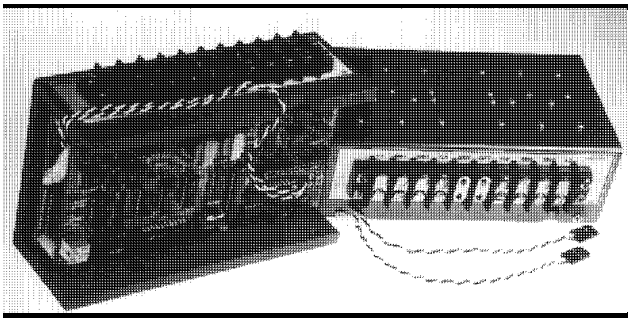
VANTEC

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

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

MANUAL



- ☐ **MODELS RDFR21 - RDFR23**
- ☐ **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 **RDFR21** through **RDFR23**. ***PLEASE*** read and understand them before connecting power. The **RDFR32** through **RDFR61E** 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 use the **SELECTOR CHART** on this page. Begin by determining your DC PM motors armature terminal resistance by consulting specifications or measurement. Armature resistance cannot be measured with a normal ohm meter. Instead, 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 specified 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	.4	RDFR61

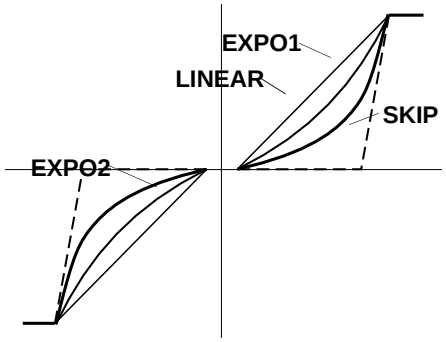
■ **JUMPERS:** The Jumpers are factory set for the most popular ***single joystick mixed tank type steering*** mode so this section may be skipped for anxious users. These settings are noted by the shaded sections in the jumper tables. Otherwise begin setting the programming jumpers for the functions 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** & *optional* ***VAR***iable ratio. The **EXPO**nential modes spread the steering to provide a gently increasing steering function for very precise neutral steering.

VANTEC RDFR2n

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 get 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 works well with other popular radios. Adjustment of gain may also be made at the transmitter using the ATV servo travel adjustment potentiometer. The Notch defines the starting duty cycle so your motor isn't driven with a non-rotating but power wasting duty cycle. Deadband is the joystick movement around center that produces no action; it makes "off" easy to find.

NON-MIXED DUAL INPUT: The mixing function may be defeated to realize two independent speed controls with two independent Servo Command Pulse 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**. To implement: install jumper **JP2**. The **RDFR** is the only controller that gives you your choice. Note this configuration may have matching curve pairs or different algorithms for each output.

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

21.6	338
JP1	JP1
ON	OFF

The PWM chopping frequency is the recommended **338** Hz(default) or install jumper **JP1** to select **21.6** KHz . The **RDFR**s 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 to 30%.

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. Jumpers **JP3** and **JP4** select the appropriate ramping for your application.

SPEC CHART

Part Number	Voltage Range	*Single Output* Con't Amps	Start'g Amps	TypLoss *LegOhms*	Approximate Size w/ connector	Wgt *Oz.*	Wire *AWG*	Comments
For 4 cell to 24VDC systems:								
RDFR21	4.5-30	14	45	.009	4.2 X 2.9 X 1.3"	7	18	Lowest Cost
RDFR22	4.5-30	20	60	.005	4.2 X 2.9 X 1.3"	9	16	Most compact unit, with
RDFR23	4.5-30	30	60	.004	4.2 X 2.9 X 1.3"	9	16	popular algorithms
For 12-36VDC systems:								
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						***SYNCOPATED*** **COMBINED ALGORITHMS**			
MIXED MODES CURVE PAIRS		**STEER GAIN / Curve**	**THRTL GAIN / Curve**	Dead band at center	Non mix **JP2**	$B0_1$ **JP5**	B12 **JP6**	$B2_4$ **JP7**	$B3_8$ **JP8**
LINEAR	A7	HI	HI	**NONE**	OFF	ON	ON	ON	OFF
	B6	HI	HI	**NORM**	OFF	OFF	ON	ON	OFF
	C8	HI	HI	WIDE	OFF	OFF	OFF	OFF	ON
EXPO1	D0	HI/expo	HI	**NORM**	OFF	OFF	OFF	OFF	OFF
	E9	**MED / EXPO**	HI	**NORM**	OFF	ON	OFF	OFF	ON
	F4	HI/expo	HI/expo	**NORM**	OFF	OFF	OFF	ON	OFF
	G15	HI/expo	HI	WIDE	OFF	ON	ON	ON	ON
	H5	HI/expo	HI/expo	WIDE	OFF	ON	OFF	ON	OFF
EXPO2	I11	HI/**EXPO**	HI/expo	**NORM**	OFF	ON	ON	OFF	ON
SKIP	J13	HI	HI	**SPECL**	OFF	ON	OFF	ON	ON
	K3	HI	HI/expo	**SPECL**	OFF	ON	ON	OFF	OFF
CUSTOM	L1	As you like it OPTION			OFF	ON	OFF	OFF	OFF
VARATIO	M12	na			OFF	OFF	OFF	ON	ON
	N2	na			OFF	OFF	ON	OFF	OFF
	O14	na			OFF	OFF	ON	ON	ON
	P10	na			OFF	OFF	ON	OFF	ON
NON-MIXED MODES MATCHED CURVE PAIRS		Gain	Notch	Dead band at center	Non Mix **JP2**	**JP5**	**JP6**	**JP7**	**JP8**
LINEAR	4	HI	NONE	**NONE**	ON	OFF	OFF	OFF	OFF
LINEAR	5	HI	NONE	**NORM**	ON	ON	OFF	OFF	OFF
expoA	8	HI	NONE	**NORM**	ON	OFF	ON	OFF	OFF
EXPOB	10	HI	NONE	**NORM**	ON	ON	ON	OFF	OFFf
LINEAR	12	HI	MED	**NORM+**	ON	OFF	OFF	ON	OFF
LINEAR	13	HI	MED	WIDE	ON	ON	OFF	ON	OFF
expoA	14	HI	MED	**NORM+**	ON	OFF	ON	ON	OFF
expoA	15	HI	MED	WIDE	ON	ON	ON	ON	OFF
UN-UNATCHED PAIRS		MOTOR 1 = S input	MOTOR 2 = T input	select curve from above	**JP2**	**JP5**	**JP6**	**JP7**	**JP8**
Curves		13	15		ON	OFF	OFF	OFF	ON
Curves		5	8		ON	ON	OFF	OFF	ON
Curves		5	14		ON	OFF	ON	OFF	ON
Curves		5	10		ON	ON	ON	OFF	ON
Curves		12	8		ON	OFF	OFF	ON	ON
Curves		12	14		ON	ON	OFF	ON	ON
Curves		8	10		ON	OFF	ON	ON	ON
Curves		8	14		ON	ON	ON	ON	ON

■ **WIRING:** Follow the layout schematic. 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. The **RDFR21-23**'s have *two* screw connections for *each node* to assure solid high current connections for the handy plug-in terminal block. Run *double* wires, one from each screw connection for a node, to the respective motor terminal or fuse. Run *4* wires from the 4 screws for the **GROUND** node; the ground supports the current for both motors. 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.

A MOV should be installed directly across the motor brushes and 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.** Some R/C receivers don't have adequate **SCP**ulse drive for Y-connecting the **RDFR** with the rudder servo without a "peanut" amplifier; contact the factory for this *easy* solution if a direct Y fails to work. 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:** provides 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. Connect at the single terminal block connection **BRK**. Install a flyback diode across your coil to protect the **RDFR**.

BRAKING / ACCELERATION RAMP SELECTION in milliseconds 0 to 100%					
ARMATURE AT REST	GENTLE BRAKING (Normal Stop)	QUICK BRAKING (Change Direction)	ACCELER-ATION	**JP3**	**JP4**
Shunted	320 ms	71 ms	74 ms	OFF	OFF
Open	71 ms	640 ms	590 ms	ON	OFF
Shunted	1300 ms	320 ms	290 ms	OFF	ON
Shunted	640 ms	160 ms	150 ms	ON	ON

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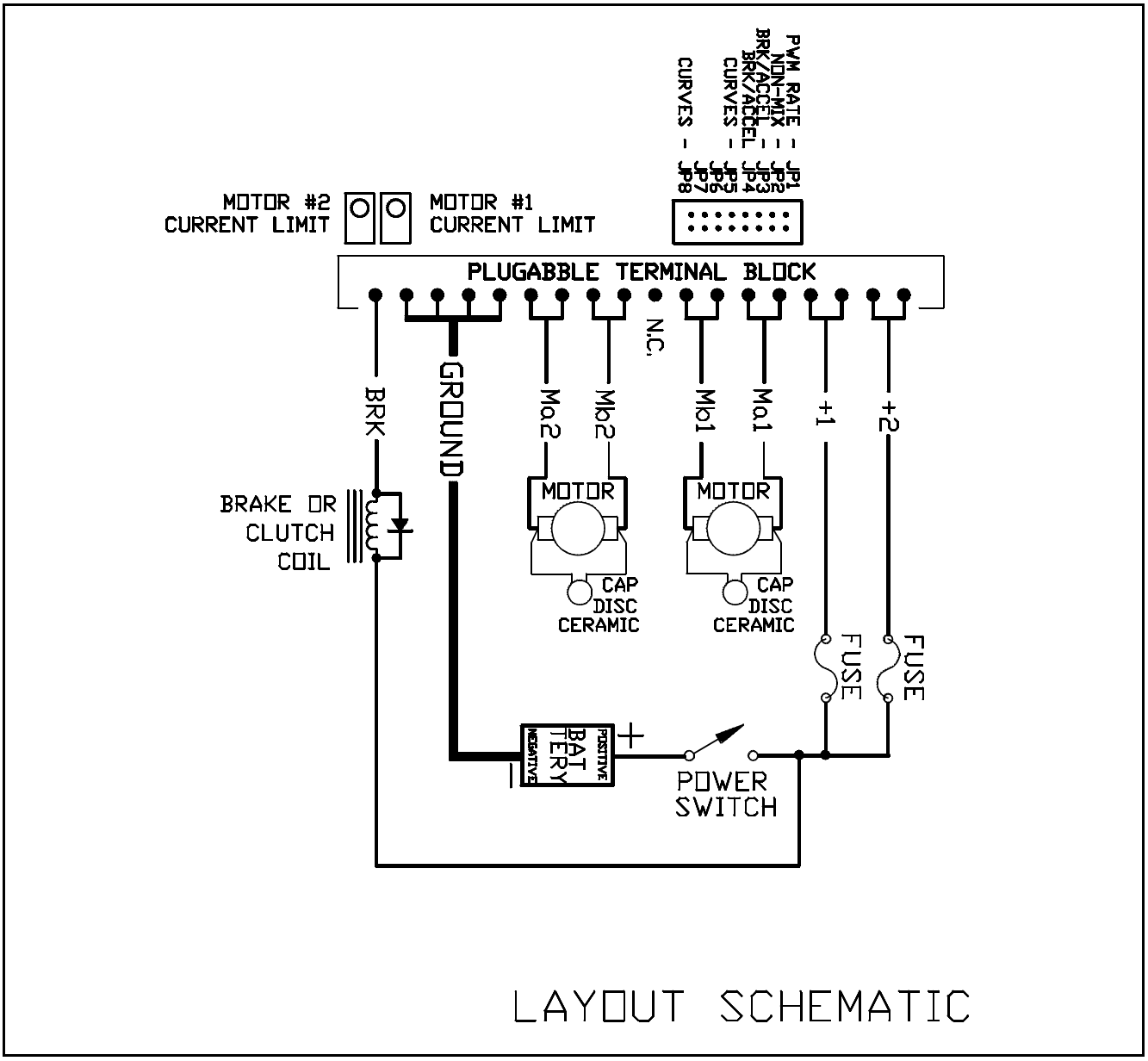
■ **MOUNTING:** Don't mount the unit directly adjacent to the R/C receiver. Simultaneous operation of both halves at maximum ratings may require cooling air or mounting the **RDFR** side-opposite-the-terminal-block to additional heat sinking. Usually the metal frame of your vehicle is sufficient. No *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 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 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 **MOSFET**ransistors is compression limited above a threshhold by **PWM** duty cycle limiting. The threshhold adjustment trimpot for each output is factory set. CW rotation increases the limiter threshhold.

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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