SpeedTrak
Radar System

Operator's Manual

Decatur electronics

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INTRODUCTION

Thank you for purchasing the Decatur Electronics, Inc. SpeedTrak radar system! We believe you will find this radar one of the most "user friendly" and highest performing radar system that you have ever experienced. The New Technology incorporated into the SpeedTrak radar offers unparalleled versatility and up-grade ability allowing you to add features in the future easily and inexpensively.

We have been instrumental in providing speed radar to the Law Enforcement Community for 50 years. We are dedicated not only to continue to do so, but also by providing such equipment assisting you in your attempt to save lives and reduce wrecks. We are also dedicated to serving our Customers by providing friendly, knowledgeable people to support our products after the purchase. If you have any questions or problems now or in the future in regard to your purchase please do not hesitate to contact us.

Thank you again and we wish you the greatest success with your New SpeedTrak radar system and in your Traffic Speed Enforcement efforts.

(SPEED TRAK Display)

(SPEED TRAK Computer Controller Unit)

(SPEED TRAK Remote Control)

INSPECTION OF SYSTEM

When you receive your New SpeedTrak Radar System, please take a moment to carefully inspect the system and make sure that nothing was damaged in shipment and that you received everything that you ordered. We make every effort possible to fill and ship your order correctly and to pack it carefully so it will not be damaged in shipment. However if there is a problem, please call us immediately on our Toll Free Telephone Number 1-800-423-5583. We assure you that your problem will be resolved quickly by one of our friendly Associates or Sales Representatives.

SYSTEM COMPONENTS

The SpeedTrak Radar System consists of the following components:

Computer Controller Unit
The Computer Controller Unit contains the microprocessor and is designed with only one small printed circuit board utilizing surface mount technology. This is the "heart" of the system. The Display may be attached to this unit or separated and be operated remotely with an interconnecting cable. To operate the SpeedTrak radar the power cable, remote hand controller and at least one antenna must be connected to the proper labeled ports located on the rear of this unit. The rear ports consist of Power, Remote, Serial, Front, and Rear. The Serial port (DB9 connector) is for interfacing with optional equipment.

Display Unit
The Display unit may be attached to the Computer Controller Unit or separated and mounted in a different location. No tools are required to separate the two units. Simply pull firmly on the display while holding the Computer Controller unit. To re-attach simply place the two units together and push until they snap. If using the Display separated, attach an interconnecting cable to the Display and Computer Controller units by connecting into the DB9 connectors located on each unit. The Power Button is located on the front of the Display module to turn the unit On/Off.

Remote Hand Controller
All the controls for the SpeedTrak radar are located on the Remote Hand Controller except for the Power Button. The unit is backlit at all times and has various keys color-coded for easy identification. A cable is provided that plugs into the back of the Computer Controller unit in the port labeled "REMOTE" and the other end plugs into the top of the Remote Hand Controller. The Remote Hand Controller has the following functions: Front and Rear Antenna, Transmit/Hold, Lock/Release, Same/Opposite, Fast/Slow, Moving/Stationary, Town/Highway, Volume/Squelch, Range, Test/Menu and Dimmer/Patrol Speed Blank. These functions are detailed further in the Remote Hand Controller section of this manual. The audio speaker is also located in the remote to eliminate any possible feedback problems and allow for a larger speaker to give clearer and louder audio.

Antenna
Single or Dual antenna operation may be chosen by the Operator and there are three antenna choices that can operate with the Computer Controller unit. The unit may be ordered with either Ka Band antenna, Selective Directional K-Band antenna, normal K-Band antenna or any combination of the three antennas. The Computer Controller unit has the ability to recognize which of the antenna are plugged into it and display the proper speeds and calculations. At least one antenna has to be connected to either the front or rear antenna port for the unit to operate beyond power up. If no antenna is connected the word "Ant?" will appear in the menu window and the "FRONT"and "REAR" icons on the front of the display will toggle back and forth. Antenna operation is explained further in a later section of the manual.

Power Cable
The following cables are furnished and are necessary to operate the SpeedTrak radar system. Power cable, with a latching connector on one end plugs into the Computer Controller unit port labeled "POWER" and a fused cigar plug with power light on the other end plugs into power cigar recepticle on the vehicle. The power cord may be ordered with other types of plugs or connectors such as ¼" Phono Plug to meet individual requirements.

Antenna Cable
One or two antenna cables depending upon whether one or two antennas were ordered are provided. Standard lengths available are 4' ft., 8' ft., 12' ft. and 18' ft. Other lengths may be special ordered. The antenna cable has latching connectors on both ends and are different so they can only be plugged into the proper port, either "FRONT" or "REAR" located on the rear of the Computer Controller unit.

Hand Remote Control Cable
The Hand Remote Control unit has a connector port located on the top of the unit. A cable is provided with a latching connector to plug into this port and the other end into the port located on the rear of the Computer Controller unit labeled "REMOTE".

Sunshade
A sunshade is included which attaches to the Display unit by two small thumb knobs included. This is adjustable to user needs and helps shade the displays from the sun and also reduces any nighttime glare on the windshield.

Tuning Forks
Two tuning forks are provided with each frequency of antenna. If one or two of the same frequency antenna are ordered then two tuning forks are provided. If two different frequency of antenna are ordered then four tuning forks will be provided, two of each frequency. Each fork comes with a Certificate of Accuracy.

Mounting Brackets
Each antenna ordered comes with a mounting bracket of choice and a three- arm knob for amounting the antenna to the bracket. A bale bracket is available for attaching the Computer Controller unit or Display unit to radio trees, etc. Also available is our Secure Mounting Bracket, which allows for the antenna, display and/or Computer Controller unit to all be attached together on the dash and fastened into the dash without drilling any holes.

Serial Communications
A serial port on the rear of the Computer Controller unit allows for the radar to be interfaced with most in-car video systems, computers, external signs, etc. A separate section in the manual addresses the data protocol.

INSTALLATION AND MOUNTING

The SpeedTrak radar system is so small and light that it allows easy installation in almost any location in the vehicle and in almost any type of vehicle. In selecting a position to mount the unit there are a few things that need to be considered.

1. Do not install any part of the radar, cables, brackets, etc. in the air bag deployment zones of your vehicle. Equipment mounted in 1994 or later vehicles may interfere with the operation of the passenger side airbags. We recommend that you refer to the vehicle's owner manual to determine the safe areas for mounting equipment such as radar.

2. Do not mount any part of the radar system in areas that might block or interfere with the proper vision of the driver's view of the roadway out the front, rear or side of the vehicle.

3. Make sure that all components of the radar are securely fastened to the mounting brackets and that the mounting brackets are securely fastened down.
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4. Check the system for interference sources within the vehicle and make sure it operates correctly in the position that you are going to mount it.

5. Make sure that you have the proper length of cables so they can be "dressed," stored in a safe location, will not bother the entry/exit of the vehicle, will not get closed in the door or window and will reach the vehicle's power source.

Mounting the Computer Controller Unit

If the Computer Controller unit is going to be attached to the Display unit then only one location is needed. With the New Advanced Technology employed in the SpeedTrak radar system it can withstand extreme heat conditions without having any effect upon the proper operation, harming or shortening the life of the components or having to be "shut down" and cooled off before operating. This allows the unit to be mounted on the dash of the vehicle. The unit is so small and low profile that it should not interfere with the driver's vision when mounted directly in front of the driver. With the Display and the Computer Controller mounted in this manner it allows the driver to constantly monitor speed-readings in the radar without taking his/her eyes off the road. Securing it to the dash can be accomplished by using Velcro, double sided tape, mounting bale or screwed into the dash, etc. If Velcro or other sticky sided material is used, the area of the dash where it is going to be mounted needs to be cleaned of any type of substances used to clean or polish the dash.

If the Computer Controller is going to be separated from the Display unit then it can be mounted in the radio tree using the threaded inserts, or bale bracket. Other areas of mounting might include under the front seat, in the glove compartment, under the dash or in the trunk.

Once a mounting decision has been made, then the cables should be connected to the rear of the Computer Controller Unit. Antenna cables in either the front or rear antenna ports, the Remote Hand Control cable in the Remote port, the Power Cable in the Power port.

Mounting the Detachable Display

If the display is separated from the Computer Controller unit, then it can be mounted as described above on the dash in front of the driver, in the console, in the radio tree, mounted to the head liner or other places of individual preference. Simply holding onto the Display and Computer Controller unit separately and pulling apart can separate the Display. An interconnecting cable is then plugged into each DB9 connector located on each unit. The cable should be routed to the Computer Controller unit and placed out of the way of the driver. The Sunshade can be mounted onto the Display unit if desired with the included knobs.

Antenna Mounting

Various mounts are provided with the antenna and individual preferences will dictate where the antenna is mounted. One of the more popular choices for mounting the front antenna is to mount it on the dash on the driver's side, left of the steering wheel. This allows for out-of-the-way placement and in most cases does not interfere with the driver's vision. It also places the antenna looking straight down the roadway toward on coming traffic. This location also seems to be less prone to fan noise. Chose one of the brackets that allow for mounting in this location. Other locations include gluing to the windshield, mounting on the head liner next to the rear view mirror and in some instances in the middle of the dash. Once a location is determined the antenna should be mounted parallel to the ground and aimed straight down the roadway. The antenna cable should be routed to the Computer Controller unit so it does not interfere with the driver.

Rear antenna mounting can be accomplished by selecting an antenna mount that will Velcro or can be screwed into the rear deck. We recommend the antenna be mounted on the driver's side in the rear and aimed straight down the roadway. Other brackets are available that allow gluing to the rear window, attaching to the head liner, or attaching to the seat-belt bolt. Place the antenna cable behind the rear seat, under the rear floorboard or down the side of the rear seat, along the floorboard under the flash plate and routed to the Computer Controller Unit. The antenna should be parallel to the ground and aimed straight down the road.

Installation Instructions
To Detach Display

To Install Cable:

1. Grasp the Computer Controller with one hand and the Display with the other and pull units apart.
2. Install the standoffs into the Display and the Computer Controller.
3. Insert the female end of the cable to the connector on the front of the Computer Controller unit and tighten thumb screws.
4. Insert the male end of the cable to the connector on the back of the Display and tighten thumb screws.

To Remove Cable:

1. Loosen both ends of cable from the Display and Computer Controller and remove cable.
2. Remove standoffs from the Display and Computer Controller units.
3. Position the Display and Computer Controller so the connectors line up, then push units together until tight. There should not be any gap between the units.
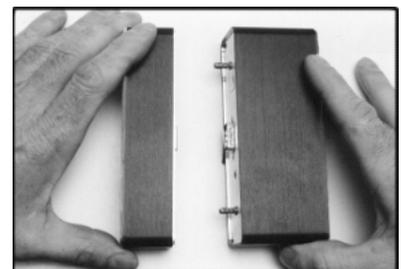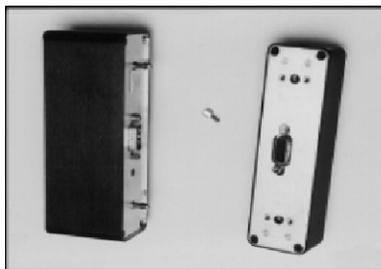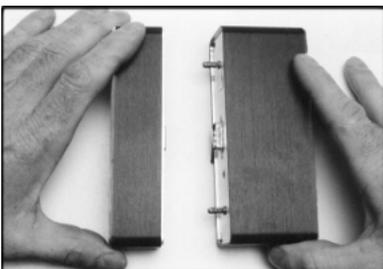
OPERATIONAL THEORY

Doppler Principle

The SpeedTrak radar system operates on the Doppler frequency shift principle to measure the speed of moving objects. In the simplest of terms, this theory states that a radar signal reflected from a moving object will experience a frequency shift that is proportional to the speed of the target relative to the radar. The Computer in the radar is then able to process the reflected signal and convert it into speed in miles per hour or kilometers. All known present day radar for speed measurement utilizes the Doppler Principle and it is well recognized and accepted in the courts as a proven method of determining speed.

General Theory of Operation

The SpeedTrak Radar System transmits a radio frequency on either K band or Ka band in compliance with the Federal Communications Commission (FCC) regulations and has a Grant of Type Acceptance. In all modes of operation, stationary, moving or directional, the unit operates on the Doppler Principle. In the stationary mode of operation the radar transmits a signal, if the target is moving a signal is returned, the radar calculates the difference between the sending and receiving signal then converts this signal into a speed.

In the moving mode of operation a portion of the sending signal strikes the roadway in front of the Patrol vehicle or some other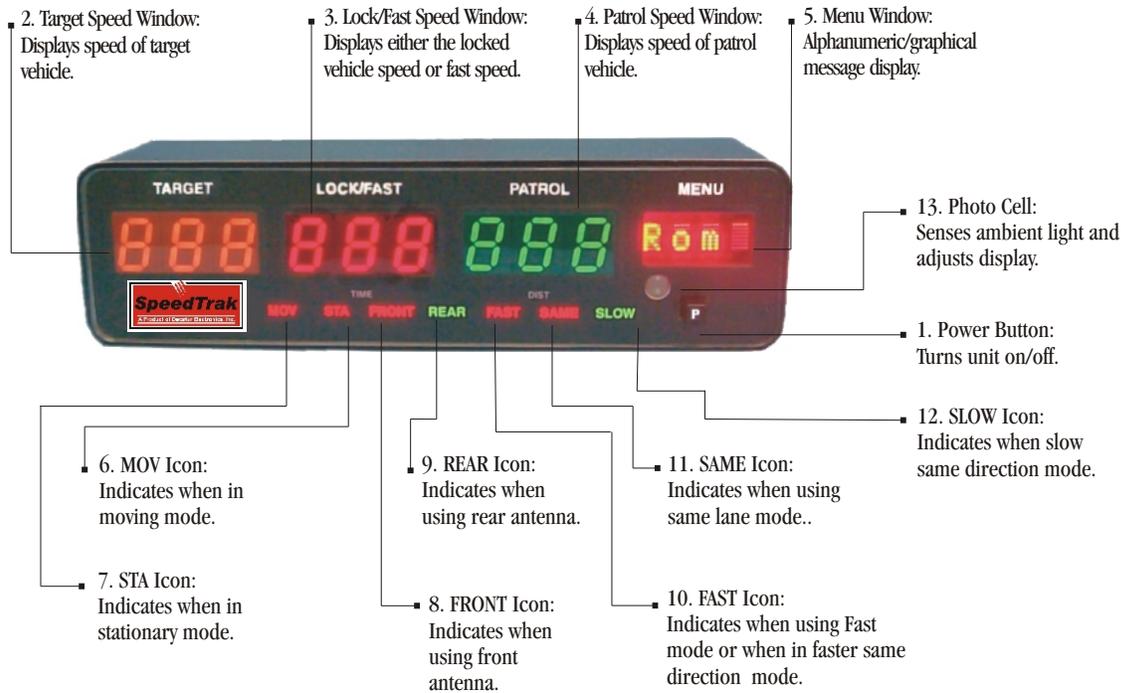 object reflects this signal back to the radar and is processed as the Patrol speed. A portion of the transmitted signal strikes an oncoming vehicle and is returned to the radar. Because the oncoming vehicle and the patrol vehicle are converging the total speed or closing speed of both vehicles is processed by the radar and the patrol speed is then subtracted from the total combined speed and displayed as the Target Speed. The Patrol speed is displayed in the Patrol speed window. The formula for computing moving vehicle speeds in the opposite direction, oncoming traffic is TARGET SPEED = CLOSING SPEED - PATROL SPEED. The formula for computing moving vehicle speeds in the opposite direction, going away from the patrol vehicle is TS = SEPARATION SPEED - PATROL SPEED. In the same direction moving mode of operation, the patrol speed Doppler and the "difference" Doppler signals are received and processed by the computer. The difference Doppler is the speed difference between the patrol speed and the speed of the vehicle traveling in the same direction. The radar will display the Patrol vehicle speed and then either add or subtract the "difference" speed to the patrol vehicle's speed to arrive at the target speed. The formula for computing moving vehicle speeds traveling faster than the Patrol vehicle in the same direction is TARGET SPEED = PATROL SPEED + SEPARATION SPEED. For computing vehicle speed traveling slower than the Patrol vehicle in the same direction the formula is TARGET SPEED = PATROL SPEED - SEPARATION SPEED.

Directional Stationary Operation

The SpeedTrak when ordered with our K Band Selective Directional Antenna gives the operator the advantage of selecting which direction of traffic to monitor excluding the other traffic. The Operator may chose to monitor traffic only going away from the radar or only coming towards the radar. The radar will display only speeds of vehicles going or coming depending on mode chosen excluding traffic going in the other direction. The Operator may choose to continue to monitor traffic in both directions, like standard radar operates. In this mode, with the Selective Directional Antenna attached, the radar will display the speed of the vehicle plus indicating to the operator which direction the vehicle is traveling by displaying a "T"(Toward) or "A"(Away) in the menu window.

Fast Speed Tracking Operation

The new technology employed in the SpeedTrak radar system allows the unit to process more than one signal at the same time, thus we can monitor, process and display both the strongest target and the next strongest target that is faster than the strongest target. This feature operates in both the moving and stationary mode of operation and is user selectable. This feature allows the operator to track and monitor small vehicles passing larger ones that could not in the past be monitored. By only monitoring the next strongest target that is faster than the strongest target rather than just the "fastest" target, it better assures the operator of proper target identification. This eliminates the problem of looking past closer vehicles only to find the very fastest vehicle which can be very difficult to identify and track.

2. Target Speed Window: Displays speed of target vehicle.

3. Lock/Fast Speed Window: Displays either the locked vehicle speed or fast speed.

4. Patrol Speed Window: Displays speed of patrol vehicle.

5. Menu Window: Alphanumeric/graphical message display.

13. Photo Cell: Senses ambient light and adjusts display.

1. Power Button: Turns unit on/off.

12. SLOW Icon: Indicates when slow same direction mode.

6. MOV Icon: Indicates when in moving mode.

9. REAR Icon: Indicates when using rear antenna.

11. SAME Icon: Indicates when using same lane mode..

10. FAST Icon: Indicates when using Fast mode or when in faster same direction mode.

7. STA Icon: Indicates when in stationary mode.

8. FRONT Icon: Indicates when using front antenna.

SYSTEM OPERATION AND DESCRIPTION

Display

1. **Power Button**: The power button, button marked with a "P" turns the unit ON/OFF. Push once for Power On and push again and hold for three seconds to turn unit Off. When unit is powered off it defaults to the last settings.

2. **Target Speed:** Displays the target speeds in both moving and stationary modes of operation. In the Stopwatch mode the calculated target speed is displayed. Amber colored LED's and window for easy recognition.

3. **Lock/Fast:** This is a triple purpose display and displays in either the moving or stationary mode of operation the speed that is "locked" when the lock button is depressed. It also displays the speed of the next strongest target that is faster than the strongest target when the "Fast" mode has been activated. In the Stopwatch mode this displays the elapsed time in seconds and tenths of seconds. Red colored LED's and window for easy recognition.

5. **Patrol Speed:** This is a dual-purpose window that displays the speed of the Patrol Vehicle when in the moving mode of operation. In the Stopwatch mode the display indicates the distance to be used for speed calculations. Green colored LED's and window for easy recognition.

6. **Menu:** Displays a four-digit alphanumeric/graphic message to aid the operator. Red LED's for easy recognition.

7. **MOV Icon:** Indicates when the unit is in the moving mode. Red LED.

8. **STA Icon:** Indicates when the unit is in the stationary mode. Red LED.

9. **FRONT Icon:** Indicates when the front antenna is selected. Red LED.

10. **REAR Icon:** Indicates when the rear antenna is selected. Green LED.

11. **FAST Icon:** Indicates when the unit is in Fast Opposite Moving, Fast Stationary or Fast Same Direction. Red LED.

12. **SAME Icon:** Indicates when the unit is in the Same moving mode. Red LED.

13. **SLOW Icon:** Indicates when the unit is in the Slow Same moving mode. Green LED.

14. **Photocell:** This allows for automatic dimming of LED's.

1. Power: latching connector for Power Cable.

5. Serial: latching connector for attaching RS232 cable.

4. Rear: latching connector for Rear Antenna Cable.

2. Remote: latching connector for Hand Remote Cable.

3. Front: latching connector for Front Antenna Cable.
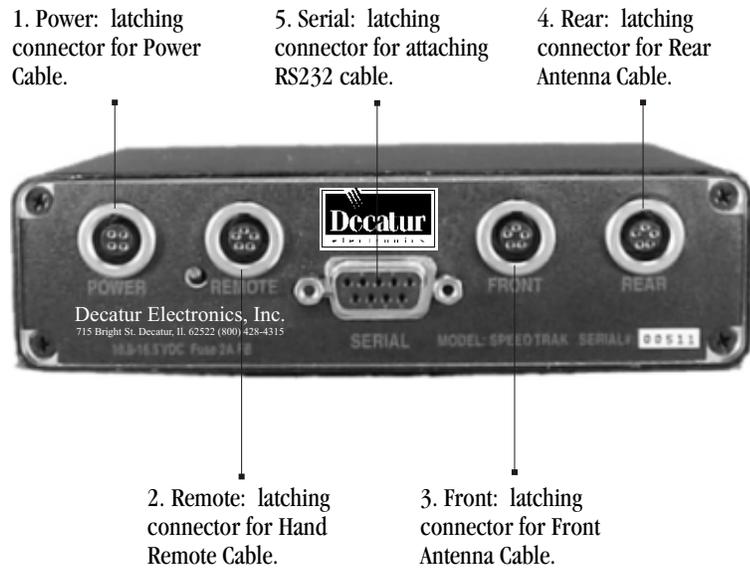
Computer Controller

The Computer Controller unit can be attached or separated from the display unit.

Rear Panel: Consists of five connectors and identification/serial number information.

   1. **Power:** Latching Connector For Power Cable

   2. **Remote:** Latching Connector For Hand Remote Cable

   3. **Front:** Latching Connector For Front Antenna Cable

   4. **Rear:** Latching Connector For Rear Antenna Cable

   5. **Serial:** Latching Connector For Attaching Rs232 Communications Cable

Front Panel: One DB9 connector for interfacing cable between Display and Computer Controller unit.

1. FRONT Antenna:
Activates front antenna, front antenna
icon will light. Alternate mode scrolls
forward through menu.

2. REAR Antenna:
Activates rear antenna, rear antenna
icon will light. Alternate mode scrolls
backward through menu.

5. SAME/OPP:
Alternates between same direction
moving mode and opposite
direction moving mode.

7. MOV/STA:
Toggles between moving
opposite, stationary and same
direction modes.

9. VOL/SQL:
Sets audio volume from 0-8, with 0
being off and 8 the loudest setting.

11. TEST/MENU:
Activates the internal tests. Hold down
3 seconds to enter the menu mode.

3. XMIT/HOLD:
Activates/deactivates the
transmitted signal of the
selected antenna.

4. LOCK/RELEASE:
Locks target reading into target window
while continuing to monitor target and
patrol speeds.

6. FAST/SLO:
Toggles fast mode on/off in opposite mode.
Toggles between fast/slow mode in same
direction.

8. TWN/HWY:
Town - sets patrol low speed to 5mph.
Highway - sets patrol low speed to 20mph.

10. RANGE:
Sets the range sensitivity from 0-5, with 0 the
lowest setting and 5 the farthest range setting.

12. DIM/PB:
Adjusts the brightness control of the
display. PB - patrol speed blanking
clears locked patrol speed.

Hand Remote Control & Functions

The Hand Remote Control unit is 100% fully back lit with color-coded key buttons. The
Remote can be programmed so button depressions "beep" or this feature can be turned off. If this
feature is not turned off then each time a button is depressed a "beep" will sound to alert the
operator that an action has taken place.

1. **FRONT:** Upward shaped triangle with positive dimple to activate front antenna.
   "FRONT" icon lights on display when activated. When in Menu mode, scrolls up to
   next choice.

2. **REAR:** Downward shaped triangle with black dot to activate rear antenna. "REAR"
   icon lights on display when activated. When in Menu mode, scrolls down to next choice.

3. **XMIT/HOLD:** Activates whatever antenna is selected to transmit. When transmitting
   "XMIT" icon will light on front of display. "HOLD" is displayed in Menu window
   when in the hold mode. When in Menu mode, scrolls to next option and locks in
   setting.

4. **LOCK/RELEASE:** Locks Target speed into Lock window Display. To lock the target
   speed, simply press the "lock" button and the current Target speed will be displayed in
   the "Lock" window and "LOCK" will be displayed in the menu window and toggle
   between "lock" and the mode of operation until released. To release the lock speed,
   simply press the "release" button. The locked speed will automatically release and
   disappear after it has been locked for 10 minutes. In moving mode when a target is
   locked the Patrol speed is stored in memory and can be recalled by using the DIM/PB

MENU

HOLD

MENU

LOCK

13

button on the remote (see DIM/PB). Note: Any mode change will release the locked speed reading.

5. **SAME/OPP:** Alternates between Same Direction and Opposite Direction moving mode. Same icon on display will light when in same mode. Two arrows will appear in the menu window when in the same moving mode, both pointing up indicating that both the Target and Patrol vehicle is traveling in the same direction. The "same" icon on the front of the display will light along with either the "FAST" or "SLOW" icon indicating which mode was chosen. When in the opposite moving mode two arrows will appear in the menu window, one pointing upward and one pointing downward, indicating that the patrol and target vehicle are moving in opposite directions. When the unit is in the Stationary mode, this key is non-active as radar must be in the moving mode for these functions to operate. By depressing this button for 3 seconds the unit is activated into the Stopwatch mode and StpW will be displayed in the menu window on the display unit. To exit the Stopwatch mode, press again.

6. **FAST/SLO:** When in the Opposite Moving mode and the Stationary mode this places the unit in the Fast Trak mode. The "FAST" icon will light on the display when in this mode. When in the Same Moving mode the "FAST" "SAME" icons will light on the display or the "SAME" "SLOW" icons to match the mode selected. When in the Stopwatch mode this button is used to set the 1's digit in yards.

7. **MOV/STA:** This button toggles between moving mode and stationary mode. If in Moving mode the "MOV" icon will light on the display unit and arrows will be indicated in the menu window. When in the normal Stationary Mode the "STA" icon will light, one arrow pointing downward and one arrow pointing upward plus one solid line indicating the patrol vehicle will be displayed in the menu window. When in the Stopwatch mode this button is used to set the 10's digit in yards. ***Mov/Sta:** *If the Selective Directional antenna is connected then this key has two additional functions. In the normal Stationary mode the Sta icon will light plus two arrows, one pointing upward and one downward, plus a solid line, displayed in the menu window, once a reading is obtained a "T" or "A" will also be displayed in the menu window indicating the direction the vehicle was traveling. Depressing the button again will place the unit in the Directional only mode whereas the radar will only monitor vehicles coming towards it. The menu window will display one arrow pointing upward or downward, depending on which antenna is being used, and one solid line indicating the patrol vehicle and a "T" will appear indicating "Toward". Depressing the button again and the radar will only detect vehicles traveling away from the radar. One arrow pointing upward or downward depending on which antenna is being used, a solid line will appear and an "A" indicating "Away".

8. **TWN/HWY:** This button is used to select the starting acquisition speed for the Patrol Vehicle. If the Town mode is selected then the Patrol speed is displayed once the Patrol speed is 5 mph or higher. "TWN" appears in the menu window when the key is first depressed and then will disappear. If Highway mode is selected then the Patrol speed has to reach 20 mph or higher before the radar will operate and a Patrol speed will be displayed. "HWY" appears in the Menu window when first depressed then disappears. When in the Stopwatch mode this button is used to set the l00's digit in yards.

9. **VOL/SQL:** This adjusts the Doppler Audio. Depressing the button will allow the unit to adjust the audio to the individual's preference. Each level will be displayed in the menu display Vol 0 for no audio through Vol 8 for the highest audio. By holding this button

MENU

TWN

MENU

HWY

MENU

VOL0

MENU

VOL8

MENU

Mute

MENU

SQL

MENU

UNSQ

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for 2-3 seconds it will place the Doppler audio in a "Mute" mode. If in mute a short press of the key will clear mute. Depressing the button and holding for 5 seconds will place the unit in the un-squelched audio position and UNSQ will appear and then disappear in the menu display. Depressing this button and holding until SQL appears in the menu window places the unit back in the Squelch mode, which allows audio to be heard only when there is a target present and being monitored.

10. **RANGE:** This adjusts the range sensitivity of the antenna. The operator can select between 0 and 5 adjustments. Zero (0) being no range and five (5) being the longest range or most sensitivity. "Rng" and the number selected will be displayed in the menu window when set and then disappear. NOTE: IF THE RADAR WILL NOT DETECT VEHICLES MAKE SURE RANGE SETTING IS NOT ON ZERO.

11. **TST/MENU:** When this button is depressed once it activates the internal test sequence, which is described in another section. It is necessary that at least one antenna be connected in order for the internal test to be preformed. By depressing and holding for 3 seconds, the operator enters the menu mode. The menu mode allows for individual preferences to be programmed into the unit. The menu selections are described in a later section.

12. **DIM/PB:** This button allows the operator to manually chose the brightness of the LED's on the display unit or put the unit in automatic dimming and allow the photocell to automatically brighten and/or dim depending upon the ambient light conditions inside the vehicle. There are 1-6 manual brightness selections and they are displayed in the menu window as the button is being depressed. "Auto" appears after the last numeral and this is how the unit is placed in auto dimming. PB- Patrol Speed Blanking: Pressing this button will clear a locked displayed Patrol Speed. The Patrol speed at the time of lock is stored in memory, if the operator wants to recall the Patrol speed, simply put the unit in Hold and press this button. The Patrol speed at the time of lock will be displayed in the Patrol Speed Window. Pressing the DIM/PB button again will re-blank the locked Patrol Speed. Once the unit is placed back in XMIT, the locked Patrol Speed will be automatically cleared out of memory.

MENU

RGN0

MENU

RGN5

MENU
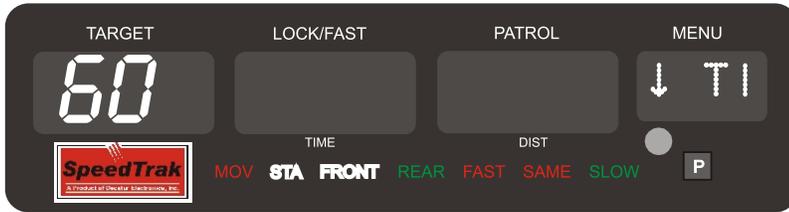
MENU

MENU

AUTO

MENU

Bri1

MENU

Bri6

15

OPERATING THE SpeedTrak RADAR SYSTEM

The SpeedTrak Radar System is one of the newest, most versatile radar offered to Law Enforcement Agencies and its user-friendly design makes it easy for the operator to understand and quickly learn to operate. The SpeedTrak Radar is unique because of new technology the system can operate any of three different types of antennas automatically by simply connecting the antenna to the controller unit. Depending on the package ordered, the radar system offers the following possible modes of operation.
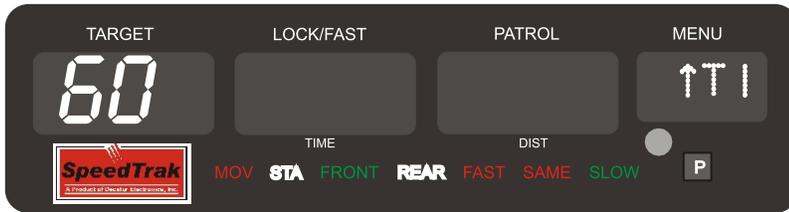
1. Stationary Front Antenna, without Direction Sensing.
2. Stationary Rear Antenna, without Direction Sensing.
3. Moving Opposite Direction Front Antenna.
4. Moving Opposite Direction Rear Antenna.
5. Moving Same Direction Front Antenna.
6. Moving Same Direction Rear Antenna.
7. Stopwatch Mode.
8. Stationary Front Antenna, with dual Direction Sensing.
9. Stationary Rear Antenna, with dual Direction Sensing.
10. Stationary Front Antenna, with "Towards" only Direction Sensing.
11. Stationary Rear Antenna, with "Towards" only Direction Sensing.
12. Stationary Front Antenna, with "Away" only Direction Sensing.
13. Stationary Rear Antenna, with "Away" only Direction Sensing

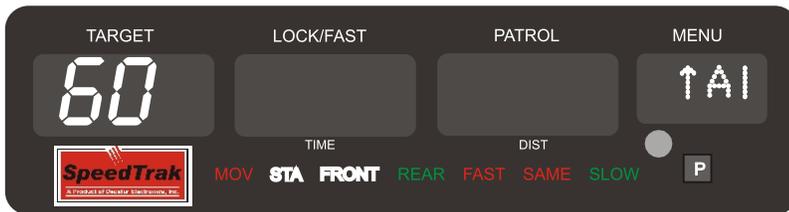The SpeedTrak Radar System comes standard with the following features:

1. Stationary and Moving Modes
2. Single or Dual Antenna Operation
3. Same Direction Operation in the moving mode (This feature may be disengaged upon request).
4. Fast Speed Tracking (This feature may be disengaged upon request).
5. Stopwatch Mode (This feature may be disengaged upon request)
6. Detachable Display from the Computer Controller Unit
7. Hand Remote Controller with color-coded, 100 % backlit buttons and removable cable.
8. Any combination of the following antenna configurations. Antenna may be ordered independently and added at a later date without any modifications to the computer controller unit such as software updates, EPROM exchanges, hardware changes, etc. The Computer Controller automatically recognizes the frequency and type of antenna plugged into it and makes the proper adjustments and calculations.

   - One Ka band Antenna
   - Two Ka band Antenna
   - One K band Antenna
   - Two K band Antenna
   - One K band Selective Directional Antenna
   - Two K band Selective Directional Antenna
   - One Ka band Antenna and one K band Antenna
   - One Ka band Antenna and one K band Selective Directional Antenna
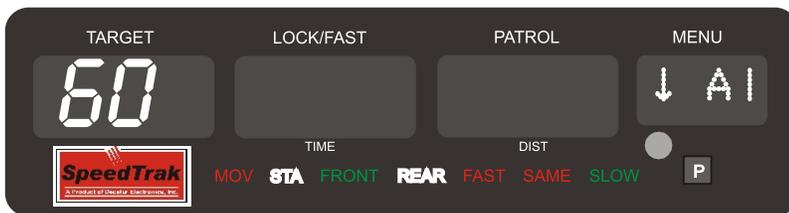   - One K band Selective Directional Antenna and one K band Antenna

TARGET	LOCK/FAST	PATROL	MENU
60			↓ T¦
	TIME	DIST	
SpeedTrak	MOV **STA FRONT** REAR FAST SAME SLOW		P

Stationary Toward Mode
Using Front Selective Direction Antenna

TARGET	LOCK/FAST	PATROL	MENU
60			↑T¦
	TIME	DIST	
SpeedTrak	MOV **STA** FRONT **REAR** FAST SAME SLOW		P

Stationary Toward Mode
Using Rear Selective Direction Antenna

TARGET	LOCK/FAST	PATROL	MENU
60			↑A¦
	TIME	DIST	
SpeedTrak	MOV **STA FRONT** REAR FAST SAME SLOW		P

Stationary Away Mode
Using Front Selective Direction Antenna

TARGET	LOCK/FAST	PATROL	MENU
60			↓ A¦
	TIME	DIST	
SpeedTrak	MOV **STA** FRONT **REAR** FAST SAME SLOW		P

Stationary Away Mode
Using Rear Selective Direction Antenna

TARGET	LOCK/FAST	PATROL	MENU
60			↓↑T¦
	TIME	DIST	
SpeedTrak	MOV **STA FRONT** REAR FAST SAME SLOW		P
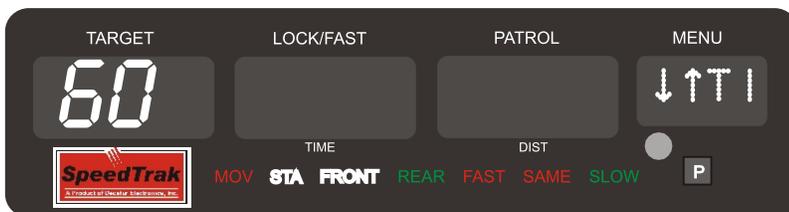
Stationary Mode (Normal)
Using Front Antenna showing Target coming
towards the radar or patrol vehicle.

TARGET	LOCK/FAST	PATROL	MENU
60			↓↑A¦
	TIME	DIST	
SpeedTrak	MOV **STA** FRONT **REAR** FAST SAME SLOW		P
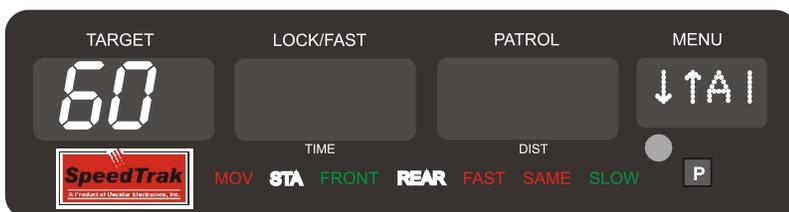
Stationary Mode (Normal)
Using Rear Antenna showing Target going away
from the radar or patrol vehicle.

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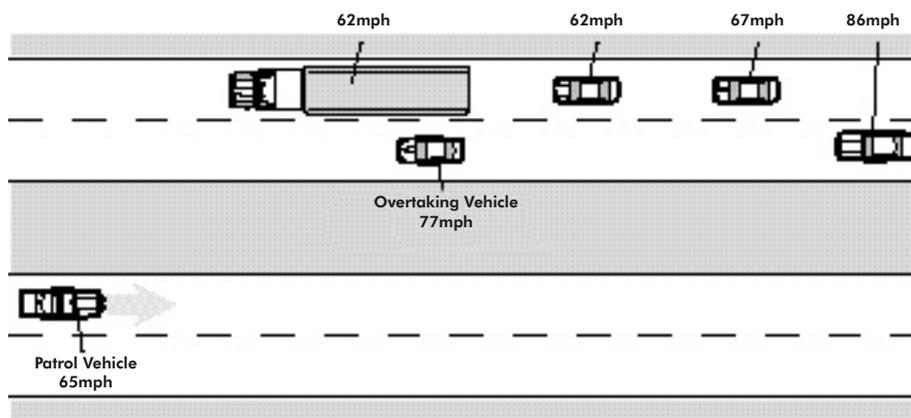**Stationary Operation with Selective Directional Sensing Antenna**
Once you have chosen your location for operating the radar and are parked out of harms way you should power up the radar by pressing the Power Button "P" located on the front of the Display unit, chose the antenna of operation by pressing either the Front or Rear antenna buttons and then press the Xmit/Hold button for activation or deactivation of the antenna. Departmental testing procedures should be followed before operation begins. If the front antenna is selected the "FRONT" icon will be lighted, if the rear antenna is selected the "REAR" icon will be lighted. If transmitting the "XMIT" icon will light on the front display, if in the hold mode, "HOLD" will appear in the menu display.

If you purchased the Directional Sensing Antenna then you have three choices of operation from the front or rear antenna (if rear antenna option was purchased). Select the choice of operation by pressing the button on the remote hand controller labeled Mov/Sta. Select either Stationary Away, Stationary Toward, or Stationary Both Directions. The "STA" icon will light on the display as well as arrow indications in the menu window depicting which mode you have chosen. In Stationary Away mode the menu window will show an arrow pointing away from a solid line which depicts the patrol vehicle or radar antenna depending upon which antenna, front or rear, was chosen and once a solid target is acquired an "A" will also appear in the menu window. In the Stationary Toward mode the menu window will show an arrow pointing toward the patrol vehicle or radar antenna depending upon which was chosen and when a valid target is acquired the letter "T" will appear in the menu window. If Stationary Both is chosen arrows pointing both directions will appear along with a solid line indicting the patrol vehicle or radar antenna, once a valid target is acquired the letter "T" or "A" will appear between the arrows indicating the direction of the vehicle the radar is monitoring.

All Target speeds are displayed in the "Target" window (orange LED's) of the Display unit. Speeds displayed in the Target window may be "locked". When a speed is locked the locked speed is transferred into the "Lock/Fast" Window (red LED's) and the radar continues to track and update speeds in the Target Window. To lock speeds simply press the "Lock/Release" button, the current speed displayed in the Target window will be transferred to the locked window and the menu display will flash, alternating between the word "LOCK" and current operating mode indicator (↓↑ ↓). To release a locked reading, press the "Lock/Release button and the locked displayed speed will be cleared. If the "Fast" mode has also been chosen, by pressing the "Fast/Slo" button on the remote hand controller the radar will monitor the next strongest target going faster than the strongest target in the "Lock/Fast" display and simultaneously display the strongest target in the "Target" window display. When in the "Fast" mode, the "FAST" icon will light on the front of the display. The "Fast" target will not lock until it switches over to being the strongest target and is displayed in the "Target" window display.
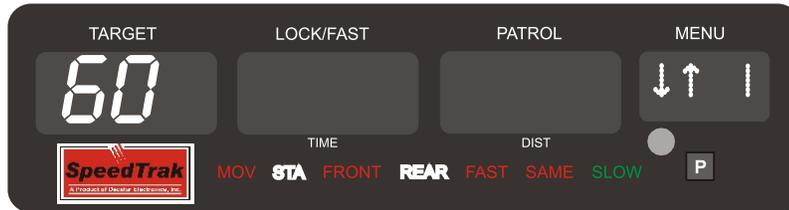
Note: When operating with the Selective Directional Antenna be sure the antenna facing forward is connected into the "Front" antenna port and if using dual antenna, the antenna facing the rear is connected into the "REAR" antenna port.
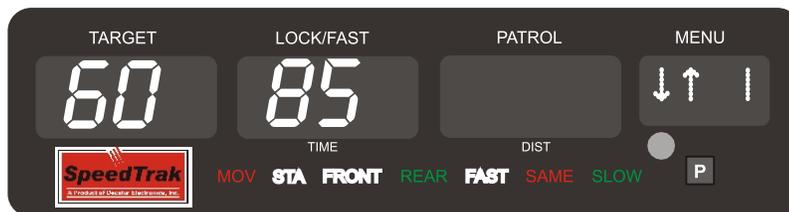
Fast Speed Tracking Example
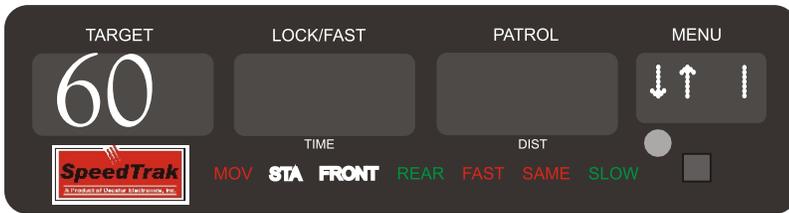
**Stationary Mode
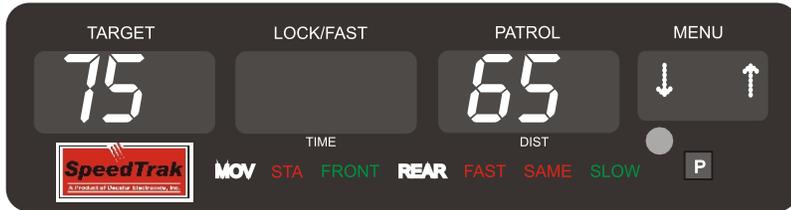Using Front Antenna**

**Stationary Mode
Using Rear Antenna**

**Stationary Mode
Fast Speed selected
Using Front Antenna**

Stationary Operation with Non-Directional Antenna

Select your location, power up unit, select your antenna and then press the Xmit/Hold button for activation or deactivation of the antenna. Departmental testing procedures should be followed before starting operation. With the non-directional antenna you only have one choice of operation in the Stationary mode, bi-directional. This is the standard method of operation of all non-directional radar. The radar will monitor and display the strongest target in whichever direction the vehicle is traveling and the operator has to make a visual observation as to the direction and the vehicle being monitored. With this antenna and stationary mode is selected, the "STA" icon will light and two arrows will appear in the menu screen, one pointing up and one pointing down along with a straight line, depicting the patrol vehicle or radar antenna. All locking functions, trak-thru-lock and fast tracking functions as described above operate the same.

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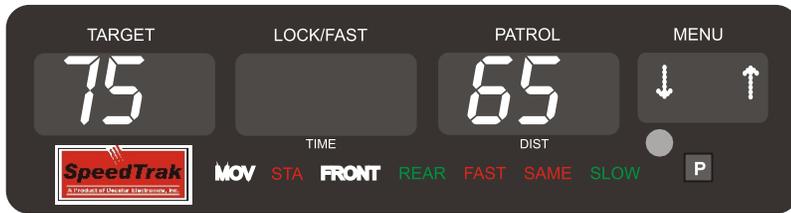
Moving Opposite Mode
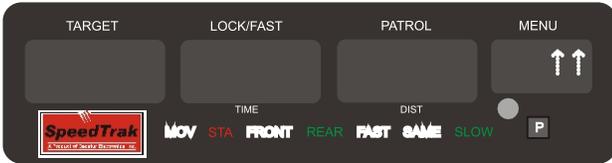Using Front Antenna

Moving Opposite Mode
Using Rear Antenna
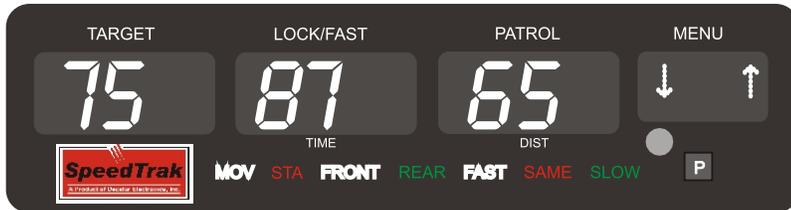
Moving Opposite Mode
Fast Speed selected
Using Front Antenna

Opposite Direction Moving Mode Operation

In the moving mode of operation is chosen, then departmental testing procedures should be accomplished before moving operation is started. Power unit up, select antenna and press the "Mov/Sta" button, the "MOV" icon will light on the front of the Display unit and two arrows, one pointing up and one pointing down will appear in the menu window display. Depress the "Same/Opp" button, if in same direction mode, "SAME" icon will light, if in opposite direction mode, same icon will not light. Chose either "Town or Highway" mode of operation by pressing the "TWN/HWY" button. When in the Town mode the radar will start operating once the Patrol Vehicle's speed reaches 5 mph. When in this mode the radar will read target speeds as low as 10 mph and can be set to read speed down to 2 mph by a setting in the menu. In the Highway mode the radar will not start operating until the Patrol vehicle's speed reaches 20 mph. The Patrol speed setting is the only difference in the radar with this mode.

The Patrol speed will be displayed in the "PATROL" display window (green LED's), the Target speed will be displayed in the "TARGET" display window (orange LED's) and the locked or fast speed with be displayed in the "Lock/Fast" display window (red LED's). If using the front antenna the radar will only monitor vehicles coming towards the Patrol vehicle while it is moving. If the rear antenna is selected, the radar will monitor traffic going away from the Patrol Vehicle while it is moving. Lock/Release, Trak-thru-Lock, Transmit/Hold and Fast speed features all operate the same as described in the above section.

Moving Same Fast Mode
Using Front Antenna
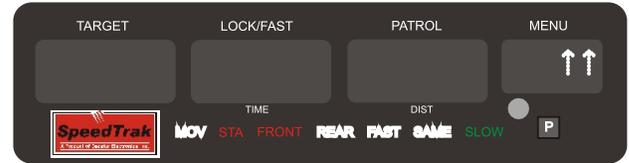
Moving Same Fast Mode
Using Rear Antenna
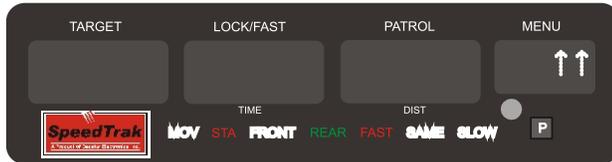
Moving Same Slow Mode
Using Front Antenna

Moving Same Slow Mode
Using Rear Antenna

Same Direction Moving Mode Operation

The SpeedTrak Radar System comes standard with the Same Direction Moving Mode. To place into this mode press the "Same/Opp" button. When same is chosen the "SAME" icon on the display will light and two arrows pointing the same direction will appear in the menu window. The radar can only operate in this mode while in the moving mode, press the "Mov/Sta" button the "MOV" icon lights on the front of the display. When in the Same Direction mode the range of the radar is automatically reduced and the "fast" function is disabled to allow the operator to have easier target identification. The Doppler audio is very low in the same direction mode as well and is distinctive from the audio in opposite direction. The Doppler audio is the "difference speed" of the Patrol speed, this is how the radar obtains a target speed.

For Targets that are traveling faster than the Patrol vehicle it is necessary to make sure the radar is in the "same fast" mode. When in this mode the "FAST" and "SAME" icons will light. For Targets traveling slower than the Patrol Vehicle's speed it is necessary to have the radar in the "same slow" mode. When in this mode the display "same" "slow" will light. To choose the fast or slow mode, press the "Fast/Slo" button on the remote.

If the radar was purchased with both a front and rear antenna, then this mode will operate from either antenna and the operator must chose which antenna by pressing either the "Front" or "Rear" antenna buttons. Whichever antenna selected the proper icon will light on the front of the display. Lock/Release and the transmit/hold features operate the same as described above.

Note: To verify that the radar is in the correct mode, "fast" or "slow" when in the moving same direction mode, it is recommended that before a final determination is made that the operator vary the patrol speed while observing to make sure that the Target speed displayed remains constant.
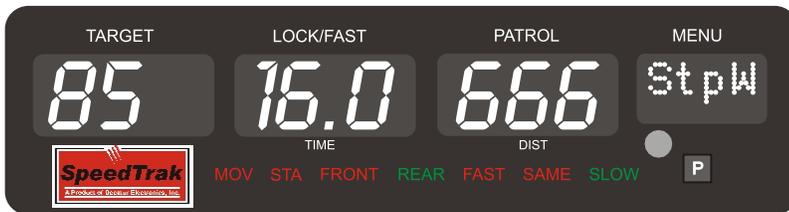
Stopwatch Mode Operation

The SpeedTrak Radar system comes standard with the Stopwatch Mode. This mode is a non-radar mode of operation and does not utilize the microwave antenna of the radar. This mode of operation is used to measure vehicle speeds using the traditional time-distance formula and the computer controller portion of the radar. This feature can be very useful in areas where radar cannot be utilized, but speed enforcement is still necessary. The radar reads the Distance that was measured and entered into the computer in the Patrol window; the time elapsed in the Lock/Fast window and the speed in the Target window.

To place the radar in the Stopwatch Mode, press and hold for 3 seconds on the "Same/Opp" button, when activated "StpW" will appear in the menu window. To exit the Stopwatch Mode press the "Same/Opp" button again. The unit has been pre-set to a minimum of 100 yards. A pre-selected and measured distance must be entered into the computer by pressing the following buttons. To change the "ones" digits press the "Fast/Slo" button, to change the "tens" digits, press the "Mov/Sta" button, and to change the "hundreds" digit press the "Twn/Hwy" button. The distance is read and calculated in yards and the maximum distance that can be entered is 999 yards. To start/stop the timer, press the "Xmit/Hold" button. Once stopped, a new calculation starts when you press the "Xmit/Hold" button again.

The Stopwatch Mode of operation is based upon the theory of measuring how much time it takes the vehicle to pass through a pre-set distance. The known distance entered is divided by the measured time and multiplied by a conversion factor (2.045) to obtain a speed. The computer of the radar does all of this calculation. The formula is MPH = 2.045 x DISTANCE (in yards) divided by TIME (in seconds). Two timing "marks" are needed, and the distance between these marks measured by a reliable means. Once this measurement is entered into the computer, then as a vehicle enters the first mark the timer is started and when it passes the second mark the timer is stopped.

Note: Time/distance calculations are based upon the human input of starting and stopping and the judgment of the operator when the vehicle has entered the start/stop location. Starting or stopping the calculations to earlier or to late can have an affect upon the speed readings produced by the computer. To lessen this possible affect it is advisable to remember the longer the distance measured the less impact time will have on the calculation. Also the greater the speeds of the vehicles being clocked then the longer the distance should be measured to reduce the affect of any errors.
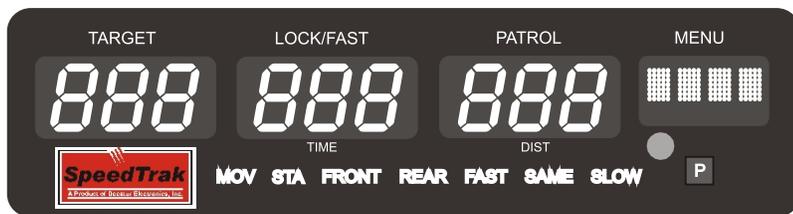
TESTING

General

The *SpeedTrak* radar system is designed to the highest standards and with the latest state-of-the-art technology. Solid State components coupled with DSP software technology assure the accuracy and calibration of the system. However it is important to check the unit on a regular basis and to keep good records of these tests to ensure not only yourself, the operator, your department, but also the offender and the courts that the radar was performing normally and producing accurate speed measurements per specifications. The internal and external test listed below should be conducted on a regular basis and the results recorded.

Power On Test

Depress the Power button "P" located on the front of the Display Unit. Each time the unit is powered ON, the unit automatically performs a light segment test and verifies the unit's functions and displays either "MPH" or "KPH" to indicate the unit of measurement of the radar. The unit will display "888" in the Target, Lock/Fast, and Patrol Speed windows, light each icon, display "FRNT" followed by the frequency of the antenna connected to the front antenna port (K, Ka, KD, or None), display REAR followed by the frequency of the antenna connected to the rear antenna port as just described, and display "TEST Okay" in the menu window. Each segment is checked and the operator should verify that each segment lights. If any segment, number or icon does not light, the unit should be taken out of operation. After the unit performs the segment and function test a "beep" will be heard and "TEST Okay" displayed in the menu window. If a problem is detected and the unit does not pass then "FAIL" will appear in the menu window.

Automatic Self-Test

The unit performs an internal self-test within every 15 minutes of power on and if the unit passes, TEST Okay will appear in the menu window and a beep tone will be heard. If any failure would occur, FAIL will appear in the window and the unit will be un-operational.

Operator Manual Initiated Test

The operator can initiate a self-test at any time the unit is powered on. When the self-test is activated the unit performs an extensive internal test. All displays are illuminated in each display window. The software program (ROM-Read Only Memory) is checked and verified. The internal memory locations (RAM-Random Access Memory) in the Digital Signal Processing Chip are checked and verified. The Dual Time base is checked and verified and the presence of the antenna is determined. As these systems are checked and verified the following messages are displayed in the Menu Window: ROM Okay, RAM Okay, DSP Okay. Next the system tests the Patrol and Target Doppler processing circuitry and simulates a 60 mph reading in each window. If all systems test okay, then TEST Okay will be displayed in the Menu window and the unit will be ready to operate. If for any reason, any part of the tests conducted do not pass, then FAIL will appear in the Menu window and the unit will not operate other than to power down upon command. The unit should be taken out of service if it does not pass the self-test.
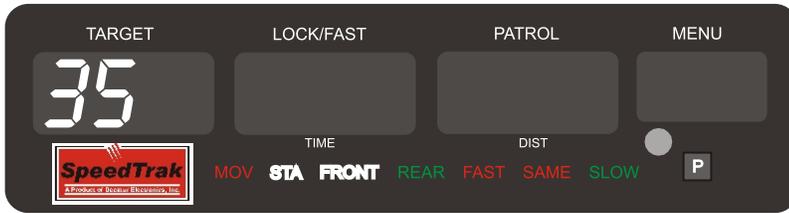
Tuning Fork Test
Stationary Mode
Using a 35mph Tuning Fork
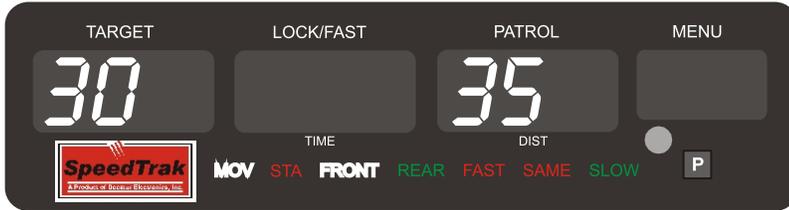
Tuning Fork Test
Moving Opposite Mode
Using a 35mph and a 65mph Tuning Fork
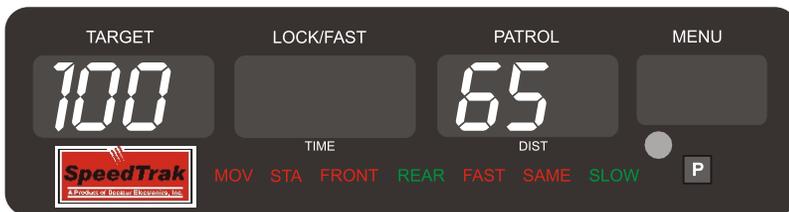
Tuning Fork Test
Moving Same Fast Mode
Using a 35mph and a 65mph Tuning Fork

Tuning Fork Test General

Two tuning forks are supplied with each radar system for each frequency of antenna purchased. For K-Band antenna, a 35mph and a 65mph Tuning fork is supplied. For Ka Band Antenna, a 35mph and 55mph Tuning Fork are supplied. These tuning forks will simulate a speed and are used to check the radar calculations in stationary, moving opposite and moving same direction. It is best to try to conduct the tuning fork test in an area with no traffic or during a period that there is no traffic in the range of the radar. If this is not possible, the antenna could be turned around not pointing toward traffic. The tuning forks will be stamped with the speed and the frequency. Care should be taken to insure that the frequency of tuning fork being used and the frequency of the antenna being checked are the same. The readings of the radar should correspond to the readings stamped on the Tuning Fork within +/- 1 mph. Tap or lightly strike the tuning fork against a nonmetallic surface and hold it 1-3 inches in front of the antenna.

Stationary Mode Tuning Fork Test

Power the unit On, place the unit in the Stationary Mode by depressing the Mov/Sta button, select the antenna to be checked, set the range control to maximum, turn the audio volume up if you wish to hear the audio and place the unit in Transmit by depressing the Xmit/Hold button. Lightly strike or tap one of the tuning forks and hold 1-3 inches in front of the antenna. Verify that the speed marked on the tuning fork and the Target Display is the same, within +/- 1mph (2 Kph) of each other. Repeat the process with the other tuning fork. If using two antennas, then select the other antenna and repeat the process.

Moving Mode Tuning Fork Test Opposite Mode

Power the unit On, place the unit in the Moving Mode by depressing the Mov/Sta button, depress the Same/Opp button (menu window should be showing arrows going in opposite direction and SAME icon should NOT be lighted on the front panel), select the antenna to be checked, set the range control to maximum, turn the audio volume up if you want to hear the audio and place the unit in Transmit by depressing the Xmit/Hold button. Lightly strike or tap the low speed tuning fork and hold it 1-3 inches in front of the antenna, verify the speed in the Patrol Speed Display is the same as stamped on the tuning fork +/-1mph (2kph), while this fork is still vibrating and the radar is reading it,

strike the high speed fork and hold it at the same time 1-3 inches in front of the antenna. The speed in the Target Speed Display should be the difference between the two tuning forks (i.e. 65mph 35mph = 30 mph. The Patrol Display should be 35 mph and the Target Display should be 30 mph. If using two antennas, then select the other antenna and repeat the process.

Moving Mode Tuning Fork Test Same Direction
Power the unit On, place the unit in Moving Mode by depressing the Mov/Sta button, depress the Same/Opp button (menu window should be showing both arrows pointing up in the same direction, same icon should be lighted on the front display), depress the Fast/Slo button and the Fast icon should be lighted, select the antenna to be checked, set the range control to maximum, turn the audio volume up if you want to hear the audio and place the unit in Transmit by depressing the Xmit/Hold button. Lightly strike or tap the high speed fork and hold it 1-3 inches in front of the antenna, check and make sure the Patrol speed displayed is the same as stamped on the tuning fork +/- 1 mph (2 kph), while the tuning fork is still vibrating, strike the low speed tuning fork and hold it at the same time 1-3 inches in front of the antenna. The Target speed displayed should be the sum of the high speed and the low speed tuning fork, +/- 1 mph (2 kph). As an example a 65 mph and a 35 mph tuning fork, in this mode should display 65 in the Patrol Speed Window and 100 mph in the Target Speed Window, +/- 1 mph (2 kph).

Moving Vehicle Road Test
Checking the radar against the speed of the vehicle it is mounted in is another test that can be routinely performed. While the Patrol Vehicle is moving down a roadway, the Speed displayed in the Patrol Speed Window should match the speed shown on the Patrol Vehicle's speedometer or within reasonable limits. Make sure the radar is aimed straight down the road in the direction of travel and hold the vehicle's speed at a constant speed. This test should be done on a regular basis, the radar's reading should be checked against the speedometer for verification at the time of making a speeding determination before stopping a violator.

Maintenance and Care

The SpeedTrak RADAR is designed to withstand normal rugged usage required of law enforcement equipment and you should experience years of trouble free use. There is no user maintenance required however the following basic guidelines will extend the life of the unit.

1. Occasionally use a damp cloth to clean the outside of the computer controller unit, remote controller and antenna(s). Do not use excessive water or cleaning solvents.

2. Check the antenna cables and connectors to make sure there are no cracks or splits in the cables and all connectors are securely fastened.

3. Check the cigar plug to make sure the fuse is good and there are no cracks or signs of stress.

4. Do not pick up or carry the unit or any components with the power, antenna or interconnect cables.

5. Do not unplug the cigar plug by pulling on the cable, remove by grasping the cigar receptacle.

INTERFERENCES

There are various sources of possible interferences from external sources that may have an effect upon the standard operation of radar. Every effort has been made in the design of the SpeedTrak Radar System to eliminate any possible interference. However there are certain influences both natural and man-made that may have an effect on the radar. A well trained and knowledgeable operator should be able to determine the nature, influence and affect of any interference on the radar. Take the steps necessary to avoid the interference or recognize the problem and ignore any possible misleading indications. There are generally two types of influences that create interferences, Natural and Man Made.

NATURAL

1. Rain, fog and snow all absorb and scatter some of the radar signal, which can reduce the effective range of the radar. The heavier the rain, fog, and snow the more effect it will have on the radar. This can also affect the patrol speed-readings if the radar is being operated in the moving mode. Consistent verification of the patrol speed-reading against the speedometer reading is recommended in these types of weather conditions. Radar Operation in heavy rain or snow is not recommended.

2. The terrain can also have an affect on radar operation, as radar signals will not pass through most large solid objects, such as heavy foliage and large trees. High or heavy fencing, barriers, and signs could also block all or part of the radar beam, thus reducing the effective range or making the radar inoperable. Hills, valleys, curves and wide medians also may possibly affect the radars operation. In these type of situations normal antenna positioning may not allow the radar to monitor vehicles or it may have an effect upon its range if vehicles are going up or down a hill, in a valley or going around a curve.

3. Large stationary objects alongside the roadway, such as large signs, bridges, overpasses, buildings, etc. can reflect back to the radar, when the radar is in the moving mode of operation, a very strong signal as the patrol vehicle passes by these objects. These very strong signals may overload the processing circuitry of the radar. In most all cases the radar's circuitry recognizes these signals as not being targets and ignores them.

MAN-MADE

Out-side Electrical Interference
Outside sources such as airport radar, street- lights, high-tension power lines, microwave transmissions towers, neon signs, transformers, two way radios, CB radios, cell telephones, etc. can produce electrical interferences. The radar has an RFI (Radio Frequency Interference) circuit that eliminates any excessive interference from affecting the radar. If interference does enter the radar then the RFI circuitry blocks the radar from reading any signals, displaying a speed and " RFI" will be displayed in the menu window. Once the source of interference ends, the radar will resume normal operation. Care should be taken by the operator to not operate the radar in areas that may cause the RFI to be activated so the radar operation is not interrupted and can be more effective.

Vehicle Noise
The rotating fan blades on the fan motor for the vehicle's air conditioner, heater and defroster representing a moving object to the radar. Although the Radar's Digital Signal Processing circuitry usually prohibits these type of readings they could cause the radar to detect the speed of the moving fan blades. This usually occurs when the radar is in the stationary mode of operation or in the moving mode when traveling at very slow speeds and the radar antenna is placed where some of the beam is "seeing" the fan movement. This may occur from either the front of rear antenna. Relocating the radar's antenna will normally eliminate this problem. To recognize the problem, find a location with no traffic and turn the radar on, in the stationary mode, and then turn on the heater, air conditioner or defroster fan and see if any speeds occur. Turn the fan speed from the slowest to the fastest setting and see if the radar reads different speeds, then turn off the fan motor and see if all speeds disappear. If the radar does detect and read fan speeds, and relocating the antenna does not solve the problem, then the operator needs to recognize this situation. These signals are very weak signals and usually only occur when there is no traffic in the radar's operational range. By listening to the Doppler audio, observing the traffic, obtaining valid tracking history, the operator can easily distinguish between these type of readings and true Doppler signals from vehicles. Other possible vehicle noise problems are noisy alternators, vibrating or system electrical noises. If any of these conditions interfere with the radar it may be necessary to install a two connector shielded cable from the vehicle's battery to the power outlet (cigarette lighter outlet).

Power Supply
If the vehicle's power-supply voltage drops below the minimum operating voltage, the SpeedTrak radar system will not display any readings and "LowV" will appear in the Menu display window. Once the low voltage situation no longer exists the radar will continue to operate. This condition may the result from a bad vehicle battery, alternator or cigarette lighter connection. If the radar will not power up, then check the fuse in the cigarette plug, the vehicle and the connections to the cigarette outlet.

FACTORS AFFECTING RADAR OPERATION

There can be certain factors that effect radar operation, however most of these factors can be avoided or eliminated provided the radar is operated correctly within its limitations and the operator is trained properly to recognize and understand these factors.

Shadowing Effect

This can occur while operating in the moving mode. Radar uses the return signal from the ground to determine the patrol vehicle's speed. The ground return usually represents the strongest signal. In some cases, when a larger or more predominant vehicle is traveling in the same direction as the patrol vehicle, it will send a signal to the radar that is stronger than what is being received from the ground. If this happens the radar looks at the speed of the more predominant vehicle as the ground speed and the difference between its speed and the patrol vehicle's speed is subtracted from the total closing speed and is displayed in the Patrol speed display window. The operator can easily detect this by comparing the speed displayed in the Patrol window against the speed on the Patrol vehicle's speedometer. The operator should also recognize the Target speed as being incorrect through visual observation, estimation and tracking history of the target vehicle. By depressing the Xmit button and then depressing again, the unit will usually reacquire the correct patrol speed.

Batching Effect

Batching may occur in some radar when the patrol vehicle is rapidly accelerating or decelerating and the processing by the radar is not fast enough to keep up and display the current patrol speed. With the 32-bit microprocessor and other state of the art circuitry designed in the SpeedTrak batching is not a problem.

Multi-path Beam Cancellation Effect

Multi-path beam cancellation refers to situations when, in the moving mode, the target speed will occasionally blank and reappear. This is usually a result of oddities in the terrain of the roadway and causes the radar to "look" at two signals which are interfering with each other, thus both are cancelled and the display is blanked. Technically, when the phase of two signals is 180° degrees maximum interference occurs and the signals cancel each other out dropping the speed reading. If only one target is in the area, then its speed will be reacquired, if more than one vehicle is present, care needs to be taken that the radar reading is on the strongest target vehicle. This can be accomplished by proper tracking history and listening to the Doppler audio by the operator.

Scanning Effect

The SpeedTrak radar is designed to be mounted on a vehicle in a fixed position. The Scanning effect can only happen when the radar antenna is deliberately moved or scanned as the radar is tracking vehicles. This is improper use of the radar and is very difficult to produce, even with hand-held type of radar. The radar antenna or the hand held radar should not be moved while operating the unit.

Panning Effect

The panning effect can occur on two-piece type of radar by pointing the antenna directly at the computer/controller unit of the radar system. This could cause feedback into the radar system. Proper installation and use of the radar by not pointing the antenna at the computer controller unit will eliminate the panning effect.

Combined Speed Effect

The combined speed effect can occur when the patrol vehicle and the target vehicle are approaching each other, very close together, at short distances and usually at very slow speeds. This may cause a combing of the patrol and target speeds. The SpeedTrak radar system has the Town/County Mode of operation, when patrolling at very slow speeds (less than 20mph) it is recommended to switch the unit to the Town mode and this will usually eliminate the combined speed effect. By depressing the Xmit button and then pressing again, usually the correct Patrol speed will appear and any combining will be cancelled.

Cosine Effect

The cosine effect refers to the angle of the target vehicle in relation to the patrol vehicle where the radar is mounted. The radar should be operated as parallel as possible to the targets. However, this is generally impossible to do both in the stationary and moving modes of operation because there is almost always some angle between the vehicle's direction of travel and the radar's position. When this angle becomes to significant the relative speed will be less than the true speed producing a lesser speed reading than what the vehicle is actually traveling. This will always be in the favor of the motorist. At angles of 10° degrees or less the angle effect is less than 1 mph on the radar readings. The greater the angle the lesser the speed will be recorded than the actual speed. In the moving mode of operation care needs to be taken to make sure the antenna is pointed at a less than 10° degree angle to the roadway. Since the Target Speed is calculated by taking the Closing Speed and subtracting the Patrol Speed, if the patrol speed is incorrect, then an incorrect Target speed reading could occur. Proper aiming and positioning of the antenna, proper tracking of the target vehicle, proper observation and proper checking of the patrol vehicle's speed displayed in the radar's Patrol Speed window against the Patrol Vehicle's speedometer should make it apparent to the operator if the reading is incorrect.

TROUBLE SHOOTING

If you experience any problems or difficultly in the operation of the unit, check the following list of possible problems and solutions before contacting the Factory or one of our authorized service centers.

Unit does not get power.

- Check the power cable to make sure it is properly plugged into the back of the computer controller unit. If not, properly connect.
- Check the cigar plug to see if the red indicator light is on. If red light is on, this indicates you have power to the cigar plug. If red light is not on, reseat the cigar plug.
- Check the fuse in the cigar plug. Replace if fuse is blown or broken.
- Check for proper voltage to the cigar plug. Clean cigar plug by using a pencil eraser. Check vehicle fuse leading to cigar receptacle. Replace if blown.

Unit will not start self-test.

- Make sure antenna is connected to computer controller unit. Unit will not self-test if antenna is not connected. If antenna is connected and unit will not complete self-test, remove unit from service and call factory.

Unit fails during Power Up or Self Test.

- Turn unit off, make sure all connections are properly made, power unit up and try test modes again. If unit still does not pass, remove from service and contact the factory.

Unit will not display a speed during the tuning fork test.

- Make sure range is at maximum setting (5).
- Make sure the unit is transmitting; HOLD is not displayed in the Menu Window.
- Make sure the tuning forks are the same frequency as the radar.
- Remove the unit from service and call the factory if unit still will not respond to the tuning forks.

Unit does not detect vehicles.

- If you have a dual antenna system, and one antenna is operating and one is not. Exchange the working antenna with the non-working antenna. If the working antenna operates, then this eliminates any problem with the cable or antenna port. If it does not work, then attach the antenna that was not working to the antenna cable and port of the working antenna. If the non-working antenna operates, then this suggests that the antenna cable is bad. Try both antennas again on both cables, if they both work on one antenna cable, but both fail on the other, replace the antenna cable with a known good cable.
- If you only have one antenna, try the antenna on the opposite antenna port or if possible on another SpeedTrak radar system.
- Make sure the unit is not in the HOLD mode.
- Make sure the range control is NOT SET ON ZERO.
- Make sure you are in the correct mode of operation, moving or stationary. If operating the Selective
- Directional antenna, make sure you are monitoring the vehicles in the direction of traffic that you have set the radar.

SPEED TRAK Error Codes.
Below is a list of possible "Error Codes" and the appropriate action that should be taken.

- SYS0 - Clock Accuracy Error: Return unit for service.
- SYS4 - Software Flash Not Configured Correctly: Return unit for service.
- SYS5 - Software Checksum Error: Return unit for service.
- SYS6 - Software Flash Error: Return unit for service.
- SYS9 - DSP Processing Error: Return unit for service.

Unit displays "shadowing effect".

- By quickly depressing the Xmit/Hold button, will usually allow the unit to recapture the correct Patrol speed-reading.
- Operating the unit in the "Highway" mode eliminates most shadowing situations. The Highway mode does not allow readings below 20mph in both the Target and Patrol windows.

Unit has short range.

- Check and make sure the range control is set to maximum (5).Note (Range is set separate for Opposite and Same modes).
- Make sure the antenna is properly aimed.
- Poor weather conditions can shorten range.
- Check the terrain you are operating in for obstructions.

Microwave Emissions

According to all credible scientific evidence, the emission levels resulting from traffic radar pose no risk to the operator or the occupants of vehicles being targeted. Traffic radar emits low level, non-ionizing radio frequency electromagnetic radiation. The American National Standards Institute (ANSI) is a widely recognized authority for safe limits of non-ionizing radiation exposure. This organization recommends maximum exposure levels for traffic radar systems to operate (ANSI/IEEE C95.1-1992, "Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300GHz"). These exposure levels, expressed in power density terms, are 7mW/cm2 for X band units and 10 mw/cm2 for K band and Ka band units. Also the Occupational Safety and Health Administration (OSHA) recommends 10 mw/cm2 ("Radiation Protection Guide", 29 CFR, Chapter XVII, Subpart G, part 1910.97). Following is a letter published by and reprinted with their permission from the Food and Drug Administration, Department of Health and Human Services entitled, "Update on Possible Hazards of Traffic Radar Devices". One other reference document is a Department of Transportation publication entitled, "Field Strength Measurements of Speed Measuring Radar Units" (NHTSA Technical Report #DOT-HS-805 928).

The SpeedTrak radar system has a nominal microwave power output of between 10 mW and 15 mW with a maximum aperture power density of < 5mw/cm2, well below the limits described above.

Federal Communications Commission Requirements (FCC)
The SpeedTrak radar system is Type Accepted by the FCC and has a Grant of Equipment Authorization number located on each antenna. The FCC amended its rules several years ago to eliminate the required annual measurement of transmitter power, frequency and modulation measurements for licensees in the Public Safety, Industrial and Land Transportation Radio Services. They also eliminated, effective February 1, 1983, the requirement for local government entities licensed in the Public Safety Radio Service to obtain a separate authorization for radar speed detection devices. It is now only necessary for licensees to list the number of speed detection units and the frequencies on which they operate at the time of the renewal of their land mobile authorization.

If the purchasing agency does not hold a Public Safety Radio license, then it is necessary to obtain an application form from your nearest FCC regional office.

Radar Case Law

The *SpeedTrak* radar system operates on the Doppler principle. Legal precedent has been clearly established through numerous court cases and challenges to the accuracy and admissibility of Doppler speed radar evidence. Since the *SpeedTrak* radar system is a Doppler radar then it falls under the same precedent. Below are some of the landmark cases establishing guidelines for Doppler radar. To obtain additional information on any of the below referenced material, consult your local library or prosecutor's office.

Reference A State vs. Dantonio (N.J.) 1955 115 A2d 35, 49 ALR 2d 460. This is the landmark case on the use and acceptance of traffic radar. It established the following:
   a. Judicial notice has been taken of the accuracy of Doppler radar
   b. A few hours of training is sufficient to qualify an operator
   c. The operator need not understand or be able to explain the internal workings of the radar.

Reference B State vs. Tomanelli (Conn) 216 A2d 625. Reviews the matter of judicial notice and recognizes the ability of Doppler radar to measure the speed of a motor vehicle and acknowledges that the tuning fork is a reliable means for testing the radar.

Reference C State vs. Shelt (Ohio) 1975 75-D O-3682, L-75-166. Establishes that the courts may take judicial notice of the reliability of moving car radar.
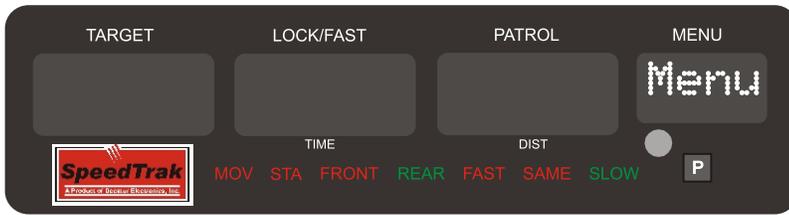
Reference D Everight vs. Little Rock (Ark) 326 SW2d 796. Establishes that the court may take judicial notice of the reliability of radar.

Reference E State vs. Graham (Mo) 322 SW2d 188. Establishes that the court may take judicial notice of the ability of radar to measure speed.

Reference F Honeycutt vs. Commonwealth (Ky) 408 SW2d 421. Establishes the following:
   a. A properly constructed and operated radar device is capable of measuring accurately the speed of a motor vehicle.
   b. The tuning fork test is an accurate method of determining accuracy of the radar.
   c. It is sufficient to qualify an operator that has such knowledge and training that enables him to properly set up, test, and read the radar.
   d. The operator is not required to understand the scientific principles of radar, nor explain its inner workings; in addition, the operator may be qualified to operate the radar after receiving a few hours of instruction.
   e. The officer's estimate of excessive speed, from visual observation, when confirmed by the readings of the radar device and when the offending vehicle is out-front, by itself, nearest the radar unit, is sufficient to identify the vehicle, if the officer's visual observations support the radar evidence
   f. Reference G Krueger, Pantos and Payne vs. State of California 1986 (class action suit-suppression hearing on radar) 887092, DP44339 and DP54571. Establishes that a properly built and tested radar used by a trained operator can accurately determine the speed of vehicles. Established that proper classroom and field training enables an officer to avoid any false or inaccurate readings due to outside influences and upheld the accuracy of Doppler radar in both the stationary and moving modes of operation.

Reference H Samual Knight vs. State of New York Superior Court 72 N.Y. 2d 481, 530 N.E. 2d 1273 (1988). Establishes that a trained operator, who properly tested the radar, observed the traffic and checked the patrol speed against the patrol vehicle's speedometer, can accurately determine the speed of vehicles while the patrol vehicle is moving.

```
     TARGET          LOCK/FAST          PATROL          MENU

                                                      Menu

                    TIME                DIST
  SpeedTrak    MOV  STA  FRONT    REAR  FAST  SAME  SLOW    P
```

Showing radar in Menu Mode
Press and hold the Test/Menu button on the
Remote for 3 seconds to activate.

```
LoSp
```
Low Speed Setting: 2mph or

```
Unts
```
Units Setting: MPH/KPH

```
FstL
```
Fast Speed Lock Option: On or Off

```
Beep
```
Beep Setting: On/Off

```
Baud
```
Baud Rate Settings: Com1, Com2, Com3,

Menu Mode

The menu mode is to allow the operator to select certain operational features other than the pre-set factory settings to be programmed into the radar. To enter the menu mode, depress and hold for 3 seconds the Test/Menu button on the remote hand controller until "Menu" appears in the Menu Display Window. To toggle through the menu choices depress the "Xmit/Hold" Button. Once a new selection is displayed, then use the Front antenna button to scroll up and the Rear antenna button to scroll down through the choices in that selection. Once the choice is made depress the Xmit/Hold button, this will place that choice into memory and move on to the next selection.

The available selections are:

LoSp Selections: "2" or "15". Allows operator to select whether the radar starts acquiring Target speeds at 2 mph or 15 mph.

Beep Selections: "On" or "Off". Allows operator to select whether a "beep" is heard when a key is depressed on the remote hand controller or to turn this function off where no beep is heard when the keys are depressed.

Units Selections: "KPH" or "MPH". This allows the operator to set the units of display in either "miles per hour" or "kilometer per hour" per the country requirements. "MPH" or "KPH" will be displayed upon the power on test sequence. Be sure to make sure the radar is set in the proper units for your particular country requirements.

Baud Selections: "CompO", "Comp1", "Comp2", "Comp3", "Comp4". Allows different baud rates to be set for various interface capabilities.

Fast Speed Lock Option: "On" or "Off". **FstL - On;** Allows the operator to "Lock" the Faster Target Speed displayed in the Fast/Lock window. If no speed is displayed in the Faster window the unit will Lock the Strongest Target Speed as normal. **FstL - Off;** Does not allow the operator to Lock the Faster Target Speed displayed in the Fast/Lock window until it becomes the Strongest Target Speed.

To Exit the menu mode: Depress the "Test/Menu" button until "Exit" appears in the menu display window.

To Check the Software Version: Depress and hold the "MENU/TEST" button while powering on the unit. After the unit has completed its self-test, the software version will appear in the middle display window.

Serial Communications Data Protocol

The *SpeedTrak* radar system provides RS232C communications through a 9-pin D-connector serial port on the rear of the computer controller unit. This allows the unit to be interfaced with giant displays, computers, in-car video systems, etc.

DB-9 Pin Outs:
- Pin 1 - 12V
- Pin 2 - TX 232
- Pin 3 - RX 232
- Pin 4 - N/C
- Pin 5 - GND
- Pin 6 - N/C
- Pin 7 - N/C
- Pin 8 - N/C
- Pin 9 - GND

Data Protocol:
- one (1) start bid
- eight (8) data bits
- one (1) stop bid
- no parity
- transmission 1200 baud

Communications is transmit only and the data is transmitted as ASCII symbols in the following sequence:
- Target hundreds digit
- Target tens digit
- Target ones digit
- Patrol hundreds digit
- Patrol tens digit
- Patrol ones digit
- Carriage return (ASCII decimal value 13)

When the Lock/Release button is pressed, the radar transmits the following sequence:
- Locked hundreds digit
- Locked tens digit
- Locked ones digit
- Carriage return (ASCII decimal value 13)

The *SpeedTrak* sends this data whenever there is a change in the Target or Patrol speed display mode or antenna. During the test mode, the Target and Patrol speed is transmitted but not the display segment check data.

WARRANTY

Decatur Electronics, Inc. warrants the SpeedTrak radar system to be free from defects in workmanship and material and to operate within specification for a period of two years. During this period, Decatur Electronics, Inc. will repair or replace, at its option, any component found to be defective. During the warranty period there will be no charge to the customer for parts or labor to make the necessary repairs. Shipping charges for shipping the unit to Decatur Electronics, Inc. will be the responsibility of the customer. Shipping charges back to the customer will be the responsibility of Decatur Electronics, Inc.

This warranty on parts and workmanship does not include normal wear and tear, frayed cords, broken connectors, crushing, dropping, immersion, damage from unauthorized repairs, impact and wreckage, or other forms of physical abuse and only covers internal electronic components and circuitry.

Decatur Electronics, Inc. warrants the radar devices are designed to perform the function of determining the speed of moving objects such as motor vehicles. The foregoing warranty is exclusive, in lieu of all other warranties, of quality, fitness, or merchantability, whether written, oral, or implied. As a further limit on warranty, and as an expressed warning, the user should be aware that harmful personal contact may be made with seller's radar devices in the event of violent maneuvers, collisions, or other circumstances, even thought said radar devices are installed and used according to instructions. Decatur Electronics, Inc. specifically disclaims any liability for injury caused by the radar devices in all such circumstances.

SpeedTrak RADAR
SPECIFICATIONS

GENERAL

Type: Two - Piece, Moving/Stationary, True Doppler radar system with choice of one or two of the following antenna: Ka-Band, Selective Directional K-Band, or K-Band.

Frequency: Ka-band, IACP Type VI
    Nominal Transmission Frequency: 33.4 to 36.0 GHz +/- 100MHz
    K-Band, IACP Type IV
    Nominal Transmission Frequency: 24.150 GHz +/- 50MHz

Band Selection: Automatic sensing of Ka-Band, Selective Directional K-Band or K-Band   antenna.

Units of Measurement: Miles per Hour or Kilometers (Radar Mode)
    Yards or Meters (Stopwatch Mode)

Accuracy: Stationary +/- 1 MPH (+/- 2 km/h)
    Moving +1/-2 MPH (+2/-3 km/h)

Environment: Ambient Operating Temperatures -30 to +70 degrees C
    Maximum Humidity 90% relative humidity at 37 degrees C

Internal Components: 100 percent solid state

Power Requirements: 10.5VDC to 16.5VDC, 1.0 amp max.

Reverse Voltage Protection: Internal, re-settable fuse

Low Voltage Threshold: 10.5 VDC with visual warning indicator

Typical Power Requirements: Current Draw with 13.6 VDC applied
    Standby, with no display - .60 amp
    Transmitting, no targets displayed - .85 amp
    Transmitting, Target speed displayed - .95 amp
    Transmitting, Target & Patrol displayed - 1.00 amp

MICROWAVE ANTENNA

Ka Band:
    Nominal Operating Frequency: 35.5 GHz +/- 100MHz
    Nominal Horizontal Beamwidth: 12 degrees +/- 1 degree
    Polarization: Circular polarized conical horn
    Side Lobes: - 25 dB below main beam
    Power Output: 10 mW min, 12 mW nominal, 15 mW max
    Maximum Aperture Power Density: < 5 mW/cm2
    Microwave Source: Solid State Gunn-Effect Diode
    Receiver: Low noise Schottky diode
    Length: 3.80 inches

Diameter: 2.12 inches
Weight: 7 ounces
Weather Resistant: Allows outside mounting

K Band Selective Directional and K Band:

Nominal Operating Frequency: 24.150 GHz +/- 50MHz
Nominal Horizontal Beamwidth: 12 degrees +/- 1 degree
Polarization: Circular polarized conical horn
Side Lobes: - 25 dB below main beam
Power Output: 5 mW min, 7 mW nominal, 10 mW max
Maximum Aperture Power Density: < 5 mW/cm2
Microwave Source: Solid State Gunn-Effect Diode
Receiver: Low noise Schottky diode
Length: 4.12 inches
Diameter: 3 inches
Weight: 12 ounces
Weather Resistant: Allows outside mounting

COMPUTER CONTROLLER/DISPLAY

Configuration: Computer Controller Unit can be separated from Display Unit without the use of any tools. Interconnecting cable allows for operation of Display unit and Computer Controller unit while separated. Mounting bosses on both the Computer Controller unit and Display unit allows for separate mounting. The Computer Controller Unit design consists of a single printed circuit board utilizing surface mounted technology.

Communications Compatibility: Ability to communicate with IBM format PC's, speed signs, in-car video systems, and mobile data terminals. A DB9 connector port for RS232C communications is located on the rear of the Computer Controller Unit.

Field Upgrades: Software upgrades available by computer downloading with flash card technology.

Signal Processing: Digital Signal Processing (DSP) with 32 bit microprocessor performs all internal speed verifications at 100 times per second.

Operational Processing: All internal operating functions are controlled by software controlled microprocessor.

Internal Test: An extensive self test is performed. All LED indicators display segments are illuminated, the software program ROM (Read Only Memory) is verified, internal memory locations RAM (Random Access Memory) in the DSP chip are verified, mathematical processing capability of the DSP chip is verified, the second time base is verified and the presence of the antenna and its operating frequency is verified.

Automatic Self-Test: An automatic self-test is performed every 10 minutes and will display in the menu window either "Test Okay" or "Test Fail". If "Test Fail" is displayed, unit will not operate.

Doppler Audio: Amplifies true Doppler audio. Operator adjustable with eight audio adjustment levels. In the Moving Mode the Target Speed audio does not vary with Patrol Speed and will increase or decrease in loudness in direct proportion to the signal strength and direction of the target.

Audio Squelch/Squelch Override: In squelch mode the only audio heard is the Doppler tone when a target is present. In Squelch Override mode, the audio will contain all tones including any interference, noise etc. that is present.
Speed Displays: High Brightness multi-color LED's with Operator's choice of manual operator adjustments (6 levels) or automatic photo-cell which adjusts with the ambient light conditions. Patrol Speed/Distance - Green, Target Speed - Amber, Lock/Fast Speed/Time - Red. Simultaneously will display patrol speed, target speed and locked or fast speed.

Menu Display: High Brightness four digit LED Red alphanumeric/graphical display for various mode information.

Automatic Clear: Speed Displays are cleared when any mode of operation is changed by the operator.

Speed Update: Target and Patrol speeds are updated a minimum of six times per second once a valid signal is acquired.

Trak-Thru-Lock: Instantaneous manual lock with Speed displayed in "Lock" window, target speed continues to be displayed and tracked in "Target" window. Patrol Speed, at the time of lock is stored in memory to allow locked Patrol Speed recall.

Range Control: Allows operator to select and adjust range sensitivity in 5 increments.

Stationary Speed Display Range: 2mph to 206mph (24km/h to 329km/h)

Moving Opposite Patrol Speed Range: Highway setting: 20mph to 125mph (32km/h to 200km/h)Town setting: 5mph to 90mph (8km/h to 144km/h)

Moving Target Speed Range: 2mph to closure of 206 (24km/h to closure of 329km/h)

Fast Speed Trak: Processes the speed of the next strongest target moving faster than the strongest target and displays the speed in the "Lock/Fast" window. The strongest target continues to be displayed and tracked in the "Target" window. Operates in both the opposite moving mode and stationary mode.

Same Direction Mode: Processes speeds of vehicles traveling in the same direction as the patrol vehicle. Patrol Speed Range 20mph to 90mph (32km/h to 144km/h) for slower target. Fast Target Speed Range 25mph to 157mph (40km/h to 252km/h). Separation speed must be at least 5 mph (8km/h) but no greater than 75 % of patrol speed.

Selective Directional Mode: When selective directional antenna is connected to the Computer Controller unit and the unit is in the stationary operating mode the radar has the ability to monitor vehicles going only in one direction, either away or toward the patrol vehicle. The operator may choose which direction of traffic to monitor, either just traffic coming toward the radar or just traffic going away from the radar. A third option, standard stationary mode allows the operator to monitor traffic in both directions but then the radar will display either a "T" or an "A" in the menu window, thus indicating to the operator which direction the vehicle the radar was monitoring was traveling.

Stopwatch Mode: Displays calculated speed in the "Target" window, elapsed time in the "Lock/Fast" window and the distance traveled in the "Patrol" window. Elapsed time is displayed in tenth of a second increments and distance is displayed in yard or meters. Distance is manually set from 1 yard (meter) to 999 yards (meters). When in this mode , STPW, will appear in the menu display.

Display Indicators: Icons in the front of the display indicate the following modes
of operation: Mov (Moving), Sta (Stationary), Front (Front antenna selected), Rear (rear antenna selected), Same (same direction selected), Fast (Fast mode selected in either opposite or same direction), Slo (slow mode selected in same direction). Directional arrows will be displayed in the menu window to correlate with the mode of operation.

RFI Indication: RFI, if present, will be displayed in the Menu Display and the unit will not operate.

Low Voltage Indication: "LowV", if present, will be displayed in the Menu Display and the unit will not operate.

Transmit Hold: When the antenna is not transmitting, HOLD will be displayed in the menu window. This mode of operation enables radar detectors from detecting the radar.

Trak-Thru-Lock: Patrol Speed, at the time of lock is stored in memory to allow locked Patrol Speed recall.

Fast Speed Lock Option: Menu selection to turn Fast Lock On or Off. FstL - On; Allows the operator to Lock the Faster Target Speed. FstL - Off; Does not allow the operator to Lock the Faster Target Speed.

Computer Controller Dimensions: Height - 1.45 inches : Depth - 3.0 inches : Width - 5.25 inches : Weight : less than 1 lb.

Display Dimensions: Height - 1.45 inches :   Depth - 1.09 inches :   Width - 5.25 inches Weight - 7 ounces

Hand Remote Dimensions: Length - 5.88inches : Height - 1.23 inches: Width - 2.08 inches: Weight - 7 ounces

REMOTE HAND CONTROLLER:

Corded with connector's on both ends of cable for quick disconnect. Twelve 100 per-cent back lit, color coded and distinctive shaped keys that allow easy identification for the operator. Speaker for Doppler Audio enclosed.   Button Functions and shapes are:
Front Antenna - Triangle with positive dimple
Rear Antenna - Triangle
Xmit/Hold and Start/Stop for Stopwatch mode - Round
Lock/Rel - Rectangle
Same/Opp and On/Off for Stopwatch Mode- Oval
Fst/Slo and 1's setting for Stopwatch Mode - Oval
Mvg/Sta and 10's setting for Stopwatch Mode - Oval
Twn/Hwy and 100's setting for Stopwatch Mode- Oval
Vol/Sql - Oval
Range - Oval
Test/Menu - Oval
Dim/PS Oval

Power Cable: 6 feet with connector on one end and fused cigar plug with power indicator light or ¼ phono jack plug.

Antenna Cable: Connector's on both ends, available in 4 ft., 8 ft, 12 ft. and 18 ft. Other lengths may be special ordered.

The above specifications are subject to change without notice