used in accordance with the instructions, it 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 tuning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:
- Reorient or relocate the receiving antenna
- Increase the distance between the equipment and the receiver.
- Connect the equipment to outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

Caution: Exposure to Radio Frequency Radiation.
This device must not be co-located or operating in conjunction with any other antenna or transmitter.
Contains TX FCC ID: MH8A