A moored data buoy for measuring meteorological and oceanographical conditions.

Optional Sensors:
- Wind Speed and Gust, Wind Direction
- Air temperature, Air Pressure
- Relative Humidity, Visibility
- Wave Height/Period
- Current Speed/Direction
- Salinity, Conductivity
- Water Temperature, Turbidity
- Oxygen, pH, ORP

Features:
- Compact, lightweight and easy to install
- Solar cell powered
- High reliability and low cost
- Customer specified sensor configuration
- Up to 30 parameters can be measured
- Several ways to transmit data
- Real-time data from distances up to 20km by using UHF radio Modem
- Remote data downloading and programming by using GSM modem
Publishing Dates

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Abbreviations

CBM Central Buoy Module
Ch Channel
CMB Coastal Monitoring Buoy
CT Conductivity/Temperature
DCS Doppler Current Sensor
GSM Global System for Mobile Communication
PDC-4 Pulse Duration Code of 4 seconds
RS-232C Recommended Standard 232C
ST Salinity/Temperature
VHF Very High Frequency
UHF Ultra High Frequency
INTRODUCTION

This operating manual describes the Coastal Monitoring Buoy CMB 4280, how it is used, maintained and serviced.

The CMB 4280 is an important member of the family of Aanderaa instruments family of data collecting instruments for land, sea and air.

It shares a number of common features with these instruments, such as rugged construction, modular design, potted waterproof units, low power consumption and minimal maintenance.

Great effort has been taken to make this buoy easy to deploy and use.

Knowledge of met/ocean information is of great importance for safe navigation, as well as for many surveys and research activities. This Buoy is a moored data buoy designed to provide such information in ports, harbours and coastal waters.

The buoy can measure wave height and period, sea current speed and direction, sea temperature as well as the most important meteorological parameters.

Two examples are shown on page 8, but the buoy can accommodate a selection of sensors depending on customer’s request.

Data can be transmitted ashore in real-time if VHF or UHF transmitter is connected. If a GSM modem 3865 is connected the buoy can be dialled-up and historical data can be downloaded.

Some illustrations in this operating manual include 4 and 6 digit stock numbers. These are available spares and the numbers must always be quoted when ordering.
SYSTEM DESCRIPTION

Payload:

- **Communication equipment:**
  - VHF Radio Transmitter 3149
  - UHF Radio Transmitter 3694
  - Argos Transmitter 2965
  - Radio Modem
  - GSM Modem 3865
- Sensor Ring 3886 with meteorological sensors.
- Mast Section with Flashing Light 3861 and optional Radar Reflector 3885.
- Control Unit 3850 with optional:
  - Wind Vane 3273
  - Data Storage Unit 2990
  - GPS Unit 3890 (prospective option)
- Central Buoy Module 3867 with:
  - Datalogger 3860
  - Rechargeable Batteries
  - Optional:
    - Wave Height Sensor 3595
    - Buoy Orientation Sensor 2864

Buoy Hardware 3870:

- Pellet-filled polyethylene buoy
- Solar Cell Panels
- Encompassing Heavy Plastic Tube
- Counter Weight

Substructure:

- Link 3962 between DCS 3900 and buoy
- Sensor string with submersible sensors
- 3m, 3/4” mooring chain
- Nylon mooring rope
- 6m, 3/8” chain
- 3m, 3/4” mooring chain
- Anchor
Specifications

VHF Radio Transmitter 3838, 141 - 143MHz. Conveying data in real-time up to 10km.
UHF Radio Transmitter 3694, 400 - 500MHz. Conveying data in real-time up to 20km.
Argos Transmitter 2965, 401.650 MHz transmitted to the satellite via the Argos Satellite system
Satellite 3-ASd Radio Modem, 370 - 470MHz. Conveying data in real-time up to 20km.
GSM Modem 3865, 900/1800MHz, 900/1900MHz optional. For remote programming and data downloading of historical data. Range > 20km, depends on local GSM network.

Sensors on Sensor Ring 3868 for a wide range of meteorological parameters.
Mast Section with Flashing Light 3861 and optional Radar Reflector 3885.
Wind Vane 3273
Control Unit 3850 with optional GPS Unit 3890 (prospective option) and Data Storage Unit 2990.
Central Buoy Module 3867 containing Datalogger 3860 and a 12V, 21Ah rechargeable battery. Also containing optional sensors like Wave Height Sensor 3595 and Buoy Orientation Sensor 2864.

Buoy Hardware 3870 containing five 6W Solar Cell Panels. Total 30W, total maximum charging current 2A. Rated Voltage 15V. The polyethylene buoy is pellet-filled and incorporates a payload counterweight of 35kg. The net buoyancy is 400kg.

Doppler Current Sensor 3900, a rugged, true averaging sensor measuring current speed / direction and sea temperature. Installed inside a plastic buoy tube, which has acoustic permeability.
Up to 4 sensors can be moored in-line for current measurements in several depths. See page 3.

Counter weight 2927, 35kg
1) The DCS 3900 can be used in combination with a Sensor Disk 3829 carrying up to five sensors:
   - Salinity/Temperature Sensors 3210
   - Conductivity/Temperature Sensor 3211
   - Turbidity/Temperature 3712
   - Oxygen Optode 3930
   - pH Sensor 3264
   - ORP Sensor 3840
2) Alternatively:
   - Temperature String with up to 25 thermistors measuring the stratification in fjords and coastal waters. See application notes on page 3.

Fastening Fixture 3823 with one submersible sensor.
6m, 3/8" Chain 287006, 13kg.
Anchor with 3m, 3/4" Mooring Chain 287004, 25kg. Additional weight up to 450 kg is recommended for rough conditions.
Examples of Applications

Fig. 1 Telemetering Temperature Profile application  Fig. 2 Doppler Current Sensor application
CHAPTER 1 Receiving the Coastal Monitoring Buoy CMB 4280

The buoy is packed in a wooden framework, containing:

the polyform buoy hardware with the central buoy module, a crate with the rest of the payload, mooring rope, anchor and chains and a encasement for the Sensor Ring with sensors.

Buoy without sensor string:

The wooden frame measures 1.28m x 1.22m x 3.07m (4’ 2.5” x 4’ x 10’ 1") and the gross weight is approximately 200kg (441lb).

Buoy with sensor string

The wooden frame measures 1.28m x 1.22m x 3.31m (4’ 2.5” x 4’ x 10’ 10") and the gross weight is approximately 200kg (441lb).

Fig. 3 CMB 4280 in Packing Case
CHAPTER 2 Theory of operation, Description of components and parts.

The measuring system
The buoy is triggered at preset time intervals by a clock in the Datalogger 3860.

The sensors are scanned in sequence and the readings, converted into engineering units, are stored in the Datalogger.

When the measuring cycle is completed, the Datalogger 3860 enters a quiescent state awaiting a new trigger pulse from the clock after which another measurement cycle is carried out.

When the GSM Modem is interrogated, the stored data are conveyed over the telephone network.

The Payload with Sensors
The payload is built up using separate modules. All the modules are joined together by watertight joints with internal electrical connectors.

Installation and removal for maintenance and service can therefore be done very easily.

Mast Section with Flashing Light 3861
A built in flashing amber light is activated by a photo diode after dark. The optional Radar Reflector 3885 is fitted below the flashing light.

Central Buoy Module (CBM)
This Module is equipped with a flange. The Module and its payload is secured to the buoy hardware with 4 bolts.

The Datalogger 3860 is located at the top of the Central Buoy Module.

It can read up to 30 sensors at a preset recording interval and has the following output formats:

1. Serial data in PDC-4 format to an Aanderaa Radio Transmitter or Deck Unit 3127.
2. RS-232C serial data, one-way communication port to a Radio Modem, enabling long distance real-time data.
3. RS-232C serial data, two-way communication port to a GSM Modem, enabling remote data downloading and programming.

The Wave Height Sensor and the Buoy Orientation Sensor are fitted on standard sensor outlets inside the module making them easily replaceable.

The module also incorporates a 21 Ah rechargeable battery.

Doppler Current Sensor (DCS)
The sensor is installed inside the plastic tube in the center of the buoy. This provides a symmetrical position at 1 meter depth with minimal current interference from the buoy structure.

Since the acoustic pulses penetrate the plastic PVC tube, the sensor is also protected from fouling.
and wave forces. A short stud connects the DCS sensor to the CMB.

A thermistor string for measuring temperature profiles in the sea can be installed instead of or below the DCS.

On top of the payload there is a sensor section which carries the UHF/VHF Transmitter or GSM modem and the atmospheric sensors.

**Communication equipment**

- Aanderaa UHF/VHF transmitters
- Argos transmitter
- GSM modem
- UHF Radio modem

The three first communication devices can be interchanged without any reconfiguration or programming of the buoy. The Radio modem will require a minor modification to the internal wiring.

**A typical sensor configuration is:**

| Ch1  | Reference                        |
| Ch2  | Wind Speed Sensor                |
| Ch3  | Wind Direction (Buoy Orientation inside Central Buoy Module) |
| Ch4  | Air Temperature                  |
| Ch5  | Air Pressure (optional Mira Visibility Sensor) |
| Ch6  | Relative Humidity Sensor         |
| Ch7  | Wave Height Sensor (inside the Central Buoy Module) |
| Ch8  | Wave Period (inside the Central Buoy Module) |
| Ch9  | Current Speed                    |
| Ch10 | Current Direction                |
| Ch11 | Water Temperature                |
| Ch13 through 30 | are free for optional sensors such as DCS 3500, CT or ST sensors or Oxygen and Turbidity sensors. |

The buoy can be fitted with alternative sensor configurations. A 25-channel Thermistor String can be mounted under the Buoy.

**The Reference**

This reading is used both as a verification of the system performance and as an identification of the buoy.

**The Wind Speed Sensor**

has a three cup rotor. The rotor shaft is equipped with a magnet that activates an internal reed switch. The rotation frequency is thus transferred to the internal electronics without the need for any sealing on the rotor shaft.

**The Buoy Orientation Sensor**
used for wind direction, incorporates a hall effect compass sensing the earth's magnetic field. This field is sampled once every second and vector averaged. Both wind speed and direction are presented as the average during the past measuring interval.

**The Air Temperature Sensor**
measurement are made using a half bridge with one platinum resistor is used. The sensor is furnished with a radiation screen to prevent it from being heated by solar radiation.

**The Relative Humidity Sensor**
uses a capacitive film for measuring the humidity of the air. This sensor is also equipped with a radiation screen.

**The Air Pressure Sensor**
contains a silicium chip with one side exposed to the air and the other side in vacuum. By sampling a resistive bridge integrated on this chip, a measurement of the absolute barometric pressure is obtained.

**The Wave Height Sensor**
is based on a silicium accelerometer. To keep it horizontal, this accelerometer is mounted on a small pendulum. A little micro-processor samples the acceleration 5 times a second and double integrates this to get an expression for the sensor’s movement. At the end of the measuring interval, significant wave height and average wave period are calculated. The significant wave height is the mean of the highest third of all the waves during the interval.

The outputs from the sensor are: 1) Significant Wave Height 2) Wave Period

**Current Speed, Current Direction and Water Temperature**
are provided by the Doppler Current Sensor 3900. This sensor transmits a short acoustic pulse into the water every second. Small particles and bubbles in the water flow will reflect a little of this sound. Due to the doppler effect the reflected sound change frequency slightly. By sensing this change in four direction, and referring them to an internal hall effect compass, vector averaged current speed and direction are found. The water temperature is measured by a Pt 2000 platinum element. The DCS 3900 can be used in combination with optional sensors as mentioned earlier.

**Polyform Buoy, Anchoring Equipment.**
Buoy Hardware 3870 containing 5 Solar Cell Panels each 6 Wmax, max. current 0.39A and rated voltage 15V. The buoy incorporates superstructure/counterweight (25kg), is foam filled with a net buoyancy of 420kg, OD 940mm.

Mooring rope as specified below can be delivered upon request:

1) Ballast Chain 3/4", part number 287004, which is 3m long and weights 25kg,
2) Mooring Rope, part number 287008, which is 14mm thick and made of Karat Estalon. Breaking Load:1400kg. Length must be specified.
3) Anchor with a 3m long anchor chain, part no. 287004 and a 6m long 3/8" chain, total weight 55kg. However, the recommended anchoring weight is up to 300kg. To be supplied by the customer.
4) Subsurface Viny float for mooring line, 972209, buoyancy:20kg
5) Elastic Rubber Band for chord anchorage in the open sea.
CHAPTER 3 Preparing the buoy for use.

Assembly
Each component and sensor in the system has been thoroughly tested in accordance with our quality assurance system, ref enclosed Test & Specifications Sheets and Calibration Sheets.

The Buoy with hardware, the Central Buoy Module with all its components, the DCS and CT sensors are shipped partly assembled in a wooden frame.

The GSM Modem, the Mast Section 3861 are packed together with the Control Unit in a plywood box and placed inside the frame. The circular cross-arm, with the Meteorological Sensors installed, is packed in a cardboard box and placed inside the wooden frame.

Assembling the Buoy
1) Remove the buoy from the frame.

2) Assemble the Control Unit and the Mast Section. Place the assembled unit on top of the Central Buoy Module and tighten up the muff nut. Each unit is furnished with a male and a female cone and quick connect/ disconnect electrical plugs.

3) Mount the Circular Cross-arm on top of the Mast section and tighten up the muff nut.

4) Install the Communication Device on top of the Sensor Ring.

5) Connect the Power Cable (2-pins) from the Buoy to the Solar Cell Receptacle in the Control Unit.

6) The five Solar Cell Panels and the batteries in the Central Buoy Module now power the buoy. The buoy operates as long as it is assembled.

Functional test
To perform a functional test, interconnect the equipment.

Insert the ON/OFF Plug into the ON/OFF Receptacle on the Control Unit.

The Datalogger will trigger the buoy and perform one measurement cycle after which it enters a quiescent state awaiting for a new triggering pulse to arrive.

Let the Datalogger perform 3-4 cycles or until the readings are stable.

Check that the different channels read sensible values.

1. Channel 1 is the reference channel. The reading is a fixed reading identifying this particular buoy. The reference number is written in the Test & Specification sheet for the Datalogger 3860. Allowable difference is ± 1 digit.

2. Wind Speed reading. If possible, use a fan to turn the sensor rotor and check for sensible readings.

3. Wind Gust reading. Use the same procedure as for channel 2. The reading should be the same as channel 2 or higher.

4. Wind Direction reading. Turn the Wind vane and see that the reading follows the Vane.

5. Wave Height reading. Test after deployment.

7. **Buoy Orientation** reading. This reading indicates the bearing of the Wind Vane on the Buoy. This bearing is the reference for the True Wind Direction measurements.

8. **Current Speed** reading. Use the Test Unit (see Data Sheet D320).

9. **Current Direction** reading. Use the Test Unit (see Data Sheet D320).

10. **Water Temperature** reading. Check against ambient temperature.

   If all readings appear logical the buoy is ready for operation.

   The buoy is now ready for deployment.

---

**Deploying the Buoy**

Prepare the anchoring equipment and the length of the mooring line according to the deployment depth.

Total Length of Anchoring Line = Depth + Max.Tide + Max.Wave Height + From 25 to 50% extra length (see drawing S6262B).

1) After the Rope, the Anchor Chain and Anchor are assembled, lower the anchor and chains gently until the anchor rests on the seabed.

2) Connect the mooring rope to the ballast chain at the bottom of the buoy.

3) Hoist the buoy overboard and hold the buoy alongside the vessel. Take care not to harm the superstructure in this operation.

   **Note!**
   
   Only use the handle on the buoy for lowering the buoy not the anchoring equipment, maximum weight 300kg (660lb).

4) If a Data Storage Unit DSU 2990 is used connect it the to the Control Unit and close the Wind Vane.

   The equipment is now waiting for the buoy to be triggered.

When the buoy is triggered the data are either stored in the Datalogger 3860 ready to be conveyed to the recipient over the GSM network when called upon or are transferred in real-time via radio or satellite.

**How to collect data from the buoy, see chapter 4.**
CHAPTER 4 Collecting Data From The Buoy

Data Transmission

The Transmitter, which is mounted on top of the Buoy, transmits the measured raw data instantaneously as they are measured. Data format is the Aanderaa PDC-4 code.

At the receiving point the radio receiver is connected to the Deck Unit 3127

If a GSM modem 3865 is connected the buoy can be dialed up and data can be downloaded. The buoy is of modular design which enables a variety of application

- Radio Modem, Frequency: 370-470MHz. Range: 20km
- GSM Modem, Frequency: 900/1800MHz. 900/1900 optional
- VHF Radio Transmitter 3838, Frequency: 142.025MHz
- UHF Radio Transmitter 3694, Frequency: 400 - 500MHz
- Argos Transmitter 2965, Frequency 401,650 Mhz

GSM Modem Setup

The GSM modem needs a SIM card prepared for data communication to operate. The SIM card is NOT delivered together with the GSM modem. Contact your network supplier to obtain a SIM card for your modem and install it as instructed.

Data display on a PC using 3710 program

Another alternative is to connect the radio receiver to a PC via Deck Unit 3127. The PC runs Display Program 3710, a real time display program with data storage capability

When using radio transmission, the program can handle data from up to 20 buoys providing data multiplexing is employed or the receiving station is equipped with several radio receivers, Deck units and Com-ports. When using GSM communication, the rate of data download will limit the number of buoys that can be connected. The user can set up the visual display as wanted.

Five different basic windows are available:

1) a bar graph to show for example water level
2) a directional compass for wind or current
3) a diagram display to show historical development of for example air temperature
4) a text display to show static text
5) a number display to show exact values

A complete display can then be built up by using a combination of these five windows. The on-line help will lead you, step by step, through a build-up of the display.

The program works almost like a drawing program with the ability to alter the drawing as the physical parameters change. Three display examples are available which can be altered by the user at will.

The program converts raw data in RS-232C format to data in engineering units. The program outputs
can be saved in a log-file for each station either as raw Data or as Engineering Data.

Log File System

It is also possible to obtain an extra software (Autolog Program 3875 for the 3710 Display Program) which among other things can save data for each day in separate files.

If the buoy is equipped with GSM modem the M version of program 3710 is required. The program has a dial-up function which can automatically dial up the buoy and download the last records.

The C version of Program 3710 has a custom-made display which can be delivered at an extra cost.

Program 3710 is intended for use in monitoring harbors, airports, power plants, reservoirs, etc., and facilities the need to monitor sea /coast or other outdoor environments. The program requires a computer with Windows ©95 (Build 1111 or later versions), Windows ©98 or Windows NTTM, version 4, with at least one free serial communications port available, 8 Mbytes of memory, 4 Mbytes of free hard-drive space and a mouse connected.

The program is delivered on 3.5” diskettes or a compact disk with a quick start-up guide, on-line help, a license code and a license agreement sheet. The program is also available on the Internet. A 30-day test program can be downloaded from our Internet site at: http://www.aanderaa.com/3710DispProg.htm

Note! To be able to publish the display on several terminals a client version of the program can also be delivered.
**Downloading Data and Programming the Buoy using Hyper Terminal & Modem**

To download data from the buoy, a computer with either an analog modem supporting 9600 baud or a GSM modem is required.

If a modem is already installed on the computer, skip the “Installing Modem” chapter and go directly to the “Setup of Hyper Terminal” chapter.

To install a modem, follow the “**Installing Modem:**” chapter below.

**Installing Modem:**

1. Open the “**Control Panel**” from the Start Menu.

2. For Windows XP, select “**Printers and Other Hardware**”.
   For Windows 95, 98, NT, and 2000, select “**Modems**” and jump to section 4.

3. Select “**Phone and Modem Options.**”

4. Click on the “**Modem**” tab, and then click “**Add**”.
5. Click in the “Don’t detect my modem; I will select from a list.” box, and then click “Next”.

6. Select a “Standard Modem” that corresponds with the maximum speed of the modem. If the maximum speed of the modem is not known, select “Standard 9600 bps Modem”. Click “Next”.

7. Select the port to which the modem is connected. If the modem is connected to an unknown port, select “All ports”. Click “Next”.

8. Click “Finish”.
Setup of Hyper Terminal:

1. Start Hyper Terminal, usually located as shown below. If Hyper Terminal is not visible there it is probably not installed on your computer. In this case contact your network administrator to install Hyper Terminal.

2. Enter a name for the connection and select an icon. Click “OK”.

3. Enter the buoy’s phone number and select the modem using the “Connect using:” drop down menu.

4. Click “Modify”.
5. Click “Configure”.

6. Set Port speed to “9600” and Flow control to “None”. Click “OK”.

7. Click “OK”.

8. Click “Dial”.

9. If a successful connection is established, the following data will be received.
Enter the Setup menu by modem:

1. If a successful connection is established, the following data will be received.

2. At the command prompt enter "setup". Enter your password.
   When delivered from factory the default password is: 3860.

---

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference</td>
<td>228</td>
<td></td>
</tr>
<tr>
<td>Wind speed</td>
<td>m/s</td>
<td>3.2</td>
</tr>
<tr>
<td>Wind gust</td>
<td>m/s</td>
<td>4.7</td>
</tr>
<tr>
<td>Wind direction</td>
<td>Deg.M</td>
<td>35.4</td>
</tr>
<tr>
<td>Air temperature</td>
<td>Deg.C</td>
<td>14.8</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>% RH</td>
<td>56.7</td>
</tr>
<tr>
<td>Visibility</td>
<td>m</td>
<td>1023.0</td>
</tr>
<tr>
<td>Air pressure (QNH)</td>
<td>hPa</td>
<td>1015.8</td>
</tr>
<tr>
<td>Wave Height</td>
<td>m</td>
<td>1.6</td>
</tr>
<tr>
<td>Wave Period</td>
<td>sec.</td>
<td>2.0</td>
</tr>
<tr>
<td>Buoy Orientation</td>
<td>Deg.M</td>
<td>350.2</td>
</tr>
<tr>
<td>Current speed</td>
<td>cm/s</td>
<td>5.0</td>
</tr>
<tr>
<td>Current direction</td>
<td>Deg.M</td>
<td>227.5</td>
</tr>
<tr>
<td>Water temperature</td>
<td>Deg.C</td>
<td>15.6</td>
</tr>
</tbody>
</table>
---

For help - write help at command prompt!

Command >
3. The "Setup" menu will now be received.
   See the operating manual for Datalogger 3860 for detailed description on each menu choice.

---

**Setup**

<table>
<thead>
<tr>
<th>Channel reading</th>
<th>Serial Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 Last Data</td>
<td>31 Modem Init String</td>
</tr>
<tr>
<td>12 Channel Settings</td>
<td>32 Set Baud Rate</td>
</tr>
<tr>
<td>13 Channel List</td>
<td>33 RS232 Port Setting</td>
</tr>
<tr>
<td>14 Display Raw Data</td>
<td>34 Serial Setting</td>
</tr>
<tr>
<td>15 Number of Channels</td>
<td>Memory Settings</td>
</tr>
<tr>
<td>16 Recording Interval</td>
<td>Memory Settings</td>
</tr>
<tr>
<td>17 Show Elapsed Sequence (Current Program)</td>
<td>Memory Settings</td>
</tr>
<tr>
<td>18 Remote Start Trigger</td>
<td>Memory Settings</td>
</tr>
<tr>
<td></td>
<td>41 Memory Setting</td>
</tr>
<tr>
<td>Misc</td>
<td>42 Sent to Voice</td>
</tr>
<tr>
<td></td>
<td>43 Clear All Data</td>
</tr>
<tr>
<td>21 Set Location and Owners Name</td>
<td>44 Clear All Parameters</td>
</tr>
<tr>
<td>22 Set Date and Time</td>
<td></td>
</tr>
<tr>
<td>23 Set New Password</td>
<td></td>
</tr>
<tr>
<td>24 Call Statistics</td>
<td></td>
</tr>
<tr>
<td>25 Command mode</td>
<td></td>
</tr>
<tr>
<td>99 Quit/Hang-up</td>
<td>51 Set Alarm Number</td>
</tr>
<tr>
<td></td>
<td>52 Set Alarm Interval</td>
</tr>
</tbody>
</table>

<Enter> or ? to show this menu. To stop listing of menu, press 's'.

---

1. Enter the “Setup” menu and select menu choice “25. Command mode”.
2. At the command prompt different commands can be given to list historical data. The commands are listed below

---

<table>
<thead>
<tr>
<th>Commands</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>list</td>
<td>Lists all historical data. The most recent data will be received first.</td>
</tr>
<tr>
<td>listbackwards</td>
<td>As for list.</td>
</tr>
<tr>
<td>lb</td>
<td>As for list.</td>
</tr>
<tr>
<td>listforward</td>
<td>Lists all historical data. Older readings first then newer readings.</td>
</tr>
<tr>
<td>lf</td>
<td>As for listforward.</td>
</tr>
</tbody>
</table>

Optional:
A time period may be added to all commands.
Syntax: <list command> <from time> - <to time>
Time syntax: YYYYMMDDHHmmSS YYYY-year, MM-month, DD-day HH-hour, mm-min, ss-seconds. Seconds may be skipped.
Example: 200206251400 - 200206251500

3. Go to the “Transfer” menu and select “Capture text...”
4. Click “Browse”. Enter a filename and select a location on the PC’s hard drive where you want the log file to be stored, then click “Start”.

5. Enter one of the list commands shown under section 2. If the list commands are given with a start and end time

Command >lf 200206250949 - 200206250959

To stop listing press 's' or Ctrl-x

-------------------------------------------------------------------------------
0-------12--------25--------37--------50--------62--------75--------87------100
...............................................................................
....
DATA LOGGER 3860
Owner’s Name
Date: 25/6-2002
-------------------------------------------------------------------------------
Reading
Parameter   Unit      9:59
-------------------------------------------------------------------------------
01 Reference                       228
02 Wind speed            m/s         6.0
03 Wind gust             m/s         8.7
04 Wind direction        Deg.M      35.7
05 Air temperature       Deg.C      12.9
06 Relative humidity     % RH       82.3
07 Visibility            m        1023.0
08 Air pressure (QNH)    hPa      1015.0
09 Wave Height           m           5.3
10 Wave Period           sec.        2.4
11 Buoy Orientation      Deg.M     238.5
12 Current speed         cm/s        0.6
13 Current direction     Deg.M      50.3
14 Water temperature     Deg.C      15.6
15 Battery Voltage   R   V         794.0
--------------------------------------- A system from Aanderaa Instruments ----
Time/Date :  25 June-2002  9:59:00
Time     Ref.   Ch002    Ch003    Ch004    Ch005    Ch006    Ch007    Ch008
Ch009    Ch010    Ch011    Ch012    Ch013    Ch014    Ch015
9:59    228        6.0      8.7     35.7     12.9     82.3   1023.0   1015.0
5.3      2.4    238.5      0.6     50.3     15.6    794.0
9:49    228        4.4      8.7     35.7     12.8     84.7   1023.0   1015.2
4.4       1.5     29.7    1.5     7.0      15.6    788.0

6. When the data has been downloaded click the “Stop” command.
Format description of the received data.

<table>
<thead>
<tr>
<th>Time/Date</th>
<th>DD m-YYYY HH:MM:SS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>Ref.</td>
</tr>
<tr>
<td>Ch002</td>
<td>Ch003</td>
</tr>
<tr>
<td>Ch004</td>
<td>Ch005</td>
</tr>
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<td>Ch007</td>
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<tr>
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<td>Ch009</td>
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<td>Ch011</td>
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<tr>
<td>Ch012</td>
<td>Ch013</td>
</tr>
<tr>
<td>Ch014</td>
<td>Ch015</td>
</tr>
<tr>
<td>HH:MM</td>
<td>rrrrr</td>
</tr>
<tr>
<td>rrrrr.dd</td>
<td>rrrrr.dd</td>
</tr>
<tr>
<td>rrrrr.dd</td>
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</tr>
<tr>
<td>rrrrr.dd</td>
<td>rrrrr.dd</td>
</tr>
<tr>
<td>D = date</td>
<td>m = January</td>
</tr>
<tr>
<td>Y = year</td>
<td>July</td>
</tr>
<tr>
<td>H = hour</td>
<td>February</td>
</tr>
<tr>
<td>M = minutes</td>
<td>March</td>
</tr>
<tr>
<td>S = seconds</td>
<td>April</td>
</tr>
<tr>
<td>r = reading</td>
<td>May</td>
</tr>
<tr>
<td>d = decimals</td>
<td>June</td>
</tr>
<tr>
<td>(can be set to</td>
<td>December</td>
</tr>
<tr>
<td>none, 1 or 2)</td>
<td></td>
</tr>
</tbody>
</table>

If the Datalogger is set to show no decimals or to list raw-data, the decimal sign and the decimal numbers will not be included in the data string.

The heading will increase together with the number of channels activated. If more than 16 channels are listed a third line will appear in the heading presenting the channel number. A LF and CR separates every line. If the Battery Voltage measurement is set to be stored, it will be added as the first channel and the heading will change. See below.

<table>
<thead>
<tr>
<th>Time</th>
<th>BattVolt</th>
<th>Ref.</th>
<th>Ch002</th>
<th>Ch003</th>
<th>Ch004</th>
<th>Ch005</th>
<th>Ch006</th>
<th>Ch007</th>
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<tr>
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<td>Ch008</td>
<td>Ch009</td>
<td>Ch010</td>
<td>Ch011</td>
<td>Ch012</td>
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<td></td>
<td></td>
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<td>Ch014</td>
<td>Ch015</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To insert the data into a spreadsheet use the "3660 List converter", a free utility program that can be downloaded from our website at:

http://www.aanderaa.no/Datalog3660.htm
To read the Data Storage Unit 2990 or 2990E, the following equipment is needed.

1) A Personal Computer
2) DSU Reader 2995
3) Data Reading Program 5059

The DSU reader 2995 will shift the level of the ASCII characters from the DSU to the standard levels of the RS-232C data format needed for further handling of the data.

When a DSU is connected to a suitably programmed computer, and when the right commands are given by the computer, the data will be transferred to the computer at a rate of 9600 baud. As this process goes on, the display of the DSU will show a steadily decreasing number until all data has been transferred. Data is not removed from the DSU during this process. If the DSU is disconnected from the DSU reader, the DSU will again show its initial number, after which the data transfer process can start over again if wanted.

To remove the data stored in the DSU, two special commands must be given. After the data have been removed, the DSU display will show five zeros.

The Data Reading Program DRP 5059 is a totally new Win32 based program, designed using the most modern software technology presently available. Emphasized has been put on ease of use together with versatile, graphical user interface and system flexibility.
Minimum requirements are:

Pentium 166 Processor (recommended),
16MB RAM for Windows 95 and 98, 32MB RAM for Windows NT, 10MB Hard Disk. It can be used with Windows ©95, build 1111, Windows ©98 and Windows NT™ Sp3.

The program replaces the Data Reading Program 4059. The program will not work with Windows 3.1 or 3.11, and customers working in these environments should still use the 4059 program.

It is a component based program, built using a large set of independent binary components that become a part of your operating system instead of building the application into one huge executable file. As such, each component becomes available to any application that can make use of it.

The advantage of using this technique is that only one copy of the component resides on your disk although several applications may use it. This yields less chance for bugs or errors and it improves productivity through reuse of programming effort.

An example of such a component is the AAICOMServer used to set up the serial (COM) ports and download the DSU. Used in the Display Program 3710, it has proven its reliability.

Perhaps the most important feature is the possibility to design your own custom analysis tool components. The DRP 5059 incorporates a special hook-in mechanism for ActiveX components. The hook-in interface provides your ActiveX component with access to the database and to a window in which you can show the analysis result.

In most cases, you will probably be satisfied with the tools shipped with the program from the factory. These tools comprise graphing features, statistical analysis and signal analysis. Analyze the exported ASCII files from the database in other products such as Microsoft Excel.

The Data Reading Program 5059 is a multi-document application. A document always links to a measurement session. A measurement session usually consists of the data that is stored in a single Data Storage Unit (DSU).

A DSU connects to a document via a COM port. Several documents can open at the same time. Each document uses a separate COM port, so to work with two DSUs at the same time, two COM ports must be available. The COM port is, however only needed during the actual DSU download (reading) session and not while working with a previously downloaded DSU file or an imported ASCII file.

The Data Reading Program 5059 is a new, multifunction handling and data processing program.

It contains:
- a Template Library of standard instruments, stations and sensors from Aanderaa Instruments
- a Custom Library to store customers’ own product specifications and
- a Tooling section for different data handling functions as well as a faster data transfer mode.

Two sample *.dsu files, located in the samples directory, allows for experimenting with the program without having to download a DSU item.

To download a complete version of the Data Reading Program 5059, see our web pages on the internet. The program grants a 30 day trial period during which time all functionality is available.

After the trial period the program reverts into a non-licensed, limited capability version. By purchasing a license key from the manufacturer, or one of our representatives, the full functionality will be retained. The size of this file is 3253KB.
CHAPTER FIVE MAINTENANCE

General

The Coastal Monitoring Buoy CMB 4280 requires a minimum of maintenance. The maintenance and cleaning intervals depend on the local environmental conditions, under which the buoy is deployed.

The buoy should be checked regularly for any damage. The outside should be kept clean, especially the Solar Cell Panels.

Before launching the buoy again, it is recommended to apply suitable anti-fouling paint to the parts of the buoy that will stay under water bearing in mind that the sensing area of the sensors must not be covered.

Maintenance Procedure

Once a year the buoy should be overhauled according to the following procedure.

1. Turn the buoy OFF by removing the ON/OFF plug. Protect open plugs with cover caps.
2. When lifted out of the sea and on deck, clean the buoy hardware for marine fouling such as seashells, barnacles, seaweed, crustacea etc. Pay special attention to the cone joints which must be separated for further inspection.
3. Disconnect the solar cell panels from the buoy hardware by detaching the cable between the buoy hardware and the Control Unit. Protect plugs with cover caps.
4. Detach meteorological and submersible sensors and protect open plugs with cover caps. Follow the maintenance instructions for each sensor.
5. Remove the four bolts fastening the Central Buoy Module to the buoy hardware and pull the superstructure with the sensor string out of the buoy hardware. Handle with extra care to avoid damage to the Doppler Current Sensor and Wave Height Sensor if installed.
7. Remove the sensor string before cleaning the inside of the buoy hardware.
8. After maintenance is performed on all sensors, reinstall sensors and perform a function test on the buoy. See next page.
**Function Test**

**Buoy Hardware**
1. Cover up all five solar cell panels.
2. Remove the cover from one of the panels and measure the voltage on the 2-pin plug with a voltmeter. The voltage reading should be between 12-15V. Cover the panel again and remove cover from the next panel and check voltage reading. Repeat procedure until all panels has been tested.

**Sensors**
1. Connect Connecting Cable 2842 between the PDC-4 input receptacle on Deck Unit 3127 and the PDC-4 Output receptacle on the Control Unit.
2. Connect RS-232C Cable 3016C between the RS-232C Output on Deck Unit 3127 and a computer’s serial port.
3. Start Display Program 3710 and open the *.aip file for the specific buoy.
4. Insert the ON/OFF plug into the ON/OFF receptacle on the Control Unit. The Datalogger will now start scanning the sensors. After the last channel has been scanned the data will be presented in the 3710 display.
5. Wind Speed/Gust, check for sensible readings.
6. Wind Direction, turn the wind vane and see that the readings change in correlation with the position of the wind vane.
7. Air Temperature, check for sensible reading.
8. Relative Humidity, check for sensible reading.
9. Visibility, cover the sensor legs with a dark cloth to get max. reading and hold a reflective surface approx. 5 cm below sensor to get min. reading
10. Current Speed/Direction, to test these parameters the buoy should be deployed into the water.
12. Conductivity, use resistor loop to check the sensor.

**GSM Modem**
Dial the GSM modem from another modem and check that data are accessible.

**Charging procedures**
1. Disconnect the power cable from the buoy hardware from the Control Unit, and connect the charging cable (Connecting Cable 3483, 2 pins and free end) to the Solar Panel receptacle on the Control Unit.
2. Adjust the Battery Charger to 16Volt.
3. Connect the charging cable to the power supply (with voltage adjuster and current limiter) and adjust the current limiter to 2.1A. Charge for 14 hours.
4. The batteries in the Central Buoy Module will withstand 100% overcharge, but **precaution should be taken to avoid temperature over 50°C**.
5. After the charging period, disconnect the charger and cable.
We do not recommend opening any of the sections of the buoy if all the readings look fine. If a problem should occur the different sections can be opened and inspected/serviced as described below.

**Central Buoy Module**
1. Check the outside of the Central Buoy Module for wear and corrosion.
2. Remove the six flange screws at the lower end of the module.
3. Pull the inner structure out of the tube.
4. Remove the link from the lower end of the Central Buoy Module by removing the four screws.
5. Check the link and the Central Buoy Module for leakage and corrosion.
6. Detach the battery connector and measure the voltage on the three battery modules. If voltage is less than 12V the batteries needs to be recharged.
   See instruction on how to recharge the batteries.
7. Remove the Buoy Orientation Sensor and the Wave Height Sensor. See instructions on how to maintain these sensors and reinstall.
8. Make sure the battery modules are fastened to the frame. If not replace the tape.
9. Replace silica gel bags.
10. Apply silicon grease to new o-rings and reinstall the module.
11. Apply anti-seize lubricant “Un-lock” on the upper cone.

**Control Unit 3850**
1. Check the upper and lower end connectors for damage and corrosion. Also check that the guiding pin on the lower end is fastened. If it is loose, remove it and clean the mounting hole with acetone and use Loctite 648 to fasten the pin again.
2. Open the unit by removing the screw on the upper end cone, and press the lower end receptacle in.
3. Pull the frame up by pulling the upper end receptacle housing until the printed circuit card is out of the tube. The whole frame cannot be completely removed from the tube. Check for leakage and corrosion.
4. Replace silica gel bags.
5. Apply silicon grease to new o-rings and replace old o-rings.
6. Apply “Un-lock” to:
   a. Upper connector housing and put the frame back into the
   b. Upper and lower cones.
   c. Locking screw on the upper cone.
   d. Threads on the muff nut.

**Mast Section with Flashing Light**
1. Check the upper and lower end connectors for damage and corrosion. Also check that the guiding pin on the lower end is fastened. If it is loose, remove it and clean the mounting hole with acetone and use Loctite 648 to fasten the pin again.
2. Open the unit by removing the screw on the upper end cone and press the lower end receptacle in.
3. Pull the frame up by pulling the upper end receptacle housing until the printed circuit card is out of the tube. Check for leakage and corrosion.
4. Replace silica gel bags.
5. Apply silicon grease to new o-rings and replace the old o-rings.
6. Apply “Un-lock” to:
   a. Upper connector housing and put the frame back into the
   b. Upper and lower cones.
   c. Locking screw on the upper cone.
   d. Threads on the muff nut.

**Sensor Ring**
1. Remove all sensors, radio/GSM Modem and cover caps.
2. Visually inspect sensor outlets and Radio/GSM outlet for signs of corrosion and leakage. Pay special attention to o-ring grooves concerning corrosion and scratches. If any leakage or corrosion is detected in any of the sensor outlets, clean with an appropriate cleaner (alcohol based). Dry out the outlet by elevating the temperature above dew point, but not above 60°C. If water has entered through a sensor or the Radio/GSM Modem, we recommend that the sensor/radio/GSM Modem be sent back to the factory for repair, test and calibration.
3. Ohm all connections between sensor outlets and the lower 18-pin connection. Use an ohmmeter set to low resistance (max 2k). Our Test Plug 3419 with 6-pin receptacle can be used. In addition measure for short circuits between the different pins (signals/data channels). When measuring for short circuits, set your ohmmeter to >1M.
4. Check that the guiding pin on the lower end is fastened. If it is loose, remove it and clean the mounting hole with acetone and use Locktite 648 to fasten the pin again.
5. Apply silicon grease to new o-rings and replace the old o-rings.
6. Apply “Un-lock” to:
   a. Upper connector housing and put the frame back into the
   b. Upper and lower cones.
   c. Lock screw on the upper cone.
   d. Threads on the muff nut.
Recommended Spares and Accessories 3889

**Consisting of:**

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<td>Ø 0,70 millimeter acid proof locking wire AISI 316</td>
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<tr>
<td>1642401</td>
<td>4</td>
<td>M 8x8 millimeter Set Screw, DIN 16 AA4</td>
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<td>1680054</td>
<td>2</td>
<td>D-Shackle No. 730 with long pin and split pin 316</td>
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<td>O-ring Angus RM 0096-24</td>
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<tr>
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<td>8</td>
<td>O-ring 10x1, Simrit material</td>
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<tr>
<td>1863002</td>
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<td>O-ring silicone 24,6 x 2,4 millimeter</td>
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<td>2</td>
<td>O-ring, RMO 186-24 (18,6x2,4)</td>
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<td>2228A</td>
<td>1</td>
<td>Three Cup Rotor for Wind Speed Sensors</td>
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<td>2620B</td>
<td>1</td>
<td>Bearing Assembly. WSS 2740</td>
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<td>3142</td>
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<td>2769</td>
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<td>Mast Cap for 2&quot; tube</td>
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<td>3738</td>
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<tr>
<td>3739</td>
<td>1</td>
<td>Un-lock Release Agent, 50 ml.</td>
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### Tool Kit, Data Buoy

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<th>Formål.</th>
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<td>10 1027</td>
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<td>Wrench, NV 10 mm</td>
<td>CBM 3867</td>
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<td>Wrench, NV 11 mm</td>
<td>Nut, Antenna</td>
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<td>10 1020</td>
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<td>Wrench, NV 13 mm</td>
<td>Adjustable Anchoring point</td>
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<td>10 1021</td>
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<td>Wrench, NV 30 mm</td>
<td>DCS 3500</td>
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<td>2</td>
<td>Wrench, NV 36 mm</td>
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<td>Sensor fot</td>
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<tr>
<td>91 3002</td>
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<td>Hex Key, NV 4 mm</td>
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<td>91 3008</td>
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<td>Hex Key, 2,5 mm</td>
<td>Wind Direction Sensor</td>
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<td>Subm. Sensor / Buoy hardware</td>
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<td>1</td>
<td>Pipe Wrench</td>
<td>Mast Mufle, old / Sensor house</td>
</tr>
<tr>
<td>91 3025</td>
<td>2</td>
<td>C Wrench, 58/62 mm</td>
<td>Mast Joints</td>
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<tr>
<td>91 3008</td>
<td>1</td>
<td>C Wrench, 52/55 mm</td>
<td>Sensor Disk</td>
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<tr>
<td></td>
<td>1</td>
<td>C Wrench, 20/22 mm</td>
<td>Air Temp. / Rel. Humidity Sensor</td>
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<tr>
<td>10 0013</td>
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<td>Screw Driver, flat 5,0 mm</td>
<td>Wind Dir. Sensor / Opne 3189 etc.</td>
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<tr>
<td>10 0018</td>
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<td>Screw Driver, flat 2,5 mm</td>
<td>Wind Speed Rotor Boss</td>
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<td>1</td>
<td>Nippers</td>
<td>Split Rivet, Thimble Bolt</td>
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<tr>
<td></td>
<td>1</td>
<td>Pliers</td>
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### Electronic Work

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<tr>
<td>10 2008</td>
<td>1</td>
<td>Tweezers, flat</td>
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<td>10 2007</td>
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<td>1</td>
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<td>Soldering Iron, Gas</td>
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<td>Solder, Dispenser</td>
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<td></td>
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<td>Desolder Wick Dispenser</td>
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### Test Equipment

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<td>Test Sensor, 6-pin</td>
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<td>97 3418</td>
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<td>Test Sensor, 10-pin</td>
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<tr>
<td>97 3443</td>
<td>1</td>
<td>Test Adapter for Field Station</td>
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</table>
Fig. 6 GSM Modem with 2” Cone 3865
TOTAL LENGTH OF ANCHORING LINE:
DEPTH + MAX TIDE + MAX WAVE HEIGHT
+ FROM 25 TO 50% EXTRA LENGTH FOR TOTAL

Fig. 7 Mooring System for Buoy S6262B
Fig. 8 Sensor Ring 3868
Fig. 9 Buoy Hardware 3870
Fig. 10 Cable 3879 for Solar panels

Part-List

<table>
<thead>
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<th>Dwg. No.</th>
<th>Qty</th>
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<td>97 2979T WATERTIGHT PLUG.2P</td>
<td>V-7784</td>
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<td>2</td>
<td>29 7013 6 COND. CABLE</td>
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<td>1.2</td>
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<td>3</td>
<td>29 7020 6 COND. CABLE</td>
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<tr>
<td>4</td>
<td>96 3297 RECEPTACLE</td>
<td>V-6912</td>
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<td>5</td>
<td>56 0051 2P LEMO INSERT</td>
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<td>6</td>
<td>26 0044A/B SCOTCHCAST</td>
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<td>98 0043 COVER CAP</td>
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<td>96 3036 COVER CAP</td>
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Last correction: 22.02.02  
Date  
Scale  
Refer to:  
Constr. by: ERM  
AANDERAA INSTRUMENTS  
5852 BERGEN, NORWAY, Tel.+47 55 109900  
Drawing no. V-8816A
Fig. 11 Solar Panels 3878

<table>
<thead>
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Finish:

Part no: Stock No./Description Qty.

SOLAR PANEL 3878

AANDERAA INSTRUMENTS
5050 NESHTUN, NORWAY, Tel.+47 55 132500

Drawing no. V-8839
### Part-List

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### Colour Code
- **BLUE**
- **GREEN**
- **ORANGE**
- **YELLOW**
- **VIOLET**
- **RED**

### Diagrams

**Fig. 12 Link 3962 between Doppler Current Sensor (DCS) and CMB 4280**

- **30 PIN INSERT, SOLDERING SIDE**
- **18 PIN INSERT, SOLDERING SIDE**

**30 PIN INSERT, SOLDERING SIDE**

**18 PIN INSERT, SOLDERING SIDE**
Fig. 13 Control Unit 3850 for Buoy with Datalogger 3860

AANDERAA INSTRUMENTS
BERGEN, NORWAY Tel. +47 55 13 5000

STATE-OF-THE-ART SCIENTIFIC PRODUCTS

WIRING DIAGRAM

18 PIN INSERT, EXTERIOR VIEW

CABLE 24 PIN DIP 14 PIN DIP PDC-4 OUTPUT

COLOR CODE PIN NO. PIN NO. EXP INSERT USED FOR
BROWN 16 3 1 SYSTEM GROUND
RED 9 11 3 6V
ORANGE 26 4 2 CONTROL VOLTAGE
YELLOW 2 10 5 OUTPUT
BLUE - 9 6 -

CABLE 24 PIN DIP 14 PIN DIP ON/OFF

COLOR CODE PIN NO. PIN NO. EXP INSERT USED FOR
VOILET 8 3 1 BATTERY
GREY 9 11 2 BATTERY
BLACK 10 9 2 6V
BROWN 11 7 2 BATTERY
RED 12 5 2 6V

CABLE 24 PIN DIP 14 PIN DIP COM PORT

COLOR CODE PIN NO. PIN NO. EXP INSERT USED FOR
ORANGE 16 2 1 SYSTEM GROUND BATTERY
GREEN 17 4 1 SYSTEM GROUND BATTERY
VIOLET 18 6 5 1 XRD COM PORT DCD
BLUE 19 8 6 1 TXD COM PORT
GREY 20 10 8 1 SYSTEM GROUND

CABLE 24 PIN DIP 14 PIN DIP INPUT SOLAR CELLS

COLOR CODE PIN NO. PIN NO. EXP INSERT USED FOR
WHITE 16 3 1 SYSTEM GROUND
BLACK 15 11 2 CHARGE
BROWN 14 9 2 SYSTEM GROUND
RED 13 7 2 CHARGE
ORANGE 12 5 1 SYSTEM GROUND
YELLOW 11 3 2 CHARGE

Part List

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Fig. 17 Mast Section with Flashing Light 3861