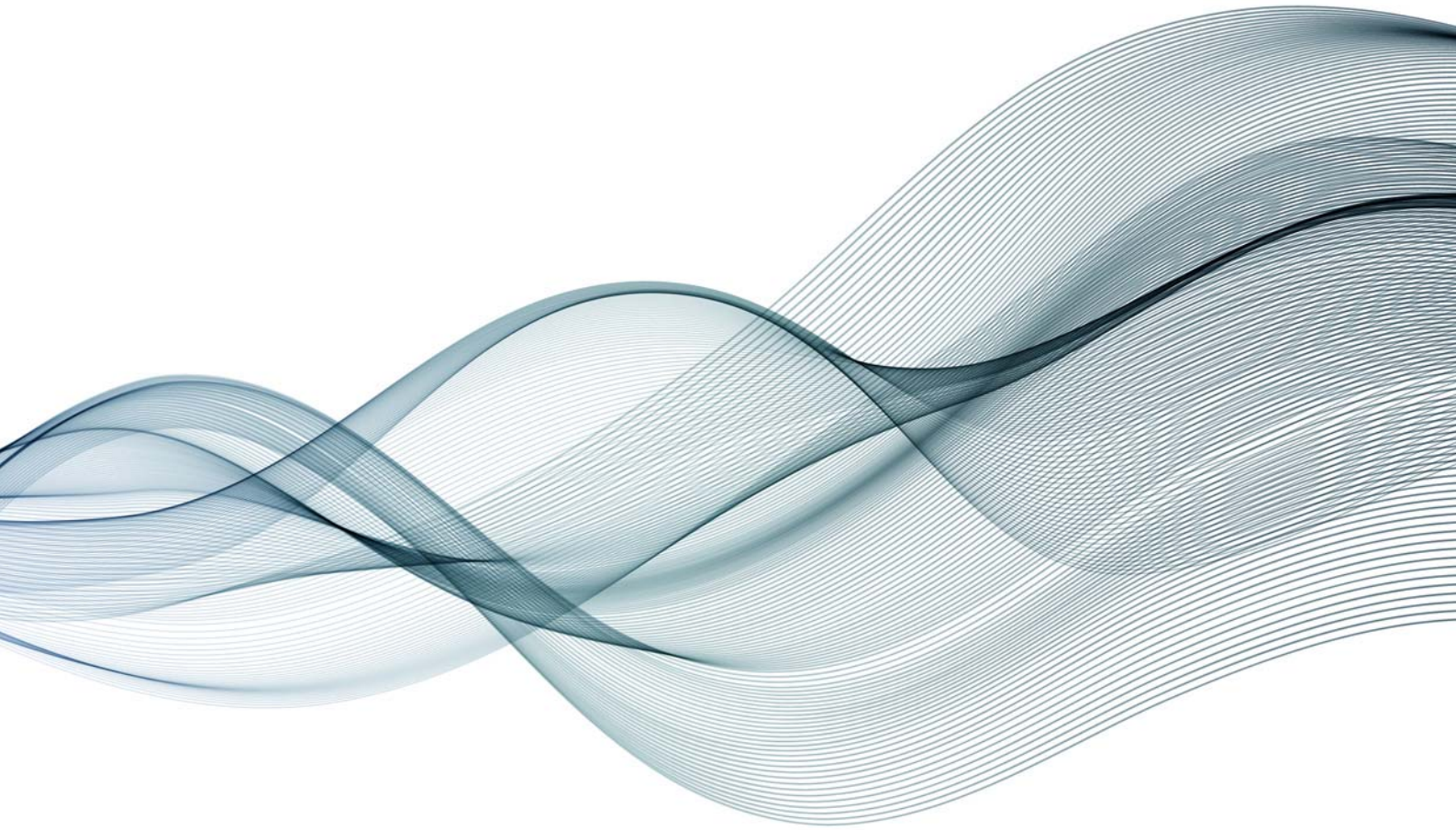

Operation and Maintenance Manual for the HeliCom Matrix™

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LIST OF ABBREVIATIONS

Abbreviation	Definition
A	Amp
BOP	Break Out Panel
Comms	Communications
DSP	Digital Signal Processor
DC	Dive Control
GPIO	General Purpose Input Output
GR	Gas Rack
Heliox	A gas mixture of Helium and Oxygen
HMCS	HeliCom Matrix Communications System
HMI	Human Machine Interface
HSU	Helium Speech Unscrambler
HSU-CU	Helium Speech Unscrambler Control Unit
Hz	Hertz
IEC	International Electro-technical Commission
I/O	Input / Output
KP	Keypanel
LCD	Liquid Crystal Display
LED	Light Emitting Diode
m	Meters
MCB	Miniature Circuit Breaker
MDR	Mini Delta Ribbon
msw	Meters Sea Water
PA	Public Announcement
PCB	Printed Circuit Board
POT	Potentiometer
psi	Pounds per Square Inch
PPO2	Partial Pressure of Oxygen
PRR	Pitch Reduction Ratio
PSU	Power Supply Unit
SDS	Saturation Dive System
SMPS	Switch Mode Power Supply
TIF	Telephone Interface

Abbreviation	Definition
STP	Screened Twisted Pair
TUP	Transfer Under Pressure
UPS	Uninterruptable Power Supply
Vac	AC Voltage
Vdc	DC Voltage
Vu	Volume Unit

DOCUMENT NOTES

Throughout this document there are notices which provide information on warnings, cautions or general notes. These should be adhered to, to ensure the safe installation and operation of the system.

Warning notes are written inside a box with a red heading, caution notes are written inside a box with a yellow heading and general notes are under NOTE heading.

Examples of each are as below:

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

	CAUTION
	SYSTEM DAMAGE MAY OCCUR The main power cable must be a three core cable with a minimum of 2.5mm (14 AWG) conductors.

NOTE
Interconnect cables must be screened.
The use of unscreened interconnect cables will reduce the overall quality of the system. See spares list for replacement cables.

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CHAPTER 1 - INTRODUCTION

1.1 HELICOM MATRIX COMMUNICATIONS SYSTEM

The HeliCom Matrix Communications System (HMCS) is packaged into two industry standard 19" racks which support all equipment required for the communication system. Fig 1.1 shows the HMCS.

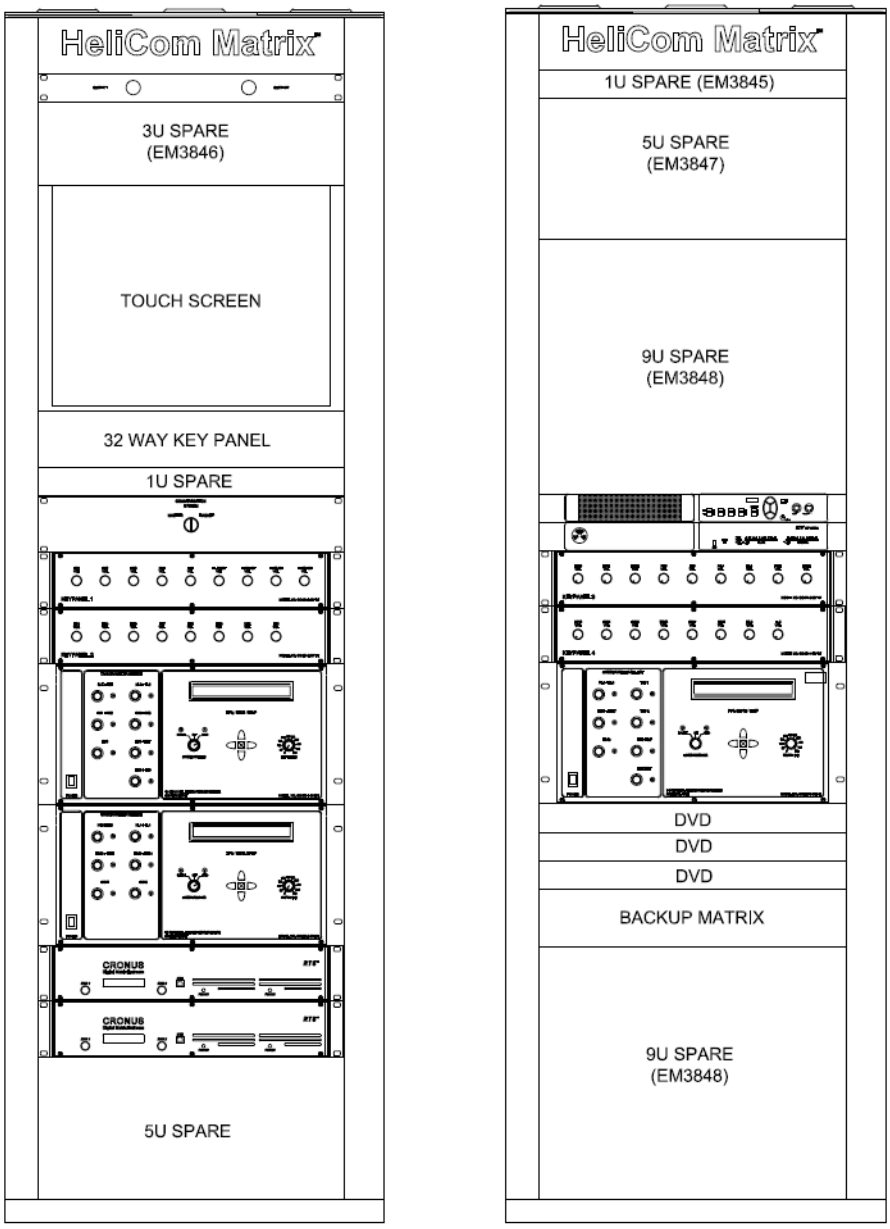

Fig 1.1 HeliCom Matrix Communication System Schematic

The main function of the HMCS is to provide high quality communications between the HMCS operator and each channel connected to the system. Within the HMCS rack there are two communications systems, the main system and the backup system.

The main communication system supports all comms and bunk boxes within the hyperbaric chamber complex. These are the five main chambers, their entry locks, two transfer under pressure (TUP) chambers and the internal and external comms boxes in the hyperbaric lifeboats (HLB's). The main system also supports a comms link to Dive Control and the Keypanels on the gas racks. The HMCS supports three entertainments channels with DVD players to play audio to the chamber occupants.

The main communication systems consists of a 19” touch screen Human Machine Interface (HMI), Entertainments Keypanel, Telephone Interface (TIF), Keypanel (KP) enclosures, Helium Speech Unscrambler Control Units (HSU-CU) and a master/slave 64 channel matrix configuration.

The backup communication system provides a means of communications to a reduced number of comms boxes in the chamber complex, the hyperbaric lifeboats and the gas racks for the TUP's and HLB's. The backup communication system is only required in the event of failure with the main communication system.

The backup communications system consists of a four channel KP, KP enclosures, HSU-CU’s and a back up matrix. When switched to the backup system the HMI is no longer utilised.

CHAPTER 2 - FUNCTIONAL DESCRIPTION

CONTENTS

2.1 POWER SUPPLY

The HMCS is typically powered using a 230Vac supply although the switch mode power supplies within the system allow it to operate on voltages ranging from 100Vac to 240Vac.

The main incoming supply is distributed to internal equipment and fused accordingly. The system has been configured to only have one main supply with an automatic change over to a second supply.

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

Fig 2.1 shows the power section of the HMCS electrical panel.

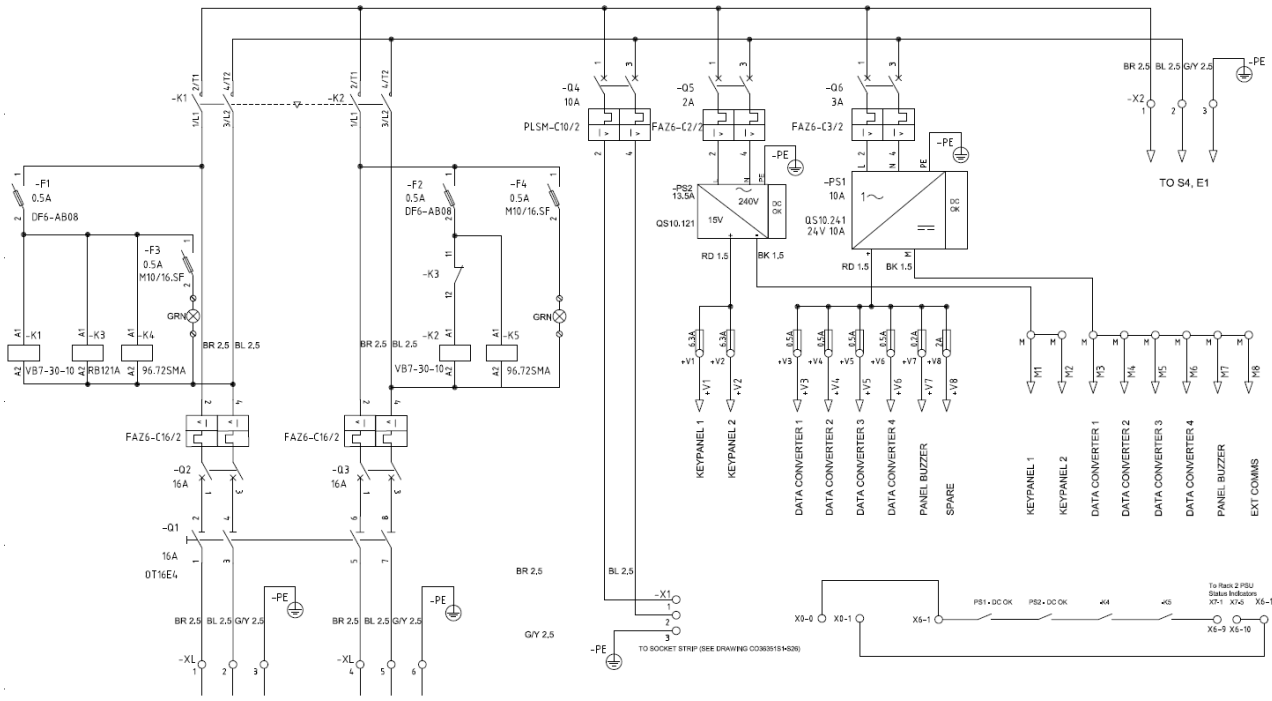

Fig 2.1 HMCS Electrical Power Panel Schematics

The main incoming power supply connects to terminals identified as XL and is distributed firstly to main isolator switch Q1 then circuit breakers Q2 and Q3 for each supply before going to a reversing contactor. The reversing contactor will automatically change the supply when one supply drops out. The active supply is then routed to miniature circuit breakers (MCB's) to power subsystems and to the second rack via X2.

MCB's Q2 and Q3 are installed as a safety device for the HMCS electrical system and are rated at 16A. If the system current draw is less than the trip current and the MCB is switched to the on position, power is supplied to the HMCS electrical equipment.

The two green power indicators will illuminate to indicate that incoming power is available from supply 1 and supply 2 respectively. Reversing contactor K1 will normally allow the system to be powered from supply 1. In the event of a failure of supply 1, K1 will automatically switch so that supply 2 is powering the system. If supply 1 is re-established then K1 will automatically switch back to supply 1.

The HMCS monitors the status of the two supplies and all four switch mode power supplies (SMPS). The relays K4 and K5 will close volt free contacts on terminals X6 when a supply is available on the XL terminals. All SMPS's have a status indicator with volt free contacts. When the supply is operational the contacts are closed. The relays K4 and K5 and the SMPS indicator contacts are connected in series so if any of the supplies fail the connection from X0-0 to X0-1 will be broken.

MCB Q4 is installed as a safety device for the IEC power strip and is rated at 10A. If the IEC power strip current draw is less than the trip current and the MCB is switched to the on position, power is supplied to the IEC strip and the equipment powered from this.

MCB Q5 is installed as a safety device for the 15Vdc Power Supply Unit (PSU) and is rated at 2A. If the PSU current draw is less than the trip current and the MCB is switched to the on position, power is supplied to the PSU and the equipment powered from this.

MCB Q6 is installed as a safety device for the 24Vdc Power Supply Unit (PSU) and is rated at 3A. If the PSU current draw is less than the trip current and the MCB is switched to the on position, power is supplied to the PSU and the equipment powered from this. The 24V supply will power the data converters and the panel buzzer.

Fig 2.2 shows the two PSU's installed on the electrical panel.

Fig 2.2 Electrical Panel PSU's

Each piece of equipment powered from the PSU's is individually fused on fused terminals also located on the electrical panel. The fused terminals are identified as V1 to V8 on rack one and VM1 to VM8 on rack 2. They are installed to protect the KP enclosures, data converters, and the call buzzer.

CAUTION
SYSTEM DAMAGE MAY OCCUR Fuses must be replaced with identical values as those removed. See operation section for fuse values.

The IEC strip which is used to power various equipment is powered from the HMCS main supply which is supplied through terminals identified as X1.

The IEC power strip distributes power to multiple pieces of equipment on the HMCS and uses industry standard IEC power cables to connect to the power strip. The power cables are all IEC male to female cables and 2m in length.

Table 2.1 details the power distribution from the IEC strip.

IEC Strip ID	Equipment	Part no
L1	HMI	CO425-SY141
L2	Matrices	CO430-32 x 2
L3	32 Key Keypanel	CO2855
L4	Control Unit 1	CO420-1-SY141
L5	Control Unit 2	CO420-2-SY141

Table 2.1 IEC Power Distribution

2.2 GENERAL

The main function of the HMCS is to provide high quality communications between the HMCS operator and each channel connected to the system.

2.2.1 Main communication system

The HMI, HSU-CU's, KP enclosures and master/slave matrix form the major components of the main communication system. Within each of these components are circuits or systems which allow the HMCS to provide communications throughout the SDS.

The control and setup of the main communication system is via the HMI where the user can set parameters required for general use or specific to a diving operation. Fig 2.3 shows the HMCS touch screen HMI.

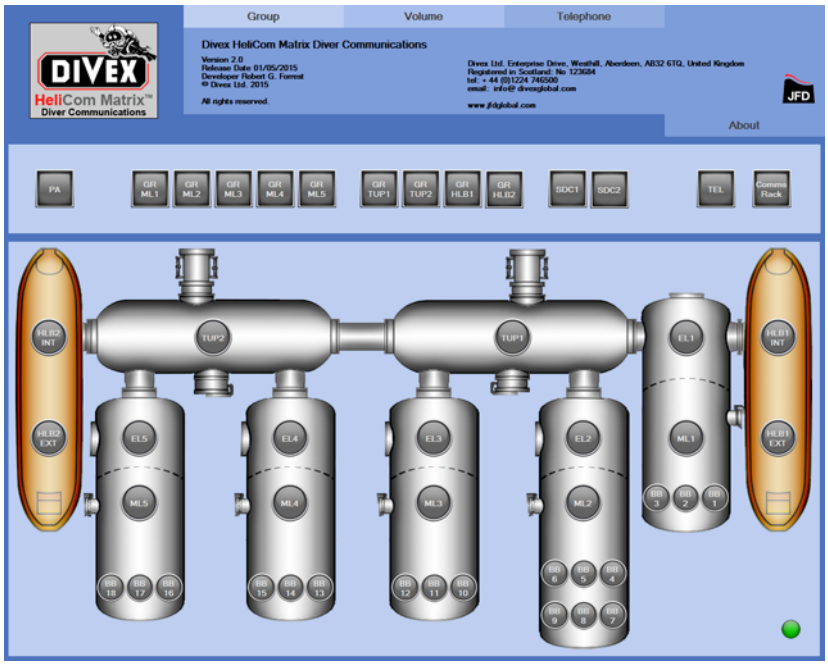

Fig 2.3 HMCS HMI

The three HSU-CU's installed within the HMCS provide a means to unscramble helium speech from the chamber occupants.

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 HSU-CU converts the helium affected speech back to a usable audio source that is easy to understand and communicate with.

There are three HSU-CU's installed in the HMCS. Control Unit 1 unscrambles channels from DDC 1 and 2. Control Unit 2 unscrambles channels from DDC 3 and 4. Control Unit 3 unscrambles channels from DDC5, TUP1, TUP2, HLB1 and HLB2.

Fig 2.4 shows Control Unit 1 which is installed in rack 1.

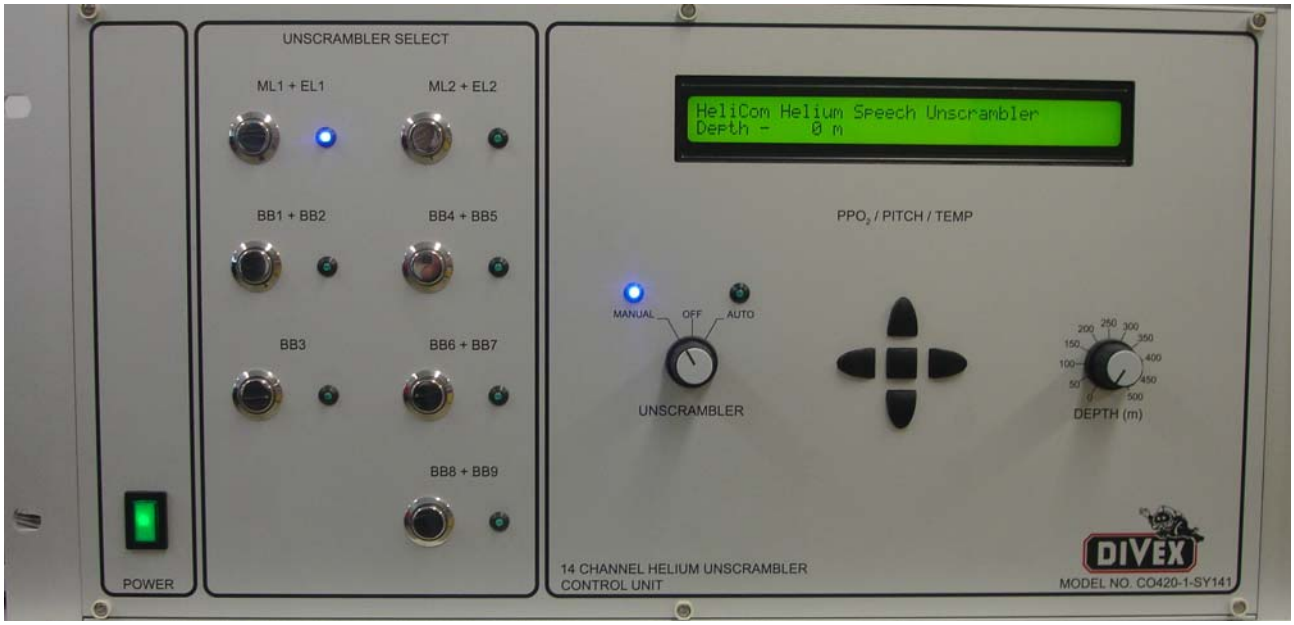

Fig 2.4 HMCS Control Unit 1

The signals transmitted and received from the chamber comms boxes or diver headsets are routed through the KP enclosures before being distributed to the HSU-CU's and matrix.

The KP enclosures house the electronics necessary to provide amplification of the audio signals to and from the chambers or other locations in the SDS and also controls the data stream used for the call function.

Fig 2.5 shows two of the KP enclosures installed in the HMCS.

Fig 2.5 KP Enclosures

The master/slave matrix provides the required switching and amplification functions of communication channels on the HMCS. The master matrix configuration is set by the HMI.

Fig 2.6 shows the master matrix.

Fig 2.6 Master Matrix

2.2.2 Backup communication system

The backup communications system is made up of the following components: 4 Key Supervisor Keypanel (MKP-4), Keypanel Enclosures 1-4, Control Units 1-3 and the 24 channel backup digital matrix.

The control and setup of the backup communication system is via the four channel KP where each of the four keys have been programmed to allow communications to dedicated groups chosen by the user and configured during factory setup. Fig 2.7 shows the four channel KP and speaker.

Fig 2.7 Four Channel KP & Speaker

The communication system power switch has to be switched to the backup position as seen in Fig 2.8 when using the backup communication system. When in this position power is removed from the master matrix and routed to the backup matrix.

The backup matrix provides the required switching and amplification functions of communication channels on the backup communication system.

Fig 2.8 shows the change over switch.

Fig 2.8 Backup Matrix & Power Change Over Switch

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CHAPTER 3 - HMCS COMPONENT OVERVIEW

CONTENTS

Chapter 3 provides an overview of the components populated within the HMCS. See chapter 5 for full functionality and control instructions.

3.1 HMI

The HMI provides the main communication system with an interface that the user can operate to allow adjustments to be made at any stage during diving operations. The HMI is a 19" rack mount PC which offers a high quality 17″ LCD display with a resistive touch screen. Fig 3.1 shows the HMCS HMI.

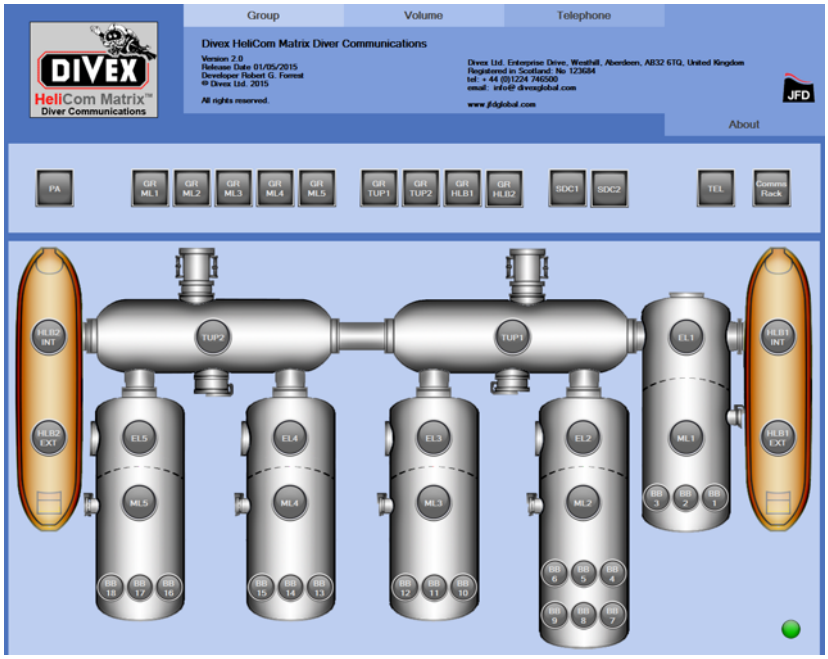

Fig 3.1 HMCS HMI

Functions available on the HMI include grouping of comms channels, volume adjustments and making & receiving telephone calls.

The 5 main tabs on the HMI are listed below:

1. About Tab
2. Group assignments tab
3. Volume control tab
4. Telephone interface tab
5. Telephone dialer tab

3.2 HSU-CU

The HMCS has three HSU-CU's installed within it which provide the unscrambling capability on both the main communications system and the backup communication system.

Two of the HSU-CU's (CO420-1-SY141 and CO420-3-SY141) can unscramble up to 14 channels. Fig 3.2 shows the fourteen channel HSU-CU1 (CO420-1-SY1414).

Fig 3.2 Fourteen Channel HSU-CU

The other HSU-CU (CO420-2-SY141) can unscramble 12 channels.

Control unit 1 is used to unscramble channels in DDC 1 and DDC 2. Control unit 2 is used to unscramble channels in DDC 3 and DDC 4. Control unit 3 is used to unscrambler channels in DDC 5, TUP1, TUP2, HLB1 and HLB2.

Fig 3.3 Twelve Channel HSU-CU (CO420-2-SY141)

3.3 KP ENCLOSURES

The HMCS has four KP enclosures installed within it which provide the audio to and from the matrix on both the main communications system and the backup communication system.

KP1 enclosure houses electronics to provide the required audio and data feeds for DDC 1 and the HLB internal and external channels.

Audio inputs from the chamber occupants (chamber comms and bunk boxes) are routed via the KP enclosures to the digital matrices. The MKP-4's and Telephone Interface (TIF) connect directly to the digital matrices. Audio from the matrix is from the supervisor KP or any other channel which has been grouped together and appears on the comms box speaker or Divers headset earphones.

The only user adjustable parameter on the keypanel enclosures is the volume to the comms box speaker or the Divers headset earphones which is available on the front panel.

Fig 3.4 shows KP1 enclosure.

Fig 3.4 KP1 Enclosure

Keypanels 2, 3 and 4 have the same functionality as Keypanel 1. Keypanel 2 houses the electronics for DDC2. Keypanel 3 houses the electronics for DDC3, ML4, EL4 and the TUP Comms boxes. Keypanel 4 houses the electronics for DDC4 bunk boxes and DDC5.

3.4 MATRIX & POWER CHANGE OVER SWITCH

There are three matrices within the HMCS which are used to control the main functions of the system. The master and slave matrix have 32 channels each and make-up the 64 channel main system. The backup matrix has 24 channels and controls the backup system. The master and slave matrices are at the bottom of rack 1 and the backup matrix is at the bottom of rack 2.

The master matrix is controlled by the HMCS HMI when using the main communication system and the backup matrix is pre programmed and operated by the four channel KP when using the backup communication system.

Fig 3.5 Shows the backup matrix at the bottom of rack 2.

Fig 3.5 Backup matrix

Each matrix performs functional changes to the system as requested by the HMI or four channel KP. Functions which can be setup and saved to the matrix are opening communications to any given channel on the system, grouping channels together, adjustment of volume controls and control of the call function.

Power is only supplied to one matrix system at any given time and can be changed over between the two systems using the power change over switch located directly below the Supervisor 32 way Keypanel.

3.5 ENTERTAINMENTS & SUPERVISOR KP

The Keypanel located directly under the HMCS HMI doubles up as an entertainments KP and a supervisors KP.

Entertainments settings are pre-programmed which allows the chamber occupants to be able to listen to audio entertainments while in the SDS.

Fig 3.6 shows the entertainments and supervisor KP.

Fig 3.6 Entertainments & Supervisor KP

Each chamber comms box or bunk box is assigned a key on this KP. Entertainments from up to three sources can be listened to.

Fig 3.7 shows an example of a key assignment for entertainments.

Fig 3.7 Example of Entertainments Channels

The supervisor also uses this KP to communicate with everyone on the system. A boom microphone and inbuilt speaker is provided on the KP and there is also an option to plug in a light weight headset when private conversations are required.

The entertainments and supervisor KP is only active when operating the main communication system, when the backup communication system is in operation the entertainments function is not available and the supervisor uses the 4 channel KP to communicate with the chamber occupants.

3.6 TELEPHONE INTERFACE

The telephone interface provides the means to make and receive phone calls through the HMCS and is linked on the system to allow communications through the entertainments & supervisor KP.

Incoming calls ring to the telephone interface which provides a visual indication of the call and the entertainments & supervisor KP which provides an audible ring tone.

All user interaction for making and receiving phone calls is through the HMI.

Fig 3.8 shows the telephone interface during a phone call.

Fig 3.8 Telephone Interface

Fig 3.9 shows the HMI making an out-going call

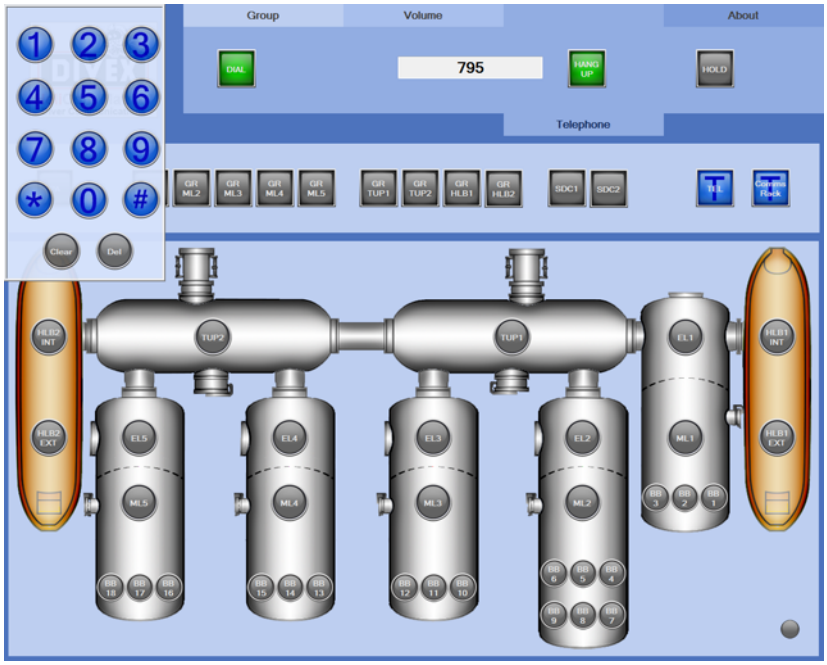

Fig 3.9 HMI Outgoing Call

3.7 FOUR CHANNEL KP & SPEAKER

The four channel KP is only used when operating the backup communication system and provides the user with pre programmed keys which can communicate with groups of comms boxes, Divers or others connected on the system.

The KP is connected to a speaker using a 1/4” stereo jack cable which provides the supervisor with audio from the other channels using the backup comms system.

Fig 3.10 shows the four channel KP and speaker.

Fig 3.10 Four Channel KP & Speaker

3.8 DVD PLAYER

The three DVD players mounted at the bottom of rack 2 form the entertainment input for the HMCS. The DVD players play audio into the matrix and the 32 Key Supervisor Keypanel is used to choose which locations(s) will hear the DVD player. The top DVD player is audio entertainments channel 1, the middle is channel 2 and the bottom DVD player is channel 3.

The DVD players can play the following formats: DVD, CD, CD-DA and data discs with the following formats: MP3, WMA, WAV, JPEG, ASF, MPEG-2/MPEG-1 and DivX.

Fig 3.11 shows the DVD player.

Fig 3.11 DVD Payer

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CHAPTER 4 - INSTALLATION

CONTENTS

The HMCS is supplied with all interconnect and power cables installed and only requires system cabling to be installed to the D-type interfaces located in the rear of the rack and mains power cables to the electrical panel.

4.1 POWER INSTALLATION

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

The HMCS only requires one supply to operate but the full system has the connection points to be powered from two supplies. The power input section of the panel means that only one supply will be loaded at a time. Supply 1 will take priority if it is live. Supply 1 is connected to terminals X1-3 and supply 2 is connected to terminals X4-6.

Fig 4.1 shows the electrical panel and terminals XL on the left hand side.

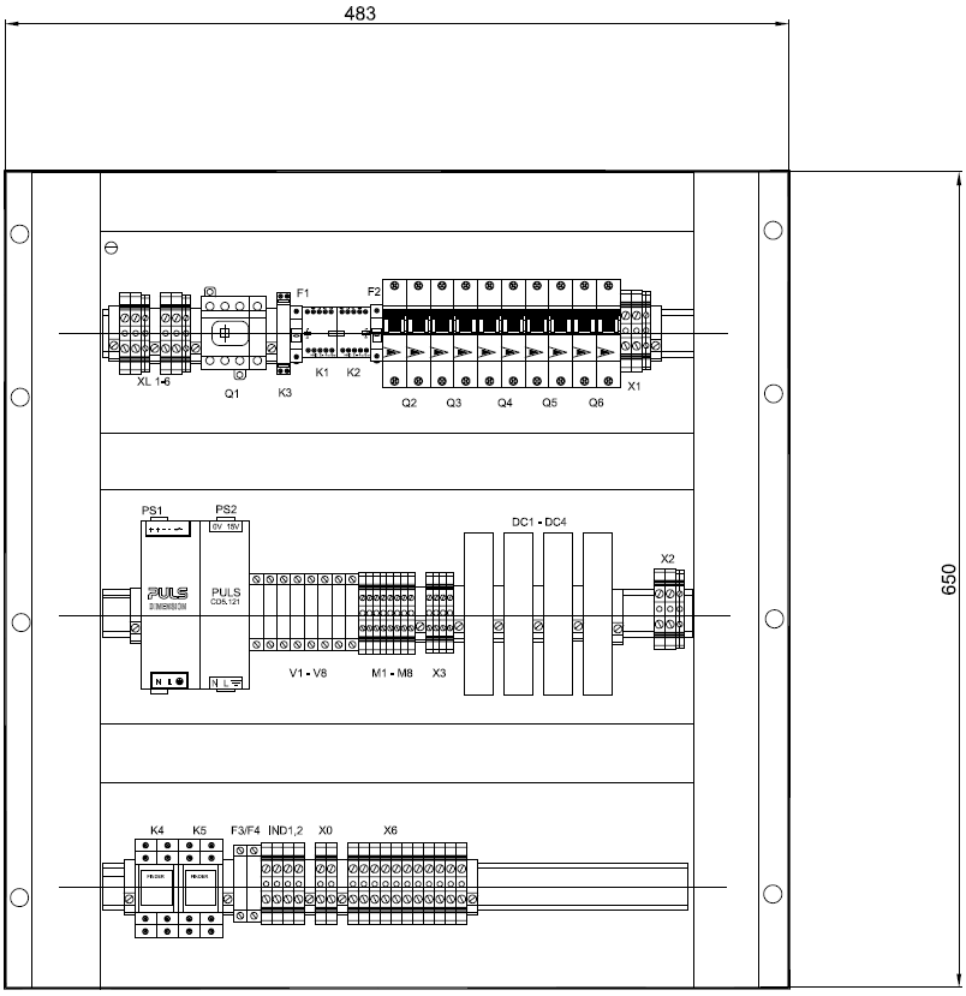

Fig 4.1 Electrical Panel Schematics

The terminal configuration of terminals XL1, 2, 3, 4, 5 & 6 are shown in Table 4.1

Terminal	Function	Wire colour
XL-1	Live (Supply 1)	Brown
XL-2	Neutral (Supply 1)	Blue
XL-3	Earth	Green/Yellow
XL-4	Live (Supply 2)	Brown
XL-5	Neutral (Supply 2)	Blue
XL-6	Earth	Green/Yellow

Table 4.1 Terminal Configuration

	CAUTION
	CAUTION: SYSTEM DAMAGE MAY OCCUR The main power cable must be a three core cable with a minimum of 2.5mm (14 AWG) conductors.

Refer to electrical schematic CO36352 when connecting the main power cable.

All other switch gear on the electrical panel is already installed and requires no further installation works to be carried out.

4.2 SIGNAL CABLE INSTALLATION

Signal cabling from the chamber complex and gas racks is required to be installed prior to operating the HMCS. All field cabling required to connect to the HMCS is to be wired to the D-type interfaces located in the rear of the rack.

The D-type interfaces provide an interface between the incoming cabling and the HMCS equipment which use D-type connectors for all Input/Output (I/O) connections.

Fig 4.2 shows the d-type interfaces used on the HMCS.

Fig 4.2 D-type Interfaces

Each D-Type interface is labelled with a pre-designated A number which is cross referenced with a channel on the HCMS. There are 45 D-Type interfaces labelled A1 to A45.

The incoming field cabling connects to the terminal block on the D-type interface and from there is routed to the HMCS equipment via interconnect cables. Refer to electrical schematic.

Fig 4.3 shows the terminal block on the D-type interface which the incoming field cabling connects onto.

Fig 4.3 D-type Interface Terminals

Table 4.2 details the pin configuration of the terminal block on the D-type interface.

Pin number	Function
1	Call Switch Common
2	Call Switch Normally Open
3	Screen (Microphone)
4	Earphone +
5	Earphone -
6	Screen (Call)
7	Microphone +
8	Microphone -
9	Screen (Earphone)

Table 4.2 D-type Interface Terminal Strip block Configuration

Interconnect cables are used to connect each piece of equipment within the HMCS and are manufactured using three screened twisted pair (STP) cable.

All interconnect cables are manufactured with a D-type plug on one end and a D-type socket on the other end. This allows for easy installation between the equipment installed on the HMCS. On each cable, female connectors plug into equipment inputs and male connectors plug into equipment outputs.

Fig 4.4 shows a typical 2m long interconnect cable (CO420107-2).

Fig 4.4 Interconnect Cable

Table 4.3 provides details on the pin assignment of the interconnect cable.

Pin number	Function	Wire colour
1	Data +	White
2	Data -	Black
3	Screen (From Matrix)	Screen
4	Audio + (To Matrix)	Red
5	Audio - (To Matrix)	Black
6	Screen (Data)	Screen
7	Audio - (From Matrix)	Black
8	Audio + (From Matrix)	Green
9	Screen (To Matrix)	Screen

Table 4.3 I/O Connector Configuration

NOTE: INTERCONNECT CABLES MUST BE SCREENED
The use of unscreened interconnect cables will reduce the overall quality of the system. See spares list for replacement cables.

Installation of the cables required for the audio entertainments should be completed during hook up of the field cabling for the chamber comms boxes.

Interconnect cables will finish at the Breakout Panels (BOP's). The breakout panels are the interfaces for the digital matrices connecting the interconnect cabling to the matrix. Each BOP has 32 D-type sockets (one for each channel). The D-type sockets are arranged in banks of 8 sockets, each bank of 8 sockets is routed onto an Mini Delta Ribbon (MDR) cable. The four MDR cables from each BOP connect to a 8 channel audio card on the matrix.

There are three BOP's - one for each matrix. Each socket is labelled by matrix, bank and socket, i.e. socket BOP A 1-1 is BOP A, bank 1, socket 1.

There are ports available on BOP-A to connect up to three different audio sources which are DVD players. The three ports used for entertainments are ports 3, 4 & 5. Fig 4.5 shows BOP-A.

Fig 4.5 BOP-A Entertainments Ports

Signal cables for the external communications system also have to be installed prior to operation. These cables are terminated to terminals X2 which are triple deck terminals and X4 which are double deck terminals.

4.3 DATA CABLE INSTALLATION

The data converters for the HMCS system provide the capability to unscramble the helium speech without any user interaction by tracking the chamber depth. The data converters require a data feed from the chambers to track the chamber depth. The cable assembly CO420119 connects the data converters to the control units (See drawing CO36352).

NOTE: AUTOMATIC UNSCRAMBLING IS OPTIONAL
The automatic unscrambling function is an optional extra and is selected by the customer during the ordering process.

Fig 4.6 shows an example of the data converters.

Fig 4.6 Data Converters

The data converters are used to convert a data feed from chamber analysers to a data format recognized by the HSU-CU's. The input data to the converters is from the analysers which constantly track the chamber depth and provide regular updates to the HSU-CU's.

The converters output RS232 data to the HSU-CU which is used to alter the parameters on the DSP PCB in order to provide accurate unscrambling of the divers helium speech.

Firstly the incoming cables from the chamber analysers must be connected to the converters and this is done via terminals X3 (Rack 1 converters) and X5 (Rack 2 converters) which are located on the HMCS electrical panels.

Table 4.4 details the terminal configuration for terminals X3 and the data convertor input.

X3 Terminal	Function	Converter pin no
1	Chamber 1 Convertor: Signal -	Converter 1 P6-3
2	Chamber 1 Convertor: Signal +	Converter 1 P6-4
3	Chamber 2 Convertor: Signal -	Converter 2 P6-3
4	Chamber 2 Convertor: Signal +	Converter 2 P6-4
5	Chamber 3 Convertor: Signal -	Converter 3 P6-3
6	Chamber 3 Convertor: Signal +	Converter 3 P6-4
7	Chamber 4 Convertor: Signal -	Converter 4 P6-3
8	Chamber 4 Convertor: Signal +	Converter 4 P6-4

Table 4.4 Data Convertor Input Configuration

Power for the converters is taken from the 24Vdc power supply on terminals V3-V6 and M3 -M6 on rack 1. The supply is VM2-VM7 and N3-N7.

Terminals	Function	Converter pin no
V3 & M3	Chamber 1 Convertor: V3 = 24V, M3 =0V	P1-1 = 24V, P1-2 = 0V
V4 & M4	Chamber 2 Convertor: V4 = 24V, M5 =0V	P1-1 = 24V, P1-2 = 0V
V5 & M5	Chamber 3 Convertor: V5 = 24V, M5 =0V	P1-1 = 24V, P1-2 = 0V
V6 & M6	Chamber 4 Convertor: V6 = 24V, M6 =0V	P1-1 = 24V, P1-2 = 0V
VM3 & N3	Chamber 5 Convertor: VM3 = 24V, N3 =0V	P1-1 = 24V, P1-2 = 0V
VM4 & N4	TUP1 Convertor: VM4 = 24V, N4 =0V	P1-1 = 24V, P1-2 = 0V
VM5 & N5	TUP2 Convertor: VM5 = 24V, N5 =0V	P1-1 = 24V, P1-2 = 0V
VM6 & N6	HLB1 Convertor: VM6 = 24V, N6 =0V	P1-1 = 24V, P1-2 = 0V
VM7 & N7	HLB2 Convertor: VM7 = 24V, N7 =0V	P1-1 = 24V, P1-2 = 0V

Table 4.5 Data Convertor Power Configuration

Table 4.6 details the pin configuration and connection information for the distributor to converter cable CO420119. For installation see drawing CO36352.

Connector pin no	Function	Convertor pin no	Wire colour
1	TX1	Converter 1 P2-6	Red (Pair 1)
2	RX1	Converter 1 P2-5	Black (Pair 1)
3	Screen	Converter 1 P2-3	Screen (Pair 1)
4	TX2	Converter 2 P2-6	White (Pair 2)
5	RX2	Converter 2 P2-5	Black (Pair 2)
6	Screen	Converter 2 P2-3	Screen (Pair 2)
7	TX3	Converter 3 P2-6	Blue (Pair 3)
8	RX3	Converter 3 P2-5	Black (Pair 3)
9	Screen	Converter 3 P2-3	Screen (Pair 3)
10	TX4	Converter 4 P2-6	Yellow (Pair 4)
11	RX4	Converter 4 P2-5	Black (Pair 4)
12	Screen	Converter 4 P2-3	Screen (Pair 4)

Table 4.6 Converter to Distributor Cable Configuration

CHAPTER 5 - OPERATION

CONTENTS

5.1 SYSTEM POWER UP

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

To power up the HMCS the following sequence should be followed:

1. Ensure all fused terminals are closed as per Fig 5.1.

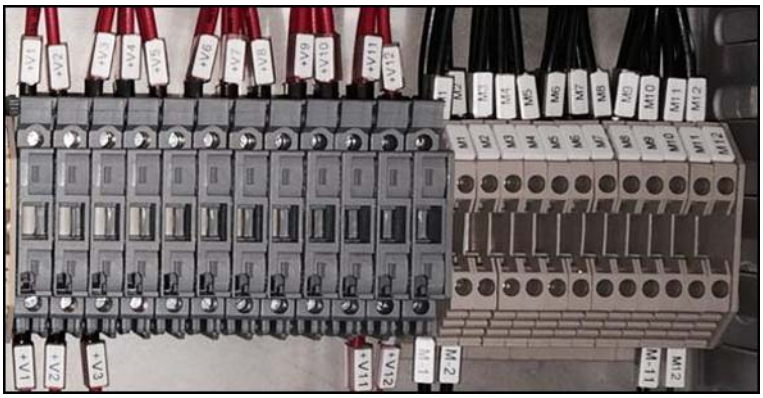

Fig 5.1 Fused Terminals Closed

2. Turn the Main Isolator Q1 to the on position (vertical) as per Fig 5.2.

Fig 5.2 Main Isolator & MCB's.

3. Switch MCB's Q2 and Q3 to the on position (up) as per Fig 5.3. Q2 and Q3 are the breakers that protect the two main supplies to the HMCS.

Fig 5.3 MCB Q2 in ON position

4. Switch on MCB Q4 as per Fig 5.3. Q4 protects the 230Vac socket strip that forms the 230Vac distribution in rack 1.

5. Switch on MCB Q5 as per Fig 5.3. Q5 protects the 15Vdc PSU in rack 1.

6. Switch on MCB Q6 as per Fig 5.3. Q6 protects the 24Vdc PSU in rack 1.

7. Switch on the main isolator Q7 in rack 2 as per Fig 5.2.

8. Switch on MCB Q8 as per Fig 5.3. Q8 protects the supply to rack 2 from terminals X2 from rack 1.

9. Switch on MCB Q9 as per Fig 5.3. Q9 protects the socket strip that forms the 230Vac distribution in rack 2.

10. Switch on MCB Q10 as per Fig 5.2. Q10 proctest the 15Vdc PSU in rack 2.

11. Switch on MCB Q11 as per Fig 5.2. Q11 protects the 24Vdc PSU in rack 2.

With the MCB's all switched to the on position the system will power up. The touch screen PC will boot and automatically load the HMI program and the master matrix will run through initializing check before sending data to the HMI.

The HSU-CU's are powered on by pressing the green push button switch located on the front panel of each one which illuminates when powered on. The DVD players are switched on by pressing the black 'power' button on the front panel of each unit.

All other equipment which forms part of the HMCS is powered on automatically when the MCB's are switched on.

5.2 HMI OPERATION

The HMI automatically boots when the touch screen PC is powered on and loads the about tab as seen in Fig 5.4.

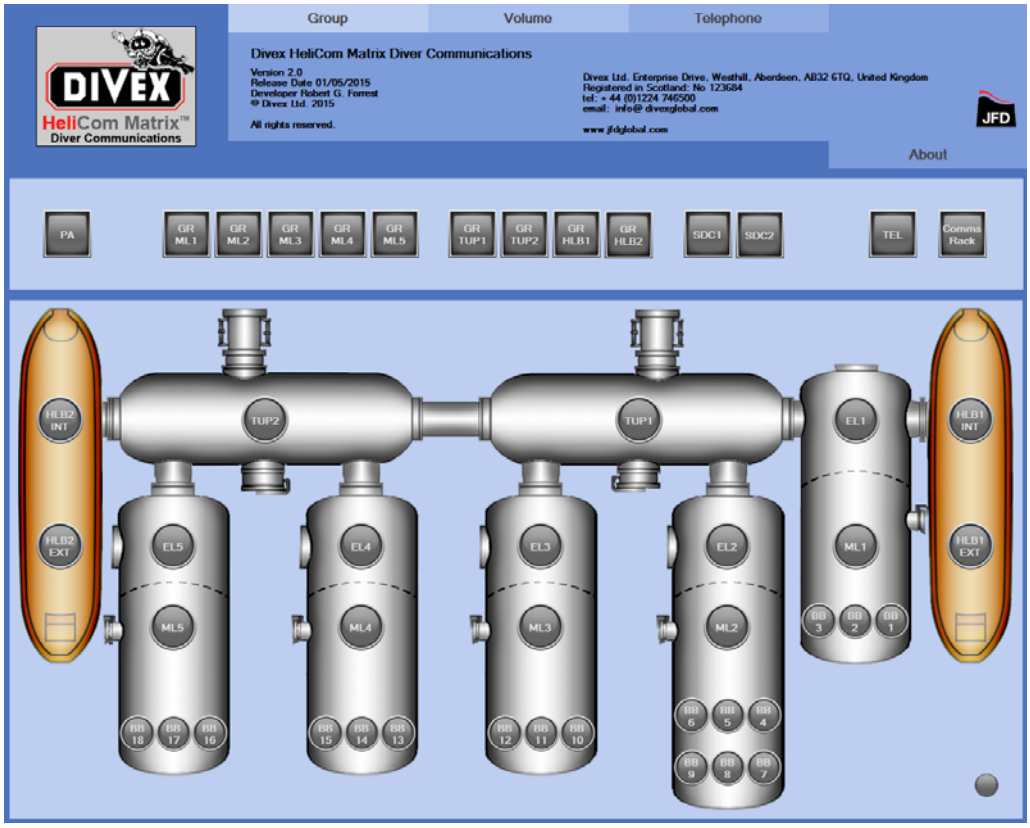

Fig 5.4 HMI About Tab

When the HMI first loads the “About” tab will be displayed showing the software version JFD contact details and the release date. The chamber complex with the groups and chamber comms assignments will also be shown below the “About” tab.

The connection indicator which is located at the bottom right hand corner of the page is a visual indication that the HMI is communicating with the matrix and this is displayed clear if the system is healthy.

While the system loads the green indicator is not visible. If the HMI is not able to communicate with the matrix the status indicator will flash red on startup.

When the HMI has loaded the user is able to move though the four main tabs: About, Telephone, Volume and Group. Each tab changes the functionality of the main page allowing the user to modify and use different aspects of the HMCS.

5.2.1 HMI Group Assignments

Pressing the Group tab opens the group assignment page as shown in Fig 5.5. The layout of the group page is such that the comms boxes associated with each chamber are positioned on top of the chamber they are installed in.

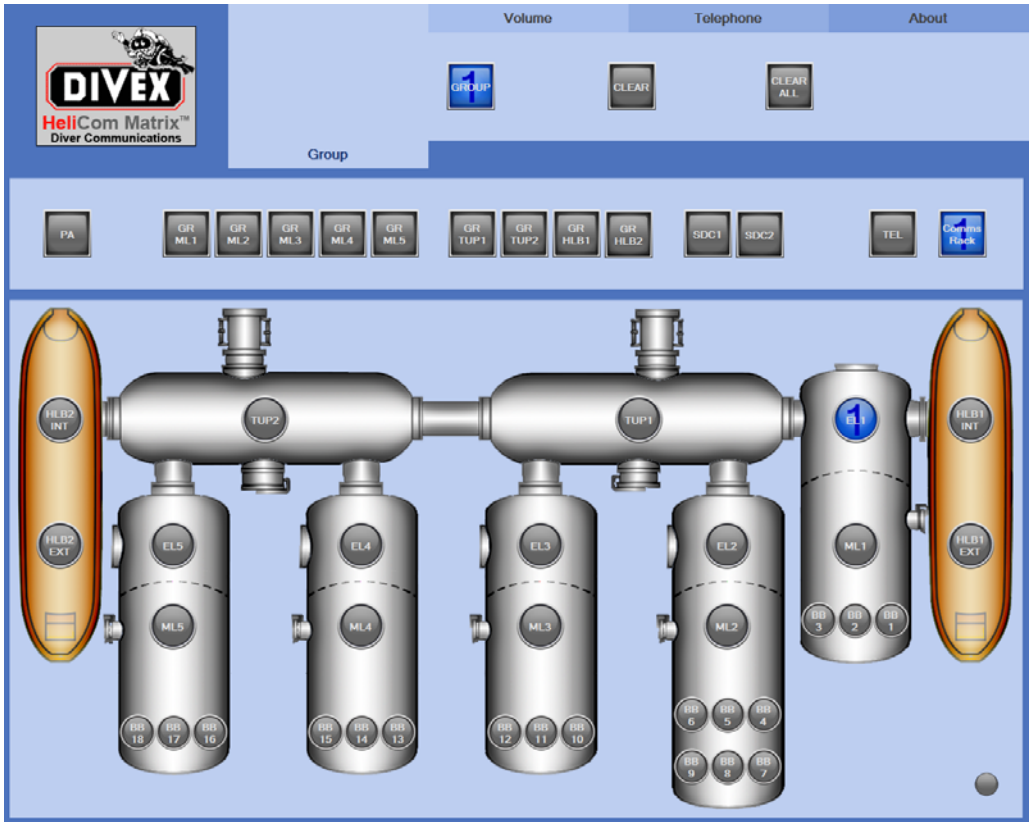

Fig 5.5 HMI Group Assignments Page

The group assignment page is used to group channels together to allow open communications between anyone on the SDS.

To create a group follow the below steps:

1. Press the GROUP button which generates a group number.

2. Press any of the buttons associated with a chamber comms box, bunk box or MKP-4 required to be in the group.

3. Any channels which are assigned to group are automatically connected to the group and open communications between all chosen channels will be available.

4. To start another group simply press GROUP again and the next numerical value will appear in the group button.

5. Repeat the process for assigning channels to the group.

Fig 5.6 shows the group page with the Comms Rack, and Comms Box EL1 in a group.

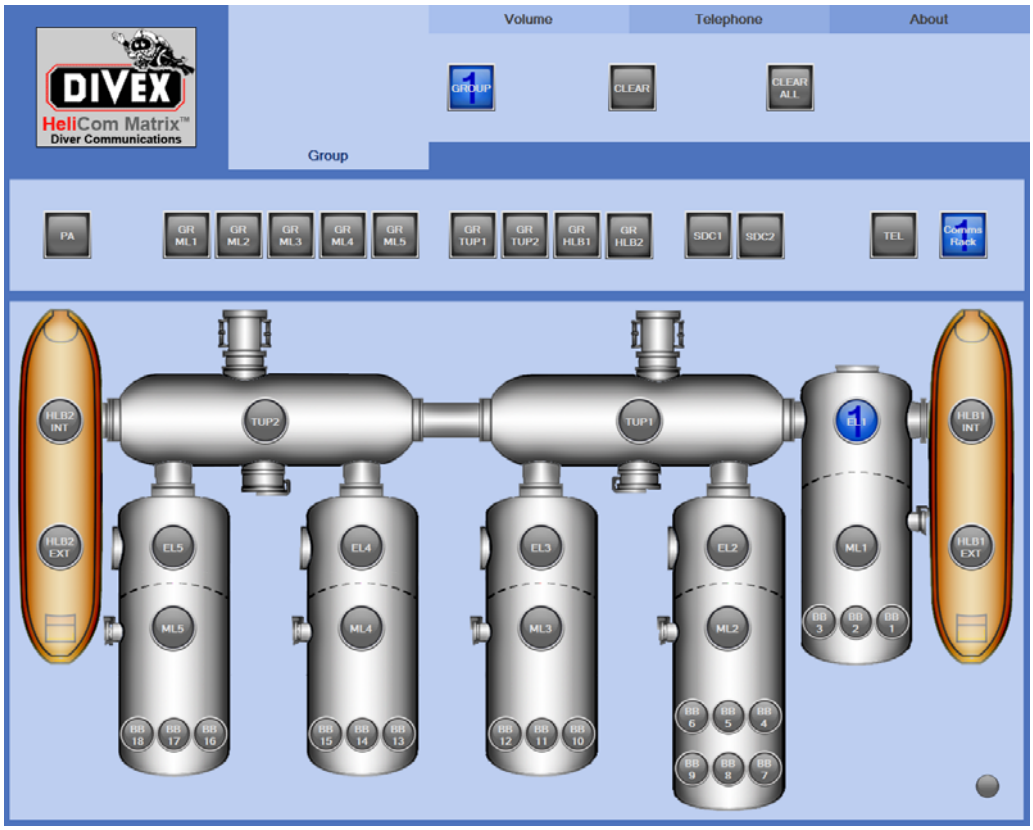

Fig 5.6 Group Assignments Page with Group 1 Set

There are limitations to which comms boxes within the chamber complex can be grouped together to avoid acoustic feedback within any given chamber.

Each Main Lock of a chamber has one comms box and multiple bunk boxes within it and these cannot be grouped together as the volume levels on the comms box would produce a high level of acoustic feedback.

For example, comms box ML1 cannot be placed in a group with bunk box BB1, BB2 or BB3 and this limitation is setup on the HMI software. If ML1 is already in a group and the supervisor tries to put BB2 in a group the BB2 button will fill with a dark red colour and will not be placed in the group as per Fig 5.7. This also applies to comms boxes in chambers 2, 3, 4 and 5.

Fig 5.7 shows BB3 button highlighted after trying to group it with ML1 button.

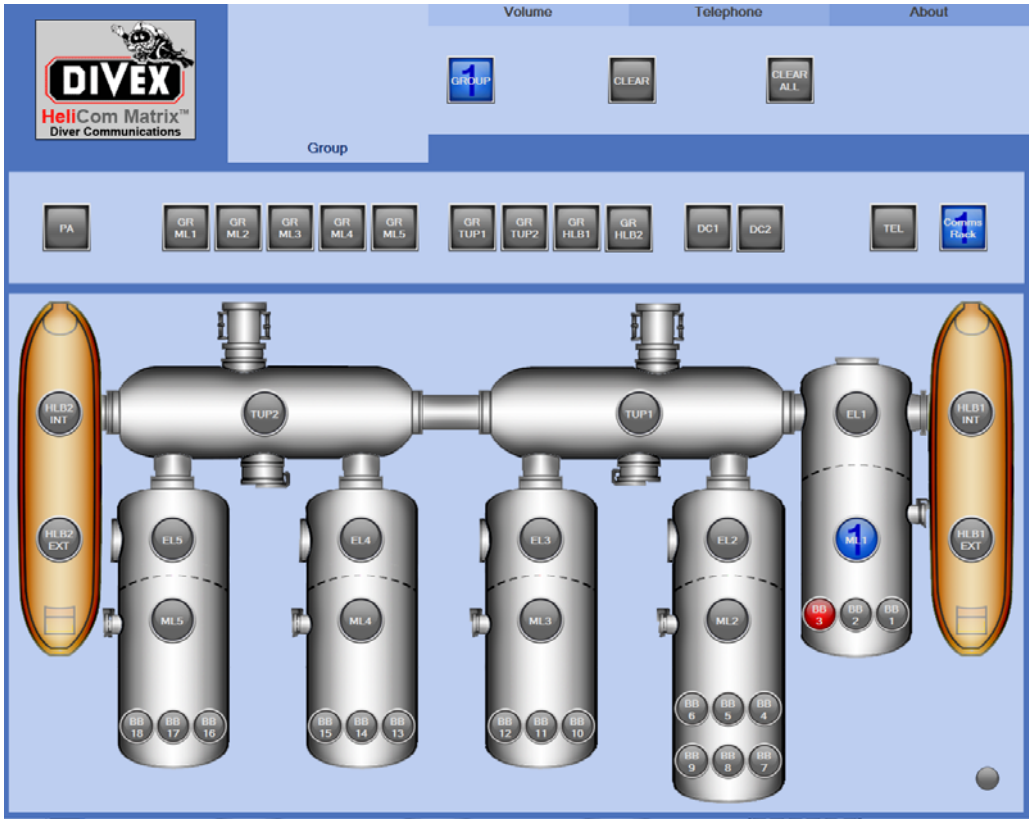

Fig 5.7 Group Limitations

The Comms Rack button is used to group the HMCS and is used in the same manner as the chamber comms box or bunk box on the group page.

Clearing groups can either be done individually or all at once. To clear a group member simply press the CLEAR button followed by the button for the comms box or bunk box that is to be cleared from the group.

To clear all groups press the CLEAR ALL button which removes all communication links setup on the system.

NOTE: CLEAR ALL REMOVES ALL GROUPS
Pressing the CLEAR ALL button removes all groups previously setup on the HMCS and any groups still required will need to be reset.

The PA button on the group page allows the supervisor to generate a public announcement (PA) to all chamber comms and bunk boxes in the chamber complex. When pressed, the supervisor has open communications to every comms box on the system allowing one way communication from the HMCS to the chamber comms boxes.

Another function made available on the group page is the visual indication of who is calling from the chamber complex.

When the call button is pressed and held on any of the chamber comms boxes or bunk boxes there is a visual and audible indication available on the HMCS. A visual indication appears on the main page and the button will glow red as seen in Fig 5.8. The audible indication is provided by the buzzer that is installed into the telephone interface bracket.

The relevant comms or bunk box will highlight red and if the comms box button is pressed it will jump the user to the group tab and automatically create a new group with the supervisor and the comms/bunk box in a new group

Fig 5.8 shows the group page while comms box ML1 call button is being pressed.

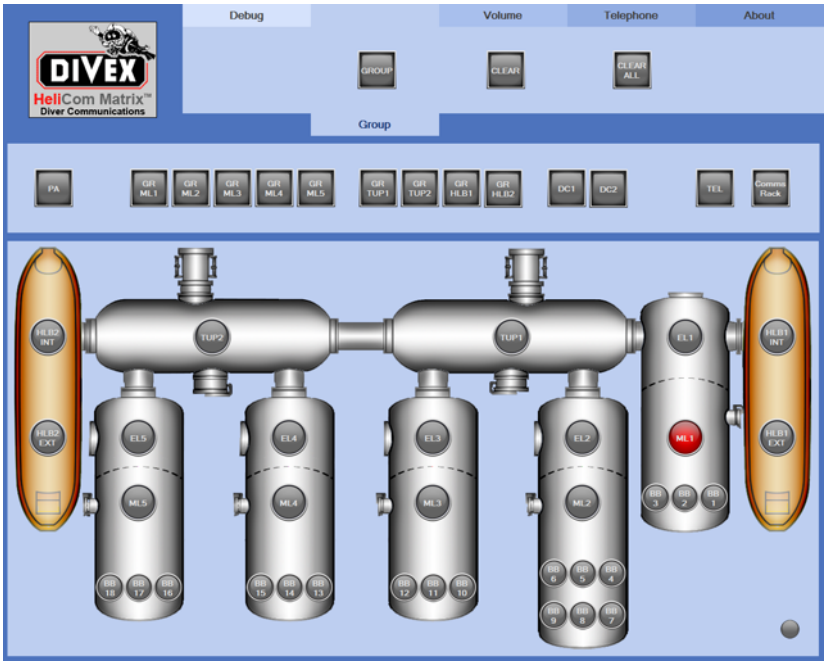

Fig 5.8 Group Page Call Indication

When the call button on the chamber comms box is released the visual indication is no longer displayed on the HMI and the audible indication is also removed.

NOTE: THE CALL BUTTON IS A MOMENTARY SWITCH
The call switch on the chamber comms box does not latch, the visual and audible indication will only appear momentarily if not held on.

5.2.2 HMI Volume Control

Pressing the Volume tab will take you to the Volume Control page as shown in Fig 5.9.

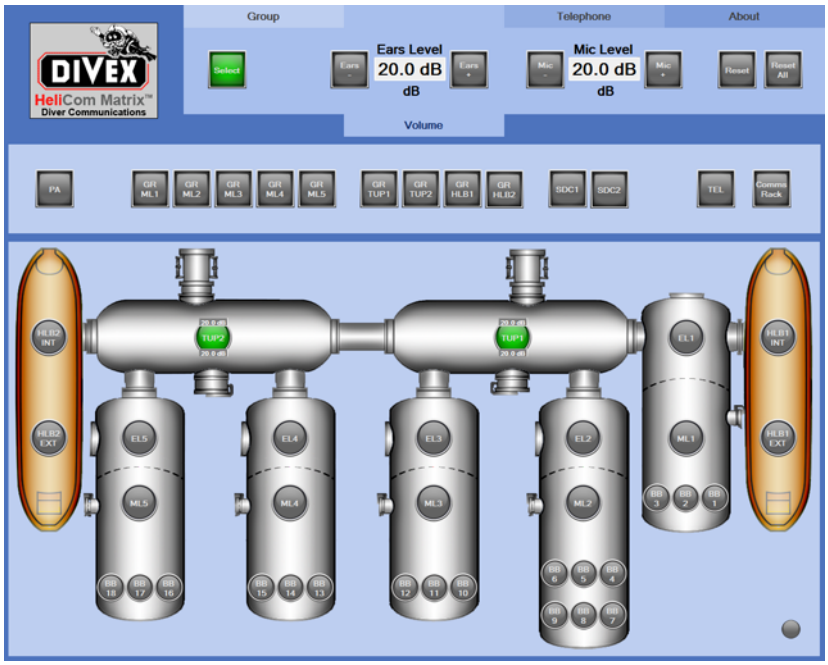

Fig 5.9 Volume Control Page

While on the volume control page it is possible to adjust the microphone or earphone volume of all channels connected to the HMCS.

To adjust a volume follow the below steps:

1. Press the Volume tab.

2. Press the button which corresponds with the channel that is to have the volume adjustment.

3. If the chosen channel's microphone volume is to be adjusted, press MIC – or MIC + to decrease or increase the channels microphone level.

4. If the chosen channel's earphone/speaker volume is to be adjusted, press EARS – or EARS + to decrease or increase the channels earphone level.

5. To adjust another channel's volume levels simply select another channel and repeat the above steps.

The volume adjustment for both microphone levels and earphone/speaker levels is over a range of 0dB to 40dB and is increased or decreased in increments of 0.5dB. The default volume for both is 20.0dB.

Volume adjustments are also available for telephone conversations where during a phone call the supervisor can navigate to the volume control page to adjust the necessary volumes.

Pressing the TEL button and repeating the steps detailing how to adjust either the microphone or earphone/speaker volume will allow the supervisor to make the necessary adjustments.

As volume adjustments are made they are sent to the matrix in real time where they are saved until the next occasion when they require adjustment.

5.2.3 HMI Telephone Interface

Pressing the Telephone tab will take you to the Telephone Interface page as shown in Fig 5.10.

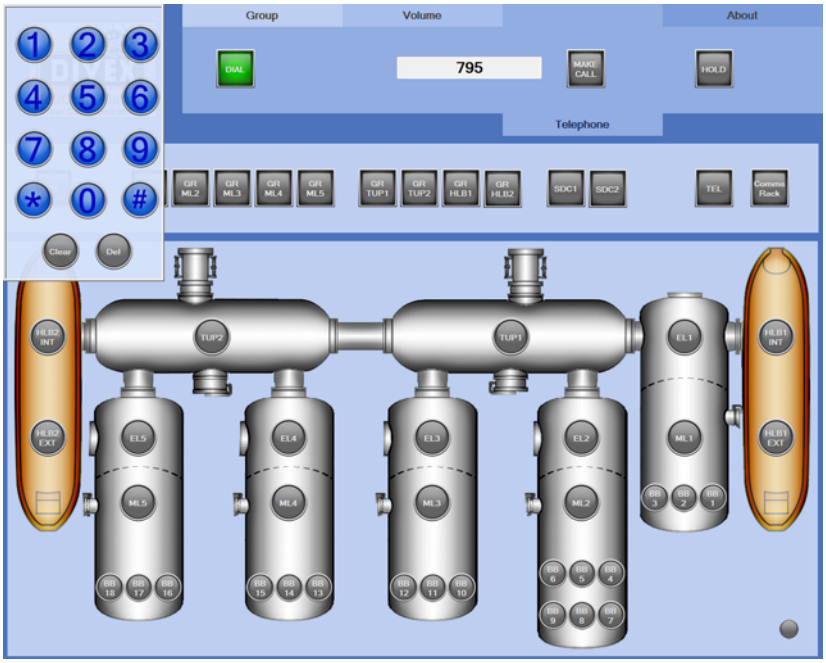

Fig 5.10 Telephone Interface Page with Open Keypad

The telephone interface page allows the supervisor to make or receive telephone calls and patch them through to anyone else on the HMCS.

This function allows the chamber occupants to communicate with family or friends during any down time where they are not working on diving operations.

The telephone interface page follows the same layout as all other pages but has additional buttons to allow for both the making and receiving of telephone calls.

To make a telephone call the supervisor must first navigate to the telephone dialer page, this is done by pressing the DIAL button on the HMI. The telephone keypad is shown in Fig 5.11.

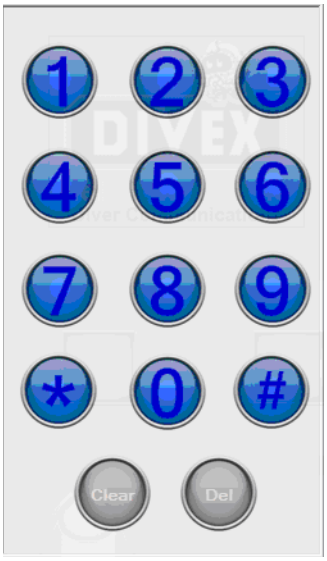

Fig 5.11 Telephone Dialer Page

To make a telephone call follow the below steps:

1. Press the 'Telephone' tab to open the telephone interface page
2. Select the channel to be placed in the call
3. Press the DIAL button to open the telephone dialer page
4. Enter the number that is to be dialled including any dialing codes.
5. Press the MAKE CALL button to place the call.

When the connect button is pressed the dial tone will sound briefly before the number is dialled. After the number has been dialled the telephone call will take place as normal.

When a channel is selected to be in a call it is removed from any groups it is in.

The HMI is also used to receive telephone calls and patch them through to the chamber occupant who needs to be contacted.

When an incoming calls is registered the HMI TEL button flashes red as shown in Fig 5.12. A ring tone is also produced which is detailed in section 5.7.

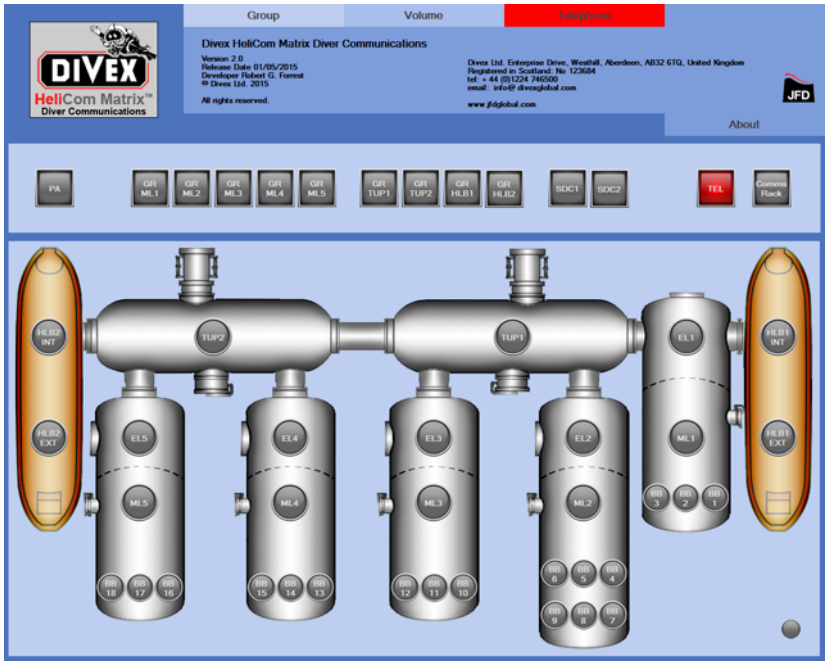

Fig 5.12 Incoming Call Indication on Home Page

To receive a call follow the below steps:

1. When an incoming telephone call is registered the telephone interface will produce an audible ring tone and the Telephone tab will flash.

2. Press the red flashing Telephone button to open the telephone interface page as previously shown in Fig 5.10.

3. Pressing the TEL button will answer the call and put the comms rack (Supervisor) into the call automatically. Using the 'T' group for the phone call the supervisor can add users to the call. Only one comms/bunk box can be added to the call at a time.

Fig 5.13 Answer Button

There is a HOLD button next to the PICK UP/HANG UP button. The HOLD button can be used to put the caller on hold while the supervisor talks to the comms/bunk box. When the HOLD button is active the telephone button will no longer be shown as part of the ‘T’ group.

4. Press the HOLD button as shown in Fig 5.14 to place the caller on hold.

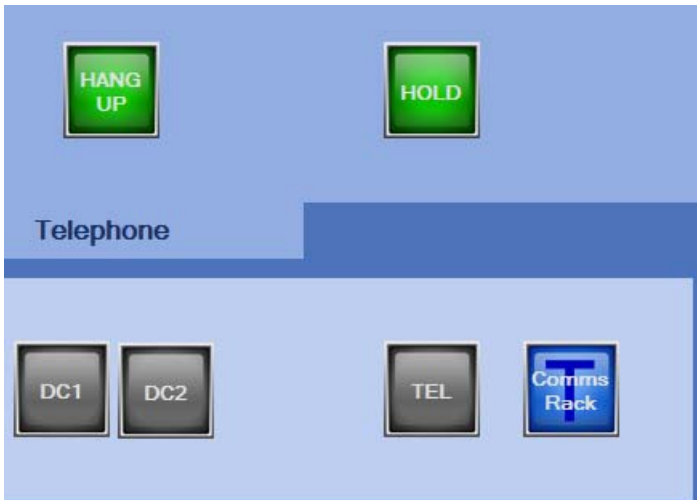

Fig 5.14 Hold Button

5. Select the chamber comms box or Diver that is to be placed in the call. A ‘T’ will be placed in the button that has been chosen. When T is placed in the button the comms box or Diver are removed from any groups they are in.

6. Deselect the HOLD button to add the caller into the conversation. The caller, supervisor and grouped comms box will now be in a conversation. A ‘T’ group icon will be displayed for each member.

7. Once the call between the comms box and the caller has been established the supervisor can take themselves out of the call by pressing the comms rack button on the HMI. The supervisor cannot re-enter the call.

The Diver can indicate the call is complete by pressing the call button on the chamber comms box or by talking to the supervisor if they are grouped together.

8. When the diver indicates the call is over or the call complete tone is audible on the telephone interface, press the HANG UP button as shown in Fig 5.15.

Fig 5.15 Hang Up Button

When the HANG UP button is pressed the call receive sequence is complete.

5.3 HSU-CU OPERATION

The HSU-CU has three operating modes, manual mode, automatic mode (optional) and unscrambler off mode.

The three modes enable the user to select the best option for any given operation.

The HSU-CU can be used in manual mode which gives the user full control over the setup and updating of each of the parameters relating to unscrambling the helium speech.

In automatic mode the user has no control of the parameter settings and updates, a data feed from the chamber controls these parameters without any user interaction.

If unscrambling is deemed unnecessary, for example when the chamber depth is near 0 msw, the unscrambler on/off switch can be turned to the off position and no unscrambling will take place.

The three operating modes can be selected by use of a rotary switch located on the front panel. The centre position on the switch will switch unscrambling off when it is not required.

5.3.1 Manual Mode

Using the rotary switch on the front panel of the control unit, select ‘MANUAL’ on the unscrambler switch, which also illuminates the manual LED. In manual mode the incoming signals are routed to the control unit through digital signal processing PCB’s to be unscrambled.

Fig 5.16 shows the unscrambler mode switch in the MANUAL position.

Fig 5.16 Unscrambler Switch in Manual Position

While in manual mode the user has full control of setup and adjustment of every parameter relating to each of the DSP PCB’s within the control unit.

Firstly select the chamber which requires its parameters to be set, this is done by pressing one of the chamber select switches on the left hand side of the front panel. On selecting a switch its corresponding LED will illuminate to confirm the selection has been made. Fig 5.17 shows ML1 + EL1 selected.

Fig 5.17 Chamber Select Switch

Each chambers depth can be set independently of the others using the depth pot and user interface. This allows full control of the major parameters for every chamber meaning each chamber can be at different depths and the HSU-CU will still perform unscrambling on each selected channel.

When changing between chambers to update the depth parameters the chamber selected automatically sets default parameters. Rotating the depth pot clears the default setting and the desired depth can be set.

Adjusting the Partial Pressure of Oxygen (PPO2), Pitch Reduction Ratio (PRR) or temperature values sets these for all chambers and not just the selected chamber (for detailed information on the unscrambling parameters see pages 43-44). Fine adjustments of the above user interface parameters are available to help to tune into the unscrambling audio quality of the unscrambler although in most cases the user only uses the depth pot to set unscrambler configurations.

The User Interface and 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.

Fig 5.18 shows the User Interface and Keypad.

Fig 5.18 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 5.19.

Fig 5.19 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 5.20 shows the user interface home page.

Fig 5.20 User Interface Home Page

All user interactions are by means of the four direction buttons ↑ ↓ ← →, 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 relevant 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 the ↑ & ↓ 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.

Fig 5.21 shows the depth potentiometer.

Fig 5.21 Depth Potentiometer

The gas mixture 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 5.22 shows the user interface PPO2 page.

Fig 5.22 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 5.23 shows the PPO2 page after the select button is pressed.

Fig 5.23 User Interface PPO2 Edit page

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

Fig 5.24 shows the user interface PRR page.

Fig 5.24 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 18DegC and it can be adjusted over a range of 0 to 30DegC.

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 5.25 shows the user interface Temperature page.

Fig 5.25 User Interface Temperature page

5.3.2 Automatic Mode

Using the rotary switch on the front panel of the control unit, select AUTO on the unscrambler switch, this also illuminates the AUTO LED.

Fig 5.26 shows the unscrambler mode switch in the AUTO position.

Fig 5.26 Unscrambler Switch in Manual Position

In Automatic mode the user has no control of setup and adjustment of any parameters relating to any of the DSP PCB's within the HSU-CU's. This is all done automatically so the user does not need to adjust any parameters manually.

NOTE

The user is still able to adjust the unscrambling parameters via the user interface and the depth pot but the updated values are not sent to the DSP.

Each chamber is fitted with an O2 analyser which feeds an input to the data converters. This data is used to control the automatic unscrambling parameters.

The outputs from the data converters are then connected to the HSU-CU's where they are further routed to internal circuitry and onto the corresponding DSP PCB's. The data is then decoded on the DSP PCB where the correct parameters are adjusted to accurately unscramble the helium speech.

The three HSU-CU's have the capability to unscramble up to 40 channels.

5.3.3 Unscrambler Off

Using the rotary switch located on the front panel select OFF on the unscrambler switch for instances when helium speech unscrambling is not required.

Fig 5.27 shows the unscrambler mode switch in the OFF position.

Fig 5.27 Unscrambler Switch in Off Position

The unscrambler switch can be turned off at any time the user feels it is not required.

5.4 ENTERTAINMENTS

Audio entertainments can be played through the HMCS and routed to a chamber comms box or Diver in the SDS by means of the entertainments/supervisor KP. Fig 5.28 shows some entertainment key assignments.

Fig 5.28 Example of an Entertainments/Supervisor KP setup

Chamber main lock comms boxes and bunk boxes have pre-assigned keys on the entertainments/ supervisor KP which provides up to three different audio sources to be available for any channel with a pre-assigned key. The keys are identified by a three or four digit code visible on the KP display.

The alphanumerical key assigned to each channel for entertainments has been setup to allow the user to distinguish which channel the entertainments has been routed to. Some examples of the alphanumerical keys are given below:

ML1E - Main Lock 1 Comms Box Entertainments

ML5E - Main Lock 5 Comms Box Entertainment

B1E - Bunk Box 1 Entertainments

B15E - Bunk Box 15 Entertainments

On the entertainments/supervisor KP the three entertainments channels are available by means of the toggle keys located above and below the KP display.

Latching the 'Talk' and 'Listen' keys on the supervisor keypanel will send audio from the DVD players to the location listed for the key. To latch a key in a 'Talk' (down) or 'Listen' (up) position tap the key in the relevant direction. If the key is pressed and held the audio will only be sent while the key is held in position.

The 'Listen' position is latched by pressing the key up, once the key has been latched the LED indicator will illuminate. Latching the 'Listen' key will send audio from DVD player 1 to the location listed for that key.

The 'Talk' Position is latched by pressing the key down, once the key has been latched the LED indicator will illuminate. Latching the 'Talk' key will send audio from DVD player 2 to the location listed for that key.

If both the 'Talk' and 'Listen' keys are latched the audio from DVD player 3 will play to the channel listed for that key. The Audio from DVD player 3 will inhibit the audio from DVD players 1 and 2.

The entertainments selections can be changed at any time using the keys on the KP without affecting any other channels.

Although the entertainments/supervisor KP is mainly used for entertainments it is also used to communicate with each channel when the touch screen HMI is in use.

It is connected on the matrix like all other channels and is used by the supervisor to communicate with any other channel on the system when grouped together on the HMI.

The entertainments/supervisor KP is provided with a gooseneck microphone and speaker as standard but can also be operated using a headset when private conversations are required or if there is background noise in the supervisor's area.

The gooseneck microphone is screwed into the 'Mic' position on the top left hand corner and the headset is plugged into the XLR socket on the bottom left hand side.

The DVD players or chosen audio sources are connected to the BOP located behind the master matrix and connect to ports 3, 4 & 5.

5.5 COMMUNICATIONS

5.5.1 Supervisor Communications

As described in section 5.4 the 32 key Keypanel will function as the communications point for the supervisor while the main comms system is in use. The 32 key Keypanel does not control any of the grouping or other functions of the main comms system. The only adjustments available to the user on the 32 key Keypanel are the speaker/headphone volume, headset select, mic mute and the entertainments settings.

Fig 5.29 Volume Control and Headset Select Key

As the volume is adjusted the Vu meter display increases or decreases to provide a visual representation of the volume level. The majority of the display is illuminated green which represents a healthy listening level, the section towards the right of the display also illuminates orange followed by red to indicate the volume may be excessive.

When the headset select key is selected the Vu display drops to a comfortable listening level while wearing a headset. When selected all communication to and from the supervisor are via the headset and the panel microphone and speaker and disabled.

The headset select key also doubles up as a microphone mute switch so to not allow unwanted communications to be heard from the control room. If the supervisor deems that the chamber occupants do not need to listen to conversations from the control room but does not want to remove the group setting the yellow key can be pushed up to disable the microphone.

5.5.2 Chamber Communications

The Comms and bunk boxes function as points for diver(s) to communicate with the dive supervisor. Comms and bunk boxes are installed in each chamber to maintain contact between the divers and the supervisor all times.

Fig 5.30 shows the chamber comms box.

Fig 5.30 Chamber Comms Box

The chamber comms box has an in-built panel microphone which is used to transmit communications from the chamber to the HMCS and the speaker box is used to provide communications to the chambers. The call switch on the chamber comms box is used by the chamber occupants to get the attention of the supervisor.

It is possible to use the comms box on headset mode when private conversations are required. When the headset switch is pressed, communications on the panel microphone and speaker box are disabled and the chamber occupant must use a chamber headset to communicate. A volume pot is provided on the comms box to control the earphone level when on headset only.

The Keypanel enclosures provide additional volume control on the audio transmitted to the chamber speaker boxes or headset if the comms box is operating in headset mode. Volume adjustments on the KP enclosures are performed by the supervisor and the chamber occupants have no control over this.

5.5.3 Backup Communications

The HMCS has a back up communications system installed within it which can be used in the event of a failure with the main communication system.

The backup system consists of a four channel KP and backup matrix and is powered on by changing the power change over switch from the master position to the backup position, which removes power to the master matrix and applies power to the backup matrix.

When the switch is in the backup position communications are routed to the backup matrix and the four channel KP as seen in Fig 5.31.

Fig 5.31 Backup Communication System

The backup communication system is limited in functionality compared to the main communication system and there are only four keys which can be used to communicate with the chamber occupants and others chosen to be on the backup communication system.

These four keys are preset during manufacture and cannot be changed by the user while the system is in operation. Each key has been assigned to a specific group chosen by the client.

Table 5.1 details the key configuration on the back up communications system.

Key	Function	Group members
1	All Main Locks and Entry Locks	(ML1,EL1, ML2, EL2, ML3, EL3, ML4, EL4,ML5, EL5)
2	All Entry Locks, TUP and Dive Control	(EL1, EL2, EL3, EL4, EL5, TUP1, TUP2, DC1, DC2, GR TUP1, GR TUP2)
3	HLB, TUP and Dive Control	(HLB1 INT,HLB1 EXT, HLB2 INT, HLB2 EXT, TUP1,TUP2, DC1, DC2, GR TUP1, GR TUP2, GR HLB1, GR HLB2)
4	All	(All Main Locks, All Entry Locks, All HLB Channels, HLB&TUP Gas Racks and Dive Control)

Table 5.1 Backup Communications System Key Configuration

The KP can be operated by pushing a key up to listen to the preset group or down to talk to the preset group.

If a key is pressed up or down the switch will latch on so communications will be hands free, when the switch is latched the LED next to each switch will illuminate to provide a visual indication that communications are live.

If a key is held up or down it will act as a press to talk or press to listen and communications will be disabled when the key is no longer held on. When held on the LED next to the switch will give a visible indication that communications are live. Upon deselecting the switch the LED will no longer be illuminated.

The supervisor can either use the gooseneck microphone and speaker or choose to use a headset if private conversations are required.

The gooseneck microphone is provided with the system and screws into the 4 channel KP MIC connector, the speaker is located to the right of the four channel KP. A headset is also provided with the HMCS and plugs into the HEADSET socket.

In normal operation the gooseneck microphone and speaker are active, to switch to headset mode the headset button is pressed which routes communications to the headset and disables communication to and from the gooseneck microphone and speaker.

5.6 MATRIX

The HMCS is supported by three digital matrix intercoms. Two form a master/slave combination that supports the main 64 channel system. The third matrix supports the 24 channel backup system. The main HMCS system controls the 64 channel combination using the HMI.

The Master/Slave matrices are mounted at the bottom of rack 1 and the backup matrix is mounted at the bottom of rack 2.

Fig 5.32 Master and Slave matrices at the bottom of rack 1

The backup matrix is typically only used in the event of a failure with the main communication system. In normal operation the backup matrix is not powered on.

Changeover between the master/slave matrix and the backup matrix is via the power change over switch which under normal operating conditions is in the master position. In the event of a failure of the main communications system the switch can be switched to the backup position to power the backup communications system.

The switch is configured as a two position change over and switches main power to either the master/slave matrix or the backup matrix depending on its position.

Neither matrix requires any user interaction to operate. Data from the HMI will ensure the master/ slave matrix operates correctly to provide the functionality available on the main communication system. The four key Keypanel communicates with the backup matrix to ensure the backup matrix communications system operates correctly. The four key Keypanel also functions as the supervisor station for the backup comms system.

Audio and data connections to each matrix are firstly routed to the relevant BOP using interconnect cables and then onto the matrix using mini delta ribbon (MDR) cables.

The MDR cables are installed during manufacture of the HMCS and details of their connections are provided in Table 5.2.

MDR cable	BOP Port	Matrix Card
1	BOP A - Port 1	Master Matrix Card Ch 1-8
2	BOP A - Port 2	Master Matrix Card Ch 9-16
3	BOP A - Port 3	Master Matrix Card Ch 17-24
4	BOP A - Port 4	Master Matrix Card Ch 25-32
5	BOP B - Port 1	Slave Matrix Card Ch 33-40
6	BOP B - Port 2	Slave Matrix Card Ch 41-48
7	BOP B - Port 3	Slave Matrix Card Ch 49-56
8	BOP B - Port 4	Slave Matrix Card Ch 57-64
9	BOP C - Port 1	Backup Matrix Card Ch 1-8
10	BOP C - Port 2	Backup Matrix Card Ch 9-16
11	BOP C - Port 3	Backup Matrix Card Ch 17-24

Table 5.2 MDR Cable Configuration

5.7 TELEPHONE INTERFACE

Incoming and out-going telephone calls are all routed through the telephone interface. The telephone interface is connected to the Master Matrix and controlled using the touch screen HMI. Fig 5.33 shows the telephone interface.

Fig 5.33 Telephone Interface

The select button on the telephone interface is intended to be used to begin a call or end a call on a system that does not have an HMI installed so is not required on this system.

As seen on the above image there are two Vu meters which display a visual indication of the volume of both the incoming caller, displayed as ‘To Matrix’, and the channel which has been placed in the call, displayed as ‘To Telephone’.

If the incoming or outgoing volume needs adjusted then the telephone interface screen can be opened on the HMI and by selecting either the channel which is in the call or TEL the volume can be increased or decreased as required.

Section 5.2.3 provides details on how to make and receive telephone calls using the touch screen HMI.

5.8 RECORDING

It is possible to record communications on both the main and backup communication systems by connecting a recording device to the record out ports on both the master matrix and the backup matrix.

A line level output is available from the main communication system for recording purposes on BOP-B Port 4-1 (Channel 57). All communications on the main system are routed to this port.

A line level output is available from the backup communication system for recording purposes on BOP-C port 1-8 (Channel 8). All communications on the backup system are routed to this port.

CHAPTER 6 - MAINTENANCE

CONTENTS

6.1 MAINTENANCE CHECK LIST

The following maintenance check list detailed in Table 6.1 should be followed to ensure the HMCS remains operational to high standard. Main power should be disconnected while checking any parts installed on the electrical panel.

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

Identification	Procedure	Interval
1	Check connections to electrical panel switch gear and tighten where necessary.	6 monthly
2	Check connections to electrical panel terminals and tighten where necessary.	6 monthly
3	Check operation of the main isolating switch on the electrical panel.	6 monthly
4	Check operation of the MCB's on the electrical panel.	6 monthly
5	Check connections from field cabling to D-type interfaces and tighten where necessary.	6 monthly
6	Check interconnect cables are securely fastened between the HMCS equipment and tighten where necessary.	6 monthly
7	Check MDR cables are securely fastened between each matrix and the break out panels.	6 monthly
8	Check operation of HMI.	6 monthly
9	Check operation of entertainments.	6 monthly
10	Check operation of Keypanels.	6 monthly
11	Check operation of HSU-CU's.	6 monthly
12	Check operation of power change over switch.	6 monthly
13	Check operation of backup communication system.	6 monthly
14	Check operation of entertainments/DVD players.	6 monthly

Table 6.1 Maintenance Check List

6.2 FUSES

There are several fuses installed within the HMCS to protect the equipment installed within it. Table 6.2 provides details of the fuses.

WARNING

RISK OF EQUIPMENT DAMAGE
Only suitably rated fuses rated should be installed on the HSU. Refer to Table 6.2 when selecting fuses

Location	Fuse Terminal	Description	Fuse Rating
Electrical Panel Rack 1	V1	Keypanel 1 Supply	6.3A
Electrical Panel Rack 1	V2	Keypanel 2 Supply	6.3A
Electrical Panel Rack 1	V3	Data Converter 1 Supply	0.5A
Electrical Panel Rack 1	V4	Data Converter 2 Supply	0.5A
Electrical Panel Rack 1	V5	Data Converter 3 Supply	0.5A
Electrical Panel Rack 1	V6	Data Converter 4 Supply	0.5A
Electrical Panel Rack 1	V7	Panel Buzzer Supply	0.2A
Electrical Panel Rack 1	V8	Spare	2A
Electrical Panel Rack 1	F1	Reversing Cont Supply 1	0.5A
Electrical Panel Rack 1	F2	Reversing Cont Supply 2	0.5A
Electrical Panel Rack 1	F3	Supply 1 Indicator	0.5A
Electrical Panel Rack 1	F4	Supply 2 Indicator	0.5A
Electrical Panel Rack 2	VM1	Keypanel 3 Supply	6.3A
Electrical Panel Rack 2	VM2	Keypanel 4 Supply	6.3A
Electrical Panel Rack 2	VM3	Data Converter 5 Supply	0.5A
Electrical Panel Rack 2	VM4	Data Converter 6 Supply	0.5A
Electrical Panel Rack 2	VM5	Data Converter 7 Supply	0.5A
Electrical Panel Rack 2	VM6	Data Converter 8 Supply	0.5A
Electrical Panel Rack 2	VM7	Data Converter 9 Supply	0.5A
Electrical Panel Rack 2	VM8	Spare	2A
IEC Socket Strip Rack 1	L1	Touch-Screen PC (HMI)	2A
IEC Socket Strip Rack 1	L2	Master/Slave Matrix	2A
IEC Socket Strip Rack 1	L3	32 Key Keypanel	2A
IEC Socket Strip Rack 1	L4	Control Unit 1	2A
IEC Socket Strip Rack 1	L5	Control Unit 2	2A
IEC Socket Strip Rack 2	L1	Backup Comms MKP-4	2A

Location	Fuse Terminal	Description	Fuse Rating
IEC Socket Strip Rack 2	L2	Telephone Interface	2A
IEC Socket Strip Rack 2	L3	Control Unit 3	2A
IEC Socket Strip Rack 2	L4	DVD Player 1 (Via X8)	2A
IEC Socket Strip Rack 2	L5	DVD Player 2 (Via X8)	2A
IEC Socket Strip Rack 2	L6	DVD Player 3 (Via X8)	2A
Control Unit 1	F1 & F2	F1 - Live, F2 - Neutral IEC Inlet	2A
Control Unit 2	F1 & F2	F1 - Live, F2 - Neutral IEC Inlet	2A
Control Unit 3	F1 & F2	F1 - Live, F2 - Neutral IEC Inlet	2A
Keypanel 1 Terminals	F1 - F9	1 to 9 Fused Terminals	800mA
Keypanel 2 Terminals	F1 - F8	1 to 8 Fused Terminals	800mA
Keypanel 3 Terminals	F1 - F9	1 to 9 Fused Terminals	800mA
Keypanel 4 Terminals	F1 - F8	1 to 8 Fused Terminals	800mA

Table 6.2 Fuse Ratings

CHAPTER 7 - TECHNICAL SPECIFICATIONS

7.1 MECHANICAL

Height:	2050mm
Width:	1240mm
Depth:	600mm
Weight:	300kg

7.2 ELECTRICAL

Main input:	100Vac - 240Vac @ 50 to 60 Hz
Internal Power supplies	
Switch mode (PS2, PS4):	+24V DC output, 240W
Switch mode (PS1, PS3):	+15V DC output, 180W
Fuses:	Refer to chapter 6 for fuse rating.

7.3 ENVIRONMENTAL

Operating Temperature:	- 5^{o}C to + 50^{o}C
Storage Temperature:	- 10^{o}C to + 60^{o}C

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CHAPTER 8 - SPARES

CONTENTS

8.1 COMMUNICATIONS HARDWARE

Part	Divex Part No
Control Unit 1	CO420-1-SY141
Control Unit 2	CO420-2-SY141
Control Unit 3	CO420-3-SY141
Keypanel Enclosure 1	CO424-1-SY141
Keypanel Enclosure 2	CO424-2-SY141
Keypanel Enclosure 3	CO424-3-SY141
Keypanel Enclosure 4	CO424-4-SY141
Master and Slave Matrix	CO430-32
Backup Matrix	CO430-24
Entertainment/Supervisor Keypanel	CO28585
Telephone Interface	CO28587
4 Channel Keypanel	CO28583
External Communications Master Station	EM16045
Modular Speaker Unit	EM30240
Break Out Panel	SY1232069
Supervisor Headset	CO39626
Gooseneck Microphone	EM30241

8.2 ANCILLARY ITEMS

Part	Divex Part No
Panel Buzzer	EM4013
D-Type Interface	EM30769
Four Channel Keypanel Bracket	EM30238
Telephone Interface Bracket	EM30239
D-Type Splitter make to 2x Female	EM3816
NC Contact Block (change over switch)	EM35805
NO Contact Block (change over switch)	EM32437

8.3 CABLES

Part	Divex Part No
Interconnect Cable, 2m	CO420107-2
RS232 Distributor Cable, 3m	CO420119
DC Output Power Cable, 3m	CO420120
RS232 Opto isolation Cable, 3m	CO420121
Male to Female IEC Power Cable, 2m	EM30606

NOTES
Interconnect cables are available in various lengths, for alternative lengths use CO420107-* where * determines the length in meters.

Refer to individual equipment manuals for lower level spares.

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