

SECTION 687

CLOSED CIRCUIT TELEVISION (CCTV) FIELD EQUIPMENT

DESCRIPTION

687.01.01 GENERAL

- A. This specification shall govern the furnishing and installation of Closed Circuit Television (CCTV) field equipment of a CCTV microprocessor unit at designated field locations and equipment cabinets as shown on the plans.
- B. This equipment will be installed by the Contractor at designated sites, and all hardware, software, and assorted components needed for the proper operation of the units shall be supplied.
- C. All materials furnished, assembled, fabricated, and installed under this item shall be new, corrosion-resistant, and in strict accordance with the specifications.
- D. The equipment design and construction shall utilize the latest techniques with a minimum number of parts, subassemblies, circuits, cards, and modules to maximize standardization and commonalty.
 - 1. The equipment shall be designed for ease of maintenance.
 - 2. All component parts shall be readily accessible for inspection and maintenance.

MATERIALS/EQUIPMENT

687.02.01 FUNCTIONAL REQUIREMENTS

- A. The CCTV Field Equipment together with the CCTV central equipment in the Traffic Management Center (TMC) will form a complete CCTV system that shall meet the following requirements.
- B. The video camera positioning system shall provide dual-mode day (color) and night (monochrome) video camera with optical zoom lens and a high speed positioning system.
 - 1. The lens shall have a focal length of 3.4 mm to 119 mm (35:1) with auto/manual focus.
 - 2. The digital zoom shall provide a range of up to 12X with an effective zoom ratio of 350:1.
 - 3. The effective focal length shall be 3.4 mm to 1,190 mm.
 - 4. The video camera shall have a 1/4-inch format Progressive Scan CCD image sensor and lens combination capable of providing an effective horizontal angle of view of 55.8 degrees wide angle to 17 degrees maximum telephoto.
 - 5. The camera shall provide Wide Dynamic Range (WDR) by use of dual-shutter exposure technique.
- C. The camera shall be provided with electronic stabilization using the 2 motion-frequency selectable stabilization method.
 - 1. The pan function shall provide 360 degrees of continuous rotation, with a variable speed from 0.1 degree per second to 160 degrees per second.

2. The tilt function shall provide 180 degrees of movement 0 degree to +90 degrees to -90 degrees, with a variable speed from 0.1 degree per second to 40 degrees per second.
3. Up to 64 presets shall be available for storing and recalling zoom, pan, and tilt positions.
4. The positioner shall be capable of 8-point or 16-point compass annotations with primary direction spelled out, intermediate directions abbreviated with 2 letters, and a tour sequence defined using up to 64 preset positions.
5. All camera functions and pan and tilt functions shall be operable via RS-422 serial communications.
6. Communications protocol command set shall be the Freeway and Arterial System of Transportation (FAST) protocol.

D. Features:

1. 1/4-inch Progressive Scan Color Sensor.
2. Horizontal Resolution of 520 TV lines.
3. 35:1 (3.4 mm to 119 mm) optical zoom lens.
4. Continuous digital zoom with selectable range from OFF to 12X.
5. Effective overall focal length of 3.4 mm to 1,190 mm.
6. Electronic Image Stabilization.
7. Auto/Manual Focus.
8. Selectable long-term integration to 1/2 second with frame store video output.
9. Selectable shutter speeds from 1/2 second to 1/30,000 second.
10. Composite video output; NTSC format.
11. Adjustable color balance.
12. Crystal or Internal phase adjust line-lock, software adjustable.
13. Programmable on-screen character generator.
14. WDR by use of dual-shutter exposure technique.
15. RS-422 serial control protocol command set to FAST protocol.
16. Camera Addressing via serial control.
17. 8-point or 16-point compass annotation.
18. 3-1/2-inch diameter sealed enclosure pressurized with dry nitrogen.
19. Continuous rotation capability in either direction.
20. Variable pan speed from 0.1 degree per second to greater than 160 degrees per second (preset mode).
21. Variable tilt speed from 0.1 degree per second to 40 degrees per second.
22. 64 zoom, focus, pan and tilt preset positions, each with a unique user programmable Preset ID.

E. Camera Specifications:

1. Imager: Interline Transfer Progressive Scan CCD with mosaic-type color compensating filter.
2. Image Area: 1/4-inch Format 3.6 mm horizontal by 2.7 mm vertical.
3. Resolution: 520 horizontal, 350 vertical.
4. Picture Elements (total): 811 horizontal by 508 vertical.
5. Video Output: NTSC, 1 V p-p at 75 ohms, unbalanced.
6. Maximum Lens Aperture: f/1.4 wide angle to f/4.2 telephoto.
7. Optical Zoom Range: 35:1, 3.4 mm to 119 mm.
8. Digital Zoom Range: 1X (Off) through 12X, Smooth transition from Optical to Digital Zoom.
9. Effective Digital Focal Length: 119 mm to 1,190 mm.
10. Optical Zoom Speed: 2 speeds, from approximately 2.9 seconds to 5.8 seconds full range.
11. Horizontal Angle of View: Optical: 55.8 degrees to 1.7 degrees; at 12X Digital: 55.8 degrees to 0.17 degree.
12. Minimum Focus Distance: 40 inches in telephoto, 0.4 inch in wide angle.
13. Electronic Stabilization: 2 motion-frequency selectable stabilization method.
14. Digital Compass: 8-point or 16-point compass annotation with primary direction spelled out and intermediate directions abbreviated with 2 letters.
15. Auto Focus: Selectable Auto/Manual. Minimum scene illumination for reliable Auto Focus, 30 percent video.
16. Manual Focus Speed: 1 speed, approximately 2.0 seconds to full range.
17. Zoom and Focus Presets: 64 preset positions; focus shall be auto and, if programmed, shall display the Preset ID.
18. Flash Memory: Update firmware and new features via serial communication.
19. Long Term Integration Range (Short Shutter):
 - a. Shall provide manual selection of integration duration for enhanced sensitivity.
 - b. Integration times shall be 1/2 second, 1/4 second, 1/8 second, 1/15 second, and 1/30 second.
 - c. Frame store video output shall provide continuous video output, updated at the integration rate.
20. Manual Shutter: Selectable shutter speeds of 1/60, 1/120, 1/180, 1/250, 1/500, 1/1,000, 1/2,000, 1/4,000, 1/10,000, and 1/30,000 second.
21. Auto Iris: Iris shall automatically adjust to compensate for changes in scene illumination and maintain constant video level output within sensitivity specifications.
22. Manual Iris:
 - a. A decrease in the video level value shall give the effect of open iris.

- b. An increase in the video level shall give the effect of close iris.
- 23. Gamma: 0.45.
- 24. AGC: 028 dB.
- 25. Color Balance: Auto Tracking Color Balance/Manual with adjustable Red and Blue Levels.
- 26. Signal to Noise Ratio: Greater than 50 dB.
- 27. Synchronization: Crystal or Phase-Adjust Line Lock on 60 Hz.
- 28. Sensitivity (3,200K): Scene illumination at F1.4, wide angle:

0.5 Lux at 1/60 Sec.	F1.4 Shutter	Color I.R. Cut On
0.05 Lux at 1/2 Sec.	F1.4 Shutter	Color I.R. Cut On
0.2 Lux at 1/60 Sec.	F1.4 Shutter	Monochrome mode I.R. Cut Off
0.01 Lux at 1/4 Sec.	F1.4 Shutter	Monochrome mode I.R. Cut Off

F. Camera Housing:

- 1. Each camera housing shall be a corrosion-resistant, tamperproof-sealed, and pressurized with 5 psi of dry nitrogen and shall include a Schrader purge fitting and 20-psi relief valve. The size of the housing shall be 3-1/2-inch diameter or smaller.
- 2. The camera housing shall include a loss of pressure sensor that will trigger an alarm message that will be inserted in the video output signal.
- 3. The enclosure shall be constructed from 6061-T6 standard aluminum tubing with a wall thickness of 0.25 inches \pm 0.03 inches.
 - a. Internal components shall be mounted to a rail assembly.
 - b. A copper-plated spring-steel ring shall be used to ensure electrical bonding of the rail assembly and components to the camera housing.
 - c. The housing exterior shall be finished by pretreatment with conversion coating and baked enamel paint.
 - d. The camera enclosure shall be designed to withstand the effects of sand, dust, and hose-directed water.
- 4. The internal humidity of the housing shall be less than 10 percent when sealed and pressurized.
 - a. Desiccant packs shall be securely placed inside the housing to absorb any residual moisture and maintain internal humidity at 10 percent or less.
 - b. A sun shield shall be provided to shield the entire housing from direct sunlight.

G. Mechanical Specifications (DSP Camera Assembly):

- 1. Weight: 4.2 pounds.
- 2. Dimensions:
 - a. Length (less connectors): 12.0 inches.
 - b. Housing Diameter: 3.5 inches.
 - c. Height (including mounting base): 5.13 inches.
- 3. Mounting: 4 mounting nuts on bottom of base.

H. Character Generator Specifications:

1. ID characters shall be white with a black border.
2. A maximum of 6 lines of user-programmable alphanumeric text shall be displayed, plus 2 fixed lines for low-pressure indicator and privacy zones.
3. Text shall only be displayed in uppercase characters.
4. Camera ID:
 - a. Up to 2 lines, each up to 24 characters long.
 - b. If both lines are programmed, Line 1 of Camera ID shall always appear above Line 2 of Camera ID regardless of top or bottom selection.
5. Preset ID:
 - a. 1 line, up to 24 characters long, user-programmable for each of the 64 preset positions.
 - b. When a preset position is recalled, the corresponding preset ID shall be displayed.
 - c. The preset ID shall remain displayed until a pan, tilt, zoom, manual focus, auto focus select, or another preset command is received.
6. Compass Annotation:
 - a. 8-point or 16-point compass annotation shall be settable for a true north position.
 - b. Display shall include North, NE, East, SE, South, SW, West, and NW.
 - c. Position shall be able to be grouped with the site location or separate from site location.
 - d. Position shall be user-selectable for a 3-second time out or permanent display and user-enabled/disabled.
7. Azimuth and Elevation:
 - a. Position shall be displayed in 0 degree to 359 degrees for AZ position, +95 to -95 in elevation (EL),
 - b. Position shall be user-selectable for 3-second time out or permanent display and user-enabled/disabled.
8. Low Pressure Indicator:
 - a. 1-line "Low Pressure" messages shall be displayed in blinking or non-blinking mode when activated by low internal pressure.
 - b. Adjustable set points by altitude shall be provided via the serial port to activate low-pressure.
 - c. Message shall be user-enabled/disabled.
 - d. In maintenance mode, readings of the internal pressure of the camera housing shall be displayed from 5 psi down to 1 psi, in 0.1 psi increments.
9. Internal Temperature Indicator:
 - a. 1 line, in degrees C, numeric messages shall be displayed in blinking or non-blinking mode.

- b. Message shall be user-enabled/disabled.
 - c. In maintenance mode, readings of the internal temperature of the camera housing shall be in 1 degree increments.
10. Sector Message:
- a. Up to 16 sectors in 360 degrees shall be able to be defined with up to 24 characters long.
 - b. Message shall be programmable via the RS-422 serial communications.
- I. Message Positioning:
- 1. Right side positioning shall be accomplished by padding left side of message with spaces.
 - 2. Messages shall be capable of being positioned at either the top or the bottom of display.
 - 3. Blank lines shall not displayed.
 - 4. Any programmed line being displayed shall fill in toward the top if top positioning is selected, or toward the bottom if bottom position is selected.
- J. Privacy Zones:
- 1. Video blanked out for up to 8 privacy zones shall be provided.
 - 2. 1-line and numeric messages shall be displayed.
 - 3. Message shall be displayed in blinking or non-blinking mode and be user-enabled/disabled.
 - 4. Privacy zones shall be programmed via the RS-422 serial communications.
- K. Communication and Camera Addressing Protocol:
- 1. Control and addressing shall be via RS-422/RS-232 optically isolated serial communications.
 - a. Additional protocols shall consist of Cohu, American Dynamics, Javelin, Philips/Bosch, Vicon, and Pelco-D.
 - b. The National Transportation Communications for ITS Protocol (NTCIP) 1205 protocol communications protocol shall be included as an option.
 - 1) Refer to NTCIP 1205 protocol for detailed description.
 - 2) This allows for migration to the NTCIP standard while maintaining operation of existing CCTV system protocols.
 - 2. Upon receipt of any given command, the Camera Positioning System shall not take longer than 1.0 second to respond.
 - 3. All programmable functions shall be stored in non-volatile memory and shall not be lost if a power failure occurs.
 - 4. System configurations such as video privacy zones, preset text, and sector ID shall be able to be stored in a computer file.
 - 5. A camera personality shall be able to be cloned or uploaded into a camera in the event that a camera replacement is necessary.

L. Pan and Tilt Positioning Specifications:

1. Continuous rotation capability in either direction.
2. 180 degrees of tilt movement, +90 degrees to -90 degrees unobstructed.
3. Pan Speed (Operator Control): Variable from 0.1 degree per second to 80 degrees per second.
4. Pan Speed (Preset Control): Greater than 160 degrees per second.
5. Tilt Speed (Operator Control): Variable from 0.1 degree per second to 40 degrees per second.
6. Tilt Speed (Preset Control): 40 degrees per second.
7. 64 Pan and Tilt preset positions with repeatability within ± 0.5 degree.
8. The positioning system shall be invertible for mounting to a ceiling.

M. Tour Specifications:

1. 8-tour sequence shall be able to be defined.
2. The tour shall be programmed by selecting the preset position by number and then selecting a dwell time.
 - a. The presets shall be able to be used in any order.
 - b. The same preset shall be able to be used more than once as long as the total number of preset positions used does not exceed 32.
3. The dwell time shall define the length of time paused at each preset position, shall be from 1 second to 60 seconds, and shall be capable of being changed individually for all stops on the tour.
4. If the appropriate preset ID is programmed, it shall be displayed for each preset position used on the tour.
5. The tour shall stop upon receipt of a pan command.
6. All programmable functions shall be stored in non-volatile memory.

N. Power Requirements:

1. Operating Voltage: 89 VAC to 135 VAC, 120 VAC Nominal, 50/60 Hz ± 3 Hz, and in accordance with NEMA TS-2, Section 2.1.2, "Traffic Control System."
2. The line variation specifications shall be tested to meet these specifications by an outside agency other than the camera manufacturer. The tests shall be provided upon request.
3. Primary Input Power Interruption: Comply with NEMA TS-2, Section 2.1.4, "Power Interruption."
4. Transients Power Service:
 - a. The CCTV field equipment shall comply with NEMA TS-2, Section 2.1.6, "Transients, Power Service."
 - b. The surge specifications shall be tested to meet these specifications by an outside agency other than the camera manufacturer.
 - c. The tests shall be provided upon request.

5. Power consumption shall not exceed a total of 30 watts for camera//P&T driver (pan and tilt in motion).
- O. Environmental Specifications:
1. Ambient Temperature Limits (Operating): -30 degrees F to 165 degrees F, NEMA TS-2, Section 2.1.5.1.
 2. Ambient Temperature Limits (Storage): -50 degrees F to 185 degrees F, NEMA TS-2, Section 2.1.5.1.
 3. The environmental specifications of the camera shall be tested to meet these specifications by an outside agency other than the camera manufacturer. The tests shall be provided upon request.
 4. Humidity: Up to 100 percent relative humidity in accordance with MIL-E-5400T, paragraph 3.2.24.4, IP 67 rating.
 5. Other: Withstand exposure to sand, dust, fungus, and salt atmospheres in accordance with MIL-E-5400T, paragraph 3.2.24.7, paragraph 3.2.24.8, and paragraph 3.2.24.9.
 6. Shock: Up to 10 g's, 11 ms, in any axis under non-operating conditions, in accordance with MIL-E-5400T, paragraph 3.2.24.6.
 7. Vibration: Sine vibration from 5 to 30 Hz, 1/2 g, 3-axis, 1 hour without damage.
 8. Wind Loading: 150 mph wind load survivability, operability to 70 mph.
- P. Mechanical Specifications:
1. Weight shall not exceed 19 pounds.
 2. Dimensions: 11 inches high by 13.3 inches wide.
- Q. Mounting Configurations: The Camera Positioning System shall include 5 possible mounting configurations: wall mount, pole mount, parapet mount, corner mount, and pedestal mount versions.
- R. Main Interface Connector: The main interface connector shall be equivalent to an Amphenol 206036-3 with back shell 206070-1 and mating connector equivalent to an Amphenol 206037-11 with clamp 206070-1.

687.02.02 LOCAL INTERSECTION CAMERA CONTROL UNIT

- A. The control unit shall provide convenient on-site camera control of camera positioning systems.
1. The unit shall offer system protocol from most major CCTV camera manufacturers.
 2. The unit shall withstand the harsh operating environment associated with roadside installations.
 3. Local control functions shall be accomplished using front panel switches that include pan and tilt, lens zoom, focus and iris.
 4. Focus and iris shall include an auto/manual toggle with LED indication of the current state.
 5. A local/remote switch shall be included that transfers control from the central system to the control unit.

6. This function shall have a built-in 5-minute timer that automatically transfers control back to the remote mode if left unintentionally in the local mode.
- B. A front panel RS-232 port shall be provided that connects to a laptop PC for programming advanced camera site settings and that allows extended camera control functions.
1. 2 rear panel DB9 connectors shall provide both RS-422 and RS-232 formats for control system data connections.
 2. The unit shall support most CCTV camera manufacturer's communications protocols.
- C. Electrical:
1. Operating voltage - 89 VAC to 135 VAC, 47 to 63 Hz, NEMA TS-2, Section 2.1.2.
 2. Mounting: EIA standard 19-inch cabinet, 1 RU.
- D. Front Panel Controls:
1. Pan: 3-position momentary switch (pan right, stop, pan left).
 2. Tilt: 3-position momentary switch (tilt down, stop, tilt up).
 3. Zoom: 3-position momentary switch (tele, stop, wide).
 4. Focus Mode: 2-position momentary switch (auto-manual) with LED indication of manual mode.
 5. Focus control: 3-position momentary switch (near, stop, far).
- E. Rear Panel Connectors: Camera - single multi-pin AMP for camera video, RS-422 data, and 20 VAC power.

687.02.03 WARRANTY

- A. The camera shall include a 2-year warranty that includes parts and labor.
- B. The 2-year period shall begin at the time of acceptance of the project.

CONSTRUCTION

687.03.01 CABLE HARNESS

- A. The cables used for CCTV control, video, and 120 VAC power shall be installed as an integrated unit.
- B. Cohu Model Number CA295H wiring harness or approved equal shall be used.
- C. The wiring shall be installed from the CCTV unit to the in-cabinet control unit.
 1. The Contractor shall be responsible for determining the length needed, and order the correct size accordingly.
 2. Connectors at both ends of the cable are required.

687.03.02 DOCUMENTATION

- A. Complete documentation of the system, as it is built, shall be provided by the Contractor.
 1. A minimum of 2 copies of descriptive manuals and brochures for each type of electronic equipment and apparatus proposed for this project shall be supplied.

2. These documents shall contain sufficient technical data for complete evaluation. The quality, function, and capability of each deliverable item shall be described.
3. Manuals or brochures shall be originals or copies equal to originals.

687.03.03 OPERATIONAL TESTING

- A. Upon completion of the system integration testing, the CCTV field equipment shall be required to complete a 30-day period of acceptable operation.
 1. The system operational test shall fully and successfully demonstrate all system functions using live data and controlling all system activities.
 2. Failure in any hardware item during the test period, with the exception of expendable items such as fuses and minor equipment as determined by the Engineer, shall necessitate restarting the 30-day test period for its full 30-day duration upon repair.
 3. Any failure of system software, discovery of a software deficiency that causes a system malfunction, or discovery of software operation that is not in compliance with the specifications shall cause the 30-day test to be restarted in its entirety after correction of the software problem.
 4. No intermittent hardware, software, communication, or control operation; malfunction not related to a specific hardware; or software malfunction shall be permitted to persist during the test period. Diagnostic testing that does not result in changes to system hardware or software shall result only in the loss of acceptable test time.

METHOD OF MEASUREMENT

687.04.01 MEASUREMENT

- A. The quantity of CCTV field equipment shall be measured per each.

BASIS OF PAYMENT

687.05.01 PAYMENT

- A. The accepted quantity of CCTV field equipment will be paid at the Contract unit price bid per each which shall be full compensation for the video camera, zoom lens, pan/tilt drive, camera housing, pole mount, receiver/driver, surge protection devices, and all cables, connections and hardware, measured as provided under **Subsection 687.04.01, "Measurement,"** complete including warranty, installation, and testing of the equipment as specified and shown on the drawings.
- B. Pre-assembly of CCTV equipment and components shall be considered incidental to CCTV field equipment.
- C. Payment will be made under:

PAY ITEM

PAY UNIT

CCTV Field Equipment.....Each