

University of Wales Trinity Saint David

Marine Weather Monitor

Assignment 1

Dr Gary L Jones

Jordan Thomas 1503513
1-25-2020

Table Of Contents

1.	Introduction	2
2.	Marine Weather Monitoring Systems	3 - 5
3.	Sensor Selection	6 - 10
	Air Temperature & Humidity	
	Wave Height	
	Wind Speed & Direction	
	Sun Light Brightness	
	GPS	
4.	Connectors	11
5.	Microcontroller Justification & Calculation.....	11 - 13
6.	SD Storage Memory.....	13
7.	Battery and Travel Case	14
8.	Start Stop Button.....	15.
9.	LED Selection.....	15 - 16
10.	Design Flows Chart.....	17
11.	Block Diagram.....	18
12.	Proteus Circuit Designs.....	18 - 20
13.	Easy-PC Schematic.....	20
14.	Easy-PC PCB design.....	20 - 23
15.	PCB Manufacture Costs.....	23
16.	Total Costs	24
17.	Conclusion and Improvements.....	24
18.	Data Sheets.....	22 - 33
19.	Bibliography.....	34

1: Introduction

This report will be based on the design of a marine weather monitor/logger. The report will include a brief review and comparison of the current weather loggers on the market. This research will be used as a guide whilst sourcing and selecting components and sensors in order to complete the task of creating a microcontroller based marine data logger. To meet the requirements the system will need to be portable, capable of completing a 7 day test, have a non-volatile memory storage and have its own power source. The system will need to record data on the air temperature, air humidity, wave height, wind speed, wind direction, sun light brightness and location.

After selected a full circuit design will be completed on Proteus, a schematic drawing completed on Easy PC and a PCB will be designed on Easy PC. A full costing and review will then be carried out stating any improvements that would be required for future design.

2: Marine Weather Monitoring Systems

Marine weather monitoring systems are widely used to provide professional, real-time data to support military, scientific, fishing operations and more. Reliable monitoring is critical as rapid changes in weather and sea conditions can have a detrimental effect on many off-shore operations. These systems can measure wind and speed direction, air temperature, barometric pressure, GPS position, wave height, humidity and much more. Below is a brief description of the products currently available: [1]

Bresser Professional WIFI Weather Centre 6 in 1



This is a very compact system that can reliably measure wind speed and direction, UV-level, humidity, temperature and precipitation rate. The internal storage will store data for a period of 24 hours. The system has its own battery power source and all data is displayed on the portable LCD tablet.

[2]

MetPak PRO weather station -1723-2-B-2-111



This is a highly sophisticated instrument that can measure a wide range of parameters. It provides a complete weather station with a single serial output (2) The system comes with MetSet visualisation software Which can easily display all collected data. There are no moving parts which means low maintenance and high durability.

Vantage PRO2 Plus



The wireless vantage pro2 plus is an expandable, professional weather station. The system transmits data every 2.5 seconds for up to 300m. This also comes with its own data logger and software. Unlike the others it uses solar for some of its power. It is easy to install and has a user friendly display screen. [3]

Name	Bresser Professional WIFI Weather Centre 6 in 1	MetPak PRO weather station – 1723-2-B-2-111	Vantage PRO2 Plus.
Image			
Output		RS232	Modular RJ-11
Supply voltage	3 x 1.5v AA battery	5v to 30v DC	3 x C cells (console battery backup)
Consumption	1A	<26mA @12v DC	30mA
IP		65	-
Internal Storage	24 Hours	N/A, 15m Power & data cable	Downloads to software
Data collected	Temperature, Wind speed/direction, air pressure, UV, humidity & Precipitation.	Wind speed/direction, Air temp, Humidity, Air pressure, Dew point.	Wind speed/direction, Air temp, Humidity, Air pressure, solar radiation, dew point & UV.
Data Display	LCD Tablet	Download software	LCD Screen/Software
Low battery indicator	Yes	N/A	-
Wifi	Yes	N/A	-
Cost	£297.00	£1,757.50	£1380.00
Operating Temp	-	-35° to +70°	-40° to +65°
Dimensions	120 x 190 x 22mm	361 x 270 x 142mm	155 x 245 x 40mm
Time & Date settings	Yes	-	Yes
Additional features	Frost/Ice warning	PCB allowing users to add additional parameters	Additional accessories can be added
Link	https://www.telescopehouse.com/dmax-professional-wifi-weather-centre-6-in-1.html?gclid=EAIaIQobChMI8vXcjrjv5gIVRrTlCh0djwomEAQYASABEgIbkPD_BwE	https://www.omniinstruments.co.uk/metpak-automatic-weather-stations.html#upsell-product-div	https://www.weathershop.co.uk/shop/davis-vantage-pro2-plus-fars-weather-station

3: Sensor Selection

Air temp & humidity

Type	Pt100 outside temperature sensor.	Humidity	Temperature & Humidity Sensor
IP Range	High	N/A – Mounted on PCB	High
Price	Low	Low	Medium – High
Size	Medium	Small	Medium
Pro's	Cheap, simple connection	Simple to use	Will do the job of 2 sensors.
Cons	Will require additional sensor for Humidity.	Direct to PCB, No IP rating	Slightly more expensive.

Name	Trodex - HX94BV1	Hx300	NEMA-4X	Observer OMC-4xx
				
Output voltage	0 – 5V	0 – 1V	2.42 – 2.54V	-
Input voltage	9 – 30V dc	12 – 40V dc	Battery (3.6V)	10 – 30Vdc
Consumption	100mA	20mA	-	50mA
IP	Stainless IP66	Plastic IP65	Polycarbonate IP65	-
Connector	4 core cable	-	Wireless	-
Other	2 separate analogue outputs	-	Needs Pc software to receive data	-
Accuracy Hum	+/-2.5% Humid	+/-2.5%	+/-2.5%	+/-0.5°C
Accuracy Temp	+/- 0.6°C	+/-0.3°C	+/-1°C	± 0.5°C
Range	0 - 100°C	0 - 100°C	-17 - 49°C	-
Price	£291.60	£159.00	£232.00	-
Dimensions	258mm L x 19mm D	-	80 x 82 x 50mm	265mm x 25mm D
Website	https://www.omega.co.uk/googlebase/product.html?pn=HX94BCW&gclid=EAlaIQobChMI3JTI_5aX5gIVyLTtCh3nVw7SEAQYAyABEglbwfD_BwE	https://www.omega.co.uk/pptst/HX300GB.html#description	https://www.omega.co.uk/pptst/UWRH-2-NEMA.html	https://osil.com/product/temperature-and-humidity-sensor-omc-406/

[4]

Wave Height

Type	Pressure Sensor data logger	Draw wire sensor	Ultrasonic Distance Sensor
IP Range	High	High	N/A
Price	Medium	Medium – High	Low
Size	Medium	Small	Small
Pro's	Robust with low maintenance. Very accurate	Accurate	
Cons	-	Difficult fixing. Vulnerable to damage	Not waterproof

Name	Aanderaa Pressure Sensor	AWAC Acoustic wave profiler	Signature 250
Photo			
Output voltage	RS -232	RS - 232	RS -232
Input voltage	6 – 30V DC	9 – 18 V DC	15-48V DC
Consumption	50mA	1 A	1.5 A
IP	-	-	-
Connector	RS-232	-	-
Other	-	Max output rate 1 Hz	-
Wave height range	30m	50M	-15M to 15M
Update rate	2 minutes	-	-
Price		-	-
Dimensions	130 x 130 x 110mm	210 x 203 mm	-
Other	Pressure can be presented directly in engineering units.		Battery Powered
Website	https://www.aanderaa.com/productsdetail.php?Wave-and-Tide-Sensor-13	https://www.nortekgroup.com/products/awac-600-khz	https://www.nortekgroup.com/products/signature250

[5]

Wind speed & Direction

Type	Cup Anemometer (Speed)	Wind direction Sensor	Direction and speed Sensor
IP Range	Medium	Medium	High
Price	Low	Low	Medium – High
Size	Medium-Large	Medium	Medium
Pro's	Easy to install	Cost effective, easy to use.	No Moving parts, 2 sensors in 1, can be very accurate.
Cons	Moving parts, Wind speed only.	Moving parts, direction only, Very sensitive.	More expensive

Name	WindObserver 65	Wind sonic 1405-PK-021	Wind Master 3D
			
Output voltage	0-5v Analogue	RS-232	0 – 5V Analogue
Input voltage	12v	5 – 30vDC	9 – 30V DC
Consumption	40mA	2 – 44mA	55mA
IP	66	66	65
Connection	18 Wires	RS-232	18 wires
Material	Stainless Steel	Polycarbonate	Aluminium/Carbon Fibre
Wind speed range	0 -145 RPM (0-65m/s)	0 – 60m/s	0 – 45m/s
Wind direction range	0 - 359°	0 - 359°	0 - 359°
Price	£1,445.00	£640.46	£1,886.00
Dimensions	381mm x 213mm	142 x 160mm	750 x 240 mm
Other	Particularly good for salt water applications. De-icing system.	Corrosion free – Maintenance free	-
Website	https://www.omniinstruments.co.uk/windobserver-65-ultrasonic-anemometer.html	https://www.omniinstruments.co.uk/weather-stations-and-instruments/wind-speed-and-direction-sensors/windsonic-solid-state-wind-speed-and-direction-sensor.html	https://www.omniinstruments.co.uk/weather-stations-and-instruments/wind-speed-and-direction-sensors/windmaster-3d-ultrasonic-anemometer.html

[6]

Sunlight brightness

Type	Photo Diode	Spectrometer	Light dependent resistor
IP Range	N/A	Low	N/A
Price	Very Low	High	Very Low
Size	Small	Large	Small
Pro's	Very simple & effective. Easily set up.	Accurate	Easy to use. Readily available. Commonly used in street lights.
Cons	Mounted direct to PCB On / off only	Complex set up	Mounted direct to PCB

Name	Luna Optoelectrics Norps-12	Luna Optoelectrics NSL-19M51	Silonex to-18 Photocells
Photo			
Mounting	Through hole	Through hole	Through Hole
Rise time	45mS	45mS	-
Pins	2	2	2
Material	Cds	Cds	cds
Power Dissipation	250mW (20.8mA @12v)	50mW (4mA @12v)	250mW
Voltage rating	250 V Max	100 V Max	250 V Max
Price	£2.44	£0.676	£0.98
Range	5.4 kΩ - 12.6kΩ	20 kΩ - 100 kΩ	170 Ω - 2kΩ
Other	-	-	-
Website	https://uk.rs-online.com/web/p/ldr-light-dependent-resistors/9146714/	https://uk.rs-online.com/web/p/ldr-light-dependent-resistors/9146710/	https://uk.rs-online.com/web/p/ldr-light-dependent-resistors/4661974/

[7]

GPS Sensor

Name	Raymarine RS150	Masestro GPS Module	TANGO20A/3M/SM AM/S/S/26
			
Input voltage	8 – 32V DC	3 – 3.6V	2.2 – 5V
Consumption	30 mA	35mA	15mA
Update Rate	10Hz	5Hz	
IP	67	PCB Mounted	IP67
Connection	RS-232		SMA/MCX
Material			ABS
Sensitivity	High		
Accuracy	<5m		
Price	£229.95	£16.40	£20.93
Dimensions		17.8 x 16.5 x 7.1 mm	25 x 25 x 4 mm
Other	High Quality		Rubber seal gasket
Website	https://www.marinesuperstore.com/gps-radar/gps-antennas/raymarine-rs150-gps-antenna	http://www.farnell.com/datasheets/1821035.pdf?_ga=2.220723537.87109925.1579626561-1529781133.1573051952&_gac=1.175310102.1579627056.EAlaIQobChMluNnpnZmV5wIVh7HtCh1INwZ2EAQYASABEgJkRPD_BwE	https://uk.farnell.com/siretta/tango20a-3m-sm-am-s-s-26/antenna-adhesive-screw-sma-3m/dp/2666846?yclid=EAlaIQobChMltWMjUeV5wIVSLTChZrNgcCEAQYDyABEgt_mvD_BwE&gross-price=true&mckys=97fDChgv_dcIpcrid178108376509Ikworid1Imatch1Iplid1Iplid1Iproduct12666846Ipgrid114406255429IptaidIaud-157604796549Ipla-449731536891I&CMP=KNC-GUK-GEN-SHIPPING-2666846

[8]

4: Connectors

This Task requires 3, 4 and 5 pin connectors:

Name	0 – 326 – 56 Schlemmer	Superseal 1.5 Series	Clarks GLLAFSLIQ-N
			
Pins Available	4,5	3,4,5	3,4,6
IP	67	67	Waterproof
Housing Material	Black Nylon	Glass-filled Nylon	Nylon
Temperature Range	-25 to 80°C	-40 to 125°C	-10 to 80°C
Supplier	ARC components	12 Volt Planet	Amazon
Max V	-	24V Dc	-
Max A	-	10A	13A
Price	Medium	Low	High
Link	https://www.arc-components.com/0-326-56-schlemmer-female-din-5-way-connector-2430.html	https://www.12voltplanet.co.uk/superseal-waterproof-connector-pair-3-way-1-5-series.html	https://www.amazon.co.uk/Glarks-Waterproof-Electrical-Connector-Motorcycle/dp/B07L9NFGG/ref=nr_1_2_sspa?keywords=waterproof+connector+v2+pin&qid=1579901058&quartzVehicle=72-1783&replacementKeywords=waterproof+connector+pin&sr=8-2-spons&psc=1&spLa=ZW5jcmlwdGVkUXVhbGlnaWVyPUFSWTA0VWp1STNUSFMinZW5jcmlwdGVkVW99QTA1Ng3MjZvYTY4TDh0VAAmMjYmV3I35cHRZFR5WQ9QTEwMzE2NjE1ZGlyZWN0mRvTm90TG9nO2xpY2s9dHJ1ZQ==

Superseal 1.5 Series has been chosen because of the low price, desired IP level and has options for the exact number of pins required.

Pin Number	3	4	5
Price	£3.73	£5.33	£6.03

5: Microcontroller justification & Calculations

Below are calculations to support my microcontroller justification.

Resolution

Air Temperature & Humidity

Air temperature & humidity sensor has a range of 0 - 100 °C for temperature and 0 – 100% for humidity. Temperature change will be detected every 0.5 °C and humidity every 1%:

Temperature = $101 \div 0.5 = 202$ readings. This means 8bits is required.

$202 \div 5v = 40.4$. Each volt will represent 40.4 °C

Humidity = $101 \div 1 = 101$ readings. 8 bits required.

$101 \div 5 = 20.2$. Each volt out will represent 20.2%

Wave Height

This sensor will measure every 50mm of change. It has a range of 30m so:

$30000 \div 50 = 600$ readings. Therefore 10 bit is required

Wind Speed

Speed will be measured every 0.5m/s. the sensor has a range on 60m/s so:

$60 \div 0.5 = 120$ readings. Therefore 8 bit is required

Wind Direction

Wind direction will be measured every 1°C and has a range of 0 -359°C so:

$360 \div 1 = 360$ readings. Therefore 10 bit is required

Signal	Pins	Analogue/Digital	Log frequency	Resolution
Temp	1	Analogue	30s	8 bit
Humidity	1	Analogue	30s	8 bit
Wind speed	1	RS 232	1s	8 bit
Direction	1	RS 232	1s	10 bit
Wave Height	2	RS 232	0.5s	10bit
GPS	2	RS 232	1s	8 bit
SunLight	1	Analogue	1s	8 bit
SD Card	4	Digital		
Start Button	1	Digital		
USB	2	D+/D-		
Power	3			
LED/Tell	1	Digital		
Total	20			

Additional Requirements

- Voltage 5V
- Clock Speed 16MHz +
- Analogue Signals 3 + 4 @ 8-bit resolution (4 analogue pins will be used for RS 232 and configured on software)
- RAM – 0.5KB
- USB – 2 Bits
- SPI – Yes (1)
- Minimum Program memory 16KB

PIC Selection

The above information was used to select my pic on Microchip.com. It is not possible to buy a standard pic with 4 RS 232 inputs, therefore 4 analogue inputs will be used and configured on software. The chosen chip is the 18F2550 which has 28 pins, 32khz clock speed and 32KB program size. It meets the all minimum criteria and is a chip I'm familiar with.



[9]

6: SD Storage

Measurement	Analogue/Digital	Bytes	Logging Rate	Total Bytes
Temperature	Analogue	1	30s	.03
Humidity	Analogue	1	30s	.03
Wind Speed	RS 232	1	1s	1
Wind Direction	RS 232	1	1s	1
GPS	RS 232	1	1s	1
Wave Height	RS 232	1	0.5s	0.5
Sunlight	Analogue	1	1s	1
TOTAL				5.1 Bytes

Total memory for 7-day trial:

$$5.1 \times 60 = 306 \quad 306 \times 60 = 18360 \quad 18360 \times 24 = 440640 \quad 440640 \times 7 = 3084480 \text{ bytes}$$

A total of 3.08 MB is required for the 7-day test.

	Kingston Class 4	KODAK Extra Class 10	My Memory
Name			
Price	£2.80	£4.99	£4.95
Storage	32GB	32GB	2GB
Read Speed	4MB/S	20MB/S	-
Operating Temp	-25 to 85 °C	-	-
Supplier	Amazon	Currys	My Memory
Link	https://www.amazon.co.uk/Kingston-microSDHC-SDC4-32GB-Adapter/dp/B0046XAROG?ref=s9_apbd_oup_hd_b_w_b1T4wpT&pf_rd_r=R5JXQHRSPYEBQ9IABZ&pf_rd_p=33adf5a5-2da2-552f-9f24-2a23f7cb6933&pf_rd_s=merchandised-search-10&pf_rd_t=BROWSE&pf_rd_i=1345826031	https://www.currys.co.uk/gbuk/cameras-and-camcorders/photography-accessories/memory-cards-and-readers/kodak-extra-class-10-microsdhc-memory-card-32-gb-10190311-pdt.html	https://www.mymemory.co.uk/memory/memory-cards/micro-sd.html?capacity=6_29

I have selected the Kingston class 4 as it is the cheapest option and easily meets the requirements

7. Battery & Travel Case Selection

Sensor	Power Consumption	Quantity	Total Power Consumption
Air Temp & Humidity	100mA	1	100mA
Wind Speed & Direction	40mA	1	40mA
GPS	30mA	1	30mA
Sunlight intensity	4mA	1	4mA
Wave Height	50mA	1	30mA
LED	20mA	2	40mA

The total power consumption per hour is 244mA. This needs to be calculated for a 7 day trial.

$$244 \times 24 \times 7 = 40,992 \text{ mA} = 40.99\text{Ah}$$

Name	Yuasa L26-80	Lion 027	YUASA LPC12-75
			
Price	£82.98	£86.99	£142.99
Voltage	12V	12V	12V
Capacity	80Ah	60Ah	75Ah
Weight	19KG	-	25KG
Dimensions	260 x 174 x 225 mm	190 x 175 x 242mm	259 x 168 x 208 mm
Link	https://www.hardwarexpress.co.uk/12v-80ah-leisure-battery-yuasa-l26-80-3156-p.asp?gclid=EAlaIqobChMlobO76tCX5wIVxlTlCh3RtA9DEAQYBCABEgJmwPD_BwE	https://www.eurocarparts.com/p/lion-027-car-battery-3-year-guarantee-444770271?type=shopping&gclid=EAlaIqobChMlyrCwyZuZ5wIVjbHtCh21pQeEEAQYAIABEgJLH7PD_BwE	https://www.hardwarexpress.co.uk/12v-75ah-sealed-lead-acid-vrla-battery-2408-p.asp?gclid=EAlaIqobChMliuu_M8f6Z5wIVWeDtCh2eAwajEAQYBSABEgJofPD_BwE

Yuasa L26-80 has been chosen because of the high capacity and low price.

Travel Case

Name	Max004S	VidaXL 140304	NWEC32
			
Price	£19.90	£58.95	£76.80
Wheels	No	Yes	No
IP	67	Dust Proof & Water Proof	55
Weight	600g	13KG	
Dimensions	31.6 x 19.5 x 8 cm	51 x 28.5 x 19 cm	20.6 x 52.4 x 42.8
Link	https://www.amazon.co.uk/Max-MAX004S-IP67-Rated-Accessory/dp/B0192PLKSO/ref=asc_df_B0192PLKSO/?tag=googshopuk-21&linkCode=df0&hvadid=226152056294&hvpos=103&hvnetw=g&hvrnd=15770968741977765195&hvpo=one&hvptwo=&hvqmt=&hvdvcmdl=&hvdvcint=&hvlvcphy=1007413&hvtargid=pla-419974745656&pvc=1&th=1&pvc=1	https://www.amazon.co.uk/vidaXL-Wheel-equipped-Equipment-Transport-Carrier/dp/B00G8VJK4C/ref=asc_df_B00G8VJK4C/?tag=googshopuk-21&linkCode=df0&hvadid=214148533669&hvpos=&hvnetw=g&hvrnd=1655371571805780391&hvpone=&hvptwo=&hvqmt=&hvdvcmdl=&hvlvcint=&hvlvcphy=1007413&hvtargid=aud-857761465096&pla=471568129188&pvc=1	https://www.bigdug.co.uk/storage-boxes-containers-c363/euro-containers-c418/newpo-waterproof-equipment-cases-p19946/s436887vs_vat=inc&utm_campaign=n=CSS:Shopping:Lockers Cabinets and Cupboards&utm_source=google&utm_medium=cpc&gclid=EAlaIqobChMlyNaBu7yf5wIVBLDtCh0hhASAEAQYASABEgIMNFD_BwE

VidaXL 140304 is the chosen protection case as it has wheel, will fit all components including battery and it is both dust & waterproof.

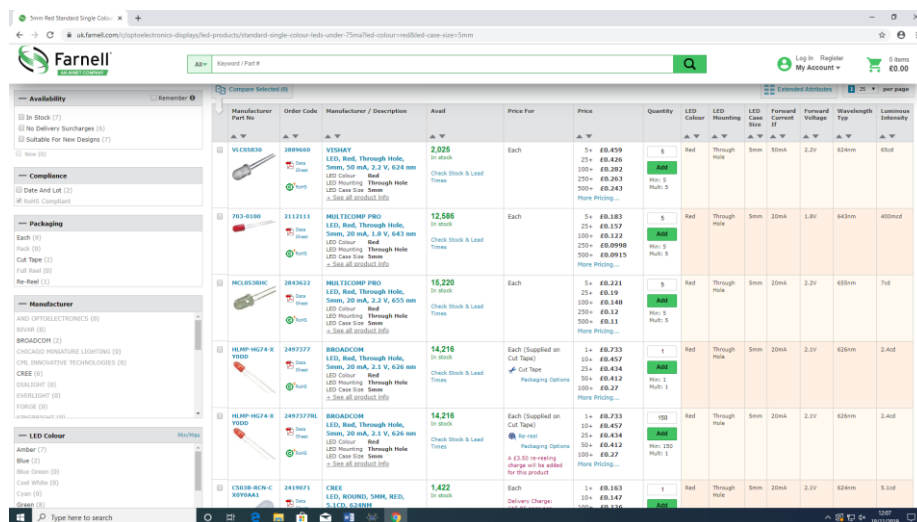
8. Stop Start Button

Name	HYLEC 1DE.02.02	VidaXL 140304	Schneider XALD211H29
			
Price	£20.78	£15.99	£36
Max A	10A	10A	6A
IP	56		65
Max V	240 V AC	300 v AC	600 V AC
Dimensions	65 x 105 x 80 mm	205 x 164 x 83 mm	68 x 106 x 53
Link	https://www.screwfix.com/p/hylec-1de-02-02ag-sf-red-green-push-button-isolator-switch/461017?pid=46101&ds_kid=92700048793290388&ds_rl=1249401&gclid=EAlaIqoBChMlWQ6D-r2f5wIVQ7DtCh2MjgiAEAQYASABEgLG69vD_BwE&gclid=aw_ds	https://www.amazon.co.uk/Momentary-Mushroom-Emergency-Assurance-hz-11ZS-GR/dp/B07PN7H4T3/ref=asc_df_B07PN7H4T3/?tag=googshopuk-21&linkCode=df0&hvadid=309857966843&hvpos=1o1&hvnetw=g&hvrand=1379601240496980136&hvpo=ne=&hvptwo=&hvqmt=&hvdvc=&hvdvcmdl=&hvllocint=&hvllocphy=1007413&hvtargid=aud-857761465096:pla-756327250219&pssc=1	https://docs.rs-online.com/6f00/0900766b811ea122.pdf

A Start/Stop button has been used in my design. During the 7 day trial anything could happen which would require the trial to stop. The chosen item has superior IP and meets all other requirements.

9. LED Selection

There is a requirement for a LED to flash once every 10 seconds. This system will have a red power on LED and a green flashing LED.



Manufacturer	Part No	Order Code	Manufacturer / Description	Avail	Price Per	Price	Quantity	LED Colour	LED Mounting	LED Case Size	Forward Current	Forward Voltage	Wavelength	Lumens Intensity
VISHAY	703-0100	2889660	LED, Red, Through Hole, 5mm, 50 mA, 2.2 V, 624 nm	2,025	Each	£0.459	5	Red	Through Hole	5mm	50mA	2.2V	624nm	65cd
MULTICOMP PRO	703-0100	2112111	LED, Red, Through Hole, 5mm, 50 mA, 1.8 V, 643 nm	12,586	Each	£0.183	5	Red	Through Hole	5mm	20mA	1.8V	643nm	40mcd
MULTICOMP PRO	703-0100	2843623	LED, Red, Through Hole, 5mm, 20 mA, 2.2 V, 625 nm	15,220	Each	£0.221	5	Red	Through Hole	5mm	20mA	2.2V	625nm	7cd
HLMP-H02A-X	703-0100	2497377	LED, Red, Through Hole, 5mm, 20 mA, 2.2 V, 624 nm	14,216	Each (Supplied on Cut Tape)	£0.457	1	Red	Through Hole	5mm	20mA	2.2V	624nm	2.4cd
HLMP-H02A-X	703-0100	2497377ML	LED, Red, Through Hole, 5mm, 20 mA, 2.2 V, 624 nm	14,216	Each (Supplied on Cut Tape)	£0.457	100	Red	Through Hole	5mm	20mA	2.2V	624nm	2.4cd
CREE	703-0100	2419071	LED, RED, 5mm, 20mA, 2.2V, 624nm	1,422	Each	£0.183	1	Red	Through Hole	5mm	20mA	2.2V	624nm	5.1cd

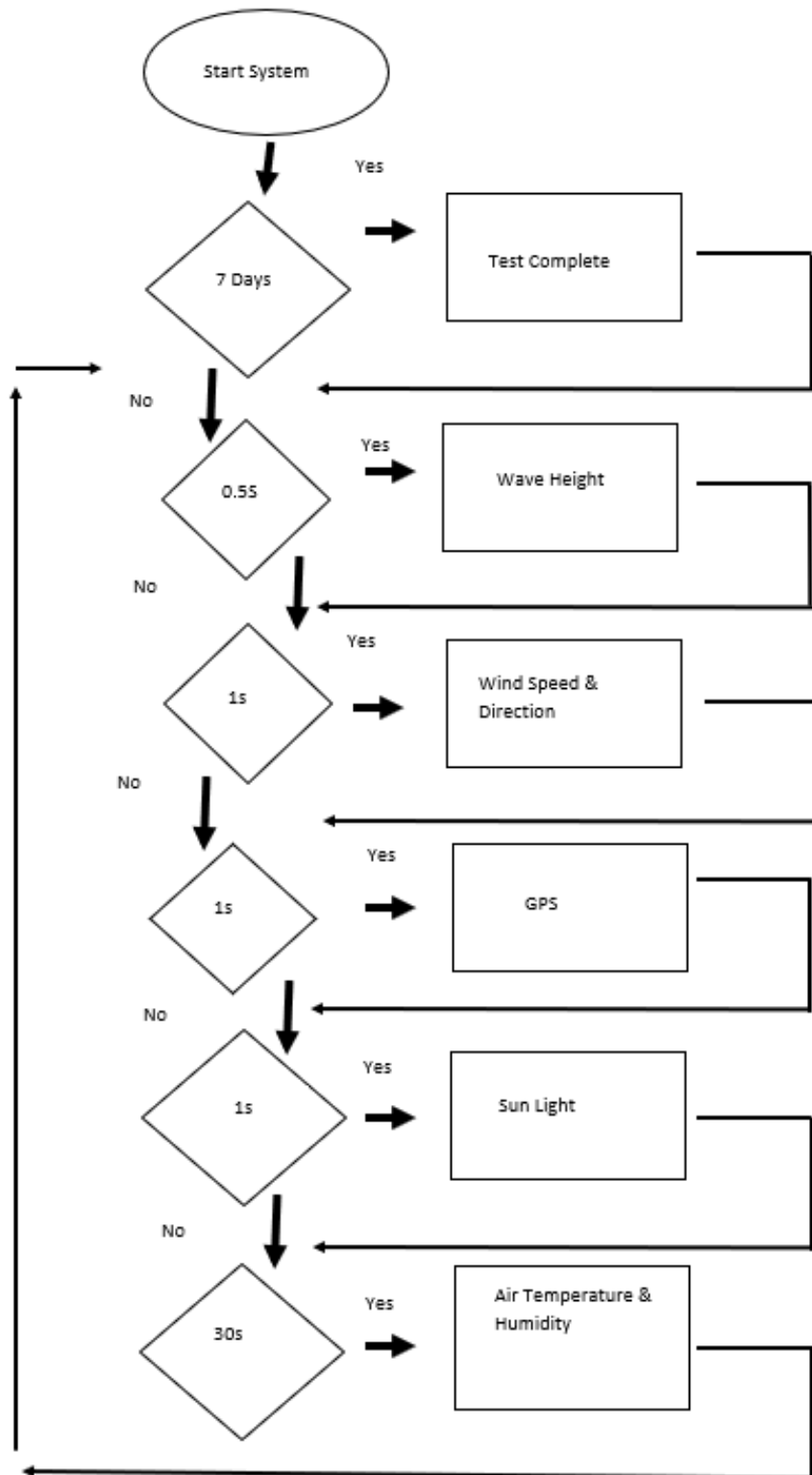
703-0100 - LED, Red, Through Hole, 5mm, 20 mA, 1.8 V, 643 nm



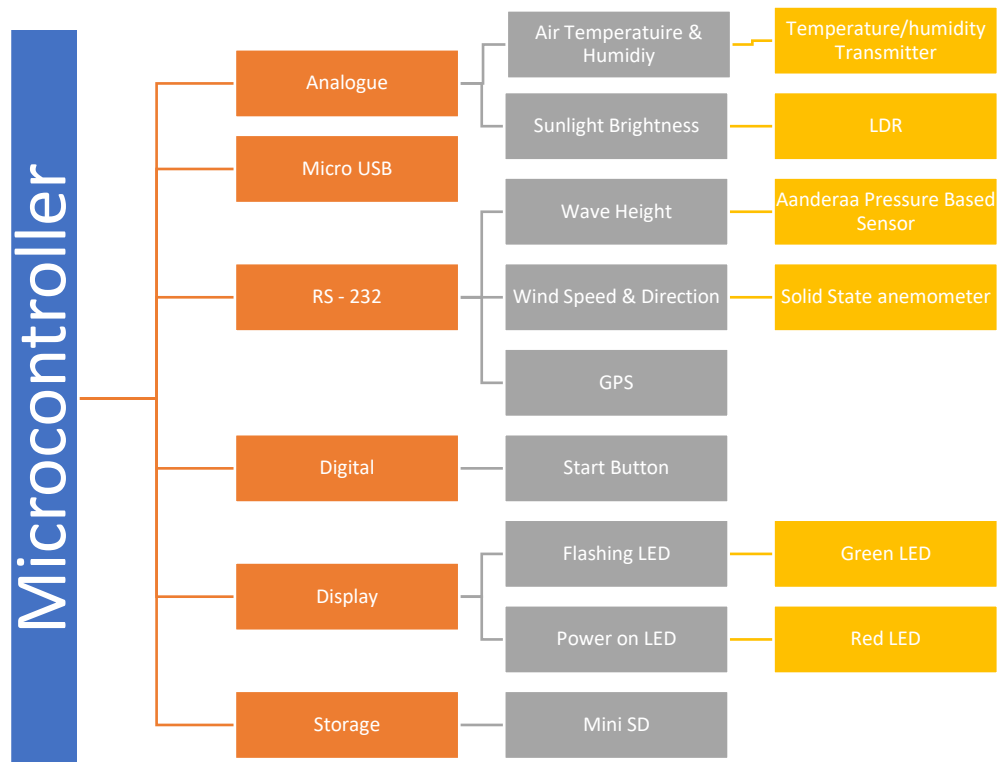
Farnell was used for the comparison and selection process. From the options above the 703-0100 was selected due to the price, availability and specification.

10: Design Flow Chart

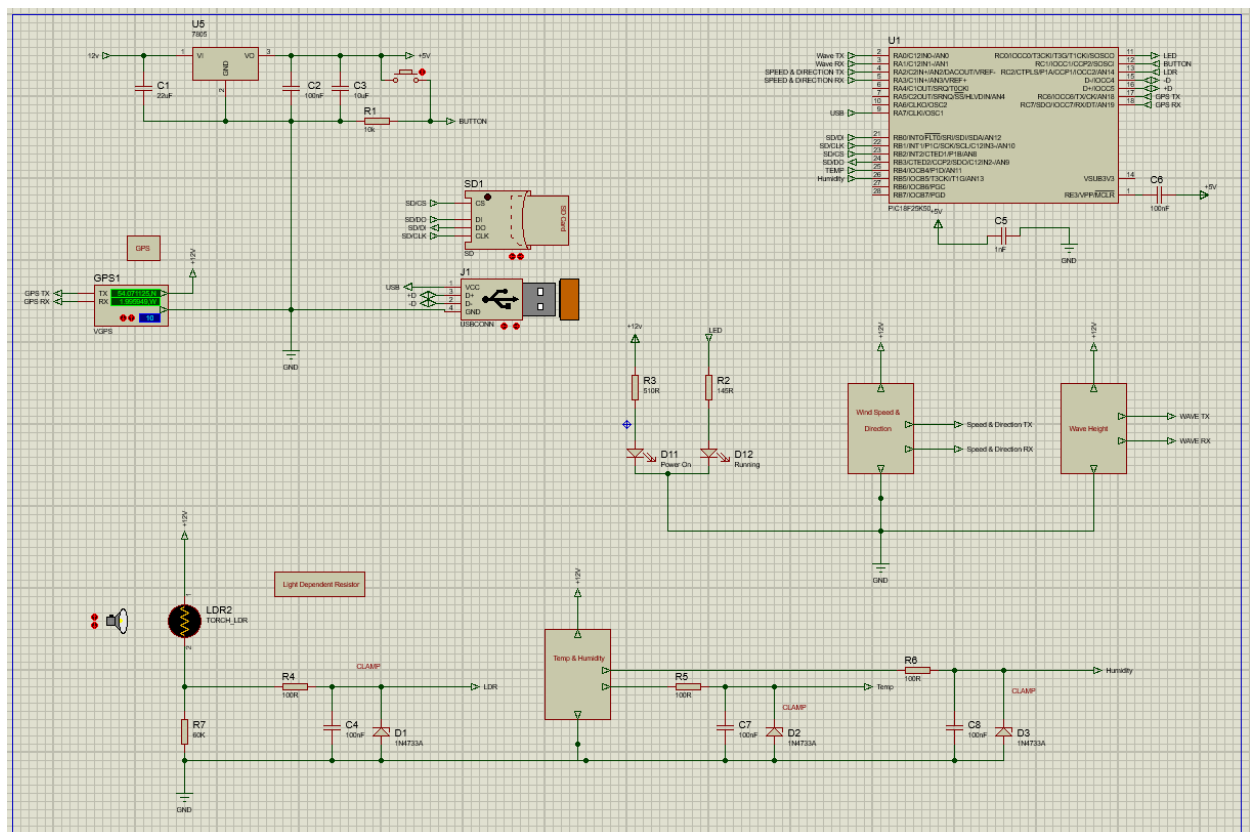
The first stage of any design is a flow chart. Below is the flow chart design for the logging rates of each sensor.



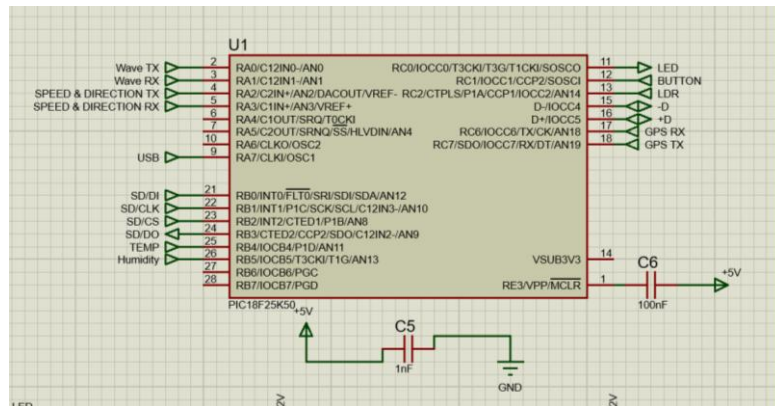
11: Block Diagram



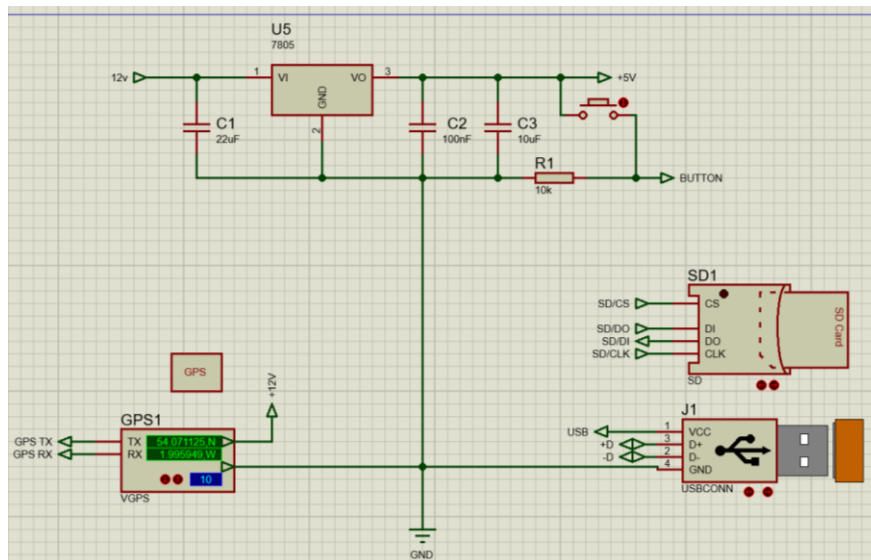
12: Proteus



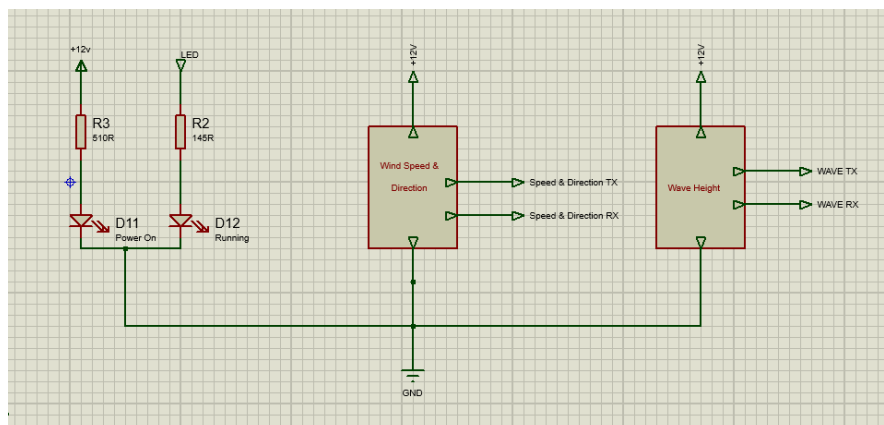
PIC



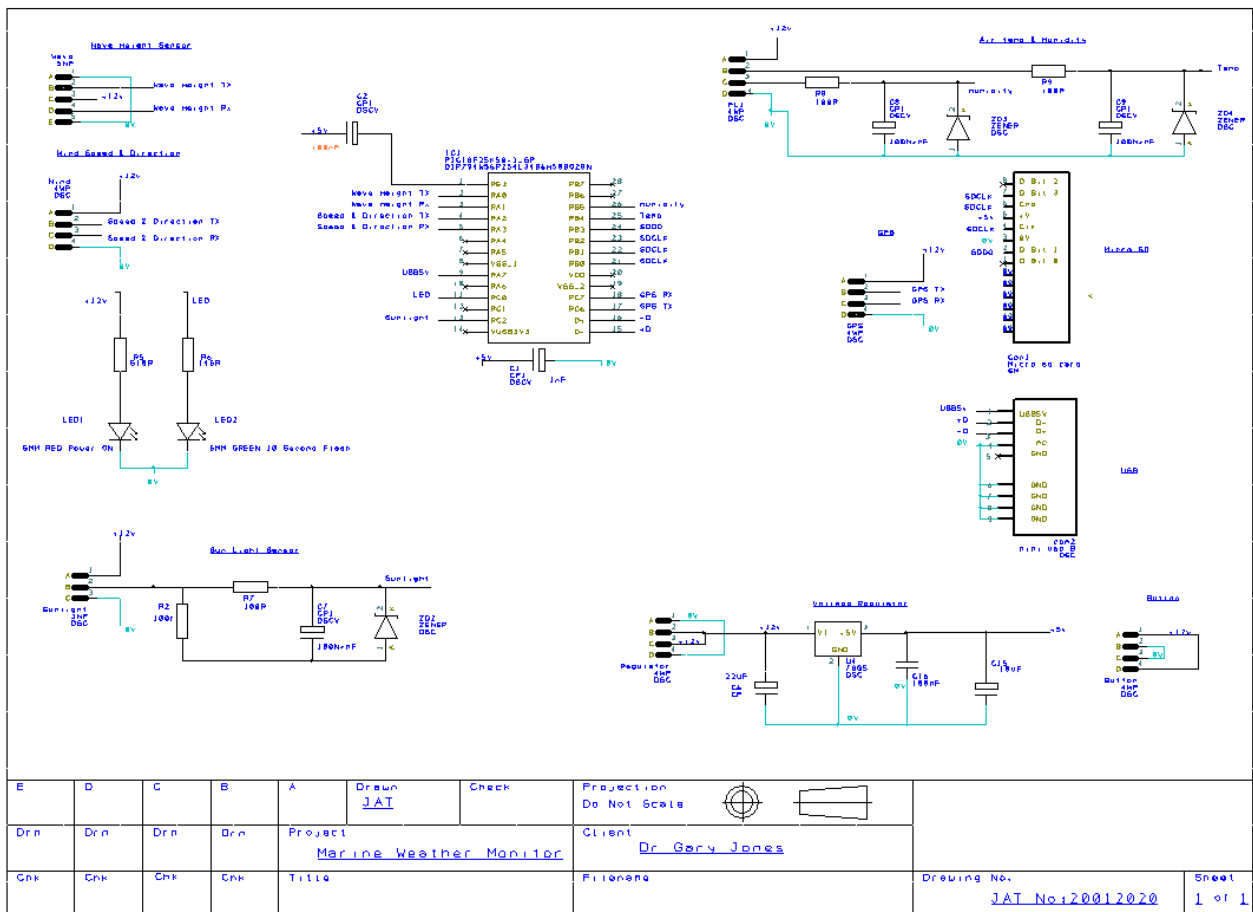
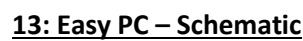
GPS, USB, Micro SD & Voltage Regulator



LED, Wind Speed, Wind Direction & Wave Height

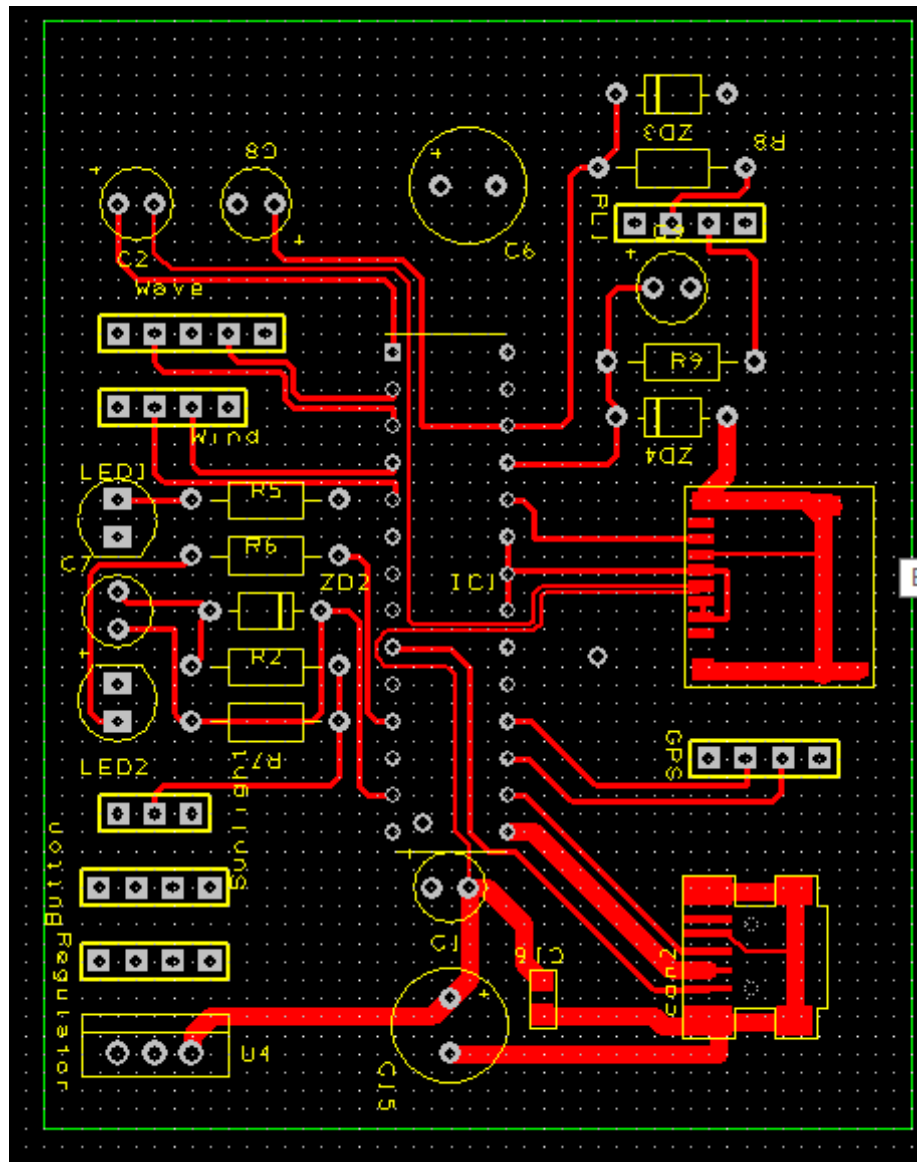


pg. 20

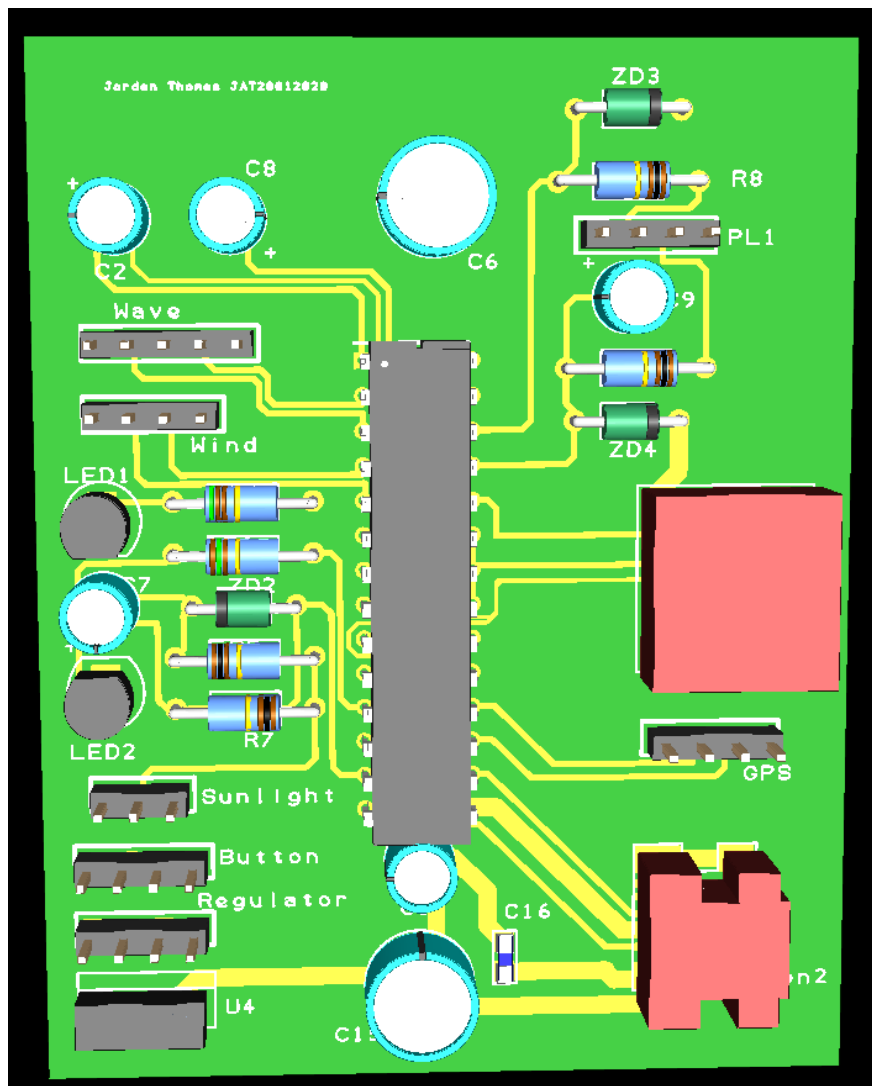
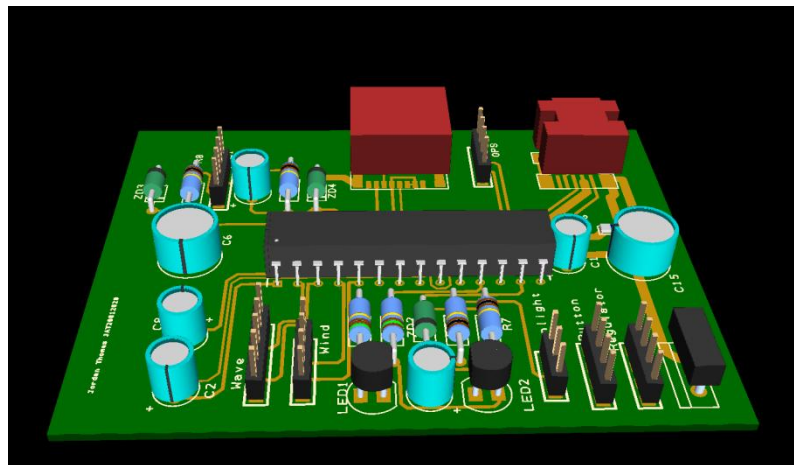


14:Easy PC - PCB

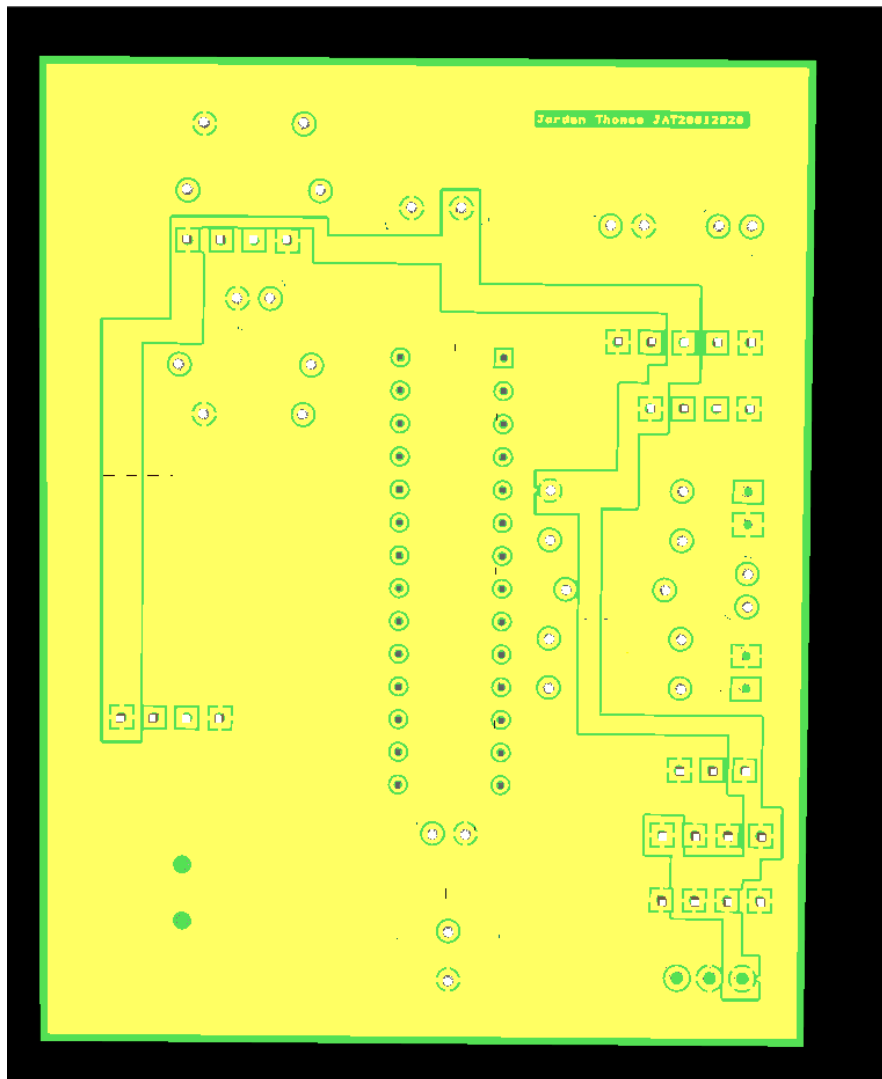
Initial Connection



3D View of Final Design



Copper Pour Complete With Unique Identity Number



15: PCB Manufacture

Summary

Quantity	Board surface / Order surface	Price	Express P
1	16.47 inch / 16.47 inch	£46.14	£58.46
10		£46.14	£58.46
100		£46.14	£58.46
1000		£46.14	£58.46
10000		£46.14	£58.46
100000		£46.14	£58.46
1000000		£46.14	£58.46

PCB Specification Selection

Board type: ☒ Single pieces ☐ Panel job as design

Dimensions: 16.47 x 16.47 inch

Quantity: 1

Layers: 2 layers

Material: FR-4

Thickness: 1.6mm

Price: £46.14

Total: £47.22

Above is 2 PCB manufacturers quotes. The Chinese manufacture does not have the United Kingdom as a delivery option. Due to this the European manufacture will be used at a cost of £47.22.

<https://www.eurocircuits.com> https://www.pcbastore.com/online_quote.php

16:Total Costs

Total Build Cost	£1,929.43
-------------------------	------------------

Item	Manufacturer	Product Number	Price	Quantity	Total
Air temperature & Humidity	Omega	HX94BCW	£291.60	1	£291.60
wind speed & direction	WindSonic	1405-PK-021	£640.46	1	£640.46
Wave height	Aandreaa	5218/5218R	£500 ish	1	£500.00
Sun light brightness	Luna Optoelectrics	NSL-19M51	£0.68	1	£0.68
GPS	Raymarine	RS150	£229.95	1	£229.95
3 Pin Connector	Superseal	SS3MF	£3.73	1	£3.73
4 pin connector	Superseal	P0195	£5.33	5	£26.65
5 pin connector	Superseal	P00196	£6.03	1	£6.03
PIC	Microchip.com	18f2550	£2.02	1	£2.02
Carry Case	vidaXL	140304	£58.99	1	£58.99
Micro SD card	Kingston	SDC4/32GB	£2.80	1	£2.80
Battery	Yuasa	L26-80	£82.98	1	£82.98
Start/stop button	Schneider	XALD211H29	£36.00	1	£36.00
Red LED	Multicomp	703-0100	£0.18	1	£0.18
Green LED	Multicomp	703-0097	£0.14	1	£0.14
PCB	Eurocircuits	JAT No:20012020	£47.22	1	£47.22

17: Conclusion & Improvements

The task was to design a marine weather station that was portable, used a non-volatile memory source and was capable of completing a 7 day trail. I believe the system meets the criteria but there is also room for improvement.

The first major improvement would involve the use of an LCD pad capable of displaying real-time data to the user. This would be wireless which would allow to allow the data to be read from a distance.

The sensors chosen are the best for this application. If there was a budget or if there was a requirement for more efficient sensors then some sensors could be swapped.

The selected carry case is very effective for transporting a prototype from trial to trial. If the system was to go into mass production then a purpose-built case would be designed. This would be more compact, light weight and contain all company logos and images.

18: Data sheets

MetPak™*PRO*

Expandable, up to 10 Reference Quality Parameters

The MetPak Pro integrates industry leading products in a convenient, economical package allowing users to concentrate on the measurement rather than the quality of the measurement. Calibration services available.

Wind Measurement

Parameters	Wind speed & direction or U & V (Vectors)	
Units of measure	m/s, knots, mph, kph, ft/min	
	Wind Speed	Wind Direction
Range	0-60m/s (134 mph)	0 to 359° - No dead band
Accuracy	±2% @12m/s	±3° @12m/s
Resolution	0.01 m/s (0.02 mph)	1°

Air Temperature

Air temperature	Pt100 1/3 Class B
Range	-35°C to +70°C
Accuracy	±0.1°C
Resolution	0.1°C (0.1°F)
Units of measure	°C or °F

Relative Humidity

Range	0-100% RH
Accuracy	±0.8% @ 23°C
Resolution	0.1% RH
Units of measure	% RH
Compensated for temperature dependency	

Barometric Pressure

Range	600-1100hPa
Accuracy	±0.5hPa
Resolution	0.1hPa
Units of measure	hPa, mbar, mmHg, inHg
Compensated for temperature dependency -30°C to +70°C	

Dew Point

Resolution	0.1°C (0.1°F)
Units of measure	°C or °F
Accuracy	±0.15°C (23°C ambient temp @ 20°C dew point)

Power Supply

Input voltage	5V to 30V d.c.
Current	<26mA (Output 1 second) @12V d.c.
SDI-12	
Input voltage	12V nominal (9.6-16V d.c.)
Current	<12mA Low power operation

Outputs

Digital outputs	RS232, RS422, RS485* or SDI-12 (user selectable) *2 wire point to point
Baud rates	4800-57600 (ASCII) or 1200 (SDI-12)
Protocols	ASCII or SDI-12 V1.3
Data output	1s, 2s, 4s or polled mode

Inputs

Analogue 1	0-5 V or 4-20mA loop or self powered
Analogue 2	0-5 V or 4-20mA loop or self powered
MetPak Pro A-D Conversion	12 bit resolution with an accuracy of ± 0.1% of reading +35µV offset
Pt100 Temperature Probe	4 Wire Pt100 conforms to IEC 60751
Digital	Contact closure for tipping bucket rain gauge Capable of capturing events up to 10Hz

Environmental

Protection class	IP65
EMC	EN 61326
Operating temperature	-35°C to +70°C
Storage temperature	-40°C to +80°C
Operating humidity	0% to 100% humidity

Mechanical

External construction	UV stabilised white thermoplastic
Fittings	Anodised Aluminium bracket to allow fitting to 30 mm to 58 mm mast dimensions
Weight	2.1kg (including bracket)

Software

MetView	Free software for the display of data and logging
MetSet	Free software for the configuration of the MetPak, MetPak RG & MetPak Pro

Optional Accessories

Cables	15m Power & Data cable USB Configuration cable
Hardware	Tipping Bucket Rain Gauge MetPak Pro Junction Box MetPak Pro Junction Box PCB MetPak Pro Junction Box Mounting Bracket Heater Interface Box

Wireless Vantage Pro2™ & Vantage Pro2™ Plus Stations
(Including Fan-Aspirated Models)



6152 6162
6153 6163

WIRELESS VANTAGE PRO2™

Vantage Pro2™ (6152, 6153) and Vantage Pro2™ Plus (6162, 6163) Wireless Weather Stations include two components: the Integrated Sensor Suite (ISS) which houses and manages the external sensor array, and the console which provides the user interface, data display, and calculations. The ISS and Vantage Pro2 console communicate via an FCC-certified, license-free, spread-spectrum frequency-hopping (FHSS) transmitter and receiver. User-selectable transmitter ID codes allow up to eight stations to coexist in the same geographic area. The frequency hopping spread spectrum technology provides greater communication strength over longer distances and areas of weaker reception. The Wireless Vantage Pro2 Plus weather station includes two additional sensors that are optional on the Vantage Pro2: the UV sensor and the solar radiation sensor.

The console may be powered by batteries or by the included AC-power adapter. The wireless ISS is solar powered with a battery backup. Use WeatherLink® for Vantage Pro2 and Vantage Vue® to let your weather station interface with a computer, to log weather data, and to upload weather information to the internet.

The 6152 and 6162 rely on passive shielding to reduce solar-radiation induced temperature errors in the outside temperature sensor readings. The Fan-aspirated 6153 and 6163 combine passive shielding with a solar-powered fan that draws outside air in over the temperature and humidity sensors, providing a much more accurate temperature reading than that available using passive shielding alone.

Integrated Sensor Suite (ISS)

(Includes product numbers: 6152, 6153, 6162, 6163, 6322, 6323, 6327 & 6328)

Operating Temperature	-40° to +150°F (-40° to +65°C)
Non-operating Temperature	-40° to +158°F (-40° to +70°C)
Current Draw (ISS SIM only)	0.14 mA (average), 30 mA (peak) at 4 to 6 VDC
Solar Power Panel	0.5 Watts (ISS SIM), plus 0.75 Watts (Fan-Aspirated)
Battery (ISS SIM / Fan-Aspirated)	CR-123 3-Volt Lithium cell / 2 - 1.2 Volt NiMH C-cells
Battery Life (3-Volt Lithium cell)	8 months without sunlight - greater than 2 years depending on solar charging
Battery Life (NiMH C-cells, Fan-Aspirated)	Up to 2 years
Fan Aspiration Rate (Fan-Aspirated only)	
Intake Flow Rate, full sun	190 feet/min. (0.9 m/s)
Intake Flow Rate, battery only	80 feet/min. (0.4 m/s)
Sensor Chamber Flow Rate, full sun	500 feet/min. (2.5 m/s)
Sensor Chamber Flow Rate, battery only	180 feet/min. (0.9 m/s)
Connectors, Sensor	Modular RJ-11
Cable Type	4-conductor, 26 AWG
Cable Length, Anemometer	40 feet (12 m) (included) 240 feet (73 m) (maximum recommended)

Note: Maximum displayable wind decreases as the length of cable increases. At 140' (42 m) of cable, the maximum wind speed displayed is 135 mph (60 m/s); at 240' (73 m), the maximum wind speed displayed is 100 mph (34 m/s).

Wind Speed Sensor	Solid state magnetic sensor
Wind Direction Sensor	Wind vane with potentiometer
Rain Collector Type	Tipping bucket, 0.01" per tip (0.2 mm with metric rain adapter), 33.2 in ² (214 cm ²) collection area
Temperature Sensor Type	PN Junction Silicon Diode
Relative Humidity Sensor Type	Film capacitor element
Housing Material	UV-resistant ABS, polypropylene

Humidity/Temperature Transmitters

HX300A Series



Optional

- ✓ Fast, Stable, and Accurate
- ✓ Watertight Enclosure
- ✓ Compact, Easy to Use
- ✓ Excellent Long-Term Stability
- ✓ Wide Input Voltage Range (12 to 40 Vdc)
- ✓ Available with Either Current or Voltage Output
- ✓ On-Site, 2-Point Calibration (Zero and Span)

The HX300A Series transmitter is designed for industrial environments requiring fast, stable, and accurate measurements. It employs a highly stable thin-film polymer capacitor to sense relative humidity, and a high-accuracy, thin-film RTD to accurately sense temperature.

Specifications

Measurement Range (Humidity):
0 to 100% RH @ 0 to 50°C
(32 to 122°F)

Measurement Range (Temperature):
0 to 100°C (32 to 212°F)

Accuracy (25°C): ±2.5% RH, ±0.3°C
Long-Term Stability: Better than 1% RH per year (typical)

Temperature Compensation:
0.008% RH/°C (offset @ 05 RH)

Response: <15 seconds (90% @ 25°C in moving air at 0.5 m/sec)

Sensors:
Humidity: Thin-film capacitor
Temperature: RTD PT 100 Ω, IEC 751, DIN 43760

Output:
Current: 4 to 20 mA, 2-wire ±15% scalable zero and span adjustment
Voltage: 0 to 1V

Supply Voltage: 12 to 40 Vdc (24 Vdc recommended)

Sensor Protection: Sintered filter

Housing: ABS plastic watertight enclosure to NEMA 4 (IP65)

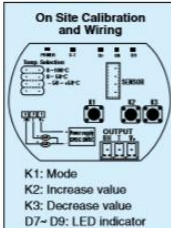
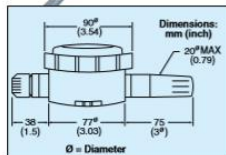
Connections: Liquid tight nylon, cable bushing fits 5 to 10 mm dia. (0.2 to 0.4") cables

Operating Temperature:
0 to 50°C (32 to 122°F)

Weight: Approx 150 g (5.3 oz)



HX303AC shown smaller than actual size.



To Order Visit omega.com/hx300gb for Pricing and Details	
Model No.	Description
HX303AC	Wall mount RH/Temperature transmitter, 4 to 20 mA current outputs
HX303AV	Wall mount RH/Temperature transmitter, 0 to 1 voltage outputs
HX302AC	Wall mount RH transmitter, 4 to 20 mA current output
HX302AV	Wall mount RH transmitter, 0 to 1 voltage output
PSR-24S	Regulated power supply, US plug, 90 to 264 Vac input, 24 Vdc output, 400 mA, screw terminals, UL
PSR-24L	Regulated power supply, US plug, 90 to 264 Vac input, 24 Vdc output, 400 mA, stripped leads, UL
PSR-24L-230	Regulated power supply, European plug, 230 Vac input, 24 Vdc output, 400 mA, stripped leads, CE
PSU-93	Unregulated power supply, 16 to 23 Vdc, 300 mA max, screw terminal
CAL-3-HU	NIST-traceable calibration

Comes complete with operator's manual.
Ordering Examples: HX303AC, wall mount RH/Temperature transmitter with current outputs.
HX303AV, wall mount RH/Temperature transmitter with voltage outputs and PSR-24L, power supply.

Hu-16

Wireless Relative Humidity/ Temperature Transmitter

UWRH-2-NEMA



- ✓ NEMA 4X (IP65) Weather Resistant Enclosure
- ✓ Measures Both Relative Humidity and Temperature in One Unit
- ✓ Free Software Converts Your PC Into a Multi-Channel Chart Recorder or Data Logger
- ✓ Low Power Operation and Sleep Mode For Long Battery Life
- ✓ Transmits Relative Humidity, Ambient Temperature, Signal Strength and Battery Status in Real Time
- ✓ Works with Any UWTC Series Wireless Receivers and Transceivers

OMEGA's new Wireless Relative Humidity transmitter features a stand-alone, compact, battery powered NEMA design that transmits measurements back to a host receiver up to 90 m (300') away. When activated the wireless transmitter will transmit readings continuously at pre set time interval that was programmed by the user during the initial setup. Each unit measures and transmits: Relative Humidity Reading, Ambient Temperature, RF Signal Strength and Battery Condition to the receiver and is displayed on your PC screen in real time using the provided software. When used with host receiver model UWTC-REC1 data from up to 96 wireless transmitters can be received and displayed. Each unit includes free software that converts your PC into a strip chart recorder or data logger so readings can be saved and later printed or exported to a spreadsheet file. When used with host transceiver model UWTC-REC2



UWRH-2-NEMA wireless relative humidity/temperature transmitter, shown smaller than actual size.

Specifications
Temperature Range: -17 to 49°C (2 to 120°F)
Accuracy: ±1°C (±1.8°F)
Relative Humidity Range: 2 to 98% RH
Accuracy: ±2.5% RH from 20 to 80% RH; ±3.5% RH below 20 and above 80% RH @ 25°C (77°F)
Operating Environment: -10 to 70°C (14 to 158°F)
Computer Interface: USB (one interface cable included with receiver)
Transmit Sample Rate: Programmable from 2 seconds to 2 minutes
Radio Frequency (RF) Transceiver
Carrier: ISM 2.4 GHz, direct sequence spread spectrum
RF Output Power: 10 dBm (10 mW)
Range of RF Link:
Up to 90 m (300'): Outdoor line of sight
Up to 45 m (150'): Indoor/urban

RF Data Packet Standard: IEEE 802.15.4, open communication architecture
Software (Included Free): Requires Windows 2000 or higher operating system
Battery: One 3.6V lithium, (C) (included)
Battery Life (Typical): 3 year at 1 sample/minute reading rate @ 25°C (77°F)
Data Transmitted to Host: Relative humidity, ambient temperature, RF transmit strength and battery condition
Enclosure: NEMA 4X (IP65)
Polycarbonate
Dimensions: 80 L x 82 W x 50 mm H (3.15 x 3.22 x 1.97")



To Order Visit omega.com/uwrh-2-nema for Pricing and Details

Model No.	Description
UWRH-2-NEMA	Wireless RH/temperature transmitter
UWTC-BATT-C	Replacement 3.6V lithium "C" battery assembly
UWTC-CABLE	Spare programming cable

Comes complete with one 3.6V lithium battery, programming software, measurement and logging software and operator's manual.
Ordering Example: UWRH-2-NEMA, wireless RH/temperature transmitter, UWTC-REC1, 96-channel receiver and UWTC-BATT-C, spare battery.
Visit omega.com/wireless for more information on UWTC-REC1.

WindObserver™ 65 Ultrasonic Anemometer



Key Features

- Precision ultrasonic anemometer
- 0-65m/s wind Speed
- 0-359° wind direction
- Optional de-icing system
- Stainless steel construction
- Sonic temperature output
- Free data logging software

The Gill WindObserver 65 is a precision, solid-state ultrasonic anemometer providing wind speed and direction data via 1 digital and 3 optional analogue outputs and features and IP66 rated stainless steel housing, which is particularly suitable for use in salt-water environments.

Offering a high wind speed measurement range, this anemometer has an optional de-icing system enabling the sensor to operate effectively in environmental conditions experienced at high altitude or at sea and is recommended for use in aviation, marine and offshore applications.



Wind Speed

Range	0 - 65 m/s (0-145mph)
Starting threshold	0.01 m/s
Accuracy	±2% @12 m/s
Resolution	0.01 m/s
Offset	±0.01 m/s

Direction

Range	0 - 359°
Dead band direction	None
Accuracy	±2° @12 m/s
Resolution	1°

Sonic Temperature

Range	-40°C to +70°C
-------	----------------

Measurement

Ultrasonic output rate	1Hz, 2Hz, 4Hz, 5Hz, 8Hz or 10Hz
Parameters	UV, Polar, NMEA, Tunnel
Units	m/s, knots, mph, kph, ft/min
Averaging	Flexible, 1 - 3600s

Digital Output

Communication	RS422/RS485 full duplex/half duplex
Baud rates	1200, 2400, 4800, 9600, 19200, 38400
Formats	8 bit data; odd, even or no parity
Anemometer status	Supplied as part of standard message

Power Requirement

Anemometer only	9-30 VDC (40mA @12 VDC)
Heating (optional)	3A @24 VAC or DC

Analogue Output - Optional

Quantity	3 (Speed, direction, status or sonic temp)
Scale	Multiples of ±10 m/s up to ±70 m/s
Type	±2.5 V, 0-5 V or 4-20mA
V output resistance	60 Ohms
4-20mA loading	10-300 Ohms

Mechanical

External Construction	Stainless steel 316
Size	381mm x 213mm
Weight	1.4kg

Environmental

Protection Class	IP66 (NEMA4X)
Humidity	< 5% to 100% RH
Operating Temperature	-55°C to +70°C (Heated option)
Precipitation	300mm/hr
EMC	EN 61000-6-2: 2001, EN 61000-6-3: 2001
Icing	MILSTD883C Method 2009.2 Procedure 1

Approvals

Standards	Traceable to NIMAS standards
Site Calibration	None required. Integrity check unit (Zero wind) supplied as optional extra

Accessories

Pipe Mount	Contact Omni Instruments Ltd
WindView Software	Display/logging software
WindCom Software	Configuration, display & logging software

Wind Speed & Direction Sensor

Key Features

- Wind Speed & Direction Sensor
- 0-60m/s (116 knots) Wind Speed
- 0-359° Wind Direction
- NMEA output
- Low Power consumption
- Fast start-up
- Solid-state - maintenance-free
- Corrosion Free

The Gill WindSonic is a low-cost anemometer, which utilises Gill's proven ultrasonic technology to provide wind speed and direction data via one serial or two analogue outputs. To confirm correct operation, outputs are transmitted together with an instrument status code.

With a robust, corrosion-free polycarbonate housing, this small, lightweight wind sensor is recommended for use in harsh environmental conditions and is particularly suited to marine & offshore (ships, data buoys) and land based installations. The WindSonic has no moving parts, offering maintenance-free operation in a wide range of applications.



WIND SPEED

Range	0 - 60 m/s (116 knots)
Accuracy	±2% @12 m/s
Resolution	0.01 m/s (0.02 knots)
Response Time	0.25 seconds
Threshold	0.01 m/s

DIRECTION

Range	0 - 360° (No dead band)
Accuracy	±2° @12 m/s
Resolution	1°
Response Time	0.25 seconds

MEASUREMENT

Ultrasonic Output Rate	0.25, 0.5, 1, 2 or 4 Hz
Parameters	Wind Speed & Direction or U and V (vector)
Units of Measure	m/s, knots, mph, kph, ft/min

OUTPUTS

Option 1	RS232
Option 2	RS232 + RS422 + RS485 + NMEA*
Option 3	RS232 + RS422 + RS485 + NMEA* 0-5V or 0-20mA or 4-20mA
Option 4	SDI-12 (refer to manual or separate data sheet for technical specifications)
Baud Rate	2400 to 38400
Anemometer Status	Supplied as part of standard message

POWER REQUIREMENT

Anemometer	5-30VDC Option 1 & 2
	7-30VDC Option 3
	9-30VDC Option 4
Current Drain	Dependent on option selected e.g. < 2mA @ 1.2V (SDI-12) to 44mA @ 12V (4-20mA) Refer to manual for further advice
	Start up time < 5 seconds

MECHANICAL

External Construction	LURAN S R0 2861/1C ASA/PC
Size	142mm x 160mm
Weight	0.5kg

ENVIRONMENTAL

Protection Class	IP66
Operating Temperature	-30°C to +70°C
Storage Temperature	-40°C to +80°C
Operating Humidity	< 95% to 100% RH
Precipitation	300mm/hr
EMC	EN 61326:1998

OPERATIONAL

MTBF	15 years
Warranty	2 years
Factory Calibration	Traceable to National Standards

ACCESSORIES

Pipe Mounting	44.45mm (1.75 in) diameter
Wind Software	Display / Logging**
Cables	Available to match output options
Display	See Gill Display datasheet

* NMEA 0183
** Download software

3-Axis Ultrasonic Anemometer

Key Features

- Precision 3-axis sonic anemometer
- 20Hz Output Rate (32Hz Optional)
- 0-45m/s wind speed
- 0-359° wind direction
- U, V, W Vector Outputs
- Aluminium/Carbon Fibre Construction
- Sonic temperature output
- Optional custom calibration

The 3D WindMaster is a precision anemometer offering three-axis wind measurement data. This instrument will monitor wind speeds of 0-45m/s and provides sonic temperature, speed of sound and U, V & W vector outputs at 20Hz (32Hz optional). This anemometer is of aluminium/carbon fibre construction and is ideal for the understanding of turbulent flows, surface energy balance and scalar fluxes. Each WindMaster is calibrated in a wind tunnel test to provide optimum performance.

This 3D sonic anemometer is ideally suited to the measurement of air turbulence around bridges, buildings, wind turbine sites, building ventilation control systems, meteorological and flux measurement sites.



Wind Speed

Range	0 - 45 m/s
Resolution	0.01 m/s
Accuracy*	<1.5% RMS @12 m/s
Accuracy*	<1% RMS @12 m/s (Custom)

Direction

Range	0 - 359°
Resolution	0.1°
Accuracy	2° @12 m/s
Accuracy	0.5° @12 m/s (Custom)

Sonic Temperature

Range	-40°C to +70°C
Resolution	0.01°C

Speed of Sound

Range	300-370 m/s
Resolution	0.01 m/s
Accuracy	< ±0.5% @ 20°C

Measurement

Internal sample rate	20 Hz or 32 Hz
Output Parameters	1, 2, 4, 8, 10, 16, 20 & 32 (Option) Hz
Units of Measure	m/s, mph, kph, knots, ft/min
Formats	UNV, Polar or NMEA
Averaging	Flexible 0-3600 s

Digital Output

Communication	RS232, 422, 485
Baud Rates	2400 - 115200
Format	ASCII

Analogue Outputs - Optional

Resolution 12 bits or 14 bits	4 channels available
Selectable Range	User selectable full scale wind speed
Output type	0-20mA, 4-20mA, 0-5 V, ±2.5 V, ±5 V

Analogue Inputs - Optional

Resolution 12 bits or 14 bits	Up to 4 single ended or 2 differential
Input Type	±5 V

Power Requirement

Anemometer	9-30 VDC (25mA @ 12 VDC)
------------	--------------------------

Mechanical

Weight	1.0 kg
Size	750mm x 240mm

Environmental

Protection Class	IP65
Operating Temp	-40°C to +70°C
Humidity	< 95% to 100% RH
Precipitation	300mm/hr
EMC	BS EN 61000 - 6 - 3 (Emissions) BS EN 61000 - 6 - 2 (Immunity)

*Accuracy spec applies for wind speed, and for wind incidence up to ±30° from the horizontal



Vented Pressure 4425/4426/4427
Vented Tide 4445/4446
Vented Wave 4428/4429

are compact fully integrated sensors for measuring pressure, tide or wave conditions, based on measuring the hydrostatic pressure and water temperature in a fixed submerged position. The pressure transducer is vented to facilitate automatic correction for atmospheric pressure fluctuations.

The sensor package consists of:

- Vented Sensor with Thermistor
- Cable with Airpipe
- Compensating Unit

Advantages:

- Smart Sensor technology - plug and play
- Sensor calibration coefficients are stored internally
- Low maintenance needs
- Low current drain
- Short update interval: 1 second to 255 minutes
- 2Hz and 4Hz sampling frequency
- 256, 512, 1024 and 2048 samples
- New updated wave parameters every 1 second
- Output parameters: see overleaf
- Output format: AiCaP CANbus, RS-232 or RS-422
- Real-time XML output

Accurate monitoring of pressure, tide, water level and waves in ports, coastal and inland waters, rivers and boreholes is of great importance to many practical projects. This series of sensors measures the hydrostatic pressure caused by the head of water above them. The influence of barometric pressure on the sensors is compensated for by applying air pressure to one side of the transducer through an air pipe and compensating unit. The sensors contain, in addition to the sensing element, a temperature compensating and a range reducing network. The sensor is based on a silicon pressure sensor. The pressure measurements are sampled and temperature compensated by an advanced Digital Signal Processor.

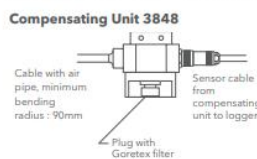
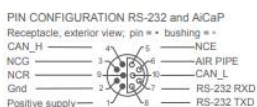
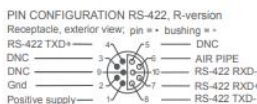
The sensor application areas are in fixed installations, either deployed in a seabed installation in shallow waters, or mounted onto a fixed structure in the upper water column. Typical applications for the sensor are measurements of wave and tide in

ports and harbors, marine operations, weather forecast, and climate studies.

The tide measurement is an average of the hydrostatic pressure measured over a time period of 10 seconds to 8 minutes (integration time configurable by the user). The update interval is between 1 second and 255 minutes.

The wave measurements are based on the pressure time series measured over a time period of 64 seconds to 17 minutes (configurable by the user). The update interval is between 1 second and 255 minutes.

All calibration and temperature compensation data are stored inside the sensor, the parameters are by default presented directly in engineering units without any external calculation. The sensor also provides raw data of the pressure and the temperature measurements.



All specifications are for the stand-alone sensor only, not the installation it is utilized with.
 Specifications subject to change without prior notice.

Range:
 4425, 4428, 4445: 0 - 50kPa (14 psia) - 5m depth
 4426, 4429, 4446: 0 - 100kPa (14 psia) - 10m depth
 4427, 4447: 0 - 200kPa (29 psia) - 20m depth
 Pressure:
 Resolution: <0.0001% FSO
 Accuracy: ±0.04% FSO
 Tide:
 Sampling rate: 2Hz, 4Hz
 Integration time: 10 sec - 8 min
 Wave:
 Sampling rate: 2 Hz, 4 Hz
 Number of samples: 256, 512, 1024, or 2048
 Output parameters:
 All versions: Pressure, temperature, rawdata pressure and rawdata temperature.
 Wave & Tide only: Tide pressure, tide level, significant wave height, maximum wave height, mean period, peak period, mean zero-crossing period, energy period, steepness, cut-off frequency, irregularity of sea state, pressure series, last pressure sample index, wave spectrum

Temperature:
 Range: 0 - 36°C (32 - 96.8°F)
 Resolution: <0.001°C (0.0018°F)
 Accuracy: ±0.4°C / 0.2°C (±0.72°F / 0.36°F)
 Response time (63%): 2 min
 Output format: AiCaP CANbus, RS-232 (standard version)
 RS-422 (R-version)
 Output interval: RS-232/RS-422: 1 sec - 255 min
 AiCaP: Controlled by SmartGuard
 Supply voltage: 5 to 14Vdc
 Current drain @ 9V: Maximum: 50 mA
 Quiescent: RS-232: 0.25 mA
 RS-422: 1.0 mA

Average (1024 samples, 40seconds tidal average):

Output Interval	2 sec	1 min	10 min	30 min
2 Hr: AiCaP	7.9 mA	4.8 mA	4.2 mA	1.6 mA
RS-232	19.5 mA	6.0 mA	4.7 mA	1.7 mA
RS-422	19.5 mA	6.0 mA	5.2 mA	2.4 mA
4 Hr: AiCaP	11.7 mA	9.3 mA	4.2 mA	1.6 mA
RS-232	24 mA	10.5 mA	4.7 mA	1.7 mA
RS-422	24 mA	10.5 mA	5.2 mA	2.4 mA

Operating temp.: -5 - +40°C (23 - 104°F)
 Operating depth: Within pressure range
 Electrical connection: 10 pin receptacle mating plug CSP
 Pressure connection: Swagelok® 1/8 inch
 Dimensions: OD: 36 x 108mm (OD: 1.4"x4.3")
 Weight: 189g (6.67oz)
 Materials: Titanium, POM, epoxycoating
 (1) Wave and Tide disabled and output interval ≥ 2 seconds
 (2) 9600 baud, 8 data bits, 1 stop bit, no parity, Run/Stop Flow control
 (3) Current drain based on wave disabled, for pressure and tide see D381 and D382



Visit our Web site for the latest version of this document and more information
www.aanderaa.no

Aanderaa is a trademark of Xylem Inc. or one of its subsidiaries.
 © 2012 Xylem Inc. D462 January 2012

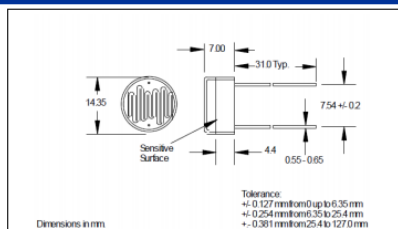
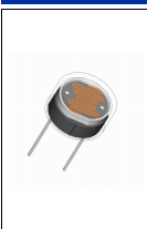
Aanderaa Data Instruments AS
 Sanddalaringen 5b, P.O. Box 103 Midtun,
 5828 Bergen, Norway
 Tel +47 55 60 48 00
 Fax +47 55 60 48 01



WWW.LUNAINC.COM

Plastic Package Cds Photocells NORPS-12

Precision - Control - Results



DESCRIPTION

The NSL-19M51 is a light dependent resistor with sensitivity in the visible light region. The CdS photoconductive cell is on a TO-18 ceramic and the photocell surface is plastic encapsulated for moisture resistance.

FEATURES

- Compact design
- 550nm peak response
- Passive resistance
- Output

RELIABILITY

Contact Luna for recommendations on specific test conditions and procedures.

APPLICATIONS

- Industrial

ABSOLUTE MAXIMUM RATINGS

SYMBOL	MIN	MAX	UNITS	(TA= 23°C UNLESS OTHERWISE NOTED)
Power Dissipation at 30°C ¹	-	250	mW	-
Operation Temperature	-60	+75	°C	-
Storage Temperature	-60	+75	°C	-
Voltage (peak AC or DC)	-	+250	V	-

NOTES:

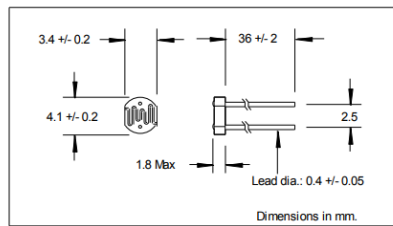
1. Derate linearly to 0 at 75°C

Information in this technical datasheet is believed to be correct and reliable. However, no responsibility is assumed for possible inaccuracies or omission. Specifications are subject to change without notice.

Page 1/2

© 2016 Luna Optoelectronics. All rights reserved.

Luna Optoelectronics, 1240 Avenida Acasos, Camarillo CA 93012 • Phone (805) 987-0146 • Fax (805) 484-9935



DESCRIPTION

The NSL-19M51 is a light dependent resistor with sensitivity in the visible light region. The CdS photoconductive cell is on a TO-18 ceramic and the photocell surface is plastic encapsulated for moisture resistance.

FEATURES

- Passive resistance output
- Ceramic package

RELIABILITY

Contact Luna for recommendations on specific test conditions and procedures.

APPLICATIONS

- Industrial

ABSOLUTE MAXIMUM RATINGS

SYMBOL	MIN	MAX	UNITS	(TA)= 23°C UNLESS OTHERWISE NOTED
Voltage (peak AC or DC)	-	100	V	-
Power Dissipation @ 25°C ¹	-	50	mW	-
Operation Temperature	-60	+75	°C	-
Storage Temperature	-60	+75	°C	-
Soldering Temperature ²	-	+260	°C	-

NOTES:

1. Derate linearly to 0 at 75°C
2. >0.05" from case for <10 sec.

Information in this technical datasheet is believed to be correct and reliable. However, no responsibility is assumed for possible inaccuracies or omission. Specifications are subject to change without notice.

Page 1/2

REV 01-04-16

© 2016 Luna Optoelectronics. All rights reserved.

Luna Optoelectronics, 1240 Avenida Acaso, Camarillo CA 93012 • Phone (805) 987-0146 • Fax (805) 484-9935



TO-18 Photocells

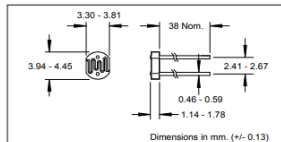
Ceramic Substrate

Features

- Five photoconductive materials
- Tolerance: ±40% @ 1 ftc, ±33% @ 2 ftc

Description

The Silonex TO-18 series of photoconductive cells provide up to seven standard resistance ranges in CdS or CdSe materials. These photocells are ceramic based with a moisture resistant plastic encapsulation. These devices are also available in a hermetic package.



Absolute Maximum Ratings

Operating & Storage Temperature -60°C to +75°C
Power Dissipation @ 25°C (1) 50 mW

Notes: (1) derate linearly to 0 at 75°C

- (2) cells to be light adapted at 30 to 50 Ftc for 16 hrs minimum prior to electrical tests
- (3) 5 sec. after removal of test light.

Electrical Characteristics (T_A=25°C, source at 2854°K)

Silonex Part No.	Sensitive Material	Spectral Peak (nm)	R @ 1 ftc (Kohms) (2)	R @ 2 ftc (Kohms) (2)	R _{typ} @ 100 ftc (ohms)	Min. R _{dark} (Mohms) (3)	Voltage Rating (peak AC or DC) (V)
NSL-4122	Type 4 CdS	515	75		1,300	4.5	80
NSL-4132			30		500	1.8	80
NSL-4142			14		250	0.8	80
NSL-4152			550		9,000	33	320
NSL-4162			260		4,000	15.6	320
NSL-4172	Type 5 CdS	550	110		1,700	6.6	320
NSL-4182			50		900	3.0	160
NSL-5112				10	700	0.67	100
NSL-5122				20	1,500	1.3	100
NSL-5152				15	400	5	60
NSL-5162	Type 6 CdSe	690		100	3,000	67	100
NSL-6112				2	170	1.3	100
NSL-7142	Type 7 CdS	615		4.5	250	3	60
NSL-7152				24	1,000	16	100

Specifications subject to change without notice

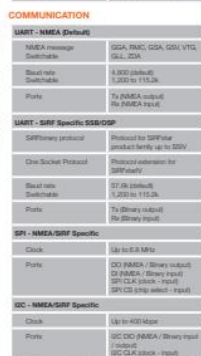
102899 REV 4

With the mission to support our customers in implementing GPS functionality into their systems, Maestru Wireless Solutions is offering a distinct product portfolio to address a wide area of applications. These range from traditional telematics solutions to latest highly integrated consumer devices, all of them having their special requirements towards a GPS module. Based on SiRFstarII and now also SiRFstarII chip sets, Maestru Wireless Solutions GPS module solutions address different specific needs and combine high performance, low power consumption, and simplified integration. Our modules comply with the RoHS standard and are 100% tested for reliability and functionally tested prior to packaging, thereby assuring the guarantee of the highest quality products.



PERFORMANCE	
Channels	48 parallel tracking
Curvature	400,000 plus
Frequency	1.1 - 1.375 MHz
Sensitivity	
Tracking	< 100 dBm
Navigation	< 100 dBm
Acquisition (cold start)	< 140 dBm
Position Accuracy (horizontal)	< 2.0 m CEP (horizontal) < 2.0 m CEP 95%
Time To First Fix	
Hot Start*	< 1 s
Warm Start*	< 35 s
Cold Start*	< 30 s
Navigation	
Update Rate	9 Hz/5 Hz Supported

SSTFlow™	High availability and coverage; improved TSP in weak signal environments
SSTFlow™	Keeps modules in a state of readiness for rapid navigation (hot start)
Jammer remover technology	Detects and removes up to 8 in-band jammers with minimal loss of sensitivity
A-GPS	Unaided Extended (SSTFlow™) and Enhanced (SSTFlow™) support
MEMS IMC interface	Prepared to use additional sensor information for improved navigation
ROM-based design	Prepared to store configuration and calibration data and to allow firmware updates
Internal antenna	Best matched built-in external for easy integration



Maestro Wireless Solutions Ltd
3603-9, 36/F
118 Connaught Road West
Hong Kong
Tel: (852) 2669 0688
Fax: (852) 2525 4701
contact@maestro-wireless.com
www.maestro-wireless.com

Temperature	
Operating	-40°C to +85°C
Storage	-40°C to +85°C
Humidity	Non condensing
POWER	
Input voltage	3.0 to 3.6 VDC Nominal 3.3 VDC
Average current draw	
Full power mode (beeping)	35 mA
Full power mode (beeping)	21 mA
Strobe Power Mode	6.2 mA
STP mode	200 nA
MPM / STP awake	115 µA
Hibernate	20 µA

Dimensions	
L x W x H	17.8 x 16.5 x 7.1 mm
L x W x H	0.7" x 0.65" x 0.28"
Weight	4.0 g / 0.14 oz.

1) The information provided herein is subject to the reliability of users' data. *Manitac Division* (including its successors or assignees) *Manitac Division* disclaims any responsibility for the use of this information, and for any information that is omitted, or the use of the same over time. Please use this information only as a guide to change your own view. *Manitac Division* (including its successors or assignees) is not responsible for any use of this information.

maestro®



Vandal Resistant Through Hole GPS/GLONASS Antenna

Frequency range:	1592 ±3 MHz
V.S.W.R:	<1.5
Polarization:	RHCP
Gain:	5dBic (Zenith)
Impedance:	50ohm
Band Width:	±25MHz
Axial Ratio	3dB (max)

Operating temperature:	-40 to +85°C
Relative humidity:	Up to 95%
Ingress protection:	IP67
Vibration:	10 to 55Hz with 1.5mm amplitude 2 hours
Environmentally friendly:	RoHS compliant

Dimensions:	ø25 x 25 x 4mm
Cable:	RG174
Connector:	SMA/MCX/FAKRA or other
Material:	ABS
Mounting method:	Screw

Gain:	28±2dB
Noise Figure:	<1.5
Filter Insertion Loss:	<3dB
Ex-band Attenuation	12dB@CF + 50MHz/16dB@CF-50MHz
Supply Voltage:	2.2-5V DC
Current Consumption	5-15mA
VSWR	<2.0

Part Number	Description
TANGO20/3M/SMAM/S/5/26	GPS/GLONASS Puck Antenna with Screw Mount 3m RG174 Cable and SMA Male Connector
TANGO20/2M/SMAM/S/5/26	GPS/GLONASS Puck Antenna with Screw Mount 2m RG174 Cable and SMA Male Connector
TANGO20/3M/FME/F/5/26	GPS/GLONASS Puck Antenna with Screw Mount 3m RG174 Cable and FME Female Connector
TANGO20/2M/FME/F/5/26	GPS/GLONASS Puck Antenna with Screw Mount 2m RG174 Cable and FME Female Connector

Siretta is a division of Sequoia Technology Group Ltd
Registered in England No. 4004881
VAT Registration No. GB614 565345

Siretta sales +44(0)118 976 9014
Basingstoke Road fax +44(0)118 976 9020
Spencers Wood email info@siretta.co.uk
Reading web www.siretta.co.uk
Berkshire RG7 1PW



Yuasa Technical Data Sheet

Yuasa L26-80 - Leisure Batteries

Performance

Voltage	12V
Capacity (20-hour)	80Ah
Cold Cranking Amps (EN1)	540A

Dimensions

Length	260mm
Width	174mm
Height	225mm

Weights & Measures

Mean Weight with Acid	18kg
Dry Weight	-
Acid Volume	4.3 litres



Container Features

Case Type	GR24 BCI
Cell Layout	1
Hold Down	B5
State of Charge Indicator	✓
Handles	✓
End Venting	✓
Semi-Traction Features	-
Lid Type	Central Venting

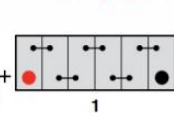
Technology

Flame Arrestor	✓
Technology	Ca/Ca
Separator	PE
VDA Roll Over Test	-
Vibration	V1 (30Hz/3g/2hr)
Recommended Charge Rate	4A

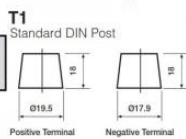
Battery Hold-down



Cell Assembly Layout



Terminal Type



Data Sheet generated on 27/02/2016 - E&OE

The world's leading battery manufacturer

www.yuasaeurope.com



Hardwarexpress.co.uk

Bibliography

- [1] "National Weather Service," December 2019. [Online]. Available:
] <https://www.vos.noaa.gov/mwl.shtml>.
- [2] "Bresser UK," December 2019. [Online]. Available: <https://www.bresseruk.com/dmax-professional-wifi-weather-centre-6-in-1.html>.
- [3] "Weather shop," December 2019. [Online]. Available:
] <https://www.weathershop.co.uk/shop/davis-vantage-pro2-plus-fars-weather-station>.
- [4] "Humidity/ambient temperature transmitters," December 2019. [Online]. Available:
] [file:///C:/Users/jordashtom/Downloads/HX94B_Specs%20\(1\).pdf](file:///C:/Users/jordashtom/Downloads/HX94B_Specs%20(1).pdf).
- [5] "aanderaa," January 2020. [Online]. Available:
] <https://www.aanderaa.com/productsdetail.php?Wave-and-Tide-Sensor-13>.
- [6] "omni instruments," January 2020. [Online]. Available:
] <https://www.omniinstruments.co.uk/weather-stations-and-instruments/wind-speed-and-direction-sensors/windsonic-solid-state-wind-speed-and-direction-sensor.html>.
- [7] "Rs Components," January 2020. [Online]. Available: <https://uk.rs-online.com/web/p/ldr-light-dependent-resistors/9146710/>.
- [8] "Marine Super Store," January 2020. [Online]. Available:
] <https://www.marinesuperstore.com/gps-radar/gps-antennas/raymarine-rs150-gps-antenna>.
- [9] "Microchip," January 2020. [Online]. Available:
] <https://www.microchip.com/wwwproducts/en/PIC18F2550>.
- [10] "Omega relative temperature/humidity," December 2019. [Online]. Available:
] https://www.omega.co.uk/googlebase/product.html?pn=HX94BCW&gclid=EAIaIQobChMI3JTI_5aX5gIVyLTtCh3nVw7SEAQYAyABEglbwfD_BwE.