INSTRUCTION MANUAL

CSBUOY-DT

Revision: 11/08
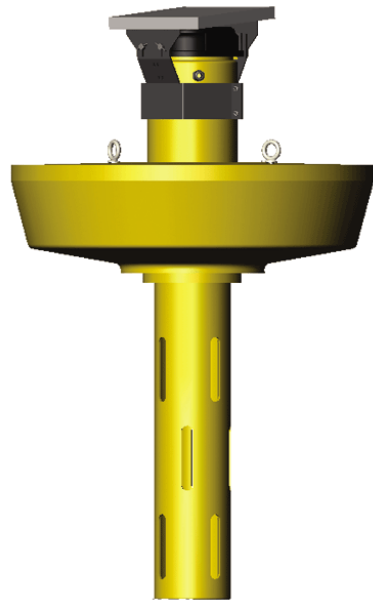
Warranty and Assistance

The **CSBUOY-DT** is warranted by CAMPBELL SCIENTIFIC, INC. to be free from defects in materials and workmanship under normal use and service for twelve (12) months from date of shipment unless specified otherwise. Batteries have no warranty. CAMPBELL SCIENTIFIC, INC.'s obligation under this warranty is limited to repairing or replacing (at CAMPBELL SCIENTIFIC, INC.'s option) defective products. The customer shall assume all costs of removing, reinstalling, and shipping defective products to CAMPBELL SCIENTIFIC, INC. CAMPBELL SCIENTIFIC, INC. will return such products by surface carrier prepaid. This warranty shall not apply to any CAMPBELL SCIENTIFIC, INC. products which have been subjected to modification, misuse, neglect, accidents of nature, or shipping damage. This warranty is in lieu of all other warranties, expressed or implied, including warranties of merchantability or fitness for a particular purpose. CAMPBELL SCIENTIFIC, INC. is not liable for special, indirect, incidental, or consequential damages.

Products may not be returned without prior authorization. The following contact information is for US and International customers residing in countries served by Campbell Scientific, Inc. directly. Affiliate companies handle repairs for customers within their territories. Please visit www.campbellsci.com to determine which Campbell Scientific company serves your country.

To obtain a Returned Materials Authorization (RMA), contact CAMPBELL SCIENTIFIC, INC., phone (435) 753-2342. After an applications engineer determines the nature of the problem, an RMA number will be issued. Please write this number clearly on the outside of the shipping container. CAMPBELL SCIENTIFIC's shipping address is:

> **CAMPBELL SCIENTIFIC, INC.**
> RMA#_____
> 815 West 1800 North
> Logan, Utah 84321-1784

For all returns, the customer must fill out a "Declaration of Hazardous Material and Decontamination" form and comply with the requirements specified in it. The form is available from our website at www.campbellsci.com/repair. A completed form must be either emailed to shanna@campbellsci.com or faxed to 435-750-9579. Campbell Scientific will not process any returns until we receive this form. If the form is not received within three days of product receipt or is incomplete, the product will be returned to the customer at the customer's expense. Campbell Scientific reserves the right to refuse service on products that were exposed to contaminants that may cause health or safety concerns for our employees.

CAMPBELL SCIENTIFIC, INC. does not accept collect calls.

CSBUOY-DT Shipping List

Items packaged with the **CSBUOY-DT** for shipment include:

- CSBUOY-DT
  - Solar panel with mounting brackets and cable
  - Lid
  - Instrument housing with antenna hole plug
  - Float with two (2) eye-bolts
  - Float plug unscrewed
  - Instrument shroud
  - Instrumentation mounting bracket
    - CR206
    - Antenna with cable
    - Relay with cable
    - 7 AH battery with cable
  - Sensors
    - Dissolved oxygen/temperature probe
    - Wiper brush

- Two (2) large desiccant packs

- Humidity card

- CSBUOY-DT manual

- CR206 manual/CD-ROM

Special Operating Notes

1. Check the shipping list in the front of the manual and make sure that all the parts checked off the list are with the CSBUOY-DT. If any parts are missing, please contact Campbell Scientific, Inc. (435) 753-2342.

2. When connecting the battery avoid shorting the battery to the CR206.

3. Damage to the electronics will occur if moisture builds up inside the CSBUOY-DT instrument housing.

4. The Heyco pressure fittings seal the cable entry points against water intrusion. These fittings must be tightened periodically to ensure a tight fit.

CSBUOY-DT Table of Contents

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Section 1. Introduction

The CSBUOY-DT is programmed to communicate directly with a personal computer operating Device Configuration Utility software and/or as a wireless sensor providing data for other Campbell Scientific dataloggers. A 5-watt solar panel is used to trickle charge the battery.

1.1 Specifications

General

CSBUOY-DT Weight:	37 lbs
Environment:	Freshwater and brackish ponds and small lakes; quiet water marine (no wave or tidal activity)

Buoy

Material:	Polyethylene
Dimensions:	47" (119 cm) height, 30" (76 cm) float diameter
Instrument Housing:	6.36" (16.15 cm) OD, 6" (15.24 cm) ID

Wireless Transmitter

Storage:	512 Kbytes Flash Final Storage; data format is 4 bytes per data point (table-based); 60 Kbytes Flash (OS/program)
Radio Type:	RF401, 916 MHz Spread Spectrum Transceiver
Average Continuous Current Drain:	20 mA radio always on, 2.2 mA radio in 1 s duty cycle, 0.6 mA radio in 8 s duty cycle

Antenna

Frequency:	900 Mhz
Distance:	5000 ft (1524 m) assuming line of sight
Gain:	0 dBd
Length:	3.25" (8.26 cm)

Solar Panel

Typical Peak Power:	5 W
Voltage @ Peak Power:	17.1 Vdc
Current @ Peak Power:	300 mA
Dimensions:	9.45" (24 cm) length, 10.4" (26.4 cm) width

Dissolved Oxygen/Water Temperature Probe

|	
Membrane Type:	PTFE (Teflon®)
Output at 100% Saturation:	24 to 42 mV
Temperature Range:	0° to 50°C
Accuracy:	+/- 2%
Response Time:	2 minutes to reach 90% of final reading
Minimum Water Flow Rate:	2" (5 cm) per second across membrane
Material:	Delrin®
PRT:	100 Ohm
Power Requirements for Agitator Brush:	12 Vdc, 1.1 A

Section 2. CSBUOY-DT Description

The CSBUOY-DT is designed to eliminate the use of hard-wire cable to connect the dissolved oxygen and water temperature sensors with the datalogger (CR510, CR10X, CR23X, CR800, CR850, CR1000, CR3000). Operation is simplified through a modular design, prewired sensors, and preprogrammed interface. This manual covers installation, communication, and maintenance.

2.1 System Components
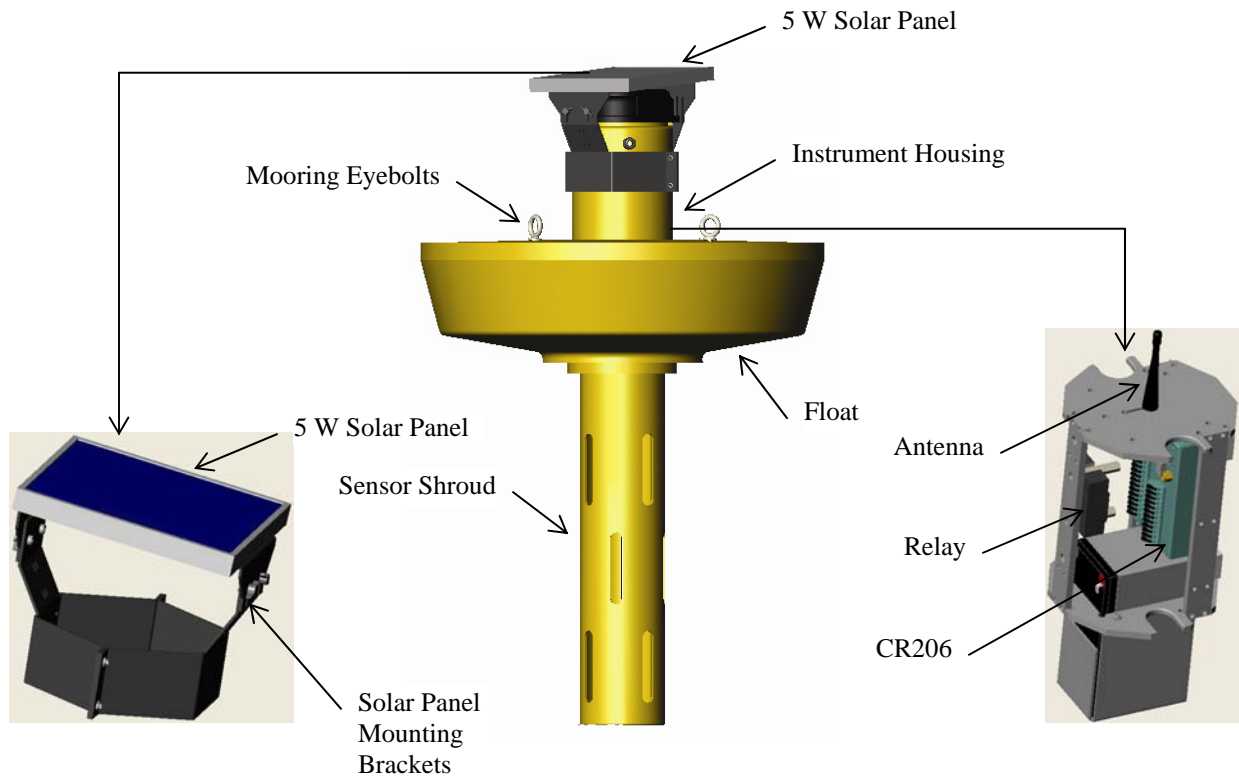
2.2 Standard Sensors

Prewired sensors include:

- Dissolved Oxygen

- Water Temperature

- Battery Voltage

- Wiper Brush

- Relative Humidity (optional)

2.3 Communication Options

- Direct RS-232 Connection to PC

- RF401 Spread Spectrum Radio Connection to PC

- Rf401 Spread Spectrum Radio Connection to Datalogger (CR510, CR10X, CR23X, CR800, CR850, CR1000, CR3000)

2.4 Power Supply

- 7 Amp/hr 12 VDC Rechargeable Battery

- 5 W Solar Panel Trickle Charger

Section 3. CSBUOY Installation

3.1 Site Selection

The site should represent the general area being measured. Placement should allow the buoy to float freely without obstruction from the bottom of the water compound being monitored. The buoy solar panel should not have any obstruction from full sunlight. Keep away from overhanging trees or other obstructions. The solar panel should be angled towards the south to maximize full solar capabilities.

3.2 CSBUOY-DT Assembly

CR206	Relay	DO/WT Probe	Wiper	Solar Panel	Batt
Battery-					Black
Battery+					Red
Charge-				Black	
Charge+				Red	
	1		Brown		
Battery+	2+ White				
SW Batt	3+ Black				
G	4 Clear				
G			Blue		
SE1		Red - DO Sig+			
GND		Black - DO Sig-			
SE2		Green - PRT V1			
GND		White - PRT G			
EX1		Purple Vex (2.5v)			
G		Clear - Shield			

Ensure that each wire is in the proper place on the CR206. Connect the battery cable to the battery. Using a wrench, tighten the Heyco Pressure fitting to ensure a watertight seal around the sensor cables exiting the **instrument housing**. Insert the **instrument mounting bracket** into the **instrument housing**, paying particular attention that the cable are not pinched. Tighten the **instrument housing lid**.

With a wrench, tighten the **vent plug** into the **float**.

Attach the **solar panel** to the **solar panel brackets**. Tighten the connection with the **thumb screws**.

Secure the **mooring eye-bolts** to a mooring line or the **anchor eye-bolt** to the anchor line to secure placement of buoy in desired location.

Section 4. Communication

The CSBUOY-DT can be used as a stand-alone monitoring system that communicates directly with the PC, or as a wireless sensor that is integrated with other Campbell Scientific dataloggers (CR510, CR10X, CR23X, CR800, CR850, CR1000, CR3000) with table-based operating systems using the PakBus communication protocol.

4.1 Direct Connection to PC

In order to communicate with the CSBUOY-DT directly from the PC:

1. Device Configuration Utility software must be installed in the PC.

2. An RF401 Spread Spectrum Radio must be connected via com port to the PC.

3. The RF401 and CSBUOY-DT Transceiver (CR206) must be configured to communicate with each other (refer to RF401 and CR206 manuals).

4.1.1 Device Configuration Utility Software Installation

Refer to the Device Configuration Utility Manual for installation and operation instructions.

4.1.2 RF401 Connection

Refer to the RF401 Manual for configuration instructions.

4.2 CSBUOY-DT as a Wireless Sensor

A CSBUOY-DT acting as a wireless sensor can communicate with a CR800, CR850, CR1000, or CR3000 datalogger using the GetVariable instruction. With a CR10X, CR510, or CR23X, the program instruction P193 is used. These instructions open the communication between CSBUOY-DT and the datalogger allowing data to be sent and received. In addition to this instruction:

1. The datalogger requires a RF401 Spread Spectrum Radio configured with a datalogger CDSC current port configuration.

2. The RF401 connected to the datalogger and the CSBUOY-DT must be configured with the same radio address, net address and hopping sequence.

Programming Examples

The following example allows the CR1000 to communicate with one CSBUOY-DT.

```
'CR1000 Series Datalogger

Public Result, Remotedata (3)

DataTable (Test,1,-1)
    DataInterval (0,60,Sec,10)
    Sample (3,Remotedata(),FP2)
EndTable

Alias Remotedata(1) = DOmV
Alias Remotedata(2) = WaterTempC
Alias Remotedata(3) = BatteryVolt

BeginProg
    Scan (30,Sec,0,0)
    GetVariables (Result,ComSDC7,0,1,0000,0,"Public","Buoydata()",Remotedata(),3)
    'where 1 is the PakBus address of the CSBUOY-DT
        CallTable Test
    NextScan
EndProg
```

This example allows the CR10X to communicate with one CSBUOY-DT.

```
  ;{CR10X-PB}
;
*Table 1 Program
  01: 30            Execution Interval (seconds)

1: Batt Voltage (P10)
  1:   1            Loc [ Batt      ]

2: PakBus - Wireless Network Master (P193)
  1:   1            Number of Remotes
  2:  10            First Remote Address
  3:   0            Time Into Transmit Interval (sec)
  4: 300            Transmit Interval (sec, 0 = use execution interval)
  5:   0            Transmit Delay Between Remotes (sec)
  6:   5            Swath to Receive
  7:   7            First Loc for Data Received [ RID_1      ]
  8:   0            Swath to Send
  9:  18            First Loc to Send [ Scratch     ]
  10: 2            Result Code Loc [ RCom_1      ]

3: Data Table (P84)
  1:   0            Seconds into Interval
  2: 300            Seconds Interval
  3:   0            (0 = auto allocate, -x = redirect to inloc x)
  4: Hist           Table Name
```

```
4:  Sample (P70)
   1:   13          Reps
   2:   1           Loc [ Batt        ]
```

For further instruction on programming, please refer to the CR10X manual.

Section 5. Maintenance

The CSBUOY-DT has been engineered to provide many years of reliable service. However, periodic maintenance is required to help ensure that the system performs up to its potential. Equipment must be in good operating condition, which requires a program of regular inspection and maintenance. Routine and simple maintenance can be accomplished by the person in charge of the CSBUOY-DT.

5.1 Instrumentation Maintenance

The instrumentation requires a minimum of routine maintenance. A few preventative maintenance steps will optimize battery life and decrease the chances of system failure.

5.1.1 Batteries

The CSBOUY-DT has been programmed to record battery voltage. This will allow the user to determine how long a fresh battery will last. The CSBUOY-DT is supplied with a fresh 12 VDC, 7.0 Ahr rechargeable battery. This battery is continually recharged by the 5-watt solar panel mounted on top of the instrument housing. Be aware of battery voltage that consistently decreases over time, which indicates a failure in the charging circuitry.

5.1.2 Desiccant

Damage to the CR206 and wiring panel will occur if high moisture levels inside the CSBOUY-DT instrument housing are not corrected. Enclosure humidity is monitored by a humidity indicator card provided with the CSBUOY-DT. It can also be more accurately monitored using the 10162 Enclosure Humidity Sensor, which is an optional sensor that can be purchased with the CSBUOY-DT. The CSBOUY-DT is programmed to provide data from this sensor.

Regardless if the humidity sensor or the humidity indicator card is used to monitor humidity inside the instrument housing, desiccant packs should be replaced when relative humidity inside the instrument housing exceeds 35%.

5.1.3 Sensor Maintenance

Sensor maintenance should be performed at regular intervals, depending on the desired accuracy and the conditions of use. A suggested maintenance schedule is outlined below.

First week

- Check the wiper brush to ensure it is removing biological growth from the dissolved oxygen sensor membrane.

- Check the Heyco pressure seals to ensure a tight fit.

- Check inside of the instrument housing to ensure against water leakage. Any leakage will also be indicated by increase in humidity inside the instrument housing.

- Check the dissolved oxygen probe to ensure a correct reading.

Each month

- Check wiper brush to ensure it is removing biological growth from the dissolved oxygen membrane.

- Check humidity indicator card (or humidity readings from sensor). Replace desiccant pack and tighten Heyco pressure fittings if needed.

- Check dissolved oxygen readings; calibrate probes if required.

Every Six Months

- Replace dissolved oxygen probe membrane and refill electrolyte solution. Calibrate dissolved oxygen probe.

Each Year

- Check cable for rodent or environmental damage.

- Replace humidity indicator card if necessary.

Every Three to Five Years

- Check anode and cathode metals inside dissolved oxygen probe. Replace if corrosion is extensive.

- Replace 10162 Humidity Sensor (if being used).

General Maintenance

- An occasional cleaning of the glass on the solar panel will improve its efficiency.

- Check sensor leads and cables for cracking, deterioration, and rodent damage.

- Check the CSBUOY-DT float, instrument housing, instrument shroud, and cap for structural damage, poor fittings, loose fittings.

5.1.4 Calibration

The multiplier is used to calibrate the dissolved oxygen probe. The calibration of the probe when using it as a wireless sensor in conjunction with another datalogger is then a function of the datalogger. Generally this is made simple by using the feature of PondView software. When using the CSBUOY-DT as a stand-alone direct to PC connection then the multiplier is changed in the Device Configuration Utility software.

5.1.4.1 Air Calibration

1. Place the dissolved oxygen probe in the air, shaded from the sun. Wait for the measurement reading to stabilize. This may take 15 minutes or more.

2. Determine the air temperature (use the temperature reading from the probe; this is found on the Device Configuration Utility screen) and the barometric pressure(preferred) or elevation.

3. Using the calibration chart determine the oxygen concentration in the air.

4. Use the following equation to calculate the multiplier:
    $M = P/R$
    M = Multiplier
    P = Concentration in PPM of the air (from calibration chart).
    R = The signal output in mV of the dissolved oxygen probe.

5. Enter the multiplier in Device Configuration Utility or LoggerNet from the calculated number.

5.1.4.2 Hand Calibration

1. Use a hand-held dissolved oxygen meter to determine the correct concentration of dissolved oxygen in the water (the accuracy of the method will be dependent upon the accuracy of the hand held device).

2. Use the following equation to calculate the multiplier:
    $M = D/R$
    M = Multiplier
    D = measured dissolved oxygen in PPM.
    R = The signal output in mV of the dissolved oxygen probe.

3. Enter the multiplier in Device Configuration Utility or LoggerNet from the calculated number.

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