# Document Control

| Issue Date | Comments | Revisions | Revision # |
|---|---|---|---|
| 3/1/99 | Draft | | |
| 7/23/99 | Draft 2 | | |
| 12/29/99 | Incorporate Bayne Smith's comments | | 1 |
| 1/12/00 | Changed "revision" to "version" for CCR control software | 936.3.05D3 | 2 |
| 1/12/00 | Project: CM-00TS(10) Ct. 1<br>Fulton County<br>P.I. No. 713155<br>Project: CM-00TS(10) Ct. 2<br>DeKalb And Fulton County<br>P.I. No. 713157 | | |
| 2/3/00 | Project: CM-056-1(57)<br>Fulton County<br>P.I. NO. 721950 | | |
| 3/20/00 | Revise Types 1,2,3 cabinets to A,B,C<br>Revise materials submittal process<br>Specify camera mounting height | <br>936.1.03<br>936.3.05.B | 3 |
| 3/23/00 | Add material submittal chart.<br>Delete separate payment for horizontal wire, pullboxes, and electrical service pole | 936.1.03<br>936.4.A | 4 |
| 5/31/00 | Project: STP-7713(650)<br>Fulton County<br>P.I. No. 771365 | | |
| 6/28/00 | Project: STP-1330-00(900)<br>Gwinnett County<br>P.I. No. 133090 | | |
| 7/7/00 | Project STP-00MS(281)<br>Bibb County<br>P.I. No. 371423 | | |
| 7/7/00 | Project STP-00MS(282)<br>Bibb County<br>P.I. No. 371426 | | |
| 9/5/00 | Add ATMS Surveillance Camera Control Integration and Calibration Procedure;<br>Add reference to above procedure | 936.3.05.C<br><br>936.3.06.A | |
| 12/6/00 | Project: CM-285-1(360)<br>DEKALB COUNTY<br>P.I. NO. 713410 | | |
| 2/9/01 | Change reference to Type 1 and 2 cabinets to Type A and B cabinets | 936.3.05.E.2, 936.3.05.E.3, 936.3.05.E.4 | |
| 2/9/01 | Document Control No. NAV01-050 | | 1.0 |
| 2/14/01 | Entered into CM Document Control | | 1.0 |
| 7/6/01 | Updated as per SCR # 238 | 936.2.C<br>936.3.05.E.1.a | 1.1 |
| 7/17/01 | Published new version to server | | 2.0 |
| 12/04/01 | Updates as per SCR # 280 | 936.3.07 | 2.1 |
| 12/10/01 | Published new version to server | | 3.0 |

# Document Control

| Issue Date | Comments | Revisions | Revision # |
|---|---|---|---|
| 12/18/02 | Modified to meet Office of Contract Administration requirements for format per TOPPS document 2445-1. SCR # 375 | | 3.1 |
| 12/19/02 | Published to server | | 4.0 |
| 9/12/03 | 936 rewrite as per SCR # 393 | New document | 4.1 |
| 9/17/03 | Published to server | | 5.0 |
| 10/9/03 | Revised per SCR #402 | Detail Drawing 936.2 | 5.1 |
| 10/9/03 | Published to server | | 6.0 |
| 1/24/05 | Revised as per SCR # 475 | 936.1.03.A.5; 936.2.01.A<br>936.2.01.C; 936.3.05.B.2<br>936.3.05.B.3; 936.3.06.B<br>936.3.06.C; 936.3.06.D;<br>936.3.08 | 6.1-6.4 |
| 1/26/04 | Published to server | | 7.0 |
| 3/7/05 | Modified to reflect Field PC for VPN Client Software as well as DSL Modem. SCR # 496 | 936.1.01; 936.1.03; Detail Drawings 936.1a, 1b, 2a, 2b | 7.1 |
| 4/18/05 | Revised as per SCR # 502 | | 7.2 |
| 4/20/05 | Published to server | | 8.0 |

**DEPARTMENT OF TRANSPORTATION**
**STATE OF GEORGIA**

**SPECIAL PROVISION**

**PROJECT: [INSERT PROJECT NUMBER(S)]**
**[INSERT COUNTY NAME(S)] COUNTIES**
**P.I. NO. [INSERT P.I. NUMBER(S)]**

# SECTION 936 – CLOSED CIRCUIT TELEVISION (CCTV)

## Section 936 - Closed Circuit Television (CCTV)

The text included herein is written in the imperative mood (sentences often begin with commands). All commands and references in, or in connection with, the text in this document are written to imply **Contractor responsibility for action** unless otherwise specified.

### 936.1 General Description

This work includes furnishing and installing closed circuit television (CCTV) system, any specified type, which is a CCTV video surveillance field installation, including but not limited to color CCTV cameras, lens, housing, pan/tilt drive, camera system assembly, cabling, mounting hardware, interface panel, camera control receiver, and cabinet wiring. This CCTV system provides operator control from and video imaging to the Department's NaviGAtor Advanced Transportation Management System (ATMS).

#### 936.1.01 Definitions

CCTV System, Type A – Previously called CCTV System. Not applicable on this project.

CCTV System, Type B – The Type B CCTV System uses a self-contained camera system assembly with an analog NTSC video output and RS-232 serial data control interface.

Type A Cabinet – As specified in Section 939, the Type A cabinet housing is a standard Model 336 stretch (336S) housing with approximate exterior dimensions of 46 in (H) by 24 in (W) by 23 in (D).

Type B Cabinet – As specified in Section 939, the Type B cabinet housing is a standard Model 337 housing with approximate exterior dimensions of 35 in (H) x 20 in (W) x 17 in (D).

Type C Cabinet – As specified in Section 939, the Type C cabinet housing is a standard Model 332 housing with approximate exterior dimensions of 64 in (H) by 24 in (W) by 30 in (D).

Type D Cabinet – As specified in Section 939, the Type D cabinet housing is a standard Model 336 stretch (336S) housing with approximate exterior dimensions of 46 in (H) by 24 in (W) by 23 in (D).

Type E Cabinet – As specified in Section 939, the Type E cabinet housing is a standard Model 336 stretch (336S) housing with approximate exterior dimensions of 46 in (H) by 24 in (W) by 23 in (D).

### 936.1.02 Related References

**A. Georgia Specifications**

Section 639 - Strain Poles for Overhead Sign and Signal Assemblies

Section 680 - Highway Lighting

Section 682 - Electrical Wire, Cable and Conduit

Section 922 - Electrical Wire and Cable

Section 923 - Electrical Conduit

Section 925 - Traffic Signal Equipment

Section 939 - Communications and Electronic Equipment

**B. Referenced Documents**

American National Standards Institute (ANSI)

American Society of Testing and Materials (ASTM)

Electronic Industries Association (EIA)

FCC Rules Part 15, Sub-part J

Insulated Cable Engineers Association (ICEA)

International Municipal Signal Association (IMSA)

MIL-STD-454

MIL-STD-810E Method 509 Procedure 1 – exterior salt atmospheres

National Electric Code (NEC)

National Electrical Manufacturers Association (NEMA)

NEMA-4

Underwriter's Laboratory Incorporated (UL)

### 936.1.03 Submittals

The following chart provides the Contractor with an outline of the submittal requirements for the equipment and components for this pay item. This chart is to be used as a guide and does not relieve the Contractor from submitting additional information to form a complete submittal package.

| Section 936 Submittal Requirements | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Material** | **Specification Reference** | **Catalog Cuts** | **Mfg. Spec.** | **Materials Cert.** | **Install. Proced.** | **Maint. Proced.** | **Submittal Due Date (Cal. Days after NTP)** |
| Camera System Assembly, Type B | 936.2.01.A | X | X | X | X | X | 15 Days |
| Camera System Assembly Mount, Type B | 936.2.01.B | X | X | X | X | | 15 Days |
| Cabinet Interface Assembly, Type B | 936.2.01.C | X | X | X | X | X | 15 Days |
| Cabling and Connectors, Type B | 936.2.01.D | X | X | X | X | | 15 Days |
| CCTV System, Type B, Demonstration Test Set, Documentation and Equipment List | 936.1.03.A.5 | | | | | | 15 Days |

Submit submittal data for all equipment, materials, test procedures, and routine maintenance procedures required for these items within sixty (60) calendar days after the Notice To Proceed and prior to any installation, unless noted otherwise in the Contract Documents.

Submit to the Engineer for approval, six (6) copies of the manufacturer's descriptive literature (Catalog Cuts), Technical data, operational documentation, service and maintenance documentation and all other materials required within these specifications.

Provide submittal data that is neat, legible, and orderly. Neatly organize each package of submittal data and separate by hardware item. Use the "Materials Certification Package Index and Transmittal Form", contained in Section 105.02 of the Special Provisions, for each pay item to document and list all material and components that are included in the submittal package. Any submittal data submitted without the Index/Transmittal form or that is incomplete will be rejected.

**A. CCTV System, Type B**

1. Camera System Assembly

Submit complete physical, performance, and operational materials submittal data for the camera system assembly and all associated components.

2. Camera System Assembly Mount

Submit complete physical, performance, and operational materials submittal data for the camera system assembly mount and all associated components and hardware.

3. Cabinet Interface Assembly

Submit complete physical, performance, and operational materials submittal data for the cabinet interface assembly and all associated components and hardware. Submit complete documentation for the CCTV system manufacturer's Embedded Protocol as implemented between the camera system assembly and the user control interface, and submit the setup and operations procedure for changeover between the NaviGAtor Standard CCTV Control Protocol and the CCTV system manufacturer's Embedded Protocol and vice versa. Submit the CCTV Embedded Protocol and control software application on CD-ROM with printed user documentation.

4. Cabling and Connectors

Submit complete physical, performance and operational materials submittal data for all cables, wire and connectors required for a complete and operational CCTV system. Submit both cables and connectors as specified here and as recommended by the CCTV system manufacturer. Submit all CCTV system wiring diagrams and documentation as is required for as-built drawings in Subsection 936.3.05.B.

5. Demonstration Test Set

Submit a demonstration test set after the Engineer approves the submittal materials for the CCTV system and the video encoder and field switch communications equipment as shown in the Plans. The demonstration test set shall be connected to and operated through the NaviGAtor system by the Engineer. Deliver the test set to the Department at the location specified by the Engineer. Request a delivery and test time a minimum of 14 days in advance.

The demonstration test set shall include all materials, components, assemblies, control software and documentation of a CCTV system, Type B, and shall be a complete, fully functional CCTV system. The camera system assembly and the camera system assembly mount shall be attached to a desktop stand that securely holds the camera system assembly while the camera is being operated. The cabinet interface assembly may be mounted to the desktop stand or to separate panel. Cables C1, C2, C3, C4, C5, and C6 shall be connectorized and terminated as required in these Special Provisions. Provide TB18 and SS15. Provide a NEMA 5-15 cord that provides power to the cabinet interface assembly and communications equipment. Provide a terminal block or strip for connection of the RS232 communications signal to the communications equipment (video encoder serial port or terminal server); label each terminal position. Provide a video decoder, a minimum 10 ft (3 m) coaxial video cable and a minimum 13 in color video monitor for viewing the video output. Serial (PTZ) communications shall be provided through the serial port on the Type A video encoder or terminal as required. Video encoder, decoder, and communications equipment will be paid for and tested under different pay items.

Review of the demonstration test set submittal shall be conducted in two parts. The first part of the review shall be performed by the Contractor in the presence of the Engineer and shall include the setup and configuration of the demonstration test set on the NaviGAtor system. The second part of the review shall be a 30-day period during which the Engineer shall operate and evaluate the demonstration test set with the NaviGAtor system. The second part of the review shall commence only upon the Engineer's approval of the first part of the review. The Contractor shall retrieve the demonstration test set upon completion of the second part of the review.

For the first part of the demonstration test set review, the Contractor shall furnish and operate a serial data protocol analyzer to monitor and record the bi-directional RS232 communications session between the NaviGAtor session and the CCTV system. The protocol analyzer shall record all communications messages and shall time-stamp and record each byte of communications. Time-stamp resolution shall be no coarser than 0.10 millisecond. Provide recordings of all communications in the form of an MS-DOS-formatted ASCII text file. The protocol analyzer shall not be provided for the second part of the demonstration test set review, and the Contractor shall remove it at the end of the first part of the review.

**B. Acceptance Testing**

Submit acceptance test procedures and a desired acceptance test schedule.

**C. Warranties and Guarantees**

Submit materials submittal data providing complete example documentation on all manufacturers' warranties or guarantees on all CCTV system equipment and hardware components furnished, as required in Subsection 936.3.07.

**D. Training**

Prior to training, submit resume and references of instructor(s). Obtain approval from the Engineer that the instructor is qualified in his/her respective field. Submit the Training Plan within 120 days of the notice to proceed. Include in the training plan an outline of the training course. Obtain approval of the Training Plan from the Engineer. The Training Plan shall explain in detail the contents of the course and the time schedule of when the training shall be given. Coordinate actual training with installation schedules as approved by the Engineer.

## 936.2 Materials

### 936.2.01 CCTV System, Type B

Ensure that the individual components and assemblies of the CCTV System, Type B, conform to the requirements specified in the following sections.

**A. Camera System Assembly**

Follow these minimum requirements for a dome-enclosed camera system assembly including the camera, lens, pan/tilt drive, and control electronics.

Provide a downward-looking circular dome-shaped enclosure assembly. The enclosure shall have a maximum diameter of 14 in (356 mm) at its widest point and a maximum height of 22 in (559 mm) from the top of the housing assembly to the bottom point of the dome. The upper housing shall be constructed of a non-metallic UV-stabilized material of a light tan, gray, or white color, or constructed of an aluminum material with a heat-cured paint coating of an equivalent color. The lower housing shall be constructed of a UV-stabilized optically-correct acrylic material. The maximum weight of the complete and fully functional camera system assembly, including the camera, lens, pan/tilt drive, control electronics, environmental control components, housing assembly, and hub adapter shall be 25 lbs (11.4 kg).

Use an enclosure assembly that secures to the mounting bracket arm with a 1-1/2 in (37.5 mm) threaded pipe nipple. Hub adapters for the threaded pipe nipple on either the enclosure or the mounting arm, or both, are permitted.

All fastening and mounting hardware on or within the enclosure assembly shall be stainless steel.

Use a pressurized enclosure assembly that uses extra dry grade nitrogen. Provide a pressure relief valve and a Schrader valve for filling and evacuating the enclosure. An additional pressure relief screw is allowed. All mounting and wiring connections shall be pressure-tight.

Electrical power for the complete camera system assembly shall be per the manufacturer's recommendations and between 12V to 120V DC or single-phase AC utilizing a two-wire (not counting ground) supply from the cabinet interface assembly in the equipment cabinet. Do not use a dual-voltage power supply. Maximum electrical load with all subsystems operational, including the heater, shall be no more than 130 VA.

Use an enclosure assembly with a heater and a circulating blower fan for environmental (temperature and defogging) control. Maximum electrical load for the heater shall be no more than 80 VA.

Use a camera unit with an integrated camera sensor and zoom lens assembly and an analog NTSC-compliant composite video output with a signal-to-noise ratio of 45dB or greater. The camera shall use an ¼-inch interline transfer CCD image sensor, with a minimum of 768 horizontal by 492 vertical active picture elements. All elements shall remain operational. The camera shall have a minimum resolution of 460 horizontal TV lines by 350 vertical TV lines. The camera shall include on/off selectable automatic gain control and manual/automatic selectable white balance. The camera shall include an electronic shutter mode with user-selectable speeds of a minimum range from 1/60 second to 1/10,000 second. The camera unit shall provide an on/off selectable day/night function where the image sensing and output automatically switch between color and black-and-white imaging; fixed color or black-and-white imaging shall be user-controllable. The camera sensitivity shall be no less than 3.0 lux in color mode (1/60 second) and 0.5 lux in black-and-white mode (1/60 second, IR cut removed).

Provide a camera unit with an integrated zoom lens of a minimum of 22X optical zoom and a minimum of 4X digital zoom. The camera shall not employ any digital zoom functionality unless the lens is at the full limit of optical zoom and the zoom command continues to be applied, in which case the camera unit shall automatically switch from optical to digital zoom. The optical focal length shall be approximately 4 mm to 80 mm. The camera unit shall include on/off selectable automatic focus and manual/automatic selectable iris control.

Use a pan/tilt drive for the camera unit that is fully-contained within the enclosure assembly. The drive shall be capable of 360 degree panning and at least 0 degree horizontal to 90 degree vertical looking downward tilting. The camera unit and pan/tilt drive shall provide automatic 180-degree image output flip at the bottom of the tilt travel. The camera unit and pan/tilt drive shall provide a minimum of eight privacy blackout zones, each zone being individually programmable to be on/off by the user. The panning speed, when a pan-left or pan-right command is applied by the user, shall be between 10 and 18 degrees per second. The tilting speed, when a tilt-up or tilt-down command is applied by the user, shall be between 4 and 10 degrees per second.

Provide an system control interface to the camera system assembly that physically and logically supplies the user commands to and monitoring from the camera system assembly, including but not limited to pan, tilt, zoom, focus, position reporting, and configuration. The system control interface shall physically connect the camera system assembly to the cabinet interface assembly through cables C1 and C3 as specified below. Do not use a system control interface through cable C2. Provide a system control interface as serial data communications of any messaging format that is in compliance with all of the physical and operational requirements specified for a CCTV System, Type B. Provide the capability to set the communications address used by the Standard Protocol (subsection 936.2.01.C) through the system control interface or through the user control interface in the cabinet; do not require the opening/disassembly of the camera system enclosure to set the communications address. Store all user configurable settings in non-volatile memory that is retained indefinitely upon loss of power.

**B. Camera System Assembly Mount**

Provide a camera system assembly mount that includes a mounting bracket arm, camera enclosure mount and disconnect, mounting straps, and incidental fastening hardware. All fastening and mounting hardware shall be stainless steel.

The mounting bracket arm shall be suitable for pole-mounted applications using mounting straps or bolts. The bracket shall be fabricated to exactly mate with the camera enclosure mount/disconnect/pipe nipple and any needed pole-mount adapter with no drilling or welding required. The bracket shall be fabricated from aluminum alloy with an exterior polyurethane coating, stainless steel, or mild steel with a heat-cured paint coating. All bracket coatings shall be beige, tan, gray or off-white in color and corrosion resistant in accordance with MIL-STD-810E Method 509 Procedure 1 for exterior salt atmospheres.

Use a mounting bracket arm that locates the vertical centerline of the camera enclosure from 14 in (356 mm) to 24 in (610 mm) from the exterior surface of the support pole. The mounting bracket arm shall provide for cable entrance through the base of the bracket directly from the support pole and from the exterior through a raintight opening on the underside of the bracket and adjacent to the support pole. Provide non-metallic cable protection grommets for both cable entrances.

Use a mounting bracket arm that fully encloses the cable connectors J1 and J2 and the manufacturer's connector on the camera enclosure for cable C3. Provide a raintight access opening to cable connectors J1 and J2 on the underside of the bracket, and provide a raintight access to the camera enclosure connector for cable C3 in accordance with the manufacturer's recommendations.

Include a camera enclosure mount and disconnect on the mounting bracket arm that secures to the camera enclosure with a 1-1/2 in (37.5 mm) threaded pipe nipple. Hub adapters for the threaded pipe nipple on either the enclosure or the mounting arm, or both, are permitted. When installed and fastened, the completed mounting mechanism assembly shall rigidly connect the camera enclosure to the mounting bracket arm with no movement relative between the enclosure and the arm. Provide a disconnect means for dismounting and remounting the camera enclosure from the mounting bracket arm with the use of threaded fasteners or locking pinned/slotted/keyed attachment mechanism and without the need to unthread the 1-1/2 in (37.5 mm) pipe nipple. The disconnecting means shall be compatible with the camera system manufacturer cable C3 and connector.

Unless otherwise shown in the Plans, mount the bracket arm to the support pole using a minimum of two 1/ 2 in (12.5 mm) or greater stainless steel mounting straps.

**C. Cabinet Interface Assembly**

Use a cabinet interface assembly that provides electrical service for the camera system assembly and provides the user control interface connection to the NaviGAtor system and/or user personnel. Install the cabinet interface assembly in the equipment cabinet. All fastening and mounting hardware shall be stainless steel. The cabinet interface panel assembly includes the following:

- CCTV Interface Enclosure
- Camera System Assembly Power Supply with surge suppression
- terminal blocks and video cable surge suppression for camera system assembly cabling
- user control interface to the NaviGAtor system and/or user personnel with surge suppression

Use the CCTV Interface Enclosure to hold the Camera System Assembly Power Supply and the user control interface unit for the camera electrical service and system control interface data path as shown in detail drawing 936.1. The CCTV Interface Enclosure shall be rack mountable on a standard 19" rack and located in cabinet rack as shown in detail drawing 936.2. The CCTV Interface Enclosure height shall not exceed 4 Rack Units, and it shall not exceed a depth of 15 inches.

Provide a Camera System Assembly Power Sypply that supports all electrical service needs for all components and subsystems of the camera system assembly. Connect the line and neutral inputs of the power supply to the equipment cabinet's 120VAC electrical supply on terminal block TB2 as shown in the CCTV system detail drawings, and use standard conductor insulation colors for 120VAC electrical service (black, white, and green). Connect the power supply output to the camera system assembly directly to the terminals of TB18, connecting to cable C1. Use only stranded copper wiring, with a minimum #12 AWG for the line and neutral conductors of the 120VAC circuit to TB2, and a minimum wire size

recommended by the CCTV system manufacturer for the power supply circuit to TB18 but not less than #18 AWG. Ground the input and output sections of the power supply in accordance with the CCTV system manufacturer's recommendations. The power supply shall have automatically-resetting transient voltage surge suppression on the power supply terminals to the camera system assembly. The power supply shall include a switch located on the front of the CCTV Interface Enclosure to disconnect power from the camera system assembly. The power supply and user control interface unit shall be sized so that they can fit inside the CCTV Interface Enclosure.

Provide terminal block TB18 for the termination of cable C1 from the camera system assembly and the termination of wiring from the power supply and the user control interface unit. Mount TB18 on the equipment cabinet side panel as shown in the CCTV system detail drawings, not in the CCTV Interface Enclosure. Use a 14-position dual-screen barrier type terminal block with 7/16 in (11.11 mm) spacing using nickel-plated brass 6-32 philslot screw (Cinch 141 or approved equivalent) and quick-clamp type wire terminals (Cinch QC-1 or approved equivalent). Use a terminal block with voltage and current ratings greater than the voltage and current ratings of the wires, which are terminated on the block. Provide an EMI/RFI shield over the terminal block if recommended by the CCTV system manufacturer. Do not use compression-type, tubular clamp, or spade lug terminals.

Provide surge suppressor SS15 for the protection and termination of the coaxial video cables C2 and C4. Mount SS15 on the equipment cabinet side panel as shown in the CCTV system detail drawings, not in the CCTV Interface Enclosure. Use a shielded solid-state surge suppressor with 6-volt line-to-ground clamping and BNC coaxial connectors (EDCO CX06-BNCY or approved equivalent). Use a minimum #16 AWG stranded copper insulated green wire to ground SS15 directly to the cabinet ground bussbar.

Provide a user control interface on the front of the CCTV Interface Enclosure to provide for control and monitoring communications between the camera system assembly and the NaviGAtor system user. The user control interface unit shall fully support control and monitoring communications from the NaviGAtor Standard CCTV Control Protocol and from the CCTV system manufacturer's own embedded protocol; simultaneous operation of these two protocols is not required. The user control interface unit shall be a protocol switching or translation, port-sharing or port-coupling, or similar device that controls and monitors the camera system assembly through its system control interface.

The NaviGAtor Standard CCTV Control Protocol (hereinafter called the "CCTV Standard Protocol") is specified below and shall connect to the user control interface unit through an RS-232 serial data interface directly from the NaviGAtor system. Provide the CCTV system manufacturer's proprietary embedded protocol (hereinafter called the "CCTV Embedded Protocol") as a Microsoft Windows-based PC software application with user interface. Provide the CCTV Embedded Protocol and control software application on CD-ROM with printed user documentation. The CCTV Embedded Protocol control software shall be capable of fully operating the camera system assembly and user control interface unit, including but not limited to control, monitoring, and configuration. Operate the control software through a cable connection between the user control interface unit and an RS-232 serial data interface on a Windows-based PC. Provide the control software with a properly configured RS-232 cable (minimum length 6 ft) with a female DB-9 connector on the cable end attached to the computer and a pre-configured connector or termination on the end attached to the user control interface unit. Provide the control software with an unrestricted, non-cancelable user license for the Department's use with any NaviGAtor equipment at any location. Furnish three copies each of the software, license, appropriate RS-232 cable, and user documentation per project.

Changeover between CCTV Standard Protocol and CCTV Embedded Protocol control and monitoring communications with the camera system assembly shall occur only through the user control interface unit. There shall be no requirement to physically access the camera system assembly or to reconfigure any wiring between the cabinet interface assembly and the camera system assembly. Use of different interface ports, or use of the same port, on the user control interface unit for the two protocols is permitted provided that the CCTV Embedded Protocol port is connectorized. Configuration changes to the user control interface unit to switch operation between the two protocols is not permitted, including but not limited to dipswitch or jumper settings, or settings accessed through the CCTV Embedded Protocol.

Connect the user control interface unit, using cable C6, to TB18 for connection through C1 to the camera system assembly. Use a single one, two or three pair multi-pair cable of stranded copper wiring, minimum #18 AWG, twisted and/or shielded as recommended by the CCTV system manufacturer, and label this cable C6. Ground or bond any C6 cable or pair shielding and any unused conductors in accordance with the CCTV system manufacturer's recommendations. Do not connect unused conductors of C1 to the user control interface unit unless recommended by the CCTV system manufacturer. Connect C6 directly to the terminating port on the user control interface unit; do not use any port adapters, gender changers, couplers, or similar components. Provide automatically-resetting surge suppression for each connected ungrounded conductor between the user control interface unit and TB18.

Connect the user control interface unit to the Video Encoder port with cable C5. Use a single multi-conductor or multi-pair cable with minimum stranded copper #18 AWG, with twisted pairs and/or shielded/bonded as recommended by the CCTV system manufacturer, and label this cable C5. Ground or bond any C5 cable or pair shielding and any unused conductors in accordance with the CCTV system manufacturer's recommendations. Cable C5 shall be pre-connectorized on one or both ends as required for the user control interface and the Video Encoder port configurations and as required by the CCTV system manufacturer. Connect C5 directly to the terminating ports on either end; do not use any port adapters, gender changers, couplers, or similar components.

**D. CCTV Standard Protocol**

1. General

Use the NaviGAtor Standard CCTV Control Protocol (hereinafter called the "CCTV standard protocol" or "standard protocol") for CCTV system control communications between the user control interface unit and the NaviGAtor central system. Implement the standard protocol as specified in this subsection for all CCTV equipment installed on this project. The CCTV standard protocol governs all control communications between the NaviGAtor central system (hereinafter called the "host") and the CCTV system specified in this Subsection 936.2.01 (hereinafter called the "remote"). Do not implement any other control communications except as required and specified in this Subsection 936.2.01.C.

2. Interface

The remote shall communicate using the CCTV standard protocol over an RS-232 serial interface. Data is transmitted using 1 start bit, 8 data bits, and 1 stop bit (no parity) at a baud rate of 9600.

Each remote shall be identified by a unique integer address between 1 and 233. This address is set during installation and shall not be altered using the standard protocol. The address is included in messages to identify the intended recipient of commands from the host and responses from the remote.

3. Message Sequence

All communication between the host and the remote is initiated by the host. The remote shall not transmit except in response to a properly formatted message from the host addressed to the remote's assigned address. The remote shall respond to such messages with an ACK (a single ASCII character 0x06) within 500 milliseconds ("ACK timeout"). The remote shall be ready to receive and process another command in as little as 150 milliseconds after the ACK is transmitted ("Inter-command spacing"). Figure 1 below depicts this sequence.

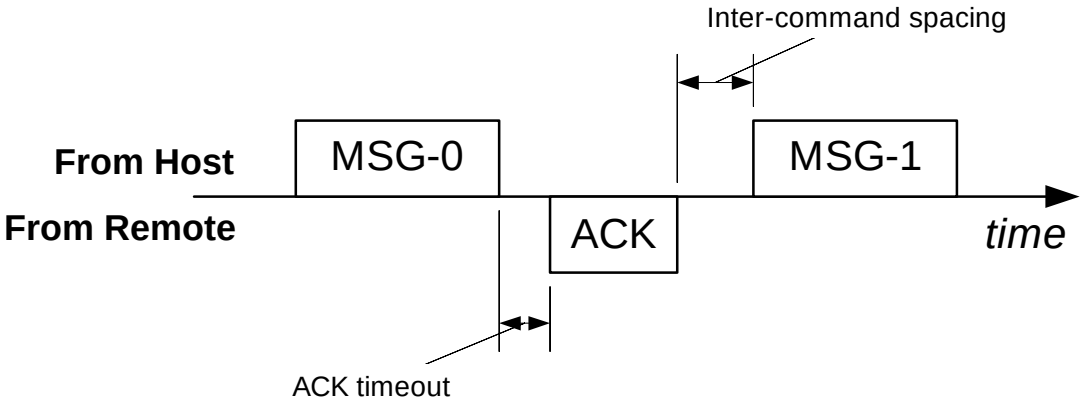



**Figure 1 - Basic Message Sequence**

Some messages from the host require a subsequent response message from the remote. In this case, the remote's ACK shall be followed immediately by a response message. When the host receives the properly formatted response, it will transmit an ACK back to the remote. This sequence is depicted below in Figure 2. The timing constraints presented above apply. Additionally, the host will wait a maximum of 500 milliseconds for each byte in the response message ("Inter-byte timeout").

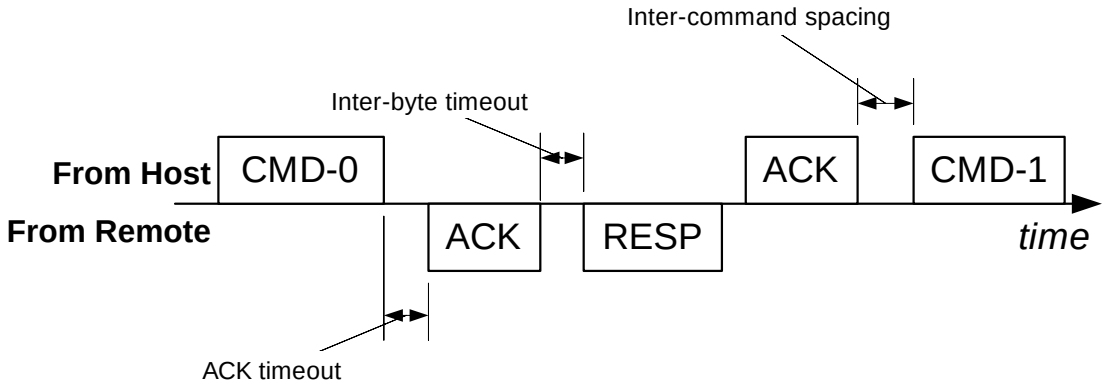



**Figure 2 - Response Message Sequence**

4. Message Format

Command and response messages shall be formatted as shown below in Table 1.

**Table 1 - Message Format**

| Size | Data | Description |
|---|---|---|
| 1 byte | 0xF8 | Message header |
| 1 byte | Address | Controller address (0x01 to 0xDF) |
| 2+ bytes | Message Data | (see Command and Response Message sections below) |
| 1 byte | Checksum | 0x80 to 0x8F (see below) |

Messages start with a single-byte header followed by a single-byte address. Two or more message data bytes follow the address. The message is terminated with a single-byte checksum.

**Checksum Calculations**

The message checksum byte is defined as the least significant nibble of the exclusive-or of all previous bytes in the message (excluding the `0xF8` header) added to `0x80`. The resulting byte will be between `0x80` and `0x8F` inclusive.

**Checksum Example:**

- The bytes of a "Pan Left" command addressed to controller 1 would be:
  `0xF8 0x01 0x50 0x4C 0x??`
- The bitwise exclusive-or of the bytes between the 0xF8 header and the checksum comes out to `0x1D`.
  `0x01 ^ 0x50 ^ 0x4C = 0x1D`
- Adding the least significant nibble to `0x80`, we get `0x8D` for the checksum byte.
  `0x80 | (0x0F & 0x1D) = 0x8D`
- The resulting 5-byte command would be
  `0xF8 0x01 0x50 0x4C 0x8D`

5. Command Messages

The tables below present the message data contained within command messages sent by the host to the remote. In most cases (exceptions will be noted), the “Data” column contains the ASCII characters of the message data to be sent. For example, the Pan Left command data is “PL”, an ASCII ‘P’ (0x50) followed by an ASCII ‘L’ (0x4C).

An “ACK” in the “Response” column indicates no response message is expected from the remote beyond the ACK itself as shown above in Figure 1. An “ACK + * Response” indicates the ACK from the remote is to be followed by the specified response message as shown above in Figure 2.

**Table 2 - Momentary Commands**

| Command | Data | Response |
|---|---|---|
| Pan Left | “PL” | ACK |
| Pan Right | “PR” | ACK |
| Pan Stop | “PS” | ACK |
| Tilt Up | “TU” | ACK |
| Tilt Down | “TD” | ACK |
| Tilt Stop | “TS” | ACK |
| Zoom In | “ZI” | ACK |
| Zoom Out | “ZO” | ACK |
| Zoom Stop | “ZS” | ACK |
| Focus Near | “FN” | ACK |
| Focus Far | “FF” | ACK |
| Focus Stop | “FS” | ACK |
| Iris Open | “IO” | ACK |
| Iris Close | “IC” | ACK |
| Iris Stop | “IS” | ACK |

**Table 3 - Position Commands**

| Command | Data | Response |
|---|---|---|
| Pan/Tilt Position Request | “P?” | ACK + Pan/Tilt Response |
| Pan/Tilt Goto Command | “pA2A1A0E2E1E0”<br><br>(see Position Encoding below) | ACK |
| Zoom/Focus Position Request | “V?” | ACK + Zoom/Focus Response |
| Zoom/Focus Goto Command | “vZ2Z1Z0F2F1F0”<br><br>(see Position Encoding below) | ACK |

**Table 4 - Latch Commands**

| Command | Data | Response |
|---|---|---|

| | | |
|---|---|---|
| Manual Iris Toggle | “LM” | ACK |
| Camera Power Toggle | “LP” | ACK |
| Lens Speed Toggle | “LL” | ACK |
| Latch Status Request | “L?” | ACK + Latch Response |

**Table 5 – Preset Commands**

| Command | Data | Response |
|---|---|---|
| Goto Preset 0 – 9 | “H0” – “H9” | ACK |
| Store Preset 0 – 9 | “P0” – “P9” | ACK |
| Preset Status Request | “H?” | ACK + Preset Response |

**Position Encoding**

The message data for the “Pan/Tilt Goto Command” above begins with an ASCII ‘p’ followed by the azimuth ($A_2A_1A_0$) and elevation ($E_2E_1E_0$) positions. The positions are 12-bit values encoded four-bits each in to the least significant nibbles of the three bytes whose most significant nibbles are always `0x30`. The subscript-2 indicates the byte containing the most significant bytes of the position and subscript-0 indicates the least significant.

*Position Encoding Example*: Encoding an azimuth position value of decimal 2748 or 0xABC, we break it up into three nibbles and add `0x30` to each so $A_2$ = `0x3A`, $A_1$ = `0x3B`, and $A_0$ = `0x3C`.

The same encoding scheme is used for the zoom and focus positions in the “Zoom/Focus Goto Command”.

6. Response Messages

The table below presents the message data contained within response messages sent by the remote to the host.

**Table 6 – Response Messages**

| Message | Data | Comment |
|---|---|---|
| Pan/Tilt Position Response | “P$A_2A_1A_0E_2E_1E_0$”<br><br>*(see Position Encoding above)* | using the same data encoding as Pan/Tilt Goto Command described earlier. (note: while the command uses a lower-case ‘p’, the response uses an upper-case ‘P’) |
| Zoom/Focus Position Response | “V$Z_2Z_1Z_0F_2F_1F_0$”<br><br>*(see Position Encoding above)* | using the same data encoding as Zoom/Focus Goto Command described earlier. (note: while the command uses a lower-case ‘v’, the response uses an upper-case ‘V’) |

| | | |
|---|---|---|
| Latch Response | "L$D_1$A$D_0$"<br><br>$D_1$ = 0x30 to 0x38<br><br>$D_0$ = 0x30 to 0x37 | The bits of $D_1$, the second byte in the data, indicate:<br>0: Iris Auto(0) or Manual(1)<br>1: Camera Power Off(0) or On(1)<br>2: Lens Speed Slow(0) or Fast(1)<br>3: Comm. Error No(0) or Yes(1)<br>4: (always 1)<br>5: (always 1)<br>6: (always 0)<br>7: (always 0)<br><br>The bits of $D_0$, the fourth byte in the data, indicate:<br>0: Aux-1 Off(0) or On(1)<br>1: Aux-1 Off(0) or On(1)<br>2: Aux-1 Off(0) or On(1)<br>3: (always 0)<br>4: (always 1)<br>5: (always 1)<br>6: (always 0)<br>7: (always 0) |
| Preset Response | "H $D_0$" | $D_0$ is a single ASCII character indicating:<br>'0'–'9':at the indicated preset<br>'A':active, going to a preset<br>'I':inactive, not at a preset<br>'E':error, unable to get to preset |

While the remote is going to a position as a result of a "Pan/Tilt Goto", "Zoom/Focus Goto", or "Preset Goto" command, "Preset Responses" will return 'A' in the D0 byte. If the remote is unable to get to the position in the "Goto" command (i.e. the pan/tilt assembly reaches the mechanical stops), the "Latch Response" will return 'E' in the D0 byte.

**E. Cabling and Connectors**

Provide cabling and connectors between the camera system assembly and the cabinet interface assembly as shown in the CCTV system detail drawings and in the Plans.

Provide coaxial video signal cables C2 and C4, with labels attached at both ends of each cable. Video signal cable C2 shall be double-shielded with tinned copper braid, #20 AWG solid copper center conductor, and polyethylene outer jacket approved for outdoor use (Belden 8281 or approved equivalent.) Video signal cable C4 shall be high-flexibility double-shielded with tinned copper braid, #22 AWG stranded copper center conductor, and PVC outer jacket (Belden 8281F or approved equivalent.) Use BNC connectors with gold-plated center pins on the video signal cables; use only connectors recommended by the cable manufacturer.

Provide control cable C1 with labels attached at both ends of the cable. Control cable C1 shall be a UL-listed six twisted-pair tray cable with #18 AWG 19-strand tinned copper conductors with individual foil or braid shield on each pair and UV-resistant PVC or polyethylene outer jacket rated for 300 V, 90 degree C dry, 75 degree C wet and wet/dry direct burial use. Terminate cable C1 in the equipment cabinet on TB18 as shown in the CCTV system detail drawings and as recommended by the CCTV system manufacturer. Ground or bond any pair shielding and any unused conductors in accordance with the CCTV system manufacturer's recommendations.

Provide camera system assembly connector cable C3 to connect cables C1 and C2, through connectors J1 and J2 respectively, with the camera system assembly connector as provided by the CCTV system manufacturer. Cable C3 shall be manufactured and configured to mate with connectors J1 and J2 in accordance with the conductor assignments shown in the CCTV system detail drawings and the CCTV system manufacturer's recommendations. Use stranded copper conductors, or a solid copper conductor for a coaxial cable, with minimum 75 degree C individual conductor and outer jacket insulation ratings on all materials. Cable C3 shall be configured with the minimum length necessary for connection within the mounting bracket arm to J1, J2 and the camera system assembly connector, while providing sufficient slack for a technician to disconnect and reconnect the cable at the camera system assembly connector. Cable C3 shall mate to the camera system assembly connector with a positive locking mechanism to prevent vibration from loosening the connection. The camera system assembly connector shall use gold-plated pins and sockets. Connector J1 on cable C3 shall be configured with male conductor pins. Connector J2 on cable C3 shall be a coaxial cable BNC connector as specified for cables C2 and C4 above. All connectors on cable C3 shall be strain-relieved. Label the cable as C3 and with the camera system manufacturer's name and model number.

Terminate the aerial end of cable C1 with connector J1, which shall connect to mating connector J1 on C3. For J1 use a strain-relieved CPC 17-14 free-hanging plug and receptacle connector set (AMP 206043 / 206044 or compatible and approved equivalent) with gold-over-nickel spring-detent two-piece pins and sockets, with female conductor sockets terminated on cable C1. Do not use one-piece "formed" pins and sockets.

Terminate the aerial end of cable C2 as connector J2 with a BNC connector as specified for cables C2 and C4 above. Connect cable C2 to cable C3 through a BNC coupler with gold-plated center socket.

#### 936.2.02 Delivery, Storage, and Handling

Not applicable

## 936.3 Construction Requirements

#### 936.3.01 Personnel

Not applicable

#### 936.3.02 Equipment

Not applicable

#### 936.3.03 Preparation

Not applicable

#### 936.3.04 Fabrication

Not applicable

#### 936.3.05 Construction

**A. General Requirements**

Apply for, obtain, and pay for all utility services and pole attachment permits that are necessary for the CCTV system installation and operation as required in the Plans. Maintain these utility services until Final Acceptance of the CCTV system. Upon Final Acceptance, make an orderly and uninterrupted transfer of these services and permits to the maintaining agency that will be responsible for subsequent maintenance and operation.

Furnish only new equipment.

**B. CCTV System, Type B**

1. Installation Requirements

Mount the camera system assembly and the mounting bracket arm at the cardinal direction and height as shown in the Plans.

Install cables C1 and C2 between the camera system assembly and the equipment cabinet inside new hollow metal or concrete support poles unless otherwise specified. Where devices are installed on existing wood poles, install cabling on the wood poles in rigid metal conduit risers of minimum 2 in (50.8 mm) diameter. Use weather heads on all nipple and conduit openings. Neatly install and route cabling to minimize movement in the wind and chafing against the pole, device or bracket. Form a drip loop at the weather head and route cabling to prevent water entry into the weatherhead or mounting bracket arm. Install the mounting bracket arm no more than 8 in (204 mm) above the weatherhead, and install a drip loop that is no more than 6 in (152 mm) below the weatherhead at the loop's lowest point.

Install the cabinet interface assembly components in the equipment cabinet as shown in the CCTV system detail drawings. Neatly arrange and dress all wiring, firmly lace or bundle it, and mechanically secure the wiring without the use of adhesive fasteners. Route and secure all wiring and cabling to avoid sharp edges and to avoid conflicts with other equipment or cabling. Route all CCTV cables separate from any 120VAC power wiring or surge suppressor ground wiring. Neatly coil and dress between 3 ft (1 m) and 5 ft (1.5 m) of cables C1 and C2 in the bottom of the cabinet. Dress and route grounding wires separately from all other cabinet wiring and with the minimum length possible between the suppressor and the ground bussbar. Do not splice any cable, shield or conductor used for video, control, communications signaling, power supply, or grounding.

Fasten all components of the cabinet interface assembly to be mounted on the equipment cabinet side panel or on the CCTV Interface Enclosure with stainless steel hex-head or phillips-head machine screws. Install the screws into tapped and threaded holes in the panels. Fasten stud-mounted components to a mounting bracket providing complete access to the studs and mounting nuts. All fastener heads and nuts (when used) shall be fully accessible within the equipment cabinet, and any component shall be removable without requiring removal of other components, panels, or mounting rails. Do not use self-tapping or self-threading fasteners. Label TB18, each terminal position on TB18, and SS15 on the equipment cabinet side panel with silk-screened lettering on the panel.

2. CCTV System Configuration

Program and configure the CCTV system in accordance with the procedure below. Provide all required documentation in writing with all data recorded in the format of the NaviGAtor Standard CCTV Control Protocol. Perform the CCTV system configuration in accordance with the acceptance procedures in subsection 936.3.06. It should be noted that configuration requirements specified herein are independent of the video encoder.

Configure each CCTV system with the communications address specified by the Department, prior to any acceptance testing at a given CCTV system site. Configure the communications address as "001" unless otherwise shown in the Plans or directed by the Engineer.

GDOT's "ATMS Surveillance Camera Control Integration and Calibration Procedure" is as follows:

- Record the position status setting for the full pan left and pan right stops, defined just as the pole comes into view in either direction.
- Record the position status setting for maximum tilt up and maximum tilt down (90 degrees down from horizontal).
- Record the position status settings for each end of maximum focus range.
- Record the position status settings for maximum zoom out and zoom in.
- Provide to the Department the following information from each field installation site:
    - Location (as shown in Plans)
    - Height of camera (ft) above travel lanes
    - Azimuth (compass heading in degrees at camera's right stop as defined above)
    - Azimuth (compass heading in degrees at camera's left stop as defined above)
    - Device ID as shown on the Plans (example: CAM001)

- CCTV system communications address (example: 001)
- IP address, port/socket of serial port on Encoder
- Comments

3. As-Built Drawings

Furnish as-built CCTV system wiring diagrams, identified by location. Include all wiring, cabling, conductor function, connector type and connector pinouts. Included but not limited in the documentation requirements are cables C1, C3, C5, C6, the CCTV embedded protocol control software cable, and all connectors and terminations on the cables, the camera system assembly, TB18, the user control interface unit and power supply of the cabinet interface assembly, and the communications equipment. Place all documentation in a weatherproof sleeve and place in the cabinet drawer.

### 936.3.06 Quality Acceptance

#### A. General

Acceptance testing consists of three phases: 1) field installation testing; 2) CCTV system site testing; and 3) burn-in period. After the Engineer's granting of burn-in period completion, obtain CCTV system acceptance.

Perform acceptance testing for all equipment, hardware and work provided under this Contract, including each CCTV video surveillance field installation assembly and all associated communications hardware at a control center or communications hub. Perform all testing in the presence of the Engineer. Notify the Engineer of a desired acceptance test schedule no less than fourteen calendar days prior to beginning the testing except for testing using the NaviGAtor software and existing NaviGAtor control center and communications equipment. For acceptance testing using the NaviGAtor software and existing NaviGAtor control center and communications equipment, coordinate this testing with the Engineer no less than 30 days prior to the start of this testing.

Except as provided herein regarding the Department's NaviGAtor software, develop, provide all equipment for, and perform all acceptance testing for all CCTV system equipment, hardware and work. Develop detailed and thorough test procedures with full test plan descriptions, test and measurement equipment listings, and test results data sheets. As part of the submittal data requirements, submit these test plans to the Engineer for approval. The Engineer will notify the Contractor of the approval or disapproval of the test procedures; only test procedures approved by the Engineer can be used. Provide all necessary testing and measurement equipment. Have a complete copy of all materials and equipment submissions and all documentary items on hand at all acceptance testing sessions.

Make the acceptance testing plan a detailed and thorough procedure for both the field installation test and the CCTV system site test. Demonstrate that the CCTV system equipment, hardware and work meet all requirements of the Contract. These requirements include but are not limited to all design, construction, materials, equipment, assembly, documentation of manufacturer's certification of assembly and configuration, environmental, performance, communications, video and data communications signal strength and clarity, compatibility with the NaviGAtor software, and documentary requirements of the Contract.

Prior to the beginning of any acceptance testing at a given CCTV system site, complete all configuration and documentation associated with GDOT's "ATMS Surveillance Camera Control Integration and Calibration Procedure," described in Subsection 936.3.05.B. Be prepared to demonstrate such work.

#### B. Field Installation Test

Perform the Field Installation Test as an onsite test of the complete field installation assembly less the communications components; no acceptance testing at a given site can begin until all work associated with that site is complete, not including the communications components. For the field equipment installation test, use a PC system, CCTV Embedded Protocol control software, and a 13 in or larger color video monitor to demonstrate full operation of the CCTV site. Demonstrate operation to include pan, tilt, focus, zoom, iris, position feedback, and communications address configuration. Measure the video signal strength at the video connector of the communications equipment.

## C. CCTV System Site Test

For the CCTV System Site Test, demonstrate proper CCTV system performance at the TMC or other control center determined by the Department. Perform the CCTV System Site Test only after successful completion of the field installation acceptance test. Demonstrate the complete video image, camera/lens control, and communications operation from each CCTV site to the TMC. Use the NaviGAtor software and existing NaviGAtor control center and communications system to demonstrate the compatibility of the CCTV equipment and installation in its permanent NaviGAtor configuration. Verify data communications (pan, tilt, focus, zoom, iris, position feedback) from the TMC as defined in the Department-approved test procedures.

## D. Burn-in Period

1. General Requirements

Provide a 30-day burn-in period for all work and equipment included in the Contract. The burn-in period shall consist of the field operation of the CCTV system in a manner that is in full accordance with the CCTV system requirements of the Plans and Specifications. An acceptance test procedure is not required for the system burn-in.

Conduct only one (1) burn-in period on the entire Contract. Commence with the burn-in period only after meeting all of the following requirements:

- All work required in all Contract documents for CCTV (may be combined with construction contract) (except this burn-in period) has been completed and inspected by the Engineer.
- Successfully complete all Acceptance Testing.

Commence with the burn-in period upon written authorization by the Department to commence. Terminate the burn-in period 30 consecutive days thereafter unless an equipment malfunction occurs. Stop the burn-in period for the length of time any equipment is defective. After repairing the equipment so that it functions properly, resume the burn-in period at the point it was stopped.

Successful completion and acceptance of the burn-in period will be granted on the 30th day unless any equipment has malfunctioned during the 15th through 30th day of the burn-in period. If any equipment has failed during the 15th through 30th day, final acceptance will be withheld until all the equipment is functioning properly for 15 days after repair.

When a specific piece of equipment has malfunctioned more than three times during the 30 day burn-in period, replace that equipment with a new unit and repeat the 30 day burn-in period.

2. Contractor Responsibilities

During the burn-in period, maintain all work under this Contract in accordance with the Specifications. Restore any work or equipment to proper operating condition within 12 hours after notification.

3. Department Responsibilities

Department responsibilities during the burn-in period will be as follows:

- Expeditious notification of Contractor upon failure or malfunction of equipment
- In the event that the Contractor does not provide the services enumerated above under his Contract responsibilities, the Department or its authorized agents may in the interest of public safety take emergency action to provide for adequate traffic control. Pay any costs incurred as a result of these emergency actions. Such action by the Department will not void any guaranties or warranties or other obligations set forth in the Contract.

4. Burn-In Period Acceptance

The Department will make burn-in period acceptance after satisfactory completion of the required burn-in period and on the basis of a comprehensive field inspection of the complete CCTV system in accordance with the Specifications. Upon burn-in

period acceptance but prior to Final Acceptance of the entire Contract, maintain the complete CCTV system in accordance with the requirements of Subsection 936.3.07.

### 936.3.07 Contractor Warranty and Maintenance

Provide a manufacturer's support (usual and customary warranties) period for all equipment and materials furnished and installed as part of the pay item for CCTV system equipment and materials. Include warranties or guarantees for system camera assembly and mount, cabinet interface assembly, and cabling/connector. Begin warranty upon successful completion of the CCTV System Site Test.

Transfer Manufacturer’s and Contractor’s warranties or guarantees to the agency or user responsible for the CCTV system maintenance, The warranties and guarantees shall be continuous throughout their duration, and state that they are subject to such transfer.

### 936.3.08 Training

Provide installation, operations, and maintenance training on the CCTV equipment at a site in the project area. Personnel trained by the various equipment manufacturers and authorized by said manufacturers shall perform the training. Include in the cost of training all supplies, equipment, materials, handouts, travel, and subsistence necessary to conduct the training. Furnish a training notebook in a labeled 3-ring binder to each trainee.

Provide installation, operations and maintenance training for up to twelve (12) people. Include in this training both classroom training and hands-on training. Limit in-shop and in-field training to group sizes of four (4) people at a time. Conduct all training in half-day sessions. Two half-day sessions may be held on the same day. The total of the training shall consist of at least six (6) clock hours of training for each participant. Provide a course content of, at a minimum, the following:

- Installation of all CCTV equipment
- Operations of all CCTV equipment
- Explanation of video quality
- Maintenance of all CCTV components
- Use of the CCTV embedded protocol control software
- Measurement of video signals
- Discussion of all warrantee clauses
- Hands-on use of CCTV equipment in signal shop environment for each trainee
- In-field maintenance training

CCTV training shall be provided in conjunction with the digital video transport system training specified in Section 939. The total of the CCTV and video transport system training shall consist of at least eight (8) clock hours of training for each participant. Meet all video transport system training requirements of Section 939.

## 936.4 Measurement

### 936.4.01 CCTV System, Type B

CCTV systems, Type B, are measured for payment by the number actually installed, complete, functional, and accepted. Unless otherwise specified in the Plans, furnish and install the following minimum items for a CCTV system, Type B:

- camera system assembly including the camera, lens, pan/tilt drive, control electronics and environmental enclosure.
- pole-mounting hardware.

- cabinet equipment, including but not limited to the cabinet interface assembly and all associated wiring, conductors, terminal blocks, and surge suppression.
- all weather heads, vertical conduit risers and conduit hardware on the CCTV support pole for power service, grounding, communications and control.
- all hardware and materials necessary to provide electrical power service to the CCTV field location as shown in the Plans, including but not limited to vertical sections of conduit, conduit hardware, wire, circuit breakers, disconnect enclosures, and grounding. The Department will pay for horizontal sections of conduit separately.
- all cables, connectors, hardware, interfaces, supplies, and any other items necessary for the proper operation and function of any CCTV system component with any other CCTV system component.

#### 936.4.02 Camera System Assembly, Type B (Furnish Only)

Camera system assemblies, Type B, are measured for payment by the number actually furnished and accepted.

#### 936.4.03 Cabinet Interface Assembly, Type B (Furnish Only)

Cabinet interface assemblies, Type B, are measured for payment by the number actually furnished and accepted.

#### 936.4.04 Camera System Assembly Mount, Type B (Furnish Only)

Camera system assembly mounts, Type B, are measured for payment by the number actually furnished and accepted.

#### 936.4.05 Testing

Testing is measured as a lump sum for full delivery of testing and acceptance requirements.

#### 936.4.06 Training

Training is measured as a lump sum for all supplies, equipment, materials, handouts, travel, and subsistence necessary to conduct the training.

#### 936.4.07 Limits

Not applicable

## 936.5 Payment

#### 936.5.01 CCTV System

CCTV systems of the Type specified in the Plans are paid for at the Contract Unit Price. Payment is full compensation for furnishing and installing the CCTV system.

Payment for CCTV systems is made under:

| | | |
|---|---|---|
| Item No. 936 | CCTV System, Type B | Per Each |

#### 936.5.02 CCTV Components

CCTV components are paid for at the Contract Unit Price. Payment is full compensation for furnishing each component.

Payment is made under:

| | | |
|---|---|---|
| Item No. 936 | Camera System Assembly, Type B | Per Each |
| Item No. 936 | Cabinet Interface Assembly, Type B | Per Each |
| Item No. 936 | Camera System Assembly Mount, Type B | Per Each |

**936.5.03 Testing**

The Department will pay for testing performed as prescribed by this Item, measured as provided under Measurement at the Lump Sum Contract bid price.

Payment for testing is made under:

| | | |
|---|---|---|
| Item No. 936 | Testing | Lump Sum |

**936.5.04 Training**

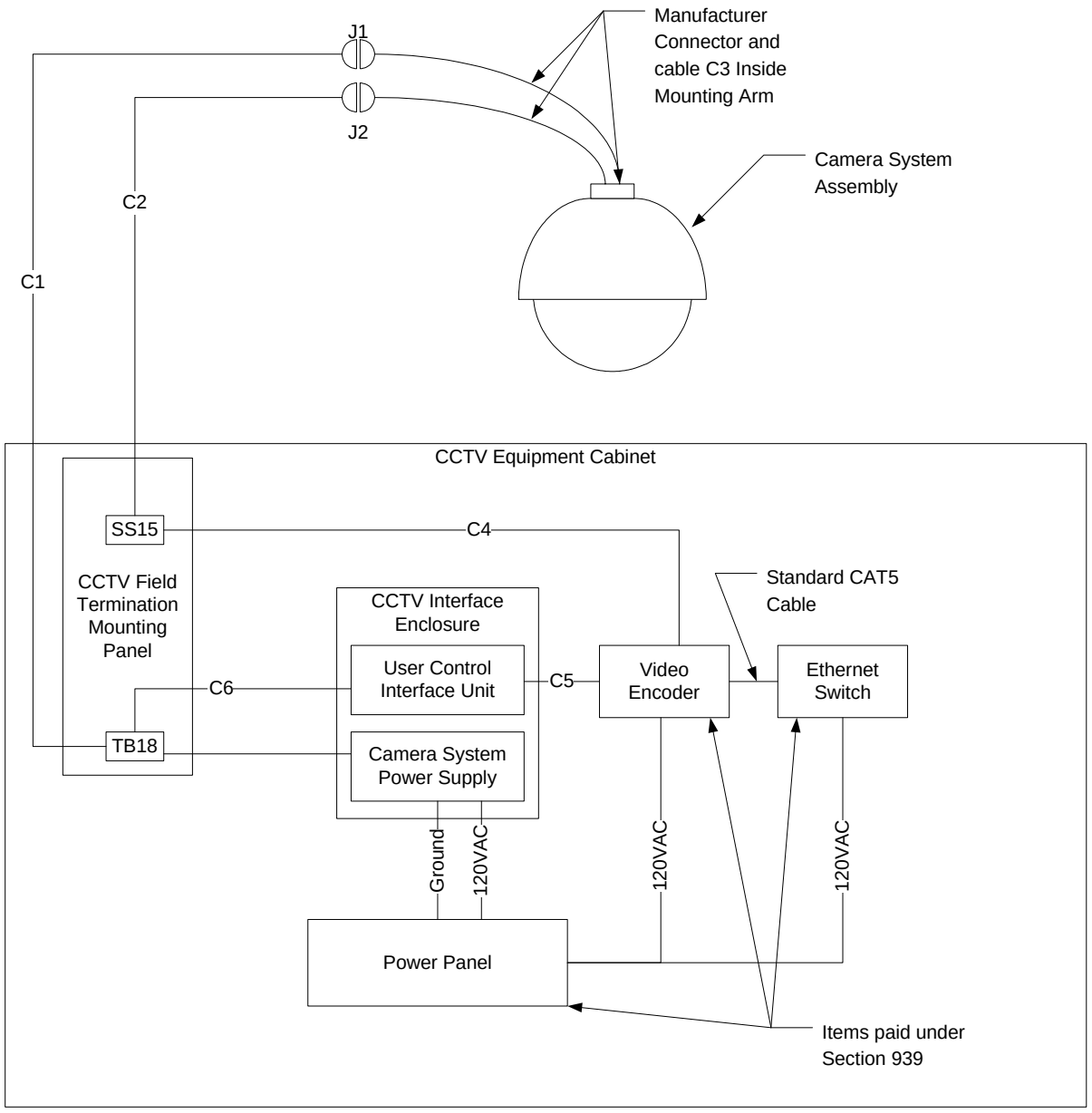
The Department will pay twenty-five (25%) of the total contract bid amount for training upon approval of the Training Plan. The Department will pay the remaining seventy-five (75%) after completion of all training as described in Subsection 936.3.08. The total sum of all payments cannot exceed the original contract amount for this item.

Payment for training is made under:

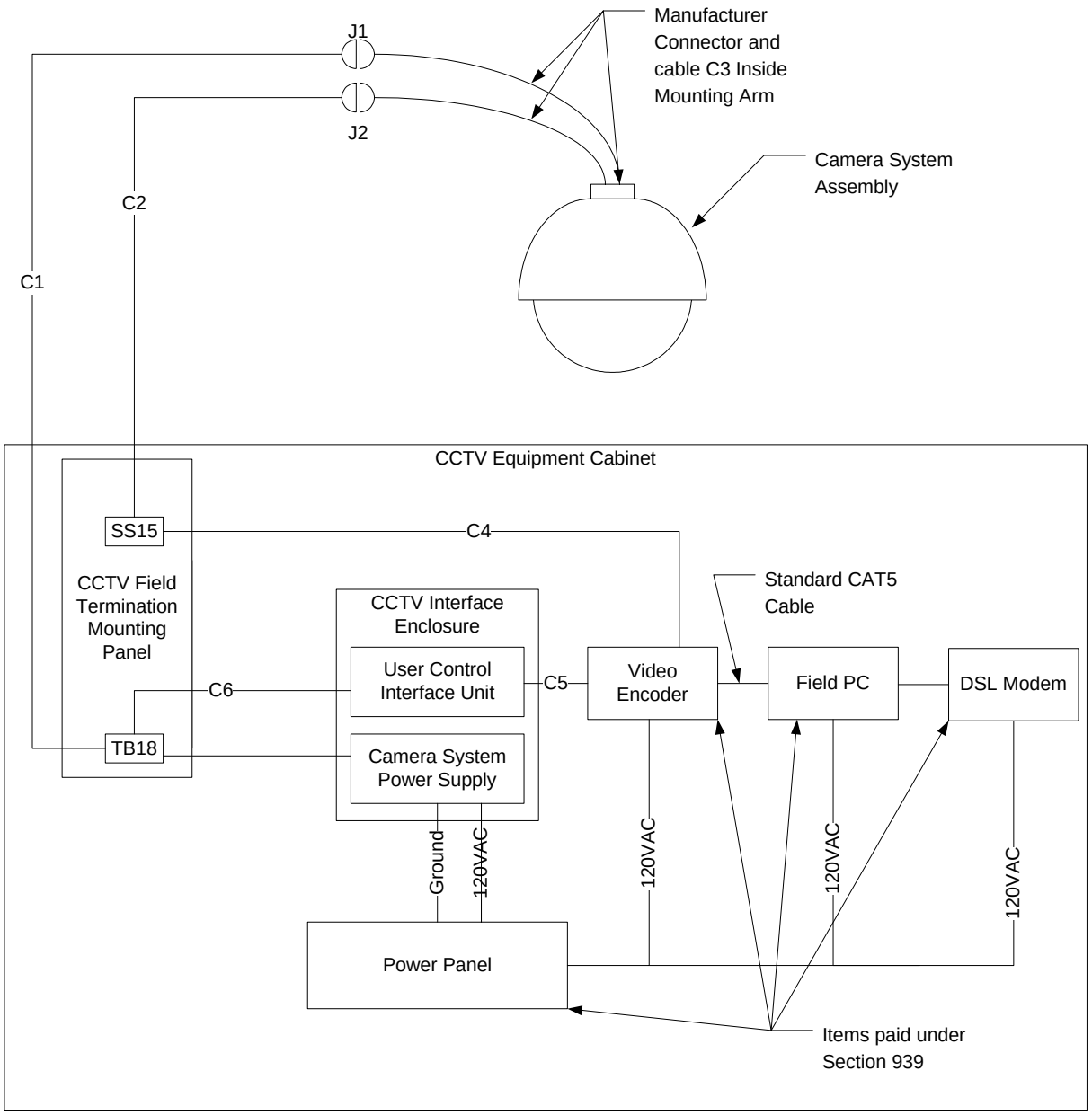
| | | |
|---|---|---|
| Item No. 936 | Training | Lump Sum |

**936.5.05 Adjustments**

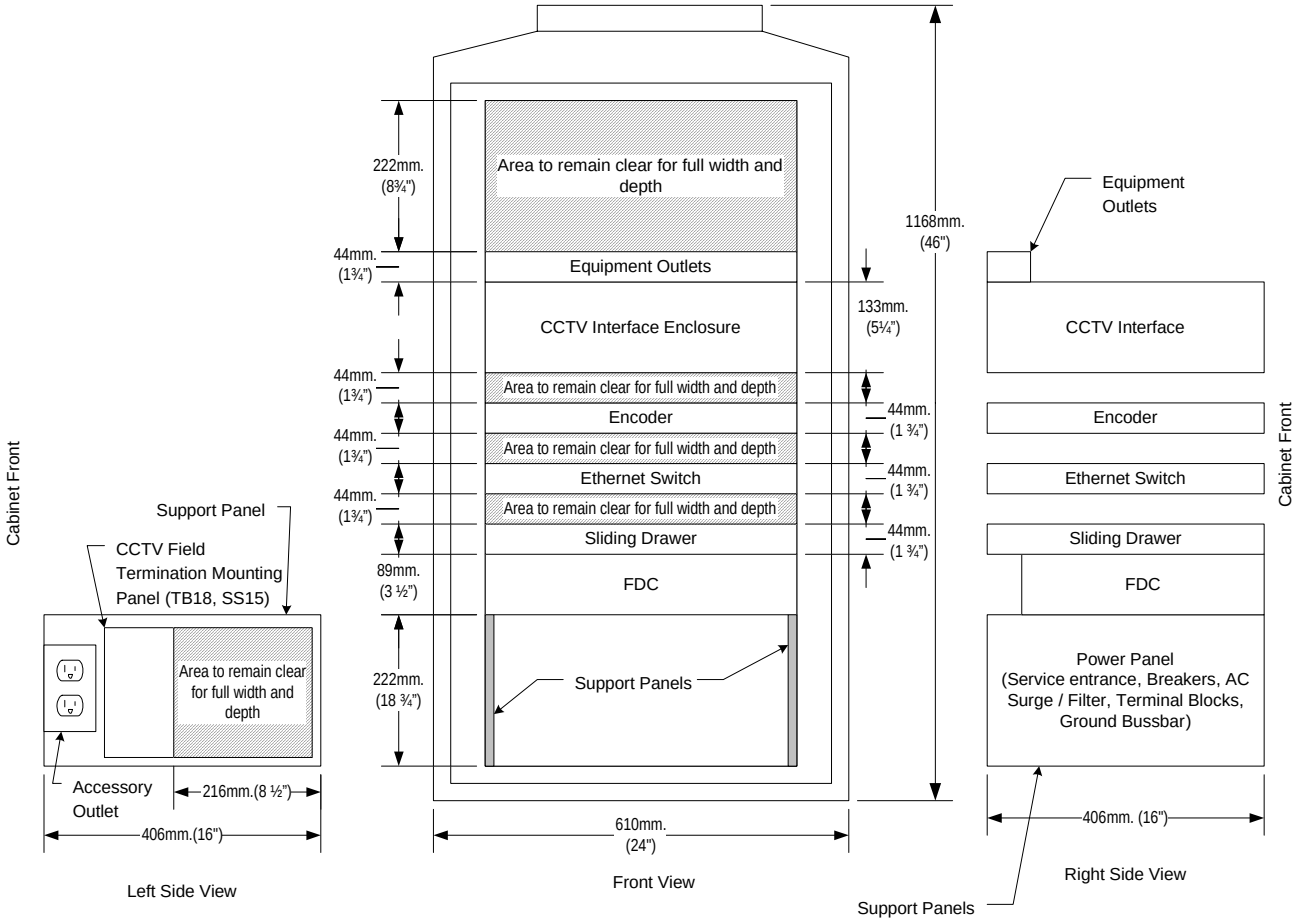
Not applicable




**CCTV System Detail Drawings**
**Detail Drawing 936.1a**
**System Block Diagram, CCTV System, Type B**
**(Ethernet over Fiber)**



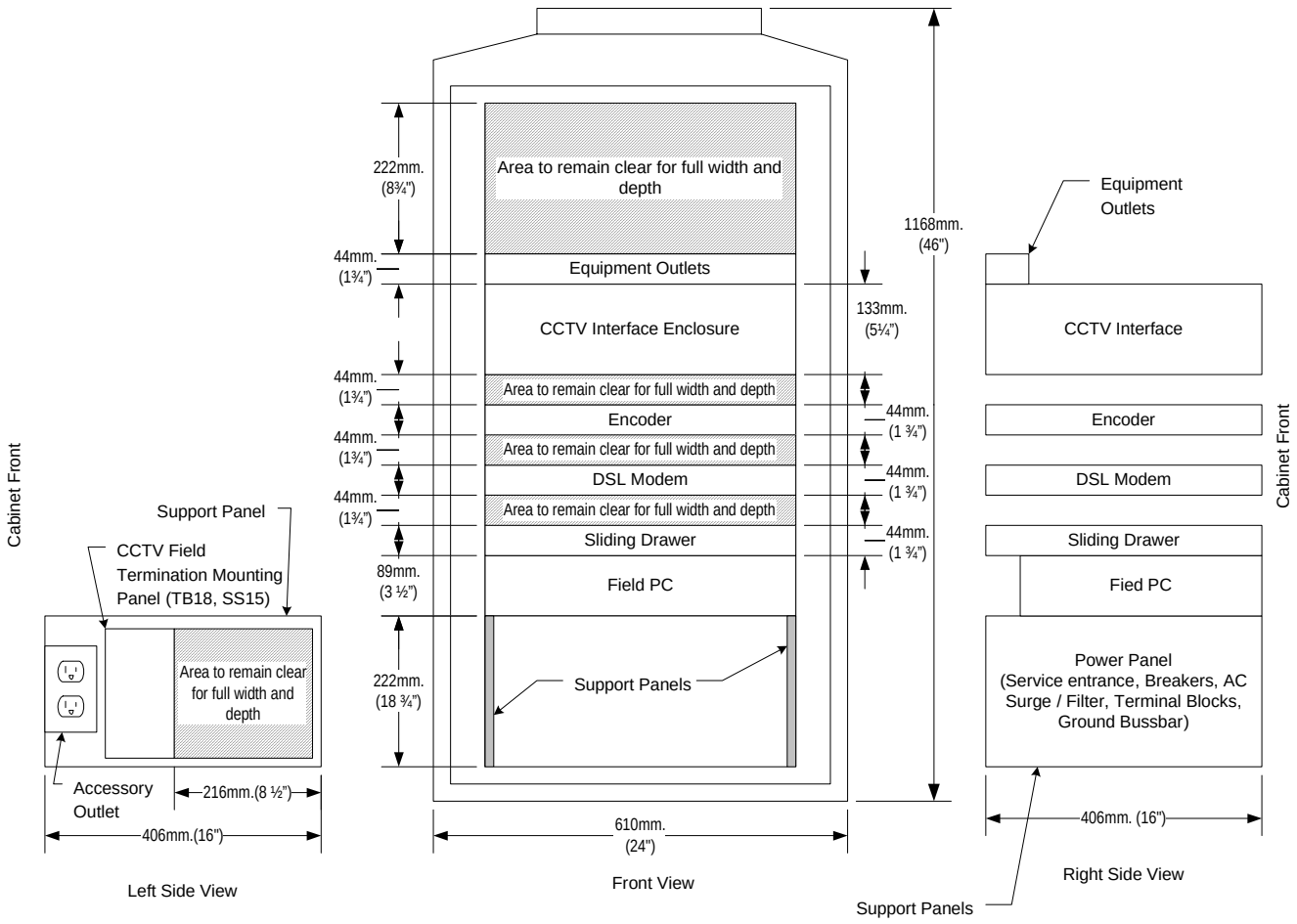

**CCTV System Detail Drawings**
**Detail Drawing 936.1b**
**System Block Diagram, CCTV System, Type B**
**(Ethernet over VPN)**




Notes:

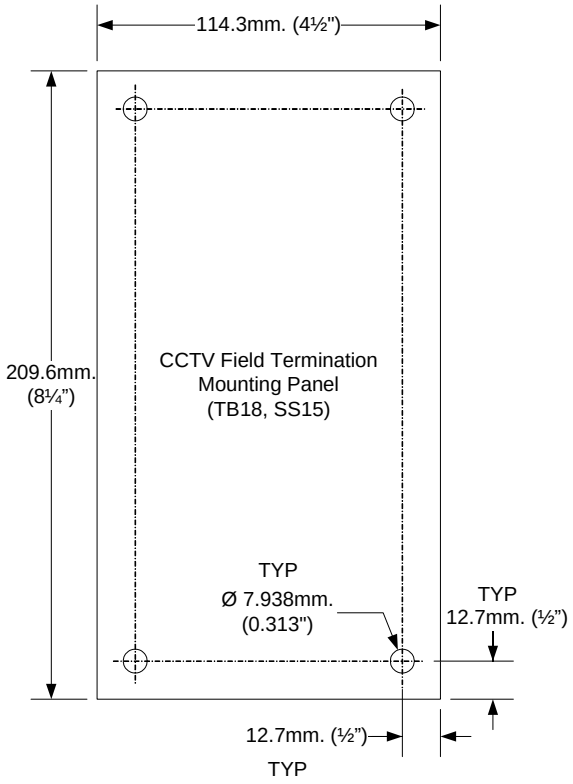
1. All dimension and scale are approximate.
2. FDC (Fiber Distribution Center) required and paid for in Section 935
3. Support Panels shall be mounted inside the cabinet rack cage .
4. Removal of a Support Panel or Mounting Panel shall not require the removal of any other cabinet component

## CCTV System Detail Drawings
## Detail Drawing 936.2a
## Type D Equipment Cabinet Assembly with Type B CCTV Equipment.



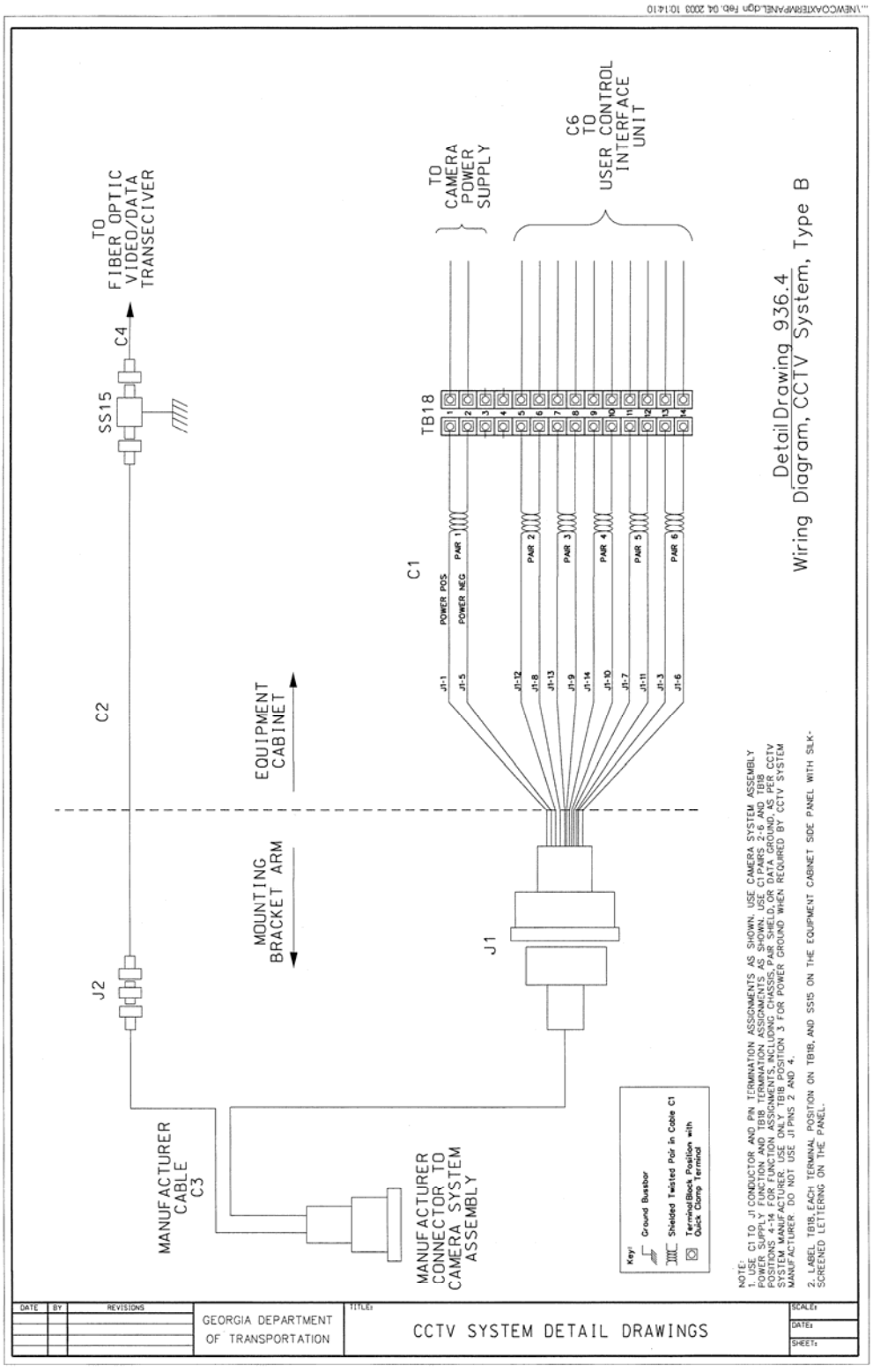

Notes:
1. All dimension and scale are approximate.
2. Support Panels shall be mounted inside the cabinet rack cage.
3. Removal of a Support Panel or Mounting Panel shall not require the removal of any other cabinet component

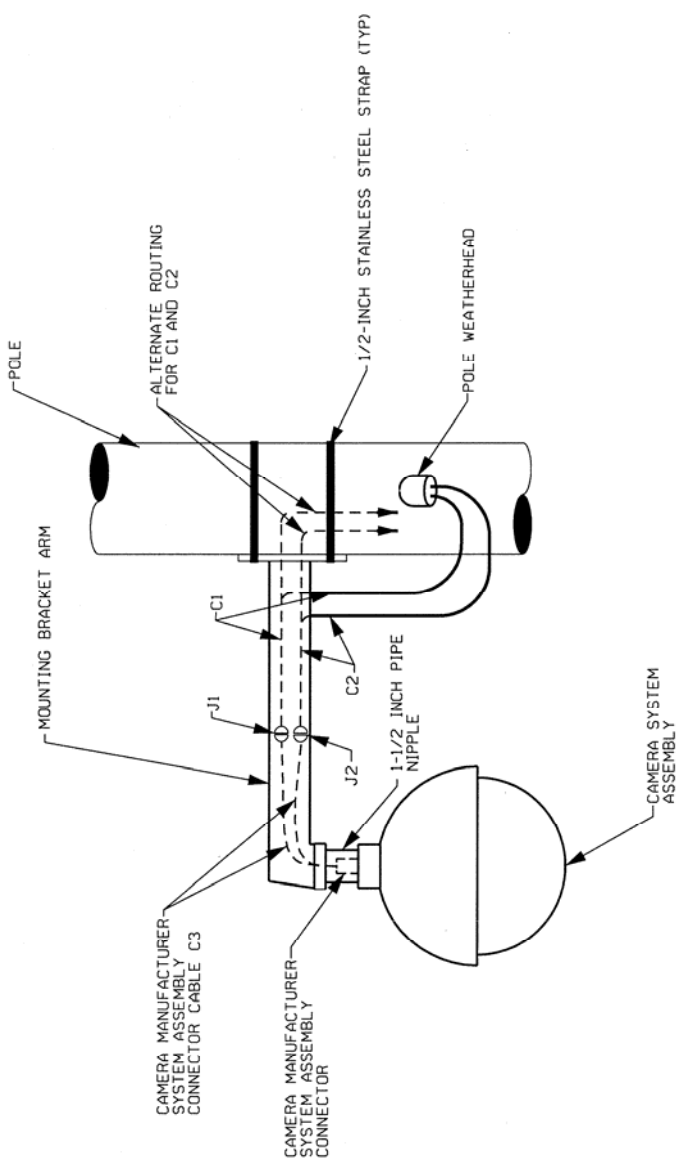
# CCTV System Detail Drawings
# Detail Drawing 936.2b
# Type E Equipment Cabinet Assembly with Type B CCTV Equipment.




Note:
1. All linear dimensions +\- 0.005" tolerance.
2. Drawing not to scale
3. Mounting Panel shall be 0.125" 5052 Aluminum

## CCTV System Detail Drawings
## Detail Drawing 936.3
## CCTV Field Termination Mounting Panel,
## CCTV System Type B


TO FIBER OPTIC VIDEO/DATA TRANSECIVER
SS15
C4
TO CAMERA POWER SUPPLY
C6 TO USER CONTROL INTERFACE UNIT
TB18
C1
C2
EQUIPMENT CABINET
MOUNTING BRACKET ARM
J2
J1
MANUFACTURER CABLE C3
MANUFACTURER CONNECTOR TO CAMERA SYSTEM ASSEMBLY
POWER POS.
POWER NEG.
PAIR 1
PAIR 2
PAIR 3
PAIR 4
PAIR 5
PAIR 6
Key:
Ground Bussbar
Shielded Twisted Pair in Cable C1
Terminal Block Position with Quick Clamp Terminal
NOTE:
1. USE C1 TO J1 CONDUCTOR AND PIN TERMINATION ASSIGNMENTS AS SHOWN. USE CAMERA SYSTEM ASSEMBLY POWER SUPPLY FUNCTION AND TB1B TERMINATION ASSIGNMENTS AS SHOWN. USE C1 PAIRS 2-6 AND TB1B POSITIONS 4-14 FOR FUNCTION ASSIGNMENTS, INCLUDING CHASSIS, PAIR SHIELD, OR DATA GROUND, AS PER CCTV SYSTEM MANUFACTURER. USE ONLY TB1B POSITION 3 FOR POWER GROUND WHEN REQUIRED BY CCTV SYSTEM MANUFACTURER. DO NOT USE J1 PINS 2 AND 4.
2. LABEL TB1B, EACH TERMINAL POSITION ON TB1B, AND SS15 ON THE EQUIPMENT CABINET SIDE PANEL WITH SILK-SCREENED LETTERING ON THE PANEL.
Detail Drawing 936.4
Wiring Diagram, CCTV System, Type B
DATE
BY
REVISIONS
GEORGIA DEPARTMENT OF TRANSPORTATION
TITLE:
CCTV SYSTEM DETAIL DRAWINGS
SCALE:
DATE:
SHEET:




Detail Drawing 936.5

Pole Mounting Detail, CCTV System, Type B

Not To Scale

| DATE | BY | REVISIONS | GEORGIA DEPARTMENT OF TRANSPORTATION | TITLE: CCTV SYSTEM DETAIL DRAWINGS | SCALE: |
|---|---|---|---|---|---|
| | | | | | DATE: |
| | | | | | SHEET: |

...\NEWCOAXTERMPANEL.dgn Jul 18, 2008 14:58:09