OTT HydroMet

SUTRON
an OTT HydroMet brand

# Accubar / Compact
# Constant Flow Bubbler

**Operational Manual**


8800-1224 | V1 (09-2024)

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# Table of contents

# 1 Scope of supply

The following items are included with delivery:

- Constant Flow Bubbler (CFB)
- 3/8" tube
- Cover cap

# 2 Order numbers and variant code

## 2.1 Product variants

### Constant Flow Bubbler, single orifice

| Variant | Order number |
|---|---|
| Accubar Constant Flow Bubbler | 56-0133-25-1 |
| Compact Constant Flow Bubbler with 3/8" fitting, 25 psi | 56-0133-25-1S |
| Compact Constant Flow Bubbler with 6 mm Fitting - Includes the desiccant | 56-0133-25-1SC |
| Compact Constant Flow Bubbler with 3/8" fitting, no Desiccant Kit | 56-0133-25-1SND |
| Accubar Constant Flow Bubbler – 50 psi | 56-0133-50-1 |
| Compact Constant Flow Bubbler with 3/8" fitting, 50 psi | 56-0133-50-1S |

### Constant Flow Bubbler, dual orifice

| Variant | Order number |
|---|---|
| Accubar Constant Flow Bubbler Dual Orifice, Dual Sensor | 56-0134-25-2 |
| Accubar Constant Flow Bubbler Dual Orifice, Dual Sensor - Canadian Use Only | 56-0134-25-2C |

### 2.2 Accessories and spare parts

| Item | Order number |
|---|---|
| Platinum 385 water temperature sensor with cable (30 m/100 ft.) | 5600-0100-100 |
| Thermistor water temperature sensor with cable (15 m/50 ft) | 5600-0030-1-050 |
| Replacement desiccant, full canister | 2911-1279-1 |
| Orifice termination bubbler termination fits on a 50 mm/2” rigid pipe | 6661-1314-1 |
| Polyurethane, black orifice tubing - 9,5 mm/⅜” OD tubing, order by the meter/foot (up to 609 m/2000 ft.) | 2911-1183 |
| Desiccant kit (includes tubing, adapter, clamps, full desiccant canister). Optional item for compact CFB models. | 6661-1320-1 |

# 3 About this manual

### 3.1 Other applicable documents

The following documents contain further information on installation, maintenance and calibration:

- Operations & Maintenance Manual Accubar® Constant Flow Bubble Gauge/Recorder 56-0133 and Dual Orifice Bubble Gauge/Recorder 56-0134.
- Data Sheets
- Installation Guide

### 3.2 General signs and symbols

The signs and symbols used in the operational manual have the following meaning:

**Practical tip**

i This symbol indicates important and useful information.

**Action**

✓ Prerequisite that must be met before performing an action.

▸ Step 1

⇨ Intermediate result of an action

▸ Step 2

⇨ Result of a completed action

**List**

- List item, 1st level
  - List item, 2nd level

### 3.3 Explanation of warnings

To avoid personal injury and material damage, you must observe the safety information and warnings in the operating manual. The warnings use the following danger levels:

**WARNING**

WARNING

This indicates a potentially hazardous situation. If the hazardous situation is not avoided, it may result in death or serious injuries.

**CAUTION**

CAUTION

This indicates a potentially hazardous situation. If the hazardous situation is not avoided, it may result in moderately serious or minor injuries.

**NOTICE**

NOTE

This indicates a situation from which damage may arise. If the situation is not avoided, products may be damaged.

# 4 General safety instructions

### 4.1 Intended use

The Constant Flow Bubler (CFB) is used to measure water level in rivers, streams, reservoirs, tidal, oceans and industrial areas.

### 4.2 Potential misuse

Any use of the product that does not comply with the intended use, be this intentional or negligent, is forbidden by the manufacturer.

- Use the product only as described in the operational manual.

### 4.3 Personnel qualification

The equipment described in this manual must be installed, operated, maintained and repaired by qualified personnel only.

- Obtain training from OTT HydroMet if necessary.

### 4.4 Operator obligations

The installer is responsible for observing the safety regulations. Unqualified personnel working on the product can cause risks that could lead to serious injury.

- Have all activities carried out by qualified personnel.
- Ensure that everybody who works on or with the product has read and understood the operational manual.
- Ensure that safety information is observed.
- File the operational manual together with the documentation of the entire system and ensure that it is accessible at all times.
- The operational manual is part of the product, forward the operational manual together with the product.

### 4.5 Personnel obligations

To avoid equipment damage and injury when handling the product, personnel are obliged to the following:

- Read the operational manual carefully before using the product for the first time.
- Pay attention to all safety information and warnings.
- If you do not understand the information and procedure explanations in this manual, stop the action and contact the service provider for assistance.
- Wear the necessary personal protective equipment.

### 4.6 Correct handling

If the product is not installed, used and maintained correctly, there is a risk of injury. The manufacturer does not accept any liability for personal injury or material damage resulting from incorrect handling.

- Install and operate the product under the technical conditions described in the operational manual.
- Do not change or convert the product in any way.
- Do not perform any repairs yourself.
- Get OTT HydroMet to examine and repair any defects.
- Ensure that the product is correctly disposed of. Do not dispose of it in household waste.

### 4.7 Risk of electrical shock

Live parts can cause electric shocks in the event of contact.

- Never touch live electrical parts.
- Turn the power off or unplug before opening.

### 4.8 Certification

**CE (EU)**

The equipment meets the essential requirements of EMC Directive 2014/30/EU.

**FCC (US)**

FCC Part 15, Class "A" Limits

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

**IC (CA)**

**Canadian Radio Interference-Causing Equipment Regulation, ICES-003, "Class A"**

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

# 5 Product description

**5.1 Design and function**

The CFB is a self-contained, precision device for measuring water levels. The device combines a pump, tank, manifold, control board, front panel (display and keypad), Accubar sensor, SDI-12 and RS-232 interfaces, and enclosure for the purpose of measuring water levels using bubble gauge principles.

The CFB with dual orifice is capable of providing redundant measurements, measuring water level in two separate bodies of water, accurately measuring water density, or providing an extended range of water level measurement. The device can maintain pressure in two lines. Internally, the device is equipped with an additional tank, an additional restrictor pressure sensor, an enhanced manifold, and an optional second Accubar sensor.

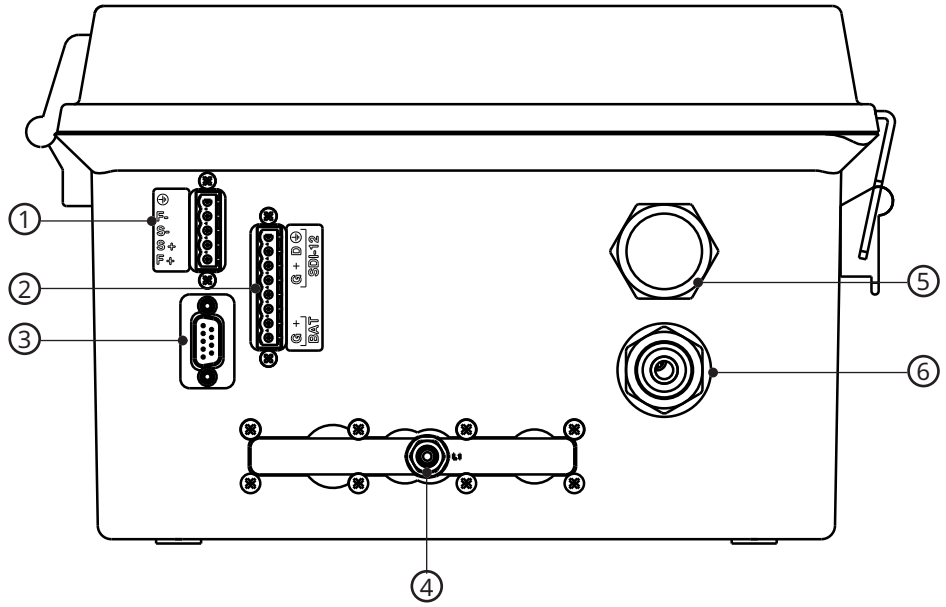
The device is both a logger and a sensor. It is capable of operating standalone, or connected to another logger. In addition, the CFB can be used in conjunction with another water level pressure sensor.

The log inside the device is capable of holding more than 300 000 readings, and allows the recording of status and water level data. The device has an SDI-12 interface as well as RS-232/RS-485 so it can provide data to data loggers or communications equipment. A front panel allows the user to setup the operating parameters, monitor performance, perform tests, and examine the log.

The RS-232 port supports a simple command line mode compatible with HyperTerminal and other communications programs. It allows full access to setup, status and data of the device. Via the interface, the device can be connected to a modem or radio.

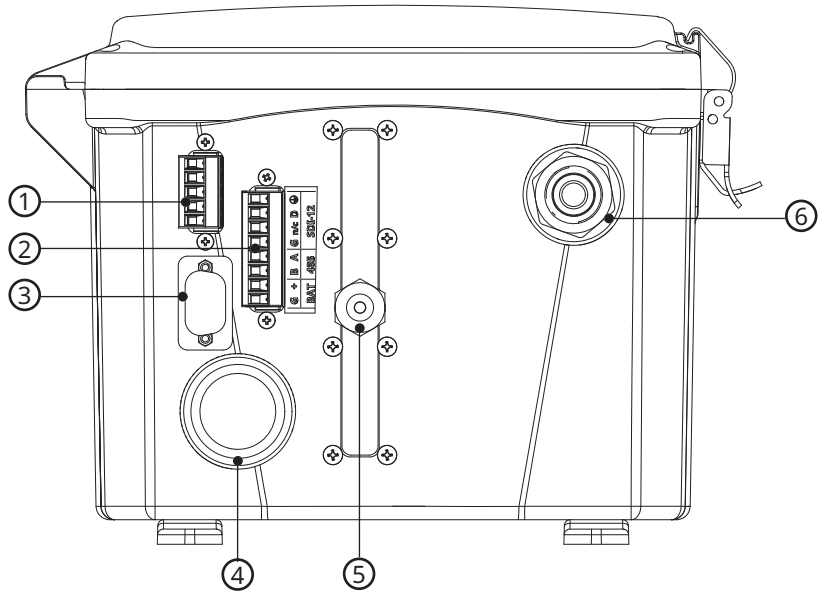
## 5.2 Product overview

### 5.2.1 Enclosure




*Accubar CFB, single orifice*

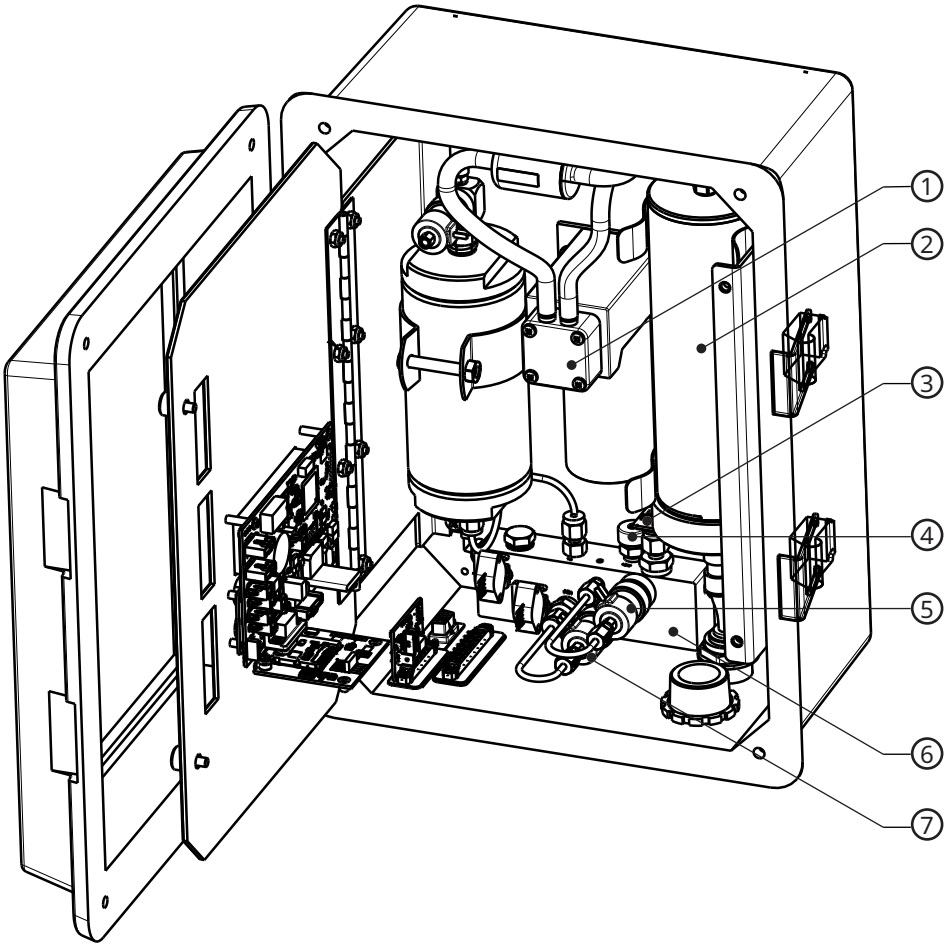
| | | | |
|---|---|---|---|
| 1 | Water temperature sensor connector | 4 | Air outlet |
| 2 | Terminal strip | 5 | Breather vent |
| 3 | DB9 connector | 6 | Bulkhead fitting for external desiccant tube connection |




*Compact CFB*

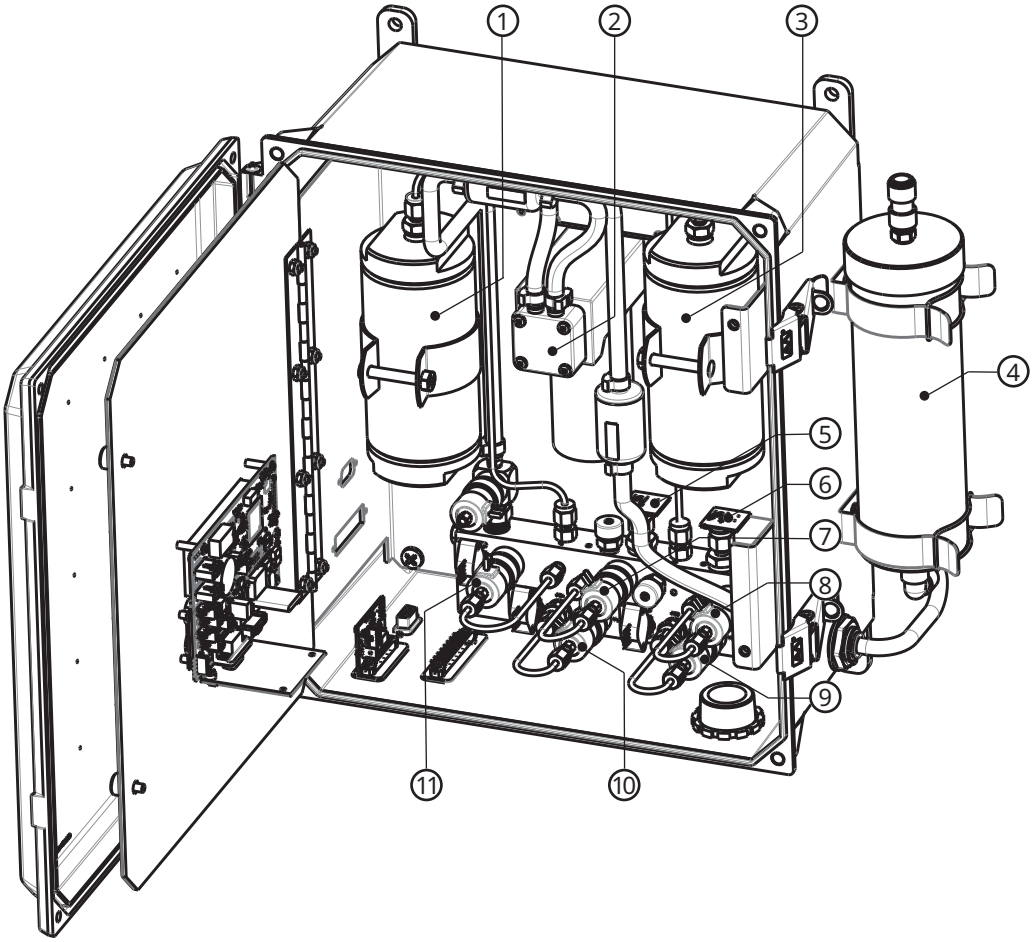
| | | | |
|---|---|---|---|
| 1 | Water temperature sensor connector | 4 | Breather vent |
| 2 | Terminal strip | 5 | Air outlet |
| 3 | DB9 connector | 6 | Bulkhead fitting for external desiccant tube connection |

### 5.2.2 Pneumatic features



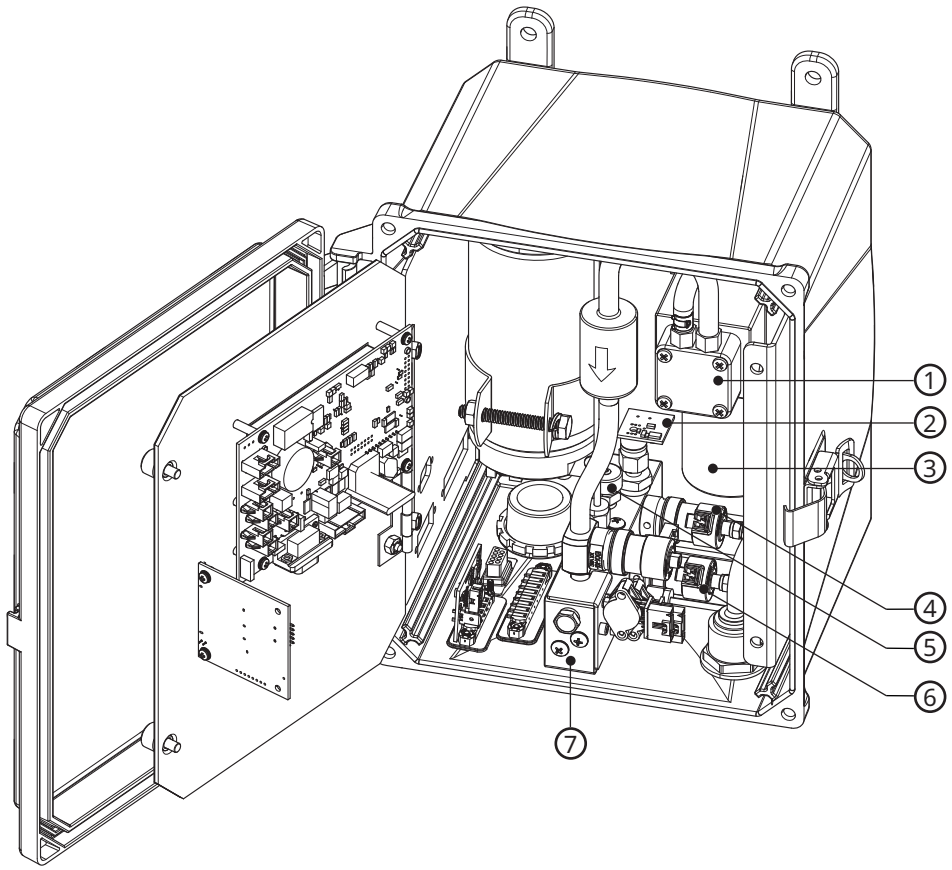

*Accubar CFB, single orifice*

| | | | |
|---|---|---|---|
| 1 | Pump | 5 | Vent valve |
| 2 | Desiccant | 6 | Manifold |
| 3 | Accubar® sensor | 7 | Purge valve |
| 4 | Relief valve | | |




*Accubar CFB, dual orifice*

| | | | |
|---|---|---|---|
| 1 | Tank 1 | 7 | Vent valve 1 |
| 2 | Pump | 8 | Vent valve 2 |
| 3 | Tank 2 | 9 | Bypass line 2 |
| 4 | Desiccant | 10 | Bypass line 1 |
| 5 | Accubar® sensor 1 | 11 | Tank valve |
| 6 | Accubar® sensor 2 | | |




*Compact CFB*

| | | | |
|---|---|---|---|
| 1 | Pump | 5 | Relief valve |
| 2 | Accubar® sensor | 6 | Purge valve |
| 3 | Desiccant | 7 | Manifold |
| 4 | Zero valve | | |

# 6 Transport, storage, and unpacking

**6.1 Transport**

- Transport the product always in its original packaging.
- Ensure that the product is not mechanically stressed during transport.

**6.2 Storage**

- Store within specified temperature ranges.
- Store in dry area.
- Store in original box where possible.

**6.3 Unpacking**

- Use two people to carefully remove the product from the packaging.
- Check that the delivery is complete and undamaged.
- If you find any damage or if the delivery is incomplete, then immediately contact your supplier or manufacturer.
- Keep the original packaging for any further transportation.

# 7 Quick installation

The device can be quickly installed and commissioned with the following steps. Additional settings can be made if required.

> Further information can be found in the Operations & Maintenance Manual Accubar® Constant Flow Bubble Gauge/Recorder.

- Mount the enclosure. See section Mounting enclosure [▶ 20]
- Install the orifice lines in the desired locations. See section Installing tube and orifice [▶ 20]
- Connect the device to the power supply. See section Power connection [▶ 22]
- Do a leak test. See section Checking for leaks [▶ 32]
- Purge the orifice line. See section Conducting purge [▶ 33]
- Customize settings:
  - Setup the orifice configuration (dual orifice device only). See section Configuring dual orifice [▶ 26]
  - Setup the bubble rate. See section Adjusting bubble rate [▶ 27]
  - Change the station name. See section Changing station name [▶ 27]
  - Set the water level. See section Setting water level [▶ 27]
  - Set level units. See section Setting level units [▶ 28]
  - Change automeasure schedule. See section Changing automeasure schedule [▶ 29]

# 8 Installation

## 8.1 Mechanical installation

### 8.1.1 Required tools and aids

The following tools and aids are required:

- Small flat blade screwdriver to tighten screws on terminal strip
- Small Cross head (Phillips) screwdriver to mount terminal strip
- Large Cross head (Phillips) screwdriver to mount mounting ears to enclosure
- 11/16 end wrench to tighten orifice tube (US models)
- 13 mm end wrench to tighten orifice tube ("C"models)
- Customer supplied tools and hardware to mount the enclosure/mounting ears to a wall

### 8.1.2 Mounting enclosure

The device is designed to mount vertically. If not mounted vertically, moisture can form inside and negatively affect the Accubar sensor.

- Ensure there are two people at the installation site to install the device.
- Mount the device vertically against a wall or other surface.
- Ensure that the orifice line connection points down.
- Do not place the device on a bench or table top.
- Use the four holes in the corners to attach the fiberglass enclosure.
- Ensure that the device is securely fastened and cannot fall down.

### 8.1.3 Installing tube and orifice

The device outlet pressure fitting accomodates an 3/8" OD tube that will run down into the water. The tube can be installed directly on the ground, buried in the ground or in a conduit. The tube must be installed with a continuous slope to the water. If moisture collects at low points in the line, readings may be erroneous.

- Fit the tube with a suitable orifice in the water.
- Attach the orifice at a wall, rock, or weight so it doesn't move.
- Install the orifice in water that ist relatively still and free from currents. Currents in the orifice area will cause a shift in the pressure reading.
- Connect the tube with a Swagelok fitting as follows:

- Insert the tube into the Swagelok tube fitting.
- Ensure that the tube rests firmly on the shoulder of the fitting and that the nut is finger tight.
- Scribe the Swagelok nut at the 6 o'clock position.
- Hold the fitting body steady with a backup wrench and tighten the nut 1 ¼ turns. Watch the scribe mark make one complete revolution and continues to the 9 o’clock position.

- If necessary, disconnect and retighten the Swaglok fitting as follows:

- Insert the tube with the pre-swaged ferrule into the fitting body until the front ferrule seats.
- Tighten the nut by hand.
- Tighten with a wrench about ½ turn.

## 8.2 Electrical installation

### 8.2.1 Electrical connections

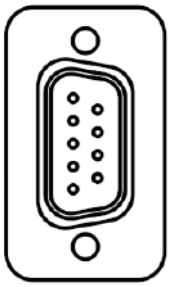
#### 8.2.1.1 Terminal strip

| Pin number | Assignment | Comment | |
|---|---|---|---|
| 1 | Earth | – |  |
| 2 | DATA | SDI-12 | |
| 3 | N/C | Not connected | |
| 4 | GND | SDI-12 | |
| 5 | RS-485 A | – | |
| 6 | RS-485 B | – | |
| 7 | +12 V | Power 12 V (4 amps) | |
| 8 | GND | Power ground | |

#### 8.2.1.2 DB9 connector

The CFB comes with a DB9F connector for connection to RS-232 devices. The DB9F connector can be connected to the serial port on most PCs using a straight cable. A null modem adapter is needed to connect to most PDAs and modems.

The following table shows the pin assignments in the DB9F connector:

| Pin number | Assignment | Comment | |
|---|---|---|---|
| 1 | N/C | Not connected |  |
| 2 | RXD | Data from the CFB | |
| 3 | TXD | Data to the CFB | |
| 4 | DTR | Signal to the CFB | |
| 5 | Ground | – | |
| 6 | DSR | Signal from the device, asserted as long as the device has power. | |
| 7 | RTS | Request to Send, signal to the CFB | |
| 8 | CTS | Clear to Send, signal from the CFB | |
| 9 | VOUT | Jumper J8 selectable for 5 V (default) or VBAT (100 mA max) – this line is NOT passed by a null modem. | |

#### 8.2.1.3 RS-485 connector

The device can be interfaced to via RS-485 A and RS-485 B connections on the front panel using the SDI-12 protocol.

The device only supports the SDI-12 protocol over the RS-485 connection. No settings need to be changed to use SDI-12 over RS-485. The device does not support connections over both the RS-485 and the SDI-12 lines at the same time.

### 8.2.2 Power connection

The device requires external +12 V power to operate. The most common power source for the device is a lead-acid battery.

- Connect the battery or other high current source to pins 7 and 8 of the external terminal strip.
- Use a wire that is at least 20 gauge and no longer than 1.5 m (5 ft.).
- Ensure that the power connections (7 and 8) go straight to the battery.
- If there are two batteries or other power sources in the system, connect the grounds of these systems together.
- When using the CFB with a Satlink or other telemetry device, connect the battery directly to the CFB's power connections.

> The power cannot be connected to the switched or protected voltages of the data loggers because the CFB uses too much power (about 4 amps at 12 V) when the pump is running.

> Further information can be found in the Operations & Maintenance Manual Accubar® Constant Flow Bubble Gauge/Recorder.

### 8.2.3 SDI-12 connection

The SDI-12 interface is a three wire interface with connections for ground, power and data. The SDI-12 interfaces on data loggers cannot provide the 4 amps power needed to operate the pump of the device. The device ground must be connected directly to a battery or other high current source.

- Connect the SDI data line on the device (pin 2) to the SDI data line on the data logger.
- Connect the SDI GND line on the device (pin 4) to the SDI GND line on the data logger.

The sensor is shipped to respond to SDI-12 address 0. The SDI-12 connections do not need to be connected for standalone operation.

Some older devices labels pin 3 as SDI +12 V. Do not use this connection. The device should only be powered using pins 7 and 8.

> Further information can be found in the Operations & Maintenance Manual Accubar® Constant Flow Bubble Gauge/Recorder.

## 8.3 Checking for blockage

If failure in pump controller overpressure air tank safety factor for pressure is rated 5x (250 psi) maximum pump output (50 psi). Sensors will stop pumping if there is a blockage in the system. The relief valve will release the pressure if above valve limits.

- Check the system for blockages.
- Check pressure relief valve function.
- Set blockage detection. See section Setting blockage detection [▸ 28]

# 9 Commissioning

### 9.1 Starting the device

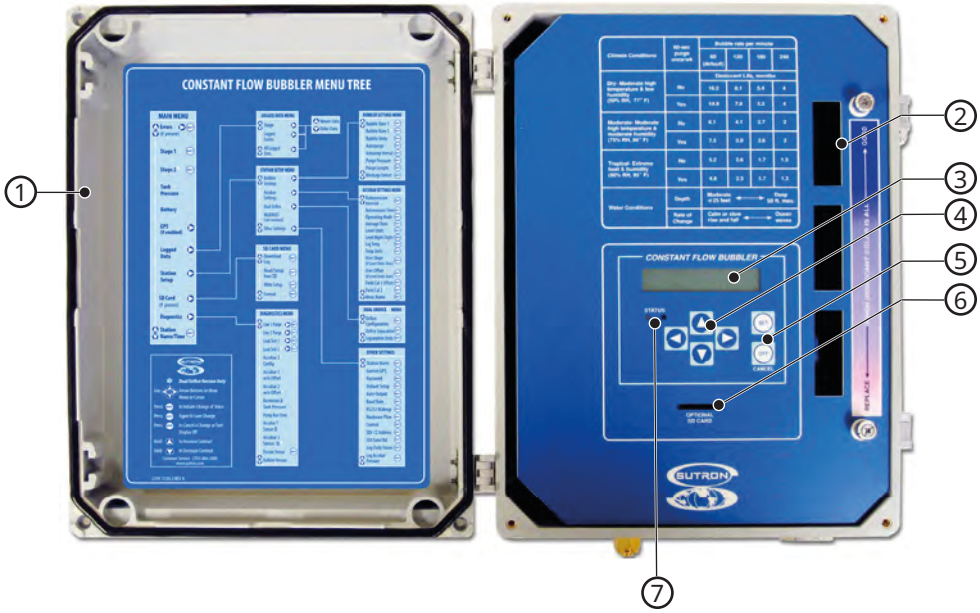
The device starts operating as soon as power is applied. The display will turn on. If an Accubar sensor is installed, measurement will commence and the front panel will be updated with a water level reading. By default, the device will measure and log water level every 15 minutes; each reading is averaged for 10 seconds.

- ▸ Connect the device to power.
- ⇨ The green status LED flashes every five seconds to indicate the device is operating normally.
- ⇨ The red status LED flashes if the device has encountered a problem.

# 10 Operation

## 10.1 Front panel

The front panel can be used to setup the station, examine it's status, view the current measurements, and view logged data.




*Accubar CFB*

| | | | |
|---|---|---|---|
| 1 | Swing out panel with menu tree | 5 | SET and OFF key |
| 2 | Desiccant view | 6 | SD card slot |
| 3 | LC-Display | 7 | Status LED |
| 4 | Arrow keys for navigation | | |


*Compact CFB*

| | | | |
|---|---|---|---|
| 1 | Swing out panel with menu tree | 4 | SD card slot |
| 2 | LC-Display | 5 | Arrow keys for navigation |
| 3 | SET and OFF key | 6 | Status LED |

### 10.1.1 Front panel key functions

| Symbol | Meaning | Function |
|---|---|---|
|  | RIGHT | navigates to a sub-menu (assuming there is one) |
|  | LEFT | goes back to the parent menu |
|  | UP | navigates among the menus on the same level<br>▸ Hold UP to change contrast setting. |
|  | DOWN | navigates among the menus on the same level<br>▸ Hold DOWN to change contrast setting. |
|  | SET | starts a change or confirms an action |
|  | OFF / CANCEL | cancels a change or action<br>goes back levels<br>▸ Hold OFF to go to the top of the menu. |

### 10.1.2 Navigating the menu tree

- Press the arrow keys UP ▲ and DOWN ▼ to browse the menu items that are on the same level.
- Press the arrow key RIGHT ► to enter a sub menu.
- Press the arrow key LEFT ◄ to go up to the parent menu.
- Press SET to change setup.
  - ⇨ The prompt changes and a flashing cursor appears.
- Use the arrow keys to select a different value.
- Numbers with decimal points can be displayed in scientific or decimal notation. To switch between the two notations, put the cursor on the E and press ▲ or ▼.
  Example: *+00001.23 E* (decimal notation), *+1.230000E+00 E* (scientific notation)
- Press SET again to save the change.
- Press OFF to cancel the change.
- If there are only two values for setting, press SET to flip-flop between the values. The change is made immediately.

### 10.1.3 Turning display on and off

The display turns off automatically after 5 minutes of inactivity in order to conserve power.

- Press any key to turn on the display.
- Press and hold OFF to turn off the display.

### 10.1.4 Adjusting contrast

- To set the contrast, press and hold ▲ or ▼ until the prompt CONTRAST appears.
- Hold the key until the display is readable.
- If the display becomes too dark or too light, press the opposite arrow key.
- Once the display is readable, release the arrow key.

⇨ The setting is stored for the next time the display is turned on.

### 10.1.5 Viewing current data

When the display is turned on, the last measured water level will display. The CFB will then initiate a new measurement and display the results as soon as the measurement completes (which is based on averaging time). As long as the water level menu is displayed, live readings will be continuously made.

### 10.1.6 Displaying errors

If the device displays a *?* after a value if there is a question about the quality of the data. If there are errors, the message *Hardware Error* will be displayed when the front panel is turned on.

- Press the arrow key ► to see details.
- Press SET to clear the errors.

## 10.2 Settings

### 10.2.1 Configuring dual orifice

The *Orifice Config* setting determines the behavior of the dual orifice device. This setting must be configured properly for the station.

- To configure the dual orifice, use *Station Setup* > *Dual Orifice Setup* > *Orifice Config* at the front panel.

The following modes can be configured:

– Single
  Only line one is utilized, and some of the power of the unit is wasted. DQAP is available only in single mode.
– Dual Separate
  The pressure is monitored and managed independently at each orifice and two water level readings are generated. Stage 1 is measured in line 1, and stage 2 is measured in line 2. Suitable for measurements in separate channels or bodies of water or within the same area as redundant sensors.
– Dual Density
  The density is computed and the result is used to calculate the water level. The tube endings have to be installed in a vertical configuration, with line 1 above line 2. Line 2 must be the deeper line and the distance between the tubes must not change. Stage is measured on line 1.
– Dual Expanded Range
  In order to measure water deeper than the range of a single Accubar sensor. The expanded mode can offer up to twice the range of a single Accubar sensor. Line 1 is placed in shallower water, and line 2 in deeper water. The device measures water level using line 1 in shallower water until that line is almost out of water.Once the water level drops, the device uses the sensor in line 2 which is in deeper water. If the water level were to rise such that the sensor in line 2 were over-pressured, the device switchs to using the sensor in line 1 in shallower water. The water level must be set so that measurements can be taken.

i The Accubar CFB with a water level sensor and a density sensor can only be configured for dual density mode. All other models can be configured for any mode.

i Further information can be found in the Operations & Maintenance Manual Accubar® Constant Flow Bubble Gauge/Recorder.

### 10.2.2 Adjusting bubble rate

The bubble rate is the measure of the amount of air going down the orifice line per unit of time. The device supports two units for bubble rate: Bubbles per minute (BPM) and Standard Cubic Centimeters per Minute (SCCM).

The bubble rate for a site with slowly changing levels is typically 60 bubbles per minute out of a 1/8 ID tube. This corresponds to a flow of about 5 SCCM. The higher the bubble rate, the more air will flow down the line and the more power is required.

- To adjust the bubble rate, use *Station Setup* > *Bubbler Setup* > *Bubble Rate* at the front panel.

The dual orifice device has two independent bubble rate settings, one for each line.

The correct bubble rate is station dependent:

- Sites measuring a deeper water level will require a higher bubble rate.
  If the bubble rate is too low, the device will not be able to overcome the pressure exerted by the water onto the air in the orifice line. This will result in no bubbles going out and an erroneous water level reading.
- Sites with rapidly changing water levels will require a higher bubble rate.
  A rapidly rising water level will not be immediately detected by the device. If a fast reaction time to water level changes is required, a higher bubble rate will be needed.

> Further information can be found in the Operations & Maintenance Manual Accubar® Constant Flow Bubble Gauge/Recorder.

### 10.2.3 Changing station name

- To change the station name, use *Station Name and Time* or *Station Setup* > *Other Setup* > *Station Name* at the front panel.

### 10.2.4 Setting water level

When the device is first installed, it will display an absolute water level based on the water pressure. Therefore, the current water level must be read from a staff gauge and set on the device.

To set the water level via the front panel, proceed as follows:

- Power up the device.
- Wait until the water level appears on the display.
- Press SET.
- Use the arrow keys to enter the correct water level.
- Press SET again.

> Further information can be found in the Operations & Maintenance Manual Accubar® Constant Flow Bubble Gauge/Recorder.

### 10.2.5 Setting blockage detection

The CFB automatically detects when the orifice line is blocked and intiates a purge. If the line is blocked, the pressure in the line increases and the sensors stop pumping in order not to overpressure. The automatic blockage detection prevents this.

- To enable the blockage detection, use *Station Setup* > *Bubbler Setup* > *Blockage Detection* at the front panel.
- Also setup *Blocked Flow* and *Blocked Pressure*.
- Set *Blocked Flow* to a small value like 2 psi (2SCCM). The flow sensor is accurate to ±1 psi, and the minimum flow is 5 psi (5SCCM).
- Set *Blocked Pressure* to a value that is higher than the highest pressure that can be caused by the water level being measured.

### 10.2.6 Setting level units

The device can report water level readings in the following units:

- feet
- psi
- kPa
- centimeters
- meters
- millimeters
- user units

Water Level = CFB reading in chosen units + Field Calibration Offset

- To change the level units, use *Station Setup* > *Accubar Setup* > *Level Units* at the front panel.

User units are defined using the fields *User slope* and *User offset*.

If user units are chosen:
Water Level = (CFB reading in PSI * user slope) + user offset + Field Calibration Offset

- To change user slope and offset, use *Station Setup* > *Accubar Setup* > *User Slope* at the front panel.

The dual orifice device will use the same units for both level readings.

### 10.2.7 Setting right digits

The number of digits after the decimal place can be adjusted, e.g. from 10.12345 to 10.12.

- To change the right digits, use *Station Setup* > *Accubar Setup* > *Level Right Digits* at the front panel.
- Set the right digits to e.g. 2.

The dual orifice device will use the same right digits for both level readings.

### 10.2.8 Changing automeasure schedule

The device can measure and log water level data automatically. The interval and time for automeasure can be changed. Automeasure may not be turned off.

- To change automeasure interval and time, use *Station Setup* > *Accubar Setup* at the front panel.

In normal mode, data is measured and logged at the following times:

**Example 1: Automeasure time 00:00:00 interval 00:10:00**

- 00:10:00 data measured and logged
- 00:20:00 data measured and logged
- 00:30:00 data measured and logged
- and every ten minutes afterwards

**Example 2: Automeasure time 00:00:30 interval 00:05:00**

- 00:00:30 data measured and logged
- 00:05:30 data measured and logged
- 00:10:30 data measured and logged
- and every five minutes afterwards

In Continuous and DQAP modes, the device is continuously collecting sensor data. When the automeasure time comes, the water level and other data are immediately calculated based on the previously recorded sensor data.

The last measurement made by automeasure is called last automeasured.

i Further information can be found in the Operations & Maintenance Manual Accubar® Constant Flow Bubble Gauge/Recorder.

### 10.2.9 Changing operating mode

- To change the operating mode, use *Station Setup* > *Accubar Setup* at the front panel.

The following operating modes can be set:

- Normal mode
  The device is in low power mode until it is time to measure.Once the measurement is complete, the device goes back to low power mode. This is the recommended mode unless the device measures very frequently.
- Continuous mode
  When it is time to measure, the previously collected data is used to instantly come up with a water level reading. The device does not got into low power mode. The continuous mode adds about 10 mA to the quiescent power consumption compared with 0.25 mA in the normal mode.
- Data Quality and Assurance Procedure (DQAP) mode
  The DQAP mode uses a data processing algorithm used to filter outliers. Disturbances to the water surface, such as waves, are excluded when reading the water level. Just like continuous mode, DQAP mode results in constant data collection and increased power consumption. DQAP is generally collected over a period of 6 minutes.

**Example: Normal mode with 10 second averaging**

- 12:00:00 measure command is received (via SDI-12, front panel, RS232, or automeasure)
- 12:00:00 sensors are powered on and measurement starts
- 12:00:11 measurement completes with data collected between 12:00:00 and 12:00:10
- 12:00:11 data is logged with a a timestamp of 12:00:00
- 12:00:11 sensors are powered down

**Example: Continuous and DQAP modes with 10 second averaging**

- 12:00:00 measure command is received (via SDI-12, front panel, RS232, or automeasure)
- 12:00:00 measurement completes with data collected from 11:59:50 to 12:00:00
- data is logged with a timestamp of 12:00:00

i Further information can be found in the Operations & Maintenance Manual Accubar® Constant Flow Bubble Gauge/Recorder.

### 10.3 Passive sensor mode

Passive sensor mode is a diagnostic mode in which the bubbler does not turn on the pump. In this mode, the bubbler will not maintain pressure. The Accubar sensor continues to measure pressure, but the bubbler stops providing air flow through the orifice. The restrictor valve is bypassed, which means that the pressure inside the tank will become equalized to the pressure on the orifice line.

In passive sensor mode:

1. The pump is not turned on.
2. The restrictor valve is bypassed.

When in passive sensor mode, the red error LED will flash. The front panel and command line status will indicate "Bubbler is stopped".

▸ To access this mode, use *Diagnostics* > *PassiveSensor* at the front panel.

### 10.4 Fast track mode

The FastTrack feature allows the bubbler to operate at locations where the level rises or drops rapidly.

When water level drops rapidly the bubbler has excess pressure in the tank that must be released in order to keep the flow in the tube from getting too large, introducing an error.

When water level rises too quickly, the bubbler has inadequate flow to keep the water from entering the orifice.

The solution to both issues is the FastTrack feature. With FastTrack enabled, the system will continuously monitor for these conditions and operate the valves to either increase the flow (rising levels) or remove excess pressure (falling levels).

For FastTrack to work, it must know the *Tube ID* and *Tube Length* of the orifice tubing. These settings and *FastTrack Enable* can be found in the menu *Station Setup* > *Bubbler Setup*.

When levels are falling, FastTrack kicks in when the pressure in the tank is 1.5 times the desired value. (This can be adjusted using the FTDownK hidden setting). When levels are rising, FastTrack kicks in when the flow in the tube is positive and 0.5 of its desired value (This can be adjusted using the FTUPK hidden setting).

The system will operate the bypass value for 1 second (again a user setting FTDOWNTIME and FTUPTIME) and then delay for 2 seconds for the system to stabilize before allowing readings again (RestHold).

If *Log Diagnostics* is enabled and FastTrack operates, the messages are shown in the log concerning FastTrackDown and FastTrackUp events.

- To get diagnostics details about FastTrack, use *Diagnostics* at the front panel.

The bubbler calls the pressure drop in the tube *deltaP*.

- First consult OTT HydroMet before making any changes to the FastTrack settings.

# 11 Maintenance

### 11.1 Maintenance schedule

The frequency of cleaning is dependent upon the local weather and environmental conditions. If a site visit is needed for any reason, it is advisable to perform a routine maintenance check of the device.

The following maintenance intervals are recommended:

| Interval | Activity | Performed by |
|---|---|---|
| On commissioning and annually | ▸ Run a leak test to verify there are no internal leaks. | Operator |
| On commissioning and annually | ▸ Check the system for blockages.<br>▸ Check the pressure relief valve. | Operator |
| On commissioning and annually | ▸ Run a purge to verify the pump and internal tubing are intact.<br>▸ If the purge fails to reach the desired pressure, check the tubing from the outlet of the pump (red barb) to the check valve at top of the pump. | Operator |
| 3 months | ▸ Check the desiccant.<br>▸ Replace the desiccant, if half of it is pink. The new desiccant is blue. | Operator |
| Annually | ▸ Carry out a visual inspection of the device.<br>▸ Note any abnormalities such as external oxidation, rust. | Operator |
| Annually | ▸ Check the wiring to ensure that it is not corroded, frayed, or loose. | Operator |
| Annually | ▸ Examine pump runtime. Verify runtime is reasonable (less than 5 min/day at 5 SCCM).<br>▸ Use purge and leak test to determine the cause of an excessive runtime. | Operator |
| Annually | ▸ Download the data and events.<br>▸ Examine the log for any abnormal readings or events. | Operator |
| Annually | ▸ Have a calibration check performed. | OTT HydroMet |

### 11.2 Checking for leaks

Leaks inside the device can be a source of inaccuracy or excessive pumping and use of desiccant.

- ▸ To start the leak test, use *Diagnostic* > *Leak Test* at the front panel.

To start the leak test via the front panel, proceed as follows:

- ▸ Disconnect the orifice line from the device.
- ▸ Plug the air outlet with the supplied cap.
- ▸ Press the DOWN ▼ arrow key at the front panel to go to *Diagnostics* in the menu tree.
- ▸ Press ► to enter the *Diagnostics* menu.

- Press ▼ to got to *Leak Test*.
- Press SET to conduct the leak test.
- Press ► to view the results.

⇨ When the leak test completes, the system displays a status indicating whether the device has passed or failed the leak test along with a score.

The dual orifice device can run leak tests on each line independently. Leak test information for each line is stored separately.

### 11.3 Conducting purge

Purging clears sediment and obstructions from the orifice line. The device builds pressure to a user settable value (default 50 psi for 25 psi devices and 70 psi for 50 psi devices) and then opens the restrictor bypass valve to force the air out the line. The pump will continue to run for a user set period (default 30 seconds) and then turn off the pump and allow the pressure to bleed out the line.

- To change purge pressure and duration, use *Station* > *Bubbler Setup* at the front panel.
- To start purging, use *Diagnostic* > *Purge* at the front panel.

To start purging via the front panel, proceed as follows:

- Connect the orifice line to the device.
- Press the DOWN ▼ arrow key at the front panel to go to *Diagnostics* in the menu tree.
- Press ► to enter the *Diagnostics* menu.
- Press ▼ to got to *Purge*.
- Press SET to conduct the purge.

The dual orifice device can purge each line independently. Purge information for each line is stored separately.

During purging, the device cannot measure the water level because the pressure in the orifice line is not caused by the water, but by the device itself. Missing data or data marked *Reading old* can be displayed.

#### 11.3.1 Auto purge

Purging can be performed automatically at specified intervals, when a blockage is detected, or when initiated by the user. If a dual orifice device ist setup for an auto purge, it will purge line 1 first, and then line 2. If a blocakge is detected, only the blocked line will be purged.

- To enable auto purge, use *Station Setup* > *Bubbler Setup* > *AutoPurge Enable* at the front panel.

To enable purging via the front panel, proceed as follows:

- Press the DOWN ▼ arrow key at the front panel to go to *Station Setup* in the menu tree.
- Press ► to enter the *Bubbler Setup* menu.
- Press ▼ to got to *AutoPurge Enable*.
- Press SET to enable the auto purge.
- To set the auto purge intervall, use *Station Setup* > *Bubbler Setup* > *AutoPurge Interval*.

### 11.4 Replacing desiccant

**CAUTION**

**Health hazard due to powdered desiccant!**

When the tube is opened, desiccant can escape and be inhaled or irritate the eyes.

- Wear goggles and mask.

---

- To disconnect the tube from the quick disconnect fitting, push the fitting collar around the tube flush against the fitting.
- Pull on the tube.
- Replace the desiccant.
- Connect the tube.

### 11.5 Replacing Accubar sensor

- Power down the device.
- Open the front panel.
- Unplug and remove the old sensor.
- Install the new sensor.
- Close the front panel.
- Power up the device.

### 11.6 Updating firmware

The CFB can only be upgraded via the RS-232 port. A terminal emulator program such as HyperTerminal or TeraTerm is required to upgrade the firmware. The program must support Ymodem file sending. For TeraTerm, use Version 4.85 or below, as a Ymodem bug was introduced in later versions.

- Download the latest version of the firmware at:
  https://www.otthydromet.com/en/p-sutron-compact-constant-flow-bubbler-38-fitting/56-0133-25-1S#resources
- Safe the `xx_xxmainBubbler1265.upg` file to a temporary folder or desktop location.
- Open and run terminal emulator on a PC.
- Set the properties to:
  Baudrate: 115 200
  Bits: 8
  Parity: None
  Stop Bits: 1

**Using UPGRADE command using terminal emulator**

- Start with the device powered up and running.
- Connect the DB9 serial cable.
- Press ENTER to establish the communication.
- Once the prompt is found, type *UPGRADE* or *UPG*.
  - ⇨ The system is waiting for HyperTerminal to send the file.
  - ⇨ An upper case *C* will repeat every 2 seconds over the serial port.
- Select *Send File*.

- Choose *Y-Modem*.
- Select the upgrade file name stored on the computer.
  - ⇨ Once the download is completed, the system will reboot.
- Type the command 'Ver' to confirm that the upgrade was successful.

**Using terminal emulator and ESCAPE key**

This method is used if a previous upgrade attempt was aborted, resulting in the device's main application not working. The bootloader of the device can still be used to upgrade the main application.

- Start with the device powered DOWN.
- Open the serial port with the terminal emulator.
- Power up the device simultaneously while holding the ESCAPE key on the keyboard of the computer running the terminal emulator.
- Release the ESCAPE key once the unit has powered up.
- Once the prompt is found, type *UPGRADE* or *UPG*.
  - ⇨ An upper case *C* will repeat every 2 seconds over the serial port.
- Select *Send File*.
- Choose *Y-Modem*.
- Select the upgrade file name stored on the computer.
  - ⇨ Once the download is completed, the system will reboot.
- Type the command 'Ver' to confirm that the upgrade was successful.

# 12 Troubleshooting

### 12.1 Error elimination

| Error | Possible cause | Corrective action |
|---|---|---|
| Pressure dropping / excessive pump operation | Leakage | ▸ Run leak test.<br>▸ Observe error codes and refer to Hardware error codes [▸ 37]. |
| Pressure dropping / excessive pump operation | Orifice lines are not correctly attached | ▸ Ensure that the orifice lines are fully attached and tight on the device orifice ports. |
| Pump does not run | Not enough voltage | ▸ Check the battery voltage. |
| Pump does not run | Blocked lines | ▸ Check if the system is blocked.<br>▸ Set blockage detection. See section Setting blockage detection [▸ 28]<br>▸ Run purge test. See section Conducting purge [▸ 33]<br>▸ If the pump never comes on, refer to Hardware error codes [▸ 37]. |
| Incorrect stage | – | ▸ Check for bubbles out of the orifice during normal operation; not during purge test.<br>▸ Lookup any error codes on the front display and address the associated issue. |
| No density value | Incorrect installation of the orifice lines | ▸ Ensure that both orifice lines are below water with some vertical separation between the orifice lines. Line 1 must be higher than line 2. |
| No density value | Incorrect setup | ▸ Check setup to ensure that it is set to density type.<br>▸ If value takes a long time to appear, check the averaging time in the setup. |
| No data | Fault wiring | ▸ Check all wiring and terminations. |
| No data | No power | ▸ Check fuse in the data recorder and power at sensor. There is no fuse in the sensor itself. |
| No data | Wrong address requested | ▸ Ensure that the data recorder is set up to request data at the proper address. |
| No data | Wrong address set in sensor | ▸ Use the identify command to ensure that the sensor is responding to the proper address.<br>▸ If not, double check the SDI-12 address using the front panel. |

| Error | Possible cause | Corrective action |
|---|---|---|
| No data | Command or address is wrongly written | ▸ Ensure that the address is proper case and that commands are written in upper case. All commands are capital letters. |
| Garbled data | Multiple sensors set to the same address | ▸ Check address settings of all SDI sensors.<br>▸ Remove all other sensors from the recorder and add them one at a time. |
| Garbled data | Command issued to a wild card address (* or ?) | ▸ Remove all other sensors from the recorder and try again. |
| Erroneous data | Wrong units selected | ▸ Verify that the desired units are selected. |
| Erroneous data | Erroneous offset entered | ▸ Check the field calibration offset, user scale and offset entered. |
| High unstable readings | Device has not been configured for use at the site | ▸ Configure the device for the site. |
| High unstable readings | Water in the orifice line | ▸ Have the device do a purge. |
| Low readings | Leakage | ▸ Carry out the leak test. |

- If problems still occur, set the *Advanced Settings/Log Diagnostics* to *enabled*.
  - ⇨ The system writes diagnostic information to the log.
- Let the system operate for at least 10 minutes.
- Retrieve the log and analyze it to better understand the problem.
- For further support, email the log file to customer service.

### 12.2 Hardware error codes

The device may record one of the following error values during its operation. The error codes may be returned in response to some SDI-12 commands, or may be shown on the front panel.

| Error code | Description |
|---|---|
| 4001 | restrictor sensor failure |
| 4002 | tank sensor failure |
| 4003 | temperature sensor failure |
| 4004 | pressure did not increase during pumping |
| 4005 | negative tank pressure |
| 4006 | pressure did not normalize during bleeding |
| 4007 | internal software error |
| 4008 | venting did not decrease pressure |
| 4009 | battery low |
| 4010 | battery low during pump |
| 4011 | Accubar sensor fail |
| 4012 | Accubar not calibrated |
| 4013 | failed to attain pressure |
| 4014 | line sensor overpressure |
| 4015 | Accubar autozero out of range |

| Error code | Description |
|---|---|
| 4016 | timeout emptying tank |
| 4017 | Accubar and tank sensor readings did not match |
| 4018 | restrictor not zero |
| 4019 | restrictor valve stuck open |
| 4020 | restrictor valve stuck closed |
| 4021 | restrictor pressure dropped too fast |
| 4022 | restrictor pressure dropped too slow |
| 4023 | line valve stuck open |
| 4024 | line valve stuck closed |
| 4025 | leak test low pressure fail |
| 4026 | leak test high pressure fail |
| 4027 | SD card failure |
| 4028 | restrictor autozero out of range |
| 4029 | Accubar autozero twin |
| 4030 | rest 2 sensor failure |
| 4031 | tank 2 sensor failure |
| 4032 | leak test 2 lo failed |
| 4033 | leak test 2 hi failed |
| 4034 | restrictor valve stuck open 2 |
| 4035 | restrictor valve stuck closed 2 |
| 4036 | restrictor flow too fast 2 |
| 4037 | restrictor flow too slow 2 |
| 4038 | Accubar valve stuck open 2 |
| 4039 | Accubar valve stuck closed 2 |
| 4040 | tank valve stuck open |
| 4041 | tank valve stuck closed |
| 4042 | Accubar sensor failure 2 |
| 4043 | temperature sensor out of range |
| 4044 | pump watchdog |
| 4045 | Accubars different |
| 4046 | water temp sensor reading exceeds range -40 to +60°C |

# 13 Repair

**13.1 Customer support**

- Have repairs carried out by OTT HydroMet service personnel.
- Only carry out repairs yourself, if you have first consulted OTT HydroMet.
- Contact your local representative: www.otthydromet.com/en/contact-us
- Include the following information:

– instrument model
– instrument serial number
– details of the fault or problem
– examples of data files
– readout device or data acquistion system
– interfaces and power supplies
– history of any previous repairs or modifications
– pictures of the installation
– overview of the local environment conditions

# 14 Notes on disposing of old devices

**Member States of the European Union**

In accordance with the German Electrical and Electronic Equipment Act (ElektroG; national implementation of EU Directive 2012/19/EU), OTT HydroMet takes back old devices in the Member States of the European Union and disposes of them in the proper manner. The devices that this concerns are labeled with the following symbol:

- For further information on the take-back procedure contact OTT HydroMet:

OTT Hydromet Corp.
Service & Technical Support
22400 Davis Drive, Suite #100
Sterling, VA 20164
USA
phone: +1 703 406-2800
email: NAtechsupport@otthydromet.com

**All other countries**

- Dispose of the product in the proper manner following decommissioning.
- Observe the country-specific regulations on disposing of electronic equipment.
- Do NOT dispose of the product in household waste.

# 15 Technical data

### 15.1 General technical data

| Specification | Value |
|---|---|
| Operating temperature range<br>Standard<br>Optional | <br>-25 to +60 °C (-13 to +140 °F)<br>-40 to +60 °C (-40 to +140 °F) |
| Operating humidity | 0 to 95 % (non-condensing) |
| Water temperature: | |
| Types supported | Platinum 385, Platinum 392, Thermistor, Custom |
| Sensor operational range | -40 to +60 °C (-40 to +140 °F) |
| Accuracy* | ±0.1 °C (-5 to +45 °C) |
| Resolution* | 0.01 °C |
| Suspended sediment: | |
| Operation range | 0 to 1,000,000 mg/L |
| Accuracy (2 ft separation) | +500mg/L<br>> 10,000 mg/L = 10.0 % accuracy<br>> 50,000 mg/L = 2.0 % accuracy<br>> 100,000 mg/L = 1.0 % accuracy |
| Desiccant | Silica Gel, lasts up to a year |
| Pressure outlet | 4/6 mm tube or 3/8” tube based on model |
| Enclosure | Fiberglass NEMA-4, IP64, lockable |

* Supplies to certain water temperature sensors (5600-0100-100 and 5600-0030-1-050)

### 15.2 Electrical data

| Specification | CFB, single orifice | CFB, dual orifice |
|---|---|---|
| Power supply | 8 to 16 V DC | |
| Average current | < 8.3 mA @12 V for a 3 sec. measurement every 15 min, no purge<br><30 mA @12 V for 120 sec. measurement every 5 min with 30 sec. purge every hour | < 15 mA @12 V for 3 sec. measurement every 15 min, no purge<br>< 30 mA @12 V for 120 sec. measurement every 5 min with 30 sec. purge daily |
| Pump on current<br>25 psi device<br>50 psi device | <br>4 amp max.; typical 2.5 amp<br>8 amp | |
| Quiescent current | < 1 mA | |
| Communication ports | SDI-12, RS-232, RS-485 | |
| Communication protocols | Modbus® (via RS232 only), SDI-12, command line | |
| Memory | Built-in flash: > 300,000 readings | |

### 15.3 Pneumatic data

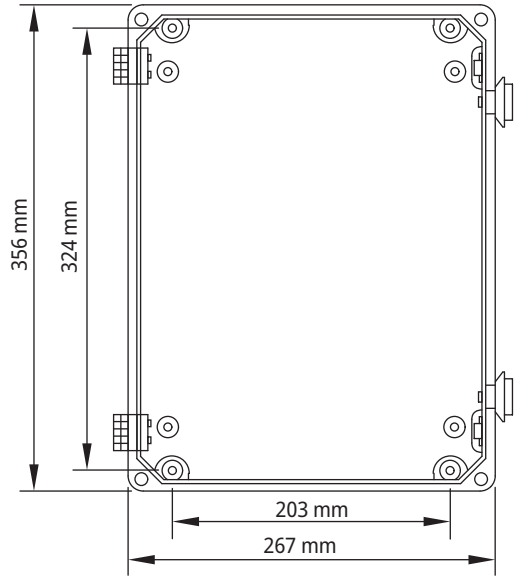
| Specification | Value |
|---|---|
| Pressure range*[1]<br>25 psi device<br>50 psi device | <br>0 to 17.5 m (0 to 57.5 ft)<br>0 to 35 m (0 to 115 ft) |
| Accuracy*[1]<br>25 psi device<br>50 psi device | 0 to 6 m (0 to 20 ft): ±0.00305 m (±0.01 ft)<br>6 to 17,5 m (20 to 57,5 ft): ±0.05 % reading<br>17,5 to 35 m (57,5 to 115 ft): ±0.05 % reading |
| Resolution | 0.0001 psi |
| Purge pressure | ≥ 50 psi |
| Bubble rate | Set by user (12 to 510 bubbler per minute) |
| Compressor type | Piston |
| Density accuracy*[2] | 0.1% (excluding orifice spacing error) |

*[1] Reference to ft based on USGS conversion factor of 2.3073 ft water per psi (pure water at 50 °C).

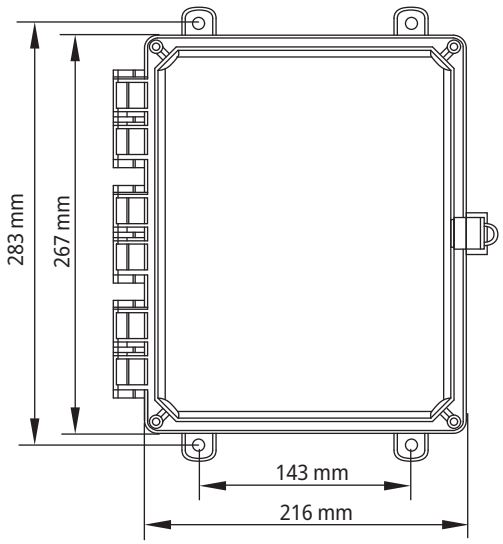
*[2] 56-0134-25-3-T model only

### 15.4 Dimensions and weight

#### 15.4.1 Constant Flow Bubbler, single orifice



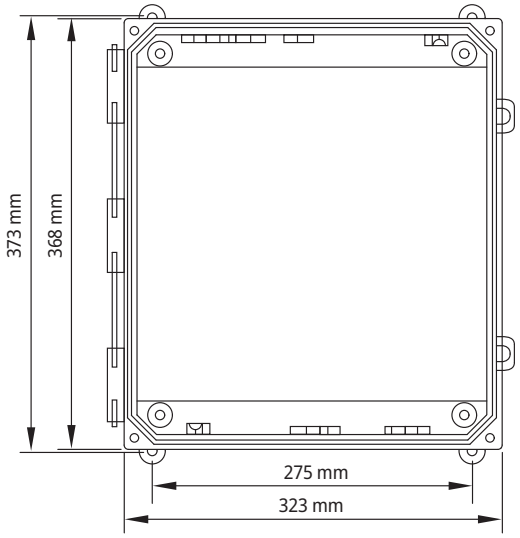

*Accubar CFB*




*Compact CFB*

| Specification | Accubar CFB | Compact CFB |
|---|---|---|
| Dimensions packed (h x l x w) | 510 x 381 x 254 mm (20 x 15 x 10 in) | 406 x 305 x 305 mm (16 x 12 x 12 in) |
| Dimensions unpacked (h x l x w) | 356 x 267 x 191 mm (10.5 x 14 x 7.5 in) | 267 x 216 x 178 mm (10.5 x 8.5 x 7 in) |
| Weight unpacked | 9.1 kg (20 lbs.) | 5.6 kg (12.2 lbs.) |
| Weight packed | 10 kg (22 lbs.) | 7.6 kg (16.7 lbs.) |

### 15.4.2 Constant Flow Bubbler, dual orifice




*Accubar CFB*

| Specification | Value |
|---|---|
| Dimensions packed (h x l x w) | 510 x 381 x 254 mm (20 x 15 x 10 in) |
| Dimensions unpacked (h x l x w) | 373 x 323 x 191 mm (15 x 13 x 7.5 in) |
| Weight unpacked | 9.1 kg (20 lbs.) |
| Weight packed | 10 kg (22 lbs.) |

OTT HydroMet

Contact Information