# SECTION 1
# INTRODUCTION

## 1.1 APPLICATIONS

1.1.1 The Model 8770 is a portable ocean profiling system used in physical, chemical and biological oceanography. A fully equipped system measures and calculates water depth (pressure), conductivity ratio, temperature, salinity, pH and dissolved oxygen.

## 1.2 SYSTEM FEATURES

(a) Portable - may be operated with two 12 V car batteries.

(b) Simple operation.

(c) Easy maintenance.

(d) Data record/playback with low cost audio cassette recorder.

(e) Parallel data output for user supplied computer.

(f) Optional digital display unit for depth, conductivity ratio, temperature, salinity, pH and dissolved oxygen.

(g) Automatic error flag - system checked every sensor scan.

(h) Analog outputs for chart recording.

(i) Model 8709 probe pressure case rated to 1000 metres.

(j) Two spare probe channels for user supplied special purpose sensor and electronics.

(k) Standard, arctic and batfish probe configurations available.

(l) Handcrank, 24/12 V DC and arctic winches available.

## 1.3 SPECIFICATIONS

### 1.3.1 Model 8709 Probe

(a) Nominal probe drop rate: One metre per second.

(b) Conductivity sensor: Four electrode cell, spatial resolution in vertical plane approximately 5 cm - Nominal conductance is 10 mmhos @ 35 ppt, 15°C.

(c) Temperature sensor: Four terminal resistance thermometer consisting of a fine copper wire sensing element, encased in an oil-filled stainless steel capillary tube.

(d) Pressure sensor: Four arm strain gauge bridge having an output of 2 mV/V to 1000 dBar.

(e) pH sensor: Combination type with glass measuring electrode and calomel reference electrode in potassium chloride solution. Generates 58.164 mV/pH unit @ 20°C.

(f) Dissolved oxygen: Polarographic type with gold cathode and silver anode in potassium chloride electrolyte gel. Oxygen diffuses through a thin teflon membrane. Approximate output at sea level with fresh air (20.95% oxygen) at 20°C is 0.7 μA.

(g) Cable requirements: Single conductor, contra-wound double armour cable.

(h) Probe connector: Electro Oceanics type B53E2M-1 mates with type B51E2F-1.

(i) Standard probe dimensions 72.4 cm long, 14 cm diameter, 36.8 cm wide.

(j) Arctic probe dimensions: 104.8 cm long, 19 cm diameter.

(k) Batfish probe dimensions: 55.9 cm long, 14 cm diameter.

(l) Standard probe weight: 16.8 kg in air, 9.3 kg in water.

(m) Arctic probe weight: 19.1 kg in air, 10.6 kg in water.

(n) Batfish probe weight: 14.5 kg in air, 7.7 kg in water.

### 1.3.2 Model 87105 Basic Control Unit

(a) Display: Analog meter with selector switch for probe cable voltage and current plus 0 to 100% indications of all data channels.

(b) Inputs/Outputs: 16 line parallel output (13 data and 3 address binary bits), serial input and output for recording and playing back probe data on audio cassette recorder.

(c) Power requirements: 28 V(dc) ±6 V(dc) at 2 A.

(d) Case: splash proof type.

(e) Dimensions (in case): 30.5 cm long, 22.9 cm wide, 31.75 cm high.

(f) Weight: 5.9 kg in case.

### 1.3.3 Model 87106 Full Control Unit

(a) Displays: Six 8.4 mm high Beckman gas discharge displays, updated every 500 ms approximately; Analog meter with selector switch for probe cable voltage and current plus 0 to 100% indications of all data channels.

(b) Inputs/Outputs: Analog outputs for chart recording pressure, conductivity ratio, salinity, temperature, dissolved oxygen, pH and two spares; serial input and output for recording and playing back probe data on audio cassette recorder; 16 line parallel output (13 data and 3 address binary bits); optional IEEE 488 data interface bus.

(c) Power requirements: 28 V(dc) ±6 V(dc) at 3 A.

(d) Case: Rugged transit case - unit may be removed and installed in standard 19 in. (48.25 cm) equipment rack.

(e) Dimensions (in case): 47 cm long, 57.2 cm wide, 21.6 cm high.

(f) Dimensions (rack mounting): 23 cm long, 48.25 cm wide, 17.8 cm high.

(g) Weight: 10.6 kg in case, 5.9 kg rack mounted.

### 1.3.4 Model 8770 System

The specifications of the Model 8770 System (including linearity, hysteresis, temperature coefficient and calibration uncertainty) are shown in Table 1.1.

## 1.4 FUNCTIONAL DESCRIPTION

### 1.4.1 General

The 8770 is a versatile portable ocean profiling system featuring simple operation and easy maintenance without sacrificing accuracy or reliability. This system consists of a probe, control unit and winch.

1.4.2 The probe electronically measures the parameters, digitizes the results, phase encodes and transmits the data to the control unit. Three versions of the probe are available. The standard (Figure 1.1) and arctic versions (Figure 1.2) are identical except for the stainless steel cage. The cage on the arctic version is designed to fit through an 8 inch hole. The batfish version is supplied without a cage.

1.4.3 The control unit decodes the data from the probe and converts it to binary format. Two control units are available. The basic control unit (see Figure 1.3) consists of a Model 87105 Power Supply mounted in a splash proof case. This unit allows the raw data from the probe to be recorded on an inexpensive audio cassette recorder. A computer may also be connected to the basic control unit if a suitable interface is provided by the user. This permits probe data recorded on an audio cassette to be

TABLE 1.1: 8770 System Specifications

Including linearity, hysteresis, temperature coefficient and calibration uncertainty

| Parameter | Range | Accuracy - 180 Days (see Note 3) | Display Resolution (Front Panel) | Scale Value Lowest Significant Bit (Binary Data Buss) | Response Time |
|---|---|---|---|---|---|
| Depth (Pressure) | 0-1000 dBar | Linearity ±.5%<br>Hysteresis ±.25%<br>Zero Offset ±1%<br>Sensitivity Error ±1%<br>(see note 5) | 0.1 dBar | 0.123 dBar | < 1 msec |
| Temp | -3 to 38.99°C | ±0.02°C | 0.01°C | 0.00512°C | 60 msec |
| Conductivity Ratio | 0.0010 to 1.6000 | ±0.0004 | 0.0002 | 0.000195 | 60 msec |
| Salinity Calculated | 0.10 to 40 ppt | ±0.04 ppt | 0.01 ppt | N/A *<br>(see Note 1) | - |
| *p.H. | 6 - 9<br>2 -12 | ±0.05<br>±0.1 | 0.01 | 0.002 @ 20°C<br>(see Note 1) | 30 sec to 90% of final value for a 6 pH or 10°C change |
| *DO Sensor Current | 0.1 nA to 1.0 uA | ±0.02 uA | 0.01% F.S.<br>(see note 2) | 0.122 nA | -5 sec to 90% of final value for a change in Oxygen only |
| *DO Sensor Temp | -5 to +40°C | ±1°C | 0.01% F.S.<br>(see Note 2) | .0045 - .0067°C<br>(see Note 4) | -3 min to 50% of final value for a 10°C change in temp. |
| *Diss. Oxygen Calculated | 0-15 ppm (mg/ℓ) | ±0.5 ppm | 0.01 ppm | N/A<br>(see Note 1) | -10 min to 90% of final value for a 10°C change in temp. |

Notes:
(1) Calculated parameter outputs available only with IEEE 488 O/P option.
(2) Front Panel Display can be selected to display % of Full Scale for DO current and Temp. in place of Calculated DO and Conductivity Ratio and also % F.S. in place of p.H.
(3) Dissolved Oxygen accuracy specified for 90 days only - warranty on sensor also 90 days.
(4) Oxygen Sensor uses thermister for temperature measurement so relationship is non-linear.
(5) Zero offset and sensitivity error are nulled at 20°C during calibration.