

# Level Measurements: Remote Lab instructions

Digital Ultrasonic Ranger, Arduino

V2

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|--------------|-------------|-------|----------|
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# Level Measurement Instructions

## Digital Ultrasonic Ranger

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### 1. Objectives

- To demonstrate the use of ultrasonics in level measurement.

#### 1.1 Getting Started

- Logon to Electomeet (Follow the How to Connect to Remote Labs\_Electomeet\_HTML5\_Remote\_Lab instructions document)
- The software to control the pressure is installed on **Remote Lab 10**

#### 1.2 Equipment used

- GROVE Ultrasonic Ranger
- ARDUINO Leonardo
- Air pressure pneumatic cylinder

#### 1.3 Ultrasonics configuration and familiarization

Often the requirement for level sensing may require that a non-contact and non-intrusive means be used. This may be due to a number of factors such as:

- temperature
- nature of the material
- distance

One of the most common types of non-contact sensors is the ultrasonic level measurement.

## 2 Ultrasonic Sensor

For this practical the following ultrasonic equipment will be used:

[http://www.seeedstudio.com/wiki/Grove\\_-\\_Ultrasonic\\_Ranger](http://www.seeedstudio.com/wiki/Grove_-_Ultrasonic_Ranger)



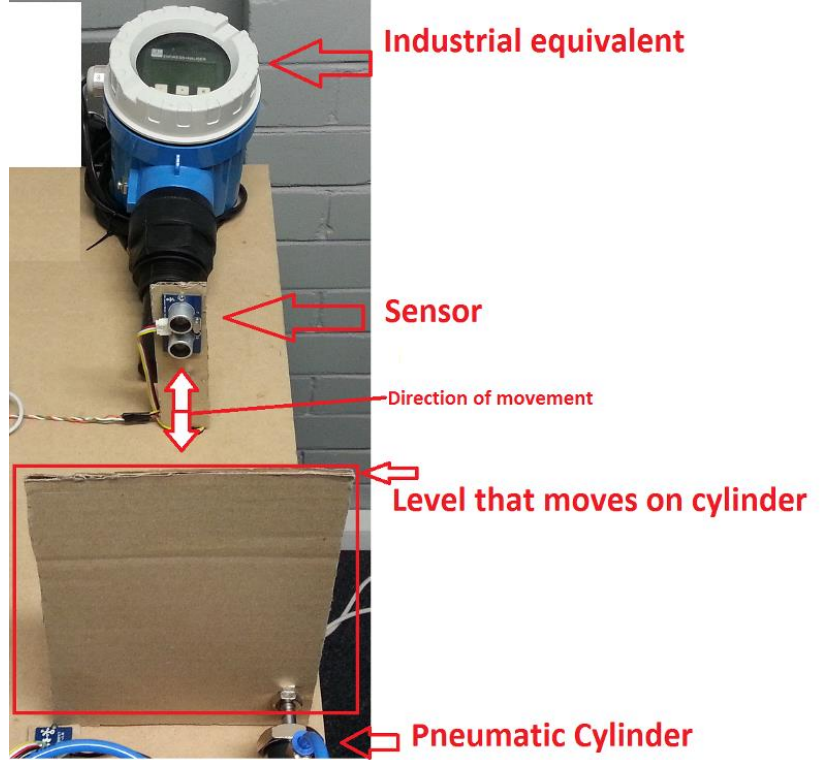
- Operating voltage: 3.3/5.0VDC
- Operating current: 15mA
- Ultrasonic frequency: 42kHz
- Measuring range: 3-400cm
- Resolution: 1cm
- Output: PWM

Note the difference between the high and low level readings (Measuring range). This is the span or operating range of the system.

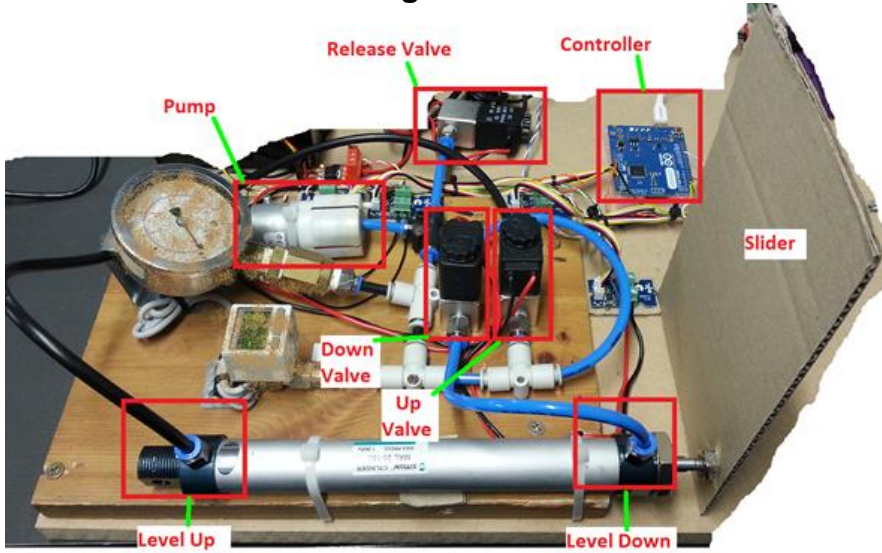
## Sensor rig



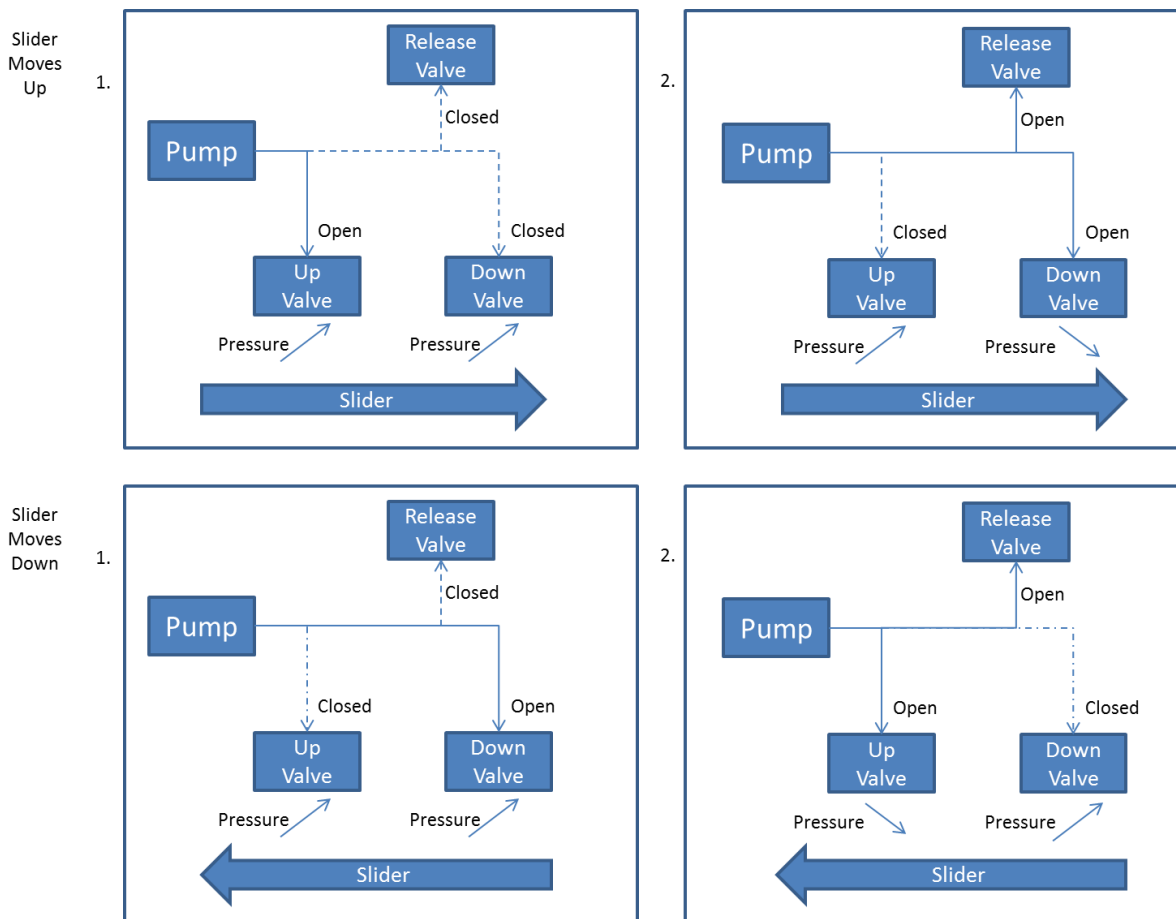
## Complete Rig



## 2.1 Parts and Functioning



Solenoid Valve



## Level control

The level will be changed using the air-pump and repeating the steps above. This is an interesting configuration, as only 3 valves are used, instead of 4. Pressure will be increased on one end of the cylinder, and the level will move up (towards the sensor). When pressure is increased on the other end of the cylinder, the level moves down (away from the sensor). An Arduino controller readings of both indicators will be recorded in order to note any difference in readings.

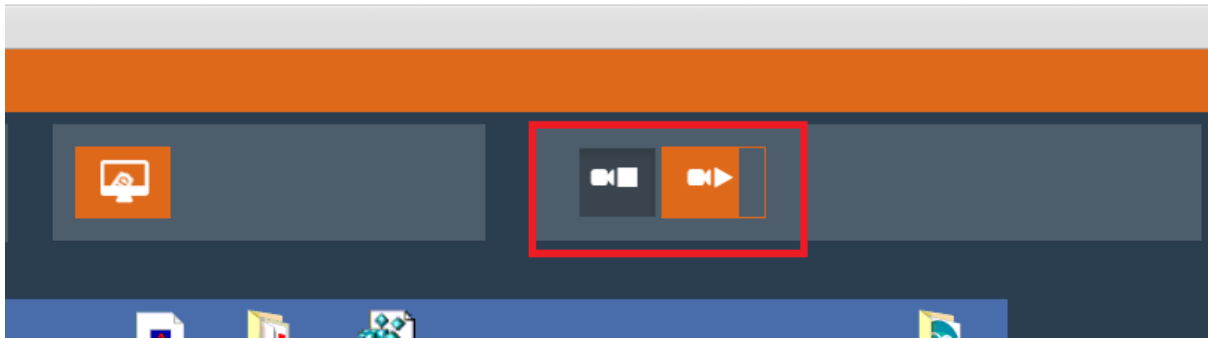
## 2.2 Software Initialisation

- Activate/open the Remote Lab Webcam view of the pressure rig. The Cam icon next to the lab name will open the lab cams (see below).
- On the remote lab, specified above, you will find a folder on the desktop called **IPKIT** which contains the shortcuts to the software to be used.

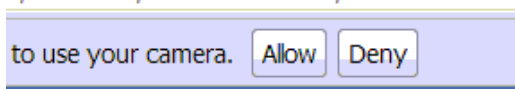
Have the Lab cam open while doing this exercise, since the pressure will be indicated in real-time.

The Lab Cam can be accessed:

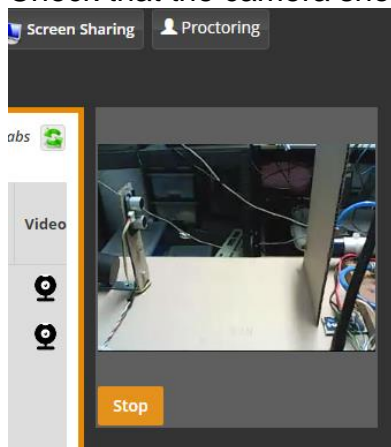
- a. By clicking the view Labcam button (The cams appear after a few seconds)



- b. The camera will appear on the right hand side (be sure to have allowed Camera on your browser, else find it here)



Check that the camera shows the Cardboard level, and the Ultrasonic sensor.



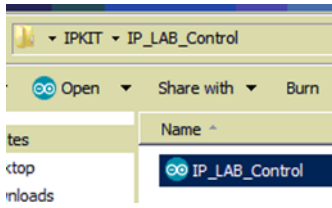
- A) Now access the remote lab using the electromeet instructions document as mentioned in 1.1 above.

(During this practical, write down the Level readings somewhere to keep track.)  
(Remember, view the Lab cam once you've switched on the pump, to see the effect of the level change):

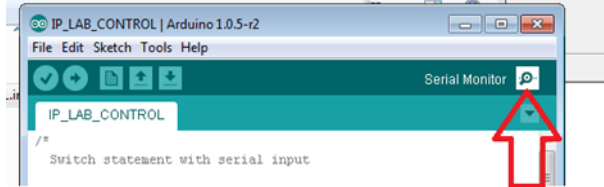
1. Open the IPKIT folder on the Remote Lab desktop




2. In the IP\_LAB\_Control subfolder, open the "IP\_LAB\_Control.ino" Arduino program (Shortcut in the "IPKIT / IP\_LAB\_Control" folder)

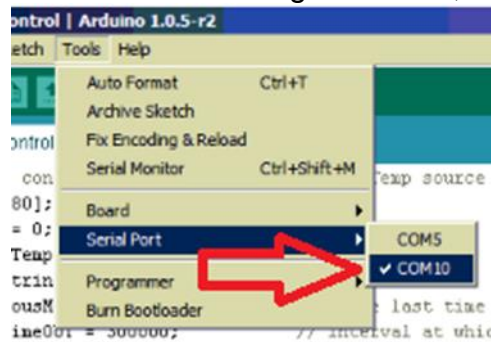


3. Ignore any messages, and Click the “Serial Monitor”



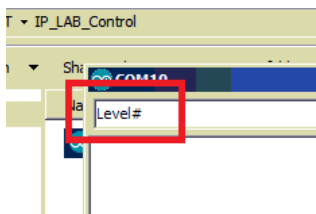
4. It should open a connection automatically and open the blank serial monitor screen.

- a. If it does not, go to “Tools” -> “Serial Port”, and select the COM 8/10 port shown. (If no serial port is shown, close the Arduino program and re-open it, and try again. If more than one port shown (and an error occurs), go to device manager and click on COM ports to see on which one the Leonardo is connected. If it fails again, reprogram, , and try the Serial Monitor again. – else, contact support)



5. In “Serial Monitor” type the following command (Remember to type the # at the end of all commands. It is case sensitive):

**Level#** (press Enter)



6. View the readings in the Serial Monitor – Note them down

7. Next, raise the level, by typing the following: (Be sure you can see the Lab cam)

**Up#** (press Enter)

8. View the change in level measurements in Serial Monitor and Lab webcam.
9. Write down the values visible in the Serial Monitor as the level changed.
10. Next lower the level by entering:

**Down#** (press Enter)

11. Write down the values visible in the Serial Monitor as the level changed.

The system works on a timer, and will automatically reset everything after a few minutes.

**DO NOT SAVE CHANGES.**

**PLEASE CLOSE ALL THE OPEN SOFTWARE WINDOWS IN THE LAB ONCE DONE**