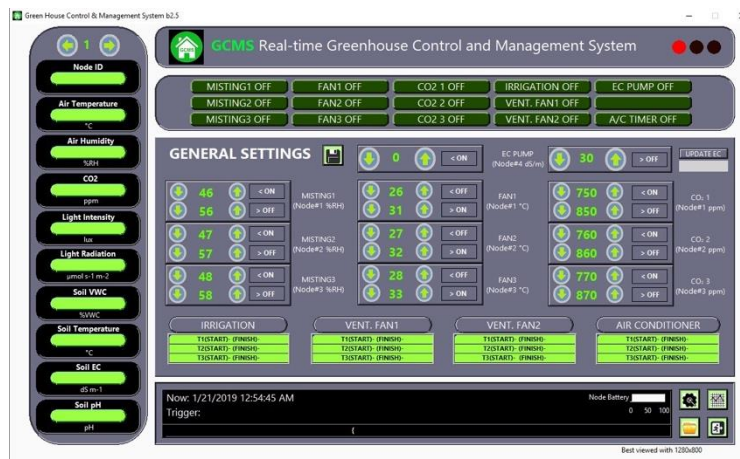


SMART CONTROL PANEL PRODUCT BROCHURE

Smart Control Panel

The food demand has greatly increased over the years in line with the increased of population. The increased of plant yield become the crucial topics among researcher and agronomist in order to meet the food demand. To overcome this, new research and technology are being developed in control environment such as laboratories or greenhouses to prove their studies and analysis. With that, there is significant demand of smart greenhouse with state-of-the art technology and it has become part of Industrial Revolution 4.0 in Malaysia.

Smart Control Panel is the main component of IoT system, designed in such a way to ease the installation and integration into existing or new greenhouse system. The integration of wireless technology in smart greenhouse becomes beneficial when cost and maintenance are the main concern among greenhouse operators. Less wires means less maintenance, off course.



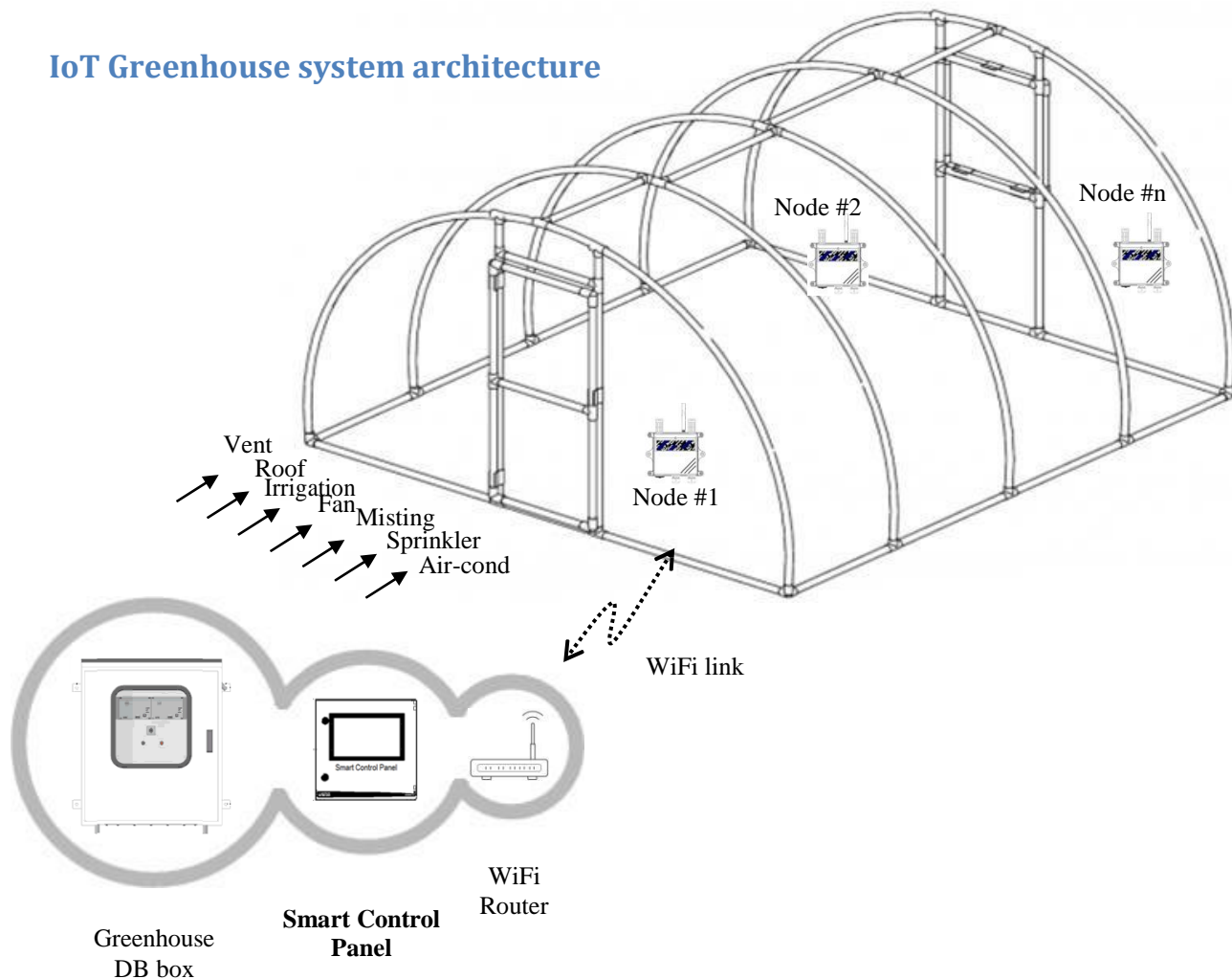
Applications:

- ❖ Smart fully automated Greenhouse
- ❖ Plant Chamber growth
- ❖ Plant LED chamber growth
- ❖ Open field agriculture
- ❖ Aquaculture
- ❖ Plant nursery

Features:

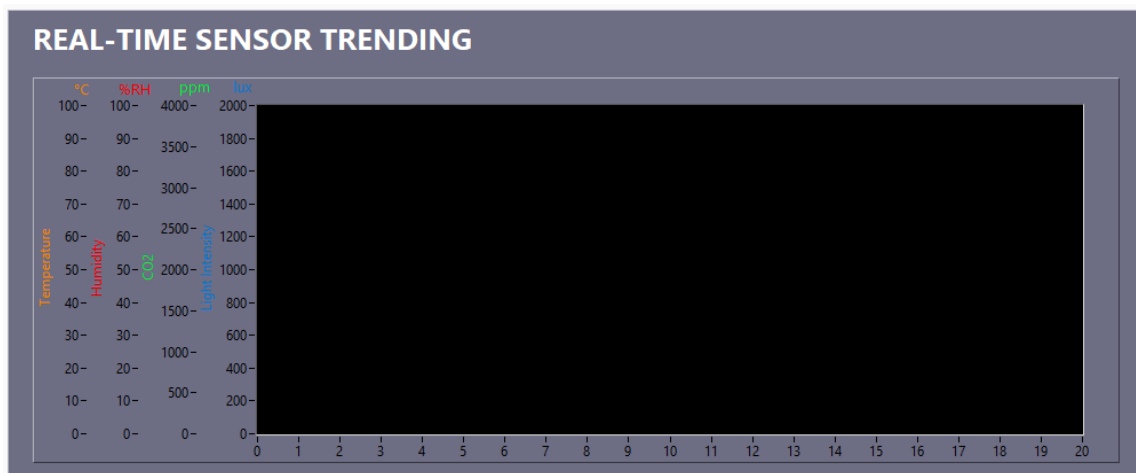
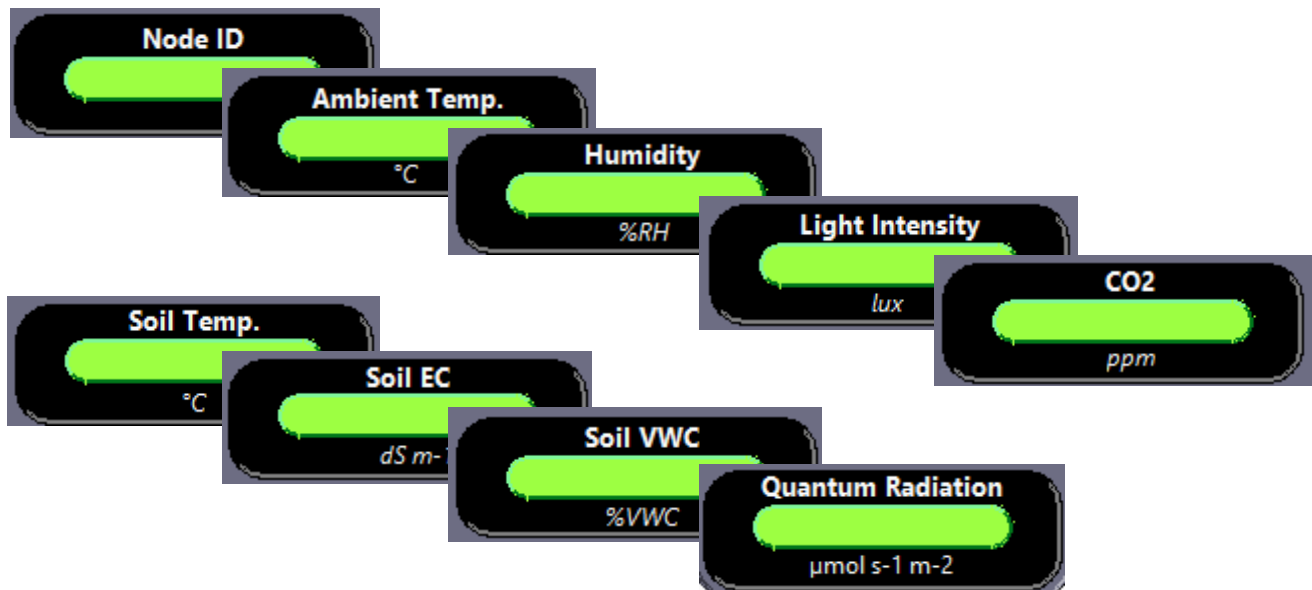
- ❖ Real-time sensor data acquisition
- ❖ Real-time sensor data graph plot
- ❖ Up to 9 sensor parameters
- ❖ Up to 5 irrigation scheduling profiles
- ❖ Up to 5 sprinkler timer profiles
- ❖ Misting control based on humidity reading
- ❖ Roof open/close scheduling
- ❖ Left/Right Vent open/close scheduling
- ❖ Thermal Screen open/close based on light intensity reading
- ❖ Circulation Fan on/off based on temperature reading
- ❖ Ventilation Fan on/off based on temperature reading
- ❖ CO₂ gas on/off based on CO₂ reading
- ❖ Up to 3 CO₂ process scheduling profiles
- ❖ Up to 3 Air-conditioner on/off timer profiles
- ❖ 10.1" Capacitive touch screen display
- ❖ Comma Separated Value datalog
- ❖ USB interface for data retrieval
- ❖ Multi-channel output control
- ❖ Easy interface to greenhouse AC distribution box (DB)

IoT Greenhouse system architecture



Real-time Sensor reading pane

Nine sensor parameters in total and all are divided into two groups, ambient and soil. If more than one Node ID is active, sensor readings can be toggled according to Node ID. The software also featured a real-time sensor trending plot on startup screen. Currently support 4-parameter graph plot, ambient temperature, ambient humidity, light intensity and CO2 gas sensor.



Threshold adjust and Scheduling

Four greenhouse parameters can be controlled according to sensor readings. Misting control is based on ambient humidity sensor, thermal screen is based on light intensity sensor, circulation fan and ventilation fan are based on ambient temperature sensor.

GENERAL SETTINGS

MISTING (%RH)	THERMAL SCREEN (LUX)	CIRC. FAN (°C)	VENT. FAN (°C)
59	0	30	30
60	2000	31	31

IRRIGATION

Timer1(ON)-8:00 AM (OFF)- 8:10 AM
Timer2(ON)-8:00 AM (OFF)- 8:10 AM
Timer3(ON)-8:00 AM (OFF)- 8:10 AM
Timer4(ON)-9:00 AM (OFF)- 9:10 AM
Timer5(ON)-10:00 AM (OFF)-10:40 AM

Total of 5 time profiles can be set. Irrigation motor will operate in between the ON and OFF set time

SPRINKLER

Timer1(ON)-9:30 AM (OFF)- 9:45 AM
Timer2(ON)-9:00 AM (OFF)- 9:15 AM
Timer3(ON)-9:00 AM (OFF)- 9:10 AM
Timer4(ON)-9:00 AM (OFF)- 9:40 AM
Timer5(ON)-9:00 AM (OFF)- 9:25 AM

Total of 5 time profiles can be set. Sprinkler motor will operate in between the ON and OFF set time

CO2 PROCESS

(START)-12:30 PM (FINISH)- 1:00 PM
(START)-2:30 PM (FINISH)-3:00 PM
(START)-11:00 AM (FINISH)-11:30 AM
CO2 (ON)-800ppm (OFF)-850ppm

Total of 3 time profiles can be set. CO2 injection process will take place in between the ON and OFF set time

AIR CONDITIONER

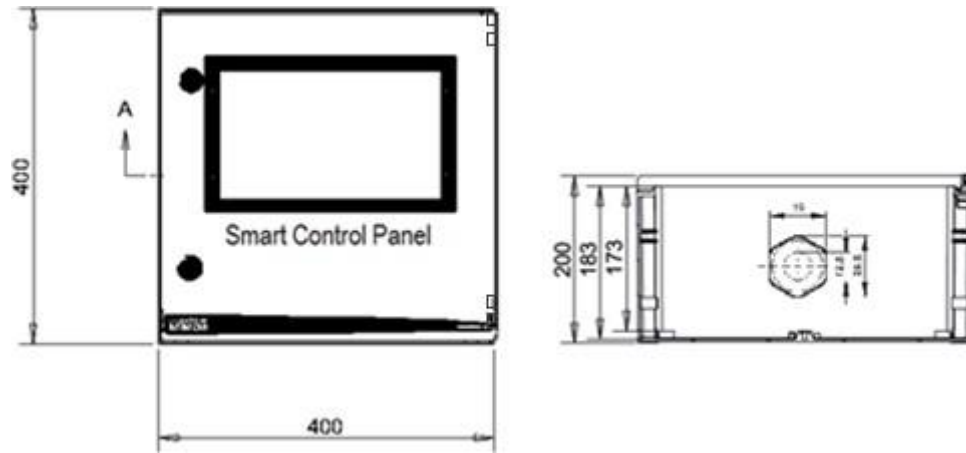
(START)-1:00 PM (FINISH)-1:30 PM
(START)-1:00 PM (FINISH)-1:30 PM
(START)-10:00 AM (FINISH)-11:30 AM

Total of 3 time profiles can be set. Air-conditioner will operate in between the ON and OFF set time

PRODUCT SPECIFICATIONS

Smart Control Panel

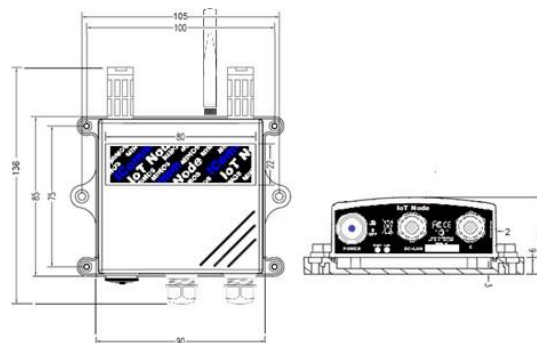
Smart Control Panel product specifications		
<i>Processor</i>	Intel Celeron J3455 (2M Cache, 2.3GHz)	
<i>Memory</i>	4GB DDR3 RAM, 256GB SSD Drive	
<i>WiFi Wireless Communication</i>	Intel Wireless-AC 3168 802.11 b/g/n, 100Mbps, 2.400GHz ~ 2.4835GHz, WPA/WPA2 security, WEP/TKIP/AES	
<i>Network Protocol</i>	HTTP Json, Proprietary MSCAN frame	
<i>Wired Communication</i>	USB-RS485 3-wire internal, surge protected	
<i>User Interface</i>	10.1" Capacitive Touch Screen LCD Display, 1280x800 resolution	
<i>Dataplot & Datalog</i>	4-parameters Real-time graph plot, Comma Separated Value (CSV) format, daily filename. Data interval depending on Node data sending interval	
<i>Supported Parameters</i>	Node ID	Soil Temperature (°C)
	Node Date&Time (GMT +8)	Light Radiation (μmol/s/m^2)
	Ambient Temperature (°C)	Soil pH (pH)
	Ambient Humidity (%RH)	Node Battery level (%)
	Ambient Light Intensity (Lux)	
	CO2 (ppm)	
	Soil VWC (%)	
	Soil EC (dS/m)	
<i>Irrigation Control</i>	5 schedule profiles	
<i>Sprinkler Control</i>	5 schedule profiles	
<i>CO2 Process Control</i>	3 schedule profiles	
<i>Air-Conditioner Control</i>	3 schedule profiles	
<i>Operating Temperature</i>	0 to 50°C	
<i>Operating Humidity</i>	0 to 90% RH (non-condensing)	
<i>Output Control</i>	16-channel, Configurable via text file	
<i>Output Rating</i>	Dry Contact, Normally Open, 30V 5A max	
<i>Power Requirement</i>	240VAC, 50Hz, 50W	
<i>Overall Dimension(WxHxD)</i>	400 x 400 x 200 (mm)	



Smart Control Panel

IoT Sensor Node

IoT Sensor Node product specifications	
Processor	32-bit Processor, 80MHz clock speed
Memory	512kbyte built-in flash, 40kbyte built-in RAM
WiFi Wireless communication	802.11 b/g/n, Up to 72.2Mbps, 2.400GHz ~ 2.4835GHz, WPA/WPA2 security, WEP/TKIP/AES encryption
Network protocol	IPv4, TCP/UDP/HTTP Json, Proprietary MSCAN frame
Firmware Update	Access via internal header
User Interface	ON/OFF push button at bottom, Blue LED on power push button, Green LED 12V input indicator, Green LED inside housing
Power Requirement	12V typical (8 to 24VDC), 160mA (max), 50uA
Temperature sensor range	0 to 100°C ($\pm 1.2^{\circ}\text{C}$), 0.1°C resolution
Humidity sensor range	5 to 100%RH ($\pm 5\%$), 0.1%RH resolution
Light Intensity sensor range	0 to 100,000lux, 0.0036lux resolution
Carbon Dioxide sensor range(opt)	0 to 5000ppm ($\pm 30\text{ppm}$), $\pm 20\text{ppm}$ resolution
Soil VWC sensor range (opt)	0 to 100% VWC ($\pm 3\%\text{VWC}$), 0.08%VWC resolution
Soil EC sensor range (opt)	0 to 23dS/m ($\pm 10\%$ for 0~7dS/m), 0.01dS/m & 0.05dS/m resolution
Soil Temperature sensor range (opt)	-40 to +50°C ($\pm 1^{\circ}\text{C}$), 0.1°C resolution
Operating Temperature	0 to 55°C
Operating Humidity	0 to 100% RH (non-condensing)
Data interval	10-min (to cloud), 1-min (to local logger)
Destination address	Up to 3 destinations (programmable)
Data logging	None
Overall Dimension (WxHxD)	116 x 136 x 41 (mm)



IoT Sensor Node

Sensor Specifications

1. Temperature and Humidity

HTU21D(F) Sensor



Digital Relative Humidity sensor with Temperature output

TEMPERATURE

Characteristics		Symbol	Min	Typ	Max	Unit
Resolution	14 bit			0.01		°C
	12 bit			0.04		°C
Temperature Operating Range		T	-40		+125	°C
Temperature Accuracy @25°C	typ			±0.3		°C
	max			See graph 2		°C
Replacement				fully interchangeable		
Measuring time ⁽¹⁾	14 bit			44	50	ms
	13 bit			22	25	ms
	12 bit			11	13	ms
	11 bit			6	7	ms
PSSR					±25	LSB
Long term drift				0.04		°C/yr
Response Time (at 63% of signal) from 15°C to 45°C ⁽²⁾		τ_T		10		s

⁽¹⁾ Typical values are recommended for calculating energy consumption while maximum values shall be applied for calculating waiting times in communication.

⁽²⁾ At 1m/s air flow

RELATIVE HUMIDITY

(@T = 25°C, @Vdd = 3V)

Characteristics		Symbol	Min	Typ	Max	Unit
Resolution	12 bits			0.04		%RH
	8 bits			0.7		%RH
Humidity Operating Range		RH	0		100	%RH
Relative Humidity Accuracy @25°C (20%RH to 80%RH)	typ			±2		%RH
	max			See graph 1		%RH
Replacement				fully interchangeable		
Temperature coefficient (from 0°C to 80°C)		T_{cc}			-0.15	%RH/°C
Humidity Hysteresis				±1		%RH
Measuring Time ⁽¹⁾	12 bits			14	16	ms
	11 bits			7	8	ms
	10 bits			4	5	ms
	8 bits			2	3	ms
PSRR					±10	LSB
Recovery time after 150 hours of condensation		t		10		s
Long term drift				0.5		%RH/yr
Response Time (at 63% of signal) from 33 to 75%RH ⁽²⁾		τ_{RH}		5	10	s

⁽¹⁾ Typical values are recommended for calculating energy consumption while maximum values shall be applied for calculating waiting times in communication.

⁽²⁾ At 1m/s air flow

ELECTRICAL AND GENERAL ITEMS

(@T = 25°C, @Vdd = 3V)

Characteristics		Symbol	Min	Typ	Max	Unit
Voltage Supply		VDD	1.5	3.0	3.6	V
Current consumption ⁽¹⁾	Sleep mode	idd		0.02	0.14	μA
	Measuring		300	450	500	μA
Power Dissipation	Sleep mode			0.06	0.5	μW
	Average 8bit ⁽²⁾			2.7		μW
Communication		digital 2-wire interface, I ² C protocol				
Heater	VDD=3V	5.5mW/ΔT=+0.5-1.5°C				
Storage		-40°C/125°C				

⁽¹⁾ Conditions: V_{dd} = 3V, SCK= 400kHz at 25°C⁽²⁾ Conditions: V_{dd} = 3V, SCK= 400kHz, Temp<80°C, duty cycle <10%**2. CO2 Sensor**

131 Business Center Drive, Ormond Beach, FL 32174

877.678.4259 Toll Free | 866.422.2356 Fax

Sales@CO2Meter.com | www.CO2Meter.com

General Performance

Storage Temperature Range	-30 to +70 °C
Sensor Life Expectancy	> 15 years
Maintenance Interval	no maintenance required
Self-Diagnostics	complete function check of the sensor module
Warm-up Time	≤ 1 min
Conformance with the standards.....	Emission: EN61000-6-3:2001
	Immunity: EN61000-6-2:2001
	RoHS directive 2002/95/EG
Operating Temperature Range	0 to 50 °C
Operating Humidity Range	0 to 95% RH (non-condensing)
Operating Environment	Residential, commercial, industrial spaces and Potentially dusty air ducts used in HVAC (Heating Ventilation and Air-Conditioning) systems.

CO2 Measurement

Measurement Range	0 – 5,000 ppm vol., within specifications
	0 – 10,000 ppm vol. total CO2 detection range
Sensing Method	non-dispersive infrared (NDIR) waveguide technology with ABC
	automatic background calibration algorithm
Sampling Method	Diffusion
Response Time (T _{1/e})	20 sec diffusion time
Response Rate	2 sec
Sensitivity	± 20 ppm ± 1 % of measured value within specifications
Accuracy	± 30 ppm ± 3 % of measured value within specifications
Pressure Dependence.....	+ 1.6 % reading per kPa deviation from normal pressure, 100 kPa
On-board calibration support	Din1 switch input to trigger Background Calibration @ 400 ppm CO2
	Din2 switch input to trigger Zero Calibration @ 0 ppm CO2

3. Light Intensity Sensor


www.vishay.com
VEML7700

Vishay Semiconductors

ABSOLUTE MAXIMUM RATINGS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)					
PARAMETER	TEST CONDITION	SYMBOL	MIN.	MAX.	UNIT
Supply voltage		V_{DD}	0	4	V
Operation temperature range		T_{amb}	-25	+85	$^{\circ}\text{C}$
Storage temperature range		T_{stg}	-25	+85	$^{\circ}\text{C}$
Total power dissipation	$T_{amb} \leq 25\text{ }^{\circ}\text{C}$	P_{tot}	-	50	mW
Junction temperature		T_J	-	100	$^{\circ}\text{C}$

BASIC CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage		V_{DD}	2.5	3.3	3.6	V
Shut down current (rem_2)	V_{DD} is 3.3 V	I_{sd}	-	0.5	-	μA
Operation mode current (rem_2)	V_{DD} is 3.3 V, PSM = 11, refresh time 4100 ms	I_{DD}	-	2	-	μA
	V_{DD} is 3.3 V, PSM = 00, refresh time 600 ms	I_{DD}	-	8	-	μA
	V_{DD} is 3.3 V, PSM_EN = 0, refresh time 100 ms	I_{DD}	-	45	-	μA
I ² C clock rate range		f_{SCL}	10	-	400	kHz
I ² C bus input H-level range	V_{DD} is 3.3 V	V_{IH}	1.3	-	3.6	V
I ² C bus input L-level range	V_{DD} is 3.3 V	V_{IL}	-	-	0.4	V
Digital current out (low, current sink)		I_{OL}	3	-	-	mA
Digital resolution (LSB count)	with ALS_SM = "01"		-	0.0036	-	lx/step
Detectable minimum illuminance	with ALS_SM = "01"	$E_{V\ min.}$	-	0.0072	-	lx
Detectable maximum illuminance	with ALS_SM = "10"	$E_{V\ max.}$	-	120 000	-	lx
Dark offset (rem_2)	with ALS_SM = "01"		-	3	-	step

Note

- rem_1: light source: white LED
- rem_2: light conditions: dark

4. *Wind Speed Sensor*



Weather Sensor Assembly p/n 80422

Imported by Argent Data Systems

Usage Notes

This kit includes a wind vane, cup anemometer, and tipping bucket rain gauge, with associated mounting hardware. These sensors contain no active electronics, instead using sealed magnetic reed switches and magnets to take measurements. A voltage must be supplied to each instrument to produce an output.

Assembly

The wind sensor arm mounts on top of the two-piece metal mast and supports the wind vane and anemometer. A short cable connects the two wind sensors. Plastic clips on the underside of the arm hold this cable in place. Screws are provided to secure the sensors to the arm.

The rain gauge may be mounted lower on the mast using its own mounting arm and screw, or it may be mounted independently.

Rain Gauge

The rain gauge is a self-emptying tipping bucket type. Each 0.011" (0.2794 mm) of rain causes one momentary contact closure that can be recorded with a digital counter or microcontroller interrupt input. The gauge's switch is connected to the two center conductors of the attached RJ11-terminated cable.

Anemometer

The cup-type anemometer measures wind speed by closing a contact as a magnet moves past a switch. A wind speed of 1.492 MPH (2.4 km/h) causes the switch to close once per second.

The anemometer switch is connected to the inner two conductors of the RJ11 cable shared by the anemometer and wind vane (pins 2 and 3.)