

Modellbau-USA

OPERATION & MAINTENANCE

MANUAL FOR MODELLBAU-USA TURBINES

T-500 & T-750

IMPORTANT !!!

MAKE SURE YOU READ THE PURCHASE AGREEMENT BEFORE YOU UNPACK THIS PRODUCT, IF YOU DON'T AGREE TO ALL OF THE TERMS AND CONDITIONS OR LIMITED WARRANTY.

DO NOT UNPACK THIS PRODUCT AND RETURN IT TO THE PLACE OF PURCHASE FOR A FULL REFUND OF THE PURCHASE PRICE

PURCHASE AGREEMENT

This Purchase Agreement (“Agreement”) is made and entered into between Buyer and Seller, Modellbau USA, Inc. (“Modellbau”), a Florida corporation, and relates to Buyer’s purchase of a Miniature Turbine Engine (“Engine”) from Modellbau or one of its authorized dealers, as more fully set forth in the documentation accompanying Buyer’s purchase.

In exchange for the payments, products, mutual covenants, and promises set forth herein or in the accompanying purchase documentation, and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, Buyer and Modellbau agree to all of the following terms and conditions:

1. **Modellbau’s Warranties.** Modellbau makes no representations or warranties, other than those set forth in the Limited Warranty Statement that accompanies this Agreement. The terms, conditions, and other provisions of the Limited Warranty Statement are incorporated in this Agreement as if fully set forth herein.

2. **Buyer’s Warranties.** Buyer represents and warrants that all of the information set forth in the Buyer’s Purchase Application is true and correct. Modellbau relies on such representations as a basis for its entering into this sale transaction and would not enter into this sale transaction but for those representations. Buyer agrees that Modellbau’s reliance on those representations is reasonable and acknowledges that he/she makes those representations in order to induce Modellbau to consummate this sale transaction. Buyer further represents and warrants that he/she is very experienced in the operation of model airplanes and is fully familiar with the Academy of Model Aeronautics (“AMA”) guidelines and rules.

3. **WARNINGS--Risks and Dangers.** Buyer acknowledges and recognizes that operation of the Engine or equipment on which it may be installed may be dangerous, and that under certain circumstances, the handling of the Engine will be dangerous. Buyer expressly acknowledges that use of the Engine is dangerous if improperly handled. Buyer further acknowledges that use of the Engine could inflict serious personal injury if attempts are made to improperly handle the Engine or if the user does not fully acquaint himself/herself with the Engine’s operation procedures. The Engine may cause burns to the user, or the user’s assistant, particularly in the start-up procedure, and Buyer agrees to use extreme caution at all times. The Engine’s exhaust is extremely hot, and will burn someone or something placed directly behind the exhaust tube. Moreover, highly flammable liquid is used to operate the Engine, and it or its fumes will ignite easily and flare up rapidly. The Engine remains extremely hot after it is shut off and requires a cooling down period. Improper use of the Engine, or failure to follow AMA guidelines and rules will result in injury to the user, the user’s assistant, or bystanders. Operation of the Engine in any location other than an approved location, and under safe circumstances could lead to injury to bystanders, who are exposed to risks of serious personal injury, including, but not limited to, severe burns. Any tampering or modifications to the Engine may cause serious personal injury and may result in explosion.

4. Operation Procedure. Buyer acknowledges receipt of operating instructions for the Engine, which instructions detail, among other things, its handling, use and operation. Buyer agrees to thoroughly familiarize himself/herself with these materials and to require his/her assistant to become equally familiar with them. Buyer expressly agrees not to allow any person who has not become thoroughly familiar with these materials to assist in the start-up procedure of the Engine.

5. Use of Qualified Assistant. The Engine's start-up procedure requires that the operator get assistance from a qualified person. Indeed, a user of the Engine cannot safely start-up the Engine without an assistant. Accordingly, Buyer expressly agrees to use an assistant who is thoroughly familiar with the Engine, its operation, and the AMA rules and guidelines each and every time that Engine is started.

6. Bystander Warnings. Buyer expressly agrees to take all steps necessary to assure that no bystander will be in a position to suffer and harm or injuries during the start-up procedure or while the Engine is running. Among other steps, Buyer will assure to warn any bystanders prior to commencing the start-up procedure and prior to any other operation of the Engine or movement of the model aircraft on which it is installed.

7. ASSUMPTION, WAIVER AND RELEASE OF LIABILITY. Buyer hereby and as hereinafter provided accepts sole and full responsibility for any and all of the risks associated with the purchase, sale, ownership, operation, use or handling of the Engine. Buyer hereby irrevocably waives and releases, completely and without limitation, Modellbau, and its officers, directors, employees, agents, representatives, assigns, parent companies, subsidiaries, affiliates, insurers ("Modellbau Parties") from any and all actions, causes of action, damages, suits, rights, obligations, claims demands, liabilities, debts, sums of money, accounts reckonings, bonds, bills, specialties, covenants, contracts, controversy, agreements, promises, expenses, compensation, attorney's fees, court judgments, executions, sums whatsoever, whether known or unknown, in law or equity, which Buyer ever had, now has, or hereafter can, shall, or may have by reason of any matter, cause or thing whatsoever arising from or relating to the purchase, sale, ownership, handling, use, or operation of the Engine or the model aircraft into which it is installed at any time, whether now or in the future. Buyer's waiver and release releases the Modellbau Parties from all conduct, no matter how it could be characterized or alleged and no matter when it may occur. The Modellbau Parties shall not be liable for: (a) their own negligence, whether active, passive, primary, or secondary; (b) their sole negligence; (c) their willful misconduct; (d) damages based upon any theory of strict liability in tort; (e) damages based upon any theory of breach of warranty other than the breach of any warranty set forth in the Limited Warranty Statement accompanying this sale; and (f) exemplary or punitive damages of any kind under any circumstance. Buyer's waiver and release is immediately effective and is effective indefinitely, without regard to the passage of time and irrespective of any later events or changed circumstances, including, but not limited to, subsequent sales, repairs, modifications, alterations, or the like. Buyer assumes all risk of injury, harm and damage, of every nature whatsoever, to himself/herself and his/her property. Buyer fully and completely waives and releases any and all claims which he/she might have at any time arising out of the purchase, handling, or operation of the Engine. Buyer understands and acknowledges that he/she is solely responsible and liable for

any and all damages, claims, demands, rights, liabilities of any kind arising from or relating to the purchase, sale, ownership, handling, use, or operation of the Engine. This assumption, waiver and release is complete, full and comprehensive.

8. **INDEMNIFICATION OF MODELLBAU PARTIES.** Buyer hereby irrevocably agrees to fully defend, indemnify, and hold harmless the Modellbau Parties from any and all actions, causes of action, damages, suits, rights, obligations, claims demands, liabilities, debts, sums of money, accounts reckonings, bonds, bills, specialties, covenants, contracts, controversy, agreements, promises, expenses, compensation, attorney's fees, court judgments, executions, sums whatsoever, whether known or unknown, in law or equity, arising from or relating to the purchase, sale, ownership, handling, use, or operation of the Engine or the model aircraft into which it is installed at any time, whether now or in the future. Buyer's defense, indemnity and hold harmless obligations extend to matters of any nature, including any matters described, set forth, or covered in Paragraph No. 7, above. The Modellbau Parties shall have the right, in their sole discretion, to retain or approve the retention of any counsel selected for their defense of any such matters and to discharge counsel and retain substitute counsel, as they may deem necessary.

9. **Engine Modifications.** Buyer agrees that he/she shall not make any modifications of any kind to the Engine at any time for the entire life of the Engine.

10. **Buyer's Sale of Engine.** Buyer agrees to fully inform any person to whom he/she sells or transfers the Engine, concerning the handling, use, and operation of the Engine, and agrees to give all operating instructions to such person, at or before the time of sale or transfer. The assumption, waiver, release, defense, indemnity and hold harmless provisions contained in Paragraph Nos. 7 and 8, above, continue in effect, following any such sale or transfer.

11. **Severability.** In the event any clause, provision, or term of this Agreement is held to be ineffective, void or otherwise unenforceable for any reason, that clause, provision, or term shall be severed from this Agreement, and the Agreement shall otherwise remain binding and effective. If any portion of Paragraph 3 is found to be unenforceable, then the parties agree that the fullest and most complete waiver and release which is permitted by law, shall be effective.

12. **Governing Law and Venue.** This Agreement shall be construed and interpreted in accordance with Florida law, without reference to conflict of law principles. Moreover, Florida law shall apply to and govern any and all controversies which may rise out of or relate to this Agreement, the sale of the Model Engine, or its ownership, use, or operation.

13. **Dispute Resolution.** Any claim or controversy arising out of or relating to this Agreement or the purchase, ownership, use, or operation of the Engine shall be submitted for resolution by arbitration pursuant to the Rules of the American Arbitration Association. The arbitration shall take place in Miami-Dade County, Florida before a panel of three arbiters all of whom shall be attorneys admitted to the Florida Bar, fully licensed to practice law in the State of Florida and practicing law in Miami-Dade County, Florida for a period of no less than ten (10) years. Buyer and Modellbau each shall select one member of the panel and the arbiters selected by the parties jointly shall select a third arbiter, who shall be the presiding arbiter for the arbitration proceedings. Discovery shall be permitted in the arbitration proceedings in accordance

with the Florida Rules of Civil Procedure and the laws of the State of Florida. The arbitration shall be binding and any court having jurisdiction may enter a judgment based upon the award. Buyer expressly and voluntarily waives any right to file a lawsuit in a court of law, to have any claim or controversy determined by a jury, and to appeal.

14. Complete Agreement. This Agreement contains the full and complete agreement of the parties. There is no representation, term, or provision which is outside this Agreement. Any and all discussions, oral agreements, and representations are merged into this single written Agreement. This Agreement cannot be modified or amended in any way, except by written Amendment, signed by the parties.

15. Headings. The headings contained throughout this Agreement are for ease of reference only and should not be used in interpreting, construing, modifying, limiting, expanding, or otherwise altering this Agreement or any of the provisions of or covenants contained in this Agreement.

16. Interpretation. Buyer understands and expressly acknowledges that he/she has the right to have an attorney read and review this Agreement before consummation of this sale. Any statute, law, ordinance, common law principles, treaty, protocol, legal decision, convention, or other authority of any jurisdiction that would require interpretation of any ambiguities in this Agreement against the party who drafted this Agreement is not applicable and is hereby waived. The provisions of this Agreement shall be interpreted in a reasonable manner to effect its purposes, and shall not be interpreted or construed against any person or entity because that person or entity or any of its attorneys or representatives drafted or participated in drafting this Agreement. This Agreement shall be interpreted as if it was drafted mutually by the parties.

17. Acceptance of Terms. If the Buyer is not prepared to fully accept in full the terms and conditions of this Agreement, the Buyer is advised to return this Engine immediately in new and unused condition to the place of purchase.

Modellbau One Year Limited Warranty Statement

This Warranty Statement sets forth the limited warranty offered by Modellbau USA, Inc., a Florida corporation (“Modellbau”), for the Miniature Turbine (“Engine”), which is as follows:

Limited Warranty: Modellbau hereby warrants that the Engine accompanying this Warranty Statement is free from defects in materials and workmanship during normal usage, according to the following terms and conditions:

1. Limited Warranty Period: The Limited Warranty shall be effective for one (1) year or twenty-five (25) hours of measured use by the Electronic Control Unit, whichever comes first. The Limited Warranty Period begins on the day you buy the Engine. The warranty on any and all repaired and replaced parts expires when the Limited Warranty Period expires. At Modellbau’s request, you must prove the date of the original purchase of the Engine by a dated bill of sale or itemized receipt and such other documentation as Modellbau deems reasonably necessary to confirm the date of original purchase of the Engine.

2. Scope of Limited Warranty: The Limited Warranty covers all parts, except for batteries, electric motors, low plug and frictional materials will be repaired or replaced free of charge. All parts, including repaired and replaced parts are covered for the Limited Warranty Period. During the Limited Warranty Period, Modellbau will repair or replace, at its sole discretion and option, any defective parts with new or factory-rebuilt replacement items, if such repair or replacement is needed, due to any defects in materials or workmanship arising during and as a result of normal usage. Modellbau will assume the costs of any such new or factory-rebuilt replacement items, as well as any labor charges incurred by Modellbau in repairing or replacing any defective parts. The Limited Warranty does not extend to any defects in appearance.

3. Shipping: You must bear the risk and cost of shipping the Engine to Modellbau at the address listed below. Modellbau shall bear the cost of shipping the Engine to you, within the continental United States, after the completion of service under this Limited Warranty. You shall bear any risks associated with such shipment and must pay any other shipping costs or related charges. If the Engine is lost, damaged, or destroyed in shipment, including at any point before arriving at or after leaving Modellbau’s address listed below, you are solely responsible for any such loss, damage, or destruction.

4. Exclusions from Coverage: The Limited Warranty does not cover or extend to and is void in the event of any of the following conditions:

- A. The Engine has been subject to abnormal use, abnormal conditions, improper storage, unauthorized modifications, unauthorized repair, improper use, misuse, neglect, abuse, accident, alteration, improper installation or other acts which are not the fault of Modellbau, including, but not limited to, damage caused by shipping.
- B. The Engine has been damaged from external causes such as crash damage, foreign object damage, weather, Act of God, improper electric connections, or connections to other products not recommended for interconnection by Modellbau.
- C. The Engine is operated for commercial or institutional use.
- D. The Engine serial number has been removed, defaced or altered.

5. Assignment/Purchases Covered: The Limited Warranty extends only to the original purchaser of the Engine and is not assignable or transferable to any subsequent purchaser of the Engine. Moreover, the Limited Warranty extends only to purchasers who purchased the Engine in the United States or Canada and to purchases that include this Limited Warranty Statement and the accompanying Purchase Agreement.

6. WARRANTY DISCLAIMER: THERE SHALL BE NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER OBLIGATION ON THE PART OF MODELLBAU WITH RESPECT TO ANY OF THE PRODUCTS, EXCEPT ANY WARRANTY OR WARRANTIES EXTENDED PURSUANT TO THIS WARRANTY STATEMENT. ANY DESCRIPTIONS OF THE PRODUCTS MADE OR PROVIDED BY MODELLBAU ARE FOR IDENTIFICATION AND DESCRIPTION PURPOSES ONLY AND DO NOT CONSTITUTE AND SHALL NOT CREATE ANY WARRANTY, EXPRESS OR IMPLIED, WHATSOEVER. THE WARRANTY DISCLAIMERS CONTAINED HEREIN SHALL CONTROL OVER ANY INCONSISTENT TERMS OR CONDITIONS OF THIS LIMITED WARRANTY STATEMENT, THE PURCHASE AGREEMENT, OR OF ANY OTHER DOCUMENTATION ACCOMPANYING THE SALE. THE PROVISIONS OF THIS LIMITED WARRANTY STATEMENT, THE PURCHASE AGREEMENT, OR ANY OTHER DOCUMENTATION ACCOMPANYING THE SALE SHALL NOT BE CONSTRUED AS CREATING ANY EXPRESS OR IMPLIED WARRANTIES, UNLESS THOSE PROVISIONS EXPRESSLY STATE THAT THEY CREATE AND ARE INTENDED TO CREATE EXPRESS OR IMPLIED WARRANTIES.

7. Limitation of Liability: In no event shall Modellbau be liable to you or any third party for any incidental, consequential, or special damages of any kind, including lost profits or loss of use, and Modellbau's sole and exclusive liability shall be the repair or replacement set forth in Paragraph 2, above. Modellbau shall not be liable for any delay in commencing, completing or otherwise rendering any service under the Limited Warranty and shall not be liable for any loss of use during the period that the Engine is undergoing any repair pursuant to this Limited Warranty. If the Engine is lost, stolen, damaged, destroyed while at Modellbau's facility, Modellbau's liability shall be limited solely to the replacement of the Engine with a replacement engine of similar characteristics, as determined in the sole discretion of Modellbau and Modellbau shall not be liable for any lost profits or loss of use damages in that or any event.

8. Adoption of Purchase Agreement: By seeking any repair, replacement, or any other benefit provided by or pursuant to this Limited Warranty, you hereby adopt and accept in full all of the terms, conditions, and provisions of the Purchase Agreement, effective from the date of original purchase of the Engine.

9. Your Acceptance of Liability: If you are not prepared to fully accept all liability associated with the use of the Engine, you immediately should return the Engine in new and unused condition to the place of its purchase. The Limited Warranty, as well as the Purchase Agreement and other documents accompanying this sale, allocates the risk of failure of the Engine and liability arising from its use between you and Modellbau. You recognize the allocation of risk any understand and agree that the allocation is reflected in the purchase price of the Engine. You understand that you are or may be able to protect against the risks and liability that you assume by securing insurance coverage to protect you and those for whose actions and omissions you are or may be responsible from any such risks and liability.

10. Warranty Procedure: If it becomes necessary for you to seek service for warranted repairs on the Engine during the Limited Warranty Period, you should contact Modellbau for appropriate instructions. You shall be instructed to ship the Engine, at your risk and expense, to Modellbau, along with a description of the problem and proof of purchase, complete with details regarding the purchase

location, purchase date, and purchase price. You will be billed for any parts or labor charges that are not covered by the Limited Warranty. If the repairs are not covered by the Limited Warranty, Modellbau shall provide you with an estimate of repair and return shipping charges prior to commencing any work. If you reject the estimate or fail to authorize the necessary repair work, Modellbau shall return the Engine to you, at your risk and expense.

11. Used Components: The Engine consists of newly assembled equipment that may contain used components that have been reprocessed to allow machine compliance with Engine performance and reliability specifications.

12. Heading: The titles to the paragraphs of this Limited Warranty Statement are solely for the convenience of the parties and shall not be used to explain, modify, simplify, or aid in the interpretation of the provisions of this Limited Warranty Statement or any accompanying agreement or documents.

13. Invalidity: The invalidity of any provision of this Limited Warranty Statement will not and shall not be deemed to affect the validity of any other provision of it. In the event that any provision of this Limited Warranty Statement is held to be illegal, unenforceable or otherwise invalid, the parties agree that the remaining provisions shall be deemed to be in full force and effect as if they had been executed by both parties subsequent to the expungement of the invalid provision. Moreover, to the extent that any provision of this Limited Warranty Statement is held to be illegal, unenforceable, or otherwise invalid, it shall be interpreted and rewritten by any court or arbitration panel with jurisdiction so as to provide the maximum permissible protection to Modellbau consistent with and in order to effectuate the purposes expressed in this Limited Warranty Statement.

14. Governing Law: This Limited Warranty Statement shall be construed and interpreted in accordance with Florida law, without reference to conflict of law principles. The Governing Law and Dispute Resolution provisions of the Purchase Agreement are incorporated in this Limited Warranty Statement, as if fully set forth herein.

15. Entire Warranty: This is the entire warranty between Modellbau and you and, except for the Purchase Agreement and documents accompanying this sale, supercedes all prior and contemporaneous agreements, verbal or written, and all communications relating to the Engine, and no representation, promise, or condition not contained herein shall modify these terms. Modellbau does not assume and has not authorized any other person or entity to assume for it any other obligation or liability beyond that which is expressly set forth in this Limited Warranty.

16. Questions concerning and shipments in accordance with the provisions of this Limited Warranty Statement may be directed to:

Modellbau USA, Inc.
741 Shotgun Road
Sunrise, Florida 33326
Telephone: 954 476 5572
Facsimile: 954 476 5573
E-Mail: info@modellbau-usa.com

TABLE OF CONTENTS

SAFETY INFORMATION RISK ZONES	11
CUSTOMER SUPPLIED EQUIPMENT	12
1. FUELS:	12
2. OIL:.....	12
3. EYE AND EAR PROTECTION:	12
4. FIRE EXTINGUISHER. (UL RATED FOR CLASS “B” FIRES)	12
TURBINE SYSTEM COMPONENT DESCRIPTIONS	13
TURBINE:	14
TURBINE SPECIFICATIONS:.....	14
FUEL SYSTEM:	15
LUBRICATION SYSTEM:	15
START BOX:.....	16
E.C.U. (ELECTRONIC CONTROL UNIT):	16
INSTALLATION	18
TURBINE PREPARATION:.....	18
FUEL HOOK-UP:	19
START GAS HOOK-UP:	19
ECU HOOK- UP:	20
GLOW PLUG PREPARATION FOR INSTALLATION INTO THE TURBINE	21
PROPANE/BUTANE TRIGGER (FILLER).....	21
ECU SETUP:.....	21
THREE MAIN START BOX MENUS	22
MANUAL CONTROL MENU	22
RECEIVER CONTROL MENU	23

RECEIVER CONTROL MENU ERROR MESSAGES	23
RECEIVER CONTROL MENU CONTROL BUTTONS	24
OPERATOR SETUP MENUS.....	26
OPERATOR SETUP MENU ERROR MESSAGES	27
OPERATOR SETUP MENU CONTROL BUTTONS.....	29
OPERATOR PARAMETER SETTINGS MENU CONTROL BUTTONS	30
OPERATOR PARAMETER SETTINGS MENU PARAMETERS	30
DATA MENU CONTROL BUTTONS	32
HISTORY MENU CONTROL BUTTONS	32
MANUAL CONTROL MENUS	33
MANUAL CONTROL MENU ERROR MESSAGES	33
MANUAL CONTROL MENU CONTROL BUTTONS	33
RUNNING MENU CONTROL BUTTONS	35
TURBINE OPERATION	36
PRE-START PREPARATIONS:	36
TURBINE START- UP OPTION #1.....	37
RECEIVER CONTROL WITH START BOX.....	37
TURBINE START- UP OPTION #2.....	39
RECEIVER CONTROL WITHOUT START BOX.....	39
TURBINE START- UP OPTION #3.....	40
MANUAL CONTROL	40
TURBINE SHUTDOWN.....	42
COMPONENT MAINTENANCE	43

SAFETY INFORMATION RISK ZONES

- 1) The T - Turbine develops high energy levels that command respect while in operation. These Turbines are not TOYS and are not tolerant of misuse or inappropriate handling by the operator.
- 2) There exists the potential for serious damage and injury to personnel and property if the **Operating and Emergency Procedures** are not followed as presented in this manual.
- 3) When operating this Turbine, always have a fire extinguisher present as a fire or explosion hazard exists as with all type of Turbines utilizing combustible materials combined with high rotational speeds of the rotating parts.
- 4) During Turbine Operations the use of Hearing Protection and Safety Glasses with Side Shields are required.
- 5) *Read ALL instructions carefully. If ANY doubt exists concerning the Safe operation of this Turbine, contact your Modellbau USA, Inc. dealer or field representative immediately for assistance.*
- 6) *Prior* to operating your T- Turbine, you are required to obtain instruction on the proper operation of the turbine by a Modellbau-USA Representative. This generally takes place at the time of delivery but field representatives can render this service as well. Contact Modellbau USA, Inc. for the representative nearest you.
This training is a pre-requisite to obtaining an A.M.A. turbine waiver.
- 7) All servicing is to be conducted by Modellbau USA, Inc.
At NO time is the Turbine to be disassembled by the owner / operator.

***PLEASE READ AND UNDERSTAND THIS MANUAL
"BEFORE" YOU ATTEMPT TO RUN YOUR T- TURBINE.***

CUSTOMER SUPPLIED EQUIPMENT

1. Fuels:

Coleman Powermax Fuel (or Equivalent Propane/Butane)
Jet-A, A1 or Clear Kerosene

2. Oil:

Exxon #2380, or equivalent Synthetic Turbine Oil

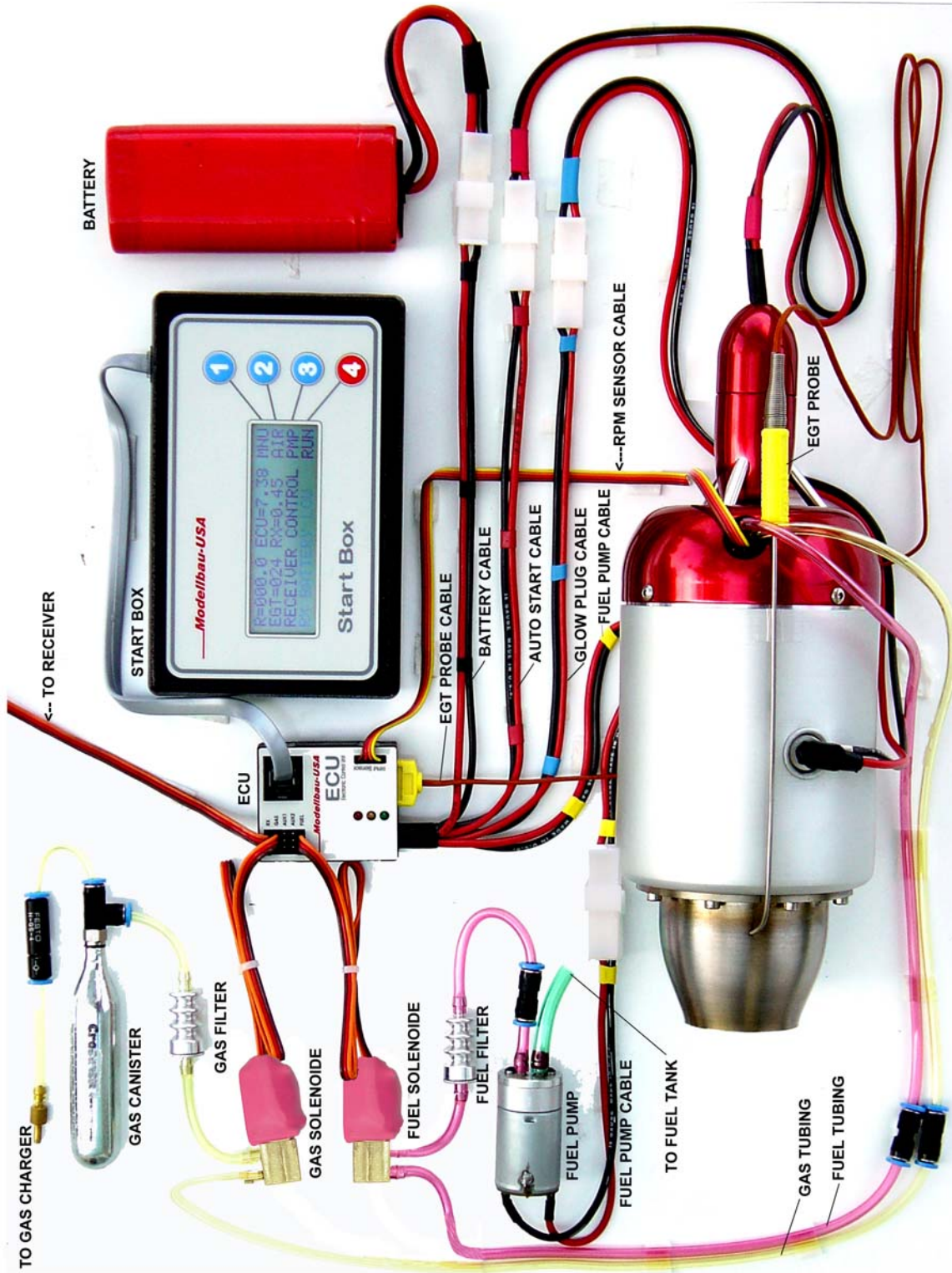
3. Eye and Ear Protection:

Ear Plugs
Safety glasses w/ Side Shields

4. Fire Extinguisher. (UL Rated for Class "B" fires)

CO2 or Halon.

QUICK INSTALLATION GUIDE



TURBINE SYSTEM COMPONENT DESCRIPTIONS

TURBINE:

The T-750 & T-500 Turbine is a single shaft turbojet with an annular combustor. The single stage centrifugal compressor is driven by a single stage axial flow turbine. The shaft is supported by (2) fuel / oil lubricated pre-loaded angular contact bearings. The turbine speed is controlled by an electric geared pump.

TURBINE SPECIFICATIONS:

Turbine Model:	T-500	T-750
Thrust Class:	13 Lbs	24 Lbs
Fuel Consumption:	6 oz / min	9 oz/min
IDLE R.P.M.:	50,000 Max	33,000 Max
MAX. R.P.M.:	155,000 Max	120,000 Max
Exhaust Gas Temp.	650°C	750°C
Weight:	2.4 lbs.	3.5 Lbs
Max. Diameter:	3.5"	4.25"
O.A. Length:	9.5"	12.25"

FUEL SYSTEM

The fuel system consists of the following components:

- a) Geared Pump
- b) Tubing
- c) Pump Battery
- d) Fuel Filter/Check valve

The geared pump is powered by a dedicated on-board battery. The pump speed is controlled by the E.C.U (Electronic Control Unit).

The Fuels used are Jet A, A1 or Clear Kerosene and butane/ Propane for the Start sequence.

LUBRICATION SYSTEM:

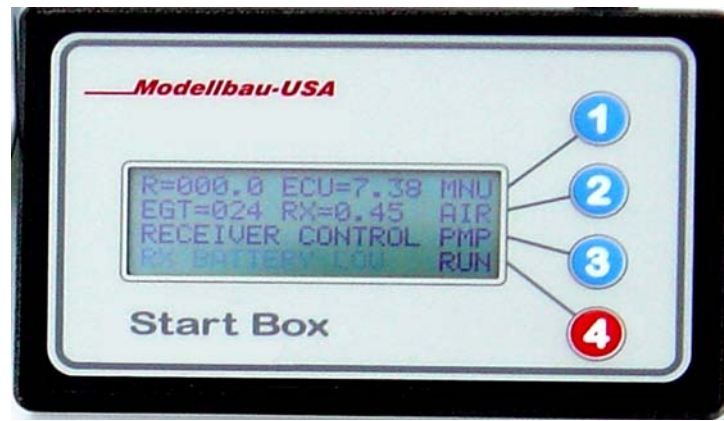
Lubrication is achieved by mixing oil in fuel at a ratio of 1 part oil to 16 parts fuel. This can be easily accomplished by adding one quart of turbine oil to four gallons of fuel. A "T" is placed in the fuel line at the Turbine to divert some fuel to the special lubrication manifold in the Turbine...

Caution: It is very important to filter the fuel. A filter must be used in your fueling system as well as in the aircraft fuel lines.

Remember: The proper formula is 1 part oil to 16 parts fuel.

Example - one quart of EXXON 2380 or equivalent turbine oil to be added to four gallons of fuel.

START BOX:



The Start Box can be the “Control Center” during the start phase of the Turbine and is used to monitor Ignition or perform a manual start. Below is a list of features of both, Start Box & ECU.

- Ultra lightweight and compact (only 1 1/8 x 1 1/4)
- Highest quality surface mount components on single very small multi-layer PC board
- Flash program memory allows easy download of program updates
- All new innovative RPM sensor
- Automatic Density Altitude Compensation for both full throttle and idle
- Needs only one receiver channel
- Built in Airspeed limiter (optional)
- Full Onboard Auto Start from transmitter or from Start Box
- Run Turbine from Start Box without receiver turned on or connected
- High contrast display (4 lines, 80 characters) easy to read in all heat/sun conditions without adjustment
- Flight data stored in EEPROM memory (saved if power shut off) can be displayed on Start Box.
- Display Max EGT, Run Time, Spool down time, etc. for previous run or for history of past runs up to 256 runs.
- Adjustable glow plug intensity
- Blown glow plug detection displayed on Start Box
- User adjustable High throttle RPM and idle RPM
- Monitors RPM and EGT during start to minimize hot starts
- Rx and ECU/pump battery voltage displayed on Start Box
- Expansion ports for future add on features

E.C.U. (Electronic Control Unit):



The E.C.U. is the “Brain” of the Turbine operating system. This unit is plugged into the Throttle Channel of your receiver and delivers a proportional signal to the Aircraft Fuel Pump which in turn controls the Turbine Speed relative to the amount of fuel being supplied to the Turbine.

The E.C.U. senses the Turbine exhaust gas temperature, RPM, ECU Battery voltage and Receiver Battery Voltage. The Turbine will not be shut down in the running state for a high EGT temperature reading in the hope that the plane can be brought in with reduced power. If the EGT temperature rises above 750 Deg. C during the running state, the maximum power will be reduced to $\frac{3}{4}$ power and if the EGT temperature is still above 750 Deg. C after 5 seconds, the maximum power will be reduced to $\frac{1}{2}$ power.

The maximum power will remain at $\frac{1}{2}$ power as long as the EGT temperature stays above 750 deg. c. The maximum power will be increased to $\frac{3}{4}$ power if the EGT temperature goes lower than 750 Deg. c and the maximum power will be increased to full power if the EGT temperature is still below 750 deg. c after 5 seconds. This reduced power sequence alerts the operator that there is a temperature problem and gives the operator a chance to land the plane with sufficient power and the reduced power gives the Turbine a better chance to stay running.

INSTALLATION

TURBINE PREPARATION:

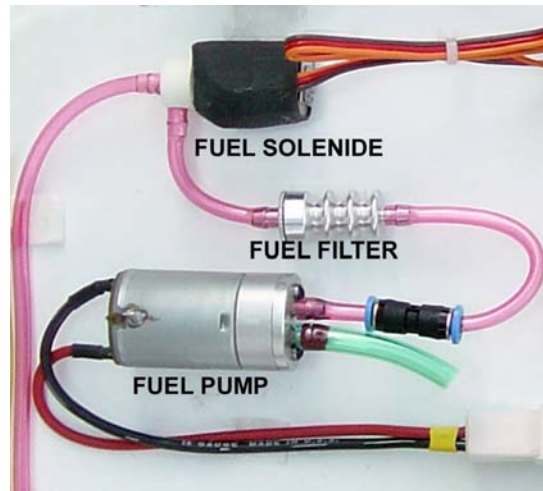
ALL T- Turbines come with the plumbing done and connectors installed.

Turbine Mounts and EGT Probe



- A.** Place EGT probe into the opening on the tailpipe. Insert no more than 1/16" into tailpipe.
- B.** Place straps around the Turbine with one mounting flange on each side.
- C.** Place EGT Probe underneath straps and tighten the 6-32 screws.
- D.** Do Not tighten straps completely until exact flange location has been determined.
- E.** The flange location will vary among different installations.
- F.** When satisfied with flange locations tighten the 6-32 screws.
- G.** Drill out flanges for preferred mounting screws.
- H.** The Turbine is now ready for installation into the airframe.

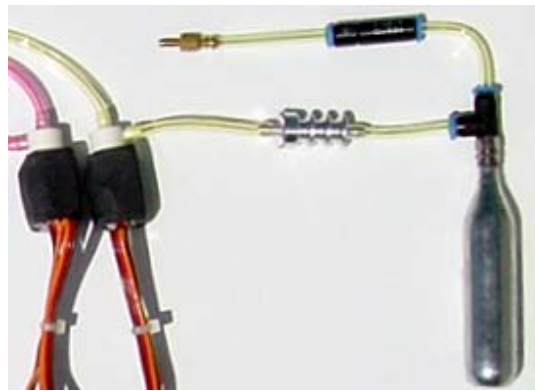
FUEL HOOK-UP:



Route clear red line from Turbine to pump and connect to “OUT” side of pump as indicated by arrow. Place a small piece of 4mm tubing over “IN” side of pump followed by the 6mm tubing from tanks.

CAUTION: Insure all fuel lines are secure and no leaks are present. Fuel leaks can cause a fire.

START GAS HOOK-UP:



The solenoid is provided with tubing already installed and hooked up to all necessary fittings and tank. The tubing can be cut to accommodate your installation.

Note that red line goes to Turbine and yellow line goes to tank. For safety reasons we have chosen to provide you with a tank that only holds enough gas for one start. You must refill for every start. Mount the tank in the upright position.

ECU HOOK- UP:



- A.** Connect Graupner connectors for Pump lead marked in **Yellow** and Glow Plug lead marked in **Blue**. Note that all cables have a color strip. These connectors can only be plugged in one-way DO NOT USE EXCESSIVE FORCE.
- B.** Connect EGT to the ECU. The slot is on the side of the ECU next to all the cables. The wider metal blade of the Connector goes towards the center of the ECU.
- C.** Connect Starter Motor wires marked in **Red** to the ECU.
- D.** Connect receiver lead to mating ECU slot marked **RX**. Note that the brown wire position is indicated by the black dot shown on the label.
- E.** Connect the RPM sensor coming out of the Turbine to the ECU in the slot marked **RPM**. There are two possible RPM cable colors; (Brown, Red, Orange, and Yellow or Black, White, Gray, and Purple). The Brown or Black cable should be towards the inside of the ECU as indicated by the black dot on the label.
- F.** ECU battery should be located in an accessible location. Battery is marked with a **Black** color strip. Notice that the Battery lead of the ECU is of the opposite polarity of the other connectors, so the battery can not be plugged into the wrong ECU cable.
- G.** Charging cables are provided for your use with any field or home charger. **A complete charge will give several flights but we recommend that the battery be charged between flights to assure proper starts and operation.**

GLOW PLUG PREPARATION FOR INSTALLATION INTO THE TURBINE

A. Refer to the “Glow plug Modification” Diagram **FIG.-9**.

Insure that your glow plug has several of the elements coils “Exposed” as per this detail. If not, use a straight pin to pull the coils out. Test the glow plug with a 1-1/2 volt power source to insure that the plug is working prior to installing it into the Turbine.

B. Remove the copper washer supplied with the Glow plug and insert the plug into the Ring-Lug of the Black Glow driver wire from the ECU then install into the Turbine. **Do not over tighten.**

PROPANE/BUTANE TRIGGER (FILLER)

A. Remove Nut from trigger exposing the nipple and Install a short piece of 4MM tubing. Re-install the nut back on to hold the tubing tightly in place.

B. Remove claw from bottom of the trigger by unscrewing it. Place the claw around the flange of the can and then re-install/screw the trigger back into place.

ECU SETUP:

Please familiarize yourself with all connections and features of the ECU that will be discussed during the ECU setup.

INSURE ALL BATTERIES HAVE BEEN CHARGED PRIOR TO ATTEMPTING THIS SETUP!!

Warning – When pressing the buttons on the Start Box, do not hold the button down for more than 1 second (except where instructed to hold down button) or the ECU software will reset to the same condition as when the power is first turned on (Receiver Control Menu).

THREE MAIN START BOX MENUS

The ECU is turned on by turning on the receiver or by plugging the Start Box into the ECU. Make sure the ECU battery and receiver cables are plugged into the ECU. The Receiver Control Menu will be displayed on the Start Box when the ECU is turned on.

Receiver Control Menu

RPM=000	ECU=7.80	MNU
EGT=032	RX=6.40	AIR
RECEIVER CONTROL	PMP	
ERROR MESSAGES	RUN	

The three main, high level, Menus are the Receiver Control Menu, Operator Setup Menu, and Manual Control Menu. The four identifiers on the right side of the Menu describe the current function of the control buttons. Each time the **MNU** (Menu) button is pressed, the next main Menu will be displayed. If **MNU** button is pressed while in the Receiver Control Menu, the Operator Setup Menu will be displayed.

Operator Setup Menu

TIM=07.5	MNU
EGT=575	TCH
SPL=18	PRM
ERROR MESSAGES	DAT

If **MNU** button is pressed while in the Operator Setup Menu, the Manual Control Menu will be displayed.

Manual Control Menu

RPM=000	ECU=7.80	MNU
EGT=032	RX=6.40	AIR
MANUAL CONTROL	PMP	
ERROR MESSAGES	RUN	

If **MNU** button is pressed while in the Manual Control Menu, the Receiver Control Menu will again be displayed.

RECEIVER CONTROL MENUS

Receiver Control Menu

RPM=000	ECU=7.80	MNU
EGT=032	RX=6.40	AIR
RECEIVER CONTROL	PMP	
ERROR MESSAGES	RUN	

The Receiver Control Menu is used to run/monitor the Turbine using the transmitter/receiver. The Menu displays the current RPM in thousands, EGT temperature in degree c, ECU battery voltage in volts, and RX (receiver) battery voltage in volts, and error messages (if any). You will not be able to start the Turbine if any of the error messages are displayed. Below is a list of error messages that may be displayed and only one error message will be displayed at a time. The error conditions for the error messages are checked in the order that they are listed. If an error message is displayed, none of the error conditions for the messages preceding it on the list will be present. If the "RECEIVER BATTERY LOW" message is displayed, then it can be assumed that the ECU battery voltage is higher or equal to the limit setting, the plug is good, the receiver is turned on, and the receiver battery voltage is higher than or equal to the voltage limit setting.

Receiver Control Menu Error Messages

"ECU BATTERY LOW" – This message indicates that the ECU battery voltage is lower than the limit set in the Operator Parameter Settings Procedure. This is a safety feature that makes sure that the ECU battery voltage is high enough to control the Turbine during the flight. It is up to the operator to set the voltage limit he or she is comfortable with. We are recommending that this limit be set at 7.5 volts.

"PLUG OPEN" - This message indicates that the plug is either bad or the plug cable is not connected to the plug and or the ECU.

"RECEIVER BATTERY LOW" – This message indicates that the receiver is either turned off, the ECU receiver cable is not connected properly, or the RECEIVER battery voltage is lower than the limit set in the Operator Parameter Settings Procedure. This is a safety feature that makes sure that the receiver battery voltage is high enough to control the plane during the flight. It is up to the operator to set the voltage limit he or she is comfortable with. This voltage will depend on the battery pack used and the operator preference.

“NO RX SIGNAL” – This message indicates that the ECU is not receiving a signal from the receiver. This probably means that the transmitter is not turned on.

“SET THROTTLE LOW” – This message means that the ECU is not measuring the correct pulse width for low throttle from the receiver. The transmitter is either not set at low throttle or the transmitter teach procedure needs to be done. Make sure the transmitter is not set for throttle cut (low throttle trim setting).

“THROTTLE AT CUT” – This message also means that the throttle is not at low but also is an indicator that the throttle is specifically at the cut setting. This extra information can be used as a sanity check that the teach process has been performed correctly and that the Turbine can be shut off in an emergency.

“THROTTLE AT HI” – This message also means that the throttle is not at low but also is an indicator that the throttle is specifically at the hi setting. This extra information can be used as a sanity check that the teach process has been performed correctly and that the Turbine will respond to throttle commands correctly.

Receiver Control Menu Control Buttons

MNU – The **MNU** button is pressed to go to the Operator Setup Menu

AIR – The **AIR** button is pressed to turn on the starter motor if desired. The starter motor will be running as long as the button is pressed down, and will stop as soon as the button is released. This feature can be used to check for proper operation of the starter motor and the RPM measurement system before starting the Turbine. The RPM reading should be 8 (8K rpm) or 9 (9K rpm) with the starter motor running and the ECU battery charged. This will not be needed to cool the Turbine down since the cool down cycle is automatic. Any time the EGT reading is over 150 deg. c, the starter motor will automatically cycle the starter motor until the EGT reading is below 150 deg. C

PMP – The **PMP** (pump) button is pressed to run the pump for priming. The pump will be running as long as the button is pressed down and will stop as soon as the button is released. The pump **MUST** be primed and the fuel lines filled with fuel for the Auto Start sequence to work smoothly. The speed of the pump (fuel flow rate) can be adjusted to the operator’s preference by setting the prime pulse width in the operator parameter settings procedure. **BE CAREFUL** not to pump fuel into the Turbine for more than a few seconds, as this will create a fire in the Turbine when the Auto Start sequence is initiated. If there is any doubt that excess fuel has been pumped into the Turbine, turn the Turbine facing down and rotate the Turbine by hand. Fuel will flow out if there was excessive fuel. Turn the Turbine facing up and then facing down (rotate again) several times to make sure all the excess fuel has been removed.

RUN – The **RUN** button is pressed to start the Auto Start sequence to run the Turbine.

The Auto Start sequence can be initiated by pressing the **RUN** button or moving the transmitter throttle stick from low throttle, to high throttle, and back to low throttle three times while in the Receiver Control Menu. This eliminates the need for using an extra channel on the receiver. When the Auto Start sequence is initiated the Ignition On Menu will be displayed first.

Ignition On Menu (Receiver Control)

RPM=009
EGT=100
IGNITION ON OFF

The Ignition On Menu is displayed when the Auto Start sequence is started and shows the status of the Turbine during the ignition cycle. During the Ignition On cycle, voltage is applied to the glow plug, the gas solenoid is opened to feed propane/butane to the Turbine, and the starter motor is turned on. The Turbine RPM and EGT temperature will be continuously monitored and displayed. Pressing the **OFF** button will terminate the Auto Start sequence. The Turbine will be shut down but no error message will be displayed in the operator setup Menu for this manual shutdown. If the Transmitter is set to throttle cutoff (low throttle trim), the Auto Start sequence will terminate, and an error message will be displayed in the Operator Setup Menu. When the RPM has increased to at least 7K rpm and the EGT temperature is greater than 80 deg. c with an increase of 10 deg. c, the Ignition cycle will end and the Fuel ramp cycle will start. The Fuel ramp Menu will then be displayed.

Fuel ramp MENU (Receiver Control)

RPM=012 PPW=040
EGT=120
RAMPING OFF

The Fuel ramp Menu is displayed during the fuel ramp cycle of the Auto Start sequence and shows the Turbine status during the Fuel ramp cycle. The Turbine RPM, EGT temperature, and PPW (pump pulse width) are continuously displayed. Pressing the **OFF** button will stop the Turbine Auto Start sequence. The Turbine will be shut down but no error message will be displayed in the operator setup Menu for this manual shutdown. If the Transmitter is set for throttle cutoff (low throttle trim), the Turbine will shut down and an error message will be displayed in the Operator Setup Menu. The pump pulse width (PPW) will start at the PWSTART pulse width value and will gradually increase based on RPM and EGT temperature readings during the Fuel ramp cycle. The PWSTART pulse width can be set in the Operator Setup Procedure. If this value is low, it will take a longer time for the fuel flow to start causing an increase in the

Turbine RPM and if this value is high, the fuel will start with too much flow at the start and cause a hot start (too much fuel for a given RPM). When the Turbine RPM reaches the idle (RPM LO) rpm, the Fuel ramp cycle will end and the Running cycle will start. The RPM will increase to 55K RPM and return to the idle RPM (RPM LO) before the Running cycle starts. The Running Menu will then be displayed.

Running Menu (Receiver Control)

RPM=037	PPW=075
EGT=450	SPW=1090
RUNNING	OFF

The Running Menu is displayed during the normal running cycle after the Auto Start sequence is completed. The Turbine RPM, EGT temperature, PPW (pump pulse width), and SPW (servo pulse width – Transmitter throttle channel pulse width) are continuously displayed. Pressing the **OFF** button will shut the Turbine down but no error message will be displayed in the Operator Setup Menu for this manual shutdown. If the Transmitter is set for throttle cutoff (low throttle trim), the Turbine will shut down and an error message will be displayed in the Operator Setup Menu.

OPERATOR SETUP MENUS

Operator Setup Menu

TIM=07.5	MNU
EGT=575	TCH
SPL=18	PRM
ERROR MESSAGES	DAT

The Operator Setup Menu is used to display some data from the last Turbine run, display any error messages from the last Turbine run, and to access other setup Menus by depressing the appropriate control button. Data displayed from the last run include TIM (Turbine run time in minutes), EGT (maximum EGT temperature in deg. c), and SPL (Turbine spool down time in seconds). If the Turbine failed during the Auto Start process or stopped while running, the error message area of the Operator Setup Menu will contain the error message describing the reason for the failure. The error message information is saved in EEPROM and will not be lost if the ECU is turned off or if the battery becomes disconnected in a crash. The error message will be displayed in the message area of the Operator Setup Menu until the Auto Start procedure is initiated for the next Turbine run.

Operator Setup Menu Error Messages

“IGN-TX SHUTDOWN” – This message means the Transmitter cut signal (low throttle trim) was detected while in the Ignition cycle of the Auto Start sequence and the Auto Start sequence was terminated. . This message only applies to errors while operating in the Receiver Control mode

“IGN-NO RPM” – This message means than no RPM was detected within two seconds after the starter motor was turned on during the ignition cycle of the Auto Start sequence and the Auto Start sequence was terminated. This can be checked in the Receiver Control Menu by depressing the AIR control button and observing the RPM reading. This message applies to errors while operating in the Receiver Control mode and the Manual Control mode.

“IGN-LOW RPM” – This message means that the RPM was not high enough to initiate fuel ramp while in the Ignition cycle of the Auto Start sequence and the Auto Start sequence was terminated. The starter motor must turn the Turbine to at least 7K rpm before fuel ramping is allowed to start. This can be checked in the Receiver Control Menu by depressing the AIR control button and observing the RPM reading. This message applies to errors while operating in the Receiver Control mode and the Manual Control mode.

“IGN-TIMEOUT” – this message means that the EGT temperature was not high enough to initiate fuel ramp while in the Ignition cycle of the Auto Start sequence and the Auto Start sequence was terminated. The EGT temperature must be at least 80 deg. C and have a 10 deg. C increase within six seconds after ignition start or the ignition cycle will be terminated. The cause of this error is probably not enough or no glow plug heat to ignite the propane/butane or not enough propane/butane gas flow to build up the Turbine temperature. The glow plug is automatically checked for the open condition but the glow plug can be removed, connected to the leads, and viewed while re-initiating the Auto Start sequence for a visual confirmation of glow brightness. The glow plug voltage can be adjusted in the Operator Settings Procedure but the default value of 40 will work if the supplied R8 plug is used. This message applies to errors while operating in the Receiver Control mode and the Manual Control mode.

“RMP-TX SHUTDOWN” – This message means the Transmitter cut signal (low throttle trim) was detected while in the fuel ramp cycle of the Auto Start sequence and the Auto Start sequence was terminated. This message only applies to errors while operating in the Receiver Control mode

“RMP-LOW RPM” – This message means that the RPM dropped below 6K rpm during the fuel ramp cycle of the Auto Start sequence and the Auto Start sequence was terminated. This message applies to errors while operating in the Receiver Control mode and the Manual Control mode.

“RMP-EGT HIGH” – This error means that the EGT temperature reached 850 deg. C during the fuel ramp cycle of the Auto Start sequence. The EGT temperature and RPM are continually monitored during the fuel ramp and the fuel ramp is continuously adjusted to keep the EGT temperature below 700 deg. C if possible. This message applies to errors while operating in the Receiver Control mode and the Manual Control mode.

“RMP TIMEOUT” – This error means that the Turbine RPM has not reached the value set for idle (RPM LO) by the time the PPW (pump pulse width) has reached 150 during the fuel ramp cycle of the Auto Start sequence and the Auto Start sequence was terminated. This is probably caused by too little or no fuel flow to the Turbine. Check the fuel system, check for fuel pump operation, and make sure that the pump is primed. This message applies to errors while operating in the Receiver Control mode and the Manual Control mode.

“RUN-TX SHUTDOWN” – This message means the Transmitter cut signal (low throttle trim) was detected while in the running state and the Turbine was shut down. This message will be displayed after the a normal run with transmitter shutdown using low throttle trim and will not actually be an error in this case. This condition is displayed as an error because if the operator did not set the transmitter low throttle trim, an actual error is recognized. This condition could occur if the signal was lost and the receiver went into the fail safe condition and the fail safe for throttle was set for the throttle cut condition (lo throttle trim). The fail safe for throttle should be set for low throttle and not for throttle cut (lo throttle trim) so that the Turbine will not shut down if the signal is lost for short periods of time. . This message only applies to errors while operating in the Receiver Control mode

“RUN-RPM LOW” – This message means that the Turbine was shut down while in the running state because the RPM dropped down below 20K rpm. This condition can be caused by running out of fuel or by some Turbine failure causing the rpm to slow down.

A faulty RPM sensor probe or other rpm measurement system error could also cause this error. Check for an rpm reading by depressing the AIR button in the Receiver Control Menu. This message applies to errors while operating in the Receiver Control mode and the Manual Control mode.

“RUN-RPM HIGH” – This message means that the Turbine was shut down while in the running state because the RPM reading was over 135K rpm. This could be caused by a faulty rpm measurement system error or some other control error allowing the Turbine rpm to raise above this safety limit. Check for an rpm reading by depressing the AIR button in the Receiver Control Menu. This message applies to errors while operating in the Receiver Control mode and the Manual Control mode.

The Turbine will not be shut down in the running state for a high EGT temperature reading in the hope that the plane can be brought in with reduced power. If the EGT temperature rises above 750 deg. C during the running state, the maximum power will be reduced to $\frac{3}{4}$ power and if the EGT temperature is still above 750 deg. C after 5 seconds, the maximum power will be reduced to $\frac{1}{2}$ power. The maximum power will remain at $\frac{1}{2}$ power as long as the EGT temperature stays above 750 deg. c. The maximum power will be increased to $\frac{3}{4}$ power if the EGT temperature goes lower than 750 deg. c and the maximum power will be increased to full power if the EGT temperature is still below 750 deg. c after 5 seconds. This reduced power sequence alerts the operator that there is a temperature problem and gives the operator a chance to land the plane with sufficient power and the reduced power gives the Turbine a better chance to stay running.

Operator Setup Menu Control Buttons

MNU – The **MNU** push button is used to go to the Manual Control Menu.

TCH – The **TCH** (teach) push button is used to go to the transmitter Teach procedure.

PRM – The **PRM** (Parameters) push button is used to go to the Operator Parameter Settings procedure.

DAT – The **DAT** (Data) push button is used to go to the Data Menu.

Teach procedure Menu

THROTTLE HI	1900	MNU
THROTTLE LO	1090	
THROTTLE CUT	0960	
		SAV

The Teach procedure Menu is used to teach the transmitter high throttle, low throttle, and throttle cut (low throttle trim) pulse widths to the ECU. When first entering the procedure, only the top line for THROTTLE HI will be displayed. With the transmitter on, move the stick to the high throttle position with the throttle trim set at center position. The pulse width reading should be around 1900ms. Press the **SAV** (Save) button to save the setting and the second line for THROTTLE LO will be displayed. Move the stick to the low throttle position and the pulse width reading should be around 1100ms.

Press the **SAV** button to save the setting and the third line for THROTTLE CUT will be displayed. Move the throttle trim lever to the low position and the pulse width reading should be around 950ms. Press the **SAV** button to save the setting and the previous Menu (Operator Setup Menu) will be displayed. The **MNU** button can be pushed at any time during this procedure to abort but the teach process will have to be performed again before the Turbine can be run in the Receiver Control mode. If the **MNU** button is

pressed as soon as the procedure is entered before the first SAV button is pushed, the procedure will be terminated without affecting any previous teaching settings. The Teach procedure does not have to be performed before the Turbine is run in the Manual Control mode.

Operator Parameter Settings Menu

LOW RPM	MNU
037	INC
	DEC
	SAV

The Operator Parameter Settings Menu is used to modify some of the Turbine the parameters if desired. The parameter name is displayed in the upper left corner (LOW RPM for example) and the current value for the parameter is displayed directly below.

Operator Parameter Settings Menu Control Buttons

MNU – The **MNU** button is used to go to the next parameter and after the last parameter, to the next Menu (Receiver Control Menu). The operator can sequence through each of the parameters and then to the Receiver Control Menu without making any changes.

INC – The **INC** (increment) button is used to increment the value of the parameter. Each time the button is pressed, the parameter value will increase by 1.

DEC – The **DEC** (decrement) button is used to decrement the value of the parameter. Each time the button is pressed, the parameter value will decrease by 1.

SAV – The **SAV** (save) button is used to save the new parameter value in EEPROM memory before going on to the next parameter. If the operator forgets to save the new parameter value, he or she must go through the whole set of parameters, exit the procedure, and then come back into the Operator Parameter Settings Menu and change/save the parameter again.

Operator Parameter Settings Menu Parameters

LOW RPM – The **LOW RPM** parameter is the rpm value for low throttle or idle.

HI RPM – The **HI RPM** parameter is the rpm value for high throttle. The high throttle rpm can be set up to the value that the ECU is certified for by Modellbau-USA to meet the thrust to weight rule. This maximum certified value is listed in the Data Menu. The operator will not be able to increment the value to a higher value than the certified maximum value.

GLOW PLUG – The GLOW PLUG parameter is a number that programs the voltage to the glow plug. The default value of 35 is a good value for the supplied R8 glow plug. If a hotter glow plug is used, the value may be increased. The brightness of the glow plug can be observed by removing the plug, connecting the plug wires, and initiating the Auto Start sequence. The operator may want to disconnect the starter motor and propane/butane solenoid cable if he or she desires, but this is not necessary.

ECU BATTERY LIMIT – If the ECU battery voltage falls below the ECU BATTERY LIMIT parameter value, the Auto Start sequence can not be initiated and the error message “ECU BATTERY LOW” will be displayed in the Receiver Control Menu and the Manual Control Menu. The default value for this parameter is 75 (7.5 volts). We recommend this voltage and we also recommend that the ECU battery is charged for each flight.

RX BATTERY LIMIT – If the RX (receiver) battery voltage falls below the RX BATTERY LIMIT parameter value, the Auto Start sequence can not be initiated and the error message “RX BATTERY LOW” will be displayed in the Receiver Control Menu. The default value for this parameter is 63 (6.3 volts). This receiver voltage limit value should be reviewed and set by the operator to match the voltage of the receiver battery pack and the preference of the operator. We are not responsible for this value as it is a value for the receiver/plane setup and not the turbine/ECU system

PRIME PW – The PRIME PW (prime pulse width) parameter is the value of the pulse width (voltage) to the pump when the **PMP** (pump – prime) button is pressed in either the Receiver Control Menu or the Manual Control Menu. This value can be adjusted up or down to increase or decrease the fuel flow during the prime operation. If the value is set too high, it may be difficult to stop the fuel flow to the Turbine in time to keep excess fuel out of the Turbine during the prime operation.

START PW – The START PW (start pulse width) parameter is the value of the pulse width to the pump when the Fuel ramp cycle of the Auto Start sequence is started. The optimum value for this parameter depends on the Turbine, pump, and ECU battery voltage. If the value is lower than the optimum, it will take longer for the fuel to flow to the degree that the Turbine will start increasing in RPM during the Fuel ramp cycle. If the value is greater than optimum, the fuel flow will be too much at the start of the Fuel ramp cycle and a hot start may occur. It is better to have the value a little low and have a short period before the fuel starts affecting the RPM than to have a hot start. The PPW (pump pulse width) is displayed during the Fuel ramp cycle and the value of the pulse width can be observed when the sound of the Turbine starting to be affected by the fuel flow is heard.

Data Menu

```
T-750  VER=A01  MNU
CYC=001  RPM=126  HIS
TIM=00:00
SN001.001
```

The Data Menu is used to display some of the ECU data and history. The Turbine model designation (T-750 for example) is displayed in the upper left corner. The total number of run cycles is displayed to the right of **CYC=**. The total time (in hrs and minutes) for all the run cycles is displayed to the right of **TIM=**. The serial number of the ECU is displayed at the lower left corner of the display. The version level of the ECU software is displayed to the right of **VER=**. The maximum authorized RPM set by Modellbau-USA to meet the thrust to weight rule is displayed to the right of **RPM=**.

Data Menu Control Buttons

MNU – The **MNU** button is used to get back to the Operator Setup Menu.

HIS – The **HIS** (history) button is used to go to the History Menu.

History Menu

CYC=001	TIM=07.5	MNU
EGT=575		DEC
SPL=18		INC

The History Menu is used to view various parameters associated with each run (cycle). When the Menu is first entered the data for the current past cycle will be displayed.

The cycle number will be displayed to the right of **CYC=**. The maximum EGT temperature during the Running cycle of the displayed run cycle will be displayed to the right of **EGT=**. The spool down time (in seconds) of the displayed run cycle will be displayed to the right of **SPL=**. The run time (in minutes) of the displayed run cycle will be displayed to the right of **TIM=**.

History Menu Control Buttons

MNU – The **MNU** button is used to get back to the Data Menu.

DEC – The **DEC** button is used to decrement the cycle number to view the data for earlier runs (cycles).

INC – The **INC** button is used to increment the cycle number.

MANUAL CONTROL MENUS

Manual Control Menu

RPM=000	ECU=7.80	MNU
EGT=032	RX=6.40	AIR
MANUAL CONTROL		PMP
ERROR MESSAGES		RUN

The Manual Control Menu is used to run/monitor the Turbine using the Start Box without the need of a receiver/ transmitter. The receiver can still be connected and the receiver can also be turned on if desired. This is a convenient way to test run the Turbine when transmitter frequency is not available or for running on a test bench. The Menu displays the current RPM in thousands, EGT temperature in degree c, ECU battery voltage in volts, and RX (receiver) battery voltage in volts, and error messages (if any). You will not be able to start the Turbine if any of the error messages are displayed. Below is a list of error messages that may be displayed and only one error message will be displayed at a time. The error conditions for the error messages are checked in the order that they are listed. If an error message is displayed, none of the error conditions for the messages preceding it on the list will be present. If the "PLUG OPEN" message is displayed, then it can be assumed that the ECU battery voltage is higher or equal to the limit setting.

Manual Control Menu Error Messages

"ECU BATTERY LOW" – This message indicates that the ECU battery voltage is lower than the limit set in the Operator Parameter Settings Procedure. This is a safety feature that makes sure that the ECU battery voltage is high enough to control the Turbine during the flight. It is up to the operator to set the voltage limit he or she is comfortable with. We are recommending that this limit be set at 7.5 volts.

"PLUG OPEN" - This message indicates that the plug is either bad or the plug cable is not connected to the plug and or the ECU.

Manual Control Menu Control Buttons

MNU – The **MNU** button is pressed to go to the Receiver Control Menu

AIR – The **AIR** button is pressed to turn on the starter motor if desired. The starter motor will be running as long as the button is pressed down, and will stop as soon as the button is released. This feature can be used to check for proper operation of the starter motor and the RPM measurement system before starting

Turbine. The RPM reading should be 8 (8K rpm) or 9 (9K rpm) with the starter motor running and the ECU battery charged. This will not be needed to cool the Turbine down since the cool down cycle is automatic. Any time the EGT reading is over 150 deg. c, the starter motor will automatically cycle the starter motor until the EGT reading is below 150 deg. C

PMP – The **PMP** (pump) button is pressed to run the pump for priming. The pump will be running as long as the button is pressed down and will stop as soon as the button is released. The pump **MUST** be primed and the fuel lines filled with fuel for the Auto Start sequence to work smoothly. The speed of the pump (fuel flow rate) can be adjusted to the operator's preference by setting the prime pulse width in the operator parameter settings procedure. **BE CAREFUL** not to pump fuel into the Turbine for more than a few seconds, as this will create a fire in the Turbine when the Auto Start sequence is initiated. If there is any doubt that excess fuel has been pumped into the Turbine, turn the Turbine facing down and rotate the Turbine by hand. Fuel will flow out if there was excessive fuel. Turn the Turbine facing up and then facing down (rotate again) several times to make sure all the excess fuel has been removed.

RUN – The **RUN** button is pressed to start the Auto Start sequence to run the Turbine. When the Auto Start sequence is initiated the Ignition On Menu will be displayed first.

Ignition On Menu (Manual Control)

RPM=009
EGT=100
IGNITION ON OFF

The Ignition On Menu is displayed when the Auto Start sequence is started and shows the status of the Turbine during the ignition cycle. During the Ignition On cycle, voltage is applied to the glow plug, the gas solenoid is opened to feed propane/butane to the Turbine, and the starter motor is turned on. The Turbine RPM and EGT temperature will be continuously monitored and displayed. Pressing the **OFF** button will terminate the Auto Start sequence. The Turbine will be shut down but no error message will be displayed in the operator setup Menu for this manual shutdown. When the RPM has increased to at least 7K rpm and the EGT temperature is greater than 80 deg. c with an increase of 10 deg. c, the Ignition cycle will end and the Fuel ramp cycle will start. The Fuel ramp Menu will then be displayed.

Fuel ramp Menu (Manual Control)

RPM=012 PPW=040
EGT=120
RAMPING OFF

The Fuel ramp Menu is displayed during the fuel ramp cycle of the Auto Start sequence and shows the Turbine status during the Fuel ramp cycle. The Turbine RPM, EGT temperature, and PPW (pump pulse

width) are continuously displayed. Pressing the **OFF** button will stop the Turbine Auto Start sequence. The Turbine will be shut down but no error message will be displayed in the operator setup Menu for this manual shutdown. The pump pulse width (PPW) will start at the PWSTART pulse width value and will gradually increase based on RPM and EGT temperature readings during the Fuel ramp cycle. The PWSTART pulse width can be set in the Operator Setup Procedure. If this value is low, it will take a longer time for the fuel flow to start causing an increase in the Turbine RPM and if this value is high, the fuel will start with too much flow at the start and cause a hot start (too much fuel for a given RPM). When the Turbine RPM reaches the idle (RPM LO) rpm, the Fuel ramp cycle will end and the Running cycle will start. The RPM will increase to 55K RPM and return to the idle RPM (RPM LO) before the Running cycle starts. The Running Menu will then be displayed.

Running Menu (Manual Control)

RPM=037	PPW=075	INC
EGT=450	PWR=LO	DEC
		FUL
RUNNING		OFF

The Running Menu is displayed during the normal running cycle after the Auto Start sequence is completed. The Turbine RPM, EGT temperature, PPW (pump pulse width), and PWR (Turbine power setting) are continuously displayed.

Running Menu Control Buttons

INC – The **INC** button is used to increase the power setting (same as increasing the throttle in Receiver mode). The power setting will be “LO” (idle) at the start of the Running Cycle and will be increased by 10% each time the **INC** button is pressed.

The range of values for **PWR** are LO,10,20,30,40,50,60,70,80,90, and HI. The HI setting is equivalent to hi throttle in the Receiver Control mode.

DEC – The **DEC** button is used to decrease the power setting. The power setting will decrease the power setting by 10% each time the **DEC** button is pressed.

FUL – The **FUL** (full power swing) button will set the power to HI if the current power setting is LO and will set the power setting to LO if the current power setting is HI. If the power setting is not at HI or LO, the **FUL** button will have no effect.

OFF - Pressing the **OFF** button will shut the Turbine down but no error message will be displayed in the Operator Setup Menu for this manual shutdown

TURBINE OPERATION

Pre-start Preparations:

- 1) Inspect the inlet and exhaust for FOD (Foreign Object Damage) or any other debris.
- 2) All switches in the Radio and Aircraft "OFF".
- 3) Fill the Propane/Butane on-board tank.
- 4) Initial priming of pump may be required. This is accomplished by the **PMP** Button on the Start Box. The pump will be running as long as the button is pressed down and will stop as soon as the button is released. The pump **MUST** be primed and the fuel lines filled with fuel for the Auto Start sequence to work smoothly. **BE CAREFUL** not to pump fuel into the Turbine for more than a few seconds, as this will create a fire in the Turbine when the Auto Start sequence is initiated. If there is any doubt that excess fuel has been pumped into the Turbine, turn the Turbine facing down and rotate the Turbine by hand. Fuel will flow out if there was excessive fuel. Turn the Turbine facing up and then facing down (rotate again) several times to make sure all the excess fuel has been removed.

Beware of ALL Risks associated with the Operation of a Turbine Turbine. Keep ALL unnecessary personnel away from the start area and abide by all AMA Turbine operating guidelines.

There are Three Ways to start your Turbine.

1. Transmitter with Start Box attached (Receiver Control Menu).
2. Transmitter without Start Box
3. Manual Mode with Start Box and no Transmitter (Manual Control Menu)

TURBINE START- UP OPTION #1

Receiver Control with Start Box

1. When Turbine is cool and throttle is set properly the ECU will display the Receiver Control Menu. For this start you will use the Transmitter and the Start Box. With all connections still attached to the Turbine from the Pre-Start Preparation check, Plug the Start Box Cable into the ECU, and then turn on the Radio. The Receiver Control Menu will be the first Menu displayed. Make sure you are in the Receiver Control Menu. See the Receiver Control Menu description in the Menu Description section.
2. Before the Auto Start sequence can be initiated, the Green LED on the ECU must be flashing and there must be no error message in the error message area of the Receiver Control Menu. If the Red LED on the ECU is flashing, there will be an error message displayed in the error message area of the Receiver Control Menu. See the Menu Description Section for the descriptions of all the possible error codes associated with the Receiver Control Menu and make the appropriate correction to get rid of all the error messages. When this is accomplished, the Green LED will be flashing, there will be no error message and the Auto Start sequence can now be initiated.
3. The Auto Start sequence can be initiated by moving the transmitter throttle stick from low throttle, to high throttle, and back to low throttle three times, within a four second time period, while in the Receiver Control Menu or by pressing the RUN button on the Start Box. This eliminates the need for using an extra channel on the receiver. The Ignition On Menu will then be displayed on the Start Box and the Red LED on the ECU will be on. The Red Led on is indicating that the ignition sequence has started. See the Ignition On Menu description under the Receiver Control area of the Menu Description section for a detailed description of the Menu and operation of the ignition sequence. The Auto Start sequence can be aborted by setting the transmitter to throttle cut (low throttle trim) or by pressing the OFF button on the Start Box at any time during the Ignition On cycle. If the Auto Start sequence is automatically terminated by the ECU, the Receiver Control Menu will again be displayed on the Start Box. The error message for cause of the abort will not be displayed in the Receiver Control Menu but will be displayed in the message area of the Operator Setup Menu. See the Menu Description Section for the descriptions of all the possible error codes displayed in the Operator Setup Menu.
4. When the propane/butane gas has ignited, the RPM is high enough, and the EGT temperature has increased the Fuel ramp cycle will begin and the Fuel ramp Menu will be displayed on the Start Box. The Red LED will go off and the Amber LED will come on at this time indicating that the Fuel ramp sequence has started. See the Fuel ramp Menu description under the Receiver Control area of the Menu Description section for a detailed description of the Menu and operation of the fuel ramp

sequence. The Auto Start sequence can be aborted by setting the transmitter to throttle cut (low throttle trim) or by pressing the OFF button on the Start Box at any time during the Fuel ramp cycle. If the Auto Start sequence is automatically terminated by the ECU, the Receiver Control Menu will again be displayed on the Start Box. The error message for cause of the abort will not be displayed in the Receiver Control Menu but will be displayed in the message area of the Operator Setup Menu. See the Menu Description Section for the descriptions of all the possible error codes displayed in the Operator Setup Menu.

5. When the fuel ramp cycle has completed, the Running Menu will be displayed on the Start Box and both the Amber LED and the Green LED will be on. See the Running Menu description under the Receiver Control area of the Menu Description section for a detailed description of the Menu and operation of the Running cycle. The Turbine can be shut down by setting the transmitter to throttle cut (low throttle trim) or by pressing the OFF button on the Start Box at any time during the Running cycle. If the Turbine is shut down by the ECU, the Receiver Control Menu will again be displayed on the Start Box. The error message for cause of the shut down will not be displayed in the Receiver Control Menu but will be displayed in the message area of the Operator Setup Menu. . See the Menu Description Section for the descriptions of all the possible error codes displayed in the Operator Setup Menu.

6. As the throttle is increased for the first time the, hi throttle RPM will occur before the throttle is raised to the hi position (unless the throttle is set to hi quickly) and will stay at the high throttle RPM as the throttle is raised to the hi position. Once the throttle is raised to the hi position and the RPM has reached the hi throttle RPM, the Amber LED will go out and the Green LED will stay on. This is indicating that the ECU has “learned” the high throttle RPM setting and the throttle will control the Turbine smoothly through the entire throttle range. See the Operator Parameter Settings Menu to change the lo throttle RPM and hi throttle RPM settings if desired. There is no problem with advancing the throttle quickly for the first time after the Turbine is running. The RPM will not overshoot when reaching the hi throttle rpm setting. It is perfectly normal to wait until takeoff to advance the throttle for the first time since a pre-runup is not required.

TURBINE START- UP OPTION #2

Receiver Control without Start Box

1. For this start you will use the Transmitter without the Start Box. With all connections still attached to the Turbine from the Pre-Start Preparation check, turn on the Radio. The ECU will automatically be in the Receiver Control mode at this time.
2. Before the Auto Start sequence can be initiated, the Green LED on the ECU must be flashing. If the Red LED on the ECU is flashing, there is some error that has to be corrected. Make sure the receiver is on, the transmitter is on, and the transmitter is set to lo throttle position (and not cut). Once these items have been checked and everything is hooked up correctly, the Start Box can be plugged in to see what the error is. Follow the procedures detailed in the Turbine Start-up Option #1 section to analyze/correct the error. Once the error is corrected and the Green Led is flashing, the operator can disconnect Start Box and proceed to the next step.
3. With the Green LED flashing, the Auto Start sequence is initiated by moving the transmitter throttle stick from low throttle, to high throttle, and back to low throttle three times, within a four second time period. This eliminates the need for using an extra channel on the receiver. The Auto Start sequence will proceed as described in the Turbine Start-up Option #1 section with the LED's sequencing as described in this section. The first throttle up description will also be the same as described in this section. The LED's do not have to be watched during this Auto Start from Transmitter sequence if desired but it is nice to know that at least the green light is flashing before the sequence is initiated using the transmitter throttle up and down sequence.
4. The Turbine can be shut down at any time during the Auto Start sequence or in the Running mode by setting the transmitter to throttle cut (low throttle trim). If the Turbine is shut down by the ECU, the shutdown error can be observed by plugging the Start Box back into the ECU. Follow the procedures detailed in the Turbine Start-up Option #1 section to view the error.

TURBINE START- UP OPTION #3

Manual Control

1. With all connections still attached to the Turbine from the Pre-Start Preparation check, plug the Start Box Data Cable into the ECU. Press the **MNU** button twice and make sure you are in the Manual Control Menu. . See the Manual Control Menu description in the Menu Description section.
2. Before the Manual Start sequence can be initiated, the Green LED on the ECU must be flashing and there must be no error message in the error message area of the Manual Control Menu. If the Red LED on the ECU is flashing, there will be an error message displayed in the error message area of the Manual Control Menu. See the Menu Description Section for the descriptions of all the possible error codes associated with the Manual Control Menu and make the appropriate correction to get rid of all the error messages. When this is accomplished, the Green LED will be flashing, there will be no error message and the Auto Start sequence can now be initiated.
3. The Auto Start sequence is initiated by pressing the RUN button on the Start Box. The Ignition On Menu will then be displayed on the Start Box and the Red LED on the ECU will be on. The Red Led on is indicating that the ignition sequence has started. See the Ignition On Menu description under the Manual Control area of the Menu Description section for a detailed description of the Menu and operation of the ignition sequence. The Auto Start sequence can be aborted by pressing the OFF button on the Start Box at any time during the Ignition On cycle. If the Auto Start sequence is automatically terminated by the ECU, the Manual Control Menu will again be displayed on the Start Box. The error message for cause of the abort will not be displayed in the Manual Control Menu but will be displayed in the message area of the Operator Setup Menu. See the Menu Description Section for the descriptions of all the possible error codes displayed in the Operator Setup Menu.
4. When the propane/butane gas has ignited, the RPM is high enough, and the EGT temperature has increased the Fuel ramp cycle will begin and the Fuel ramp Menu will be displayed on the Start Box. The Red LED will go off and the Amber LED will come on at this time indicating that the Fuel ramp sequence has started. See the Fuel ramp Menu description under the Manual Control area of the Menu Description section for a detailed description of the Menu and operation of the fuel ramp sequence. The Auto Start sequence can be aborted by pressing the OFF button on the Start Box at any time during the Fuel ramp cycle. If the Auto Start sequence is automatically terminated by the ECU, the Manual Control Menu will again be displayed on the Start Box. The error message for cause of the abort will not be displayed in the Manual Control Menu but will be displayed in the message

area of the Operator Setup Menu. See the Menu Description Section for the descriptions of all the possible error codes displayed in the Operator Setup Menu.

5. When the fuel ramp cycle has completed the RUNNING Menu will be displayed on the Start Box and both the Amber LED and the Green LED will be on. See the Running Menu description under the Manual Control area of the Menu Description section for a detailed description of the Menu and operation of the Running cycle. The operation of the Turbine using the INC, DEC, and FUL buttons on the Start Box is described in this section. The Turbine is shut down by pressing the OFF button on the Start Box at any time during the Running cycle. If the Turbine is shut down by the ECU, the Manual Control Menu will again be displayed on the Start Box. The error message for cause of the shut down will not be

6. displayed in the Manual Control Menu but will be displayed in the message area of the Operator Setup Menu. . See the Menu Description Section for the descriptions of all the possible error codes displayed in the Operator Setup Menu.

TURBINE SHUTDOWN

Always avoid shutting down the Turbine from a Full Power setting!!

- 1) Throttle set to idle.
- 2) Operate at this setting for 1 min.
- 3) Shutdown the Turbine with the Radio throttle trim tab or turn off the radio which will terminate the E.C.U. and fuel pump operation.
- 4) Wait for the ECU to spool/cool down your turbine
- 5) White smoke may appear at this time. It is unburned fuel and oil running thru the hot Turbine. This is normal.

COMPONENT MAINTENANCE

TURBINE:

1) After Each Run Cycle (1 Start and Stop), visually inspect the turbine for damage to the Compressor Wheel, Turbine housing, mounting system and discharge nozzle. Should any damage to the rotating parts be observed, the Turbine must be returned to Modellbau USA, Inc. for servicing.

2) When the Turbine has achieved a total of *100 Run Cycles*, the unit must be returned to Modellbau USA for a factory inspection of the Rotating components.

FUEL PUMP:

1) After Each Run Cycle, Visually inspect the pump for leaks.

E.C.U.:

1) The E.C.U. is not serviceable by the Owner. Should a problem develop with the E.C.U., it must be returned to Modellbau USA, Inc. for service.

START BOX:

1) The unit is not serviceable by the Owner. Should a problem develop with the Start Box, it must be returned to Modellbau USA, Inc. for service.

AUTHORIZED SERVICE CENTER:

For USA & Canada:

Modellbau-USA

741 Shotgun Rd.

Sunrise, FL

Florida 33326

Phone: 954 476 5572

Fax: 954 476 5573

For Latin America:

Modellbau USA, Inc.

741 Shotgun Road

Sunrise

Florida 33326

Phone: 954 476 5572

Fax: 954 476 5573