

**SP-090064
(New)**



Iowa Department of Transportation

SPECIAL PROVISIONS

FOR

TRAFFIC SIGNALS – VIDEO DETECTION SYSTEM

Des Moines County

NHSX-61-2(83)--3H-29

Letting Date

MARCH 16, 2010

THE STANDARD SPECIFICATIONS, SERIES OF 2009, ARE AMENDED BY THE FOLLOWING ADDITIONS AND MODIFICATIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

TABLE OF CONTENTS

1. GENERAL
2. VIDEO IMAGE PROCESSING SYSTEM

ATTACHMENTS

SCHEDULE OF UNIT PRICES

1. GENERAL

- A. This part of the Special Provisions consists of the general requirements necessary when furnishing a video traffic detection system installation complete, in place and operative as described in the project plans and these specifications.
- B. The Developmental Specifications for Traffic Signals (DS-09030) and the Standard Specifications for Highway and Bridge Construction, Series 2009, Iowa Department of Transportation, as modified by these specifications, or other appropriate special provisions shall apply to this project. The installation of the traffic control signals and appurtenances shall be in conformance with the Manual on Uniform Traffic Control Devices, 2003 edition.

2. VIDEO IMAGE PROCESSING SYSTEM

INTENT:

The intent of the following specification is to describe the minimum requirements for providing a complete Video Detection System. The system shall be capable of providing presence vehicle detection and traffic data collection at selected intersections. The video system shall be expandable without removing or replacing existing units.

OVERVIEW:

Using standard image sensor optics and in the absence of occlusion, the system shall be able to detect vehicle presence with 98% accuracy under normal conditions (days and nights), and 96% accuracy under adverse conditions (fog, rain, snow).

All items and materials furnished shall be new, unused, current production models installed and operational in a user environment and shall be items currently in distribution. The detection and data collection algorithms shall have a proven record of field use, with a minimum of three years of service.

GENERAL:

These technical specifications describe the minimum physical and functional properties of a video detection system. The system shall be capable of monitoring all licensed vehicles on the roadway, providing video detection for areas outlined in the construction drawings. The entire video detection system shall consist of the following:

- Video Image Processing unit(s).
- Video system communications module.
- Video camera(s) with IR filter, enclosure and sunshield.

- Camera lens.
- Surge suppressor.
- All other necessary equipment for operation.

1.0 HARDWARE

- 1.0 The Video Image Processor (VIP) shall be modular by design and housed in either a self-contained stand-alone unit or fit directly into NEMA TS1 & TS2 type racks as well as Type 170/179 input files. The VIP shall be interchangeable between a shelf or rack mount installation without replacing or modifying the existing VIP units.
- 1.1 The system shall control from 1 to 5 VIP boards allowing for 1 to 10 image sensors.
- 1.2 The system shall be designed to operate reliably in the adverse environment of roadside cabinets and shall meet or exceed all NEMA TS1 and TS2, as well as Type 170/179 environmental specifications.
- 1.3 Ambient operating temperature shall be from -35°C to $+75^{\circ}\text{C}$ at 0 to 95% relative humidity non-condensing.
- 1.4 The system shall be powered by 12-40 VDC and draw less than 2 amperes.
- 1.5 The system shall utilize cabinet 24 VDC for rack mount installations or external 24 VDC for stand-alone shelf installations.
- 1.6 Surge ratings shall be set forth in the NEMA TS1 and TS2 specifications.
- 1.7 Serial communications shall be through an RS232 serial port. This port can be used for communications to a modem or laptop to upload/download detector configurations, count data and software upgrades. RS485 on the rear edge connector shall facilitate communications to other VIP boards.
- 1.8 Each VIP board shall have 4 opto-isolated open collector outputs. Twenty additional outputs shall be available via the expansion port. The VIP shall have 20 presence detection zones and 4 data detection zones per camera. Data zones shall collect and store vehicle counts, volume, speed, gap time, headway, occupancy, and classification. Data shall be time-stamped (6713 intervals) and stored onboard (non-volatile memory) in intervals from 1-60 minutes.
- 1.9 Data alarms are generated for: queue, inverse direction, speed drop, no video, and errors.
- 1.10 Must be able to provide single or double loop emulation.

- 1.11 Presence hold time must have parameters that range from 10 to 600 seconds.
- 1.12 Each VIP board shall allow for 20 digital inputs via the I/O Expansion port.
- 1.13 Each VIP board shall have error detection. An output contact will open if the video signal is bad or the VIP board is not functioning properly. A user defined quality level will automatically put the VIP into a recall state in cases of severe degraded visibility (i.e., fog, blizzard, etc.). Normal detection resumes when visibility improves above the user defined quality level.
- 1.14 Operator selectable recall shall be available via the VIP front panel. Holding the recall switch on for 5 seconds shall activate this function.
- 1.15 A video select button on the VIP front panel will switch between camera images of the VIP.
- 1.16 The VIP board shall have 2 video inputs (RS-170 NTSC or CCIR composite video) and two video outputs (one on the front panel and one on the edge connector). The video inputs shall be through the VIP board's edge connector.
- 1.17 The VIP board shall have a reset button on the front panel to reset video detectors to "learn" the roadway image. During "relearn", selectable recall can be enabled or disabled for immediate operation. Learning time of video detectors shall be less than 5 minutes.
- 1.18 External surge suppression, independent of the VIP board shall separate the VIP from the image sensor.
- 1.19 The VIP board shall have separate light emitting diodes (LEDs) that indicate:

POWER	Red to verify power supply.
I/O COMM	Red to indicate communications to expansion boards.
VIDEO 1 & 2	Red to verify the presence of video input 75 Ohm.
TX & RX	Red to indicate communications via the serial port.
OUT1- OUT4	Green if the corresponding detection group is active.

The VIP board shall also have 2 separate buttons for:

VIDEO SELECT

RECALL	Manually places call on detectors.
RESET	Manually reset detectors to "learn" new background.

- 1.20 The video detection system shall be capable of being programmed locally with a handheld keypad. Keypad and monitor must be

separate units. A PC mouse will not be allowed. The setup monitor is to have a 9 inch, black and white screen.

- 1.21 The VIP board shall have a video out female RCA style connector, DB9 female Service port and DB9 I/O Expansion port
- 1.22 The VIP Expansion board shall also have separate LEDs that indicate:

POWER	Red to verify power supply.
COMM	Red to indicate communications to VIP board.
I/O1- I/O4	Green if the corresponding detection group is active.

The VIP Expansion board shall have 8 dip switches that define inputs and outputs used (range: 1-12 or 13-24).

- 1.23 Event Log Database

The VIP module shall have an onboard database capable of time stamping and storing 500 events. The Event Log Database can be viewed or downloaded to a selected spread sheet. Erasure of the Event Log Database shall not alter programmed configurations. As a minimum, the VIP shall log and time stamp the following events;

Firmware upgrade.

- Loss of video signal.
- Resumption of video signal.
- Configuration change.
- Bad video quality.
- Loss of power to VIP module.
- Resumption of power to VIP module.
- Speed alarm.
- Inverse direction.
- Recall activated.

Video System Communications Module

- 1.24 The Communication board shall be modular by design and housed in either a self-contained stand-alone unit or fit directly into NEMA TS1 & TS2 type racks as well as Type 170/2070 input files.
- 1.25 The Communication board shall be able to control from 1 to 6 VIP boards allowing for 1 to 12 image sensors.
- 1.26 The system shall be designed to operate reliably in the adverse environment of roadside cabinets and shall meet or exceed all NEMA TS1 and TS2, as well as Type 170/2070 environmental specifications.
- 1.27 Ambient operating temperature shall be from -34°C to $+74^{\circ}\text{C}$ at 0 to 95% relative humidity non-condensing.
- 1.28 The system shall be powered by 12-40 VDC and draw less than 2 amperes.

- 1.29 Serial and Ethernet (TCP/IP) communications shall be through respectively an RS232 serial port (F DB9 connector) and Ethernet port (RJ-45 connection). These ports can be used for communications to a laptop or modem to upload/download detector configurations, traffic data, technical events, send software upgrades and do remote setup of detectors. RS485 on the rear edge connector shall facilitate communications to VIP boards.
- 1.30 Surge ratings shall be set forth in the NEMA TS1 and TS2 specifications.
- 1.31 The Communication board shall have separate light emitting diodes (LEDs) that indicate:

POWER	Red LED to verify power supply.
LAN	Red LED to indicate data activity over Ethernet communication.
VIDEO OUT	Female RCA style connector.
RESET	Manual reset to re-initialize communications.
SERVICE	DB9 female Service port for setup of communication board and also used for serial/dial-up communication.
- 1.32 The Communications Board and equipment shall be furnished only when required in the project documentation.

2.0 FUNCTIONAL CAPABILITIES

- 2.1 Real Time Detection
- 2.2 Each VIP board shall be capable of processing two separate video signals (two separate cameras) per VIP board. The video signal shall be analyzed in real time (30 times per second).
- 2.3 The system shall be expandable up to 10 cameras that may be connected to different VIP units and programmed independently.
- 2.4 The system shall be capable of displaying detectors on the video image with associated outputs. Outputs/Inputs status will be indicated on the screen. Parameters will also include the ability to view raw video without any verbiage and/or detectors for surveillance purposes.
- 2.5 Each VIP board will detect within the view of the connected camera the presence of vehicles in user defined zones. Detectors available shall be presence, count, queue, delay, extension, or pulse mode of either arrival or departure of vehicles. - Delay and extension shall be defined between 0.1 – 99.9 seconds and pulse mode between 0 – 200ms in 33ms increments if NTSC is used. Each VIP board shall also detect and collect traffic data of passing vehicles in user-defined zones within the view of the connected camera.

Collected traffic data by direction shall include:

- Volume (absolute numbers) per length class and per lane.
- Average speed (km/h or mph) per length class and per lane.
- Average gap time (1/10 sec) per length class and per lane.
- Average headway (m or feet) per lane.
- Occupancy (%) per lane
- Concentration (vehicles/km or mile) per lane.
- Average length (m or feet) per lane.
- Confidence level (0-10) per lane.

2.6 The VIP board shall be programmed without the use of a supervisor computer. A standard CCTV monitor and handheld keypad plugged into the VIP serial port will facilitate detector programming. The handheld keypad shall include the following keys and respective functionalities:

Keys	Functionality
Enter Key	<ul style="list-style-type: none"> • To enter a menu, a submenu or an item within a submenu. • To select a value for a parameter and exit the topic.
Escape Key	<ul style="list-style-type: none"> • To exit the menu or submenu. • To exit the main menu and save the settings in the current configuration.
Arrow Keys	<ul style="list-style-type: none"> • To scroll through a menu. • To scroll through the values of a parameter. • To select a submenu. • To make a presence zone direction sensitive.
F1 Next Key	<ul style="list-style-type: none"> • To proceed to the next detection zone.
F2 Prev Key	<ul style="list-style-type: none"> • To move to the previous detection zone.
F3 Add Key	<ul style="list-style-type: none"> • To add a detection zone.
F4 Del Key	<ul style="list-style-type: none"> • To delete a detection zone.
Dir Key	<ul style="list-style-type: none"> • To make a data zone direction sensitive.
Help Key	<ul style="list-style-type: none"> • To display help text for an item.
Output Number Key	<ul style="list-style-type: none"> • To assign an output number to a detection zone.
Operate Key*	<ul style="list-style-type: none"> • To put the board in operation mode.
Edit Key	<ul style="list-style-type: none"> • To change settings while starting from default values for all parameters.
Modify Key*	<ul style="list-style-type: none"> • To change settings while starting from the last saved settings for all parameters.

* The functionality of this key is only for the video system communications modules

2.7 The VIP board shall store up to 8 detector configurations (4 per video input). It shall be possible to switch between detector configurations manually, automatically by time of day or remote input.

2.8 Via the serial port, detector configurations can be uploaded to a laptop and stored on disk.

- 2.9 Detectors may be linked to 24 outputs and 20 inputs using Boolean Logic features: AND, OR, NOT. It will be possible to generate conditional outputs based upon inputs from a controller.
- 2.10 It shall be possible to make a detector directional sensitive. Options will include an omni-directional detector or a detector that only senses movement: from right to left, left to right, up to down or down to up as you look at the monitor.
- 2.11 All detectors and parameters can be changed without interrupting detection. For example: when one detector is modified, all existing detectors continue to operate, including the one that is being modified. When the new position is confirmed, the new detector will enter a learning phase. Once the new detector is in function, it will take over the job of the old one. In this way, the detector is always fully operational with no interruption on any detector, even during modification. Learning phases for new detectors shall not exceed 10 seconds.
- 2.12 Four data detection zones per camera on a two camera VIP board may be used for collection of vehicle count, speed, classification, occupancy, density, headway, and gap time. These detectors will detect and store traffic data at user-defined intervals of 1, 2, 3, 5, 6, 10, 15, 30 & 60 minutes. It shall be possible for each VIP board to store up to 6713 intervals of data in non-volatile memory.
- 2.13 Six detectors per camera may be used as queue detectors. Using on screen calibration, queue detectors will detect queue delays and display the queue length in feet or meters. A queue may also generate an output alarm from the VIP board.
- 2.14 Associated software shall be used with a PC to download count data and export to a spreadsheet. The software shall also be used to upload/download detector configurations, traffic data, technical events and update software versions of the VIP board.
- 2.15 All software upgrades to associated software and VIP board software shall be provided at no cost to the city. The VIP boards and software shall be compatible with the video detection systems currently in use at Central Avenue & Washington Avenue and at West Avenue & West Burlington avenue in the existing installations in the City of Burlington, Iowa.
- 2.16 The VIP board shall have an internal clock with daylight savings time system, which can be enabled or disabled.
- 2.17 The VIP board shall provide overlaid tool tips for each individual menu- and submenu-items.
- 2.18 The VIP board shall have an optional password implementation. Different user-levels shall be available each having different rights. All equipment must be capable of having a minimum of 10 users that can be defined for each user-level.

- 2.19 The VIP board shall be able to delay or extend a detector zone output in combination with an input from the controller.
- 2.20 The VIP board shall detect wrong-way drivers and shall provide an alarm/event via communication board and/or output.
- 2.21 The VIP board shall provide an alarm and/or output when the user selected queue detection threshold of occupancy is exceeded for more than a user selected time threshold.
- 2.22 The VIP board shall distinguish five classes of detected vehicles based upon user selectable vehicle length thresholds.
- 2.23 The VIP shall be able to emulate loop emulation with user selectable loop dimensions.
- 2.24 The VIP shall have a Detection Hold Time function. The timing parameters shall be 10 – 600 seconds.
- 2.25 The VIP board shall provide advanced settings to optimize detection to avoid cross-lane traffic occlusion. Directional detectors shall be able to be programmed for Low, Medium or High depending on the severity of the occlusion.
- 2.26 The VIP shall be programmable for Wrong Way Suppression Delay. The timing parameters shall be 1 – 30 seconds.
- 2.27 The VIP board shall utilize advanced shadow rejection algorithms. It shall be possible to place detection zones over lane markings without affecting the shadow rejection accuracy from adjacent vehicle (moving) shadows.
- 2.28 The VIP board shall utilize an advanced Tree Shadow Suppression algorithm to suppress false detection of moving shadows (non-vehicular, i.e. trees) within a detection zone. It shall be possible to enable or disable this feature.
- 2.29 The VIP board shall provide integrated image quality diagnostics eliminating the need for users to manually place quality detection zones on the image. Advanced diagnostic information shall display both the quality of the video images (Qim) as well as the quality of detection (Qdet). The Qim and Qdet together will be averaged to provide an overall quality (Q). Each quality diagnostic (Qim, Qdet & Q) will be based on a 1 (poor quality) to 10 (excellent quality) scale. The Qim and the Qdet quality information for the individual camera under observation shall both be displayed simultaneously on the setup monitor equipment for quality diagnostics.
- 2.30 The VIP board shall provide the capability to enter a “recall” state if the quality threshold falls inside a user-defined range. The range shall be defined by the Quality Level (1-10) and a timeout range of 1 to 99 minutes. For example, if the quality drops to level 5 for 2 minutes, the VIP shall enter a “recall” mode. Once the quality rises

above level 5 for 2 minutes, the VIP resumes normal operation. The VIP shall also provide a contact closure output during this condition.

VIDEO SYSTEM COMMUNICATION MODULE:

- 2.31 The Video System Communication board shall be able to control from 1 to 6 VIP boards allowing for 1 to 12 image sensors.
- 2.32 The Video System Communication board shall provide a serial or Ethernet interface and communication to provide traffic data and allow remote configuration from the Traffic Operations Center.
- 2.33 The LAN port shall meet IEEE 802.3 with a RJ-45 connector and meet the following specification:
- Data rates for Ethernet via LAN port: 10Mbit/s
TCP/IP based protocol
- 2.34 The serial communications port shall meet EIA-232-E and meet the following specifications:
- Dial-up data rates for RS232 via Serial port: maximum 57600 bps
 - Direct data rates for RS232 via Serial port: maximum 115200 bps
 - Mode of operation: asynchronous, serial, 8 bit word, 1 stop bit, duplex or half-duplex
 - Parity: none
 - Handshake: RTS - CTS, DCD
 - Configuration: DTE
- 2.35 The communication shall support all functions of the video detection system.
- 2.36 All data transmissions shall be protected by CRC (cyclic redundancy checking) or an equivalent error detection method.
- 2.37 The communication board shall be programmed without the use of a supervisor computer. A standard CCTV monitor and keypad plugged into the communication serial port will facilitate board programming.
- 2.38 The communication shall support streaming video over Ethernet and serial communication.
- Streaming video frame rate:
 - Over Ethernet: 10 frames/second
 - Over serial communication: guarantee of 1 frame every 2 seconds.
- 2.39 Password protected remote setup (configuration upload/download, setup of detectors and detector parameters, setup of communication board parameters, firmware updates for Communication and VIP module) and monitoring of every connected VIP module shall be possible.

- 2.40 Dialup shall be possible through PSTN modems.
- 2.41 The Communication board shall log data and events provided by the VIP module(s) and transmit data and events to the HOST computer.
- 2.42 RS485 communication to every VIP module shall be established via the Edge connector.
- 2.43 The Communication board shall be able to store on board pre-post video sequences of alarm triggered upon traffic user defined events. When connected to a HOST computer, the JPEG video sequences shall automatically be downloaded to the HOST computer.
- 2.44 The Communication board shall be able to accept PAL or NTSC video format.
- 2.45 A (via Ethernet) connection with a standard Internet browser shall be possible to communicate with the Communication board for remote set-up, monitoring and real-time data of the VIP modules.
- 2.46 The Communications Board and equipment shall be furnished only when required in the project documentation.
- 2.47 Password protection shall be provided on the Communication board for remote operations.

3.0 IMAGE SENSOR- CAMERA

- 3.1 The unit shall be a high resolution, 1/3 inch image format CCD camera, designed for professional video surveillance systems. Cameras shall be available commercially. No sole source cameras will be allowed. Incorporating the latest in CCD technology, the video camera shall provide detailed video without lag, image retention, or geometric distortion. System must also be capable of working with either a color or black and camera.

Temperature range	-20°C to + 55°C
Humidity	0% to 95% relative, non-condensing
Dimensions	47mm by 47mm by 83mm
Weight	7.1oz.
Camera mounting slots	1/4-20, top and bottom
Connectors	BNC for video out
Lens mount	CS Power-in / pressure screw
Finish	Lens / 6-pin miniature "DIN" style
Construction	Off-white semi-gloss polyurethane
Rated input voltage	All metal housing
Voltage range	24 VAC, 60 Hertz
Nominal power	21 to 30 VAC
Imager	4 Watts
Imager spectral response	Interline transfer CCD 1/3 inch format
	100% @ 550nm:
	30% @ 400nm and 800nm
Sync system	EIA RS-170

Active picture elements	768 H X 494 V		
Horizontal resolution	580 TVL		
Sensitivity (2856 K)		Usable Picture	Full Video
Scene Illumination	fc	0.01	0.048
	lx	0.1200	0.480
Imager Illumination	fc	0.0024	0.01
	lx	0.0024	0.10
* F 1.2 lens @ 89% highlight			
Signal to noise ratio	48 dB minimum		
	58 dB typical		
AGC	21 dB, (max)		
Electronic Shutter	1/60 to 1/600000 sec. (EIA)		
Aperture Correction	Horizontal and vertical symmetrical		
Video out	1.0 volts peak-to-peak +/- 0.1 volt @ 75 Ohms		
Programmable Controls	Video level, shutter, AGC, BLC, Auto Black		

4.0 IMAGE SENSOR- LENS

4.1 The camera lens shall be a motorized vari-focal 6.5-65mm with auto iris.

- Image format 1/3 inch
- Focal length 10X zoom (6.5-65mm)
- Iris range f 1.4 – Approx. 360 (With ND Spot Filter)
- Focus range 9.85mm (in air)
- Back focus distance 10.05mm (0.4in.) in air
- Weight 285g.
- Lens mount CS
- Iris control 4 pin DC control
- Focus control Motorized
- Zoom Motorized

5.0 IMAGE SENSOR- HOUSING

5.1 The environmental housing shall be an aluminum enclosure designed for outdoor CCD camera installations.

Temperature range	-40°C to +50°C
Dimensions	449mm by 97mm by 112mm
Weight	1.4kg
Housing mounting	Three 1/4-20 tapped holes
Camera mounting	Removable cradle assembly
Cable entry	Three liquid-tight fittings that will accept cable diameters of: One fitting - 2 to 7 mm Two fittings - 3 to 10 mm
Finish	Off-white semi-gloss polyurethane
Construction	Extruded aluminum housing, Aluminum rear-end cap, Aluminum front cap with

	glass face plate, and Aluminum cradle. A sunshield shall be included
Window	3 mm thick glass that includes a Thermostatically controlled window Heater/defogger strip
Rated input voltage	115 VAC 60 Hertz
Voltage range	108 VAC to 132 VAC
Output voltage	24 VAC 60 Hertz
Nominal power	30 Watts
Enclosure protection	Waterproof and dust-tight in a NEMA-4, IP65, enclosure Type 3

6.0 SURGE PROTECTION

- 6.1 A video surge suppressor(s) shall be available for installation inside the traffic signal controller cabinet. The suppressor shall provide coaxial cable connection points to an EDCO CX06-BNCY (EDCO CX-06-M), or approved equal transient suppresser for each image sensor.

Peak Surge Current (8 x 20 us)	20KA
Technology	Hybrid, Solid State
Attenuation	0.1db @ 10Mhz
Response Time	<1 nanosecond
• Protection	Line to Ground
Shield to Ground	(isolated shield modules)
• Clamp Voltage	6 volts
• Connectors	BNC
• Impedance	75 Ohms
• Temperature	-40°C to +85°C
• Humidity	0-95% non-condensing
• Dimensions	4.5 inch by 1.5 inch by 1.25 inch
• UL Listed	UL 497B

7.0 IMAGE SENSOR- MOUNTING BRACKETS

- 7.1 Mast arm installations shall be mounted at a sufficient height to prevent occlusion from cross traffic between the stop bar and the mast arm on which the camera is installed. A 74 inch maximum length of internally reinforced, aluminum tube shall be attached to the mast arm bracket for camera mounting above the mast arm. Camera shall be mounted to the top of the tube with the camera manufacturers recommended bracket. Camera bracket shall provide adjustments for both vertical and horizontal positioning for the camera. Camera attachments shall be designed to securely fasten the camera to prevent the extension tube from falling into the path of vehicles and/or becoming loose. Mounting bracket must fasten to the Mast arm using a 64 inch or 82 inch aircraft cable. Miscellaneous hardware shall be stainless steel or galvanized steel. The cameras and associated pole/arm attachment unit shall be designed to withstand a wind load of 90 MPH with a 30-second gust factor.

- 7.2 Luminaire arm installations shall be installed on the luminaire arm, with the camera/video manufacturers recommended brackets. Camera luminaire brackets shall provide adjustments for both vertical and horizontal positioning of the camera. Camera attachments shall be designed to securely fasten the camera to the luminaire arm. Mounting bracket shall be made of aluminum. Miscellaneous hardware shall be stainless steel or galvanized steel. The cameras and associated pole/arm attachment unit shall be designed to withstand a wind load of 90 MPH with a 30-second gust factor.

8.0 IMAGE SENSOR- CABLE (COAXIAL & POWER)

- 8.1 Coaxial & Power cable (Siamese) shall be installed in conduits or overhead as indicated in the plans. Coaxial cable shall be suitable for exterior use and in direct sunlight. Power cable will have a minimum of five conductors.
- 8.2 A junction box on the camera bracket arm shall provide access to video and power cable terminations. No soldering shall be required in the field. Coaxial cable will terminate with a "barrel" style BNC connector and power shall be terminated via a small terminal strip or via "wire nuts."
- 8.3 Coaxial cable will be terminated in the surge suppressor before being connected to the VIP boards.
- 8.3 Power cable will be terminated into a fuse panel provided by the manufacturer and connected to 120 VAC in the controller cabinet.
- 8.4 Description of cable: Composite, 6 Conductors 2 elements: 18awg 5 conductors 7/26 bare copper, 0.016 inch polyethylene, 20awg 1 conductor, solid bare copper, 0.056 inch foam polyethylene jacket black, overall 0.030 inch PVC jacket black.

8.5

	ELEMENT 1	ELEMENT 2
CONDUCTORS/PAIR COUNT:	5 CONDUCTORS	1 CONDUCTOR
GAUGE & STRANDING:	18AWG 7/26 BC	20AWG SOLID BC
PRIMARY INSULATION TYPE:	POLYETHYLENE	FOAM PE
INSULATION THICKNESS:	0.016 inch	0.056 inch
COLOR CODE:	WHITE, RED, BLUE, BLACK, BROWN	NATURAL
SHIELD:	N/A	N/A
TAPE:	N/A	N/A
DRAIN WIRE:	N/A	N/A
BRAID:	N/A	95% BC
CAPACITANCE:	N/A	N/A
PRINT LEGEND:	N/A	N/A
JACKET TYPE:	N/A	POLYETHYLENE
JACKET COLOR:	N/A	BLACK
JACKET THICKNESS:	N/A	0.035 inch
NOMINAL OD:	N/A	0.242 inch

8.6 **OVERALL ASSEMBLY OF WIRE**

JACKET THICKNESS:	0.030 inch
JACKET COLOR:	BLACK
JACKET MATERIAL:	PVC
RIPCORD:	YES
NOMINAL OD:	0.512 inch
VOLTAGE RATING:	600V
TEMP. RATING:	75C
UL TYPE OR STYLE:	N/A
PRINT LEGEND:	TBD
PACKAGING:	TBA
COPPER WEIGHT:	39.87 LBS/MFT
SHIPPING WEIGHT:	100 LBS/MFT

9.0 INSTALLATION

- 9.1 A factory certified representative from the product supplier of the video detection equipment shall be on-site during the final set up of the video detection system to supervise the final installation and final testing of the video equipment.

10.0 WARRANTY

- 10.1 The video detection system shall be warranted against manufacturing defects in materials and workmanship for a period of one year from the date of installation. The video detection supplier shall provide operational documentation for the VIP system.

