Congratulations on purchasing your Glove Radar®! If used and cared-for as described in this Manual, you should enjoy many hours of fun and constructive use.

The Glove Radar® is a small inexpensive Doppler radar velocity sensor which attaches to a baseball or softball glove to measure the speed of the ball just before it is caught. It is easily attached to, and removed from, virtually any ball glove. Clever design results in a small, versatile low-cost device affordable for youth and senior level teams and individual players.

The purpose of the Glove Radar® is to assist in developing players’ throwing capabilities by providing a measure of velocity improvement which results from using proper throwing techniques. By learning the proper way to condition, train, warm-up and throw, players can achieve their best accuracy and velocity performance, while reducing the risks of injury to their arm and body.

The Glove Radar® can aid any player— infielders and outfielders, as well as pitchers and catchers, throwing from any distance. Professional and high-level amateur players can use the Glove Radar® when warming-up. Young ballplayers will benefit from velocity information when tossing or training. Everyone will have fun using it.

Worn by the receiver of the ball, or by multiple tossing partners in non-game situations, the Glove Radar® "sees" through the glove and responds to the approaching ball just before it reaches the glove. Thus, unlike most “radar speed guns”, a long range capability is not required. Powered by a single cell lithium battery, the Glove Radar® transmission level is well below that of most “wireless” consumer products such as cellular and portable telephones, for example. Transmission characteristics are well within FCC requirements and prescribed safety levels. The Glove Radar® is microprocessor controlled, like a mini-computer, and indicates calculated kilometers-per-hour ball speed on a liquid crystal display.

**FEATURES**

The Glove Radar® is packaged in a rugged plastic housing assembly, sealed to protect the internal electronics from the dust, dirt and moisture encountered during normal use. However, the unit is not hermetically sealed and is not intended to be immersed in water. Two screws hold the cover in place, which can be removed to replace the internal battery. A rubber pad, molded onto the housing surface adjacent to the glove, absorbs ball impact “shock” forces.

The internal electronics are in the “sleep” mode until activated by depressing the push-button “on” switch. This action applies electrical power from the battery to the Doppler radar transmitter. The liquid crystal KM/H display will indicate the last velocity reading. Depressing the push-button again will cause the display to show a **flashing “00”**, indicating that the Glove Radar® is transmitting.

Upon receipt of a velocity signal produced by a ball about to be caught in the glove, the ball speed is calculated and shown on the display in kilometers-per-hour. Receipt of a velocity signal turns-off the radar transmitter until the “on” switch is depressed. If a velocity signal is not received within twenty seconds after depressing the push-button “on” switch, electrical power is automatically removed from the radar transmitter until the switch button is again depressed. Limiting the “on” time of the radar transmitter conserves battery power in order to maximize battery life. The last velocity reading continues to be displayed. However, after prolonged inactivity (about one minute) battery power is also removed from the display and the electronics go into the “sleep” mode.

**GLOVE ATTACHMENT REFERENCE**

Instructions for attaching the Glove Radar® to any ball glove/mitt are described later in this Manual. The prescribed attachment techniques have been developed to assure safe, reliable operation of the Glove Radar® while experiencing the significant impact forces created when catching balls thrown at very high velocities.

**USING THE GLOVE RADAR®**

1. Attach the Glove Radar® to the glove, as explained in the GLOVE ATTACHMENT instructions.

2. Press the push button “on” switch (denoted by the Glove Radar® logo) to energize the Doppler radar transmitter. The KM/H display will show the last reading.

3. Press the push button “on” switch a second time. **Two flashing zeros** indicate that the radar is transmitting. The Glove Radar® is now ready for measuring the velocity of a ball being caught.

4. After the ball is caught, observe the KM/H display to read the ball speed.

5. **Before returning the ball back to the thrower, reset the radar transmitter by depressing the push button “on” switch.** This sequence is recommended to avoid the situation where the person catching the ball will not be concentrating on the next throw, when the thrower is preparing to throw. (The push button “on” switch is large and conveniently located such that it can be found and depressed without actually looking at it.)

6. If the next throw does not occur within twenty seconds, the power-saving timer will turn off the radar transmitter. Therefore, when preparing to receive the next throw, again depress the push button “on” switch. Flashing zeros on the KM/H display indicate that the radar is transmitting and ready to record the ball speed.

7. When speed-measuring throwing activities have been concluded, and the Glove Radar® is dormant for about one minute, it will automatically switch into the “sleep” mode, which conserves battery power. The display will then be blank until the sequence in 2. above is resumed.
THROWING PREPARATIONS

Taking care of your arm and body and learning proper techniques are vital to achieving success in throwing/pitching. Consult your coach, trainer, doctor or parent for guidance. The following steps are strongly recommended:

1. Undertake a conditioning program to get your arm and body in shape for baseball/softball.
2. Before throwing, stretch and warm-up your arm and body.
3. Begin throwing at slow speeds and over short distances. Gradually extend the distance and increase the speed. The Glove Radar® can help monitor this process.
4. Be sure you know and practice the proper throwing/pitching techniques. By throwing correctly, you will be able to achieve your best velocity and hit your target, while reducing the likelihood of injuring your arm or body. As you learn and master the proper techniques, you will see improvements in your performance. The Glove Radar® will provide the measurements by which velocity performance improvements can be readily seen. This reinforcement creates player enthusiasm for seeking improvement by applying proper throwing/pitching techniques.
5. If you experience pain while throwing/pitching, or afterward, consult your doctor, trainer, coach or parent immediately. Do not ignore pain!!

SUMMARY OF PROPER THROWING TECHNIQUES

1. By learning the proper throwing techniques, players can achieve their best velocity and accuracy while reducing the risk of injury to their arm and body.
2. Learning the proper throwing techniques when young allows a player’s muscles and mind to develop the correct memory. Proper throwing can therefore become a good habit that will stay with players through out their playing lives.
3. Proper throwing starts with conditioning activities well before the ball season begins.
4. Stretching and warming-up the entire body, as well as the shoulders and arms, is necessary before actually starting to throw. “Warm-up to throw; don’t throw to warm-up,” as stated by the American Sports Medicine Institute.
5. Start throwing slowly, over a short distance. Gradually lengthen the distance and increase velocity. This warm-up period will vary with the individual, but will be typically 10--20 minutes.

6. Proper throwing techniques can be summarized as follows:
   - Plant the back foot, on the side of your throwing arm, and step with the front foot toward the receiver.
   - As you step, turn the shoulder of your gloved hand also toward the receiver.
   - Reach down and back for power, keeping your hand on top of the ball, palm facing downward.
   - Extend the arm of the gloved hand forward, for balance, generally with the elbow somewhat bent and your thumb down.
   - Keep your eyes on the target as you “come almost over the top” with the ball. Sidearm throws are sometimes necessary in game situations, but maximum velocity and accuracy can be achieved with an overhand throwing motion. Let this be your natural motion.
   - Release the ball out in front of your body after your arm passes your head.
   - Follow through with your arm and body—do not let your throwing side stay back.
   - Your arm follow-through will be a smooth arc down and across to the opposite side of your body to allow your arm to slow down after releasing the ball.
   - The entire throwing motion should be smooth, not herky-jerky.
   - Start off slowly until the entire sequence becomes natural and comfortable.

7. Practice throwing from your position on the field.
   - Work on receiving the ball coming to you on either side, high or low.
   - Get into your throwing position as you are receiving the ball.
   - To be best prepared to make a quick throw, catch the ball with both hands so that the ball can be transferred easily to your throwing hand. — Get your body moving as you receive the ball so that your step toward the receiver is a natural part of making the catch. A short hop or “crow-step” will give your body momentum to make the throw.
   - Get set when making a throw; try to avoid throwing off-balance, although occasionally it will be necessary.
   - Practice getting rid of the ball quickly—infielders to get a fast runner and outfielders to nail the runner tagging-up or stretching a hit. Imagine various game situations as you toss and practice.

8. The three things that make a good ballplayer are:
   - PRACTICE
   - PRACTICE
   - and PRACTICE!!
**SPECIFICATIONS**

The specifications of the Glove Radar® are summarized as:

- **Size:** Triangular, 6.4 cm w; 8.9 cm lg; 3 cm th
- **Weight:** 85 g
- **Display Type:** 2 1/2 Segment LCD
- **Speed Units:** Kilometers-Per-Hour (KM/H)
- **Speed Range:** 19-193 KM/H
- **Accuracy:** Within 1.6 KM/H of typical sports radar speed guns at comparable receiving positions
- **Battery:** 3 Volt, 160 mAh, Lithium CR-1/3N, DL-1/3N, 2L76BP
- **Battery Operating Life:** Approx. 30 Hours of continuous use; over 5000 transmission cycles (5000 speed measurements)
- **Operating Temperature:** 4.4-43 degrees C
- **Storage Temperature:** 0-49 degrees C
- **Related Patents:**
  - U.S.: 5,864,061; 6,079,269; 6,378,367; 6,666,089; 6,898,971 B2
  - Canada: 2,248,114
  - Japan: 3,237,857

**EMISSION AND SAFETY STANDARDS**

The Glove Radar® has been tested and certified to meet requirements established by the Euro Union, Industrie Canada, The Australian Communications Authority, and the Federal Communications Commission. The FCC ID is NVE 360. “This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that might cause undesired operation.” The Glove Radar® complies with current standards established for safety levels of human exposure to radio frequency energy, including the requirements of C95.1-1992.2 defined by the American National Standards Institute (ANSI) and the Institute of Electrical and Electronics Engineers (IEEE); and those of the Canadian Department of Health and Welfare, Safety Code 6. Use of the Glove Radar®, or any other radiating device, may create problems when in close proximity to electronic medical devices, such as heart monitoring equipment or pacemakers/ regulators. Avoid such use. RoHS and CE compliant.

**PROBLEMS/TROUBLESHOOTING**

The Glove Radar® is designed to provide trouble-free performance when used properly, and given proper care. Battery replacement is the primary corrective action that can be taken by the user. Symptoms of a low or dead Battery are: No flashing display after the radar “on” button is pushed; No display or an erratic display. Other abnormal operating characteristics can be caused by a weak Battery or loose Battery contacts. Nearby sources that are “electrically noisy”, such as fluorescent lights, electric motors, cell phones, or high power transmission lines, for example, can cause the spontaneous display of anomalous speed or tempo readings. Avoid close proximity to such sources when using the Glove Radar®.

**BATTERY REPLACEMENT**

Replace the Battery by removing the two screws which hold the Cover in place, exposing the Battery. Remove the Battery and replace it with a new one, being careful to insert the new Battery with the negative terminal toward the spring in the center of the contact nest, and the positive terminal (case) protruding outward toward the Cover which has been removed. Carefully place the Battery into the contact nest, being sure that the three upright contacts are snug against the Battery case. (Loose Battery contacts can cause intermittent electrical connection, indicated by a “188” reading on the LCD Display.) Engage the two tabs on the Cover with the slots in the Housing, and pivot the Cover down over the Battery, which is positioned in the contacts nest. Replace the two screws that hold the Cover in place. Tighten the screws snugly, but do not over-tighten. Depress the radar “on” button and perform the operating sequence described in the section of this manual entitled USING THE Glove Radar®.

Battery (3 volt lithium, N/3 size) can be purchased at many stores which sell camera supplies or similar electronic devices.
ATTACHMENT OF THE GLOVE RADAR® TO ANY GLOVE

The Glove Radar® is attached to any ball glove, large or small, baseball or softball, by a strong, weather-resistant nylon cord. The cord is inserted through the three Glove Radar® eyelets, carefully routed, secured around selected glove features, such as the leather lacing and/or the wrist strap, and tied in place. This attachment technique is compatible with the designs and dimensions of virtually any conventional ball glove or mitt commonly in use. The strong nylon cord, and attachment of the Glove Radar® on the back of the glove finger area, provide safe, reliable performance even after encountering the severe impact forces created by high velocity ball impacts (ball speeds greater than 14.5 km/h). Design of the Glove Radar®, and its attachment system, to withstand the maximum likely thrown ball velocities assures considerable margin for most users who are involved with much lower ball speeds. For small gloves (less than 25 cm patterns), and for ball velocities less than 80 km/h, the Glove Radar® may be attached behind the glove web, if necessary. However, the finger area is recommended for attachment whenever possible, and must be used for ball speeds over 80 km/h. One step-by-step attachment technique is described as follows:

1. Insert each end of the cord down through the top two eyelets and pull upward such that the cord ends are about even in length.
2. Place the Glove Radar® behind the glove fingers, about 2.5 to 7.5 cm below the glove finger tips. (See TIPS.) Pull each end of the cord up toward the glove finger tips. Wrap the cord ends around the glove lacing between the glove fingers, with one cord end around the lacing between the first and second fingers, and the other cord end around the lacing between the third and fourth glove fingers.
3. Bring both cord ends back toward, and up through, their respective eyelets.
4. Route each cord adjacent to the Glove Radar® cover and down through the bottom eyelet. Pull out the slack in the cord. Slip the two cord ends into the small rubber band and slide the band up toward the lower eyelet.
5. Wrap one cord end (the longer one, if different lengths) around a lower glove lace, or other glove feature that the cord can securely wrap around.
6. Adjust the cord for a snug fit around the Glove Radar®, removing slack. Pull and tie the two cord ends together into a tight knot, locating the knot near the bottom where the cord is attached to the glove.
7. Place the two free cord ends within the band loop, sliding the band to the proper place to encircle the cord bundle. Long loose ends can be tucked between the Glove Radar® and the glove. The Glove Radar® is now ready for use.

8. The lower cord attachment can also be made by wrapping the lace around the wrist strap of a small glove.

9. If the glove does not have fingers, such as a catcher’s mitt or first baseman’s glove, use the top edge lacing for the top two cord attachments. Slip the cord tip under the lacing and wrap the cord around the lace for a secure attachment.

10. The Glove Radar® can also be attached behind the thumb of a catcher’s mitt.

**TIP**—Be sure to keep the Glove Radar® attached snugly to the glove. If it becomes loose, untie the knot, pull out the cord slack, and re-tie the knot.

**VARIABLES OF BALL SPEED RADAR MEASUREMENTS**

**Ball Speed Slow-Down**

When a ball leaves the thrower’s hand, it is travelling at its’ maximum velocity. Air resistance (drag) causes the ball to decrease in velocity as it travels away from the thrower. The rate at which the ball slows-down is dependent upon many factors. Robert K. Adair, Sterling Professor of Physics, Yale University, describes in great detail the flight of a thrown (and batted) baseball in his outstanding book, “The Physics of Baseball”*. Written for the layperson, but appropriately supported by theory, the book summarizes the Professor’s conclusion (page 33) that a typical (Major League) fastball slows-down at a rate of about 1.5 kilometers-per-hour for every 2 meters of travel. Thus, a ball thrown by a pitcher will reach home plate, 20 meters away, at a speed about 14 kilometers-per-hour slower than when it left the pitcher’s hand. Many variables which affect the air resistance “drag” on the ball, and associated air turbulence, enter into this conclusion, including air density, temperature, altitude, barometric pressure, wind velocity and direction, etc.; as well as the ball cross-section area, surface roughness, stitch height and stitch orientation relative to ball spin axis; and ball velocity. However, for the purposes of this discussion, and the applicability to using ball speed measuring devices, it is sufficient to apply the Professor’s generalization that a ball slows-down at a rate of 1.5 km/h for each 2 meters of travel from the thrower’s hand. When asked the specific question about the deceleration of a softball, Professor Adair offered the opinion, interpreted by this writer, that the increased drag, relative to a baseball, would be offset by the momentum of the heavier softball, resulting in approximately the same rate of slow-down as the baseball.

**Radar Speed Variables**

Several different “Radar Speed Guns” are used to measure the speed of a thrown ball. Some radars, referred to as “fast guns”, measure the speed of the ball within a few meters after it leaves the hand of the thrower or pitcher. Since the speed at “release” is the pitcher’s maximum, it is often the speed that most players use as a reference, since everyone is generally interested in quoting their “fastest” speed. Although these “fast guns” are excellent instruments, they can occasionally present an erroneous speed indication due to the pitcher’s motion, leg kick, arm swing, or other false target anomalies often referred to as “ghost” readings for all radars.
It is of interest to note that the ball speed measured by any radar is that of the ball velocity vector directly toward the radar. If the radar is not aligned with the actual flight path of the ball from the thrower to the receiver, the radar speed reading will be reduced by the cosine of the angle by which the radar is displaced from the ball travel path. This difference is insignificant when the radar is located essentially in-line, or near alignment, with the ball flight path. However, if any radar is positioned on the ground, or on a tripod, such that it is appreciably away from the ball flight path, speed measurement inaccuracies can occur.

Glove Radar® Variables

The broad antenna pattern and unique signal processing of the Glove Radar® facilitate speed measurements of virtually any ball which is caught in the glove. However, if the glove is held such that the Glove Radar® is facing downward, looking toward the ground without facing at least somewhat in the direction of the ball, some balls can be “missed” by the radar. No radar gun can see the ball when looking away from the ball’s flight path. Since the Glove Radar® is measuring and calculating the speed as the ball is approaching the glove, the flight path vector created by any “break” on the ball is inherent in the speed measurement. This feature is unique to the Glove Radar®, unlike that of radar guns reading the ball velocity at a greater distance from the catcher, before the break.

Doppler radar speed measurements indicate the relative closing, or departure, velocity between the object being illuminated by the radar and the radar itself. If, in the act of catching the ball, the glove is moved vigorously toward the ball, a slightly higher speed reading can occur. If the receiver “gives” with the ball, moving the glove away as the ball is caught, then a slightly lower velocity can be indicated. The normal movements in catching most balls are not a serious factor in measurement accuracy, but lunging for wild throws, and scooping-up low throws near or hitting the ground can produce anomalous speed readings. As you use your Glove Radar®, you will become acquainted with its’ “personality”, recognizing good readings and ignoring anomalies. Don’t be mislead by an unusually high reading as an indication of sudden improvement, or a low reading as a loss of strength or technique. Averaging several readings, and/or discarding the high and low extremes is a good technique for assessing progress.
Measuring speed improvements resulting from applying proper throwing techniques is an important aspect of developing position players as well as pitchers and catchers. However, experienced pitchers, for example, can also profit from the data that can be obtained by comparing the relative speed of their fastball to that of their change-up, breaking ball, knuckler, riser, split finger, etc. or other pitches that they throw. The optimum amount for a pitcher to “take off” their fast ball is different for each pitcher, depending on their fastball speed, their motion and delivery technique, and other variables unique to them. Glove Radar® can help quantify the relative target speeds for each pitch and provide real time feedback during practice and warm-up.

The Glove Radar® is an excellent training device to provide RELATIVE SPEED READINGS by which throwing improvement and progress can be measured. It is affordable for parents, coaches and players of all ages.

REMEMBER, BASEBALL AND SOFTBALL ARE GAMES TO BE ENJOYED

HAVE FUN WITH YOUR GLOVE RADAR®!!

AND NEVER THROW HARD WITHOUT PROPER WARM-UP AND PREPARATION!!


WARRANTY & SERVICE

What is covered?—This limited warranty covers all defects in workmanship or materials in your Glove Radar® that is purchased either directly from Sports Sensors, Inc. or from an authorized reseller. This warranty applies only to defects that occur while your Glove Radar® is being used in the normal manner described herein. This warranty does not apply to any defects that are caused by misuse, abuse, neglect or improper storage, handling or maintenance, or any modifications or repairs performed by anyone other than Sports Sensors, Inc. Except as expressly stated in this warranty, Sports Sensors Inc. makes no implied warranties, whether of merchantability or fitness for a particular purpose or use or otherwise with respect to Glove Radar®, for more than 180 days from the date of purchase.

How long is the coverage period?—This limited warranty runs for 180 days from the date that you buy the Glove Radar®.

What will Sports Sensors Inc. do?—If your Glove Radar® fails during the warranty period and you return it before the end of this period, Sports Sensors Inc. will, at its discretion, and at no additional charge, repair or replace the defective unit. In no event shall Sports Sensors Inc. be liable for, or pay, any indirect, special, incidental or consequential damages in connection with your Glove Radar®.

How can you get service?—You must send the Glove Radar®, appropriately protected and packaged, shipping charges prepaid, to Sports Sensors, Inc., c/o Electronics Development Corp., 9055F Guilford Rd., Columbia, MD 21046, USA. Evidence of date and place of purchase, such as a copy of your sales receipt or other “proof of purchase”, must accompany the returned unit. Please describe the nature of the problem or reason for return.

How does state law apply?—This warranty gives you specific legal rights which vary from state to state. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty is governed by the State of Ohio, USA.

For technical support or service information, call, toll-free: (800) 394-6650. For ordering information, or other non-technical questions, call toll-free: (888)542-9246. Visit our Web Site for the latest information about the Glove Radar® or other new products at: www.sportssensors.com

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