



INSTRUCTION BOOKLET AND WARRANTY

FOR TURBO ZETA SPEED CONTROLLER

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TURBO ADDENDUM

TURBO SHIFT DETECT AND REVERSE ACTION — The reverse feature in the Turbo ZETA is very different from that in other speed controllers. During setup you will set a shift detect point on a portion of the reverse trigger/stick throw of the transmitter. The micro-computer will now monitor the trigger/stick, and when it detects the trigger/stick has been pushed past that detect point, it will enable reverse motor direction. The motor will not actually turn in the reverse direction until you come back forward on the trigger/stick. This is called the shifter mechanism. Just remember, when you push the trigger/stick up in the reverse direction, you will not get any motor action until you come back forward on the trigger/stick. However, when you do come back forward on the trigger, you will get motor action in the opposite direction.

EXTERNAL RECEIVER BATTERY BACK — You should not need to run an external receiver battery pack, but if you choose to, it is very important to not let the receiver battery feed a voltage back into the Turbo ZETA. This is done by clipping open the red wire that connects the Turbo ZETA to the receiver. If you do not clip open this red wire, the Turbo ZETA may jam and will probably have to be returned to the factory for repair.

SPLIT BATTERY SYSTEM — The Turbo ZETA is the most powerful speed controller ever developed with reverse. One of the reasons is because it does use a separate battery for reverse. The reverse battery must be a totally separate battery, not linked to the forward battery in any way except through the Turbo ZETA. There is no way around this; it is by design.

ABOVE 10 CELL OPERATION — The instructions will tell you to clip open the green wire whenever you apply greater than 10 cells. The reference to 10 cells does not include the reverse pack. Also, this means 10 cells in series. So, if you put 2 - 7-cell packs in parallel on the forward connector, you will not clip the green wire.

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INTRODUCTION

The Turbo ZETA is one in a family of PDI programmable, all electronic speed controls. It achieves programmability by incorporating a micro-computer into its design. This allows the user to make many more adjustments than with a speed controller that does not have a micro-computer. In addition to being programmable, the Turbo ZETA is water-tight, will handle multiple high performance motors, and has a proportional reverse capability.

The Turbo ZETA achieves its reverse capability by using separate forward and reverse battery packs. With this split battery system, the forward battery can have from 6 to 32 cells in series, while the reverse battery can have from 3 to 7 cells. This will give a large amount of forward power and maintain a controlled amount of reverse power (not overpowering reverse is important in some applications).

The Turbo ZETA is two separate units: the speed control unit which is installed into the model vehicle and the handheld programmer. The handheld programmer is only used to calibrate the speed controller to the transmitter and to allow the features to be selected. Once this is done, the handheld programmer is disconnected from the speed controller and stored for future use.

The handheld programmer is connected to the speed controller via a 3-wire connector. Two seconds after the programmer is plugged in, the speed controller will shut down all speed controller functions. The micro-computer in the Turbo ZETA then looks for information to come in from the handheld programmer.

The adjustments are made by simply setting the seven (7) switches on the handheld programmer to the desired position and then pressing and releasing the SEND push button. When the desired adjustments have been made, the handheld programmer is disconnected. The microcomputer in the Turbo ZETA will then resume operation in the speed controller mode after a short delay. All programmed parameters are permanently stored in memory. Any single parameter can be changed without affecting any other parameter.

The following parameters can be programmed by the user:

- 1) Trigger response
- 2) Acceleration rate
- 3) Acceleration rate bypass one time after power on
- 4) Reverse enable/disable
- 5) Trigger full speed set position
- 6) Trigger start of speed set position
- 7) Trigger reverse position shift point
- 8) Trigger end of reverse position

The trigger response curves are used to allow better low to mid-range speed control with some high torque motors. Because there are 9 trigger response curves to choose from, the modeler can select which curve, by experimentation, that provides the best speed feel. The trigger response curves are shown in Figures 3, 4, and 5.

The modeler can also program an acceleration rate that will prevent his vehicle from making too quick a response. This acceleration rate limiting function is used in cars to prevent spin out on a slippery track surface, but can also be used by scale modelers to add additional realism to their scale vehicles. In general the modeler should become familiar with these features and let his imagination determine where they might apply in his particular application.

DESCRIPTION OF THE SPEED CONTROLLER

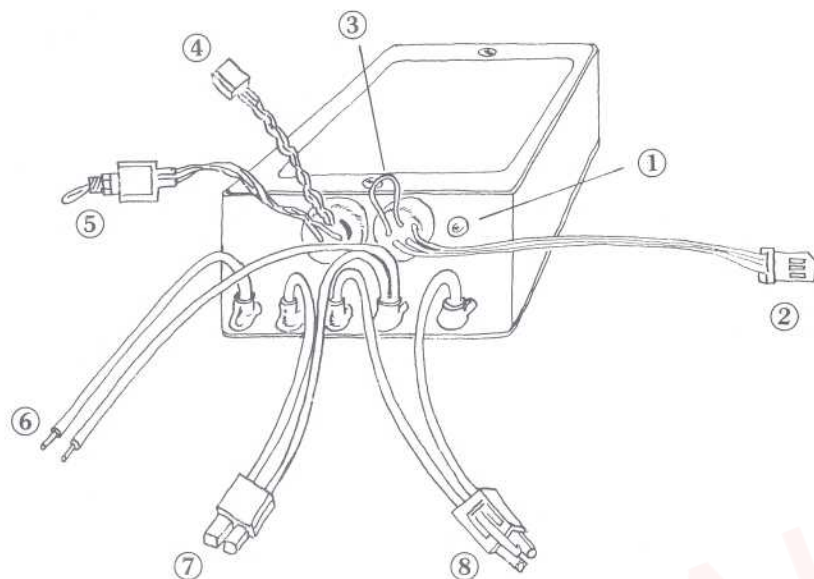
Refer to Figure 1 while reading the following descriptions:

- ① **SPEED CONTROLLER LED (LIGHT EMITTING DIODE)** This LED is a multi-purpose indicator. When the handheld programmer is connected, the LED indicates a good data transfer by flashing on and then off one time just after the PRESS TO SEND button has been pressed and then released. If the LED flashes on and then off several times in rapid succession, then there is a problem. See the "What causes the error LED to flash when in the program mode?" section for a complete list of potential problems.

When the programmer is not connected to the speed controller, the LED becomes a full speed indicator. The LED also becomes an over-temperature indicator. If either the forward or reverse power transistors approach the burnout point, the microcomputer will automatically turn them off while continuing to monitor them. When the transistors cool down, the microcomputer will turn them back on. When a thermal shutdown occurs, the LED will flash on and off indicating a thermal shutdown has occurred. This LED can only be reset by removing power to the unit.

- ② **RECEIVER CONNECTOR** This connector gets connected to the receiver. Speed control command information is received from the receiver via this connection. See the "Wiring information for frequently used receivers" section if you have to change the receiver connector to a different type.

FIGURE 1 TURBO SPEED CONTROLLER



③ **GREEN BYPASS WIRE** This wire should only be cut if the Turbo ZETA is going to be operated above 10 cells on the forward battery pack. If you are operating at 10 cells or lower just leave this wire intact.

*****VERY IMPORTANT***** Do NOT connect more than 10 cells to the Turbo ZETA when this wire is intact.

④ **HANDHELD PROGRAMMER CONNECTOR** This 3-pin connector is the programmer port. The microcomputer will receive information from the handheld programmer via this port when the programmer is connected.

*****NOTE***** There is a polarity notch on this connector that MUST match the notch on the programmer connector when the handheld programmer is connected.

⑤ **MAIN POWER ON-OFF SWITCH** This switch applies all power to the internal control circuitry and also will power up the receiver and steering servo when it is run off the internal BEC regulator.

⑥ **MOTOR POWER WIRES** These wires supply the power to the motor or motors if multiple motors are being used. The RED motor wire must be wired to the motor + and the BLUE motor wire must be wired to the motor minus (-).

⑦ **FORWARD BATTERY WIRES** These wires connect to the forward battery pack. The forward battery pack can contain from 6 to 32 cells in series. The Turbo ZETA will supply BEC output to the receiver and steering servo over this full range of input cells. The RED forward battery wire must be connected to the + side of the forward battery pack. The BLACK forward battery wire must be connected to the minus (-) side of the forward battery pack.

⑧ **REVERSE BATTERY WIRES** These wires connect to the reverse battery pack. The reverse battery pack can contain from 3 to 7 cells in series. The reverse battery pack is optional. If your application does not require the reverse feature, you can disable the reverse control with your handheld programmer and not connect any battery to the reverse battery input wires so there will be no reverse. The red plug is the reverse connector.

*****NOTE***** The reverse battery pack must be a separate battery NOT connected in any way to the forward battery other than through the Turbo ZETA.

DESCRIPTION OF THE HANDHELD PROGRAMMER

Refer to Figure 2 while reading the following descriptions:

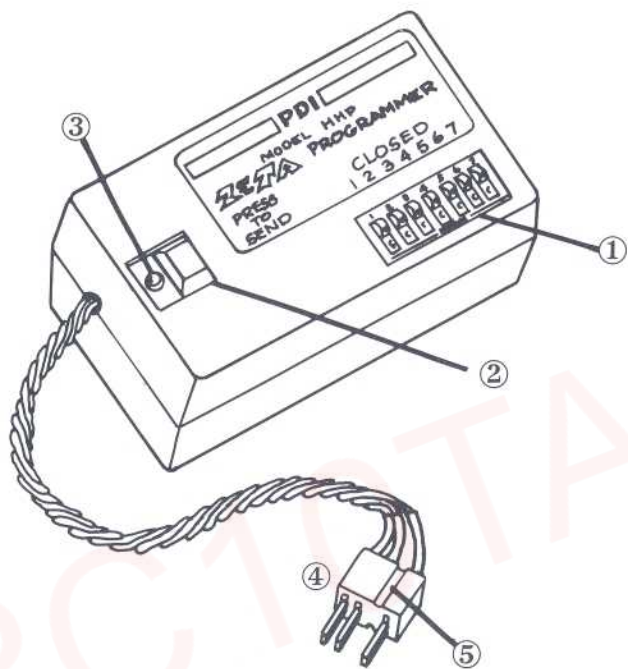
① **SWITCHES 1 THROUGH 7** These are used to select the programmed features. These switches are either open or closed as noted in the "Reference table of all programmable settings" section.

② **PRESS TO SEND SWITCH** Used to transmit the switch setting information to the microcomputer. When using the programmer always quickly press and release the PRESS TO SEND switch.

③ **PROGRAMMER LED** This LED turns on approximately 2 seconds after the programmer is plugged into the speed controller. This indicates the programmer is ready to send data. This LED flashes after the PRESS TO SEND button has been pressed, indicating data is being transferred to the microcomputer.

- ④ 3-PIN PLUG This connects the handheld programmer to the speed controller. The programmer contains no internal battery. It gets its power from the speed controller via this connection. Data is sent to the microcomputer in the speed controller via these wires.
- ⑤ *****VERY IMPORTANT NOTE***** This 3-pin plug has a notch that **MUST** line up with the mating connector before proper operation will occur.

FIGURE 2 HANDHELD PROGRAMMER



DESCRIPTION OF THE NON-PROGRAMMABLE FEATURES

The following is a list of the additional features of the Turbo ZETA. Included with each feature is a short description of how that feature works:

- 1) **Automatic power MOS FET thermal shutdown and recovery.** The forward and reverse power MOS FET's temperature is monitored by the microcomputer. The microcomputer will automatically shut power off to these transistors before they burn out. When these transistors cool down, it will automatically turn them back on. If a thermal shutdown occurs, the microcomputer will indicate a thermal shutdown has occurred by flashing the speed controller LED. This flashing LED can only be reset by turning power off to the speed controller.
- 2) **Automatic shutdown due to a receiver or steering servo short circuit.** The Turbo ZETA has a battery eliminator circuit (BEC) built-in. If excessive current is demanded from this circuit, it will automatically shutdown, providing protection to the speed controller.
- 3) **Software deglitch filtering.** The microcomputer monitors the receiver command pulses. If the command pulses are outside the proper range, then the microcomputer will use the last known good receiver pulse. If the receiver does not supply any known good pulses for one second, then the microcomputer will prevent the model from running away. This feature may cause a receiver failure to look like a speed controller failure. If you suspect a speed controller problem, please check the receiver for proper operation first.
- 4) **Rugged watertight aluminum case.** The rugged aluminum case of the Turbo ZETA is watertight. In addition, the case is the Turbo's heat sink. Each individual wire goes through a pressure seal and the unit will totally function underwater.

DESCRIPTION OF TRIGGER RESPONSE CURVES

The microcomputer in the speed controller contains a family of nine (9) trigger response curves. These curves control the amount of energy that flows from the battery to the motor as a function of the trigger position. Curve 1 is a standard linear curve and will provide very good control for the mild motor winds and 6 cell battery packs. As you use higher torque motors and a larger number of cells, you should progress through the curves numbered 2 through 7. These additional curves will expand the low and mid-speed range control so that you can achieve very accurate speed control with very hot motor/battery setups.

Several factors must be considered when selecting the proper trigger response curve. Some of these factors are:

- 1) The power of the motor
- 2) The torque of the motor
- 3) The weight of the scale model
- 4) The medium the model is running on

FIGURE 3 LOW END NON-LINEAR

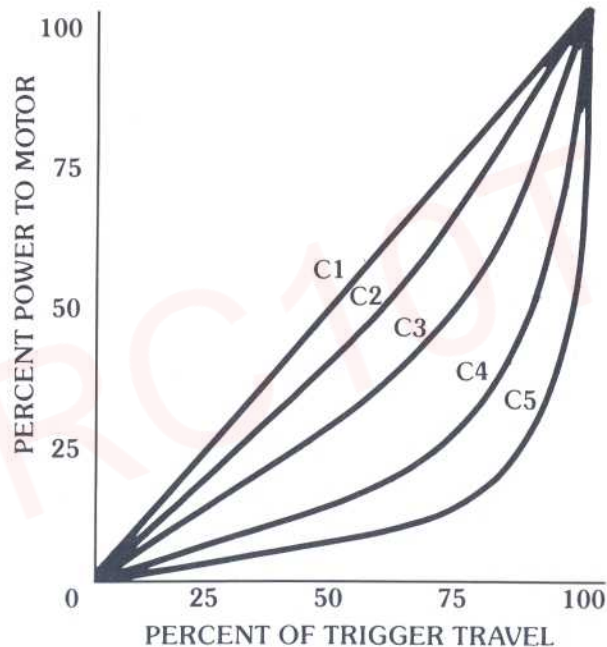


FIGURE 4 LOW END LINEAR

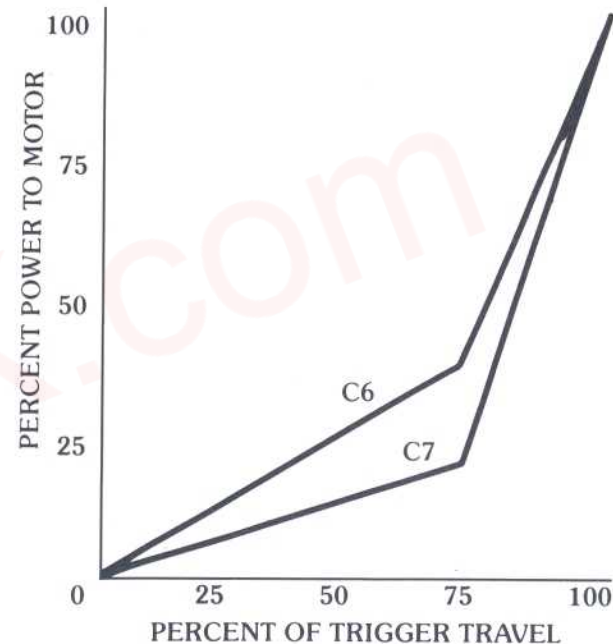
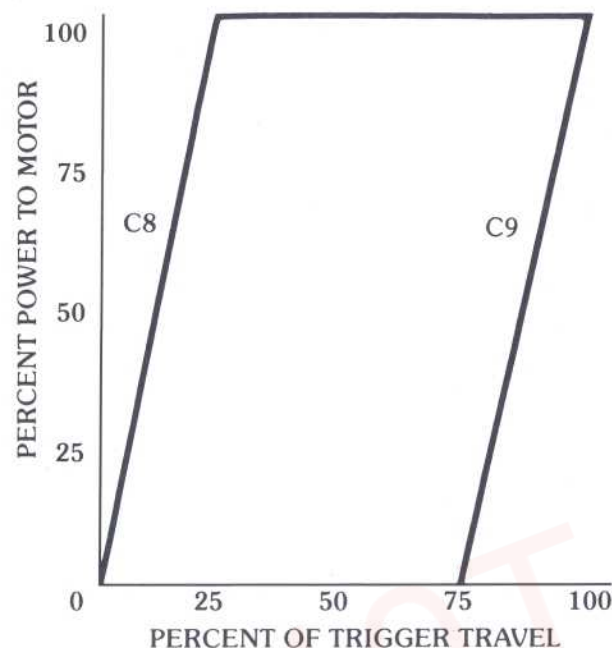


FIGURE 5 ON/OFF



Curves 8 and 9 are on/off type curves. These curves are primarily for drag racing or certain types of tight-in race tracks. See the graphs of the curves for assistance in the final curve selection. The ultimate selection will come as a result of experimentation. It is that total feeling of control that you are trying to achieve.

DESCRIPTION OF ACCELERATION RATE RESPONSES

One of the unique features of the Turbo ZETA is the capability to set the acceleration rate. This parameter is totally different from the trigger response curve. The acceleration rate controls how fast energy is transferred to the motor when speed is being commanded. The Turbo ZETA has two (2) separate speed ramp-up rate tables. These are referred to as the SLOW ACCELERATION and FAST ACCELERATION RATE TABLES. These tables are shown as TABLE 1 and TABLE 2. They are also referred to as rates R1 through R32. Two of the 32 ramp-up rates are INSTANT. The INSTANT in the FAST ACCELERATION RATE TABLE is quicker than the INSTANT in the SLOW ACCELERATION RATE TABLE. The other 30 rates are controlled rates at which the speed would be ramped up from a stop position to a full speed position. Another name for this feature could be ramp-up rate.

This feature allows for a more controlled speed startup when very high performance motors are used with very light chassis. This feature becomes even more important when slippery track surfaces are encountered. This same feature can be viewed differently in different applications. In a monster truck it could be used to save the gears from being stripped out, thus providing less wear and tear on the vehicle hardware. The rate ramp-up also prevents wasted energy that occurs from jackrabbit starts and will extend the total run time.

PDI recommends the modeler experiment with different settings to determine which is the best setting for his application.

TABLE 1
ACCELERATION RATES

ZERO TO FULL SPEED RAMP	
RATE NO.	TIME (SECONDS)
R1.....	INSTANT
R2.....	.097
R3.....	.104
R4.....	.112
R5.....	.121
R6.....	.132
R7.....	.146
R8.....	.162
R9.....	.182
R10.....	.208
R11.....	.242
R12.....	.291
R13.....	.364
R14.....	.485
R15.....	.727
R16.....	1.455

TABLE 2
ACCELERATION RATES

ZERO TO FULL SPEED RAMP	
RATE NO.	TIME (SECONDS)
R17.....	INSTANT
R18.....	.024
R19.....	.026
R20.....	.028
R21.....	.030
R22.....	.033
R23.....	.036
R24.....	.040
R25.....	.045
R26.....	.052
R27.....	.061
R28.....	.073
R29.....	.091
R30.....	.121
R31.....	.182
R32.....	.364

HOW TO GET REVERSE MOTION

The Turbo ZETA will always power up in the forward mode. If the user has done the following two things, then he can get reverse motion:

- 1) Enabled the reverse shift via the handheld programmer.
- 2) Installed a reverse power pack.

Reverse action occurs when the trigger/stick is pushed past the shift detect point. If the unit is in the forward mode it will shift into the reverse mode. If the unit is in the reverse mode it will shift into the forward mode. This shifting action will allow the user to expand the transmitter trigger/stick throw to achieve even more proportional control, because it does not take much trigger/stick throw to perform the shift function.

When used in conjunction with trigger response curve 4, accurate braking action can occur.

HOW TO ACHIEVE BRAKING ACTION

Because of the split battery system of the Turbo ZETA, braking can be achieved by shifting the unit into reverse and applying a slight amount of reverse power. This achieves a very active braking action and will stop even the heaviest models very quickly. The user will find that this takes some getting used to but works very well.

HOW TO PROGRAM THE TURBO ZETA

To program the Turbo ZETA you must do the following things:

- 1) The forward power pack must be plugged in
- 2) The on/off switch must be turned ON
- 3) The handheld programmer must be plugged into the programmer 3-pin connector

If the trigger position settings are being programmed, the transmitter must be turned ON. Once these things have been done, the user then selects the feature to be programmed from the "Reference table of all programmable settings" section.

The user then simply selects the switch settings from the table, sets the switches labelled 1 through 7 on the handheld programmer, and presses and then releases the PRESS TO SEND button. A single flash of the speed controller LED indicates the microcomputer has accomplished the desired feature modification. A multiple flash of the speed controller LED indicates there is an error condition that must be resolved. See the section "What causes the error LED to flash when in the program mode?" for the possible cause of the error.

Progress through the settings until everything is set. Calibrate the five trigger position settings as shown starting with section "Transmitter Speed Controller Setups". Now you can set the acceleration rate, the trigger response curve, and any of the other many features that do different things. Enter the switch settings for each parameter and press and then release the PRESS TO SEND button for each individual choice.

Carefully read the sections describing all the features so that you understand what the microcomputer will be doing in each case.

The user should only have to calibrate the speed controller to the transmitter positions once. The settings are accurately stored and there should be no drift in these settings in the speed controller. The user can now concentrate on setting and changing the parameters that set up the feel of the vehicle. Any parameter can be changed without affecting any other parameter.

REFERENCE TABLE OF ALL PROGRAMMABLE SETTINGS

The table included here defines all the handheld programmer switch settings for the Turbo ZETA speed controller. An "O" indicates the programmer switch must be placed in the "open" position. A "C" indicates the programmer switch must be placed in the "closed" position. The open and closed positions are clearly indicated on the handheld programmer front panel.

PROGRAMMED FUNCTION	SWITCH SETTINGS						
	1	2	3	4	5	6	7
Trigger Calibration							
Set full speed trigger position	C	C	C	C	C	C	C
Set start of speed position	O	C	C	C	C	C	C
Set Reverse/Forward shift point*	O	O	C	C	C	C	C
Set End of Trigger/Stick Travel*	O	O	O	C	C	C	C
Set End of Trigger/Stick Travel*	O	O	O	O	C	C	C
*The shift band set points only have meaning when the reverse feature is enabled.							
Trigger Response Curves							
Curve 1 (linear)	O	C	C	C	O	O	O
Curve 2	C	O	C	C	O	O	O
Curve 3	O	C	C	C	O	O	O
Curve 4	C	O	C	C	O	O	O
Curve 5	O	C	O	C	O	O	O
Curve 6	C	O	O	C	O	O	O
Curve 7	O	O	O	C	O	O	O
Curve 8 (low end on/off)	C	C	C	O	O	O	O
Curve 9 (high end on/off)	O	C	C	O	O	O	O

Slow Acceleration Rate

		1	2	3	4	5	6	7
Instant	R1	O	O	O	O	C	O	O
0.097 seconds	R2	C	O	O	O	C	O	O
0.104 seconds	R3	O	C	O	O	C	O	O
0.112 seconds	R4	C	C	O	O	C	O	O
0.121 seconds	R5	O	O	C	O	C	O	O
0.132 seconds	R6	C	O	C	O	C	O	O
0.146 seconds	R7	O	C	C	O	C	O	O
0.162 seconds	R8	C	C	C	O	C	O	O
0.182 seconds	R9	O	O	O	C	C	O	O
0.208 seconds	R10	C	O	O	C	C	O	O
0.242 seconds	R11	O	C	O	C	C	O	O
0.291 seconds	R12	C	C	O	C	C	O	O
0.364 seconds	R13	O	O	C	C	C	O	O
0.485 seconds	R14	C	O	C	C	C	O	O
0.727 seconds	R15	O	C	C	C	C	O	O
1.455 seconds	R16	C	C	C	C	C	O	O

Fast Acceleration Rate

		1	2	3	4	5	6	7
Turn instant start ON		O	C	C	C	O	C	C
Turn instant start OFF		C	C	C	C	O	C	C
Turn Fast Acceleration Table ON*		O	O	O	C	O	C	C
Turn Fast Acceleration Table OFF		C	O	O	C	O	C	C

*enabling the faster acceleration table will not change the existing acceleration rate.

Instant	R17	O	O	O	O	C	O	O
0.024 seconds	R18	C	O	O	O	C	O	O
0.026 seconds	R19	O	C	O	O	C	O	O
0.028 seconds	R20	C	C	O	O	C	O	O
0.030 seconds	R21	O	O	C	O	C	O	O
0.033 seconds	R22	C	O	C	O	C	O	O
0.036 seconds	R23	O	C	C	O	C	O	O
0.040 seconds	R24	C	C	C	O	C	O	O
0.045 seconds	R25	O	O	O	C	C	O	O
0.052 seconds	R26	C	O	O	C	C	O	O
0.061 seconds	R27	O	C	O	C	C	O	O
0.073 seconds	R28	C	C	O	C	C	O	O
0.091 seconds	R29	O	O	C	C	C	O	O
0.121 seconds	R30	C	O	C	C	C	O	O
0.182 seconds	R31	O	C	C	C	C	O	O
0.364 seconds	R32	C	C	C	C	C	O	O
Reverse shift enable		O	C	C	O	O	C	C
Reverse shift disable		C	C	C	O	O	C	C

TRANSMITTER SPEED CONTROLLER SETUPS

The speed controller must be set up initially with the transmitter/receiver to be used with the model. The setup will require that the speed controller be connected to the receiver and the transmitter turned on.

Start by setting all the transmitter potentiometer settings to their full open positions. The brake trim should be set to the center or nominal position. All adjustments can now be done in the following simple calibration steps.

The first step is to set the full speed position. The speed controller full speed must be set to match the transmitter full speed when the trigger/stick is positioned to the desired full speed point. (Make sure the model is raised off any surface when making any adjustments.)

This is done as follows:

FULL SPEED TRIGGER/STICK TRAVEL SET

- 1) Make sure the on/off switch is in the OFF position.
- 2) Connect the forward power pack to the Turbo ZETA.
- 3) If using the reverse feature, connect the reverse power pack.
- 4) Connect the handheld programmer to the speed controller.
****NOTE** that the handheld programmer connects via a 3-pin connector. Be sure to observe the proper connector polarity. Connecting the programmer backwards will not damage the units; it simply will not work.
****NOTE** that there is approximately a 2 second delay from power turn on to when the programmer enables itself.
- 5) Turn the on/off switch ON.
- 6) Set the handheld programmer switches 1 through 7 to the desired full speed trigger position. (All closed)
- 7) Set the transmitter trigger/stick to the desired full speed position. Always try to set full speed to a position before the end of the physical trigger/stick travel. This will ensure that the end of physical trigger/stick travel is full speed plus some margin.
- 8) While holding the trigger/stick in the full speed position, press and release the PRESS TO SEND button on the handheld programmer.
- 9) Observe:
 - a) The handheld programmer LED flashes.
 - b) The speed controller LED flashes on and then off once.

- c) If the speed controller LED flashes several times, then the microcomputer in the speed controller has detected an error condition of some type. See the "What causes the error LED to flash when in the program mode?" section for what could be causing the error.
- 10) Once you have done this step a few times it will go much faster. It is not as difficult as all this verbiage makes it out to be.

START OF SPEED TRIGGER/STICK TRAVEL SET

- 1) Set the handheld programmer switches 1 through 7 to the START OF SPEED position (OCCC CCC).
- 2) Move the trigger/stick on the transmitter to the desired start of speed point.
- 3) While holding the trigger/stick in the position, press and then release the PRESS TO SEND button on the handheld programmer.
- 4) Observe:
 - a) The handheld programmer LED flashes.
 - b) The speed controller LED flashes on and then off once.
 - c) If the speed controller LED flashes several times, then the microcomputer has detected an error condition. See the section "What causes the error LED to flash when in the program mode?"

REVERSE/FORWARD SHIFT DETECT POINT SET

(Only necessary if the reverse feature is used)

- 1) Set the handheld programmer switches 1 through 7 to the positions for REVERSE/FORWARD SHIFT DETECT POINT (OCCC CCC).
- 2) Move the transmitter trigger/stick to the position where you want the microcomputer to perform the speed control direction shift.
- 3) While holding the trigger/stick in this position, press and then release the PRESS TO SEND button on the handheld programmer. PDI recommends this be halfway between the start of speed point and the farthest reverse trigger/stick position.
- 4) Observe:
 - a) The handheld programmer LED flashes.
 - b) The speed controller LED flashes on and then off once.
 - c) If the speed controller LED flashes several times, then the microcomputer has detected an error condition. See the section "What causes the error LED to flash when in the program mode?"

END OF TRIGGER/STICK TRAVEL SET

- 1) Set the handheld programmer switches 1 through 7 to the END OF SHIFT BAND POINT (OOOC CCC).
- 2) While holding the trigger/stick in the farthest reverse position, press and release the PRESS TO SEND button.
- 3) Set the handheld programmer switches 1 through 7 to the END OF REVERSE TRIGGER/STICK TRAVEL position (OOOO CCC).
- 4) While holding the trigger/stick in the farthest reverse position, press and release the PRESS TO SEND button.
- 5) Observe:
 - a) The handheld programmer LED flashes.
 - b) The speed controller LED flashes on and then off once.
 - c) If the speed controller LED flashes several times, then the microcomputer has detected an error condition. See the section "What causes the error LED to flash when in the program mode?"
- 6) ***NOTE: Besides setting the REVERSE/FORWARD SHIFT DETECT POINT, the user must also enter via the handheld programmer the REVERSE SHIFT ENABLE code, and install a reverse battery power pack.
- 7) ***NOTE: This last position may seem unnecessary, but it provides the microcomputer with a complete trigger/stick travel picture, so it can determine the difference between good receiver pulses and glitch pulses.

Proceed to program any additional parameters by entering the handheld programmer switch settings for that parameter and then pressing and releasing the PRESS TO SEND button.

When the programming is complete, disconnect the handheld programmer from the speed controller. The speed controller will turn on and then off quickly. As soon as the LED turns off, the speed controller is ready for action.

WHAT CAUSES THE ERROR LED TO FLASH WHEN IN THE PROGRAM MODE?

A flashing speed controller LED can be caused by several conditions. The conditions that cause the LED to flash must be cleared before data can be accepted. Generally the cause is associated with the receiver information. The following is a complete list of errors that will cause a flashing speed controller LED:

- 1) Sometimes when a flashing LED occurs on the FULL SPEED TRIGGER/STICK TRAVEL SET step, nothing is wrong; you may just need to go on to the START OF SPEED TRIGGER/STICK TRAVEL SET point, and then cycle back to the FULL SPEED TRIGGER/STICK TRAVEL SET step for verification.
- 2) If the speed controller is not plugged into the receiver, any attempt to program the trigger position settings will result in a flashing LED.
- 3) If the transmitter is not turned on, any attempt to program the trigger positions will result in an error.
- 4) If the servo reversing switch for the throttle channel is in the wrong position, any attempt to program the full speed trigger position or start of speed position will result in an error.
- 5) If you try to set the start of speed position out of logical sequence with the full speed position, an error will result.
- 6) If you have entered an incorrect switch setting into the seven program switches, an error will result.

WIRING INFORMATION FOR FREQUENTLY USED RECEIVERS

The Turbo ZETA speed controller can be ordered with any one of four brands of connectors. These are Futaba G, Futaba J, KO, and Airtronics. In the event you need to change from one type to the other, refer to the following:

<u>CONNECTOR</u>	<u>POWER</u>	<u>SIGNAL</u>	<u>GROUND</u>
Futaba G	RED wire	WHITE wire	BLACK wire
Futaba J	RED wire	WHITE wire	BLACK wire
KO	PIN 1	PIN 3	PIN 2
Airtronics	PIN 3	PIN 1	PIN 2

**** NOTE **** The Futaba receiver signals are easily identified by the wire color codes. The KO and Airtronics cables usually clearly identify the power by a red color code stripe. You must accurately identify the KO and Airtronics signals by viewing the connector pin numbers.

PDI recommends that users of other brand radios contact the factory of those brands to obtain similar information before making any wiring changes.

INSTALLATION OF MOTOR CAPACITORS

PDI strongly recommends the use of capacitors on motors. These capacitors will significantly reduce the amount of noise generated by the motor. Consequently, your model will be much less susceptible to glitching. Also note that PDI sells a deglitch kit that can be used in extremely stubborn cases of glitching. This usually occurs when multiple motors are being used and the number of applied cells goes over 12. See our catalog for further details on this product.

CAUTIONS/WARNINGS

- 1) If changing the power connector, always observe the proper polarity. **WIRING THE SPEED CONTROLLER TO THE BATTERY BACKWARDS WILL CAUSE DAMAGE TO THE UNIT AND IS NOT COVERED BY WARRANTY REPAIR.**
- 2) **DO NOT CONNECT THE MOTOR OUTPUT WIRES TO A BATTERY OF ANY KIND. THIS WILL CAUSE DAMAGE TO THE SPEED CONTROLLER AND IS NOT COVERED BY WARRANTY REPAIR.**
- 3) The forward and reverse power packs must be totally separate power packs not connected in any way except via the Turbo ZETA wires.
- 4) When through operating the Turbo ZETA, never store the unit with forward or reverse power packs connected. Always remove the battery packs even though they may not have any energy left.
- 5) The Turbo ZETA contains an internal lithium battery that is used to power the microcomputer's internal memory. The user may have to send the Turbo ZETA in for the replacement of this internal battery after approximately five years. The Turbo ZETA will notify the user that the internal battery needs to be replaced by flashing the speed controller LED multiple times at power turn on.
- 6) **DO NOT** use polarized capacitors on your motor to eliminate noise. This type of capacitor will explode when the Turbo applies a reverse voltage to the motor.

SOFTWARE COPYRIGHT

The software/firmware contained within the microcomputer memory is copyrighted. Any attempt to copy or duplicate the software will be in direct violation of the copyright laws. PDI will prosecute to the full extent of the law any violators.

TURBO ZETA LIMITED WARRANTY

Product Design Inc. (PDI) warrants the Turbo ZETA electronic speed controller to the original purchaser for 90 days from the date of purchase against defects in material and workmanship. During this period, PDI will repair or replace, at its discretion, the defective component.

This warranty does not apply to any unit which has been improperly installed (including application of reverse voltage), mishandled, abused, or damaged in a crash, nor to any unit which has been repaired or altered by unauthorized agencies.

The Turbo ZETA speed controller is a sealed unit. Any evidence that the top and/or bottom lids of the unit have been opened will void the warranty and repair will proceed under the non-warranty repair policy.

Every Turbo ZETA Speed Controller is thoroughly tested and operational when it leaves our factory. Because PDI has no control over the installation and use of our speed controllers, we cannot accept any liability for damages resulting from using our product. When the user installs and operates our speed controller, he accepts all resulting liability.

WARRANTY PROCEDURE

The Turbo ZETA warranty should be filled out and mailed to PDI within 10 days of original purchase date along with your dated sales receipt (xeroxed copy acceptable). These two items **must** be submitted and on file with PDI before we can perform warranty repair work.

In the event that service is required, ship your Turbo ZETA in its original carton or equivalent, fully insured and prepaid. PDI is not responsible for any damages incurred during shipping. Send a description of the problem with the Turbo ZETA along with your legible name and street address. Sorry, no PO Box numbers. Under the non-warranty policy, the unit will be repaired for a \$25.00 charge. Switch, receiver cable and motor wire replacements are an additional charge. Please call factory for a quote. If our personnel determine that excessive abuse has occurred, then additional charges may be incurred. **Shipping charges are extra.** Repairs are returned UPS (Second Day Air)/COD/CASH.

Canadian and foreign repair customers, please phone or write for a price quote **before** sending in ZETA for repair.

Hobby dealers will under no circumstances replace units thought to be defective. These units must be returned to PDI for repair or replacement.

TURBO ZETA WARRANTY

In order that PDI may handle your Turbo ZETA for any service need, please complete the bottom portion and return to Product Design Inc., 16922 N.E. 124th St., Redmond, WA 98052

Turbo ZETA

Date of Purchase _____ (month-day-year)

Place Purchased _____

Purchaser's Name _____

Address _____

street

city

state

zip code

Phone Number (_____) _____

(In case we have a question about your Turbo unit.)

Complete this portion and send it to PDI. It will be kept on file for potential warranty repair.