Air Bubbler Depth Gauge
DG2200

Installation and Reference Manual

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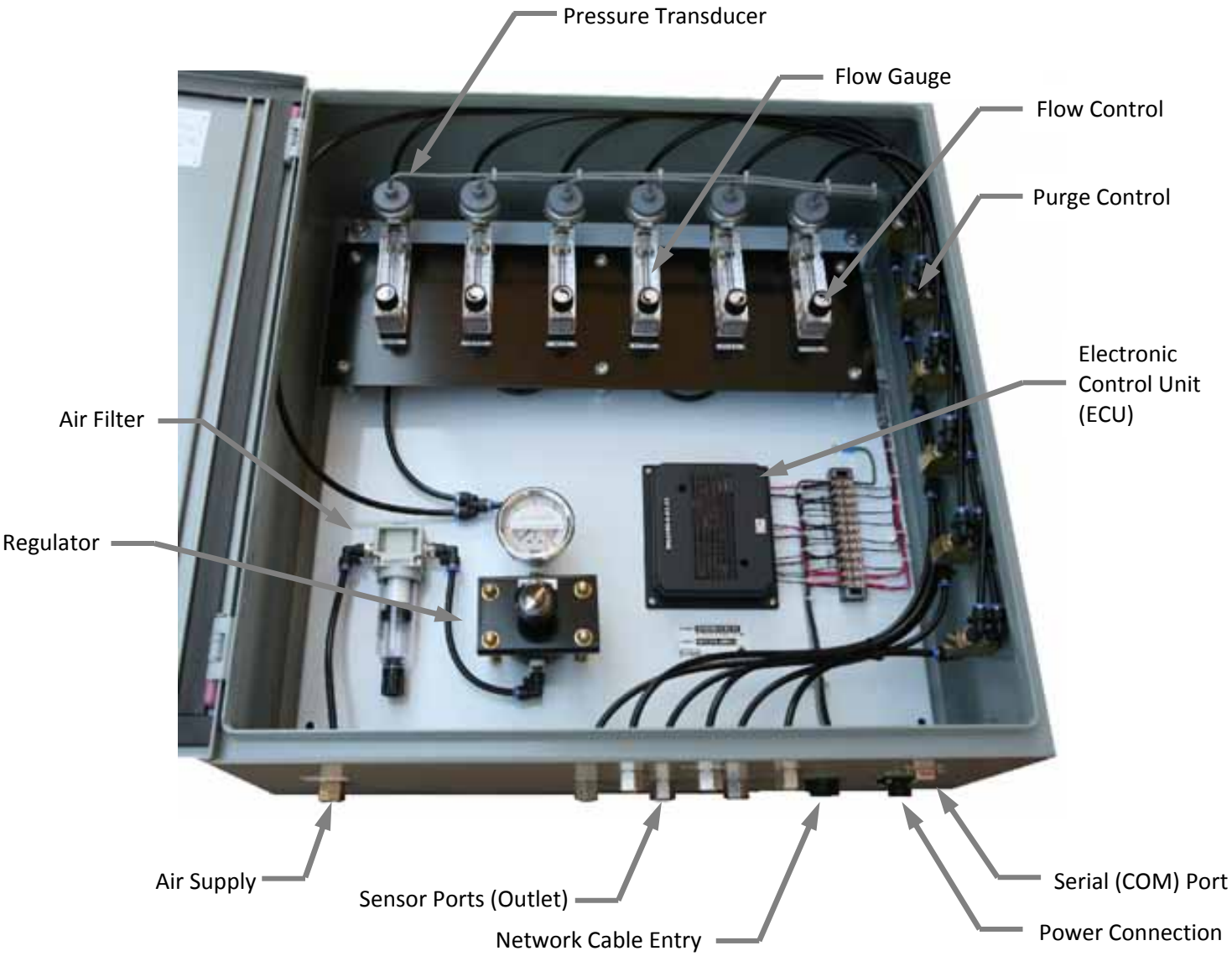


Figure 1. DG2200 Location Diagram

1.2 Basic Operation

The Entek DG2200 Air Bubbler Depth Gauge is designed to provide accurate depth measurements without the need for costly sensors to be located underwater. This drastically increases sensor life and reduces sensor maintenance requirements. The integral electronic control unit (ECU) can communicate with external software via serial or Ethernet connection. Configuration is achieved through a user-friendly web interface.
The DG2200 is available in both single and multi channel configurations, and requires only a basic air supply and control power. All components are housed in a NEMA 4 rated enclosure and includes a convenient purge function for each channel.

1.3 Connection

Both Ethernet and RS232 (serial) connections are provided to communicate with the user's software or systems.

1.3.1 Ethernet

The ECU includes a single Ethernet port with RJ-45 connection. This port provides a network connection, enabling the user to browse the DG2200 Web Application, and also to receive data via UDP packets.
Once connected to the user's network, the DG2200 configuration web pages will be visible through a standard browser.

The default IP address is 192.168.1.100.

To view the DG2200 web pages, enter http://192.168.1.100 into the address bar of your web browser.

***NOTE**: If direct connection is required to another computing device, such as a laptop or PC, use a standard ethernet crossover cable directly from the computing device to the Ethernet port.*

1.3.2 Serial RS232

A standard RS232 interface utilizing a simple ASCII protocol also provides a data interface from the DG2200 to the user's computer. A DB-9 pin female connector is provided for the RS232 interface with connections as follows:

Pin 2	TX
Pin 3	RX
Pin 5	GND

The DG2200 communications parameters are as follows:

Baud Rate:	9600
Bits:	8
Stop Bits:	1
Parity:	None
Echo:	None
Handshaking:	None

1.3.3 Power

The power requirement is 12 – 25 VDC 2 Watt. An AC adaptor or another suitable clean DC power source (battery, power supply, etc.) may be used to power the system.

Power connection is made via the 4 pin circular connector as follows:

Pin 1	+VDC
Pin 2	GND
Pin 3	N/C
Pin 4	N/C

1.4 Air Supply

A clean air supply (providing minimal air flow < 1 CFM) is required. This should be connected to the inlet port fitting on the bottom of the gauge enclosure (refer to Figure 1). If the air supply drops below the rated PSI, the accuracy of the gauge may be affected. Refer to Table 1. for the correct minimum supply pressure. In any case, the supply pressure should never exceed 150 PSI.

1.5 Sensor Ports (Outlets)

A suitable hose or pipe should be installed between the DG2200 gauge and the location to be measured. A separate line is required for each channel, or location, to be measured. The line should be installed taking care to ensure that it will not be kinked, crushed, or damaged during operation. It should maintain its original shape, or form, at all times, to ensure consistent and accurate measurements.

If fittings or couplings are required, they should be chosen to allow unrestricted air flow in the line.

Larger diameter tubing is generally an advantage over smaller sized tubing.
Rigid tubing is generally more reliable than soft tubing.

Each line should be connected to the corresponding sensor port outlet.

Additionally, any leaks in the sensor lines will cause inaccurate readings.

In some cases it is not practical to terminate the sensor line at the desired depth; however, in most cases the readings can be scaled to achieve the desired depth measurements.

In turbulent applications, the end of the sensing line can be installed into a stilling well. Often, a simple stilling well can be created with a larger diameter tube or pipe, with open ends, placed over the open end of the sensing line.

In applications with foreign objects in the liquid being measured, a screen can be installed at the end of the sensor line. Extra care must be taken when calibrating this configuration. It may be necessary to purge the line more often, in order to avoid build-up in the screen.

1.6 Range

The DG2200 is available in a variety of depth ranges. It is recommended to specify a maximum range as close as possible to the desired maximum depth; however, the maximum range of the DG2200 must exceed the maximum depth in order to ensure reliable and accurate performance.

***NOTE**: On multi-channel units, all channels will be supplied with the same maximum depth.*

Chapter 2: Adjustment and Calibration

2.1 Regulator Setting

The regulator is factory set for the appropriate pressure and should normally NOT require re-adjustment. If adjustment is necessary, the following steps should be taken:

1. Determine the appropriate regulator PSI setting from Table 1. based on the maximum design depth or pressure transducer rating.
2. Loosen regulator dial lock-nut using suitable wrench by rotating counter clock-wise(CCW).
3. Turn the regulator adjustment knob, located on top of the regulator, fully counter-clockwise to minimize air flow.
4. Rotate all flow gauge adjustment knobs "*gently*" clockwise to prevent air flow from all sensing lines.
5. Turn on, or connect, the air supply to the gauge.
6. Rotate the regulator adjustment knob, to achieve the required PSI setting as indicated on the gauge. *Do **NOT** exceed the required PSI setting as damage may occur*. A regulator setting lower than the required PSI will limit the maximum depth the gauge is able to sense.

2.2 Air Flow Valve Setting

The air flow valve(s) *SHOULD* be adjusted after the sensor line installation and any regulator adjustments; however, any changes to the air flow valve settings will affect the calibration of the DG2200.

The procedure for setting the air flow valve is as follows:

1. Turn the flow controls fully clockwise to minimize flow.

2. Turn on, or connect, the air supply to the gauge.

3. Set the specific sensor line to the maximum depth to be measured.

4. Turn the flow control counter clockwise until the flow gauge indicates 20-60% of maximum flow. Confirm that with the sensor line out of the water that approximately 80-100% air flow is achieved. Ensure that the gauge is installed with the flow gauges in a vertical orientation.

5. If you are unable to achieve maximum airflow, check that sensing tube is not kinked or plugged and that the air supply is connected and the regulator gauge is reading the appropriate maximum PSI.

2.3 Regulator Maximum PSI Settings

Table 1. Regulator Maximum PSI Settings

Maximum Depth (ft)	Maximum Depth (m)	Regulator PSI Setting	Model
20	6	10	DG2200-X-10
50	15	25	DG2200-X-25
100	30	50	DG2200-X-50
215	65	100	DG2200-X-100
330	100	150	DG2200-X-150

NOTE: The regulator PSI setting must correspond with the model of gauge. Never exceed the Regulator PSI setting for the specific model.

Chapter 3: Communications

3.1 Network Settings

The default network settings are as follows:

Subnet Mask- 255.255.255.0
IP Address: 192.168.1.100
Port Number: 1238
Remote IP Address: 255.255.255.255

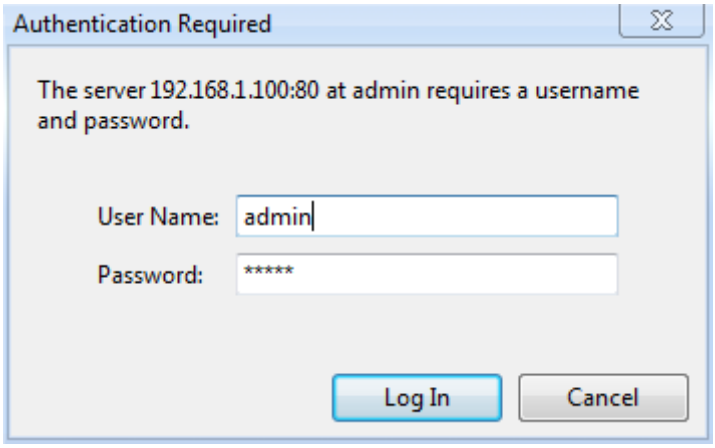
3.2 Web Interface (HTTP)

The Web Interface allows the user to monitor the DG2200 and configure the device to the required settings.

Initially, to access the web application, open up a browser and enter the device IP address.
***NOTE**: the default IP address is 192.168.1.100 unless otherwise changed by the user.*

You may need to ensure that your computer network IP address is valid for the same subnet mask as the DG2200 IP address.

The following screen should appear.

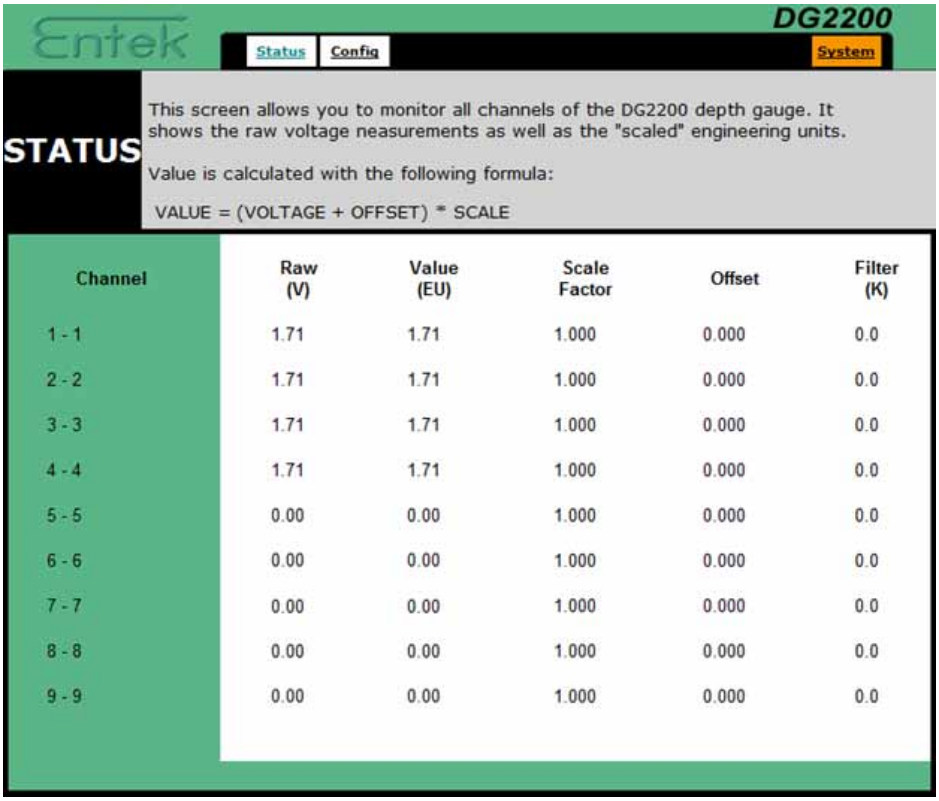


To change or view any of the configuration or system settings the user must first log in.
***NOTE**: Default user name and password:*

USERNAME: admin
PASSWORD: admin

3.2.1 Status Web Page

The **Status** web page allows the user to monitor the operation of the DG2200 gauge.



Channel	Raw (V)	Value (EU)	Scale Factor	Offset	Filter (K)
1 - 1	1.71	1.71	1.000	0.000	0.0
2 - 2	1.71	1.71	1.000	0.000	0.0
3 - 3	1.71	1.71	1.000	0.000	0.0
4 - 4	1.71	1.71	1.000	0.000	0.0
5 - 5	0.00	0.00	1.000	0.000	0.0
6 - 6	0.00	0.00	1.000	0.000	0.0
7 - 7	0.00	0.00	1.000	0.000	0.0
8 - 8	0.00	0.00	1.000	0.000	0.0
9 - 9	0.00	0.00	1.000	0.000	0.0

Channel: Displays the channel number and the user given channel name. By default this will be 1-1, 2-2, etc.
***NOTE**: Number of channels will depend on the specific gauge model.*

Raw(V): Displays the measured sensor voltage which is proportional to the current water depth. *This measurement is taken prior to the application of scaling and offset*.

Value(EU): The calibrated measurement after corresponding scaling and offsets settings have been applied to the raw measurement. VALUE (EU) = (VOLTAGE + OFFSET) * SCALE.

Scale Factor: Scale factor setting for specific channel.

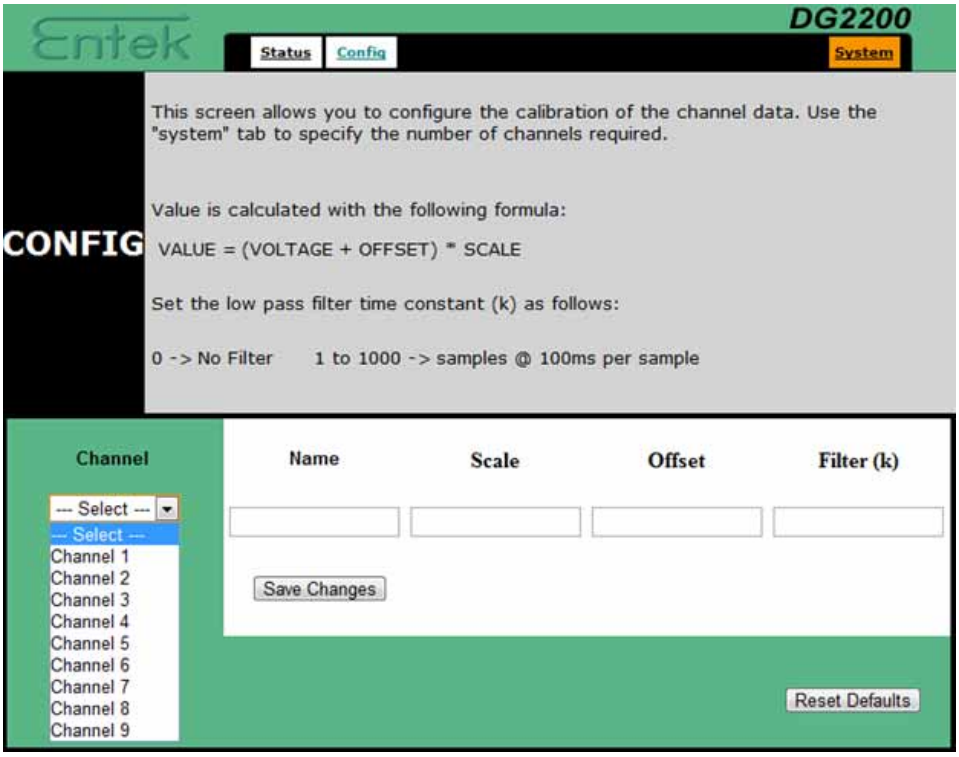
Offset: Offset setting for specific channel

Filter(K): Filter coefficient, K, for specific channel.

3.2.2 Config Web Page

In order to change the settings for a specific channel, select that channel in the channel drop-down list box.

All values for that channel must be entered prior to clicking the “save changes” button as all values will be overwritten. Any settings left blank will revert back to the default value.



Name: Allows the user to create specific names for each channel.

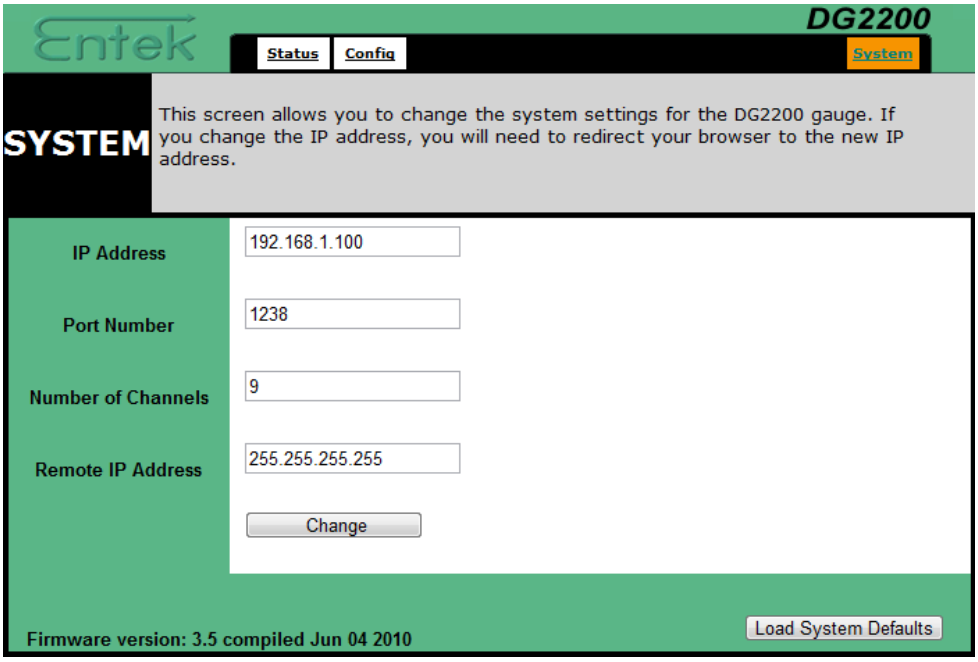
Scale: Sets the scale factor to the specific value required by the user.

Offset: Sets the offset to the specific value required by the user.

Filter(k): Sets the low pass filter constant, K, to the specific value required by the user.
0 -> No filter
1 to 1000 -> samples @ 100ms per sample
***NOTE**: A larger K value will result in lower sensitivity to higher rates of change.*

3.2.3 System Web Page

Allows the user to change the network settings and also specify the number of utilized channels.



IP Address: Allows user to set local IP address of DG2200.

Port Number: Remote port ID for UDP packets.

Number of Channels: Number of channels utilized by specific DG2200 unit.

Remote IP Address: Remote IP for UDP packets.
***NOTE**: 255.255.255.255 specifies all nodes (broadcast).*

3.3 UDP Packet and Serial Protocol

The calibrated (EU) values are output continuously in order by channel in the following format:

+{Calibrated EU Value} [{Channel Number}]<CR><LF>
where <CR> = carriage return
<LF> = line feed

NOTE: *Only the number of channels as set on the system web page will be output.*

Sample output:

+00016.65[1]<CR><LF>
+00005.23[2]<CR><LF>
+00017.98[3]<CR><LF>
+00008.88[4]<CR><LF>
+00016.22[1]<CR><LF>
+00005.24[2]<CR><LF>
+00018.05[3]<CR><LF>
+00007.99[4]<CR><LF>
+00015.47[1]<CR><LF>
+00005.33[2]<CR><LF>
+00007.55[3]<CR><LF>
+00008.88[4]<CR><LF>
...

Chapter 4: Maintenance and Troubleshooting

The following maintenance and troubleshooting procedures will ensure reliable and consistent operation of the DG2200 gauge.

4.1 Air Line Purge

Press and hold the channel purge valve (located on the right hand side of the gauge) for several seconds. This bypasses the flow control and sensor, sending a large volume of air out the sensor line, removing any sludge, dirt, or ice from the sensing line.

Build up of foreign material in the sensing line will cause the calibration of the gauge to change resulting in inaccurate readings.

***NOTE**: Only one channel should be purged at a time.*

4.2 Filter Cleaning

Drain the water periodically from the bottom of the air filter jar. Ensure that the water does not run onto the electronic control unit by using a small container or cloth to collect the water.

4.3 Flow Gauge Cleaning

Occasional cleaning may be required if dirt appears in the flow tube or if float movement becomes restricted. To clean, remove the top plug and remove the float. Wash the tapered hole and top plug with a mild liquid detergent and soft brush. Rinse all parts with clean water and dry thoroughly with clean air or nitrogen. **Do not use solvents to clean this meter** as they will attack the acrylic and destroy the meter.

4.4 Basic Initial Settings

1. Confirm a clean air supply of at least the maximum PSI required (Refer to Table 1.) but not exceeding 150 PSI is connected to the air supply inlet.

2. Turn all flow gauge valves CW until there is no flow indicated for each channel.

3. Adjust the precision pressure regulator valve until the pressure gauge reads the maximum PSI required (Refer to Table 1.).

4. Purge each sensing line using the purge button for each to ensure there is no blockage in each line.

5. Visually inspect each sensing line to ensure there is no damage.
   Alternatively, the end of each sensing line can be temporarily plugged, while opening the corresponding flow gauge valve, to confirm there is no air flow present, and therefore no leaks.

6. With the sensing line clear and intact, and set at the maximum depth, adjust the flow valve on the corresponding flow gauge until there is approx 20-60% of maximum air flow, or, alternatively, with the sensing line OUT of the water, adjust the flow valve to approx 80-100% of the maximum air flow using the flow gauge.

7. Confirm that with each sensing line at minimum depth (or out of water) the flow does not exceed maximum air flow on the gauge. Ideally, you want to have a range of flow from 20-100% for the full range of the depth you will be working in. Adjust the flow valve for each channel as required to achieve a stable range for each channel.

8. The Bubbler Gauge should now be capable of reliable and stable calibration in software.

4.5 Sensor Testing

A digital voltmeter can be used to confirm that the pressure sensor on each channel is operating correctly as follows:

1. Ensure correct power supply is connected to DG2200 unit and powered on.

2. Temporarily disconnect the incoming air supply

3. Using a digital voltmeter (20 VDC scale), connect the black lead to Ground (J15 – terminal 9) on the controller, and confirm approx 1 volt at each sensor input (J15 – terminal 1 to 8)
   NOTE: One pin is used for each channel – so for 4 channel bubbler, normally terminal 1 to 4 is only used. This voltage reading can also be verified on the **Status** web page.

4. Reconnect the air supply line to the bubbler unit.

5. Close all the flow gauge valves (CW) to prevent any air flow.

6. Set the precision flow regulator to the maximum PSI setting (Refer to Table 1.).

7. One at a time, install a plug at the outlet for each sensing line, by temporarily disconnecting the sensing line, and using a ¼" NPT pipe plug.

8. Open the corresponding flow valve slightly (CCW) so that the full regulator pressure is present at the plug (and pressure sensor)

9. Now measure the corresponding J15 terminal voltage again, and confirm now that the sensor is providing approx 5 volt output to the controller (at maximum PSI).

10. Repeat this process for each channel, taking care to close the other flow valves, so the air does not escape the system during the test.

11. This test could also be repeated at other pressures (ie. half-maximum PSI) with corresponding voltage (3VDC)

12. Reconnect all sensing lines, reset to “Basic Initial Settings” and re-calibrate.

13. Replace any sensors that do not provide the expected output voltages – there will be some slight variation in the voltages, and these are taken into account during calibration.

Appendix A: Spare Parts

Part Number	Description
DG2200-FLR-001	Air Filter
DG2200-ECU-V40	Electronic Control Unit (V4.0)
DG2200-FLG-005	Flow Gauge (5 SCFH)
DG2200-PRG-060	Precision Regulator (0-60 PSI)
DG2200-PTX-010	Pressure Transducer (10 PSI)
DG2200-PTX-025	Pressure Transducer (25 PSI)
DG2200-PTX-050	Pressure Transducer (50 PSI)
DG2200-PTX-100	Pressure Transducer (100 PSI)
DG2200-PTX-150	Pressure Transducer (150 PSI)
DG2200-PRV-001	Purge Valve