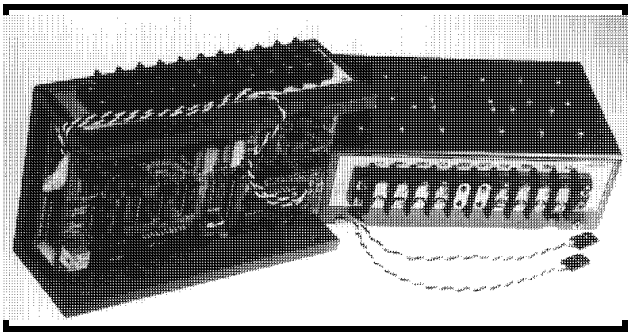
VANTEC

HELP: **(805)929-5055**

RadioControl Dual FORWARD & REVERSE SPEED CONTROL

MANUAL



- ☐ **MODELS RDFR32 - RDFR38E**
- ☐ **ROBOTS, TWINSCREW BOATS**
- ☐ **INSTALLATION & WIRING**
- ☐ **JUMPER SELECTIONS**
- ☐ **MOUNTING**

■ **OVERVIEW:** The **RDFR** *DIRECTORS* perform speed, direction and steering functions for **R**adio/**C**ontrolled 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 maneuverablility 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 through special logic that generates 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. Other modes of operation are available. **RDFR** *DIRECTORS* are compatible with most model R/C systems, including Futaba.

These instructions are for the **RDFR32** through **RDFR38E.** ***PLEASE read and understand them before connecting power.*** The **RDFR21** and **RDFR22** have a separate instruction manual.

■ **VERIFY MODEL SELECTION:** On page 2 the **SPEC CHART** shows ratings for one *single* motor output. Measure your motor's continuous running current under *actual normal mechanical load.* Or determine your DC PM motors armature terminal resistance by consulting specifications or measurement. Take the measurement by mechanically locking the motor shaft and reading the current drawn while briefly powered from a fresh alkaline 1.5 volt "D" cell. The **SELECTOR CHART** on this page shows armature resistance in "D" cell amps or ohms. At your operating voltage the **RDFR** model choosen should list *lower* Ohms or *higher* Amps than your motor. **VANTEC** surge ratings express usable motor starting surge current over a realistic 5 second period.

SELECTOR CHART

V	Ohm	"D" Amp	Part #
9	0.17	7	RDFR21
9	0.12	9	RDFR22
9	0.13	8.3	RDFR32
9	0.08	15	RDFR33
12	0.23	5.3	RDFR21
12	0.16	7	RDFR22
12	0.17	6.6	RDFR32
12	0.11	9.5	RDFR33
12	0.07	NA	RDFR36E
12	0.05	NA	RDFR38E
18	0.34	3.7	RDFR21
18	0.24	5.2	RDFR22
18	0.25	4.7	RDFR32
18	0.17	7	RDFR33
18	0.12	9	RDFR36E
18	0.08	NA	RDFR38E
24	0.46	2.9	RDFR21
24	0.32	4	RDFR22
24	0.34	3.7	RDFR32
24	0.21	5.5	RDFR33
24	0.15	7.2	RDFR36E
24	0.10	9.6	RDFR38E
36	0.52	2.5	RDFR32
36	0.33	3.8	RDFR33
36	0.24	5.2	RDFR36E
48	0.73	1.8	RDFR42
48	0.53	2.5	RDFR43E
60	0.92	1.4	RDFR42
60	0.66	2	RDFR43E
140	3.40	0.4	RDFR61

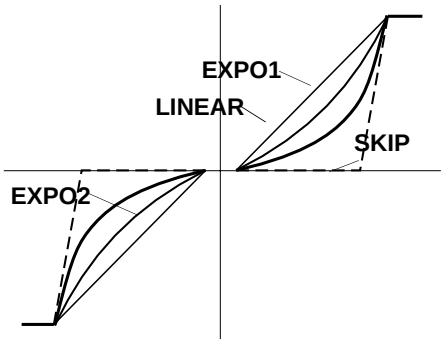
■ **JUMPERS:** The Jumpers are factory set for the most popular ***single joystick mixed tank type steering*** mode so this section may be skipped for anxious users. These settings are noted by the heavy shaded sections in the jumper tables. Otherwise begin by setting the programming jumpers for the functions that suite your application. Jumper ON = installed=present=closed.

DUAL INPUT MODES: These modes use both R/C **S**ervo **C**ommand **P**ulse inputs.

MIXED FOR TANK STEERING: Five algorithms are jumper selectable: **LINEAR**, mild **EXPO**nential**1**, moderate **EXPO**nential**2**, **SKIP** and *optional* ***VAR***iable ratio. The **EXPO**nential modes spread the steering function to provide a gently increasing steering function for very precise neutral steering.

VANTEC RDFR3x

The **SKIP** algorithm is for boats with rudders. It mixes steering into the speed commands only near the *extremes* of rudder steering. This gives maximum speed and stable roll forces and still offers maneuverability. Especially for subs. A Y-connector splits the steering command to the **RDFR** and the rudder servo.



The optional **VAR**iable ratio adjusts the steering gain according to the speed command. At slow speeds steering gain and effectiveness is maximum. At full speed the steering gain is reduced. This places the less stable high speed turns beyond operator reach for safety.

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-8UAP 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.

NON-MIXED DUAL INPUT: The mixing function may be defeated to realize two independent speed controls with two independent **S**ervo **C**ommand **P**ulse inputs. This enables you to control your vehicle with a separate joystick for each motor and do the turning algorithm with your thumbs. **SCP** Input **S**=Motor **#1**, **SCP** input **T**=Motor **#2**. Note this configuration has a separate set of independent algorithms for each output.To implement**:** install the **CR**oss jumper. The **RDFR** is the only controller that gives you *your* choice of steering methods.

SINGLE INPUT MODES: The remaining configuration uses a single **S**ervo **C**ommand **P**ulse 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 **SIN**gle jumper. With **CR**oss open (no jumper) the **S** input commands motor #1. If **CR**oss 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**.

The factory **CUSTOM** *option* allows you to optimize mixing/ non-mixing, gain, deadband and failsafe values.

The PWM chopping frequency is jumper selectable to **338** Hz(default), **169** Hz, and **21.6** KHz. The RDFRs operate optimally in a radio environment at 338 HZ. At 21.6 KHz more RFI is generated which requires additional RFI filters and the amperage must be derated 30%.

SPEC CHART

Part Number	Voltage Range	*Single Output* Con't / Start'g Amps		TypLoss	Approximate *LegOhms*	Wgt *Oz.*	Wire *Size AWG*	Comments
For 12-24VDC systems:					*SPEC CHART*			
RDFR21	*9-30*	*14*	*45*	*.009*	*4.2 X 2.9 X 1.3*	*8*	*18*	*Most compact, factory program-*
RDFR22	*9-30*	*20*	*60*	*.005*	*4.2 X 2.9 X 1.3"*	*8*	*18*	*med steering, limited features*
For 12-36VDC systems:								
RDFR32	*9-43*	*24*	*65*	*.010*	*6.25 X 2.2 X 4"*	*25*	*16*	**All Program features, Best buy!**
RDFR33	*9-43*	*35*	*95*	*.006*	*6.25 X 2.2 X 4"*	*27*	*12*	*Most popular!*
RDFR36E	*9-43*	*60*	*160*	*.004*	*6.25 X 2.3 X 4.5"*	*39*	*10*	*Used in Bomb Disposal Robots*
RDFR38E	*9-32*	*80*	*220*	*.002*	*6.25 X 2.3 X 4.5"*	*43*	*8*	*Drives 3 HP Acrobatic Go-Cart*
For 42-48VDC systens:								
RDFR42	*32-60*	*20*	*54*	*.013*	*6.25 X 2.3 X 4"*	*27*	*18*	*Medium voltage systems*
RDFR43E	*32-60*	*35*	*95*	*.013*	*6.25 X 2.3 X 4.5"*	*39*	*39*	*Extruded case*
For 60-120 VDC systems (Units below require filtered +12-36 VDC @ 180ma)								
RDFR61	*50-140*	*10*	*27*	*.03*	*6.25 X 2.2 X 4"*	*27*	*18*	*Grainger's Dayton or Minarik*
RDFR61E	*50-140*	*15*	*40*	*.03*	*6.25 X 2.3 X 4.5"*	*39*	*16*	*90 VDC Gearhead motors*

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DUAL INPUT					SINgle	CROss			SYNCOPATED COMBINED ALGORITHMS					
MIXED MODES CURVE PAIRS		STEER GAIN / Curve	THRTL GAIN / Curve	Dead band at center	JP1	JP2	JP13	JP14	JP3	JP4	JP5	JP6	JP15	JP16
									$B0_1$	B12	$B2_4$	$B3_8$		
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
EXPO2	I11	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
CUSTOM	L1	As you like it OPTION			OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
VARATIO	M12	na			OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF
	N2	na			OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
	O14	na			OFF	OFF	OFF	OFF	OFF	ON	ON	ON	OFF	OFF
	P10	na			OFF	OFF	OFF	OFF	OFF	ON	OFF	ON	OFF	OFF

MIXED MODES SEPARATE CURVES		Gain	Notch	Dead band at center	SINgle	CROss	STEERING INPUT CURVES				THROTTLE INPUT CURVES			
					JP1	JP2	$B2_4$ JP13	$B3_8$ JP14	$B0_1$ JP3	$B1_2$ JP4	$B0_1$ JP5	B12 JP6	B24 JP15	B38 JP16
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	VERY 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					SINgle	(Non mix)	MOTOR OUTPUT #1 = input S	MOTOR OUTPUT #2 = input T
					OFF	ON	select curve from above	select curve from above
SINGLE INPUT					SINgle	CROss	MOTOR OUTPUT selected below	MOTOR OUTPUT selected below
Input S ONLY					ON	OFF	Use "Steering" Curves above	S COMMANDS MOTOR#1
					ON	ON	S COMMANDS MOTOR#2	Use "Throttle" Curves above

Single Input Mode Only	HOLD1	HOLD2
	J11	J12
	ON	X
	X	ON

21.6	338	21.6
JP17	JP18	JP19
OFF	ON	OFF
Place only one jumper ON		

BRAKING AND REVERSING:

the optically isolated outputs are **P**ulse **W**idth **M**odulated 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 quickly sequenced to first bring the motor to a halt, then the reversing **PWM** power is acccelerated up to the commanded speed. This forced sequencing minimizes motor "plugging" and stress on your mechanical components. The implementation and timing of these functions is user selectable via jumpers **B**ra**K**e**1-2**, **AC**ce**L**eration**1-2.**

GENTLE BRAKE RAMP

BRAKE RAMP 0-100% TIME	ARMATURE AT REST	BK1 JP8	BK2 JP9
640 milliseconds	SHORTED/BRAKED	OFF	OFF
71 milliseconds	OPEN	ON	OFF
1.3 SECONDS	SHORTED/BRAKED	OFF	ON
320 milliseconds	SHORTED/BRAKED	ON	ON

REVERSING BRAKE AND ACCELERATION RAMPS

BRAKE RAMP 0-100% TIME	ACCELERATION RAMP TIME	ACL1 JP7	ACL2 JP10
320 milliseconds	290 milliseconds	OFF	OFF
71 milliseconds	74 milliseconds	ON	OFF
640 milliseconds	590 milliseconds	OFF	ON
160 milliseconds	150 milliseconds	ON	ON

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■ **WIRING:** Follow the layout schematic. Connect **G1** and **G2** together on the terminal strip. Do not power the **RDFR** from batteries under charge, battery eliminators or chargers without consulting factory.

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 **SCP**ulse cables. Ground your chassis at a single point but don't use the chassis to conduct current. Use separate regular-blow fuses to feed the **+1** and **+2** power terminals; select the smallest fuse which will support normal operation.

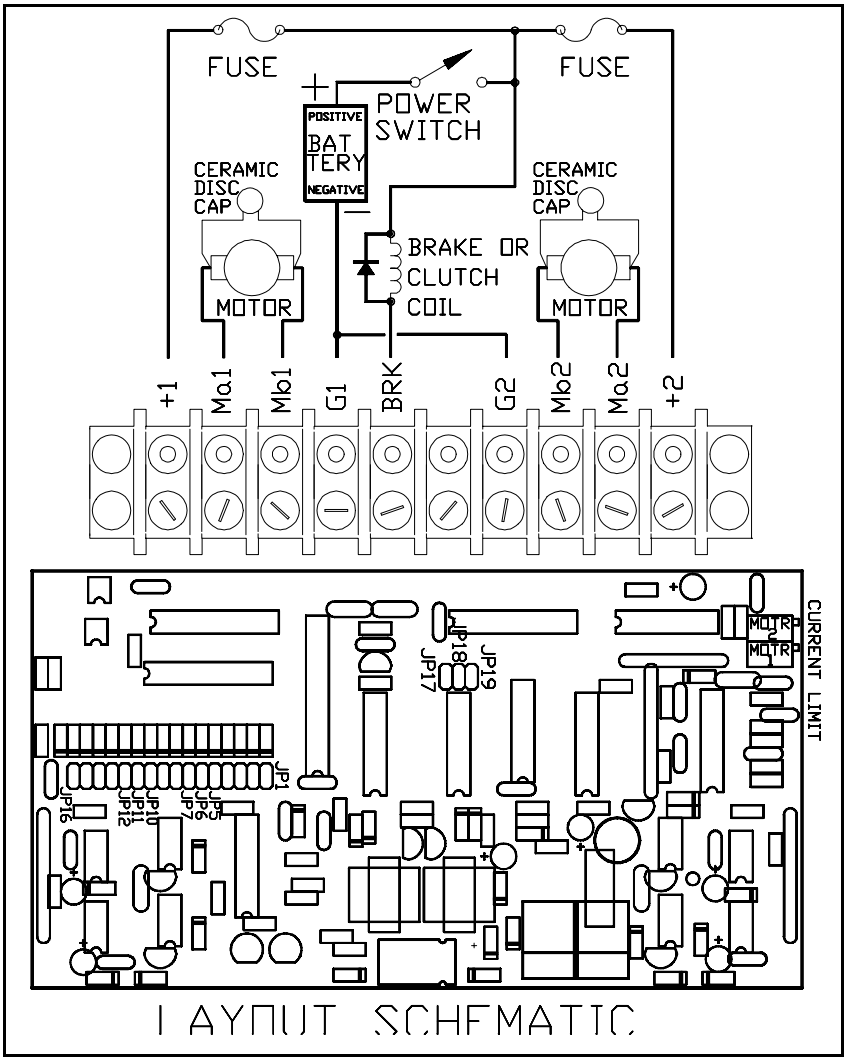
Install a .001 ufd ceramic disc capacitor directly across each motors brushes and between each brush and their motor case for RFI protection.

SERVO COMMAND PULSE: The inputs plug into your receiver like a servo and the connectors are engraved: Steering = **S**, and Throttle = **T**. Only the receiver common and your **S**ervo **C**ommand **P**ulse signal wires are required to drive the optical isolators within the **RDFR.** The **RDFR** neither takes power from nor supplies power to the R/C receiver; thus the plus (red) wire is not used. Available with Futaba J or G, Airtronics, Deans, or JR connectors, it works with FM or PCM radios. Use the full length supplied R/C antenna and locate it away from other wires and metal structures.

OPTIONAL BRAKE RELEASE or **CLUTCH ENGAGEMENT:** A 2 Amp output current sink that turns on when there's an R/C "motion" command. With a "stop" R/C command it goes off after a short delay. Although available independently per motor this option is normally supplied as a single *OR'd* output at the **BRK** terminal. Install a flyback diode across your coil to protect the **RDFR**.

■ **MOUNTING:** Don't mount the unit directly adjacent to the R/C receiver. Simultaneous operation of both halves at max ratings may require cooling air or mounting the **RDFR** side-opposite-the-terminal-block to additional heat sinking; usually the metal frame of your vehicle is sufficient. No *special* heatsinks are required. While mounting remove the cover to monitor the mounting screw length; screws should not thread into the case more than 1/8".

■ **OPERATION:** If the **RDFR** becomes to 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 channesls to set motors off deadband. Assignment of right/left motors to #1 or #2 outputs, motor(s) polarity, and transmitter servo reversing switches have numerous combinations; select the correct combination experimently but NEVER reverse the motor battery polarity. Noise in sound systems is due to a poor power distribution scheme; ask for our application note on AF noise.



Output current through the MOSFETransistors is compression limited above a threshhold by PWM duty cycle limiting. The threshhold adjustment trimpot for each output is factory set.

■ The **RDFR** comes with a limited one year warranty based upon a fixed repair charge for units not tampered with or abused. These products are ***not safety devices nor for use in life-critical or life-support systems.*** 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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