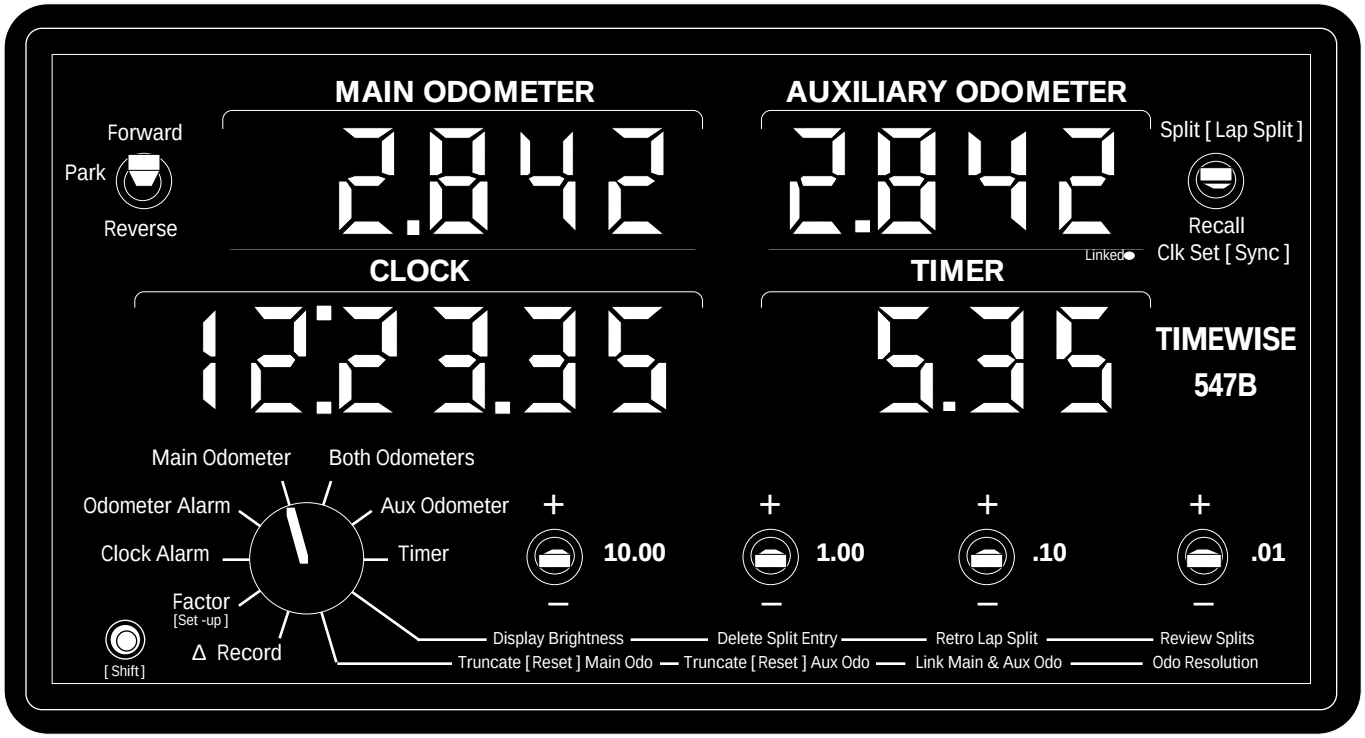
TIMEWISE
547B
RALLY ODOMETER



USER'S MANUAL

Limitation on Warranty and Liability

Timewise warrants this equipment to be free from defects in material and workmanship for a period of two years from the date of shipment to the original purchaser. This warranty is limited to the repair and replacement of parts and the necessary labor and services required to repair the equipment. This warranty is made in lieu of all other expressed or implied warranties, whether written or oral.

Except as specified below, this warranty covers all defects in materials and workmanship. The following are not covered: Damage as a result of accident, misuse, abuse, or as a result of installation, operation, modification, or service on the equipment; damage resulting from failure to follow instructions contained in the User's Manual; damage resulting from the performance of repairs by someone not authorized by Timewise; damage caused by direct exposure to liquids, solvents, salty air, or corrosive gases; damage caused by exposure to excessive amounts of dust or dirt; damage caused by exposure to temperatures above or below the storage or operating limits of the equipment; or normal wear of the instrument enclosure, connectors, or cables.

While under warranty, Timewise will service, repair, replace, or adjust any defective part or parts free of charge, when the instrument is returned freight prepaid to Timewise. The purchaser is responsible for insuring any equipment returned, and assumes the risk of loss during shipment.

Limitation of Implied Warranties and Exclusion of Certain Damages

All implied warranties, including warranties of merchantability and fitness for a particular purpose, are limited in duration to the length of this warranty.

In no event will Timewise be liable to the purchaser or any user for any damages, including any incidental or consequential damages, expenses, lost profits, lost savings, or other damages arising out of the use or inability to use this equipment. This exclusion includes damages that result from any defect in the firmware or manual.

How to Obtain Repair Service

If your Timewise equipment requires service, return it to Timewise directly. Do not return it to your dealer. Include a detailed description of the problem. Timewise must be able to verify the problem in order to repair it. Please include telephone numbers at which you can be reached during the day and evening.

Equipment to be repaired must be returned freight prepaid to Timewise. All equipment must be packaged with sufficient protection against shipping damage. You are responsible for transportation charges when returning equipment to Timewise. Insuring the shipment is recommended. Warranty repairs will be returned via UPS ground freight prepaid. Non-warranty repairs will be returned via UPS ground COD (repair charges, freight, and COD collection fee), cash only, unless prior arrangements have been made. Alternate shipping methods can, or will, be used as necessary to assure a prompt and safe delivery.

Repairs on equipment beyond the effective date of warranty or when abnormal usage has occurred will be charged at applicable rates. Timewise will submit an estimate for such charges before commencing repair, if so requested.

About this Manual and the Operating Firmware of Timewise Equipment

Disclaimer

Although every effort has been made to make this User's Manual technically accurate, Timewise assumes no responsibility for any errors, omissions, inconsistencies, or misprints within this document.

For Further Information

Please feel free to contact Timewise should you have any comments about this equipment. We encourage suggestions for product improvements. Special applications or customization of Timewise equipment to individual needs will also be entertained.

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Users Manual 1001–547B Revision 3.2L

ABOUT THIS MANUAL

THANK YOU…

for choosing the Timewise 547B Class B rally odometer! Your Timewise 547B is one of the most powerful and sophisticated rally tools available. Its features, accuracy, ease of operation, and rugged construction give you the competitive edge.

This manual will guide you during installation and teach you the function of each control on the 547B. The information presented in this manual is structured for first time users of electronic rally equipment, so even basic procedures used to install and operate rally equipment are presented.

If you've used traditional rally odometers, you'll really appreciate the improved quality, additional features, and expanded resolution provided by the 547B. There are some significant features of the 547B that are new to the world of rallying, so please take the time to learn all of its capabilities.

What This Manual Will Tell You

- what the 547B does
- mounting procedures for the 547B
- how to electrically connect the 547B
- what an odometer transducer is and how to install one
- the function of each switch on the 547B
- how to use the features of the 547B
- simple troubleshooting and how to prevent problems

How to Use This Manual

For a brief description of what the 547B does, read the **Introduction**. Study the **Installation** section of the manual for suggestions of various 547B mounting methods. Then carefully follow the electrical connection procedure for safe and dependable operation of the instrument.

The **Installation** section also describes odometer transducers and how mileage is measured. Here you will find several guidelines to assist you in the proper selection of an odometer transducer, suggested mounting locations, and recommended installation procedures.

The section covering the **Operation** of the 547B will teach you the meaning and use of each switch on the instrument.

Technical references are given in the **Appendices**. Here you can find information on signal connections, how to adapt custom made transducers, and specifications of the 547B. Please read the discussion in **Appendix B** about preventing problems and general troubleshooting, including warnings about overheating and sub-zero freezing.

A **Complete Reference Guide** in **Appendix G** briefly describes how to operate all aspects of 547B.

And lastly, in **Appendix I**, a **Quick Reference Guide** lists, in a single page, the less obvious procedures for operating the 547B.

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- Optional RS232C interface to sending data to a printer when "split" activated
- Ergonomic design
- Small, sturdy case with flat back for easy mounting with Velcro™
- Designed for harsh automotive environment
- Alternator "load dump" protection built-in

For Your Information…

The Timewise 547B is designed with the demanding requirements of professional road rallying in mind. Non-slip switch actuators on detent action toggle switches give positive operator feedback, even on the worst of roads. Switches are logically grouped by function and are placed far enough apart so that accidental activation of the wrong switch is minimized. A multi-position rotary switch eliminates a confusing array of switches, some of which would only be used infrequently during a rally.

All course parameters are shown on ultra-bright 0.6" tall LED displays to assure easy readability, even in bright light. For nighttime use, the LEDs can be dimmed to lower intensity levels.

The use of large scale integrated HCMOS and CMOS technology keeps component count and power dissipation to a minimum, while simultaneously providing increased reliability. The 547B uses a microcomputer designed for industrial environments where battery back-up, crashproof operation, data retention, speed, efficiency, adverse ambient conditions, and electrical noise play a significant role in product specification and selection. Every safeguard was used to assure continual operation in the harsh environment of a rally vehicle.

What the 547B Does

The 547B rally odometer provides the rallyist with precise distance and time information needed during the course of a rally. A quartz crystal oscillator and full featured, custom programmed microcomputer control all functions of the instrument.

Dual odometers measure distance to a resolution of 0.001 mile. Distance on the main odometer reads a maximum 9999.999 miles before reverting to 0.000 miles. An auxiliary odometer reads to 99.999 miles.

These two odometers can count up or down, or they may be frozen at current values. Any value may be preset into either odometer. Also, either odometer may be independently truncated or reset to zero. The auxiliary odometer counts independently of the main odometer; or, it may be linked to the main odometer so they always count in synchronism.

Two odometer inputs are provided. When running in "TSD" mode, two factors are available, independent of the odometer inputs. One factor can be used for dry pavement, the other for gravel or snow. Distance measuring accuracy is assured through the use of a six digit factor, allowing adjustments to one part in one hundred millionth of a mile per pulse. An optional odometer input pulse divider allows you to connect the odometer input of the 547B directly to high speed electronic speedometer/odometer signals now provided on many vehicles.

Time of day is displayed in hours, minutes, and hundredths of a minute (12:59.99). Optionally, the rallyist can select the standard six digit format of hours, minutes, and seconds (12:59:59). This time of day clock can be set to any hour, minute, or hundredths of a minute (second).You can switch between counting in hundredths or seconds at any time; and, you can synchronize the beat of the clock to a time standard at any time. You can even electronically set and synchronize the clock to a Timewise 610, 650, 0r 660 Multi-Split Chronometer. An additional digit of resolution (tenths of seconds, or thousandths of minutes) is displayable when the clock is split.

A second time display shows a independent resettable and adjustable one hour timer. Like the time of day clock, the timer can show an additional digit of resolution when split.

Both the timer and auxiliary odometer can be simultaneously split and internally reset to zero in a "Lap Split" action. You can retroactively activate a lap split to the last split location. You can even "undo" an accidental lap split!

The 547B has a 250 split memory to log each split entered. The odometers, the clock, and the timer are saved upon each split. You can review splits at anytime, even after power has been

removed and re-applied. The instrument can therefore function as a 250 multi-split chronometer when working at a checkpoint with full review capabilities. An external split input is available for remote split trip mechanisms; and, an optional RS-232C interface is available to download to a printer the time of day whenever split is activated.

An optional remote driver's module displays shows a duplicate of the main odometer, or, when operating in the "TSD" mode, the vehicle's actual speed (up to 150.0 mph). (When operating in the "Pro" mode, the vehicle's speed is replaced by the auxiliary odometer in the display.) Vehicle speed is displayed to a resolution of 0.1 mile per hour and is mathematically corrected to the official course mileage.

Both an odometer alarm and clock alarm are available. The distance and time to the alarm is even displayed.

Virtually all parameters within the 547B can be altered by the rallyist. (You can even adjust the alarm beep time.) Changes can be made while course parameters are split or free running. A confirmation of the change is available in a resettable amount of change, or "delta record" display.

WHEN YOU'RE READY TO BEGIN…

You should plan on spending an entire afternoon installing the 547B. Some transducer installations require that you wait overnight for epoxy to fully cure, so make allowances for that time, too. You will also need to spend additional time learning how to use the instrument.

Do not attempt to run a rally on the same day you install the 547B. In fact, it is highly recommended that you use the instrument under simulated rally conditions before running an actual rally. Without the pressure of having to stay on time, familiarization and confidence in the instrument will develop rapidly. As with everything else: Practice Makes Perfect. When you are comfortable using the 547B, you will be able to concentrate on navigating the rally course rather than the front panel of the instrument.

READ THIS BEFORE YOU DO ANYTHING!

CAUTION! The 547B is for 12 volt DC negative ground vehicles. As of this writing, some 24 volt DC vehicles are becoming available. If you intend on installing the 547B in such a vehicle, contact Timewise for a modification that is necessary to prevent destroying the 547B when connecting to such voltage.

You will destroy the 547B if it is powered from a 24 Volt DC system! Take extreme caution to prevent this from happening!

READ THIS BEFORE YOU OPEN THE 547B!

CAUTION! The 547B has a 30 year lithium battery back-up for all data in its memory, including the actual operating firmware. If you open the 547B and inadvertently short out a trace within the unit, or apply a negative voltage as little as – 0.3 volts to any trace inside the instrument, the life of the battery can be severely shortened. The 547B will lose its operating memory when the battery voltage drops below 2.5 volts; the instrument will then become useless. The only recourse will be to return the unit to Timewise for replacement of the battery and microprocessor, and complete reprogramming of the instrument. There is a very substantial charge for this replacement and reprogramming!

You can damage the 547B if you touch anything inside! Take extreme caution to prevent this from happening!

Mounting the 547B

The 547B can be mounted most easily using Velcro™ fastening strips attached to the back of the instrument. Velcro is available at most hardware stores. When using Velcro, purchase the type with pre-applied adhesive on its back, rather than the type that requires an application of glue. Glue generally doesn't adhere as well as the adhesive and often fails after a short time because of temperature extremes within the vehicle. Glue also leaves a terrible mess if you remove the strips later.

If you do use Velcro, only a few small strips are necessary. If you use large amounts of Velcro, you may not be able to remove the 547B without putting substantial stress on the instrument. You could warp the printed circuit boards inside and break a solder joint.

Before attaching Velcro to the dashboard, thoroughly clean the area where you intend to apply the strips. Adhesives will not reliably stick to surfaces contaminated with dirt or oil. Vinyl conditioners must be completely removed. Use a household cleaner or mild solvent. ***Careful!*** *Highly active solvents may damage the dashboard!*

To remove Velcro from the dashboard after its adhesive has baked in the sun, Timewise suggests you apply a general purpose cleaner. Isopropyl alcohol or ethanol will usually soften

dried-on, hardened adhesive, allowing you to completely remove the Velcro. Careful! some plastics used on dashboards may be damaged by these chemicals. Never use methanol, methylene chloride, acetone, 1,1,1-trichloroethane, or nitromethane. Test an inconspicuous place first and wait awhile before concluding that the chemical does not harm the surface. Lexan (polycarbonate) and polysulfone have a nasty habit of just falling apart after exposure to some alcohols. It sometimes takes several minutes before any sign of a problem, and then, suddenly, the plastic fractures in a million pieces.

Chlorinated fluorocarbons ("HCFC" and other Freon replacements) cleaners are available at industrial electronic suppliers. Only some of these cleaners are OK. Be forewarned that many of them can literally make polycarbonate and polysulfone crumble. (**Do not use a TV tuner cleaner. Such formulations contain unspecified lubricating oils and additives.**)

The 547B case is ABS plastic and the front panel is polycarbonate. Take care when using chlorinated cleaners around the 547B. See **Appendix E** for more information.

When selecting a mounting location, avoid placing the 547B high on the dashboard out of easy reach. Most navigators cannot comfortably operate the instrument with an extended arm. A lower position, perhaps just above the glove box, usually provides easier access. Such a location is also out of direct sunlight much of the time, thereby keeping the instrument cooler. Choose a location that will not present a safety hazard during hard braking or sudden turns.

If your vehicle has a passenger side airbag, you may consider an alternative to mounting the 547B on the dashboard. Some rallyists are mounting the instrument on a homemade enlarged version of a clipboard. If you do mount the 547B to a clipboard, remember to disconnect wires and cables prior to exiting the vehicle! When your vehicle is in every day use, removing the clipboard and 547B reduces the potential theft of the instrument.

You can also recess the 547B into a cutout in the dashboard or center console. However, air circulation around the instrument will be restricted and overheating may occur. Also, a remote power switch would certainly have to be installed to turn the 547B on and off without its removal from the cutout.

If you do recess the 547B into the dashboard, you may find it tempting to remove the rear cover. If you do so, here is a very important warning:

READ THIS AGAIN BEFORE YOU OPEN THE 547B!

The 547B has a 30 year lithium battery back-up for all data in its memory, including the actual operating firmware. If you should inadvertently short out a trace in the 547B, or apply a negative voltage as little as – 0.3 volts to any trace inside the instrument, the life of the battery can be severely shortened. The 547B will lose its operating memory when the battery voltage drops below 2.5 volts; the instrument will then become useless. The only recourse will be to return the unit to Timewise for replacement of the battery and microprocessor, and complete reprogramming of the instrument. There is a very substantial charge for this replacement and reprogramming!

You can damage the 547B if you touch anything inside! Take extreme caution to prevent this from happening!

The optional Model 326 driver's module for the 547B is generally mounted with Velcro. The mounting location does not necessarily have to be on top of the dashboard directly in front of the driver. Some rallyists position the module slightly to one side of the driver or place it on the steering column in front of the instrument panel.

When positioning the driver's module, lay the cable that attaches it to the 547B neatly along the edge of decorative trim or near the windshield. If possible, do not lay the cable directly over a blower motor located within the dashboard. Blower motors radiate incredible amounts of electrical interference that can cause a malfunction in the 547B. See **Appendix B** for details.

Regardless of the mounting method you select, make certain both the main 547B and driver's module are mounted securely. If they are loosely attached, they may become dislodged by a bump, sudden acceleration, or hard braking. Also, avoid mounting them at such an angle that sunlight reflects off the panels into your eyes. Don't forget this warning when installing the 547B while in a garage or at night.

Electrical Connection

The 547B operates from a nominal 12 volt DC, negative ground vehicle supply. A voltage range of 8 to 15 volts is tolerated continuously. Additional allowance is made for short duration drops to 7 volts, as well as the high voltage transients typically found in a vehicle.

WARNING!

DO NOT CONNECT THE 547B TO A POSITIVE GROUND VEHICLE!

The power connections of the 547B must be made with the utmost of care. The red wire must be connected to the positive (+) potential of the vehicle's power supply. The wire must make continuous contact to a circuit that is not switched off anytime during driving, starting, or parking. The black wire must be connected to the negative (–) potential of the battery. Attaching both leads securely is mandatory. ***Do not use a cigarette lighter adapter plug! Such a loose fitting connector just invites trouble.***

A good attachment point for the red wire is at the fuse box. Here, the positive potential cable from the battery brings uninterrupted power to all circuits in the vehicle. The red wire is supplied with a slip-in connector that may fit between a fuse and its holder. Several other attachment methods include: attaching to the power distribution panel screw terminals provided in some vehicles, removing the fuse box and attaching to a terminal on its underside, soldering (or crimping) directly to the 12 volt cable connector at the battery terminal, or tapping a circuit that always powers an electrical accessory (e.g., a clock or cigarette lighter).

If you attach the positive (red) wire to a circuit already protected by a fuse, keep in mind that a problem elsewhere in the vehicle may blow that fuse and disable the 547B. Make certain that the vehicle fuse is free of corrosion and makes continuous contact with its holder.

Connection of the negative (black) wire should be to a screw or bolt on the chassis *that is near the point of attachment for the red wire*. The connection must be free of dirt, oil, grease, and paint. Do not overtighten the connection, as you may weaken the wire by breaking some of its fine strands.

Really IMPORTANT!

IMPORTANT! The red and black wires must be attached to points that are as close to each other as reasonably possible. In addition, the two wires must be twisted around each other approximately one turn for every inch of travel. Do not attach the black wire to some point on the chassis directly behind the 547B and run the red lead a long distance to the fuse box or battery! By doing so, you create a huge antenna that can pick up all manner of radiated energy. Such energy cannot be filtered out of the power line without prohibitively expensive electronics. See **Appendix B** for more information. **The connection for the black wire must be near the attachment point for the red power lead!**

Make sure the cable between the battery's negative terminal and the chassis is clean and secure. If the vehicle chassis is isolated from the negative side of the battery, choose a connection point for the black wire at a convenient location along a negative potential line.

IMPORTANT! *When routing the red wire, make certain that the fuse holder has some freedom of movement. If the fuse holder is held too tight, a spring inside the fuse holder could be compressed if the red wire is pulled. The fuse will then lose electrical contact with the ends of the wire. (This may occur only when the vehicle is jarred by a bump in the road.)*

On the other hand, do not let the wires hang too lose, or the navigator may snag the wires with his or her foot. Also, be careful when routing wires around the glove box or among movable cables and levers. The wires may be pulled when the glove box is opened or control levers are moved. Wires placed below floor mats or carpeting can likewise be pulled when stepped upon.

If you need to extend the electrical power wires of the 547B, extension cables are available from Radio Shack as part number 270-026. If you need to replace the entire fused power cable, ask for part number 270-025. The 547B uses a 1.5 amp 3AG fast blow fuse.

Note that the power wires *may* be fed through a dark gray metallic ring prior to entering the left side power entry point. There may also be rings on the cables of the driver's module and odometer transducer. These rings, termed "ferrite beads" help to prevent high frequency radio frequency interference (RFI) from entering the 547B. Overly strong RFI can upset the 547B. For the ferrite beads to be most effective in removing RFI, they must be located next to the 547B. See **Appendix B** for more information.

Odometer Transducers

The 547B will operate from a wide variety of odometer transducers (often referred to as **probes**, **pick-ups, sensing units**, **impulse units**, or **sending units**). An odometer transducer is an electro-mechanical device that produces an electrical signal indicating the passage of distance. There are two common types available: photoelectric and magnetic.

Photoelectric odometer transducers are supplied as a one-piece assembly consisting of a housing, a source of light, a slotted disk, and a light sensitive transistor (a phototransistor). The "closed" self-contained mechanism is constructed such that the disk can be made to spin as the vehicle moves. The light source and phototransistor are placed on opposite sides of the rotating disk, so that a beam of light alternately flashes on the phototransistor. As the flashing beam of light strikes the phototransistor, electrical signals are sent to the 547B. Note: Timewise does not recommend the use of photoelectric transducers.

Magnetic odometer transducers use a type of special transistor that is sensitive to a powerful magnetic field. Magnetic transducers turn on and off in the presence and absence of this magnetic field, each time sending a signal to the 547B. Two styles are available: a "closed" self-contained unit similar to the photoelectric unit, and an "open" two-piece arrangement consisting of a housing containing the sensing element and a separately mounted permanent magnet. Timewise manufactures both types of magnetic odometer transducers.

Many automotive manufacturers are now installing electronic speedometers in their vehicles as standard equipment. These systems use an electronic pulse sending unit (some are similar to the closed magnetic transducer; others are effectively small generators) attached to the transmission. Such systems can be used as the odometer signal source for the 547B. Rallyists wishing to do so must first read the discussion in **Appendix C** regarding odometer transducer specifications. If you plan on using an original equipment electronic speedometer system as your signal source, you must understand the needs and limitations of the 547B, as well as your vehicle's electrical system. Your 547B will need an odometer input signal conditioner/frequency divide installed. This optional accessory will attempt to buffer and shape high speed original equipment electronic signals so that the 547B will count mileage correctly without interfering with normal vehicle functions. See **Appendix C** for more information.

If you plan on using a transducer other than one supplied by Timewise, you will need an adapter cable to connect to the "eight contact unkeyed modular jack" used on the 547B. Timewise can provide cables (with an eight contact modular plug on one end), with or without a mating connector for another brand of transducer. ***Do not use a four or six contact modular plug! Such plugs will damage the eight contact jack!*** Refer to **Appendix C** for a listing of the transducer connector pin assignments.

Note that there are two odometer inputs on the left side of the 547B. Either input can be used at any time. To use both inputs, all you need are two odometer transducers. The transducers may be of different types. One may be from the vehicle's electronic speedometer, the other from a transducer you have installed.

If you have only one odometer transducer, install the supplied dust cover into the unused input. This prevents dirt from contaminating the contacts in the unused jack. A dust cover is also provided for the Remote Display jack while it is unused.

Transducer Selection

Which type of odometer transducer is the best? Unfortunately, there is no clear-cut winner. There are advantages and disadvantages to each. When selecting a transducer, you'll have to weigh the following features for each type and decide which are important to you.

Obviously, measurement accuracy is on everyone's list of required features. So which type of transducer provides the greatest accuracy? There are two schools of thought about this. Some rallyists argue that wheel slippage during hard acceleration rules out the use of any transducer attached to the drive train or to a speedometer cable mechanism driven by the transmission. These rallyists believe that a transducer sensing the rotation of an undriven wheel must be used.

Other rallyists argue, however, that during hard braking (especially on gravel) an undriven wheel can lock up easier. In such a case, a transducer sensing the rotation of an undriven wheel will miss pulses more often than a wheel connected to the drive train.

Note that on four wheel drive vehicles, the transmission usually turns when *any* wheel looses traction. In such a case, a transducer attached to the odometer cable will record extra pulses regardless of which wheel spins. It has, therefore, been suggested that sensing the rotation of a single wheel may, on the average, reduce the measurement of erroneous pulses by a factor of four.

As it happens, the distance measuring accuracy of the 547B is not predictably improved by the choice of transducer or mounting position. Unless you install an undriven, non-braking, "fifth wheel" you will always experience missing or erroneous pulses from some manner of wheel slippage. Only by precise determination of the odometer factor (explained later) and a conscious effort to minimize wheel slippage is accuracy improved.

Photoelectric Transducers

Photoelectric transducers are generally attached to the speedometer cable mechanism of your vehicle. Alternatively, some rallyists install a mechanical cable drive to the hub of a wheel and attach the photoelectric transducer to the end of that cable. Consult your rally equipment dealer for further information on that type of installation. Note: Timewise does not recommend the use of photoelectric transducers.

The photoelectric transducer is easy to install providing it has the correct mechanical fittings for your vehicle. Occasionally, because of the wide variety of odometer cable fittings in use, transducers with appropriate fittings are not available. Short adapter cables must then be used.

There are some potential problems with photoelectric transducers. Many of these transducers use an incandescent bulb as a light source. Proper designs use a bulb rated at a higher voltage than the voltage supplied by the rally 547B. This greatly increases bulb life. Unfortunately, it is

still possible for the light bulb to burn out in the middle of a rally. Also, photoelectric transducers generally must be mounted inside the vehicle since weather and high levels of ambient light can adversely affect their operation. This restriction limits your selection of mounting locations.

Another problem exists with many photoelectric transducers: They often do not output "clean" pulses (i.e., pulses with sharp rising and falling edges) when the vehicle is moving very slowly. A design feature of the 547B is that it can accommodate slowly changing transducer signals. However, if the slowly changing signal varies excessively between "on" and "off" states before settling, the 547B can mistakenly count more than one pulse. (This problem will not be encountered if the photoelectric transducer utilizes a "photo-darlington" transistor.)

Note: The 547B has a current limiting resistor in the power supply circuitry for the odometer transducer. This safety feature protects the 547B if you cause a short circuit when installing a homemade transducer. The resistor will also increase the life of the light bulb in the photoelectric transducer. Unfortunately, it also decreases its light output. As such, it is possible that a photoelectric transducer may not work on the 547B even though it works when connected to another brand of rally 547B. Note: Timewise does not recommend the use of photoelectric transducers.

Magnetic Transducers

The most reliable transducer is the closed magnetic style. Like the photoelectric transducer, adapter cables are often required to attach the transducer to your vehicle. (Timewise closed magnetic transducers have 5/8"–18, 7/8"–18, 22mm–1.5mm, or 18mm–1.5mm cable fittings.) Some closed magnetic transducers (e.g., Timewise) are sealed against the elements and may, therefore, be mounted outside the vehicle. Magnetic transducers also have built-in hysteresis, so you won't have a problem counting extra pulses when moving slowly. When properly fitted to a vehicle, closed magnetic transducers will provide years of trouble free service.

Lastly, there is the open two-piece magnetic transducer. An advantage of the open magnetic transducers is that it can be installed in a location where wheel slippage is not a concern. Open magnetic transducers are generally less expensive than other styles.

A disadvantage of the open magnetic transducer is the greater effort required in its installation. The components are generally mounted under the vehicle, thereby making placement of the pieces difficult. Choosing a location for the transducer requires considerable planning and understanding of the mechanics of the vehicle. The installation also requires critical alignment of the two components. If not correctly mounted, open two-piece magnetic transducers can be damaged or dislodged during rough driving.

Even with the difficulties mentioned, the open magnetic transducers are by far the most popular. They have been installed on virtually every type of vehicle.

Transducer Installation

Anyone with average mechanical abilities can install an odometer transducer. Household tools are generally all that is required. Jack stands are a must if you work under your vehicle. If you don't feel comfortable working on or under your vehicle, enlist the aid of friends or hire a mechanic. Make sure your assistants understand the seriousness of the sport and your intent on winning. Insist on perfection. You don't want a poorly installed transducer to fail during a rally.

Depending on the type of transducer, anywhere from one hour to twenty-four hours (if you're waiting for epoxy to cure) may be required for proper installation.

Read the following procedures and choose the method that you prefer. If you plan on using a signal from your vehicle's OEM electronic speedometer, you will have to plan your own installation method.

Closed Self-Contained Transducers

Generally, photoelectric transducers are mounted inside the vehicle since water, dirt, and ambient light levels can affect their operation. As mentioned, closed "self-contained" magnetic transducers may be mounted outside the vehicle if they are weatherproofed. Check with the manufacturer to determine if you are restricted to passenger compartment mounting locations. Timewise closed magnetic transducers use a gasketed housing that weatherproofs the transducer, allowing it to be mounted outside the vehicle.

Installation of a closed transducer is rather straight forward. Simply disconnect the speedometer cable at one end, attach one end of the transducer to where the cable was removed, and re-connect the cable to other end of the transducer. Generally, the speedometer cable is disconnected from the back of the speedometer, and the transducer is attached (with adapters, if required) to the speedometer. If your vehicle is equipped with a cruise control, the transducer may also be connected at the cruise control interface module. The transmission end of the cable is sometimes used if the transducer is weatherproof. All these mounting methods are termed an "in-line" installation.

In some vehicles, a formed metal cavity surrounds the speedometer. This metalwork may prevent you from attaching the transducer directly to the rear of the speedometer. In such a case, you can purchase short extension cables that will allow the transducer to be located a few inches away from the speedometer.

When installing a weatherproofed closed transducer, you may choose to attach the transducer directly to the hub of an undriven wheel. Your rally equipment dealer can supply you with the correct hardware to do this.

Avoid sharp bends in the speedometer cable when installing the transducer. If necessary, push the speedometer cable back through the firewall. You could also have the speedometer cable shortened or purchase a replacement cable that is shorter than the original. Local speedometer repair shops can assemble custom speedometer cables.

Open Two-Piece Magnetic Transducers

The permanent magnet and sensing probe of an open "two-piece" magnetic transducer are mounted under the vehicle. The magnet is epoxied to a rotating shaft or to a wheel rim. The sensing unit (the actual transducer) is rigidly mounted to a non-rotating part of the vehicle. The mounting locations for these items are chosen such that the permanent magnet rotates past the sensing end of the transducer.

The standard Timewise two-piece magnetic transducer (a.k.a. the Permalloy (magneto-resistive) super-sensitive Model 217-15) is activated by either the North or South pole of a magnet. The transducer is 2" long and 0.375" in diameter. The body of the transducer is threaded along its entire length, allowing you to adjust its axial position after installation.

When installing the transducer, position it so the magnet will pass approximately 3/8" to 5/8" from the its sensing end. Stronger magnets can activate the transducer at greater distances.

The distance between the magnet and transducer may be reduced until the two pieces nearly touch each other. However, since there is always vibration of the elements in the installation, a very small gap increases the risk that the magnet and transducer will hit each other. Mounting the magnet and transducer too far apart will cause the transducer to work erratically or not at all.

You can use common magnets found at many hardware stores and electronic distributors. Radio Shack sells a small "button" magnet (0.5" dia. x 0.2" thick; part number 64-1883, package of 5) that will activate the transducer at a distance of 3/8". When you purchase magnets, make sure you get the standard two-pole type; do not use multi-pole "ring" magnets or plastic magnetic sheet. Don't use magnets with holes, either; the odd shape magnetic field they produce can cause double pulses. The common household message holder magnet on your refrigerator will

not work. If you cannot find appropriate magnets at a local source, contact your rally equipment dealer. Many sizes and shapes are available.

Note: Long rectangular magnets whose North/South orientation is transverse (i.e., the poles are along the long sides of the rectangle, rather than at the ends) have an unusual magnetic field very close to the material's surface. A transducer may be activated twice if it passes too close to such magnets. When using these magnets, mount the transducer so that it passes no closer than 3/8" from the magnet. The more uniform field at that distance will properly activate the transducer.

Selecting a Mounting Location

Since every vehicle model is unique, there are many possible attachment locations for the open magnetic transducer. Use your own judgement when selecting a mounting location by studying the undercarriage of the vehicle. The time spent evaluating possible locations can save hours of aggravation later. A hastily chosen mounting location may turn out to be too close to a moving suspension arm or susceptible to debris thrown up by a wheel.

A custom designed mounting bracket to hold the transducer must be attached to the vehicle. To maintain the correct distance between the magnet and transducer, the mounting bracket must be attached to a part of the vehicle that does not move relative (axially and radially) to the rotating member holding the magnet. Remember that you will be installing the transducer on a stationary vehicle. Poor mounting locations are not always apparent.

A popular attachment location for the transducer is to a disc brake caliper or a drum brake backing plate. The magnet is then epoxied to a wheel. (Do not epoxy the magnet to a brake drum or brake disc—they get so hot during hard braking that the magnet will demagnetize.)

Another popular method is to mount the transducer directly to the transmission or differential housing. The magnet is then epoxied to the flange of a universal or constant velocity joint. This location is well under the vehicle and out of the way of any debris that might be thrown up by the wheels.

Don't attach the transducer to the chassis and the magnet to the transmission output shaft. Since the transmission is mounted on rubber bushings, both the transmission and the drive shaft will twist and vibrate as the engine applies torque to the drive train. When that happens, the gap between the transducer and magnet will change. There may be enough movement to cause damage to the transducer. This same warning applies to mounting the transducer on the chassis next to the differential with the magnet on a half shaft.

A better method is to mount the transducer directly to the transmission or differential housing. The magnet is then epoxied to a flange of the universal or constant velocity joint. This way, the transducer and magnet will vibrate in unison. This location is also well under the vehicle and out of the way of any debris that might be thrown up by the wheels.

On rear wheel drive vehicles that have an independent rear suspension, the differential is often attached directly to the chassis. In such a case, the transducer can be mounted to the chassis, with the magnet(s) epoxied to a flange on the drive shaft or half shaft. However, be forewarned that some independent rear suspension differentials are supported by hard rubber bushings that isolate drive train vibrations from the chassis. The differential will still vibrate during severe road conditions. Do not assume the differential does not move.

Be careful when attaching the transducer to a McPherson strut shock absorber. The apparent solid assembly may be isolated from the suspension arm with a hard rubber bushing that compresses during severe road conditions. Also note that straight axle suspensions and independent suspension differentials may have semi-flexible arms supporting them.

Remember that the suspension will be fully extended while the vehicle is raised. What appears to be an unobstructed location for the transducer may actually be the headroom for part of the suspension mechanism. Make certain that the suspension will not hit the transducer, bracket, or cable when encountering severe road conditions. Be careful of seemingly fixed objects in the suspension. A stabilizer bar will change shape and position when the suspension moves.

As mentioned, when installing the transducer, you will need to position it so the magnets will pass approximately 3/8" to 5/8" from the transducer's sensing end.

Mounting the Transducer

CAUTION! When working under a raised a vehicle, always use jack stands or another approved vehicle support system! Never use several boards of lumber, cinder blocks, or the tire changing jack that comes with your car! **Serious injury will result if you are under your vehicle when an improper support mechanism fails.**

Mount the transducer to the vehicle before you epoxy the magnet in place. You may have to relocate the magnet if the intended mounting position for the transducer doesn't work out. While you are mounting the transducer, temporarily hold the magnet in its expected mounting location with adhesive tape. On steel, the magnet will hold itself to the surface.

Determine the path that you will use to route the transducer cable. The cable may have to run through the firewall or other metal obstruction. It is usually easier to start inside the vehicle and feed the transducer through any required holes, rather than pushing the plastic modular plug through the opening. The transducer is considerably more durable than the plug.

A bracket for the transducer must be attached to the vehicle. Timewise can supply a bracket with several pre-drilled 1/4" holes for mounting bolts and a 3/8" hole for the transducer. You can also fashion your own bracket from a steel mending plate. Mending plates with pre-drilled holes are available at most hardware stores. You can cut, bend, or drill additional holes as necessary. Your particular installation will dictate the exact size and shape you need. Keep the bracket as short as possible to reduce transducer vibration.

If you mount the bracket to the brake or suspension mechanism, use thread locking compound when re-seating any bolts you remove. The bolt must be re-tightened to the correct torque. Also, the added thickness of the bracket may require the use of a longer bolt. Always replace a loosened expansion bolt with a new one.

When mounting the transducer to part of the suspension, allow enough slack in the cable so that it can flex with maximum wheel movement. Don't let the cable get entangled in the steering mechanism. Also, route the cable along a path that protects it from debris. If the cable follows the brake fluid line, these problems can generally be solved.

To hold the cable in place, use electrical tape or cable ties. Cable ties are available at electronic, electrical, hardware, and automotive parts stores. If you route the transducer cable through a hole with sharp edges, place a protective grommet around the cable.

Mounting the Magnet

Rallyists have traditionally used two magnets in open magnetic transducer installations. This has been done for several reasons. First, having two magnets provides redundancy. If, by some misfortune, a magnet is dislodged, the remaining magnet can be used to measure distance. Secondly, two magnets mounted radially opposite each other helps keep a rotating component dynamically balanced.

Lastly, rallyists use two magnets in an attempt to improve measuring accuracy. As is turns out, however, overall accuracy is not improved by using more than one magnet. Accuracy is improved only by good driving habits (i.e., no wheel slippage) and precise determination of the odometer factor (explained later).

Using two magnets does, nevertheless, increase the frequency of odometers pulses. You will, as a result, be able to identify a specific point on the course with greater assuredness. On wheel mounted installations, pulses will occur approximately every 3 feet, instead of every 6 feet. (Note: Using more than two magnets may make the speedometer on the driver's module erratic. This is due to the timing method used to determine your speed.).

For most rallyists, the advantages of using two magnets outweigh the extra effort of the installation. By the way, when mounting magnets on a wheel, you should also put magnets on your spare tire. Should you get a flat tire on the wheel chosen for the transducer, the magnets on the spare tire will allow you to measure distance.

IMPORTANT! Magnets are generally very brittle. Be careful when handling them near ferrous metals or other magnets. Should a magnet slip from your fingers, it may shatter on impact with another surface. Even if the magnet doesn't break, the physical shock will often reduce its magnetic field strength.

When mounting the magnets, do not recess them in a hole drilled in a metal surface, or locate them in a depression in metal. Doing so will change the shape of the magnetic field, drawing it closer to the surrounding surface. When the magnetic field does not extend far away from the magnet, you may not be able trigger the transducer. Also, do not machine a magnet to fit a particular location. Cutting, drilling, or grinding a magnet will reduce its strength in two ways: by material loss and by stress induced demagnetization. The magnetic field of the remaining material may not be sufficient to stimulate the transducer.

If you need magnets of a different shape, size, or magnetic orientation, contact Timewise.

When installing the Timewise Model 217-15 transducer, you need not be concerned which pole of the magnet faces the transducer. However, do make certain that one of the two poles (North or South), not a non-pole side, passes by the sensing end of transducer.

Even though it isn't absolutely necessary to install magnets with a specific pole facing the transducer, Timewise does suggest that you consider placing the South pole toward the transducer. Doing so assures you that, should you subsequently install a "southpole only" transducer, the magnets will be appropriately oriented. ("Southpole only" transducers are sold elsewhere.)

Note: The South pole of a magnet can be determined with the aid of a compass. The South pole will attract the end of the pointer in a handheld compass that normally points to the North pole of the earth. An automotive compass that shows you the direction you are heading will turn to have the "S" designation face toward a permanent magnet's South pole.

When mounting the magnet to a wheel, it may be easier to do so with the wheel removed from the vehicle. Locate the magnet onto the wheel at the required position and then carefully remove the wheel. Don't bump the transducer while doing this.

The epoxy used for attaching the magnet must firmly bond it to the selected mounting surface. Make sure you use an epoxy designed to adhere to the materials being bonded. Use a gap filling, non-shrinking type. Consult your rally dealer or your local hardware store for recommendations of a long lasting, strong epoxy. "Five minute" epoxies are usually not strong enough, so avoid using those.

A word of caution: Reliable attachment of the magnet to an aluminum or magnesium wheel can be a problem. The epoxy will adhere well to the oxide film that rapidly forms on those metals, but the microscopic film may "peel" off the base metal, causing the magnet and epoxy to fall off. You must epoxy the magnet to the wheel *immediately* after the surface has been sanded to roughen the surface and cleaned with a strong solvent. Methyl ethyl ketone (MEK) or acetone

can be used as they dry the surface and leave no residue. ***Careful!*** *These solvents remove paint and damage plastics!*

Carefully mark the location of the magnet using crosshairs. Remove the magnet and thoroughly clean the attachment area so it is free of all dirt, rust, grease, oil, and paint. You can use navel jelly or a little vinegar to remove small amounts of surface rust. Use emery paper or a wire brush to remove paint and heavy deposits of rust. Following this, clean the surface with alcohol to remove all residue. Clean the magnet also, removing all the dirt, grease and oil that has accumulated during handling.

Prepare the epoxy according to the directions on the package. Now carefully coat the surface of the magnet that will lie against the mounting surface. Use a thin layer of epoxy—just enough to fill small gaps. Too much epoxy here and the magnet may not lie flat. Precisely place the magnet in position and use additional epoxy to fill-in along the sides of the magnet. Apply a liberal amount here, but be careful not to cover the upper surface; and don't form a ridge around the magnet that will interfere with the transducer.

If you have attached the magnet to a shaft or flange (as opposed to a wheel), you may wish to wrap nylon reinforced tape around the rotating member to hold the magnet in place while the epoxy is curing. Keeping this tape in place after the epoxy cures provides additional holding power should the epoxy bond fail. Always wrap the tape in the direction opposite the normal turning motion of rotating member. ***Caution!*** *Improperly applied tape may begin to unravel and get caught between the transducer and rotating member, possibly damaging the transducer and/or magnet.*

If you have epoxied the magnet to a wheel that was removed from the vehicle, replace the wheel only after the epoxy has cured. This will prevent accidental movement of the magnet. Be careful not to bump the transducer when locating the wheel on the hub.

CAUTION! If you spin balance a wheel that has a magnet attached, be forewarned that an improperly epoxied magnet could come off.

Finally, re-align the transducer. The body of the transducer is threaded along its entire length to aid in adjustment to the required spacing. The magnets should pass approximately 3/8" to 5/8" from the transducer's sensing end

Once everything is in place the open magnetic odometer transducer will provide years of reliable service. The transducer is not affected by water, dust, or extreme temperatures. In fact, the transducer will operate from –40°C to 100°C.

Final Installation Procedures

After installing the 547B and the transducer(s), plug the transducer(s) into the **Odo Input** jack(s), and, if used, the Model 326 driver's module into the **Remote Display** jack on the left side of the 547B. If you plan on using the **Remote Split** input feature (see **Appendix A**), install the necessary hardware now.

MATERIALS LIST

Throughout this manual there are references to components and materials used during installation of the 547B, as well as suggested spare parts and cleaning supplies required for maintenance of the instrument. The following is a list of those items and suggested suppliers for them.

Personal preference must guide you in the selection of some items, such as the switch needed for operating the remote split function. Visit your local Radio Shack or auto parts store to make your selection.

The abundance of Radio Shack stores in North America is the reason that store is listed so often. Please note that similar items are usually available from hardware, home center, and auto parts stores.

ITEM	SUPPLIER	PART NUMBER
Magnetic odometer transducers:		
Open two-piece	Timewise	214-12; 8 Contact Modular Plug, 12 ft
Open two-piece, sensitive	Timewise	216-12; 8 Contact Modular Plug, 12 ft
Closed (for Speedometer Cable)	Timewise	215-6; 5/8" x 18 fittings, 8 Contact Modular Plug, 6 ft. Other fittings available.
Power cable w/ fuse holder	Radio Shack	270–025 (w/ quick-disconnect, 4'); stocked by Timewise
Power cable extension	Radio Shack	270–026 (w/ quick-disconnect on both ends, 1')
Multi-conductor signal cable	Radio Shack	Radio Shack carries many styles
	Timewise	100-xx (3 conductor, 26 gauge, shielded; substitute length in feet for -xx). Available with or without modular plug.
		110-8-xx (7 conductor plus shield, 26 gauge, w/ 8 contact unkeyed modular plug on one end, shield drain wire on pin 1; substitute length in feet for -xx). Also available without modular plug.
Modular jack coupler (for connecting two male 8 contact plugs)	Timewise	Hubble # BRIA4P (8 contact, straight through; female both ends)
Modular plugs (8 contact, unkeyed)	Timewise	AMP # 5-554739-3 *Use only with AMP crimping tool.*
	Digi-Key (800) 344-4539	AMP # 5-554739-3 (Digi-Key # A9094) *Use only with AMP crimping tool.*
Modular plug crimping tool (for 8 contact modular plugs)	Digi-Key (800) 344-4539	AMP crimping tool # 231652-1 (Digi-Key # A9900-ND) *Important! Only use AMP modular plugs with this tool.*
Modular jack dust cover	Timewise	455 (for 8 contact modular jacks)
Fuse (3AG, 1.5 Amp)	Radio Shack	270–1274
Electrical noise suppression filter	Radio Shack	270–051
Stereo phone plug (3 contact, 1/8")	Radio Shack	274–1547 (shielded, w/ spring strain relief)
		274–284 (black)
		42-2387 (6' long 3 conductor cable, plug at both ends)
		42-2462 (20' long 3 conductor cable, plug and jack)
Magnets	Radio Shack	64–1883 (0.5" dia x 0.2"; package of 5)
		64-1895 (1/8" dia x 1/16"; strong, rare earth; pkg. of 2)
		64–1877 (1.9" x 0.9" x 0.375")
Cable ties	Radio Shack	278–1631 (4"), 278–1632 (5"), or 278–1642 (8")
Double-sided foam tape	Ace Hardware	3M picture hanging tape; in rolls and pre-cut pads. Use the 3M brand only; other brands are too hard to remove.
Anti-static spray	Computer stores	Ask for a spray-on chemical that reduces static electricity.
Velcro®	Radio Shack	64–2345 or 64–2360
	Hardware stores	Ask for self adhering Velcro® strips

START-UP PROCEDURE…

Their is no **ON–OFF** switch for the 547B. To power-up the instrument, just attach the power cable to the 12 volt DC source of your vehicle. The power cable supplied with the 547B has a standard 2 contact polarized connector in line. This connector is often used for trailer hitch power connections. Replacement power cables are available from Radio Shack. Their part number 270-025 is the power cable supplied with the instrument. Please! Do not bypass the fuse!

When the 547B is powered-up, the time of day clock will begin counting from the value last displayed when power was removed unless you have the Real Time Clock (RTC) option. In that case, the clock and timer will have continued counting even while power was removed. (Without power applied, the RTC is accurate to about 30 seconds per month.)

All other parameters in the 547B will be exactly as you had left them when power was last removed. This includes the odometers, split memory, odometer factor(s), odometer input selection, clock counting mode, odometer display resolution, delta record (amount of change counters), alarm settings, and beep length. You may begin using the 547B immediately.

If you wish, you can turn the rotary switch to the **Factor [Set-up]** position, then push and hold the **Shift** button, and finally select **Recall**. The displays will show the serial number, firmware version, date of manufacture, and operating mode ("**Pro**" or "**tSd**").

This manual describes version 3.2L firmware. See the version history supplement for an itemization of changes that have occurred to the 547B as features have been added or procedures have been altered.

If you call Timewise with a question about your 547B, please be familiar with the firmware version in your unit.

Note: *These instructions use the timing mode of hundredths of minutes when describing the operation of the 547B. When timing in seconds, substitute "seconds" in any reference to "hundredths of a minute".*

Similarly, you may measure distance in miles or kilometers.

NOTE The displays on the 547B go off automatically after 16 minutes of total inactivity. Actuate any switch, or drive the vehicle (to input an odometer pulse), to re-illuminate the displays. The "+ / – " toggle switches will not enter a value when exiting this power savings "sleep" mode.

If you do not want the displays to turn off while the 798A is idle, turn the rotary switch to the **Clock Alarm** or **Timer** position. The displays will then not turn off after 16 minutes.

ADJUSTING RALLY PARAMETERS

Throughout this manual there are references to altering the value of rally parameters in the 547B. To operate the 547B you must understand how to use the "+ / –" toggle switches to change these values. Read the following information carefully.

Using the "+ / –" Toggle Switches

The four "+ / –" adjustment toggle switches are used to alter parameters in the 547B. Each switch alters a parameter by a specific amount:

The **.01** switch increases (+) or decreases (–) the selected parameter .01 unit with each activation of the switch. If this switch is held in either position for more than a half second, the parameter will change at a rate of .10 unit per second until the toggle handle is released.

The **.10** switch increases (+) or decreases (–) the selected parameter .10 unit with each activation of the switch. If this switch is held in either position for more than a half second, the parameter will change at a rate of 1.00 unit per second until the toggle handle is released.

The **1.00** switch increases (+) or decreases (–) the selected parameter 1.00 unit with each activation of the switch. If this switch is held in either position for more than a half second, the parameter will change at a rate of 10.00 units per second until the toggle handle is released.

The **10.00** switch increases (+) or decreases (–) the selected parameter 10.00 unit with each activation of the switch. If this switch is held in either position for more than a half second, the parameter will change at a rate of 100 units per second until the toggle handle is released.

When adjusting the odometers in the 547B while they are shifted from their normal position, the toggle switches increase or decrease the odometers by amounts relative to their position from the right side of the display. The switches effectively have an adjustment capability ten times or one tenth of the value indicated by the label next to the switch.

The Rotary Switch

The rotary switch selects which parameter will be altered when using the "+ / –" switches. Each position of the rotary switch will be defined while explaining the operation of the 547B.

WARNING!

The rotary switch has a rotational stop clockwise from the **Timer** position. The switch will not rotate continuously. Do not force the switch to turn past this built-in stop! You will either break the switch or loosen the knob on the shaft!

THE SHIFT PUSHBUTTON SWITCH

The **Shift** pushbutton switch is generally used to shift displayed values right or left so that you may view digits not normally visible.

The **Shift** switch is also used to enable other special features in the 547B: synchronize the time of day clock to a time standard, display the split memory location being viewed, activate a lap split when the **Split** switch is used, select a group of special "set-up" parameters, and as a "safety switch" when executing various special features of the instrument.

All these uses of the **Shift** switch will be detailed as necessary throughout this manual.

SPLITTING PARAMETERS

When **Split** is selected on the **Split–Recall** toggle switch, the values shown in the **CLOCK**, the **TIMER**, and both **ODOMETER** displays are frozen and a beeper will briefly sound. You may split the clock while the rotary switch is in any position.

While split, the 547B continues to keep track of the passage of time and distance. When you depress **Recall**, the 547B will once again display current time and distance. It will be as if you had never entered the split mode at all.

If you activate **Split**, again, before recalling the live values, the 547B will save the new split internally. Depressing **Recall** will call up the new split values. Depressing **Recall** a second time will bring back the live values.

You may **Split** repeatedly before recalling. With each activation of **Recall**, the 547B displays the split values in the sequence they were saved. The 547B always remembers the most recent 250 splits you enter.…numbered 1 through 250…with the most recent entry becoming "split number 1".

Note that as **Recall** is activated, the **TIMER** display will show which of the 250 splits is being recalled. Note too that if you press **Shift** while viewing at a split memory, the **TIMER** display will again temporarily display the current memory location (1 - 250) that you are viewing. After all splits have been recalled, the displays will become live again.

When the 547B is split, the **AUXILIARY ODOMETER** blanks briefly every 2 seconds. At this time, the three horizontal segments of the rightmost digit are displayed in a rapid downward sequence as a moving "marquee", alerting you that the 547B is split.

Temporarily Splitting the Displays

If you depress **Recall** while the 547B is "live", the displays will temporarily freeze. The 547B is effectively split without entering the values into memory. Releasing the **Recall** switch returns the displays to "live".

Executing a Lap Split

If you push and hold the **Shift** button before activating **Split**, the 547B will execute a "**Lap Split**". (The **Split** position of this switch is also labeled **[Lap Split]** to remind you of this secondary function.) When this occurs the auxiliary odometer and timer are split as before, but are also reset to zero internally. (Note that as of version "1.8 L" firmware, fractional parts of a second (or hundredth) are retained by the timer after the lap split so the timer remains in synchronism with the clock.) When **Recall** is activated, the timer and auxiliary odometer will show the time and distance from the where the lap split was executed.

To indicate that a lap split is being displayed, the rightmost decimal point in the **TIMER** display will illuminate while looking at the lap split values. When reviewing splits (described below) the illuminated decimal point will remind you as to where each lap split was executed.

Executing a Retroactive Lap Split

Even the best navigator occasional enters a standard split when a lap split was intended. The 547B provides a method for recovering from such a difficult situation. This is called a "Retroactive Lap Split".

The retroactive lap split feature of the 547B effectively simulates backing-up in distance and time (!) to where and when the last split was execute, removing the original split, inserting a lap split, and returning you to current time and location. This is all done in an instant and does not cause any inaccuracies.

To execute a "Retro Lap Split", turn the rotary switch to select the upper row of "**+ / –** " toggle switch special functions. Then depress **Shift** and activate the "**+ / –** " **.10** switch (labeled **Retro Lap Split**) either up or down. You can depress **Shift** before or after activating **Retro Lap Split**. If you didn't pressed **Shift** beforehand, the 547B will tell you to do so after activating **Retro Lap Split**. (Pressing **Shift** is a safety measure so you don't inadvertently execute this function.)

Upon executing the retroactive lap split, the displays automatically go to the most recently entered split, which has now become a "Lap Split".

When you subsequently recall "live" values, the auxiliary odometer and timer will read the values that would have been present had the lap split been originally executed at the location and time of the most recent split.

"Undoing" a Lap Split

If you wish to undo a lap split (providing it is the most recent "split" entered), follow the same procedure used to enter a retroactive lap split. Just select the upper row of "+ / – " toggle switch special functions, depress **Shift**, and activate the "+ / – " **.10** switch (labeled **Retro Lap Split**) either up or down. Again, you can depress **Shift** before or after activating **Retro Lap Split.**

Also as before, after executing the "undo", the displays automatically go to the most recently entered split to show you the location where the lap split was "undone". When you subsequently recall "live" values, the auxiliary odometer and timer will read the values that would have been present had the lap split never been executed.

Reviewing the Split Memory

To review all the splits previously entered into the 547B memory, turn the rotary switch to select the upper row of "+ / – " toggle switch special functions. Then activate the "+ / – " **.01** switch (labeled **Review Splits**) to cycle through the 250 split memory. The **Timer** display will show which of the 250 splits is being reviewed until shortly after the **Review Splits** switch is released. If you hold the **Review Splits** toggle up or down, the 547B will quickly cycle through the memory.

Deleting a Split from Memory

Any split can be deleted from the 250 split memory of the 547B. To do so, select the split you want to delete with the **Review Splits** function as described above. Then, still having selected the upper row of "+ / – " toggle switch special functions, depress **Shift**, and activate the "+ / – " **1.00** switch (labeled **Delete Split Entry**) either up or down. You can depress **Shift** before or after activating **Delete Split Entry.** If you didn't pressed **Shift** beforehand, the 547B will tell you to do so after activating **Delete Split Entry**. (Pressing **Shift** is a safety measure so you don't inadvertently execute this function.)

When you delete a split, the 547B will automatically move you to the next memory location. You will then be viewing a more recent split than the one you just deleted. All splits higher in number than the one you have deleted are moved down one position. The split memory is then filled in from the top with zeros for the odometers and timer, and 12:00:00.0 for the clock.

ADJUSTING A SPLIT PARAMETER

You may make adjustments to a parameter with the "+ / –" toggle switches whether or not you are in the "live" or split mode. If split, you must be viewing the most recently entered split when altering a split parameter.

If you attempt to change an "older" split, the 547B will inform you that you cannot do this by displaying, "**AdJSt LASt SPLit onLY**".

When you adjust the split value of a parameter, the internal "live" value is also adjusted by that same amount. Upon exiting the split mode, the updated parameter will include the changes you have made as well as the normal advances that have occurred.

For example, you can use this feature to set the main odometer to a particular value, even while you are moving. Here's how:

1. Split the 547B when you get to a point on the course with an official mileage.
2. As you drive away from that location, adjust the split odometer mileage to the value it should have been at the point you split the 547B.
3. Recall "live" values.

Changing the split odometer to the official mileage at the reference also corrects the internal "live" value. After exiting the split mode, the updated odometer will include your adjustment.

THE TIME OF DAY CLOCK

The **CLOCK** display shows a twelve hour time of day clock. This clock is derived from a quartz crystal oscillator circuit that has a specified accuracy of ± 0.01 minute after a twelve hour period. (Actually, the clock is usually accurate to ± 0.01 minute after twenty-four hours.) If you participate in a rally lasting several days, Timewise suggests you carry a radio receiver that can be tuned to an official time broadcast. You can then re-align the clock as necessary.

The clock may count in either hours, minutes, and hundredths of minutes (11:59.99); or hours, minutes, and seconds (11:59:59 — notice the colon (:) between the minutes and seconds). The mode of operation you select will be a matter of convenience. If the rallymaster has used "seconds" in the instructions, you might find it easier to operate in that mode; or, you might wish to use "hundredths" anyway, to get an *apparent* improvement in timing accuracy.

A convenient feature of the 547B is that the counting mode of the clock may be changed at any time. To change the mode of the clock, rotate the rotary switch to the **Factor [Set-up]** position. Then push the **Shift** button and to display the "Set-up" selections. The **MAIN ODOMETER** display shows the current counting mode of the clock, either "**SEC**" or "**Hund**". Now use the "**+ / –** " **10.00** switch to change between "seconds" or "hundredths of minutes". Each time you activate the switch, either up or down, the 547B will change the counting mode.

One advantage to changing the counting mode of the clock is evident when setting the clock at the beginning of the rally. You can use the "seconds" mode when aligning to WWV or another time standard, and switch to "hundredths" to run the rally. (Of course, always confirm that the rallymaster's clock is set to that same time standard you use.)

The important point here is that you can select the clock counting mode at any time. You can also switch between the modes whether or not the 547B is split. All split values in memory are converted to the new time counting mode. There is no introduction of a timing inaccuracy when you do this.

Setting the Clock

To set the clock in the 547B, select **Δ Record** ("delta record") on the rotary switch, then at a noted time of day, depress and hold the **Split–Recall** toggle switch down. (The **Recall** position of this switch is also labeled **Clk Set [Sync]** to remind you of this clock setting function.) When you select **Clk Set [Sync]**, the clock is split just like in the split mode. It does not stop. (A split is not saved in the datalog, however.)

With **Clk Set [Sync]** selected, use the "**+ / –**" toggle switches to adjust the split value of the clock to the exact time at which you activated **Clk Set [Sync]**. You may take as much time as necessary to do this. Adjustments you make to the split clock will be included in the updated value when the **Clk Set [Sync]** switch is released.

Here's the step by step method for setting the clock:

1. Select **Δ Record** on the rotary switch.
2. Noting the time of day, depress (and hold) **Clk Set [Sync]**.
3. Use the "**+ / –**" toggle switches to adjust the clock to the time you noted in step **2**.
4. Release the **Clk Set [Sync]** switch.

The current time of day will now be displayed. If your reaction time is a bit slow, you may find the clock to be off by one hundredth of a minute. If so, select **Clk Set [Sync]** again and adjust the clock one count.

You can set the clock whether or not the 547B is split. You will note that when Δ **Record** is selected on the rotary switch, the clock is always live. (Thus, you can use this feature to temporarily see the live clock even when viewing split values.)

Synchronizing the Clock

Setting the clock does not alter the beat of the clock. That is, the procedure just described corrects the numerical value of the clock, but the "ticking" pulse of the clock is not changed. If the beat of the clock is "out of sync" with the official time standard, you should also synchronize the clock to that time standard.

To do so, select Δ **Record** on the rotary switch, depress and hold the **Recall** toggle switch. (The **Recall** position is also labeled **Clk Set [Sync]** to remind you of this clock setting/sync'ing function.) Then momentarily depress the **Shift** switch. The clock will become "live" again. Do not release the **Clk Set [Sync]** switch yet.

Now actuate any "+ / –" toggle switch to "nudge" the clock's ticking pulse closer to the time standard. Each "+" actuation advances the clock about 1/50th of a second; each "–" actuation retards the clock about 1/50th of a second. Repeat as needed until you are satisfied that the clock is synchronized to the time standard. (You can hold a "+ / –" switch in position to repeatedly advance or retard the clock.)

When the clock is synchronized to the time standard, release the **Clk Set [Sync]** switch. (Or, you can momentarily push **Shift** to re-enter the regular clock setting mode again.)

To recap, follow this procedure to synchronize the 547B clock to an official time standard:

1. Select Δ **Record** on the rotary switch.
2. Select (and hold) **Clk Set [Sync]**.
3. Momentarily depress the **Shift** switch.
4. Actuate any "+ / –" switch to advance (+) or retard (–) the clock. Repeat as needed.
5. Release the **Clk Set [Sync]** switch.

Always check the numerical value of the clock after synchronizing. You may find the time to be off by a count because you advanced or retarded the clock so much during the procedure that the clock has been shifted by a full second. If necessary, correct the clock once again to match the official clock. The synchronization will not change.

Automatically Setting the Clock

As a convenience, the clock in the 547B can be automatically set and synchronized to the time in a Timewise Model 610 Multi-Split Chronometer.

To do so, select **RUN** on the 610, and insert an 1/8" stereo phone plug cable between the **Remote Split** jacks on the both the 610 and 547B. Then, on the 547B, select Δ **Record** on the rotary switch, depress and hold **Recall** (**Clk Set [Sync]**), and momentarily push **Shift**. If you wait long enough before releasing the **Clk Set [Sync]**, the 547B will indicate that the sychronization is finished by displaying display "**SYnc donE**".)

To recap, follow this procedure to synchronize the 547B clock to Model 610 chronometer:

1. Select **RUN** on the 610.
2. Insert an 1/8" stereo cable between the **Remote Split** jacks on the 610 and 547B.
3. Select Δ **Record** on the 547B rotary switch.
4. Depress (and hold) **Clk Set [Sync]** on the 547B
5. Momentarily push the **Shift** switch on the 547B.
6. Wait until the 547B indictes " **SYnc donE** ".
7. Release the **Clk Set [Sync]** switch.

The 547B will be set to the same time as the 610, and the clock counting mode will be the same as in the 610.

A 547B cannot be used as a master clock for setting either another 547B, or a 610 chronometer.

THE TIMER

The **TIMER** display shows a one hour timer. The timer will run in either minutes and hundredths of minutes (59.99); or minutes and seconds (59:59). The counting mode you choose for the time of day clock also sets the counting mode for the timer. The timer has the same accuracy specifications as the clock.

Adjusting the Timer

With the rotary switch in the **Timer** position, the "**+ / –**" toggle switches can be used to adjust the timer. If you push and hold **Shift**, first, the "**+ / –** " **.01** toggle switch can be used to adjust the timer by fractions of seconds, allowing it to be sped up, or slowed down, slightly. While **Shift** is pushed, the other "**+ / –** " toggles will have no effect on the timer. You can use this feature to align the timer to the clock after you toggle between "hundredths" and "seconds".

(As of version 1.8L firmware, the timer and clock are linked so their counting rhythm remains synchronized following a lap split. Note, however, that because the "hundredths" and "seconds" counting modes are themselves non-synchronous in nature, switching between the two counting modes when the clock and timer are not at an exact minute generally results in the two becoming unsynchronized. You may need to manually re-synchronize the timer to the clock after switching between seconds and hundredth.)

Hiding the Timer

For some rallies you may not need the timer. To accommodate this, the 547B allows you to blank the **TIMER** display. To enable this feature, turn the rotary switch to the **Factor [Set-up]** position. Then depress and hold the **Shift** button. In the **TIMER** display, you will see the abbreviation "**DSPL**", indicating that the timer is being displayed. To hide the timer from view, activate the "**+ / –** " **.01** switch. The **TIMER** display will now show "**HidE**", indicating that the timer will normally be hidden

Note that the timer continues to run while hidden. In fact, you can look at the timer temporarily by selecting the **Timer** position of the rotary switch. You can also adjust the timer while **Timer** is selected on the rotary switch.

Displaying a Speedometer in place of the Timer

If you wish, the **TIMER** display can show a Speedometer, instead of the Timer. To do so, turn the rotary switch to the **Factor [Set-up]** position. Then depress and hold the **Shift** button, and activate the "**+ / –** " **.01** switch. The **TIMER** display will now show "**SPED**", indicating that the speedometer will be shown

The speedometer is shown to resolution of 1 mph.

Note that the timer continues to function while the speedometer is displayed. You can even look at the timer temporarily by selecting the **Timer** position of the rotary switch. You can also adjust the timer while **Timer** is selected on the rotary switch.

To continuously display the timer again, turn the rotary switch to **Factor [Set-up]**, depress and hold **Shift**, and reselect "**DSPL**" in the **TIMER** display using the "**+ / –** " **.01** switch.

Viewing the Clock and Timer in Higher Resolution

To temporarily look at the clock or timer in "tenths of seconds" or "thousandths of minutes" depress **Shift** when the displays are split. The time displays will shift two places left. A decimal point will be placed between the seconds (or "hundredths") and the additional digit of resolution. The rightmost digit of the time displays will be blank.

Viewing the time displays in high resolution when looking at "live" values has been disabled intentionally. Contact Timewise if you need to see "live" time displays in high resolution.

THE ODOMETERS

The **MAIN ODOMETER** of the 547B displays distances from 0.00 to 999.99 miles (optionally resolved to .001 mile; or, to only .1 mile, so you can see thousands of miles…see below). Every 10000 miles the odometer overflows to 0.00 mile.

In addition to the main odometer, the 547B has an **AUXILIARY ODOMETER**. This auxiliary "trip" odometer can be used to measure CAST sections, free zones, incremental mileages, actions keyed to a mileage interval after a reference, pauses over a distance, etc. The auxiliary odometer can range from 0.00 to 99.99 miles (optionally resolved to .001 mile; or, to only .1 mile…see below). Every one hundred miles the auxiliary odometer overflows to 0.00 mile.

The odometer displays blank leading zeros when mileage is less than one hundred miles. Leading zero blanking will not occur after the thousand mile point in the main odometer. Blanking leading zeros every time a thousand mile point is reached could startle the navigator as there would be a sudden major change in the appearance of the display.

Selecting the Active Odometer Input

The 547B provides two odometer inputs. Which of the two odometer inputs is currently being used is displayed in the **AUXILIARY ODOMETER** display when **Factor [Set-up]** is selected on the rotary switch and **Shift** is pushed. When displaying the current odometer input selection, activating the "**+ / –** " **1.00** switch will change between "**in 1**" and "**in 2**". The odometer factor (described later) in use applies to both odometer inputs.

Selecting the Direction of Travel

The **Forward–Park–Reverse** toggle switch is used to select the counting mode for both the main and auxiliary odometers.

Forward makes the odometers increase with each odometer transducer pulse. Use this mode while you are "on-course" or whenever you want mileage to accumulate as you drive.

Reverse is used when you want the odometers to decrease when pulses are received from the transducer. Use this mode while returning from an "off-course" excursion or whenever you want mileage subtracted from the odometers as you drive. If you back up your vehicle to check a reference, you must use **Reverse** to tell the 547B that you are going backwards—the odometer transducer has no way of indicating this to the 547B.

Park is used when you don't want to count pulses from the transducer. Use this mode for dead mileage or whenever you want to disregard incoming transducer pulses.

Selecting **Park** is very useful when you need to make a U-turn or jockey your vehicle during a three point turn. For example, if you realize that you are off-course and must reverse your direction of travel, here's what you should do: Look for an easily identifiable landmark such as a sign, mailbox, or utility pole. As you pass by the landmark switch to **Park**. Then turn around at a safe opportunity and select **Reverse** as you pass the landmark in the opposite direction. This procedure removes the guesswork out of where to switch into reverse. When you return to the location where you left the correct course, switch directly to **Forward**. The odometers will again equal official course values.

When **Park** is selected, the **MAIN ODOMETER** display will blank momentarily every 2 seconds. At this time, the middle horizontal segments of the digits are displayed. Similarly, when **Reverse** is selected, the **MAIN ODOMETER** display will blank momentarily every 2 seconds and the lower horizontal segments of the digits are displayed. These are reminders of the fact that you are operating in a non-standard mode. The importance of selecting **Forward** after an off-course excursion is clear when the display is flashing.

Adjusting the Main Odometer

With the rotary switch in the **Main Odometer** position, the "+ / –" toggle switches can be used to adjust the main odometer. Use this feature to align the main odometer to an official mileage (e.g., an outmarker or other mileage reference).

Adjusting the Auxiliary Odometer

With the rotary switch in the **Aux Odometer** position, the "+ / –" toggle switches can be used to adjust the auxiliary odometer.

Adjusting Both Odometers Together

With the rotary switch in the **Both Odometer** position, the "+ / –" toggle switches can be used to simultaneously adjust the both the main and auxiliary odometers.

Temporarily Displaying Thousandths of Miles

A standard feature of the Timewise 547B is that it allows you to display and adjust the odometers in thousandths (.001) of miles.

To temporarily display "thousandths of miles" on the odometers, push the **Shift** button. The displayed digits of the odometers will automatically shift one place to the left, revealing the thousandths of miles (xx.xxx). When you release the **Shift** button, the odometers will return to their normal display (xxx.xx) of "hundredths of miles."

Constantly Displaying Thousandths of Miles

If you wish to display "thousandths" continuously, turn the rotary switch to select the lower row of "+ / – " toggle switch special functions. Now activate the "+ / – " **.01** switch (labeled **Odo Resolution**) either up or down. The odometers will then display "thousandths" regardless of the **Shift** pushbutton position. If you activate **Odo Resolution** again, the odometers will switch to a "tenths" mode, displaying mileage as xxxx.x, so you can see thousands of main odometer miles. To revert to standard hundredths of miles, activate **Odo Resolution** again.

Changing the Shifted Odometer Resolution

If you wish, the **Shift**ed position of the displays can also be changed. Simply push **Shift** while activating the **Odo Resolution** toggle. Each time you activate **Odo Resolution**, you cycle through the three odometer resolution choices for the shifted condition. Any combination of shifted and unshifted odometer resolution is possible.

Adjusting Thousandths of Miles

To adjust "thousandths of miles," in the odometers, display .001 mile resolution (either constantly, or with the **Shift** button - see above) and use the "+ / – " **.01** switch. When the odometer displays are showing a resolution other than .01 mile, the "+ / – " switches effectively have a value that increases or decreases the odometers by amounts relative to their position from the right side of the display (e.g., the "+ / –" **.01** toggle switch will have a value of .001 mile; the "+ / –" **.10** toggle switch will have a value of .01 mile, etc.).

If you are viewing "tenths" of miles (xxxx.x) resolution, the "+ / – " switches behave in a similar fashion, having values ten times the labeled amount.

Truncating the Main Odometer

The 547B actually measures distance to a resolution of 0.00**000001** mile. You cannot see the six digits in bold type, however. (Actually, you can see the most significant bold digit when viewing "thousandths of miles".) These less significant digits are kept internally.

Generally, the internal, non-visible digits of the odometer are not of any concern because official mileages are given to a resolution of 0.01 mile. The rallymaster doesn't provide mileages with more resolution because it is virtually impossible for a rallyist running without the benefit of a 547B to estimate a distance more precise than one hundredth of a mile.

There are occasions, however, when the internal digits of the odometer can be significant. For example, when setting the odometer to 0.00 at the beginning of the rally, the six internal digits could still contain non-zero values. You must clear the internal digits so the main odometer starts measuring from exactly 0.00000000 mile.

To clear the internal digits of the main odometer, turn the rotary switch to select the lower row of "**+ / –** " toggle switch special functions and use the "**+ / –** " **10.00** switch (labeled **Truncate [Reset] Main Odo**). If split, the 547B automatically returns to "live" values the instant you execute this procedure. The non-visible digits of the main odometer are cleared to 000000.

Truncating the main odometer does not affect the auxiliary odometer, unless the Linking function is enabled. (See below.)

IMPORTANT! *As long as you activate the truncate function, the 547B will not accumulate any mileage in the odometer you are truncating.*

Truncating the Auxiliary Odometer

To clear the six internal digits of the auxiliary odometer, select the lower row of " **+ / –** " switch special functions and use the " **+ / –** " **1.00** switch (labeled **Truncate [Reset] Aux Odo**).

If split, the 547B automatically returns to "live" values the instant you execute this procedure. The non-visible digits of the auxiliary odometer are cleared to 000000.

Truncating the auxiliary odometer does not affect the main odometer.

IMPORTANT! *As long as you activate the truncate function, the 547B will not accumulate any mileage in the odometer you are truncating.*

Resetting the Main Odometer

To completely clear the main odometer to 0.00000000 miles, turn the rotary switch to select the lower row of "**+ / –** " toggle switch special functions, push the **Shift** button, and use the " **+ / –** " **10.00** switch (labeled **Truncate [Reset] Main Odo).** You must push the **Shift** button first, in order to execute the reset; otherwise you will only truncate the main odometer. If split, the 547B automatically returns to "live" values the instant you execute this procedure.

Resetting the main odometer does not affect the auxiliary odometer, unless the Linking function is enabled. (See below.)

IMPORTANT! *As long as you activate the reset function via this procedure, the 547B will not accumulate any mileage in the main odometer.*

You can also reset the main odometer via the **Remote Split** input. See **Appendix A** for more information.

Resetting the Auxiliary Odometer

To completely reset the auxiliary odometer to 0.00000000 miles, turn the rotary switch to select the lower row of "**+ / –** " toggle switch special functions, push the **Shift** button, and use the " **+ / –** " **1.00** switch (labeled **Truncate [Reset] Aux Odo)**). You must push the **Shift** button first, in order to execute the reset; otherwise you will only truncate the auxiliary odometer. If split, the 547B automatically returns to "live" values the instant you execute this procedure.

Resetting the auxiliary odometer does not affect the main odometer.

IMPORTANT! As long as you activate the reset function via this procedure, the 547B will not accumulate any mileage in the auxiliary odometer.

Linking the Main and Auxiliary Odometers

Normally, the main and auxiliary odometers count independently of each other. For example, the main odometer will count without regard to any reset of the auxiliary odometer. Since it is possible to reset the auxiliary odometer at any point, the starting point for the auxiliary odometer can be between the "hundredths" of miles counted by the main odometer. As a result, the two odometers will increment their hundredths digit out of sync.

The 547B can be put in a mode where the auxiliary odometer always counts in synchronism with the main odometer. This is called a "linked auxiliary odometer" mode.

To link the auxiliary odometer to the main odometer, select the lower row of "+ / –" toggle switch special functions and actuate the "+ / – " **.10** switch (labeled **Link Main and Aux Odo**) either up or down. When linked, the lower right radix point in the **Auxiliary Odometer** display will illuminate. To "unlink" the auxiliary odometer, activate **Link Main and Aux Odo** again.

When linked, the thousandths of miles in the auxiliary odometer will be blank when attempting to display them. Also, you cannot adjust the auxiliary odometer's "thousandths" while linked.

Also note: If linked, the auxiliary odometer is automatically truncated when the main odometer is truncated or reset.

THE ODOMETER FACTOR

Whenever **Factor** is selected on the rotary switch, the time of day in the **CLOCK** display is replaced by the odometer factor. (If you are operating with the 547B in the "**Pro**" mode, there are two factors available. More on this later.)

The odometer factor is the distance, in decimal parts of a mile, that the 547B accumulates with each pulse received from the odometer transducer. By selecting an appropriate factor, the 547B will correctly measure distance.

To understand how the odometer factor is used, a brief explanation of the internal workings of the 547B is necessary:

As stated earlier, the odometers in the 547B are resolved to 0.00000001 mile. When a pulse is received from the transducer, the factor is added to the non-visible, six least significant digits of the odometers. When enough pulses are received, the addition mathematically carries into the hundredths place of the odometers and you see the displays increment.

When the 547B is delivered, the odometer factor(s) are set to a value of 050000. This value represents 0.00050000 mile. With a factor of 050000 the 547B accumulates 1.00 mile after receiving 2000 transducer pulses. This default value was selected because two piece transducers often output about 2000 pulses per mile when sensing magnets attached to a wheel.

Most installations do require the use of a different odometer factor.

Determining Your Base Factor

The procedure described below is used to compute a unique "base factor" for your installation. When your base factor has been determined, enter that value into the 547B. Your base factor will make the 547B correctly measure mileage when it is used in your vehicle.

To determine a base factor, you must drive an officially measured distance. Most rallyist use the official statute mileage posted along major highways. Alternatively, measure a course with the standard odometer in your vehicle. Select a course of about ten miles.

Note: *Although you will have an opportunity to compute a new factor at each rally, it is advisable to have your base factor as accurate as possible.*

After having driven a selected official route, compare the official distance for the route to the distance measured by the 547B. Then use this formula to compute a new factor:

$$\text{NEW FACTOR} = \frac{\text{OFFICIAL DISTANCE x OLD FACTOR}}{\text{MEASURED DISTANCE}}$$

In this formula, the **OLD FACTOR** is the factor that was in the 547B as you traversed the official measured route.

After you compute a new value, select **Factor** on the rotary switch and use the "+ / –" toggle switches to adjust the factor to the new value. The factor you put into the 547B remains unchanged until you alter it, even if power is removed.

A bigger factor makes the 547B display more miles while driving. Thus, to accumulate more miles during passage of a route, the odometer factor must increase. Conversely, **a smaller factor will make the 547B display fewer miles** after traversing the route.

The factor can be set to any value in the range 000000 to 999999, although most installations use a factor from 020000 to 150000. Recheck your computations if you calculate a factor outside this restricted range. If your computations are correct, a poorly installed or defective transducer may be indicated.

IMPORTANT! Although the odometer factor can be set to values less than 020000, using a smaller factor implies that the 547B is receiving more than 5000 pulses per mile. Under such conditions, when traveling at high speeds, the 547B may receive pulses so quickly that it may not count every pulse. Such high pulse rates usually occur when using an OEM electronic speedometer signal as the odometer transducer source. If your signal source produces such high pulse rates, see the discussion in **Appendix C** about the optional odometer input circuit that allows the use of such high rate odometer input signals.

Selecting the Active Odometer Factor ("TSD" Mode Only)

Operating the 547B in the "**TSD**" allows you to select between two available factors. (The "**Pro**" mode of operation provides only one factor. See **Selecting the "Pro" or "TSD" Mode** on how to alternate between the "**Pro**" and "**TSD**" modes.)

When operating in the **TSD** mode, the currently odometer factor active (**1** or **2**) is displayed in the **AUXILIARY ODOMETER** when **Factor** is selected on the rotary switch. Activate **Recall** to toggle between the two factors. **The factor currently in use applies to both odometer inputs.**

IMPORTANT: When you select **Factor** and use the "+ / –" toggle switches to adjust the value of the active odometer factor, the inactive one is not adjusted. You must separately select and adjust both factors if you expect to use both of them.

Determining a New Factor at a Rally

An accurate base factor will make the 547B measure distance according to the official standard you select. However, because individual rallymasters use different measurement techniques, the official standard changes slightly at each rally. Your factor, therefore, must also change.

The **NEW FACTOR** formula shown previously is used to compute a new factor at each rally. When figuring a new factor at a rally, the odometer check distance is used as the **OFFICIAL DISTANCE** and your base factor is the **OLD FACTOR**. After driving the odometer check route, your measurement for the route becomes the **MEASURED DISTANCE**.

After calculating a new factor for the rally, just enter the new value into the 547B. From then on your mileage measurements will match the rallymaster's.

If you need to use both factors while operating in the "**Pro**" mode, you will have to calculate new values for both factors. Remember to adjust both factors; and don't forget to switch back to

your primary factor after adjusting the second odometer factor. If you plan to use only one factor, it's still a good idea to adjust both factors to the same value…should you accidentally switch odometer factors, you will continue to count mileage correctly.

Details on the Odometer Factor

Note that the least significant digit of the odometer factor represents one hundred millionth of a mile (0.00000001 mile). Adjusting a factor by one count means that the 547B will gain (or lose) an extra 0.00000001 mile with each pulse from the transducer. You would have to receive one million pulses before such a small adjustment would make a [visible] correction of 0.01 mile.

To illustrate further: On installations where the transducer senses two magnets mounted to a wheel rim, the wheel must turn 500,000 times before a factor adjustment of one count would make a visible correction in the odometers. Since a wheel turns approximately 1000 times per mile, you would have to drive about 500 miles before a one count adjustment in the factor would make a noticeable difference in the odometers. Obviously, corrections to the odometer factor usually mean adjusting them more than just a few counts.

Fine Tuning the Odometer Factor

Whenever the rallymaster gives an official mileage reference you can confirm the measuring accuracy of the 547B. When doing so, you will often notice a slight difference between the official mileage and your measurement. Such inaccuracies occur because the rallymaster's driving style differs from yours. Also, since most rallies are put together over a period of time, sections of the rally may have been measured under differing road and weather conditions. Such differences affect the relative accuracy of your mileage measurement.

Although you can simply align your odometer at each official mileage, you may decide to re-figure your odometer factor in the middle of the rally. Changing your factor to adjust for these varying course conditions is called "fine tuning" the factor.

To fine tune your factor in the middle of a rally, use the **NEW FACTOR** formula as before. You will need two official mileage references and your odometer reading at both locations. Simply use the distances (official and measured) between the references in the formula.

Instead of using the **NEW FACTOR** formula to re-calculate the factor, it is sometimes easier just to do a quick fix "in your head". Let's look at the relationship between a mileage measurement error and the correction required in the odometer factor to eliminate the error.

Assume your factor is 065000. Then suppose your odometer has increased 1.00 mile after traveling 0.99 official course miles. Your measurement of 1.00 was in error by 0.01 mile. That is, your measurement error is 0.01 mile per 1.00 mile, or 1% (0.01 ÷ 1.00). This 1% figure is also the error in the factor.

A decrease of the factor by this same percentage is necessary to correct the factor. (Remember, decreasing the factor will make the 547B measure fewer miles.) Thus, reduce the factor 1% of 065000, or 650 counts. The correct factor would be 064350. (You must also adjust your odometer to match the rallymaster's, as well as correct the inactive factor.)

If you had traveled 10.00 miles before noticing the 0.01 mile error, you would only have a 0.1% error (0.01 ÷ 10.00). Your factor must then be reduced 0.1% of 065000, or 65 counts, to a new value of 064935.

Unfortunately, when an opportunity to fine tune the factor does occur, you will probably not have such easy to use "round numbers" for the mileage or factor. Still, the principle is the same. Just figure the percentage error in the mileage, and change the factor by that same percentage.

Here's a more realistic example: Assume your factor is 072563 and that you reset the odometer to 0.00 miles at the beginning of the leg. You are currently working on an instruction that reads,

"Turn on Reynolds at 4.32 miles"

When you turn on Reynolds you note that your odometer displays 4.30 miles, giving you an error of 0.02 miles. This is approximately a 0.02 mile error in 4.00 miles, or 0.5%. To correct the factor, increase it by 0.5%, or approximately 360 counts. Set your new factor to 072920, rounding off for ease of any future recalculations. Don't forget to adjust the inactive factor by the same percentage. Also, remember to correct the odometer!

The inaccuracies of this method are of little significance in the short run. You can always adjust the factor again, if necessary.

CAUTION! *As all experienced rallyists know, mileage references at anything other than clearly labeled signs should be suspect as to their accuracy. Do not change your factor every time a reference mileage is given! Rather, align your odometer, if you must, and watch for a repeating trend. If your odometer continues to drift, you may then wish to change your factor.*

It is also unwise to change your factor when noting only a 0.01 mile error between your odometer and the official mileage, no matter what overall distance has been driven. This is because the actual distance measured by the rallymaster may have been within inches of your measurement. A single pulse from the transducer could cause the apparent 0.01 mile error.

Of course, the way to win a rally is to exactly match the rallymaster's odometer at all points along the course. To do so, many rallyists keep a constant watch on their odometer, looking for a pattern of measurement differences. That is really the most effective method for knowing when to adjust the factor or just align the odometer. By using the thousandths of miles capabilities of the 547B, you can get a idea of how close you are at every mileage reference given by the rallymaster. If you wish, you can precisely align your odometer to the rallymaster's at each such reference.

THE "DELTA" RECORD

When the Δ **Record** ("Δ" is the Greek letter "delta") position of rotary switch is selected, you can see the amount of change, or delta adjustment record, you've made to the odometers and timer. There are three delta counters, allowing you to keep a running total of changes to the main odometer, auxiliary odometer, and timer.

To reset the main odometer delta record, select Δ **Record** on the rotary switch, push and hold **Shift**, and activate the "**+ / –** " **10.00** switch.

To reset the auxiliary odometer delta record, select Δ **Record** on the rotary switch, push and hold **Shift**, and activate the "**+ / –** " **1.00** switch.

To reset the timer delta record, select Δ **Record** on the rotary switch, push and hold **Shift**, and activate the "**+ / –** " **.10** switch.

SETTING THE ODOMETER ALARM

While **Odometer Alarm** is selected on the rotary switch, the **MAIN ODOMETER** display will show the odometer alarm mileage. This figure is adjustable within the range 0.00 to 999.99 miles. (The odometer alarm does not use thousands of miles.) Use the "**+ / –**" toggle switches to change the alarm value.

The odometer alarm is used to notify you that a predetermined mileage has been reached. For example, use this feature when the rallymaster tells you, at the beginning of a rally, to change speed at an specific distance into the rally. You can preset the indicated mileage when you start the rally, and the odometer will notify you when that mileage occurs. You won't forget to make

the speed change when the alarm sounds. Generally, the alarm is set to signal about 0.2 mile before the point of action. This gives you time to react.

While **Odometer Alarm** is selected, the **AUXILIARY ODOMETER** display will show the distance before/after the odometer alarm will/has alarm(ed). You can split this value, although it is not retained in memory. **(The normally displayed parameters are entered into the memory, however, so don't be surprised by the extra entry into the split memory.)**

The odometer alarm will sound for a selected amount of time when the specified mileage is reached. You must change the alarm setting in order to re-arm the alarm. This prevents the alarm from sounding every 1000 miles as the **ODOMETER** display cycles. It also stops unnecessary alarming on rallies that reset official mileage to 0.00 at the beginning of each leg.

SETTING THE CLOCK ALARM

While **Clock Alarm** is selected on the rotary switch, the **Clock** display will show the time of day alarm. Use the "**+ / –**" toggle switches to change the alarm value.

While **Clock Alarm** is selected, the **TIMER** display will show the time before/after the clock alarm will/has alarm(ed). You can split this value, too, although it is not retained in the datalog memory. **(The normally displayed parameters are entered into the memory, however, so don't be surprised by the extra entry into the split memory.)**

The clock alarm will sound for a selected amount of time when the specified time of day is reached. You must change the alarm setting in order to re-arm the alarm. This prevents the alarm from sounding every 12 hours as the **CLOCK** display cycles.

CHANGING THE ALARM BEEPER TIME

To change the length of time the alarm sounds when the time or mileage alarm is reached, select **Factor [Set-up]** on the rotary switch, and push Shift to display the "Set-up" selections. Now use the "+ / – " **.10** switch to change the beep length from 0 to 19 (tenths of seconds). When Shift is released, a sample beep will sound.

CHANGING THE DISPLAY INTENSITY

The brightness of the displays in the 547B can be changed to fit ambient lighting conditions. With the upper row of special functions for the "**+ / –**" toggle switches chosen, the "**+ / –**" **10.00** toggle switch (labeled **Display Brightness**) changes the intensity of the displays. The selected intensity level is shown in the **Clock** display until shortly after the switch is released.

There are 16 display intensities, plus off. The displays are at their brightest level when the 547B is powered up. The displays get dimmer each time you select the "**–**" toggle switch position; they get brighter each time you select the "**+**" position. The brightest setting is used during daylight hours. The dimmer settings are generally used during evening or night rallying.

Depressing **Shift** prior to activating the "**+ / –** " **10.00** switch will automatically select the brightness ("**+**") or dimmest ("**–**") intensity level.

The displays will turn off when attempting to dim them below their the lowest intensity level. All functions continue to operate internally, however, and the optional 326 driver's display will still be illuminated. When turned off, the displays will turn back on to their brightness setting with the activation of *any* "**+ / –**" toggle switch, *regardless of the position of the rotary switch.*

Activating a "**+ / –**" toggle switch to turn the displays back on will not change the value of any parameter in the 547B. This prevents accidental alteration of a parameter.

AUTOMATIC DISPLAY SHUT-OFF

The displays on the 547B (and optional 326) go off automatically after 16 minutes of total inactivity. Actuate any switch, or drive the vehicle (to input an odometer pulse), to re-illuminate the displays.

If you do not want the displays to turn off while the 798A is idle, turn the rotary switch to the **Clock Alarm** or **Timer** position. The displays will then not turn off after 16 minutes.

OPERATING MODE INDICATIONS

Note that some operating modes of the 547B can cause non-recoverable changes to course parameters as you drive. Although there is nothing inherently wrong with operating in these modes, you must be aware of the consequences of doing so. For example, after you select **Park** during a rest stop, it is imperative that you select **Forward** as soon as you start on the course again. If you remain in **Park**, the 547B will become useless. The only way to recover from such a mistake would be to return to the rest stop and start over.

For the same reason, the "+ / –" toggle switches should be used only when you are certain of the rotary switch position. For example, an adjustment to the main odometer while **Both Odometers** is selected will also change the auxiliary odometer. If you had intended to change the main odometer *only* using the **Main Odometer** position on the rotary switch, an error will have been entered into the auxiliary odometer. Although you can recover from this kind of mistake, you can do so only if you take notice of it. Even then, because you are in the midst of a rally, panic usually ensues. It's better to make the adjustment correctly the first time.

Because of this potential for error, the 547B is programmed to alert you while it is operating in a non-standard mode or when you select certain rotary switch positions. To alert you, the 547B will either flash the entire display or just the decimal point (and colon, if appropriate) in the relevant rally parameter(s). The list below shows which displays are affected.

Operating Mode	Flashing Display:
Park	**MAIN ODOMETER**
Reverse	**MAIN ODOMETER**
Split	**AUXILIARY ODOMETER**

Rotary Switch Position	Flashing Decimal Point in:
Timer	**TIMER**
Aux Odometer	**AUXILIARY ODOMETER**
Both Odometers	**AUXILIARY and MAIN ODOMETER**
Main Odometer	**MAIN ODOMETER**
Odometer Alarm	**MAIN ODOMETER**
Clock Alarm	**CLOCK**

THE OPTIONAL MODEL 326 DRIVER'S MODULE

The optional Model 326 Driver's Module can show two parameters that are of particular importance to the driver: the **MAIN ODOMETER** and a true rally speed **SPEEDOMETER**.

The driver's display is always "live" — the split mode does not freeze the display.

The 326 plugs into the **Remote Display** modular jack on the left side of the 547B.

The driver's display can show mileage from 0.00 to 99.99. When the odometer exceeds this range, the *displayed* digits will still be correct. Speed values range from 0.0 to 150.0.

Two switches on the front of the 326 provide parameter selection and brightness adjustment.

The **right-hand switch** selects the parameter to be displayed. When moved to the right, the main odometer mileage is displayed. This value is the same as the **MAIN ODOMETER** on the 547B; however, only the rightmost four digits are shown. When the switch is moved to the left,

the 326 will display the current speed of your vehicle. Speed is shown to tenths of a mile per hour and is updated approximately every second.

As of version 2.6 firmware, when operating in the "**Pro**" mode (see next page), the parameter selection switch selects the **MAIN ODOMETER** or the **AUXILIARY ODOMETER**, rather than the **MAIN ODOMETER** or the **SPEEDOMETER**.

The **left-hand switch** selects the display brightness of the 326. There are two brightness levels. When the switch is moved to the right, the display is at its brightest setting. When the switch is moved to the left side, the display is dimmed for night rallying.

WARNING!

Connection of the 326 to the 547B must be done only while power to the 547B is disconnected. This will prevent damage from occurring to either device.

SELECTING THE "Pro" or "TSD" MODE

Various rallying governing bodies are constantly changing regulations for what had traditionally been called a "non-computerized" class of rallying. In addition, local rallying regulations vary depending on whether or not the event chairperson follows national rally board guidelines. This means that allowable rally equipment also constantly changes.

To accommodate a common difference in the definition of "non-computerized" rally equipment, the 547B can run in two modes of operation: "**tSd**" or "**Pro**". In the "**Pro**" mode, the 547B has one odometer factor available for use. In the " **tSd** " mode, two odometer factors are available.

To check the current mode, select **Factor [Set-up]** on the rotary switch, push and hold the **Shift** button, and select **Recall**. The operating mode ("**Pro**" or "**tSd**") will be shown in the **TIMER** display. (Or simply note that you can or cannot select among two factors.)

To alternate between the "**Pro**" or "**tSd**" operating modes, follow this procedure: Turn the rotary switch to the **Factor [Set-up]** position, push and hold the **Shift** button, and select **Recall**. Then actuate the "+ / – " **.01** switch. Each time you actuate the switch, the 547B will alternate between the two modes.

As of version 2.6 firmware, when operating in the "**Pro**" mode, the optional driver's module can display either the main or auxiliary odometer, rather than the main odometer or a speedometer.

PARTIAL SYSTEM RESET

To clear the entire split memory in the 547B, simultaneously hold all four "**+ / –**" toggle switches down. At this time, both factors (assuming you are using the TSD mode) will be assigned the same value as the currently active factor.

NOTE: To prevent a change to any parameter as you depress the "**+ / –**" toggle switches, turn the rotary switch to select the special functions in the upper row of the "**+ / –** " toggle switches before you execute the partial system reset.

OVERALL RESET

If the 547B malfunctions, a complete reset to factory default conditions can be initiated as follows:

1. Remove power from the 547B. (Disconnect the in-line polarized plugs.)
2. Hold the four "**+ / –**" toggle switches in the following pattern:

DOWN	UP	UP	DOWN
(– 10.00)	**(+ 1.00)**	**(+ .10)**	**(– .01)**

   You will probably find it easiest to use the index fingers and thumbs of both hands to apply this pattern to the "**+ / –**" toggle switches.
3. Apply power to the 547B.

The odometers and timer will be reset to 0.00, the time of day clock will restart at 12:00:00, the split memory will be cleared, and the factors and personalized set-ups will be reset to factory default selections. The "**Pro**" mode of operation will be enabled.

PLEASE READ ON…

This completes the section on the **OPERATION** of the 547B. You are encouraged to read the **APPENDICES**, where you will find information about the remote split feature of the 547B, the technical requirements for the odometer transducer, and suggestions for troubleshooting and care of the 547B.

A thorough understanding of the information presented in **Appendix B** is of particular importance. The information presented there concerning overheating and electrical connection of the 547B can prevent temporary or permanent failure of the instrument.

There is also a **QUICK REFERENCE GUIDE** that briefly describes how to operate most of the features on the 547B.

EXTERNAL CONNECTIONS

The left side input and output connections for the 547B are described below. A stereo jack is used to remotely activate special functions in the 547B. If you plan to use these functions, you will need to study the information given here. Otherwise, you may consider this appendix a technical reference only.

The **Remote Split** input provide features that some rallyists find useful when using the 547B in specific types of rallying. To use these functions, you must build a cable/switch assembly.

Here's what you need:

1. A miniature stereo phone plug (three contact; 1/8th inch diameter)
2. Two or three conductor cable (shielded cable is recommended but not required)
3. A single pole, normally open switch (e.g., a non-lighted door bell switch)
4. Tools and materials for cutting, stripping, and soldering wires to the switch and plug.

Radio Shack is a good source for all these items. The plugs are available with a black plastic handle (part number 274-284) or chrome plated metal handle (part number 274-1547.) Ask for assistance from the store personnel on the other items.

The switch assemblies are easy to make: At one end of a cable, solder one conductor to the "tip" or "ring" contact (depending on the function you want to activate), and another conductor to the "shaft" contact of an 1/8th stereo phone plug. At the other end of the cable, solder each conductor to a switch contact. With shielded cable, also solder the shield drain wire to the "shaft" contact on the plug.

Note: The "tip" and "ring" contacts in the **Remote Split** input jack are pulled high (to 5 volts) with a 1,000 ohm resistor inside the 547B. The "shaft" contact is connected to the digital ground circuitry and then to the ground side of the vehicle.

WARNING!

To activate the **Remote Split** input(s), all you need to do is make an electrical connection between the contacts of the input jack. **Do not apply vehicle voltage to any of the contacts!**

Remote Split and Remote Lap Split with Version 2.2 Firmware or Higher

To execute a **Remote Split**, connect together the "ring" and "shaft" contacts on the stereo plug. The 547B will be split similar to the activation of the **Split** switch on the front panel.

To execute a "one button" **Remote Lap Split**, connect together the "tip" and "shaft" contacts on the stereo plug. The clock and main odometer will be split, while the auxiliary odometer and timer are lap split.

Important note: If you depress the **Shift** switch when actuating a **Remote Lap Split**, the main odometer will also be lap split. This is a quick way to reset the main odometer.

The beeper will briefly sound when either a remote split or remote lap split is activated.

Unlike the front panel split (or front panel lap split), the displays automatically become "live" again as soon as the remote switch is released, As a result, the **Recall** switch is not required to "unfreeze" the displays. That is, the displays are split only while the remote switch is closed.

With version 2.2 and higher firmware, split data is saved in the datalog memory upon each remote split or remote lap split execution. (This was not the case in version 1.9, 2.0, and 2.1 firmware.) Note, however, that because the displays are frozen only as long as the remote

switch is closed, you must use the **Review Splits** function to view logged data once you release the remote switch.

Note: If the 547B was already split (via the front panel **Split** function), or you were reviewing data via the **Review Splits** function, when a remote split/lap split is activated, the newly split data will not be visible without use of the **Recall** or **Review Splits** function.

When a remote split or remote lap split is executed, the 547B will wait a short time before another split is accepted. This prevents multiple splits during erratic switch activation in a bouncing vehicle. Releasing the remote switch initiates a waiting period before the displays return to "live" data and another split can be recognized.

The length of time that the 547B waits before the displays become "live" (and another split can be recognized) is variable. It is the same time period as that selected for the alarm beep. To change the time delay, select **Factor [Set-up]** on the rotary switch, and push **Shift** to display the "**Set-up**" selections. The **CLOCK** display will show the word "**BEEP**" followed by a number from 0 to 19. Use the "**+ / – "** **.10** switch to adjust the delay from 0 to 19 (tenths of seconds). When **Shift** is released, a sample beep will sound, indicating the length of time the 547B waits between remote splits. (Obviously, this procedure also changes the length of time the beeper sounds when an odometer or clock alarm is triggered.)

IMPORTANT!

Note that the automatic clock setting procedure (see **External Clock Synchronization**, below) uses the same "tip" contact as does the remote lap split function. Consequently, if you activate the front panel clock synchronization procedure while there is a "closed" remote lap split switch attached, it is possible to load erroneous time of day data into the clock. *This error is non-recoverable.* Therefore, it is highly recommended that you do not have a remote lap split switch attached to the 547B when you activate the clock synchronization procedure.

Remote Split with Version 1.9 through 2.1 Firmware

In version 1.9, 2.0, and 2.1 firmware, the **Remote Split** function actually executes a **remote lap split**. That is, all parameters are split while the timer and auxiliary odometer are reset to zero internally. However, unlike a front panel split (or lap split), the 547B does not store the displayed data in the datalog memory when a remote lap split is executed.

To use the **Remote Split** function, short together the "ring" and "shaft" contacts on the stereo plug.

If you depress the **Shift** switch when actuating a remote lap split, the main odometer will also be lap split (i.e., split and reset to 0.000 internally).

The beeper will briefly sound when a remote split is activated.

Unlike the front panel split (or front panel lap split), the displays automatically become "live" again as soon as the remote switch is released, As a result, the **Recall** switch is not required to "unfreeze" the displays. That is, the displays are split only until the remote switch is closed.

Note: Since a remote split does not cause the 547B to save display values in memory, and does not keep the displays split when the external switch is released, the **Remote Split** input cannot be used as a multi-split checkpoint clock with a pneumatic rollover sensor. Contact Timewise to have a different version of firmware installed if you wish to use the 547B in such a manner.

When a remote split is executed, the 547B will wait a short time before another split is accepted. This prevents multiple splits during erratic switch activation in a bouncing vehicle. Releasing the remote switch initiates a waiting period before the displays return to "live" data and another split can be recognized.

The length of time that the 547B waits before the displays become "live" (and another split can be recognized) is variable. It is the same time period as that selected for the alarm beep. To change the time, select **Factor [Set-up]** on the rotary switch, and push **Shift** to display the "**Set-up**" selections. The **CLOCK** display will show the word "**bEEP**" followed by a number from 0 to 19. Use the "**+ / –** " **.10** switch to adjust the delay from 0 to 19 (tenths of seconds). When **Shift** is released, a sample beep will sound, indicating the length of time the 547B waits between remote splits. (Obviously, this procedure also changes the length of time the beeper sounds when an odometer or clock alarm is triggered.)

Note:

With version 1.9, 2.0, and 2.1 firmware, the **Remote Split** function acts like the **Recall** switch if your are viewing previously stored split values in the displays. That is, instead of splitting the displays, the next memory location is recalled. (When using **Remote Split** to move forward in memory, the **TIMER** display will not temporarily show which of the splits is being recalled.)

Remote Split and Remote Lap Split with Version 1.8 firmware and earlier

The description below is for those rallyists using version 1.8 firmware or earlier.

To execute a **Remote Split**, short together the "ring" and "shaft" contacts on the stereo plug. The 547B will be split similar to the activation of the **Split** switch on the front panel.

To execute a **Remote Lap Split**, first connect the "tip" and "ring" contacts of the **Remote Split** input together, and then short the combination to ground. As in the execution of a lap split via the front panel, the timer and main odometer are split, while the auxiliary odometer and timer are split and reset to zero internally.

The beeper will signal when either a remote split or remote lap split has been executed.

When the **Remote Split** or **Remote Lap Split** function is deactivated, the **Recall** switch must be used to return the displays to "live" values.

When a remote split or remote lap split is executed, the 547B waits .6 seconds after the switch is released before another split is accepted. This delay prevents multiple splits from being recorded in a bouncing vehicle. When the 547B is used as a checkpoint clock connected to a pneumatic rollover sensor, the delay prevents two splits from being recorded as the front and rear wheels of a vehicle trip the sensor in sequence.

External Clock Synchronization

The **Remote Split** input can also be used to automatically set and synchronize the clock in the 547B to a Timewise 600 series Multi-Split Chronometer. See the Operation section of this manual for the procedure to do this. The "tip" contact is the pathway for the clock synchronization data. Use a standard $1/8^{th}$ inch stereo phone plug cable to connect the chronometer to the 547B. There is no need to build your own cable, as Radio Shack has a 6 foot version (part number 42-2387) that works fine.

Other Connections

The **Odo Input 1**, **Odo Input 2**, and **Remote Display** modular jacks are the connectors for the odometer transducers and optional driver's module, respectively.

Appendix C describes the odometer inputs in detail, as well as the use of an optionally installed pulse divider circuit accessible through a covered opening in the rear of the 547B.

There is also a small opening on the back of the 547B to access an oscillator frequency adjustment control. **Appendix D** describes the technical procedure that must be followed to re-calibrate the oscillator in the 547B.

Note: You will not electrically damage either an odometer transducer or the driver's module if you accidentally connect them to the wrong modular jack, *provided the 547B is not powered up as the driver's module is plugged in.*

PREVENTING PROBLEMS

The 547B has a 30 year lithium battery back-up for all data in its memory, including the actual operating firmware. If you open the 547B and inadvertently short out a trace within the unit, or apply a negative voltage as little as – 0.3 volts to any trace inside the instrument, the life of the battery can be severely shortened. The 547B will lose its operating memory when the battery voltage drops below 2.5 volts; the instrument will then become useless. The only recourse will be to return the unit to Timewise for replacement of the battery and microprocessor, and complete reprogramming of the instrument. There is a very substantial charge for this replacement and reprogramming!

CAUTION!

You can damage the 547B if you touch anything inside! Take extreme caution to prevent this from happening!

Just touching a component or a solder trace on the printed circuit board can damage the 547B. Don't fool yourself about your immunity to static charges. Static electricity can be generated by just sliding around in a chair. You can destroy the 547B with a static charge that is a thousand time weaker than the energy required to form a spark when you touch a doorknob.

While driving your vehicle, a static charge is generated as the tires flex against the road. Such static charges are generally dissipated evenly throughout the vehicle and therefore do not cause a problem with the operation of the 547B. However, sometimes the fabric used to cover the seats produces a localized charge on your body. In such a case, just touching the outside of the 547B can cause a problem. If you get a shock when you touch the door frame as you exit your vehicle, you can be sure that you're generating a very substantial static charge.

IMPORTANT! If static is a problem in your vehicle, Timewise suggests you treat the inside of your vehicle with a static dissipating chemical. Anti-static chemicals, often in an aerosol or pump spray bottle, are available from stationary and computer stores. Radio Shack sells an anti-static aerosol spray as part number 64-2330.

As a general rule with all electronic instrumentation, never plug or unplug accessories while the unit is turned on. The 547B carries the same warning. Damage to the 547B or the accessory may occur as voltages are randomly applied to internal components. The 547B and its accessories are engineered with protection against such random power surges, but following the above guideline reduces the possibility of damage.

Transducer Troubleshooting

When the magnet of an open two-piece odometer transducer is mounted on the rim of a wheel, use caution when parking in slush or snow. A bridge of ice might form between the magnet and transducer if the two components are next to each other when you park. It is possible that the transducer could be pulled out of alignment when the vehicle is subsequently moved. Park with the magnet and transducer offset to avoid this potential problem. (You can mark the outer rim of the wheel to identify the magnet's location.)

Do not use a *reduction* tee gear assembly in the installation of an in-line transducer. Although you can select an odometer factor that will count mileage correctly, the pulses from the transducer arrive so infrequently that the 547B assumes you stop between pulses. The result is that the speedometer on the driver's module may not function except at medium to high speeds.

The 547B will generally display an erratic speedometer reading when operating from a malfunctioning odometer transducer. If the speedometer momentarily flashes an unusual value (especially when on rough terrain), it is likely that you've either missed a pulse or received multiple pulses from a vibrating odometer transducer. (A single missed odometer pulse can momentarily reduce the speedometer reading to four-fifths of its correct value.) In either case, double check your placement of the transducer and/or strengthen the mounting arrangement. Also check for a loose wheel, worn bushings, or even worn wheel bearings.

Electrical Troubleshooting

If you experience problems with electrical operation of the 547B, the following discussion suggest several areas to investigate before concluding that the instrument is broken. Most problems are caused by incorrect wiring techniques used during installation of the 547B.

Improper operation of rally equipment is often traced to faulty wiring or a defective charging system within the vehicle itself. Ideally, the 547B should be connected directly to the battery terminals. Such a practice reduces susceptibility to low voltage "brown outs" often produced when starting a vehicle with questionable wiring.

You must be certain that power is never interrupted to the 547B. Since it is often impractical to run power wires directly to the battery, your best protection against a power failure is clean, secure wiring. A loose connection to the battery or a power distribution point in the wiring harness is a common problem. If a connection is loose, road and engine vibrations can cause an intermittent loss of power. All connections must be as clean, secure, and direct as possible.

IMPORTANT!

A proper connection to vehicle ground is extremely important. Make certain the chassis location you choose for this connection provides an easy path for draining static discharges and high frequency noise. Faulty ground connections throughout a vehicle chassis are common.

Make certain that the in-line fuse holder has some freedom of movement. Power to the 547B can be interrupted if the wires are pulled: a spring in the fuse holder compresses, thereby causing loss of electrical contact. Also, be careful when routing the wires around the glove box or among control levers. The wires may be pulled when the glove box is opened or control levers are moved. Wires placed below floor mats or carpeting can be accidentally pulled.

Some rallyist experience trouble with the 547B only when starting their vehicle. This is often caused by an ignition switch that momentarily breaks contact with a circuit as you turn the key from "RUN" to "START". During this short period the 547B can "lock-up". Under certain conditions of extremely poor power, the 547B will reset itself and clear all of its memory. Confirm that power to the 547B is not disrupted as you start the vehicle. Sometimes the circuit is not disconnected, but the voltage supplied to the circuit is lowered to an unacceptable level while the starter motor operates. This can also cause a failure.

Make certain that your battery charging system is operating properly and that the cables between the battery, the alternator, and the voltage regulator are securely attached. If any of these cables have loose connections, the alternator can create what is termed a "load dump". When that happens, voltage spikes of 400 volts can be generated. The 547B has circuitry to guard against some of this destructive energy, but continual exposure to that high voltage will rapidly deteriorate the protection circuitry and the 547B can be damaged.

When the 547B is disconnected from your vehicle, keep the electrical power connector free of dirt, oil, and moisture. Contamination might cause a future intermittent power failure. This warning applies to odometer transducer and optional driver's module connectors as well.

Electrical Noise

A problem that plagues all automotive instrumentation is electrical noise. The 547B is no exception. Electrical noise (referred to as Electromagnetic Interference or EMI), comes in two basic varieties: "radiated" and "conducted" noise. Radiated noise is caused by anything that produces a spark. The resulting electromagnetic noise is often referred to as "Radio Frequency Interference" (RFI). Devices that broadcast a signal also produce RFI. Such interference enters the 547B through its case or by inducing voltages in power supply and accessory cables.

Conducted noise is an undesirable voltage transient that "pollutes" the power and/or ground lines of the instrument. Conducted noise is produced when switching another electrical device on or off. A static discharge to the front panel of an instrument is also conducted noise.

Although each of these types of EMI has particular modes of entering the 547B, the end result is the same: the instrument will fail to function correctly—either temporarily or permanently.

Electrical noise originates from ignition systems (yours as well as those of other vehicles), CB and business band radio transmissions, lightening, high tension wires, nuclear explosions, static discharges, microwave receivers (radar detectors), microwave transmitters (police radar and communication links), OEM trip computers, computerized dashboards, microwave ovens, AC and DC motors (blower motors and wiper motors are particularly nasty), etc. Cellular telephones also cause electrical noise, particularly when transmitting.

Electrical noise can cause the 547B to fail in a variety of ways. Some modes of failure are: meaningless information in the displays, erratic odometer measurements (usually too high), locked-up displays, reset of the odometers, or a restart of the clock at 12:00. Unfortunately, electrical noise problems can show up after long periods of correct operation.

Obviously some sources of electrical noise are of less concern than others. Few rallyists have an onboard microwave oven; and, if there is a nearby nuclear explosion—well, you've got other things to worry about. On the other hand, electrical noise from some sources occur regularly in a vehicle. Spark plug wires, CB radios, business band radios, cellular telephones, and static discharges are the most common sources of radiated noise. Alternators, voltage regulators, blower motors, power seats, air conditioners, electronic fuel injection systems, and microprocessor controlled instrumentation generate electrical noise that pollutes the 12 volt power system of a vehicle.

Reducing Electrical Noise

The 547B has been designed, both electrically and physically, with protection against high levels of electrical noise. Still, proper attention must be given to protecting the 547B from excessive electrical noise. Correct installation of the 547B and proper maintenance of the vehicle play a significant role in eliminating electrical noise problems.

One sure sign that you have a problem with electrical noise is a "ticking" sound heard when listening to the vehicle's AM radio. This ticking sound is often caused by a faulty ignition system. It can enter the radio through the power connection (conducted noise), or via the antenna (radiated noise). (**Note:** You can have an electrical noise problem even when your AM radio reception is fine. Some radios filter out electrical noise better than others.)

To determine whether the ticking is caused by conducted or radiated noise, you can perform a simple test. Disconnect the radio antenna and listen for the ticking sound again. If you continue to hear the ticking sound over the background static on the radio, the interference is probably coming over the power line as conducted noise. If the ticking is eliminated after the antenna is disconnected, the noise is being received by the antenna as radiated noise (RFI).

If conducted noise is polluting the 12 volt power, appropriate electrical components can be used to "clean-up" the power lines. The 547B is designed with an electrical filter network to remove most of this interference. However, with excessive interference you will need to add another filter to the power lines. Radio Shack's part number 270–051 should solve the problem.

If the noise is being picked-up by your radio's antenna, the problem is more difficult to solve. Since such interference is received by the antenna, it means that an RFI field literally surrounds the entire vehicle. Any instrument placed in the vehicle is subjected to the same stray RFI field. In the radio, excessive interference causes an aggravating noise. In the 547B, the interference can cause complete disruption of the instrument.

There are two ways to stop the effects of RFI on the 547B. One is to protect the instrument from high levels of such interference. The other is to prevent the interference from being generated in the first place, or at least reduce its level.

Several features of the 547B are very significant in preventing RFI from affecting its operation. The printed circuit board layout and component selection absorb and/or reject most of the RFI. The cable that connects the optional driver's module to the main unit is shielded to reduce pick-up of RFI. Timewise odometer transducer cables are also shielded. For protection beyond what these features provide, you would need to use military style connectors, cables, and housings.

The power cable of the 547B may pass through a dark gray metallic ring just prior to entering the instrument. There may also be a ring on the cable from the odometer transducer. These rings, termed "ferrite beads," prevent some RFI from entering the 547B along the cables. For the ferrite beads to be most effective in removing this RFI, they must be located next to the 547B. If ferrite beads are present on your 547B, be sure they do not slide down the cables.

There are several procedures you should follow to help prevent radiated noise from affecting the 547B. *Unless you follow these procedures, you will likely have electrical noise problems!*

- Solid spark plug wires radiate incredible amounts of RFI. *If your vehicle has solid spark plug wires, you must replace them with carbon resistance wires or use shielded solid wires!* Suppressor resistor spark plugs or spark plug caps also help to reduce ignition noise. Don't be misled by an apparent lack of trouble when using solid wires. Ignition noise can be very elusive—occurring only on humid days, during hard acceleration, or when your engine is cold, hot or out of tune.
- The vehicle's battery charging system is also a source of RFI. Most vehicles have, as standard equipment, noise suppressing capacitors and/or chokes on the alternator and voltage regulator that absorb this RFI. If your vehicle is lacking these components, contact your automobile dealer or a local installer of quality vehicle sound systems for such components and advice on how to install them.
- Do not attach the 547B's black wire directly behind the odometer and run the red wire a long distance to the fuse box or battery. By doing so, you create a huge loop antenna that can pick up all manner of RFI. Such interference cannot be filtered out of the power line without prohibitively expensive electronics. Attach the power leads to the vehicle at locations as close together as possible.
- Even properly connected power leads pick up some RFI. The best ways to remove interference is to twist the two leads together—about one turn for every inch of wire. By doing so, the interference on each wire is canceled out. *You must do this!* Replacement power cables are available at Radio Shack. Ask for part number 270–025.
- Make certain the battery's negative terminal is firmly connected to both the chassis and engine block. Do not overlook this important point. A poor chassis ground connection reduces the voltage supplied to the 547B and also lets the ground wire act as an antenna.
- If you do connect the 547B power wires directly to the battery, you may consider replacing the two wire cable supplied with the 547B with a shielded, twisted pair cable. Such a shielded cable will give you added protection against RFI. You can purchase shielded, twisted pair cable from electronic and electrical suppliers. Radio Shack's part number 278-1276 will work fine, although heavier wire (18 gauge) should be used if available. When installing shielded cable, connect the shield drain wire to the chassis near the battery (or directly to the negative terminal of the battery).

The preceding discussion is not meant to cause undo concern about the ability to use the 547B in a typical rally vehicle. Rather, this information is to aid you should a problem occur. If the 547B reacts to electrical noise once, you can bet it will happen again unless the offending electrical noise is eliminated.

Electrical noise problems can be solved. Please check—and double check—your installation before calling Timewise.

Overheating

The 547B uses industrial grade components throughout its construction and is designed to operate within the broad environmental conditions that occur within the passenger compartment of an automobile. However, the extremely high temperatures that occur in a closed vehicle left standing in the bright summer sunlight can have a detrimental effect on the instrument.

On a hot summer day with little wind blowing, the temperatures reached in a closed vehicle can exceed 60˚ C (140˚ F). In that environment, when the 547B is on and the displays are at their brightest setting, the instrument *will* exceed its maximum operating temperature. Should the 547B overheat, the life of internal components will be shortened considerably. The 547B can lose its operating program if this happens.

Please! Read the Technical Specifications for storage and operating temperature limits.

If the 547B is exposed to temperatures over 85˚ C (200˚ F), even momentarily, the lithium battery in the instrument may be damaged and the operating firmware can be altered.

To prevent overheating on hot days, dim the displays and park your vehicle in the shade during lunch breaks, rest stops, or whenever you leave your vehicle for substantial lengths of time. To help prevent overheating, the 547B displays will automatically turn off when the instrument is idle for 16 minutes.

Fresh air must be allowed to circulate through the instrument. Normally, there is enough air movement while driving; but, be careful if the instrument is placed in the glove box or recessed into the dashboard as air circulation will be restricted. ***Do not block the ventilation grill openings across the top and bottom of the instrument.*** The 547B will get warm; however, it should never get too hot to touch.

If you use an odometer transducer other than one supplied by Timewise, be forewarned that the higher power required by some designs (particularly photoelectric types) will cause additional internal heat build-up in the 547B. If the odometer transducers draw over 60 milliamps of current, the 547B can overheat. Please see **Appendix C** for warnings regarding this limitation.

WARNING!

Do not have the 547B plugged in if you jump start your vehicle with a 24 volt starting system, or whenever you recharge your battery! ***The higher voltage of such charging systems will cause overheating of the 547B within seconds*****!**

And, Yes, The 547B Can Get <u>Too</u> Cold!

The 547B uses a lithium battery to maintain its operating firmware. Laser sealing of the battery allows long term exposure to the high temperatures encountered in a vehicle; low temperature operation is limited by the lithium battery's chemistry.

Lithium battery chemistry can withstand short term exposure to – 40°C (–40° F) and a continuous low temperature of – 30°C (–22° F).

Sub-zero temperatures are experienced on Arctic rallies such as Satch Carlson's Rally of the Lost Patrol, or Jerry Hines' Alcan 5000. Be forewarned that if you use the 547B on a rally where the weather gets very cold, keeping the instrument in a unheated vehicle overnight may result in loss of the operating program. During overnight rest stops, it is imperative that the 547B be brought inside to warmer conditions. If the 547B fails because the battery freezes and the operating firmware is lost, the unit must be returned to Timewise for reprogramming.

Please! Read the Technical Specifications for storage and operating temperature limits. **Also, remember that the displays shut down when the instrument is idle for 16 minutes.**

Appendix C ODOMETER INPUT SPECIFICATIONS

ODOMETER INPUT SPECIFICATIONS

The following information is for rallyists designing their own odometer transducer or adapting another manufacturer's transducer to the 547B. Rallyists using an odometer transducer supplied by Timewise do not need to read this information.

Cable Requirements

The odometer transducer inputs on the 547B are eight contact unkeyed modular jacks. The connector on the transducer cable must be an eight contact unkeyed modular plug. Do not use a four or six contact modular plug. The smaller plug will fit into the eight contact jacks, but some of the contacts will be damaged. Timewise or your rally dealer can supply cables with an eight contact modular plug attached to one end. Cables are available in any length, with or without a mating connector for another brand of transducer.

Cables with modular plugs are also available from the following suppliers. These companies may have minimum order requirements.

Virginia Plastics Co.	Digi-Key
3453 Aerial Way Dr.	701 Brooks Avenue South
Roanoke, VA 24018	Thief River Falls, MN 56701
540-981-9700	800-344-4539

You must describe in exact detail the cable you require. (e.g., "Seven conductor (26 gauge stranded), with overall shield (metalized polyester foil) with 24 gauge stranded drain wire, rubberized neoprene jacketed cable (black), twelve feet long; one end blunt cut; other end with an eight contact unkeyed modular plug—shield must be on pin 1.")

If you wish to make your own cable, you can purchase a special tool for installing modular plugs. The tool (and a supply of modular plugs) can be ordered from specialty tool suppliers. The tool is expensive. Shielded multi-wire cable is available at virtually all electronic distributors. Make sure you purchase shielded cable with a drain wire. Also, the individual insulated wires must be small enough to allow insertion into the modular plug. Thin insulation (.009) on 26 or 28 gauge wire is required.

Odometer Input 1 Contact Assignments

Pin assignments for the odometer input 1 modular jack are listed below. Pin 1 is on the right when looking at the jacks on the side of the 547B. The plug on the transducer cable will enter a jack with its flexible locking lever up.

Pin 1 — Shield; connected to vehicle ground within the 547B. Do not use this pin as the signal ground.

Pin 2 — Five volts output; current limited with a 4.3 ohm, 1/2 watt resistor (or 0.17 amp PTC (positive temperature coefficient) automatically resettable fuse).

Pin 4 — Odometer signal input; held high (to 5 volts) with a 3300 ohm pull-up resistor and connected to a Schmitt trigger CMOS gate via a 1000 ohm series resistor. The odometer input must be brought to 1 volt or less for a pulse to be sensed by the 547B. The input must be allowed to return to 4.5 volts or more to reset the sensing circuitry. The maximum input frequency is 120 Hertz, unless the optional frequency divider is installed.

Pin 7 — Signal ground. Internally connected to the black (negative) power supply wire.

Pin 8 — External reset line for the microprocessor. This is for factory use only. Under no circumstances should any signal be applied to this pin. You could erase the operating firmware of the instrument.

Odometer Input 2 Contact Assignments

Pin assignments for the odometer input 2 modular jack are listed below. Pin 1 is on the right when looking at the jacks on the side of the 547B. The plug on the transducer cable will enter a jack with its flexible locking lever up.

Pin 1 — Shield; connected to vehicle ground within the 547B. Do not use this pin as the signal ground.

Pin 2 — Five volts output; current limited with a 4.3 ohm, 1/2 watt resistor.

Pin 3 — Data out (Tx) for the **optional** RS-232C interface. This is a standard –15 volt inverted logic, RS-232C transmit data signal at 19.2 killobaud. An RS-232C printer connected to an RS-232C equipped 547B will receive data every time a split is activated.

Pin 4 — Odometer signal input; held high (to 5 volts) with a 3300 ohm pull-up resistor and connected to a Schmitt trigger CMOS gate via a 1000 ohm series resistor. (If your 547B is equipped with the optional odometer input frequency divider, the pull-up resistor will be approximately 33,000 ohm.) The odometer input must be brought to 1 volt or less for a pulse to be sensed by the 547B. The input must be allowed to return to 4.5 volts or more to reset the sensing circuitry. The maximum input frequency is 120 Hertz, unless the optional frequency divider is installed.

Pin 5 — Data in (Rx) for the optional RS-232C interface. Currently not used. Receiving data by the 547B is not enabled.

Pin 6 — Data output during programming of the 547B. **This is for factory use only. Under no circumstances should any signal be applied to this pin.**

Pin 7 — Signal ground. Internally connected to the black (negative) power supply wire.

Pin 8 — Data input for programming the 547B. **This is for factory use only. Under no circumstances should any signal be applied to this pin. You could erase the operating firmware of the instrument.**

Note that the 5 volt supply (pin 2) is current limited with a 4.3 Ω resistor. If your transducer uses an incandescent light bulb, the current drawn by the bulb (typically 60 milliamps) will cause a voltage drop across the resistor of about 0.26 volt. Thus, the light bulb will be operating at only 4.74 volts. This lower voltage will significantly extend the life of the bulb. However, it also means that the light output from the bulb will be less. The phototransistor in some photo-electric transducers will not respond to this lower intensity light.

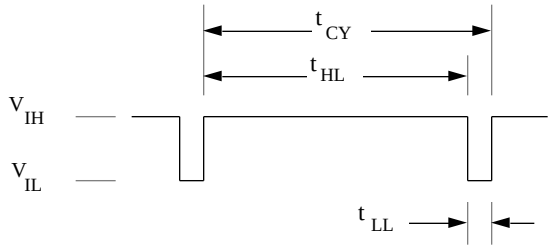
The more current your transducer uses, the hotter the 547B will become. It is possible to overheat the 547B if you draw more than 60 milliamps for your transducers!

Appendix C ODOMETER INPUT SPECIFICATIONS

Signal Specifications

If you are designing your own odometer transducer system or are planning to use a signal from the OEM electronic speedometer in your vehicle, the following odometer signal input specifications for the 547B will be of interest:

Symbol	Parameter	Min.	Typ.	Max.	Unit	Comment
t_{CY}	Cycle Time	8.33		∞	msec	120 Hertz Max.
t_{HL}	High Level Valid	8.32		∞	msec	
t_{LL}	Low Level Valid	10		∞	µsec	
V_{IH}	Input High Level	4.5	5	12	volts	5 volts typ.
V_{IL}	Input Low Level	–0.5	0	1	volt	



IMPORTANT!

The 547B counts a pulse from the transducer as the signal goes low. As shown in the table, this low level pulse needs to be valid for at least 10 µsec to be certain it is sensed by the odometer. However, please note that it is often possible for the 547B to sense a low level pulse within 2 µsec. (The 547B program operating system sometimes slows the response time to the 10 µsec figure, so this longer period must be quoted.) Be forewarned that odometer inaccuracies can occur when using a reed switch or other mechanical switching device in an odometer transducer. Multiple counts from switch contact bounce can be significant in such systems.

Transducers utilizing mechanical switches have a life expectancy of only 2 to 10 million operations. This is actually not very many operations when you consider that the switch will be operating 1000 to 2000 times per mile. These switches operate at all times (whether or not power is applied) when installed on the vehicle, making their useful life often less than 4000 miles. Such transducer systems are not recommended.

Transducer Input Limitations

At a vehicle speed of 120 mph the 547B can sense up to 3600 pulses per mile (a factor of 027777) and keep up with incoming pulses. At this speed you will be receiving one pulse every 8.33 milliseconds. (This is a rate of 7200 pulses per minute, or 120 Hertz.) If you limit your maximum speed to 100 mph, the pulses per mile figure can increase to 6000 (a factor of 016666) before you exceed the 120 Hertz (cycles per second) limit.

Note that these figures are valid only if the odometer input signal meets all restrictive aspects of the signal timing specifications. This is generally not possible; nor is it necessary.

For instance: In a installation using an open two-piece transducer, with magnets attached to a wheel, a typical factor of 060000 is used. In such an installation, the vehicle would have to be driven at approximately 175 mph before a timing limitation is exceeded. In this case, the limitation is the short time (< 10 µsec) that the magnet passes in front of the transducer, rather than too little time between pulses. Using either one or two magnets does not alter the limitation. When a speed of 175 mph is reached, the cycle time is still about 12.5 msec (80 Hertz). This is well within the limits of the timing specifications.

On the other hand, if you plan to connect the 547B to an OEM electronic speedometer signal, be aware that some vehicle systems output pulses at rates faster than 120 Hertz—even at 30 mph. Others may have slower pulse rates but will fail to work correctly because the signal does not meet one of the other input signal specifications.

Optional Odometer Input Frequency Divider

The 547B can be supplied with circuitry that allows you to connect to odometer signal sources that output pulses more rapidly than normally permitted by the 547B. This frequency divider option may allow you to utilize high pulse rate signals from an OEM electronic speedometer.

When the optional frequency divider circuitry has been installed, the pull-up resistor for Odometer Input 2 will be changed to a value of approximately 33,000 ohms. This higher than normal value (it's normally 3300 ohms) is less likely to affect the vehicle's electronic circuitry. As a result, it is recommended that Odometer Input 2 be used as the input for OEM electronic speedometer signals. Note that Odometer Input 1 may also work.

With this option, odometer input pulses may be divided by 1, 2, 4, 8, or 16, as selected via a rotary switch accessible through the rear of the 547B. If your 547B has the odometer divider option, a 3/16" opening on the back of the 547B will have a slotted white nylon shaft recessed deep within the unit. (If you do not have this option, the opening should be covered with a black plastic cap.)

Use a small **non-conductive** flat blade adjustment tool to rotate the shaft to the frequency division you require. Careful! Don't force the switch. The shaft will not rotate continuously. And don't touch anything else inside the instrument, as you could damage a circuit.

You will have to experimentally determine the correct "divide by" switch position for your installation. First, select the most counter-clockwise position of the recessed rotary switch. This is the "divide by 1" position, meaning that the odometer input signal is not divided. Then, rotate the switch to the next clockwise position. This will be the divide by 2 position. Drive the vehicle slowly (20 mph) for a short distance and compute a new odometer factor. If the factor is below 015000, select the next clockwise (divide by 4) position and re-try. Usually the "divide by 4" is appropriate. (Contact Timewise if you need to "divide by" more than 16.)

Be aware that both odometer inputs are affected by the division ratio you select. If this is unsatisfactory in your application, contact Timewise about altering your 547B so that only Odometer Input 2 is directed through the "divide by" circuitry.

Appendix C ODOMETER INPUT SPECIFICATIONS

IMPORTANT: While the 547B circuitry does electronically buffer and reshape low amplitude signals from OEM electronic speedometer systems, many such systems do not reliably provide signals at low speeds. This warning particularly applies to American manufactured vehicles from GM and FORD. The electronic systems used by these manufactures are essentially small generators that cease to function at low speeds. The status of Chrysler manufactured vehicles is unknown. European manufactured vehicles typically use a Hall Effect transducer that outputs logic level signals at any speed, so signals from those system should work fine.

Usually a single electrical connection to your vehicle's electronic speedometer is all that is required when connecting to the 547B. Just locate the appropriate signal from the speedometer drive circuitry and carefully connect that signal to pin 4 of the odometer input. (Timewise can supply a shielded cable with a modular plug on only one end. Connection of the shield should be to pin 1 of the modular plug as well as the chassis.)

NOTICE! The exact point at which you connect to the circuitry that drives your OEM electronic speedometer must be determined by you. Timewise assumes no liability associated with the use of this option. Timewise will not assist in locating either a wiring diagram of your vehicle or a specific connector under the dash. Timewise has no information in this regard for any vehicle. Do not call Timewise for help in this matter!

Typically, neither the 5 volt power output or the signal ground connection is required when operating the 547B from an electronic speedometer signal source. Timewise suggests that you **do not** make a signal ground connection (pin 7) to the chassis unless the attachment point is identical to the main power negative lead attachment location for the odometer. Otherwise, you may create a "loop antenna" and the odometer signal divider circuitry may work erratically. (Shielded wire is recommended for the signal connection. Connect the shield to pin 1 of the modular plug as well as the chassis near the signal source.)

Note: When using an OEM electronic speedometer system as a transducer input signal, the *speedometer* in the optional driver's module may not work correctly, even though the 547B functions correctly in all other aspects. This is because the time between pulses from the OEM system may vary even while vehicle speed is held constant. If the speedometer shows widely varying values even while you carefully maintain vehicle speed, it could be that the pulses from the OEM system are not evenly spaced. (The 547B uses the time between several sequential pulses to calculate your speed.) Contact Timewise for suggested circuits to correct this problem.

Frequency Divider Specifications

- Permissible input signal voltage range: –1 to 15 volts
- Input signal level for "low": 0 to 2 volts
- Input signal level for "high": 4 to 15 volts
- Input current, high signal level: Typically +13 µamp (Assumes an 8 volt signal source)
- Input current, low signal level: Typically –115 µamp. (The Odometer Input 2 connection is pulled to 5 volts within the 547B via a 33,000 ohm resistor.) The OEM electronic speedometer drive circuitry must be able to sink this additional 115 µamps when it outputs a low level signal.
- Input frequency range: 0 to 960 Hz (0 to approximately 57,600 pulses per mile)
- Signal frequency division selection: ÷1, ÷2, ÷4, ÷8, or ÷16

OSCILLATOR ADJUSTMENT

The Timewise 547B uses an 11.0592 MHz quartz crystal oscillator circuit to accurately run the time of day clock and timer. The frequency of this oscillator has been adjusted to provide a timing accurate to within ± 0.01 minute after twelve hours. (Actually, time is usually accurate to ± 0.01 minute after twenty-four hours.)

After a period of time, the crystal and other parts of the circuit age and the frequency of the oscillator drifts slightly. (This is true for all oscillator circuits.) The clock and timer will then begin to gain or lose time to a greater amount than the specified accuracy. The oscillator frequency should then be re-adjusted. Although the procedure is rather simple, the equipment required to make the frequency adjustment is quite specialized. Timewise will calibrate any 547B for a minimal charge.

Do not attempt to adjust the oscillator unless you have the appropriate test equipment and are experienced at calibrating electronic instrumentation.

For those of you that qualify, here's the procedure to follow:

1. Remove power from the 547B and connect the input of an eight digit *reciprocal* frequency counter to the tip contact on the **Remote Split** jack port on the left side of the 547B. Use a cable you have fabricated. The ground contact must be the shaft of the stereo plug.

2. Hold the **Recall** toggle switch on the front of the 547B down, and then apply power to the instrument. Release the **Recall** toggle switch. The 547B will output a 38,400 Hertz square wave to the **Remote Split** jack. The LED segments will turn on randomly.

3. Let the 547B warm up for at least 30 minutes. (The displays will not automatically go out after 16 minutes.)

4. Carefully insert a small **non-conductive** flat-blade adjustment tool into the very small (7/64" dia.) frequency adjustment opening on the back of the 547B and locate a small adjustable capacitor recessed approximately 3/4" deep inside the instrument. **The slotted head on the capacitor is very hard to find!** It is flush with the plastic shell of the adjustable capacitor. Be very careful! If you're not, you can break the capacitor or damage a surface mount solder bond on a nearby component (the microprocessor).

   Do not use a metal screwdriver for making this adjustment! You can permanently damage the 547B by doing so! Making electrical contact to circuitry near the capacitor will destroy the microprocessor or short out the lithium battery! In addition, the capacitance of your body will unpredictably change the frequency of the oscillator as you make the adjustment.

5 Using a gate time on the frequency counter of at least five seconds, adjust the 547B clock output to a frequency of 38,400.000 Hz ± 100 mHz. The adjustment screw will need to be turned *very* little.

   (As a matter of interest, the clock in the 547B will be accurate to ± 0.01 minute after 24 hours if the oscillator is set to 38,400.000 Hz ± 400 mHz.)

6. After making the adjustment, depress the **Shift** button to resume normal operation.

CLEANING THE 547B

Keep the 547B free of as much dirt and grime as possible. Although it is obviously impossible to prevent accumulation of dust and fingerprints on the instrument during normal use, ordinary precautions can protect the 547B from excessive dirt. One of the easiest way to do this is to remove the 547B from your vehicle when you are not on a rally. In doing so, you will also remove a temptation from the prying eyes of thieves.

The 547B was supplied with two modular jack dust covers installed in the typically unused connections on the left side of the instrument. Keep these in place. If the connections are used, save the covers for later installation when the connections are no longer used. Replacement dust covers are available from Timewise; however, they are expensive.

Clean the 547B often. Front panel switches and connectors can eventually be damaged by accumulations of dirt and grime.

Be careful when cleaning the polycarbonate front panels of the main odometer and optional driver's module. Although they are protected from fingerprints, minor scratches, and chemical damage by a special protective coating, abrasive grit and certain cleaning chemicals will mar the surface. To remove fingerprints, use a mild **plastic** cleaning solution. Do not use chemical solvents, bathroom and kitchen cleansers, or any aromatic hydrocarbon based cleaner. Use a soft cloth and wipe accumulated dirt off carefully to prevent scratches.

CAREFUL!

Never spray a cleaner directly on the 547B; rather, spray a cloth and then clean the panels with the damp cloth. If you spray a cleaner directly or the front panel of the 547B, some of the liquid will enter the switches and cause internal corrosion and eventual failure of the switch mechanism.

Do not open the 547B to clean inside. Not only will you void the warranty, but the likelihood of doing electrical damage is very high. If your 547B needs to be cleaned internally, return it to Timewise for a thorough checkup. Timewise will clean and calibrate any 547B for a minimal charge. Whenever a 547B is returned for a check-up, Timewise will always update the instrument to the latest firmware.

If you feel that the contacts in the odometer input and remote display modular jacks need to be cleaned, you may use isopropyl alcohol. Some chlorinated fluorocarbons ("HCFC" and other Freon® replacements) are OK, too, but be forewarned that some such chemicals can attack the ABS, Lexan (polycarbonate) and polystyrene plastics of the 547B. Note that there absolutely must not be any additives such as methanol, methylene chloride, acetone, 1,1,1-trichloroethane, or nitromethane, in the spray. Also, please be extremely careful not bend the wires in the modular jacks.

Do not use contact lubricators on the 547B! Such formulations contain unspecified oils and additives that may damage the 547B. Note that some sprays used for cleaning electrical contacts (e.g. television tuner cleaner sprays) usually contain unspecified additives that lubricate metal shafts and surfaces, or to dissolve waxes and heavy deposits of grease. You *will* dissolve, fracture, and/or soften some of the plastics (especially the polycarbonate front panel, polycarbonate modular plugs, and polystyrene LEDs) in the 547B with those chemicals.

One final warning: *Some chemicals used in insect repellents can damage the front panel and/or case of the 547B. Do not let these chemicals contact the 547B, as you can ruin the appearance of the instrument.*

TECHNICAL SPECIFICATIONS

Design

CPU type: 8 bit, DS5000FP (8051 class) operating @ 11.0592 MHz
Memory: Program: 4096 bytes Data: 4224 bytes
Displays: 0.6" tall, ultra-bright, high efficiency red LEDs

Accuracy

Odometers: ± 0.01 mile (km) after 1000 miles (km)
Clock and Timer: ± 0.01 minute after 12 hours (24 hours typical)
Battery backed Real Time Clock: ± 50 seconds per month while 12 Volt power removed

Displayed Information

Main Odometer: 0.00 to 999.99 miles (km)
Optionally: 0.000 to 99.999 miles (km)
Optionally: 0.0 to 9999.9 miles (km)
Auxiliary Odometer: 0.00 to 99.99 miles (km)
Optionally: 0.000 to 9.999 miles (km)
Optionally: 0.0 to 99.9 miles (km)
Clock: 12:00.00 to 11:59.99 (:59)
Timer: 00.00 to 59.99 (:59)
Factor(s): 0 to [0.00]999999 mile (km)/pulse
Odometer Alarm: 0.00 to 999.99 miles (km)
Clock Alarm: 12:00.00 to 11:59.99 (:59)
Delta Counters: Main Odometer: –9999.999 to 9999.999 miles (km)
Aux Odometer: –99.999 to 99.999 miles (km)
Timer: –9.99 (:59) to 59.99 (:59)
Odometer (on driver's module): 0.00 to [9]99.99 miles (km)
Speedometer (in Timer display): 0 to 199 mph (kph)
Speedometer (on driver's module - "Pro" mode only): 0.0 and approx. 1.5 – 199.9 mph (kph)

Electrical

Power requirements: 8 – 15 Volts DC; 850 mamp max.
Fuse: 1.5 amp; type 3AG or equivalent
Odometer input: 0 – 15 VDC; 0 - 120 Hz (5 volts supplied)
Optional RS–232C interface: 19.2 killobaud, 8 bits, 1 stop bit, no parity

Environmental

Note: Do not exceed these limits, as the operating memory will be erased. Low temperatures limitations are due to the lithium battery chemistry freezing.

Storage temperature (unplugged; 12 hours): –40°C to 85°C
Storage temperature (unplugged; continuous): –30°C to 75°C
Operating temperature (powered, displays off, free air; 12 hours): –40°C to 70°C
Operating temperature (powered, displays off, free air; continuous): –30°C to 70°C
Operating temperature (powered, displays off, vents blocked): –30°C to 65°C
Operating temperature (powered, displays on, free air): –40°C to 45°C
Operating temperature (powered, displays on, vents blocked): –40°C to 30°C
Humidity: 90%, non-condensing

Physical

Enclosure: High Temperature ABS plastic
Front panel: Scratch protected polycarbonate
Size: 7.5" W x 4.0" H x 1.75" D
Weight: Approximately 14 oz.
Optional Driver's Module:
Enclosure: Aluminum
Front Panel: Hard coat protected polycarbonate
Size: 3.1" W x 2.1" H x 2.50" D
Weight: Approximately 5 oz.
Cable length: Approximately 3.5 ft

Turning On the 547B

Plug into 12 volts DC negative ground. There is no On-Off switch. **Do Not plug the 547B into a 24 volt DC vehicle!**

Set Clock

Select Δ **Record,** depress and hold **Recall/Clk Set [Sync]**, adjust the clock to the time when **Recall/Clk Set [Sync]** depressed.

Synchronize Clock

Select Δ **Record,** depress and hold **Recall/Clk Set [Sync]**, momentarily push **Shift**, and then use any "+ / – " switch to speed up/slow down the clock. Pushing **Shift**, again, will re-enter the set clock mode.

To automatically synchronize to a Timewise 610 clock, insert an 1/8" stereo phone plug cable between the **Remote Split** connections on the 610 and 547B and select **Run** on the 610. Then, on the 547B, select Δ **Record,** depress and hold **Clk Set [Sync]**, and momentarily push **Shift**. Release **Recall/Clk Set [Sync]** after the 547B indicates the synchronization is finished.

Change Clock Counting Mode

Select **Factor [Set-up]**, push **Shift** to display the "Set-up" selections, use the "+ / – " **10.00** switch to change between "**SEC**" (seconds) or "**Hund**" (hundredths of minutes) showing in the **Clock** display.

View Clock and Timer in Higher Resolution

Depress **Shift** when the displays are split. The time displays will shift two places left. A decimal point will be placed between the seconds (or "hundredths") and the additional digit of resolution. You cannot view the time displays in high resolution when the values are "live".

Synchronize Timer and Clock

Select **Timer** on the rotary switch, push **Shift**, use the "+ / – " **.01** switch to speed up/slow down the timer.

Hide or Display the Timer

Select **Factor [Set-up]**, push **Shift** to display the "Set-up" selections, use the "+ / – " **.01** switch to change between "**DSPL**" or "**HidE**".

Show a Speedometer in the Timer Display

Select **Factor [Set-up]**, push **Shift** to display the "**Set-up**" selections, use the "+ / – " **.01** switch to select "**SPEd**" in the **Timer** display.

To Enable Adjusting a Value

Display "live" values, OR the most recent split entered (split number "1"). Split values from 2 through 250 cannot be adjusted. Adjustments made to split values are also automatically made to internal "live" values. You can also adjust a temporary split displayed while **Recall** is depressed.

Adjust Timer

Select **Timer** on the rotary switch, use the "+ / – " toggle switches.

Split - Enter into Memory

Activate **Split**. The most recent 250 splits are retained in memory, in the order received. They are numbered 1 through 250, with the most recent entry becoming "split number 1". When a split is entered all previous splits shift up one position.

Recall "Live" Values

Depress **Recall** once for each split entered. While the **Recall** toggle is depressed, the **Timer** display will show which of the 250 splits is being recalled. Splits are recalled in the order entered, until the "live" values are once again displayed.

Split - Temporarily

Depress and hold **Recall** when the displays are "live". This "split" is not retained in memory.

Split – Temporarily, with Data Storage

Activate the **Remote Split** function when the displays are "live". This split is retained in memory.

Execute a Lap Split

Depress and hold **Shift** prior to activating the **Split** switch. The decimal point in the rightmost position of the **Timer** display will illuminate when showing the split values to indicate that this split is where a lap split was executed..

Lap Split – Temporarily, with Data Storage

Activate the **Remote Lap Split** function when the displays are "live". This split is retained in memory.

Retroactively Execute a Lap Split

Select the upper row of "+ / – " toggle switch special functions, depress **Shift**, use the "+ / – " **.10** switch (labeled **Retro Lap Split**). You can depress **Shift** before or after activating **Retro Lap Split**. Prior to executing the retroactive lap split, the displays automatically go to the most recently entered split. The "live" auxiliary odometer and timer will now read the values that would have been present had the lap split been originally executed at the location and time of the most recent split.

To "Undo" a Lap Split

Select the upper row of "+ / – " toggle switch special functions, depress **Shift**, use the "+ / – " **.10** switch (labeled **Retro Lap Split**). You can depress **Shift** before or after activating **Retro Lap Split.** Prior to executing the "undo" the displays automatically go to the most recently entered split. The "live" auxiliary odometer and timer will now read the values that would have been present had the lap split never been executed.

Review Saved Splits

Select the upper row of "+ / – " toggle switch special functions, use the "+ / – " **.01** switch (labeled **Review Splits**) to cycle through the 250 split memory. The **Timer** display will show which of the 250 splits is being reviewed until shortly after the **Review Splits** switch is released.

Deleting Splits

Select the upper row of "+ / – " toggle switch special functions, depress **Shift**, use the "+ / – " **1.00** switch (labeled **Delete Split Entry**). You can depress **Shift** before or after activating **Delete Split Entry**. Any of the 250 splits can be deleted.

Adjust Main Odometer

Select **Main Odometer** on the rotary switch, use the "+ / – " toggle switches.

Adjust Auxiliary Odometer

Select **Aux Odometer** on the rotary switch, use the "+ / – " toggle switches.

Adjust Main and Auxiliary Odometer Simultaneously

Select **Both Odometers** on the rotary switch, use the "+ / – " toggle switches.

Adjust Odometer Alarm

Select **Odometer Alarm** on the rotary switch, use the "+ / – " toggle switches. The odometer alarm setting is shown in the **Main Odometer** display, and the difference between the alarm setting and the actual main odometer is displayed in the **Auxiliary Odometer**. If **Shift** is pushed, the displays will show the normal main and auxiliary odometer.

Adjust Clock Alarm

Select **Clock Alarm** on the rotary switch, use the "+ / – " toggle switches. The clock alarm setting is shown in the **Clock** display, and the difference between the alarm setting and the actual clock time is displayed in the **Timer**. If **Shift** is pushed, the displays will show the normal clock and timer.

Adjust Factor

Select **Factor [Set-up]** on the rotary switch, use the "+ / – " toggle switches to adjust the factor (shown in the clock display).

Select 2nd Factor

Select **Factor [Set-up]** on the rotary switch, depress **Recall**. Select **Factor [Set-up]** on the rotary switch, depress **Recall**. (The second factor is only available while operating in the "Pro" mode.)

Toggle between "Pro" and "tSd" modes

Select **Factor [Set-up]** on the rotary switch, push and hold **Shift**, depress and hold **Recall**, activate the "+ / – " **.01** switch.

Change Odometer Resolution (Unshifted)

Select the lower row of "+ / – " toggle switch special functions, use the "+ / – " **.01** switch (labeled **Odo Resolution**).

Change Odometer Resolution (Shifted)

Select the lower row of "+ / – " toggle switch special functions, push **Shift**, use the "+ / – " **.01** switch (labeled **Odo Resolution**).

Adjust Odometer(s) by .001 Mile Increments

Select odometer(s) to be adjusted, display .001 mile resolution (see above), use the "+ / – " **.01** switch.

Truncate Main Odometer

Select the lower row of "+ / – " toggle switch special functions, use the "+ / – " **10.00** switch (labeled **Truncate [Reset] Main Odo**). If split, the 547B automatically returns to "live" values.

Reset Main Odometer

Select the lower row of "+ / – " toggle switch special functions, push **Shift**, use the "+ / – " **10.00** switch (labeled **Truncate [Reset] Main Odo**). If split, the 547B automatically returns to "live" values.

Truncate Auxiliary Odometer

Select the lower row of "+ / – " toggle switch special functions, use the "+ / – " **1.00** switch (labeled **Truncate [Reset] Aux Odo**). If split, the 547B automatically returns to "live" values.

Reset Auxiliary Odometer

Select the lower row of "+ / – " toggle switch special functions, push **Shift**, use the "+ / – " **1.00** switch (labeled **Truncate [Reset] Aux Odo**). If split, the 547B automatically returns to "live" values.

Select Linked Auxiliary Odometer

Select the lower row of "+ / – " toggle switch special functions, use the "+ / – " **.10** switch (labeled **Link Main and Aux Odo**). When linked, the **Auxiliary Odometer** display will have its lower right decimal point illuminated.

Reset Main Odometer "Delta" Counter

Select Δ **Record**, push and hold **Shift**, depress the "+ / – " **10.00** switch.

Reset Aux Odometer "Delta" Counter

Select Δ **Record**, push and hold **Shift**, depress the "+ / – " **1.00** switch.

Reset Timer "Delta" Counter

Select Δ **Record**, push and hold **Shift**, depress the "+ / – " **.01** switch.

Change Odometer Input

Select **Factor [Set-up]**, push **Shift** to display the "Set-up" selections, use the "+ / – " **1.00** switch to change between "**in 1**" and " **in 2**"

Change the Alarm Beep Length

Select **Factor [Set-up]**, push **Shift** to display the "Set-up" selections, use the "+ / – " **.10** switch to change the beep length from 0 to 19. When **Shift** is released, a sample beep will sound.

Adjust Display Intensity

Select the upper row of "+ / – " toggle switch special functions, use the "+ / – " **10.00** switch (labeled **Display Brightness**). The selected display intensity level is shown in the **Clock** display until shortly after the switch is released.

Depressing **Shift** prior to activating the "+ / – " **10.00** switch will automatically select the brightness/dimmest intensity level.

When dimming below the lowest setting, the displays will turn off, but odometer pulse counting and time keeping continue. Activating any "+ / – " toggle switch will return the displays to full brightness

Re-illuminate the LED Displays

The displays go off automatically after 16 minutes of total inactivity. Activate any switch (or drive the vehicle to input an odometer pulse) to re-illuminate the displays. If the 547B displays were intentionally turned off, activate any "+ / – " toggle switch. The "+ / – " toggle switches will not enter a value when coming out of these power savings modes.

Display Instrument System Information

Select **Factor [Set-up]** on the rotary switch, push **Shift**, depress **Recall.** The displays will show the serial number, firmware revision, date of manufacture, and operating mode ("Pro" or "tsd").

Overall System Reset

Disconnect power from the 547B, hold the four "+ / – " toggle switches **DOWN – UP – UP – DOWN** (select **– 10.00**, + **1.00**, + **.10**, and **– .01**), re-apply power, release toggle switches.

MPH	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9	MPH
10	6.00000	5.94059	5.88235	5.82524	5.76923	5.71429	5.66038	5.60748	5.55556	5.50459	**10**
11	5.45455	5.40541	5.35714	5.30973	5.26316	5.21739	5.17241	5.12821	5.08475	5.04202	**11**
12	5.00000	4.95868	4.91803	4.87805	4.83871	4.80000	4.76190	4.72441	4.68750	4.65116	**12**
13	4.61538	4.58015	4.54545	4.51128	4.47761	4.44444	4.41176	4.37956	4.34783	4.31655	**13**
14	4.28571	4.25532	4.22535	4.19580	4.16667	4.13793	4.10959	4.08163	4.05405	4.02685	**14**
15	4.00000	3.97351	3.94737	3.92157	3.89610	3.87097	3.84615	3.82166	3.79747	3.77358	**15**
16	3.75000	3.72671	3.70370	3.68098	3.65854	3.63636	3.61446	3.59281	3.57143	3.55030	**16**
17	3.52941	3.50877	3.48837	3.46821	3.44828	3.42857	3.40909	3.38983	3.37079	3.35196	**17**
18	3.33333	3.31492	3.29670	3.27869	3.26087	3.24324	3.22581	3.20856	3.19149	3.17460	**18**
19	3.15789	3.14136	3.12500	3.10881	3.09278	3.07692	3.06122	3.04569	3.03030	3.01508	**19**
20	3.00000	2.98507	2.97030	2.95567	2.94118	2.92683	2.91262	2.89855	2.88462	2.87081	**20**
21	2.85714	2.84360	2.83019	2.81690	2.80374	2.79070	2.77778	2.76498	2.75229	2.73973	**21**
22	2.72727	2.71493	2.70270	2.69058	2.67857	2.66667	2.65487	2.64317	2.63158	2.62009	**22**
23	2.60870	2.59740	2.58621	2.57511	2.56410	2.55319	2.54237	2.53165	2.52101	2.51046	**23**
24	2.50000	2.48963	2.47934	2.46914	2.45902	2.44898	2.43902	2.42915	2.41935	2.40964	**24**
25	2.40000	2.39044	2.38095	2.37154	2.36220	2.35294	2.34375	2.33463	2.32558	2.31660	**25**
26	2.30769	2.29885	2.29008	2.28137	2.27273	2.26415	2.25564	2.24719	2.23881	2.23048	**26**
27	2.22222	2.21402	2.20588	2.19780	2.18978	2.18182	2.17391	2.16606	2.15827	2.15054	**27**
28	2.14286	2.13523	2.12766	2.12014	2.11268	2.10526	2.09790	2.09059	2.08333	2.07612	**28**
29	2.06897	2.06186	2.05479	2.04778	2.04082	2.03390	2.02703	2.02020	2.01342	2.00669	**29**
30	2.00000	1.99336	1.98675	1.98020	1.97368	1.96721	1.96078	1.95440	1.94805	1.94175	**30**
31	1.93548	1.92926	1.92308	1.91693	1.91083	1.90476	1.89873	1.89274	1.88679	1.88088	**31**
32	1.87500	1.86916	1.86335	1.85759	1.85185	1.84615	1.84049	1.83486	1.82927	1.82371	**32**
33	1.81818	1.81269	1.80723	1.80180	1.79641	1.79104	1.78571	1.78042	1.77515	1.76991	**33**
34	1.76471	1.75953	1.75439	1.74927	1.74419	1.73913	1.73410	1.72911	1.72414	1.71920	**34**
35	1.71429	1.70940	1.70455	1.69972	1.69492	1.69014	1.68539	1.68067	1.67598	1.67131	**35**
36	1.66667	1.66205	1.65746	1.65289	1.64835	1.64384	1.63934	1.63488	1.63043	1.62602	**36**
37	1.62162	1.61725	1.61290	1.60858	1.60428	1.60000	1.59574	1.59151	1.58730	1.58311	**37**
38	1.57895	1.57480	1.57068	1.56658	1.56250	1.55844	1.55440	1.55039	1.54639	1.54242	**38**
39	1.53846	1.53453	1.53061	1.52672	1.52284	1.51899	1.51515	1.51134	1.50754	1.50376	**39**
40	1.50000	1.49626	1.49254	1.48883	1.48515	1.48148	1.47783	1.47420	1.47059	1.46699	**40**
41	1.46341	1.45985	1.45631	1.45278	1.44928	1.44578	1.44231	1.43885	1.43541	1.43198	**41**
42	1.42857	1.42518	1.42180	1.41844	1.41509	1.41176	1.40845	1.40515	1.40187	1.39860	**42**
43	1.39535	1.39211	1.38889	1.38568	1.38249	1.37931	1.37615	1.37300	1.36986	1.36674	**43**
44	1.36364	1.36054	1.35747	1.35440	1.35135	1.34831	1.34529	1.34228	1.33929	1.33630	**44**
45	1.33333	1.33038	1.32743	1.32450	1.32159	1.31868	1.31579	1.31291	1.31004	1.30719	**45**
46	1.30435	1.30152	1.29870	1.29590	1.29310	1.29032	1.28755	1.28480	1.28205	1.27932	**46**
47	1.27660	1.27389	1.27119	1.26850	1.26582	1.26316	1.26050	1.25786	1.25523	1.25261	**47**
48	1.25000	1.24740	1.24481	1.24224	1.23967	1.23711	1.23457	1.23203	1.22951	1.22699	**48**
49	1.22449	1.22200	1.21951	1.21704	1.21457	1.21212	1.20968	1.20724	1.20482	1.20240	**49**
50	1.20000	1.19760	1.19522	1.19284	1.19048	1.18812	1.18577	1.18343	1.18110	1.17878	**50**
51	1.17647	1.17417	1.17188	1.16959	1.16732	1.16505	1.16279	1.16054	1.15830	1.15607	**51**
52	1.15385	1.15163	1.14943	1.14723	1.14504	1.14286	1.14068	1.13852	1.13636	1.13422	**52**
53	1.13208	1.12994	1.12782	1.12570	1.12360	1.12150	1.11940	1.11732	1.11524	1.11317	**53**
54	1.11111	1.10906	1.10701	1.10497	1.10294	1.10092	1.09890	1.09689	1.09489	1.09290	**54**
MPH	**.0**	**.1**	**.2**	**.3**	**.4**	**.5**	**.6**	**.7**	**.8**	**.9**	**MPH**

MPH	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9	MPH
55	1.09091	1.08893	1.08696	1.08499	1.08303	1.08108	1.07914	1.07720	1.07527	1.07335	**55**
56	1.07143	1.06952	1.06762	1.06572	1.06383	1.06195	1.06007	1.05820	1.05634	1.05448	**56**
57	1.05263	1.05079	1.04895	1.04712	1.04530	1.04348	1.04167	1.03986	1.03806	1.03627	**57**
58	1.03448	1.03270	1.03093	1.02916	1.02740	1.02564	1.02389	1.02215	1.02041	1.01868	**58**
59	1.01695	1.01523	1.01351	1.01180	1.01010	1.00840	1.00671	1.00503	1.00334	1.00167	**59**
60	1.00000	0.99834	0.99668	0.99502	0.99338	0.99174	0.99010	0.98847	0.98684	0.98522	**60**
61	0.98361	0.98200	0.98039	0.97879	0.97720	0.97561	0.97403	0.97245	0.97087	0.96931	**61**
62	0.96774	0.96618	0.96463	0.96308	0.96154	0.96000	0.95847	0.95694	0.95541	0.95390	**62**
63	0.95238	0.95087	0.94937	0.94787	0.94637	0.94488	0.94340	0.94192	0.94044	0.93897	**63**
64	0.93750	0.93604	0.93458	0.93313	0.93168	0.93023	0.92879	0.92736	0.92593	0.92450	**64**
65	0.92308	0.92166	0.92025	0.91884	0.91743	0.91603	0.91463	0.91324	0.91185	0.91047	**65**
66	0.90909	0.90772	0.90634	0.90498	0.90361	0.90226	0.90090	0.89955	0.89820	0.89686	**66**
67	0.89552	0.89419	0.89286	0.89153	0.89021	0.88889	0.88757	0.88626	0.88496	0.88365	**67**
68	0.88235	0.88106	0.87977	0.87848	0.87719	0.87591	0.87464	0.87336	0.87209	0.87083	**68**
69	0.86957	0.86831	0.86705	0.86580	0.86455	0.86331	0.86207	0.86083	0.85960	0.85837	**69**
70	0.85714	0.85592	0.85470	0.85349	0.85227	0.85106	0.84986	0.84866	0.84746	0.84626	**70**
71	0.84507	0.84388	0.84270	0.84151	0.84034	0.83916	0.83799	0.83682	0.83565	0.83449	**71**
72	0.83333	0.83218	0.83102	0.82988	0.82873	0.82759	0.82645	0.82531	0.82418	0.82305	**72**
73	0.82192	0.82079	0.81967	0.81855	0.81744	0.81633	0.81522	0.81411	0.81301	0.81191	**73**
74	0.81081	0.80972	0.80863	0.80754	0.80645	0.80537	0.80429	0.80321	0.80214	0.80107	**74**
75	0.80000	0.79893	0.79787	0.79681	0.79576	0.79470	0.79365	0.79260	0.79156	0.79051	**75**
76	0.78947	0.78844	0.78740	0.78637	0.78534	0.78431	0.78329	0.78227	0.78125	0.78023	**76**
77	0.77922	0.77821	0.77720	0.77620	0.77519	0.77419	0.77320	0.77220	0.77121	0.77022	**77**
78	0.76923	0.76825	0.76726	0.76628	0.76531	0.76433	0.76336	0.76239	0.76142	0.76046	**78**
79	0.75949	0.75853	0.75758	0.75662	0.75567	0.75472	0.75377	0.75282	0.75188	0.75094	**79**
80	0.75000	0.74906	0.74813	0.74720	0.74627	0.74534	0.74442	0.74349	0.74257	0.74166	**80**
81	0.74074	0.73983	0.73892	0.73801	0.73710	0.73620	0.73529	0.73439	0.73350	0.73260	**81**
82	0.73171	0.73082	0.72993	0.72904	0.72816	0.72727	0.72639	0.72551	0.72464	0.72376	**82**
83	0.72289	0.72202	0.72115	0.72029	0.71942	0.71856	0.71770	0.71685	0.71599	0.71514	**83**
84	0.71429	0.71344	0.71259	0.71174	0.71090	0.71006	0.70922	0.70838	0.70755	0.70671	**84**
85	0.70588	0.70505	0.70423	0.70340	0.70258	0.70175	0.70093	0.70012	0.69930	0.69849	**85**
86	0.69767	0.69686	0.69606	0.69525	0.69444	0.69364	0.69284	0.69204	0.69124	0.69045	**86**
87	0.68966	0.68886	0.68807	0.68729	0.68650	0.68571	0.68493	0.68415	0.68337	0.68259	**87**
88	0.68182	0.68104	0.68027	0.67950	0.67873	0.67797	0.67720	0.67644	0.67568	0.67492	**88**
89	0.67416	0.67340	0.67265	0.67189	0.67114	0.67039	0.66964	0.66890	0.66815	0.66741	**89**
90	0.66667	0.66593	0.66519	0.66445	0.66372	0.66298	0.66225	0.66152	0.66079	0.66007	**90**
91	0.65934	0.65862	0.65789	0.65717	0.65646	0.65574	0.65502	0.65431	0.65359	0.65288	**91**
92	0.65217	0.65147	0.65076	0.65005	0.64935	0.64865	0.64795	0.64725	0.64655	0.64586	**92**
93	0.64516	0.64447	0.64378	0.64309	0.64240	0.64171	0.64103	0.64034	0.63966	0.63898	**93**
94	0.63830	0.63762	0.63694	0.63627	0.63559	0.63492	0.63425	0.63358	0.63291	0.63224	**94**
95	0.63158	0.63091	0.63025	0.62959	0.62893	0.62827	0.62762	0.62696	0.62630	0.62565	**95**
96	0.62500	0.62435	0.62370	0.62305	0.62241	0.62176	0.62112	0.62048	0.61983	0.61920	**96**
97	0.61856	0.61792	0.61728	0.61665	0.61602	0.61538	0.61475	0.61412	0.61350	0.61287	**97**
98	0.61224	0.61162	0.61100	0.61038	0.60976	0.60914	0.60852	0.60790	0.60729	0.60667	**98**
99	0.60606	0.60545	0.60484	0.60423	0.60362	0.60302	0.60241	0.60181	0.60120	0.60060	**99**
MPH	**.0**	**.1**	**.2**	**.3**	**.4**	**.5**	**.6**	**.7**	**.8**	**.9**	**MPH**

Set the Clock
Select Δ **Record,** depress and hold **Recall/Clk Set [Sync]**, adjust clock.

Change Clock Mode
Select **Factor [Set-up]**, push **Shift** to display the "Set-up" selections, use the "+ / – " **10.00** switch to change between "**SEC**" (seconds) or "**Hund**" (hundredths of minutes) showing in the **Clock** display.

Synchronize the Clock
Select Δ **Record,** depress and hold **Recall/Clk Set [Sync]**, momentarily push **Shift**, and then use any "+ / – " switch to speed up/slow down the clock.

To synchronize to a Timewise 610, select **Run** on the 610 and insert a stereo phone plug cable between the **Remote Split** inputs on the 610 and 547B. Then, on the 547B, select Δ **Record,** select **Recall/Clk Set [Sync]**, and depress **Shift**.

Sync Timer and Clock
Select **Timer** on the rotary switch, push **Shift**, use the "+ / – " **.01** switch to synchronize timer.

Change Odometer Input
Select **Factor [Set-up]**, push **Shift** to display the "**Set-up**" selections, use the "+ / – " **1.00** switch to change between "**in 1**" and "**in 2**" in the **Auxiliary Odometer** display.

Show a Speedometer in the Timer Display
Select **Factor [Set-up]**, push **Shift** to display the "**Set-up**" selections, use the "+ / – " **.01** switch to select "**SPEd**" in the **Timer** display.

Hide or Display the Timer
Select **Factor [Set-up]**, push **Shift** to display the "**Set-up**" selections, use the "+ / – " **.01** switch to select "**DSPL**" or "**HidE**" in the **Timer** display.

Execute a Lap Split
Depress and hold **Shift** prior to activating the **Split** switch.

Retroactively Execute a Lap Split
Select the upper row of "+ / – " toggle switch special functions, depress **Shift**, use the "+ / – " **.10** switch (labeled **Retro Lap Split**). You can depress **Shift** before or after activating **Retro Lap Split**.

To "Undo" a Lap Split
Select the upper row of "+ / – " toggle switch special functions, depress **Shift**, use the "+ / – " **.10** switch (labeled **Retro Lap Split**). You can depress **Shift** before or after activating **Retro Lap Split**.

Review Saved Splits
Select the upper row of "+ / – " toggle switch special functions, use the "+ / – " **.01** switch (labeled **Review Splits**) to cycle through the 250 split memory.

Deleting Splits
Select the upper row of "+ / – " toggle switch special functions, depress **Shift**, use the "+ / – " **1.00** switch (labeled **Delete Split Entry**). You can depress **Shift** before or after **Delete Split Entry**.

Select 2nd Factor
Select **Factor [Set-up]** on the rotary switch, depress **Recall**. (The second factor is only available while operating in the "Pro" mode.)

Change Odometer Resolution
Select the lower row of "+ / – " toggle switch special functions, use the "+ / – " **.01** switch (labeled **Odo Resolution**). To change the shifted odometer resolution, push **Shift** before using the "+ / – " **.01** switch.

Truncate [Reset] the Main or Auxiliary Odometer
Select the lower row of "+ / – " toggle switch special functions, use the "+ / – " **10.00** switch (labeled **Truncate [Reset] Main Odo**), or, the "+ / – " **1.00** switch (labeled **Truncate [Reset] Aux Odo**). Push **Shift**, first, to completely reset the odometer.

Reset "Delta" Counters
Select Δ **Record**, push and hold **Shift**, depress the "+ / – " **10.00** switch to reset the Main Odometer delta counter, or the "+ / – " **1.00** switch to reset the Auxiliary Odometer delta counter, or the "+ / – " **.01** switch to reset the Timer delta counter.

Adjust Display Intensity
Select the upper row of "+ / – " toggle switch special functions, use the "+ / – " **10.00** switch (labeled **Display Brightness**). Depressing **Shift** prior to activating the "+ / – " **10.00** switch automatically selects the brightness/dimmest intensity level.

Change the Alarm Beep Length
Select **Factor [Set-up]**, push **Shift** to display the "**Set-up**" selections, use the "+ / – " **.10** switch to change the beep length from 0 to 19 showing in the **Clock** display.

Select Linked Auxiliary Odometer
Select the lower row of "+ / – " toggle switch special functions, use the "+ / – " **.10** switch (labeled **Link Main and Aux Odo**). When linked, the **Auxiliary Odometer** display will have its lower right decimal point illuminated. Activate this function again to de-select.

Optional Firmware and Hardware Modifications for the TIMEWISE 547B

The TIMEWISE 547B is designed to be the most comprehensive class B rally computer possible. Within the limits of ease of use, the 547B provides all the features needed in the great majority of rally situations. Nevertheless, TIMEWISE recognizes that many rallyists have their own style of rallying and often have a preconceived notion about the proper techniques of doing things. Additionally, new applications and/or changes in governing rally regulations are not always anticipated at the time of manufacture.

To accommodate new or individual requirements, TIMEWISE offers modifications that can be installed in the 547B. The following is a brief description of currently available options. To have an option installed in your 547B, you must return the instrument to TIMEWISE. Option prices range from $37.50 to $75.00, plus return shipping.

Option 1 Battery backed Real Time Clock when power removed. See the Operator's Manual for details.

Option 2 Odometer input pulse divider/buffer. See **Appendix C** in the Operator's Manual for details.

Option 3 An RS232C serial interface that dumps data to a computer or printer whenever the 547B is split.

Option 4 "Remote Recall" jack installed on right side of 547B.

547B Firmware Version History

Version 1.0 August 25, 1995
Initial release for approval by outside testers.

Version 1.1 September 9, 1995
Several new features, procedural changes, and bug fixes result from input by outside testers. First product delivered.

Version 1.2 September 13, 1995
Added new feature: The odometers can also be displayed in "tenths" resolution. The 547B now exceeds initial published feature specifications.

Version 1.3 October 1, 1995
Added new feature: The **TIMER** display can be blanked when it is not being used.

Version 1.4 October 5, 1995
Fixed display problem when viewing odometers in "tenths". Also removed random illuminated LED segments in **TIMER** display when blanked and rotary switch in **Odometer Alarm** position.

Version 1.5 October 18, 1995
Changed odometer reset procedure: To completely reset an odometer, the **Shift** switch must be pressed before activating the appropriate "truncate" toggle switch. Previously, the **Shift** switch could be depressed either before or after the "truncate" toggle switch was activated.

Version 1.6 November 2, 1995
Corrected firmware to prevent premature battery depletion in units with the Real Time Clock (RTC). An error in the RTC firmware caused a current drain that would drain battery in 2 years, instead of 50 years. All units with RTC option recalled for updating.

Version 1.7 June 6, 1996
Corrected firmware to eliminate an error in the auxiliary odometer following a lap split. If the odometers **were not** linked, the thousandths of miles position in the auxiliary odometer was not cleared by a lap split. If the odometers **were** linked, and if an odometer pulse was received at exactly the same moment that a lap split was executed, a .01 mile error in the auxiliary odometer could occur.

Version 1.8 L September 29, 1996
Corrected firmware to eliminate an occasional .01 mile error in the auxiliary odometer following a retroactive lap split (or when "undoing" a lap split) if, and only if, the odometers were linked.

Also with version “1.8 L” the 547B links the timer and clock. Previously, the timer was not linked to the clock, so following a lap split the timer was often out of "sync" with the clock. Version "1.8 L" keeps the timer and clock synchronized following a lap split. Note, however, that because the "hundredths" and "seconds" counting modes are themselves non-synchronous in nature, switching between the modes when the clock and timer are not on the same count generally results in the two becoming visually unsynchronized. You may need to manually re-synchronize the timer to the clock after switching between seconds and hundredths.

Version 1.8.1 L May 15, 1998 (version 1.8.1 L is displayed as “1.8 L”)
Corrected firmware to eliminate the necessity of a double activation of the .01 toggle when adjusting thousandths of minutes in a split timer value when a “0” or “5” was in the thousandths position.

Version 1.9 L February 6, 1999
The remote split function was changed. A remote split now executes a lap split, and does not store the various parameters in the datalog memory. Also, the displays become “live” immediately upon release of the external switch. Finally, the delay before another remote split will be recognized is now variable...it is the same as that selected for the beeper alarm.

Version 2.0 L June 22, 1999
Added ability to show a speedometer in the **TIMER** display.

Version 2.1 L September 12, 1999
Added ability to reset the main odometer upon a remote split if **Shift** depressed at the same time.

Version 2.2 L July 12, 2000
The remote input functionality was changed again. It is now possible to separately execute either a remote split or a remote lap split using individual external contacts. Depressing the **Shift** button while executing a remote lap split will execute a lap split on the main odometer, as well as the timer and auxiliary odometer

Restored automatic parameter storage in the datalog memory upon executing either a remote split or a remote lap split. (The datalog storage had been removed when version 1.9 L was introduced.)

Version 2.3 L February 12, 2001
Automatic display blanking (that normally occurs after 16 minutes of inactivity) can now be disabled by turning the rotary switch to either the **Clock Alarm** or **Timer** positions.

The speedometer is now displayed in the optional Model 326 driver's module in either the "**Pro**" or "**TSD**" operating modes. Also, a new procedure was implemented to alternate between the "**Pro**" or "**TSD**" mode.

The internal power-on routine that occurs when power is applied to the 547B was changed to eliminate a start-up problem that sometimes occurred if the user accidentally applied a short circuit to the odometer transducer inputs. Also, a front panel overall system reset procedure was implemented.

Version 2.4 L November 8, 2001
Changed the method used to select between the "**Pro**" and "**tSd**" modes.

Version 2.5 L December 18, 2001
Updated firmware code to help recover from an electrical glitch.

Version 2.6 L September 24, 2002
Changed the displayed parameter selection for the optional driver's remote module. When operating in the "**Pro**" mode, the remote module will show either the main or auxiliary odometer. When operating in the "**tSd**" mode, the remote module will show either the main odometer or a speedometer.

Version 2.7 L October 24, 2003
Allow odometer pulse rates up to 200Hz. Previously, the maximum pulse rate was 100Hz.

Version 2.8 L April 4, 2005
Changed the LED display routine to include a longer delay between transmitted digits, and to re-initialize the LED drivers 10 times per second. This eliminates random scrambled display information.

Version 2.9 L March 28, 2006
Corrected a bug introduced in version 2.4 that caused incorrect digits to change during an odometer adjustment while the SHIFT button was depressed.

Version 3.0 L June 8, 2008
Changed the "Watchdog Timer" reset routine.

Version 3.1 L March 5, 2009
Added code to watchdog reset routine to include a stack reset.

Version 3.2 L June 25, 2012
Changed watchdog reset routine to not reset visible parameters.