TEXAS DEPARTMENT OF TRANSPORTATION
SPECIAL SPECIFICATION
TO-6300
THERMAL TRAFFIC CAMERA

1.0 GENERAL

This special specification sets forth the minimum requirements for a thermal traffic camera for use with video imaging vehicle detection systems (VIVDS) that monitor and provide vehicle stop bar detection at a roadway intersection.

2.0 FUNCTIONAL CAPABILITIES

2.1 The thermal traffic camera (TTC) must not depend on any visible or invisible (infrared) illumination or image intensifier to "see" i.e. produce images. The TTC must be totally passive and not produce any energy or emit light in any bandwidth. The TTC must provide the user the ability to clearly identify images in the total absence of light.

2.2 The TTC must operate while directly connected to VIVDS processor unit.

2.3 The TTC must allow the user to see through smoke and light fog and to view the thermal patterns and contrast in the scene.

2.4 The TTC must utilize a vanadium oxide (VOx) uncooled microbolometer responding in the long wave infrared (LWIR) spectral range of 7.5 – 13.5 μm, which is beyond what is visible to the human eye.

2.5 The TTC must be based on VOx microbolometer detector technology, and shall not be susceptible to permanent damage after imaging the sun. Amorphous silicon detector technology which can be permanently damaged when viewing the sun or even reflections of the sun is not acceptable.

2.6 The TTC must not utilize shutters to prevent damage from the sun, but rather the TTC shall provide uninterrupted video which shall be required for traffic and intelligent transportation system (ITS) installations.

2.7 The TTC must not utilize dynamic apertures to protect the image sensor because these mechanisms reduce sensitivity for an extended period of time, thus reducing the TTC performance, which is not be acceptable for traffic installations.

2.8 The TTC must provide thermal optics that automatically adjust to background thermal changes, and therefore do not require re-adjustment and/or thermal refocusing.

2.9 The TTC must not be susceptible to "image blooming" caused by bright lights as are image intensifiers and visible spectrum cameras.

2.10 The camera must be factory configured with the following fixed anti-reflection coated germanium lenses with the field of view (FOV) and resolutions as indicated:

Lens	Resolution (pixels)	FOV
13 mm	320 x 240	34° H x 28° V
19 mm	320 x 240	28° H x 18° V
9 mm	320 x 240	48° H x 37° V

2.13 The noise equivalent temperature difference (NETD) is the measure of the smallest object temperature that can be detected by the thermal image sensor relative to the system noise. The measurement is usually quantified as an mK value. This is the most common figure of merit of a thermal imaging system and a true measurement of the thermal camera's sensitivity. The TTC image sensor shall provide a NETD of < 75mk, <50mK f/1.0 or lower.

2.14 The TTC must include auto digital detail enhancement (auto DDE) which is an advanced non-linear image processing algorithm. The auto DDE function must be fully automatic and require no input or adjustment from the user. The auto DDE shall enhance the image detail to match the total dynamic range of the original image allowing details to be visible to the user even in scenes with low or high thermal contrast. Auto DDE will increase the probability of detection of low contrast images. These settings shall be optimized for performance with traffic video detection.

2.15 The TTC must utilize non-uniformity correction (NUC) which is a set of compensation factors for each pixel. NUC shall enable the following features and benefits:

- Eliminate the need for focal plane array (FPA) temperature stabilization.

- Allow for near instantaneous camera turn-on.

- Reduced system complexity and power consumption.

- Allow for a wider operating temperature range.

2.16 The TTC must include automatic gain control (AGC) circuitry to compensate for scene variations, improve image quality by avoiding saturation and distortion, and balance signal levels prior to display to maximize image quality.

2.17 The TTC must have both white-hot and black-hot operating modes. In the white-hot (default) mode warmer objects will be displayed in white or lighter shades than cooler or background areas. In the black-hot mode warmer images will be displayed as black or dark gray as compared to cooler background objects.

2.18 The TTC shall provide standard National Television System Committee (NTSC) or phase alternation by line (PAL) analog composite video output (factory configured) to allow it to function as a direct replacement for daylight camera and to connect directly to industry standard video detection software cards, and recording devices. The analog video signal shall be available via both a BNC video output connector and a connector free terminal block. The video outputs shall be surge protected.

2.19 The TTC shall be furnished in an IP-66 rated outdoor enclosure with sunshield and mounting base. The mounting base shall be provided with 1/4 x 20 holes for mounting to a pedestal or wall mount. All cable connections shall be made inside of the enclosure. The enclosure shall be provided with liquid-tight sealed cable gland fittings for the video and power cables.

2.20 The camera enclosure must include grounding and surge protection. A separate earth ground connection shall be made inside the enclosure to a designated grounding lug. The earth ground conductor may be run as part of the power cable bundle.

2.21 The TTC must operate on surge protected 110/220 VAC.

2.22 The TTC must include a 10-year warranty on the thermal detector.

3.0 TECHNICAL REQUIREMENTS

3.1 Technical Description

The TTC must meet the following minimum requirements:

Sensor Type	Long-life VOx uncooled microbolometer with 10-year warranty
Spectral Response	7.5 to 13.5μm
Sensitivity (Thermal Camera sensor)	< 75mk, <50mK f/1.0
Pixel Pitch	25 microns
Video Output	Dual NTSC or PAL (BNC and connector free)
Serial Control Interface	RS-232 or RS-422
User Interface	Via Windows-based application program (Windows-based GUI)
Input Voltage	90-240 VAC single phase 50-60hz
Power Consumption	90-240 VAC: 1.7W with 110 VAC 90-240 VAC: 18W peak with heaters
Operating Temperature Range	-50° C to 75° C (continuous operation) -40° C to 75° C (cold start)
Storage Temperature Range	-55° C to 85° C
NEMA TS 2	Must be tested to Section 2.1 of NEMA TS-2 2003 and either meet or exceed requirements in the following categories: operating voltage, operating frequency, ambient temperature, humidity, vibration and shock
Enclosure Rating	IP-66
Weight	Less than 6 pound with sun shield
Dimensions	Nominal 11 inch x 6 inch x 5 inch (with sun shield) ± 2 inch

4.0 INSTALLATION AND TRAINING

4.1 The supplier of the video detection system shall supervise the installation and testing of the video and computer equipment. A factory certified representative from the supplier shall be on-site during installation.

4.2 If requested, up to two days of training shall be provided to personnel of TxDOT in the operation, setup and maintenance of the video detection system. Instruction and materials shall be provided for a maximum of 20 persons and shall be conducted at a location selected by TxDOT. TxDOT shall be responsible for the cost of training.

4.3 Instruction personnel are required to be certified by the equipment manufacturer. The user's guide is not an adequate substitute for practical, classroom training and formal certification by an approved agency.

4.4 Formal levels of factory authorized training are required for installers, contractors and system operators. All training must be certified by the manufacturer.

5.0 WARRANTY, MAINTENANCE AND SUPPORT

5.1 The TTC shall be warranted to be free of defects in material and workmanship for a period of 10 years from date of shipment from the supplier's facility. During the warranty period, the supplier shall repair with new or refurbished materials, or replace at no charge, any product containing a warranty defect provided the product is returned FOB to the supplier's factory or authorized repair site. Product repair or replaced under warranty by the supplier will be returned with transportation prepaid. This warranty does not apply to products damaged by accident, improper operation, abused, serviced by unauthorized personnel or unauthorized modification.

5.2 During the warranty period, technical support shall be available from the supplier via telephone within 4 hours of the time a call is made by a user, and this support shall be available from factory certified personnel or factory certified installers.

5.3 The supplier shall maintain an adequate inventory of parts to support maintenance and repair of the TTC.