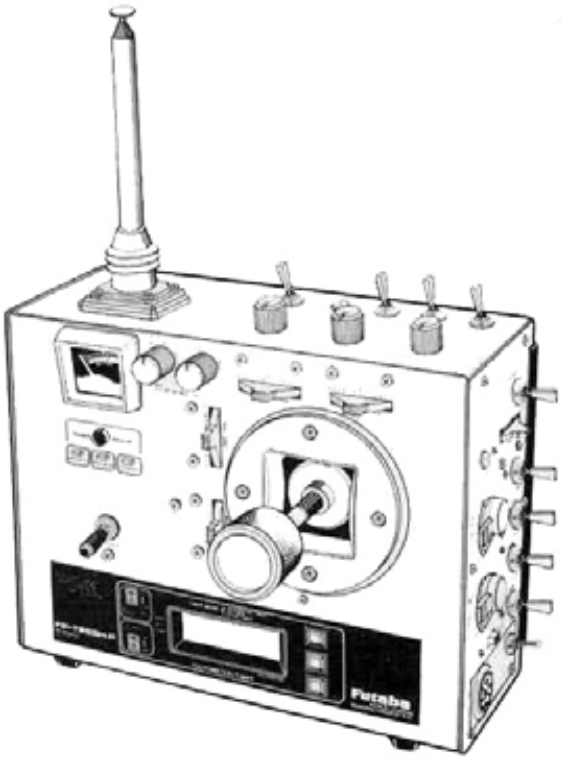


Futaba

DIGITAL PROPORTIONAL
RADIO CONTROL

PCM

SINGLE STICK
PULSE CODE MODULATION SYSTEM

INSTRUCTION MANUAL

FP-8SSHP

PCM 8 CHANNELS
F3C HELICOPTER

FUTABA CORPORATION OF AMERICA
FUTABA CORPORATION

D60421

Thank you for purchasing a Futaba digital proportional radio control set.
Please read this manual carefully before using your set.

When reading this manual, refer to the foldout at the end of this manual.

CONTENTS

•FEATURES

The FP-8SSHP is a digital proportional R/C set with PCM (Pulse Code Modulation) for helicopters.
The system is extremely noise and dead-point resistant digital proportional R/C sets with a microprocessor in the transmitter and receiver.
The FP-8SSHP was specially developed for FAI RC aerobatics F3C use.
Please read this manual before using your set.

TRANSMITTER FP-T8SSHP

- Newly designed rotatable open gimbal stick provide maximum operation feel. Stick position and spring tension can be adjusted.
- RF module system. The frequency band can be changed with one touch.
- DSC (Direct Servo Controller). The servos can be operated without turning on the transmitter.
  Wire operation is also possible by using the special cord supplied with the set. (FSC-1)
- Servo reversing switch on all channels. The direction of operation of each servo can be reversed with the flip of a switch.
- Dual rates or non linear VTR (variable trace ratio) on the aileron, elevator, and rudder channels. Aileron and elevator dual rate can be switched simultaneously, or independently.
- Easy-to-adjust two-knob revolution mixing. Pitch control -> rudder and throttle -> pitch control mixing.
- Revolution mixing compensation. The revolution mixing (pitch control -> rudder mixing) up side can be set in the direction at which the mixing amount to the rudder becomes smaller. This increases high-speed straightforward flight and also minimizes the power loss.
- Acceleration mixing.
- Throttle hold function for auto-rotation.
- Throttle hold delay. The pitch servo operating time at throttle hold can be freely set with a built-in delay circuit.
- Four (4) pitch-curve trimmers for best pitch for hovering and maneuvering.
- New single-chip microprocessor allows one-touch fail safe setting and introduction of **an** automatic transmission system which eliminates the need for fail safe setting at the beginning of each flight and improves safety.
- Hovering throttle permits independent adjustment of the hovering point throttle position.
- Hovering pitch lever permits independent adjustment of the hovering point pitch without regard to the throttle.
- Two idle up functions used for static and dynamic aerobatics.
- Hovering memory reproduces the best mixing point at any throttle position & even during performance of flight.
- Throttle ATL (Adjustable Throttle Limiter) allows simple and reliable throttle linkage hook-up.
- Rudder button with timer is convenient in 540* stall turns.
- Tachometer/timer with built-in tachometer, up timer, down timer, integrating timer, and battery alarm.
- New ATV (Adjustable Travel Volume) on all channels allows independent pushbutton adjustment of servo left, right, up, and down throw.
- Second ATV. Besides new pushbutton ATV on aileron and elevator, conventional trimmer ATV is also installed.
- Monitor lamp glows when two idle up systems or throttle hold is set and flashes when they areworking.
- Fail safe switch (safety switch). Internal switches that turn the throttle hold, idle up, and other functions on and off. If the internal switch is set to off beforehand, when that function is not used, it will not operate even if the switch on the transmitter is set to on.
- Built-in power error back-up circuit. When the internal Nicd battery approaches the fully discharged state, an LED blinks to indicate that the memory circuit (memory, ATV, FS, etc.) is not working.
- Two servo test functions. A slow sweep to check neutral characteristic, trackability and to cycle servo to test servo operation.
- Highest quality aluminum case with sophisticated design. The transmitter fits easily in your hand.
- Optional CCPM (Cyclic Corrective Pitch Mixing).
- Trainer system offers an easy training of flight for beginners.

RECEIVER FP-R118GP

- The receiver is a miniature PCM receiver in which the highest reliability has been pursued. It is the first R/C receiver in the world to **use** the newest computer technology.
- Miniature PCM receiver with hi-speed single-chip microprocessor. Resistance against adjacent band and noise interference has been increased by one full order of magnitude.
- Microprocessor-controlled servo hold function eliminates erroneous operation when the "dead point" area is entered.
- Microprocessor provides fail-safe and battery fail-safe functions for greater safety.
- Error lamp display allows checking of the receiver operating state.
- DC-DC converter in the power supply improves the low-voltage operation characteristic.
- High sensitivity design with RF amplifier circuit.
- Ultra narrow-band ceramic filter and PCM system are practically invulnerable to adjacent band interference.
- Gold-plated connector pins eliminate poor contact. Polarized housing increases reliability against shock and vibration.
- DSC circuit. Each servo can be controlled from the transmitter without turning on the transmitter by connecting the transmitter directly to the C terminal.

SERVO FP-S130

- New indirect-drive potentiometer improve vibration and shock resistance and improves neutral precision tremendously.
- Futaba low-power custom 1C provides high starting torque, narrow dead band, and excellent trackability.
- Fiberglass-reinforced PBT (polybutylene terephthalate) injection molded servo case is mechanically strong and invulnerable to glow fuel.
- Strong polyacetal resin ultra-precision servo gear features smooth operation, positive neutral, and very little backlash.
- Fiberglass-reinforced epoxy resin PC board with thru-the-hole plating improves servo amp vibration and shock resistance.
- Thick-film gold plated connector pins ensure positive contact and greater reliability against shock and vibration. The connector housing is polarized to prevent reverse insertion.
- Six special adjustable splined horns are available.

•CONTENTS AND RATINGS

Ratings and specifications are subject to change without prior notice.

Model	FP-8SSHP
Transmitter	FP-T8SSHP x 1 with module FP-TF-FM
Receiver	FP-R118GPx 1
Servo	FP-S130x4
Switch	SWH-5 (R4-SWJ) x 1
Nicd battery	NR-4Jx 1
Accessories	Charger, extension cord, DSC cord (FSC-1), CHG adaptor, DSC-CHG cord, frequency flag, spare horn, mounting screws, tachometer sensor (FTA-3)

Transmitter FP-T8SSHP

Operating system	: Single-stick, 8 channels for helicopter
Transmitting frequency	: 50/53MHZ BANDSIChosen 72/75MHz BANDS[band 53MHz • • 72MHz Frequency change to any of above bands Is possible by merely changing RF module.
Modulation	: PCM (FM)
Power requirement	: 9.6V 8/500mAH internal Nicd battery (NT.8H)
Current drain	: 250mA

Receiver FP-R118GP

Receiving frequency	: 50/53MHz BANDSIChosen 72/75MHz BANDS) band
Intermediate frequency	: 455kHz
Power requirement	. 4.8V Nicd battery (NR-4J-shared with servo)
Current drain	: 42mA (at 4.8V reception)
Dimensions	: 2.23 x 1.65 x 0.94 in (57 x 42 x 24mm)
Weight	:1.85ozl53g)
Receiving range	: 500m on the ground 1000m in the air When FP.T8SSHP used (at the best conditions)

Servo FP-S130

Control system	-+pulse width control 1520uS.N
Operating angle	: One side 45"or more (including trim)
Power requirement	: 4.8V (shared with receiver)
Current drain	: 5mA (at idle)
Output torque	: 55.6oz-in (4kg-cm)
Operating speed	: 0.24sec/60°
Dimensions	: 1.52 x .77 x 1.36 in l38.5xl9.5x34.5mm)
Weight	:1.47oz(42gl

Charger FBC-8B12L

Input voltage	: 120VAC, 50/60H2.4VA
Output	: Tx side 9.6V. 45mA Rx side 4.8V. 45mA

Receiver and servo Nicd battery NR-4J

Voltage	4.8V.4/500mAH
Dimensions	: 2.01 x 2.28 x 0.59 in 151 x5 8x 15mm)
Weight	: 3.350Z (95g)

•TRANSMITTER

This section explains the operation of the transmitter controls when the servo reversing switches are in the normal position. When the reversing switches are in the reverse position, servo operation is the opposite of that described here.

1. **AllerOn** Controls the ailerons.
2. **ElevatOr** Controls the elevators.
3. **Throttle** Controls the throttle.
4. **Rudder** Controls the rudders.
5. **CH5 Switch** Controls the rate gyro output.
6. **Hovering pitch lever** Right side of transmitter.
   - •The hovering point pitch can be independently adjusted without affecting the throttle.
   - •When the throttle lever *3* is near the center, the pitch servo can be adjusted over approximately 20% of its total travel with this lever.
   - •When the throttle lever 3 is at the Low or High side, this lever has no affect on the pitch servo, even if it is moved.

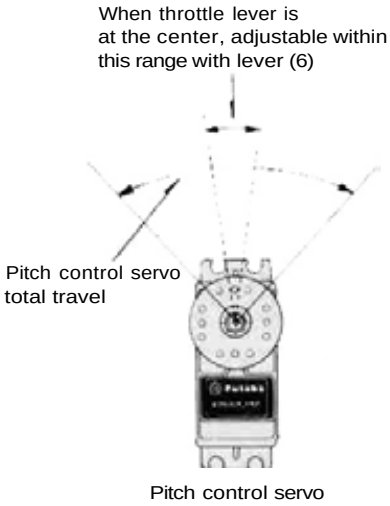


Fig. 4

7. **CH7 knob** Spare channel.
8. **CH8 Switch** Spare channel.
9. **Aileron trim lever** Aileron trimmer.
10. **Elevator trim lever** Elevator trimmer.
11. **Throttle trim lever w/ATL**
    Adjustable travel trim lever. This lever acts as a trimmer only when the throttle lever is at the low side as shown in Fig. 5. It is very convenient because the high side of the throttle position remains unchanged even when the low side is adjusted.

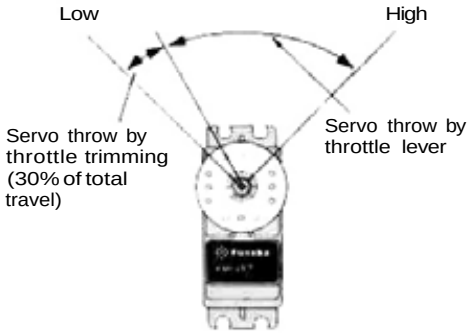


Fig. 5

12. **Ruddertrimlever**
    Rudder trimmer.
13. **Pitch control HIGH side trim lever (CH6), Right side of transmitter**
    Pitch control servo High pitch trimmer. The servo throw can be adjusted from 0 to 30% of the total servo travel. Set this lever for optimum pitch during normal flight.

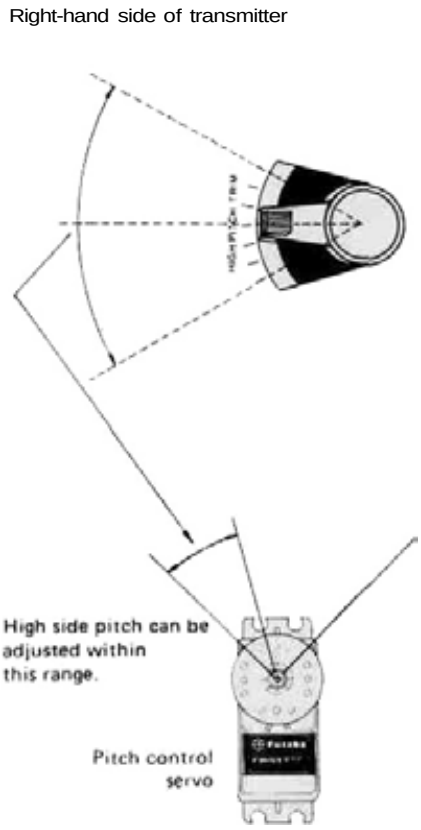
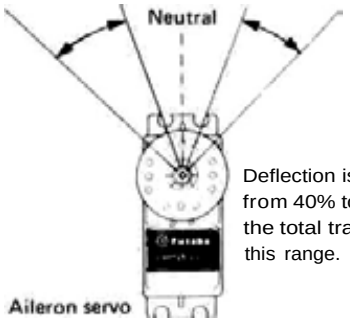


Fig. 6

14. Aileron dual rate switch

Aileron dual rate ON-OFF switch. When set to the pull position dual rate is turned on, and when set to the push position, dual rate is turned off. At dual ON, the deflection can be set as shown in Fig. 7 with the (1) aileron dual rate trimmer located on the trimmer panel at the back of the transmitter. At dual OFF, the operating linearity can be switched as shown in Fig. 8 with the (2) LINEAR-VTR switch also located on the trimmer panel.



Deflection is adjustable from 40% to 100% of the total travel within this range.

Fig. 7

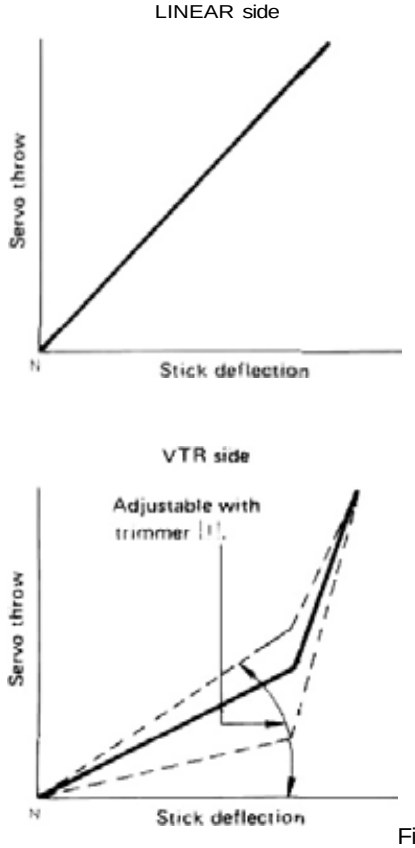


Fig. 8

15. Elevator dual rate switch

- Elevator dual rate ON-OFF switch
  Similar to aileron dual rate, the elevator deflection can be adjusted with the elevator dual rate trimmer [23] and LINEAR-VTR switching can be performed with switch [24] Other functions are the same as elevator dual rate.
- Aileron dual rate and elevator dual rate can be switched ON and OFF simultaneously (combination ON-OFF) or separately by setting switch [25] on the trimmer panel at the back of the transmitter. In the simultaneous ON-OFF mode, aileron dual rate and elevator dual rate are turned on and off with the aileron dual rate switch [14]

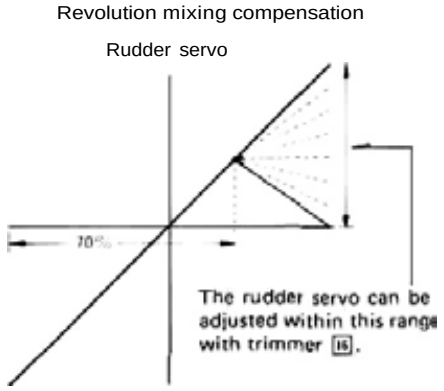
16. Rudder dual rate switch

Rudder dual rate ON-OFF switch. Similar to aileron dual rate, the rudder deflection can be adjusted with the rudder dual rate trimmer [20] and LINEAR-VTR switching can be performed with switch [21] . Other functions are the same as aileron dual rate.

17. Revolution mixing up side ratcheted knob (UP knob)

18. Revolution mixing down side ratcheted knob (DOWN knob)

- These knobs vary the pitch control — rudder mixing amount from 0 to 70% of the total travel at the up and down sides. This mixing is performed when the hovering memory switch [36] on the back of the transmitter is set to ON, when switch [36] *is* set to OFF, mixing is not performed even if knobs [17] and [18] *are* turned. The UP knob [17] adjusts the high side mixing amount from the memorized throttle stick hovering position. The DOWN knob [18] adjusts the low side mixing amount from the memorized throttle stick hovering position.
- Switch [22] on the trimmer panel changes the mixing direction and releases the mixing function.
- The mixing amount to the rudder (pitch control -> rudder) is controlled by adjusting the revolution mixing compensation with trimmer [16] in Fig. 9.



When this compensation is suitably applied, the high speed linearity in the air is improved and power loss is minimized.

FIG. 9

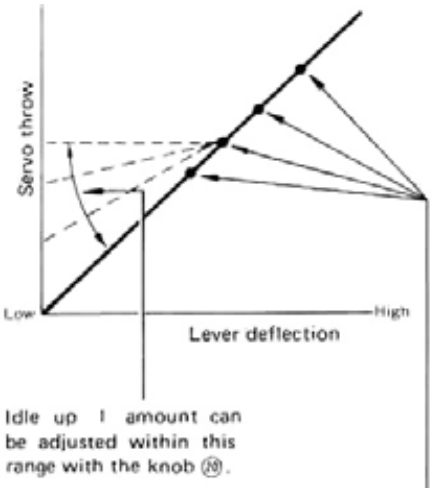
(19) Idle up 1 switch (1 switch)

Right ON, Left OFF.

(20) Idle up 1 ratcheted knob (1 knob)

- When the 1 switch [19] is set to ON, the throttle servo "stop position" (idle up amount) can be adjusted with this knob.
- If fail safe switch [13] on the trimmer panel at the back of the transmitter is set to the INH position, the idle up 1 function is inoperative. Light goes out to indicate that. When switch [13] is set to the IDLE1 position, monitor lamp [B] comes on to indicate that the idle up 1 function is operative. If the switch [19] is then set to ON, lamp [B] flashes to indicate that the idle up I function is operating.

Throttle servo



Idle up I point Adjustable with trimmer 9 on the trimmer panel at the back of the transmitter.

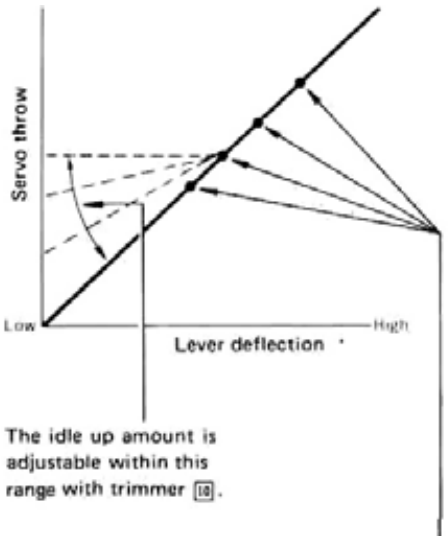
Fig. 10

(21) Idle up 2 switch (2 switch)

Right ON, Left OFF.

- When the 2 switch [21] is set to ON, the throttle servo idle up point can be adjusted with trimmer [10] on the trimmer panel at the back of the transmitter. The idle up 2 point can also be adjusted with trimmer [11].
- When fail safe switch [14] on the trimmer panel at the back of the transmitter is set to the INH position, the idle up 2 function is inoperative. When the switch is set to the IDLE2 position, monitor lamp [C] comes on to indicate that the idle up 2 function is operative. If the 2 switch [21] is then set to ON, lamp [C] goes out to indicate that the idle up 2 function is operating.

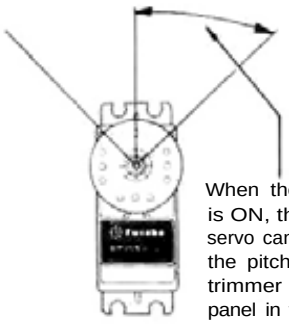
Throttle servo



Idle up 2 point Adjustable with trimmer [11] on the trimmer panel at the back **of** transmitter.

Fig. 11

- The pitch control servo low side can also be adjusted with trimmer [6] (when idle up switch 2 is ON). This is convenient in rolls and other aerobatics.



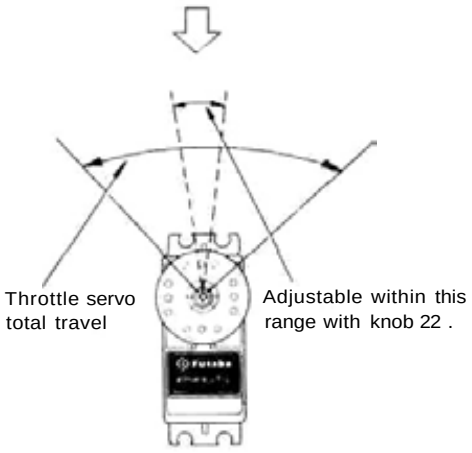
When the idle up 2 switch is ON, the pitch control servo can be varied 50% at the pitch low side with trimmer 6 on the trimmer panel in the back of the transmitter.

Pitch control **servo**

Pig. 12

22 Hovering throttle ratcheted knob

- •Trims the throttle servo independently from the pitch control servo (without regard to mixing). Since the throttle servo can be trimmed without interfering with other mixing, this knob is very convenient when trimming the throttle while hovering.
- • When the throttle lever [3] is at about the center, the throttle servo throw can be adjusted about 25% of the total travel with this knob.
- •When the throttle lever [3] is at the low or high sides, the throttle servo does not operate even if this knob is turned.



Throttle servo

Fig. 13

23 Throttle hold switch (TH switch)

Right ON, Left OFF.

- •This switch is used during auto-rotation. If this switch is set to ON when the throttle lever [3] is in the maximum slow position, the throttle servo will stop at the position (idling or engine stop) set at trimmer [8] on the trimmer panel at the back of the transmitter. At this time, the time set at trimmer [7] (throttle hold delay) is applied and the pitch control servo is set to the optimum pitch for auto-rotation set with trimmer [5]. This setting can be made without regard to the position of the pitch control high side trimmer lever [13]
- •When fail safe switch [12] on the trimmer panel at the back of the transmitter is set to the INH position, the throttle hold function is inoperative. When it is set to the T.HOLD position, monitor lamp [D] comes on to indicate that the throttle hold function is set.
  If the TH switch [23] is then set to ON, lamp [D] goes out to indicate that throttle hold is being performed.

24 Monitor lamps

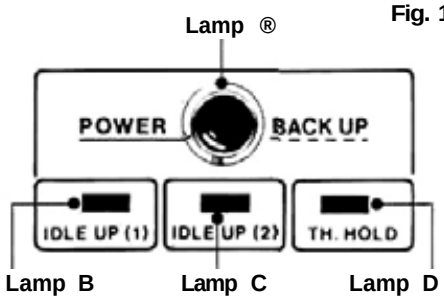


Fig. 14

Lamp A

When the power switch [30] is set to ON, this lamps comes on and the pointer of the level meter deflects. At FS data transmission, this lamp goes out momentarily and data transmission can be monitored. The lamp goes out once every 60 seconds. When the internal Nicd battery approaches full discharched, this lamp starts blinking. This alarm indicates that the power error backup function is activitated the memory and circuit (memory, ATV, FS, etc.) is not functioning.

Lamp B

When fail safe switch [13] on the trimmer panel at the back of the transmitter is to the IDLE 1 position (idle up 1 function ON), this lamp lights. When the idle up 1 switch [19] is set to ON, this lamp goes out.

Lamp C

When fail safe switch [14] *on* the trimmer panel at the back of the transmitter is set to the IDLE 2 position (idle up 2 function ON), this lamp comes on. When the idle up 2 switch [21] is set to ON, this lamp goes out.

Lamp D

When fail safe switch [12] on the trimmer panel at the back of the transmitter is set to the T.HOLD position (throttle hold function ON), this lamp comes on. When the throttle hold switch [23] is set to ON, this lamp goes out.

When the power switch [30] is set to ON, lamp [[A] will go out momentarily. This indicates automatic data transmission on and is not a failure.

Functions priority

Lamp B (Idle up 1)
Lamp C (Idle up 2)
Lamp D (Throttle hold)
The function priority is hold -> idle up 2 -> idle up 1 . Lamps B, C, and D come on when the pertinent fail safe switch (13, 14, 12) is set to the ON position. When the idle up 1 switch [19] is set to ON, lamp [B] goes out. Keeping the idle 1 switch [19] in the ON position, try setting the idle up 2 switch [21] to ON. Lamp B comes on and lamp [C] goes out, indicating that the idle up 2 function has priority. Similarly, if the throttle hold switch [23] is set to on while the 1 switch [19] and 2 switch [21] are ON, lamps B and C go out, indicating that the throttle hold function has priority.

25 Rotative open gimbal stick

- Rotative open gimbal stick allows setting of the operating direction of the stick within a range of ±34 degrees by losening screws 1 to 4 in the figure 1/2 turn and turning the stick grille.
- Set the stick in the direction in which operation is easiest.
- After setting, retighten the screws.

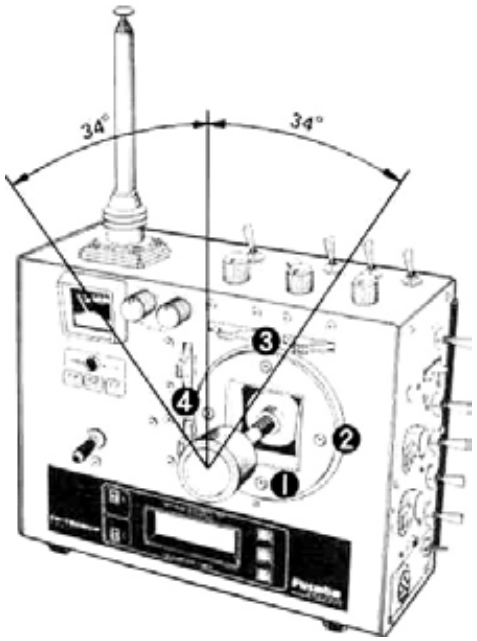
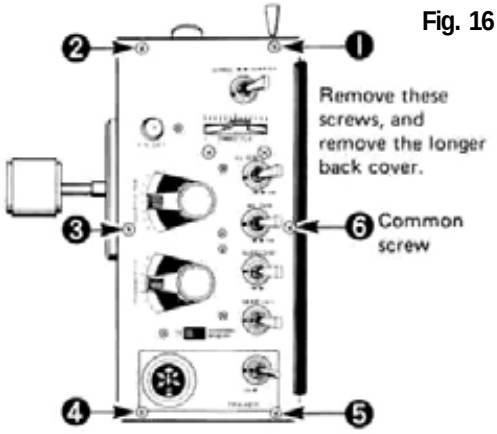


Fig. 15

- The new gimbal is open. This one has been used only for the most expensive radio controls. It also has the built-in tension adjustment mechanism on open gimbal for the first time. You can adjust tension of spring for your best stick feeling.
- Remove the rear panel and right side panel and adjust the spring tension.

Right Side panel mounting screw

Fig. 16



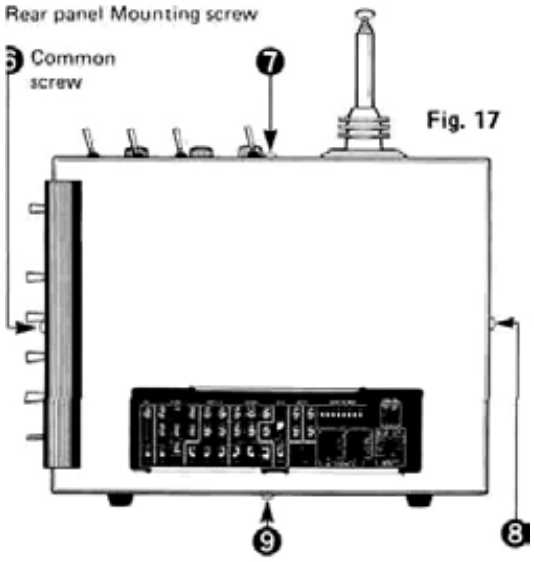


Fig. 17

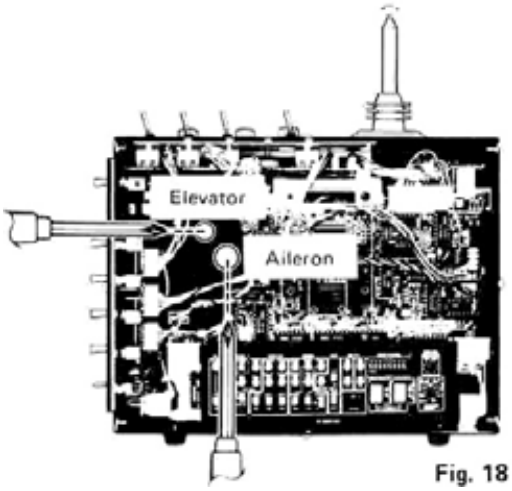


Fig. 18

Turn with a Phillips screwdriver

The spring tension can be adjusted as desired by removing the transmitter longer back cover and turning the adjusting screw of each stick. Adjust the spring tension for the best stick feel.

26 Inverted flight ON/OFF switch

An inverted flight ON/OFF switch is provided. The pitch control, elevator, and rudder servos are reversed for inverted flight when this switch is set to ON, inverted flight is then extremely easy.

27.Tachometer/timer

The tachometer/timer has the following functions:

1 Tachometer

•Measurement by external sensor.
•Two blade propeller specifications.
• LOW range 100 to 30,000 rpm
Error +100 rpm
•HIGH range 100 to 60,000 rpm
Error +200 rpm

2. UP TIMER
• 0 to 60 minutes with seconds displays.

3. DOWN TIMER
•60 to 0 minutes with seconds display

4. INTEGRATING TIMER
• 0 to 60 hours with minutes display

5. Battery alarm
•This alarm sounds when the transmitter nicd battery approaches its limit.

NOMENCLATURE AND FUNCTIONS

-REV.RANGE SW
Switches the range when used as a tachometer. LOW - 100 to 30,000 rpm, HIGH - 100 to 60,000 rpm

LIQUID CRYSTAL DISPLAY

Do not press the keys too quickly. Press them at a speed of about once per second.

POWER SW!
Tachometer/timer power switch.

MODE DISPLAY
•< is displayed at the mode selected at the MODE SEL key switch.

INTEGRATING TIMER
Blinks during counting and stops blinking when counting stops.

UP TIMER

DOWN TIMER

TACHOMETER

[Do not expose the display to direct sunlight for a long time

MODE SEL KEY SW—
Selects the tachometer/timer mode.

The INTEGRATING TIMER mode is selected and 0:00 is displayed when the power is turned on.

The first time this switch is pressed, the UP TIMER mode is selected and is displayed.

The second time it is pressed, the DOWN TIMER mode is selected and is displayed.

The third time it is pressed, the TACHOMETER mode is selected and is displayed.

The fourth time this switch is pressed, the tachometer/timer returns to the INTEGRATING TIMER mode and is displayed.

TIMESETKEYSW
This switch sets the alarm time in the UP TIMER and DOWN TIMER modes. One minute is set each time this key is pressed. If it is pressed and held for two seconds or longer, the time is set in 5 minute steps.
A beeping signal begins 10 seconds before the dot time. A beep is produced every minute to indicate the lapse of time.

ENTER KEY SW
This switch is used for memorization, starting, stopping, and clearing in the UP TIMER and DOWN TIMER modes. In the INTEGRATING TIMER mode, this switch acts as the reset switch.

Fig. 19

OPERATING INSTRUCTIONS

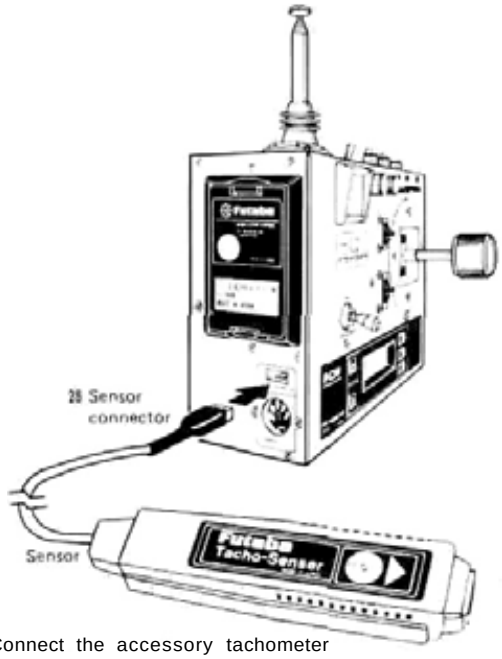
1 Tachometer

Set the tachometer/times POWER switch to ON. appears on the display. Next, press the MODE SEL key switch at the upper-right corner three times. The display changes to and the tachometer mode is selected. Hold the sensor about 20 to 30 cm from the rotating propeller (two blade). The propeller speed is displayed on the LCD.

indicates that the propeller is rotating at 12,300 rpm. For propeller speeds up to 30,000 rpm, set the REVOLUTION RANGE switch at the upper left-hand corner to LOW and for propeller speeds above 30,000 rpm, set the REVOLUTION RANGE switch to HIGH.

The speed of a three blade propeller is displayed value divided b y 3x2.

The speed of a four blade propeller is *1/2* the displayed value.



Connect the accessory tachometer sensor to the sensor connector 28 as shown above.

Fig. 20

Make all speed measurements outdoors under natural lighting. Accurate speed measurements cannot be made indoors under artificial lighting becau se of the affect of the 50 or 60 Hz power.

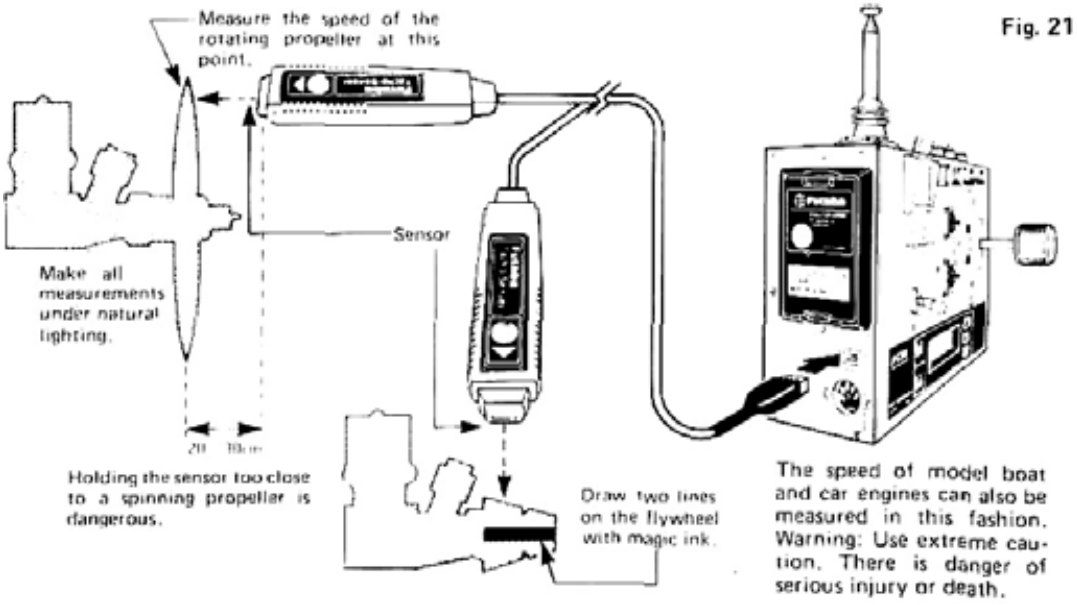


Fig. 21

To measure the speed of the main rotor of a model helicopter, measure the speed of the tail rotor as shown in Fig. 22 and calculate the exact speed from the equation.

$$\text{Main rotor speed} = \frac{\text{Tail rotor speed}}{\text{Main rotor and tail rotor gear ratio}}$$

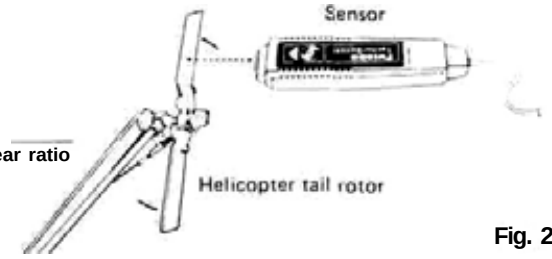


Fig. 22

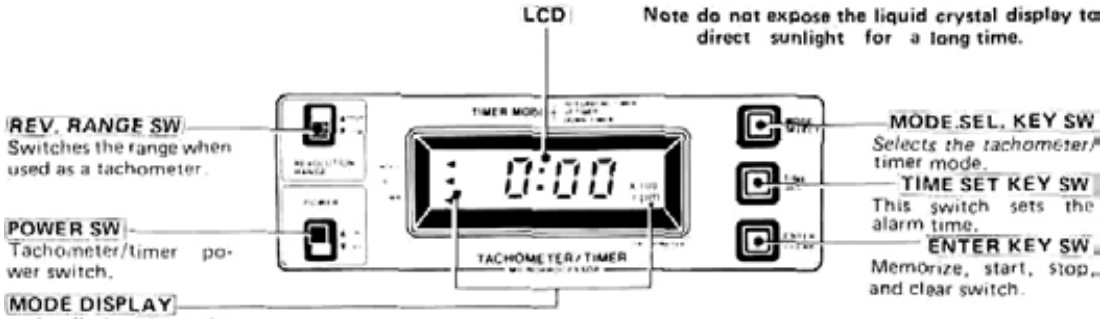


Fig. 23

2 UP TIMER

Set the tachometer/timer POWER switch to ON. 0:00 is displayed. Next, press the MODE.SEL key switch at the upper right-hand corner one time. The display changes to ↑ 0:00 , and the UP TIMER mode is selected. When the ENTER key switch at the bottom right-hand corner is pressed, a beep is head and the timer starts and the second digit of the display changes every second. A beep is produced every minute to indicate the passage of time. To stop counting, press the ENTER key switch again. The usage time is displayed on the display. For example, 12'05"S means that 12 minutes 05 seconds had elapsed. The UP TIMER mode can be used as a second stop watch. To clear the display, press the ENTER key switch again.

ALARM SETTING

The alarm can be set with the TIME SET key. Clear the display, by pressing the ENTER key, then press the TIME SET key twice.

↓ 2:00 appears on the display indicating that two minutes was set. Next, press the ENTER key once to memorize this two minutes The display changes to 0:00 and is memorized. Start the timer by pressing the ENTER key. The display changes every second. When the display reaches 5 1 fhe timer keeps ten times, every once a second, to indicate that two minutes have elapsed. Thereafter the timer continues to count up to 60 minutes. If the TIME SET key is pressed and held for two seconds or longer when memorizing the alarm time, the time is set in five minute steps and the set alarm times are memorized until the power is turned off or reset. If the timer is started without setting the time after the display has been cleared, the previously set alarm time remains effective. An arbitrary alarm time up to 59 minutes can be set.

(3 DOWN TIMER

Set the tachometer/timer POWER switch to ON and press the MODE SEL key twice.

↓ 0:00 appears on the display to indicate that the DOWN TIMER mode was selected. Next, press the ENTER key. The timer keeps. 60:00 appears on the display, and the display begins to count down every second. The timer keeps every second from 10 seconds before the end of the count-down, the same as the UP TIMER.

TIME AND ALARM SETTING

Set the time and alarm with the TIME SET key, the same as the UP TIMER. To set the alarm **to** 3:00 at the display, clear the display by pressing the ENTER key, then press the TIME SET key three times. Next, memorize this time by pressing the ENTER key again. The display begins to count down in seconds. When the display begins to count down in seconds. When the display reaches 0:05 the timer begins to keep every second to indicate that three minutes have elapsed. If the TIME SET key is pressed and held for two or more seconds, the time is set in five minute steps, the same as the UP COUNTER, and the alarm can be set to any desired time up to 33 minutes.

4) **INTEGRATING TIMER**

Set the tachometer/timer POWER switch and the transmitter power switch to ON. The ◂ blinks, counting begins, and the elapsed time is displayed in minutes. For example, ↑ 0:03 indicates that three minutes have elapsed. If the transmitter power switch is set to OFF, counting stops. When the transmitter power switch is turned back on, counting continues. The integrating timer function can be started and stopped as long as the tachometer/timer POWER switch is on even if another mode is selected with the MODE.SEL key. This can be used to monitor the transmitter operating time If the ENTER key is pressed in the INTEGRATING TIMER mode, the old integrating time is cleared and a new count begins. This can be used to forecast the remaining Nicd battery capacity and other applications.

28 Tachometer sensor connector

The tachometer sensor connects to this connector as described in the preceding item.

When this connector and charging connector [29] are not in use, cover them with the rubber-backed cover supplied.

29 Charging and DSC (Direct Servo Controller) connector

This connector is used as both the internal Nicad battery charging connector and the DSC connector.

Always charge the battery before use.

•Connect the DIN connector of the FBC-8B(2) charger to the transmitter charging connector and the 3P connector to the receiver/servo NR-4J battery, and plug the charger into a 120 VAC outlet as shown in Fig. 24. The battery can also be charged through the DSC-CHG cord by installing the CHG adaptor to the charger as shown in Fig. 24. The NR-4J receiver/servo Nicad battery can be charged while inside the aircraft.

•Normally charge the battery for about 15 hours. When the battery has not been used for some time, discharge it 2 to 3 times before charging.
(Leaving the battery discharged for a long time will lower the battery capacity and shorten the battery life.)

•The transmitter and receiver Nicad batteries can be charged simultaneously or independently.

•A fully charged transmitter battery can be used for about 10 flights of 10 minutes each. The receiver and servo NR-4J Nicad battery can be used for about 4 flights when used as a common power supply with the rate gyro and for about 6 flights when a separate rate gyro power supply is used.

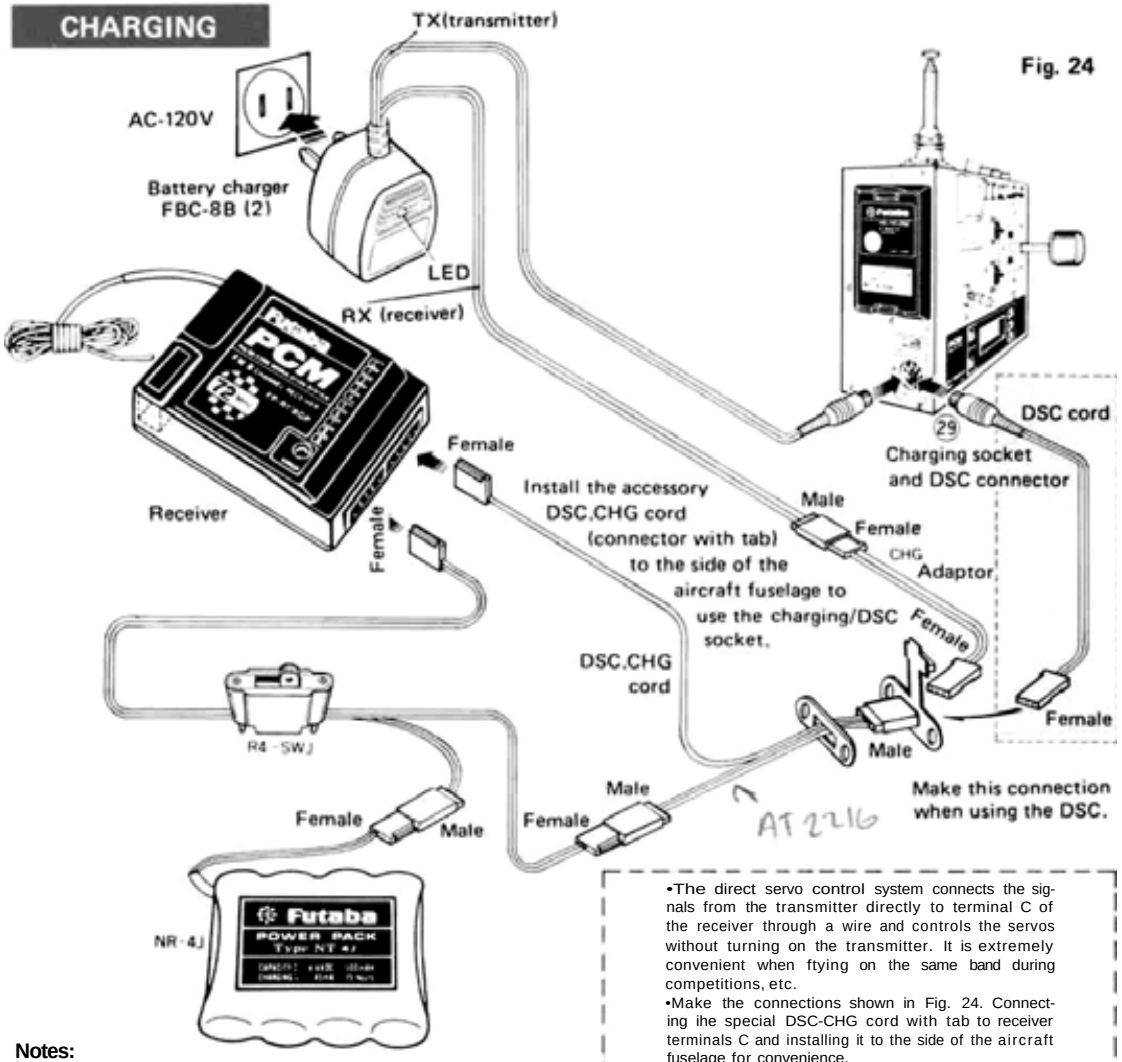


Fig. 24

Notes:

(1) First, connect to TX Nicd and red lamp goes on
(2) Then, connect to RX Nicd after connecting, L,E,D, changes color from red to greenish red (orange) which indicates that both TX and RX Nicds are being charged.
(3) In case of separate charging, L.E.D, color will be: RX Nicd - Green TX Nicd - Red

•The direct servo control system connects the signals from the transmitter directly to terminal C of the receiver through a wire and controls the servos without turning on the transmitter. It is extremely convenient when ftying on the same band during competitions, etc.
•Make the connections shown in Fig. 24. Connecting ihe special DSC-CHG cord with tab to receiver terminals C and installing it to the side of the aircraft fuselage for convenience.
•When the DIN connector of the DSC cord is connected to the DSC connector *29,* the power to the encoder inside the transmitter is turned on. Se; the transmitter power switch to OFF.
•When not using the DSC. disconnect the DIN connector.
•To operate the servos, turn on the receiver and servo switches.

30 Power switch

Transmitter lock-type power switch. To turn the switch on and off, pull the knob forward and set it to the desired position.

31 Antenna

Strong 1m 10cm telescoping antenna. Extend the antenna to its full height when using the transmitter. The antenna will lock in place with a click when pulled up to its full height.

32 Level meter

- This meter indicates the transmitter battery voltage and output power (power meter).
- When the antenna [31] is fully extended and the power switch [30] is set to ON, the pointer should deflect to the white zone.
- If the transmitter RF module [35] is removed, the level meter pointer will not deflect even if the power switch [30] is set to ON.
- If the meter pointer deflects to the red zone, indicating that the Nicd battery voltage is low. the range of the radiowaves will become shorter and the tachometer/timer [27] battery alarm [5] will operate. If the meter pointer deflects to the boundary between the white and red zones, recharge the battery.

33 Rudder button

- While this button is being pressed, the rudder moves to the deflection angle preset at trimmer [17] on the trimmer panel at the back of the transmitter. After the time set at trimmer [18] elapses, the rudder servo returns to the neutral position. This is convenient when making 540" turns.
- The rudder servo left and right throw can be set with trimmer [17] . When fail safe switch [19] is set to the INH position, the rudder button [33] becomes inoperative. When the fail safe switch is set to the RUD.REV position, the rudder button becomes operative.

34 Hovering memory switch

- This switch turns the memory function which memorizes the rudder mixing hovering point on and off. When it is set to OFF, the revolution mixing knobs [17] and [18] become inoperative.
- When this switch is set to ON when hovering, the position of the throttle lever *[3]* is memorized.
- The revolution mixing up knob [17] and revolution mixing down knob [18] can be independently adjusted and set from the throttle lever *3* .

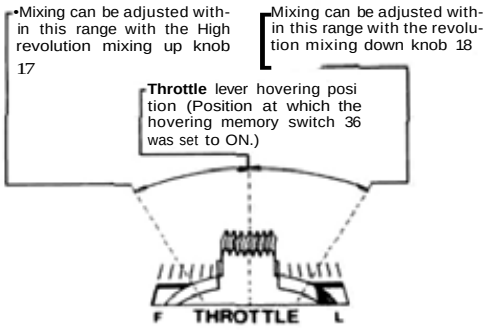


Fig. 25

35 Transmitter RF module

Change this module to switch frequency among different bands.

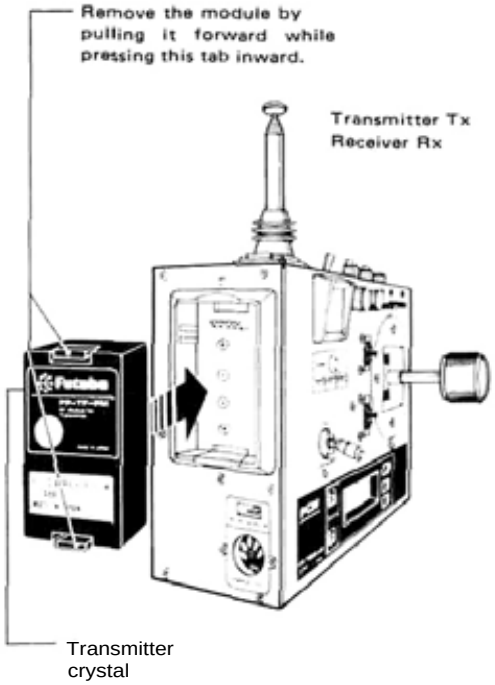


Fig. 26

36 FS set button

This pushbutton **switch** is **used when setting the fail** safe servo position.

Fjg, 27

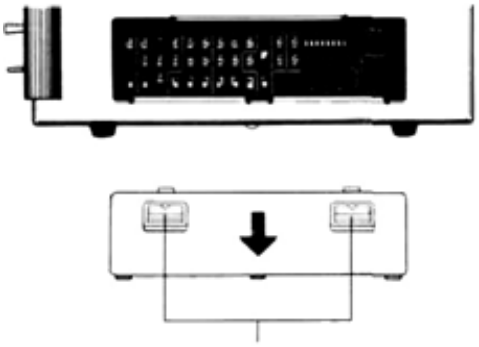
When this button is pressed when the function select switch [35] on the trimmer panel [38] at the back of the transmitter is set to the FS ALL or FS SELECT position and the transmitter sticks are set to the desired servo positions, the transmitter memorizes those servo positions and simultaneously signals to the receiver.

Since this data is automatically transmitted every 60 seconds thereafter, pressing the button at every flight is unnecessary. After the servo position data has been set, set switch [35] to the OFF position to prevent erroneous setting.

During fail safe data transmission, lamp [A] of monitor lamps [24] goes out momentarily and transmission of the data is then confirmed.

37 Back cover

To operate the trimmers and switches on the trimmer panel [38] , remove this cover as shown in Fig. 28.



Remove the back cover by pulling stoppers in the direction of arrows.

Fig. 28

38 Trimmer panel

Switch and adjust the trimmers and switches on this panel with the small flat blade screwdriver supplied.

A Ailerons

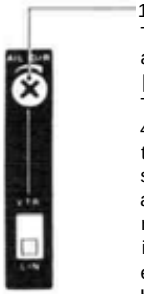
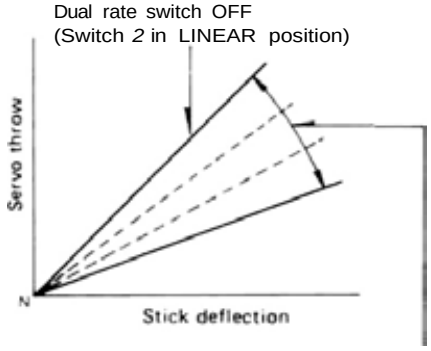


Fig. 29

1. Ailerons dual rate trimmer
This trimmer sets the aileron deflection angle when the aileron dual rate switch [14] is set to the ON position.
The deflection angle is adjustable from 40% to 100% of the total travel. When the dual rate switch is set to ON, the servo throw can be set to an arbitrary angle smaller than that when the dual rate switch is OFF (normal) as shown in Fig. 30. Use the throw matched to the helicopter and maneuvers to be performed.



When the dual rate switch is ON, the servo throw can be adjusted (within this range) with the dual rate trimmer,

FIG 30

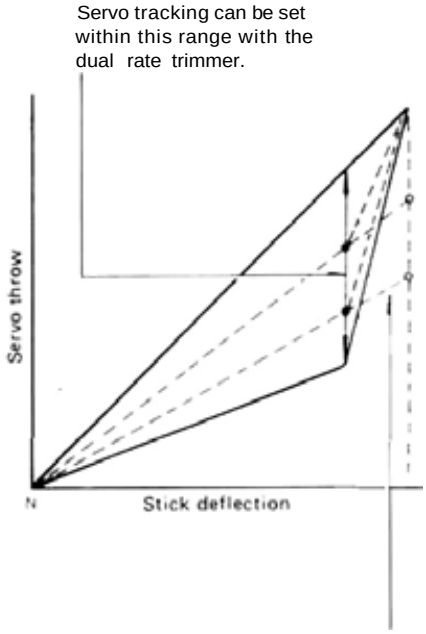
Fig. 31

2. LINEAR-VTR switch

This switch switches the travel linearity of the aileron servo when the aileron dual rate switch [14] is in the OFF position.

•When this switch is set to the LINEAR position, servo tracking is directly proportional to the deflection of the transmitter stick as shown by curve B of Fig. 30.
•When this switch is set to the VTR (Variable Trace Ratio) position, the maximum servo throw is the same as LINEAR shown in Fig. 32. However, servo tracking is the same as the dual rate switch ON up to about 80% of the total travel. Servo tracking then increases abruptly up to the same throw as dual rate OFF. This tracking method resembles exponential operation and is easy to use.

Fig. 32 shows the servo tracking operation when dual rate switch is OFF and when switch is set to the VTR position.



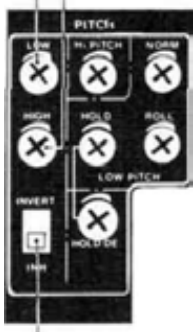
When the dual rate switch is set to ON, operation is the same as dual rate ON at LINEAR.

Fig. 32

B Pitch

A Inverted flight low-side trimmer

B Inverted flight high-side trimmer



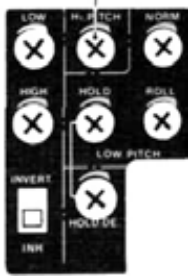
C Inverted flight FS switch

Fig. 33

- The inverted flight function can be turned on and off with the [c] inverted flight FS switch on the trimmer panel at the back of the set.
  INVERT: Inverted flight function ON
  INH : Inverted flight function OFF
- When the [C] switch is in the INVERT (function ON) position, normal flight - inverted flight switching can be performed with the [26] Inverted flight ON-OFF switch at the side top corner of the transmitter.
  * When the [26] switch is pushed back, normal flight is selected. At this time, the pitch can be adjusted with trimmers [3 , 4 , 5, 6 , and 7] as usual. When the [26] switch is pulled forward, inverted flight is selected. At this time, the pitch control servo, elevator servo, and rudder servo are reversed and the pitch control servo low-side and high-side throws can be adjusted with trimmer A and B.

When the [C] inverted flight FS switch and [26] Inverted flight ON-OFF switch are switched, the A inverted flight low-side trimmer and B inverted flight high-side trimmer operate the pitch control servo (servo connected to channel 6 of the receiver) as shown in the figure.

3 High side pitch trimmer. Adjusts the high side pitch from about 60% of the full throw of the pitch control servo as shown in Fig. 35.



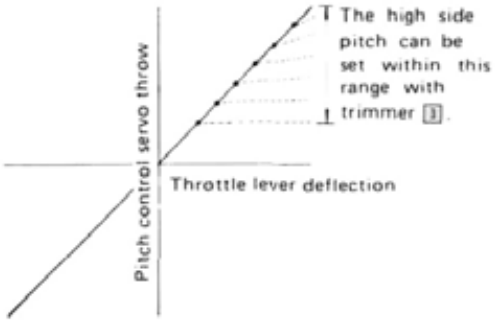
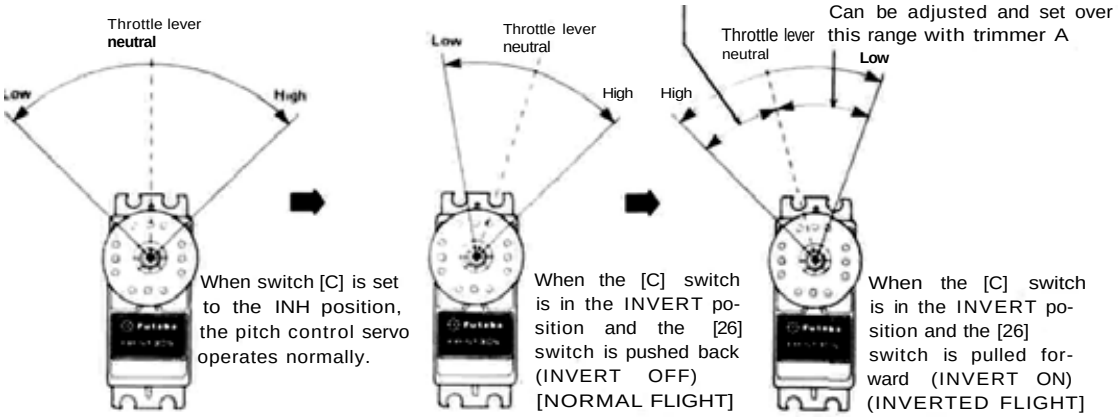


Fig. 35

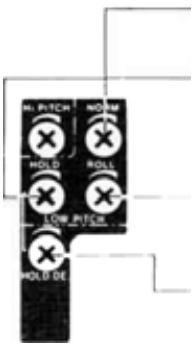
Fig. 34



When switch [C] is set to the INH position, the pitch control servo operates normally.

When the [C] switch is in the INVERT position and the [26] switch is pushed back (INVERT OFF) [NORMAL FLIGHT]

When the [C] switch is in the INVERT position and the [26] switch is pulled forward (INVERT ON) (INVERTED FLIGHT]



4. Normal pitch trimmer
Adjusted to match normal flight.

5. This trimmer sets the low pitch (minus pitch) when the throttle hold switch [23] is ON. It is adjusted to the auto-rotation pitch.

6. This trimmer adjusts the low pitch (minus pitch) when the idle up [2] switch [21] is ON. It is used during rolls, etc.

7. Hold delay trimmer. This trimmer adjusts the delay time the pitch servo operates when the throttle hold switch [23] is set to ON. An operating time of 0 to about **2** seconds can be set.

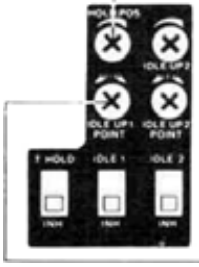


Fig. 37

8. This trimmer sets the throttle servo stop point when the throttle hold switch [23] is set to ON. The stop point can be set as described in the throttle hold switch [23] section on on page 6. When the trimmer is turned clockwise, the throttle servo moves to the slow side.

9. Idle up 1 point trimmer. For a description of this trimmer, see page 5 and Fig. 10. When the trimmer is turned counterclockwise, the idle point moves to the low side.

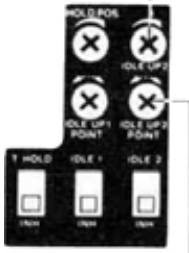


Fig. 38

10. This trimmer adjusts the idle up amount of the throttle servo when the idle up 2 switch [21] is set to ON. The idle up amount can be set as described in the idle up 2 switch [21] section on page 5 and in Fig. 11. When the trimmer is turned counterclockwise, the idle up amount decreases.

11. Idle up 2 point trimmer. For a description of this trimmer, see the page 5 and Fig. 11. When the trimmer is turned counterclockwise, the idle up point moves to the low side.

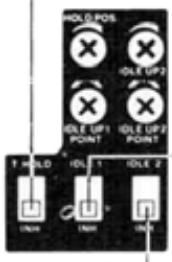


Fig. 39

12. Throttle hold switch [23] fail safe switch
- When this switch is set to the T.HOLD position, the throttle hold function operates and the TH.HOLD monitor lamp comes on.
- When this switch is set to the INH side, the throttle hold function does not operate even if the throttle hold switch [23] is set to ON.

13 Idle up 1 switch [19] fail safe switch
- When this switch is set **to** the IDLE1 position, the idle up 1 function operates and the IDLE UP I monitor lamp comes on.
- When this switch is set to the INH side, the idle up 1 function does not operate even if the idle up 1 switch [19] is set to ON.

14. Idle up 2 switch [21] fail safe switch
- When this switch is set to the IDLE2 side, the idle up 2 function operates and the IDLE UP 2 monitor lamp comes on.
- When this switch is set to the INH side, the idle up 2 function does not operate even if the idle up 2 switch [21] is set to ON.

D. Rudder

15. Rudder servo acceleration amount trimmer
- When hovering is stable, but the tail yaws a little during takeoff, reduce the acceleration with this trimmer until the tail no longer yaws.
- The acceleration amount differs with fixed pitch helicopters. The acceleration amount can be set to a maximum of amount 50% by turning this trimmer clockwise and to a minimum of 0% by turning this trimmer counterclockwise.

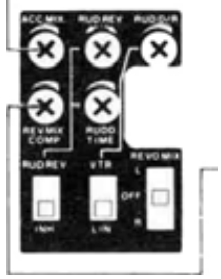


Fig. 40

16 Revolution mixing compensation trimmer
The revolution mixing (pitch control —> rudder mixing) can be set in the direction in which the mixing amount decreases as shown in Fig. 41 with this trimmer.

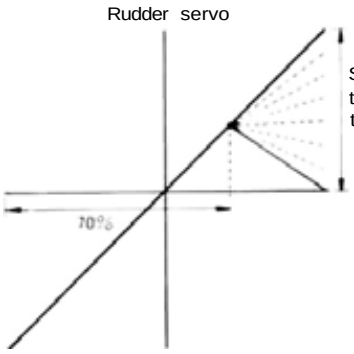
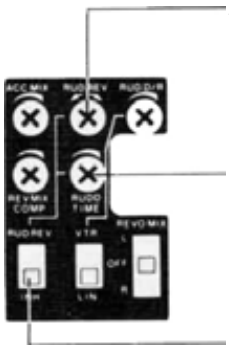


Fig. 41



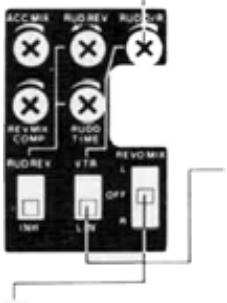
17. This trimmer sets the rudder servo throw and direction when the rudder button [33] is set to ON (pressed). The servo throw can be adjusted up to the total travel.

18. Rudder time trimmer
This trimmer sets the time the rudder servo stops at a fixed deflection when the rudder button [33] is pressed. A time from 0 to about 3 seconds can be set.

19. Rudder button fail safe switch
When this switch is set to the RUD.REV position, the rudder button operates. When it is set to the INH side, the rudder button becomes inoperative.

Fig. 42

Fig. 43



20. Rudder dual rate trimmer
This trimmer adjusts the rudder servo throw when the rudder dual rate switch [16] is set to ON. It has the same functions as the aileron dual rate trimmer [1] described on page 13.

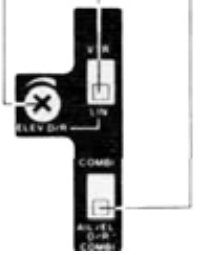
221 LINEAR <->VTR switch.
This switch has the same functions as the aileron LINEAR <-> VTR switch described on page 13.

22. Revolution [17] and [18] and acceleration mixing trimmer [15] direction switching and function OFF switch

- When the main rotor turns clockwise, set this switch to the R position. If the main rotor rotates counter-clockwise, set this switch to the L position. (The linkage may also be reversed.)
- When the switch is set to the center position, the revolution [17] and [18] and acceleration [15] functions are turned off.

E. Elevator

23. Elevator dual rate trimmer
This trimmer adjusts the elevator servo throw when the elevator dual rate switch [15] is set to ON. It has the same functions as the aileron dual rate trimmer [1] described on page 13.



24. LINEAR <-> VTR
This switch has the same functions as the aileron LINEAR <-> VTR switch [2] described on page 13.

25. This switch is used to select aileron dual rate and elevator dual rate simultaneous ON-OFF or separate ON-OFF.

- When this switch is set to the lower position, the aileron dual rate switch [14] and elevator dual rate switch [15] can be turned on and off separately.
- When this switch is set to the COMB position, the aileron and elevator dual rates can be turned on and off simultaneously with the aileron dual rate switch [14]. Set it to the position you like best.

Fig. 44

F. 2nd ATV

ATV is the abbreviation of Adjustable Travel Volume. It is a device which allows independent adjustment of the servo left and right (up and down) throw without affecting the neutral position. Because of the engine torque, precision of the model, and for other reasons, the radius of left and right turns is always different even if the left and right steering throws are perfectly matched. The ATV is most convenient when left turns are good, but right turns are to sharp. In this case, left and right turns of the same radius can be easily made by reducing the servo right throw slightly. The aileron and elevator 2nd ATV is the conventional trimmer type ATV.

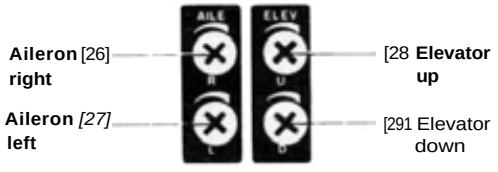


Fig. 45

When the ATV trimmer is turned clockwise, the throw increases. When it is turned counter-clockwise, the throw decreases.

G. Cyclic Corrective Pitch Mixing (optional)

CCP mixing is performed after the helicopter corrective pitch and cyclic pitch control systems are electrically mixed. Since direct linkage from the servo to the swash plate is possible by using CCP mixing, the model can be made lighter by eliminating the intermediate mechanism. Linkage rattle is also minimized.

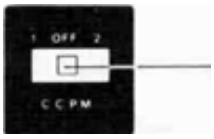


Fig. 46

30 CCPM switch
1 and 2 turn MIX ON-OFF and switch the pitch direction when the CH2 (elevator) servo is operated **as** the pitch servo.

- When mounting the servos in the fuselage, mount the CH1 servo (aileron servo) at the right side facing the front and the CH6 servo (pitch servo) at the left side facing the front.
- Set the CH2 (elevator) up and down directions with the reversing switch. Next, set CH2 elevator to pitch operation and set the switching and pitch direction with CCPM SW1 and 2.
- Check if the high, low, aileron left and right, and elevator up and down directions are correct by pitch operation.
- Set aileron CH1, elevator CH2, pitch CH6, ATV, and 2nd ATV to maximum.
- Set the CCPM switch from OFF to 1 or 2 (ON). When the CCPM switch is set to ON, the CH1, CH2, and CH6 servos throw is automatically set to 50% of the total travel.
- The CH1 and CH6 deflection width is set so that the left and right throws of the two servos at each ATV are the same.
- Adjust the aileron left and right throws using the 2nd ATV when CH1 and CH6 operate with mixing ON. (CH1 and CH6 can be adjusted simultaneously.)
- Check the aileron direction when CH1 & CH6 operate. Use the reversing switches to correct the aileron direction.
- The CH2 deflection can be adjusted with ATV or 2nd ATV.

When mixing is used, the swash plate is moved up and down. Use a coaxial swash plate.
Since the servo throw is about one half of the total travel, so that the servo horn throw must be adjusted to make larger at the servo horn side.

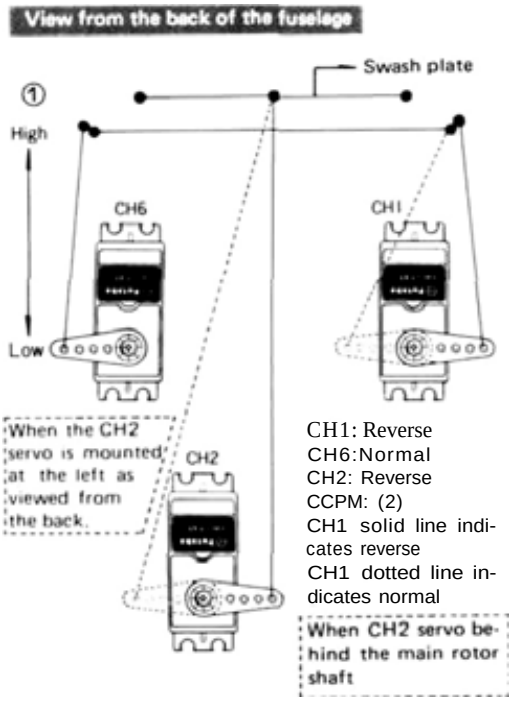


Fig. 47

When the CH2 servo is in front of the main rotor shaft, CCPM (1) and the horn rod are indicated by the dotted lines.

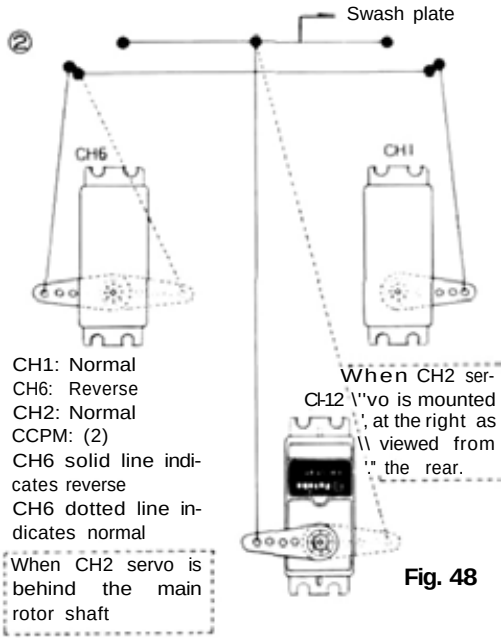


Fig. 48

When the CH2 servo is in front of the main rotor shaft, CCPM (1) and the horn rod are indicated by the dotted lines.

H. Servo reversing switches

These switches reverse the direction of the servos. They are very convenient when connecting the linkage.

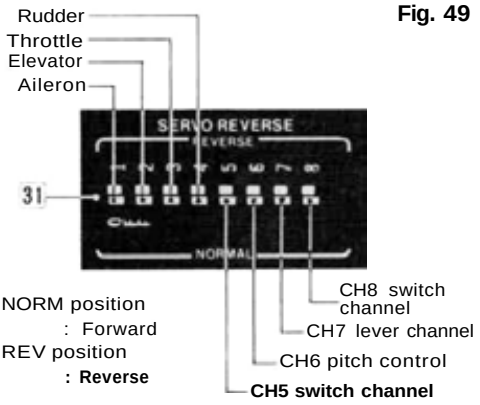


Fig. 49

I. ATV/FS button

•These two pushbutton switches are used for servo deflection angle setting of ATV, FS or HOLD function; servo test start & stop; reset; battery FS memory set, etc.

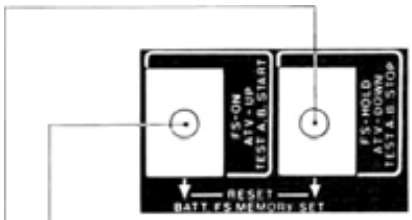


Fig. 50

[32]This pushbutton switch is used when:
1 Making the ATV servo deflection angle larger.
2 Turning the FS function on.
3 Starting the servo test.

[33] This pushbutton switch is used when:
1 Making the ATV servo deflection angle smaller.
2 Turning the HOLD function on.
3 Stopping the servo test.

When button [32] and [33] are pressed at the same time, reset or battery FS memory setting is possible. At this time, lamp [A] of monitor lamps [24] goes out momentarily so that setting can be monitored.

•USING ATV (Aileron ATV taken as an example)

1 First, set switch [K] [35] to the ATV side.
2 Next, set CHANNEL SELECT switch [J] [34] to the 1 (aileron) position.
3 Set the transmitter and receiver power switches to ON, and check the operation of the servos.
4 Set the aileron stick for full right rudder, hold it in that position, and set the aileron right throw to the desired angle by pressing buttons [33] and [32].
5 To set aileron left, hold the aileron stick in the full left position and set the servo throw with buttons [33] and [32].
(ATV can be adjusted in 64 steps. ATV can be continuously varied by pressing and holding the button for more than 1.5 seconds.)
6 For the other channels, select the channel with the CHANNEL SELECT switch [J] [34] and operate ATV.
7 At the end of adjustment, set switch [K] [35] to the center OFF position and set switch [J] [34] to OFF position.
8 This ATV function is memorized even if the power switch is set to off, the ATV function is lost if the transistor Nicd is fully discharge.
9 When clearing the ATV, set switch [35] to RESET and switch [34] to position 2 and press buttons [32] and [33] simultaneously. ATCs of all channels are cleared and servos deflect their 100% angle.

ATV SETTING

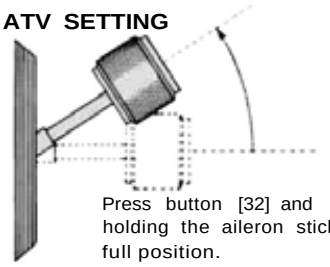


Fig. 51

Press button [32] and [33] while holding the aileron stick in the full position.
Switch switches [J] [34] and [K] [35]

HOW TO USE FS (Fail Safe) (Throttle channel as an example.)

1 First, set switch [K] [35] to FS SELECT.
2 Set the transmitter and receiver power switches to ON, and check the movement of each servo.
3 Next, while switching the channel select switch [34] from 1 to 8 in order, set the channels to be used with FS, with button [32] and set the channels to be used with HOLD, with button [33]. In this example, set 3 (throttle) to FS with button [32].
4 Set the throttle lever to the slowest position, and press the FS set button [36] on the back of the transmitter.
5 The 1 — 4 above set low throttle for the FS function. After setting FS function, turn switch [35] and [34] to OFF. Test fail safe by turning the transmitter power switch to OFF.

Each servo moves to the neutral position except the throttle servo which moves to the slow position that was just set.

6 Pail safe for all channels can be set with one touch by setting the sticks and switches of the all channel to any predetermined position and pressing the FS button [36] one time.

7 The FS function can be set for all channels and any servo deflection angle in this manner. When using FS in all channels the function select switch must be set to the FS ALL position.

8 Since this FS function is memorized by the transmitter which transmits the data every 60 seconds, even when the receiver power switch is set to OFF, resettingisunnecessary.

9 After those settings, set switch [35] to OFF-to prevent erroneous setting.

10 When button [36] is pressed twice, setting FS in flight, etc., the servo position of the second is memorized in FS and transmitted.

11 To clear the preset FS information, set switch [35] to reset position switch *[34]* to position *1* and press buttons [32] and [33] simultaneously. FS of all the channels is cleared and all the servos move to the neutral position.

FS function/HOLD function

The FS function is turned on with button [32] and the HOLD function is turned on with button [33] as previously described.

FS (Fail safe function)

FS is a function which moves the servo of each channel to a position preset on the transmitter when no radio waves are received by the receiver from the transmitter or when continuous strong noise is received for about one second or longer. The set operates by the hold mode in one second and then, by the FS mode. When the noise or interference disappears and normal radio waves are received in approximately one second, FS is released.

HOLD (Hold function)

HOLD is a function which stops all the servos specified by HOLD (by button [33] to the last correct command immediately before the erroneous signal wasreceived.

When the noise, interference, etc. disappears and normal radio waves are received, HOLD is released.

Set the FS function and HOLD function as you like.

SERVO TEST

•The operation of the servos can be checked by setting the transmitter and receiver power switches to ON.

•When switch [35] is switched to TEST-A, the servos move half-side first and then, come back to neutral and repeat the other-half from channel 1 to channel 8. (Channel select switch [34] to TEST-ALL position at this time.) The servos set by the channel select switch do not operate. (If set to 5, the landing gear servo does not operate.)

•When switch [35] is switch to TEST-B. all the servos operate linearly over their full travel. (Channel select switch [34] in TEST-ALL position at this time.) Only the servos set at the channel select switch are operated.

• The servo test is started by pressing button [32] and is stopped by pressing button [33].

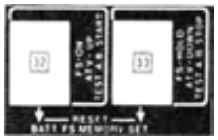


Fig. 52

BFS MEMORY SETTING

1 BFS (Battery fail safe function) is a function which moves the throttle servo to a preset position as set by the FS when there is only a small amount of power left in the receiver Nicd battery. (If not set, the throttle servo will be set to medium slow automatically.)

2 The BFS setting method is the same as the FS usage method previously described.

3 To release the throttle servo from the preset position set by BFS and regain control, lower the throttle lever in the slow direction. When the throttle lever reaches a certain point, BPS will be released and the throttle servo can be controlled for 36 seconds.

4 Setting this throttle lever point is called BFS memory setting, and is done as follows:

•First, set switch [35] to BFS MEMO.SET and set switch [34] to position [3] (throttle channel.).

• Next, while watching the movement of the servo, set the throttle lever to the desired position (between slow and medium slow recommended) and press buttons [32] and [33] simultaneously. This completes BFS memory setting.

•This memory allows setting the throttle to any position, slow to high.

•Lamp [A] of monitor lamps [24] goes out at the point where BFS is released, this allows BFS to be checked.

•When there is little power left in the receiver Nicd battery, the throttle servo automatically stops at the position set by BFS, BFS is released when the throttle lever is moved to the memorized point. Throttle can then be controlled for 36 seconds by throttle lever

•When the BFS status comes out during flight, immediately lower the throttle lever to release BFS. then quickly land.

FS/HOLD can be confirmed by monitor lamp.

Function setting can be confirmed by means of lamp [A] of monitor lamps [24].

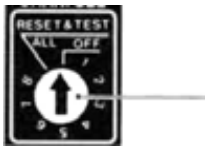
1 When switch [35] is at FS SELECT
When lamp [A] is on, HOLD and when lamp [A] **is** off, FS.

2 When switch [35] set to ALL FS, off.

3 When switch [35] set to ATV and button [32] or [33] pressed, blink.

J Channel select switch

•This switch selects the channel to be set by ATV or FS, when used in conjunction with item [1] ATV/FS button previously described. It is also the select switch for servo test and the switch which selects the channel to be by switch [35] RESET.



[34] Channel select switch

Fig. 53

Relationship among channel select switch number, servo and reset.

No.	At switch [35] FS SELECT, ATV, TEST A.B	Atswitch[35] RESET
1	Aileron	FS (fail safe)
2	Elevator	ATV
3	Throttle	BFS memory
4	Rudder	
5	Channel 5 switch	
6	Channel 6 pitch	
7	Channel 7 knob	
8	Channel 8 switch	
RESET & TEST ALL	All the servos are operated at servo test.	FS, ATV, and BFS memory are reset simultaneously.
OFF	Usually set to this OFF position.	

K Function select switch

•This switch selects ATV, FS, servo test, reset, and BFS memory setting as described at [I] ATV/FS button.

• Normally set it to OFF.

1 FS ALL
Switch to this position when setting fail safe for all channels, FS is described in the "HOW TO USE FS" section.

2 FS SELECT
This position allows setting of fail safe and hold as described in the "HOW TO USE FS" section.

3 ATV
This position allows setting ATV as described in the "HOW TO USE ATV" section.

4 TEST A
This position allows servo test A as described in the "SERVO TEST" section.

5 TEST B
This position allows servo test B as described in the "SERVO TEST" section.

6 BFS MEMO SET
Switch to this position when setting the BFS release point as described in the "BATTERY FS MEMORY SETTING" section.

7 OFF
Normally set to this position.

35 Function select switch

Fig. 54

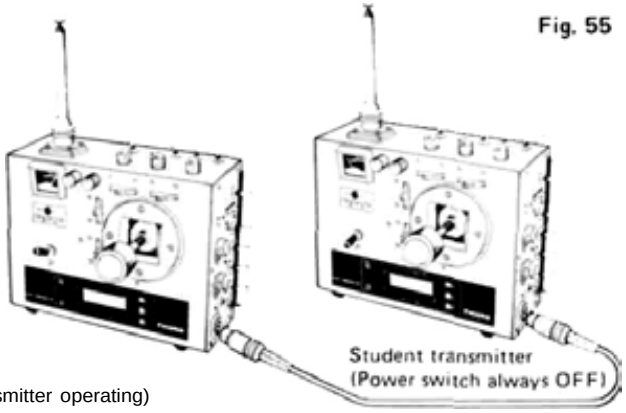
39 Trainer cord socket

40 Trainer switch
Push on/self-off switch. The transmitter connected by the trainer cord (M-TC) operates and when it is OFF, your-own transmitter only operates.

Trainer

Connect the transmitters with the trainer cord (M-TC-FM, purchased separately) as shown in Fig. 55. When the switch is in the ON (push) position, the student's transmitter operates and when the switch is in the OFF position, the instructor's transmitter Operates. The transmitter at which the trainer switch is operated on-off becomes the instructor's.

Fig. 55



Instructor transmitter
(Power switch ON and transmitter operating)

RECEIVER AND SERVOS

FS (Fail safe) and HOLD functions

•The HOLD function holds all the servos at the position immediately before a bad set of signal is received. When normal radio waves arrive, or the interference disappears, hold is released.

•The FAIL SAFE function moves the servos to a preset position set at the transmitter, one second after interference is received. When the interference disappears, FAIL SAFE is released.

Although already described in the transmitter section, FS (fail safe) is a function which moves the servo of all the channels to the position preset at the transmitter when continuous strong noise is received by the receiver for about one second or longer. The set operates in the hold mode during the one second the noise or interference is received.

B.F.S, (battery fail safe) function

The B.F.S, locks the throttle channel only in the position preset by FS when there is very little power left in the receiver and servo side Nicd battery. (If nothing is set, the throttle channel becomes medium slow.) The throttle channel can be released and operated for 36 seconds by moving the throttle stick in the slow direction. After 36 seconds, the set reenters the B.F.S. mode. When the set enters the B.F.S, state, immediately land the aircraft.

PRECAUTIONS

•Connect the receiver, servo switch, and battery firmly as shown in Fig. 57. Then extend the transmitter and receiver antennas to their full length.

•Set the transmitter power switch to ON, then set the receiver switch to ON. The servos stop near the neutral position. Operate the transmitter sticks and check that each servo follows the movement of the stick.

•Connect the pushrod to each servo horn, then check if the direction of travel of each servo matches the direction of operation of its transmitter stick. If the direction of servo travel is opposite the desired direction, switch the servo reversing switch.

•Operate each servo to its full stroke and check if the pushrod binds or is loose. Unreasonable force applied to the servo horns is not only bad for the horns, but will also cause the battery to run down quickly. Always make the stroke of each control mechanism somewhat larger than the full stroke (including the trim component) of the servo horn. Adjust the servo horns so they move smoothly even when the trim lever and stick are operated simultaneously in the same direction.

•Be alert for noise.

This set has noise rejection circuits, however, noiseless parts are recommended.

•When installing the switch harness, cut a rectangular hole somewhat larger than the full stroke of the switch, and install the switch so it moves smoothly from ON to OFF. Install the switch inside the fuselage and attach a piece of wire to the switch so it can be turned on and off from the outside. Install the switch where it will not be exposed to engine oil, dust, etc.

•Even though the receiver antenna may appear to be too long, do not cut or bundle it.

•Install the servos securely. Tighten the mounting screws until the rubber damper is slightly crushed. If the screws are too tight, the cushioning affect of the rubber damper will be lost.

•The crystal can be changed from the outside of the receiver case. Always use the Futaba transmitter/receiver matched crystal set to change the band.

•A spare servo horn is supplied with the set. Use this horn as needed.

•Use extension cords as needed.

•Wrap the receiver in sponge rubber. Water- and dust-proof the receiver by placing it in a plastic bag and wrapping a rubber band around the mouth of the bag. Do the same with the receiver/servo battery.

•Use the rubber bands wrapped around the receiver to hold the servo and switch leads.

•After mounting is complete, recheck each part, then check the transmitting range by making the transmitter antenna as short as possible, extending the receiver antenna to its full length, and operating the transmitter from a distance of 20m to 30m from the receiver. The movement of each servo should follow the movement of each transmitter stick.

PCM RECEIVER FP-R118GP

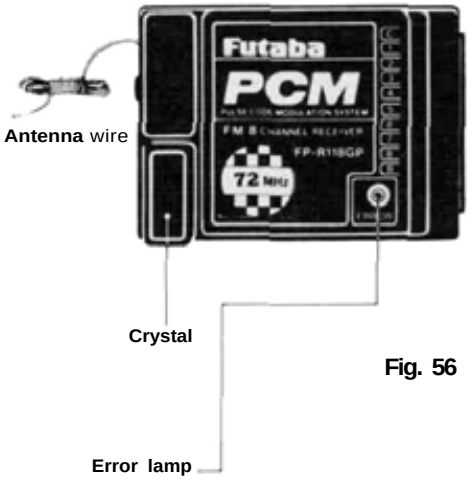


Fig. 56

- System checking can be performed with this lamp.
- When the receiver and servo side Nicd is connected and this LED is on, radiowaves are not being received from the transmitter, check to be sure the frequency is correct. Checking is possible by the lamp being on.
- When strong noise has been received, or the radiowaves from the transmitter are intermittently interrupted, this lamp will blink. This usually is not a problem.

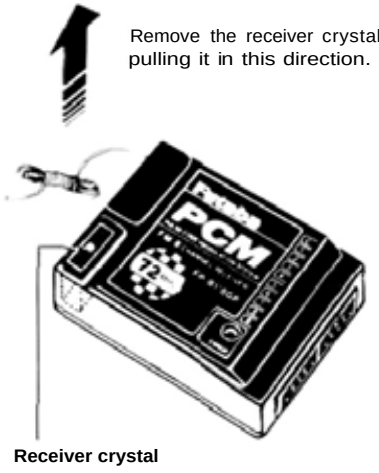


Fig. 58

Receiver, servo switch, and battery connections

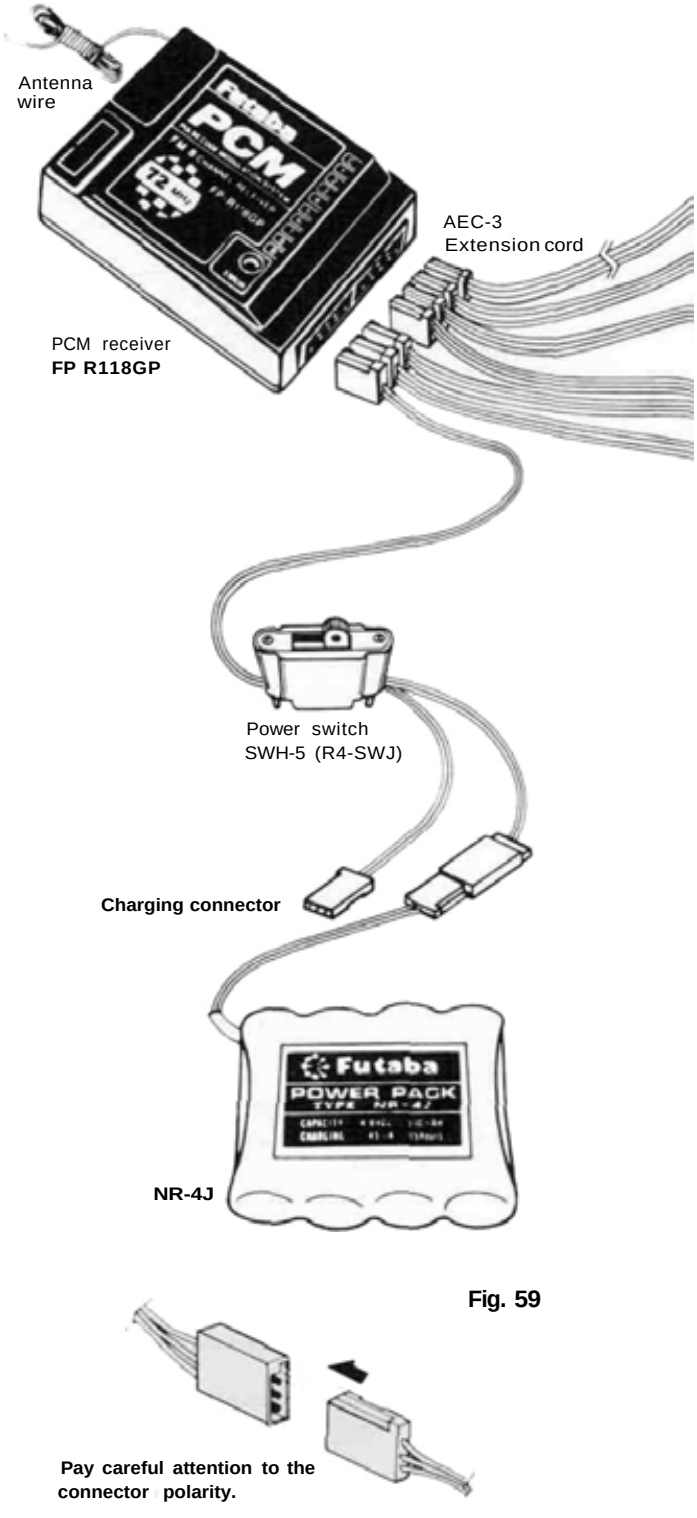


Fig. 59

Pay careful attention to the connector polarity.

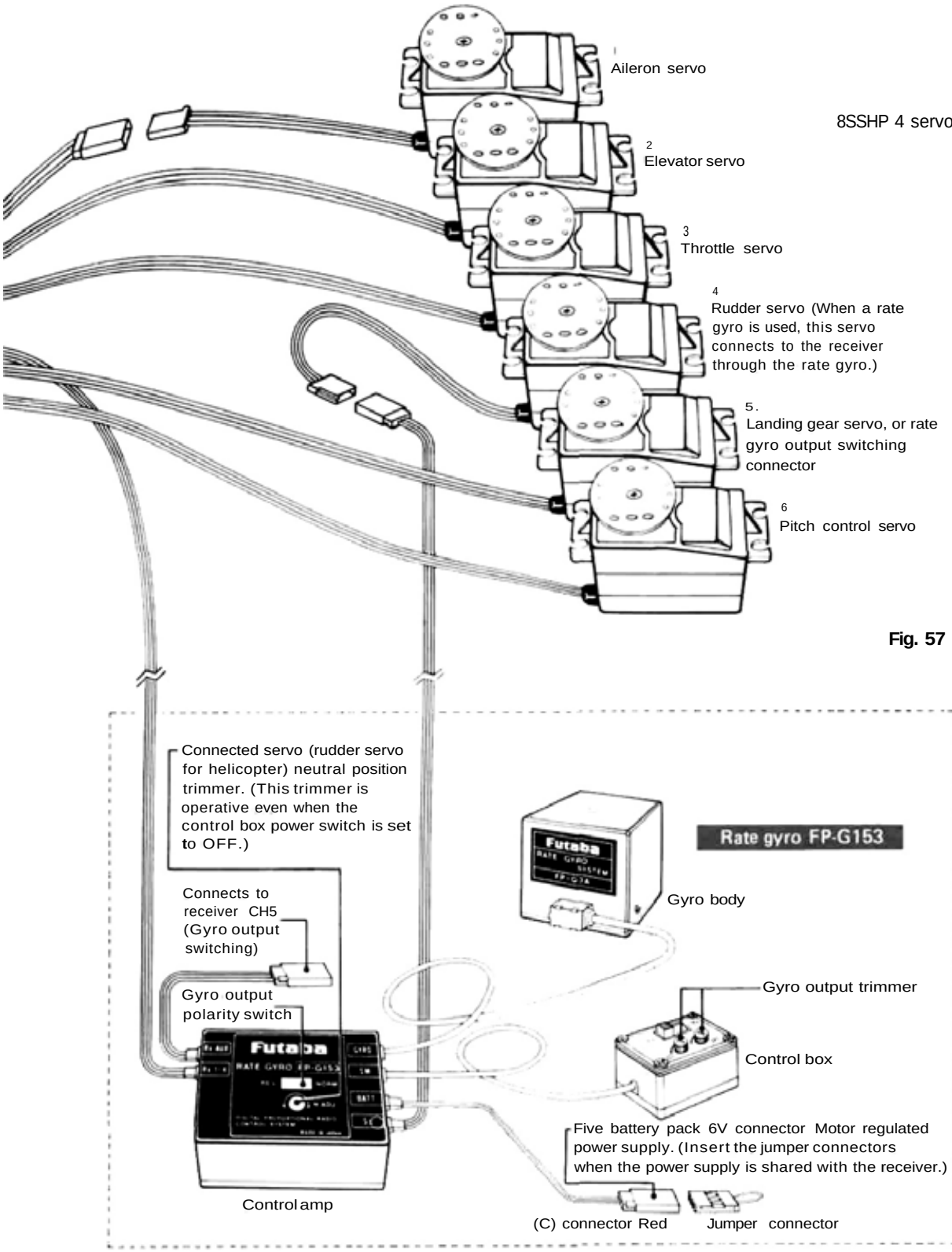

1
Aileron servo
8SSHP 4 servos
2
Elevator servo
3
Throttle servo
4
Rudder servo (When a rate gyro is used, this servo connects to the receiver through the rate gyro.)
5.
Landing gear servo, or rate gyro output switching connector
6
Pitch control servo
Connected servo (rudder servo for helicopter) neutral position trimmer. (This trimmer is operative even when the control box power switch is set to OFF.)
Connects to receiver CH5 (Gyro output switching)
Gyro output polarity switch
Futaba
Rate gyro FP-G153
Gyro body
Gyro output trimmer
Control box
Five battery pack 6V connector Motor regulated power supply. (Insert the jumper connectors when the power supply is shared with the receiver.)
Control amp
(C) connector Red
Jumper connector

Fig. 57

•General adjustments

Make the basic fuselage linkages and adjustments according to the helicopter manufacturer's assembly and adjustment instructions.

1. Check the direction of operation of each servo. If the servo rotates in the wrong direction, switch the setting of the pertinent servo reserving switch.
2. Set the idle up [1] switch [19], idle up [2] switch [21] and throttle hold switch [23] to OFF (to the opposite side).
3. Set the hovering pitch lever [6] and hovering throttle knob [22] to about the center of the scale.
4. Check the left and right (up and down) throw of each servo. If the throw is wrong, correct it with the ATV trimmer and by changing the hole position of the servo horn, etc.
5. Set the throttle lever [3] to about the center medium slow position and set the hovering memory switch [34] to ON.
   Set the compensation setting amount to 0 by turning the hovering mix compensation setting trimmer [16] on the trimmer panel at the back of the transmitter.
6. Set the revolution mixing up knob [17] to about division 5 and the revolution mixing down knob [18] to about division 7.
7. Check the pitch control -> rudder mixing direction. If the direction is wrong, correct it with switch [22] on the trimmer panel on the back of the transmitter.
8. Recheck the operating and mixing directions of each servo, and set the hovering memory switch [34] to OFF,
9. Check the engine and throttle linkage.
   - o Pull throttle when throttle lever in high position Zero throttle when throttle lever in maximum slow position and throttle trim in maximum slow position.
   - o Set the ATL (Adjustable Throttle Limiter) to the maximum limit. This is very convenient because the high side does not change even if the slow side is adjusted.
10. Turn the normal pitch trimmer [4] (high side pitch trimmer [3] at the pitch trimmer [B] on the trimmer panel at the back of the transmitter and set the pitch control high side trimmer [13] to the maximum (upper) position. Set for maximum pitch control servo throw when the throttle lever is operated over its full stroke. Set the maximum pitch width and set the pitch control high side trimmer lever [13] to about the center.

Connect the linkage so the main rotor pitch variation width is somewhat larger than that recommended by the helicopter manufacturer.

11. Start the engine. After needle adjustment, hover the helicopter, trim the ailerons and elevators, and make the main rotor pitch larger during the next hovering with the fuselage linkages. Then trim with the hovering throttle knob [22] and pitch control trimmer [6] . Adjust the throttle lever position at hovering to 50% to 55% of its full stroke.
12. Trim the rudder by adjusting the linkage so the rudder is in the neutral position when hovering.
13. After adjusting all the trim levers, hover and set the hovering memory switch [34] to ON. The memorized hovering point remains memorized even when the transmitter power is turned off. It is cleared when the hovering memory switch [34] is set to OFF.
14. If the helicopter slips to the right when hovering, increase the mixing amount by turning the revolution mixing down side knob [18] clockwise. If the helicopter slips to the left. turn the knob counterclockwise.
15. If the helicopter slips to the left when climbing from hovering, turn the revolution mixing up knob [17] clockwise. If the helicopter slips to the right, turn the knob counterclockwise.
16. Next adjust the acceleration amount with trimmer [15] of the rudder trimmers [D] on the trimmer panel at the back of the transmitter. Although it depends on the helicopter, it should have some effect because of the interaction with the rate gyro output. For fixed pitch helicopters, a pitch of about 0 is usually suitable.
17. Adjust the normal pitch trimmer [4] of the pitch trimmers [B] on the trimmer panel of the ideal pitch at takeoff. Although it depends on the helicopter, a pitch of about 0 is usually suitable.
18. Rate gyro output adjustment (when FP-G152 used)
    - • Hovering
      Set the rate gyro control box scale to about 40% to 80% of full scale, depending on the helicopter. Increase the gyro output within the range at which the tail does not swing back and forth.
    - • Maneuvering
      Set the rate gyro control box to about 30 to 50% of full scale, depending on the helicopter. Adjustment within the range at which the tail does not swing during high speed level flight is suitable.
19. Adjust the pitch control high side trim lever [3] so the pitch is reduced during high speed level flight so that the main rotor does not load the engine. When flying in a strong wind, increase the pitch slightly with this lever. Adjust to the conditions for the time of day while flying.

•Revolution Mixing Compensation Adjustment

When high speed level flight is performed with a helicopter, the tail rotor reverse torque required is small, however the high side revolution mixing amount is large, the fuselage will veer to the right. The power loss by the tail rotor becomes large. (Opposite when the main rotor rotates counterclockwise.)
If only the mix amount "up side" is reduced at the high side about 70% of the throttle stick at this time, maneuverability also improves and the power loss is also reduced.

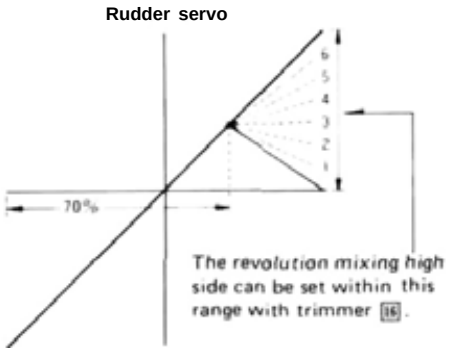


Fig. 60

1 Fly in level flight at full speed.
2 When the speed does not increase at high speed flying, or when the helicopter swings to the right, when the speed does not increase while the helicopter rises vertically, etc., the revolution mixing amount is probably excessive.
3 Adjust the compensation setting amount with trimmer [16] and set it so that the revolution mixing amount is reduced at throttle lever maximum.
4 The compensation setting amount should normally be about 3 ~ 4 of Fig. 60 for fuselage system and 4 ~ 5 tor frame system.
5 Fly at full speed again to adjust the trimmer [16] maximum for highest acceleration at high speed and vertical moving up.
6 Since the set value depends on the diameter and shape of the tail rotor, adjust repeatedly for maximum linearity and power.

•IDLE UP 1 ADJUSTMENT

1 Hover and check the throttle lever hovering position.
2 Stop the engine, set the throttle lever to the hovering position, and set the idle up 1 knob [20] to division 10 (maximum). Adjust the idle up point up and down with trimmer [9] of the throttle trimmers [C] on the trimmer panel at the transmitter. Make this adjustment so that the throttle servo does not operate when switch [19] is turned ON and OFF. Idle up is maximum at this point.
3 When the idle up 1 switch [19] is set to ON, the throttle servo operates up to the position set at the idle up 1 knob [20] .
4 Set the idle up 1 knob [20] to 0, start the engine, and set the throttle lever to maximum slow.
5 Next, set switch [19] to ON and turn knob [20] slowly clockwise. While slowly accelerating the engine, set the rotor speed to the same speed as when hovering.
6 With this setting, the change in the main rotor and tail rotor speed from takeoff to hovering is small, the change in the effect of the rate gyro and servos is also small, and aerobatics are extremely easy.

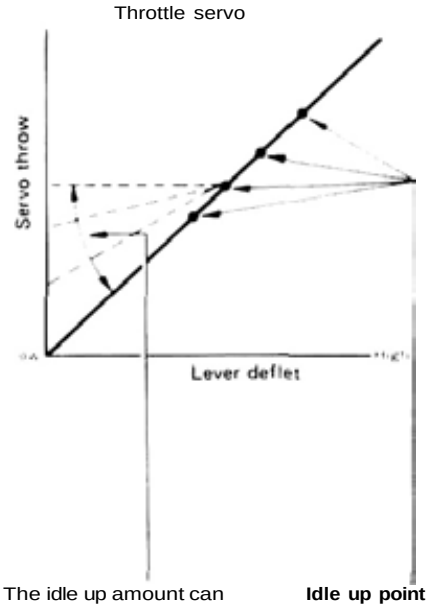
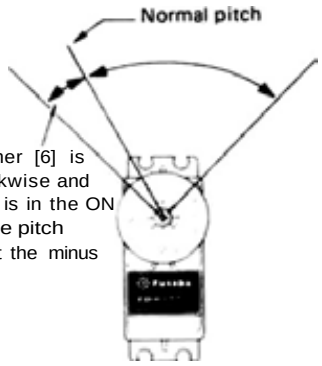


Fig. 61

•IDLE UP 2 ADJUSTMENT

1 When the idle up 2 switch [21] is set to ON, the idle up amount (throttle servo stop position) can be adjusted with trimmer [10] of the throttle trimmers [C] on the trimmer panel at the back of the transmitter. The low side pitch can be adjusted with trimmer [6] of the pitch trimmers [B] on the trimmer panel on the back of the transmitter.
2 When trimmer [10] is turned clockwise, idle up is applied. (See Fig. 61.)
3 Set the idle up 2 point trimmer [11] for dynamic patterns.
4 Adjust the low side pitch to match rolls and other dynamic pattern with trimmer [6].



When trimmer [6] is turned clockwise and switch [21] is in the ON position, the pitch increases at the minus side.

Pitch control servo

Fig. 62

•Throttle hold and throttle hold delay adjustment for auto-rotation

1 When the throttle hold switch [23] is set to ON, the throttle circuit is disconnected from the throttle lever and only pitch control can be performed with the lever.
2. The auto-rotation pitch can be adjusted with trimmer [5] of the pitch trimmers [B] and the auto-rotation throttle servo stop position can be adjusted with trimmer [8] of the throttle trimmers [C] ***on*** **the trimmer panel at the back of the transmitter.**
3. Adjust trimmer [5] for a pitch of about minus 2 when switch [23] is ON and the throttle lever is in the maximum position. (This pitch differs somewhat with the helicopter.)
4. Adjust trimmer [8] so the engine stops (throttle fully closed) when entering auto-rotation and when switch [23] is in the ON position and idles (throttle slightly open) during practice.
5 Adjust the maximum pitch when switch [23] is set to ON with the ATV button.
The pitch servo moves to the position set at the ATV button without regard to the position of the pitch control high side trim lever [13].
6 Throttle hold delay adjustment
Set the hold delay trimmer [7] full counterclockwise to the 0 position.
• Next, perform auto-rotation. When the drop is fast the instant throttle hold is applied, turn the hold delay trimmer [7] and set it for a constant drop.
•Set the hold delay trimmer [7] to the minimum required time. Normally, about 0.7 second. This is about 30% to 40% by trimmer position.
7 When performing auto-rotation using hold delay, set the throttle lever to maximum slow, then immediately turn on throttle hold switch [23].
• If you are not familiar with auto-rotation, use the set with the hold delay trimmer [7] turned fully counterclockwise to 0 hold delay.

• Rudder button adjustments

1 When the rudder button [33] is pressed, the rudder servo moves in the direction and to the angle set at trimmer [17] of the rudder trimmers [D] on the trimmer panel at the back of the transmitter.
2. The time the rudder is operated can be set with the rudder time trimmer [18] on the trimmer panel at the back of the transmitter.
3 Set the rudder servo throw to the direction and angle matched to 540* for stall turns and other spinning maneuvers.

[Fail safe switches]

After you have become completely familiar with your set, set switches 12, 13, 14, 19 and C on the trimmer panel at the back of the transmitter to the ON position. When first using your set, practice with the switches in the OFF (INHIB) position.

FP-T8SSHP INVERTED FLIGHT SPECIFICATIONS
HANDLING PRECAUTIONS

- When the [C] inverted flight FS switch at the rear panel trimmers is switched to the INVERT position, normal flight <-> inverted flight switching,can be performed with the Inverted flight ON-OFF switch.

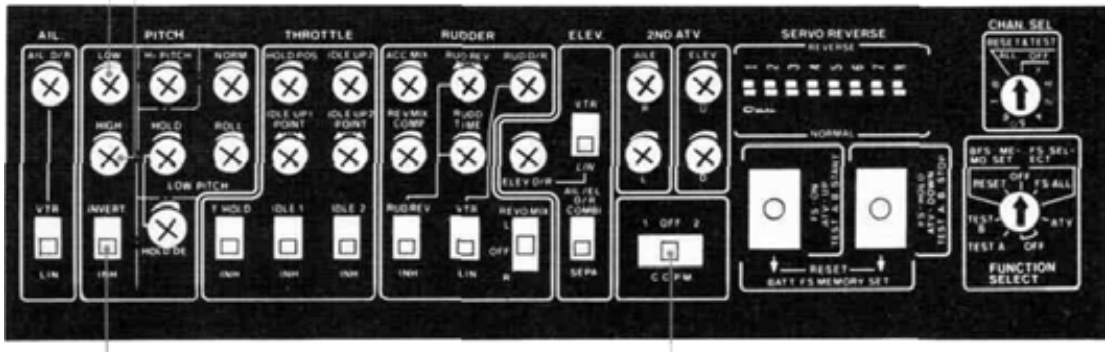
- Note that the cyclic corrective pitch mixing (optional) function and inverted flight function are not performed simultaneously.
  * When the [30] CCPM switch and [C] inverted flight FS switch are set to ON, the CCPM function has priority.

FP-T8SSHP INVERTED FLIGHT SPECIFICATIONS
TRIMMER PANEL

[A] Inverted flight low-side trimmer

B] Inverted flight high-side trimmer

Fig. 63



[C] Inverted flight FS switch

30 CCPM switch (optional)

• The inverted flight function can be turned on and off with the [C] inverted flight FS switch on the trimmer panel at the back of the set.

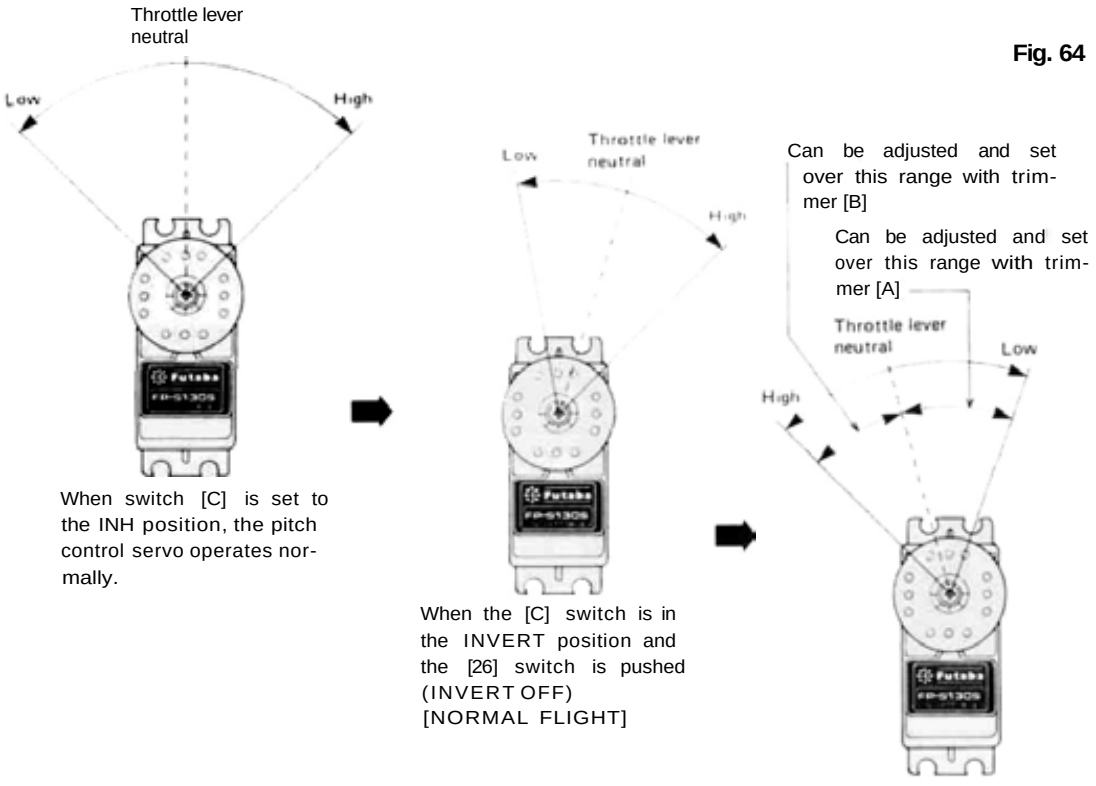
* INVERT: Inverted flight function ON
INH : Inverted flight function OFF

•When the [C] switch is in the INVERT (function ON) position, normal flight <-> inverted flight switching can be performed with the [26] Inverted flight ON-OFF switch at the side top corner of the transmitter.

* When the [26] switch is pushed, normal flight is selected. At this time, the pitch can be adjusted with trimmers [3, 4 5, 6, and 7] as usual. When the [26] switch is pulled, inverted flight is selected. At this time, the pitch control servo, elevator servo, and rudder servo are reversed and the pitch control servo low-side and high-side throws can be adjusted with trimmer [A] and [B].

When the [C] inverted flight FS switch and [26] Inverted flight ON-OFF switch are switched, the [A] inverted flight low-side trimmer and [B] inverted flight high-side trimmer operate the pitch control servo (servo connected to channel 6 of the receiver) as shown in the figure.

Fig. 64



When switch [C] is set to the INH position, the pitch control servo operates normally.

When the [C] switch is in the INVERT position and the [26] switch is pushed (INVERT OFF) [NORMAL FLIGHT]

When the [C] switch is in the INVERT position and the [26] switch is pulled (INVERT ON) [INVERTED FLIGHT]

INVERTEDFLIGHTPREPARATIONS

- Set the [C] inverted flight FS switch on the trimmer panel at the back of the set to the INVERT position.
- At this time, pitch control servo, elevator servo, and rudder servo forward **< - >** reverse switching can be performed with the [26] switch and normal <-> inverted flight switching can be performed.
- When the [26] switch is pulled (inverted flight function ON) when the [3] throttle lever is in the neutral (center) position, the neutral position of the pitch control servo moves to the plus side (pitch HIGH side at the rear panel).
- When connecting the linkage with the inverted flight specifications, always set the [C] switch to the INVERT position.
- Then adjust the set so that normal flight is normal.
- After adjusting normal flight, adjust inverted flight.
  * Before flight, set the [26] switch to the back position (inverted flight function ON) and set the throttle lever to maximum slow, then set the minimum pitch at inverted flight with the [A] trimmer.
  * Next, set the throttle lever to maximum high and set the maximum pitch at inverted flight with the [B] trimmer.
  * The [A] and [B] trimmers can be adjusted only when the [26] switch is in the back (inverted flight function ON) position.
  * Since the [6] hovering pitch lever and [13] pitch control high side trimmer lever control the pitch control servo even at inverted flight, they can be adjusted to the optimum pitch.

FLIGHT

- Perform normal flight and adjust the pitch.
- After adjustment, switch from normal flight to inverted flight.
  There are various methods of changing from normal flight to inverted flight. One method is to enter inverted flight by making a half roll from straight flight.
  * First, make a half roll from straight horizontal flight at an altitude of about 30m and when the helicopter is exactly on its back, turn on the inverted flight function by pulling the [26] switch back.
  * If the throttle lever remain high at this time, the posture of the helicopter will change suddenly. Shifting to inverted flight can be performed smoothly by lowering the throttle lever to about medium slow.
  * Learn the [26] switch switching timing, throttle lever operating setting, etc. by practicing normal flight<->inverted flight switching repeatedly.
- Next, switch from inverted straight flight to inverted hovering.
  * Lower the altitude by slowly lowering the throttle lever.
  * At this time, when the helicopter descends sluggishly and the main rotor speed drops even when the throttle lever is lowered, return to normal flight, then land and lower the lowest pitch of the main rotor at inverted flight with the [A] trimmer.
  * Set the [6] hovering pitch lever, etc. so that the main rotor speed at inverted hovering and normal hovering is about the same.
  * If the difference it too large, readjust the linkage.

  Finally, check the high side pitch.
  * Try setting the throttle lever to maximum high **at** inverted hovering.
  * If the main rotor speed drops at this time, lower the high side pitch with the [13] pitch control high side trim lever, then land and correct the [13] lever portion with the [B] trimmer.
    (Correct with the [B] trimmer so that the [13] lever position is the same at normal flight and inverted flight.)

TRANSMITTER CONTROLS

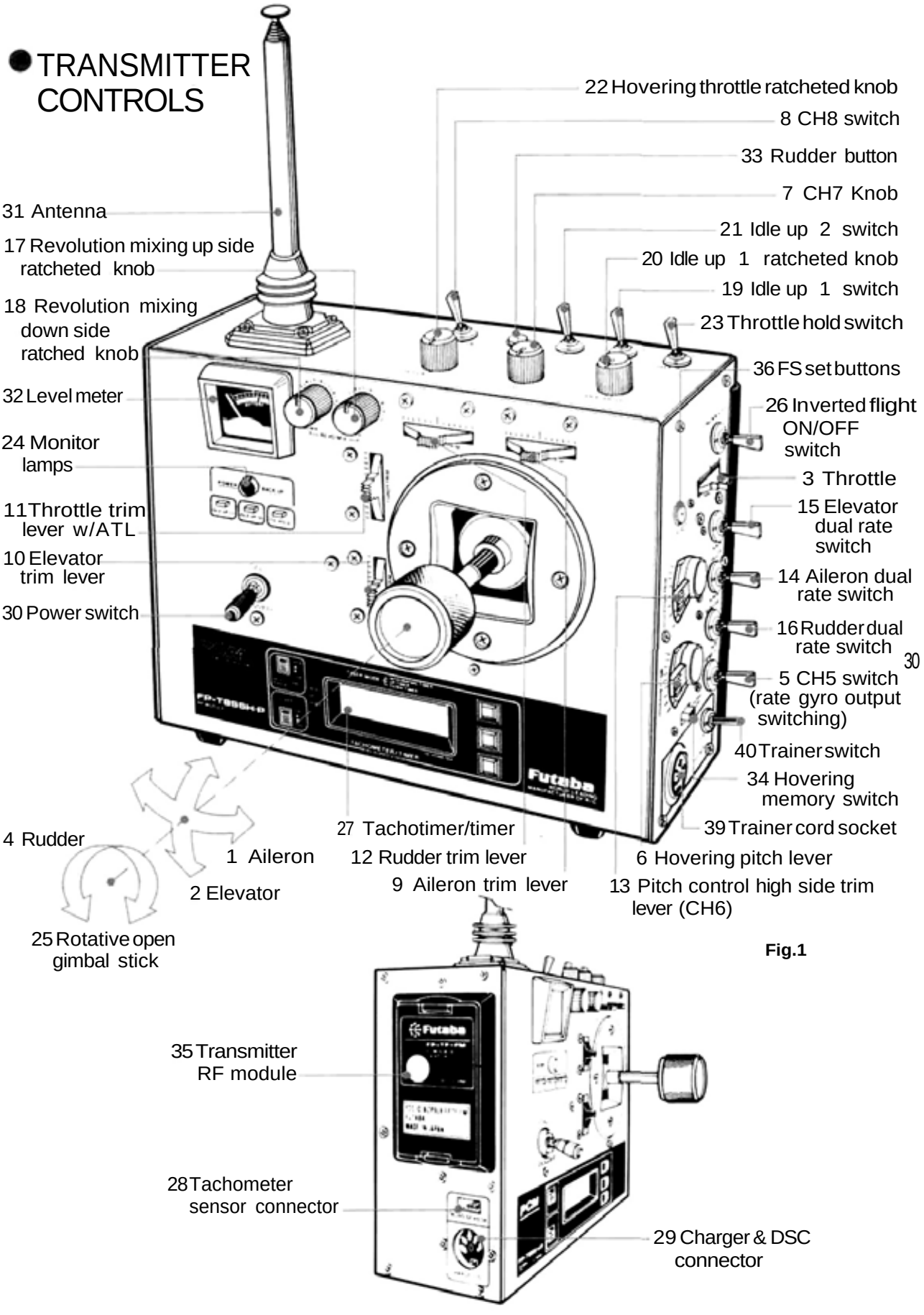
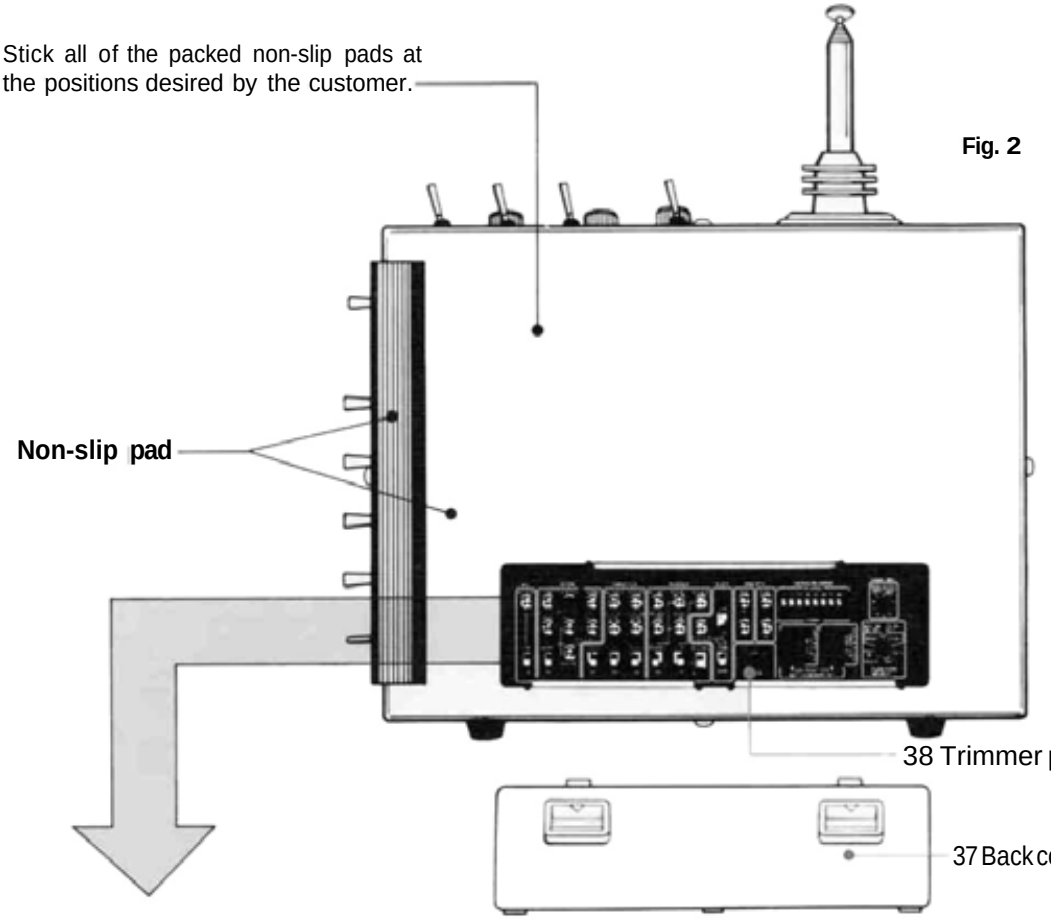


Fig.1

TRANSMITTER CONTROLS

Stick all of the packed non-slip pads at the positions desired by the customer.

Fig. 2



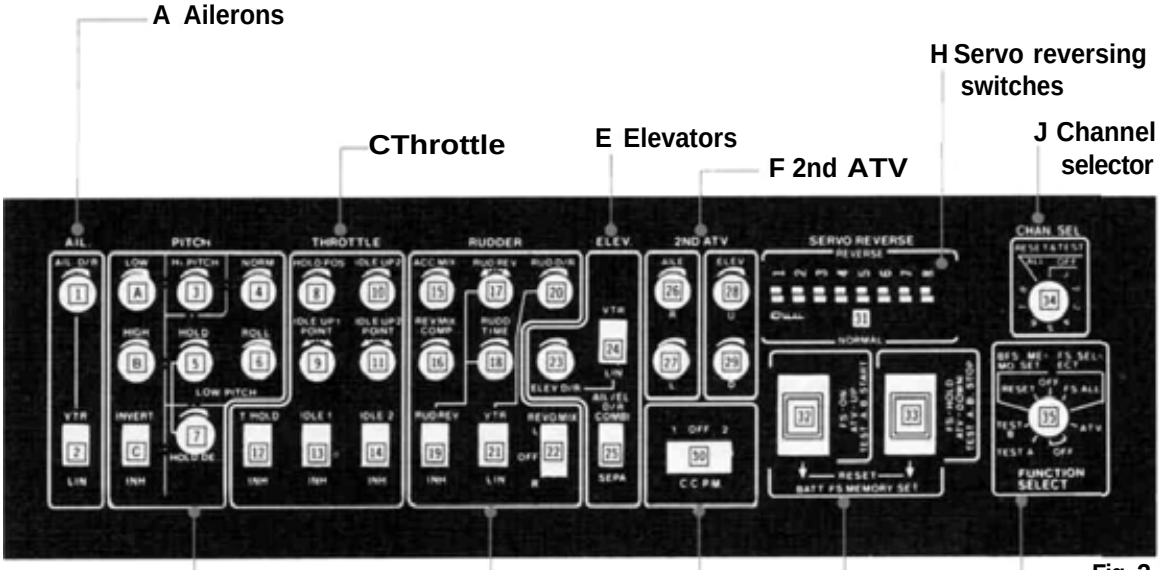


Fig. 3

SPLINED HORNS

The splined horns allow shifting of the servo neutral position at the servo horn.

Setting and shifting the neutral position

a) Angle divisions

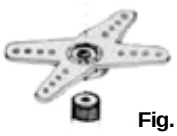


Fig. 65

1) The splined horn has 25 segments. The amount of change per segment is; 360 : 25 - 14.4"
2) The minimum adjustable angle is determined by the number of arms or number of the holes in the shaft. For four arms, the minimum adjustable angle is:

$$360 : \frac{25 \times 4}{\text{Number of divisions}} = 3.6$$

b) Effect

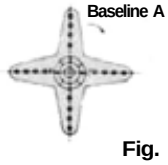


Fig. 66

To shift the holes center line "o the right (clockwise) relative to baseline A, shift arm 2 to the position of arm 1 and set it to the position closest to baseline A.

(Example] For a four arm horn. the angular shift per segment is 14.4° The shift to the right is 90" – (14.4 x 6) 3.6°

To shift the same angle in the opposite direction, use the opposite arm number.

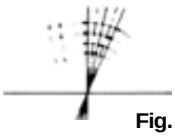


Fig. 67

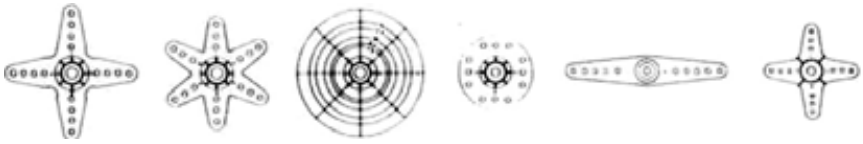
For a six arm horn, turn the arm counterclockwise and set arm 2 to the position of arm 1. The adjustable angle is 60° - (14.4 x 4) = 2.4°.

Arm 3 shift 4.8° to the right, arm 6 shifts 2.4° to the left. and arm 4 shifts 7.2° to the right and left.

Fig. 68

The following splined horns are optional.

Fig. 69



HORN A HORN B HORN C HORN D HORN E HORN F

Futaba Digital Proportional Frequencies (FOR U.S.A.)

- The frequency of Futaba digital proportional sets can be changed among bands (1)~(6) on the 27MHz band only.
- However, a 27MHz band set cannot be changed to 72MHz band, and vice versa.
- Therefore, always attach the correct frequency flag to the end of the transmitter antenna. Each frequency band has its own designated color, as stated above. The frequency flag is intended for identificantion purposes.
- Also change the frequency flag when frequency is changed.
- Futaba paired crystals are precisely matched. Always use a Futaba crystal set (transmitter, receiver) when changing the frequency.
- It is illegal to change crystals of transmitter on the 72-75MHz bands in the U.S.A.

Frequency	Channel No.	Flag Color
26 27MHz • Aircraft/Car/Boat		
26 995		**Brown**
27.045		Red
27.095		Orange
27.145		Yellow
27.195		Green
27.255		Blue
72/75MHz • Aircraft only "Shared		
72.030	12	Brown-Red ITop Flaq/Ribbon-Bottom Flag/Ribbon)
72.080		White/Brown
72.160- 72.240		White/Blue White/Red
72.320- 72.400		White/Purple White/Orange
72.550	38	Orange/Grey
72.590	40	Yellow/Black
72.630	42	Yellow/Red
72.670	44	Yellow/Yellow
72.710	46	Yellow/Blue
72.750	48	Yellow/Grey
72.790	50	Green/Black
72.830	52	G'een/Red
72.870	54	Green/Yellow
72.910	56	G'een/Blue
72.960'		White/Yellow
75.640		While/Green
75 MHz Car & Boat only		
75430	62	Blue-Red (Top Flag'Ribbon-Bottom Flag/RibbonI
75470	64	Blue-Yellow
75510	66	Blue-Blue
75550	68	Blue-Grey
75.590	70	Purple-Black
75670	74	Purple-Yellow
75.7)0	76	Purple-Blue
75.750	78	Purple-Grey
75.790	80	Grey.Black
75B30	82	Grey-Red
75fl70	84	
53MHz • Aircraft/Car/Boat • FCC Amatuer License Required		
53.100		Black/Brown
53.200		Black/Red
53.300		Black/Orange
53.400		Black/Yellow
53.500		Black/Green
53.600		Black/Blue*
53.700		Black/Purple* *Not generally in use*
53.800		Black/Grey*

FP-S130 EXPLODED VIEWS

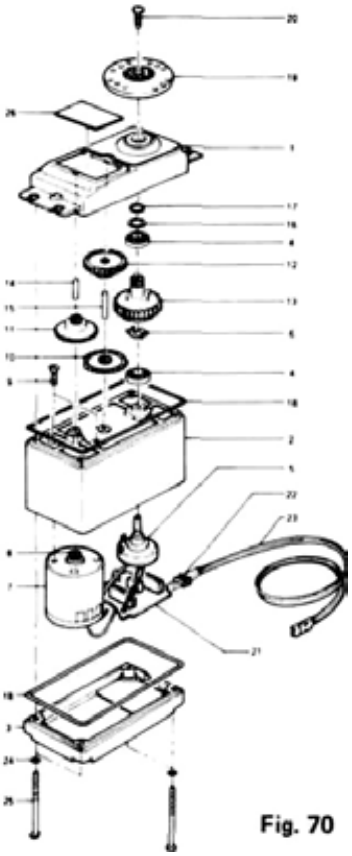


Fig. 70

No.	Part Name	Part No.
1.	Upper case	FCS 30
2.	Middle case	FCS 30
3.	Bottom case	FCS 30
4.	Ballbearing	S04130
5.	Potentiometer	I39995
6.	VR drive plate	S02753
7.	Motor	S91243
8.	Motor pinion	S02461
9.	1st gear	FGS30
10.	2nd gear	FGS30
11.	3rd gear	FGS30
12.	Final gear	FGS-30
13.	2nd shaft	S02481
14.	Intermediate shaft	S02480
15.	Spacer washer 0.3T	S02486
16.	Seal ring	S90415
17.	0-nng	S90426
18.	Servo horn D	FSH-6W
19.	Horn mouting screw	FSH-41
20.	Printed wiring board S130	AS1220
21.	Lead wire packing	S90045
22.	S130 3PB-WRB-300	FPC-8M
23.	Screw 0-nng	S90410
24.	Case mounting screw	J50085
25.	S130 Nameplate	S60101

GUARANTEE

Your NEW FUTABA Digital Proportional R/C system is guaranteed against defacts in workmanship and material for 180 days from the date of purchase when the attached registration card is returned to us within ten days of purchase.

This Guarantee is null and void if the R/C system has been improperly handled, damaged in a crash, or tampered with and does not cover the replacement of plastic housings or electronic components damaged due to the use of improper voltages.

When service is required, please take your 'uipment to your local authorized service station or ship it directly to us. All postage, shipping, and insurance changes must be paid by the user.

FACTORY REPAIR SERVICE

To insure prompt service, please follow the instructions given below.

1. Charge the batteries for **at** least 18 hours prior to shipment.
2. Return the system only. Not your complete installation. **Remove the servos from their** mounts and remove the foam **padding** from the receiver.
3. Plugs or other modifications which interfere with factory test procedures will **be** relumed to factory standard at your expense.
4. Carefully pack all components **individually, using sufficient packing material to prevent damage** during shipment.
5. Include a brief but thorough explanation **of** all problems **and** service required **and tape** it **to** the back **of** the transmitter Place a label describing the function of the servo on each servo.
6. **Be** sure to include your full **address** and tel. **No..** zip **code** inside the **box as** well as on the outside.
7. **Include a packing list of all items being returned, and double check to make sure that all items are packed.**
8. **Upon** receipt of your equipment al the Futaba factory, an estimate of the **cost** of **repair** (over $25 00 only) will be sent to you- Your equipment will then **be repaired** and returned to you upon receipt of payment or C O.D. (cash),

This factory repair service applies only 10 the continental U.S.A., Hawaii, and

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FUTABA CORPORATION OF AMERICA
555 West Victoria Street, Compton, Calif. 90220, U.S.A.
Phone: 213-537-9610 Telex: 23-0691227 Facsimile: 213-637-8529

FUTABA CORPORATION
Tokyo Office: Inagaki Bldg., 1-21-3, Kanda Suda-cho, Chiyoda-ku, Tokyo 101, Japan
Phone: (03) 255-6811 Facsimile: (03) 255-6880

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