TALON

TRAFFIC SAFETY RADAR

USER MANUAL

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REV. C

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EXHIBIT 2.983(d)(8)

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Section 1.0 INTRODUCTION

The Kustom Signals Talon radar system comes from a long standing commitment to the law enforcement community to provide quality, state-of-the-art speed measuring equipment. The Talon offers features never before available on a moving/stationary handheld K_a-Band radar system, yet allows easy operation and easy one button mode changes.

Since the Talon radar system uses Digital Signal Processing (DSP), it has available options to the officer which allow same direction speed detection and fastest vehicle mode, showing the operator the speed of the strongest and fastest vehicle speeds detected. Along with the above features, the Talon offers Kustom Signals proven quality and service to the customer.

This is the smallest handheld, battery operated moving and stationary radar Kustom Signals has produced. While small size was an important feature during the design of the Talon, durability was the key issue. We know police radar equipment, building the first digital traffic radar unit in 1970. Our history of firsts has never been overshadowed by the need for durability and a strong case. Things do get dropped. Our Falcon, HR-12 and other handheld products are designed to meet these demanding needs. The Talon is no exception and its one-piece extruded aluminum case protects the electronics not only from shock and vibration, but from rain and moisture.

All these features and performance standards are packed into this small, lightweight, battery operated unit. A unit that must be seen to be believed.

2.0 SPECIFICATIONS

Type:	One-piece, Moving/Stationary True Doppler radar system
Frequency:	K_a-Band 33.4-36.0 GHz ±100 MHz
System Accuracy:	Stationary ±1 mph (±2km/h) Moving +1/-2 mph (+2/-3 km/h)
Operating Voltage:	Corded: 10.8 to 16.5 VDC, 800 mA max Cordless: 7.2 VDC nominal NiMH

Nominal Power Reqm'ts:	Voltage (VDC)	Current (mA)
Without target present:	13.6	600
With target present:	13.6	625
With target & backlight	13.6	650
Standby (HOLD):	13.6	95

Reverse Voltage Protection:	Diode protection. No damage if supply leads reversed.
Electronic Components:	100% solid state; integrated circuits, microprocessor and Digital Signal Processor
Operating Temperature:	-22°F to +140°F (-30°C to +60°C) 90% relative humidity, non-condensing

Dimensions:

w/o handle:	
Height:	3.56" (9.04 cm)
Width:	3.0" (7.62 cm)
Depth:	7.25" (18.42 cm)
Weight:	1 lb. 12 oz. (.79 kg)
Handle:	
Height:	5.75" (14.6 cm)
Width:	2.17" (5.51 cm)
Depth:	3.61" (9.16 cm)
Weight:	13 oz (.37 kg)
Cordless:	13 oz (.37 kg)
Corded:	6 oz (.17 kg)

2.1 OPERATIONAL

Speed Processor:	Digital Signal Processing (DSP) Performs all signal analysis.
Operational Processor:	All functions are microprocessor controlled.
Manual Test:	All display segments checked; checks internal calibration and performs a cross check of quartz crystals for accuracy.
Automatic self-test:	Comparison of quartz crystals done periodically (5 minutes maximum), upon every mode change and at the time of lock. "ERR" displayed if an error is found.
Lock Time:	Instantaneous.
Patrol Window:	Displays Doppler patrol speed.
Target Window:	Displays truncated target speed
Lock/Fast Window:	Displays locked target speed or fastest vehicle in Fast mode.
Display Type:	Active matrix Liquid Crystal Display (LCD).
Back Lighting:	Light pipe weave, single Light Emitting Diode (LED).
Automatic Clear:	All locked displays are cleared when mode of operation changes.
Speed Range:	Meets IACP/NHTSA specifications. Stationary: Target channel sensitivity of 10 dB from 35 to 90 mph (56 to 144 km/h); 5 dB from 60 to 90 mph (96 to 144 km/h) Moving (Opposite direction): within 10 dB for targets between 40 to 90 mph (64 to 144 km/h). Maximum closing rate 210 mph (336 km/h).

	Moving (Same direction): 10 dB for target difference speeds of 5 to 25 mph (8 to 40 km/h)
Stationary:	10 to 210 mph (16 to 336 km/h)
Patrol:	10 to 80 mph (16 to 128 km/h) Typical patrol speeds to 120 mph (193 km/h)
Target Opposite Direction:	Maximum target speed is a function of combined patrol and target speeds to 210 mph (336 km/h)
Same Direction:	Minimum difference: 3 mph (5 km/h) Maximum difference: 55 mph (88 km/h)
Indicators: Stationary:	"TARGET" window displayed
Moving:	"PATROL" window displayed along with Target window.
Low Voltage:	"BATT" displayed when internal or corded supply voltage falls below minimum operating levels. Locked speeds will remain.
Radio Frequency Interference:	"RFI" displayed during radio frequency interference. Speed displays will blank during this condition. Locked speeds will remain.
Error:	"ERR" displayed when an internal error in the operating system is detected. All speed displays will blank. Locked speeds will remain.
Hold:	"HOLD" is displayed when the system is not transmitting. Controlled by the trigger in stationary mode or remote control in moving mode.

Opposite:	"OPP" displayed when in moving-opposite direction mode.
Same:	"SAME" displayed when in moving-same direction mode.
Lock:	"LOCK" displayed and flashing indicating locked target speed.
Fastest:	"FAST" displayed when fastest mode (stationary or moving-opposite) selected. Flashes in locked fastest mode.
Same:	"SAME" displayed when in moving-same direction selected. Operator controlled when target is slower than patrol vehicle. Flashes in locked slower mode.
Microwave Source:	Gunn-Effect diode.
Beam Width:	$12° \pm 1°$
Power Density:	Less than 5 mW/cm^2
Side Lobes:	25 dB below main lobe.
Receiver:	Low Noise Schottky diode.
Weather Resistant:	For use outside vehicle.

3.1 INITIAL INSPECTION

Before installing your Talon, please take a moment to carefully inspect the shipping carton for damage. Contact the shipping carrier at once if you notice any damage.

Remove the unit from the shipping carton and check the packing list against your original purchase order. If the shipment is incomplete or parts are missing, please contact Kustom Signals Customer Service Department at 1-800-835-0156, or (316)431-2700.

3.2 MATERIALS SUPPLIED

DESCRIPTION

The following equipment is normally included:

Corded Handle
Dash Mount
Mounting Pod
Remote Control
55 mph Tuning Fork
30 mph Tuning Fork
Speedometer Input Cable
Operator's Manual

OPTIONAL

Fastest Vehicle Mode
Same Direction Mode
Battery Handle w/charger
Battery Pack w/charger
Heavy Duty Carrying Case
Auxiliary Power Receptacle Cable

3.3 EQUIPMENT MOUNTING

3.3.1 AUXILIARY POWER RECEPTACLE

Cigarette lighter receptacles have been the traditional source of power for traffic radar over the years. In the newer vehicles, it is possible that poor grounding of this receptacle, electrical noise from the vehicle's alternator charging system, electrical fuel pump and microprocessor noise can combine to create an unacceptably high level of ambient electronic interference.

AIRBAG CAUTION

Equipment mounted in 1994 or later series police vehicles may interfere with the operation of passenger side airbags. Information is available directly from the automobile manufacturers regarding areas for safe mounting of equipment such as police radar.

Since this information will vary by vehicle make and model year, Kustom Signals recommends contacting the vehicle manufacturer and following their instructions with respect to mounting of radar units and other equipment.

For additional mounting suggestions, please contact the Kustom Signals Customer Service Department.

Kustom Signals cannot accept any liability for equipment which has been mounted in conflict with the vehicle manufacturer's recommendation for proper airbag deployment.

This interference can affect the radar's performance in several ways: decreased range, no target speeds being displayed or abnormal tones or noise in the audio. Available for each Talon radar system is an auxiliary power receptacle, which mounts under the dashboard and wires directly to the battery.

1. Mount the receptacle in the desired location using the hardware provided.

2. Connect the black wire to the receptacle's mounting bracket. Connect the white wire (with Faston terminal) to the rear plug of the receptacle. Route the cable through the firewall and up to the battery.

3. Connect the white wire of the power cable to the battery (+) positive terminal and the black wire to the (-) negative terminal.

4. The auxiliary power receptacle is supplied with a 2 amp fuse to protect the battery should the cable become shorted.

3.3.2 SPEEDOMETER PULSE CABLE INSTALLATION

1. The speedometer pulse cable has a two-conductor connector at one end and no connection at the other end. The connector plugs into the mounting pod of the Talon, see Fig. 2, next to the remote control connector.

2. The inner conductor of the speedometer pulse cable will be connected to the patrol vehicle's electrical speedometer input cable using the splice connector provided. Please refer to the attached cabling diagrams to identify the proper vehicle wire location for your particular make, model and year of vehicle. For additional information, or if your vehicle is not listed in the diagrams, contact the vehicle manufacturer directly.

NOTE: Only the inner conductor of the speedometer pulse cable is used. The outer shield is not connected.

3. The speedometer interface will be set up later, in Section 6.6.

3.3.3 INDICATOR UNIT (MOVING MODE)

1. The indicator unit consists of the antenna/display unit and the mounting pod. If required, remove the battery or corded handle by depressing the release button on the bottom of the

indicator, just behind the rear of the handle and pull the handle rearward. Refer to Fig. X.

It is recommended that the Talon indicator unit be mounted on the dashboard of the patrol vehicle within view of the driver and in a safety zone during airbag deployment. Please contact the vehicle manufacturer or Customer Service for suggested mounting locations.

2. Locate the dash bracket and mounting pod. Secure the mounting pod to the dash bracket, if necessary and position in a suitable location on the dash.

3. Connect the Talon's power cable to the proper power source. See Section 3.3.1.

4. Momentarily depress the PWR switch on the rear panel of the Talon. (Refer to Section 4.1 for location and function of the switches.) The Talon will process through an indicator test, internal test and several other reliability tests. Select the Stationary mode of operation by depressing the MODE switch, if required. (If the PATROL window is active, depress the MODE switch.) Only the TARGET will be visible in the stationary mode.

5. Momentarily depress the AUDIO. The Target window will display "Aud" and a number from 0 to 5 indicating the audio level. With "Aud" displayed, depress the RANGE switch until level 4 or 5 is displayed. Also, with "Aud" displayed, depress the MODE switch , which will unsquelch the audio.

6. Start the patrol vehicle and position the A/C-heater fan to a mid-range speed. Move the Talon left or right of it's initial location and listen for any raspy sound (fan interference) in the audio. Position the Talon to minimize the amount of interference.

CAUTION: Review the airbag warning statement shown earlier in this manual before securing the dash bracket.

7. When a suitable location is found, secure the dash bracket to the windshield using the suction cups and Velcro, or permanently mount the bracket to the windshield.

8. Position of the antenna:

   Moving: Aim the antenna parallel to the ground and straight down the roadway.

Stationary: Unit may be moved on the mount or handheld to achieve maximum performance and pointed directly toward the vehicles being monitored.

4.1 REAR PANEL

A.	Target Speed	Displays the truncated speed of target vehicles in stationary and moving modes.
B.	Lock/Fast Display	Displays locked and fastest vehicle targets.
C.	Patrol speed	Displays the speed of the patrol vehicle.
D.	Opposite	Activates when in the moving - opposite direction mode.
E.	Same	Activates when in the moving - same direction mode.
F.	Fast	Activates when the fastest vehicle mode has been activated.
G.	Slow	Activates when in moving - same direction, slower mode selected.
H.	Range Indicator	Bar graph display indicates set level of range control.
I.	TEST	Switch used to test the internal accuracy and lights all indicators.
J.	MODE	Switch used to select operating mode: moving or stationary.

K.	RANGE	Switch used to place the Talon in the range set mode. Secondary function is the increment (up) control.
L.	AUDIO	Switch used to display the level of audio currently selected. Secondary function is the decrement (down) control.
M.	PWR	Switch control for power on/off.
N.	HOLD	Indicates when the Talon is in the non-transmit mode.
O.	ERR	Indicates when an internal error has occurred.
P.	BATT	Indicates when the battery or external power source is below the minimum operating voltage.
Q.	RFI	Indicates when an excessive amount of RF interference is present.

4.2 TRIGGER

Moving:	Trigger is not active in this mode.
Stationary:	Trigger used to activate transmitter, lock the active target speed and control the optional fastest vehicle feature.

4.3 REMOTE CONTROL

The remote control operates through the dash bracket pod. The unit plugs into the pod and allows direct control of the following functions:

A.	Lock-Release	This push-button switch is used for locking and releasing target and/or patrol speeds.
B.	Hold	This switch is used to turn the microwave transmitter on and off.
C.	Fast/Slow	This switch is used in the stationary and opposite direction moving mode to activate the fastest target vehicle mode. In the same direction mode, used to tell the DSP that the target vehicle is slower than the patrol vehicle.
D.	Same/Opposite	Switch selects either the (target) same or opposite direction modes.
E.	Patrol Blank	This switch will blank and recall a locked patrol speed. It also activates setting minimum patrol speeds and synchronizing the speedometer input.

5.0 GENERAL

The handheld/mounted Talon moving radar system transmits a radio frequency on K_a-Band, in compliance with the Federal Communications Commission (FCC) regulations. In stationary, a portion of the transmitted signal strikes a moving target, traveling toward or away from the transmitter, and the reflected signal is received at the antenna. From the antenna, the signal travels to the Digital Signal Processing (DSP) where it is translated to the speed of the target.

In the moving mode, a portion of the transmitted signal strikes the surface of the roadway and surrounding terrain and reflects back to the antenna. The returning signal is the "low" Doppler. From the antenna, the signal travels to the Digital Signal Processing (DSP) where it is translated to the speed of the patrol vehicle (groundspeed) and displayed in the patrol window.

With speedometer pulse input, the DSP compares the indicated patrol speed from the vehicle's speedometer and is directed to "look" for the microwave low Doppler signal around this speed, ±5 mph (±8 km/h). If a low Doppler signal is found, it is counted and displayed in the Patrol window. The Talon does not use the speedometer input other than to direct the DSP toward the desired area.

A portion of the transmitted signal strikes an oncoming vehicle (target vehicle) and returns to the antenna at a higher frequency because the two objects (patrol vehicle and target vehicle) are converging. This returning signal is the "high" Doppler. Then the Talon measures the speed of convergence, or combined speed, of the patrol vehicle and target vehicle.

After receiving the "high" Doppler signal, the Talon automatically computes the difference between the speed of the patrol vehicle and the target vehicle. The speed of the approaching vehicle registers in the Target display. If for example, a patrol vehicle is traveling at 50 and an approaching vehicle is traveling at 70, the Talon would process the groundspeed of 50 and combined speed of 120. The DSP would subtract the patrol speed from the combined speed to determine the target speed (120-50=70). The patrol display would indicate 50 and the target display would indicate 70.

In the Same Direction mode, the "low" Doppler and the "difference" Doppler signals are received and sent to the DSP. The Difference Doppler is the speed difference between the patrol vehicle and the vehicle traveling in the same direction. The Talon will display the patrol speed then add or subtract the "difference" speed to the patrol speed for the target speed.

Assume the patrol vehicle's speed was 50, and the target was traveling in the same direction at 70. The Talon would display the patrol speed as 50 and add the "difference" Doppler signal (20) to the patrol speed and display 70 in the target display. (50+20=70)

5.1 MICROWAVE RF EMISSIONS

Traffic radar operators may have some questions about the biological effects of exposure to the microwave energy produced by traffic radar devices. According to all credible evidence, the emission levels resulting from traffic radar use pose no threat whatsoever, either to the radar operator or to target vehicle occupants.

One widely recognized authority for safe limits of nonionizing radiation exposure is the American National Standards Institute, which recommends maximum exposure levels for the frequencies on which the Kustom Signals traffic radar systems operate (ANSI/IEEE C95.1-1992, "Standard for Safety Levels With Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz"). These exposure levels, expressed in terms of power density, are 7 mW/cm^2 for X-Band radar, and 10 mW/cm^2 for K-Band and K_a-Band radar units. Similarly, the Occupational Safety and Health Administration (OSHA), a division of the U.S. Department of Labor, recommends a 10 mW/cm^2 exposure limit for all three frequency bands ("Radiation Protection Guide", 29 CFR, Chapter XVII, Subpart G, Part 1910.97). This limit is clearly accepted by most reputable scientific and medical authorities.

Kustom Signals radar systems utilize microwave transmitters which produce aperture power densities, measured directly at the face of the antenna, in the range of approximately 0.3 to 2.3 mW/cm^2. Typical levels for the vast majority of units are in the 0.4 to 1.0 mW/cm^2 range, which is but a small fraction of the recognized safe limits. Bear in mind that these are level measurements taken directly in the main beam of the antenna, and that the power densities produced at the sides and rear of the unit are typically at least one hundred times lower than in the main beam.

Another reference document on this topic is a DOT publication entitled "Field Strength Measurements of Speed Measuring Radar Units" (NHTSA Technical Report #DOT-HS-805 928). This report documents a series of tests performed by the National Institute of Standards (formerly the National Bureau of Standards) on twenty-two (22) commonly used models of traffic radar units, from six different manufacturers including Kustom Signals. Aperture power density levels measured were from 0.25 to 2.82 mW/cm^2, while back-lobe power density values ranged from 0.001 to 0.02 mW/cm^2. These measurements were obtained with the radars mounted inside vehicles, as in normal operating conditions. Since the NIST study, other laboratories have duplicated these types of measurements, producing consistently similar results.

For a free copy of the latest information regarding the safe human exposure standards, please call or write Kustom Signals to request the "RF Emissions Packet." You may contact us at our corporate headquarters:

Kustom Signals, Inc.
9325 Pflumm Road
Lenexa, KS 66215-3347
(913)492-1400
(913)492-1703 FAX

While traffic radar devices do emit microwave energy, the levels are so low that there are no probable harmful effects. You may use your Kustom Signals radar unit with complete confidence in its safety, as well as in its accuracy.

6.0 OPERATION

The internal test and tuning fork tests explained below should be conducted at the beginning and end of each patrol shift to ensure the accuracy and functionality of the unit. The results of these tests may be recorded in a radar log, or officers shift log.

6.1 POWER ON

Momentarily depress the PWR switch. The unit will display all display segments and perform a test of the internal ROM, RAM and a crystal cross check to verify the accuracy of the speed processing circuitry.

If these tests pass, the unit will display "32" in the target display window, stationary mode, or both target and patrol display windows in the moving mode. This will remain for approximately one (1) second. The displays will clear and the unit will be operational in the speed mode.

6.2 AUTOMATIC SELF-TEST

The Talon performs an internal accuracy test whenever the unit's mode of operation is changed, such as moving to stationary, or upon the lapse of a maximum time period of 5 minutes, as long as the unit is powered up. In addition, this self-test will be initiated each time the target speed is locked.

This test is automatic and will not interfere with any radar speed readings being taken. The test does not appear in the displays, but if an error is detected, the target display will indicate "ERR" and further speed readings will be inhibited.

6.3 MANUAL TEST

The operator can depress the Test switch at any time during normal radar operation to perform the indicator and internal tests as described in the following section.

If either the manual or automatic internal tests fail, "ERR" will be displayed in the Target window and no further speed readings will be displayed. The unit should be removed from service and sent to an authorized service center for repair.

6.4 ACCURACY TESTING

6.4.1 STATIONARY MODE

Depress the Mode switch, if necessary to place the Talon in the stationary mode (only the Target display will be indicated). The Talon is automatically placed in the stationary mode when the handle, corded or cordless, is attached.

Momentarily depress the Test switch. The indicator test will be performed followed by the display of "32" in the Target window indicating the internal crystal cross-check has been successfully completed. The unit will return to normal stationary radar mode.

6.4.2 MOVING MODE

Depress the Mode switch, to place the Talon in the moving mode. Both the Target and Patrol displays will be indicated. Momentarily depress the Test switch. The unit will proceed through the indicator and internal tests as described above except both the patrol and target windows will display 32.

INTERNAL TEST TOLERANCE: 0

6.5 TUNING FORK TESTING

Supplied with the Talon are two tuning forks, 30 and 55 mph (45 and 80 km/h). These tuning forks will simulate moving vehicles in the stationary, moving opposite and moving same direction modes.

The tuning fork tests should be conducted in an area with no traffic. If this is not possible, point the Talon upward to avoid reflections from moving vehicles.

6.5.1 STATIONARY TUNING FORK TEST

1. Place the Talon in the stationary mode of operation.

2. Verify the range level is set a maximum. Depress the Range switch to display "rnG", then use the UP arrow to increment the range level to maximum.

3. Lightly strike the lower speed tuning fork on a hard, nonmetallic surface. Place the fork in front of the antenna and pull the trigger, placing the Talon in the transmit

mode. Verify a target speed display of the value stamped on the tuning fork, ±1 mph (±1 km/h).

4. Repeat for the higher speed tuning fork.

6.5.2 MOVING-OPPOSITE DIRECTION TUNING FORK TEST

1. Place the unit in the mounting pod and select moving mode, opposite direction.

2. Depress the Mode switch to toggle to the moving mode, if necessary.

3. From the remote control, depress the OPP/SAME switch, if necessary, to select opposite direction. The OPP indicator will be lit.

4. Place the Talon in the transmit mode by depressing the Hold switch, HOLD indicator is off.

5. Lightly strike the lower speed tuning fork on a hard, nonmetallic surface and placing it in front of the antenna. The Patrol window should read the speed stamped on the tuning fork, ±1 mph (±1 km/h).

6. While holding the lower speed fork in front of the antenna, lightly strike the higher speed tuning fork and place it in front of the antenna. The Target window should display the difference between the lower fork and the higher fork.

   The Target display tolerance is ±1 mph (1 km/h).

6.5.3 SAME DIRECTION TUNING FORK TEST

1. From the moving mode, depress the Opp/Same switch on the remote control and place the unit in the Same Direction mode. The SAME indicator will be lit.

2. Lightly strike the higher speed tuning fork on a hard, nonmetallic surface and hold it in front of the antenna. The Patrol window should display the speed stamped on the fork, ±1 mph (±1 km/h).

3. While holding the high speed tuning fork in front of the antenna, lightly strike the lower speed tuning fork and hold it in front of the antenna. The Target window should display the sum of the higher and lower speed tuning forks.

   The Target display tolerance is ±1 mph (±1 km/h).

6.5.3 TUNING FORK TEST FAILURE

If the proper speed reading are not obtained during the previous tests, check the following:

1. Verify that the tuning forks are the proper tuning forks supplied with the unit.

2. Striking the tuning fork too hard or on a metallic surface will cause spurious overtones from the tuning fork. This may cause the speed readings to be double the specified speed. Also, moving the tuning fork while in front of the antenna may cause the speed reading to be slightly lower or higher than specified. These readings are only momentary and the proper readings should appear as the false overtones dissipate.

3. Ensure that the Talon is in the transmit mode and the range control is set to maximum.

4. If the proper readings cannot be obtained, remove the unit from service and send to an authorized service center for repair.

6.6 SPEEDOMETER VERIFICATION

The initial use of the Talon with speedometer pulse input requires the radar unit to be synchronized with the speedometer.

1. After installation and initial testing with tuning forks, the Talon should be driven at a constant speed, between 30 and 70 mph (48 and 112 km/h). Depress the Patrol Blank switch on the remote control two (2) times. "Snc" will appear in the Target window and low Doppler patrol speed will appear in the Patrol window.

2. Verify the patrol speed displayed is correct, cross check with the speedometer reading, and depress the Lock/Release switch. This tells the DSP processor that the current speedometer reading and the low Doppler patrol speed reading agree, within speedometer tolerance limits.

3. After approximately, two (2) seconds, a synchronization number will appear in the Lock window. For a Ford Crown Victoria, this number will be between 28 and 30. This indicates the Talon is reading and comparing the speedometer speed input and the true low Doppler patrol speed.

NOTE: ONLY THE TRUE LOW DOPPLER SPEED SIGNAL IS USED FOR PATROL SPEED. THE SPEEDOMETER INPUT IS USED ONLY TO STEER OR GUIDE THE DSP TO "LOOK" FOR THE LOW DOPPLER SIGNAL IN A SPECIFIC AREA, IGNORING OTHER SIGNALS.

4. During normal operation, at patrol speeds below the minimum limit of 10 mph, 16 km/h, or when a "low" Doppler signal cannot be found, the Patrol window will display two dashes (--), indicating that the speedometer speed is being received but a patrol speed cannot be found or displayed. As an example, a patrol vehicle is slowing down and as the speed passes the minimum speed, dashes will be displayed.

6.7 MINIMUM PATROL SPEED SET

1. The Talon allows the operator to set a minimum patrol speed of 10, 20, 30 or 40 mph (16, 32, 48 or 80 km/h). This feature will only be active when the speedometer input feature is not used.

2. To activate this feature, place the unit in the moving mode and depress the Patrol Blank switch one (1) time. The unit will display "Pat" and the last selected minimum patrol speed will be displayed. Default is the lowest value.

   This value will remain for approximately two (2) seconds unless the remote's Lock/Release switch is depressed, which increments the speed value. Once the proper minimum value is selected, the unit will time out in two (2) seconds and the last displayed value will be accepted as the new minimum patrol speed.

3. To display the existing minimum patrol speed, depress the Patrol Blank switch one (1) time. The current minimum patrol speed will be displayed in the Patrol window. After two (2) seconds, the Talon will return to normal operation.

6.8 MOVING MODE TEST

Verification of speed readings between the patrol vehicle's speedometer and the Talon's patrol speed display is another accuracy test that can be performed. These readings should be the same, or within reasonable limits, allowing for minor speedometer error.

If a discrepancy is found, the radar unit should be removed from service until the error can be corrected.

7.0 OPERATING MODES

The Talon radar system offers the operator one of the most versatile handheld K_a-Band traffic radar available today. This versatility allows the operator to monitor traffic traveling in both directions in the stationary mode, and both directions while the patrol vehicle is moving, using opposite and same direction modes.

NOTE: The following guide to operating the Talon radar system is not intended to be a training program. Before operating this unit or any other traffic radar system, Kustom Signals urges all operators to have prior training in radar speed monitoring devices. Such courses are offered by Kustom Signals, various state and local agencies and either IPTM (Institute of Police Technology and Management) or Northwestern University. Contact your District Manager for further details.

7.1 Setup

The Talon may be used with a corded handle, requiring external power from a portable battery pack, auxiliary power receptacle (see Section 3.3.1) or through the patrol vehicle's cigarette lighter receptacle. In addition, the Talon has an optional battery handle which offers complete portability for the traffic officer.

7.1.1 BATTERY OPERATION

The Talon's battery handle must be charged prior to usage. An internal monitor checks the voltage and alerts the operator should the voltage drop to a minimum operating level. A short alert tone will be heard and the "BATT" indicator will flash momentarily. This will repeat every two minutes, but the Talon will continue to provide speed readings until the voltage drops below the minimum operating level, when the "BATT" indicator will be steady and no further speed readings will be possible.

7.1.2 BATTERY CHARGING

Remove the battery handle by turning the unit upside down and depress the blue handle release button located directly behind the handle. Slide the handle off the unit and connect the battery charging cable to the bottom of the handle. The charging time will vary depending upon the amount of discharge, but typically overnight will completely charge the Talon's battery.

7.1.3 STATIONARY

1. For stationary operation, select an area that provides a good view of the traffic to be monitored.

2. Check the immediate area for potential interference sources, such as large reflecting signs in the direct path of the radar's microwave beam, power substations and other potential sources of electrical interference.

3. Position the patrol vehicle in a safe location, with easy access to the roadway.

NOTE: Cosine effect, angle between the target's direction of travel vs. the path to the radar, in the stationary mode, will ALWAYS be in the driver's favor. Refer to the National Highway Traffic Safety Administration's "Basic Training Program in RADAR Speed Measurement" for speed reduction information due to cosine angle.

7.1.4 ADJUSTING AUDIO

Adjust the Doppler audio for the desired listening level. Depress the Audio switch. The Target window will display "Aud" and the Patrol window will display the current audio level. This display will remain for approximately two (2) seconds unless another switch is activated.

With "Aud" displayed, depress either the down arrow (Audio) or up arrow (Range) to decrement or increment the audio level. The displays will return to their normal mode two (2) seconds after the last switch is released.

7.1.5 AUDIO UNSQUELCH

1. To unsquelch the audio, depress the Audio, "Aud" showing in the Target window, and depress the Mode switch. "Un" will be displayed, and the audio will be unsquelched. To return to squelched audio, repeat this step.

2. Set the range control to the desired level. Depress the Range switch and "rnG" will be displayed, along with the current level (0-5). Also, the range bar graph will indicate the current level. The range can be incremented or decremented by depressing the up arrow (Range) or down arrow (Audio). The Talon will return to normal operation with the new range level approximately two (2) seconds after the last switch activation.

Range level 5 is the maximum range, range level 1 reduces the Talon's range to its minimum distance, typically 250 feet (90 meters). Some states or departments require a minimum range level of "0". The Talon may be ordered with the minimum set level of "0" instead of "1".

7.2 OPERATION - STATIONARY, HANDHELD

1. Place the unit in the stationary mode.

2. Set the range and audio levels as needed.

3. Complete a tracking history on the target vehicle.

   A. Observe the target and surrounding traffic.

   B. Estimate the speed of the target vehicle.

   C. Point the Talon at the intended target vehicle and pull the trigger, holding the trigger depressed to complete the tracking history.

   D. Listen to the audio pitch and compare the pitch to the estimate of speed in B.

   E. Observe the speed reading shown on the Talon's Target window. It should correspond with B and D above. Continue tracking the target vehicle as required for proper target identification.

   F. If any of the above elements are incompatible, the reading must be disregarded.

7.3 STATIONARY TARGET LOCK - HANDHELD

1. To lock the target speed reading, release the trigger. A short audio alert tone will be heard in the speaker and the target speed will be locked and flash in the Lock window.

2. The Talon will continue to transmit for a period of five (5) seconds to allow additional tracking of the target vehicle. When the Target window blanks, or at the end of the five (5) second time out, the transmitter will return to Hold (non-transmit) and the target window will blank.

3. To release a locked speed, pull and release the trigger. The Lock window will blank. No speeds can be recalled.

NOTE: Some models, due to state or local law, require an automatic unlock feature. The Talon software has a feature that, when enabled, will unlock all locked speeds when 15 minutes has elapsed.

7.4 STATIONARY FASTEST VEHICLE MODE - HANDHELD

1. If a faster vehicle is observed within the range of the radar, but due to closer and/or larger targets, would not be the strongest reflected signal, the operator may place the Talon in the fastest vehicle mode.

2. While observing traffic, the operator may activate the fastest vehicle mode by depressing the trigger (transmit mode), then quickly release and depress, and hold, the trigger a second time, within ¼ second. As long as the trigger is held depressed, the Talon will remain in the fastest vehicle mode.

3. When the trigger is released, and a fastest vehicle is displayed, an alert tone will be heard, the Lock window will indicate the fastest vehicle locked speed, the Fast indicator will be lit and flashing, and the Target window will continue to track the fastest vehicle until:

   A. Five (5) seconds has elapsed.

   B. The Target window blanks.

7.5 MOVING MODE - OPPOSITE DIRECTION

1. Remove the handle from the Talon by depressing the handle release button on the bottom of the main unit.

2. Slip the Talon on the mounting pod, pushing rearward until the release button clicks, indicating the unit is securely in place.

3. Connect the remote control and speedometer input cables as required. See Fig. XX.

4. Place the Talon in the moving mode by depressing the Mode switch, if needed. Both the Target and Patrol windows indicators will be lit.

5. The Talon may be placed in the Hold mode (non-transmit) by depressing the Hold switch on the remote control. The Hold indicator on the rear panel of the Talon will be lit.

6. While driving, observe traffic and complete a tracking history as described in Section 7.2 and verify the radar's patrol speed reading with the patrol vehicle's speedometer. When all elements agree, enforcement action may be taken.

7.6 MOVING MODE - TARGET LOCK

1. If the operator wishes to lock the target speed reading, depress the Lock switch. A short alert tone will be heard and the Lock window will display the speed of the target vehicle.

2. The Talon will continue to track the target and patrol speeds.

3. When the patrol vehicle's speed has dropped 10 mph (16 km/h) below the speed when lock was activated, or the Talon is

placed in Hold, the patrol vehicle's speed, at the time of lock, will be flashing in the Patrol window.

NOTE:	This allows the operator to continue to track the target while monitoring the patrol vehicle's speed and still retain the locked patrol speed.

4. The locked speeds may be unlocked by:

   A. Depressing the remote's Lock/Release switch.

   B. Auto-unlock after 15 minutes, if activated.

   C. Changing the mode of operation, moving to stationary.

7.7 MOVING MODE - PATROL BLANK

1. The operator may blank the flashing locked patrol speed display by depressing the Patrol Blank switch on the remote control. Depressing the switch again will return the patrol display.

7.8 MOVING MODE - FASTEST VEHICLE

1. With the unit operating in the moving mode, observe traffic.

2. Depress and HOLD the Fastest switch on the remote control.

3. The Fast indicator will be lit, the fastest speed will be displayed in the Fast window and the strongest signal speed will be displayed in the Target window, and the patrol speed will continue to track.

7.9 MOVING MODE - FASTEST VEHICLE LOCK

1. To lock the fastest vehicle speed, momentarily depress the Lock/Release switch on the remote control.

2. After a short alert tone, the Fast display will indicate Lock, the Target window will track the fastest speed and the patrol window will track patrol speed.

3. The Talon will continue to track the speeds as in Section 7.6.

7.10 MOVING MODE - SAME DIRECTION

1. Select the moving mode, same direction by depressing the Opp/Same switch on the remote control. The Same indicator will be lit.

2. While driving, observe traffic traveling the same direction as the patrol vehicle.

3. Complete a tracking history, and verify the patrol speed agrees with the speedometer speed reading. Enforcement action may be taken.

NOTE: If the patrol speed is 34 mph (54 km/h) or lower, the maximum difference in speed between the patrol vehicle and the target vehicle is 25 mph (40 km/h). However, if the patrol speed is 35 mph (56 km/h) or higher, the maximum difference speed is 55 mph (88 km/h). The minimum difference in speed between the patrol vehicle and the target vehicle is 3 mph (5 km/h).

4. If the target vehicle is traveling slower than the patrol vehicle, the operator should depress and hold the Slower switch on the remote control. The Slow indicator will be lit.

5. When the slower switch is released, it will remain active for approximately two (2) seconds. This will allow the operator time to lock the target speed reading.

8.0 INFLUENCES AND INTERFERENCE

Interferences from external sources may affect the standard operation of any radar device, including the Talon. These influences can be natural or man-made, however the Digital Signal Processing circuitry will eliminate most of these influences and a knowledgeable operator should be able to determine the nature of the influences and their effect, if any, on the performance of the Talon.

8.1 NATURAL INFLUENCES

1. Heavy rain and blowing dust can cause a scattering effect which may reduce the effective range of the Talon. The patrol speed can also be affected by driving rain. It is recommended that the operator compare the patrol speed reading and the speedometer reading frequently during rainy periods.

2. Terrain can affect the range of the Talon. Improper aiming of the antenna can cause the radar to appear to have short range. If the target vehicle were on a slight incline, the antenna could be shooting short of the intended target vehicle.

3. Strong reflections from roadside objects, such as large signs, parked cars and buildings can cause double bounce reflections which are the same as the patrol speed. These "harmonics" are detected by the DSP, which inhibits their display. This also occurs if the intended target vehicle is traveling at the same speed or a harmonic of the patrol speed.

   To notify the operator a harmonic speed was detected, the Target window will display two (2) dashes (--). This feature is normally enabled, but may be disabled. The Target window will be blank if this feature is not activated.

8.2 MAN-MADE INLUENCES

1. Various reflections can cause most radar to display incorrect speed readings. These include shadowing, combined speeds, moving cosine and fan interferences (splitting speeds).

Unlike other radar, the DSP processor in the Talon can sense and eliminate most of the interferences that other radar might see as speeds during normal operation.

Another anomaly of Doppler radar is slow speed combining when a close target vehicle and the slow patrol speed combine and are displayed in the Patrol window. The Talon with speedometer input will eliminate this effect, and the unit will display the proper patrol and target speeds.

2. If the power source or internal battery voltage nears the minimum operating voltage, the Talon will notify the operator with a short alert tone and flash the "BATT" indicator for one (1) second. This message will repeat every two (2) minutes until:

   A. The voltage drops below the minimum operating voltage.

   B. The voltage raises above the minimum voltage alert level.

3. Radio Frequency Interference (RFI) exists when there are strong RF transmitting stations in the immediate area of the radar unit, such as the patrol vehicle's transmitting radio, high power radio or television stations. These sources of interference will be detected by the Talon and the RFI indicator will be lit and all speed readings will be blanked, except for locked speeds, until the source of interference is reduced or eliminated.

NOTE:	Refer to the National Highway Traffic Safety Administration's Basic Training Program in RADAR Speed Measurement, June 1991, for further information on interferences and training guides.

8.3 GROUNDSPEED

True groundspeed of the patrol vehicle is required by all moving traffic radar systems before a target vehicle's speed can be accurately computed. If the Talon loses groundspeed, due to weak patrol speed returns, the operator may momentarily place the unit in the Hold mode then activate the transmitter again to restore groundspeed.

If the speedometer input is being used with the Talon, the DSP will accurately track even a weak patrol speed return due to the small tracking window, unlike radar without speedometer input.

The Talon will always look for and display groundspeed before displaying any targets. The groundspeed radar signature is unlike any target or interference signal. The DSP can identify this pattern, which is helpful in situations such as shadowing or combined speeds. While the speedometer input and DSP technology will eliminate most of the influences found in moving radar, it is still the responsibility of the operator to complete a tracking history on the target vehicle and verify the patrol speed with the patrol vehicle's speedometer. Close observation of the patrol vehicle's speed reading is recommended to avoid possible confusion.

NOTE: The Talon will not display patrol speeds below 10 mph (16 km/h).

Operating moving radar in the rain and snow requires the operator to pay close attention to the patrol speed. Since rain, fog and snow may affect the ability of the radar system to find groundspeed, the operator must verify the displayed patrol speed reading is correct.

CARE OF THE TALON

The Talon radar system is designed for long reliable use by law enforcement agencies. Following basic care guidelines will ensure the unit gives many years of trouble-free service.

1. Use a damp cloth to clean the outside of the radar unit if it becomes dirty. DO NOT use excessive water or any cleaners or sprays on the outer surface of the Talon's mounting pod or remote control.

2. As with all electrical or electronic equipment, protect from water. While the Talon is a sealed radar unit, the mounting pod and remote control are not considered waterproof and if any liquid should get inside, remove power immediately and send the unit in to a repair facility. Prompt action can minimize any damage.

3. If the Talon is used outside in rain or snow, it should be wiped dry with a clean cloth before ending the shift.

4. There are no user serviceable parts in the Talon. The internal battery handle is protected by an automatic resettable fuse. The fuse for the mounting pod is located in the end of the cigarette lighter plug. Simply unscrew the tip and replace with the same size fuse.

5. Do not pick up or carry the Talon by the power or remote control cable when plugged into the mounting pod. Broken power and remote control cables are a common cause of intermittent operation.

6. If the Talon exhibits decreased range over a period of time, the unit should be examined by an authorized service center for possible receiver diode degradation. Receiver diode degradation has no effect on the unit's accuracy, but will result in unsatisfactory target range.

7. Kustom Signals recommends periodic maintenance of the Talon radar system. Check with your local service center and judicial district for requirements.

9.1 EQUIPMENT REPAIR/RETURN

Should the Talon need repair or calibration from Kustom Signals, Customer Service, the following information is required:

1. Department name, return shipping address and phone number.

2. Contact name at owning department.

3. Complete description of failure or problem with unit. Please describe, in detail, what the failure is and when it is observed. EXAMPLE: In moving mode, targets are close to patrol vehicle before being displayed. Target speeds are not multiples of patrol speed.

4. Method of return shipment.

NOTE: Kustom Signals will return the unit UPS Ground transportation unless otherwise directed.

5. For further information, please contact Customer Service at:

1-800-835-0156
or
E-mail www.cs@kustomsignals.com

10.0 CASE LAW

This section is included so radar operates and those individuals responsible for prosecuting traffic arrests can familiarize themselves with the more important legal cases involving the use of traffic radar. To obtain additional information on the referenced material, consult your community's local law library or the prosecutor's office.

Since the Talon is a Doppler based traffic radar system, some older case law is presented because of its significance to the acceptance of the Doppler principles as well as the basic requirements of the tuning fork test and operator training.

Reference A - State vs. Dantonio (N.J.) 1955 115 A2d35, 49 ALR 2d 460. Landmark case on the acceptance of the Doppler principles as used in traffic radar.

Reference B - 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 radar.

Reference C - Honeycutt vs. Commonwealth (Ky) 1966 408 SW 2d 421. Court establishes that a tuning fork test is an accurate method of testing the accuracy of a radar unit and along with the visual observations of a trained operator, is an accurate means of determining the speed of vehicles.

Reference D - Krueger, Pantos and Payne vs. State of California 1986 (class action suit - suppression hearing on radar) 887092, DP44339 and DP54571. Court ruled that a properly built and tested radar used by a trained operator can accurately determine the speed of vehicles. The judge dismissed each of the defendant's claims that outside influences render the radar readings inaccurate in the moving mode of operation. He ruled that proper classroom and field training enables an officer to avoid any false or inaccurate readings due to outside influences. The court held and took judicial notice of the accuracy of Doppler radar in both the stationary and moving modes of operation.

Reference E - Samuel Knight vs State of New York Superior Court. 72 N.Y. 2d 481, 530 N.E. 2d 1273 (1988). The court ruled 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. The court affirmed the lower court's ruling and accepted judicial notice of the radar in the moving mode of operation.

11.0 FCC - TRANSMITTER RULES AMENDED

The Federal Communications Commission (FCC) has amended its rules to eliminate the required annual measurement of transmitter power, frequency and modulation and to specify transmitter power in terms of output power for licensees in the Public Safety, Industrial and Land Transportation Radio Services. The action was the result of a rule making procedure initiated October 29, 1976, on the request of HT&B Electronics.

Under the rules, which amend Part 89, 91 and 93, licensees are required to operate their transmitters within the specified technical parameters.

Each licensee must take effective measures to ensure the integrity of his communications system, including periodic evaluation of receiver performance in order that undue air time not be consumed in repeating messages lost through poor effective receiver sensitivity, the FCC said.

For the sake of convenience and simplicity of transmitter power measurement, the FCC specified that in the future, transmitter output power, rather than the direct current input power to the final radio frequency stage, be the standard parameter used to indicate transmitter power. The FCC defined transmitter output power as that power measured at the transmitter output terminals when connected to a load of the impedance recommended by the equipment manufacturer.

11.1 FCC - RADAR UNIT LICENSING AMENDED (PART 90)

The Commission has eliminated the requirement for local governmental entities licensed in the Public Safety Radio services to obtain a separate authorization for radar speed detection devices.

This change reduces paperwork for the Commission's licensing staff and for police and other local government units, which 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 such units in use, the licensees are required to list the number of speed detection units and the frequencies on which they operate at the time of renewal of their land mobile authorization. Ordinarily, this would be once every five years and would not be a significant addition to the renewal process, the Commission noted.

This action became effective February 1, 1983.

If the owning department does not hold a Public Safety Radio license, but is dispatched by another agency, the owning department will need to obtain a Public Safety Radio license from the FCC. Filing FCC form 574 and obtaining a separate license will be required before placing the radar into service.

12.0 TROUBLESHOOTING

If an operating difficulty is encountered, check the following list of possible problems and solutions before returning the unit to the factory or local Service Center.

Problem	Possible Solution
No Power Indication	Check for proper voltage at cigarette plug. Reseat cigarette plug in the socket. Check fuses if using vehicle's cigarette socket.
Unit will not complete test cycle or shows ERR	Verify the power plug is secure. If the ERR message indicator is lit, power the unit off, then back on. If the problem persists, remove unit from service and record the error code.
No target speed reading during tuning fork test	Verify that unit is set for maximum range. Verify unit is not in HOLD Unsquelch audio. Listen for Doppler tone. Lightly strike tuning fork to avoid harmonics.
No patrol speed during tuning fork test	Verify that the unit in not in HOLD mode. If speedometer input is used, press TEST switch before beginning tuning fork test. Verify the proper tuning forks are being used. Lightly strike the tuning forks and retest. Remove unit from service if above tests fail.

No target readings in stationary mode.	Verify unit is not in HOLD. Verify range control is set properly. Verify unit is aimed properly and the target is within range of the radar. Unsquelch audio and verify that a Doppler tone is heard when targets are present. If no Doppler tone is heard, remove unit from service.
No patrol speed	Verify unit is not in HOLD Verify the unit is aimed parallel to the ground and straight down the roadway. Verify there are no obstructions directly in front of the unit. Weather conditions (heavy rain, snow or fog) may affect the unit's ability to pick up groundspeed. Verify speedometer input is synchronized properly. Verify the patrol speed is above 10 mph (16 km/h) and below 100 mph (160 km/h). Place unit in stationary mode and drive patrol vehicle. Verify target window displays proper groundspeed. If no speed readings, remove unit from service.
Speedometer verification shows "0"	Check speedometer input cable. Verify it is connected to unit and to proper input wire.

	Synchronize unit.
	If above tests fail, disconnect speedometer input cable, press TEST switch and continue using radar.
No target readings in moving mode.	Verify unit is not in HOLD.
	Verify the range control is set properly.
	Verify proper patrol speed is displayed.
	Verify proper moving mode is selected.
	Target speed may be a harmonic of patrol speed. Speed up or slow down patrol vehicle.
	Remove unit from service if above tests fail.
Short range	Verify the range control is properly set for the desired distance to target vehicles.
	Verify the unit is aimed properly.
	Verify there are no obstructions between the unit and the target.
	Weather conditions (heavy rain, snow and fog) may affect the units range.
	Check for electrical interferences.
	Strong fan interference will reduce the operating range of the unit.

NOTE: use a shielded power cable (KSI p/n 155-2127-00) to eliminate the vehicle's electrical noise problems.

Remove the unit from service if the above tests fail.

EXHIBIT 2.983(d)(9)

KUSTOM SIGNALS, INC.

K_A-BAND TALON

RADAR UNIT

Tuning Procedure

The only adjustment on the K_a-Band antenna is the variable power supply for the Gunn oscillator. This adjustment can only be made by an authorized Service Center or Kustom Signals Customer Service Department.

The output frequency is set by the vendor of the Gunn oscillator and is not adjustable by the end user or service center.

Required equipment:

1. Digital Voltmeter: $\pm$0.1% accuracy, DC voltage <10 VDC
   Suggested DMM Fluke Model 75 or equivalent

2. Power Supply: Variable 1 to 20 volt regulated DC supply.
   Nominal voltage 13.6 VDC
   Output current: approximately 1.0 ADC

Procedure:

1. Remove the (+) red lead from the Gunn oscillator.

2. Note the stamped voltage on the top of the Gunn oscillator. Nominal voltage 4.5-5.0 VDC.

3. connect the (-) black Digital Multimeter (DMM) lead to ground or the black lead from the Gunn oscillator.

4. Connect the (+) red DMM lead to the red lead from the motherboard's Gunn oscillator power supply.

5. Apply 13.6 VDC from the variable power supply to the Talon radar unit.

6. Measure the DC voltage at the Gunn oscillator. Adjust as needed to the specified voltage, see step 2, using variable resistor R19 on the motherboard. Set voltage to the specified value, $\pm$0.1 VDC.

7. Remove the power supply. Reconnect the Gunn oscillator's (+) lead.

8. Apply power to the Talon radar unit and verify the Gunn oscillator voltage at the Gunn oscillator.

9. Remove the power supply and all test equipment.

END OF PROCEDURE