ภาคผนวก

ภาคผนวก ก. คู่มือการใช้งานของแผงเซลล์แสงอาทิตย์

BP SOLAR

SOLAR MODULES

BP280F & BP275F

SOLAR MODULES

PRODUCT FEATURES

- High efficiency monocrystalline silicon cells.
- Designed for maximum reliability and minimum maintenance.
- Produced using in-house technology in cell manufacturing and encapsulation.
- Highly resistant to water, abrasion, hail impact and other environmental factors.
- Lightweight anodised aluminium frame or laminate version only.
- All proven products. Only materials with extensive field experience used.
- Designed and manufactured to comply with European and International standards. European specification ESTI503.
- 20 year product warranty

APPLICATIONS

GRID-CONNECT

Rain-screen Façades
Sun-shade & Balcony Products
Roofing Products
Domestic/Residential Roof Products
Multi-Kilowatt and Megawatt Power Stations
Generator-type Power for centralised locations.

TELECOMS

Microwave Repeaters and Terminals.
VHF/UHF Radio Systems and Repeaters.
Mobile Radio Systems.
HF/SSB Radio Transceivers
TV Translators
Radio Telephones & Telemetry.
Radio Navigational Aids
Fibre Optic Repeaters
Miscellaneous Packages DC Loads

RURAL INFRASTRUCTURE

Community/Village Water Pumping
Community/Village Water Purification
Community/Village Refrigeration, Medical and Domestic
Community/Village Lighting
Community/Village Television & Video
Individual House Power
Community/Village Power

SPECIALIST

Cathodic Protection
Aircraft Obstruction Lighting
Lighthouse Lighting Systems
Beacon Systems
Beacon Buoy Lighting Systems
Fog Warning Systems

CELL SPECIFICATIONS

36 series connected, 125 mm monocrystalline silicon pseudo square cells.

TECHNICAL SPECIFICATIONS

Module Catalogue Number	BP280	BP275
Nominal Peak Power (Pmax)	80.00W	75.00W
Voltage @ maximum power (V mp)	17.00V	17.00V
Current @ maximum power (I mp)	4.70A	4.45A
Short-circuit current (I sc)	5.0A	4.75A
Open-circuit Voltage (V oc)	21.8V	21.40V

Dimensions		F=Framed L=Laminate
BP275/280F	Length 1188 mm	Width 530 mm
	Depth 43.5 mm	Weight 7.5 kg
BP275/280L	Length 1183 mm	Width 525 mm
	Depth 4 mm (±1 mm)	Weight 5.5 kg

HIGH EFFICIENCY BP280F/BP275F MODULES

POWER SPECIFICATIONS

All performance specifications given are as measured at the standard test conditions.

Standard Test Conditions

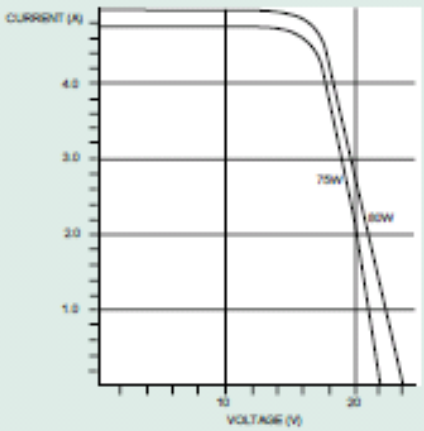
Description	Parameter	Value
Intensity of Illumination	Insolation (W/m^2)	1000
Special Density	Air Mass (AM)	1.5
Operating Temperature	Cell Temperature (°C)	25

Description of performance parameters

P max	Maximum power of a module. The point on the curve where the IV is at a maximum
V_{mp}	Voltage at the maximum power point
I_{mp}	Current at the maximum power point
I_{sc}	The short circuit current of a PV module
V_{oc}	The open circuit voltage of a PV module
P_{min}	Minimum guaranteed power of a module

VOLTAGE/CURRENT CURVE (Nominal)

The graph below details module performance at an insolation of 1000 W/m^2, air mass 1.5 D



Tolerance – Minimum power, the peak power of all high power modules is normally supplied within minus 5watts actual of the nominal value, for further details contact BP Solar.

Coefficient of Voltage -0.0022 V/cell/°C

Coefficient of Current 8.9 $mA/cm^2/°C$

CEC APPROVAL SPECIFICATION NO.503

BP Solar modules have been tested and qualified to the Commission of European Communities specification number 503 at the CEC Joint Research Centre in Ispra, Italy. The qualification tests are designed to demonstrate the module's suitability for use in field conditions.

- 200 thermal cycles from -40°C to 85°C.
- 10 humidity/freeze cycles from 85°C at 85% relative humidity to -40°C.
- Ice ball impact test.
- Ultra violet exposure.
- Outdoor exposure.
- Damp heat.
- Hot spot endurance (to simulate partial shading).
- Mechanical endurance, to simulate wind loads of up to 225 km/h.

Power specifications are measured at Standard BP Solar Test Conditions. For further information on module performance contact BP Solar.

Approved by TÜV Rheinland Group for use as Class II equipment, Schutzklasse II.

CONSTRUCTION

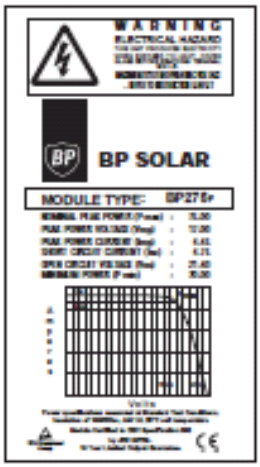
BP280 & BP275 modules are manufactured using industry-standard materials and lamination techniques. Stainless steel fasteners are used throughout. The junction box is bonded directly to the laminate to facilitate both framed and laminate only module products.

Materials are as follows:

Front Cover:	Toughened glass, 3mm, high light transmission (c 92%)
Encapsulant:	Ethylene-vinyl-acetate (EVA)
Rear Cover:	Tri-laminate of PVF/Polyester/PVF
Frame:	Extruded Aluminium, Anodised
Frame Sealant:	High strength bonding tape
Junction Box:	Glass filled polycarbonate

Electrical connections to the module are made via screw terminals within the junction box. One cable gland is fitted and 3 further knockouts (suitable for glands or conduit) are provided to facilitate series and/or parallel connection.

Rear Module Label



ภาคผนวก ข. คู่มือการใช้งานของเครื่องควบคุมการประจุแบตเตอรี่

INSTRUCTION MANUAL

---------For solar charge controller,

---------EPRC-ST series

RATINGS (12V or 12/24V auto work)

EPRC-5, 12V or 12/24V auto-work, 5Amp
EPRC-10 12V or 12/24V auto-work, 10Amp
NOTES: For use with solar panels only

TECHNICAL INFORMATION

	12Volt	24Volt
Rated solar input	5/10A	5/10A
Rated load	5/10A	5/10A
25% Current overload	1 min.	1 min.
Load disconnect	11.1V	22.2V
Load reconnect	12.6V	25.20V
Equalization voltage(30 minutes)	14.6v	29.2v
Boost voltage(30 minutes)	14.4v	28.8v
Float voltage	13.8v	27.2v
Temp Comp.(mV/℃)	-30mV	-60mV
Terminals	For wire sizes to 8mm²	
Temperature:	-35℃ to +55℃	

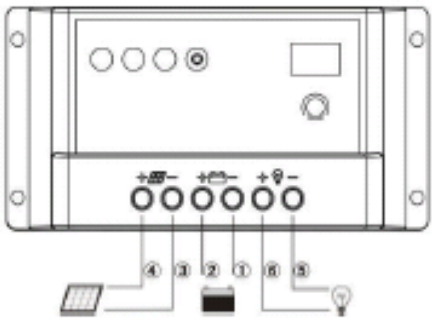
Note: for 12V system only, for 24v, use 2X)

QUICK START INSTRUCTIONS

This section provides a brief overview of how to get started using the controller. However, please review the entire manual to ensure best performance and years of trouble-free service.

1. Mount the controller to a vertical surface. Allow space above and below the controller for air flow.
2. Make sure the PV and load currents will not exceed the ratings of the controller being installed.
3. It is recommended that the connections be made in order from 1 to 6. (see the following

picture)



- Use with 12V or 24V batteries only
- Use with 12V or 24V systems only

4. Connect the **BATTERY** first. Use care that bare wires do not touch the metal case of the controller.
5. Connect the **SOLAR**(PV array) next. The green LED indicator will light if sunlight is present.
6. Connect the **LIGHT** last. If the red LED indicator lights, the battery capacity is low and should be charged before completing the system installation
7. Press the **BUTTON** as **16** or **17** to verify the system connecting.

LIGHTING CONTROL OPTIONS

8. Press the power switch for 5 seconds, and select the desired LIGHTING CONTROL option. The LED is on, which confirmed you have selected the right one.
9. The controller requires 10 minutes of continuous transition values before it starts to work. These constraints avoid false transitions due to lightning or dark storm clouds.
10. 10 minutes off before the controller start to work.
11. A brief description follows below:

Number 0	Dusk-to-Dawn, light is on all light
Number 1	Light is turn on after sundown for 1 hour
Number 2	Light is turn on after sundown for 2 hours
Number 3	Light is turn on after sundown for 3 hours
Number 4	Light is turn on after sundown for 4 hours
Number 5	Light is turn on after sundown for 5 hours
Number 6	Light is turn on after sundown for 6 hours
Number 7	Light is turn on after sundown for 7 hours
Number 8	Light is turn on after sundown for 8 hours
Number 9	Light is turn on after sundown for 9 hours
Number 10	Light is turn on after sundown for 10 hours
Number 11	Light is turn on after sundown for 11 hours
Number 12	Light is turn on after sundown for 12 hours
Number 13	Light is turn on after sundown for 13 hours
Number 14	Light is turn on after sundown for 14 hours
Number 15	Light is turn on after sundown for 15 hours
Number 16	Lights remain turned off, ON/OFF mode
Number 17	Test mode, lights on after it detects no light, lights off after it detects light.

LED INDICATOR

Green ON when solar is charging battery
Green blink when the system over voltage

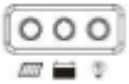
Green ON when battery level in the right range
Green slowly flashing when battery level full
Yellow ON when battery level low
Red ON when loads cut off

Red ON when the output is on.
Red slowly flashing when its over load
(the load amps is 1.25 times of rated current for 60 seconds, or the load amps is 1.5 times of rated current for 5 seconds)
Red blink when the load is short-circuit.

Please note:

the output will cut off once there is over load or short circuit. Disconnect all the equipment and reconnect, and press the button, the controller will resume to work after 10 seconds, or wait for it to work the next day.

TROUBLESHOOTING



1. Charging LED indicator is off when it is daytime
   a. The green Charging LED should be on if its day time.
   b. Check that the proper battery type has been selected.
   c. Check that all wire connections in the system are correct and tight. Check the polarity(+ and -) of the connections
   d. Measure the PV array open-circuit voltage and confirm it is within normal limits. If the voltage is low or zero, check the connections at the PV array itself. Disconnect the PV from the controller when working on the PV array.
   e. Measure the PV voltage and the battery voltage at the controller terminals. If the voltage at the terminals is the same(within a few tenths of volts) the PV array is charging the battery. If the PV voltage is close to the open circuit voltage of the panels and the battery voltage is low, the controller is not charging the batteries and may be damaged.
2. Charging LED indicator is blinking
   a. First check the operating conditions to confirm that the voltage is higher than specifications. Consider the temperature compensation of the controller's PWM setpoint. For example, at 0℃ the controller will regulate at about 15.0 volts
   b. Check that all wire connections in the system are correct and tight.
3. Load LED indicator is blinking, or flashing or on red(load not operating properly)
   a. Check that the load is turned on. Check that no system fuses are defective.
   b. Check connections to the load, and other controller and battery connections. Make sure voltage drops in the system wires are not too high.
   c. If the LED indicator is blinking and no output, check if the load is short-circuit. Disconnect

the load, and press the switch button, the controller will return to work after 30 seconds.

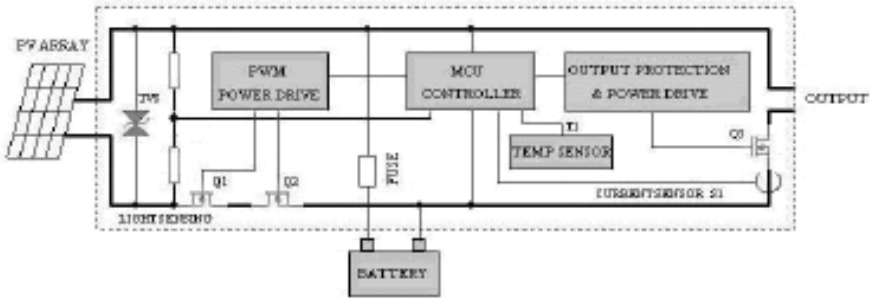
d. If the LED indicator is flashing and no output, check if the load is over the rated power. Reduce the load, and press the switch button, the controller will return to work after 30 seconds.

INSPECTION AND MAINTENANCE

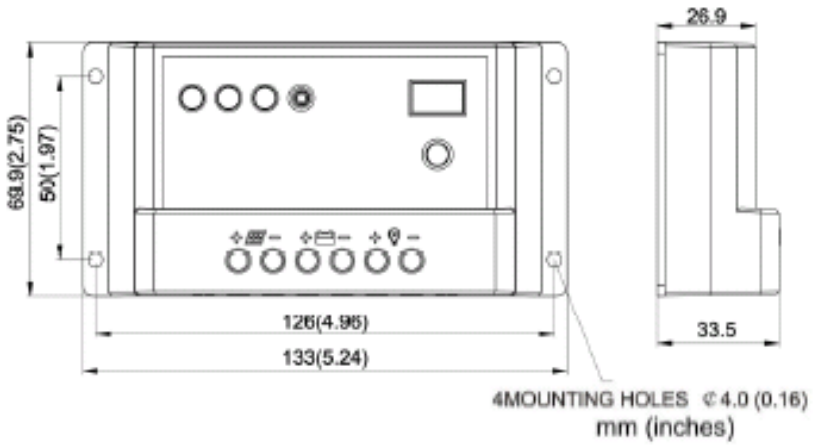
The following inspections and maintenance tasks are recommended at least once per year for best controller performance

1. Confirm that the correct battery type has been selected.
2. Confirm that the current levels of the solar array and load do not exceed the controller ratings.
3. Tighten all the terminals. Inspect for loose, broken, or burnt wire connections. Be certain no loose strands of wire are touching other terminals
4. Press the TEST button(number: 16 or 17) to verify the lights are working
5. Check that the controller is securely mounted in a clean environment. Inspect for dirt, insects and corrosion.
6. Check the air flow around the controller is not blocked.
7. Protect from sun and rain. Confirm that water is not collecting under the cover
8. Check that the controller functions and LED indicators are correct for the system conditions at that time.
9. Make sure the PV array is clean and clear of debris and snow. Confirm the array is oriented correctly for the installation location.

SYSTEM MAIN CIRCUIT DIAGRAM



MECHANICAL

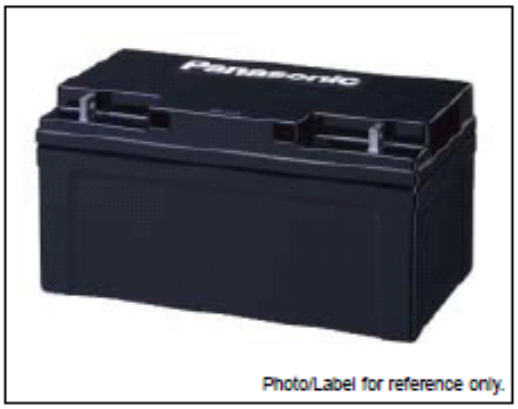

26.9
69.9(2.75)
50(1.97)
126(4.96)
133(5.24)
33.5
4MOUNTING HOLES ⌀4.0 (0.16)
mm (inches)

ภาคผนวก ค. คู่มือการใช้งานของแบตเตอรี่

VALVE-REGULATED LEAD ACID BATTERIES: INDIVIDUAL DATA SHEET

LC-X1265P

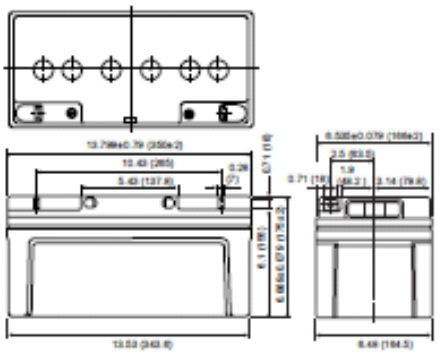
For standby power supplies. Expected trickle life: Approx. 6 years at 25°C, Approx. 10 years at 20°C.



Photo/Label for reference only.

Dimensions (mm)

Terminal type: M6 bolt and nut



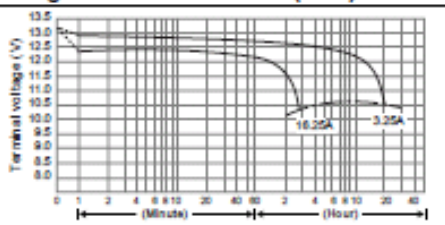
Battery case resin: Standard (UL94HB) Color is black.
Optional (UL94V-0) Color is grey.

Specifications

Nominal Voltage		12V
Rated Capacity (20 hour rate)		65Ah
Dimensions	Length	13.780 inches (350 mm)
	Width	6.535 inches (166 mm)
	Height	6.890 inches (175 mm)
	Total Height	6.890 inches (175 mm)
Approx. mass		44.1 lbs. (20.0 kg)
Standard Terminals and Resin	UL94HB M6 Bolt and Nut	LC-X1265P
	UL94V-0 M6 Bolt and Nut	♦ LC-P1265P

♦ Please contact Panasonic for availability on optional items. Optional items may be subject to minimum order quantities.

Discharge characteristics 77°F (25°C) (Note)

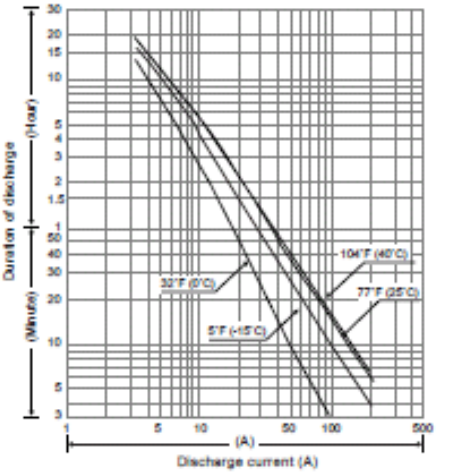


Characteristics

Capacity (note) 77°F (25°C)	20 hour rate (3.25A)	65Ah
	10 hour rate (5.9A)	59Ah
	5 hour rate (10.6A)	53Ah
	1 hour rate (40A)	40Ah
	1.5 hour rate discharge Cut-off voltage 10.5 V	26A
Internal Resistance	Fully charged battery 77°F (25°C)	Approx. 7mΩ
Temperature dependency of capacity (20 hour rate)	104°F (40°C)	102%
	77°F (25°C)	100%
	32°F (0°C)	85%
	5°F (-15°C)	65%
Self discharge 77°F (25°C)	Residual capacity after standing 3 months	91%
	Residual capacity after standing 6 months	82%
	Residual capacity after standing 12 months	64%
Charge Method (Constant Voltage) Trickle use	Initial current	9.75 A or smaller
	Control voltage	13.6V to 13.8V (per 12V cell 25°C)

(Note) The above characteristics data are average values obtained within three charge/discharge. Cycles not the minimum values.

Duration of discharge vs. Discharge current (Note)



ภาคผนวก ง. คู่มือการใช้งานของอุปกรณ์กระจายสัญญาณแบบไร้สายระบบเครือข่ายคอมพิวเตอร์

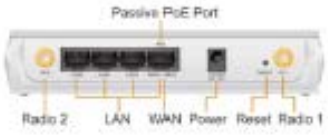
Air Live
Powered by OvisLink Corp.

AirLive G.DUO

Dual 11g PoE Access Point

After more than one year of research and development, the AirLive G.DUO has finally arrived. It is the first Access Point with 2 Wireless-G radios that combines breakthrough design and advance functions to make dual radio applications more affordable and practical than ever. If your wireless deployment requires more than one access point, the G.DUO not only reduces your deployment cost but also reduces the energy consumption.

Dual Radios | 802.11 g/b | WISP | Hotel
Multi Mode | Bandwidth Control | HTTPS | Passive POE



2 x Access Points in One

The G.DUO has 2 wireless g/b radios on board; therefore, each radio can perform completely separate functions. Installations that used to require 2 separate access points can now be achieved using only one G.DUO. Both radios are hi-powered up to 26dBm (20dBm in EU) for extra long distance. In addition, G.DUO's firmware features 5 wireless operation modes to satisfy various wireless deployment requirements.

Wireless Mode	Radio1	Radio2	WAN
WISP + AP	Client Router	Access Point	Radio1
Dual AP	Access Point	Access Point	----
Client + AP	Client	Access Point	----
Gateway + AP	AP Router	AP Router	LAN1 Port
WDS + AP	WDS Bridge	Access Point	-----

Manufacturer
OvisLink Corp.
5F, No.96, Min-ChuanRd, Hsin-tien City, Taipei, Taiwan

www.airlive.com

Air Live®
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Crystal Synergy Design

Take one look at the G.DUO and you will indulge yourself in its stylish design. The G.DUO uses AirLive's latest Crystal Synergy design statement. It combines the elements of transparency, suspension, and kinetic movement to form the breathtaking gravity defying style. It is not only beautiful to look at but also provides the maximum amount of cooling surface. At AirLive, we believe our products should complement your interior design and stands out as a piece of art decor. The Crystal Synergy statement is a pinnacle achievement to that goal.

WISP 2-Radio CPE Application

Traditionally, the WISP operators will need 2 access points to provide total wireless access for their subscribers. That means one AP to outdoor and one AP for subscriber's home wireless network. Not only this increases the deployment cost, it also consumes more energy and complicates the installation. G.DUO's "WISP+AP" wireless operation mode is specially designed to satisfy WISP operator's requirement. The Site Survey wizard combines AP scanning, antenna alignment, and establish connection into one simple step. Service provider can even limit the bandwidth of the connection according to the subscription class. Moreover, the "partial configuration restore function" let you restore only wireless or network settings. It is a dream feature to allow changing wireless settings across a large number of access points.

Hotel Hotspot Deployment

Building a wireless network for hotel is always a challenging task. Many deployments require complete wireless coverage without hurting the existing decoration. That means the number of APs and cablings should reduce to the minimum. With G.DUO's "WDS+AP" operation mode, you can have one radio for Bridge network and one radio for AP mode. This eliminates the need for cables between the access points. Furthermore, the built-in PoE port allows G.DUO to be installed in location where there is no nearby power source.

Manufacturer
OvisLink Corp.
5F, No.96, Min-ChuanRd, Hsin-tien City, Taipei, Taiwan
www.airlive.com

Air Live
Powered by OvisLink Corp.

Shopping Malls and Public Areas

When used with directional antennas, the G.DUO's dual radio system makes it ideal for wireless coverage over large area such as shopping malls, parks, schools, and vacation resorts. It can greatly reduce the number of access points required. The G.DUO's Crystal Synergy design is even more stylish when wall mounted. It will fit into decorations of the public area much better than conventional access points.

AirLogic System Architecture

The G.DUO software system is built upon the new AirLogic software architecture. The under laying system core is our legendary wireless engine that offers superior performance and rich set of functions. It features firmware recovery system, multi-operation wireless mode, bandwidth control, and over 100 other features that make AirLive wireless products famous in the industry. The AirLogic Web Interface integrates all these powerful functions into an extremely easy to use multi-language interface that can change language instantly at any page.

The G.DUO is the culmination of the latest wireless technology and innovative design. It is also a masterpiece of meticulous engineering. But its greatest achievement is to bring the cost and flexibility of a dual-radio product to the new level.

* DC Injector not included

Air Live
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Specifications

Hardware Feature:
- 2 x 11g/b Radios
- 4MB Flash, 32MB SDRAM
- RoHS compliant
- 4 10/100 Mbps Ethernet Port with Auto MDI/MDI-X support
- 12V Passive PoE Port (LAN1)
- WAN Port (LAN1)
- Radio1: 26dBm(South America) or 20dBm(EU) TX output power
- Radio2: 24dBm(South America) or 20dBm(EU) TX output power
- 7 LED Indicators
- Wall Mount Screw Holes
- Reset Button

Antennas:
- 2 x R-SMA antenna connectors
- 2 x 2dBi dipole antennas

Frequency Band
- USA (FCC) 11 Channels: 2.412GHz~2.462GHz
- Europe (ETSI) 13 Channels : 2.412GHz~2.472GHz

Rate and Modulation
- Data Rate: 54, 48, 36, 24, 18,11, 5.5, 2, 1 Mbps
- Modulation
  - 11g Orthogonal Frequency Division Multiplexing (64QAM, 16QAM, QPSK, BPSK)
  - 11b Direct Sequence Spread Spectrum (CCK, DQPSK, DBPSK)

TX Output Power
Radio1:
- South America: 26dBm (11b)
- South America: 20dBm (11g)
- EU: 20dBm(11b)
- EU: 20dBm(11g)

Radio2:
- South America: 24dBm (11b)
- South America: 20dBm (11g)
- EU: 20dBm(11b)
- EU: 20dBm(11g)

Receiver Sensitivity
- RF1

Data Rate	Receiver Sensitivity (dB)
1 Mbps	-92
2 Mbps	-91
5.5 Mbps	-88
6 Mbps	-86
9 Mbps	-86
11 Mbps	-85
12 Mbps	-85
18 Mbps	-84
24 Mbps	-80
36 Mbps	-78
48 Mbps	-73
54 Mbps	-72

- RF2

Data Rate	Receiver Sensitivity (dB)
1 Mbps	-90
2 Mbps	-88.5
5.5 Mbps	-88
6 Mbps	-83
9 Mbps	-83
11 Mbps	-84
12 Mbps	-83
18 Mbps	-82
24 Mbps	-81
36 Mbps	-77
48 Mbps	-74
54 Mbps	-71

Manufacturer
OvisLink Corp.
5F, No.96, Min-ChuanRd, Hsin-tien City, Taipei, Taiwan
www.airlive.com

Air Live®
Powered by OvisLink Corp.

Operation Modes
- WISP + AP Mode
- Dual AP Mode
- Client + AP Mode
- Gateway + AP Mode
- WDS + AP Mode

Advance Functions
- Site Survey with Signal Strength Indicator
- Bandwidth Control / Traffic Shaping
- Wi-Fi, WPA compatible Interoperability
- WPA with PSK/TKIP/AES support ,WPA2 support
- Privacy Separator support
- Hide SSID Support
- Support adjustable output power
- ACK Timeout Adjustment
- Bootloader Protection and Emergency Firmware Upload Code
- Radius Supported
- Up to 40 Static DHCP entries
- Firmware upgrade and configuration backup via Web
- Partial Configuration Backup and Restore

Dimensions and Weight
- Dimension: 154 x 130 x 316 mm
- AP Unit Weight(Approximate): 280g
- Package Weight(Approximate): 686g

Power Supply
- Input: 100~240Vac/50~60Hz ,
- Output: DC 12V/1A
- 12V Passive PoE Port (DC Injector not included)

Certification
- CE
- FCC

Environment
- Operating temperature: 0~50°C
- Operating humidity (non-condensing): 20~80%
- Storage temperature: -20~65°C
- Storage humidity: 95% Max

Ordering Information:

AirLive G.DUO	Dual 11g PoE Access Point

Manufacturer
OvisLink Corp.
5F, No.96, Min-ChuanRd, Hsin-tien City, Taipei, Taiwan

www.airlive.com