

PA-2

PILOT-ASSIST-LINK

INSTRUCTION MANUAL

HORIZONTAL STABILIZER FOR MODELS

1M23N06202

CAUTION

- Please read this manual before using the PA-2.
- Keep this manual close at hand so that you can refer to it immediately.

RECOMMENDED DIGITAL PROPORTIONAL R/C SETS

When used with a transmitter with volume channel, such as the transmitters shown below, the sensitivity of the PA-2 can be adjusted from the transmitter.

- SKYSPORT-6A, 6XA, 7UA, 8UA and 9ZA.

1 FOREWORD

Thank you for purchasing the PA-2 Pilot-Assist Link.

The PA-2 is a horizontal stabilizer for model aircraft and incorporates the latest sensor technology. When you release the transmitter sticks, the PA-2 automatically returns the aircraft to level flight even if it enters a dangerous state due to the effect of wind or erroneous operation.

The PA-2 simplifies training in model aircraft flying techniques.

However, the PA-2 only keeps the aircraft level. It does not automatically fly the aircraft from takeoff to landing.

Use the PA-2 with a airplane model only. Futaba disclaims all responsibility for any modification, adjustment, or parts replacement of this product.

•No part of this manual may be reproduced in any form without prior permission.

•The contents of this manual are subject to change without prior notice.

•This manual has been carefully written. Please write to Futaba if you feel that any corrections or clarifications should be made.

•Futaba is not responsible for the results of use of this product by the customer.

2 PRECAUTIONS

To use the PA-2 safely, please observe the following precautions.

Explanation of symbols

For safety, the parts indicated by the following symbols require special attention.


Symbol & Meaning


⚠ Danger Indicates a procedure that could result in death or serious injury to the user or other persons if ignored or not carried out properly.

⚠ Warning Indicates a procedure that could result in death or serious or superficial injury to the user or other persons, or physical damage, if not carried out properly.

⚠ Caution Indicates a procedure that could result in superficial injury to the user or other persons, or physical damage only, if not carried out properly.


Graphic symbols

 ; Operation that must not be performed.


 ; Operation that always must be performed.

Operating precautions

⚠ Warning

 Do not fly in rainy weather, or when water or mud may get on the sensor.

If water, mud, or other foreign matter enters the sensor, the sensor will operate erratically and result in loss of control and create a dangerous situation.

 Do not fly in the following places and under the following conditions:

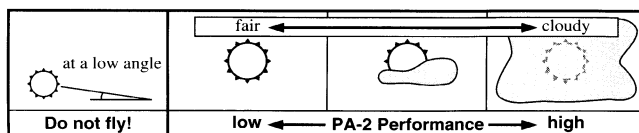
- At dawn and dusk when the sun is low. (Less than about 25 degrees) (Especially in the winter)
- On fair days when there is snow on the ground.
- Above water.
- Above places where there are structures that reflect onto the ground.

The PA-2 operates by sensing the strength and contrast of light. The conditions listed above cause erroneous operation and loss of control and are extremely dangerous.

Safety Points

Because the PA-2 operates by sensing the strength and contrast of light, extremely strong sunlight or no contrast between the sky and ground may affect its performance. When the sun is at a low angle early in the morning and in the evening, the PA-2 may assume that the aircraft has banked and may operate erroneously. On fair days when there is snow on the ground, the contrast between the ground and the sky is extremely low and the PA-2 may not operate. (This may also occur over water.)

We recommend that you fly with the PA-2 in normal (not extreme) sunlight and away from structures that reflect. (at least 50m)



Get advise from an experienced R/C operator.

Flying a model aircraft is dangerous. Handle your model conscientiously and responsibly. We recommend that you join a local radio control club so that experienced R/C operators in the club can help you in making trial flights and give you advise. Another method is to consult you local R/C dealer. Always fly with an experienced R/C operator.

Aircraft selection and adjustment

Begin with a slow, high wing aircraft for beginners. The center of gravity must be adjusted as specified by the kit instruction manual and the engine must run satisfactorily from idling to full power. In particular, idling must be perfect.

The PA-2 will try to stabilize even unadjusted aircraft and aircraft with special flying characteristics. However, to learn flying techniques, it is important that the PA-2 be installed after the aircraft has been adjusted by a professional. As you gain experience, changes in the flight characteristics when the sensitivity of the PA-2 drops will become meaningless.

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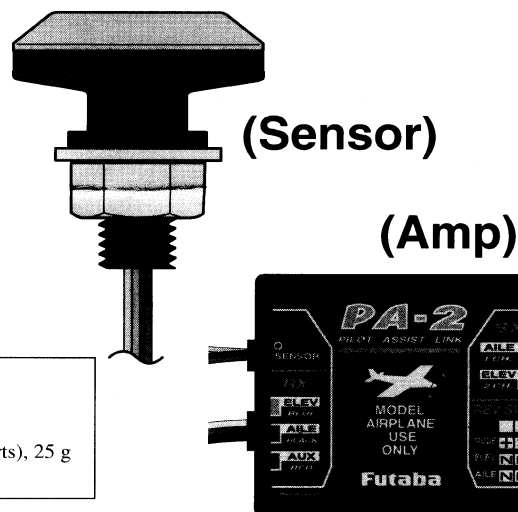
Set Contents

This set includes the following:

- PA-2 amp (X1)
- PA-2 sensor (X1)
- Instruction manual (this manual)

PA-2 Specifications

- Power requirement: 4.8V (Nid battery)
- Current drain: 5 mA (at 4.8V)
- Size and weight:
(Amp) 33.5 x 53.5 x 14.5 mm (excluding protruding parts), 25 g
(Sensor) 33 dia. x 19 mm (excluding screws), 15 g

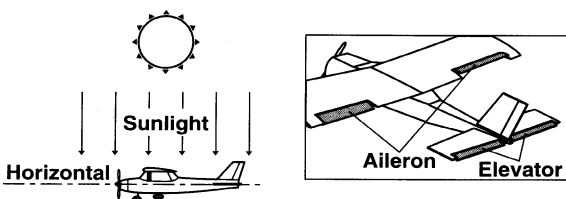


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PA-2 Operation

Horizontal stabilization operation

The PA-2 recognizes tilting of the aircraft relative to sunlight and returns the aircraft to level flight by controlling the elevator and aileron servos.



When the aircraft tilts, the left and right (front and rear) brightness of the sun changes. The sensor outputs this difference in the form of a signal. The ampli-

fier processes this signal and drives the servos until the PA-2 again recognizes that the aircraft is level.

For example, when you lose sight of the aircraft during operation, the PA-2 automatically returns the aircraft to level flight by release (return to neutral position) of the transmitter sticks.

Stick operation priority

The PA-2 automatically controls the elevators and ailerons, but when the operator operated a stick, the sensitivity of the PA-2 drops according to the amount of stick operation and stick operation has priority.

During stick operation, the aircraft can be positively controlled with the sticks. Near the neutral position, the sensitivity of the PA-2 increases and the PA-2 controls the aircraft.

Sensitivity adjustment

The PA-2 sensitivity can be adjusted from 0 to 100% by using an idle transmitter volume channel.



Adjust the PA-2 sensitivity at the following times

- In the beginning, use the PA-2 at high sensitivity, then reduce the sensitivity as you become more proficient.
- On warm days, smooth flight is possible by using the PA-2 at low sensitivity. On windy days, smooth flight is possible by using the PA-2 at high sensitivity.
- The PA-2 can also be used to stabilize flight of scale models whose stability during flight is a problem and if one engine of a multiple engine model fails.

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Installation

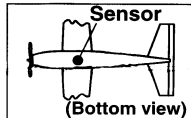
Warning

Match the sensor installation direction and the direction of the amp "MODE" switch.

If the aircraft is flown when the two directions are not the same, control will be lost and is extremely dangerous.

Sensor installation position

- 1 First, select the sensor installation position.



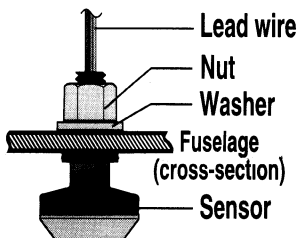
Install the sensor to the bottom of the fuselage. However, do not install the sensor directly behind the muffler or engine exhaust. Keep sensor clean at all times.

Sensor fastening

- 1 Drill a 10mm diameter hole through the bottom of the fuselage to install the sensor.

- 2 Pass the sensor lead wire through this hole.

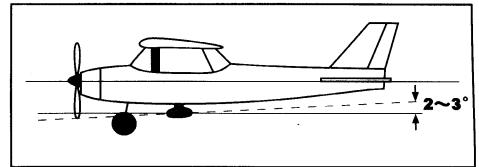
- 3 Pass the lead wire through the washer and nut and tighten the nut hand tight. (Temporary tightening)



However, the sensor, nut, etc. are made of plastic. If the nut is tightened to tight, the parts will break.

We recommend that the sensor be installed with the front of the sensor pointing downward (2 or 3 degrees). If this is done, the aircraft will fly with the nose up slightly. This eliminates flying with the nose

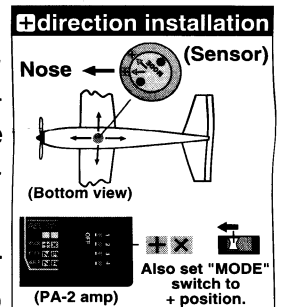
down even when the sensor installation angle is somewhat different. This is also useful when a beginner tries to land unassisted.



Sensor direction

Install the sensor as described below so that it is facing the + side.

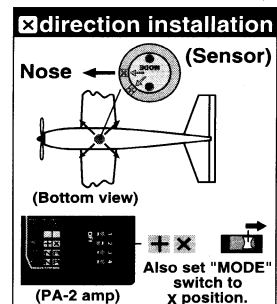
- 1 Position the sensor so that the + mark is facing the nose of the aircraft.



- 2 Fasten the sensor with the nut so that the sensor direction will not change during flight.

- 3 Switch the "MODE" switch of the PA-2 amp to the + position using a miniature screwdriver.

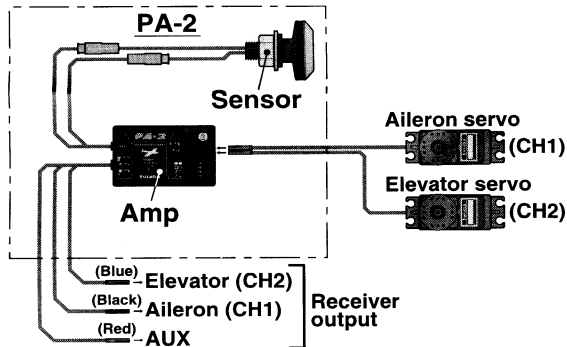
If the landing gear or muffler obstructs the horizontal view of the sensor near the sensor input hole and affects operation, turn the sensor 45 degrees and install the sensor so that the X mark faces the front. In this case, switch the "MODE" switch to the X position.



Connection

Connect the sensor, receiver, servo, and other parts to the PA-2 amp as shown in the figure and confirm that operation of each servo follows operation of the transmitter sticks.

If a servo operates in the wrong direction, switch the direction of operation using the transmitter servo reverse function.



Warning

! Firmly insert the connectors and receiver crystal fully.

If vibration, etc. causes a connector to work loose during flight, the aircraft may crash.

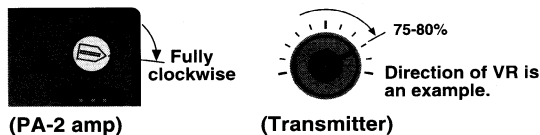
Caution

! Always use an Nicd battery as the receiver power supply.

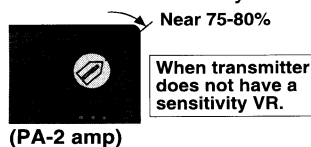
When the PA-2 is used, servo movement becomes active and the total current drain increases. Therefore use of a dry cell battery will cause erroneous operation.

Check and Adjustment Preparation

Set the PA-2 sensitivity VR (GAIN) fully clockwise (maximum), and set the transmitter sensitivity VR to 75~80%.



If the transmitter does not have a sensitivity VR, set the PA-2 sensitivity VR to 75~80%.



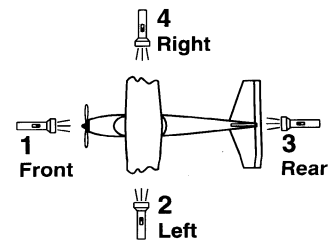
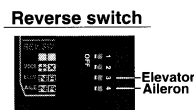
Reference: Use the sensitivity VR when adjusting the PA-2 sensitivity to match the characteristics, etc. of the aircraft during flight. The sensitivity must be set according to the aircraft speed and surrounding conditions.

Indoor test

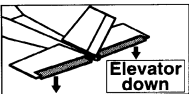

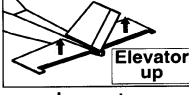

When sensor installed with + mark facing nose of aircraft

Use a flashlight to check the direction of operation of the servos as described below.

If a servo operates in the wrong direction, use a miniature screwdriver to switch the direction of the aileron or elevator reverse switch on the amp.



Turn on the transmitter and receiver power switches and make the following checks:

- 1 Point the flashlight beam toward the sensor from the nose of the aircraft. The elevator servo should move down. 
- 2 Point the flash beam toward the sensor from the left side of the aircraft, relative to the direction of flight. The aileron servo should move to the left. 
- 3 Point the flashlight beam toward the sensor from the tail of the aircraft. The elevator servo should move up. 
- 4 Point the flashlight beam toward the sensor from the right side of the aircraft, relative to the direction of flight. The aileron servo should move to the right. 

When sensor installed with X mark facing nose of aircraft

Use a flashlight to check the direction of operation of the servos as described below.

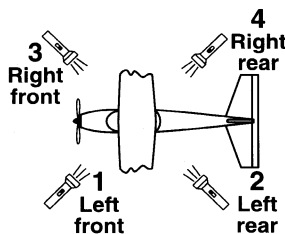
When the sensor is installed in this way, the position of the sensor light entrance holes are offset 45 degrees to the front-rear and left-right axis of the aircraft. Therefore when the light from the flashlight is shined on the light entrance holes, both the ailerons and elevators operate.

If a servo operates in the wrong direction, use a miniature screwdriver to switch the direction of the aileron or elevator reverse switch on the PA-2 amp.

Reverse switch



Turn on the transmitter and receiver power switches and check the following.



- 1** Point the flashlight beam toward the sensor from the left front of the aircraft. The aileron servo should move to the left and the elevator servo should move down.
- 2** Point the flashlight beam toward the sensor from the left rear of the aircraft. The aileron servo should move to the left and the elevator servo should move up.
- 3** Point the flashlight beam toward the sensor from the right front of the aircraft. The aileron servo should move to the right and the elevator servo should move down.
- 4** Point the flashlight beam toward the sensor from the right rear of the aircraft. The aileron servo should move to the right and the elevator servo should move up.

Warning

Check if the direction of operation of the servos is correct by making these checks two or three times.

If the direction of operation is wrong, the aircraft may crash.

When the direction of operation of a servo is wrong when checked with a flashlight, always switch the direction using the PA-2 reverse switches.

If the transmitter reverse function is used to change the direction of operation, the direction of stick operation and the direction of operation of the PA-2 will be reversed and control may be lost and cause a crash.

Outdoor test

After all the indoor tests using a flashlight are complete, perform a daylight operation test out of doors.

- 1** Turn on the transmitter and receiver power switches and hold the fuselage as far as possible away from your body so that the sensor light entrance holes are not blocked.
- 2** Tilt the nose of the aircraft downward. The elevators move up.
- 3** Tilt the nose of the aircraft up (tail down). The elevators move down.
- 4** Lower the left wing. The ailerons move to the right.
- 5** Lower the right wing. The ailerons move to the left.

Reference: When the aircraft is tilted, if the sensitivity setting is low, the servo travel will be small and will increase as the sensitivity is increased.

Reference: The neutral position may change slightly, depending on the surroundings.

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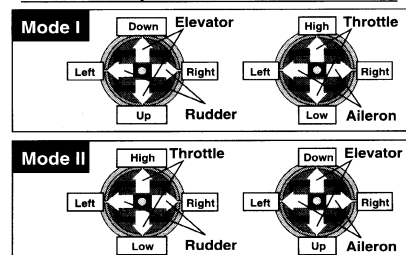
Flying When PA-2 Used Operation feel when PA-2 used

During PA-2 use, the operation feel of the aircraft is not the same as that during normal operation. This is because when the sticks returns to the neutral position, the aircraft automatically returns to level flight. As the sensitivity increases, the tendency for the aircraft to return to level flight increases and the feeling of unease increases for the more experienced the operator. Beginners do not have this sense of unease and

react naturally.

A slight error may also appear in left and right recovery force depending on the surrounding environment and tendency of the aircraft.

Direction of operation of transmitter sticks



Fail safe position setting

Always hold the aileron and elevator stick in the position you wish them to go to when the fail safe function is activated and turn on the receiver power switch.

[Example]

Aileron: slightly right or left position

Elevator: slightly up position

Preparations

•Have an experienced R/C operator check that all the control surfaces operate properly and that engine operation is good from high to low.

•First, always have an experienced R/C operator trim the model so that it flies level when the PA-2 is disabled (sensitivity 0%).

•Take off by raising the elevators a little.

•Set the transmitter sensitivity VR to 75~80%. Later readjust the sensitivity to match the prevailing conditions.

Taking off

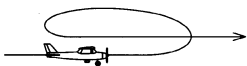


Turn the aircraft into the wind and push the throttle stick smoothly to the high side. While accelerating, correct the direction of the aircraft with the rudder so that it is facing into the window.

After the aircraft reaches takeoff speed, pull the elevator stick slightly to the up side and hold it in that position.

After takeoff, climb to a stable altitude (at least 75 ft.). When the direction must be changed, operate the rudder slightly. Do not operate the ailerons and elevators.

Flying



In the air, lower the throttle stick about halfway and start banks and other maneuvers.

When operating the aircraft, move the transmitter sticks a little at a time. Do not suddenly set them to the full left or full right position. First, operate the aileron and elevator sticks so that movement at the end of the stick does not exceed 5mm.

(Banking)

First, push the aileron stick a little to the left and

watch the reaction of the aircraft and return the stick to its original position. (Center stick)

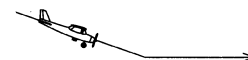
To continue the bank, hold the aileron stick in the position at which the aircraft is at the desired bank angle. The aircraft will continue to bank. If the aircraft begins to lose altitude while banking, maintain altitude by pulling the elevator stick slightly to the UP side. After banking to the left, practice banking to the right.

•When the PA-2 is used, to bank, climb, and dive, the sticks must be tilted and held in position. When the sticks are returned to their original position (neutral), the aircraft automatically returns to level flight.

•If you lose sight of the aircraft, or the aircraft enters a dangerous state, immediately release the sticks so that the aircraft will return to level flight.

•When the aircraft is so far away that you do not know which direction it should bank, set the aileron or rudder stick fully to one side and hold it in that position until you can confirm the direction of travel of the aircraft, then resume control of the aircraft and turn it toward you.

Landing



While banking in the air, point the nose of the aircraft toward a landing zone 100m to 150m downwind from the zone at which you want to land at an altitude of 15m to 30m and move the throttle stick to the LOW side so that the aircraft descends by itself.

When it appears that the aircraft will land at a point in front of the desiring landing zone, increase the power slightly. When the aircraft overshoots the landing zone, move the throttle stick to the HIGH side and climb again and repeat the landing procedure from the beginning.

To correct the direction, use the rudder. In this case, do not operate the aileron stick.

•Pull the elevator stick slightly to the UP side at an altitude just before landing (50cm to 1m) and pull the nose up and drop the speed of descent.

•After throttling down, drop the aircraft speed by setting the elevator trim slightly to the UP side and land.

•It takes some time to learn how to fly perfectly. As you gain experience, lower the PA-2 sensitivity so that you can fly the aircraft without PA-2 assistance.

9

Others

If your transmitter has a programmable mixing function (2 circuits), the banking operation can be performed easily by applying mixing from aileron to rudder and elevator. The values given in the setting examples are typical values.

Example of setting that simplifies banking operation

Mixing 1 side setting

(Mixing channel)	(Mixing rate)
Aileron -> rudder	20% ~ 40%

Mixing 2 side setting

(Mixing channel)	(Mixing rate)
Aileron -> elevator	30% ~ 40%

However, make these settings so that the elevators are raised when the ailerons are moved to the left and right.