

Kirby Morgan Air Control System 5 Operations and Maintenance Manual

Part # 100-075



KMDSI

1430 Jason Way

Santa Maria, California

United States of America

Postal Code 93455

Telephone (805) 928-7772

Fax (805) 928-0342

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Definitions of Signal Words Used in this Manual

DANGER: This word indicates an imminently hazardous situation, which if not avoided, will result in death or serious injury.

WARNING: This word indicates a potentially hazardous situation, which if not avoided, could result in death or serious injury.

CAUTION: This word indicates a potentially hazardous situation, which if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

Warranty Information

KMDSI warrants every new mask, helmet, SCUBA regulator or air control system (KMACS) (each, a Product) to be free from defects in workmanship for a period of ninety (90) days from the date of purchase from a KMDSI authorized dealer. This warranty covers all metal, fiberglass, and plastic parts, but does NOT cover rubber parts, communications components, or head cushions.

Any defect of the product in workmanship or material covered by this warranty discovered within ninety (90) days from the date of purchase must be promptly communicated in writing to the nearest authorized KMDSI dealer or (if no such dealer in the buyer's country) contact KMDSI directly at (805) 928-7772. ***No Product returns will be accepted by KMDSI without a returned merchandise authorization (RMA) number from KMDSI.*** Upon receipt of the RMA from KMDSI, the buyer should return the defective Product or part, freight prepaid, to an authorized KMDSI dealer or the KMDSI plant, as directed by the RMA. KMDSI will repair or replace the Product at no charge, within a reasonable time, as it deems necessary.

This warranty is null and void if:

- 1) The Product is not registered with KMDSI within ten (10) days of purchase, or
- 2) The Product has not been properly serviced and/or maintained according to KMDSI factory recommended procedures described in the manual or Product updates have not been performed as recommended by KMDSI, or
- 3) Unauthorized attachments or modifications have been made to the Product, or
- 4) The Product has been used for purposes other than those for which it was designed, or otherwise has been abused, misused, or subjected to unusual conditions, or the Product's intended service has been exceeded.

EXCEPT AS SPECIFICALLY PROVIDED HEREIN, THERE ARE NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES FOR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THE PRODUCT COVERED BY THIS WARRANTY IS MARKETED AND SOLD BY KMDSI SOLELY FOR COMMERCIAL OR INDUSTRIAL USE AND IS NOT A CONSUMER PRODUCT INTENDED FOR PERSONAL, FAMILY, OR HOUSEHOLD USE.

In purchasing any Product subject to this warranty, the buyer agrees that its sole and exclusive remedy and KMDSI's entire obligation in contract, tort, or otherwise under this contract will be repair or replacement at KMDSI's option of the Product or any parts which KMDSI determines during the applicable warranty period are defective in workmanship or material covered by this warranty. All exchanged parts are the property of KMDSI. The buyer's exclusive remedy and the KMDSI's entire liability in contract, tort, or otherwise is the payment by KMDSI of the buyer's actual damages up to but not to exceed the amount paid by the buyer for the Product.

In no event shall KMDSI be liable to the buyer for indirect, special, incidental or consequential damages (including, but not limited to, damages for lost profits, lost sales, loss of business opportunity, or for injury to persons or property arising out of the use of the Products). Any claim or action for breach of warranty must be commenced within one year following delivery of the Product to the buyer.

Buyer acknowledges that this warranty is the sole and exclusive warranty of the Product and that it supersedes any and all oral or written representations and undertakings between KMDSI, its dealers, and the buyer relating to the Products. This warranty allocates the risks of product failure between KMDSI and the buyer, which allocation is recognized by both parties and is reflected in the price of the goods. The buyer acknowledges that it has read this agreement, understands it, and is bound by its terms.

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*Kirby Morgan Air Control System 5
with no communications.*



Kirby Morgan Air Control System 5 with communications.

Section 1.0

GENERAL INFORMATION

1.1 DEFINITIONS

The following terms may be unfamiliar to the reader. They are defined as they relate to this manual and diving. All parts locations are referenced by LETTER on the diagram, Figure 5, Page 8.

KMACS 5 : Kirby Morgan Air Control System 5. The Trademark name of the device this manual describes. The KMACS 5 contains all of the components necessary to properly control and monitor surface supplied air dives. Included in the KMACS 5 is a two-way voice communicator for talking between the KMACS 5 operator and the diver(s), or diver-to-diver. The communicator operates in both the two wire and four wire mode. The KMACS 5 will supply plenty of air for two surface supplied divers.

Scuba: Self contained underwater breathing apparatus.

SSAir Diving: Surface Supplied Air Diving. Diving operation where the diver is supplied breathing air by way of a hose which is part of the diver's umbilical from the surface. Usually the source of the breathing air is a compressor, but compressed air tanks on the surface can also be used.

Diver's Umbilical: Several components run together from the KMACS 5, (Dive Control System 2A) to the diver. These components are joined together, usually by tape, forming the umbilical. The most common components used in the diver's umbilical are: (A) a hose through which the breathing air flows to the diver; (B) a multiconductor wire for communications transmission; (C) another (smaller) hose which is used to show the diver's depth on the pneumofathometer (see below); (4) a strong line used as a strength member to prevent strain on the other components of the umbilical. The umbilical should be taped every 10 feet with colored tape to indicate the length of the hose.

High Pressure (H.P.) Hose: A flexible hose designed to carry a working pressure of gas (or air) of more than 300 pounds (20.7 bars) per square inch. The rated working pressure is usually indicated on the hose and must not be exceeded. The working pressure of the high pressure hose on the KMACS 5 is 5000 psi (345 bars).

Whip: A hose complete with fittings at each end for use in hooking up two pieces of deck equipment for gas (or air) flow. For instances, the hoses and fittings used to connect the KMACS 5 to the high pressure tanks are called "high pressure whips."

H.P.: High pressure. Usually any pressure over 300 psi. (20.7 bars).

L.P.: Low pressure. Usually any pressure under 300 psi. (20.7 bars).

Pneumofathometer: (pronounced "new-mo-fath-ometer") This device measures the diver's depth. A small hose, which is part of the diver's umbilical runs from the KMACS 5 to the diver. The hose is open at the diver's end and attaches with a fitting to a gauge at the KMACS 5. The gauge is calibrated in feet and meters of sea water. A valve is attached between the hose and the gauge so the operator can use a small amount of breathing air to purge water from the small hose. When the valve is shut off, excess air bubbles out of the hose at the diver's end, and the air left in the hose will be at a pressure equal to the pressure of the water column. This is the exact depth of the diver.

Pneumo: Short for pneumofathometer. Used such as "pneumo-gauge," "pneumo -valve", "pneumo-hose", to describe the parts that make up the pneumofathometer subsystem.

Dressed-in: A commercial diver's suit was originally called a "dress." Although the name changed

to “suit” the term “dressed-in” has remained to describe putting the suit on. A diver who is “dressed-in” has a suit on. The term is also used to describe a diver who, in addition to his suit, has more, or all of his/her equipment on.

Bailout Bottle: This is the emergency tank of breathing gas. “Bailout” which is the familiar term for parachuting from an airplane, also applies to the shallow water diver who ditches part of his diving gear and swims to the surface. The “bailout” bottle term came from this use.

The bailout bottle is an independent air source connected directly to the diver’s mask or helmet via a first stage scuba regulator and hose. The first stage regulator must be equipped with an overpressure relief valve (Part #200-015). The overpressure relief valve will vent pressure in the event of a first stage leak and prevent the low pressure hose from rupturing, causing a complete loss of the diver’s bailout supply.

The bailout bottle is worn on the diver’s back, mounted to a harness. The diver’s umbilical should be attached to this harness to prevent a direct pull on the diver’s mask or helmet.

The size/volume of the bailout bottle should be determined by the diver’s depth, or the distance required for a direct ascent to the surface. For deeper dives, or penetration dives inside wrecks or pipelines, a larger capacity bailout bottle should be used.



Fig. 1 Divers with all of the gear they need to dive.

1.2 DESIGN PURPOSE

The Kirby Morgan Dive Control System 5 (KMACS 5) is designed to provide a central control center for the operator/dive supervisor during a surface-supplied air dive. Provisions for the control of the breathing air supply, diver depth monitoring, and voice communications are all located on a simple panel. The KMACS 5 is a full service control system for all Surface Supplied Air diving operations.

The KMACS 5 is fitted with shut off valves on the diver’s air supply. The shut off valves are designed to allow air to be shut off on either or both of the diver’s umbilicals. When the handles of the valves are vertical the valves are open and air is flowing to the divers. When the valve handles are horizontal the valves are shut and the air to the divers umbilicals is off.

By having total control located at one panel, the KMACS 5 operator can rapidly respond to the diver’s needs without leaving the control station. In a standard commercial SSAir diving operation the KMACS 5 provides a backup air supply system which the operator can activate in the event of the main air supply failure (such as compressor malfunction). This can be accomplished without leaving the control panel, which allows the operator to inform the diver and continuously monitor umbilical supply pressure and depth at the same time.

The compact size of the KMACS 5 usually makes it possible to locate it at the water entry site, allowing the operator to tend the diver’s umbilical while maintaining control of the KMACS 5.

In addition to its compact size, the ability of the KMACS 5 to use high pressure air allows SSAir diving from small boats or remote locations where transportation and setup of a compressor would be impractical. Two or more standard scuba bottles can be used as the breathing air supply.

For example, when commercial divers are working on an offshore rig, a common SSAir diving job is the inspection and cleaning of a propeller on a crew boat. This job can be performed easily and simply with the KMACS 5, a couple of scuba bottles, a full face mask or helmet, and an umbilical. Transporta-

tion to the job site is simple and a large surface support vessel is not needed. At the dive site, full communications, backup breathing supply, pressure readouts, and depth monitoring are provided by the KMACS 5.

This is one of many situations where the KMACS 5 can be used to provide the safe and efficient operation of SSAir diving.

1.3 SPECIFICATIONS

Use: For SSAir diving only. Pure oxygen **MUST NOT** be used. Compressed air from high pressure tanks (scuba or other types of compressed air tanks), or from a compressor should be the only supply to the KMACS 5

CAUTION: Pure oxygen is a potential fire hazard, its use can lead to explosion of the KMACS 5. Pure oxygen also presents a physiological hazard to the diver.

Outer Dimensions: Length = 21 inches
Width = 10 1/2 inches
Height = 17 1/2 inches

Weight: 54 pounds. (24.5 kilos)

Shipping Weight: 60 pounds. (27 kilos)

Recommended Maximum Dive Support Depth: 130 fsw (feet of sea water) (40 meters).

CAUTION: Decompression and other human limits must be observed. Decompression diving should not be conducted with the KMACS 5 unless a properly equipped recompression chamber facility with oxygen is immediately available at the dive site. In-water decompression is not recommended.

High Pressure Supply Pressure Maximum: 4500 pounds per square inch. (300 bars)

Low Pressure Supply Pressure Maximum: 225 pounds per square inch. (15.5 bars)

CAUTION: Although the high pressure gauges on the KMACS 5 are rated to 5000 psi (345 bars), this is a safety precaution only. The regulator on the KMACS 5 is not designed to operate at pressures greater than 4500 psi (300 bars).

Umbilical Pressure Range: 115-225 pounds per square inch. (8-15.5 bars)

Regulator Output: 40 SCFM at 2500 psi (172 bars) supply pressure with 150 psi (10.3 bars) delivery pressure.

Relief Valve: Set at 300 psi (20.7 bars).

Pneumofathometer Range: 0-250 FSW (feet of sea water) (0-76 meters).

Communicator: 4 wire system. Can also be used in 2 wire mode.

Battery Type: Rechargeable, 12 volt system.

Battery Performance: 20 hours of continuous use between charges in 4 wire mode.

Charger: Will accept external 12 volt source.

Communicator Power Output: 8 watts.

Communicator Frequency Response: 600 to 12,000 HZ.

Remote Operation Capability: Yes, with optional unit.

Direct Recording Capability: Yes.

1.4 GENERAL DESCRIPTION

Only equipment certified and tested according to EN 250/E DIN 58 642 may be used with the KMACS 5 when conducting diving operations in European EC compliant countries.

The KMACS 5 components are housed in a durable polyethylene case. However, caution should be used in transporting the KMACS 5. Rough handling will rarely cause damage to the case, but it is possible to damage the calibrated pneumo gauges and/or

the electronic components. The KMACS 5 should be treated as you would any expensive life support equipment.

1.4.1 BREATHING AIR SUBSYSTEM

The diver's breathing air subsystem starts with the supply tank yokes (K) and connects to the diver's supply manifold. The high pressure hoses with the yokes are stored for transit by connecting them to the posts on the panel inside the lid of the KMACS 5. The knurled knobs on the yokes should be tightened until just snug. Excessive force should not be applied.

1.4.2 PRINCIPLE OPERATING FEATURES

I. DIVE CONTROL PANEL (A)

The panel is the main frame to which the functional components are mounted. In addition, the component names and some instructions are on the panel. The blue and orange lines (K, Q) on the panel represent the flow paths of supply air from the two high pressure hoses/yokes (S).

2. RED DIVER DEPTH GAUGE (C) (PNEUMOFATHOMETER)

This gauge indicates the "red" diver depth. The red diver pneumo valve knob (D), is turned to supply a small volume of air to the small pneumo hose that is part of the diver's umbilical. The gauge reads the pressure of the air in the pneumo hose. This pressure, measured in feet (or meters) of sea water, equals the water pressure at the diver's depth.

3. UMBILICAL PRESSURE GAUGE (B)

This gauge (B) is connected to the low pressure air supply system that supplies both umbilical fittings. It indicates the breathing air pressure that is in both the "red" and "white" diver umbilicals. When the air supply is from high pressure tanks (such as scuba tanks) the umbilical hose pressure can be varied by turning the regulator adjustment knob (H)

4. WHITE DIVER DEPTH GAUGE (P) (PNEUMOFATHOMETER)

This gauge indicates the "white" diver depth. The white diver pneumo valve knob (O), is turned to supply a small volume of air to the small pneumo-hose that is part of the diver's umbilical. The gauge reads the pressure of the air in the pneumo-hose. This pressure, measured in feet (or meters) of sea water, equals the water pressure at the diver's depth.

5. BLUE AIR SUPPLY FLOW INDICATOR LINE

The "BLUE" air supply flow indicator line (Q) indicates the flow path of breathing air from entry into the KMACS 5 to exit to the diver's umbilical(s) at the fittings on the manifold (G). There are two high pressure whips which are color coded BLUE and ORANGE.

Starting from the high pressure air tank, the BLUE air supply flows through the whip into the KMACS 5. Following the BLUE flow indicator line (Q) it shows the flow to the BLUE Breathing Air Supply Pressure Gauge (M), then to the Breathing Air Supply Selector Valve which is controlled by the Breathing Air Selector Valve Handle (I). The Selector Handle (I) must be turned all the way "UP" until it stops for the BLUE supply. This places the selector valve handle in line with the flow path indicating the "BLUE" air supply (Q). The ORANGE supply is off when the Selector Handle is in the up position.

CAUTION: When using H.P. air, the selector handle must be turned up until it stops for BLUE supply or down until it stops for Orange supply. Never allow the selector handle to stay in the marked "H.P. OFF ZONE". Both high pressure air supplies are off in the yellow striped H.P. OFF ZONE".

After flowing through the Selector Valve the BLUE air supply enters the Breathing Air Supply Regulator (H) which reduces the high pressure breathing air to an adjustable range between 115-225 pounds per square inch (psi) (8-15.5 bars). The BLUE air supply then goes to both diver's umbilicals through the fittings on the manifold (G).

6. ORANGE AIR SUPPLY FLOW INDICATOR LINES

The “ORANGE” air supply flow indicator line indicates the flow path of breathing air from entry into the KMACS 5 to exit to the diver’s umbilical(s) at the fittings on the manifold (G). The second high pressure whip is color coded ORANGE.

Starting from the high pressure air tank, the ORANGE air supply flows through the whip into the KMACS 5. Following the ORANGE flow indicator line (K) it shows the flow to the ORANGE Breathing Air Supply Pressure Gauge (L), then to the Breathing Air Supply Selector Valve which is controlled by the Breathing Air Selector Valve Handle (H). The Selector Handle must be all the way “DOWN” until it stops for the ORANGE supply. The BLUE supply is off when the Selector Handle is in the down position.

After flowing through the Selector Valve the ORANGE air supply enters the Breathing Air Supply Regulator (H) which reduces the high pressure breathing air to an adjustable range between 115-225 psi (8-15.5 bars). Then the ORANGE air supply goes to both diver’s umbilicals through the fittings on the manifold (G).

7. LOW PRESSURE INLET FITTING (N)

The low pressure inlet fitting is positioned between the connections for the two H.P. supply hoses. It is marked by the arrow containing the words “L.P. Supply”. Low pressure supply breathing air, usually from a compressor (with volume tank) is supplied through a whip (low pressure hose and fittings) that attaches here. When the low pressure supply is the only air source, the supply pressure will be indicated on the umbilical pressure gauge (B). In the low pressure supply mode, the selector/valve handle will be positioned in the H.P. OFF ZONE.

CAUTION: When using H.P. air, the selector handle must be turned up until it stops for BLUE supply or down until it stops for ORANGE supply. Never allow the selector handle to stay in the marked “H.P. OFF ZONE”. Both high pressure air supplies are off in the yellow striped H.P. OFF ZONE”.

- A Dive Control panel
- B Umbilical Pressure
- C Red Diver Depth Gauge
- D Pneumo Valve Handle, Red
- E Divers Umbilical Breathing Hose Attachment Fittings
- F Pneumofathometer Hose Attachment Fittings
- G Outlet Manifold
- H Regulator Adjustment Knob
- I Breathing Air Supply Selector Valve Handle
- J Case
- K Orange Air Supply Flow Line
- L Orange Breathing Air Supply Gauge
- M Blue Breathing Air Supply Gauge
- N Low Pressure Inlet Fitting
- O Pneumo Valve Handle, White
- P White Diver Depth Gauge
- Q Blue Air Supply Flow Line
- R Communicator
- S Yokes w/DIN Fittings for H.P. Cylinder Attachment
- T Access door for storage compartment.
- U O-Ring Seal
- V Communicator Panel

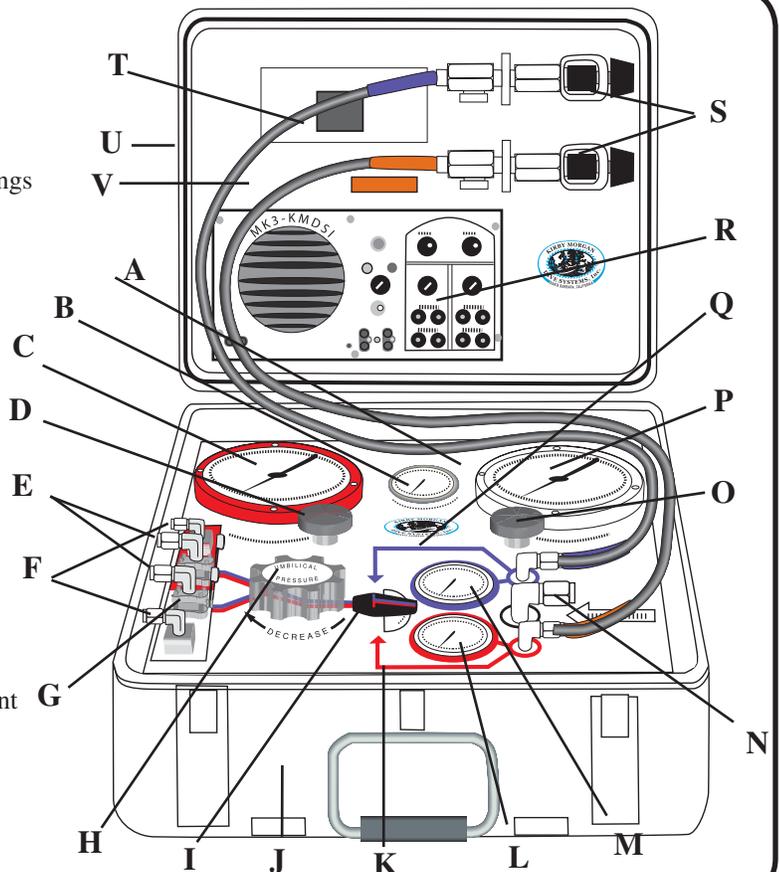


Fig. 2

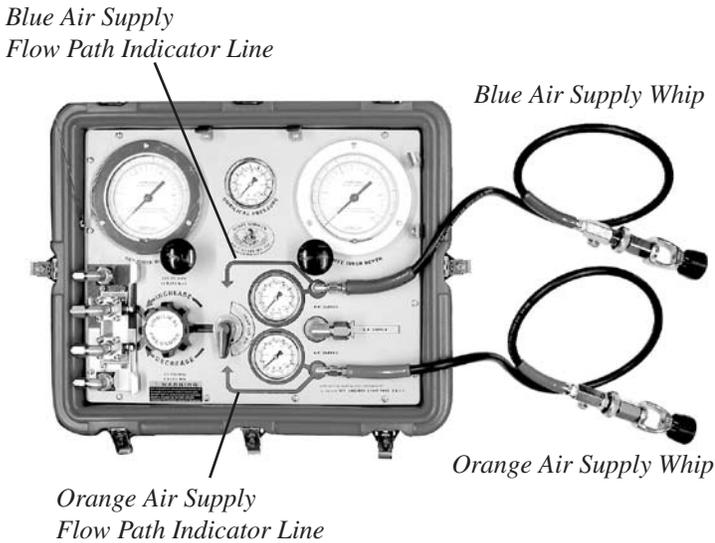


Fig. 3 Air flow paths from the H.P. cylinders.

8. BLUE BREATHING AIR SUPPLY PRESSURE GAUGE (M)

The Blue pressure gauge (M) indicates the pressure remaining in the “BLUE” high pressure tank. (NOTE: If two divers are supplied by the KMACS 5 both divers will be breathing from the same selected high pressure supply).

9. ORANGE BREATHING AIR SUPPLY PRESSURE GAUGE (L)

The Orange pressure gauge (L) indicates the pressure remaining in the “ORANGE” high pressure tank. (NOTE: If two divers are supplied by the KMACS 5, both divers will be breathing from the same selected high pressure supply).

10. YOKES FOR HIGH PRESSURE CYLINDER ATTACHMENT (S)

The yoke fittings (S) provided have standard U.S. scuba cylinder attachments as well as Din Fittings. Each yoke has a bleeder valve to vent the remainder of the pressure in the whip when changing out scuba bottles. The yokes attach to posts mounted on the panel in the lid of the KMACS 5 for storage and transport.

11. CASE (J)

The Dive Control panel (A) is attached to the bottom

half of the case (J). The top half of the case contains the communicator panel with the yoke blocks and the communicator if there are communications. If there are no communications there are only the yoke blocks. (see picture in front of manual). The top is not designed to be removed.

12. BREATHING AIR SUPPLY SELECTOR VALVE HANDLE (I)

This handle (I) controls the two position Breathing Air Supply Selector Valve and allows uninterrupted diving operations while full air supply tanks replace expended tanks. The selector valve controls **ONLY the high pressure air supply**. It is NOT possible to shut off any low pressure supply connected to the low pressure inlet fitting (N), at the KMACS 5 itself.

CAUTION: When using H.P. air, the selector handle must be turned up until it stops for BLUE supply or down until it stops for ORANGE supply. Never allow the selector handle to stay in the marked “H.P. OFF ZONE”. Both high pressure air supplies are off in the yellow striped H.P. OFF ZONE”.

When changing out the H.P. air supply cylinders, always observe the diver’s umbilical pressure gauge (B) for any sudden fall in pressure. Should this occur, it indicates that the cylinder in use has mistakenly been turned off. If so, immediately turn the cylinder back on and move the selector valve handle to select the full cylinder and change out bottles.

Due to the construction of the selector valve, it is impossible for gas to back-flow from one cylinder to the other.

13. REGULATOR ADJUSTMENT KNOB FOR UMBILICAL PRESSURE (H)

The regulator Adjustment Knob (H) allows the operator to adjust the umbilical pressure within a range of 115 psi to 225 psi (8-15.5 bars). Incoming high pressure air from the ‘ORANGE’ or ‘BLUE’ supply is reduced by the internal regulator. The Adjustment Knob controls the regulator. Turning the Knob clockwise decreases the umbilical pressure; counterclockwise increases it.

14. OUTLET MANIFOLD INCLUDING DIVER’S UMBILICAL FITTINGS (G)

The ‘WHITE DIVER’ and ‘RED DIVER’ air supply hoses are connected to the KMACS 5 at the manifold (G). The fittings coming out of the KMACS 5 are male #6 JIC (3/8”, 37°) flared fittings. The diver’s air supply hoses must have matching female #6 JIC flared fittings with swivel nuts.

The ‘WHITE DIVER’ and ‘RED DIVER’ pneumofathometer hoses are also connected to the KMACS 5 at the manifold (G). The fittings coming out of the KMACS 5 are male #4 JIC (1/4”, 37°) flared fittings. The diver’s pneumofathometer hoses must have matching female #4 JIC (1/4”, 37°) flared fittings with swivel nuts.

15. PNEUMO VALVE KNOB, WHITE DIVER (O)

The Pneumo Valve Knob, White Diver turns on and off the air supply to the ‘WHITE’ pneumofathometer system.

16. PNEUMO VALVE KNOB, RED DIVER (D)

The Pneumo Valve Knob, Red Diver turns on and off the air supply to the ‘RED’ pneumofathometer system.

17. O-RING SEAL (U)

The O-ring seal helps keep dust and moisture out of the KMACS 5 when the case is closed. The O-ring seal is not pressure proof, however, and the KMACS 5 case will flood if the box is submerged.

18. COMMUNICATOR PANEL (V)

The diver’s electronic communicator (R) is attached to the communicator panel. The battery for the communicator is located behind this panel.

19. COMMUNICATOR (R)

The MK3-KMDSI communicator is a standard open circuit/round robin diver’s communicator, which functions like a telephone. It can also be used as a 2 wire, ‘push-to-talk’ system. It is connected to the diver’s umbilicals by ‘banana plug’ fittings on the communicator. The communicator is mounted on the communicator panel. You should read and understand the accompanying radio operations manual supplied with the unit before using the unit. Improper use or connections could damage the radio.

CAUTION: Never connect the charger during a dive or when anyone is in contact with connected equipment. Although electrical shock danger is remote, connection of the recharging cord should only be done when the KMACS 5 is not in use.

Section 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.

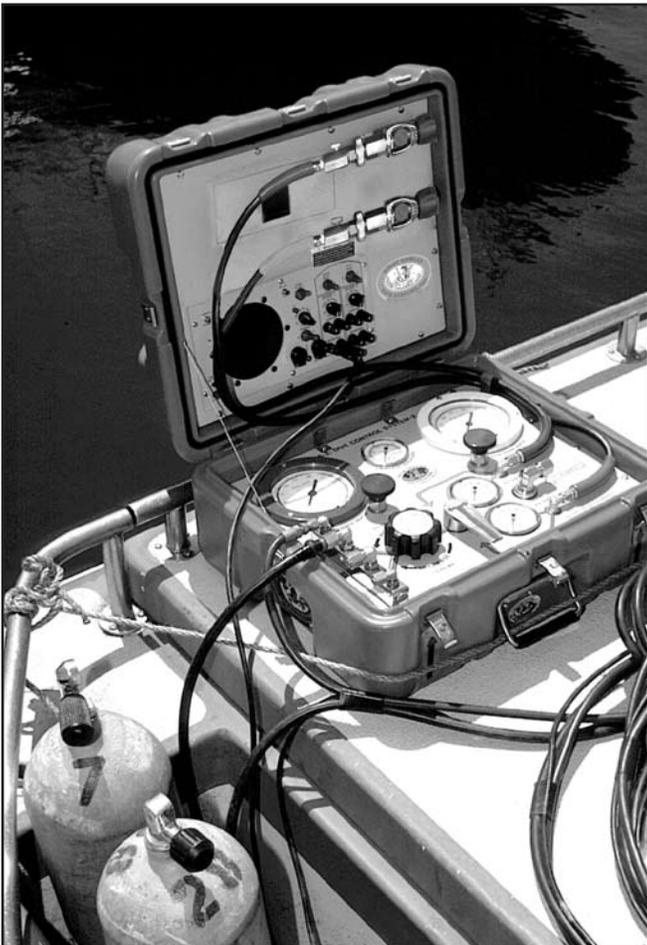


Fig. 5 Note the line which passes through the handle of the KMACS 5 and is secured to the rail to prevent the KMACS 5 from moving about.

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.

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 (S) 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

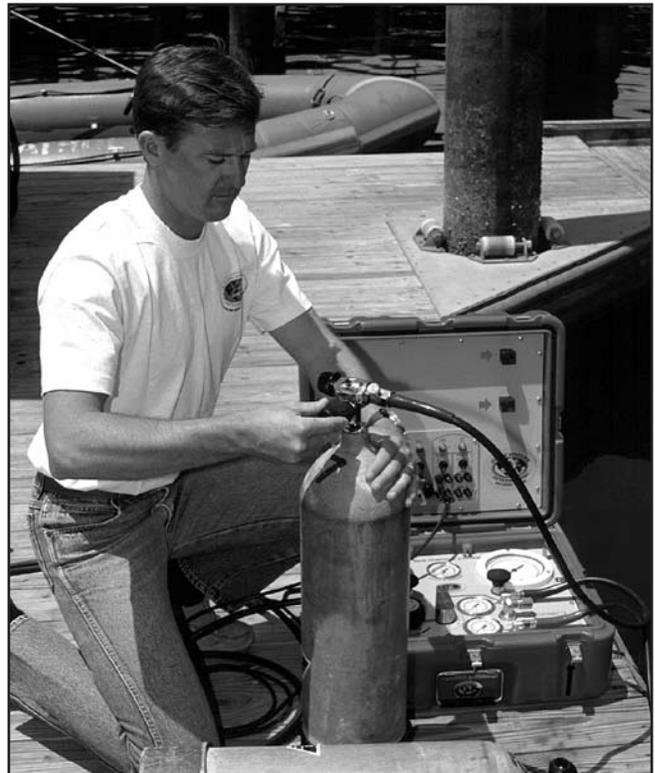


Fig. 6 Connecting a scuba air supply to the KMACS 5.

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.

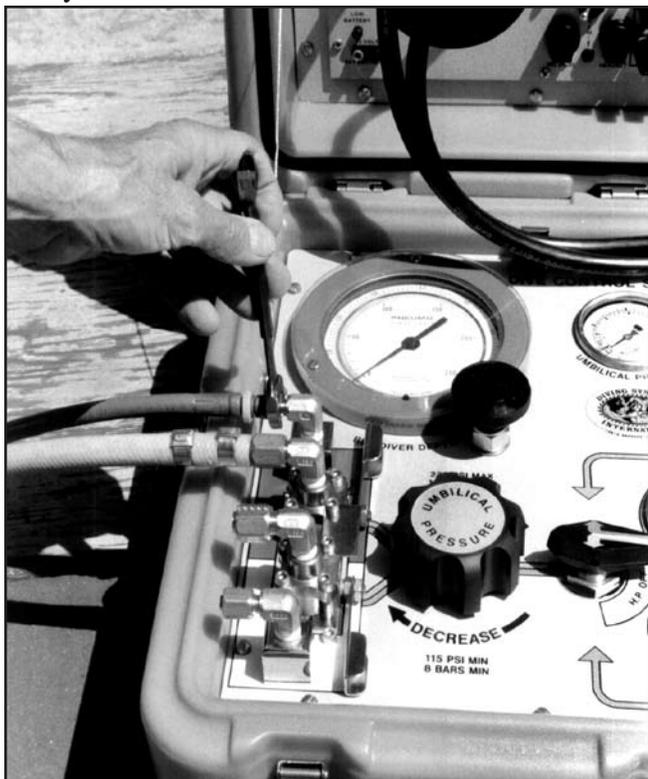


Fig. 7 Always use the right size wrench to connect the hoses to the KMACS 5.

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

If available, a low pressure compressor should be used as the primary air supply and scuba cylinders should be used as a backup, or reserve air source.

CAUTION: Low pressure compressors used for breathing air should be specifically designed for diving. Paint compressors or similar equipment are unacceptable for diving applications. (Contact KMDSI for a list of equipment manufacturers who supply compressors with breathing quality air).

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.

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 (N) 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 TriValve™ exhaust system.

CAUTION: 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 (G) 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 (L,M). 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 (H). 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 below for approximate pressure settings.

TABLE 1
Suggested Regulator settings for the KMACS 5

Depth - fsw	Pressure	Optimal	Minimum
0’	14.7 psia	150 psig	150 psig
33’	29.4 psia	165 psig	150 psig
66’	44.1 psia	180 psig	150 psig
99’	58.8 psia	195 psig	160 psig
132’	73.5 psia	210 psig	175 psig
165’	88.2 psia	225 psig	190 psig
198’	102.9 psia	225 psig	205 psig

TABLE 1, Metric
Suggested Regulator settings for the KMACS 5

Depth-Meters	Pressure	Optimal	Minimum
0	1 bar	10.3 bars	10.3 bars
10	2 bars	11.4 bars	10.3 bars
20	3 bars	12.4 bars	10.3 bars
30	4 bars	13.4 bars	11.0 bars
40	5 bars	14.5 bars	12.1 bars
50	6 bars	15.5 bars	13.1 bars
60	7 bars	15.5 bars	14.1 bars

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 (I) 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 (R) 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, 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, 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, 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.



Fig. 8 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, 1/4 turn, and observe the needle's response on the red diver depth gauge (C).

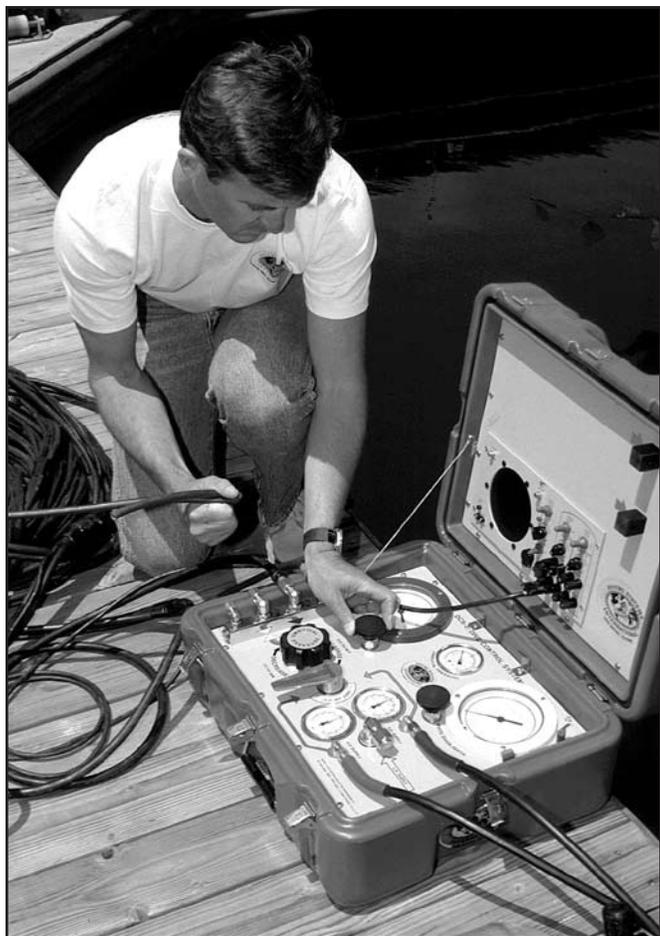


Fig. 9 Carefully test the pneumo prior to every dive.

CAUTION: 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 the above procedure for the white diver.

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 #200-015). 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.

CAUTION: 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,O) and gauge (C,P). The diver's descent rate should not exceed 75 feet (23 meters) per minute.

As the diver descends, the KMACS 5 operator should adjust the regulator (H) on the KMACS 5 to provide 150 psi (10.3 bars) over the pressure at the diver's depth at all times. This provides the best breathing performance from the diver's demand regulator.



Fig. 10 KMACS 5 operator taking a reading with the pneumo knob. The knob should be turned very slowly.

It is essential that the KMACS 5 operator keep pace with the diver's descent and not lag behind in his depth monitoring. If this occurs, it is possible for the diver to exceed his maximum planned depth without the KMACS 5 operator being aware this has occurred.

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.

Most umbilicals are made up with the diver end of the pneumo hose having about two feet (.6 meters) of loose hose. The diver can use this hose as an air supply for inflating lift bags or for taking an exact

reading of the bottom depth. In an emergency, the pneumo air can be used as a breathing air supply for a diver. The diver tells the KMACS 5 operator to “Turn on the pneumo-air...”, then inserts the hose into the mask or helmet. When using the pneumo in this mode the air pressure should be regulated by the KMACS 5 operator to be slightly greater than the diver’s depth. For example, if the diver is at 100 feet (30 meters), the pneumo should be opened until the gauge reads a depth of 110 feet (33 meters), so that a positive pressure exists.

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,O) 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 (L,M) 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 (I). 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 (S) 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 (S) 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 (L,M).

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,P) . 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.



Fig. 11 All of the outlet fittings on the KMACS 5 must be capped prior to storage.

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 (R). Plug both ends of the hose and cap the outlet manifold (G) nipples on the KMACS 5 to prevent foreign matter from entering either.

Open the bleed valves on the HP yokes (S) 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 (N) 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 (U) 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.

Section 3.0

KMACS 5 Maintenance

3.1 RECOMMENDED MAINTENANCE OF THE KMACS 5

The KMACS 5 requires very little user maintenance. With proper care, the KMACS 5 should last for years and give excellent service.

On a daily basis, the KMACS 5 operator should inspect the high pressure whips attached to the yokes (S) for signs of wear.

After each use the case, interior panels and high pressure hoses should be wiped down with a rag which has a small amount of Armor-All. Never spray cleaners directly on the KMACS 5.

Approximately every six months, the high pressure hoses should be treated with Armor-All or similar protection.

Once a year, the KMACS 5 should be returned to your authorized dealer, or KMDSI , to service the regulator, selector valve, and calibrate the diver's depth gauges. This is especially important if the unit is used for deep, decompression, or repetitive dives.

3.2 REPLACING THE BATTERY

The battery used with the KMACS 5 communicator is very reliable and will offer many years of service. However, storing the KMACS 5 with the battery drained can cause the battery to fail. ***The battery should be completely charged before storage.*** Gel cell batteries have an excellent shelf life if properly charged prior to storage.

To replace the battery, remove the screws which hold the communicator panel (V) into the top of the KMACS 5 box. Do not remove the screws which secure the communicator to the larger panel. Tilt the panel out but do not remove it from the lid. The battery is held in place by brackets and "Velcro" strips on the back of the large panel. Reach behind the panel and support the battery. Lift the panel and battery out as a unit.

Replace the old battery with a new unit. Position the new battery on the back of the large panel using the "Velcro" strips to hold it in place. Connect the leads back to the battery and push the communicator panel (V) back into its normal position. Install the screws which hold the large panel in place and tighten them in a staggered pattern.



Fig 12 After each use the case, interior panels and high pressure hoses should be wiped down with a rag which has a small amount of Armor-All. Never spray cleaners directly on the KMACS 5.

Trouble Shooting the KMACS 5 System

4.1 GENERAL

The KMACS 5 is an extremely simple system which should not malfunction if the instructions in this manual are followed. Most problems encountered in using the system can be easily remedied. The following information covers the common operating difficulties.

4.2 NO COMMUNICATIONS

Symptoms	Probable Cause(s)	Remedy
1) No sound at either KMACS 5 or diver's mask.	a) Communication power not on.	Activate switch and adjust volume.
	b) Communications incorrectly hooked up.	Switch terminal wires.
	c) Communications not hooked up.	Plug into terminals.
2) Battery indicator does not respond.	Battery low or dead.	Charge or replace battery, or bypass battery with external power.
3) Communications weak or broken up.	Terminals covered with corrosion.	Clean Terminals with wire brush to bright shiny metal.
4) Communications will not work with headset but works otherwise.	Headset not working Short in internal wiring.	Replace headset. Return to factory for repair
5) Communications interrupted when umbilical is moved.	Break in diver's communication wire.	Splice wire if damage is minor. Replace wire if damage is major.
6) Communications interrupted when waterproof connector is moved.	Break in splice at waterproof connector or failure of connector. Test with VOM.	Replace splice or connector.
7) Satisfactory communications through one earphone or microphone only (4 wire mode).	a) One wire in cable is broken	Stack connectors in microphone terminals. Communications works in two wire mode.
	b) Microphone/earphones dead.	Replace microphone/earphones.
8) No sound at either KMACS 5 or mask.	Communicator not functional.	Return to factory for repair after verifying no cure by following above procedures.

4.3 NO PNEUMO READING

Symptoms	Probable Cause	Remedy
1) No air to diver's end of pneumo	Pneumo hose not connected	Attach fittings to KMACS 5
2) Gauge reads sustained pressure at surface.	Pneumo crimped or plugged.	Check entire length of hose. Relieve any restrictions.
3) Hose will not hold pressure and gauge needle will not rise.	Pneumo fitting cracked or loose.	Check fittings at console with soap and water solution. If fittings bubble, either tighten or replace as necessary.
4) Needle will not respond properly to flow.	a) Hole in pneumo hose.	Check hose; replace or splice as necessary.
	b) Gauge mechanism damaged.	Replace or repair gauge. Return to factory.
5) Air can be heard escaping into console interior.	KMACS 5 internal plumbing may be cracked or broken.	Return to factory for service.

4.4 NO AIR TO DIVER

Symptoms	Probable Cause	Remedy
1) No hose pressure in diver's umbilical	a) primary air source not connected.	Connect proper hose to console.
	b) Valve closed at low pressure source	Open valve at low pressure compressor.
	c) Selector valve in "H.P. OFF" zone.	Move selector valve handle in line with flow from either high pressure source.
2) No gauge reading on high pressure gauge.	Valve closed at high pressure source	Open valve at high pressure source.
3) Low hose pressure in diver's umbilical.	Regulator not properly loaded.	Rotate adjustment wheel in appropriate direction.
4) Air can be heard escaping from hose.	Fitting loose on diver's hose, or fittings damaged.	Tighten fittings until snug. Do not over tighten. Replace fittings if damaged.
5) Umbilical registers pressure at console gauge, but no flow at mask.	Mask improperly serviced.	Clean and adjust mask.

Symptoms	Probable Cause	Remedy
6) Air can be heard escaping into console interior.	Leakage in DCS plumbing.	Return KMACS 5 to factory for service.
7) Umbilical hose pressure and supply pressure drops rapidly.	Diver's Umbilical cut or severed.	Replace diver's hose.
8) With high pressure air on and regulator loaded, no umbilical pressure.	Regulator malfunction.	Return DCS- 2A to factory for service

5.0 APPENDIX

5.1 EMERGENCY PROCEDURES

The following are general recommended emergency procedures. However, it is up to the individual diver and dive supervisor to make judgements under specific conditions on how to best cope with particular situations.

Problem	Action
1) Loss of communications	a) Abort dive if operations are not absolutely necessary. b) Use line pull signals as per this appendix section.
2) Loss of primary air supply.	Switch to emergency backup system and abort dive.
3) Diver's umbilical severed.	a) Diver switches to bailout bottle and aborts dive. b) Standby diver enters water and supplies first diver with air from pneumo.
4) Pneumo will not operate.	a) Dive hose should be marked with colored tape every 10 feet. Take depth readings from this. (will only be approximate) b) Diver's personal depth gauge can provide back up.

5.2 DIVER LINE PULL SIGNALS

# of Pulls	From Tender to Diver	From Diver to Tender
1	"Are you all right?" When diver is descending, one pull means "Stop!"	"I am all right", or ... "I am on the bottom"
2	"Going down" During ascent, this means, "You have come up too far, go back down until we stop you."	"Lower me down", or "Give me slack"

# of Pulls	From Tender to Diver	From Diver to Tender
3	“Stand by to come up”	“Take up my slack”
4	“Come up”	“Haul me up”

5.3 COMMUNICATIONS WIRING SCHEMATICS

If your KMACS has communications, refer to the radio manual

5.4 EXPLODED VIEWS & PARTS LISTS

The following parts are not shown on the blow apart drawing and are listed reference only.

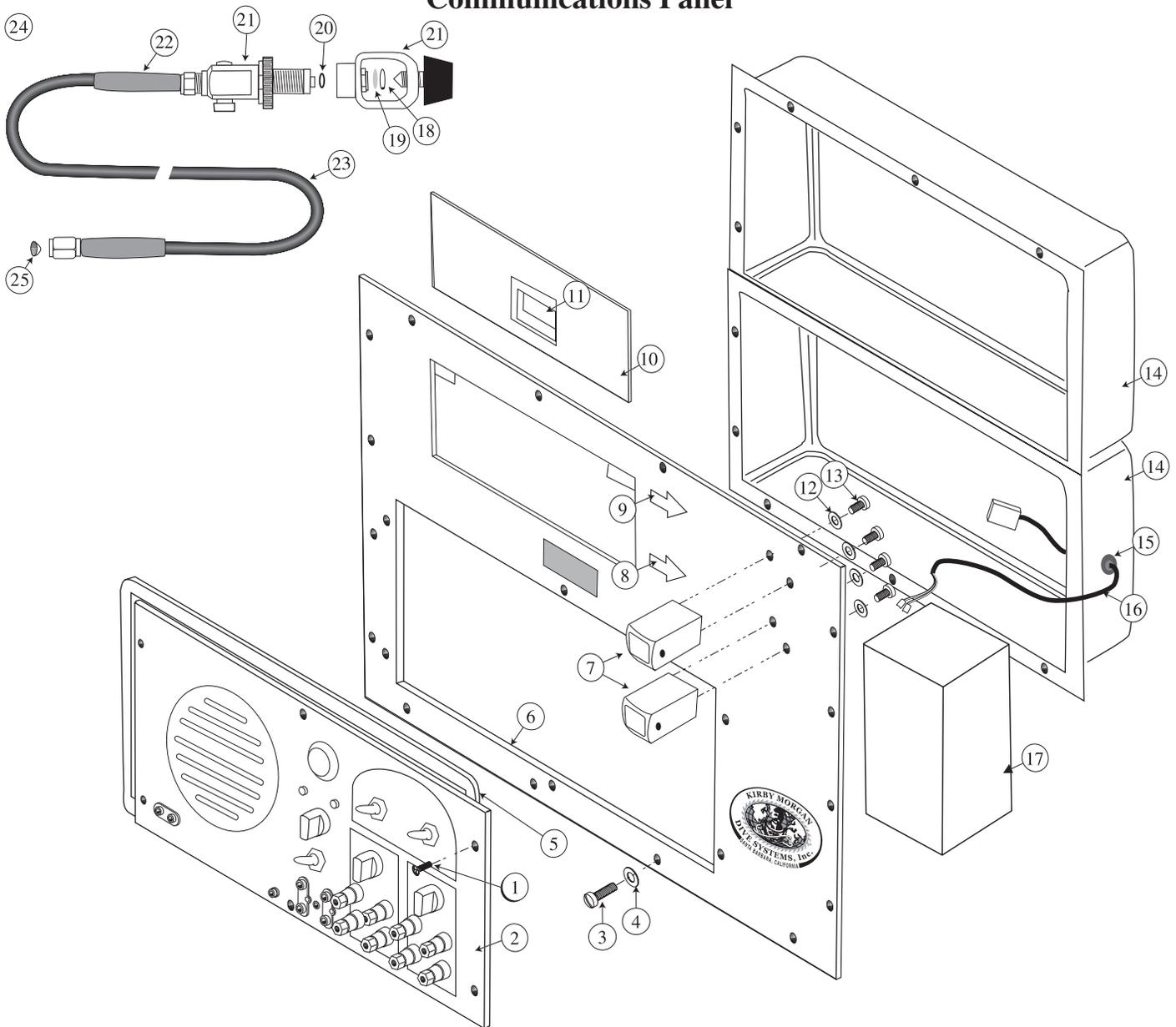
Location	Part #	Description	Qty
Not Shown	420-100	Case, KMACS 5	1
Not Shown	405-039	Battery Charger Assembly	1

* The following parts in the interior plumbing require the use of Conical Seals, # 455-135. the conical seals are provided with the items listed below.

Location	Part #	Description
29	405-105	Inlet Tube, H.P. (blue)
31	405-105	Inlet Tube, H.P. (orange)
40	405-106	S .S. Tube Assembly, H. P.

KMACS 5 EXPLODED VIEWS & PARTS LISTS

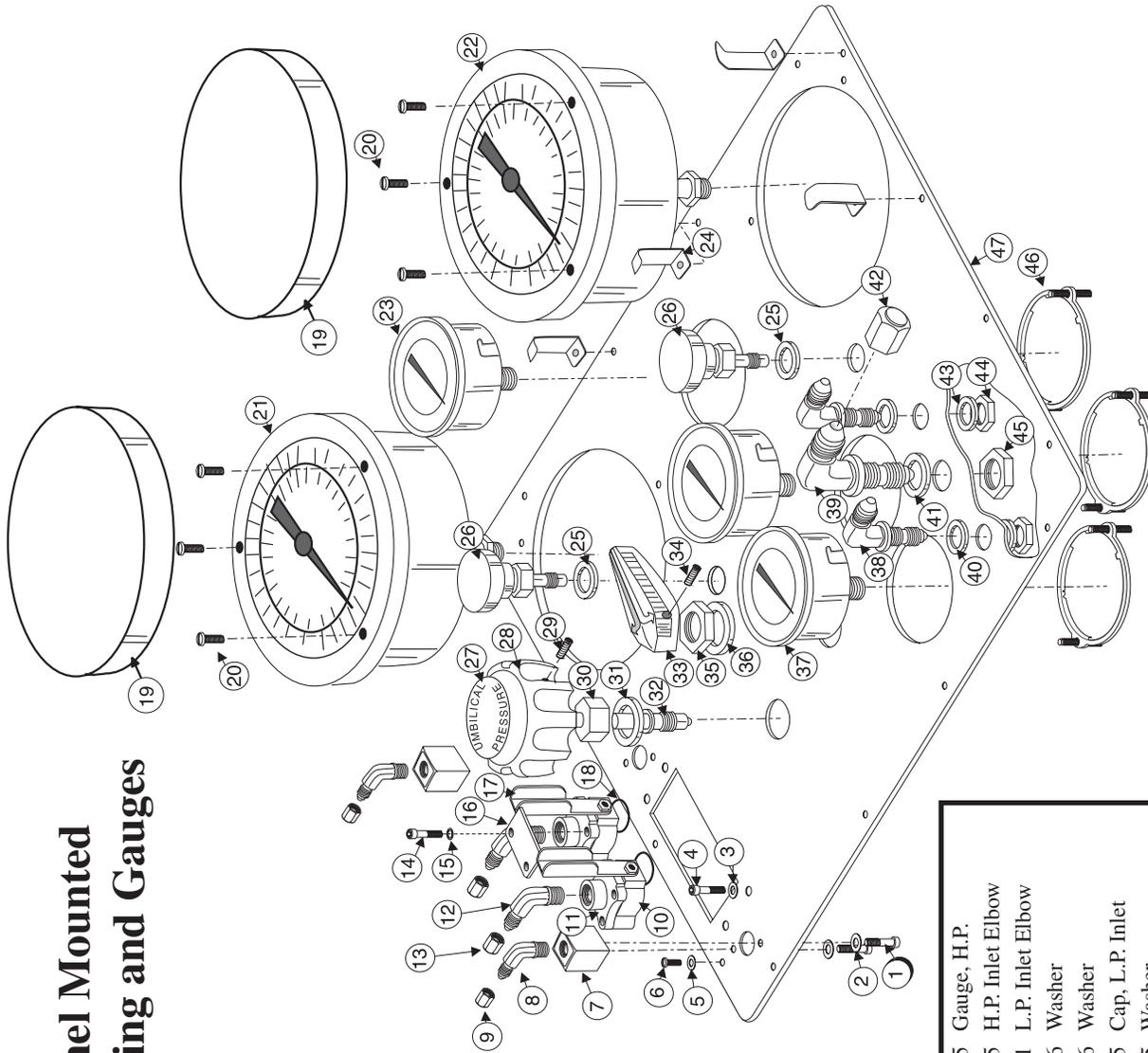
Communications Panel



Key#	Part #	Description
1	530-017	Screw
2	415-105	Communicator
3	530-035	Screw
4	430-075	Washer
5	410-003	Gasket, Foam
6	445-105	Panel, Auxiliary
7	450-106	Yoke Retainer
8	420-125	Arrow, Orange
9	420-120	Arrow, Blue
10	445-115	Door, Storage Compartment
11	420-160	Slide Latch
12	330-405	Lock washer
13	530-070	Screw
14	420-105	Box, Plastic
15	410-145	Grommet
16	415-110	Cable, Battery

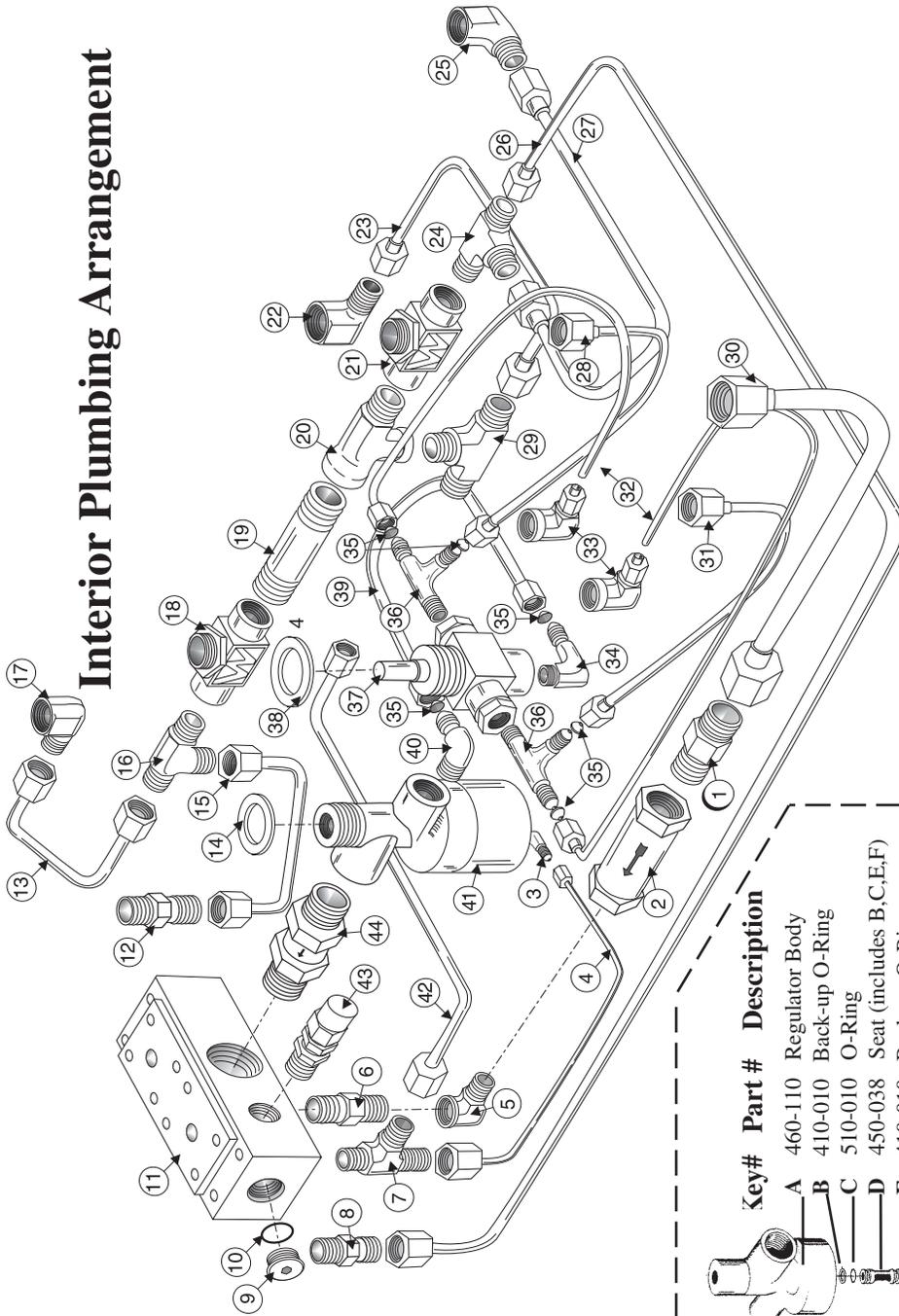
Key#	Part #	Description
17	415-056	Battery, Gel Cell 12V
18	430-060	Retainer Ring
19	455-065	Filter
20	510-491	O-Ring
21	455-317	Yoke/Din Assembly (18-21)
22	410-006	Hose Protector, Orange
	410-007	Hose Protector, Blue
23	455-054	Hose, H.P. Supply
24	405-175	Hose, Yoke Assem., Blue (18-23)
	405-176	Hose, Yoke Assem., Orange (18-23)
25	455-135	Conical Seal
	400-046	KMACS 5 with Communicator
	400-045	KMACS 5 No Communicator
		Bracket for no comm version not shown
	440-004	Mount Bracket
	530-078	Screw
	530-540	Washer

Panel Mounted Plumbing and Gauges



Key#	Part #	Description
1	430-111	Screw
2	430-134	Washer
3	430-134	Washer
4	430-111	Screw
5	430-075	Washer
6	530-035	Screw
7	450-144	Pneumo Block
8	455-032	SS Elbow
9	455-007	Cap, Pneumo
10	455-157	Valve Body
11	455-145	Valve flange
12	455-143	SS Elbow
13	455-006	Cap, Umbilical Outlet
14	430-141	Socket Head Screw
15	430-134	Washer
16	440-210	Handle Stop
17	440-212	Valve Handle
18	425-110	Kit, Shut Off Valve
19	510-014	O-Ring
20	420-140	Gauge Cover
21	530-070	Screw
22	440-010	Pneumo Gauge, Red
23	440-011	Pneumo Gauge, White
24	440-150	Gauge, L.P.
25	440-115	Hose Holder
26	430-130	Washer
27	455-051	Pneumo Valve Assembly w/ #18 from interior plumbing drawing.
28	420-135	Decal
29	450-170	Knob, Regulator Adjustment
30	430-110	Set Screw
31	450-125	Mount Nut, Regulator
32	430-126	Washer, Regulator Mount
33	450-120	Stem, Regulator Adjustment
34	420-225	Selector Handle
35	430-140	Set Screw, Selector Handle
36	455-140	Selector Valve Assembly w/ #37 from interior plumbing drawing.
	430-205	Washer
37	440-155	Gauge, H.P.
38	455-185	H.P. Inlet Elbow
39	455-111	L.P. Inlet Elbow
40	430-116	Washer
41	450-136	Washer
42	455-005	Cap, L.P. Inlet
43	430-115	Washer
44	455-152	Nut
45	455-190	Nut, H.P. Inlet Mount
46	445-020	Gauge Bracket
47	445-100	Main Panel

Interior Plumbing Arrangement



CAUTION - WARNING
 Use only Kirby Morgan original replacement parts. The use of other manufacturer's parts will interfere with the performance characteristics of your life support equipment and may jeopardize your safety. Additionally, any substitutions will void any warranties offered by KMDSI. When ordering spares, always insist on Kirby Morgan Genuine Parts.

Key#	Part #	Description
A	460-110	Regulator Body
B	410-010	Back-up O-Ring
C	510-010	O-Ring
D	450-038	Seat (includes B,C,E,F)
E	410-010	Back-up O-Ring
F	510-010	O-Ring
G	450-037	Piston Stem
H	510-014	O-Ring
I	450-034	O-Ring Cap, Small
J	510-014	O-Ring
K	510-008	O-Ring
L	410-008	Back Ring, Large
M	450-033	O-Ring Cap, Large
N	435-006	Spring
O	450-032	Piston Head
P	410-119	O-Ring
Q	410-121	Thread Seal
R	430-022	Nylon Locknut
S	450-157	Regulator Cylinder
T	455-026	Regulator Sensor Elbow

Key#	Part #	Description
1	455-024	Connector, L.P.
2	455-049	Check Valve, L.P.
3	455-026	Male Elbow
4	405-155	Tube, Regulator Sensor
5	455-120	Elbow
6	455-122	3/8" NPT Nipple
7	455-180	Male Run Tee
8	455-149	Straight Tube Connector
9	350-062	L.P. Plug
10	510-013	O-Ring
11	450-142	Manifold Block
12	455-149	Straight Tube Connector
13	405-150	Tube, Red Pneumo Gauge
14	430-126	Washer, Regulator Mount
15	405-160	Outlet Tube, Red Pneumo
16	455-180	Male Run Tee
17	455-040	Female Elbow
18	455-051	Pneumo Valve
19	455-123	1/4" NPT Nipple
20	455-121	1/4" NPT Street Tee
21	455-051	Pneumo Valve
22	455-040	Female Elbow
23	405-107	Tube, Umbilical Gauge
24	455-180	Male Run Tee
25	455-040	Female Elbow
26	405-161	Outlet Tube, White Pneumo
27	405-102	Tube, White Pneumo Gauge
28	405-105	Inlet Tube, H.P. Blue
29	455-117	Male Branch Tee
30	405-110	Tube, L.P. Supply
31	405-105	Inlet Tube, H.P. Orange
32	405-104	Tube, H.P. Gauge
33	455-305	Elbow Assembly, Swagelok®
34	455-032	Male Elbow
35	455-135	Conical Seal
36	455-196	Male Run Tee, H.P.
37	455-140	Selector Valve
38	430-120	Washer
39	405-106	SS Tube Assy., H.P.
40	455-197	Male Elbow
41	405-120	Regulator Assembly
42	405-145	Tube, Main Pneumo Supply
43	455-047	Relief Valve
44	455-130	1/2" Check Valve L.P.

KMACS 5 DIVE LOG

Diver: _____ **Date:** _____

KMACS 5 Operator: _____

Dive Location: _____

Weather Conditions: _____

Purpose of Dive: _____

Low Pressure Air Source Pressure: _____

High Pressure Air Source Pressure: _____

Cylinder #	Start	Finish
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____

Dive Times:

Diver Left Surface: _____

Diver Reached Bottom: _____

Diver Left Bottom: _____

Maximum Depth: _____

Diver Reached Surface: _____

Total Bottom Time: _____

Repetitive Group: _____

Decompression Required?: Y N

Decompression Schedule: _____

Diver's Signature _____ **KMACS 5 Operator** _____

Table of Equivalents

To convert units appearing in Column 1 (left column) into equivalent values in Column 2 (center column), multiply by factor in Column 3. Example: To convert 7 gallons into cubic inches, multiply $7 \times 231 = 1617$. To convert units appearing in Column 2 (center) into equivalent values of units in Column 1 (left), divide by factor in Column 3. Example: To convert 25 horsepower into Btu per minute, divide 25 by $0.02356 = 1061$

<i>PSI</i>	<i>BARS</i>	<i>K/Pa</i>
1	0.06895	6.895
15	1.03425	103.425
50	3.4475	344.75
100	6.895	689.5
300	20.685	2068.5
500	34.475	3447.5
1000	68.95	6895.0
2000	137.9	1379.0
3000	206.85	20685.0
4500	10.275	31027.5
5000	44.75	34475.0

TO CONVERT	INTO	MULTIPLY BY
INTO	TO CONVERT	DIVIDE BY
Atmospheres	Feet of Water	33.9
Atmospheres	Inches of Mercury (Hg)	29.92
Atmospheres	PSI (LBS per Sq. Inch)	14.7
BTU	Foot Pounds	778.3
BTU per hour	Watts	0.2931
BTU per minute	HorsePower	0.02356
Celsius (Centigrade)	Fahrenheit	$^{\circ}\text{C} \times 1.8 + 32$
Centimeters	Inches	0.3937
Cubic Centimeters	Gallons (U.S. Liquid)	0.0002642
Cubic Centimeters	Liters	0.0001
Cubic Feet	Cubic Inches	1728
Cubic Feet	Gallons (U.S. Liquid)	7.48052
Cubic Feet	Cubic Feet	0.0005787
Cubic Inches	Gallons (U.S. Liquid)	0.004329
Cubic Inches	Seconds	86.400
Days	Radians	0.01745
Degrees (Angle)	Meters	0.3048
Feet	Miles	0.0001894
Feet	Atmospheres	0.0295
Feet of Water	Inches of Mercury (Hg)	0.8826
Feet of Water	PSI (Lbs per Sq. Inch)	0.4335
Feet of Water	Miles per Hour	0.01136
Feet per Minute	Miles per Hour	0.6818
Feet per Second	BTU	0.001286
Foot-Pounds	Horsepower	0.0000303
Foot-Pounds per Minute	Horsepower	0.001818
Foot-Pounds per Second	Cubic Feet	0.1337
Gallons (U.S. Liquid)	Cubic Inches	231
Gallons (U.S. Liquid)	Pounds of Water	8.3453
Gallons of Water	BTU per Minute	42.44
Horsepower	Foot-Pound per Minute	33,000
Horsepower	Foot Pounds per Second	550
Horsepower	Watts	745.7
Horsepower	Days	0.04167
Hours	Weeks	0.005952
Hours	Centimeters	2.54
Inches	Atmospheres	0.03342
Inches of Mercury (Hg)	Feet of Water	1.133
Inches of Mercury (Hg)	PSI (Lbs. per Sq. Inch)	0.4912
Inches of Mercury (Hg)	PSI (Lbs. per Sq. Inch)	0.03613
Inches of Water	Cubic Centimeters	1000
Liters	Gallons (U.S. Liquid)	0.2642
Liters	Inches	0.00004
Micron	Feet	5280
Miles (Statute)	Feet per Minute	88
Miles per hour (MPH)	Feet per Second	1.467
Miles per hour	Pounds	0.0625
Ounces (Weight)	Cubic Inches	1.805
Ounces (Liquid)	Quarts (Liquid)	0.5
Pints (Liquid)	Grains	7000
Pounds	Grams	453.59
Pounds	Ounces	16
Pounds	Atmospheres	0.06804
PSI (Pounds per Sq. Inch)	Feet of Water	2.307
PSI (Pounds per Sq. Inch)	Inches of Mercury (Hg)	2.036
PSI (Pounds per Sq. Inch)	Gallons	0.25
Quarts	Square Inches	144
Square Feet	Temperature ($^{\circ}\text{C}$)	0.5555
Temperature ($^{\circ}\text{F} - 32$)	Pounds	2000
Tons (U.S.)	Horsepower	0.001341
Watts		