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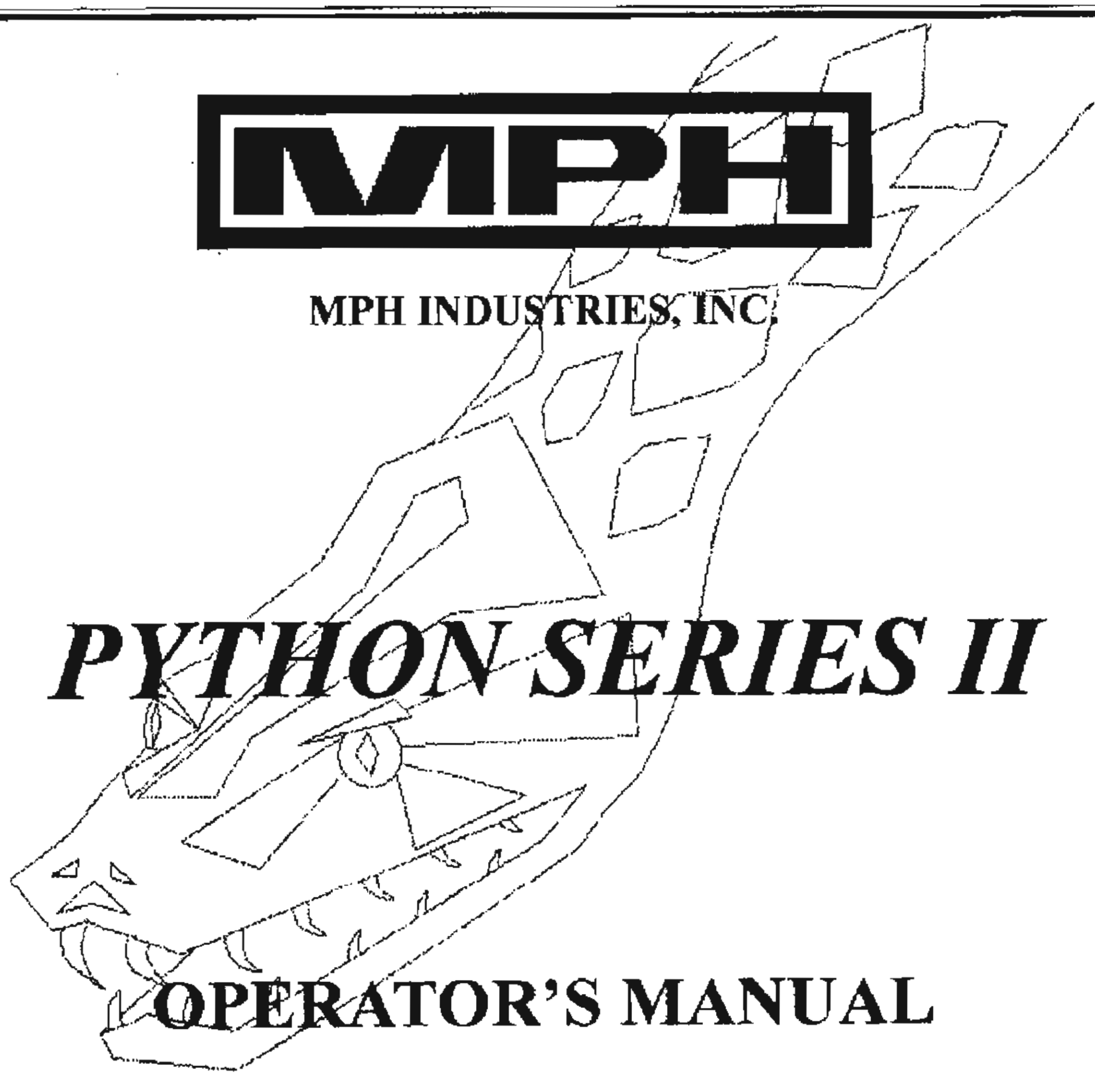

PYTHON SERIES II

OPERATOR'S MANUAL

FOR

MOVING AND STATIONARY

RADAR

MPH

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OPERATOR'S MANUAL FOR MOVING AND STATIONARY RADAR

PYTHON SERIES II

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Operational Recommendation

Subsequent to an August 1992 Congressional hearing convened by Senator Joseph Lieberman of Connecticut on the safety of police traffic radar devices, the U.S. Congress directed the National Institute for Occupational Safety and Health (NIOSH) to study the cancer incidence among law enforcement officers who had used traffic radar devices.

In June 1995 NIOSH issued a report titled "Occupational Exposure of Police Officers to Microwave Radiation from Traffic Radar Devices" describing their findings, including an exposure assessment, an analysis of existing record sources, and a summary of their recommendations. The report concluded that there was not a sufficient basis to identify health risks to humans, although the possibility could not be ruled out. The following are quoted directly from the report and are procedures that are recommended to reduce or prevent exposure to microwave energy emitted from traffic radar devices:

1. Hand-held devices should be equipped with a switch requiring active contact to emit radiation. Such a switch, referred to as a "dead-man switch", must beheld down for the device to emit radiation, even though the electrical power to the device is on. Adherence to this recommendation should permit the continued use of one-piece or hand-held radar units.

2. Older hand-held devices that do not have a "dead-man switch" should not be placed with the radiating antenna pointed toward the body, whether it is held in the hand or placed near the officer. A holster or other similar device should be used as a temporary holder for the radar when not in use.

3. When using two-piece radar units, the antenna should be mounted so that the radar beam is not directed toward the vehicle occupants. The preferred mounting location would be outside the vehicle altogether, although this may not be practical with older units that cannot withstand adverse weather conditions. Other options, e.g., mounting on the dashboard of the vehicle, are acceptable if the antenna is at all times directed away from the operator or other vehicle occupants. Mounting the antenna on the inside of a side window is not recommended.

4. Radar antennas should be tested periodically, e.g. annually, or after exceptional mechanical trauma to the device, for radiation leakage or back scatter in a direction other than that intended by the antenna beam pattern.

5. Each operator should receive training in the proper use of traffic radar before operating the device. This training should include a discussion of the health risks of exposure to microwave radiation and information on how to minimize operator exposure.

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I. INTRODUCTION

This manual covers the operation of the **PYTHON SERIES II** and the **PYTHON SERIES II FS** radars. The **PYTHON SERIES II FS** has fastest and same direction modes as optional features in addition to all functions on the standard **PYTHON SERIES II**. When a reference to **PYTHON SERIES II** is made in this Operator's Manual, application to the **PYTHON SERIES II FS** is also implied.

MPH Industries, Inc. designed the MPH **PYTHON SERIES II** Doppler radar with the working police officer in mind. The unit is easy to operate and includes the performance you want.

The **PYTHON SERIES II** employs state of the art digital signal processing (DSP) technology that allows the unit to have both high performance and high reliability in a small package. The digital signal processor is a specialized microprocessor chip that can perform the required calculations for detecting patrol and target speeds very efficiently.

The MPH **PYTHON SERIES II** is composed of an antenna, a remote and a readout unit. MPH designed high quality parts into the unit. Combined with the workmanship provided by MPH's Manufacturing Department, the **PYTHON SERIES II** will provide years of high performance.

The MPH **PYTHON SERIES II** offers more than features and performance. MPH provides training through our vast network of experienced field representatives. We also offer the most revolutionary and comprehensive two-year warranty available in the industry. We know that our success depends upon your success with our equipment. We are dedicated to keeping our customers satisfied. The following pages describe the operation of the MPH **PYTHON SERIES II** radar. We also provide useful information on the legal aspects of traffic radar.

We at MPH Industries thank you for purchasing our equipment. We wish you the greatest success in your speed enforcement program. We are proud that our radar is a part of your department.

II. UNDERSTANDING TRAFFIC RADAR

A. A HISTORICAL PERSPECTIVE

The development of RADAR (an acronym for Radio Detection and Ranging) cannot be attributed to a single inventor or even an identifiable group of inventors. Its basic concepts have been understood as long as those of electromagnetic waves have. As long ago as 1886, it was known that radio waves could be reflected from solid objects. Although use of a radio echo for detection purposes was discussed for many years in the literature, it took the imminent threat of war in Europe in the late 1930's to bring about serious research and development.

The original purpose of radar was to provide advance warning of approaching enemy aircraft. Consequently, a technique of transmitting radio waves and listening for the reflection was developed in Germany, Great Britain, and the U.S. almost simultaneously. This search and detection system measured the length of time it took for a reflection to come back, and from that, distance could be calculated. Using this technique, many familiar devices were developed during the war years, often under great secrecy. These include aircraft and ship navigation, the aircraft altimeter, and radar mapping.

With the lifting of military security restrictions in 1946, the level of research in radar declined and attention was turned to the development of civilian applications such as radio astronomy and weather radar. Although a method of velocity measurement using a theory of physics called the Doppler principle was well known, it was never applied to a radar until this post-war period. One of the first applications in 1948 was in a primitive traffic radar to measure the speed of autos. While these early units were an improvement over the time distance stopwatch technique, they were bulky, difficult to operate and suffered from certain technical limitations. It was more than twenty years before a significant breakthrough was made to enable the development of the modern-day radar, as we now know it.

B. THE DOPPLER PRINCIPLE

As we have seen, a wide variety of radar devices have been developed over the years to perform an even wider variety of tasks. Let us turn our attention to how this technology is being applied to velocity measurement.

In 1842, an Austrian physicist and mathematician by the name of Christian Johann Doppler postulated a theory that connects the frequency of a wave with the relative motion between the source of the wave and the observer. This today is known as the Doppler principle and is used to determine the velocity of everything from a pitched baseball to the largest galaxies in space.

An appreciation of the Doppler effect can best be gained if one considers everyday sounds produced by familiar moving objects: the auto horn, a train whistle and a jet plane in flight will all demonstrate a marked change in tone as they pass a stationary object. This is a result of the wave nature of sound. For example, consider the automobile horn. The horn itself is producing waves of sound at a constant rate, say 250 waves per second. As long as the auto is sitting still, we perceive the sound of the horn as a 250 cycle per second tone. If we next put the auto in motion toward us at 55 mph, it becomes apparent that we no longer receive 250 waves per second at our ear because, while the waves travel at a constant speed, each succeeding wave has a shorter distance to travel to our ear. The waves are effectively compressed to a higher frequency per second and consequently a higher tone is heard. The waves momentarily drop to 250 per second at a point perpendicular to the observer and then begin to decrease in frequency as the vehicle moves away from the observer and each succeeding wave has farther to travel to the ear. The waves are now effectively being stretched. Moreover, if the speed of the auto is increased, so is the compression and stretching effect upon the waves and we perceive a higher and lower tone respectively.

C. THE DOPPLER PRINCIPLE AS APPLIED TO VELOCITY MEASUREMENT

Up to this point, we have been using sound to demonstrate the effects of the Doppler principle. However, as you may know, radio energy and light also exhibit a waveform and this fact opens several interesting areas to consideration.

As we have seen earlier, it is possible to determine the existence and the location of an object at great distance by transmitting a beam of radio energy and then receiving that small portion of the beam that is reflected back. If it is possible to reflect radio energy from an object, and that object is in motion toward or away from the transmitter, the reflected radio waves should be altered in accordance with the Doppler principle. More specifically, they will be compressed to a higher frequency as the object moves nearer to the source and, conversely, stretched as the object moves away. Furthermore, the faster the object approaches or recedes, the greater the compression/stretching effect upon the waves.

Therefore, if we are able to transmit a radio wave of a known frequency which travels at a constant speed, and then construct a device to measure the frequency of the reflected waves, by comparing the two frequencies we will know how much our beam was altered by motion, the Doppler frequency. From here, it is a straightforward calculation to determine the velocity of our target object. This is precisely the approach taken in all modern speed measurement devices.

D. PRACTICAL APPLICATION IN A TRAFFIC RADAR

Now that we have an understanding of the Doppler principle as applied to velocity measurement, let us examine how it is used in MPH traffic radar.

You will recall in the example of the automobile horn that the frequency of the horn tone and its rate of travel through the air were assumed to be constant, so that the only factor affecting the tone from the observer's standpoint was the change in position of the automobile. With radio waves, we are able to assume this with much greater confidence. For a source of radio waves, MPH has selected a sophisticated solid state device called a Gunn oscillator that generates radio energy in the microwave region. Specifically, at a K band frequency of 24,150 MHz and a Ka band frequency range of 33,400 MHz to 36,000 MHz.. This high frequency radio energy is focused into a narrow beam and directed at the target vehicle at the speed of light, the universal constant. A small portion of the beam is reflected back to a second solid state device called a mixer diode. The mixer diode compares the frequency of the reflected beam to the transmitted frequency. The difference between these two frequencies is called the Doppler frequency. Furthermore, the Doppler frequency is directly proportional to the sum of the transmitter (patrol) and target velocities. It can be shown mathematically that for a transmitted frequency of 24,150 MHz, a Doppler frequency of 72.023 Hz will be produced for each mile per hour. For example:

K band: 72.023 Hz/mph X 60 mph = 4321 Hz Doppler frequency

Knowing this relationship, we are able, by means of modern electronic circuitry, to convert the Doppler frequency as determined by the mixer diode into a digital presentation of the target's speed in miles per hour.

Some appreciation of the accuracy required of the complete system may be gained by looking at the very small numerical value of the Doppler frequency as compared to the transmitted and received frequencies.

K BAND **Vehicle Approaching-60 mph**

Reflected Frequency	24,150,004,321 cycles per sec.
Transmitted Frequency	24,150,000,000 cycles per sec.
	4,321 cycles per sec.

Vehicle Receding-60 mph

Transmitted Frequency	24,150,000,000 cycles per sec.
Reflected Frequency	24,149,995,679 cycles per sec.
	4,321 cycles per sec.

Note again how the reflected frequency is greater than the transmitted as the vehicle approaches and less than the transmitted as it recedes, yet the difference, the Doppler shift, remains constant for this particular vehicle speed.

E. MOVING RADAR THEORY

Moving traffic radar refers to units that have the ability to function while the patrol vehicle itself is in motion. They have this ability in addition to their standard stationary capabilities. When being used as a moving traffic radar, the MPH **PYTHON SERIES II** will simultaneously display both the patrol vehicle speed and the target vehicle speed. Like the stationary radar, the moving radar is based on the Doppler theory. However, with moving radar, the signal processing is more involved than with stationary. The radar receives reflected signals from both the target and the roadway. The target signal contains information on the combined speed of the two vehicles while the patrol signal has the information concerning the speed of the police vehicle. The receiver (mixer diode) in the antenna provides all of this information.

III. PRACTICAL USE

The MPH **PYTHON SERIES II** allows the operator to choose various types of use and operation. The radar may be used as a MOVING, STATIONARY, or PACING radar. The **PYTHON SERIES II FS** model also features the SAME DIRECTION and FASTEST features. Each of these uses is described below.

A. STATIONARY RADAR

As a stationary radar, the MPH **PYTHON SERIES II** allows the officer to monitor traffic coming or going while the patrol vehicle is stopped. The most widely used application is to park the patrol vehicle parallel to the roadway and aim the antenna backward to monitor the traffic coming up behind the patrol vehicle.

This type of operation is usually carried out in known locations of high-speed traffic or complaint areas. In the stationary mode, the unit displays only the speed in the target window. The target window will display speeds from a minimum of 15 mph; 20 mph for X band and up to a maximum closing speed of 209 mph for X and K band, and up to 200 mph for Ka band.

B. PACING RADAR

The **PYTHON SERIES II** radar allows the officer an accurate means of pacing vehicles. Of course, this should be done by following your departmental guideline for pacing. The unit should be placed in the stationary mode for this type of operation and will read out speeds up to 209 mph for X and K bands and up to 200 mph for Ka band.

C. FASTEST (FS OPTION)

Historically, traffic radar has displayed the strongest target. Case law has centered around the ability of the radar operator to confidently identify what vehicle is associated with that indication. It was relatively simple for analog radars to process this method.

A modern DSP radar such as the **PYTHON SERIES II FS** can process many targets at the same time, but there is no practical way to display multiple targets and associate them with the correct vehicles. FASTEST mode gives the operator an opportunity to view one other target besides the strongest. In this mode, the **PYTHON SERIES II FS** considers all possible targets (there may be several) and displays the fastest one. Doppler audio is also provided for this target.

While the speeds indicated in the fastest mode are as accurate as normal targets, visual identification of the offending vehicle is more difficult. For this reason, the **PYTHON SERIES II FS** only displays fastest targets on request from a momentary switch and does not allow them to be locked. It is intended to be used as a way to gather additional information about a specific situation.

D. MOVING RADAR

As a moving radar, the MPH **PYTHON SERIES II** allows the officer to monitor traffic speeds while carrying on other routine patrol activities. The unit monitors the speed of each approaching vehicle, displaying that vehicle's speed in the target window. Speeds can be monitored from a minimum of 20 mph up to a maximum closing speed of 209 mph for X and K band, and 200 mph for Ka band.

The speed of the patrol vehicle that can be acquired is 12 mph to 80 mph. This feature helps reduce the false patrol speeds while in heavy traffic conditions. The patrol vehicle speed is continuously displayed so that the operator may check the speed displayed against the speedometer reading. If these two speeds correspond, then the officer is assured that the reading of the violator's speed is correct at the instant of determination.

In opposite direction mode, care should be taken by the operator to recognize that the violator is traveling at a higher rate of speed than the norm, that the vehicle is out front, by itself, nearest the radar, that proper identification of the violating vehicle is made, and at the time of speed determination the patrol vehicle's speed indication on the radar is the same as the reading on the speedometer. If these steps are taken, and the radar was properly checked for calibration beforehand, the officer knows the radar was operating properly and that the radar made a true and accurate determination of the vehicle's speed.

E. SAME DIRECTION (FS OPTION)

Same Direction mode allows the **PYTHON SERIES II FS** to track targets moving faster or slower and in the same direction as the patrol vehicle. This mode is best used in light traffic where visual target identification is easier. With this feature active, the patrol speed range is limited to 20-80 mph and the target speed range is limited to patrol speed ±70%. The target must be greater than 3 mph faster or slower than patrol.

IV. MPH PYTHON SERIES II SPECIFICATIONS

The unit is designed for convenient use by law enforcement agencies to measure the speed of motor vehicles when operated from a moving or stationary patrol vehicle. The MPH **PYTHON SERIES II** utilizes the well known and legally accepted Doppler principle and has been type accepted by the Federal Communications Commission.

A. SYSTEM SPECIFICATIONS

Nominal Power Supply Voltage:	13.6 Vdc
Low Voltage Condition Level:	10.8 Vdc
Low Voltage Condition Alert:	When supply voltage decreases below 10.8 Vdc, a message is displayed on the front panel to warn the officer of a low voltage condition.
Power Requirements & Voltage:	10.8 Vdc-16.5 Vdc (13.6 Vdc Nominal)
Current:	Standby, no displays (.5A typical) Front antenna "on", no target (.8A typical) Front antenna "on", with target (1.0A typical) Front antenna "on", during LED test (1.6A typical)
Stationary Operating Speed:	Stationary mode operating speed range is from 15 mph up to 209 mph for K band or 200 mph for Ka band. X band operating speed is 20 mph to 209 mph.
Moving Operating Speed:	In opposite direction mode, Patrol Speed range is 12 mph to 80 mph. Target Speed Range is 20 mph up to a closing speed of 209 mph for K band and up to 200 mph for Ka band. X band target speed range is 20 mph up to a closing speed of 209 mph. In same direction mode, Patrol Speed range is 20 mph to 80 mph. Target Speed Range is patrol speed ±70%. There must be a minimum difference of 3 mph between target and patrol speeds.
Operating Temperature Range:	-30°C (-22°F) to 60°C (+140°F)
Operating Humidity Stability:	Operates normally up to at least 90% relative humidity at 37°C (99°F).

B. READOUT UNIT

Speed Display:	Three windows for LED speed display on Lexan scratch resistant front panel. LED displays automatically adjust brightness to ambient conditions. Windows display: Target Speed Target Lock Speed (or Fastest Vehicle Speed) Patrol Speed

LED Indicators:	SAME (same direction) (FS option) FAST (fastest vehicle) (FS option) FRONT (antenna) STBY (standby) REAR (antenna)

Switches:

Power	Moving/Stationary	Patrol Blanking
Test	Range Up	Audio Up
Squelch	Range Down	Audio Down

RS-232 Communications:	9-pin connector provides information to a mobile video recording system, LED speed monitor sign or remote display unit.
Physical Size:	Weight =.79 kg (1.75 pounds) Depth = 12.7 cm (5.00 inches) Width = 17.78 cm (7.00 inches) Height = 4.45 cm (1.75 inches)

C. ANTENNA UNIT

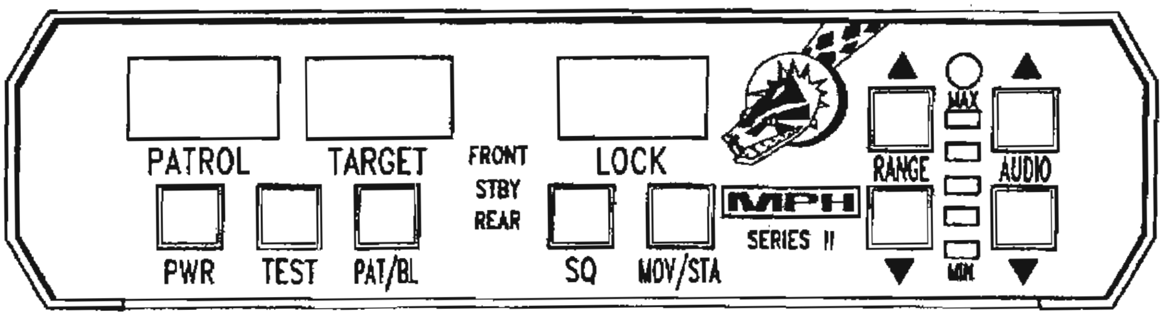
Circularly polarized antenna in an enclosed, seamless, cylindrical metal housing with a lens covering.

Operating Frequency:	X band:	10.525 GHz ± 25 MHz
	K band:	24.150 GHz ± 100 MHz
	Ka band:	Select frequencies between 33.4 and 36.0 GHz ± 100 MHz Ka band = 33.8 GHz
Microwave Source:	Solid state Gunn effect diode.	
Output Power:	Nominal 12-30 mW / Maximum 50 mW	
Radiated Power Density:	Less than 2mW/cm^2 at 5 cm.	
Type:	Circularly polarized conical horn	
Beam Width:	X band:	does not exceed 18°
	K band:	does not exceed 15°
	Ka band:	does not exceed 15°
Beam Width Variance:	±1° at maximum manufacturer's tolerance	
Side Lobe:	X band:	24 dB down from main beam
	K band:	24 dB down from main beam
	Ka band:	25 dB down from main beam
Received Microwave Beam:	Utilize transmitting antenna. Isolation accomplished by a turnstile phase shifter.	

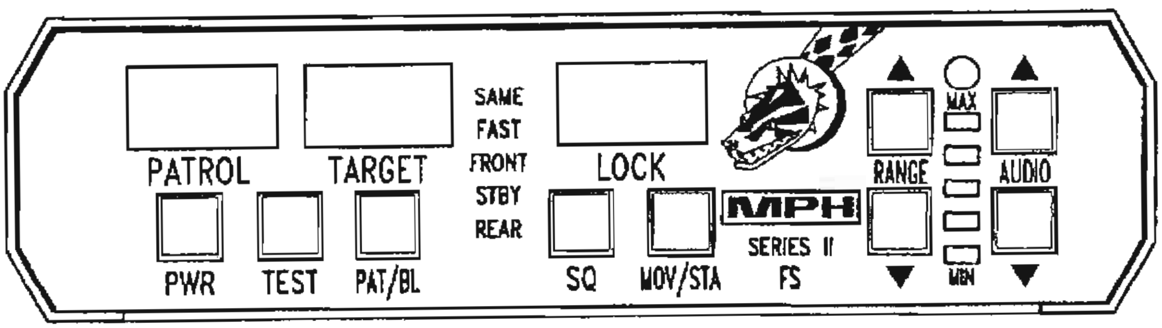
Transmitter:	Complies with FCC Part 90
FCC Type Acceptance:	X band: CJR-XPYT-001 K band CJRB-09-000831 K band (weatherproof) CJR-KWP-001 Ka band CJR-KA-BEE 36-001 Ka band (weatherproof) CJR-KAWP-001
Mixer Diode:	Schottky barrier type rated for 100 mW burnout.
Range:	1219m (4000 feet)typical for average size vehicle. Range varies by size of vehicle, terrain, traffic conditions, weather conditions, and other external conditions present in various locations.
Physical Size:	X band: Length = 14.0 cm (5.50 inches) Diameter = 11.4cm (4.50 inches) K band: Length = 12.7 cm (5.00 inches) Diameter = 9.5 cm (3.75 inches) Ka band: Length = 8.9 cm (3.50 inches) Diameter = 6.4 cm (2.50 inches)

V. MPH PYTHON SERIES II OPERATIONS

A. READOUT UNIT, FRONT PANEL



SERIES II



SERIES II FS

DISPLAYS / INDICATORS

PATROL: Displays the speed of the **PATROL** car in moving mode. Shows the locked patrol speed when in standby, if the target has been locked in moving mode.

TARGET Displays the speed of **TARGET** vehicles. Will also indicate low voltage (LO) or radio frequency interference (RFI) conditions. In standby, will display a warning before auto-clear.

LOCK: Displays the target vehicle after the **LOCK** button is pressed. The target window will continue to read vehicles and patrol will remain valid, giving the operator the opportunity to track through lock (or relock the same or a new target). Will also display the fastest vehicle when the "fast" key is depressed. When in same direction mode, with the "slow" key depressed, this window will display "SLO", while the target window displays the strongest target slower than patrol. Locked targets will be automatically cleared after 15 minutes.

FRONT: Indicates that the **FRONT** antenna has been enabled by the remote and is transmitting. Flashes when a vehicle is locked on the front antenna, but is not currently selected.

STBY: Indicates STandBY (anti-radar detector capability) has been enabled by the remote.

REAR: Indicates that the **REAR** antenna has been enabled by the remote and is transmitting.. Flashes when a vehicle is locked on the rear antenna, but is not currently selected.

SAME: (FS OPTION) Indicates that only targets traveling in the same direction as patrol will be recognized.

FAST: (FS OPTION) Indicates that "lock" window is being used to display the fastest vehicle instead of a locked speed.

MAX/MIN: Five LED's show the audio or range setting.

B. REMOTES

This module provides easy access to the essential radar functions. Three rocker switches provide mode selection and indication for most of the **PYTHON SERIES II FS** features. All of these controls and features are integrated into a small, remote hand-held module designed for convenience and ease of operation.

The DIRECTION button selects the direction of travel for targets while in the moving mode. The rocker switch allows the operator to choose OPPosite or SAME direction as patrol.

FASTEST and SLOW share the same momentary switch. The function is determined by the position of the DIRECTION switch.

FASTEST asks the **PYTHON SERIES II FS** to search for targets which are moving faster than the strongest signal, and display them in the lock window (This function is valid whether stationary or moving, but only in the opposite direction mode).

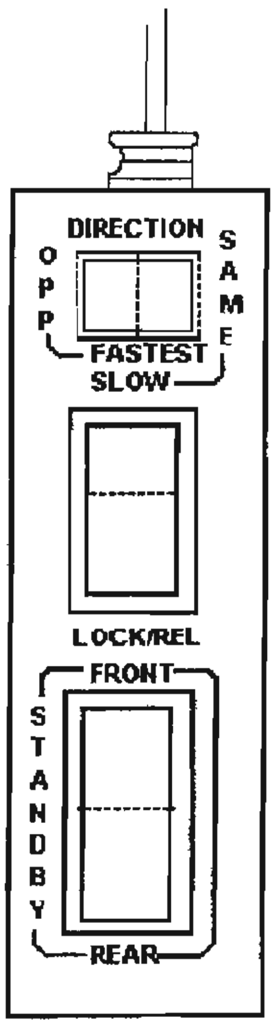
SLOW signals the **PYTHON SERIES II FS** that the target is slower than patrol (This function is valid in the same direction mode). Slow mode continues for one second after release to allow locking. The **PYTHON SERIES II FS** may be locked into slow mode by pressing the slow button twice in rapid succession (double click).

Pressing the LOCK/REL switch will cause the **PYTHON SERIES II** to lock the current patrol and target speeds and display the locked target speed in the LOCK window. Pressing LOCK when there is no target will clear the locked speeds. To clear the display when there are valid targets, press the lock button twice in rapid succession (double click).

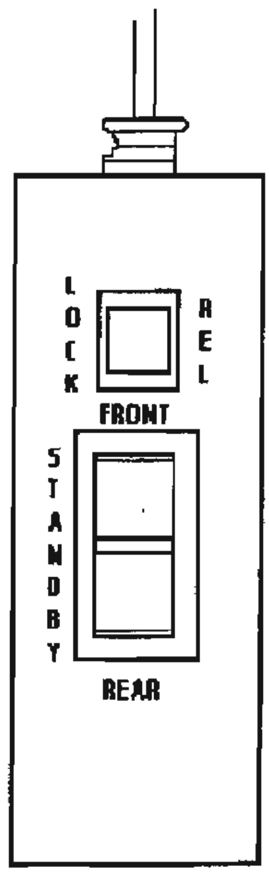
The FRONT/STANDBY/REAR rocker switch gives the operator the capability to control both antennas during dual antenna operation. Pushing the rocker switch toward the front label operates the front antenna, and turns on the FRONT indicator on the readout unit. The rear antenna (when applicable) is operated by depressing the switch toward the rear label to activate the REAR indicator. By setting the rocker switch in the middle position, the officer is able to place the radar unit in the standby mode (STBY indicator illuminated on the readout unit). If speeds are locked, the patrol and lock windows will display them along with flashing indications of antenna and direction at the time of locking. Leaving standby mode clears locked speeds.

The Operator may follow a locked target from one antenna to the other without losing the locked speed by switching quickly from one antenna to the other (without stopping in standby). If the displayed locked speed is from the opposite antenna, both that antenna's indicator and the locked speed indication will flash.

This module provides easy access to the essential radar functions. A push button allows control of the LOCK/RELease feature. This push button switch is used to lock or release the target and patrol speed reading. In addition, a rocker switch gives the operator the capability to control both antennas during dual antenna operation. Pushing the rocker switch towards the front label operates the front antenna, and turns on the FRONT indicator on the readout unit. The rear antenna (when applicable) is operated in a similar manner only the rocker switch is depressed toward the rear label and the REAR indicator is illuminated. Setting the rocker switch in the middle position, the officer is able to place the radar unit in the STandBy mode (STBY) mode (STBY indicator illuminated on the readout unit). STandBY mode provides the officer a means to completely defeat radar detectors. LED indicators on the from panel allow for quick confirmation of the antenna mode. All of these controls and features are integrated into a small, remote hand-held module designed for convenience and ease of operation.



Remote with Fastest and Same Direction Features



Remote without Fastest and Same Direction Features

C. FEATURES AND CONTROLS

1. **PWR (POWER)**
   Press and release **PWR** (power) to activate unit. Once the unit is activated an LED segment check is executed, followed by the internal circuit test described further in the description of "TEST." The unit will then be preset to the following operating modes: moving mode, maximum range, half audio volume, squelch, and no patrol blanking.

2. **TEST**
   Press and release **TEST** to perform the LED segment check followed by the internal circuit test. The LED segment check will display "-188" in the patrol speed window. The target and lock windows will display "888." The SAME, FAST, FRONT, STBY, REAR and the five LED's used for the audio and range will also be activated. This tests all the segments, indicators and LED's on the unit's front panel for approximately 3 seconds.

   The internal circuit test, which follows after the LED test, checks the internal speed processing circuitry by producing a simulated Doppler signal. With the unit in moving mode, a reading of "32" is displayed in the patrol and target windows. In the stationary mode, "32" will appear only in the target speed window. "PAS" will appear in the lock window if the unit passes internal tests. If the number "32" is not displayed, "ERR" is displayed in the lock window to indicate a failure in the unit. If this occurs, the unit should be taken out of service. **TEST** may be pressed at any time, locked speeds will be retained.

3. **PAT/BL (PATROL/BLANK)**
   Press and release **PAT/BL** (patrol/blank) to blank a locked patrol display while in the standby mode. Press and released **PAT/BL** again to display the locked patrol speed.

4. **MOV/STA (MOVING/STATIONARY)**
   Press and release **MOV/STA** (moving/stationary) to place the unit in stationary mode, dashes will be displayed in the patrol window. In stationary mode, the radar will monitor speeds of traffic coming and going in the direction in which the antenna is aimed. The patrol vehicle must be stopped unless the radar is being used for pacing, and the speed will be displayed in the target window. The unit is placed back into the moving mode by pressing and releasing **MOV/STA** again. In the moving mode, the radar will monitor the speed of moving traffic while the patrol vehicle is moving. The moving traffic speeds will be displayed in the target window and the patrol vehicle's speed will be continuously displayed in the patrol window.

5. **SQ (SQUELCH)**
   Press and release **SQ** (Squelch) to override the audio squelch to check audio for specific noise interference. Press and release again to enable the audio squelch.

6. **AUDIO UP AND DOWN**
   Press and release **UP** to increase the Audio volume. Press and release **DOWN** to decrease the Audio volume. The LED max/min bar indicates the 6 audio volume settings. The volume is muted when the LED's on the bar are off due to the down button being pressed past the min LED. The LED max bar will display the audio volume for 4 seconds after the **UP** or **DOWN** button is released.

7. **RANGE UP AND DOWN**
   Press and release **UP** to increase the range. Press and release **DOWN** to decrease the range. The LED max/min bar indicates the 5 range settings. The LED max bar will display the range for 4 seconds after the **UP** or **DOWN** button is released.

   NOTICE: If any of the preceding functions do not operate as described, the unit should be immediately shut down and taken out of service. We suggest the unit be shown to your department's Radar Specialist to determine if the problem is an operator training problem or a malfunction of the unit and requires servicing.

D. RS-232 COMMUNICATIONS

The **PYTHON SERIES II** has the capability to transmit serial communications via the 9 pin female connector on the rear panel labeled "Communications RS-232." The RS-232 communications port is designed to communicate with a mobile video recording system or an LED Speed Monitor sign, or a Remote Display unit.

E. REQUIRED MAINTENANCE

No user maintenance is required on this unit. However, as with any electrical system, careful handling of your **PYTHON SERIES II** will extend its life and usefulness. Abusive treatment of your system will increase the occurrence of broken connections, frayed cords, and damaged hardware and, consequently, could result in downtime for your system.

F. DUAL ANTENNA OPERATION

All MPH **PYTHON SERIES II** traffic radar units may be ordered with the dual antenna option. In this type of operation, one antenna is placed on the dash looking forward and one antenna is placed in the rear facing backward. The antenna is controlled from the remote control module by pushing the large black rocker switch to either the front or rear position. The STandBY mode, which makes the unit silent to radar detectors, is in the middle position of this rocker switch and controls both antennas. Only one antenna, either front or the rear, can be operational at any time.

The rear antenna has been very effective in monitoring vehicles who, after once passing the patrol vehicle, think they are safe and speed up. Likewise, it is very effective against the violators who are radar detector equipped.

In the stationary mode, the front antenna monitors traffic traveling in both directions in front of the patrol vehicle. The rear antenna does the same for the vehicles to the rear of the patrol vehicle. This allows for very easy and effective bi-directional monitoring of traffic.

G. PLACING THE PYTHON SERIES II INTO OPERATION

When the operator has become familiar with the controls, then the **PYTHON SERIES II** is ready to be placed into operation. The antenna should be placed in the mount provided and the read out module positioned convenient to hand and vision.

The **PYTHON SERIES II** is dash-mounted with a remote and one or two antennas. The unit is powered from the 12-volt, vehicle power system using a cigarette-plug cable from the counting unit. Each component should be installed in a location that provides good operator visibility and convenience while not interfering with air bag operation. The weatherproof antenna units are fully weatherproof and may be installed outside the vehicle, if desired. The other antennas and counting unit are <u>not</u> weatherproof and must be installed in a location sheltered from the weather. Longer cables are available from the factory for specific installations, if needed.

Counting Unit - To mount the counting unit, plug the remote, front and/or rear antenna cables into the back of the counting unit. If using only one antenna, plug it into the front jack. Attach the counting unit to the mounting bracket with the screws provided. Attach the mounting bracket to the selected mounting surfaces with suction cups, Velcro, screws, etc.

Antenna Unit - Before proceeding with the final installation, check the intended mounting locations for fan interference on both antennas. See the section entitled, "Interference Information and Precautions" in this operator's manual. Find a suitable location and attach the antenna mounting bracket to the selected mounting surface. Attach the antenna unit to the bracket. Connect the antenna cable to the antenna. Repeat these steps for the second antenna, if desired. After the unit is installed, the following step by step procedures will place the unit into operation.

1. Plug the cigarette lighter connector into the power source, either 12 Vdc vehicle socket or an optional battery pack.

2. Press **PWR** (power) to activate unit.

3. Select the mode of operation, either moving or stationary.

4. Perform a display segment check and circuit test by pressing **TEST**.

5. Perform a stationary mode tuning fork test. Place the unit in the stationary mode. Strike the tuning fork on wood or plastic and hold the ringing fork in a fixed position two or three inches in front of the antenna with the narrow edge of the fork facing the antenna front. This will cause the target speed window to display the speed labeled on the fork. While performing the tuning fork test, the audio volume level may be preset to a desirable level.

   Fastest mode (FS option) may be tested by using the lower speed tuning fork as above and by placing the ringing higher speed fork into the antenna beam at a greater distance since the fastest target should be a weaker signal than the target. The fastest button must be pressed and held on the remote. The audio will switch to the fastest target when present.

   For example, for forks marked 20 mph and 50 mph, the target would read 20 (the closer fork) and the fastest window would read 50.

6. Perform a moving mode tuning fork test.

7. Moving radar units are designed to acquire a patrol speed and look for target speeds that are faster (opposite direction) or slower (same direction) than patrol. These two speeds may be simulated using tuning forks.

   The two forks are manufactured to vibrate at different frequencies. One will be used to simulate patrol speed and the other target speed. In moving mode, the speed printed on the target fork will not match the speed shown on the **PYTHON SERIES II** display. It will be added to or subtracted from patrol.

   For opposite direction moving mode, the lower speed fork will simulate patrol speed while the higher speed fork will represent the target.

   For same direction moving mode (FS option), the higher speed will be the patrol fork while the lower speed will be the target.

   Strike the patrol fork on wood or plastic and hold the ringing fork in a fixed position two or three inches in front of the antenna with the narrow edge of the fork facing the antenna. The speed will be shown in the patrol window.

While continuing to hold the ringing fork in place, strike the other fork and hold it next to the patrol speed fork. Both forks must be vibrating while being held an equal distance from the antenna.

For opposite direction moving mode, the radar should display the low speed fork as patrol and the difference between the forks as the target speed. For example, for forks marked 20 mph and 50 mph, the patrol would read 20 (low speed fork) and the target would read 30 (high speed fork minus low speed fork).

For same direction moving mode (FS option), the radar should display the high speed fork as patrol and the sum of the forks as the target speed. For example, for forks marked 20 mph and 50 mph, the patrol would read 50 (high speed fork) and the target would read 70 (high speed fork plus low speed fork).

For same direction moving mode (FS option) with slow mode selected, the radar should display the high speed fork as patrol and the difference between the forks as the target speed. For example, for forks marked 20 mph and 50 mph, the patrol would read 50 (high speed fork) and the target would read 30 (high speed fork minus low speed fork).

VI. LEGAL GUIDE

The **PYTHON SERIES II** Doppler radar is based upon the well known and legally accepted Doppler principle of operation. Because of its accuracy and wide legal acceptance over the years, most citations based on Doppler radar now result in guilty pleas.

The arresting officer does need to acquaint himself, however, with the basic case laws regarding radar and make sure that he performs certain guidelines to meet these precedent cases. A brief description of the more important landmark cases are listed below. Much of the referenced material may be obtained at your local law library or prosecutor's office.

Reference A - 7 AMJr2d 870 (Sec. 327)

A legal encyclopedia dealing with automobiles and highway traffic, which describes the conditions under which evidence of excessive speed determined by the use of radar may be admitted.

Reference B - 49 ALR2d 469 and Cumulative Supplements Thereto

A legal publication reporting the Dantonio case (1955) and briefing it and subsequent cases dealing with proof, by means of radar devices, or violation of speed regulations.

Reference C - State v. Dantonio (NJ), 115 A2d 35, 49 ALR2d 460

A landmark case on the subject. This case sets precedent of the following:

1. Judicial notice has been taken of the accuracy of radar.
2. A few hours training is sufficient to qualify an operator.
3. The operator need not understand, or be able to explain, the internal workings of the radar.

Reference D - Everight v. Little Rock, Ark., 326 SW2d 796

Establishes that the court may take judicial notice of the reliability of radar.

Reference E - State v. Graham, Mo., 322 SW2d 188

Establishes that the court may take judicial notice of the ability of radar to measure speed.

Reference F - State v. 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 that the tuning fork is a reliable accuracy test.

Reference G - Honeycutt v. Commonwealth, Ky., 408 SW2d 421

In this appeal, the court rejects the arguments of the appellant that the evidence should not have been admitted and again establishes that: **1)**. A properly constructed and operated radar device is capable of accurately measuring the speed of a motor vehicle; **2)**. The tuning fork test is an accurate method of determining the accuracy of a radar unit; **3)**. It is sufficient to qualify an operator who has knowledge and training which enables him to properly set up, test, and read the radar; **4)**. It is not required that the operator understand the scientific principles of radar or be able to explain its internal workings, and that a few hours of instruction normally should be enough to qualify an operator; **5)**. The officer's estimate of excessive speed from visual observation, when confirmed by the reading of the radar device and when the offending vehicle is out front, by itself, nearest the radar, is sufficient to identify the vehicle if the observations support the radar evidence.

From the case law, the officer needs to know and to be able to testify to the following points to have a successful prosecution:

1. The officer must know the time and place of the offense, and location of the radar device.

2. The officer must determine the location of the offending vehicle at the time the offense took place.

3. The officer must determine that the offending person was the operator of the vehicle.

4. The officer must state his qualifications and training.

5. The officer must establish that the radar was tested for accuracy prior to its use by the use of a tuning fork.

6. The officer must be able to identify the vehicle.

7. The officer should have made a visual observation of its apparent excessive speed.

We also recommend you read our legal publication, *Legal Basis for the Use of Police Radar.*

VII. FCC LICENSE REQUIREMENTS

The MPH **PYTHON SERIES II** has a Grant of Type Acceptance from the Federal Communication Commission. Grant of Type Acceptance Number:

X BAND	CJR-XPYT-001
K BAND	CJRB-09-000831
K BAND (Weatherproof)	CJR-KWP-001
Ka BAND	CJR-KA-BEE36-001
Ka BAND (Weatherproof)	CJR-KAWP-001

The Read-out Unit has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructor's manual, may cause harmful interference to radio communications. If operation of this equipment in residential area causes harmful interference, the user will be required to correct this interference at his own expense.

Report No 17247 **ACTION IN DOCKET CASE** **November 5, 1982 PR**

LOCAL UNITS NO LONGER NEED SEPARATE LICENSE FOR SPEED DETECTORS (PR DOCKET NO. 82-183)

The Commission has eliminated a requirement for local governmental entities licensed in the Public Safety Radio Services to obtain a separate authorization for radar speed detection devices. This change will reduce paperwork for the Commission's licensing staff and for police and other local government units. They will no longer have to apply for new radar authorizations or modify or renew existing licenses and may operate speed detection devices as part of their base/mobile communications systems.

To provide the Commission with a record of the number of such units in use, licensees will be required 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 authorizations. Ordinarily, this would be once every five years and would not be a significant addition to the renewal process, the Commission noted.

Action by the Commission November 4, 1982, by Report and Order (FCC 82-488). Commissioners Fowler (Chairman), Quello, Fogarty, Jones, Dawson and Sharp.

PUBLIC NOTICE
Federal Communications Commission
1919 M Street N.W.
Washington, D.C. 20554

--REVISED-- AUGUST 1, 1985

FCC REGULATES RADAR TRANSMITTERS, BUT NOT RADAR DETECTORS

The FCC continues to receive many inquiries about regulations governing police radar, radar detectors, and other radar devices used in highways. This Notice explains the scope of FCC regulation over these devices. It updates and supersedes the Bulletin on the same subject dated July 18, 1980.

Traffic radar used by the police to enforce highway speed limits are transmitters. As such, they are type-accepted and authorized by the FCC under Part 90 of its rules. These rules permit any state or local government, with an FCC license for its radio communications system, to operate speed radar without getting separate licenses for them. The radar frequencies and number of units do not have to be shown on the license itself.

FCC rules explain how radar may be operated as transmitters but not how they may be used by police to measure vehicle speeds. The FCC has no jurisdiction over the calibration of radar or over the reliability of their readings.

The U.S. Department of Transportation's National Highway Traffic Safety Administration (NHTSA) is the federal agency concerned with the enforcement of highway speed limits and with the operation of police radar as enforcement tools. For more information, write to NHTSA's Office of Enforcement and Emergency Services, 400 Seventh St., Washington, D.C. 20590. (Or call the state or local police department for information about how radar is used in a particular area.)

Radar jammers are transmitters tuned to interfere with ('jam') a radar signal. The intentional use of jammers is considered "malicious interference," which is strictly prohibited by the Communications Act of 1934, as amended, and by FCC rules. Anyone using a jammer risks such penalties as losing any FCC licenses, paying a fine, or even facing criminal prosecution.

Radar detectors are radio receivers popularly known for being tuned to receive police radar signals and to warn motorists of radar "traps" ahead of them. In this regard, the FCC regulations pertaining to receivers are limited in scope and, as currently drafted, do not address the subject of radar detectors. The use of radar detectors by members of the public, therefore, does not constitute in itself a violation of FCC rules.

In summary, the FCC regulates transmitters but exercises only limited jurisdiction over receivers, with the subject of radar detectors not being addressed in the FCC rules. From a policy standpoint the FCC favors authorizing the use of radio, including radar, to promote safety on the public highways and elsewhere.

This notice is a revision of Public Notice 5947, released July 23, 1985. For more information about the subject of this notice, contact Richard Kenney in the Private Radio Bureau at (202) 632-6497.

VIII. INTERFERENCE INFORMATION AND PRECAUTIONS

There are several factors that can influence the operational behavior of Doppler radar. These influences can be natural or man-made. A knowledgeable operator will not be confused by these external influences.

1. NATURAL INFLUENCES

a. Driving rain or blowing dust can cause a scattering effect, or diffusion, which can decrease the effective range. The patrol display may be affected by a driving rain storm. Close observation of the patrol vehicle speed is recommended.

b. Terrain can affect the range. Should the patrol car be on a slight decline, the antenna could be shooting short of the target vehicle. If on a slight incline, it could be shooting over the target vehicle. Range may be shortened in either case.

c. Strong reflectors can cause target readings which are the same as the patrol speed when in the moving mode. To avoid this problem, the MPH **PYTHON SERIES II** detects these harmonics and inhibits their display.

NOTE: This feature may cause occasional blanking of legitimate target speeds when it is the same as the patrol speed, or a multiple of it. If the operator suspects this is the case, he can change his speed. In any case, the range of any other target is not changed- i.e., if the closest target is blanked due to the coherence detector, the MPH **PYTHON SERIES II** will not acquire and display a weaker, more distant target in its place.

2. MAN-MADE INFLUENCES

These influences are normally the most troublesome because they generally involve electronic signals which may cause spurious displays, or they may lessen the effective range.

a. Electronic noises are generated by: power transformers, radio transmitters, neon lights, etc. These influences generate a phenomenon that can cause a radar to display a false reading or lessen the effective range.

b. Intermittent readings need not be confusing if the officer is familiar with the operation of the MPH **PYTHON SERIES II**. For example, if the radar is pointed at the dashboard of the patrol vehicle, it may read the speed of the defroster/heater fan, because most dashboards are now made of plastic. The MPH **PYTHON SERIES II** comes equipped with a specially designed dashboard mount which will help to eliminate this intermittent reading.

b1. All radar speed measurement devices are sensitive to objects that move or vibrate in front of the antenna. In instances where the antenna is pointed in the general direction of the fan, or where the radar beam is reflected by the glass towards the heater / defroster fan, the radar may read the speed of the fan. Reading the fan speed is annoying and, in some cases, can reduce the effective range of the speed measurement device.

MPH Industries suggests the following if fan interference is suspected:

b1a. First, determine the fan is the source of interference by checking whether the readings change when the fan is turned off or when the fan speed is increased or decreased.

b1b. Reduce the effects of the fan by locating the antenna in an area that is less susceptible to the fan motion. MPH Industries provides several antenna mounting options. Our dashboard mount is designed to reduce fan pick-up. In some cases, the upper left-hand corner of the windshield has been found to be the best internal mounting location.

An external antenna mounted outside the patrol vehicle is the best solution to help eliminate the fan pick-up and increase effective range. MPH Industries provides a weatherproof antenna that can be permanently mounted outside the patrol vehicle.

c. The RFI indicator will show the presence of strong RF fields caused by local transmitters. To prevent possible readings caused by the interference, no target speed will be displayed when this indicator is on.

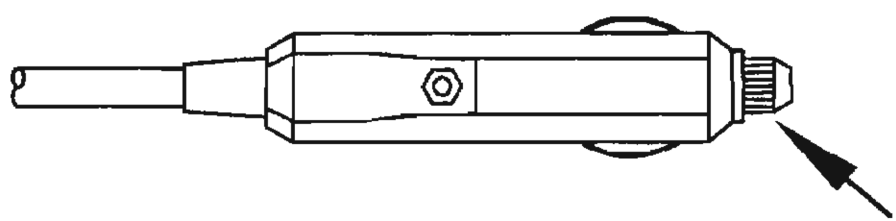
IX. POWER SOURCE AND FUSE

Cigarette lighter receptacles have been the traditional source of power for traffic radar. However, poor grounding, electronic ignition bleed over, and alternator noise in newer cars can combine to create an unacceptably high level of ambient electronic interference. In some instances, an unusually noisy vehicle ignition/alternator noise can result in false readings and/or reduce the range.

To combat this, it is recommended that a shielded cable be run from the battery directly to an auxiliary receptacle installed under the dash or on the console. This should effectively eliminate any power source problems.

NOTICE

Units are shipped with a fused cigarette lighter plug. The fuse is housed inside the tip of the plug. (See arrow in below illustration.) To remove fuse: twist, and pull out tip with fuse. Replacement fuses should be 2 Amp/AGC.



X. QUALITY CONTROL AND TESTING PROCEDURES FOR TRAFFIC RADAR

All MPH Industries, Inc. traffic radar comply to the following Quality Control conditions:

1. All parts and components are ordered to commercial high reliability accuracy and performance specifications.

2. Only vendors that meet standards for Quality are selected to supply parts and materials.

3. All electrical and electronic components are utilized within their performance specification and adequate safety factors are provided for voltage, current and heat dissipation.

4. Assembled circuit boards are individually tested before incorporation into higher level assemblies.

5. Each completed traffic radar is tested in an anechoic chamber for proper performance and compliance to accuracy requirements.

6. Each tested radar is run on burn-in for not less than twelve hours. After completion of burn-in testing, the unit is again checked to assure product excellence.

7. Each radar is road tested under conditions encountered in actual operation.

8. Tuning forks are individually tested using calibrated equipment with traceability to the National Institute of Standards and Technology. A certificate of accuracy is furnished with each tuning fork.

9. Samples of police traffic radar devices are tested by outside laboratories for compliance to requirements specified for Critical Performance Test (CPT) by the International Association of Chiefs of Police (IACP).