

**Operation and Maintenance Manual
for the
Dive Control Helium Speech
Unscrambler**

Part Number: CO363AY

**Document Number: CO-OM-248
Revision: 6**



(Intentionally Blank)

APPROVAL SHEET

Document Information

Advitium No	Title	Classification	Current Revision	Date
CO-OM-248	Dive Control Helium Speech Unscrambler Operator Manual	Commercial in confidence	6	17/08/2015

Revision History

Rev	Date	BY	CHK	APP	Comments
5	08/03/2012	S. Coull	G. Robb	S. Coull	Headset part number change, images updated, ECN: 14611
6	12/10/2015	J. Lastauskiene	L. Wedekind	M. Hossack	Update for new XLR connectors, ECN: 16449

Original Approvals

Responsibility	Name	Position	Date
Author	S. Coull	Electronics Engineer	November 2008
Checked	I. Bishop	Senior Electronics Engineer	November 2008
Approval	I. Bishop	Senior Electronics Engineer	November 2008

Copyright Details

© 2015 JFD

Copyright of this document is the property of JFD and it may not be copied, used or otherwise disclosed in whole or in part except with prior written permission from JFD or, if this document has been furnished under a contract with another party, as expressly authorised under that contract.

(Intentionally Blank)

LIST OF ABBREVIATIONS

Abbreviation	Definition
Comms	Communications
A	Amp
DSP	Digital Signal Processor
m	Meters
msw	Meters of Sea Water
HSU	Helium Speech Unscrambler
Heliox	A gas mixture of Helium and Oxygen
PTT	Push to Talk
Hz	Hertz
I/O	Input / Output
LCD	Liquid Crystal Display
LED	Light Emitting Diode
PCB	Printed Circuit Board
POT	Potentiometer
PPO2	Partial Pressure of Oxygen
STP	Screened Twisted Pair
Vac	Voltage (AC)
Vdc	Voltage (DC)

(Intentionally Blank)

TABLE OF CONTENTS

	Page
Chapter 1 - Introduction	1
Chapter 2 - Functional Description	3
Chapter 3 - Panel Components	7
Chapter 4 - Operation	17
Chapter 5 - Technical Specifications	27
Chapter 6 - Spares	31

(Intentionally Blank)

CHAPTER 1 - INTRODUCTION



Fig 1.1 Dive Control HeliCom Speech Unscrambler

The CO363AY Helium Speech Unscrambler has been designed into a 19" rack enclosure which contains the electronics that perform the unscrambling and communications functions.

Divers in saturation breathe a gas mixture of Helium and Oxygen (Heliox) which distorts the human voice to sound high pitched and difficult to understand. The CO363AY converts the helium affected speech back to a usable audio source that is easy to understand and communicate with.

The main function of the Dive Control Unscrambler is to provide clear, two way voice communications between the divers and a supervisor, using three independent communications circuits – Channel 1 (Diver 1), Channel 2 (Diver 2) and Channel 3 (Diver 3 and Bell).

The Unscrambler has round robin functionality that will allow the divers using the unit to communicate with each other. When round robin is switched on Channel 1, Channel 2 and Channel 3 can communicate with each other.

There is a supervisor round robin mode which when enabled will allow the supervisor to communicate with all three channels without using a push to talk (PTT) button. When supervisor round robin is switched off the supervisor will use a PTT button to talk with each channel individually via that channel's PTT or all three channels at the same time with an "PTT ALL DIVERS" button.

The Unscrambler has a Liquid Crystal Display (LCD) for the user interface that will indicate specific unscrambling parameters such as Depth (msw), Partial Pressure (PPO₂), Pitch Reduction and Temperature. All of these parameters may be manipulated individually via the user interface.

The Unscrambler is also fitted with a loudspeaker so that the diver's speech is audible to the supervisor independently of the supervisor's headset. It is possible to have the loudspeaker switched ON or OFF, as desired. The Unscrambler is also fitted with a record function. The audio to and from the unscrambler can be recorded on an external device via a BNC connector on the rear panel.

(Intentionally Blank)

CHAPTER 2 - FUNCTIONAL DESCRIPTION

CONTENTS

	Page
2.1 Power Supply	4
2.2 General	5


2.1 POWER SUPPLY

The Unscrambler has two switch mode power supplies installed within the enclosure. The unit is designed to receive an AC voltage of 85 to 264 Volts with a frequency of 47 to 63Hz. Generally it is powered from 110VAC or 230VAC.

The power inlet is a twin fused IEC socket on the rear panel. The socket is fused using 2 Amp anti-surge fuses.



Fig 2.1 AC Power Inlet

WARNING	
	RISK OF ELECTRIC SHOCK. Only qualified personnel conversant with operation of electrical systems should perform hook up, repair or maintenance.

2.2 GENERAL

The main function of the Unscrambler is to provide a means of unscrambling within a Dive Control system. There are two main sections to the Unscrambler, the power supply section and the PCB/Audio section.

Within the 19" rack enclosure are several Printed Circuit Boards (PCB's) that provide the function of helium speech unscrambling as well as routing for the audio signals. There is a digital signal processor (DSP) PCB which digitally corrects the Helium speech effect on the Divers voice when the Unscrambler is turned on.

There are five modular PCB cards that fit onto a main routing or "Backplane" PCB. The backplane PCB is the largest PCB in the unscrambler and is responsible for connecting and routing signals between the different cards inside the unscrambler. Three of these cards are the audio module PCB's. The audio module PCB's are responsible for the volume control for each of the diver channels. The other two cards are the audio mixing PCB which mixes the three audio signals before they are unscrambled via the DSP PCB and the input transformer PCB which controls the PTT functions, the VU display and houses the audio input transformers.

The power supplies are mounted onto an acetal plate along with the DSP power supply. There are two switch mode power supplies which convert the incoming AC supply to +12Vdc and -12Vdc. The DSP power supply converts the incoming AC voltage down to 7.2Vdc to supply the DSP PCB.

The front panel contains the main interface for the user to interact with the Dive Control Unscrambler and is split into two main sections. The section on the left of Fig 2.2 is the power and audio controls. This section contains many of the controls for the audio functions of the unit. The adjustable gains and PTT switches are all controlled from the front panel.

The right hand side of Fig 2.2 shows the DSP interface which contains the Unscrambler on/off button and the DSP controls. The DSP has a set of unscrambling parameters that can be adjusted. The unscrambler user interface is displayed on an LCD. The keypad below the LCD will allow the user to navigate through the unscrambling properties and adjust to suit. The depth control is controlled via the depth potentiometer which will update the DSP and the LCD will give a readout of the current depth setting.



Fig 2.2 Front Panel

(Intentionally Blank)

CHAPTER 3 - PANEL COMPONENTS

CONTENTS

	Page
3.1 Front Panel Power and Audio Controls	8
3.2 Front Panel DSP Interface	10
3.3 Rear Panel	11
3.4 Rear Panel Audio Connectors	12
3.5 Remote PTT Connections	13
3.6 5 Way XLR Signal Cable Assembly	14
3.7 5 Way XLR Remote PTT Assembly	15
3.8 Record Output Connector	16

3.1 FRONT PANEL POWER AND AUDIO CONTROLS

The front panel contains the power on/off switch which is a green illuminating push-button switch. When pressed the Unscrambler will power on and the power button and LCD display will illuminate.

Next to the power on/off switch is a jack socket for a supervisor headset and the speaker power switch. The speaker switch will illuminate with a blue LED when the speaker is on.

The supervisor headset (CO23986) can be plugged into the 1/4" jack socket on the front panel of the unscrambler. The Supervisor headset and Diver headsets are not to be mistaken as being the same. Only the supervisor headset with a 1/4" jack plug can be used on the front panel.

The supervisor's headset connector uses an industry standard 1/4" jack socket located on the front panel of the Unscrambler. The below image shows the mating half plug which is on the supervisor headset.



Fig 3.1 Headset Jack Connections

Pin number	Function
Centre	Supervisor Microphone Signal
Sleeve	Supervisor Mic/Earphone Return
Tip	Supervisor Earphone Signal

Table 3.1 Headset Jack Connections

The speaker can be switched on when the headset is in use and the audio from the divers will be audible from the speaker. When supervisor round robin is switched on the supervisors audio will also be audible from the speaker.

The top section seen in Fig 3.2 shows the supervisor and diver round robin switches. When the supervisor round robin is switched on the supervisor will be able to talk to all divers without the use of the PTT switches.

When diver round robin is switched on the divers will be able to communicate with each other. Each diver channel has its own dedicated round robin volume control.

The 'Master' or 'All Diver' controls contain the master volume controls and the all divers PTT button. The master volume controls will change the volume for all channels when adjusted. The diver to supervisor and supervisor to diver master volumes can be adjusted. The 'PTT All Divers' enables the supervisor to address all divers at the same time using one button.

Each diver communications channel is equipped with its own set of dedicated volume controls which have a minimum listening level. The volume controls available for each individual channel include the diver to supervisor volume and the supervisor to diver volume. Each channel has its own PTT switch so the supervisor can address an individual channel at a time.

Fig 3.2 shows the power on/off switch and audio control switches



Fig 3.2 Power & Audio Control Switches

3.2 FRONT PANEL DSP INTERFACE

Fig 3.3 shows the user interface section of the front panel.

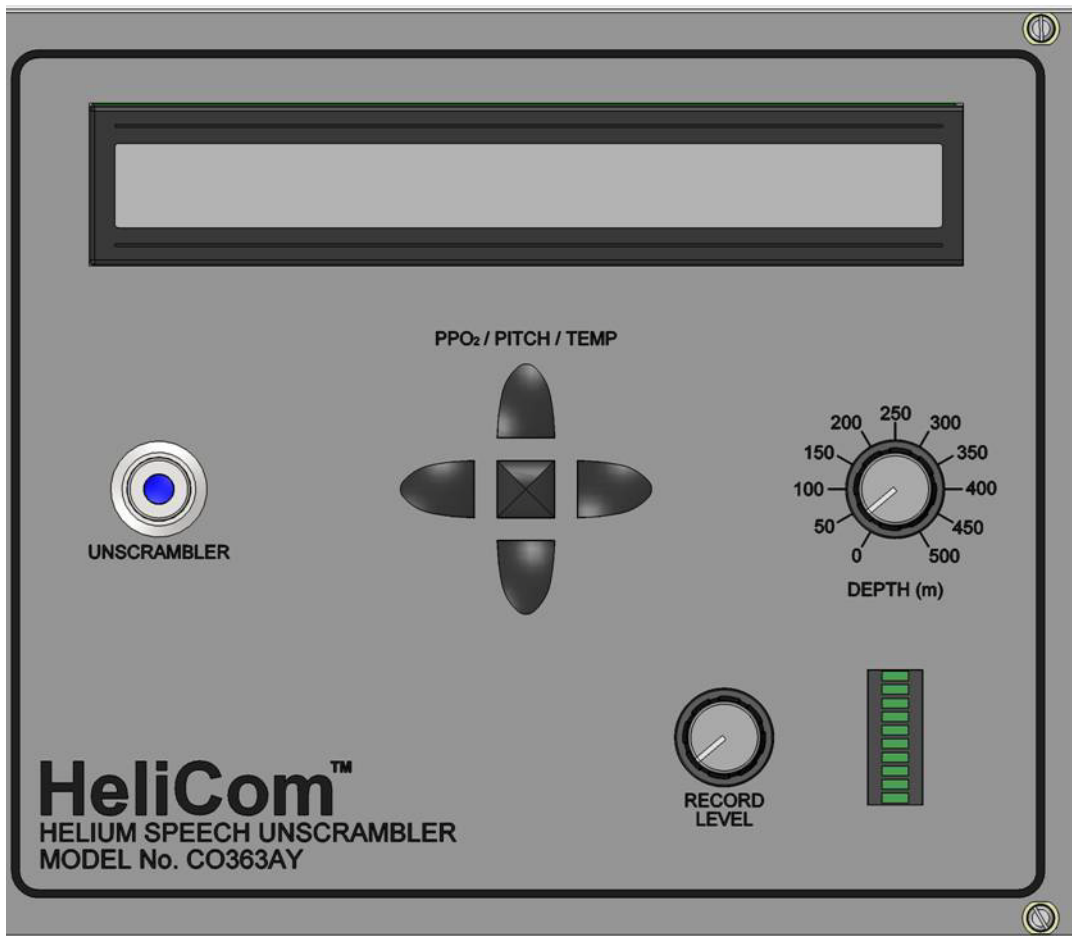


Fig 3.3 Unscrambler Controls

To switch the Unscrambler on, push the illuminating push-button switch on the front panel. The Unscrambler power switch will illuminate with a blue LED when the Unscrambler is on.

The user interface Liquid Crystal Display (LCD) shows parameters used by the unscrambling algorithm and allows adjustments of these parameters to the users preference. The keypad is used to scroll through and set the chosen parameters. For detailed information on the user interface see section 4.4.

The depth pot is the main control for the helium unscrambling function and this alone can be used to set the unscrambler parameters to match the depth and gas mix of any given Diver. The depth pot varies over a range of 0m to 500m.

3.3 REAR PANEL



Fig 3.4 Rear Facia

The rear facia of the Unscrambler contains all of the diver/bell communications connections. The diver/bell communications and the remote PTT connections use 5 way XLR sockets. The four audio connections can be seen on the left hand side of the Fig 3.4. The power socket and earth stud for the unit are also both located on the rear facia.

The comms cables from the Divers can be connected to the Diver 1, Diver 2, Diver 3 and Bell sockets on the rear of the unit - as per the pin allocations shown in section 3.4.

Remote PTT's can be connected to the remote PTT socket on the rear of the unit - as per the pin allocations shown in section 3.5.

The Jack socket on the front panel can be used to connect a supervisor headset and the jack socket on the rear panel can be used to connect an external microphone and speaker.

The Record Signal output can be accessed from the BNC socket on the rear of the unit – as per the pin allocations shown in section 3.8.

Ensure that the Power switch on the front of the unit is switched off and connect the supplied Mains Power Lead to the IEC bulkhead socket on the rear of the unit as shown above in Fig 3.4.

3.4 REAL PANEL AUDIO CONNECTORS

Signal wiring to the Unscrambler is via the five way XLR cable assemblies (CO363180) which connect onto the four sockets on the left side of the rear panel. The five way cable assemblies (Part No. CO363180) are used for diver 1, diver 2, diver 3 and the bellman.

See below for image of 5 pole XLR sockets on rear panel.

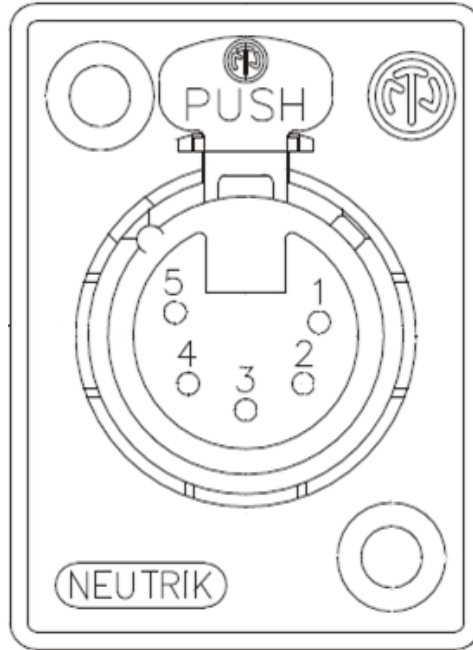


Fig 3.5 Rear Panel Audio Output XLR Socket Face view

The cable assemblies are to be installed between the incoming signals coming from the divers/bell to dive control.

(Diver 1, Diver 2, Diver 3 and Bell - 5 Pin Panel Mount Socket) Pin out allocation

Functional Name	Wire Colour	Function	Pin number
Mic (Rtn)	Grey (Red Screen)	Microphone Return	1
Mic (Sig)	Red	Microphone Signal	2
Ear (Rtn)	Grey (Yellow Screen)	Earphone/Speaker Return	3
Ear (Sig)	Yellow	Earphone/Speaker Signal	4
Screen	Grey	Headset screen	5

Table 3.2 Comms Input Connector Details

3.5 REMOTE PTT CONNECTIONS

There is another 5 way XLR socket for remote PTT connections. This supplies a means of remote press to talk where a five way cable assembly (Part No. CO363181) can be connected between the socket and a remotely located set of switches, typically located on Dive Control panels. This carries the same function as the front panel press to talk switches.

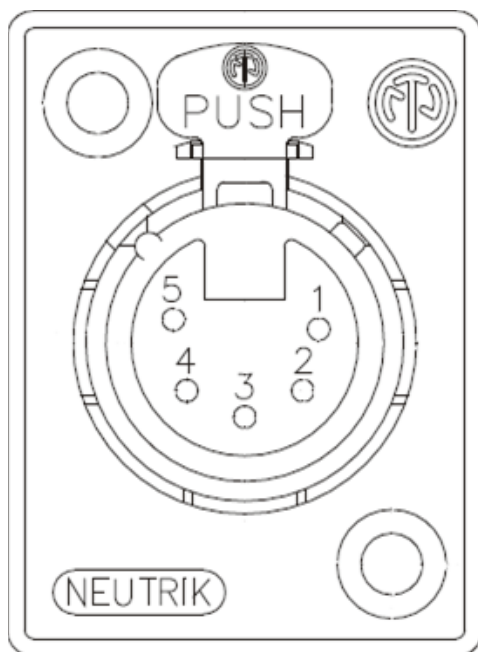


Fig 3.6 Rear Panel PTT XLR Socket Face view

(Remote PTT Switches: All Divers – 5-pin Panel Mount Socket) pin out allocation

Functional Name	Wire Colour	Function	Pin number
PPT Common	Red	PTT Switch Common	1
PTT Contact Ch 1	Grey	PTT Switch Contact Channel 1	2
PTT Contact Ch 2	White	PTT Switch Contact Channel 2	3
PTT Contact Ch 3	Black	PTT Switch Contact Channel 3	4
PTT All Diver	Green	PTT Switch Contact All divers	5

Table 3.3 Remote PTT Connector Details

3.6 5 WAY XLR SIGNAL CABLE ASSEMBLY

The 5 way XLR cable assembly (CO363180) connects to the rear panel XLR sockets to provide the Diver/Bell audio input/output. The cable has a 2M tail with two pair STP (Red/Black) and (Green/Black) and a screen wire. The Green and Black pair is known as pair 1 and the Red and Black pair is known as pair 2.

See below for a pin layout of the XLR cable connector.

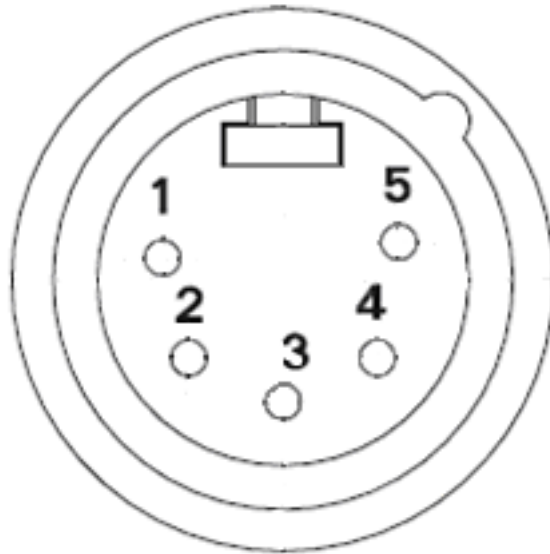


Fig 3.7 XLR Cable Mount Plug Face view

(CO363180 Cable Assembly-5 pin XLR Cable Connector) Pin out allocation

Functional Name	Wire Colour	Pin number
Mic (Rtn)	Black (Pair 1)	1
Mic (Sig)	Green (Pair 1)	2
Ear (Rtn)	Black (Pair 2)	3
Ear (Sig)	Red (Pair 2)	4
Screen	Grey (Screen)	5

Table 3.4 Signal Cable Plug Connections

3.7 5 WAY XLR REMOTE PTT ASSEMBLY

The 5 way XLR Cable assembly (CO363181) connects to the “REMOTE PTT” XLR socket on the rear panel to provide the remote PTT connections. The cable has a 2M tail with three pair STP (Red/Black), (Green/Black) and (White/Black). The Green and Black pair is known as pair 1, the Red and Black pair is known as pair 2 and the White and Black pair is known as pair 3.

See below for a pin layout of the XLR cable connector.

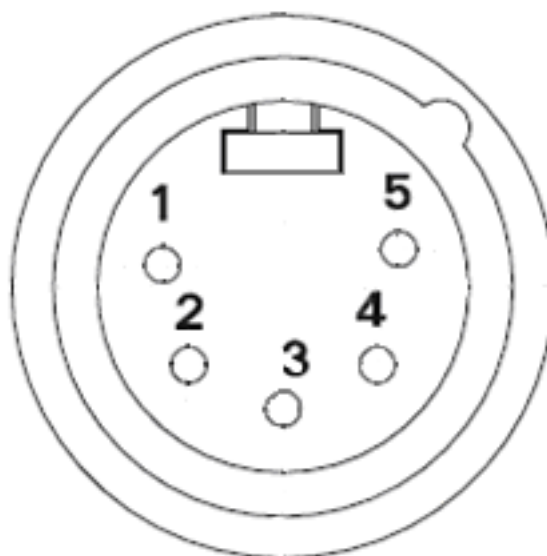


Fig 3.8 XLR Cable Mount Plug Face view

(CO363181 Cable Assembly- 5 pin XLR Cable Connector) Pin out allocation

Functional Name	Wire Colour	Pin number
PPT Common	Black (Pair 1)	1
PTT Contact Ch 1	Green (Pair 1)	2
PTT Contact Ch 2	Black (Pair 2)	3
PTT Contact Ch 3	Red (Pair 2)	4
PTT All Diver	White (Pair 3)	5

Table 3.5 PTT Cable Plug Connections

3.8 RECORD OUTPUT CONNECTOR

The record out socket is a standard BNC socket and is located on the rear panel of the Unscrambler. Comms are available for recording at all times from this connector. The audio output from this connector is set at a standard line level output.



Fig 3.9 Record out Connector

Pin	Function
Centre	Record Output
Outer	0V

Table 3.6 Record out Connector Details

CHAPTER 4 - OPERATION

CONTENTS

	Page
4.1 Diver Communications	18
4.2 Powered Microphones	19
4.3 Supervisor Communications	20
4.4 User Interface	21
4.5 Maintenance	25

4.1 DIVER COMMUNICATIONS

The audio path for the signals received from a Diver Microphone is: Diver Microphone to Unscrambler XLR sockets to Audio Module PCB to Mixer PCB to the DSP PCB. After the audio has been unscrambled it is then routed to the supervisor headset and speaker. If diver round robin is active the signal will also be routed to the headsets of the other divers.

Audio signals are routed within the Unscrambler to the audio module PCB's where the signals are amplified depending on the position of the volume controls. Each channel has its own dedicated audio module. The audio signals are mixed together in the mixing PCB before being processed through the DSP to be digitally unscrambled. The unscrambled audio is then routed back to the audio output connectors, speakers or supervisor headset.

The divers can talk to the supervisor and the diver microphone outputs will always be audible at the surface end. The diver microphone output has a minimum listening level so the volume of a diver can not be turned down so low that they cannot be heard.

When diver round robin is switched on Channels 1, 2 and 3 are able to communicate with each other. Each channel has its own dedicated volume control for diver round robin.

The diver to supervisor volume can be adjusted for each channel individually via the channels volume control or the volume of all channels to the supervisor can be adjusted using the master volume control.

4.2 POWERED MICROPHONES

Powered microphones can be used to enhance the audio quality of the Divers speech and have become very popular in recent years. Due to the superior clarity and improved safety factor, Divex has developed a powered microphone interface which can be installed along with the HeliCom Dive Control Unscrambler to allow the use of powered microphones.

The powered microphone interface supports 4 channels which typically would be diver 1 microphone, diver 2 microphone, diver 3 microphone and the bell microphone. There are 4 large digital displays on the front panel which provide a milliamp (mA) current reading for each channel.

Not only does the use of power microphones improve the audio quality immensely it also improves safety and maintenance as the constant monitoring of the microphones present on each individual display will provide an early sign of microphone deterioration or failure if the current reading changes from the typical reading of 18mA.

Installation is made easier by the fact the rear panel connectors for input and output connections are the same as those used on the HeliCom Helium Unscrambler range supplied by Divex. This means the same cabling can be used which minimises installation time and reduces the need for several cable types.

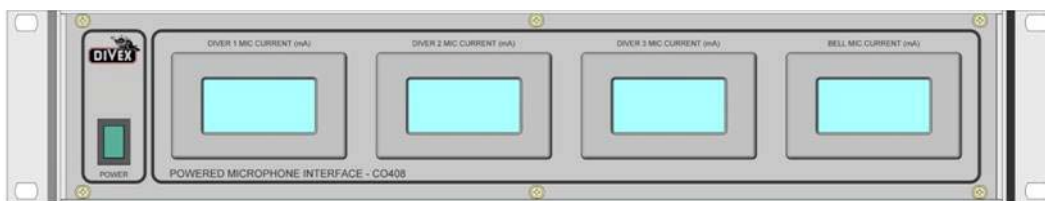


Fig 4.1 Front Facia of the powered Mic Interface



Fig 4.2 Powered Microphone Interface (Order Code: CO408)

4.3 SUPERVISOR COMMUNICATIONS

The audio path for the signals from the supervisor headset is: Headset to 1/4" jack to Audio Module PCB to the audio outputs.

Signals are routed within the Unscrambler to the audio module PCB's where the signals are amplified depending on the position of the volume controls. The supervisor microphone output is routed to the diver earphone connections and the speaker if supervisor round robin is switched on.

The supervisor will only be heard by the divers when the individual channels PTT or the "All Divers" PTT button is pressed while not on supervisor round robin. When supervisor round robin is active the supervisors microphone output will be open and live to all channels until the round robin switch is switched off.

The supervisor to diver volume can be adjusted for each channel individually via the channels volume control or the volume of all channels to the supervisor can be adjusted using the master volume control.

4.4 USER INTERFACE

The User Interface & associated Keypad is responsible for user interaction and communication of environmental parameters to the Unscrambler. It provides the means by which the gas and environmental parameters of the unscrambling operation can be changed.

The Unscrambler gives the user full control over the setup and updating of each of the parameters relating to unscrambling the helium speech.

If unscrambling is deemed unnecessary, the Unscrambler on/off switch can be turned off and no unscrambling will take place.

Turn the Unscrambler on using the round push-button switch on the user interface section of the front panel marked "UNSCRAMBLER". The "UNSCRAMBLER" pushbutton will illuminate blue when the unscrambler has been switched on.

Fig 4.3 shows the User Interface and Keypad.

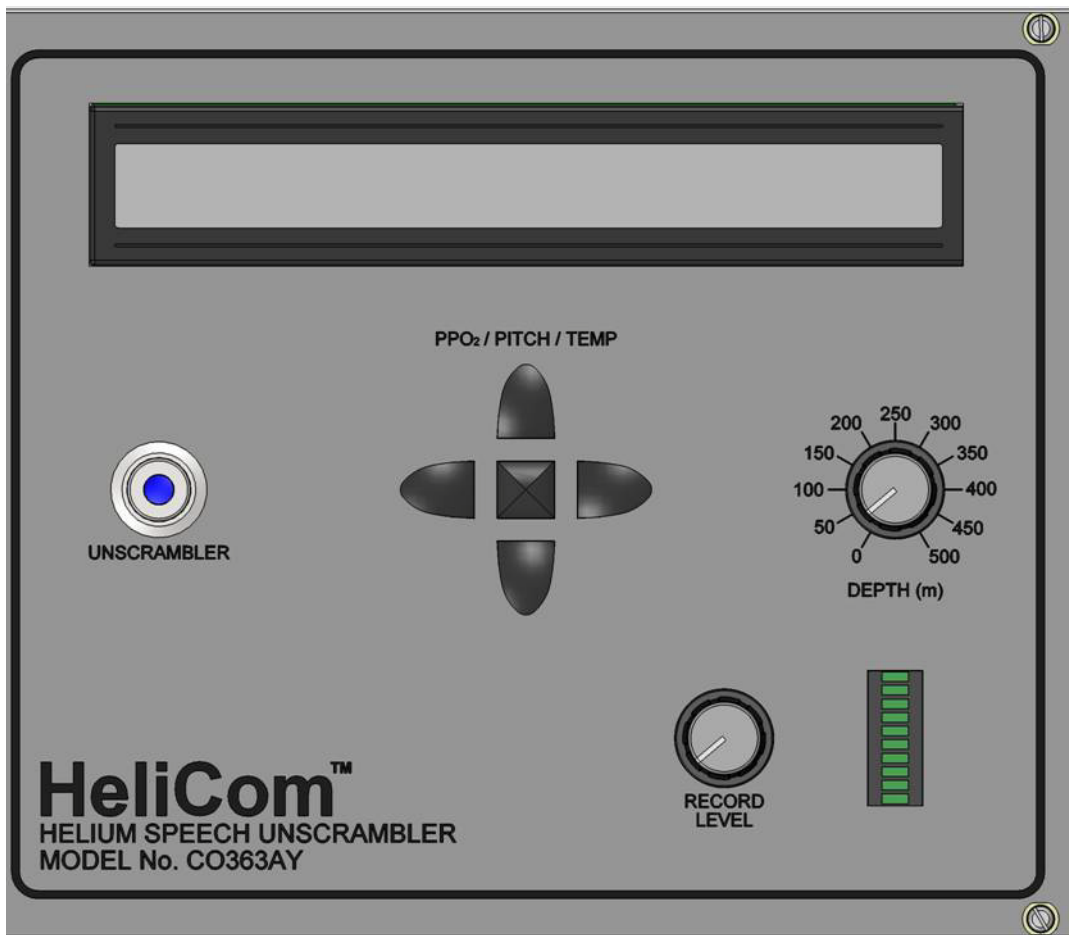


Fig 4.3 User Interface & Keypad

There are a number of user interface pages which can be viewed and/or adjusted. The power up page is shown in Fig 4.4



Fig 4.4 User Interface Power Up Page

After power up the user interface defaults to the home page which displays the depth at which the depth pot is set at. Fig 4.5 shows the user interface home page.



Fig 4.5 User Interface Home Page

All user interactions are by means of the four direction buttons \uparrow \downarrow \leftarrow \rightarrow , the select button (centre) and the depth control potentiometer. The LCD provides feedback to the user and prompts them for the appropriate key selection to either scroll to the next field or to edit the displayed field.

The depth control potentiometer can be adjusted at any time and updated parameters will be transmitted automatically to the Unscrambler DSP. There is also a real time update to the LCD which displays a digital read out of the depth at which the potentiometer is set.

The User Interface operates in two modes, a scrolling mode where by the \uparrow & \downarrow buttons will take the user through the environmental fields (PPO2, Temperature & Pitch Reduction) and an editing mode where a nominated field can be incremented or decremented.

Depth and PPO2 are the dominating parameters in the operation of the Unscrambler. The Depth parameter is expressed in meters of sea-water (msw) and operates over a range of 0 to 500 msw. The depth adjustment is the controlling factor behind the unscrambling operation and can be operated on its own without any interaction on the user interface to successfully unscramble helium speech.

The gas mixture (PPO2) is defined by the normalised ratio of the partial pressures of the Helium and Oxygen components of the Heliox atmosphere. No other gas components are considered in the software algorithms.

The default PPO2 value is 0.8 atm and it can be adjusted over a range of 0.0 to 2.0 atm.

Fig 4.6 shows the user interface PPO2 page.



Fig 4.6 User Interface PPO₂ Page

To adjust the value, the select button (centre) should be pressed and upon doing so the user interface enters edit mode, this applies to each page that can be edited. Fig 4.7 shows the PPO₂ page after the select button is pressed.



Fig 4.7 User Interface PPO₂ Edit Page

Pressing the ← or → buttons on the keypad changes the PPO₂ value by increments of 0.01 and pressing the ↑ or ↓ buttons changes the PPO₂ value by increments of 0.1.

Pitch Reduction Ratio (PRR) refers to a reduction in the pitch of the un-scrambled speech and can improve the ‘naturalness’ of the divers voice, but may not necessarily improve intelligibility - it may make long term listening less tiring.

The default PRR value is 1.00 and it can be adjusted over a range of 0.6 to 1.00. Under normal circumstances PRR can be left in its default state.

Pressing the ← or → buttons on the keypad changes the PRR value by increments of 0.1 and pressing the ↑ or ↓ buttons changes the PRR value by increments of 1.

Fig 4.8 shows the user interface PRR page.



Fig 4.8 User Interface PRR Page

Temperature also has a minor effect on the Unscrambler function although under normal circumstances is usually left in its default state.

The default temperature value is 18°C and it can be adjusted over a range of 0°C to 30°C.

Pressing the ← or → buttons on the keypad changes the temperature value by increments of 1 and pressing the ↑ or ↓ buttons changes the PPO₂ value by increments of 5.

Fig 4.9 shows the user interface Temperature page.



Fig 4.9 User Interface Temperature Page

4.5 MAINTENANCE

The following maintenance check list should be followed to ensure the Unscrambler remains operational to high standard.


Identification	Procedure	Interval
1	Check rear facia connections and tighten in necessary	6 monthly
2	Check operation of the main power switch	6 monthly
3	Check operation of unscrambler power switch	6 monthly
4	Check operation of rotary channel volume switches	6 monthly
5	Check operation of PTT switches	6 monthly
6	Check operation of remote PTT switches (If installed)	6 monthly
7	Check operation of Record out function and VU meter	6 monthly
8	Check operation of depth potentiometer	6 monthly
9	Check operation of user interface buttons	6 monthly


Table 4.1 Maintenance Check List

There are two anti-surge fuses installed into the fused terminals on the top plate of the Unscrambler.

Location	Fuse	Description	Fuse Rating
Rear Panel - IEC Inlet Fuse Holders	F1 & F2	Power Supply - Input	2A

Table 4.2 Fuse ratings

	WARNING
	<p>RISK OF EQUIPMENT DAMAGE Only suitably rated fuses rated should be installed on the Dive Control Unscrambler. Refer to Table 4.2 when selecting fuses.</p>

	WARNING
	<p>RISK OF ELECTRIC SHOCK. Only qualified personnel conversant with operation of electrical systems should perform hook up, repair or maintenance.</p>

(Intentionally Blank)

CHAPTER 5 - TECHNICAL SPECIFICATIONS

CONTENTS

	Page
5.1 Mechanical	28
5.2 Electrical	29
5.2.1 Mains Power Inlet	29
5.2.2 International Power Supplies	29
5.2.3 Digital Signal Processing PCB)	29
5.2.4 Power Amplifiers- One per channel	29
5.2.5 Input Frequency Response - 300Hz to 12kHz	29
5.3 Environmental	30
5.3.1 Temperature	30

5.1 MECHANICAL

Chassis Dimensions:

19" Sub-rack (Width over mounting flanges = 482.6mm or 19")

Height: 4U (1U = 44.45mm or 1 3/4")

Width: 84 HP (1HP = 5.08mm or 2/10")

Depth: 355mm

Weight: 7.5Kg

5.2 ELECTRICAL

5.2.1 Mains Power Inlet

Input: **85VAC - 264VAC 50 / 60 Hz**
 Fuses: 2 Amp (Anti-surge)

5.2.2 Internal Power Supplies

Switch Mode Power Supply (Main System) +12V DC output, 30W
 Switch Mode Power Supply (Main System) -12V DC output, 30W
 Switch Mode Power Supply (DSP power supply) +7V DC output

5.2.3 Digital Signal Processing PCB

One DSP PCB providing one channel of
 Voice Correction Range down to 500 m

5.2.4 Power Amplifiers- One per channel

Output – 10 Watts into 8ohms
 Frequency Response – 300Hz to 12kHz

5.2.5 Input Frequency Response - 300Hz to 12kHz General

Channel 1 – 4 wire system, screened twisted pairs
 Channel 2 – 4 wire system, screened twisted pairs
 Channel 3 (Diver 3) - 4 wire system, screened twisted pairs
 Channel 3 (Bellman) - 4 wire system, screened twisted pairs

5.3 ENVIRONMENTAL

5.3.1 Temperature

Operation: -10°C to +40°C

Storage: -20°C to +60°C

CHAPTER 6 - SPARES

6.1 PCB's

DSP PCB	CO362100
Audio Module PCB Channel 1	CO363205
Audio Module PCB Channel 2	CO363206
Audio Module PCB Channel 3	CO363207
Audio Mixer PCB	CO363208
Power and Transformers PCB	CO363145

6.2 FRONT PANEL COMPONENTS

User Interface LCD	CO363307
Volume Pot PCB	CO363142
Round Robin PCB	CO363143
Keypad Assembly	CO363314
Record Out Volume Pot	EM2075
Depth Potentiometer	EM2076
Power Switch	EM3030

6.3 ANCILLARY ITEMS

Supervisor Headset (Lightweight)	CO363175
Supervisor Headset (Rugged)	CO23986
2A Anti-Surge Fuses	EM13357
Powered Mic Interface	CO408
Powered Microphone	CO140
Bell Comms Box	CO439
Comms Speaker	CO437

6.4 CABLE ASSEMBLIES

Audio Interface Cable	CO363180
Remote PTT Cable	CO363181
IEC Power Cable with UK mains plug	EM996

(Intentionally Blank)