

# PPM-FM

四通道發射機  
4 CH Transmitter



[www.skyartec.com](http://www.skyartec.com)

# 使用說明書

## Instruction Manual



### 注意

使用本產品前請先閱讀此說明書，本書請妥善保管，  
以備不時之需。

### Caution

Before using your machine, read this manual carefully  
After reading this manual, store it in a safe place.

數碼比例無綫控制系統  
DIGITAL PROPORTIONAL RADIO CONTROL SYSTEM

# 目錄 CONTENTS

1.目錄 . . . . .	1
Contents	
2.特殊符號說明 . . . . .	2
Meaning of Special Markings	
3.航行時的注意 . . . . .	3
Precautions During Flight	
4.強制事項 . . . . .	4
Mandatory	
5.各部分的名稱及操作 . . . . .	5
Name and operation of each part	
6.各部位名稱/操縱方法 . . . . .	6
Name and control method of each part	
7.調整程序 . . . . .	7
Adjustments	
8.發射機及各個伺服器的調節 . . . . .	8
Transmitter operation and movement of each servo	
9.組裝時安全上的注意點 . . . . .	8-9
Assembly Precautions	
10.鎳氫電池的充電 . . . . .	9-11
Ni-mh battery charging precautions	
11.術語表 . . . . .	11-12
Glossary	

為能安全使用本產品，請注意以下各點




To ensure safe use, please observe the following precautions.

## 特殊符號說明

### MEANING OF SPECIAL MARKINGS

在手冊部分顯示下列符號的請特別注意安全

Pay special attention to the parts of this manual indicated by the following marks.

標 示 Mark	意 義 Meaning
 危 險 DANGER	如果不按正確的操作方法可能會導致操作者嚴重受傷甚至致命的情況。 Procedures which may lead to a dangerous condition and cause death or serious injury to the user if not performed properly.
 警 告 WARNING	如果不按正確的操作方法可能會導致操作者嚴重外傷、重傷或者致命。 Procedures which may lead to a dangerous condition and cause physical damage, serious injury or death to the user if not performed properly.
 注 意 CAUTION	如果不按正確的操作會有輕傷的危險，但一般不會致操作者重傷。 Procedures which the possibility of serious injury to the user is small, but there is a danger of slight physical damage if not performed properly.

符 號：  
Symbol:



禁 止  
Prohibited



强 制  
Mandatory

## 航行時的注意 PRECAUTIONS DURING FLIGHT

### ! 警告 WARNING

### 禁止事項 PROHIBITED

禁止用相同的頻率同時使用。  
避免因頻率發生衝突而導致模型產品墜毀或損壞。  
\*使用不同的調制方式的同一相同頻率也會發生衝突導致模型產品墜落或損壞。

Do not fly simultaneously on the same frequency.  
Interference may cause a crash.

\*Use of the same frequency will cause interference even if the modulation method (AM, FM, PCM) is different.

Simultaneous flight on the same frequency and same time prohibited.



禁止在相同的頻率上同時控制  
Do not fly simultaneously on the same frequency



不要在夜晚、下雨或刮風的時候使用。發射機會因環境影響導致對控制造成干擾，控制不靈甚至發生意外。

Do not fly on rainy or windy days, or at night. Water will penetrate into the transmitter and cause faulty operation, or loss of control, and cause a crash.



請不要在夜晚、  
下雨或刮風的  
時候使用。



Do not fly  
Rain  
Wind  
Night

使用時要把天線拉到最大長度。如果天線抽出太短，那麼發射的有效信號強度也會更弱，從而影響到控制距離。

Extend the antenna to its full length. If the antenna is short, the effective range of the radio waves will become shorter.



使用時要把  
天線拉到最  
大長度。

↑  
Extend to  
full length



\*在開始飛行之前，檢查每個伺服器匹配的操縱杆的方位。如果伺服器不能往正確的方向或者于不正常狀態下，請不要使用。

Always test the digital proportional R/C set before use.

\*Before starting the engine, check that the direction of operation of each servo matches the operation of its control stick. If a servo does not move in the proper direction, or operation is abnormal, do not fly the plane.



檢測  
Test





## 强制事項 MANDATORY

啓動電源開關時：

把發射機油門（第三通道）操縱杆以及微調打到最小的位置，然後打開發射機電源開關，再連接接收機電源。

切電源時：

在模型產品停止時先切斷電源關掉接收機後關閉發射機。

\*操作順序若相反的話，會有意外失控危險。

\*最小位置：機器或發動機運行時的最小速度。

When turning on the power switch

After setting the transmitter throttle lever to maximum slow.

1. Turn on the transmitter power switch.
2. Then turn on the receiver power switch.

When turning off the power.



Switch after stopping the engine.

1. Turn off the receiver power switch.
2. Then turn off the transmitter power switch.

\* If the power switch is turned off in the opposite order, the engine may go to full throttle unexpectedly and cause an injury.

\* Maximum slow: minimum speed when machine's operating.

\*調整發射器，必須在引擎停止（馬達連接拔除）的狀態下，才可進行。不然會有意外失控的危險。

When adjusting the digital proportional R/C set, always stop the engine (disconnect the motor).

If the engine suddenly goes to high speed, it may cause an injury.

\*行使時，請務必對合微調進行調整，微調即使在行使時，可能會有挪移的情形發生，如果微調偏移，又啓動電源的話，可能會在不注意時忽然跑動，危險。

When flying, always install the frequency board to the transmitter antenna.

When the frequency was changed, also change the frequency board.

When flying, always adjust the trims.

The trims will have a little move even not in flying time, when the trim has excursed, it will cause a serious damage.

確認事項：

確認發射機的天線是否鬆弛，飛行中因鬆弛而脫離的話，將因無法發射信號而失控。

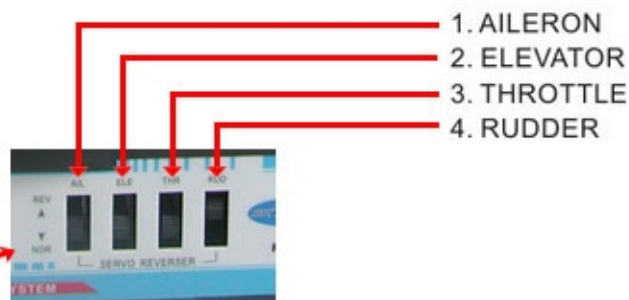
**NOTICE：**

Check that the transmitter antenna is not loose. If the transmitter antenna comes off during use, control will be lost and the model will crash.

## 各部分的名稱及操作 DESIGNATION AND OPERATING



頻 率 (35M)  
Mode (40M)  
(72M)



1. AILERON
2. ELEVATOR
3. THROTTLE
4. RUDDER



電池蓋 Battery Cover

當更換電池時，請按住  
“PUSH”向下滑動蓋子。  
Use when replacing the  
battery, slide the cover  
downward while pressing  
the part marked PUSH.

### 輸出/電池連接

Output / battery connector

- B.(battery connector)
- 6.Not used(CH6)
- 5.Not used(CH5)
- 4.Rudder servo(CH4)
- 3.Throttle servo(CH3)
- 2.Elevator servo(CH2)
- 1.Aileron servo(CH1)

- B. (電源連接)
- 6. 未用 (CH6)
- 5. 未用 (CH5)
- 4. 方向舵機 (CH4)
- 3. 油門舵機 (CH3)
- 2. 升降舵機 (CH2)
- 1. 副翼舵機 (Ch1)



S + -



接收機的天線  
Antenna

### 晶振 CRYSTAL

晶振的替換在接收機的旁邊

The crystal is replaced from the side of the receiver.





# 各部位名稱/操作方法

## NAME AND OPERATION OF EACH PART

### 發射機 GM-401-002 TRANSMITTER GM-401-002



這是一款普通型4通道發射機，用于直升機與飛機，所包含有顯示LED，伺服器倒置開關混控開關等。

GM-401-002 is a standard transmitter with 4 channels for helicopters, including LED, servo reverser, mixing control switch, etc.

1. 通道數: 四通道
2. 充電插口: 有
3. 頻率波段: (35MHz, 40MHz, 72MHz)
4. 高頻模塊: 內置
5. 使用電源: 1.5V\*8 "AA" 電池
6. 編碼方式: PPM
7. 調制方式: FM
8. 射頻功率:  $\leq 1\text{mW}$
9. 靜態電流:  $\leq 180\text{mA}$
10. 伺服器倒置開關: 有
11. 升降舵大小動作開關: 有
12. 尾舵大小動作開關: 有
13. 混控開關: 有
14. 電壓顯示方式: LED
15. 低電壓警告: 有
16. 方向舵微調: 有
17. 油門微調: 有
18. 尺寸: 187\*112\*215mm
19. 重量: 561g
20. 外殼顏色: 黑色
21. 天綫長度: 957mm
22. 使用範圍: 飛機、滑翔機

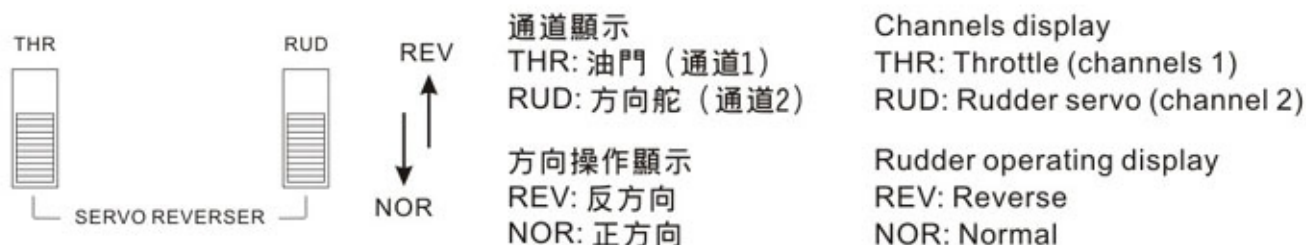
1. Channel: 4 channels
2. Charging port: Yes
3. Frequency band: (35MHz, 40MHz, 72MHz)
4. H.F.M: Inner set
5. Power resource: 1.5V\*8 "AA" Battery
6. Program type: PPM
7. Modulation type: FM
8. RF power:  $\leq 1\text{mW}$
9. Static current:  $\leq 180\text{mA}$
10. Servo reverser: Yes
11. Elevator switch: Yes
12. Tail servo switch: Yes
13. Mixing control switch: Yes
14. Voltage display type: LED
15. Low voltage warning: Yes
16. Rudder trim: Yes
17. Throttle trim: Yes
18. Dimension: 187\*112\*215mm
19. Weight: 561g
20. Shell color: black
21. Antenna length: 957mm
22. Use range: airplane、glider

## 調整程序 Adjustments

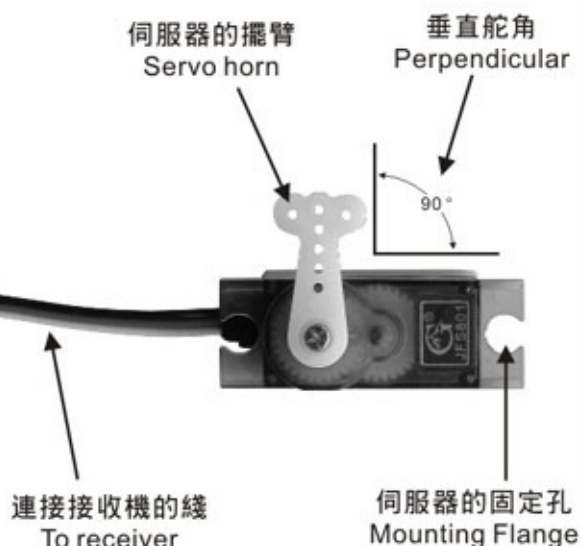
在做任何調節之前，請把發射機前面所有的開關調到最小（正常）位置。  
before making any adjustment, set all the servo reverser switches on the front of the transmitter to the lower (normal) position.

打開接收機和接收電源開關，做下列的調節：  
Turn on the receiver and power switch then make the following adjustments:

1. 檢查每個伺服系統的設置位置如果伺服器的操作方向錯誤，請轉換它的伺服倒置開關。  
(不需改變連接，操作方向也會改變)  
Check the direction of operation of each servo, if a servo operates in the wrong direction, (the direction of operation can be changed without changing the linkage.)



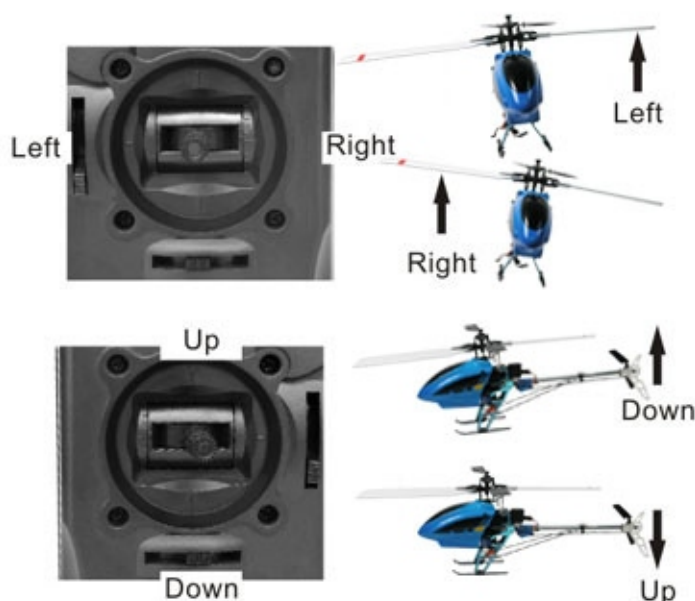
2. 檢查油門的中位設置，當微調開關於中心位置的時候，請測試和調整調速器的停止點或發動機的怠速動點。
3. 同時檢查控制面的中位位置方向舵，如果中位改變，請重新設置和調試，伺服器的擺臂和舵角成90度垂直。
4. 所有的連接都連好後，重新檢查操作方向，設置，等等。
2. Check that when trimmed to the center, the servo horn is perpendicular to the servo.
3. Check the neutral position of the fuselage control surfaces, if the neutral position has changed, reset it, the servo horn is perpendicular to the servo.
4. After all the linkages have been connected, recheck the operating direction, throw, etc.





## 發射機及各個伺服器的調節

### TRANSMITTER OPERATION AND MOVEMENT OF EACH SERVO



Before making any adjustments, learn the operation of the transmitter and the movement of each servo. (In the following descriptions, the transmitter is assumed to be in the standby state.)

#### AILERON OPERATION

When the aileron stick is moved to the right, the right aileron is raised and the left aileron is lowered, relative to the direction of flight, and the plane turns to the right.

在做任何調節之前，請仔細學習如下發射機及各個伺服器的調節（請確認發射機在待機狀態）

#### 副翼操作

當把副翼操縱杆打向右邊時，左副翼升起而右副翼降低，因而飛機飛行方向為轉向右邊，反之則為相反的方向。

#### 升降舵操作

當把升降舵操縱杆往後打，尾升降舵升起，飛機尾部下傾，作用于機翼上氣流改變，升力增加，飛機上升。當把升降舵操作杆往前打，飛機升降降低，飛機尾部上傾，作用于機翼上的氣流改變，升力減少飛機下降。

When the aileron stick is moved to the, the ailerons in the opposite direction.

#### ELEVATOR OPERATION

When the elevator stick is pulled back, the tail elevator is raised and the tail of the plane is forced down, the air flow applied to the wings is changed, the lifting force is increased, and the plane climbs (UP operation). When the elevator stick is pushed forward, the air flow applied to the wings is changed, the lifting force is decreased, and the plane dives (DOWN operation).

## 組裝時安全上的注意點

### ASSEMBLY PRECAUTIONS

#### 警告 WARNING

##### 連接綫之連接 Connect

\*接收機、伺服器、電池等的連接綫，確實插到最裏面。如果沒有，在飛行中時，因機體的振動等，連接綫脫落則會有失控，跌落的危險。

Check the receiver, servos, and battery connectors, to be sure they are firmly connected.

If a connector is not fully inserted, vibration may cause the connector to work loose while the model is operating. This will result in loss of control.

##### 伺服器的動作幅度 Servo operating

\*各舵的伺服器試着讓它以大動作做做看，但不使搖杆卡住及彎曲為原則來進行調整。

伺服器擺臂持續施加壓力及卡死的狀態下，則伺服器會破損、電池提早耗盡，且有失控的危險。

Operate each servo horn over its full stroke and check to see that the linkage does not bind or is not too loose.

Excessive force applied to the servo horn by binding or poor installation may lead to servo problems and cause result in loss of control.

### 接收機的防振 Receiver cushioning

\*接收機以厚片的變面膠帶固定，做為防振措施。

Isolate the receiver from vibration by attaching to the chassis or mounting plate with thick double sided tape.

### 接收機天綫 Receiver antenna

\*請勿切斷及捆綁。

\*請勿與伺服器的綫一起捆綁。

\*馬達及動力電池等大電流流通的部分（包含配綫）保持1CM以上的距離。

\*切斷、捆綁靠近雜訊源則受信感度降低，飛行範圍變小，成為失控的原因，雜訊在金屬及碳棒等的電氣流通時會產生傳導作用，也請遠離這些零件。

\*Do not cut and rap the receiver antenna.

\*Do not wrap together the servo's wire.

\*Motor and electric battery and their wires keep far away more 1 centimeters.

\*If the receiver antenna length is altered, the receiver will be adversely effected. The receiver will become considerably more susceptible to interference and high frequency noise which will result in loss of range and control.

### 伺服器的裝配 Servo installation

\*伺服器安裝在伺服器支架上。

Install the servo on servo bracket.

### 馬達的噪音對策 Motor noise suppression capacitors

\*機體用馬達，一定要安裝除雜訊的電容器。如果沒有安裝時，因雜訊的影響，會使飛行的範圍變窄，并有失控的危險。

\*Noise suppression capacitors should be installed on almost all motors. If the proper capacitors are not in stalled, high frequency noise will reduce range and cause loss of control along with various other problems.

## 鎳氫電池的充電 NI-MH BATTERY CHARGING



### 警告 WARNING

請用交流充電器充電，如果充電過時、過熱等情況可能會導致燙傷、起火等等。鎳氫電池請使用GM原廠的充電器，或快速充電器進行充電。充完電後，注意關掉充電器，如果充電時間過長出現過熱或其它情況可能會導致燙傷、起火等等。

Never plug the special charger into an AC outlet other than specified, if the charger is plugged into an AC outlet other than specified, overheating, sparking, etc, may cause burns, fire, etc. Use the specied charger, or digital proportional R/C quick charger, separately to charge the digital proportional R/C ni-mh battery. Overcharging will cause burns, fire, injury, or blindness due to overheating, breakage, electrolyte leakage,etc.



## ! 警告 WARNING

飛行以外的時間，必須拿掉飛行用鎳氫電池，如果仍然保持連接，可能會有意外的危險。  
When not using the ni-mh battery charger, disconnect it from the AC outlet.

### 鎳氫電池的充電 CHARGING THE NI-MH

1. 連接到發射機充電插孔充電。
  2. 用220V的交流充電器充電。
  3. 檢查充電信號燈是否亮。
  4. 充好電後，拔下插頭。
- 
1. Connect the charger connector to the transmitter charging jack and the charger receiver connector to the receiver servo battery.
  2. Connect the charger to a 220V AC outlet.
  3. Check that the charging light.
  4. At the end of charging, disconnect the charger from the AC outlet.



## 鎳氫電池處理時的注意事項 NI-MH BATTERY CHARGING PRECAUTIONS

## ! 警告 WARNING

### 一定要實行的事項 MANDATORY

\*發射機用鎳氫電池在飛行前，務必要充電。如果飛行中沒有電量，會有亂飛的危險。  
Always charge the NI-MH battery before each flight. If the battery goes dead during flight, the plane may crash.

\*對發射機用鎳氫電池進行充電，需另外購買GM原廠的專用充電器或是發射器用的快速充電器。充電時若超過規定值，容易因異常發熱破裂、漏液等而有燙傷、火災受傷、失明等危險。

Always disconnect the NI-MH battery it is not in flight. If the plane is connected with the battery when it is not in flight, the plane may crash. Charge the digital proportional R/C NI-MH battery with the special charger, or digital proportional R/C quick charger, sold separately. Overcharging may cause burns, fire, injury, blindness, etc, due to overheating, breakage, electrolyte leakage, etc.

## ! 電池更換方法 Battery Replacement

將電池的+-極正確地插入，極性錯誤時會造成發射機毀損。不使用時，請取出電池，萬一有液體漏出時，請將沾濕的蓋子或接點擦拭幹淨。

Always be sure the batteries are loaded in the correct polarity order, if the batteries are loaded incorrectly, the transmitter may be damaged.

When the transmitter will not be used for any short or long period of time, always remove the batteries. Make certain that the contacts in the battery holder stay clean by using a pencil eraser to gently remove any corrosion or dirt that may accumulate on them.



## 電池警告表示 Battery Alarm Display

當發射機電池量指示燈（LED）的綠色消失變成紅色時請立即更換電池或對電池進行充電。  
When the Green battery level indicator (LED) goes off and the Red LED flashes, change the batteries immediately.



## 禁止事項 Red Green

燃料、廢油、排氣等請勿直接接觸電池的包裝塑膠部分，一旦附着，容易侵蝕塑膠而破損。  
Battery Level indicator PROHIBITED Do not get fuel, waste oil, etc. On plastic parts. In case, the plastic will be damaged by corrosion.

## 術語表 GLOSSARY

### 副翼 AILERON (Ail)

在機翼左右兩邊的操縱杆，它用來控制飛機的轉向。  
Control surface at the left and right sides the main wing of an aircraft. It usually controls turning of the aircraft.

### 通道 CHANNEL

控制系統的通道表示，也可以用來表示伺服操作的數字表現。  
Represents the number of control systems. It can also represent the number of servos that are operated.

### 向下 DOWN

升降舵向下的意思。  
Means down elevator.

### 升降舵 ELEVATOR (ELE)

控制飛機向下或向上的水平穩定器，用來控制升降。  
Control surface that moves up and down the horizontal stabilizer of an aircraft. It usually controls up and down.

### 調制方式 MODULATION METHOD

無線電控制的兩種調制方式：AM（調幅）和 FM（調頻）。飛機的無線電裝置通常使用FM。另一種方式是脈衝編碼調制數字信號叫“PCM”。  
Two modulation methods are used with radio control: AM(Amplitude Modulation) and FM (Frequency Modulation). Radio sets for aircraft mainly use FM. Another method that encodes and transmits the modulated signals called “PCM”.

### 空檔 NORMAL

空檔，不運轉時發射杆回到中心位置時的情況。  
Means the neutral position. It is the state in which a transmitter stick returns to the center when not operated.

### 正常 NORMAL (NOR)

舵機的回轉運行，是正常面，其反面是反向。

For the servo reversing function, it is the normal side, the opposite side is the reverse side.

### 平衡器 PROPORTIONAL

現在的無線電控制操作是平衡杆運動，無線電控制機器就叫平衡器。

Because today's radio control sets control servos in proportion to stick operation, radio control equipment is called proportional.

### 方向舵 RUDDER (RUD)

操縱板尾部控制飛機的方向。

Tail control surface that controls the direction of the aircraft.

### 相反 REVERSE (REV)

舵機的回轉運動，這裏用來表示反面，其反面是正常面。

With the servo reversing function, this is used to mean the reverse side. The opposite side is the normal side.

### 連杆 ROD

連接舵機和機身控制的把。

A bar that connects the servos and the fuselage control surfaces.

### 舵機擺臂 SERVO HORN

舵機裝置的一部分，掌管旋轉運動、直線運動和發射到杆上，舵機擺臂以多種方式運行。

A part that is installed to the shaft of a servo and changes the rotating motion of the servo the linear motion and transmits the linear motion to a rod. Servo horns come in various shapes.

### 舵機設置 SERVO MOUNT

機身的舵機設置。

Fuselage base for installing a servo to the fuselage.

### 操縱杆 STICK

發射器操作杆。

Rod for operating the transmitter.

### 油門 THROTTLE (THR)

控制空氣氣流吸入量。當打開（高油門），會吸進大量的氣流，速度加快。當關閉時（低油門）則速度降低。

Part that controls the air mixture at the engine intake. When opened (throttle high side), a large air mixture is sucked in and the engine speed increases. When closed (throttle low side), the engine speed decreases.

### 教練開關 TRIM

安全飛行的裝置，飛行器正確指導的裝置。

A device that fine adjusts the neutral point of each servo for safe flying. It is a mechanism that corrects bad tendencies of the aircraft.

### 向上 UP

升降舵上升，描述升降舵一直升高到最高點。

Means up elevator. Direction in which the trailing edge of the elevator is pointing up.



**泉速电子科技有限公司**

**Dong guan quan su dian zi co.LTD**

**中国广东东莞厚街汀山管理区汀坑大道**

Peng Hsin Chuan

R/C Model Fun Limited

Tingkeng Rd, Tingshan,

Houjie, Dongguan,

Guangdong, China.

email: [james@skyartec.com](mailto:james@skyartec.com)

Tel: +86 769 8918 013-3/-2

Fax: +86 769 8592 5878

