MS 900D SONAR - OPERATORS MANUAL

900-10107001

Issue 1.0   **July 1998**

KONGSBERG MESOTECH LTD.

OFFSHORE
WARRANTY STATEMENT
Effective Jan 1, 2006

Kongsberg Mesotech Ltd. warrants that its products are free from defective materials and/or workmanship for a period of 24 months from the date of receipt of goods by the end user, or 30 months from date of product shipment from the manufacturing facility (which ever occurs first). Kongsberg Mesotech Ltd. will - at no charge - repair or replace (at its option) any part(s) determined to be defective of workmanship or materials, provided the warranty claim is made to either the manufacturing facility, or its authorized repair centres within the warranty period.

The purchaser is responsible for the examination of the product upon receipt. The purchaser is required to report any irregularity to received Kongsberg Mesotech Ltd. goods to either the manufacturer - its Sister companies - or Agents, within 15 days of receipt of goods. Proof of date received may be required.

The warranty is void if warranty labels are broken; Kongsberg Mesotech Ltd. will not warrant any product which is physically damaged, abused, altered, subjected to accident or negligence or misuse, or is incorrectly installed or used by the purchaser - or purchaser's representative.

Consumable items (including lamps, fuses, and worn O rings or shaft-seals) are excluded by the warranty.

All Product/Equipment being returned for warranty, repair/replacement shall have freight costs "prepaid". All warranty Product/Equipment being returned to the customer will be freight charges "prepaid" by Kongsberg Mesotech Ltd.

> NOTE: Shipping method and carrier for warranty returned items will be at the discretion of Kongsberg Mesotech Ltd.
> A Kongsberg Mesotech Ltd. Warranty Claim form must be completed and submitted to KML Service Department prior to warranty claim acceptance.

Kongsberg Mesotech Ltd. cannot warrant that its products are suitable for any particular or intended purpose. No other warranty is expressed or implied; Kongsberg Mesotech Ltd. accepts no liability on consequential damages – these include, but are not limited to: loss of profit, property damage, personal injury.

The maximum liability shall not, in any case, exceed the price of the product claimed to be defective.

LIST OF CONTENTS

MODIFICATION RECORD

MS 900D OPERATORS MANUAL

900-10107001
Issue: 1.0

July 1998

Issue No.	Date	Initial	Comments
1.0	07.98		Update
Draft	06.97		First Release

To assist us in making improvements to the product and this document, Kongsberg Simrad Mesotech welcomes comments and constructive criticisms. Please send all such comments, in writing, to:

Kongsberg Simrad Mesotech Ltd.
Documentation Department
1598 Kebet Way
Port Coquitlam, BC   V3C 5M5
CANADA

PART 1

INTRODUCTION

1. INTRODUCTION

1.1 PURPOSE AND FUNCTION

The Kongsberg Simrad Mesotech Model MS 900D Sonar is a high resolution sonar display and control unit that is compatible with Kongsberg Simrad Mesotech Model 971 Digital Sonar Heads. The sonar processor, when used with a digital head, form a very effective system that can be used for obstacle avoidance, salvage search, debris clearance, and as a general aid in almost any type of underwater operation.

1.2 FEATURES

The Kongsberg Simrad Mesotech Model MS 900D Sonar Processor includes the following features:

- Simplified operating controls to select the area to be scanned.

- Non-volatile memory to save control settings with power off.

- Dual cursors with digital readout of range and bearing.

- Cursors automatically repositioned when display mode or range changed.

- Zooms of x2 and x4.

- Pixel zooms of x2, x3, and x4.

- On screen date and time.

- User adjustable color palette.

- Serial I/O port to allow remote control and screen annotation.

- Bottom or object profiling with serial output of profile data.

- Printer port for connection to optional Hewlett-Packard Paintjet color printer for color hard copy of the display.

- ■ Adjustable speed of sound.

- ■ Digital Telemetry - RS485 or RS422 or RS232

1.3 SPECIFICATIONS

1.3.1 Performance Characteristics

Display Modes .... Polar, Linear, Sector, SideScan
Range Units .... Meters, Yards, or Feet
Ranges .... 5,10,15,20,25,30,40,50,75,100,150,200,250 meters
5,10,15,20,25,30,40,50,75,100,150,200,250 yards
15,30,45,60,75,90,120,150,225,300,450,600,750 feet
Scan Sector Width .... 7.2 to 360 degrees in 7.2 degree steps
Scan Sector Center .... -180 to +180 in 7.2 degree steps
Scan Speeds .... Slow, Medium, Fast, Extra Fast, 16, 32, 64
Sound Speed .... Adjustable from 1400 to 1600 m/s
Display Resolution .... 640 by 480 by 8 colors (or 128 colors)
Zoom .... x2 or x4 Zoom
Magnifier .... x2, x3, or x4 Pixel Zoom
Cursors .... Dual cursors with range/bearing readout
Printer Port .... Standard IBM PC type parallel port
Serial Port .... Asynchronous RS-232C
   Baud Rates .... 300 to 9600 baud
   Parity .... Even, Odd, or None
   Data Bits .... 7 or 8
   Stop Bits .... 1 or 2
Telemetry RS232/RS485/RS422
   Formats .... Asynchronous Serial Data
   Baud Rates .... 9600 to 230 kbps
   Parity .... None
   Data Bits 8
   Stop Bits 1

1.3.2 Physical Specifications

Size .... 3.5" high by 13" wide by 16.5" deep
Weight .... 12 lbs

1.3.3 Power Requirements

Input Voltage ....Automatic selection of 115 or 220 volts
Input Voltage Range .... 115 VAC nominal (85 to 132 VAC)
                                                    230 VAC nominal (170 to 264 VAC)
Frequency .... 47 to 63 Hz.
Power Consumption .... 100 watts maximum

1.3.4 Environmental

Temperature (operating)...0 to 50° C
Temperature (storage) .... -20 to +60° C

PART 2

THEORY OF OPERATION

2. THEORY OF OPERATION

2.1 BASIC PRINCIPLES

- Sound waves travel very efficiently through water.

- A sound pulse can be projected through water in a controlled direction with a properly designed transducer.

- An object in the path of the projected sound pulse will (in most instances) reflect some sound energy back toward the transducer.

- The speed of sound in water can be predicted for given conditions of temperature, salinity, and depth.

2.2 DETERMINING TARGET POSITION

The sector scanning sonar measures the time from the transmission of the pulse to the reception of the echoed pulse. The measured time is then converted to distance by using a value for the speed of sound in water.

Since the sound was projected in a known direction, the bearing of the object is also known. This makes it possible to locate the object with respect to the transducer. A graphic video display is used to plot the position of the target.

2.3 FORMING AN IMAGE

The sound pulse will be attenuated as it travels through the water from the transducer to the target and back. Much of this attenuation is a predictable function of knowing the output frequency, and the total time or distance traveled. This decrease in signal level with time can be compensated by increasing the receiving gain with time. This is done automatically in the sonar head with a Time Varying Gain (TVG) circuit.

The strength of the reflected energy will vary with the size, shape, texture, and composition of the target object in addition to the distance from the transducer. After TVG correction, the absolute levels of the received signals will be determined by the nature of the reflecting target.

The sonar system repeatedly measures the TVG corrected echo levels by digitizing a sequence of samples after each pulse transmission. Each sample is then plotted on the video display at the appropriate position according to its range and bearing. The color used to plot each sample is determined by the level of that sample.

The process can be repeated with the transducer pointed in different directions to form an image of a large area of the bottom on the display screen.

PART 3

INSTALLATION AND PREPARATION FOR USE

LIST OF FIGURES

3. INSTALLATION AND PREPARATION FOR USE

3.1 INTRODUCTION

This section explains the necessary steps to install and prepare the sonar system for use.

3.2 SONAR HEAD MOUNTING

3.2.1 Orientation

The Sonar Head must be mounted such that the transducer is free to turn and has an unobstructed field of view. Normally it is mounted vertically with the transducer up or down. For applications where bottom profiles are to be made, the head should be mounted horizontally.

3.2.2 Electrical Isolation

It is very important that the Sonar Head be electrically isolated from the structure it is mounted on to prevent corrosion damage due to electrolysis.

3.3 PROCESSOR MOUNTING

The Processor can be mounted in any convenient location and in any orientation. The unit can be rack mounted in a standard 19 inch rack by using the rack mounting ears supplied with the system. Dimensions are given in Figure 3.1.
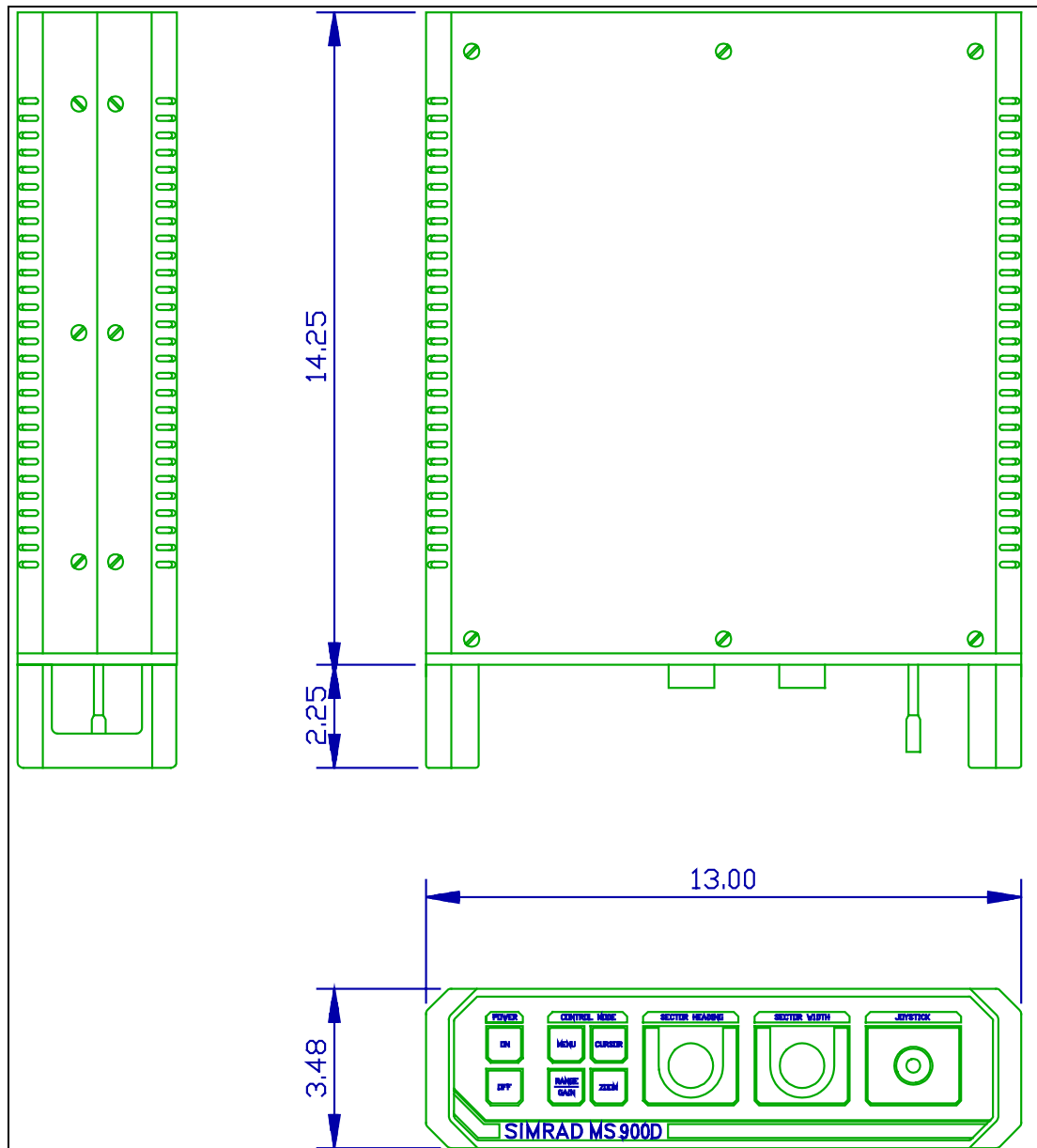
Figure 3.1 MS 900D Processor Dimensions

3.4 REAR PANEL CONNECTIONS

All connections are made to the rear panel, shown in Figure 3.2.

Figure 3.2 MS 900D Processor Rear Panel

2/4 wire RS 485, RS 232   4 wire RS 422

Switch: RS 232 (switch up)
RS 485 (switch in down position

Figure 3.3   MS 900D Processor Rear Panel (units shipped after May 15, 1998)

3.4.1 AC Power Connection

The MS 900D will operate from either 115 or 230 VAC. Voltage selection is automatic and there are no jumpers or switches to set.

Connect the AC power cord to the 3 pin connector at the lower right of the rear panel.

The switch on the power input connector is the Master AC power switch and should normally be left ON. This will allow the system to be turned off or on from the front panel POWER buttons.

The power input connector contains two fuses each rated at 2 amperes. To remove or replace the fuses, pry the cover off the power switch using a small screwdriver under the right side of the cover as viewed from the rear.

3.4.2 Digital Telemetry Information

The widespread adoption of Fiber Optic transmission systems and digital technology by the offshore industry has led to the development of telemetry systems based on commercial serial communications standards.

These standards are referred to as RS-232 and RS-422 or RS-485. The RS-232 interface standard is cheap and very common, and is available on all PCs today. It does, however, suffer from a few drawbacks which are particularly important in the offshore environment. The *RS-232 standard will not suppo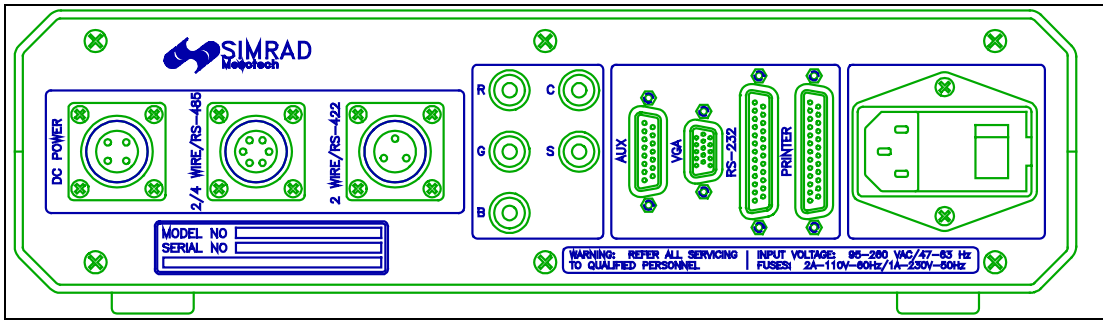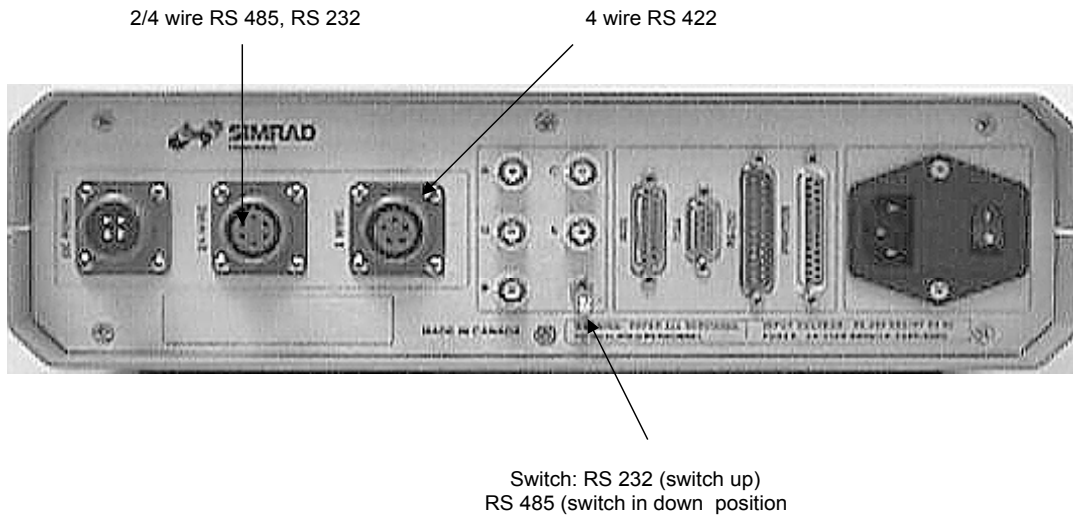rt very long cables or high data rates.* Typically this standard could not be used at practical bit rates over more than 100m of cable.

This problem has been largely overcome by the newer standards, RS-422 and RS-485. These forms of telemetry use a differential signaling technique which has better noise immunity, and can drive longer cables at useable bit rates. The RS-422 and RS-485 signal levels are *essentially* the same. The RS-485 standard differs from the RS-422 standard in only one respect, it supports multi drop capability, and can operate over a single twisted pair. See Figure below.
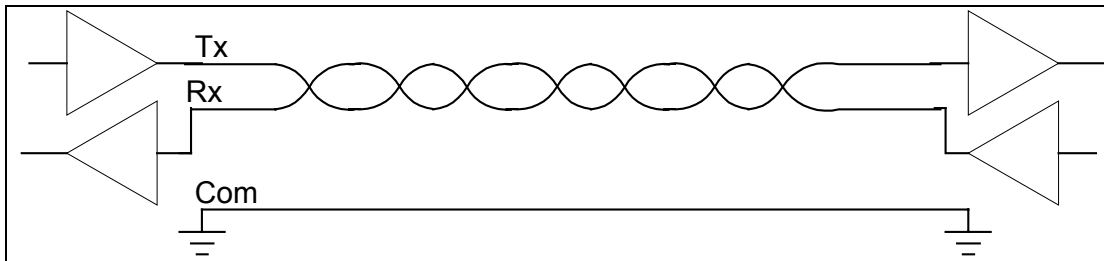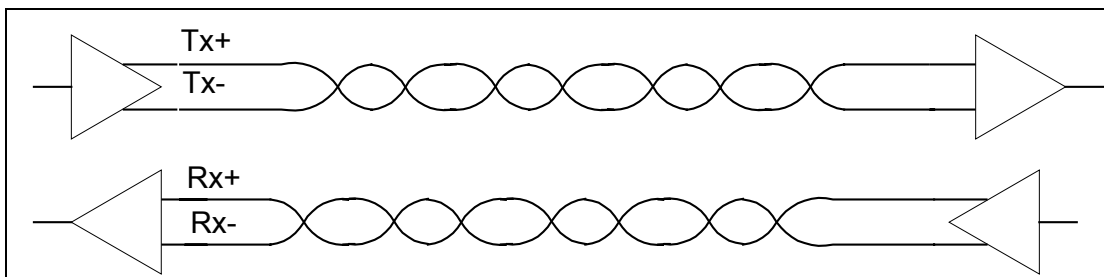
Figure 3.4 RS-232 Standard, 2-Wire + Common

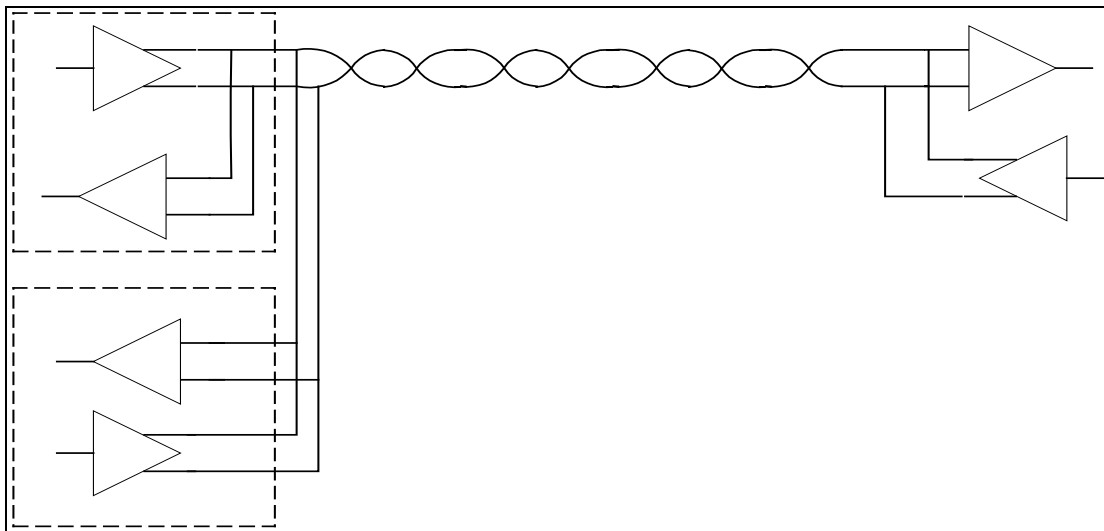*Figure 3.5 RS-422 Standard, 4-Wire System*

Figure 3.6 RS-485 Standard, 2-Wire with Dual Head Option Shown

In the case of digital telemetry, the communications standard employed is

usually the same for both the uplink and the downlink, although the data rate (i.e. the number of bits/second transmitted) may vary widely. This transmission is also often referred to as the *baud* rate, which in this case is exactly the same as the bit rate, and may be used interchangeably.

While the RS-XXX standards define the voltage levels for communications, they do not specify or determine in any way the structure of the information to be transmitted (i.e. baud rate, how many bits are sent, in which order, and how they are to be interpreted).

At this point it is worthwhile discussing the formats and size of the data transmission required as it relates to a typical scanning sonar system.

3.4.2.1 Data Format for transmission

A byte of data is a sequence of 8 bits of information. A byte, having 8 binary states, can represent a number between 0 and 255. Larger combinations of bytes can be used to represent larger numbers and even very complex objects, by common agreement between transmitter and receiver (i.e. by prearranged rules about the ordering and interpretation of the byte sequences). This is an issue of software/design compatibility between sender and receiver; is has nothing to do with RS-XXX transmission standards.

In typical sonar systems based on the RS standards, each byte of information is sent as a distinct entity. To guarantee that each byte is distinguishable at the receiver from an otherwise long string of single bits, rules and overheads are imposed. On the cable medium, each byte is actually sent as 10bits of data, the extra two bits removed at the receiver. The only practical effect of this is that it simplifies the baud rate to byte rate calculation.

3.4.2.2 Data Rates

By common agreement, the following transmission rates are considered standard in the industry.

4800, 9600, 19200, 38400, 57600, 115200, 230400 etc.

These are also loosely referred to by approximations to these rates: e.g.

4800, 9k6, 19k2, 38k4, 57k, 115k, and 230k

Since each byte requires 10 bits for transmission, the overall byte transmission rate is therefore $1/10^{th}$ of the baud rate (i.e. at 9600 bit/s, we effectively get very

nearly 1000 bytes or characters/sec).

3.4.3 Sonar Head Connection - RS485/RS232

This connector is used for Kongsberg Simrad Mesotech sonar heads equipped with 4-wire Digital Telemetry. Power is also supplied on this connector.

Pin assignments for this connector are as follows:

	SIGNAL
A	Shield (chassis ground)
B	Not Used
C	TEL (+) RS485 (Tx RS232)
D	TEL (-) RS485 (Rx RS232)
E	Common
F	+24 VDC (from MS 900D)

Note!

The Polarity of the telemetry connections are very important and must be maintained (rear panel switch used to select RS485 or RS232).

3.4.4 Optional Sonar Head Connection - RS422

Optional RS422 is available on special order and must be done at the factory. This connector is used for connection to those telemetry systems that require a RS422, 4-wire telemetry interface. Power is not available on this connector.

Pin assignments for this connector are as follows:

PIN	SIGNAL
A	Rx - 422(+)
B	Rx - 422(-)

C	Telemetry Common
D	Tx - 422(+)
E	Tx - 422(-)

3.4.5 DC Power

Not used in the MS900D.

3.4.6 Video Monitor Connection

Video monitor connection depends upon the type of monitor being used.

An industry standard VGA monitor can be connected to the 15-pin D-type VGA connector.

Pin assignments for this connector are as follows:

PIN	SIGNAL
1	R - Red analog video output
2	G - Green analog output
3	B - Blue analog output
4	GND
5	Red Shield
6	GND
7	Green Shield
8	Blue Shield
9	N/C
10	GND
11	GND
12	N/C
13	Horizontal Sync
14	Vertical Sync
15	N/C

3.4.7 Surface Equipment Configuration

MS 900D Scanning Sonar Processor; P/N 900-10100000
SURFACE EQUIPMENT CONFIGURATION FOR DATA HARDCOPY,
BITMAP, and COMPOSITE VIDEO RECORDING

Option:
VGA Display
P/N 801-00510000

Selected printers to produce hardcopy
images directly from MS 900D, or print
BITmap and profile data from PC

Video Converter allows simultaneous
VGA display, and composite video
recording of sonar signal

Laptop used to
store BITmap
images, and/or
profile data

PC to NTSC Video Converter

Composite Video out of converter to Video In of VCR

To Digital Sonar Head

MS 900D

Note 1

Technical Information
P/N 900-10107902

Accessory Kit
P/N 422-12010000

Operator's Manual
P/N 900-10107001

SIMRAD Mesotech Manufactured Items —

Stereo VCR

Option:
Composite
Video Display
NTSC or PAL

NOTES:

1: MS 900D software allows BITmap screen images
to be stored to a PC

2: All items with grey shading are optional; all non-
Mesotech manufactured items can be procured
independently by the user to avoid third party
handling charges

Figure 3.7 Surface Equipment Configuration

3.4.8 Printer Connection

The 25 pin PRINTER connector is provided for use with an optional Hewlett-Packard PaintJet color printer, or the supplied data transfer cable (to be used when transferring bitmap files to a host PC). No connection is required if a printer or cable is not being used.

Pinout is standard IBM PC type parallel port.

Additional HP printers supported by the MS 900D include:
    HP 560
    HP 660
    HP 680
    HP 1200

Clients have also reported using:
    HP 672
    HP 890

These last two have not been tried at the factory.

3.4.9 Serial I/O Connection

The 25 pin RS-232 connector is provided for interfacing to the following: the serial (COM) port of an optional computer for control, annotation of the sonar display or for output of profile data. Refer to Appendix A for details. No connection is required if the computer is not being used.

Pin assignments for this connector are (relative to the MS 900D) as follows:

PIN	SIGNAL
2	Receive Data - RxD
3	Transmit Data - TxD
7	Signal Ground

PART 4

OPERATING CONTROLS AND DISPLAYS

LIST OF FIGURES

4. OPERATING CONTROLS AND DISPLAYS

4.1 INTRODUCTION

This section explains the functions of all the operating controls of the sonar system. It also describes the features of the different display modes.

The MS 900D Sonar uses a combination of dedicated front panel controls for the most frequently needed adjustments, and a software menu system for less frequently needed controls.

4.2 FRONT PANEL CONTROLS

As seen in Figure 4.1, all processor controls are located on the front panel, arranged in functional groupings.
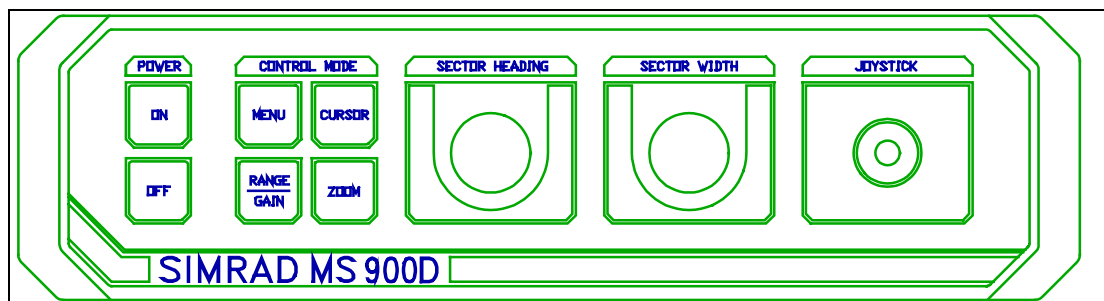
Figure 4.1 MS 900D Front Panel (to May 1998)
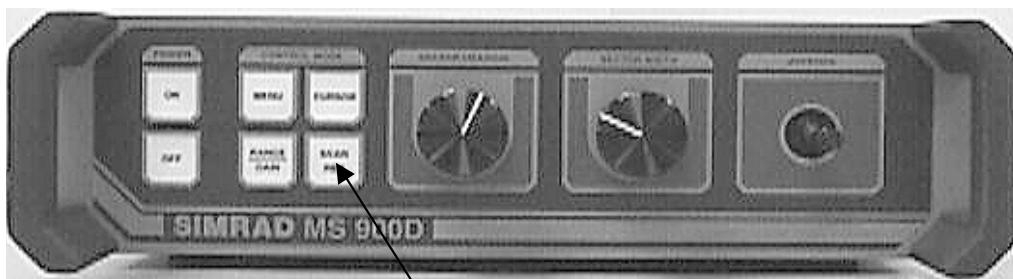
SCAN REVerse Button

Figure 4.2 New MS900D Front Panel

The POWER keypad buttons are used to turn the system power on and off.

The CONTROL MODE keypad buttons are used to set the function of the joystick control.

Their individual functions are as follows:

4.2.1 ON Button

This button is used to turn the power to the sonar system ON. All six of the keypad buttons illuminate to show power is on.

Note that a built-in time delay requires that this button be held for approximately one second before the system power is applied.

4.2.2 OFF Button

This button is used to turn the system OFF.

Note that a built-in time delay requires that this button be held for approximately one second before the system power is removed.

Since the MS900D Sonar can distinguish between power-down resets and warm resets, the user is advised to keep the MS900D Sonar at least 1 second in the OFF state before powering ON again.

4.2.3 MENU Button

This button is used to enable the Joystick for control of the on-screen menu. It is also used to select a different video format during power-up (see Section 4.3).

4.2.4 CURSOR Button

This button is used to enable the Joystick for control of one of the display cursors. It is also used to select a different video format during power-up (see Section 4.3).

4.2.5 RANGE/GAIN Button

This button is used to enable the Joystick for control of RANGE or GAIN. Press once for Range control, again for Gain. MS 900D software includes 300, 400 and 500 meter range display. Note, however, that the range of acoustic return depends on the operating frequency of the sonar head. For example, a 675 kHz transducer has a maximum operating range of 130 meters in absolute perfect conditions (fresh water). A 330 kHz may achieve double that range under ideal conditions.

4.2.6 ZOOM Button

This button is used to select a zoomed display. It is also used to select a different video format or system configuration during power-up (see Section 4.3).

4.2.7 SCAN REV Button

For MS 900D processor deliveries starting in May 1998 the front panel has been changed. The ZOOM Button has been replaced with a SCAN REV Button (scan reverse button). Activating this button during system operation (with the head actively scanning) will cause the scan to change to the opposite direction.

It is also used to activate the printer when the system is configured to print the display (see 4.14.1)

4.2.8 SECTOR HEADING Control

This is a rotary control used to set the center of the sector to be scanned. If the SIDE SCAN HEAD system configuration is enabled, this control sets the LEFT channel gain instead.

4.2.9 SECTOR WIDTH Control

This is a rotary control used to set the width of the sector to be scanned. Sector width can be set up to 360 degrees in the Polar mode, but is automatically limited to 120 degrees in the Linear mode.

4.2.10 JOYSTICK

This is the main operating control for the sonar. It is used to operate the menu system, move the cursors around the display, and to set the Range and Gain.

4.3 OPTIONAL POWER-UP SELECTIONS

4.3.1 Video Formats

The MS 900D Sonar can generate any of three different video formats:

VGA   (IBM computer standard) requires a color VGA or multisync monitor. This is the preferred video format when video taping is not required. It will produce the sharpest images and is flicker-free.

RGB   (North American television standard) must be used when video taping is required or a VGA or multisync monitor is not available. In this mode, a composite video signal is available on the rear BNC connector labelled "C".

NTSC Composite video output

BNC	SIGNAL
R	Red analog video output
G	Green analog output
B	Blue analog output
S	Sync output
C	Composite video output

Four coaxial cables, supplied in processor accessory kit, should be used to connect the monitors red, green, blue, and vertical/comp. sync to the processor BNC connectors R, G, B and S, respectively. With some monitors, however, better results are obtained when the sync cable is connected to control unit BNC connector C. For RGB monitors that can input either analog or TTL signals, the selector switch should be set to "analog".

4.3.2 Enabling Power-Up Selections

The video format must be set to match the monitor being used. Normally, this will only need to be done when first installing the system or when changing monitors.

To set the video format, proceed as follows:

- Press the POWER OFF button to be sure the sonar is off.

- Press and hold down the MENU button first, then press the POWER ON button while continuing to hold the MENU button for at least 5 seconds.

- Release the MENU button.

- Press and release the CURSOR button to set VGA
  -or-
  Press and release the RANGE/GAIN button to set RGB/NTSC

- The sonar display should now appear on the monitor.

Note!

Should the internal battery require replacing, it is possible that the settings stored in the non-volatile memory could be lost. If this happens, the screen will remain blank until a button is pressed to set the power-up selections as described above.

4.4 THE SONAR DISPLAY

The MS 900D is provided with two display layout formats—a Small Text Mode and a Large Text Mode. The reason for these modes is to provide a stable functional display regardless of the type of monitor used. *Large text mode is recommended if NTSC video mode is selected or the VGA signal is being sent to a VGA to NTSC (or PAL) converter. This will remove screen flicker on the converter NTSC (or PAL) output.* The general arrangement of the sonar displays are shown in Figure 4.3.
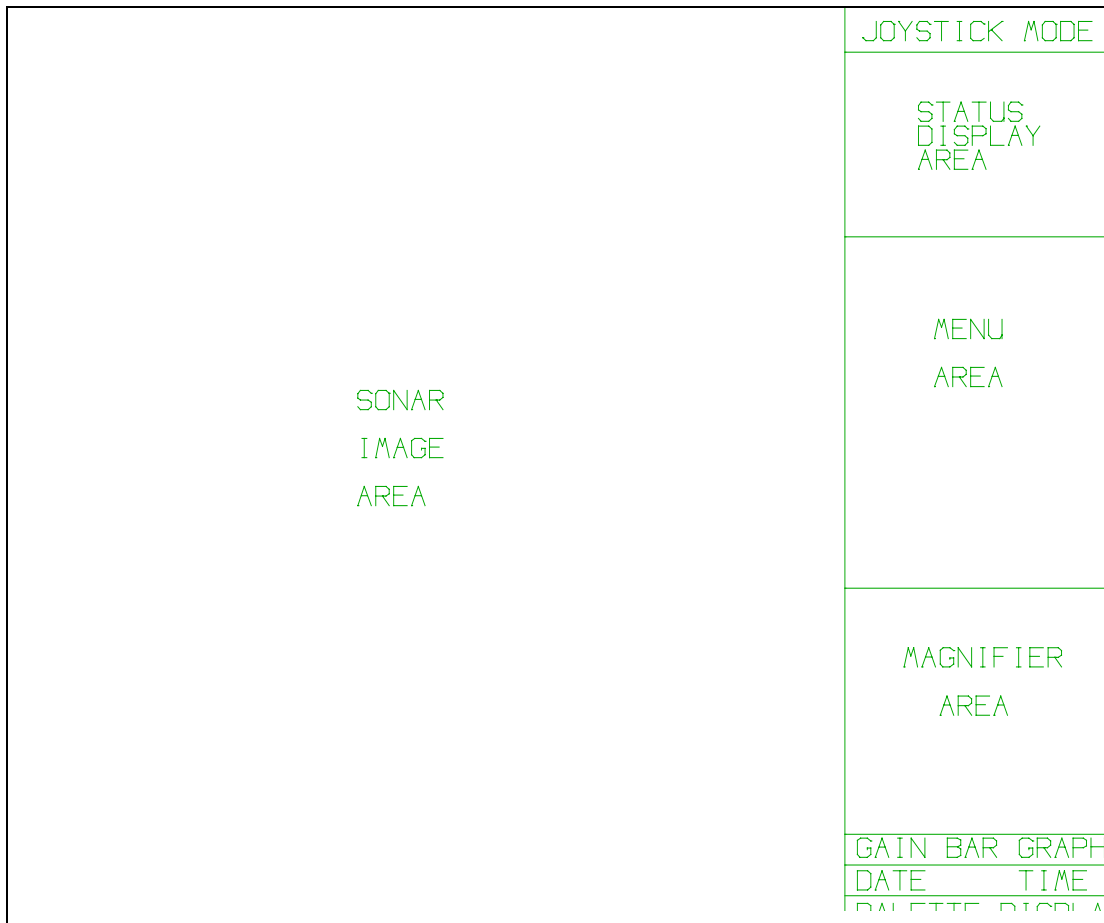
Figure 4.3 MS 900D Display Format

The displays are divided into the following main areas:

The **Sonar Image Area** is the largest area and is reserved for the sonar image.

The **Joystick Mode** is normally used to display the current function of the Joystick. Normally, one of the following messages will appear in the Joystick Mode area:

MENU ACTIVE.
   The Joystick will control the menu.

RANGE ADJUST.
   The Joystick will adjust the system Range setting.

GAIN ADJUST
   The Joystick will adjust the system Gain setting. This mode is not available
   if the SIDE SCAN HEAD system configuration is enabled.

CURSOR 1
   The Joystick will control the position of Cursor 1.

CURSOR 2
   The Joystick will control the position of Cursor 2.

MAGNIFIER
   The Joystick will control the position of the Magnifier window.

The **Status Display Area** is reserved for the display of digital readouts of cursor
positions, display mode, range, and sector size and position.

The **Menu Area** is reserved for the Menus.

The **Magnifier Area** is reserved to display a magnified image of the sonar image
inside the Magnifier window.

The **Gain Bar Graph** is a small bar graph showing the relative gain setting.

The **Date Time** is an area reserved for display of the current date and time.

The **Palette Display** contains a color bar showing the current palette of colors
selected. Each color represents a particular range of return-signal amplitude. The
left and right most colors in the Palette Display correspond to the lowest and
highest amplitudes respectively.

4.4.1 The STATUS Display Area

The Status Display Area is divided into nine boxes; the layout is dependant on
whether the Small or Large Text Mode is selected. The layouts are shown in
Figure 4.4 and Figure 4.5.

CURSOR 1	CURSOR 2	CURSOR 1-2
RANGE MODE	SECTOR GRAPH	SECTOR HEADING
TEXT A	TEXT C	TEXT E
TEXT B	TEXT D	TEXT F

Figure 4.4   The Status Display Area - Small Text Mode

CURSOR 1	CURSOR 2
RANGE MODE	CURSOR 1-2
SECTOR GRAPH	SECTOR HEADING
TEXT A	TEXT B
TEXT C	TEXT D
TEXT E	TEXT F

Figure 4.5 The Status Display Area - Large Text Mode

The box labelled Cursor 1 is used for a numeric readout of the range and bearing from the transducer position to the current position of Cursor 1.

The box labelled Cursor 2 is used for a numeric readout of the range and bearing from the transducer position to the current position of Cursor 2.

The box labelled Cursor 1-2 is used for a numeric readout of the range and bearing from Cursor 1 to Cursor 2.

The box labelled Range Mode is used to show the current full scale range setting and the display mode.

The box labelled Sector Graph is used to show graphically the current sector size and heading.

The box labelled Sector Heading is used to show the current heading of the center of the sector being scanned.

The remaining boxes labelled TEXT A through TEXT F are reserved for the display of user defined text or data input by means of the serial I/O connector. Refer to Appendix A for details.

4.4.2 Operational Differences

When Large Text Mode is selected, the display format is modified from the standard or Small Text Mode as shown in Figure 4.4.

In this mode the display area that, in the Small Text Mode, contains the menus,

is displaced by a larger Status Display Area. The layout of information in the Status area varies from that in Small Text Mode as shown in Figure 4.5

When operating in Large Text Mode, the menus are activated by pressing the Front Panel MENU button. Individual pages within the menus are then accessed normally with the Front Panel Joystick. Pressing any Cursor or Range button when the menus are active in Large Text Mode will cause the menus to be replaced by the Status display.

The display format can be reset to the Small Text Mode by activating the menus and selecting Small Font at the Text Size entry in the DISPLAY MENU. The order of menu entries and pages are the same in both the Large and Small Text Mode; however, when operating in Large Text Mode, the names of a number of menu entries are abbreviated. Refer to section 4.4.3.

The system retains the text size mode at power down and automatically restores this setting at the next power up. The large text size is available in VGA and RGB video modes.

4.4.3 Large Text Menu Abbreviations

To accommodate the smaller area available when operating in Large Text Mode, a number of menu items are abbreviated from the their Small Text Mode definition.

This sections lists the affected menus and the Large Text Mode abbreviation used. Entries that are not abbreviated are not included.

MENU PAGE	ABBREVIATION	DESCRIPTION
MAIN MENU	Disp:	Display
	Lin	Linear
	Sect	Sector
	SScn	Side Scan
	ScnSp:	Scan Speed
	SSDis:	Side Scan Display
	ScnR:	Scan Reverse
	Magn:	Magnifier
	Thrsh:	Threshold
	Clear Disp	Clear Display

SUB-MENUS	CONFIG.	CONFIGURATION
	STD SETTING	STANDARD SETTING
CONFIGURATION MENU	Units	Range Units
	S-Spd	Sound Speed
	ReCen	Re-center
	SMark	Scan Marker
	Trans	Transducer
	AX_PLs	Auto Xmit Pulse
	TBaud	Telem Baud
	Cmprs	Compression
SERIAL I/O MENU	Prty	Parity
	SBits	Stop Bits
	DBits	Data Bits
	Prof	Profile
	Curs	Cursors
CLOCK SET MENU	Min	Minutes
	Sec	Seconds
DISPLAY MENU	Palet:	Palette
	SMRD1	SIMRAD 1
	SMRD2	SIMRAD 2
	PROF	PROFILE
	HCntr	Horizontal Center
	VCntr	Vertical Center
	Offs	Offset
PRINTER MENU	Print Disp	Print Display
	Prntr	Printer
	Palet	Palette
PROFILE MENU	Prof	Profiling
	Thrsh	Threshold

	Rtrns	Returns
	MinRn	Minimum Range
	Width	Minimum Width
	Gap	Minimum Gap
	Filtr	Filter

SELF-TEST MENU	Telem Test	Telemetry Test

SENSOR MENU	STst	Surface Test
	HTst	Head Test
	SSXMT	SS Transmit
	TXPls	Test X-Pls

4.5 THE DISPLAY CURSORS

There are two display cursors that can be moved within the Sonar Image Area. Their shapes are shown in Figure 4.6.
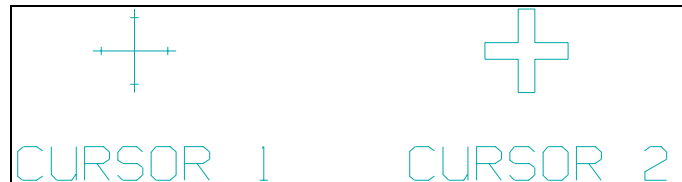
Figure 4.6 The Display Cursors

The primary purpose of the cursors is to allow measurements of target size and location. Refer to Figure 4.7 below.
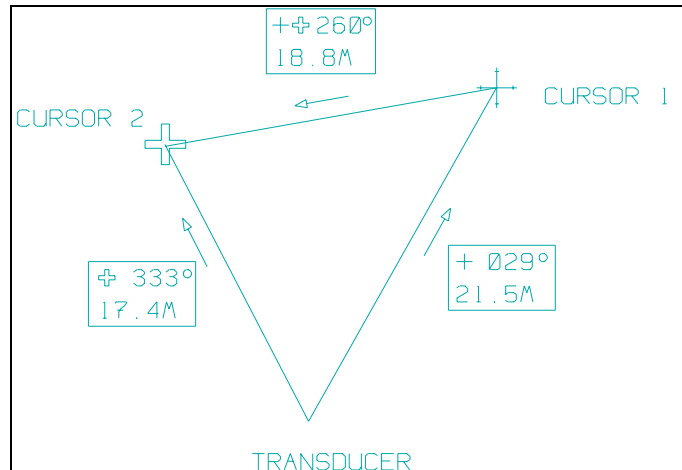
Figure 4.7 Range and Bearing

The sonar keeps track of the cursors in terms of their real world positions as opposed to their screen positions. This has several effects:

If a cursor is placed on a sonar target, it will remain on that target if the range or display mode is changed.

The cursor readouts of range and bearing will not change when the range or display mode is changed since the cursor real world positions do not change.

It is possible for either or both of the cursors to disappear from the screen if the range or display mode is changed. They can be made to reappear by increasing the range or by moving them with the Joystick.

4.6 THE MAGNIFIER AND ZOOM FEATURES

The MS 900D Sonar includes two features that allow a section of the sonar image to be enlarged. At first glance, the Magnifier and Zoom features may appear to be the same, but each works in a different way:

The MAGNIFIER enlarges a small area of the existing sonar image into the Magnifier area of the display by simply enlarging each pixel by a factor of 2, 3 or 4. Since this enlarges the cursors as well, it can be used to help in accurately positioning the cursors on a target.

The ZOOM feature enlarges the entire sonar image by increasing the rate at which the sonar data is digitized. The Zoomed image can show only a portion of the selected sector but with more detail due to the higher sampling rate.

The MAGNIFIER and ZOOM features can be used independently or simultaneously.

4.6.1 Magnifier

To use the Magnifier, it must be turned on in the Main Menu by setting it to x2, x3, or x4 (the magnification factor).

It must then be selected using the CURSOR button. It can then be moved within the Sonar Image Area with the Joystick.

4.6.2 Zoom

For systems with Scan Reverse on front, panel, see Section 4.6.3.

To use the Zoom feature, select Cursor 1 with the CURSOR button, and then use the Joystick to position the cursor in the center of the area to be zoomed.

Next, press the ZOOM button once for a zoom factor of 2. The display will be erased and redrawn with cursor 1 at or near the center of the display.

If Cursor 1 is moved and the ZOOM button pressed again, the display will be re-centered around Cursor 1. On the other hand, if the ZOOM button is pressed again without moving Cursor 1 the zoom factor will increase to 4.

To summarize, the ZOOM control logic works as follows:

If the ZOOM button is pressed and Cursor 1 *has not* been moved, the zoom factor will change from x1 to x2, or from x2 to x4 or from x4 to x1.

If the ZOOM button is pressed and Cursor 1 *has* been moved, the zoom factor will remain the same and the display will be re-centered about Cursor 1.

If the SIDE SCAN HEAD system configuration is enabled and the system is operating in the dual channel side scan display mode (Section 4.8), the first ZOOM button press will initiate a single channel display mode. The channel selected is the one CURSOR 1 is located, and is equivalent to a zoom x2 of that channel. The zoom control logic will then operate as before, except that an effective zoom of up to x8 can be achieved. When the zoom factor is changed from x8 back to x1, the dual side scan display mode will be restored.

Note!

While the MAGNIFIER and ZOOM features are both very useful, they each require extra processing time and will reduce the scanning speed slightly. You can disable them by using x1 zoom and Magnifier Off when maximum speed is required.

4.6.3 ZOOM Control from the MAIN Menu

New models of the MS 900D will have a front panel with a scan reverse button under the cursor button. If this is the case, the ZOOM function is joystick controlled in the MAIN MENU.

There are three selections in this ZOOM control:
* Off
* X2
* X4

By moving the joystick to the right the desired selection will be activated.

The position of cursor 1 will dictate the boundaries of the ZOOM area. The sector coverage will narrow if the area of sector angle is set larger than what is displayed on the screen. This eliminates time wasted in scanning an area that is

not displayed on the CRT. If cursor 1 is moved and the ZOOM is re-enabled, the
ZOOM window will reference itself to the new position of the cursor.

4.7 THE MENU SYSTEM

The Menu System is provided to allow adjustments to be made to several system
parameters without requiring a dedicated control on the front panel for each
item. The Menu System is organized as one MAIN MENU leading to a number
of sub-menus.

Menus can contain either:

SUB MENU NAMES. These will be shown entirely in capital letters, for
example "CONFIGURATION MENU".

ADJUSTABLE ITEMS. These will show the item name and its current
setting, separated by a colon, for example "Scan Speed: Fast".

Menu selections and adjustments are made as follows:

MAKE THE MENU ACTIVE. If the status display does not show "MENU
ACTIVE" press the MENU button.

SELECT THE ITEM. The selected item is high lighted in reverse video (black
on white), unselected items appear in normal video (white on black). To select
an item, move the Joystick up or down to highlight the desired item.

ACTIVATE THE ITEM. Push the Joystick to the right to activate the selected
item. If the selected item is adjustable, the present setting will be highlighted.
If the selected item is a sub menu name, the sub menu will appear and another
item can be selected.

MODIFY THE SETTING. Push the Joystick up or down to change the setting.
When the desired setting is shown, push the Joystick to the left. The entire
menu line will again be highlighted and the new setting will now become
effective.

4.8 THE MAIN MENU

The MAIN MENU is shown in Figure 4.8 below. It contains the most frequently used selections and provides access to the Sub Menus.

```
MAIN MENU

Display:    Polar
Scan Speed: Fast
Grid:       On
Hold:       Off
SS Display: Right
Scan Rev.:  -->
Magnifier:  Off
Threshold:  1
Clear Display
SUB-MENUS
```

Figure 4.8 The MAIN Menu for Software Versions 1.0 - 1.2

Please Note: For software version 1.3 or greater, the main menu will have the "Scan Rev:" replaced with "ZOOM." Please review 4.6.3 for ZOOM operation.

```
MAIN MENU

Display:    Polar
Scan Speed: Fast
Grid:       On
Hold:       Off
SS Display: Right
ZOOM:
Magnifier:  Off
Threshold:  1
Clear Display
SUB-MENUS
```

Figure 4.9 MAIN MENU for Software Version 1.3 or greater

Display: is used to set the Display Mode of the sonar. It can be set to Polar, Linear, Sector, or S-Scan (Side Scan). This selection is unavailable if the SIDE SCAN HEAD configuration is enabled (SIDE SCAN mode is always selected).

Scan Speed: is used to set the scanning speed of the sonar head. It can be set to Slow, Medium, Fast, or Xfast (eXtra Fast), 16, 32 or 64. This selection is unavailable if the SIDE SCAN HEAD configuration is enabled.

Grid: is used to turn the calibrated grid On or Off. When the Grid is On, a set of range rings will appear on the Polar display or a set of range lines will appear on the Linear display.

Hold: is used to hold or "freeze" the display. When Hold: On is selected, the sonar will stop scanning and the image will remain on the screen where it can be examined with the cursors or photographed.

SS Display: is used to select the direction of increasing range in the Side scan display mode. Possible settings are Left or Right.

Scan Rev.: is used to reverse the direction of scan. This can be useful when trying to track a moving target. This selection is unavailable if the SCAN HEAD configuration is enabled.

Front Panel: For MS900D processors delivered from May 1998, the Scan Reverse Control is on the front panel. Scan Reverse on the front panel is also supported with software version 1.3 or greater.

Magnifier: is used to control the Magnifier operation. It can be set to Off, x2, x3, or x4.

Threshold: is used to set the minimum level in the sonar return that will be displayed on the screen. It can be set from 1 to 5. For 128 color systems the range is 1 to 75. This feature can be used to remove the weaker (lower numbered) colors from the image to emphasize the strongest targets.

Clear Display is used to clear the sonar image from the display.

SUB-MENUS is used to select the Sub-Menus described in Section 4.9.

4.9 THE SUB-MENUS

The Sub-Menus page is used to select any of the Sub-Menus. It is shown in Figure 4.10 followed by a description of its contents.

```
┌─────────────────────────────┐
│ SUB-MENUS                   │
├─────────────────────────────┤
│ CONFIGURATION MENU          │
│ SERIAL I/O MENU             │
│ CLOCK SET MENU              │
│ DISPLAY MENU                │
│ PRINTER MENU                │
│ PROFILE MENU                │
│ SELF-TEST MENU              │
│ STANDARD SETTINGS           │
│                             │
│                             │
│                             │
│                             │
└─────────────────────────────┘
```

Figure 4.10 The SUB-MENUS Menu

CONFIGURATION MENU is used to select the Configuration Menu described in Section 4.10.

SERIAL I/O MENU is used to select the Serial I/O Menu that is described in Section 4.11.

CLOCK SET MENU is used to set the time and date for the on-screen clock. It is described in Section 4.12.

DISPLAY MENU is used to select the color palette to be used for the display. It is described in Section 4.13.

PRINTER MENU is used to control the optional PaintJet printer. It is described in Section 4.14.

PROFILE MENU is used to select the Profile Menu that is described in Section 4.15.

SELF-TEST MENU is used to select the Self-Test Menu that is described in Section 4.16.

STANDARD SETTINGS is used to select the Self-Test Menu described in Section 4.17.

SENSOR MENU will appear only if the sonar head is fitted with an optional compass sensor

4.10 THE CONFIGURATION MENU

The Configuration Menu is used to set some less frequently changed parameters. It is shown in Figure 4.11 followed by a description of its contents.

```
┌─────────────────────────────┐
│ CONFIGURATION MENU          │
├─────────────────────────────┤
│ Range Units:      Meters    │
│ Sound Speed:      1475m/s   │
│ Re-Center:        Off       │
│ Scan Marker:      Off       │
│ Grid Type:        Polar     │
│ Transducer:       Up        │
│ Auto Xmit Pulse: 100        │
│ Telem Baud:       9600      │
│ Compression:      Off       │
│                             │
│                             │
│                             │
└─────────────────────────────┘
```

Figure 4.11 The CONFIGURATION Menu

Range Units: can be set to Meters, Feet, or Yards. The units selected will be used for the range settings and the cursor readouts. Meters, Feet, and Yards are abbreviated as m, f, or Y elsewhere on the display.

Sound Speed: is the value used by the system for the speed of sound in water. It should be set to the speed of sound in water for the area in which the system is being used. It can be set from 1400 to 1600 meters per second in steps of 1 meter per second or the equivalent in feet or yards.

Note!

The accuracy of the sonar in determining target size and range is dependent upon the correct setting of the Sound Speed. The speed of sound in water varies with water temperature and salinity and can vary by several percent at different locations around the world. If you don't have an accurate value to use for your location, the following values are suggested as good rough estimates:

Colder Water (North Sea) 1475 m/s

Warmer Water (Gulf of Mexico) 1510 m/s

Very Warm Waters (Equatorial) 1540 m/s.

(Refer to The Principles of Underwater Sound by R. URICK, McGraw Hill, 1983, 3rd edition, page 121, Figure 5.16)

Re-Center: is a feature that can be used to re-center the scanned sector on a target. Normally, the Sector Heading control is used to set or change the sector heading. The Re-Center feature provides an alternate method for changing the scan heading. With Re-Center set to On, each press on the Menu key will cause the Sector Heading to readjust itself to the current scan position, temporarily overriding the Sector Heading control. Any adjustment of the Sector Heading control will restore normal operation. This selection is unavailable if the SIDE SCAN HEAD configuration is enabled.

Scan Marker: is a feature that can be used to mark the current position of the transducer as it scans for display range settings greater than 5 m. With Scan Marker set to On, the current scan position will be shown by a moving solid line. This selection is unavailable if the SIDE SCAN HEAD configuration is enabled.

Grid Type: is used to select the type of grid overlay for the Polar and Sector modes. It can be set to Polar (circular grids) or Rect.(rectangular grids). This selection is unavailable if the SIDE SCAN HEAD configuration is enabled.

Transducer: can be set to Up or Down according to the position of the transducer relative to the body of the sonar head. If this setting is incorrect, the sonar image will be reversed (a mirror image). If the SIDE SCAN HEAD configuration is enabled, the settings are "Fore" and "Aft".

AutoXmit Pulse: The transmit pulse length is now automatically set at an optimum to match the receive bandwidth, which in turn is determined by the sonar head sampling frequency.

The transmitted pulse cannot be changed by the user in the configuration menu.

If a shorter pulse length is desired, the user can enter the SELF-TEST MENU and over ride the automatic condition.

IF the user changes ranges, the unit will revert to AutoXmit.

Telemetry Baud: is used to set the uplink baud rate of the Digital head. The available baud rates are 9600, 19200, 38,400, 57,600, 76,800, 115,200, and 230,400. When manually selecting a baud rate, the selection takes effect only when the left joystick is applied and you exit that menu line item.

An *Auto*matic baud rate selection has been added to this menu. This selection will start the MS 900D at the fastest possible baud rate and test to see which data rate can be supported on the cable/telemetry system. Should the cable or telemetry system deteriorate (for any reason), the unit will automatically adjust the baud rate to compensate. The lowest possible rate is 9600 bps. The system always displays the implemented baudrate.

Note: The system always chooses Auto at power up

When the MS 900D AutoXmit is set to *Auto*, if more than 3 consecutive serious telemetry breakdowns are detected, the system will automatically activate the telemetry test sequence, described above, in an attempt to recover the telemetry link by using a lower baud rate.

Note: The system does not automatically select a higher baud rate after long periods of error-free telemetry operation.

The telemetry baud value displayed in the CONFIGURATION MENU is only updated to reflect this recovered baudrate when the user enters the CONFIGURATION MENU. You must exit and re-enter this menu if currently in the CONFIGURATION MENU.

If the recovery test is activated, the telemetry baud rate will be displayed in the *Auto* value.

The system always displays the actual baudrate it implements after passing the test.

Compression: In order to reduce the amount of data being sent on the telemetry system, signal compression can be applied. If enabled, the 8 bit resolution is reduced to 4 bit resolution (hence, halving the data overhead). Use of this function is advantageous only when using slow telemetry baud rates ($\leq$ 57.6 k), or at very short ranges (10 metres or less).

Not enabling the compression feature will always give the best dynamic signal resolution; the penalty, however, may be slower update rates at shorter ranges. At high baud rates and longer ranges there will be no difference in the update speed.

4.11 THE SERIAL I/O MENU

The SERIAL I/O MENU is used to configure the serial I/O port to match the settings required by the user's serial I/O device. This menu is shown in Figure 4.12 below followed by a description of its contents.

```
SERIAL I/O MENU

Baud Rate:  4800
Parity:     None
Stop Bits:  1
Data Bits:  8
Profile:    OFF
Compass:    OFF
Cursor:     OFF
```

Figure 4.12 The SERIAL I/O Menu

Baud Rate: is used to set the Baud rate of the RS-232 serial I/O port. Possible settings are 300, 600, 1200, 2400, 4800, and 9600.

Parity: is used to set the Parity of the serial I/O. Possible settings are None, Even, and Odd.

Stop Bits: is used to set the number of Stop Bits for the serial I/O. Possible settings are 1 or 2.

Data Bits: is used to set the number of Data Bits for the serial I/O. Possible settings are 7 or 8.

Profile: is used to enable the serial port for sending profile coordinates, described in section 4.17, to an external computer. See Section A.5.6 for details.

Compass: is used to enable the serial port for sending compass values. See Section A.5.7 for details.

Cursor: is used to enable the serial port for sending cursor positioning data to an external computer. See Section A.5.8 for details.

4.12 THE CLOCK SET MENU

The CLOCK SET MENU is used to set the correct time and date for the on-screen clock. It is shown in Figure 4.13 followed by a description of its contents.

```
┌─────────────────────────┐
│ CLOCK SET MENU          │
├─────────────────────────┤
│ Year:    1991           │
│ Month:   May            │
│ Day:     4              │
│ Hour:    14             │
│ Minute:  52             │
│ Seconds:  10            │
│ Set Time Now            │
│                         │
│                         │
│                         │
│                         │
└─────────────────────────┘
```

Figure 4.13 CLOCK SET Menu

Year: is used to set the current year. Possible settings are from 1990 to 2030.

Month: is used to set the current month. Possible settings are the twelve months from Jan to Dec.

Day: is used to set the day of the month. Possible settings are 1 to 31.

Hour: is used to set the current hour. The 24 hour format is used. Possible settings are from 0 to 23.

Minute: is used to set the current minute. Possible settings are from 0 to 59.

Seconds: is used to set the current second. Possible settings are from 0 to 59.

Set Time Now is used to reset and start both the on-screen clock and the battery operated clock to the time and date defined by the settings above.

4.13 THE DISPLAY MENU

The DISPLAY MENU is used to select the color palette, center the image on the display and the text size, used for the sonar image. It is shown in Figure 4.14 followed by a description of its contents.

```
DISPLAY MENU

Text Size:    Large
Palette:      SIMRAD1
Hor. Center: 0
Ver. Center: 0
Offset:       90°



```

Figure 4.14 The DISPLAY Menu

Text Size: provides an option for the size of text on the display. It can be set to Small or Large. In order to prevent flickering in the NTSC or PAL mode, it is recommended to select Large. Operation with large text is referred to as Large Text Mode.

Palette: is used to select the color palette. It can be set to SIMRAD1, SIMRAD2, PROFILE or USER. The SIMRAD1 palette is similar to the palette used in the Mesotech Model 971 sonar. The SIMRAD2 palette is similar to the palette used on color echo sounders produced by Simrad. PROFILE is similar to SIMRAD1 but with lower intensities for most of the colors. It is recommended to use this palette when in Profile Mode, to get maximum contrast between the profile points and the rest of the image. The USER palette allows the creation of a custom palette that will be saved in the battery backed-up memory.

Hor. Center: can be set from -20 to 20 and is used to adjust the horizontal position of the sonar display so it is centered on the video monitor.

Ver. Center: can be set from -20 to 20 and is used to adjust the vertical position of the sonar display so it is centered on the video monitor.

Offset: this entry is used for rotating the sonar image on the screen by steps of 90 degrees.

This is basically a display modification and has no effect on the actual position of the transducer. The offset should primarily be used in instances where the transducer is out of phase with the zero degree heading of the sonar head. The situation may arise when different types of transducers are used with the same (low profile) sonar head housing. Setting the display offset to 270 degrees say, would introduce a rotational phase shift of -90 degrees between the transducer heading and the sonar head zero degree heading.

Note that this entry **must** be set to zero for normal operation of the system and should only be used for situations where there is a rotational phase shift associated with the transducer as explained above, otherwise the user would effectively be introducing a phase shift in the cursor, sector heading, profile data and compass readings.

4.13.1 The User Palette

When Palette: USER is selected in the DISPLAY MENU, four additional menu items appear:

```
┌─────────────────────────────┐
│ DISPLAY MENU                │
├─────────────────────────────┤
│ Palette:     USER           │
│ Color:       2              │
│ Red:         6              │
│ Green:       2              │
│ Blue:        0              │
│ Hor. Center: 0              │
│ Ver. Center: 0              │
│                             │
│                             │
│                             │
│                             │
└─────────────────────────────┘
```

Figure 4.15 The User Palette DISPLAY Menu

Color: is the color number to be adjusted. It can be set from 0 to 7 or to GRID. The Magnifier Area will be filled with the selected color to aid in adjustment.

Some color numbers have special significance as follows:

Colors 0 through 7 are the colors used to show the different return levels from weakest to strongest.

Color 0 is also used as a background color for the entire display.

Color 6 is also used for the text color in the menus in SMALL TEXT mode.

Color 5 is used for text color in LARGE TEXT mode.

GRID color is the color used for the Grids and Cursor. It is also used to highlight a Held display or error messages in the Joystick Status Box.

Red: is the amount of red in the selected color. It can be set anywhere from 0 (no red) to 15 (maximum red).

Green: is the amount of green in the selected color. It can be set anywhere from 0 (no green) to 15 (maximum green).

Blue: is the amount of blue in the selected color. It can be set anywhere from 0 (no blue) to 15 (maximum blue).

4.13.2 Some Notes on Adjusting the Colors

Colors are adjusted by changing the amounts of red, green and blue in each Color number. Thousands of combinations are possible. For example:

Various shades of Red are obtained by setting Green and Blue to 0 and Red to some higher number.

Black is obtained by setting Red, Green, and Blue all to 0.

White is obtained by setting Red, Green, and Blue all to 15.

Various shades of grey result when Red, Green, and Blue are all set to the same value.

Note!

Yellow is obtained by setting Red and Green to 15 and Blue to 0. Color 0 will automatically be set to Black and Color 6 to White if you try to set either color too close to the other. This is done to prevent the menu from disappearing against the background.

For 128 color systems the adjustable colors 0..7 represent 8 equally spaced colors in the 128 color spectrum. The remaining colors are calculated from the user-adjustable colors using an interpolation technique to obtain 128 colors with smooth transitions.

4.14 THE PRINTER MENU

The PRINTER MENU is used to control printing to an optional color printer such as the Hewlett-Packard PaintJet and DeskJet, etc.. It is shown in below Figure 4.16.

```
┌─────────────────────────────┐
│ PRINTER MENU                │
├─────────────────────────────┤
│ Print Display               │
│ Printer:   HP-DJ            │
│ Palette:   SIMRAD1         │
│                             │
│                             │
│                             │
│                             │
│                             │
│                             │
│                             │
└─────────────────────────────┘
```
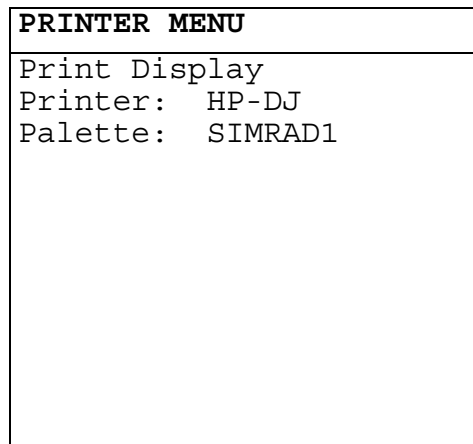
Figure 4.16 The PRINTER Menu

Print Display is used to print the sonar display on the optional color printer.

Printer: is used to select the type of printer attached to the MS 900D. Note that settings "BMP-I" and "BMP-S" are used to send print to a PC in the form of a bitmap. The "I" and "S" stand for image and sonar respectively.

Palette: is used to select the color palette to be used for printing. Possible settings are SIMRAD1, SIMRAD2, and USER.

4.14.1 Printing The Display

If Print Display is selected, an additional message will appear in the **PRINTER MENU** as follows:

```
┌─────────────────────────────┐
│ PRINTER MENU                │
├─────────────────────────────┤
│ Print Display               │
│                             │
│    PRINTER READY            │
│ ******************          │
│ Press ZOOM to Print         │
│       -or-                  │
│ Press MENU to Abort         │
│ ******************          │
│                             │
│                             │
│                             │
│                             │
└─────────────────────────────┘
```
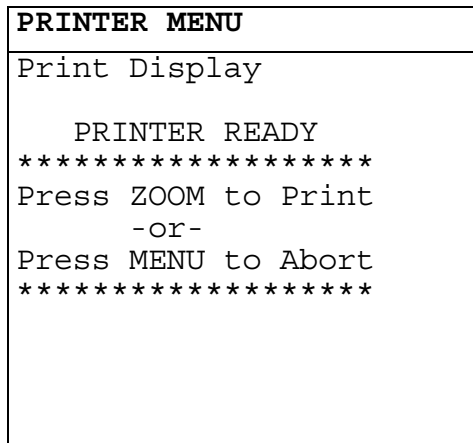
Figure 4.17 The Print Display PRINTER Menu

In addition, the Joystick Mode message in the upper right corner of the display will indicate `--PRINTER--` to remind you that the printer is "armed" and ready to print.

Note!

Printer menu display for systems with the Scan Rev. Button on the front panel indicate Scan Rev in place of zoom for all described print functions

Note!

If no printer is connected, or if the printer is not turned on, the status message will be NO PRINTER! Similarly, if the printer is out of paper, the status message NO PAPER! will appear. In either case, the printer is not ready and the PRINTER MENU will not change.

The sonar will continue to operate normally until the ZOOM button is pressed. This will freeze the display and print it on the printer. Printing time is about two minutes. The MENU button can be pressed anytime to cancel the printing operation either before or after printing is started.

This scheme allows any of the displays to be printed, even the System Test display. Note that if you want to print a zoomed display, it must be set up *before* arming the printer since the ZOOM button will start the printer.

4.14.2 The Printer Palettes

The color palette SIMRAD1 and SIMRAD2 for the printer are similar to the SIMRAD1 and SIMRAD2 palettes used for the display screen but with one significant difference: Black and White are reversed.

The reason for this is simply that the printer paper is white and the background color of the display screen is black. If the black areas of the display were to be printed in black, the printer would quickly run out of black ink and the printed image "just doesn't look right".

The remaining colors are as close as possible to the colors used on the display, but there will be some differences depending on the settings of contrast and brightness of the color monitor and the make of monitor used.

For 128 color systems, displays are represented in the same 8 colors used for 8 color systems. The printer colors represent 8 signal levels evenly spaced within the sonar image color spectrum. This will reduce the image definition of the printed copy.

It is also possible for you to select your own colors for the printer. You can select from any of the colors shown on this printout.

Note!

To print a colour spectrum on a PaintJet printer:

■ *Turn the printer Off.*

■ *Press the LF (Line Feed) button down and hold it down while pressing the ON/OFF button to turn the printer On.*

■ *Release the ON/OFF button first, then release the LF button.*

■ *The printer will print two pages. Discard the first page. The second page is the color spectrum you will need.*

The color spectrum printout contains a total of 330 colors arranged in 33 rows and 10 columns. Colors are referred to by their Row number and Column number. For example:

Row 15 Column 4 is bright yellow,
Row 33 Column 10 is white,
Row 33 Column 7 is black.

When the Printer Palette is set to USER, three additional menu items appear as shown in Figure 4.18 below:

```
┌──────────────────────────────┐
│ PRINTER MENU                 │
├──────────────────────────────┤
│ Print Display                │
│ Palette:   USER              │
│ Color:     3                 │
│ Row:       6                 │
│ Column:    7                 │
│                              │
│                              │
│                              │
│                              │
│                              │
│                              │
│                              │
└──────────────────────────────┘
```

Figure 4.18 The User Palette PRINTER Menu

Color: is used to select the color number to be defined. It can be set from 0 to 7 or to GRID

Row: is used to select the row number of the color on the color spectrum printout.

Column: is used to select the column number on the color spectrum printout.

To define your own printer palette, set the Row and Column values for each of the 9 Colors. All the settings will be saved in the non-volatile memory when the Joystick is pushed to the left to exit the PRINTER MENU.

4.14.3 Bitmap Transfer

The MS900D Bitmap Transfer installation kit consists of the following items:

· BMP900 V1.0 Software Disk
· Parallel File Transfer Cable (Belkin F3D508-10)

4.14.3.1 Theory of Operation

The MS900D Bitmap Transfer Feature allows the user to transfer a sonar image from the MS900D processor to any PC running DOS or Windows. The parallel file transfer cable installed between the Printer connector on the rear of the MS900 and either LPT1 or LPT2 on the PC is used for this purpose.

The data stored on the computer will be in a Windows .BMP format which can be read by many Windows programs.

4.14.3.2 Installation

General Introduction
The installation of this kit consists of three sections:

· Installing the Bitmap Software
· Connecting the Parallel File Transfer cable

Software Installation
The two files on the Simrad diskette are:

· **Readme.txt** Installation Instructions (Use Notepad or DOS Edit to view)
· **Bmp900.exe** Program File

These two files can be copied to any desired directory on your computer using a DOS or Windows copy command.

   NOTE: Program must be run in DOS (or DOS Mode in Windows95).

Connecting the Cable
Connect either end of the File Transfer Cable to the Printer connector on the rear of the MS900 processor. Connect the other end of the cable to a parallel printer port on a computer.

4.14.3.3 Operation

General Introduction
The operation of the Bitmap Transfer software is simple and easy to use.

Operation
The following procedure will help with start-up:

· To start the Bitmap Transfer software, type **BMP900** at the DOS prompt.
· To activate the Menu, click on FILE or use "ALT F" as a shortcut.
· To select a printer port, click on "Select Printer Port" and select"LPT1" or "LPT2".
· To select a destination directory for file storage, click on "Change Directory".
· To acquire sonar data, click on "Get Sonar Data".
· To store a transferred image, click on "File/Get Sonar", and enter a filename with a .BMP extension.
· To transfer an entire MS900 screen including the menu, select the "Printer Menu" in the MS900 and "BMP-S".
· To transfer the sonar portion of the MS900 screen, select "BMP-I".
· To start the transfer, select "Print Display" and then press the "Zoom" front panel (or Scan Rev Button) key when you are ready to transfer the image.

4.15 PROFILE MENU

The PROFILE MENU, shown in Figure 4.19, contains a list of parameters that are incorporated in the target detection procedure. When the system is set to profile mode, a series of points corresponding to the boundary of the desired target are displayed on the monitor.

The profile points are always displayed in the same colour as the menu text which is normally white with the exception of SIMRAD3 palette. In order to distinguish between the profile points and the rest of the image, all image data with the same colour as the profile points are converted to a lower colour prior to displaying. This is merely a display option and does not alter the actual amplitude of the returned signal. For added clarity, the user may set the display palette to PROFILE. This will increase the contrast between the profile points and the rest of the image.

```
PROFILE MENU

Profiling:    ON
Threshold:    3
Returns:      2
Min. Range: 10.30 m
Min. Width:  1.37 m
Min. Gap:    5.06 m
Filter:       ON
```

Figure 4.19 The PROFILE Menu

Profiling: is used to enable (ON) or disable (OFF) the profile mode. It should be noted that the profiling procedure can slow down the scanning speed.

Threshold: Image points with amplitudes equal or higher than the threshold are considered as candidates. It can be set to any value from 1 to 7 inclusively. This feature aids the rejection of noise and other undesired signals. For 128 color system the range is 1..127.

Returns: describes the number of possible targets at each bearing. The system is capable of detecting up to 6 targets at any bearing. This feature allows the user to profile complex objects.

Min. Range: This determines the closest possible target to the sonar. By setting this parameter to a particular range, the user can prevent the system from considering any points closer than that range to be a candidate target. The setting is displayed in the current Range Unit and can assume any value within 0.1 to 100.0 meters.

Min. Width: is the smallest possible width of the target along a scan line. This parameter is used in conjunction with the setting of the threshold. The number of neighbouring points with amplitudes greater or equal to the threshold, has to be larger than the setting of Min-Width before the system can grant a profile point to them. The parameter setting is displayed in the current range units and can assume any value within 0.01 to 10.00 meters.

Min. Gap: describes the minimum spacing between the targets along a scan line. This parameter is effective only for multi target detection (when the parameter *Returns* is set greater than 1). Once the system has detected a target, it avoids any other candidate within the Min-Gap range. The setting of this parameter is displayed in the current range unit and can assume any value within 0.00 to 30.00 meters at steps of 0.01 meters. For overlapping targets, this parameter should be set to zero. In this case the system assigns a profile point at Min-Width intervals, as long as the amplitude of the return signal is greater than the threshold.

Filter: is used to smooth the profile points. Once enabled (**ON**), neighbouring profile points at different bearings are placed close to each other so that continuity of the target boundary is preserved. It must be noted that the filtering process is computer intensive and can slow down the scanning speed.

In general, a wide variety of targets can be detected by the profiling algorithm. The procedure can be optimized for specific environments to provide correct profile points, utilizing different combinations of the above settings. Consider the following example, where the exact range of three cargo ships anchored in the harbour are required to be measured. The number of Returns are therefore set to 3. If the ships are legally bound to anchor more than 30 meters from the shore, then the Min-range should be set to 30 meters. It is preferred for the system to avoid detection of the smaller pleasure boats. Hence the Min-width will have to be set to the width of the smallest ship (note that this value is dependent on the orientation of the ship with respect to the sonar). It is also predicted that the ships are not anchored closer than 25 meters from each other. The Min-gap must therefore be set to 25 meters. The Threshold setting is dependant on the strength of the returned signal and should be set accordingly. With the above settings, any vessel that is closer than 30 meters to the shore or 25 meters to another vessel or has a width of less than the setting of Min-width will not be detected as a candidate target. The resulting profile points may then

be sent to a central processing station via the serial port, for automatic analysis and monitoring.

4.16 SELF-TEST MENU

The SELF-TEST MENU is used to select the self test operations. It is shown in
Figure 4.20 below followed by a description of its contents.

```
┌─────────────────────────────┐
│ SELF-TEST MENU              │
├─────────────────────────────┤
│ System Test                 │
│ Serial I/O Test             │
│ Calibrate                   │
│ Telemetry Test              │
│ Surf Test                   │
│ Head Test                   │
│ Reset Head                  │
│ SS Transmit                 │
│ Test X.-PLS                 │
│                             │
│                             │
│                             │
└─────────────────────────────┘
```

Figure 4.20 The SELF-TEST Menu

System Test will perform a series of tests on most of the major system compo-
nents and display the results of each of these tests.

Serial I/O Test will start a test of the RS-232 serial I/O port. To use this test, the
external serial I/O device to be checked must be connected to the I/O port and the
settings in the Serial I/O Menu must be set to match this device. During this test,
the printable ASCII character set is output repeatedly. Any printable characters
received from the external device are displayed on the screen. The test is
terminated when the screen becomes full when the joystick is moved, or when any
of the four front panel control buttons are pressed.

Calibrate will repeat the sonar head calibration that normally occurs on power-
up.

Telemetry Test will continuously send and receive test data to the head, which is
compared to detect telemetry errors. This can be useful when troubleshooting the
cable telemetry system. Hold the joystick to the left to exit this test.

Surf Test: These tests are reserved for system diagnostics at the factory. Tests
0-4 will not be noticed if engaged by the operator. Tests 5,6,7 will interrupt the
operation of the head for approximately 10 seconds.

Head Test: These tests have been reserved for future head capabilities and serve no function at this time.
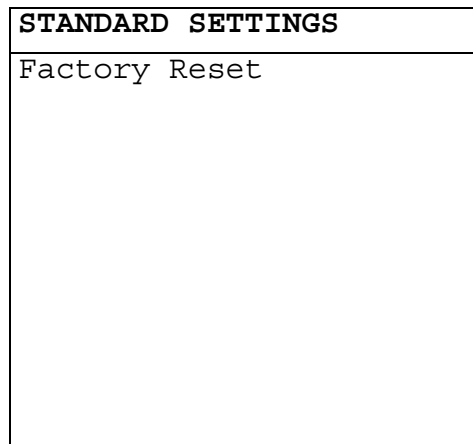
Head Reset: This test completely resets the hardware and software in the sonar head; as such it takes approximately 5 seconds to complete.

SS Transmit: To check to see what background noise is present this test enables the user to turn off the transmitter in the side scan mode of operation. It only will work with the side scan mode enabled.   If the user begins to detect directional noise on a polar (or sector) plot. The direction should be noted and this test employed to determine if it is acoustic or electrical interference.

Test X-PLS: A test transmit pulse can be set in this menu selection. This allows the user to over-ride Auto X-mit Pulse length selection (in the Configuration MENU). The operator-selected pulse length will be used until the range is changed; if the operator wants to change the pulse length at the new range, enter into the Test X-PLS and change it as desired. An advantage to a lower pulse length is less output power, and as such, less chance of acoustic multiples in a confined environment. The backside of this is the signal to noise ratio increases when a smaller pulse length is used.

4.17 THE STANDARD SETTINGS MENU

The STANDARD SETTINGS MENU is used to reset the most important sonar settings to a known or "Factory Reset" state. It is shown in Figure 4.21.

```
┌────────────────────────────┐
│ STANDARD SETTINGS          │
├────────────────────────────┤
│ Factory Reset              │
│                            │
│                            │
│                            │
│                            │
│                            │
│                            │
│                            │
│                            │
│                            │
└────────────────────────────┘
```

Figure 4.21 The STANDARD SETTINGS Menu

Factory Reset will cause several sonar and menu settings to be reset to known states. This should be done if there is any doubt that the sonar is not functioning properly due to improperly set controls.

PART 5

SYTEM STARTUP AND SHUTDOWN

5. SYSTEM STARTUP AND SHUTDOWN

5.1 INTRODUCTION

This section explains how to start up and shut down the sonar system.

5.2 START UP

Note!

In circumstances where the sonar head is being powered from a remote source (as in most ROV applications), power must be applied to the head prior to initializing the MS 900D. Failure to follow this sequence will result in a calibration problem as the MS 900D cannot recognize the sonar head.

5.3 TURN ON THE DISPLAY UNIT

Turn on the Display Unit power switch. The Pilot light on the display unit should light.

Note that a built-in time delay requires that this button be held for approximately one second before system power is applied.

TURN ON THE SONAR SYSTEM

Press the **POWER ON** keypad button on the control panel. The six keypad buttons should light up dimly. The operator can change the video format or system configuration using the procedure described in Section 4.3.

Note: The system should remain in the power OFF state for at least 1 second before power ON again. The reason is that the system distinguishes between "war" and "cold" resets.

WAIT FOR AUTOMATIC START UP SEQUENCE TO COMPLETE

The Sonar system will automatically run through a four stage start up sequence, each stage requiring a few seconds. A message will appear on the screen during each stage:

SELF-TEST... The system is performing a test of the hardware and software. The results will be shown later if any of the tests fail.

DETECTING HEADS... The system is interrogating the attached sonar heads.

RESTORING SETTINGS... The system is recovering the menu settings and other data stored in the non-volatile memory.

CALIBRATING HEAD... The stepper motor drive system in the sonar head is being calibrated. The transducer is rotated from one extreme to the other. This test is not performed in the SIDE SCAN HEAD system configuration.

THE SONAR DISPLAY SHOULD APPEAR

If all the Self Tests have passed, the sonar display will appear on the screen. The display mode and menu settings will be the same as they were before power down.

SELECT THE DISPLAY MODE

Press the MENU button if necessary to get the MENU ACTIVE indication in the upper right corner of the display. Use the Joystick to select the desired display mode. The normal display mode is the Polar mode. The Linear mode can be useful to see details of targets at short ranges. In the SIDE SCAN HEAD system configuration the side scan display mode is always selected; Linear, Sector & Polar display modes are not available.

SELECT THE RANGE

Press the RANGE/GAIN button to get the RANGE ADJUST indication in the upper right corner of the display. Push the Joystick up or right to increase the range setting. Press the Joystick down or to the left to decrease the range setting.

SELECT THE SECTOR WIDTH AND HEADING

Adjust the SECTOR WIDTH and SECTOR HEADING controls to set the desired sector to be scanned. The SECTOR indicators in the display will show the current sector size and direction. In the SIDE SCAN HEAD configuration,

the WIDTH & HEADING controls set the LEFT & RIGHT channel gains, respectively.

SET THE GAIN

Press the RANGE/GAIN button again to get the GAIN ADJUST indication in the upper right corner of the display. Push the Joystick up or right to increase the gain. Press the Joystick down or to the left to decrease the gain. In the SIDE SCAN HEAD system configuration, joystick control of GAIN is not available. Use the SECTOR WIDTH & HEADING controls instead, as described above.

5.4 SHUT DOWN

TURN OFF THE SONAR SYSTEM

Press the POWER OFF keypad button on the control panel. The keypad lighting should go out and the display should disappear.

Note that a built-in time delay requires that this button be held for approximately one second before system power is removed.

TURN OFF THE DISPLAY UNIT

Turn off the Display unit power switch. The pilot light on the Display unit should go out.

PART 6

TROUBLESHOOTING

6. TROUBLESHOOTING

6.1 INTRODUCTION

This section describes how to use the built in test features of the sonar system to do basic troubleshooting.

6.2 BASIC CHECK LIST

If the system is completely dead, check the fuses as described in section 3.4.1.

If the system powers up but there is no display or the display will not synchronize, check the setting of the Video Display mode as described in section 4.3.1.

For problems with the serial I/O, refer to Appendix A.

6.3 SYSTEM TEST

The System Test is performed automatically every time the system is powered up. Results are shown only if one or more of the tests fail.

The system Test also can be performed any time after power up by selecting "System Test" in the SELF-TEST MENU. Here results are shown even if all tests pass.

The System Test is a series of tests designed to detect problems and isolate them to one part of the system. It also displays a list of any optional sensors that are installed in the Sonar Head.

Results for each test are reported with one of the following words:

NORMAL (Green background) The test has passed.

FAILED (Red background) The test has failed.

UNKNOWN (Red background) The test could not be performed due to the failure of another test.

LOW (Red background) The test has failed because the parameter being measured is lower than normal.

HIGH (Red background) The test has failed because the parameter being measured is higher than normal.

6.3.1 System Processor Tests

The following tests are performed on the system processor:

Software Version This test reports the version number of the software in the system processor. A failure message of LOW or HIGH for this test shows that the software version is not compatible with the software installed in the Sonar Head. "B" indicates a 128-color system.

ROM Test This test is a checksum test of the EPROM's in the system processor. If it is reported as FAILED, it means that at least one of the EPROM's is faulty and both should be replaced.

RAM Test This test checks all the RAM on the system processor board. If this test is reported as FAILED, the system processor board should be replaced.

Video Mode shows the current video mode VGA, NTSC (when RGB mode is selected).

6.3.2 Sonar Head & Interface Tests

The following tests are performed on the sonar head and interface:

Interface Type shows the interface type number. If the failure message UNKNOWN is shown, it indicates an incompatible interface type or other internal hardware problem.

Interface Errors shows the number of internal communication failures that have occurred since the last time the test was made. Anything other than zero indicates an internal hardware problem.

Head Type shows the type of sonar head connected to the system currently, head types 13 is compatible with the MS 900D software. Any other head type will be shown as UNKNOWN.

Sensors will list any optional sensors that are installed in the sonar head such as a compass. If no sensors are installed, nothing will be shown.

6.3.3 Calibration CW CCW

This test shows the results of the sonar head motor drive calibration. Four angular reference points located approximately 90 degrees apart are checked in both the clockwise (CW) and counter-clockwise (CCW) directions. It is normal for there to be a few degrees difference between the CW and CCW reference points. If the differences are too great, they will be reported as FAILED. This can indicate a problem with the sonar head or possibly a problem due to noisy telemetry.

6.3.4 Telemetry

The following tests are performed on the cable telemetry system:

Parity Errors is a count of the total number of parity errors that have been detected since the Self-Test was last run. Parity checking is used when reading the Head Type and when reading an optional compass.

Ack Errors is a count of the total number of head motor step command acknowledgments received incorrectly since the last time the Self-Test was run.

Telemetry Timeouts is a count of the total number of commands that were not acknowledged by the head since the Self-Test was last run.

Telemetry errors and timeouts are usually caused by noise induced into the surface to head cable system and a few errors per hour are normally acceptable. The system is designed to be tolerant of telemetry errors and will make automatic corrections and continue to operate as long as a telemetry rate of at least 9600 bps is possible. The display of the accumulated errors is provided to give a general indication of the "health" of the system.

6.4 CONTROL PANEL TESTS

The System Test also includes a graphic control panel test that allows each panel control to be checked for proper operation.

Initially, most of the controls will be shown in white indicating that they have not been tested yet. To test each of the controls proceed as follows:

6.4.1 Power Buttons

There is no test for the POWER ON/OFF buttons in this test, so leave them alone unless you want to turn the system off.

6.4.2 Control Mode Buttons

First, verify that all four buttons are shown in white. If any of them are Red to begin with, it probably means that the pushbutton is stuck on and faulty.

Next, press each of the four control mode buttons one at a time. The button on the display should turn Red while the button is pressed and turn Green when it is released indicating that it works properly.

If any of the buttons remain White when pressed or remain Red when released, it is not working.

6.4.3 Joystick

First, verify that the center position of the display Joystick is Red and the other eight positions are all White.

Next, move the Joystick to every possible position and verify that the current position is shown in Red and previously tested positions have turned Green. The Joystick test can be considered to pass if all positions are shown in Green except the current position that will be shown in Red.

6.4.4 Sector Width and Sector Heading Controls

First, verify that the positions of the SECTOR HEADING and SECTOR WIDTH controls are indicated by a Red pie slice on top of a larger White pie slice.

Next, adjust each control slowly from one extreme to the other. As the controls are moved, the tested area of the White pie slice should turn Green and the present position will be shown by the narrow Red pie slice.

These tests can be considered to have passed if the entire white area of the pie can be turned into Green.

Note that if the controls are moved too quickly during this test that some areas may remain white. If this happens, adjust the control slowly through this area until it turns Green.

If it is still not possible to remove all the White from the pie, the control potentiometer may be faulty and should be replaced.

6.4.5 Ending the Control Panel Test

Press any two of the CONTROL MODE buttons simultaneously to end the test and return to the normal sonar display.

PART 7

ROUTINE MAINTENANCE

7. ROUTINE MAINTENANCE

7.1 MONTHLY MAINTENANCE

7.1.1 Processor

Gently wipe clean the display screen and the control panel with a soft, slightly dampened cloth.

Check to ensure that all interconnecting cables are tight and making good electrical connection.

7.1.2 Sonar Head

Wash the transducer active area using a mild liquid dish-washing detergent. The purpose of this is to remove any film of oil on the transducer. Oil can interfere with the coupling of the transducer to the water and can reduce the effective range of the sonar.

PART 8

SERIAL CONTROL

LIST OF FIGURES

8. SERIAL CONTROL

The MS900 Processor's serial interface enables the operator to externally control the system using a remote terminal or computer. This section describes the control of the MS900 Processor through the serial interface.

The serial interface input allows external entry of several menu, text, and other data parameters as well as some front panel switch functions. The serial interface output provides command acknowledges as well as data output such as profile or compass for external processing by a computer. All serial input and output sequences are composed of ASCII characters, terminated by a carriage return / line feed character pair (denoted as `<CRLF>`).

8.1 SERIAL I/O CONNECTION

The MS900 Processor's serial port uses a 3 wire RS-232C asychronous-mode interface. The pin-outs for the rear panel serial connector (DB25 pin male) are as follows:

> pin 2 - Data In (RxD)
> pin 3 - Data Out (TxD)
> pin 7 - Common
> other pins - no connection

The SERIAL I/O MENU (section 4.11) should be configured to same specifications as the external terminal or computer for proper communications. The Serial I/O Test should be used to verify proper operation. If no data can be sent or received, try swapping the connections to pins 2 and 3.

8.2 SERIAL I/O COMMANDS

The MS900 processor recognizes two basic classes of serial input commands: **DISPLAY CONTROL** and **REMOTE OPERATION**. DISPLAY CONTROL commands allow the external computer to specify text labels to be displayed on-screen as well as to clear the sonar display. REMOTE OPERATION commands are used to externally set menu parameters as well as panel-controlled settings.

In the command definitions that follow, characters in **bold** letters denote actual ASCII characters. The linefeed character is denoted `<LF>` and the carriage

return, linefeed character pair is denoted as `<CRLF>`. Command argument character fields are italicized and delimited by "*{ }*" brackets. Numeric values are represented as ASCII characters.

8.3 DISPLAY CONTROL COMMANDS

The external computer can specify labels to be displayed in either the sonar image or status display areas as defined in section 4.4. These command strings have the following format:

$$\{C\}\{str\}<CRLF>$$

where:

{C}   is a single character command prefix.

{str}   is a text string representing the desired setting of the parameter to be adjusted. Leading spaces will be ignored. In the case of numeric settings, leading zeros will also be ignored. All numeric values must be integers.

`<CRLF>`   is the terminating carriage return, line feed pair.

No command acknowledges are sent back to the external computer but results will be immediately seen on the display.

Text can be placed in the sonar image area (**USER IMAGE TEXT**) or in the status display area (**USER STATUS TEXT**).

8.3.1 User Image Text

The following commands allow the external computer to specify labels to be drawn on the sonar image area of the display:

U*{text}*`<CRLF>`   defines the label to be displayed. *{text}* is an ASCII string of between 0..40 characters.

X*{xxx}*`<CRLF>`   defines the horizontal pixel position of the label relative to the top left corner of the sonar display area. *{xxx}* specifies an ASCII value between 1 and 478 inclusive.

Y*{yyy}*`<CRLF>`   defines the vertical pixel position of the label relative to the top left corner of the sonar display area. *{yyy}* specifies an

ASCII value between 1 and 478 inclusive.

T$\{s\}$<CRLF>   defines the font size $\{s\}$ to be used (0=small, 1=medium, 2=large).

User image text is always displayed in the present GRID color. The following example command sequence will print the word "Hello" in medium size letters near the center of the sonar image area:

UHello<CRLF>
X200<CRLF>
Y200<CRLF>
T1<CRLF>

The commands can be sent in any sequence and do not all have to be sent every time a change is desired. For example, if the following command is sent:

T2<CRLF>

the message will be redrawn in the same position using the large font.

8.3.2 User Status Text

The following commands allow the external computer to specify labels to be displayed in the Status Display Area of the screen, as shown in Figure 4.4, where $\{text\}$ is a 0..6 character string:

A$\{text\}$<CRLF>   defines the label at location **TEXT A**.

B$\{text\}$<CRLF>   defines the label at location **TEXT B**.

C$\{text\}$<CRLF>   defines the label at location **TEXT C**.

D$\{text\}$<CRLF>   defines the label at location **TEXT D**.

E$\{text\}$<CRLF>   defines the label at location **TEXT E**.

F$\{text\}$<CRLF>   defines the label at location **TEXT F**.

As an example, the following series of commands will produce the text shown in Figure 8.1.

AHDG<CRLF>
B135<CRLF>
CDEPTH<CRLF>
D34.8<CRLF>
EALT<CRLF>
F12.5<CRLF>

HDG	DEPTH	ALT
135	34.8	12.5

Figure 8.1 Status Text Display

A null string (zero length) will erase the corresponding label on the display. For example, **A**<CRLF> will erase the text at location **TEXT A**.

The user text locations in the Status Display Area can be used to display externally-entered ASCII heading, depth, and altitude data using the following shorthand command:

    \$*{hhh}{ddd}{aaa}*<CRLF>

where *{hhh}*, *{ddd}*, and *{aaa}* are heading, depth and altitude, respectively. These values must be 3 character integers (including optional sign) padded with leading or trailing spaces as necessary. The command is equivalent to the following command sequence:

    AHDG<CRLF>
    B*{hhh}*<CRLF>
    CDEPTH<CRLF>
    D*{ddd}*<CRLF>
    EALT<CRLF>
    F*{aa.a}*<CRLF>

All labels displayed on-screen will remain until another User Status Text command is received, or when the processor is turned off (labels are not saved in non-volatile memory).

8.3.3 Redraw Display Request

The following command will force the MS900 Processor to clear and redraw the entire screen:

`R`<CRLF>

This command is ignored in any of the test display modes.

8.3.4 Latitude/Longitude Data Display

The MS900 accepts positional data via the serial port. The data format is based on the Standards for Interfacing Marine Electronic Devices, NMEA 0183 Version 2. The following formats are adopted.

GGA - Global Positioning System Fix Data
GLL - Geographic Position - Latitude/Longitude

The received data is in ASCII with the general format.

$*{Sender ID}{Format ID},{Data field}*

The "$" character indicates the start of the sentence. All positional data sent to the MS900 have to start with this character. The "Sender ID" specifies the external device. This is a two character code such as

GP for Global Positioning System
LC for Loran C

The "Format ID" is a three character code describing the data format. The MS900 can only accept data in **GGA** and **GLL** formats. The "Format ID" has to be followed by a "," and the "Data field". Possible data fields are described in the following sections.

8.3.4.1 Global Positioning System Fix Data (GGA)

The data format for the GGA is

$--GGA,*{time}*,**llll.ll,a,yyyyy.yy,a,***{Other data}*<CRLF>
where
   --   represents the Sender ID.

   time   is the Universal Time Coordinated (UTC).

   llll.ll   is the Latitude with

two (fixed) digits of Degrees,
two (fixed) digits of Minutes and
a variable length decimal fraction.

a   is one (fixed) character indicating North (N) or South (S).

yyyyy.yy is the Longitude with
three (fixed) digits of Degrees,
two (fixed) digits of Minutes and
a variable length decimal fraction.

a   is one (fixed) character indicating East (E) or West (W).

Other data   represents additional data such as GPS quality indicator, units of
geoidal separation, etc.

The "time" and "other data" described above are ignored by the MS900 and only
the Latitude and Longitude data are extracted and displayed. The format of the
data, however, must be maintained. If the value of a particular parameter is not
available, it may be replace by a NULL character. An example of the GGA format
is

   $GPGGA,,5652.83,N,00950.4,E<CRLF>

Note that the time is omitted but the commas are still present.

8.3.4.2 Geographic Position - Latitude/Longtitude (GLL)

The data format for the GLL is

   $--GLL,llll.ll,a,yyyyy.yy,a,*{Other data}*<CRLF>

the parameter description is the same as that of the GGA. The difference is that
the GLL format does not contain the time information. An example of the GGA
format is

   $GPGLL,0301.9,S,08950.431,W<CRLF>

8.3.4.3 Data Display

The extracted Latitude and Longitude are displayed in the Status-Text-Display
area as shown in Figure 8.2 for Small Text mode and Figure 8.3 for Large Text

mode.

	03° 01	089° 50
	.9 S	.431 W

Figure 8.2 Status Text Display in Small Text Mode

03° 01 . 9S
089° 50 . 431 W

Figure 8.3 Status Text Display in Large Text Mode

8.4 REMOTE OPERATION

The Remote Operation class of serial input commands permits external setup and control of the MS900 Processor. These commands can directly effect menu-entered settings as well as emulate front panel controls. An external computer can therefore automatically configure and operate the MS900 with little or no user intervention.

When a remote operations command is received, the MS900 Processor will enable **REMOTE OPERATIONS MODE** in which all front panel controls are disabled (except for POWER), and all control is performed solely by the remote computer. A specific command (described in section **Error! Reference source not found.**) must be issued to terminate REMOTE OPERATIONS MODE and re-enable the front panel controls.

Remote operation commands may be entered in either upper or lower case; they will be internally converted to upper case in the MS900 Processor. All commands must be prefixed with an "**S**" and terminated with a carriage-return / line-feed pair <CRLF>. All space characters will be ignored.

The external computer should wait for a brief period for the proper acknowledgment (section **Error! Reference source not found.**) from the MS900 processor before issuing the next command.

There are 4 types of Remote Operation commands:

1) **Menu Settings:** These commands modify most of the menu-entered settings. The format of the command string is as follows:

> **S***{mmm}{ss}*=*{val}*<CRLF>

where *{mmm}* is a 3 character code specifying the menu in which the setting to be modified is located. *{ss}* is a 2 character code specifying the selected setting. *{val}* is the new assigned value. Commands with invalid codes and/or assigned values will be ignored. A list of valid codes, along with their valid settings is shown in Table A.1.

As an example, the following sequence will select "feet" as the displayed range units, which is located in the CONfiguration menu:

> **SCONRU=F**<CRLF>

2) **Menu Help:** These commands request menu help. Valid commands will be acknowledged with a formatted ASCII text data block describing the possible settings for the menu specified in the command (see section **Error! Reference source not found.**). The format of the command string is as follows:

> **S***{mmm}***?**<CRLF>

where *{mmm}* is a 3 character code specifying the menu selected. Command strings with invalid menu codes or extra non-space characters inserted between the "**?**" and the <CRLF> terminator will be ignored. A list of valid menu codes is shown in Table A.1.

As an example the following sequence will request help on the CONfiguration menu:

> **SCON?**<CRLF>

A special case of the menu help commands is when the *{mmm}* field is a null string, i.e. "**S**<CRLF>" command is issued. This special command will generate a formatted summary of control panel and MAIN MENU commands. It is important to note that this specific command will **NOT** enable or disable REMOTE OPERATIONS MODE!

3) **Direct Control Settings:** These commands directly modify front panel and MAIN MENU settings, such as sector center, sector width, and display mode. The format of the command string is as follows:

> **S**$\{sss\}$**=**$\{val\}$<CRLF>

where $\{sss\}$ is a 3 character code specifying the setting to modify. $\{val\}$ is the new assigned value. Command strings with invalid codes and/or assigned values will be ignored. A list of valid codes along with their valid settings is shown in Table A.1.

As an example, the following sequence enables the POLAR display mode:

> **SDIS=P**<CRLF>

4) **Toggle Controls:** These commands emulate front panel controls such as key presses as well as menu settings which toggle some display features. The format of the command string is as follows:

> **S**$\{sss\}$<CRLF>

where $\{sss\}$ is a 3 character code specifying the switch to emulate, or the setting to toggle. Command strings with invalid codes or excess non-space characters will be ignored. A list of valid codes is shown in Table A.1.

As an example, the following sequence will emulate two consecutive zoom button presses and initiate a scan reverse:

> **SZOM**<CRLF>
> **SZOM**<CRLF>
> **SREV**<CRLF>

8.4.1 Remote Operation Commands

This section lists all of the remote operations commands. Refer to Section 4 for further details on front panel settings and menu settings.

Return to Local Operation

The following sequence will terminate remote operation of the system and re-enable the front panel controls:

SLOC`<CRLF>`

Zoom Button

A zoom button press can be emulated by issuing the following sequence:

SZOM`<CRLF>`

This can be used whenever the normal ZOOM button press is appropriate i.e. for true zoom control or during PRINT operations. Serial output messages related to the ZOOM button may be issued, see section **Error! Reference source not found.** for details.

Menu Button

The following sequence will emulate a MENU button key press:

SMNU`<CRLF>`

This can be used whenever the normal MENU button press is appropriate i.e. to enable the joystick to adjust menus, to trigger the sector re-center feature (if enabled), or to cancel printing.

Dual Button Keypress

The following sequence is useful for emulating the dual simultaneous keypress required to exit the SYSTEM TEST RESULTS display page:

SBOT`<CRLF>`

This is the only valid command in the SYSTEM TEST RESULTS Display Page; all other commands will be ignored.

Cursor Control

The following sequences enable and move a cursor to new positions in the sonar image area:

SCRO=$\{x\}$**,**$\{y\}$`<CRLF>`   - Cursor 1
SCRT=$\{x\}$**,**$\{y\}$`<CRLF>`   - Cursor 2

       SCRZ=$\{x\}$**,**$\{y\}$**<CRLF>**   - Pixel Zoom Magnifier

where $\{x\}, \{y\}$ is the pixel position of the cursor center, relative to the top-left corner. $\{x\}$ and $\{y\}$ will both be limited to within 1..478.

Sector Width / Right Channel Gain

The following sequence modifies the sector width:

       SSCW=$\{width\}$**<CRLF>**

where $\{width\}$ is the width in degrees. Values will be rounded internally to the nearest 7.2 degrees and limited to within 7 to 360 degrees (full rotation). In LINEAR and SECTOR display modes, this will be limited to within 180 degrees. In SIDESCAN mode this command has no effect.

In the sidescan head configuration this command modifies the right channel panel gain, where $\{width\}$ is limited to within 0..255.

Sector Center / Left Channel Gain

The sector center can be changed by sending the following string:

       SSCC=$\{center\}$**<CRLF>**

where $\{center\}$ is the sector heading in degrees. Values will be rounded internally to the nearest 7.2 degrees and limited to within 0 to 360 degrees.

In the sidescan head configuration this command modifies the right channel panel gain, where $\{center\}$ is limited to within 0..255.

Display Range

The sonar display range can be specified by the following command sequence:

       SRNG=$\{range\}$**<CRLF>**

where $\{range\}$ is the range in meters. The range will be limited to within 5..250 meters and rounded to the nearest available range setting (as listed in the specifications section).

Gain

The front panel control gain is specified by the following command sequence:

    SGAN=$\{gain\}$CRLF

where $\{gain\}$ is the relative gain from 0..25. The value will be limited to within this range. This command is invalid in the SIDE SCAN HEAD system configuration.

Display Mode

The display mode can be specified by the following command sequence:

    SDIS=$\{d\}$<CRLF>

where $\{d\}$ = "**P**", "**C**", "**L**", or "**S**" to select Polar, seCtor, Linear, or Sidescan mode, respectively. This command is invalid in the SIDE SCAN HEAD system configuration.

Scan Speed

The following sequence modifies the scanning speed in all display modes except sidescan:

    SSCS=$\{speed\}$<CRLF>

where $\{speed\}$ = "**S**", "**M**", "**F**", "**X**", "**16**", "**32**", or "**64**" corresponding to speeds of 1, 2, 4, 8, 16, 32, or 64 steps per shot, respectively. This command is invalid in the SIDE SCAN HEAD system configuration.

Grid

The following sequence will enable or disable the sonar display grid:

    SGRD=$\{g\}$<CRLF>

where $\{g\}$ = "**O**" (Off) or "**N**" (oN).

Hold

The following sequence will hold or release the sonar display:

    SHLD=$\{h\}$`<CRLF>`

where $\{h\}$ = "**O**" (Off) or "**N**" (oN).

Scan Reverse

The following sequence will initiate a reversal in scan direction in the Polar, Sector, and Linear display modes:

    SREV`<CRLF>`

This command is invalid in the SIDE SCAN HEAD system configuration.

Sidescan Display Direction

The following sequence select the sidescan display mode direction:

    SSDS=$\{d\}$`<CRLF>`

where $\{d\}$ = "**L**" (Left), "**R**" (Right), or "**B**" (Both). The last selection is valid only in the SIDE SCAN HEAD system configuration. In the SIDE SCAN HEAD system configuration this command automatically selects the corresponding sonar head channel.

Pixel Zoom Display Magnifier

The magnification factor of the pixel zoom display can be specified with the following sequence:

    SMAG=$\{factor\}$`<CRLF>`

where $\{factor\}$ = "**O**" (Off),"**1**", "**2**", "**3**", or "**4**".

Display Threshold

The display threshold will be modified by the following sequence:

STHR=$\{threshold\}$<CRLF>

where $\{threshold\}$ is the threshold color level. For 8 color systems, this setting will be limited to 1..7. For 128 color systems the limits are 1..75.

Clear Display

The following sequence will clear the sonar image area of the display:

SCLR<CRLF>

Range Units

The following sequence will modify the currently display range units:

SCONRU=$\{u\}$<CRLF>

where $\{u\}$ = "**F**" (feet), "**M**" (meters), "**Y**" (yards).

Speed of Sound

The following sequence specifies the speed of sound used in range calculations:

SCONSS=$\{speed\}$<CRLF>

where $\{speed\}$ is the speed in m/sec. This value is limited to within 1400..1600.

Sector Scan Re-center

The following sequence will enable or disable the sector scan re-centering feature (see section 4.10):

SCONRC=$\{r\}$<CRLF>

where $\{r\}$ = "**O**" (Off) or "**N**" (oN). This command is invalid in the SIDE SCAN HEAD system configuration. Unless the "SLOC" command is

subsequently issued, the "SMNU" command should then be issued to trigger re-centering, since the front panel will be disabled.

Sector Scan Marker

The following sequence will enable or disable the sector scan position marker in the Polar, Sector and Linear display modes:

SCONSM=*{m}*<CRLF>

where $\{m\}$ = "**O**" (Off) or "**N**" (oN). This command is invalid in the SIDE SCAN HEAD system configuration.

Head/Transducer Mounting Position

The following sequence selects the head"s assumed mounting position:

SCONTR=*{t}*<CRLF>

where $\{t\}$ = "**U**" (Up/fore) or "**D**" (Down/aft). This command will immediately initiate a cable and head calibration sequence.

Polar Grid Type

The following sequence will select the Polar and Sector display mode sonar grid:

SCONGT=*{g}*<CRLF>

where $\{g\}$ = "**P**" (Polar) or "**R**" (Rectangular). This command is invalid in the SIDE SCAN HEAD system configuration.

Gain Contol

The new menu entry can be accessed and changed through serial port by sending the following command:

SCONGN = *{s}*<CRLF>

where *{s}* = "L" or "H" for low and high gain settings respectively. Note that

the new entry is in the CONfiguration menu, hence the code "S CON". Incremental gain adjustments can still be requested by the command **SGAN = *{gain}***. The difference now being that the *{gain}* can have any integer value up to 64 (representing 100% gain).

Serial I/O Baud Rate

The following sequence selects the serial interface baud rate:

> **SSERBR=**$\{rate\}$<CRLF>

where $\{rate\}$ = 300, 600, 1200, 2400, 4800, 9600 bits per second. It should be noted that **changing this parameter will result in loss of communications with the MS900 processor!**

Serial I/O Parity

The following sequence selects the serial interface parity:

> **SSERPA=**$\{p\}$<CRLF>

where $\{p\}$ = "**N**" (None), "**O**" (Odd), or "**E**" (Even). It should be noted that **changing this parameter will result in loss of communications with MS900 processor!**

Serial I/O Stop Bits

The following sequence selects the number of stop bits per character:

> **SSERSB=**$\{b\}$<CRLF>

where $\{b\}$ = "**1**" or "**2**". It should be noted that **changing this parameter will result in loss of communications with MS900 processor!**

Serial I/O Data Bits

The following sequence selects the number of data bits per character:

> **SSERDB=**$\{b\}$<CRLF>

where $\{b\}$ = "**7**" or "**8**". It should be noted that **changing this parameter will result in loss of communications with MS900 processor!**

Profile Data Output

The following sequence enables or disables profile data output to the serial port:

> **SSERPR=**$\{p\}$<CRLF>

where $\{p\}$ = "**O**" (Off) or "**N**" (oN). See section **Error! Reference source not found.** for details.

Compass Data Output

The following sequence enables or disables compass data output to the serial port:

> **SSERCO=**$\{c\}$<CRLF>

where $\{c\}$ = "**O**" (Off) or "**N**" (oN). This command is invalid if the compass sensor is not present. See section **Error! Reference source not found.** for details.

Cursor Data Output

The following sequence enables or disables cursor data output to the serial port:

> **SSERCU=**$\{c\}$<CRLF>

where $\{c\}$ = "**O**" (Off) or "**N**" (oN). This command is invalid if the compass sensor is not present. See section **Error! Reference source not found.** for details.

Clock Year

The following sequence selects the year the system clock will be set to:

> **SCLKYR=**$\{year\}$<CRLF>

where $\{year\}$ is limited to 1990..2030.

Clock Month

The following sequence selects the month the system clock will be set to:

    SCLKMT=$\{month\}$**<CRLF>**

where $\{month\}$ = 1 (Jan) .. 12 (Dec). This value will be limited to within
this range.

Clock Day

The following sequence selects the day the system clock will be set to:

    SCLKDY=$\{day\}$**<CRLF>**

where $\{day\}$ is limited to within 1..31. Note that it is possible to set an
invalid date with this setting as some months have less than 31 days!

Clock Hour

The following sequence selects the hour the system clock will be set to:

    SCLKHR=$\{hour\}$**<CRLF>**

where $\{hour\}$ is limited to within 1..23.

Clock Minute

The following sequence selects the minute the system clock will be set to:

    SCLKMN=$\{min\}$**<CRLF>**

where $\{min\}$ is limited to within 0..59.

Clock Second

The following sequence selects the second the system clock will be set to:

> **SCLKSC=***{sec}*<CRLF>

where *{sec}* is limited to within 0..59.

Set Time Now

The following sequence will initialize the system clock to the current menu settings:

> **SCLKST**<CRLF>

Text Display Size

The following sequence will select the display text size and initialize the display:

> **SDSMTS=***{S}*<CRLF>

where *{S}* = "**S**" (Small) or "**L**" (Large).

Display Color Palette

The following sequence will select the display color palette:

> **SDSMPT=***{P}*<CRLF>

where *{P}* = "**1**" (Simrad 1), "**2**" (Simrad 2), "**U**" (User), or "**P**" (Profile).

User Palette Color Select

The following sequence selects the user palette color to be modified:

> **SDSMCR=***{color}*<CRLF>

where *{color}* = "**0**".."**7**", or "**G**" (Grid). Command sequences with invalid color selections will be ignored. For 128 color systems, section 4.13.2 describes how these colors are used to generate a 128 color palette. This command is valid regardless of the color palette selected.

User Palette Color Levels

The following sequences selects the red, blue and green color levels for the user palette color selected:

SDSMRD=*{red}*<CRLF>
SDSMGN=*{green}*<CRLF>
SDSMBL=*{blue}*<CRLF>

where *{red}*, *{green}*, and *{blue}* are limited to within 0..15. The MS900 processor prevents color combinations that would make the menu disappear (section 4.13.2). This command is valid regardless of the color palette selected.

Display Positions

The following sequences modifies the display position to allow external centering of the display:

SDSMVC=*{vert}*<CRLF>   (vertical)
SDSMHC=*{horiz}*<CRLF>   (horizontal)

where *{vert}* and *{horiz}* are limited to within ±20.

Print Display

The following sequence issues a request to print the display:

SPRTPD<CRLF>

The MS900 will output the present printer status as well as a formatted help message (see section **Error! Reference source not found.**.2). Since the MS900 Processor will enable REMOTE OPERATIONS MODE when this command is received, the **"SZOM"**command must be issued to start printing, since the front panel zoom switch will be disabled! The **"SMNU"** command can be issued to abort print requests or printing in progress. All other commands will be ignored while printing is in progress!

Printer Palette

The following sequence selects the printer palette:

      SPRTPT=$\{P\}$<CRLF>

where $\{P\}$ = "**1**" (Simrad 1), "**2**" (Simrad 2), or "**U**" (User). This command is invalid and has no effect while printing is in progress.

Printer User Palette Color Select

The following sequence selects the printer user palette to be modified:

      SPRTCR=$\{color\}$<CRLF>

where $\{color\}$ = "**0**".."**7**", or "**G**" (Grid). Commands with invalid color selections will be ignored. This command is valid regardless of the printer palette selected.

Printer User Palette Color Levels

The following sequences selects the red, blue and green color levels for the printer user palette color selected:

      SPRTRO=$\{row\}$<CRLF>
      SPRTCO=$\{col\}$<CRLF>

where $\{row\}$ is HP-Paintjet color reference table row select, limited to within 1..33. $\{col\}$ is the table column select, limited to within 1..10. This command is valid regardless of the printer palette selected.

Enable Profiling

The following sequence enables or disables the profiling feature:

      SPROPR=$\{P\}$<CRLF>

where $\{P\}$ = "**O**" (Off) or "**N**" (oN).

Profile Returns

The following sequence selects the number of returns for profile detection:

    SPRORT=$\{returns\}$**<CRLF>**

where $\{returns\}$ is limited to within 1..6.

Profile Threshold

The following sequence selects the signal level threshold for profile detection:

    SPROTR=$\{threshold\}$**<CRLF>**

where $\{threshold\}$ is limited to within 1..7 for 8 color systems and 1..127 for 128 color systems.

Profile Minimum Range

The following sequence sets the minimum range for profile detection:

    SPROMR=$\{rng\}$**<CRLF>**

where $\{rng\}$ is the range in cm. This value will be limited to within 1..1000.

Profile Minimum Gap Between Returns

The following sequence sets the minimum gap range between returns:

    SPROMG=$\{rng\}$**<CRLF>**

where $\{rng\}$ is the gap in cm. This value will be limited to within 1..2999.

Profile Filtering

The following sequence enables or disables the filter used in profile detection:

    SPROFT=$\{F\}$**<CRLF>**

where $\{F\}$ = "**O**" (Off) or "**N**" (oN).

Perform System Test

The following sequence initiates a system test:

    SSELST<CRLF>

The system test will return a formatted test results message at the end of a test. The "**SBOT**" command must be used to exit this test upon completion; no other commands or front panel controls will be recognized!

Perform Head Calibration

The following sequence initiates a head calibration:

    SSELCT<CRLF>

At the end of the calibration sequence, a formatted data block of test results will be output. The "**SBOT**" command must be used to exit the SYSTEM TEST RESULTS Display Page if an error was detected; no other commands or front panel controls will be recognized! This command is invalid in the SIDE SCAN HEAD system configuration.

Reset System to Standard Settings

The following sequence will force the MS900 Processor to reset the most important settings to the "Factory Reset" state (section 4.17):

    SSTA<CRLF>

Enable Compass

The following sequence enables or disables the compass sensor:

    SSENCO=$\{C\}$<CRLF>

where $\{C\}$ = "**O**" (Off) or "**N**" (oN). This command is invalid if the compass sensor is absent.

Compass Variation (declination)

The following sequence selects the compass declination from true north:

   SSENVR={*dec*}**<CRLF>**

where {*dec*} is limited to within ±180 degrees. This command is invalid if the compass sensor is absent.

8.5 SERIAL OUTPUT

The MS900 processor outputs several forms of data to its serial interface:

  - serial command acknowledgments
  - status messages
  - menu help, print control, and system test results message blocks
  - profile data
  - sensor data
  - cursor position data

In the message definitions that follow, the double quotes ("") are not part of the actual message, but serve to de-limit the ASCII message strings. Characters in **bold** letters denote actual ASCII characters. The linefeed character is denoted <LF> and the carriage return, linefeed character pair is denoted as <CRLF>.

8.5.1 Remote Operations Command Acknowledgments

Most remote operation commands are echoed back from the MS900 Processor if valid and successful. Unsuccessful or invalid commands will be ignored. Commands to request menu help will **NOT** be echoed, but acknowledged with a formatted message block. Since status messages and profile and sensor data output may be generated periodically, the external computer may receive messages or data **before** the command is processed and acknowledged!

8.5.2 Status Messages

Status messages will occasionally be output when a change in the MS900 Processor's state occur. Typically they will be output when the screen is re-drawn, the display HOLD is enabled or disabled, the printer state changes, a front panel change is detected, or an external command is received.

`"**  HELD!  **"<CRLF>`   Display is HELD. This message is also output when an attempt was made to modify a setting not adjustable while the sonar is HELD.

`"  NO PRINTER!"<CRLF>`   Printer not ready when a display print was attempted.

`"   NO PAPER!"<CRLF>`   Printer has run out of paper when during printing or when a display print was attempted.

`"  --PRINTER--"<CRLF>`   Printer is armed and ready to print.

`"Zoom = 1"<CRLF>`   One of these messages are always output after
`"Zoom = 2"<CRLF>`   the ZOOM button press has been detected,
`"Zoom = 4"<CRLF>`   indicating the new true zoom state.

`"Zoom was set at 1"<CRLF>`   One of these messages are output when an
`"Zoom was set at 2"<CRLF>`   external command to emulate a ZOOM button
`"Zoom was set at 4"<CRLF>`   press was received. The message indicates the true zoom state at the time the command was received.

8.5.3 Menu Help Message Blocks

Menu help message blocks are output in response to received menu help commands. These commands are typically used when an operator is using a terminal to remotely operate the MS900. This "on-line" help data is formatted for readability, much like the messages received from a typical computer bulletin board system.

As an example the command "**SPRT?**" would generate the following response:

```
"PaleTte    = [1,2,User]        --> example:   S PRT PT=U"<CRLF>
"ColouR     = [0,1,2...6,7,Grid] --> example:   S PRT CR=G"<CRLF>
"ROw        = [1-33]            --> example:   S PRT RO=13"<CRLF>
"COlumn     = [1-10]            --> example:   S PRT CO=U"<CRLF>
"Print Display                  --> example:   S PRT PD"<CRLF>
<LF>
```

The extra linefeed character at the end of the block terminates the message.

The menu help message displays commands for all possible menu settings, even those currently disabled in the menu display (eg. the PRINTER MENU entries for

"Color", "Row", and "Column" would not be displayed if the User palette was not selected).

8.5.4 Printer Help Message Blocks

The following message will be issued if the operator or an external computer issues a request to print the display and the printer is ready for printing:

```
"     PRINTER READY"<CRLF>
"press ZOOM to print"<CRLF>
"         or "<CRLF>
"press MENU to abort"<CRLF>
```

8.5.5 System Test Results Message Block

The following message will be issued when the SYSTEM TEST RESULTS summary is displayed:

```
"*************SYSTEM TEST RESULTS**************"<CRLF>
<LF>
"PROCESSOR UNIT"<CRLF>
"Software Version: vv.v rrrrrrr"<CRLF>
"ROM Test: rrrrrrr"<CRLF>
"RAM Test: rrrrrrr"<CRLF>
"Video Mode: mmmm"<CRLF>
<LF>
"SONAR HEAD & INTERFACE"<CRLF>
"Interface Type: iii rrrrrrr"<CRLF>
"Interface Errors: iii rrrrrrr"<CRLF>
"Head Type: iii rrrrrrr"<CRLF>
"Sensors: ccccccc"<CRLF>
<LF>
"CALIBRATION    CW       CCW"<CRLF>
"    0        fff.f   fff.f rrrrrrr"<CRLF>
"    90       fff.f   fff.f rrrrrrr"<CRLF>
"    180      fff.f   fff.f rrrrrrr"<CRLF>
"    270      fff.f   fff.f rrrrrrr"<CRLF>
<LF>
"TELEMETRY"<CRLF>
"Cable Gain: iii,iii"<CRLF>
"Parity Errors: iii rrrrrrr"<CRLF>
"Ack Errors: iii rrrrrrr"<CRLF>
"Telemetry Timeouts: iii rrrrrrr"<CRLF>
"          ***  Enter SBOT to continue  ***"<CRLF>
```

The following character fields are defined:

   ccccccc is the sensors present sting (currently the only **"COMPASS"** is possible). This is a null string if none are present.

`fff.f`   is a 5 character single decimal place fixed point number, right justified, with no leading zeros.

`iii`   is a 1..3 character integer, left justified, with no leading zeroes.

`mmmm`   is the video mode ("**VGA**", "**PAL**", or "**NTSC**").

`rrrrrrr`is a 1 to 7 character test results message string ("   **LOW**", " **HIGH**", "**UNKNOWN**", " **FAILED**", or " **NORMAL**").

`vv.v`   is the software version number, left justified, with no leading zeroes.

The MS900 will ignore all remote operation commands while in the SYSTEM TEST RESULTS Display except "**SBOT**" (which would then cause an immediate exit).

8.5.6 Profile Data

Profile range and bearing data output is enabled when the Profiling feature is enabled (section 4.15.2) and Profile Output is enabled (section 4.11). Profile data is output for every shot, in the following format:

    {D}{ang},{r1},{r2},{r3},...,{rN}<CRLF>

where:

  {D}   is a single character indicating the scan direction in the polar, sector, and linear display modes. Possible values are "**L**" (Left / CCW) and "**R**" (Right / CW). In the sidescan display mode this indicates the display direction (section 4.8). In the dual sidescan head configuration, this indicates the channel the profile data was acquired (in the dual sidescan display mode, data will be output from both channels in an alternating sequence).

  {ang}   is the 1..4 character integer heading of the acquired shot in 0.225 degree units. Possible values are 0..1599. In the dual sidescan head configuration this value is always zero. Leading zeros are suppressed.

  {rI}   is a 1..6 character integer range of the "Ith " return in units of microseconds. The number of returns "N" is equal to the setting in the PROFILE MENU (section 4.15). Leading zeros are suppressed.

Since Profile Data output may occur while remote operation commands are being issued, **the MS900 Processor may process and/or acknowledge received commands after Profile Data has been sent!** The remote computer must inspect all incoming data and wait for a brief period of time for the anticipated command acknowledgment.

8.5.7 Sensor Data

If a sensor has been enabled in the SENSOR MENU and serial output has been enabled in the SERIAL I/O MENU, sensor data will be output every time the sensor is read.

Compass Data

The compass data format is:

        `C`*{aaa.a}*`<CRLF>`

where *{aaa.a}* is a 3..5 character single decimal place fixed point number which represents the compass angle in decimal degrees. Leading zeros are suppressed.

Since Compass Data output may occur while remote operation commands are being issued, **the MS900 Processor may process and/or acknowledge received commands after Compass Data has been sent!** The remote computer must inspect all incoming data and wait for a brief period of time for the anticipated command acknowledgment.

8.5.8 Cursor Position Data

If the cursor serial output has been enabled in the SERIAL I/O MENU, the following data will be output every time the operator or remote computer switches from a true ZOOM*4 to a ZOOM*1 display (no zoom):

        {u}{rng1},{brg1},{rng2},{brg2},{rng2-1},{brg2-1}`<CRLF>`

where *{u}* is the range units: "**M**" (Meters), "**F**" (Feet), or "**Y**" (Yards). *{rng1}* and *{rng2}* are the ranges for cursor 1 and 2 relative to the head. *{brg1}* and *{brg2}* are the bearings for cursor 1 and 2 relative to the transducer zero angle. *{rng2-1}* and *{brg2-1}* is relative range and bearing between cursor 1 and cursor 2. All range and bearing values are output to single decimal place precision with leading zeros suppressed. Bearing values will include the compass sensor reading if present and enabled and will then indicate angles relative to true north.

Since Cursor Data output may occur while remote operation commands are being issued, **the MS900 Processor may process and/or acknowledge received commands after Cursor Data has been sent!** The remote computer must inspect all incoming data and wait for a brief period of time for the anticipated command acknowledgment.

DEFINITION	CODE	DEFINITION	CODE	VALUE	EXAMPLE
LOCal station	LOC				SLOC
ZOoM button	ZOM				SZOM
MeNU button	MNU				SMNU
two buttons	BOT				SBOT
CuRsor One	CRO		=	x:1-478 y:1-478	SCRO= 238,239
CuRsor Two	CRT		=	x:1-478 y:1-478	SCRT= 100,290
CuRsor Zoom	CRZ		=	x:1-478 y:1-478	SCRZ= 300,240
SeCtor Width / Left SS gain	SCW		=	7-360 degrees	SSCW=90
SeCtor Center / Right SS gain	SCC		=	0-360 degrees	SSCC=10
RaNGe	RNG		=	5-250 meters	SRNG=120
GAiN	GAN		=	1-25	SGAN=15
DISplay mode	DIS		=	Polar seCtor Linear Sidescan	SDIS=P SDIS=C SDIS=L SDIS=S
SCan Speed	SCS		=	Slow Medium Fast Xfast 16 32 64	SSCS=S SSCS=M SSCS=F SSCS=X SSCS=16 SSCS=32 SSCS=64
GRiD	GRD		=	Off, oN	SGRD=N
HoLD	HLD		=	Off, oN	SHLD=O
scan REVerse	REV				SREV
SS Display	SSD		=	Left Right Both	SSSD=R
MAGnifier	MAG		=	Off 2, 3, 4	SMAG=O SMAG=3
THReshold	THR		=	1-5 (8 color) 1-75 (128 color)	STHR=4
CLeaR display	CLR				SCLR

DEFINITION	CODE	DEFINITION	CODE	VALUE	EXAMPLE
CONfiguration. sub-menu	CON	Range Unit	RU =	Feet Yards Meter	S CONRU=F
		Sound Speed (m/sec)	SS =	1400-1600	S CONSS= 1495
		EXpansion	EX =	Off, oN	S CONEX=O
		Re-Centre	RC =	Off, oN	S CONRC=N
		Scan Marker	SM =	Off, oN	S CONSM=N
		Grid Type	GT =	Polar Rect.	S CONGT=P
		TRansducer	TR =	Up, Down	S CONTR=D
SERial I/O sub-menu	SER	Baud Rate	BR =	300 600 1200 2400 4800 9600	S SERBR= 9600
		PArity	PA =	None Odd Even	S SERPA=N
		Stop Bits	SB =	1, 2	S SERSB=1
		Data Bits	DB =	7, 8	S SERDB=8
		PRofile output	PR =	Off, oN	S SERPR=N
		COmpass output	CO =	Off, oN	S SERCO=O
		CUrsor output	CU =	Off, oN	S SERCU=O
CLocK set sub-menu	CLK	YeaR	YR =	1990-2030	S CLKYR= 1991
		MonTh	MT =	1-12	S CLKMT=11
		DaY	DY =	1-31	S CLKDY=19
		HouR	HR =	0-23	S CLKHR=10
		MiNute	MN =	0-59	S CLKMN=32
		SeCond	SC =	0-59	S CLKSC=47
		Set Time	ST		S CLKST

DEFINITION	CODE	DEFINITION	CODE	VALUE	EXAMPLE
DiSplay sub-Menu	DSM	Text Size	TS =	Small Large	S DSMTS=L
		PaleTte	PT =	1,2,User Profile	S DSMPT=1
		ColouR	CR =	0-7,Grid	S DSMCR=2
		ReD	RD =	0-15	S DSMRD=4
		BLue	BL =	0-15	S DSMBL=13
		GReen	GN =	0-15	S DSMGN=7
		Horiz. Centre	HC =	±20	S DSMHC=-5
		Vertical Centre	VC =	±20	S DSMVC=10
PRinTer sub-menu	PRT	PaleTte	PT =	1,2,User	S PRTPT=U
		ColouR	CR =	0-7,Grid	S PRTCR=G
		ROw	RO =	1-33	S PRTRO=20
		COlumn	CO =	1-10	S PRTCO=9
		Print Display	PD		S PRTPD
PROfile sub-menu	PRO	PRofile	PR =	Off, oN	S PROPR=N
		TRreshold	TR =	1-7 (8 color) 1-127 (128 color)	S PROTR=3
		ReTurns	RT =	1-6	S PRORT=2
		Min. Range	MR =	1-1000 0.1 X meters	S PROMR=30
		Min. Width	MW =	1-1000 cm	S PROMW= 941
		Min. Gap	MG =	0-2999 cm	S PROMG=639
		FilTer	FT =	Off, oN	S PROFT=O
SELf test sub-menu	SEL	System Test	ST		S SELST
		CalibraTe	CT		S SELCT
STAndard setting sub-menu	STA				S STA
SENsors sub-menu	SEN	COmpass	CO =	Off, oN	S SENCO=N
		VaRiation	VR =	±180	S SENVR=-9

Figure 8.4 Coding Summary for Remote Operation Commands Table