

Futaba

DIGITAL PROPORTIONAL
RADIO CONTROL

PCM1024H

PULSE CODE MODULATION SYSTEM

INSTRUCTION MANUAL

FP-9VHP

PCM 9 CHANNELS
FOR F3C HELICOPTER



FUTABA CORPORATION OF AMERICA
FUTABA (EUROPE) GmbH
FUTABA CORPORATION

**Thank you for purchasing a FUTABA
digital proportional radio control set
Please read this manual carefully before using your set
The last page of this manual
is a three-part foldout
Refer to this foldout when reading the manual.**

TABLE OF CONTENTS

<p>FEATURES 1 ~ 2</p> <p>SET C O N T E N T S 3</p> <p>RATINGS 3</p> <p>RECEIVER AND SERVOS 4~5</p> <p>Nicd BATTERY CHARGING 6</p> <p>BASIC TRANSMITTER T9VHP CONTROL 7~9</p> <p>OPERATING INSTRUCTIONS</p> <p>TIMER 10-11</p> <p>TACHOMETER 12</p> <p>LOW BATTERY WARNING 12</p> <p>BACK-UP WARNING 13</p> <p><SYSTEM PROGRAMMING></p> <p>EDIT PROGRAM KEY 13</p> <p>REVERSE 14</p> <p>FAIL SAFE (F/S) 14-15</p> <p>ADJUSTABLE TRAVEL VOLUME (ATV) 16</p> <p>ADJUSTABLE FUNCTION RATE (AFR) 17</p> <p>DUAL RATE (D/R) 18-19</p> <p>END SOFT KEY 19</p> <p>EXPONENTIAL (EXP) 20-21</p> <p>MIXING 22</p> <p>PROGRAMMABLE MIXING 23-27</p> <p>PITCH</p> <p>PITCH CURVE 28-30</p> <p>HOVERING PITCH/PITCH TRIM 31</p> <p>HOVERING OFFSET 32</p>	<p>RUDDER MIXING (ROTOR DIRECTION, REVOLUTION MIX, ACCELERATION MIX, RUDDER OFFSET) 33-34</p> <p>SWASH MODE 35-37</p> <p>THROTTLE MIXING 37-39</p> <p>THROTTLE CURVE 38-39</p> <p>HOVERING THROTTLE 38-39</p> <p>IDLE-UP 1, 2 40-41</p> <p>THROTTLE HOLD (AUTO ROTATION) 42-43</p> <p>RUDDER TO THROTTLE (RUDDER ^ THROTTLE MIX) 43</p> <p>TRIM (CROSS TRIM, TRIM MEMORY) 44-45</p> <p>PARAMETERS (SERVO TEST, MIXING MODE, PCM/PPM, D/R SW DIR. COMBI S W) 46</p> <p>MODEL SELECTION 47</p> <p>MODEL COPY 48</p> <p>NAME 49</p> <p>SERVO (TEST MODE) 50</p> <p>RESET 50</p> <p>SPLINED HORNS 51</p> <p>SOFT MAP 1 52-53</p> <p>T9VHP TRANSMITTER CONTROLS 54-55</p> <p>SOFT MAP 2 56</p> <p>SERVO EXPLODED VIEW 57</p>
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WARNING:

The FUTABA PCM1024H system has numerous operating features and is designed for serious and experienced radio control hobbyists. Newcomers to the hobby should seek advice and assistance in operating this set. Improper operation can result in property damage and/or serious personal injury. Radio control model helicopters and airplanes are not toys. If you are new to the hobby, it is recommended that you contact your local hobby dealer regarding clubs and individuals offering advice and assistance to beginners.

•FEATURES

The PCM1024H was specially-developed to meet the needs of the serious and demanding R/C Helicopter hobbyist. Numerous features make this system adaptable to a wide variety of complex radio control helicopters and stunt and scale aircraft. This is the most advanced system available for FAI R/C Helicopter (F3C) competition. The built-in microprocessor utilizing PCM (Pulse Code Modulation) makes this set very versatile and extremely noise and deadpoint resistant.

Please read this manual carefully before using your set.

TRANSMITTER FP-T9VHP

- Programming data is displayed pictorially and graphically on a large, easy-to-read LCD (Liquid Crystal Display) panel. Programming and Cursor keys allow convenient adjustment of aircraft functions.
- "1024" Channel Resolution: New 1024 PCM encoder format provides unexcelled servo resolution and response time.
- RF module uses a narrow band modulation circuit and PCM transmission.
- Precise control is made possible by three different endpoint adjustment functions: Adjustable Travel Volume (ATV), Adjustable Function Rate (AFR), and Adjustable Trim Rate.
- Dual Rates, Exponential, and Variable Trace Rate (VTR) functions provide unlimited flexibility in "fine tuning" aircraft control response.
- There are many functions for collective pitch, throttle, and rudder, including four adjustable pitch and throttle curves (plus inverted program). Precise and convenient adjustments enable optimum helicopter performance.
- Four programmable mixing circuits allow many diverse applications for the control of complex helicopters and fixed-wing aircraft.
- Four kinds of "swash plate mixing" are available for direct control and mixing of cyclic and collective pitch functions (CCPM).
- Programming for up to 6 different models (including model name) can be stored in the transmitter memory. Memorized data is protected by a 5 year lithium battery.
- Accessory "Sub-Trimmers" are provided on the transmitter front for convenient field adjustment of frequently-used functions.
- Trim positions for each model can be memorized by the Trim Memory Function, allowing the trim levers and sub-trimmers to be returned to neutral. Neutral positions can be reproduced in the future, or copied onto another model program if desired.
- The Tachometer function measures engine rpm by means of a built-in sensor.
- Speed (rpm) can be measured for 1 to 5 bladed propellers.
- Digital alarm/timer has Up, Down, and Rhythmic timing modes.
- Integrating (Total Timer) timer monitors total transmitter ON time.
- Ball bearing open gimbal sticks, angled switches, and "human-engineered" transmitter case enhance the feeling of comfort and precision in transmitter operation.
- "Quick Change" Nicd battery pack is easily accessible by means of a convenient panel on the transmitter back.
- Power Off function turns off the transmitter power automatically if the controls are not operated for 30 minutes.
- PCM or standard PPM operation can be selected. (Allows operation of standard FM receivers on the same frequency.)
- DSC (Direct Servo Control): The DSC cord allows operation of all servos without turning on the transmitter. The voltage of the transmitter and receiver Nicd batteries can also be read simultaneously using the cord.
- Servo reversing is available on all channels.
- Auto Dual Rate: If desired, aileron, elevator, and rudder dual rate can be turned ON and OFF automatically, according to throttle stick position.
- Stick length and angle is easily adjusted.
- Knobs and levers are conveniently located for adjustments of Idle-Up functions. Revolution Mixing, Hovering Throttle and Pitch, etc.

RECEIVER FP-R129DP

- Extremely quick response, high resolution, and high reliability are achieved with a newly-developed, low voltage PCM decoder.
- RF amplifier and monolithic IF amp designed for high sensitivity.
- Dual conversion "1991" design with ultra narrow-band ceramic filter is immune to adjacent band interference (cross modulation interference, mutual modulation interference) and spark noise.
- Fail Safe and Battery Fail Safe functions provide greater safety and reliability.
- Servo Hold function eliminates "glitches" during momentary signal losses or strong interference.
- Gold-plated connector pins provide positive contact.
- DSC System: Operation of all servos is possible without turning on the transmitter by connecting the accessory cord directly to the C terminal of the receiver.

SERVO FP-S9201

- High torque and high speed water-and dust-proof servo with highest-quality coreless motor, Output torque 5 kg-cm (69.5 oz.-in.). Operating speed 0.22 sec/60 .
- New indirect drive potentiometer improves vibration and shock resistance and neutral precision tremendously.
- Futaba custom 1C provides high starting torque, narrow dead band, and excellent trackability. Neutral holding force is also improved substantially.
- Fiberglass reinforced PBT (polybutylene terephthalate) molded servo case is mechanically strong and invulnerable to glow fuel.
- Strong polyacetal resin, ultra precision servo gears ensure smooth operation, positive neutral, and minimal backlash.
- Fiberglass reinforced epoxy resin PC board with thru-the-hole plating improves reliability against shock and vibration.
- Seven special adjustable splined output arms.

•SET CONTENTS

Model	PP-9VHP
Transmitter	FP-T9VHP x 1
Receiver	FP-R-129DPx 1
Servos	FP-S9201 x 5
Switch	SSW-J x 1
Nicd Battery	NR-4LBx 1
Misc.	Battery charger, extension cord, DSC cord, CHG adaptor, DSC-CHG cord, frequency flag, spare output arms, neck strap, screws

•RATINGS

Transmitter FP-T9VHP

Operating System : Two-stick, 9 Channel, PCM
Transmitting Frequency: 72MHz CH.12—CH.56,
 53MHz, and 50MHz
Modulation : FM-PCM/PPM selectable.
Power Requirement : 9.6 volt (8/500mAH) internal
 Nicd battery
Current Drain : 230mA

Receiver FP-R-129DP

Receiving Frequencies 72MHz, 53MHz, and 50MHz
Intermediate Frequency 1st IF : 10.7MHz
 2nd IF:455kHz
Power Requirement 4.8 volt Nicd battery (shared
 w/servos)
Current Drain 35mA (4.8V reception)
Dimensions 60.3x37.8x24.1mm
Weight 45g(1.6oz.)
Receiving Range 500m (1,500 ft.) ground
 1,000m (3,000ft.) air
 (When FP-T9VHP used under
 best radiowave conditions)

Charger FBC-6B (2)

Input Voltage : 1 20VAC, 60Hz, 4W
Output Voltage : TX side 9.6V, 50mA
 RXside 4.8V. 100mA

Servo FP-S9201

Control System + pulse width control
 1520µSneutral
Operating Angle Each direction from neutral —
 45° or greater (including trim)
Power Requirement 4.8 volt Nicd battery (shared
 w/receiver)
Current Drain 8mA at 4.8V (at idle)
Output Torque 5 kg-cm (69.5 oz.-in.)
Operating Speed 0.22 sec/60°
Dimensions 40.5 x 20 x 35.5mm
Weight 50g(1.8oz.)

Receiver and Servo Nicd Battery Pack NR-4LB

Voltage : 4.8V 1,000mA
Dimensions : 56 x 67 x 14.8mm
Weight : 1 20g (4.2 oz.)

(Specifications are subject to change without prior notice.)

•RECEIVER AND SERVOs

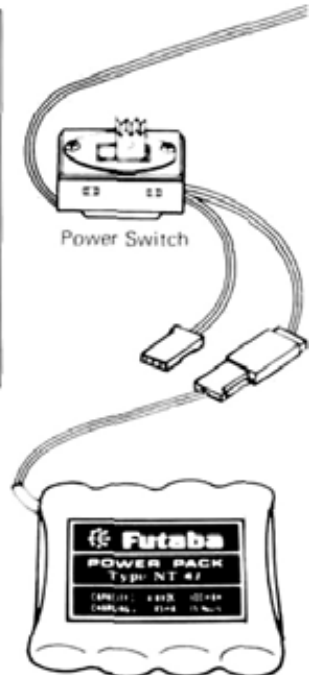
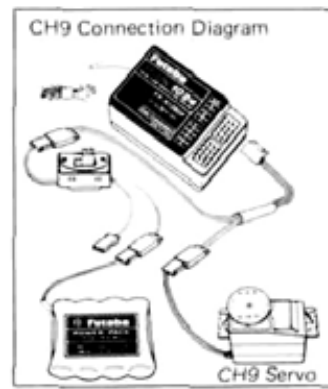
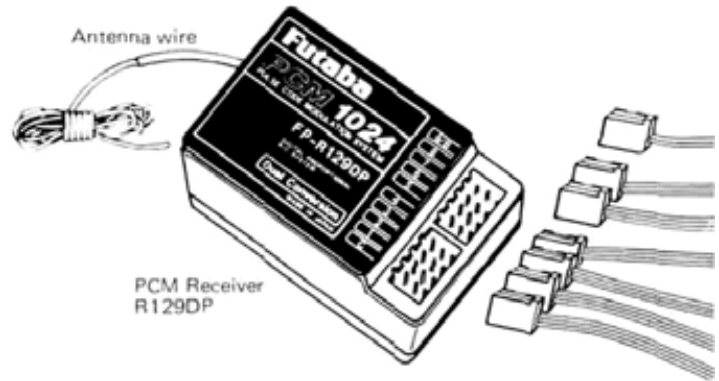
Receiver, servo, switch, and battery connections

The channel order is:

① AIL	Aileron	⑥ PIT	Pitch
② ELV	Elevator		(Collective)
③ THR	Throttle	⑦ AUX1	Accessory 1
④ RUD	Rudder	⑧ AUX2	Accessory 2
	(Tail rotor)	⑨ CH9	Channel 9
⑤ GER	Retract gear		
	(Rate gyro		
	output		
	switching)		

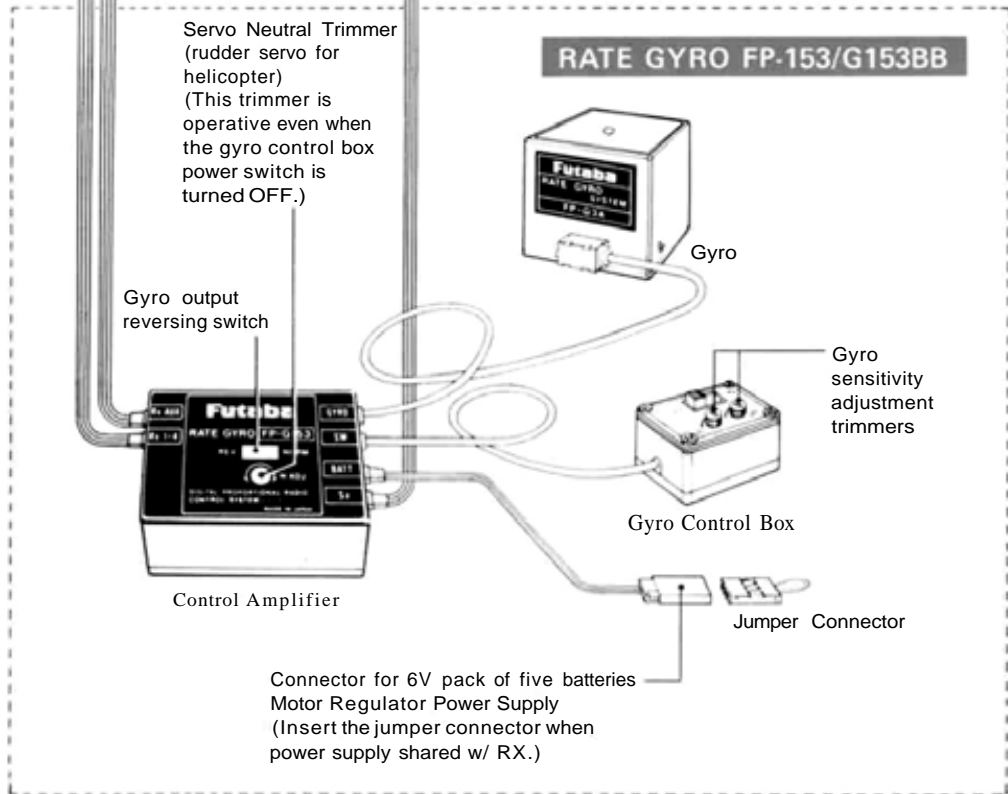
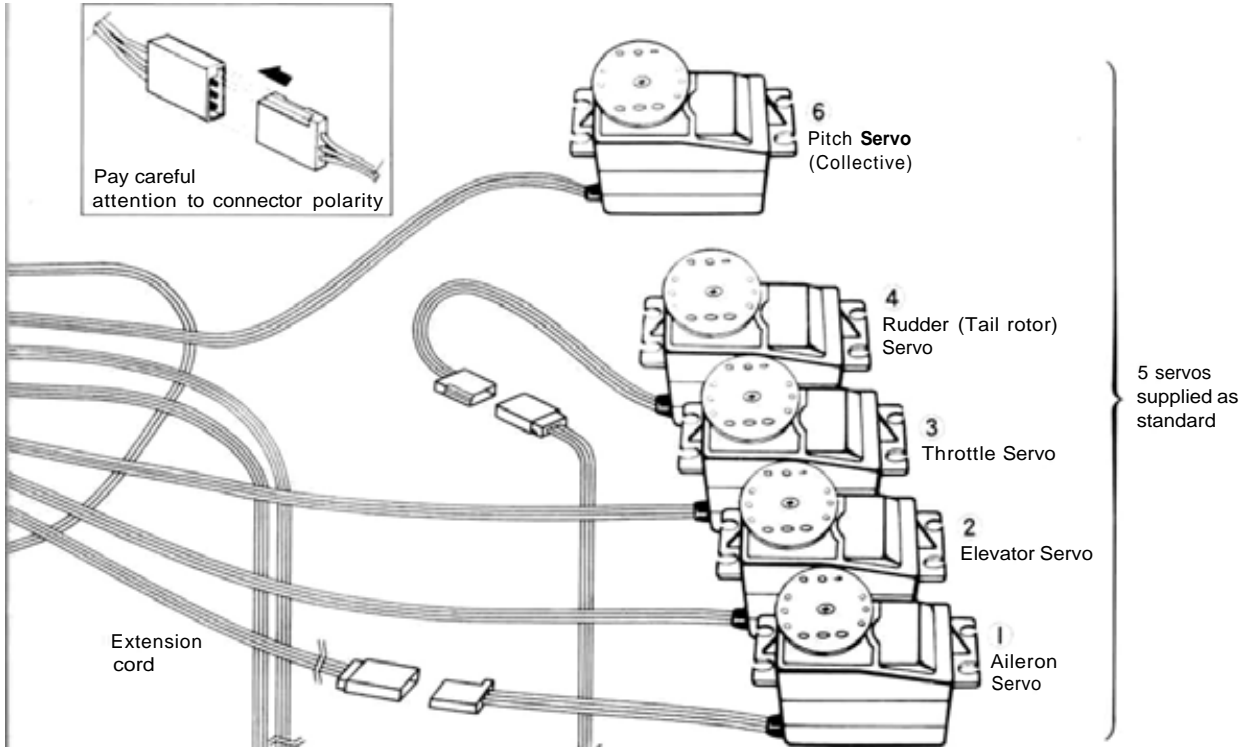
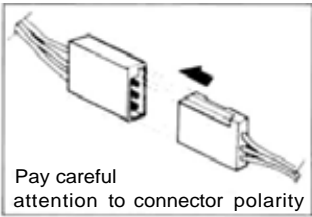
PRECAUTIONS

- Connect the receiver, servos, switch harness, etc. as shown in the figure. Extend the transmitter and receiver antennas to their full length. Turn on the transmitter power switch, then turn on the receiver power switch. The servos will go to their neutral position. Move the transmitter sticks one at a time to check that each servo follows its control stick movement.
- Connect pushrods and linkages to the servos and check that the direction of travel of each servo matches the direction of movement of its control stick. If a servo does not move in the proper direction, use the servo reversing function (See page 14).
- Operate each servo to its full extent, and check for binding and/or excess slop in the linkage or pushrod. Unreasonable force on the servo arm may damage the servo and will drain the batteries very quickly.
- Adjust servo output arms and aircraft control linkage as necessary so that each servo moves smoothly throughout its full range of travel, even when the control stick and trim lever are operated simultaneously in the same direction.
- Be alert for possible sources of electrical noise. This set is noise-resistant, but the use of noiseless parts is recommended.
- When installing the switch harness, make sure that the switch can move smoothly, to its full extent in each direction without binding. Install the switch where it will not be exposed to engine oil, dust, dirt, etc. The switch can be installed inside the fuselage and operated from the outside with a piece of wire.
- Do NOT shorten the receiver antenna or fold it back along its length.
- When installing the servos, tighten the mounting screws so that the rubber grommets are compressed slightly. If the screws are too tight,



the vibration-dampening effect of the grommets will be lost and servo damage may occur.

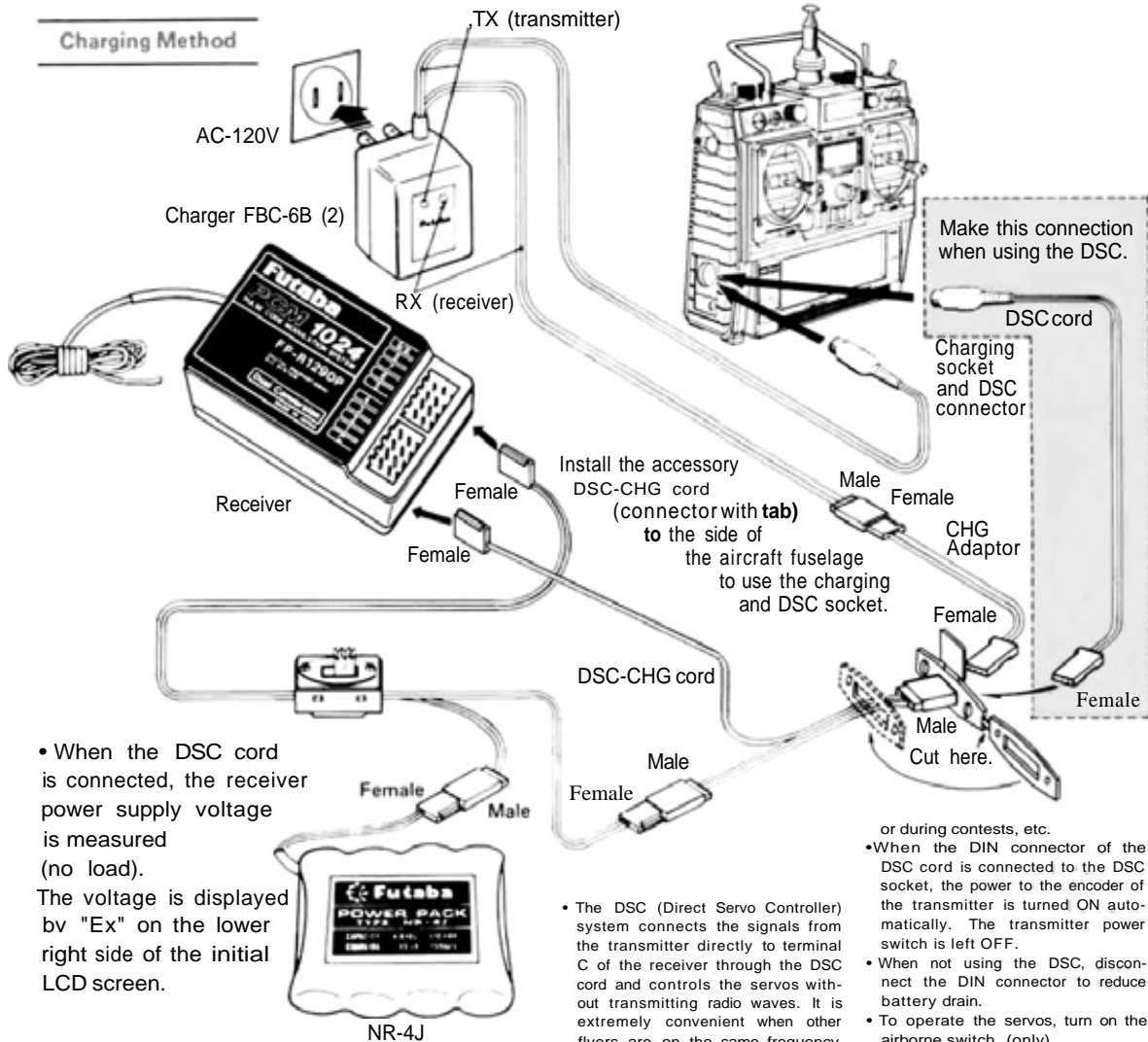
- The crystal can be changed without opening the receiver case. Always use a Futaba matched TX/RX crystal set to change frequencies.
- Extra servo output arms **are** supplied. Use them as needed.
- Use extension cords where necessary. RF "chokes" are not required with the PCM receiver.
- Wrap the receiver and the airborne battery pack separately in foam padding. Padding should be wrapped loosely for maximum vibration protection. Place each inside a waterproof plastic bag and secure the end of the bag with a rubber band.
- Use the rubber bands wrapped around the receiver to hold the servo and switch leads.
- After installation and adjustments are complete, perform a range check by collapsing the transmitter antenna and extending the receiver to its full length and operating the transmitter from a distance of 60 to 90 feet from the receiver (aircraft). The system should operate normally at this range.



BATTERY CHARGING INSTRUCTIONS (Transmitter and Receiver Nicd Batteries)

Before operating your system, recharge the Nicd batteries as follows:

- Connect the DIN connector of the FBC-6B (2) battery charger to the transmitter charging socket, and connect the 3P connector to the airborne NR-4LB Nicd battery pack and plug the battery charger into a 120VAC outlet as shown in the figure.
- The TX and RX LEDs light to show that batteries are being charged. The Nicd batteries can also be charged through the DSC-CHG cord by connecting the CHG adaptor to the charger as shown in the figure. This allows the NR-4LB airborne Nicd pack to be charged without removing it from the model.
- Normally recharge the battery for about 15 hours. If it has not been used for some time, discharge and recharge it two or three times, then charge it a full 15 hours.
- The amount of operating time before the batteries must be recharged can be estimated by checking the integrated timer at the moment the TX battery alarm sounds (antenna extended).
- Leaving batteries in the discharged state for a long time will adversely affect their capacity and life.
- The TX and RX Nicd batteries can be charged simultaneously or independently.
- A fully-charged TX battery can be used for about 10 flights of 10 minutes each. The airborne NR-4LB Nicd battery pack can be used for about 7 flights when 5 servos are used.

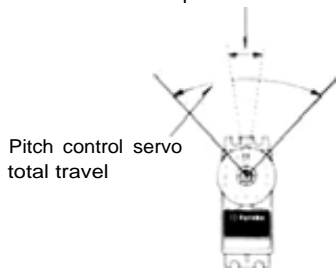


•BASIC TRANSMITTER T9VHP CONTROLS

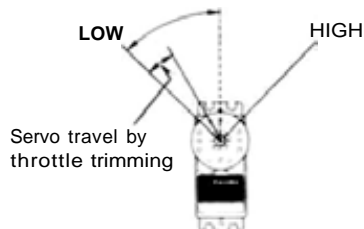
Refer to the fold-out illustration at the back of the manual.

- 1 Aileron Control (Right and Left Cyclic on helicopter)
- 2 Elevator Control (Fore and Aft Cyclic on helicopter)
- 3 Throttle Control (Throttle and Collective Pitch (T/C) on helicopter)
- 4 Rudder Control (Tail rotor on helicopter)
- 5 **CH5** Switch Multiple uses depending on programming by modeler.
 - Landing Gear (fixed wing aircraft)
 - Rate gyro output sensitivity switching (helicopter)
 - **COMBI** Switch - Rudder offset, Idle-Up, and Dual rate can be turned ON and OFF.
 - Inverted flight switch
- 6 Hovering Pitch Lever — left side of transmitter **CH6** Control Lever (In BASIC mixing mode)

Throw can be adjusted within this range with the lever when the throttle stick is in the neutral position.



- 7 **CH7** Control Knob Pitch Trim Knob (If function activated)
- 8 **CH8** Control Switch **COMBI** Switch (if selected) - RUD offset, Idle-Up, and D/R ON/OFF
- 9 Aileron Trim Lever
- 10 Elevator Trim Lever
- 11 Throttle (ATL) Trim Lever

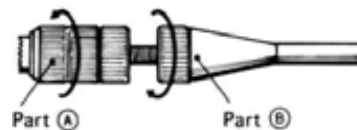


- 12 Rudder Trim Lever
- 13 High Pitch Trim Lever — right side of transmitter

- 14 Aileron Dual Rate ON/OFF Switch
 - 15 Elevator Dual Rate ON/OFF Switch
 - 16 Rudder Dual Rate ON/OFF Switch
- NOTE: Functions of the D/R switches can be selected, combined, ON/OFF directions changed, etc. (See page 46)
- 17 Revolution Mixing (Pitch -> Rudder Mixing) UP Side Knob
 - 18 Revolution Mixing (Pitch -> Rudder Mixing) DOWN Side Knob
 - 19 Idle-up 1 ON/OFF Switch
 - 20 Idle-up 1 Knob
 - 21 Idle-up 2 ON/OFF Switch
 - 22 Idle-up 2 Knob
 - 23 Hovering Throttle Trim Knob
 - 24 Throttle Hold Switch

Non-Slip Adjustable Control Sticks

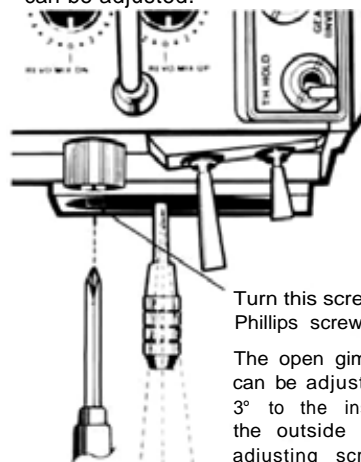
The length of the control sticks can be adjusted to suit operator preference.



Unlock Parts A and B by turning them in opposite directions as indicated by the arrows, and adjust the control stick to the most comfortable length.

Adjustable Stick Angle

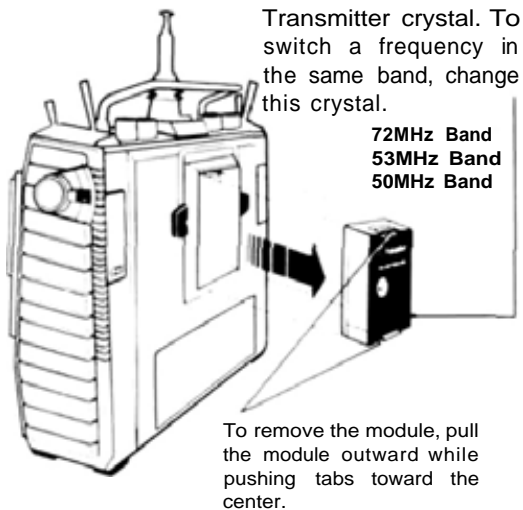
The horizontal angle of the control sticks can be adjusted.



Turn this screw with a Phillips screwdriver.

The open gimbal stick angle can be adjusted from about 3° to the inside to 4.5° to the outside by turning the adjusting screw as shown. Adjust the control stick to the most comfortable angle.

Transmitter RF Module



A temperature rise in the RF module during use is normal.

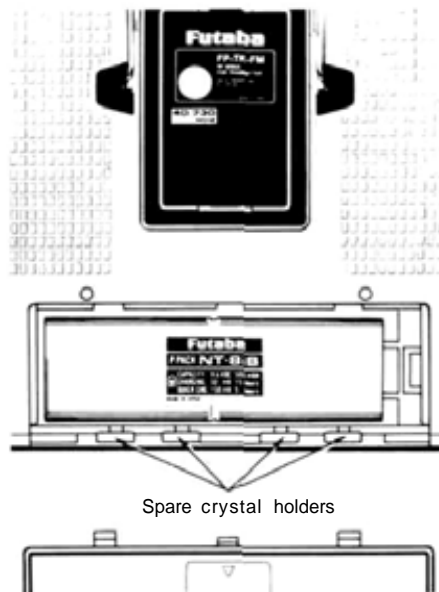
Mini Stand

Use this fold-out Mini Stand as shown when laying the transmitter down. This makes operation easier and protects the transmitter and module.



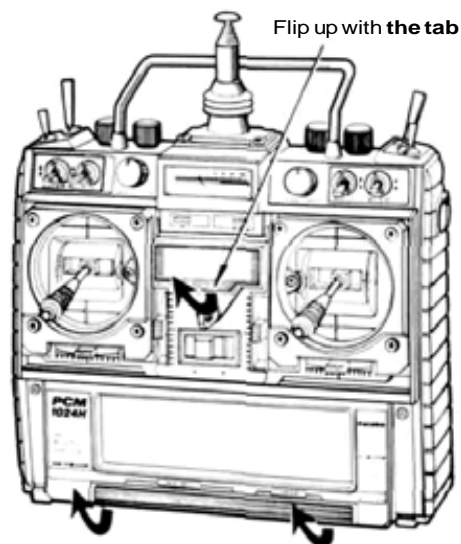
Transmitter Battery Pack Replacement and Spare Crystal Holder

Remove the battery box cover. Lift out the Nicd battery pack and disconnect the connector.



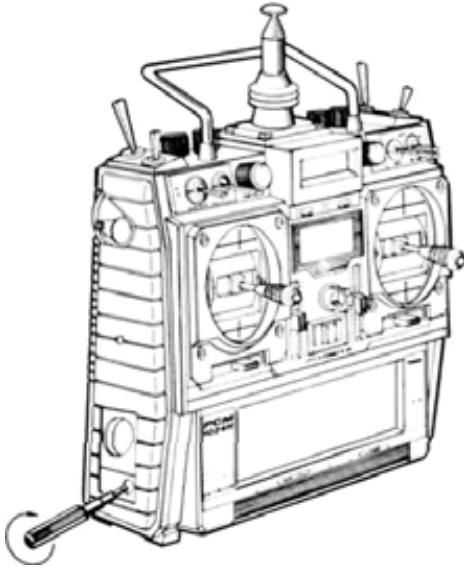
NOTE: Be careful not to drop the Nicd battery pack.

Opening Trimmer Panel and Key Cover



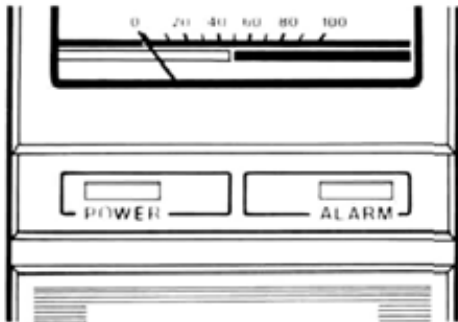
NOTE: Flip up at both sides with your fingers. Do not try to open the panel at the center. The cover may be damaged.

Screen contrast adjustment



Adjust the screen contrast with the special screwdriver provided. The contrast increases when the adjusting screw is turned clockwise.

Monitor Lamps



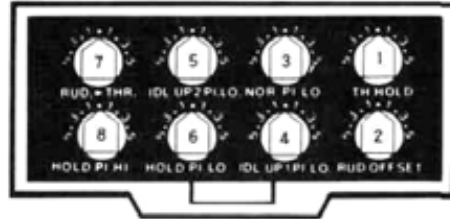
The POWER Lamp lights when the transmitter power is turned ON.

The ALARM LED Lamp at the right:

- Blinks off once per minute during Fail Safe data transmission.
- Blinks on and off when an activated mixing switch is ON (T. Hold, Idle-up, Invert)
- Lights steadily at all other times.

Functions of Sub-Trimmers

Sub-trimmers are located on the front panel to allow convenient trimming of programmed settings on the field or during flight. Master the computer functions before using them.



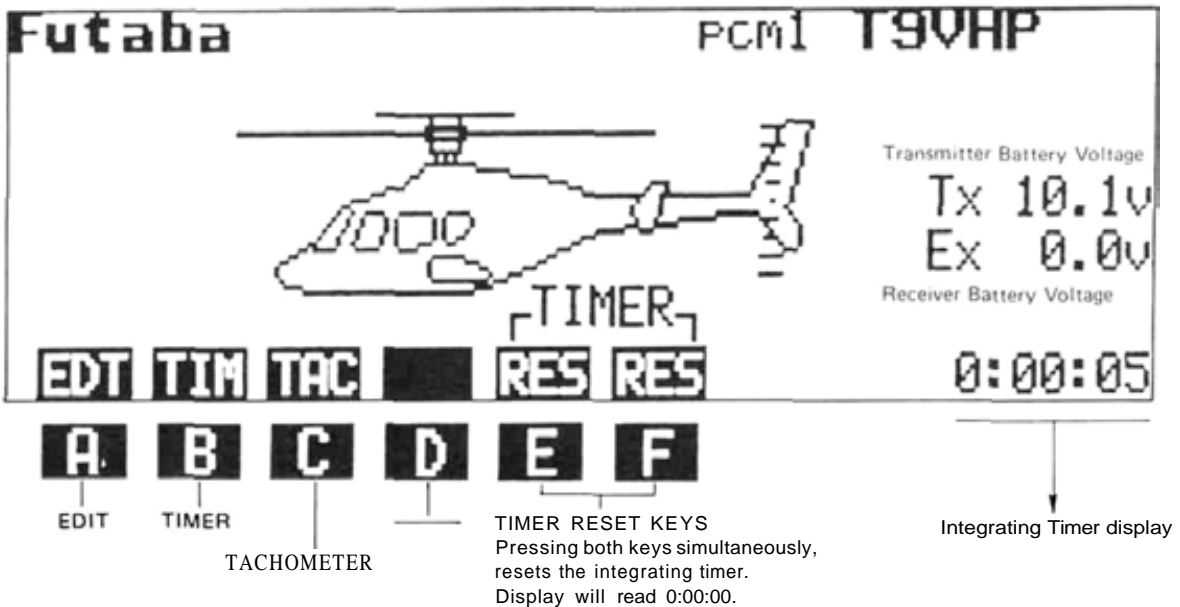
- | | |
|----------------|---|
| 1 TH. HOLD | Throttle hold (TH. servo) position adjustment |
| 2 RUD.OFFSET | Rudder offset adjustment |
| 3 NOR.PI.LO | Normal pitch low side adjustment |
| 4 IDL.UP1PI.LO | Idle-up 1 low pitch adjustment |
| 5 IDL.UP2PI.LO | Idle-up 2 low pitch adjustment |
| 6 HOLD.PI.LO. | Hold pitch low side adjustment |
| 7 RUD. -> THR. | Rudder -> throttle mixing adjustment |
| 8 HOLD.PI.HI. | Hold pitch high side adjustment |

Sub-trimmers do not operate unless the pertinent function is set to **ACT**

ADJUSTMENTS AND FLIGHT TECHNIQUES

•OPERATING INSTRUCTIONS.

- When adjusting and setting the transmitter functions, connect the receiver and servos, and make the adjustments while observing the operation of the servos.
- Alternatively, when studying the operation of transmitter functions, remove the transmitter RF module (to reduce battery drain). The effects of adjustments can be viewed on the SRV program screen (See page 50).
- Set the power switch to the ON position. The standard screen shown below appears on the LCD display.



- Tx 10.1V Transmitter Voltage
- Ex 0.0V The receiver battery voltage can be measured by using the DSC cord supplied.

TIMER

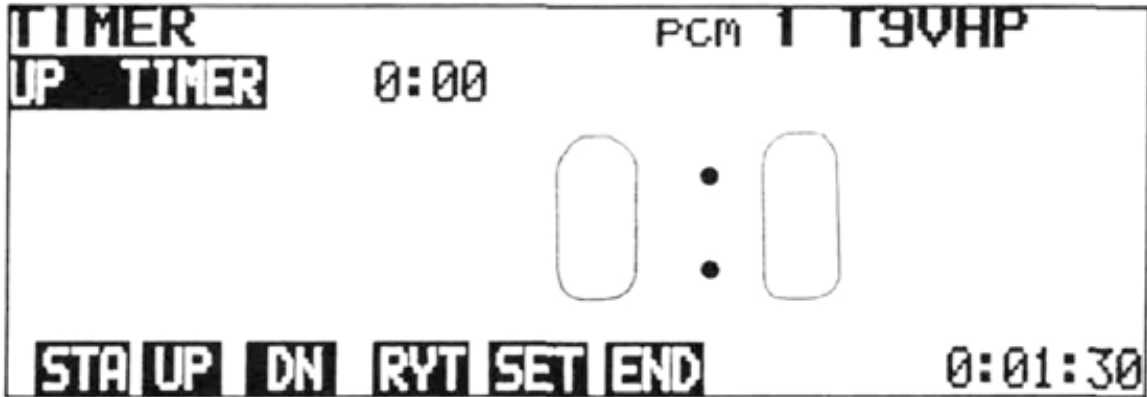
The *TIMER* function can be used to monitor flying time, fuel consumption, at contests, etc. Four different timing functions are available: *Up Timer*, *Down Timer*, *Rhythmic Timer*, and *Total (Integrating) Timer*.

Timer Functions

- 1) *Up Timer* This timer counts up from zero in 1 second steps. Its maximum count is 59:59. When the alarm time is set, a buzzer begins to sound 10 seconds before the set time is up. The buzzer also sounds at each 1 minute interval. When the time reaches 59:59, timing restarts from 00:00.
- 2) *Down Timer* This timer counts down from the set time in 1 second steps. Operation is otherwise the same as the Up Timer.
- 3) *Rhythmic Timer* This is a 0.1 second cyclic timer. A buzzer sounds at each set alarm interval. When the set alarm interval elapses, the counting automatically restarts.
- 4) *Total (Integrating) Timer* This timer records the total transmitter ON time. It is very useful for estimating remaining Nicd battery capacity and monitoring total flying time. Maximum count is 59:59:59.

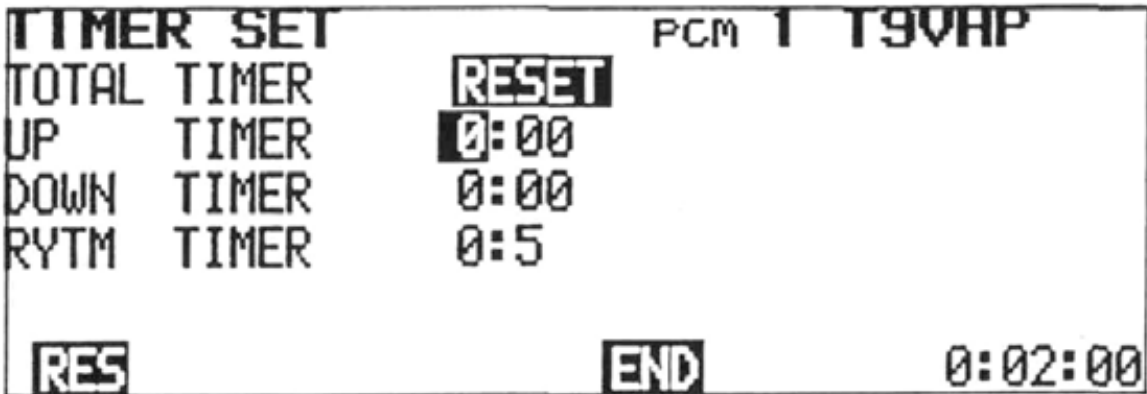
Setting Instructions

- 1) Display the standard screen.
- 2) Reset the Total Timer by pressing the two RES program keys simultaneously.
- 3) Press the TIM key. The TIMER program screen will appear on the display. The Up Timer will be displayed first.
- 4) Select the UP (Up), DN (Down), or RYT (Rhythmic) timer mode by pressing the **UP**, **DN**, or **RYT** program key. The example shown is for the Up Timer.



- 5) To set the alarm time, switch to the TIMER SET display by pressing the SET key. Move the cursor to the timer mode to be set using the **↓**, **↑**, **←**, and **→** cursor keys. Pressing the **RES** key will

Set the alarm time with the **+** and **-** program keys.



When time and alarm setting is complete, return to the TIMER display by pressing the **END** program key.

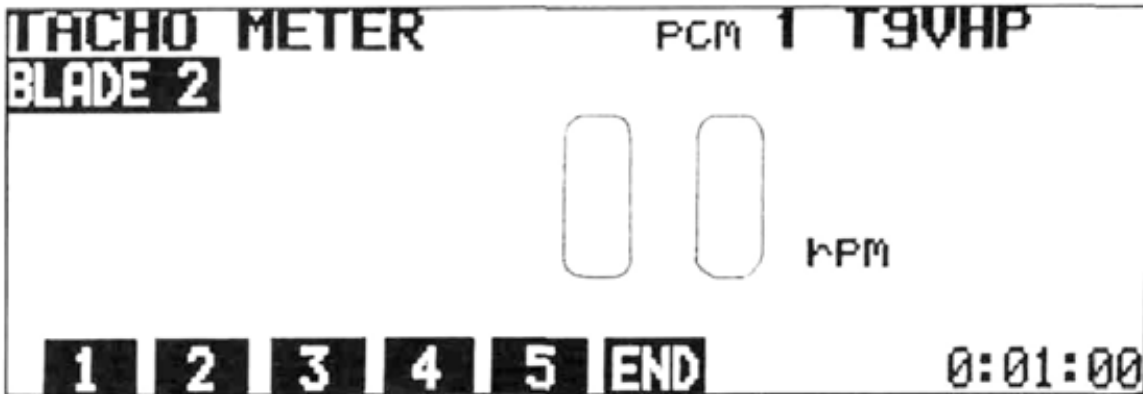
- 6) To start the timer, press the STA program key. The program key characters **STA** change to **STP**. When the **STP** key is pressed, the timer stops.
- 7) When the **END** program key is pressed, the display returns to the standard screen.

Timer Counting Range	1. UP/DN Timers	55min.59sec.
	2. Total Timer	55 hrs. 59 min. 59 sec.
	3. Rhythmic Timer	0.5 sec. to 59.9 sec. interval

ADJUSTMENTS AND FLIGHT TECHNIQUES

TACHO METER Tachometer

The tachometer function is used to measure the speed on one to five-bladed propellers, etc. Speed (rpm) is measured up to a maximum of 50,000 rpm in 20 rpm increments).



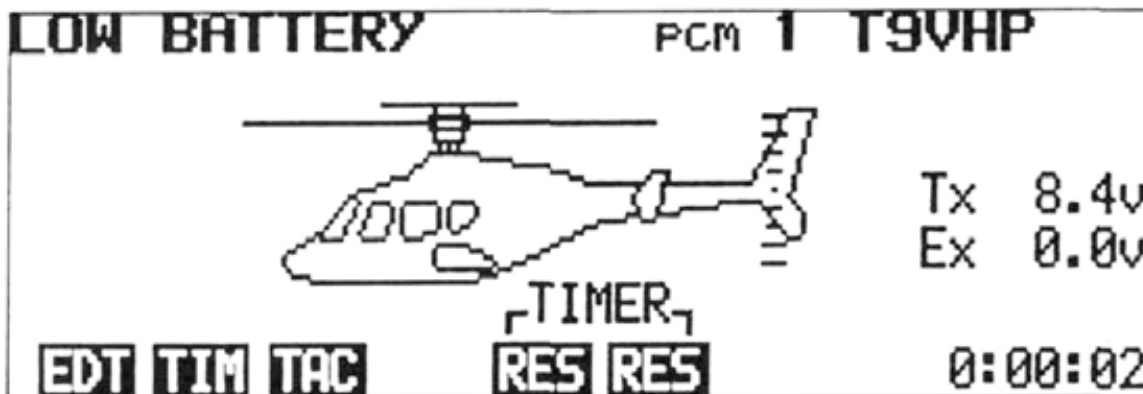
Setting Method

- 1) Display the standard screen, and press the **TAC** program key.
- 2) Press program key **1** to **5** to select the number of blades.
Ex: **2** for a two-bladed propeller.
- 3) Measure the speed by pointing the built-in sensor on the transmitter (center of the left

side panel) at the front or rear of the propeller disc from a distance of 8 to 12 inches. Be sure the model is restrained by an assistant, and be very careful of the rotating propeller.

Allow a few seconds for the display to stabilize, then read the measured value. Maximum speed range is 50,000 rpm.

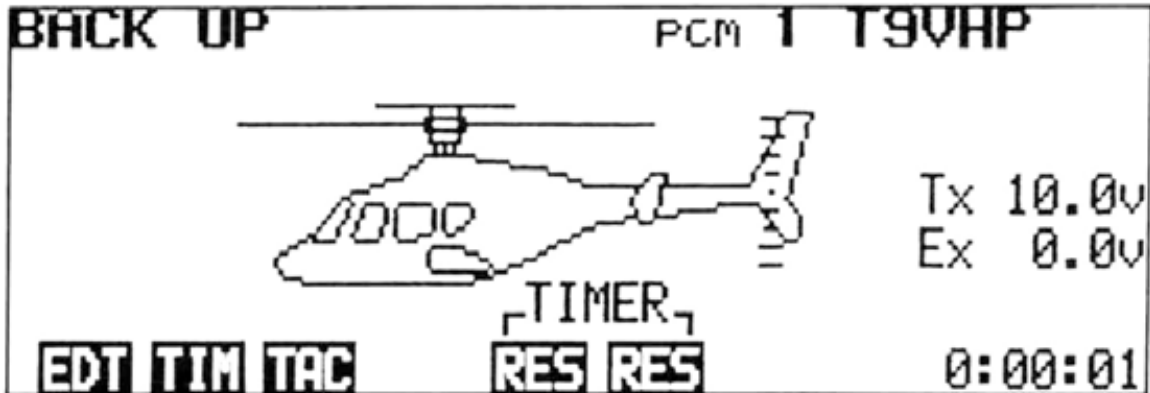
Low Battery Warning



This function operates when the transmitter Nicd battery voltage drops below 8.5 volts. The characters "LOW BATTERY" blink on the

screen, and a buzzer sounds. When this occurs, land immediately and recharge or replace the Nicd battery pack.

Back Up Warning



When the stored data is lost, the characters "BACK UP" blink on the screen and a buzzer sounds. When the power switch is turned on again, the error display disappears and all the settings return to the factory-set values. When a

Back Up error occurs, the back-up lithium battery is probably dead, or there is trouble in the system. To locate the cause, call your Futaba service center. The back up lithium battery life depends on the usage state, but is about 5 years.

1 ▶ REV F/S ATU AFR D/R END

SYSTEM PROGRAMMING

Press the EDIT program key **EDT** of the standard screen.



Reversing

Fail Safe

Adjustable
Travel Volume

Dual Rate

Adjustable
Function Rate

End
(Returns to
preceding screen)

System functions are programmed and adjusted by using the LCD display screen, the five DATA INPUT (Program) keys, and the four CURSOR keys.

Pressing the **EDT** (EDIT) program key of the standard screen will display the EDIT or "Menu" screen. The **↓** **↑** cursor keys can be used to move the cursor bar to Line 1, 2, or 3 of the screen. The program keys are used to select

the desired programming screen to be displayed. NOTE: At all times, pressing the **END** program key will return the display to the next previous screen. To return to the standard screen, just keep pressing the **END** key.

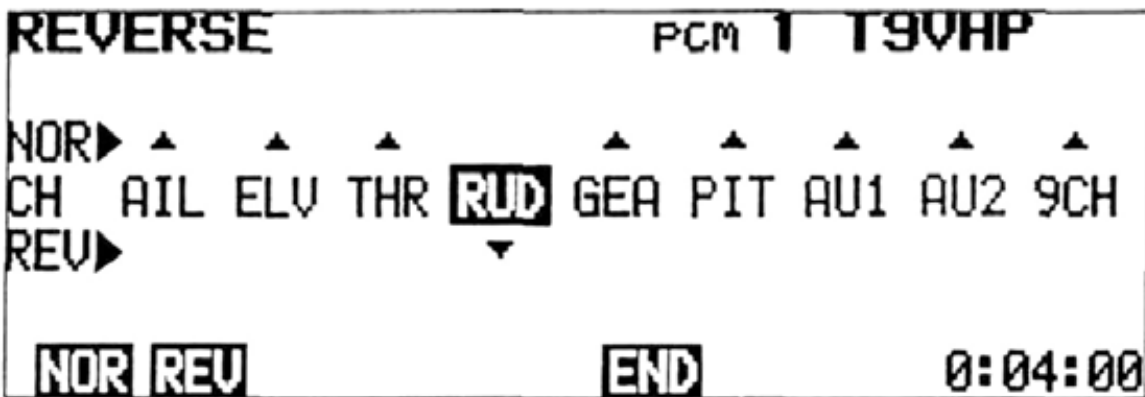
ADJUSTMENTS AND FLIGHT TECHNIQUES

REV REVERSE Servo Reversing

This function is used to change the direction of servo operation in relation to control stick or /ever movement.

Setting Method

- 1) Select the EDIT screen, then select the REVERSE screen by pressing the **REV** program key.
- 2) Select the desired channel with the **←** and **→** cursor keys.
- 3) Select NORMAL or REVERSE operation by pressing the **NOR** or **REV** program key.
In the display example, **RUD** (Rudder) is set to REVERSE.
- 4) Return to the EDIT screen by pressing the **END** program key.



F/S FAIL SAFE Fail Safe

Fail Safe and Hold Functions

The HOLD (Hold) and F/S (Failsafe) functions are designed to allow the aircraft or helicopter to "fly through" a momentary loss of signal or very strong interference, rather than experiencing the familiar "glitch" as the servos react violently to the unwanted signal. These functions cannot be expected to prevent a crash however, if the normal signal interruption is of sufficient duration.

The HOLD function stops the servo at the position held just before the normal signal is lost. When a normal signal is again received, the Hold function is released.

The FAILSAFE function will move a servo to neutral or a pre-set position when the normal signal is interrupted for 1 second or longer (The system will remain in HOLD for the first 1 second of signal loss). When a normal signal resumes, FAILSAFE is released.

BFS (Battery Fail Safe) Function

The BFS function moves the throttle (CH3) servo to the pre-set Fail Safe position when the airborne power supply is nearly exhausted. If no Fail Safe position has been set, the throttle servo will move to medium slow (neutral).

BFS can be released by lowering the throttle Stick past the release point (adjustable), or with the CH9 switch. Throttle control is then regained for about 30 seconds. At the end of 30 seconds, BFS will re-engage and the throttle will again move to the Fail Safe position. Whenever BFS engages, land the aircraft as quickly as possible and recharge or replace the Nicd battery pack.

Fail Safe and Hold General Instructions

Fail Safe

- F/S or HOLD can be selected for each channel (1 to 8).
- Channels selected for HOLD will remain in HOLD until a normal signal resumes. Those selected for F/S will move to their pre-set positions after 1 second of signal interruption.
- F/S SET simultaneously stores the desired Fail Safe position in the transmitter memory and sends it to the receiver.
- The F/S data is automatically sent to the receiver when the transmitter is first turned ON and at one minute intervals as long as the transmitter is left on.
- The F/S position can be checked with the **CHK** program key.
- Only the Throttle channel (CH3) can be set for Battery Fail Safe.

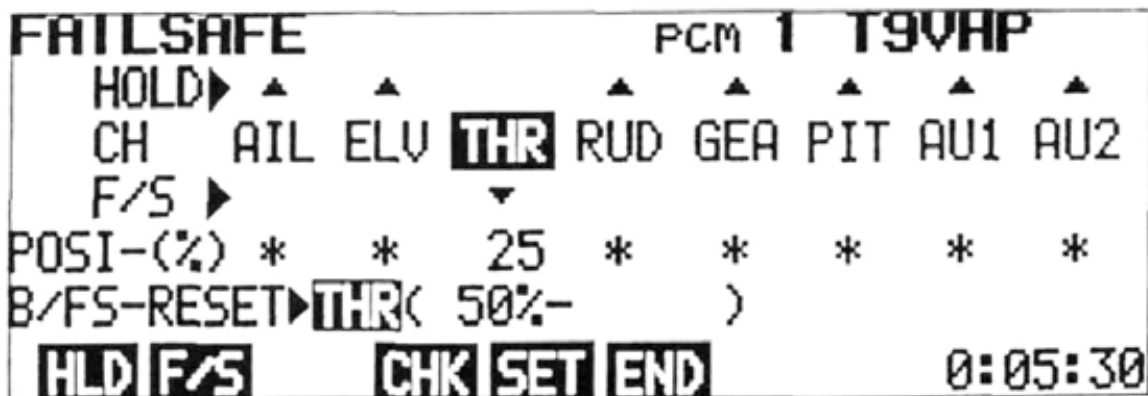
Fail Safe Setting

- 1) Display the EDIT screen, then select the FAILSAFE screen by pressing the **F/S** program key.
- 2) Move the cursor to the desired channel with the **←** and **→** cursor keys and select HOLD or F/S for each channel by pressing the **HLD** or **F/S** program key. When Failsafe is selected, the number 50 will appear below the appropriate channel on the POSI-(%) line of the FAILSAFE screen.
- 3) Store the Failsafe positions in the transmitter memory by pressing the **SET** key while holding the stick or lever of the channel being set in the desired Failsafe position. Simultaneously, the data is also transmitted to the receiver and is automatically re-transmitted at one minute intervals.

Battery Fail Safe Setting

- 1) Set the Failsafe position on the throttle channel (CH3) as described above. A position slightly above the minimum engine idle speed is recommended.
- 2) BFS Release Point Setting (When THR is designated as the release channel)
 - Move the cursor to the B/Fs-RESET line of the FAILSAFE screen with the **↓** or **↑** cursor key.
 - Select the BFS release channel with the **THR** or **9CH** program key.
 - Set the throttle stick to the desired BFS release point and press the **THR** program key. This designates CH3 (Throttle) as the release channel and sets the stick release point simultaneously.
- 3) To release BFS by the CH9 switch, press the **9CH** program key.
 - BFS can be released by the CH9 switch only when the switch is moved to the upper position. If the CH9 switch is in the lower position, BFS cannot be released.
 - In the BFS release state, the characters 0%-RESET are displayed on the B/Fs-RESET line of the FAILSAFE screen.
- 4) If Battery Fail Safe is not desired, press the **INH** program key (when the cursor is on the B/Fs-RESET line). The BFS function will then be disabled.

In the example below, **THR** (Throttle) was set to Fail Safe and Battery Fail Safe.



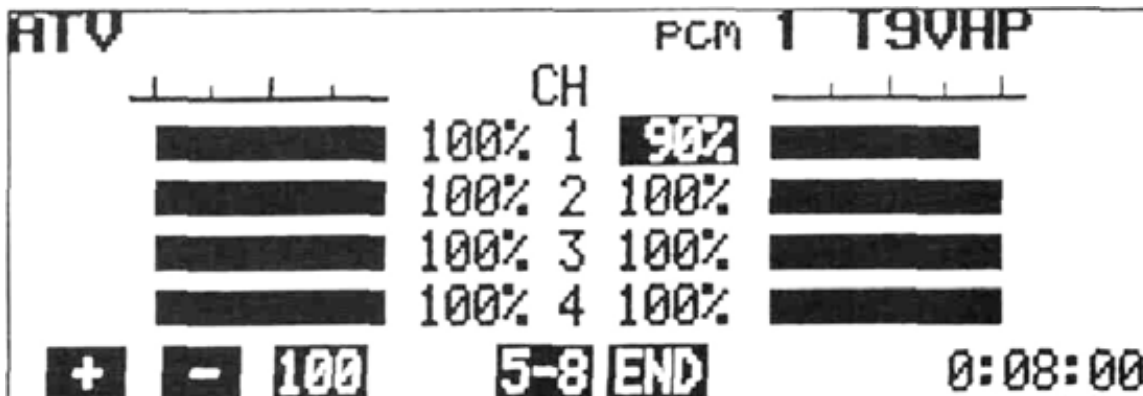
ADJUSTMENTS AND FLIGHT TECHNIQUES

ATV ADJUSTABLE TRAVEL VOLUME

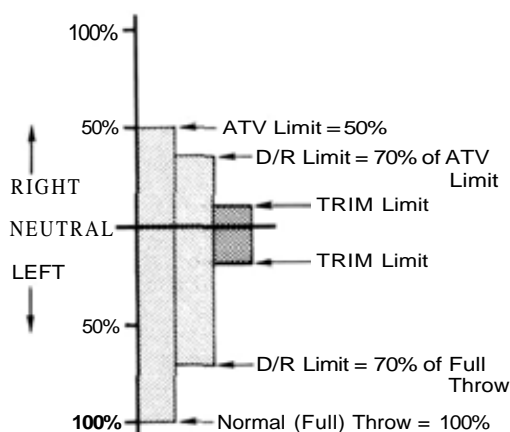
- The ATV function is used to adjust servo travel limits. Servo travel can be adjusted independently in each direction from neutral. Adjustment from 30% to 110% of normal full travel (throw) is possible.
- NOTE: When servo travel is changed by ATV, the limits of trim throw and the Dual Rate ON (Low Rate) limits are increased or reduced by the same percentage.
- ATV limits are displayed by a bar graph and numbers. The point at which the cursor moves from left to right, as the stick or lever is moved, is the electrical neutral point of that channel.

Setting Method

- 1) Select the EDIT screen, then select the ATV program screen by pressing the **ATV** program key.
- 2) Rate data (endpoint limits) for Channels 1 to 4 is displayed on the screen. To display and adjust Channels 5 to 8, press the **5-8** program key. Rate data for Channels 5 to 8 will be displayed.
- 3) Select the channel to be set with the **+** and **-** cursor keys.
- 4) Operate the control stick, lever, or switch of the channel to be adjusted to its maximum extent in the desired direction. The cursor will automatically move to the left or right confirming the direction to be set.
- 5) Servo endpoint limits can be set by pressing the **+** and **-** program keys while holding the appropriate stick or lever in the same direction. Pressing the **100** program key will return the set limit to 100%.
- 6) When you are finished, press the **END** key to return to the EDIT screen.



In the example shown, the CH1 (Aileron) right throw is reduced to 90%.



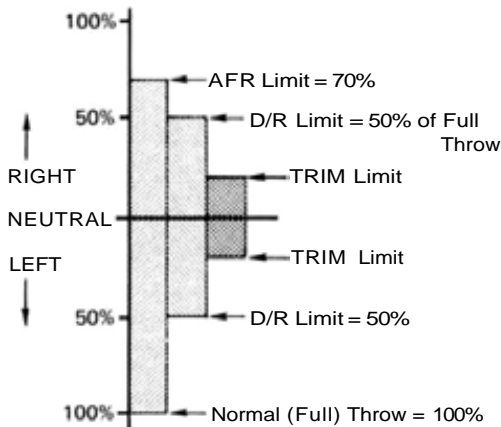
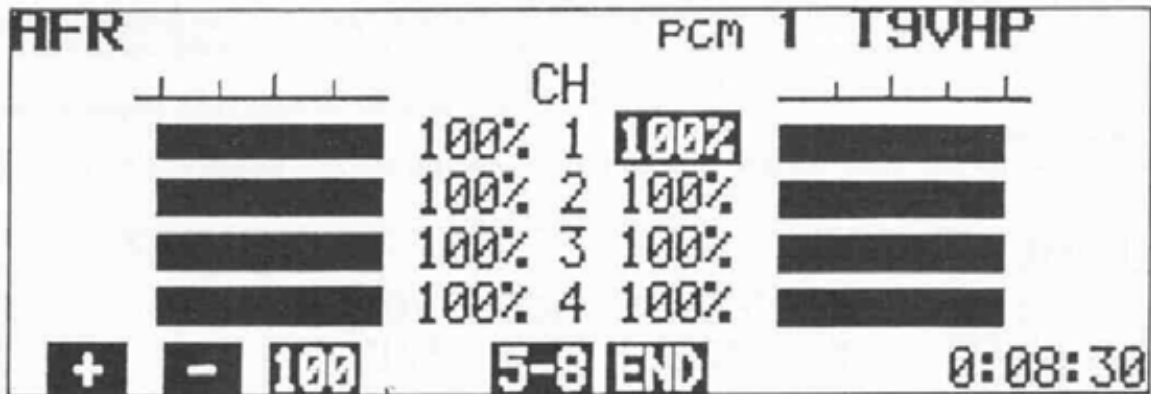
In the bar graph illustration below, the right hand throw is reduced to 50% of normal, while the left hand throw is set to 100%. Note that on the right side. Dual Rate ON (Low Rate) and Trim throw limits are also reduced to 50% of normal.

AFR ADJUSTABLE FUNCTION RATE

AFR is a servo endpoint limiting function, similar to ATV with one exception: AFR limits only the Dual Rate OFF (High-Rate) servo travel. Trim throw/and Dual Rate ON (Low Rate) limits are unaffected (unless AFR is reduced below the D/R ON limit).

Setting Method

- 1) The setting method for AFR is the same as for ATV (See page 16).
- 2) Select the EDIT screen and press the AFR program key.



In the bar graph illustration below, the right hand throw is reduced to 70% of normal throw by AFR. Note that the Dual Rate ON (Low Rate) limit and Trim throw limits remain the same on both sides (Compare with the ATV illustration on page 16).

NOTE: Trim Limits and D/R Limits same in both directions.

ADJUSTMENTS AND FLIGHT TECHNIQUES

D/R DUAL RATE

Dual Rate functions allow the modeler to switch servo travel limits in flight, thus varying the control sensitivity for different flight conditions or maneuvers.

- Dual Rate functions are available on CH1 (Aileron), CH2 (Elevator), and CH4 (Rudder/Tail Rotor).
- Dual Rate ON (Low Rate) limits can be adjusted from 30% to 100% of full throw.
- If servo travel is reduced by ATV, the D/R ON throw will be 30% to 100% of the limit set by ATV (in D/R OFF). If AFR is used, the D/R ON limit is unaffected, and will be 30% to 110% of normal (full) throw.
- Dual Rate ON limits can be adjusted independently in each direction from neutral.
- There are three D/R ON/OFF Switches. Control of the three D/R functions can be assigned to these switches in any combination the modeler desires, or D/R functions can be switched ON and OFF automatically according to the position of the Throttle/Collective stick.
- The ON/OFF directions of the D/R switches can be reversed using the PARAMETERS program screen (See page 46).
- In the AUTO D/R mode, the D/R functions can be turned ON and OFF according to the position (adjustable) of the T/C stick.

DUAL RATE			PCM 1		T9VHP	
	inh	L/D	R/U	sw	mode	Pos
AIL	ON	70%	70%	1	MAN	50%
ELU	INH	70%	70%	2	MAN	50%
RUD	INH	70%	70%	3	MAN	50%
INH ACT			END		0:10:30	

Setting Method

- 1) Select the EDIT screen, then select the DUAL RATE screen with the **D/R** program key.
- 2) Select the channel to be set with the **↓** or **↑** cursor key.
- 3) Move the cursor to the **INH** position with the **←** or **→** cursor key and press the **INH** or **ACT** program key to activate or deactivate the D/R function for that channel.
- 4) When the **ACT** key is pressed, "ON" or "OFF" will be displayed in the "INH" position, depending upon the position of the pertinent D/R ON/OFF Switch.
- 5) Using the **←** and **→** cursor keys, move the cursor to the L/D or R/U position and set the desired D/R ON throw with the **+** or **-** program keys. Pressing the **100** program key will return the set limit to 100%.
- 6) Select the desired ON/OFF Switch for each D/R function by moving the cursor to the "sw" position with the **←** **→** key and/or selecting Switch No. 1, 2, or 3 with the **1**

2, or **3** program key.

The D/R ON/OFF Switches are designated by numbers as follows:

- | | |
|--------------------|---|
| 1 ... Aileron D/R | } As designated on the transmitter front. |
| 2 ... Elevator D/R | |
| 3... Rudder D/R | |

Each switch may be used to control one, two, or all three D/R functions as desired.

- 7) D/R may also be switched ON and OFF in conjunction with other functions (Idle-up, etc.) using the COMBI SW function of the PARAMETER program screen (See page 46).

Auto Dual Rate

- Dual Rate functions may be switched ON and OFF automatically, according to the Throttle (CH3) control stick position.

- 1) Move the cursor to the "mode" position with the **←** or **→** cursor key.
- 2) Use the **↓** or **↑** cursor key to select the D/R function to be set to AUTO and press the **AUT** program key.
- 3) Use the **→** and **←** cursor keys to move the cursor to "pos".
- 4) Set the Throttle stick at the point you wish ON/OFF switching to occur, and press the **ENT** program key.
- 5) When the Throttle stick is below the ON/OFF switching point and the pertinent D/R ON/

OFF Switch is set to OFF, Dual Rate will be OFF.

- If the assigned D/R ON/OFF Switch is set to ON, then D/R will be ON even if the Throttle stick is still below the ON/OFF point.
- 6) When the Throttle stick is moved above the ON/OFF point, then D/R will be ON, regardless of the position of the D/R ON/OFF Switch.

NOTE: Dual Rate ON/OFF Switch directions can be reversed using the PARAMETER program screen (See D/R SW DIR page 46).

DUAL RATE		PCM 1		T9VHP		
	inh	L/D	R/U	sw	mode	pos
AIL▶	ON	100%	70%	3	AUT	10%
ELU▶	INH	70%	70%	2	MAN	50%
RUD▶	INH	70%	70%	3	MAN	50%
ENT		END		0:12:30		

In the example shown, the AIL Dual Rate function will be switched to D/R ON (Low Rate) when the Throttle stick is moved above the 10% position. AIL and RUD D/R functions are both set to Switch No. 3.

END End Soft Key

Press the **END** program key to return to the EDIT screen.

ADJUSTMENTS AND FLIGHT TECHNIQUES

2 ▶ EXP MIX TRM PAR MDL END

Select the EDIT screen, and move the cursor to Line 2 with the **↑** or **↓** cursor key.

EDIT PCM 1 T9VHP

	A	B	C	D	E	F
1	▶REV	F/S	ATV	AFR	D/R	END
2	▶EXP	MIX	TRM	PAR	MDL	END
3	▶NAM	SRV	RES			END

0:03:00

EXP MIX TRM PAR MDL END

↓ ↓ ↓ ↓ ↓ ↓

Exponential Mixing Trim Parameter Model End

EXP EXPONENTIAL/VTR

Exponential or VTR functions can be used to change the servo response curve from the normal linear operation. This can be very helpful if control response is either sluggish or too sensitive near the neutral position. Maximum servo deflection limits (set by ATV and/or AFR) remain the same.

Exponential

- With Exponential control, the amount of servo movement in relation to a given amount of control stick deflection can be made to steadily increase (or decrease) as the stick is moved farther from neutral (or as in the case of CH3 (Throttle), from one extreme to the other).

- Exponential control is available on CH1 to CH8.

- Two different types of Exponential response curves can be selected.

The TYPE 1 Curve is symmetrical in both directions from neutral. This type is generally

used, when desired, on "neutralizing" controls such as AIL, ELEV. and RUD.

The TYPE 2 Curve is exponential in one direction over the full stroke of the control stick or lever. This type is normally used with functions such as THR.

- The amount of exponential can be varied from 0% to 100% in 4% steps. By using positive or negative exponential with either the TYPE 1 or TYPE 2 EXPO Curves, a total of four different types of Exponential control response can be selected.

EXPONENTIAL/VTR PCM 1

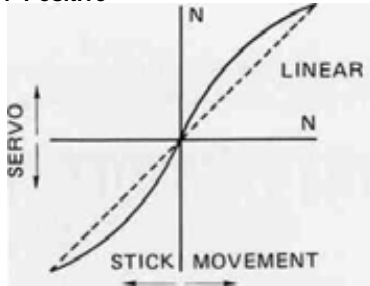
		inh	rate	typ
1	AIL	▶EXP	-100%	1
2	ELV	▶VTR	+ 0%	1
3	THR	▶INH	+ 0%	1
4	RUD	▶INH	+ 0%	1

AIL ↑

0:14:00

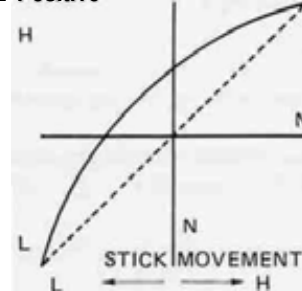
+ - 0 5-8 END

TYPE 1 Positive



With this type of curve, control response will be made more sensitive near neutral and less sensitive as the stick is deflected farther towards its extreme limits.

TYPE 2 Positive



With this type of curve, response will be most sensitive at the LOW end of control stick travel, and decrease as the stick is moved toward HIGH.

TYPE 1 Negative

With this type of curve, control response will be "softer" around neutral and increase as the stick is deflected farther.

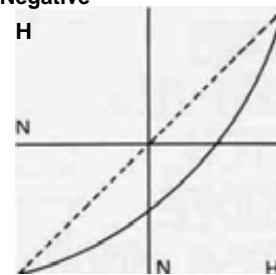
- When VTR is used, servo response remains linear, but the response is automatically switched to a higher rate at a certain (adjustable) point in the control stick deflection.
- The initial response rate is the same as the Dual Rate ON rate (See page 18).
- Maximum servo travel limit is still controlled by ATV and/or AFR.

Setting Methods

Exponential

- 1) Select the EDIT screen and move the cursor to Line 2 with the \downarrow or \uparrow cursorkey. Select the EXPONENTIAL/VTR program screen by pressing the **EXP** program key.
- 2) Select the channel to be set with the \downarrow or \uparrow cursor key, then select the operation mode with the **INH**, **EXP**, or **VTR** program key. VTR is available only on CH1, CH2, and CH4.
- 3) When the EXP mode is selected, the type of curve can be selected by moving the cursor to the "typ" position with the \leftarrow or \rightarrow cursor key and pressing the **1** or **2** program key. (The type of curve is not selected in the VTR mode.)
- 4) When the EXP or VTR mode is selected, the servo response curve is displayed on a graph at the right side of the screen. The amount of Expo can be changed by moving the cursor to

TYPE 2 Negative



VTR Variable Trace Ratio

With this curve, the response is less at the LOW end and steadily increases as the stick is moved toward HIGH.

- 5) In the VTR mode, the "rate" adjustment is used to adjust the stick position at which the servo response changes from Low to High. The initial (Low) rate is adjusted by the D/R adjustment program (See page 18).
 - 6) Channels 5 through 8 can be displayed and set by pressing the **5-8** program key.
- In the above example, a TYPE 2 Negative Exponential Curve is shown. This type is often helpful on the Throttle channel. Depending on the carburetor design and linkage, actual power transition can be made more linear in relation to stick movement. (About —20% is a good initial setting for fixed-wing aircraft).

ADJUSTMENTS AND FLIGHT TECHNIQUES

MIX MIXING

- Mixing allows two or more channels to be controlled by a single transmitter control stick or lever. This set features Programmable Mixing with four independent mixing circuits, along with special built-in mixing circuits.
- NOTE: Only PROG-MIX Programmable Mixing can be used in the BASIC Parameter mode. (See PARAMETER, page 46).

• There are five types of mixing (including Prog. Mixing).

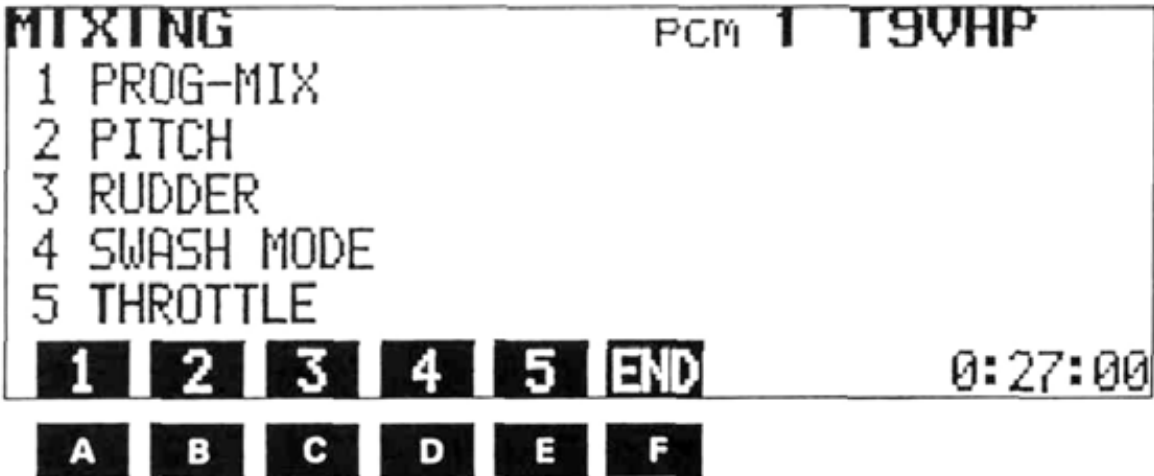
1: **PROG MIX**
Programmable Mixing

2: **PITCH-MIX**
Pitch Mixing

3: **RUDDER-MIX**
Rudder Mixing

4: **SWASH-MODE**
Swashplate Mixing

5: **THROTTLE-MIX**
Throttle Mixing



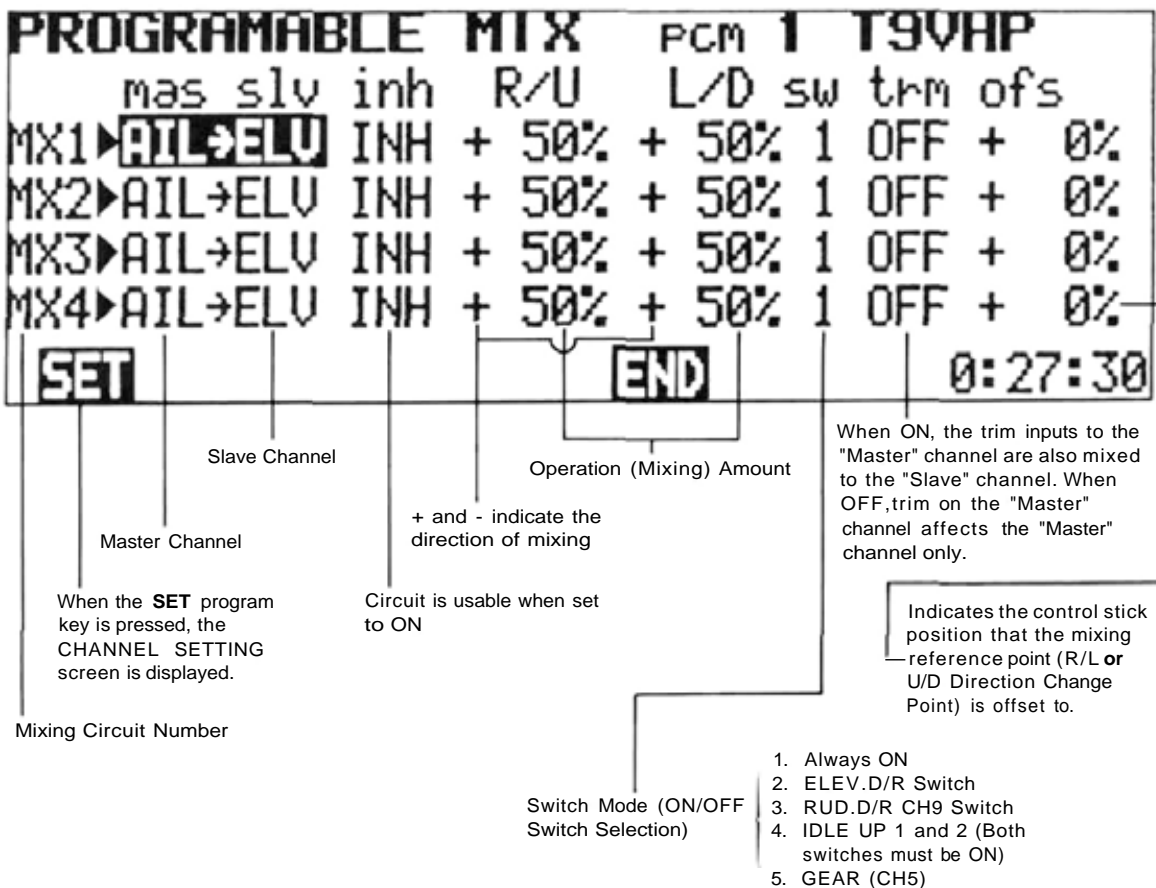
- 1) Select the EDIT screen and move the cursor to Line 2 with the **↓** cursor key, then press the **MIX** program key.
- 2) **1** to **5** can be selected with the program to keys.
- 3) To use 1:PROG-MIX, press the **1** program key. The PROGRAMABLE MIX screen will be displayed.

1:PROG-MIX

PROGRAMMABLE MIX Programmable Mixing

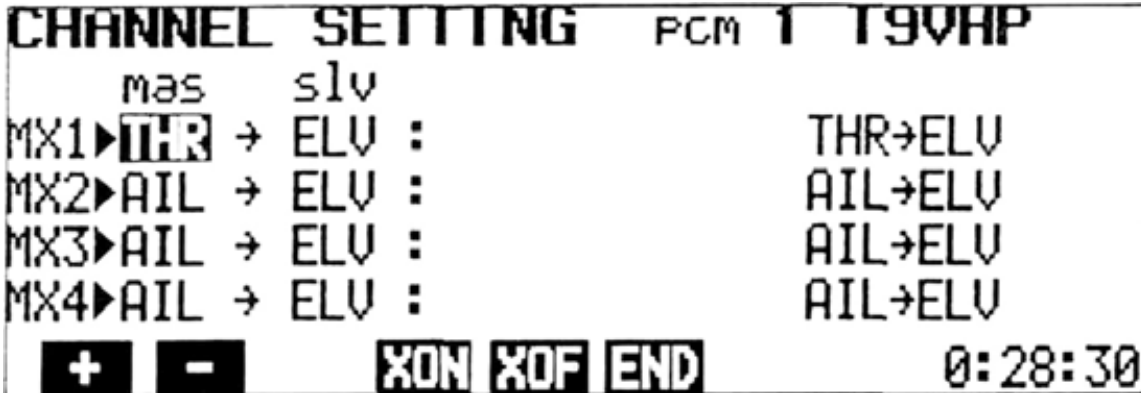
Four separate Programmable Mixing circuits allow almost infinite mixing combinations. The features of this program provide the modeler with unlimited versatility in trimming and controlling complex, high-performance models.

- Mixing of any two channels is possible.
- Four completely independent mixing circuits are available.
- Mixing amounts can be adjusted independently in either direction from neutral or offset point.
- The PROG-MIX ON/OFF Switch can be selected.
- The point at which the mixing direction reverses is fully-adjustable.
- PROG-MIX circuits can be mixed with or "slaved" to built-in mixing functions.
- PROG-MIX circuits can be mixed with each other.
- Trim corrections on the "Master" channel can be added to the slave channel or not, as desired.
- Bi-directional mixing can be accomplished using two mixing circuits (Ex: Flapperons)
- Adverse coupling of control inputs in fixed-wing aircraft can be eliminated. (Ex: Tendency to roll when rudder is applied in knife-edge flight.)

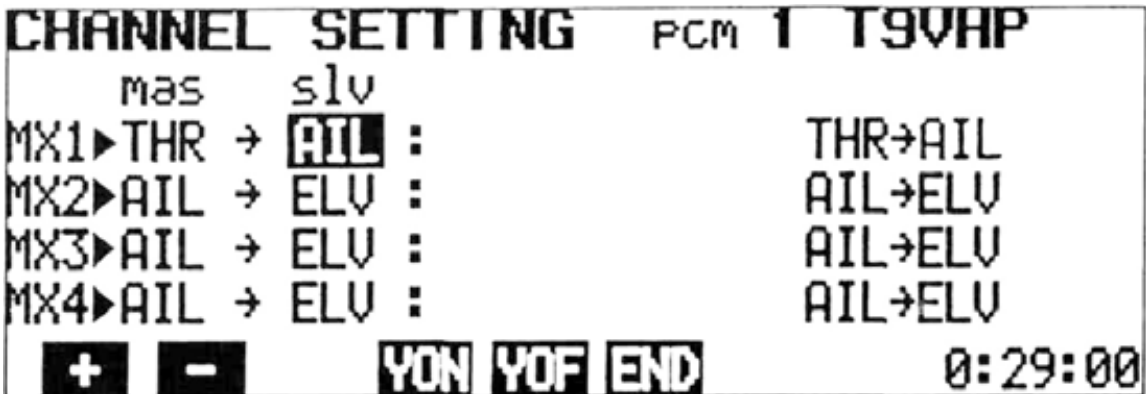


ADJUSTMENTS AND FLIGHT TECHNIQUES

CHANNEL SETTING Master and Slave Channel Selection



In the first example shown, THR (Throttle) is set at "mas". The Master channel can be changed by pressing the **+** or **-** program key.



The cursor can be moved to the "slv" position with the **←** or **→** cursor key and the Slave channel selected by pressing the **+** or **-** program key.

Master Channel Setting

- 1) Select the PROG-MIX screen as described on page 22.
- 2) Select the CHANNEL SETTING screen by pressing the SET program key.
- 3) The Master channel can be set by pressing the **+** or **-** program key to change the channel.
- 4) The mixing circuit to be programmed can be selected by moving the cursor with the **↓** or **↑** cursor key.

Slave Channel Setting

- 1) Move the cursor to the "slv" position with the **←** or **→** cursor key.
- 2) Select the Slave channel with the **+** or **-** program key. In the example above, the Slave channel on **MX1** (Mixing Circuit No. 1) is set to AIL.

Combination of Mixing Circuits

Programmable mixing circuits can be combined with each other, or with built-in mixing circuits by two methods.

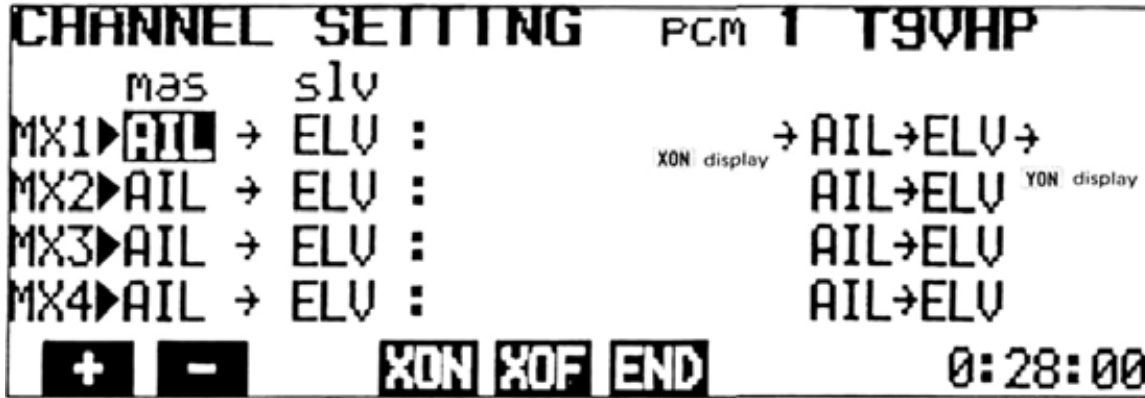
- 1) Setting a Mixing Circuit No. in the "mas" position (MX1, MX2, MX3, or MX4).
- 2) **XON** and **YON** setting.

Mixing Number Method

Depending upon which channels are selected on different mixing circuits, MX1, MX2, MX3, or MX4 can be displayed in the "mas" position. The slave channel of the mixing number displayed in the "mas" column, then, becomes a Master channel on the mixing circuit line that it is displayed and the two circuits are connected.

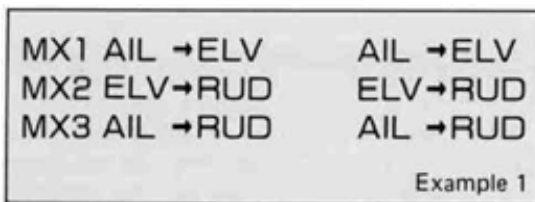
XON and **YON** Method

- 1) **XON** **XOF** are displayed when the cursor is in the "mas" position. **YON** **YOF** are displayed when the cursor is in the "slv" position.

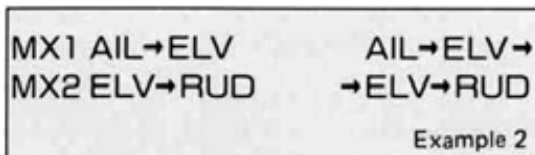


Displayed when cursor is in "mas" position.
Indicates that Master channel is "slaved" to another circuit.

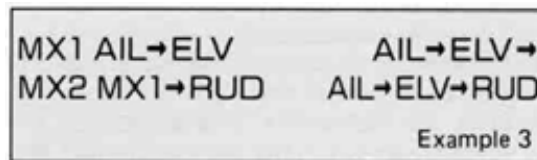
- 2) To activate XON or YON mixing, press the **XON** or **YON** key, The character "→" will appear next to the appropriate channel on the left side of the screen to indicate that **XON** or **YON** has been set.
 - Combinations allow more efficient use of the number of mixing circuits. An example is shown below.



When **XON** are **YON** not used, three circuits are required for the mixing program shown below. Programmable mixing is performed from Aileron to Elevator and Rudder, and from Elevator to Rudder. This is the same as AIL -> ELV -> RUD mixing.



The same mixing program as in Example 1 can be set up using only two 2 mixing circuits when the **XON** and **YON** functions are used. MX1 is set to AIL -> ELV mixing. MX2 is set to ELV -> RUD mixing. The cursor is moved to the MX1 "slv" position, and **YON** is set. The cursor is then moved to the "mas" position and **XON** is set. MX3 is turned OFF (Set to **INH**). This is also the equivalent of AIL -> ELV -> RUD mixing.





Setting MX1 as the MX2 Master channel in the example is the same as setting **XON** .







- Combinations are effective when the number of mixing circuits is insufficient, and when PROG-MIX circuits are mixed with built-in mixing circuits.

ADJUSTMENTS AND FLIGHT TECHNIQUES

• Activation of Programmable Mixing Circuits








- 1) Move the cursor to the "INH" position with the  or  cursor key.
- 2) To activate the circuit, press the **ACT** key. "ON" or "OFF" will be displayed according to the position of the designated Mixing ON/OFF Switch.
- 3) To deactivate the mixing circuit, press the **INH** program key.

PROGRAMMABLE MIX				PCM 1	TRIM		
mas	slv	inh	R/U	L/D	sw	trm	ofs
MX1	THR	AIL	ON + 20%	- 15%	1	OFF	+ 0%
MX2	AIL	ELEV	INH + 50%	+ 50%	1	OFF	+ 0%
MX3	AIL	ELEV	INH + 50%	+ 50%	1	OFF	+ 0%
MX4	AIL	ELEV	INH + 50%	+ 50%	1	OFF	+ 0%







0:30:00





Mixing Rate and Direction Setting

The mixing rate setting determines the amount of deflection of the Slave servo in relation to movement of the Master channel control stick or lever. Both the amount (rate) and direction (+ or -) of movement can be set independently, either side of the mixing point (neutral).

- 1) Move the cursor to the R/U or L/D position with the   cursor key.
- 2) Set the desired rate with the , , or  program key.
- 3) The servo operating direction can be changed with the  and  program keys.

Mixing ON/OFF Switch Selection

Programmable Mixing can be designated as "always ON" or switched ON and OFF in flight by any four different switches.

- 1) Move the cursor to the "sw" position with the  or  cursor key.
- 2) Press the appropriate program key ( through ) for the switch selection desired.

Switch assignments are designated by numbers as shown below:

1.	Always ON
2.	ELEV.D/R Switch
3.	RUD.D/R CH9 Switch
4.	IDLE UP 1 and 2 (Both switches must be ON)
5.	Gear (CH5)



Trim ON/OFF Setting

- In the "Trim ON" mode, trim lever inputs on

the Master channel will be "carried over" to the Slave channel, causing a corresponding change in the Slave channel neutral position when the mixing is ON. In the "Trim OFF" mode, trim changes to the Master channel affect the master channel only, regardless of the mixing ON/OFF switch position.



- Trim ON/OFF selection is only relevant if the Master is a primary control stick (AIL, ELEV, RUD AND THR).

Setting Method

- 1) Move the cursor to the "trm" position with the  or  cursor key.
- 2) Select the "Trim ON" or "Trim OFF" mode with the **ON** or **OFF** program key.

Offset (Rate and Direction Change Point) Setting

- Normally, the neutral (center) position of the Master channel control stick will be the point at which the Slave channel servo rate and direction change occurs. This control stick position can be changed (Offset) if desired.

- 1) Move the cursor to the "ofs" position with the  or  cursor key.
- 2) Move the Master channel control stick to the desired position at which you wish rate and direction change of the Slave channel servo to occur. (Mixing amount = 0 Point)
- 3) Press the **ENT** key. The Master channel stick position is memorized and will be displayed as a percentage in the "ofs" position of the screen. "+" indicates a stick position to the R/U side of neutral. "-" indicates a position to the L/D side of neutral. "0%" indicates that the direction will change at the normal control stick neutral position.