

# **STARLOG**

## **Hydrostatic Water Depth Probe**

**Model 6508**



### **Copyright Notice**

Copyright © Unidata Australia 1997. All rights reserved. No part of this publication may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any language or computer language, in any form or by any means, electronic, mechanical, magnetic, optical, chemical, manual or otherwise, without prior written permission of Unidata Australia, 3 Whyalla Street, Willetton, Western Australia, 6155, Australia.

Published by MacLaren Enterprises.

Printed in Australia.

IBM® is a registered trademark of International Business Machines Corp.

## Table of Contents

<b>1. INTRODUCTION</b> .....	<b>1</b>
<b>2. USING THE HYDROSTATIC WATER DEPTH PROBE IN A STARLOG SCHEME</b> .....	<b>3</b>
2.1. Choosing a Logger to Use .....	3
2.2. Notes About a Water Depth Monitoring Scheme .....	3
2.2.1. Adding an Instrument. ....	3
2.2.2. What to Log .....	5
<b>3. INSTALLATION</b> .....	<b>6</b>
3.1. CONNECTIONS .....	6
<b>4. SPECIFICATIONS</b> .....	<b>8</b>
<b>5. TESTING</b> .....	<b>9</b>
5.1. Using Version 3 for STARLOG Software. ....	9
5.2. Using STARLOG Software (Version 2) .....	10
<b>6. MEASUREMENT METHOD</b> .....	<b>11</b>



# 1. INTRODUCTION

The Hydrostatic Water Depth & Temperature Probe (Models 6508 A/B/C/D/E) provides accurate long term measurements of water depth from 0 to 20 metres and water temperature from 0°C to 60°C. It is fully sealed, factory calibrated (to standard ranges) and temperature compensated.

The Water Depth Probe contains an integral temperature transducer (the same type as the Model 6507A Red Thermistor, supplied with a 15k reference resistor). Earlier models do not include the temperature probe.

This probe is ideal for monitoring drainage, bore depth and river height. It can also be used to measure water with dissolved solids (i.e. brine) and other liquids provided consideration is given to the following factors:

- a) density of the liquid under measurement
- b) relationships between changing temperature and changing density of the liquid under measurement
- c) effect of liquid under measurement on PVC housing and cable

These factors are discussed further in section 5.

There are five different Water Depth Probes available. Each probe operates within a specific depth range. The following models exist:

Model	Depth Range	Resolution
Model 6508A	0 to 1 metre	4mm
Model 6508B	0 to 2 metres	8mm
Model 6508C	0 to 5 metres	20mm
Model 6508D	0 to 10 metres	40mm
Model 6508E	0 to 20 metres	80mm

The Water Depth Probe connects directly to a STARLOGGER or MACRO Data Logger. It uses two analog channels and is designed to be self-powered from UNIDATA's STARLOG Data Logger battery. It includes an integrated amplifier and correction circuitry.

The probe uses the hydrostatic pressure of water to measure water depths in a variety of environments. The hydrostatic pressure of water is dependent on the depth at which the water pressure is measured and the atmospheric pressure.

The maximum expected change in atmospheric pressure due to the change in weather is approximately 10kPa (100hPa) which is 1% of 1000kPa (100m head of water). The 1% is within the accuracy of a hydrostatic pressure transducer.

Hence for this type of transducer it is important to relate the measurement against atmospheric pressure. For water depths of less than 100 metres (1000kPa) a gauge type transducer fitted with vented cable is used. For depths greater than 100 metres you can use an absolute type transducer without vented cable.

## 2. USING THE HYDROSTATIC WATER DEPTH PROBE IN A STARLOG SCHEME

UNIDATA's instruments are designed for automatic monitoring and collection of data in a STARLOG Data Logging System. When the instruments are connected to a STARLOGGER or MACRO Data Logger, data sensed by the instruments is logged and stored according to a program you define using STARLOG Software.

STARLOG Software runs on a computer compatible with IBM systems (PC/XT/AT, PS/2). This package includes a menu-driven program so that you can easily generate a data logging program – called a Scheme – then load the Scheme into a Data Logger. To discover how to use this program see the STARLOG Users Manual (manual 6203 or 6245).

This section provides you with information you will find helpful in creating and executing a Water Depth Monitoring Scheme. The examples illustrate Software Versions 3 and 2.02.

### 2.1. Choosing a Logger

Any of the STARLOG range of Data Loggers can be used with this instrument to record water depth and temperature. Each Logger offers Analog channels with sufficient resolution to record data sent by the instrument. In fact, an 8-bit channel is sufficient for most water depth & temperature monitoring projects.

When connecting the instrument to a STARLOGGER (Model 6004) or MACRO Data Logger (Model 7000) you will want to program the Logger for *PDL compatibility mode* which will configure Analog channels for 8-bit resolution. This is automatic via Version 3 Software. When using Version 2 Software, consult the Users Manual 6203.

## 2.2. Notes About a Water Depth Monitoring Scheme

This section describes the probe's attributes and suggests how you might want to use data gathered.

### 2.2.1. Adding an Instrument

To create a Water Depth & Temperature Monitoring Scheme, select a Probe from the Instrument List to add it to the Scheme.

If the model you have does not appear in this list, you will want to add it. (Use the **Instrument Editor** in Version 3 or **Maintain Instruments** in Version 2.)

Once you add the instrument to the Scheme, check to see which channel is allocated, scaling factors, format of data shown in reports, etc. The default settings are:

Transducer 1			
Description: Water Depth 1 m			
Output:	Analog Voltage (mV)	Channel:	a0
Min:	0		
Max:	2550		
Scale:	FullScale a to b	Title:	Depth
a:	0	Units:	m
b:	1	Using:	##.##
Formula:			
		OK	Cancel

*Model 6508A Hydrostatic Water Depth Probe Water Depth Transducer in Version 3 for STARLOG Software*

Transducer 2			
Description: Red Thermistor 15k			
Output:	Analog Voltage (mV)	Channel:	a1
Min:	0		
Max:	2550		
Scale:	Formula	Title:	Temp
a:	1	Units:	deg C
b:	0	Using:	###.#
Formula:	red		
		OK	Cancel

*Model 6508A Hydrostatic Water Depth Probe Temperature Transducer in Version 3 for STARLOG Software*

If you choose to use a channel other than the default as listed here, ensure that you make the connection to the correct terminal of the Field Termination Strip, if you are using that option, or the correct pin in the INPUT SIGNALS connector.

In Compatibility Mode, the STARLOGGER offers eight 8-bit Analog channels (a0 –a7): each Water Depth Probe uses two channels.

The connections described in this supplement (see Section 3 Installation) assume that you are using a0 and a1, the default channels.

## 2.2.2. What to Log

You will want to log data from both analog channels 0 and 1 (if you are using the defaults). You will probably want to log one or any of the following: average, maximum, minimum water depth calculated over the log interval, or "raw", the value read at the log interval.

### ➤ Using Version 3 Software

Make the following selections in the Log Buffer window:

```

===== Log Buffer 1 =====
6004B - STARLOGGER Data Logger 128K + KB
Channel Xducer RAW MAX MIN T1 T2 T4 AVE SD ave
a0      Depth  [X] [X] [X] [ ] [ ] [ ] [X] [-] [ ]
a1      Temp   [X] [X] [X] [ ] [ ] [ ] [X] [-] [ ]

```

*What to Log in a Water Depth Monitoring Scheme  
using Version 3 for STARLOG Software*

### ➤ Using Version 2 Software

1. First, add the Counter channel to the Scheme's list of **What to Log**.
2. Once you add a0 or a1 (or whatever channel you use) to the Log, you will want to choose a **Log Action**, for example:

#### What to Log

Channel	a0	Depth
Action		Maximum

Channel	a1	Temp
Action		Average

## 3. INSTALLATION

The Water Depth Probe is a simple device to install. There are factors that need to be borne in mind when installing the device. These are as follows:

1. Do not twist or crimp the cable. This cable contains a high quality small teflon tube which vents the body of the Water Depth Probe. If this vent tube is twisted or crimped errors in the data recorded will occur.
2. The vent tube outlet needs to be open to atmosphere. This allows the sensor to reference water pressure to atmospheric pressure.
3. The overall length of the cable should not exceed 50 metres.
4. Strong water currents should be avoided as these can lead to the Water Depth Probe "swinging" and producing inaccurate and oscillating data. If the Water Depth Probe is to be used in a high current area use of a still well is recommended.
5. Although the Water Depth Probe is of a robust design the ingress of mud and silt into the sensor nozzle can contribute to data errors. Immersion of the probe in mud or silt may result in data error.

### 3.1. CONNECTIONS

The Water Depth Probe has four wires emerging from the cable as well as the vent tube for the probe housing. You connect these wires to either a Field Termination Strip (FTS) or directly to the Data Logger. The use of the FTS eases the task of connecting and disconnecting devices to the Data Logger.

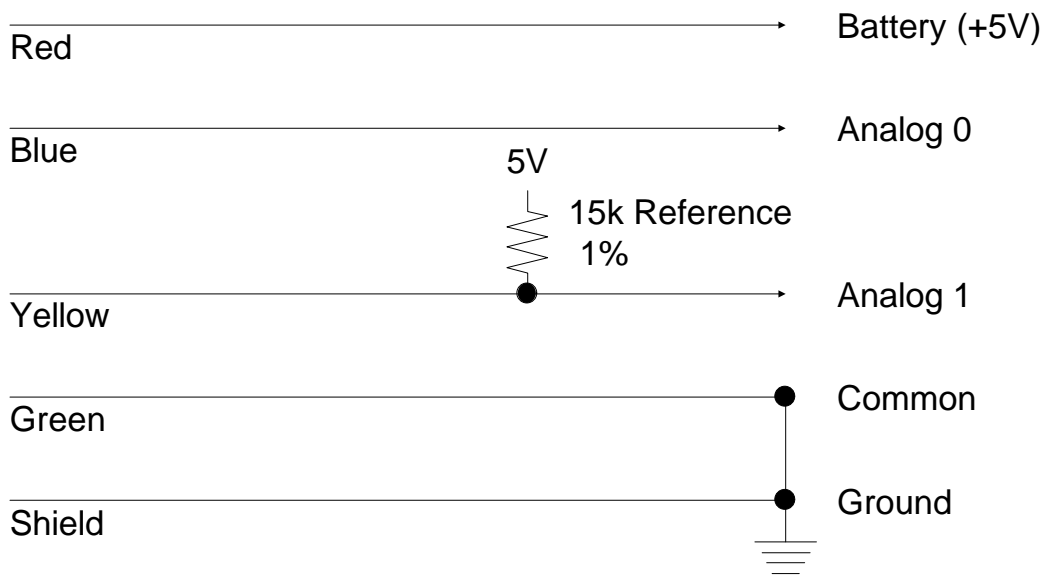
To be able to measure temperature, you must install the 15k resistor provided. (See diagram on the next page.)

The connections are as follows:

Probe		STARLOGGER	
Colour	Function	Pin	Terminal
Red	+5.00 V DC power supply	13	15
Blue	Data (0 – 2.55V DC)	1*	39
Yellow	Data (Temperature)	2*	36
Green	Common	23	41
Shield	Ground	23	38

- » The STARLOGGER offers eight analog channel inputs located on pins 1–8 (a0 to a7). Any of these can be used with a Water Depth Probe provided that the correct channel number is designated when using STARLOG Software. See section 3.

The 15k reference resistor must be connected to the Analog input channel used to log temperature. It may be connected on the Field Termination Strip (see Supplement 6208) or to the relevant pin on the Data Logger's Input Signal Connector.



*Wiring Water Depth Probe to Data Logger*

## 4. SPECIFICATIONS

### Ranges Available

- Model 6508A 0 to 1 metre of water (4 mm resolution)
- Model 6508B 0 to 2 metres of water (8mm resolution)
- Model 6508C 0 to 5 metres of water (20 mm resolution)
- Model 6508D 0 to 10 metres of water (40 mm resolution)
- Model 6508E 0 to 20 metres of water (80 mm resolution)

### Output and Input Signals

- Resolution: 0.1% of full scale
- Accuracy:  $\pm 1\%$  of fullscale
- Overpressure: up to 100% of rated depth
- Operating Temp.:  $-1^{\circ}\text{C}$  to  $60^{\circ}\text{C}$
- Sensor: Semi-conductor strain gauge element
- Electronics: Integrated amplifier & correction circuitry
- Output Signal: 1 analog for depth, 0–2.55 V DC  
1 analog for temperature, 0 – 2.55 V DC
  
- Connector: Supplied with 25-pin 'D' connector
- Cable: Flexible PVC 4 core vented cable with shield  
Length: Depth capacity plus 5 metres  
(Not to exceed 50 metres in any circumstances.)
- Power: 5V DC, 4mA from logger (4% of battery life)
- Material: UV resistant PVC, impervious to oil, dirt, and most solvents (excluding methyl ethyl ketone).  
Fitted with chromed brass nose cone.
- Size: 25mm diameter, 180mm long (excluding cable)
- Weight: 200 gm (excluding cable)

## 5. TESTING

The Water Depth Probe connected to a Data Logger can be tested using STARLOG Software.

### 5.1. Using Version 3 for STARLOG Software

When connected to a STARLOG Data Logger, a computer running Version 3 for STARLOG Software can be used to interrogate a Water Depth Probe for real time data readings and programming information.

1. Connect the Probe to the Data Logger (see section 3). Use pin#1, Analog Channel 0, as the signal input pin.
2. Connect the STARLOGGER to the computer.
3. Start STARLOG Software.
4. Select the Water Depth Monitoring Scheme (or create one, if you haven't yet).
5. If the Scheme has not been loaded, choose **Program Logger with Scheme** from the Control Panel. If the STARLOGGER already is loaded with the Scheme, then...
6. From the Scheme's Control Panel, select **Scheme Test Mode**.
7. View the display to determine how the scheme is operating. The Test Window (upper window) displays scheme information from the STARLOGGER and its content is updated every Scan. The Log Entry Window (lower window) displays what has been logged.

You can also use Scheme Test Mode to create your own Test Screens. (See the Users Manual, 6245)

## **5.2. Using STARLOG Software (Version 2)**

When connected to a Portable Data Logger, a computer running STARLOG Software Version 2 can be used to interrogate a Water Depth Probe for real time data readings. You can use Scheme Test Mode or Test a Logger.

1. Connect the Probe to the Data Logger (see section 3). Use pin#1, Analog Channel 0, as the signal input pin.
2. Connect the Logger to the Computer.
3. Define a Water Depth Monitoring Scheme.
4. Program the Logger with this Scheme.
5. Select **Scheme Test Mode** from the **Use a Scheme** menu to test the Scheme just generated or select **Test a Logger** from the Main Menu.
6. The first Test Screen you see includes general information for a Scheme and displays Data Logger memory addresses 0 to 35 in boxes on the right side of the screen.

The Depth Probe, when connected to PDL Pin 1, sends data to address 16.

Check the data which appears in address 16 (the place in Data Logger memory where information for analog channel 0 is found.)

## 6. MEASUREMENT METHOD

The Water Depth Probe uses hydrostatic pressure exerted on a Motorola piezo electric pressure sensor as the primary data source. Hydrostatic pressure is reliant on several factors:

- The density of the liquid (D)=specific gravity (S.G.)
- The acceleration of gravity (g)
- The depth of the liquid (d)
- Atmospheric Pressure at the top of the liquid (Atm)

Absolute Pressure at d mm = (g x D x b) + atm  
however the vent tube cancels Atm so:

$$\text{gauge pressure} = g \times D \times b \text{ (kPa)}$$

The gauge pressure from the Water Depth Probe is sent as a 0 - 2.55 Vdc signal (.1 V resolution). Using the above formula and the raw data readings measurements can be made for any liquid. The UNIDATA Water Depth Probes are calibrated in clean water (S.G = 1.0) at room temperature.

If the probes are used in sea water (S.G = 1.025) the accuracy of the readings using the default transducer scaling in the Software Package, (which assume S.G. = 1.00), will be affected by a factor of: -2.5%.

(To overcome this define NEW transducers and scale the transducers appropriately.)

E.g., A 10 metre depth probe in sea water should be scaled as follows:

User formula is: scale 0 to 9.75

using ##.#, units m

The Water Depth Probe is compensated for temperature effects on the sensor however it is not compensated for density changes in water or other liquids caused by temperature change. This is significant only in water where large temperature changes occur in the range 20 to 60 degrees. A table below shows density changes in this range:

Temperature	Density
20X	.99823
25X	.99732
30X	.99567
40X	.99225
60X	.9832

Obviously the effect is not significant in normal use.