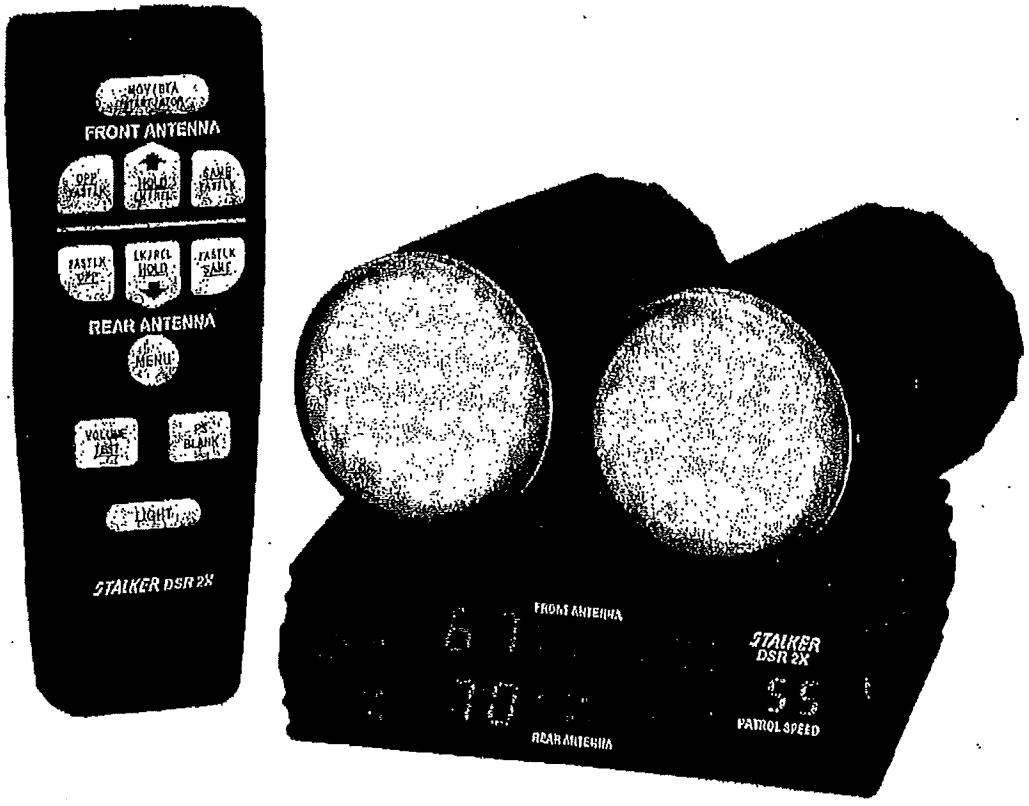
STALKER®
DSR 2X
Direction Sensing Moving Police Radar



Operator's Manual

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011-0076-00 Rev A

HOW TRAFFIC RADAR WORKS

Stationary Mode - All traffic radar uses the Doppler frequency shift technique to measure the speed of moving vehicles. This technique is based on the Doppler Principle, which states that a radar signal reflected from a moving target will experience a frequency shift that is proportional to the speed of the target relative to the radar. Circuitry in the traffic radar then processes the reflected signal to obtain the frequency shift and translate this frequency shift to speed.

In stationary mode, the transmitted signal strikes a moving target and is reflected back to the antenna. The traffic radar then measures the frequency shift to obtain the target speed.

Prior to the introduction of the ***STALKER DSR*** line of products, traffic radar could not sense the direction of vehicles in the radar beam. In conventional traffic radar, targets both closing and moving away generate the same Doppler frequency shift, and it is not possible to distinguish their direction. Since the conventional radar cannot distinguish the direction of the targets in its beam (closing or away) the operator had to rely on visual observation to determine target direction.

Now, the ***STALKER DSR 2X*** has the ability to filter out Doppler signals based on their direction. For example, while monitoring front closing targets, the 2X can reject Doppler signals from all front away targets.

STALKER DSR line is the first practical radar to use a dual-channel antenna design. Each antenna actually has two sets of microwave circuits and two sets of amplification/digitizing circuits. The two microwave circuits are designed to provide two simultaneous Doppler signals with a 90° phase difference depending on direction.

Both channels of digitized Doppler information are sent to the DSP (Digital Signal Processor) circuit in the counting unit. The high-speed DSP circuit then performs a Complex Fast Fourier Transform computation simultaneously on each channel to obtain relative direction for each target.

Opposite Lane Moving Mode - In opposite lane moving mode, two (2) signals must be processed to determine target speed. The first signal, patrol speed, results from the radar signal reflecting from the roadway ahead of the radar. Since the Doppler shift is proportional to the relative velocity between the radar and the roadway, the Doppler shift of this signal will be proportional to the speed of the patrol vehicle. The second signal, closing speed, results from the radar signal reflecting from an approaching or retreating opposite lane moving target back to the patrol vehicle. The Doppler shift of this signal will be proportional to the sum of the patrol speed and target speed, or closing speed. To determine the target speed, ***STALKER DSR 2X*** subtracts the patrol speed from the closing speed.

Same Lane Moving Mode - In same lane moving mode, two (2) signals must be processed to determine target speed. The first signal, patrol speed, results from the radar signal reflecting from the roadway ahead of the radar. Since the Doppler shift is proportional to the relative velocity between the radar and the roadway, the Doppler shift of this signal will be proportional to the speed of the patrol vehicle.

The second signal, the difference speed, results from the radar signal reflecting from an approaching or retreating same lane moving target back to the patrol vehicle. The Doppler shift of this signal will be proportional to the difference speed between the patrol and target vehicles. If the target vehicle is moving faster than the patrol vehicle, the difference speed will be added to patrol speed to obtain target speed. If the target vehicle is moving slower than the patrol vehicle, the difference speed will be subtracted from the patrol speed to obtain target speed. To reduce user confusion, front same-lane targets and rear same-lane target will be rendered by the ***STALKER DSR 2X*** using two different Doppler tones. Front same-lane targets will use the same Doppler tones as used for opposite-lane targets and stationary targets. Rear same-lane targets will use a lower tone that is proportional to the difference Doppler shift between the patrol vehicle and the target.

Prior to the introduction of the ***STALKER DSR*** line, a radar operator had to observe the relative speed of the target vehicle and "tell the radar" whether to add or subtract the difference speed from the patrol speed as described above. These older same lane radar models require that the operator select the "correct speed" by the "correct position" of the "Slower" key on the remote control.

The unique Direction Sensing ability of the ***STALKER DSR 2X*** allows the radar to automatically (without the traditional "slower key") determine the correct speed of all same lane targets in the radar beam.

Fast Mode - ***STALKER DSR 2X*** offers a feature called *Fast Speed Tracking*. *Fast Mode* display can be easily turned ON/OFF in the Operator Menu. See Page 8. In addition, *FAST* target locking (for both same and opposite lane targets) can be turned ON/OFF in the Options Menu. See Page 38.

The addition of the *fast mode* allows the ability to track small high speed targets that normally could not be tracked because a stronger target shields the weaker target from normal speed measurement. The classic example is where a speeding sports car passes a slower moving eighteen wheeler. The *faster* sports car, although clearly speeding, previously could not be measured because the strongest truck target captures the target display window. ***STALKER DSR 2X***, in this example, will display the speed of the strongest truck in the target window, while the speed of the *faster* sports car will appear in the middle *fast* window. Tracking of both targets may be performed simultaneously.

REAR TRAFFIC ALERT

Rear Traffic Alert, a proprietary new feature of the ***STALKER DSR 2X***, is designed to warn the patrol officer of rapidly overtaking rear same-lane traffic. Rear Traffic Alert is active when the patrol vehicle is most vulnerable to rear-end collisions - pulling into traffic from a standing start or traveling at a speed substantially below the prevailing traffic flow. If the ***STALKER DSR 2X*** senses a rear approaching vehicle closing at a speed in excess of the user adjustable approach speed, it prompts the officer with a distinctive "English Horn" audio sound and flashes ALE rt in the rear antenna speed windows.

Rear Traffic Alert can be disabled in the OPTIONS MENU (See page 38). Please contact Applied Concepts, Inc. at 1-800-***STALKER*** or your Factory Sales Representative. Rear Traffic Alert can also be disabled by setting the closing speed to a high speed such as 200.

Rear Traffic Alert is always active (unless disabled in the OPTIONS MENU – see page 38). Rear Traffic Alert is independent of the rear target zone selection – either the Rear Opposite or Rear Same target zone can be selected. If tracking targets in Rear Same Lane mode, the 2X will sound the alert tone and flash the alert display once, then resume tracking the Rear Same Lane targets. Rear Traffic Alert will be disabled if the rear antenna is placed in Hld (hold).

With Rear Traffic Alert enabled, go to the OPERATOR MENU (See page 8) to select the Rear Traffic Alert closing speed. In the OPERATOR MENU, repeatedly press the MENU key until ALE rt is displayed. Set the desired Rear Traffic Alert speed by using the ↑ and ↓ keys (the factory default speed is 30 mph). Pressing the ↑ key or the ↓ key will initially change the number count slowly, but after about 1 second, the counting will speed up. Exit the OPERATOR MENU mode and return to radar mode by pressing any of the four zone keys.

Rear Traffic Alert Requirements:

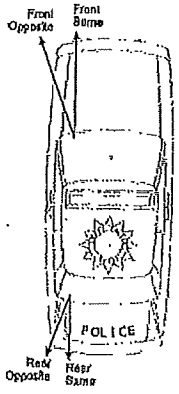
1. The radar must have VSS cabling installed in the vehicle and must be operating in VSS mode.
2. The rear antenna must be transmitting with either the Rear Opposite target zone or the Rear Same target zone selected.
3. Direction sensing will be used to ensure that the rear traffic is closing on the patrol vehicle.
4. The radar sensitivity is reduced to less than SEn 1 (to ensure close proximity) for measurement of approaching rear traffic. All rear targets that are "outside" of the Rear Traffic Alert requirements will have normal sensitivity.
5. To reduce Rear Traffic Alert warnings while slowing down to turn or slowing down to a stop, the radar disables Rear Traffic Alert when it senses vehicle deceleration.

ABOUT TARGET ZONES

This manual refers to the four areas that a traffic radar monitors as: Target Zones

Conventional moving radar can monitor traffic in only one Target Zone. Now, with the introduction of the ***STALKER DSR 2X***, two moving target zones and all four stationary target zones can be monitored simultaneously. ***STALKER DSR 2X*** is actually two independent radar units operating on a single display unit.

Those Target Zones are:



- Front Opposite
- Front Same
- Rear Opposite
- Rear Same

In moving mode, two Target Zones can be simultaneously monitored – one front Target Zone and one rear Target Zone.

In stationary mode, all four Target Zones can be simultaneously monitored. The direction arrows indicate target direction for both the front and the rear display windows. Or, if desired, only one front Target Zone and one rear Target Zone can be simultaneously monitored.

STALKER's superior Direction Sensing Radar technology monitors both the speed and direction of vehicles traveling in each Target Zone. Voice enunciators confirm a locked target vehicle's position and direction relative to the patrol car for quick confirmation.

HOW TO INITIATE A SELF-TEST

Self Testing Modes — 2X Display Unit

Power-On Self-Test

Each time the unit is powered on, an automatic self-test is performed to verify that the unit functions. All displays indicate 888 (Fig. 40) during the test. A 4-beep "happy" tone indicates the successful completion of this test. If a problem is detected, FAIL will be displayed along with a 20-beep tone. Immediately after power-on, and while all display segments are illuminated, pressing the **MENU** key will display the software version followed by the nominal transmitter frequency.

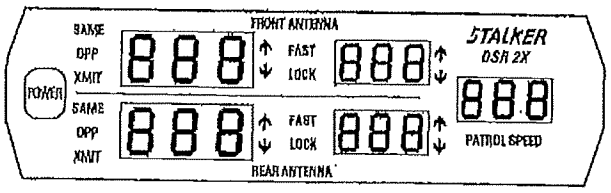


Fig. 40

Internal Circuit Test

An internal circuit test can be performed at any time by pressing and holding the **TEST** key. This performs a diagnostic check on the display/counting unit (Fig. 41), the antennas, and antenna cables.

The display/counting unit will first perform a segment test, processor check, memory check, and crystal accuracy check. Next the input voltage and internal temperature is checked to verify they are within limits. (Fig. 42) Following will be the display of speeds 10, 35, and 65 (Figures 43, 44, and 45).

A comprehensive test is also performed on both antennas by the display/counting unit to ensure the integrity of the antenna cables and electronics. After all the tests are completed, PASS (Fig. 46) along with a 4-beep "happy" tone indicate successful test completion. FAIL along with a 20-beep tone indicates a failed self-test.

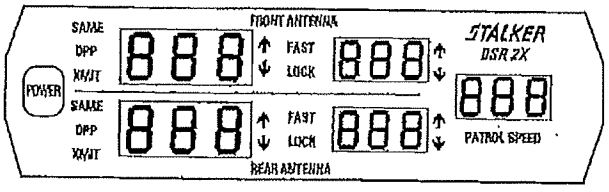


Fig. 41

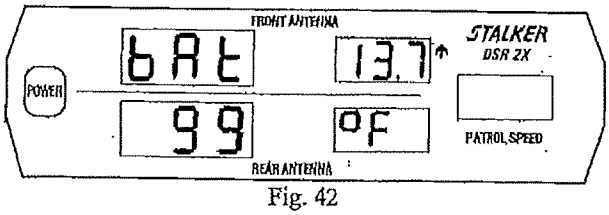


Fig. 42

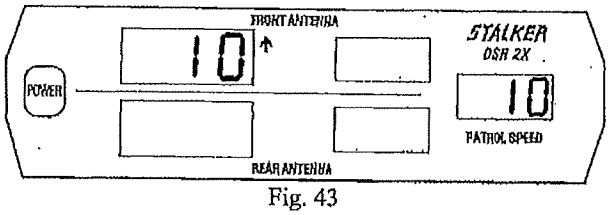


Fig. 43

Self Testing Modes — 2X Display Unit

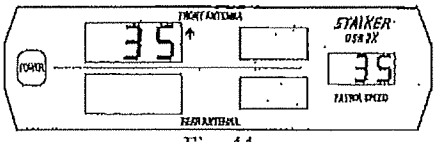


Fig. 44

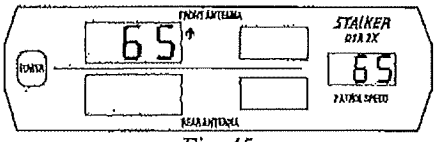


Fig. 45

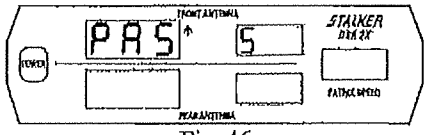


Fig. 46

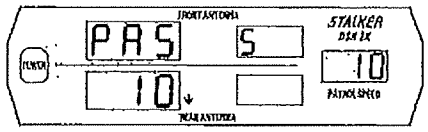


Fig. 47

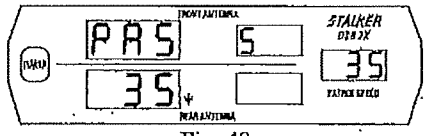


Fig. 48

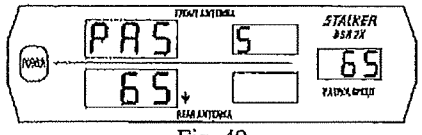


Fig. 49

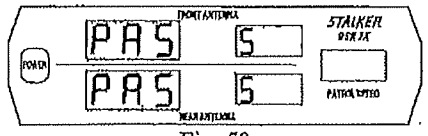


Fig. 50

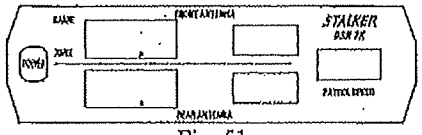


Fig. 51

Automatic Self-Test

An automatic self-test (indicated by a 4-beep "happy" tone) is performed every 10 minutes while *STALKER DSR 2X* is transmitting. Switching antennas from **XMIT** to HLd to **XMIT** will reset the 10-minute timer.

DIRECTIONAL MOVING-VEHICLE TEST

A directional moving vehicle test can be performed as an additional check of performance and accuracy. To perform the moving vehicle test: press the **PWR** key to turn on the radar. Use the **MOV/STA** key to switch into Stationary mode. (Note: This test cannot be performed with VSS activated.)

TO TEST THE FRONT ANTENNA:

While driving a patrol vehicle, with an accurately calibrated speedometer, aim the front antenna down an empty highway directly in front of the vehicle. While driving forward, alternately switch between the *front* **OPP** target zone and the *front* **SAME** target zone. As you alternate between the two target zones, verify that the *front* **OPP** target zone always shows an accurate ground speed in the target window while the *front* **SAME** target zone always shows no speed in the target window. While in *front* **OPP** target zone, the moving roadway appears as an approaching target to the radar and will be seen in the front target window but will not be seen when the radar is in the stationary *front* **SAME** target zone.

TO TEST THE REAR ANTENNA:

While driving a patrol vehicle, with an accurately calibrated speedometer, aim the rear antenna down an empty highway out the rear window of the vehicle. While driving forward, alternately switch between the *rear* **OPP** target zone and the *rear* **SAME** target zone. As you alternate between the two target zones, verify that the *rear* **OPP** target zone always shows an accurate ground speed in the target window while the *rear* **SAME** target zone always shows no speed in the target window. While in *rear* **OPP** target zone, the moving roadway appears as a receding target to the radar and will be seen in the target window but will not be seen when the radar is in the stationary away *rear* **SAME** target zone.

The speed indicated by ***STALKER DSR 2X*** should match the speedometer indication within a small error (depending on speedometer accuracy). This simple test verifies both accurate speed measurement and proper direction sensing operation.

THE PERFECT PATROL SPEED WITH VSS

Traffic Radar Patrol Speed Measurement

Moving traffic radar systems normally obtain patrol speed by measuring the speed of the radar return from the moving roadway in front of the moving vehicle. Patrol speed tracking sometimes suffers from anomalies known as "batching" and "shadowing." These anomalies occur during moments when the roadway is obstructed from the radar beam by road conditions or other vehicles. The solution is to allow the traffic radar to monitor vehicle tire rotation and to use this information to perform "patrol speed steering." The simplest way to monitor tire rotation is to attach to the Vehicle Speed Sensor (VSS) signal in the patrol vehicle.

The VSS Speedometer Signal

All modern vehicles have a VSS sensor (Vehicle Speed Sensor) attached to the transmission or an axle that generates a speed signal. The speedometer and other electronics in the vehicle use the VSS speed signal. By tapping into this signal, the Stalker DSR 2X can monitor the actual patrol car speed and use the VSS speed information to help the radar pick the correct ground speed. The radar's patrol car speed is still always measured by radar. The VSS simply helps steer the radar into making the right choice.

The Result is PERFECT Patrol Speed

- The radar will never shadow.
- The radar will never batch.
- It tracks and acquires patrol speeds from 1-200 mph.
- Moving/Stationary selection becomes automatic.
- Patrol speed variations produced by weather effects are greatly reduced.
- Patrol speed variations produced by road clutter cosine effects are greatly reduced.
- Low speed combing effects are eliminated.