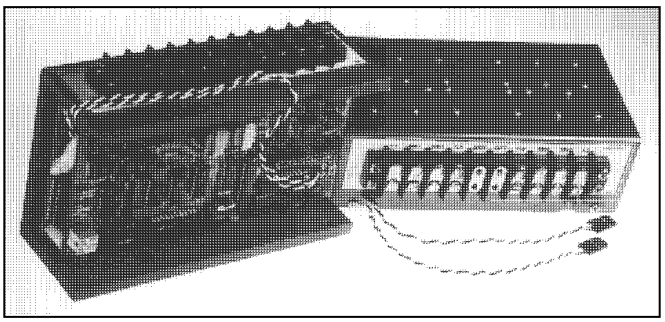
VANTEC

Help: **(541) 471-7135**

R/C DUAL FORWARD & REVERSE SPEED CONTROL - Mixed Steering

RDFR33 – 61E (V.LH) MANUAL



- **MODELS RDFR33 - RDFR61E**
- **ROBOTS, TANKS & TWIN SCREW BOATS**
- **INSTALLATION, WIRING, PROGRAMMING**
- **DUAL CONTROLS IDEAL FOR STEERING WITH RIGHT & LEFT MOTORS**

OVERVIEW: RDFR *DIRECTORs* perform speed, direction and steering functions for Radio/Controlled vehicles powered by two independent electric motors employed as a right drive and a left drive. They're used for robots with tank tread drives or separate drive wheels, and twin-screw boats or subs where maneuverability is enhanced by differential props combined with rudder steering. They require two R/C channels, one to command throttle speed & direction and the other steering. Each **RDFR** unit has two rugged forward/reverse speed controls coupled together to generate the differential right and left motor rotation needed to guide the vehicle. When used with a spring centered joy stick: hands off is stopped, up stick gets straight ahead, and down yields backwards. Pure right or left twirls the vehicle as the motors turn opposite directions. In between stick positions are completely proportional, including reverse. Additionally the two controllers inside may be un-coupled by program jumpers to operate entirely independently. Except for AM radio types they are compatible with most model R/C systems including Futaba, Hitec, and JR, and Direct Current Permanent Magnet field Brush commutated iron core wound rotor motors.

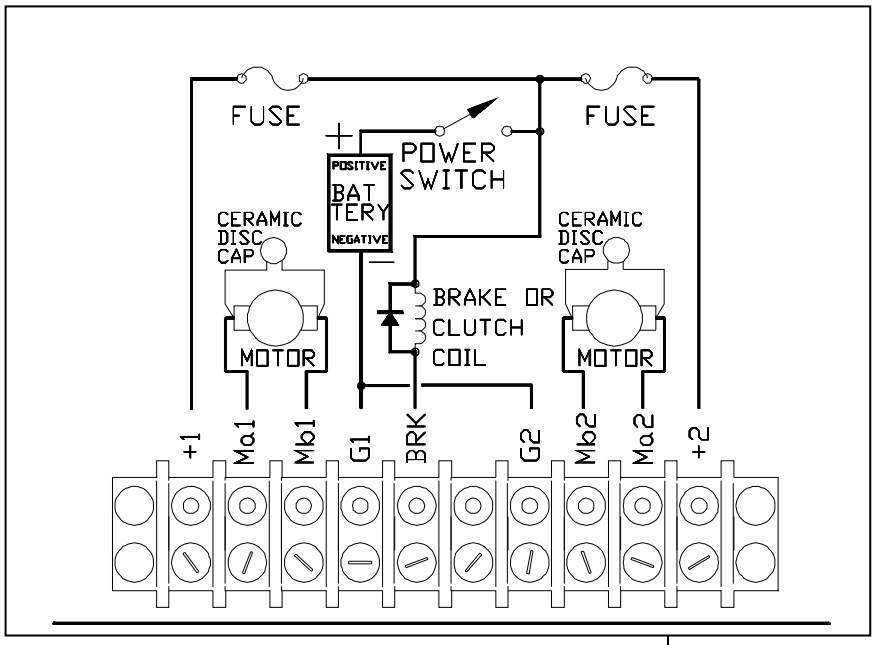
These instructions are for the RDFR33 through RDFR61E that use the circa 2008 "LH" control board. *PLEASE* read and understand them before connecting power. The RDFR2n's have a separate instruction manual.

GETTING GOING: These units are factory shipped with the most popular mixed steering mode programmed. It is ***strongly*** recommended to initially power up the unit in this mode and with the default response curves. This configuration works well in the majority of applications. Later, after successful operation is verified THEN experiment with different curves and modes. Initially power the unit up gingerly with small fuses, low voltage and un-loaded motors as detailed below. Do not power the **RDFR** from batteries under charge, battery eliminator Power Supplies or chargers without consulting factory.

MOUNTING: Don't mount the unit directly adjacent to the R/C receiver. All competitive robot applications such as BattleBots that use both halves at maximum ratings will require mounting the **RDFR** side-opposite-the-terminal-block to an additional heat sinking surface. Usually the metal frame of your vehicle is sufficient. While mounting remove the cover to monitor the mounting screw length; screws should not thread into the case more than 1/8". Do NOT drill into or near the controller. Protect the controller from the environment, especially metal shavings.

WIRING: Follow the Layout Schematic. G1 and G2 of these RDFR products MUST be connected together via the screw terminal at all times to establish a solid low resistance high current connection that is mechanically secure under high currents and temperature; this in addition to supplied soldered connection.

POWER & MOTOR: Observe battery polarity. The SPEC CHART shows the minimum size wire for battery power and motor wiring; wire with the minimum length wire practical and keep this wiring separated from the R/C receiver and Servo Command Pulse cables. Ground your chassis at a single point but don't use the chassis to conduct current. Use separate regular-blow automotive plastic blade fuses or Type 3AG glass fuses to feed



the +1 and +2 power terminals; start with a 5-10 amp fuse and work your way up to the smallest fuse amperage fuse which will support your normal operation. NAPA auto parts has a variety of plastic cased hi-amp fuses. Vantec doesn't recommend thermal Circuit Breakers.

The motor must NOT be connected to anything but the Vantec unit and the RFI suppression components described below. Improper mounting of the motor may create a motor to case short.

Install a MOV of suitable voltage or a .001 ufd 100V ceramic disc capacitor (yellow) directly across each motors brushes or across the motor leads no more than 8 inches from the motor. Some motors come with the capacitors already installed saving you the trouble. These components help prevent RFInterference. MOVs help protect the controller by shunting damaging voltage spikes naturally produced by the inductive motor windings. If not supplied select an AC MOV voltage 120% above your battery voltage. If after testing you experience jerky operation you probably still have RFI. Stubborn RFI cases may require that each motor have installed two yellow .001 ufd ceramic disc capacitors, one from each brush to the motor case and ferrite toroid chokes. PCM type radio control systems are recommended to combat RFI.

OPTIONAL BRAKE RELEASE or CLUTCH ENGAGEMENT: Unless you *specifically* ordered this *extra cost* option ignore the wiring shown on the layout schematic for the BRK node, the Brake/Clutch coil, and *skip this paragraph*. This option is a 2 Amp current sink output that turns on when there's a "motion" command. Use a flyback diode across your coil per the Layout Schematic to protect unit.

SERVO COMMAND PULSE: The inputs plug into your receiver like a servo and the connectors are engraved: Steering = S, and Throttle = T. For the controller to operate both must be plugged into your receiver. Universal JR style connectors may be supplied in lieu of Futaba "J" connectors. They can be harmlessly plugged into a Futaba receiver incorrectly but for the controller to operate they must both be plugged in so that the Vantec controllers brown or black wires lines up with the black wire of a Futaba servo. Plug a Futaba servo in an unused adjacent receiver channel to make this easy. If your controllers connectors are missing the red wire don't worry.

If you decide to Y-connect the **RDFR** with the rudder servo or another **RDFR** be aware some **R/C** receivers don't have adequate **SCP**ulse drive without a "peanut" amplifier; contact the factory for this easy solution if a direct Y fails to work.

Use the full length supplied R/C antenna and locate it away from other wires and metal structures.

SPECIFICATION CHART

PART Number	VOLTAGE Range	Con't Amps for Single Output	Start'g	Typ H-Leg Ohms	Approximate Size	Wgt Oz	Wire AWG
RDFR33	9-43	35	95	.006	6.25 x 2.2 x 4"	27	12
RDFR36E	9-43	60	160	.004	6.25 x 2.3 x 4.5"	39	10
RDFR47E	9-55	77	220	.002	6.25 x 2.3 x 4.5"	43	8
RDFR61	50-112	10	27	.03	6.25 x 2.2 x 4"	27	18
RDFR61E	50-112	15	40	.03	6.25 x 2.3 x 4.5"	39	16

OPERATION: We ***strongly*** recommend you begin initial operation with 12 volts, 5-10 amp fuses and un-loaded motors and/or mechanically disconnected chain drives or belts. Work your way up in voltage, amperage, and mechanical load. Think of fuses as recording amp meters. If the RDFR becomes too hot to hold cease operation and investigate the cause. In the popular tank steering mixed mode both servo connectors must be plugged in for the unit to operate even one motor. Use transmitter trims of *both* channels to set motors "off". They interact so repeat the procedure several times. Assignment of right/left motors to Motor#1 or Motor#2 outputs, motor(s) polarity, and transmitter servo reversing switches have numerous combinations; select the correct combination experimentally but **NEVER reverse the motor battery polarity.** Operation that is punctuated with hesitations indicates your battery voltage is dropping below 9 volts, usually observed during motor starting or lugging. If the battery is new and charged, the motor may be too big for the "cranking amps" rating of the battery. Slower acceleration response curves described below may mitigate this.

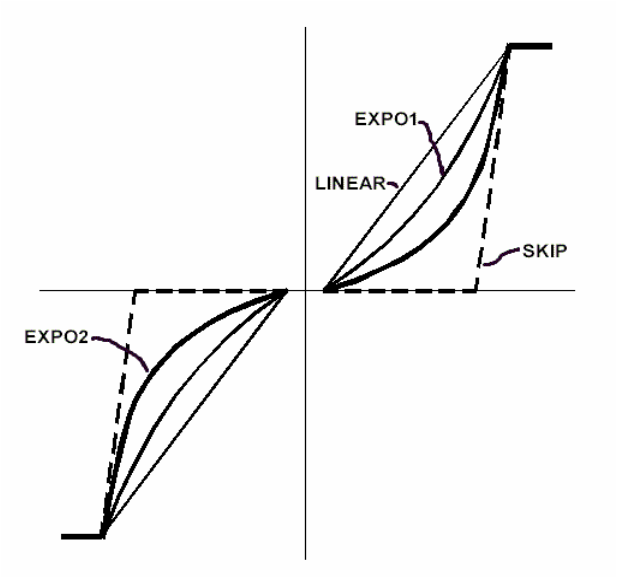
OTHER POSSIBILE MODES:

JUMPERS: The Jumpers are factory set for the popular single joystick mixed tank type steering mode; noted by the shaded sections in the jumper tables. To make a change set the programming jumpers for the functions that suite your application. Jumper ON = installed = present= closed. Pin pairs to receive the Jumpers are in row down the center of the top circuit board.

DUAL INPUT MODES: These modes use both R/C Servo Command Pulse inputs.

MIXED FOR TANK STEERING: Four algorithms are jumper selectable: LINEAR, mild EXPOnential1, moderate EXPOnential2, and SKIP. The EXPOnential modes spread the steering function to provide a gently increasing steering function for very precise neutral steering.

Gain selection: most users prefer HI gain to achieve the maximum possible speed with the stick straight up; when the vehicle turns at full speed the wheel on the inside slows down but the outside wheel can't go any faster because it's already at top speed. Gain calibration is based upon a Futaba FP-9CAP with 100% ATV, 100% Dual Rate, no trim, centered at 1.53 ms, and factory defaults. This gain works well with other popular radios. Adjustment



of gain may also be made at the transmitter using the ATV function or servo travel adjustment potentiometer.

Deadband is the joystick movement around center that produces no action; it makes "off" easy to find. None, Normal, Normal+, and Wide are available.

The SKIP algorithm is an exceptionally wide deadband for boating applications that use rudders. It mixes rudder steering commands into the speed commands only near the extremes of rudder steering. This give maximum speed and stable roll forces over and still offers maneuverability from differential prop action. Great for subs. A Y-connector splits the steering command to the **RDFR** and rudder servo.

Notch defines the starting duty cycle so that your motor isn't driven with a non-rotating but power wasting duty cycle. The bigger the notch the greater the first increment of duty cycle or speed.

Unless you *specifically* ordered this *extra cost* option ignore the Vari-Brake entry in the jumper table. This option provides a joystick variable electro-dynamic brake using the special RP3 microprocessor.

NON-MIXED DUAL INPUT: The mixing function may be defeated to realize two independent speed controllers with two independent Servo Command Pulse inputs by a jumper on JP2. This enables you to control your vehicle with a separate joystick for each motor and do the turning algorithm with your thumbs. The RDFR gives you the choice of steering

methods. Servo Command Pulse Input S=Motor #1, SCP input T=Motor #2. Note this configuration ***mandates*** you choose a separate set of independent response curves for each output and load the appropriate program jumpers. Leaving the relevant jumpers off in the NON-MIXED mode results in indeterminate response. The "NON-MIXED" portion of the chart refers to "select curve from above". Use the "STEERING INPUT CURVES" in "MIXED MODES-Separate Curves" for Motor #1 input S, and the "THROTTLE INPUT CURVES" for Motor #2 input T. The curve(s) labeled 14 are a good choice. For robot speed control applications do NOT select a "NONE" Deadband curve like curve 4.

DUAL INPUT					**SIN gle**	**CR oss**			**SYNCOPATED COMBINED ALGORITHMS**					
MIXED MODES		**STEER GAIN**	**THRTL GAIN**	Dead band at Center		(non-mix)			BO^1	B1^2	B2^4	B3^8		
CURVE PAIRS	RD8 CURVES NAME	CURVE	CURVE		**JPF**	**JPH**	**JPG**	**JPI**	**JPC**	**JPE**	**JPK**	**JPM**	**JPO**	**JPQ**
LINEAR	A7	HI	HI	NONE	OFF	OFF	OFF	OFF	ON	ON	ON	OFF	OFF	OFF
	B6	HI	HI	NORM	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF
	C8	HI	HI	WIDE	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
EXPO1	D0	HI/expo	HI	NORM	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
	E9	MED /EXPO	HI	NORM	OFF	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF
	F4	HI/expo	HI/expo	NORM	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
	G15	HI/expo	HI	WIDE	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF
	H5	HI/expo	HI/expo	WIDE	OFF	OFF	OFF	OFF	ON	OFF	ON	OFF	OFF	OFF
EXPIO2	/11	HI/EXPO	HI/expo	NORM	OFF	OFF	OFF	OFF	ON	ON	OFF	ON	OFF	OFF
SKIP	J13	HI	HI	SPECL	OFF	OFF	OFF	OFF	ON	OFF	ON	ON	OFF	OFF
	K3	HI	HI/expo	SPECL	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF
RESERVED	L1	na	na	na	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
	M12	na	na	na	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF
	N2	na	na	na	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
	O14	na	na	na	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	OFF	OFF
	P10	na	na	na	OFF	OFF	OFF	OFF	OFF	ON	OFF	ON	OFF	OFF
extra cost option **Vari-Brake RP3 uproc**	RP3 ONLY CURVE	HI/expo	HI/expo	WIDE	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF

DUAL INPUT					**SIN gle**	**CR oss**	**S=STEERING INPUT CURVES**				**T=THROTTLE INPUT CURVES**			
MIXED MODES		**GAIN**	**NOTCH**	Dead band at Center		(non-mix)	B2^4	B3^8	BO^1	B1^2	BO^1	B1^2	B2^4	B3^8
SEPARATE CURVES	CURVE NAME				**JPF**	**JPH**	**JPG**	**JPI**	**JPC**	**JPE**	**JPK**	**JPM**	**JPO**	**JPQ**
LINEAR	4	HI	NONE	NONE	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	ON	OFF
LINEAR	5	HI	NONE	NORM	OFF	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
LINEAR	6	HI	slight	WIDE	OFF	OFF	ON	OFF	OFF	ON	OFF	ON	ON	OFF
SKIP	7	HI	NONE	WIDE+	OFF	OFF	ON	OFF	ON	ON	ON	ON	ON	OFF
expoA	8	HI	NONE	NORM	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	ON
expoA	9	HI	slight	WIDE	OFF	OFF	OFF	ON	ON	OFF	ON	OFF	OFF	ON
EXPOB	10	HI	NONE	NORM	OFF	OFF	OFF	ON	OFF	ON	OFF	ON	OFF	ON
EXPOB	11	MED	NONE	NORM	OFF	OFF	OFF	ON	ON	ON	ON	ON	OFF	ON
LINEAR	12	HI	MED	NORM+	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	ON	ON
LINEAR	13	HI	MED	WIDE	OFF	OFF	ON	ON	ON	OFF	ON	OFF	ON	ON
expoA	14	HI	MED	NORM+	OFF	OFF	ON	ON	OFF	ON	OFF	ON	ON	ON
expoA	15	HI	MED	WIDE	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON
NON-MIXED					**SIN gle**	Non-Mix	MOTOR OUTPUT #1 = Input S				MOTOR OUTPUT #2=Input T			
					OFF	ON	**Select Curve from Steering Curves Above**				**Select Curve from Throttle Curves Above**			

SINGLE INPUT		**HOLD1**	**HOLD2**		**SIN gle**	**CR oss**	**S=STEERING INPUT CURVES**				**T=THROTTLE INPUT CURVES**			
Input S only					O	(non-mix)	B2^4	B3^8	BO^1	B1^2	BO^1	B1^2	B2^4	B3^8
		JPN	**JPP**		**JPF**	**JPH**	**JPG**	**JPI**	**JPC**	**JPE**	**JPK**	**JPM**	**JPO**	**JPQ**
		ON	X		ON	OFF	**Select Curve from Steering Curves Above**				S commands Motor #1			
		X	ON		ON	ON	S commands Motor #2				**Select Curve from Throttle Curves Above**			

GENTLE BRAKE RAMP		**BK1**	**BK2**
Brake Ramp 0-100% Time in milliseconds	Motor Armature at 100%	**JPJ**	**JPL**
640 ms	Shorted	OFF	OFF
71 ms	Open	ON	OFF
1.3 Seconds	Shorted	OFF	ON
320 ms	Shorted	ON	ON

REVERSING BRAKE & ACCELERATION RAMPS		**ACL1**	**ACL2**
Brake Ramp 0-100% Time in milliseconds	Acceleration Ramp Time	**JPB**	**JPD**
320 ms	290 ms	OFF	OFF
71 ms	74 ms	ON	OFF
640 ms	590 ms	OFF	ON
160 ms	150 ms	ON	**ON**

PWM RATE	
	JPA
338 Hz	OFF
21.5KHz	ON
Not Recommended	

SINGLE INPUT MODES: The remaining configuration uses a single Servo Command Pulse input, input S, as a switchable command to control either motor output section, each with its own algorithm. This provides a way to get *two speed control functions from a single R/C channel.* A VANTEC channel expanding KeyKoder is one possible source for the switching signal. To implement: install the SINgle jumper. With CRoss open (no jumper) the S input commands motor #1. If CRoss has a jumper or is connected to a standard 5V HCMOS "low" logic signal the active output crosses to motor #2. To enhance this feature you may select what happens to the abandoned motor output. A jumper on HOLD1 will cause the motor #1 output to continue it's last command before the input is cross switched, otherwise it goes to fail safe off. Likewise for HOLD2.

BRAKING AND REVERSING: the optically isolated outputs are Pulse Width Modulated full H-bridge circuits. For speed control the bottom half of the bridge is modulated while the diagonal upper bridge leg is held on. Sequenced electro-dynamic braking shunts the motor by modulating both top legs of the bridge. With a command to "stop" the brake is gently ramped from 0 to 100% duty cycle. When an R/C command changes direction the brake is abruptly sequenced to first bring the motor to a halt, then the reversing PWM power is accelerated up to the commanded speed. This forced timed sequencing minimizes motor "plugging" and stress on your mechanical components. The implementation and timing of these functions is user selectable via jumpers BraKe1-2, ACceLeration1-2; jumpers B,D,J & L. Longer acceleration times are easier on mechanical components and starting currents imposed upon the battery.

These units are principally used in high current applications and are factory strapped for 338 Hz PWM switching frequency to realize maximum current capacity and low EMI/RFInterference for Radio Control environments. Changing the PWM chop rate to 21 KHz drastically reduces the current capability of these products and introduces a host of new problems, including RFI. It is NOT recommended; especially not for competitive robots.

Noise in audio systems from the PWM is usually caused by modulation of the battery system by the PWM rate AND no filtering of the power going to audio components, or a poor ground scheme. Those problems are best addressed rather than resorting to the 21 KHz PWM chop rate.

CURRENT LIMITING: The two outputs, Motor #1 and Motor #2 are individually current limited. The adjacent adjustment pot is factory set for the particular model controller, up to 300 amp. Vantec suggests using the factory setting. As controller temperature increases the current limiting function reduces current more yet.

The limiting function holds the current steady beginning at the adjusted setting current even as the loading nearly doubles. Further yet increases of the load cause the current to dramatically fold back. Thus the current supplied actually reduces with increasing load to protect the controller. Note that it is possible to reduce the current limit setting to the point the motor fails to start. Most users do not have an accurate super hi current load to enable reproducing the factory setting so Vantec recommends not altering the factory adjustment.

IMPORTANT DISCLAIMERS: These products are not safety devices nor for use in life-critical or life-support systems. The RDFR comes with a limited one year warranty based upon a fixed repair charge for units not tampered with or abused. For single channel controllers with these features see our RSFR spec sheet. Specifications and price subject to change without notice. Patented. Some tradenames & trademarks owned by others.

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