

Chapter 2.0 Operating Instructions

2.1 Unpacking The KMACS 5

When you first receive your KMACS 5, carefully unpack it and examine it for any damage that may have occurred during shipment. Be sure to complete the enclosed warranty card and return it to KMDSI immediately. No warranty claims will be honored without a satisfactorily completed warranty card on file at KMDSI.

Visually check the KMACS 5 to ensure that it has not been damaged in transport.

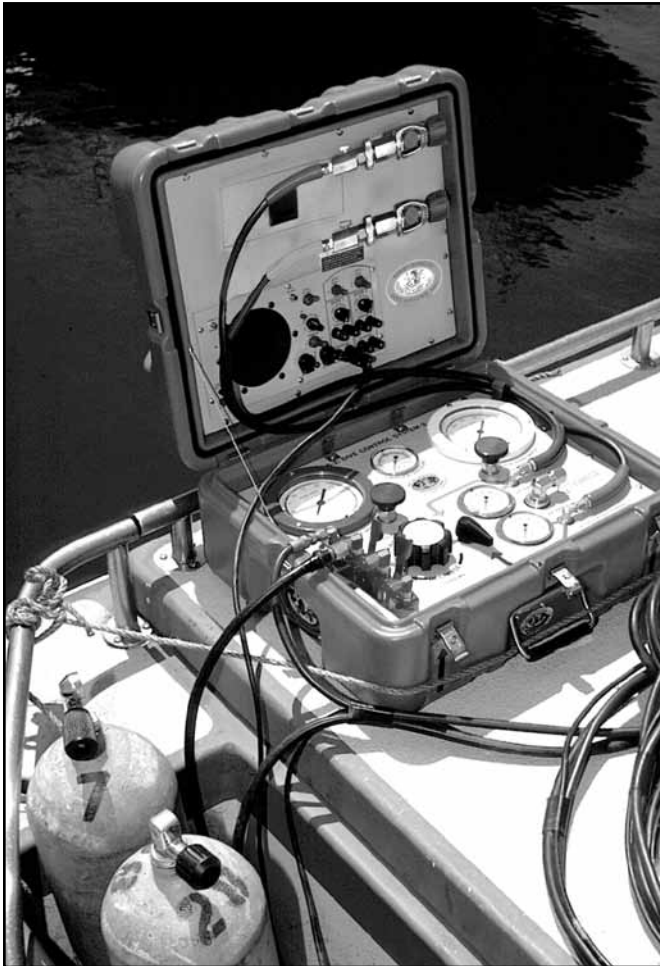


Figure 4 Note the line which passes through the handle of the KMACS 5 and is secured to the rail to prevent the KMACS 5 from moving about.

2.2 First Use Of The KMACS 5

Place the Dive Control System on a firm surface. The KMDSI logo should be right side up. Release the latches and lift up the lid to expose the panels.

When using the KMACS 5 aboard a vessel subject to waves or swell be sure to tie the KMACS 5 securely in position so that it doesn't fall. Thread a piece of line through the handles and fasten the ends to fittings on the boat. Tie back the lid of the KMACS 5 as well to prevent damage or injury.

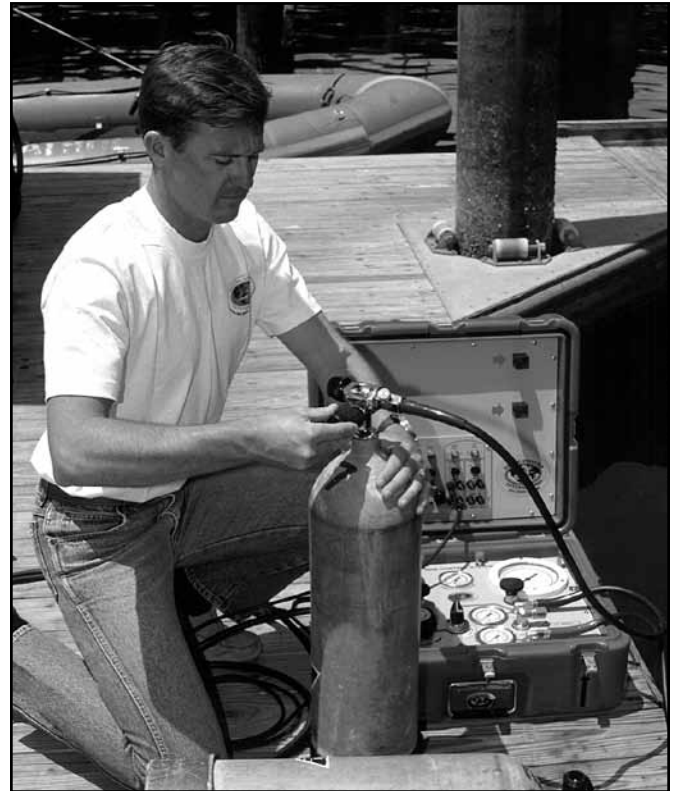


Figure 5 Connecting a scuba air supply to the KMACS 5.

2.3 Connecting The Air Supply

Loosen the knurled knobs which connect the yokes to their storage posts in the KMACS 5 and remove the yokes (T) from the blocks. Attach each yoke

to a high pressure cylinder as you would connect a scuba regulator to a tank. The knobs on the yoke should be screwed down finger tight. Do not apply excessive force to the knobs; air pressure from the tanks will create a good seal. Be sure the bleed valve on each yoke is in the closed position. Do not turn the cylinders on at this time.

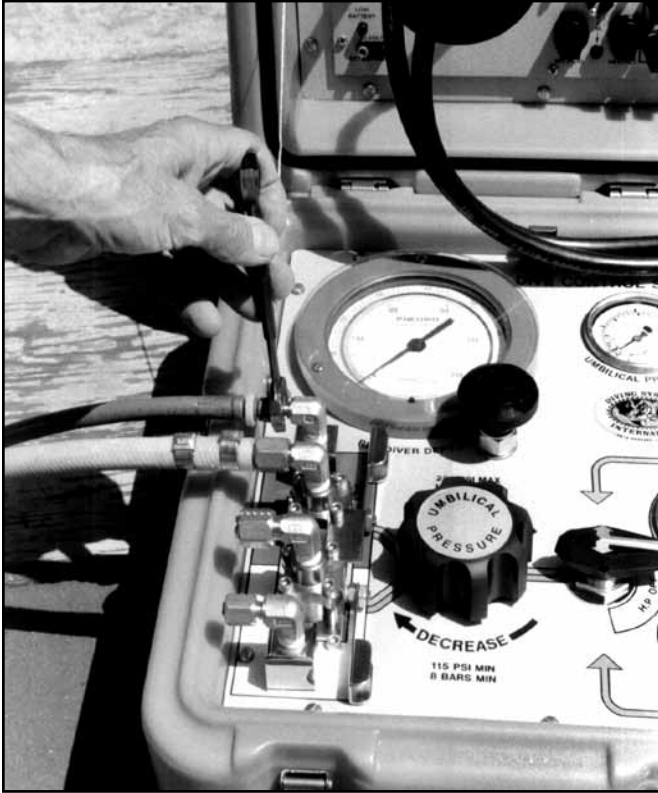


Figure 6 Always use the right size wrench to connect the hoses to the KMACS 5.

Check the function of the selector handle to ensure correct operation.

⚠ CAUTION

Low pressure compressors used for breathing air should be specifically designed for diving. Paint compressors or similar equipment are unacceptable for diving applications.

⚠ DANGER

If a low pressure compressor is used, the intake must be at a sufficient distance from and upwind of the exhaust. If exhaust gas is sucked into the intake, the diver will suffer from carbon monoxide poisoning. This can be fatal.

In normal use, a low pressure compressor or air

source should be used as the primary air supply and scuba cylinders should be used as a backup, or reserve air source.

Prior to connecting the low pressure hose to the KMACS 5, the deck whip should be flushed with air to make sure no foreign matter is in the hose. Connect the deck whip to the low pressure compressor and while firmly holding the end of the hose start the compressor and flow air through the deck whip for at least one minute. Attach the low pressure hose to the low pressure inlet fitting (O) and screw the fitting down finger tight. While using one wrench to hold the low pressure inlet fitting tighten the hose fitting with a second wrench. Do not use excessive force as this will only damage the fitting and cause it to leak.

2.4 Connecting Diver's Hoses To The KMACS 5

Each diver's umbilical should be color coded with plastic tape to identify each individual hose. This action will not only serve to make it easier to connect the hoses, but will also serve to differentiate between hoses for purposes of inspection or repair.

A standby diver should always be equipped and ready to go to the diver's aid whenever a surface supplied diver is working in the water. Generally, it is not necessary for more than one diver to be in the water at a given time when using surface supplied gear. However, a standby diver is considered essential for safe, surface supplied operations. The standby diver can be either a scuba diver or another hose supplied diver since the KMACS 5 provides enough air for two hose supplied divers. In contaminated water diving operations, however, both divers must be equally equipped with a vulcanized rubber dry suit, dry gloves, and Kirby Morgan dive helmet equipped with either a double exhaust system or the new Quad Valve™ exhaust system.

⚠ WARNING

Contaminated water diving operations are very hazardous. They should not be attempted without specialized training, procedures, and equipment.

Remove the protective caps from the outlets of the manifold (E, F) on the console. Connect the diver's umbilical hose fittings (air supply hose and pneumo) to the KMACS 5. Remove the end caps from the hoses themselves and while firmly holding the end of the hose, blow out the lines before connecting the

hoses to the mask or helmet, (refer to the manual for the mask or helmet for the proper connection procedures for your life support equipment). This action will prevent any foreign matter from entering the helmet or mask breathing system. Once the hose is blown out, immediately connect the fitting on the hose to the fitting on the mask or helmet.

Connect the communications portion of the diver's umbilical to the communications fittings on the communicator and to the mask or helmet. Be sure the proper connection is made with the right communications line for each diver. The wires in the diver's umbilical should be marked so it is easy to identify which plug connects to the earphone terminals and which plug connects to the microphone terminals.

2.5 Pre-Dive Check

Prior to EVERY dive, the following should be checked:

With the free flow and demand regulator on the mask/helmet(s) shut off, turn on the air supply at each of the air cylinders. During operation with scuba bottles as the main supply, the selector valve handle must be FULLY up or FULLY down. Fully up turns the "BLUE" supply on and the "ORANGE" supply off. Fully down turns the "ORANGE" supply on and the "BLUE" supply off.

Note the air pressure in each cylinder by reading the gauges (M,N). The low pressure supply should be switched "OFF" at the source at this time. A check valve in the low pressure system prevents back flow to the compressor.

Both cylinders should be full prior to diving. Load the regulator on the KMACS 5 using the regulator adjustment knob (I). Observe the umbilical hose pressure (B) which should be set at 150 psi (10.3 bars) over top side pressure, or 165 psi (11.5 bars) The regulator used in the KMACS 5 is a non-venting regulator. If the regulator has been left set at a higher pressure setting than is presently desired, the operator must turn the regulator adjustment knob (H) clockwise and vent air from the system by bleeding either the pneumo system or diver's breathing apparatus.

As the diver descends, the KMACS 5 operator should increase the regulator setting so that the umbilical pressure is always 150 psi (10.3 bars) over the pressure at the diver's depth. Consult the table in "Appendix 1

Umbilical Supply Pressure Requirements & Tables" on page 26 for approximate pressure settings.

2.5.1 Testing L.P. Supply

With the air on at the bottles and the communications switched on, check the regulator function. The diver should insert his face in the mask/helmet and take several breaths to test the demand regulator.

To test the low pressure supply, place the selector valve handle (J) in the "H.P. OFF" zone and the console will be running off the low pressure supply only. Observe the umbilical pressure gauge (B). As the compressor cycles, the gauge will rise and fall as the compressor's volume tank fills and empties. The maximum pressure for the L.P. inlet should be 225 psi. Again, check the mask/helmet function which will also confirm the low pressure supply routing.

2.5.2 Testing Communications

Test the communications between the diver and the KMACS 5. With the communicator (S) switched on, turn the speaker switch to "on" and adjust the volume to a comfortable level for both the diver and the KMACS 5 operator. In the 2 wire mode and the 4 wire mode without headset and boom microphone, the communicator functions similarly to a citizens band radio; i.e., the KMACS 5 operator must depress the push to talk switch to speak to the diver. In the 4 wire mode, with headset and boom mic, the communicator functions like a telephone conference call; i.e., everyone on the line can hear and speak to everyone else. In either mode, for the diver to talk top side, it is only necessary for him to speak into the oral/nasal microphone in his mask or helmet. If two divers will be working together using 2 wire mode, test the cross-talk functions at this time as well.

To extend the life of the battery, it is recommended that the communications be used in the 4 wire mode. Operation as a 2 wire system uses relays inside the unit which will cause a higher battery drain.

⚠ CAUTION

In the 2 wire mode, when the push-to-talk switch is depressed, the KMACS 5 operator should keep all of his communications short (10-15 seconds) at any one time. This allows the diver to call for assistance if necessary.

Plug the earphone connectors on the diver's umbilical into the earphone jacks on the communicator. Plug

the microphone connectors on the umbilical into the microphone jacks on the communicator. This will create a 4 wire system/round robin system. Test the system and adjust all volume controls.



Figure 7 Preliminary testing of the umbilical with a volt-ohm meter to check for continuity.

Unplug the earphone connectors on the diver's umbilical from the communicator and reinstall them in the connectors attached to the plugs for the microphone. This will change the communicator to a 2 wire system. Test this system and adjust volumes.

If there are no communications, recheck all of the connections to ensure they are tight at each junction. If the KMACS 5 has been operating in a coastal environment, look for corrosion on the top side connectors which may interfere with the communications. If corrosion is evident, disassemble the connectors, clean, and retest. If corrosion is heavy, replace the top side connectors.

Substitute other masks or umbilicals to test for failures in the microphones or umbilical. Substitute one piece of new gear at a time to track the fault down. If the fault is in the mask or helmet, replace the earphones or microphones as needed.

If the fault is in the umbilical, disconnect the umbilical and carefully inspect its length for damage. Look for obvious nicks or cuts.

If there is physical damage to the outside of the communications wire there probably is a break on the inside, too. Test the continuity of the wire end-to-end with a volt-ohmmeter.

Uncoil the umbilical and lay it out flat with the two ends close to each other. Set the volt-ohmmeter to resistance (ohms) and hold one probe to one prong

on an umbilical connector plug and touch the other probe from the meter to the wires (or connector) at the opposite end of the diver's umbilical. Upon locating the other end of the same wire, the meter should indicate zero resistance, i.e., there is a complete, uninterrupted circuit. If touching none of the wires at the other end of the umbilical produces a zero reading and all readings are infinity (~), this indicates a complete break in the wire. If the reading is somewhere between zero and infinity, and changes as the umbilical is moved, this indicates a partial break, and communications will be intermittent. In either case, a waterproof splice must be made in the wire.

2.5.3 Testing The Pneumo

The pneumo supply may be tested in either the high pressure supply mode or the low pressure supply mode. To test the pneumo, select either mode and pinch the open end (diver's end) of the red diver pneumo hose. With the hose crimped tightly shut, slowly open the red pneumo valve (D) momentarily, $\frac{1}{4}$ turn, and observe the needle's response on the red diver depth gauge (C).

NOTICE

Do not "peg" the needle on the pneumofathometer with a maximum reading. A test of pressure equal to 50 feet (15 meters) on the gauge is satisfactory to ensure correct operation.

Close the valve after observing correct operation and release the end of the pneumo hose. The gauge needle should return to zero. Repeat this procedure for the white diver.



Figure 8 Carefully test the pneumo prior to every dive.

2.6 Preparing The Diver

The diver should be dressed in with the appropriate exposure suit for the local water temperature. The diver should be equipped with a harness to provide an attachment point for his umbilical. By attaching the umbilical to the harness, the possibility of a direct pull on the diver's helmet or mask will be eliminated.

A bailout bottle should be mounted on the diver's harness. Always dive with a bailout bottle, no matter how shallow the dive. The danger of entanglement is always present and a bailout bottle will give the diver that few extra minutes to free himself in the event he becomes hung up on fishing line, wire, or other submerged objects.

The bailout regulator should be equipped with a quick disconnect whip to make it easier to dress the diver in and out. In addition, the bailout regulator should also be equipped with an over pressure relief valve (Part #200-017). This will permit the regulator to bleed off and not rupture the low pressure hose connecting it to the diver's bailout or emergency valve, should the first stage develop a leak.

With the hose attached to the harness, tuck the pneumo hose under the harness at the diver's chest. This serves two purposes: 1) it provides instant access in the event the pneumo is to be used as an alternative air supply; 2) gas absorption and elimination of nitrogen is considered to occur at the diver's chest level.

When diving under a potential decompression situation, a depth gauge or dive computer should be worn by the diver as a backup system. If decompression is anticipated there must be enough air on hand for the diver to complete the dive and the decompression obligation.

2.7 The Dive Supervisor And The KMACS 5 Operator

During the diving operation, one person should always be in charge to avoid confusion. Generally, this should be the most senior diver, by virtue of his diving experience.

The dive supervisor may not always be the KMACS 5 operator. The dive supervisor may want or need the freedom to direct the entire operation including the tenders and other personnel. As such, he is responsible for making decisions regarding diving conditions and safety. However, the KMACS 5 operator must always be an experienced diver who understands the diver's needs and has the diver's best interests always in mind.

⚠ WARNING

The KMACS 5 operator must not leave the dive control system unattended while the diver is in the water. The KMACS 5 operator is directly responsible for the diver's safety and well being.

The diver must follow the KMACS 5 operator's directions in regards to depth and time. The diver can NOT run the dive from the bottom. Thus, when the dive supervisor himself is required to dive he should relinquish control to the next most senior diver remaining top side.

2.8 Descent

Upon entering the water, the diver should immediately recheck communications with top side and ensure that his mask or helmet is working correctly. When he/she is ready to descend he should notify the KMACS 5

operator that he is, "Leaving the surface."

Both the diver and tender should communicate in a normal tone of voice. It should not be necessary for either person to shout to be heard. Although the quality of the communications will usually be excellent, not all divers speak clearly. The KMACS 5 operator should listen carefully at all times to what the diver is saying.

Once the diver has entered the water, monitor his descent rate using the pneumo valve (D,P) and gauge (C,Q). The diver's descent rate should not exceed 75 feet (23 meters) per minute.



Figure 9 KMACS 5 operator taking a reading with the pneumo knob. The knob should be turned very slowly.

As the diver descends the KMACS 5 operator should monitor the air supply pressure and insure the proper pressure for depth. If using the KMACS 5 HP supply system the operator should slowly increase the supply pressure as the diver descend and slowly decrease the pressure as the diver ascends the KMACS 5 operator should try to keep the supply pressure within the minimum and maximum parameters in accordance with "Appendix 1 Umbilical Supply Pressure Requirements & Tables" on page 26

To operate the pneumo, turn the knob for the appropriate diver, counter clockwise, until the indicator needle on the depth gauge starts moving. When the depth gauge for the individual diver indicates a depth that is known to be deeper than the diver, the knob is turned clockwise until it is off. The indicator needle on the depth gauge will move shallower as the air bubbles leave the open end of the pneumo hose at the diver. When the needle stops, that is the diver's actual depth.

The diver should practice using the pneumo as an alternative air source under controlled conditions in shallow water. The pneumo hose should be bubbling when it is inserted in the diver's mask, otherwise the diver will receive a blast of water when the pneumo is first turned on.

2.9 Diver At Depth

Once the diver reaches the bottom, or his maximum planned depth, the diver should inform the KMACS 5 operator that he is, "On the bottom." At this time, the KMACS 5 operator should ensure that he gets an accurate depth reading. The KMACS 5 operator should inform the diver that he is "Taking a pneumo...", when he opens the pneumo purge valve. The diver should observe the end of the pneumo hose and immediately inform top side that, "He has bubbles...". Once the diver has a flow of bubbles at the end of the hose, the pneumo valve (D,P) should be closed immediately.

Should the diver move deeper at any time during his dive he must inform the KMACS 5 operator and another pneumo should be taken for a new maximum depth reading. If the KMACS 5 operator knows that the diver is moving over an uneven bottom he should periodically take additional pneumo readings to ensure that the diver has not accidentally gone deeper and neglected to notify top side. Keep in mind, however, that every pneumo reading does use some air. If high pressure air is the air source and the dive is deep, or the diver is working hard, pneumo readings should be taken as sparingly as possible.

2.10 Changing Out High Pressure Cylinders

The KMACS 5 operator should continuously monitor the diver's air supply at the two high pressure gauges (M,N) when diving with high pressure air as the primary supply. When the initial supply source pressure drops to between 300 and 500 psi (20.7 and 34.5 bars), depending upon depth, the diver should

be switched over to the second air source using the selector valve handle (J). While the diver is breathing off the secondary source a fresh cylinder should be put on line immediately.

To change out high pressure cylinders, first close the cylinder valve on the tank which is low. Once the valve is closed, open the bleeder valve on the yoke (T) and allow the pressure to bleed from the line. The high pressure whips are color coded to help the KMACS 5 operator to ensure he is selecting the correct one. Always observe the umbilical pressure gauge (B) carefully during this procedure. If the KMACS 5 operator is not careful he may accidentally turn off the high pressure cylinder supplying the diver's breathing air. If the umbilical pressure gauge (B) needle starts to "fall", turn the cylinder back on immediately and double check to ensure the correct cylinder is being changed.

When the high pressure whip is empty, unscrew the knurled knob on the yoke (T) and attach the yoke to a fresh cylinder. Tighten the yoke knob finger tight, close the bleeder valve, and slowly open the cylinder tank valve. Read the new pressure on the appropriate gauge (M,N).

2.11 Procedures During The Diver's Ascent

At the end of the dive, the diver should prepare to leave bottom upon orders from the KMACS 5 operator. The KMACS 5 operator must carefully note the diver's depth and time on the dive log. The KMACS 5 operator is responsible for monitoring the diver's ascent rate which should not exceed 60 feet (18 meters) per minute, or slower if a dive computer is being used to monitor decompression/no decompression status. The diver should not leave the bottom until he is instructed to do so by the KMACS 5 operator. At the start of the diver's ascent he should inform top side that he is, "Leaving the bottom." The KMACS 5 operator should carefully note the time in the dive log. The KMACS 5 operator must monitor the diver's rate of ascent carefully, observing his watch and the pneumo gauge (C,Q). There is no need to pneumo the diver as he ascends because the air in the pneumo hose will automatically expand and vent the hose as the diver approaches the surface.

2.12 Decompression

If the diver has decompression stop(s) required as a result of his dive, slow the diver's ascent as he approaches his first stop. Upon reaching his first stop,

the diver should assume a relaxed and comfortable position in the water. A weighted line or some other apparatus should be provided to the diver to assist him in maintaining a proper depth. Decompression in mid-water, without a line or other method of fixing the diver's depth, is **NOT** acceptable as it is impossible to maintain an exact depth without something to hang onto.

An accurate pneumo should be taken at the diver's decompression stop. There should be no unnecessary slack in the diver's hose, i.e., no part of the umbilical should be lower than the diver, as this will give a false reading (deeper) of the diver's depth. Make sure the end of the pneumo hose is held at the diver's chest with the open end pointing down.

2.13 Completion Of Diving Operations

Immediately following the completion of diving operations the dive station should be disassembled and the KMACS 5 protected from the weather.

Both high pressure and low pressure air supplies should be turned off at their source. Bleed the air from the diver's umbilical(s) by opening the free flow valve(s) on the diver's mask/helmet(s). Disconnect the mask/helmet(s) from the umbilical and the umbilical from the KMACS 5. Unplug the communications connectors and turn off the communicator (S). Plug both ends of the hose and cap the outlet manifold (E, F) nipples on the KMACS 5 to prevent foreign matter from entering either.



Figure 10 All of the outlet fittings on the KMACS 5 must be capped prior to storage.

Open the bleed valves on the HP yokes (T) to allow any remaining air to vent and replace the yokes on their storage posts. Disconnect the low pressure air source if used and cap the low pressure inlet (F)

Kirby Morgan Air Control System 5

to prevent foreign substances from entering the KMACS 5.

If the KMACS 5 has been used on the ocean the panels should be wiped down with a clean rag dampened with fresh water. The O-ring seal (V) on the case may be periodically treated with Armor-All or other rubber protection.

Place the KMACS 5 in a dry area and recharge the communications.

Refill any high pressure cylinders (scuba) used during diving operations and store them in a secure location.