



P3010
Los Angeles LRV

CCTV



Section 1900 RUNNING MAINTENANCE & SERVICING MANUAL

LIST OF EFFECTIVE PAGES

Insert latest changed pages; dispose of superseded pages in accordance with applicable regulations.

NOTE: On a changed page, the portion of the text affected by the latest change is indicated by a vertical line.

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Revision.....	1	April 2021
Revision.....	2	October 2021
Revision.....	3	April 2022
Revision.....	4	October 2022

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SAFETY SUMMARY

Some of the procedures in this section are preceded by warnings/cautions regarding potential hazards in handling this equipment. These warnings/cautions should be carefully read and understood before proceeding. Failure to observe these precautions may result in serious injury to personnel performing the work and/or bystanders. The key warnings for this equipment are as follows:

Electrical - The electrical equipment described in this section operates at voltages and currents that are extremely dangerous to life. Personnel should closely observe all generally prescribed cautions and warnings before performing any work on the LRV.

Chemicals – Follow safety precautions for handling hazardous chemicals as provided by the manufacturer. The manufacturer's warnings should be closely heeded to avoid personal injury.

Location – Special caution should be taken when accessing or servicing equipment located on the roof and under the car.

Weight – To prevent possible personal injury when attempting to remove or install equipment on the vehicle, adequate support of a lifting device must be used to prevent the equipment from falling. Personnel's failure to heed these warnings could result in severe injury or death and or damage to the equipment.

Contact – Some components in this equipment attain temperatures that can cause severe burns. Closely follow all warnings and recommended procedures for handling these components.

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CHAPTER 1.0

GENERAL DESCRIPTION

1.1 Introduction

The information contained in this section includes scheduled maintenance tasks, scheduled maintenance, lubrication and component removal and installation information for the following CCTV equipment:

- Interior View Camera
- Forward View Camera
- Cab Camera
- Roof Mounted Camera
- Rear View Camera
- Rear View Monitor
- Train Operator Display (TOD)
- PoE Switch
- Network Video Recorder (NVR)

1.2 List of Acronyms

<u>Acronym</u>	<u>Definition</u>
CCTV	Closed Circuit Television
cm	Centimeter
ESNA	Elastic Stop Nut Division
ft-lbs.	Foot Pounds
GPIO	General Purpose Input and Output
in-lbs.	Inch Pounds
kg	Kilogram
LACMTA	Los Angeles County Metropolitan Transportation Authority
LED	Light Emitting Diode
LRV	Light Rail Vehicle
MDS	Monitoring Diagnostic System
MVB	Multi-Function Vehicle Bus
Nm	Newton Meter
NVR	Network Video Recorder

<u>Acronym</u>	<u>Definition</u>
PoE	Power over Ethernet
PTU	Portable Test Unit
RMSM	Running Maintenance and Servicing Manual
RTSP	Real Time Streaming Protocol
TCN	Train Control Network
TOD	Train Operator Display
WWAS	Wayside Worker Alert System

CHAPTER 2.0

FUNCTIONAL DESCRIPTION

2.1 Introduction

This chapter provides a functional description of the CCTV equipment.

2.1.1 General Overview

The CCTV systems leverages Power over Ethernet (PoE) cameras connected through a dedicated logical network to provide video to the Network Video Recorder (NVR).

In addition to the video provided to the NVR, video is also provided to the TODs of the operating cab across the CCTV Ethernet network and shown on the rear-view monitors of the active cab. These displays have the ability to show the rear-view camera view from the rear view of the leading car as well as the rear-view camera view from the trailing cars.

All of the interface between cameras, the NVR, the rear-view displays and the vehicle network are represented in the block diagram below.

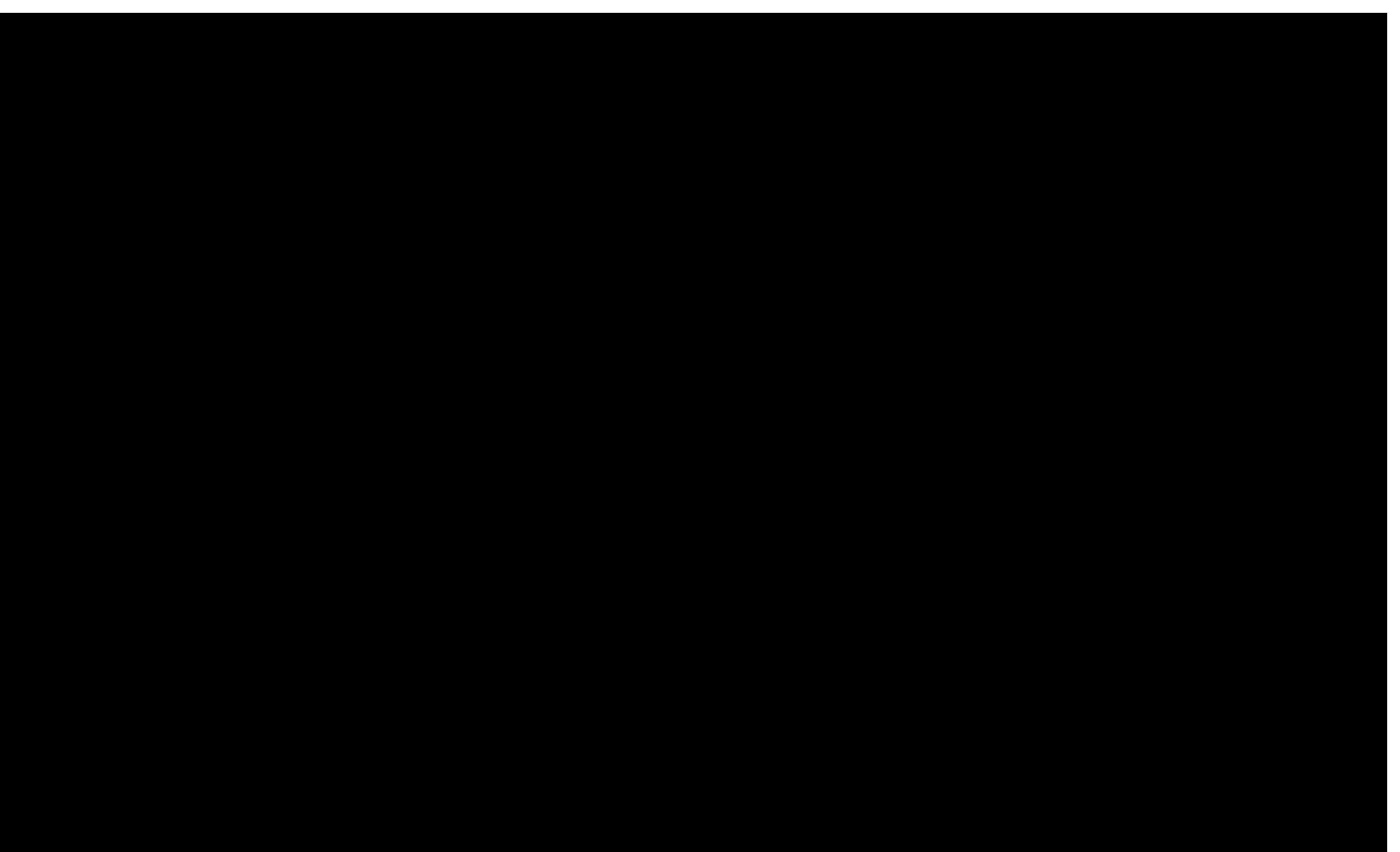
2.1.2 Operational Description

IP cameras capture video and digitize the image. The camera then transmits the digital stream via the RTSP protocol. This video stream is sent to the NVR via the Ethernet network. The cameras and the NVR are directly connected to PoE switches that are connected in a ring topology to facilitate the transmission of video data across the Ethernet network. Once the stream reaches the NVR the video stream is watermarked, encrypted and then stored on the video storage drives of the NVR. Video is stored on the drives in the encrypted file format until the storage drives are full. Once the drives are full video is overwritten in a first in-first out queue.

The passenger compartment cameras and the cab view camera are equipped with microphones that record audio associated with those camera locations. The audio is streamed with the camera video to the NVR for storage. This function is configured on camera enrollment / setup.

The NVR (Digital Video Recorder) is designed for a graceful shut down. This is to ensure that video is captured / transferred completely and that essential software files are *not* corrupted. The Digital Video Recorder system circuit breaker (B-Cab) is a protective device and **NOT** an On/Off switch. The vehicle should be keyed off using the master controller key / local off switch to power down the NVR. **Failure to follow this process may result in lost video and or corrupted /inoperative software files!**

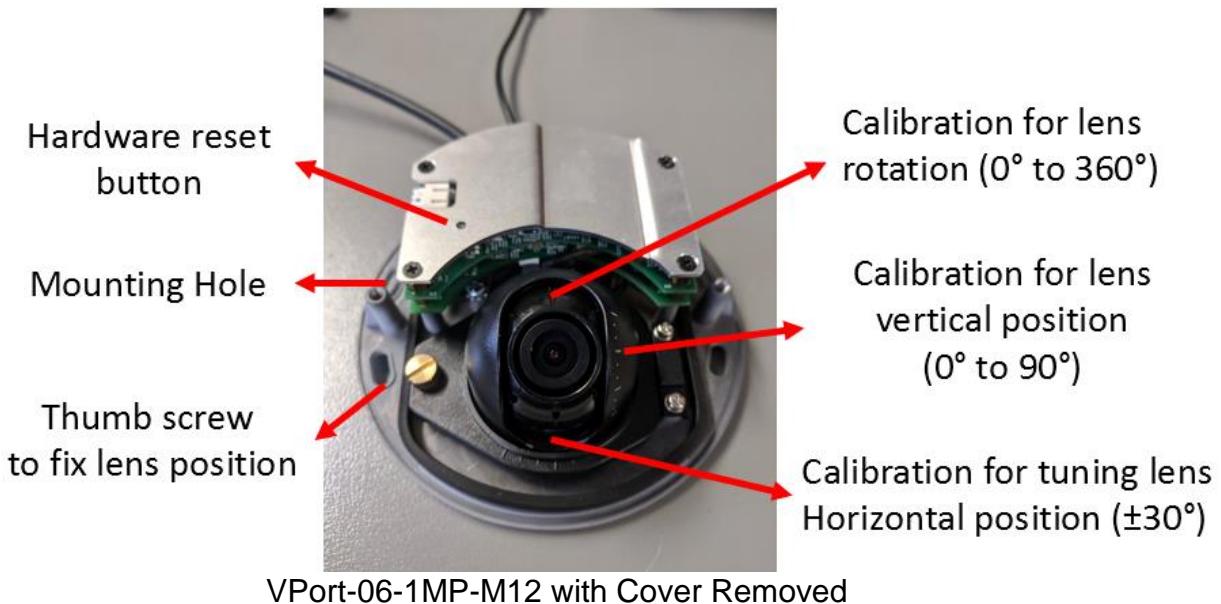
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2.2 Equipment Locations

2.2.1 Interior View Camera

There are four Interior View Cameras per car. See Figures 2-1 and 7-3. Two are located each in the A and B-Unit mounted on the side access covers. The interior view cameras provide security for the passengers. They are equipped with microphones and a Power indication LED.



VPort-P06-1MP-M12 with Cover On (interior VPort with LED and Mic)

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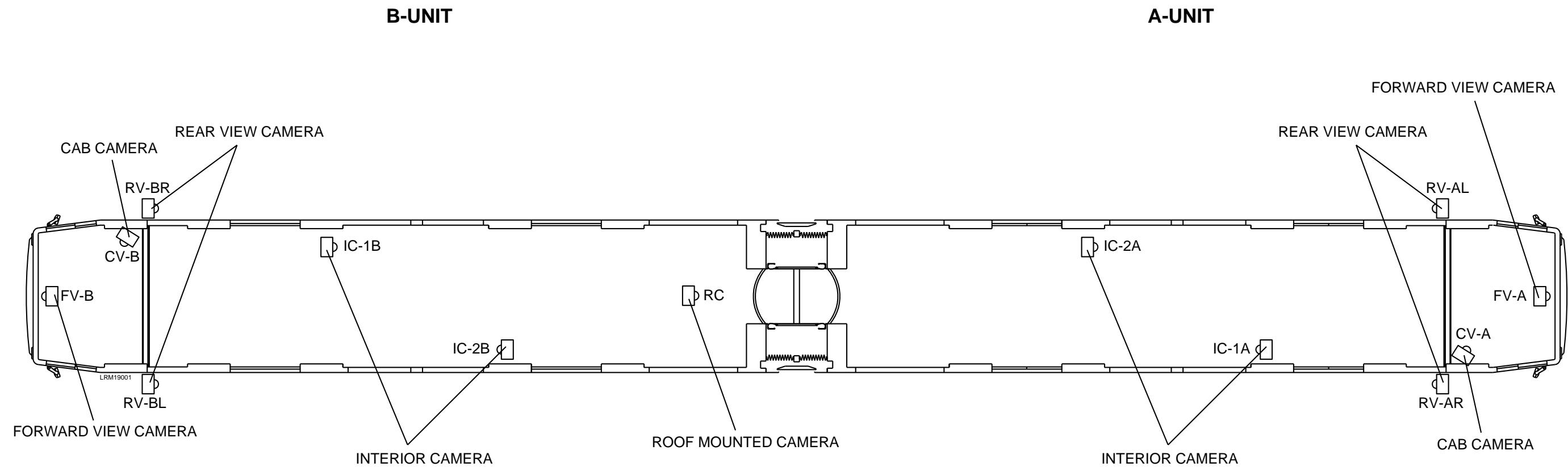


Figure 2-1: CCTV Camera Layout

2.2.2 Forward View Camera

There is one Forward View Camera located below the Destination Sign in each A and B-Unit cab. See Figures 2-1 and 7-4. The forward view cameras provide video footage from the Operator's point of view.

The camera is physically the same as the Interior View Camera without LED and Microphone.

2.2.3 Cab Camera

There is one Cab Camera located in the right side of the cab ceiling in each A and B-Unit. See Figures 2-1 and 7-5. The cab cameras provide security for the Operator.



Cab Camera with Cover On



Cab Camera with Cover Removed

2.2.4 Roof Mounted Camera

There is one Roof Mounted Camera located on the B-Unit roof. See Figures 2-1 and 7-6. The roof mounted camera provides footage of proper pantograph contact with the overhead catenary.

NOTE: Not all vehicles have a roof mounted camera, however ALL vehicles are wired to accept a roof mounted camera. The NVR must include a license for the 13th camera. The NVR is labeled if it has the license for the roof camera. Metro must track location of NVRs with this additional license.

This camera is physically the same as the Interior View Camera.

2.2.5 Rear View Camera

There are four Rear View Cameras, two mounted on the A-Unit and two on the B-Unit. See Figures 2-1 and 7-7. The rear-view cameras are located on both the right and left sides of each cab. These cameras enable the Operator to supervise the loading and unloading at all doorways of the vehicle when the vehicle doors are open and verify that the last door on the train is clear of passengers with the rear-view monitors that are located on the front pillars in each A and B-Unit.

2.2.6 Rear View Monitors

There are two Rear View Monitors located on the front pillars in each A and B-Unit cab. See Figures 2-2, 2-3 and 7-8. The rear-view monitors show the video from the rear-view cameras.

2.2.7 Train Operator Display (TOD)

There are two Train Operator Displays (TOD) located in each Cab Console Panels 1 and 4. See Figures 2-4 and 7-9. The Train Operator Displays are used to select which side cameras in a consist are and to see if any cameras have errors or are connected to the Network Video Recorder.

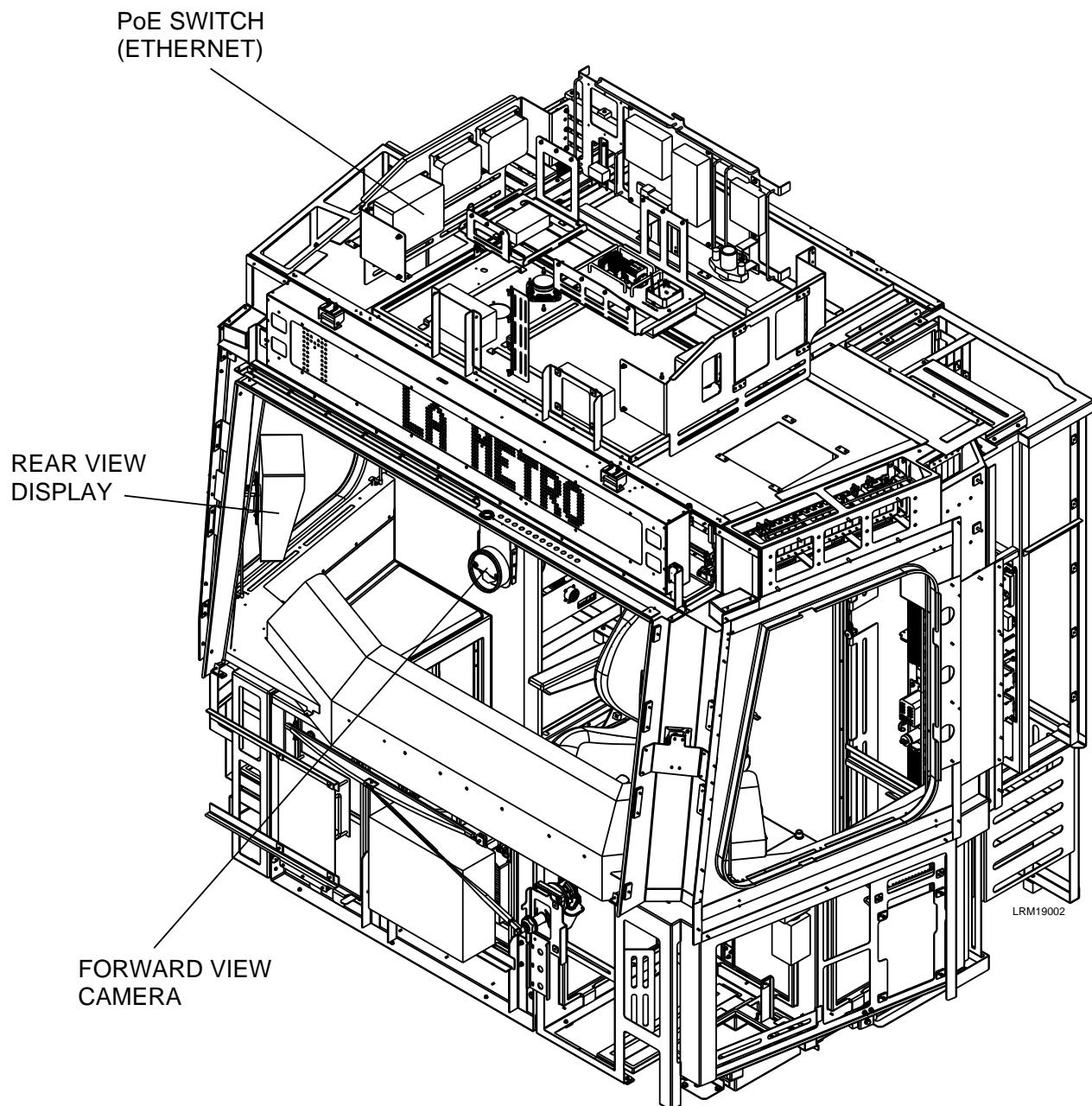


Figure 2-2: CCTV Equipment



Figure 2-3: CCTV Cab Equipment

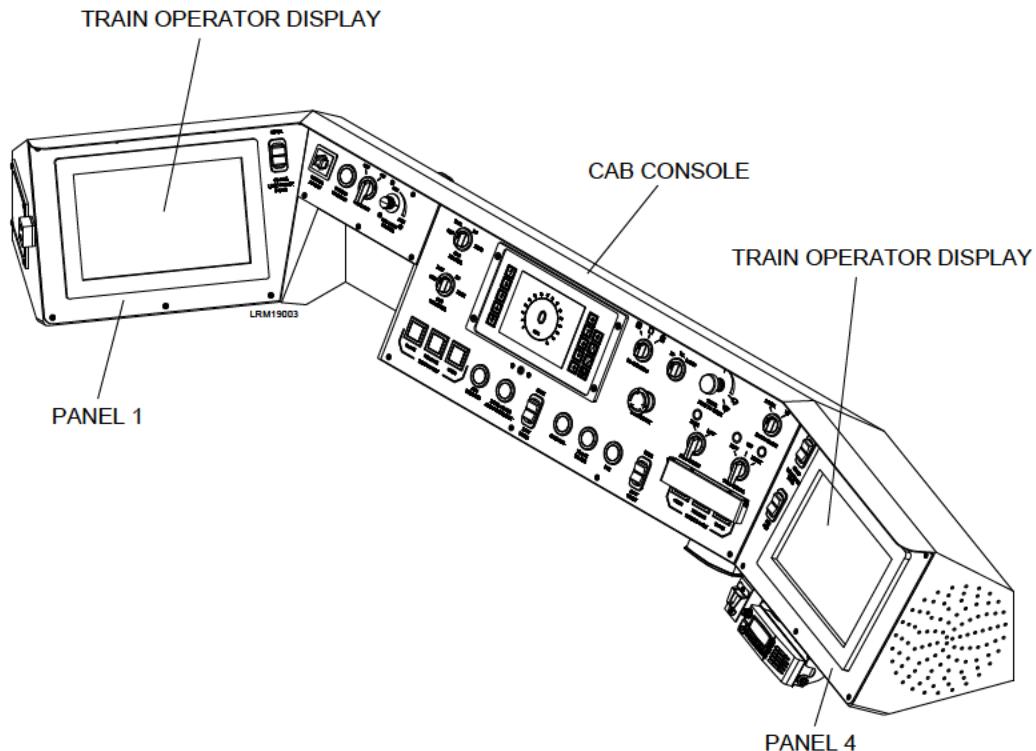


Figure 2-4: Train Operator Display (TOD)

2.2.8 PoE Switch

There is one PoE Switch (ethernet) located in the cab ceiling in each A and B-Unit. See Figures 2-2 and 7-10. The PoE Switch connects the cameras to the Network Video Recorder and powers the cameras. Troubleshooting of this switch is covered in Section 2.7.3.4 of Running Maintenance and Servicing Manual, Section 1700, Data Communications (TCN).



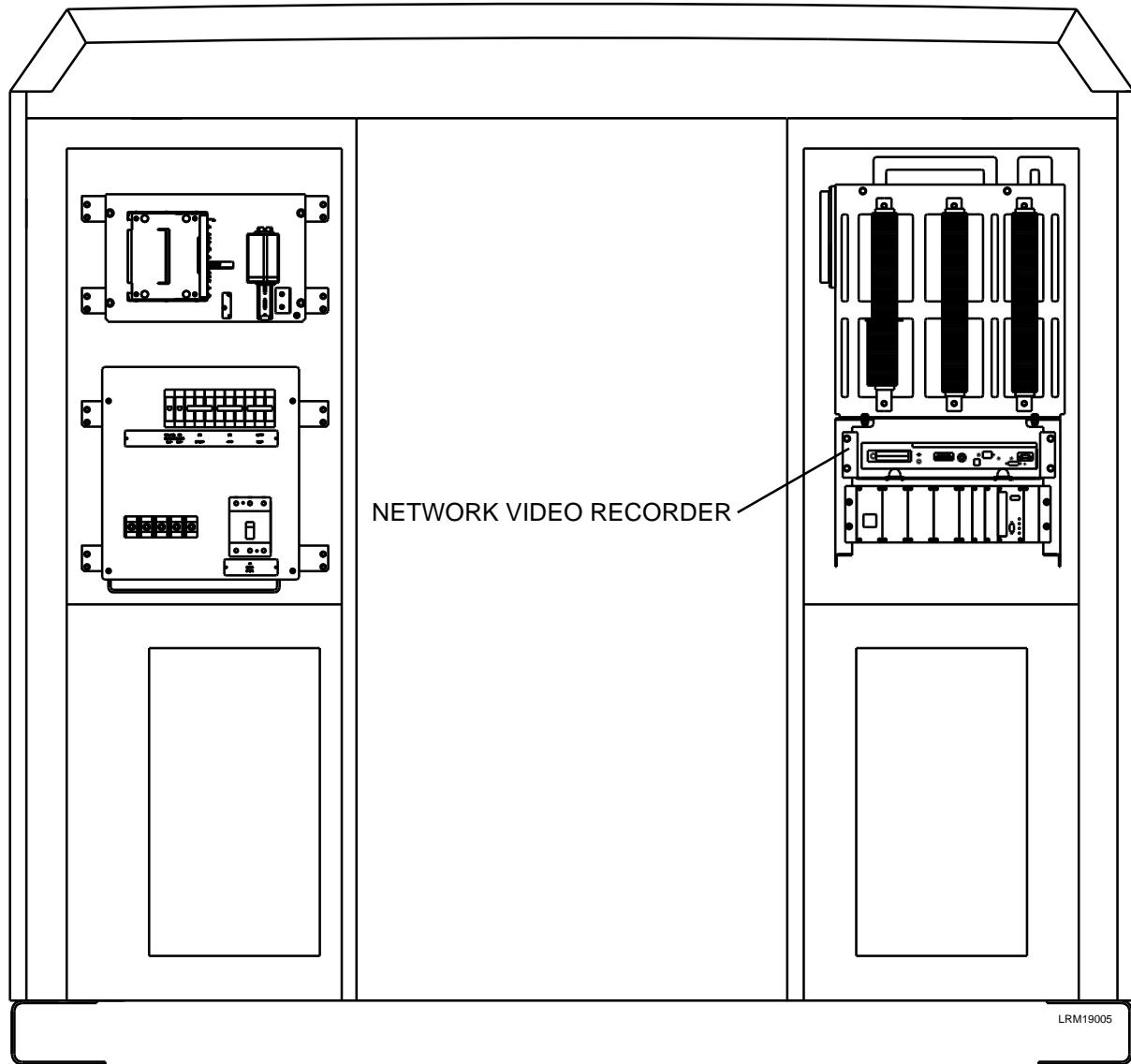
PoE Switch Front View

2.2.9 Network Video Recorder (NVR)

There is one Network Video Recorder (NVR) located in the B-Unit electric locker. See Figures 2-5 and 7-11. The Network Video Recorder receives streamed audio and video from all of the cameras on the car and stores it on the storage drives in a RAID 0 configuration.



NVR Front View



DETAIL A

Figure 2-5: Network Video Recorder (NVR)
(Sheet 2 of 2)

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CHAPTER 3.0

SPECIAL TOOLS AND MATERIALS

3.1 Introduction

No special tools are required. However, this section of the Running Maintenance and Servicing Manual includes the possibility of removing and installing hardware that interfaces with the LRV.

M12 Torque Driver

The Ethernet network uses M12 Connectors for Ethernet connections. Connectivity issues and faults in the Ethernet network can occur with improperly seated connectors. Therefore, the use of a M12 torque screwdriver and a M12 torque bit is recommended.

The following are the part numbers for the tool below. Other equivalent drivers are available.

- M12 Torque Screwdriver: TSD 08 SAC – 1212597 (Figure 3-1)
- M12 Torque Bit: SACC BIT M12-D20 – 1208445 (Figure 3-2)



Figure 3-1: M12 Torque Screwdriver



Figure 3-2: M12 Torque Bit

Patch Cable

If necessary, to connect a PTU to the network systems an RJ-45 to M12 PTU cable is required. This patch cable is included with the PTUs supplied to Metro.

Thermal Paste

Thermal paste is used when opening the NVR or TOD case, as in a battery replacement. Thermal paste (ArticSilver AS5 or equivalent) should be used.

CHAPTER 4.0

SCHEDULED MAINTENANCE TASKS

4.1 Introduction

This chapter provides scheduled maintenance tasks in the form of a quick reference table. A thorough visual inspection should be performed before proceeding. Obvious malfunctions from damage observed during the visual inspection are to be corrected.

4.2 Scheduled Maintenance Index

Table 4-1 is a scheduled maintenance index, which lists maintenance intervals and each maintenance task for the CCTV equipment. The reference column indicates the section of this manual section that details these maintenance procedures.

Table 4-1. Scheduled Maintenance Index

Maintenance Interval	Part Description	Scheduled Maintenance Task	Section 1900 CCTV Running Maintenance & Servicing Manual Section Reference
10,000 Miles	Interior View Camera	Visually inspect the lens for cracks and scratches	5.3.1.1
10,000 Miles	Forward View Camera	Visually inspect for loose components. Clean lens of camera	5.3.2
10,000 Miles	Cab Camera	Visually inspect for loose components. Clean lens of camera	5.3.3
10,000 Miles	Rear View Camera	Visually inspect for damage and dirt	5.3.4
10,000 Miles	Rear View Monitor	Visually inspect for loose components. Clean screen of displays	5.3.5
10,000 Miles	PoE Switch	Visually inspect for loose components and secure panel mounting hardware	5.3.7
10,000 Miles or as required	Roof Camera	Visually inspect for loose components. Clean lens of camera	5.3.9
30,000 Miles	Interior View Camera	Clean the lens	5.3.1.2
30,000 Miles	Train Operator Display (TOD)	Visually inspect for loose components and scratches	5.3.6 5.4.1
		Calibrate TOD touch screen	
		Run TOD functional tests	
60,000 Miles	Network Video Recorder (NVR)	Visually inspect for loose components and secure mounting hardware	5.3.8
120,000 Miles	Train Operator Display (TOD)	Visually inspect for loose wiring or connectors	5.4.2
		Clean screen of displays	
		Ensure there are no obstructions blocking ventilation	
480,000 Miles	NVR Hard Drives	Replace the hard drive	8.2.10
840,000 Miles	Train Operator Display (TOD)	Replace the battery for Real Time Clock	5.4.3

CHAPTER 5.0

SCHEDULED MAINTENANCE

5.1 Introduction

This chapter provides inspection and adjustment procedures for the CCTV equipment.

5.2 Safety Information

WARNING

BEFORE INSPECTING ANY ELECTRICAL EQUIPMENT IN AN ELECTRICAL SYSTEM, MAKE SURE THAT THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THERE IS NO VOLTAGE PRESENT WHERE WORK IS PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.

WARNING

CLEANING MATERIALS CAN BE TOXIC AND DANGEROUS TO HANDLE. READ THE HANDLING INSTRUCTIONS BEFORE USING AND FOLLOW THE MANUFACTURER'S RECOMMENDATIONS.

WARNING

ALL AIR SUPPLY AND/OR ELECTRIC CURRENT TO THESE DEVICES AND/OR ANY COMPONENT PARTS MUST BE CUT-OFF BEFORE THESE DEVICES AND/OR COMPONENT PART ARE REMOVED FROM THE EQUIPMENT ARRANGEMENT.

WARNING

TO PREVENT RECEIVING ELECTRICAL SHOCK WHEN PERFORMING ELECTRICAL TEST, HANDS MUST BE CLEAR OF ELECTRICAL COMPONENTS, CONTACTS AND HOUSING AND THERE MUST BE NO BODILY CONTACT WITH THE WORK BENCH. FAILURE TO HEED THIS WARNING COULD RESULT IN SEVERE INJURY OR DEATH.

WARNING

SHUT OFF POWER TO THE CAR BEFORE ATTEMPTING TO SERVICE ANY ROOF MOUNTED EQUIPMENT.

WARNING

MUCH OF THE EQUIPMENT ON THESE CARS OPERATES AT VOLTAGE AND CURRENT LEVELS THAT ARE HAZARDOUS AND LIFE THREATENING. PROPER PRECAUTIONS SHOULD BE TAKEN AND METRO SAFETY RULES, PRACTICES AND PROCEDURES CLOSELY OBSERVED.

WARNING

INSULATED GLOVES MUST BE WORN AND EXTREME CARE TAKEN TO PREVENT BURNS WHEN HANDLING HEATED PARTS.

5.3 Maintenance Procedures**5.3.1 Interior View Camera****5.3.1.1 10,000 Mile Maintenance Interval**

Visually inspect the lens for cracks or scratches. See Figure 2-1.

5.3.1.2 30,000 Mile Maintenance Interval

Clean the lens.

5.3.2 Forward View Camera**WARNING**

BEFORE INSPECTING ANY ELECTRICAL EQUIPMENT IN AN ELECTRICAL SYSTEM, MAKE SURE THAT THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THERE IS NO VOLTAGE PRESENT WHERE WORK IS PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.

Visually inspect the Forward View Cameras for loose components and clean the lens every 10,000 miles. See Figure 2-1.

5.3.3 Cab Camera

Visually inspect the Cab Cameras for loose components and clean the lens every 10,000 miles. See Figure 2-1.

5.3.4 Rear View Camera

Visually inspect the Rear-View Cameras for damage and dirt every 10,000 miles. See Figure 2-1.

5.3.5 Rear View Monitor

WARNING

DO NOT SPRAY CLEANER OR WATER DIRECTLY ON THE SCREEN.

Visually inspect the Rear-View Monitors for loose components and clean screen by spraying the cleaner or water on a soft cloth and then wipe the screens clean every 10,000 miles. See Figures 2-2 and 2-3.

5.3.6 Train Operator Display (TOD)

Visually inspect the Train Operator Displays for loose components and scratches every 30,000 miles. See Figure 2-4.

5.3.7 PoE Switch

WARNING

BEFORE INSPECTING ANY ELECTRICAL EQUIPMENT IN AN ELECTRICAL SYSTEM, MAKE SURE THAT THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THERE IS NO VOLTAGE PRESENT WHERE WORK IS PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.

Visually inspect the PoE Switches for loose components and secure panel mounting hardware every 10,000 miles. See Figure 2-2.

5.3.8 Network Video Recorder (NVR)

Visually inspect the Network Video Recorder (NVR) for loose components and secure mounting hardware every 60,000 miles. See Figure 2-5.

5.3.9 Roof Mounted Camera (if mounted)

Visually inspect for loose components and clean lens every 10,000 miles and when roof inspections are performed. The roof is a very dirty environment and lens cleaning may be required more frequently.

5.4 Train Operator Display Maintenance Procedures

5.4.1 30,000 Mile Maintenance Interval

The following should be performed every 30,000 miles:

1. Visually inspect for loose components and scratches.
2. Calibrate the TOD touch screen. This can be done from the Settings screen which is under the Maintenance screen.
3. Run the following TOD functional tests.

User Interface Test

- a. With the TOD in an active cab, touch the tabs listed below to ensure that the TOD is operating.
 - o Fault Screen
 - o CCH Screen
- b. Touch the network status tab on the Operating Screen

From the Network status screen, run the MVB Bus Test and the Ethernet test and confirm that all devices are connected.

System Error Validation

- a. Turn off the high-speed circuit breaker control breaker in the active cab of the vehicle.
- b. Go to the fault screen on each of the TODs on the vehicle and confirm that the fault (HB28_F “HSCB Power source abnormality”) is being displayed.
- c. Turn the high speed circuit breaker control break in the active cab back on.
- d. Go to the fault screen on each of the TODs on the vehicle and confirm that the fault is no longer being displayed.

5.4.2 120,000 Mile Maintenance Interval

The following should be performed every 120,000 miles:

1. Visually inspect for loose wiring or connectors. See Figure 5-1.

WARNING

DO NOT SPRAY CLEANER OR WATER DIRECTLY ON THE SCREEN.

2. Spray the cleaner or water on a soft cloth and then wipe the screens clean. See Figure 2-4.
3. Ensure there are no obstructions blocking ventilation. See Figure 5-1.

5.4.3 840,000 Mile Maintenance Interval

The following should be performed every 840,000 miles:

1. Replace the battery for the Real Time Clock (PN: BR2032).
 - a. Remove the seven #8-32 flat head screws (#1, Figure 7-9) securing the panel to the cab console.
 - b. Carefully remove the panel and disconnect the Ethernet electrical connectors from LAN1 and LAN2, power connector, GPIO connector, COM1 RS-485 connector, and the VGA OUT connector. See Figure 5-1.
 - c. Remove the screws (10) that secure the heat sink to the TOD.
 - d. Lift away the heat sink and remove the thermal paste. See Figure 5-2.
 - e. Remove the battery. See Figure 5-3.
 - f. Install a new BR2032 battery.
 - g. Replace the thermal paste (ArticSilver AS5 or equivalent) and reposition the heat sink.
 - h. Reinstall the screws (10) that secure the heat sink to the TOD.
 - i. Reconnect the Ethernet electrical connectors, power connector, GPIO connector, COM1 connector, and VGA OUT connector. See Figure 5-1.
 - j. Align the panel with the holes in the console and install the seven #8-32 flat head screws (#1, Figure 7-9) and tighten.



Figure 5-1: Rear View of TOD



Figure 5-2: Heat Sink Removed

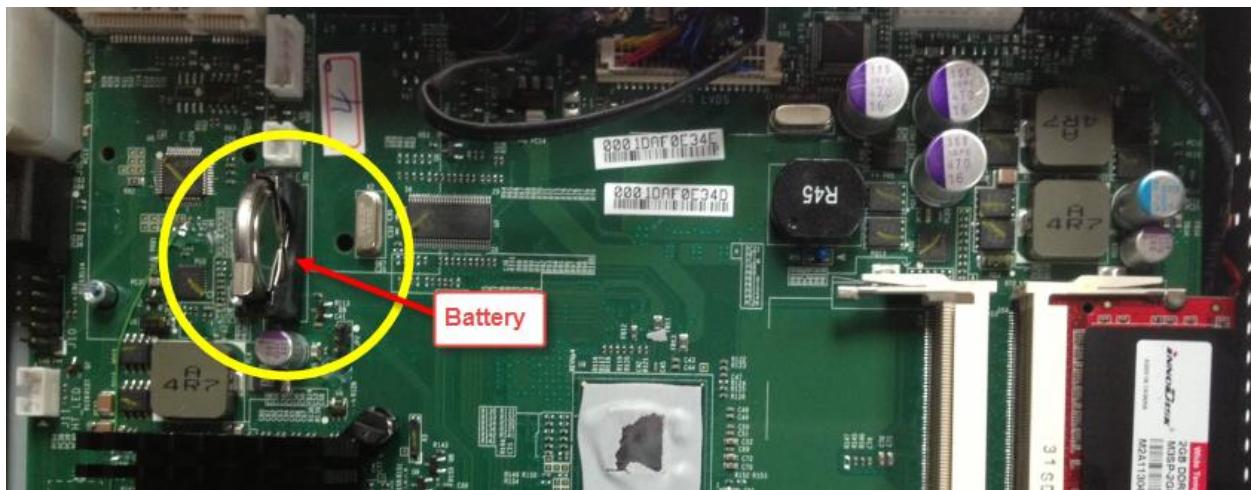


Figure 5-3: Battery Location

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CHAPTER 6.0

LUBRICATION

6.1 Introduction

This section requires no lubrication on the CCTV or TOD equipment.

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CHAPTER 7.0

COMPONENT REMOVAL AND INSTALLATION

7.1 Introduction

This chapter provides general guidelines on component removal and installation of the CCTV equipment.

7.2 Safety Precautions

The following statements of warning and caution apply to the handling of the CCTV equipment and appear as appropriate throughout this manual.

CAUTION

THE NVR (DIGITAL VIDEO RECORDER) IS DESIGNED FOR A GRACEFUL SHUT DOWN. THIS IS TO ENSURE THAT VIDEO IS CAPTURED / TRANSFERRED COMPLETELY AND THAT ESSENTIAL SOFTWARE FILES ARE NOT CORRUPTED. THE DIGITAL VIDEO RECORDER SYSTEM CIRCUIT BREAKER (B-CAB) IS A PROTECTIVE DEVICE AND **NOT** AN ON/OFF SWITCH. THE VEHICLE SHOULD BE KEYED OFF USING THE MASTER CONTROLLER KEY / LOCAL OFF SWITCH TO POWER DOWN THE NVR. **FAILURE TO FOLLOW THIS PROCESS MAY RESULT IN LOST VIDEO AND OR CORRUPTED /INOPERATIVE SOFTWARE FILES!**

WARNING

BEFORE INSPECTING ANY ELECTRICAL EQUIPMENT IN AN ELECTRICAL SYSTEM, MAKE SURE THAT THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THERE IS NO VOLTAGE PRESENT WHERE WORK IS PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.

WARNING

TO PREVENT RECEIVING ELECTRICAL SHOCK WHEN PERFORMING ELECTRICAL TEST, HANDS MUST BE CLEAR OF ELECTRICAL COMPONENTS, CONTACTS AND HOUSING AND THERE MUST BE NO BODILY CONTACT WITH THE WORK BENCH. FAILURE TO HEED THIS WARNING COULD RESULT IN SEVERE INJURY OR DEATH.

WARNING

WHEN REMOVING DAMAGED GLASS, WEAR LEATHER GLOVES AND SAFETY GLASSES TO PREVENT SKIN AND EYE INJURY.

CAUTION

WEAR SAFETY SHOES AND HARD HATS WHEN WORKING WHERE OBJECTS MIGHT FALL.

WARNING

ALL AIR SUPPLY AND/OR ELECTRIC CURRENT TO THESE DEVICES AND/OR ANY COMPONENT PARTS MUST BE CUT-OFF BEFORE THESE DEVICES AND/OR COMPONENT PART ARE REMOVED FROM THE EQUIPMENT ARRANGEMENT.

WARNING

MUCH OF THE EQUIPMENT ON THESE CARS OPERATES AT VOLTAGE AND CURRENT LEVELS THAT ARE HAZARDOUS AND LIFE THREATENING. PROPER PRECAUTIONS SHOULD BE TAKEN AND METRO SAFETY RULES, PRACTICES AND PROCEDURES CLOSELY OBSERVED.

WARNING

INSULATED GLOVES MUST BE WORN AND EXTREME CARE TAKEN TO PREVENT BURNS WHEN HANDLING HEATED PARTS.

7.3 Removal and Installation Standard Shop Practices

The following paragraphs provide general mounting hardware and torqueing practices applicable to all installation and removal work of the Car Body and Articulation equipment.

7.3.1 Mounting Hardware

All fastening bolts on the LACMTA P3010 LRV are Grade 5, or higher. When removing any component from the vehicle, replacement fasteners MUST BE Grade 5 or better. See Figures 7-1 and 7-2.

7.3.2 Torquing Practices and Procedures

All safety related fasteners, including truck and brake equipment bolts and all fasteners exposed to fatigue loads must be torqued to a minimum preload equal to 75% of their proof load and torqued striped after torqueing by paint or equally approved means. All other fasteners must be torqued so that they do not loosen in service.

7.3.3 Torquing Methods

1. Select the correct wrench and avoid using wrenches that are oversized or undersized for the torque required.
2. Pull the wrench - Pulling is no more accurate than pushing, however, when a part fails unexpectedly, finger and knuckle injuries are prevented.

Grade Marking	Specification	Material
	SAE-Grade 1	Low or Medium Carbon Steel
	ASTM-A 307	Low Carbon Steel
	SAE-Grade 2	Low or Medium Carbon Steel
	SAE-Grade 5	Medium Carbon Steel, Quenched and Tempered
	ASTM-A 449	
	SAE-Grade 5.2	Low Carbon Martensite Steel, Quenched and Tempered
	ASTM-A 325 Type 1	Medium Carbon Steel, Quenched and Tempered
	ASTM-A 325 Type 2	Low Carbon Martensite Steel, Quenched and Tempered
	ASTM-A 325 Type 3	Atmospheric Corrosion (Weathering) Steel Quenched and Tempered
	ASTM-A 354 Grade BB	Low Alloy Steel, Quenched and Tempered
	ASTM-A 354 Grade BC	Low Alloy Steel, Quenched and Tempered
	SAE-Grade 7	Medium Carbon Alloy Steel, Quenched and Tempered Roll Threaded After Heat Treatment
	SAE-Grade 8	Medium Carbon Alloy Steel, Quenched and Tempered
	ASTM-A 354 Grade BD	Alloy Steel, Quenched and Tempered
	ASTM-A 490	Alloy Steel, Quenched and Tempered

Figure 7-1: Standard Grade Marking Chart

Property Class Marking	Property Class Designation	Material
	4.6	Low or Medium Carbon Steel
	4.8	Low or Medium Carbon Steel, Fully or Partially Annealed
	5.8	Low or Medium Carbon Steel, Cold Worked
	8.8	Medium Carbon Steel, Quenched and Tempered
	A325M Type 1	
	8.8	Low Carbon Boron Steel, Quenched and Tempered
	A325M Type 2	
	A325M Type 3	Atmospheric Corrosion Resistant Steel, Quenched and Tempered
	9.8	Medium Carbon Steel, Quenched and Tempered
	9.8	Low Carbon Boron Steel, Quenched and Tempered
	10.9	Medium Carbon Alloy Steel, Quenched and Tempered
	A490M Type 1	

Figure 7-2: Metric Grade Marking Chart
(Sheet 1 of 2)

Property Class Marking	Property Class Designation	Material
	10.9	Low Carbon Boron Steel, Quenched and Tempered
	A490M Type 2	
	A490M Type 3	Atmospheric Corrosion Resistant Steel, Quenched and Tempered
	12.9	Alloy Steel Quenched and Tempered

Figure 7-2: Metric Grade Marking Chart
(Sheet 2 of 2)

3. Add the run-down resistance - Tight threads and locknuts produce added resistance to the desired torque. Read the scale on the last rotation or as close to the make-up point as possible, then add the ft-lbs. (or in-lbs.) of resistance to the desired torque to obtain the value required.
4. Don't stop at set or seizure - When a fastener pops it has seized. Accurate torque settings are not possible before the point of last rotation. To break a set, back off and again apply torque. Lightly lubricate the thread and seat when conditions allow.

7.3.4 General Guide for Maximum Torque Values

When manufacturer's specifications are not available, Tables 7-1 and 7-2 may be used as a guide to the maximum allowed torque for a given fastener and thread (standard or metric).

Table 7-1: Standard Fastener Torques for LACMTA P3010 LRV

Diameter / Pitch	Force / Torque	Stainless Steel Group 1, 2, 3 Condition CW		Steel Fastener			
				Grade 5		Grade 8	
		A	B	A	B	A	B
1/4 - 20	ft-lbs.	6	5	8	6	12	9
	Nm	8	6	11	8	16	12
	kg cm	80	60	110	80	165	120
5/16 - 18	ft-lbs.	13	10	17	13	25	18
	Nm	18	14	23	18	34	24
	kg cm	180	140	230	180	350	250
3/8 - 16	ft-lbs.	24	18	31	23	44	33
	Nm	33	24	42	31	60	45
	kg cm	330	250	430	320	610	460
7/16 - 14	ft-lbs.	38	28	49	37	70	53
	Nm	52	38	67	50	95	72
	kg cm	530	390	680	510	970	730
1/2 - 13	ft-lbs.	58	43	76	57	105	80
	Nm	78	58	103	77	142	108
	kg cm	800	590	1050	790	1450	1100
5/8 - 11	ft-lbs.	115	85	150	125	210	160
	Nm	155	115	205	170	285	215
	kg cm	1590	1190	2070	1730	2900	2200
3/4 - 10	ft-lbs.	140	105	265	200	370	280
	Nm	190	145	360	270	500	380
	kg cm	1940	1500	3660	2770	5120	3870
7/8 - 9	ft-lbs.	225	170	430	320	600	450
	Nm	305	230	585	435	815	610
	kg cm	3110	2350	5940	4430	8300	6220
1 - 8	ft-lbs.	340	255	640	480	910	580
	Nm	460	345	870	650	1230	925
	kg cm	4700	3530	8850	6640	12500	9400

NOTE A: DO NOT USE LUBRICANT FOR FASTENERS – DRY

NOTE B: TO BE OILED OR WAXED ON THREADS OF FASTENERS - LUBRICATED

Table 7-2: Standard Metric Torques for LACMTA P3010 LRV

Nominal diameter	Grade 4.6 (4T)		Grade 4.8		Grade 5.6 (5T)	
	Dry	Oil	Dry	Oil	Dry	Oil
	N*m(kgf cm)	N*m(kgf cm)	N*m(kgf cm)	N*m(kgf cm)	N*m(kgf cm)	N*m(kgf cm)
M5	2.5 (25)	2.1 (21)	3.3 (34)	2.8 (29)	3 (31)	2.5 (26)
M6	3.9 (40)	3.5 (35)	5.6 (57)	4.8 (49)	5.1 (52)	4.3 (44)
M8	9.8 (100)	8.5 (85)	14 (140)	12 (120)	12 (130)	10 (110)
M10	22 (220)	17 (170)	27 (270)	23 (230)	25 (250)	21 (210)
M12	37 (380)	30 (300)	47 (480)	40 (410)	43 (440)	36 (370)
M14	60 (620)	46 (470)	75 (760)	65 (650)	68 (690)	58 (590)
M16	95 (1000)	72 (730)	120 (1200)	100 (1000)	110 (1100)	90 (920)
M18	120 (1300)	100 (1000)	160 (1650)	135 (1400)	150 (1500)	130 (1300)
M20	170 (1800)	140 (1400)	230 (2300)	195 (2000)	210 (2100)	180 (1800)
M22	240 (2500)	190 (1950)	310 (3160)	265 (2700)	280 (2900)	240 (2400)
M24	300 (3100)	245 (2500)	400 (4000)	335 (3400)	360 (3600)	300 (3100)
M27	460 (4700)	355 (3600)	580 (5900)	490 (5000)	520 (5300)	440 (4500)
M30	630 (6500)	485 (4900)	780 (8000)	660 (6800)	710 (7200)	600 (6100)

Table 7-2: Standard Metric Torques for LACMTA P3010 LRV (continued)

Nominal diameter	Grade 5.8		Grade 6.8 (6T)		Grade 8.8 (7T)	
	Dry N*m(kgf cm)	Oil N*m(kgf cm)	Dry N*m(kgf cm)	Oil N*m(kgf cm)	Dry N*m(kgf cm)	Oil N*m(kgf cm)
M5	4.1 (41)	3.4 (35)	4.7 (48)	4 (41)	6.2 (63)	5.2 (53)
M6	6.9 (70)	5.8 (59)	8 (81)	6.8 (69)	10 (110)	8.9 (91)
M8	17 (170)	14 (140)	19 (200)	16 (170)	25 (260)	22 (220)
M10	33 (340)	28 (290)	38 (390)	32 (330)	50 (510)	43 (440)
M12	58 (590)	49 (500)	67 (680)	57 (580)	91 (930)	77 (790)
M14	92 (940)	78 (790)	110 (1100)	90 (920)	150 (1500)	120 (1300)
M16	140 (1500)	120 (1200)	170 (1700)	140 (1400)	230 (2300)	190 (2000)
M18	200 (2000)	170 (1700)	230 (2300)	190 (2000)	310 (3200)	260 (2700)
M20	280 (2800)	240 (2400)	320 (3300)	280 (2800)	440 (4500)	370 (3800)
M22	380 (3900)	320 (3300)	440 (4500)	370 (3800)	600 (6100)	510 (5200)
M24	480 (4900)	410 (4200)	560 (5700)	470 (4900)	760 (7800)	650 (6600)
M27	710 (7200)	600 (6100)	820 (8400)	690 (7100)	1100 (11000)	950 (9700)
M30	960 (9800)	820 (8300)	1100 (11000)	940 (9600)	1500 (15000)	1300 (13000)

Table 7-2: Standard Metric Torques for LACMTA P3010 LRV (continued)

Nominal diameter	Grade 9.8		Grade 10.9		Grade 12.9	
	Dry	Oil	Dry	Oil	Dry	Oil
	N*m(kgf cm)					
M5	6.9	5.9	8.8	7.5	10	8.8
	(71)	(60)	(90)	(77)	(110)	(89)
M6	12	10	15	13	18	15
	(120)	(100)	(150)	(130)	(180)	(150)
M8	28	24	36	31	43	36
	(290)	(250)	(370)	(320)	(430)	(370)
M10	57	48	72	61	84	72
	(580)	(490)	(740)	(630)	(860)	(730)
M12	100	84	130	110	150	130
	(1000)	(850)	(1300)	(1100)	(1500)	(1300)
M14	160	130	200	170	230	200
	(16000)	(1400)	(2000)	(1700)	(2400)	(2000)
M16	240	210	310	270	360	310
	(2500)	(2100)	(3200)	(2700)	(3700)	(3200)
M18			430	370	500	430
			(4400)	(3700)	(5100)	(4300)
M20			610	520	710	610
			(6200)	(5300)	(7300)	(6200)
M22			830	710	970	820
			(8400)	(7200)	(9900)	(8400)
M24			1100	900	1200	1000
			(11000)	(9100)	(13000)	(11000)
M27			1500	1300	1800	1500
			(16000)	(13000)	(18000)	(16000)
M30			2100	1800	2400	2100
			(21000)	(18000)	(25000)	(21000)

7.4 Removal

The following sections contain the instructions for the removal of the following equipment:

- Interior View Camera
- Forward View Camera
- Cab Camera
- Roof Mounted Camera
- Rear View Camera
- Rear View Monitor
- Train Operator Display (TOD)
- PoE Switch
- Network Video Recorder (NVR)

CAUTION

THE NVR (DIGITAL VIDEO RECORDER) IS DESIGNED FOR A GRACEFUL SHUT DOWN. THIS IS TO ENSURE THAT VIDEO IS CAPTURED / TRANSFERRED COMPLETELY AND THAT ESSENTIAL SOFTWARE FILES ARE NOT CORRUPTED. THE DIGITAL VIDEO RECORDER SYSTEM CIRCUIT BREAKER (B-CAB) IS A PROTECTIVE DEVICE AND **NOT** AN ON/OFF SWITCH. THE VEHICLE SHOULD BE KEYED OFF USING THE MASTER CONTROLLER KEY / LOCAL OFF SWITCH TO POWER DOWN THE NVR. **FAILURE TO FOLLOW THIS PROCESS MAY RESULT IN LOST VIDEO AND OR CORRUPTED /INOPERATIVE SOFTWARE FILES!**

Note that after powering down via a local off the Digital Video Recorder circuit breaker can be turned off and the car powered on to provide interior lighting while removing and reinstalling equipment.

Upon removal and reinstallation of any CCTV Equipment, a functional verification must be performed to confirm the repair.

7.4.1 Interior View Camera

WARNING

BEFORE INSPECTING ANY ELECTRICAL EQUIPMENT IN AN ELECTRICAL SYSTEM, MAKE SURE THAT THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THERE IS NO VOLTAGE PRESENT WHERE WORK IS PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.

1. Using a crew key, unlock and open the side access cover.
2. Disconnect the wiring from the Interior View Camera (5). See Figure 7-3.
3. Remove the four M4 nuts (1), M4 lock washers (2), eight M4 plain washers (3) and M4 x 16 screws (4).
4. Remove the Interior View Camera (5).
5. Close and lock the side access cover using a crew key.

7.4.2 Forward View Camera

1. Remove six M4 x 10 screws (3) from cover (2). See Figure 7-4.
2. Remove the cover (2).

WARNING

BEFORE INSPECTING ANY ELECTRICAL EQUIPMENT IN AN ELECTRICAL SYSTEM, MAKE SURE THAT THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THERE IS NO VOLTAGE PRESENT WHERE WORK IS PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.

3. Disconnect the electrical connection.
4. Remove the two M4 x 12 screws (4) and M4 plain washers (5).
5. Remove the Forward View Camera (1) with bracket (6).
6. Remove the two screws (7) from the camera housing.
7. Carefully remove the housing.
8. Remove the four M4 ESNA nuts (8), M4 plain washers (9), M4 x 12 screws (10), and M4 plain washers (11).
9. Remove Forward View Camera (1) from bracket (6).

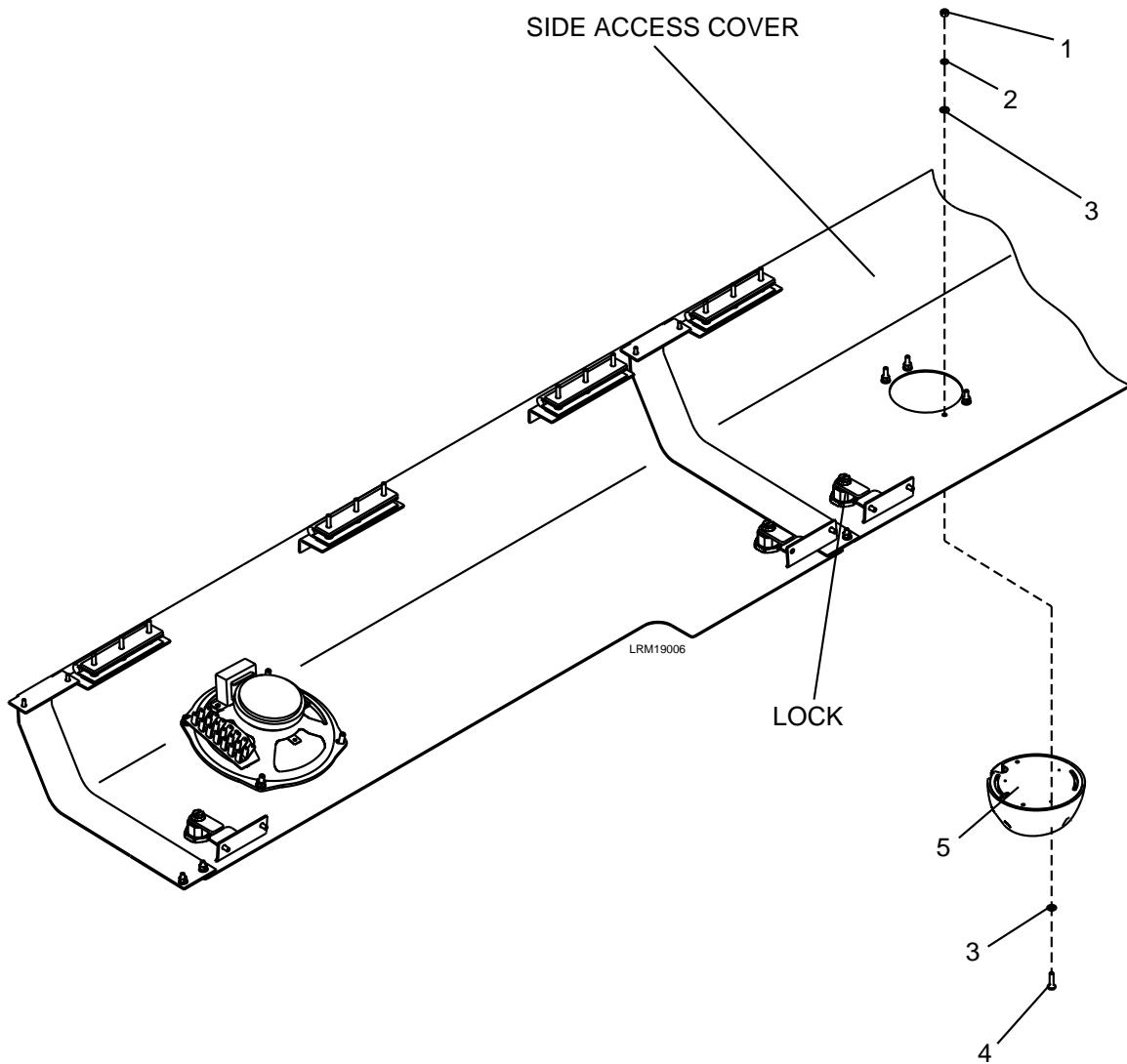


Figure 7-3: Interior View Camera

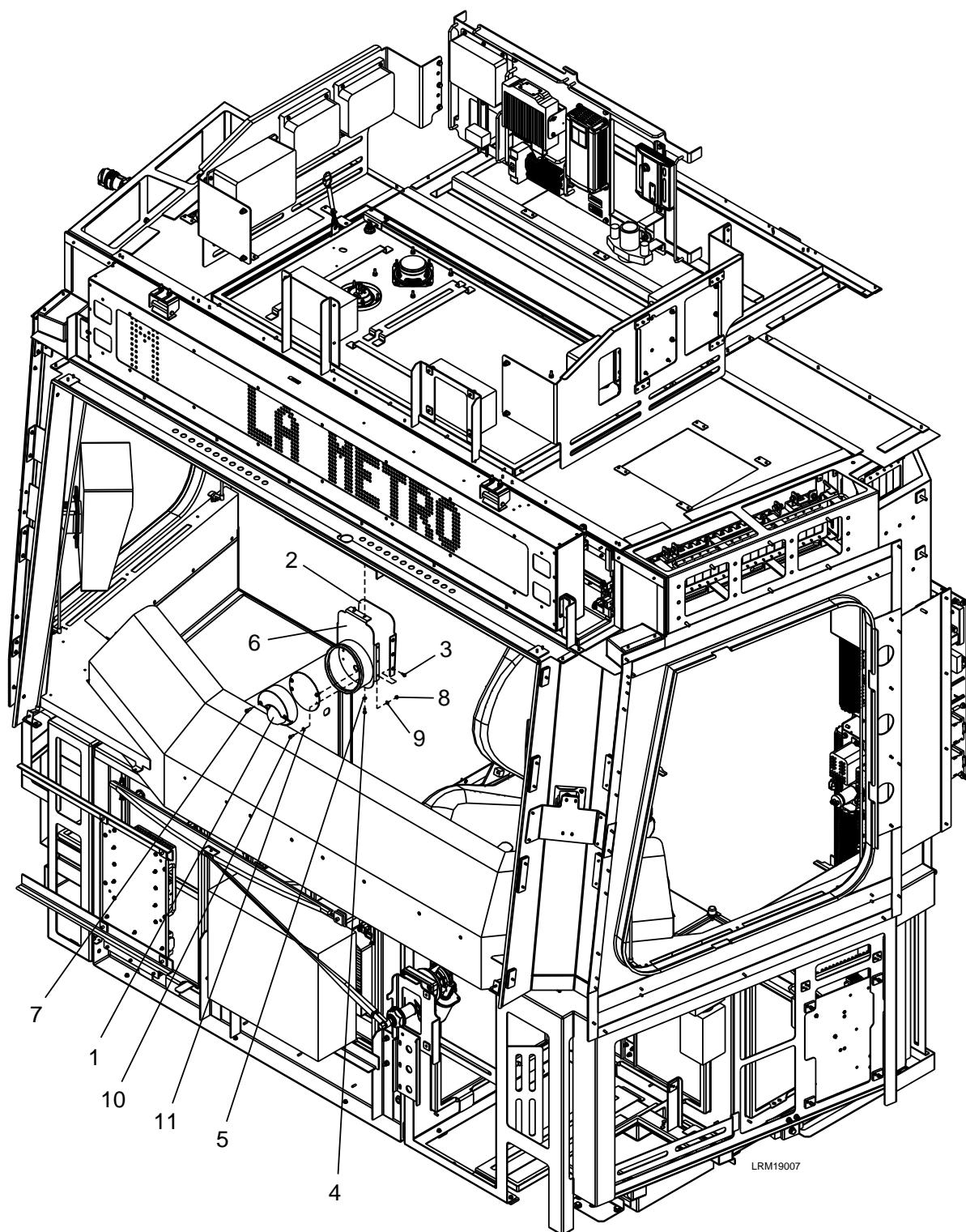


Figure 7-4: Forward View Camera

7.4.3 Cab Camera

WARNING

BEFORE INSPECTING ANY ELECTRICAL EQUIPMENT IN AN ELECTRICAL SYSTEM, MAKE SURE THAT THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THERE IS NO VOLTAGE PRESENT WHERE WORK IS PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.

1. Unlock the two locks (9) and lower the cab ceiling panel (3) to access the Cab Camera (1) and disconnect the electrical connection. See Figure 7-5.
2. Remove the two screws (2) from the camera housing.
3. Carefully remove the housing.
4. Remove the two M3 nuts (4), M3 lock washers (5), M3 plain washers (6), M3 x 12 screws (7), and M3 plain washers (8).
5. Carefully remove the Cab Camera (1).

7.4.4 Roof Mounted Camera

WARNING

BEFORE INSPECTING ANY ELECTRICAL EQUIPMENT IN AN ELECTRICAL SYSTEM, MAKE SURE THAT THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THERE IS NO VOLTAGE PRESENT WHERE WORK IS PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.

1. Disconnect the electrical connection (4) from the receptacle. See Figure 7-6.
2. Remove the four M6 x 16 bolts (7), M6 lock washers (8), and M6 plain washers (9).
3. Carefully remove the Roof Mounted Camera Assembly from the roof junction box (1).
4. Install the four M6 plain washers (9), M6 lock washers (8), and M6 x 16 bolts (7), that were removed in step 2 above. Torque the bolts to 6.9 Nm (5 ft-lbs.).
5. Install the dust cover (3) onto the receptacle.

NOTE: The following steps are to remove the Camera (6) from the bracket.

6. Disconnect the electrical connection (5) from the cable assembly (4).

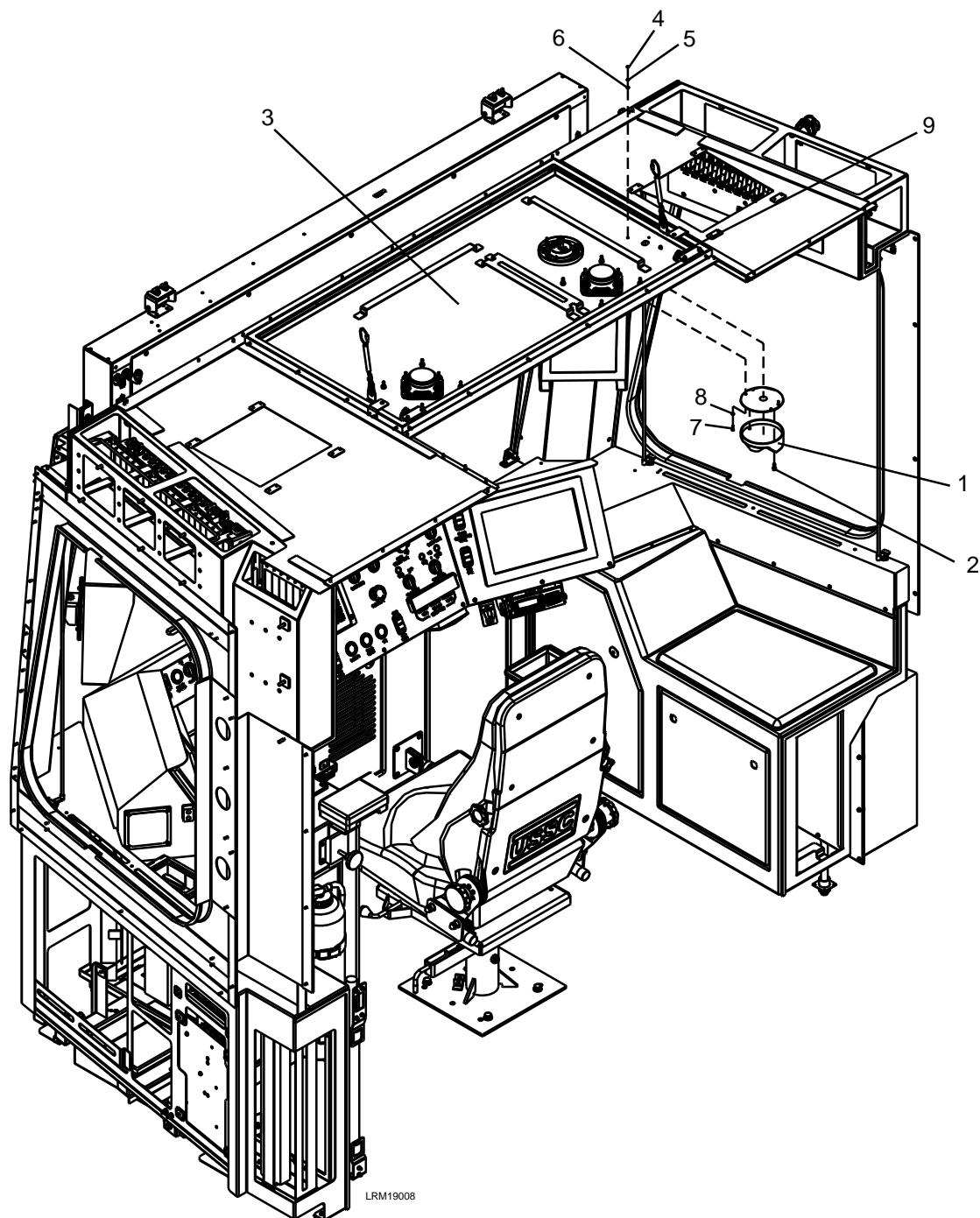


Figure 7-5: Cab Camera

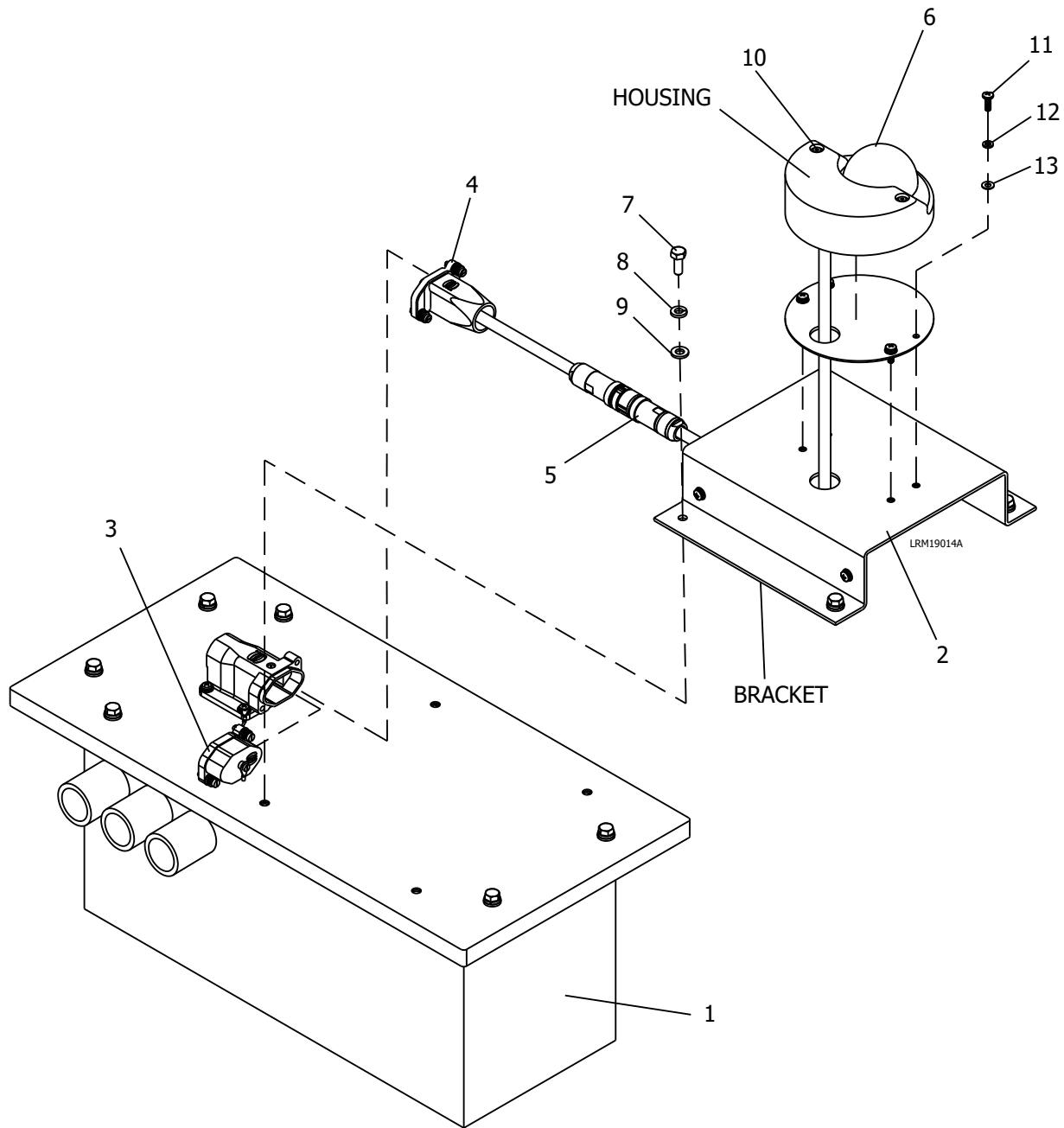


Figure 7-6: Roof Mounted Camera

7. Remove the two screws (10) from the camera housing.
8. Carefully remove the housing.
9. Remove the four M4 x 12 screws (11), M4 lock washers (12) and plain washers (13).
10. Carefully remove the Roof Mounted Camera (6) from the bracket.

7.4.5 Rear View Camera

1. Remove the three M6 x 20 screws (3). See Figure 7-7.

WARNING

BEFORE INSPECTING ANY ELECTRICAL EQUIPMENT IN AN ELECTRICAL SYSTEM, MAKE SURE THAT THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THERE IS NO VOLTAGE PRESENT WHERE WORK IS PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.

2. Carefully remove the Rear View Camera (1) and gasket (2) from the car body and disconnect the electrical connector (4) from the Rear View Camera (1).

7.4.6 Rear View Monitors

WARNING

BEFORE INSPECTING ANY ELECTRICAL EQUIPMENT IN AN ELECTRICAL SYSTEM, MAKE SURE THAT THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THERE IS NO VOLTAGE PRESENT WHERE WORK IS PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.

1. Disconnect the electrical connection.
2. Remove the four M5 x 16 bolts (4), M5 lock washers (5), and M5 plain washers (6) from the base plate (2). See Figure 7-8.
3. Carefully remove the Rear View Monitor assembly (1).
4. Remove the four M4 x 8 screws (7), M4 lock washers (8), and M4 plain washers (9) from the Rear View Monitor (1) and remove the Bracket Assembly (3).

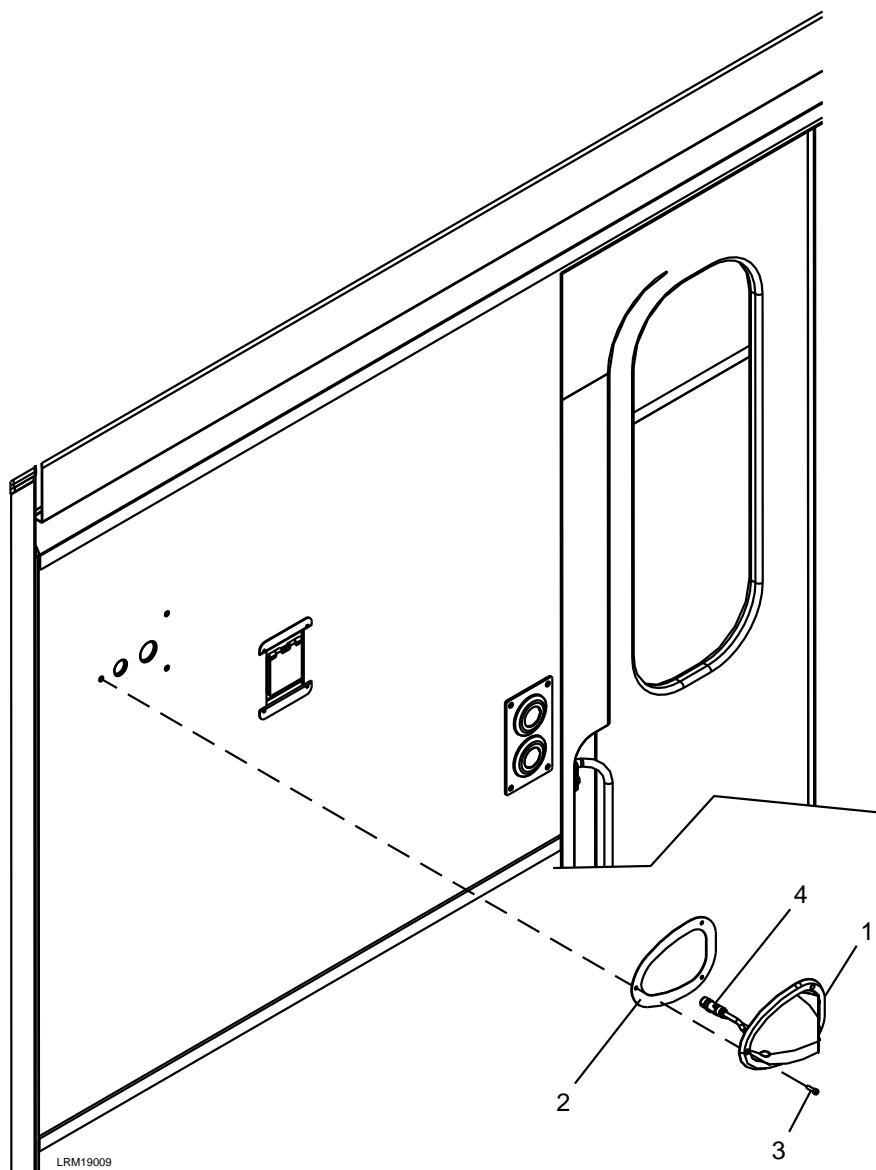


Figure 7-7: Rear View Camera

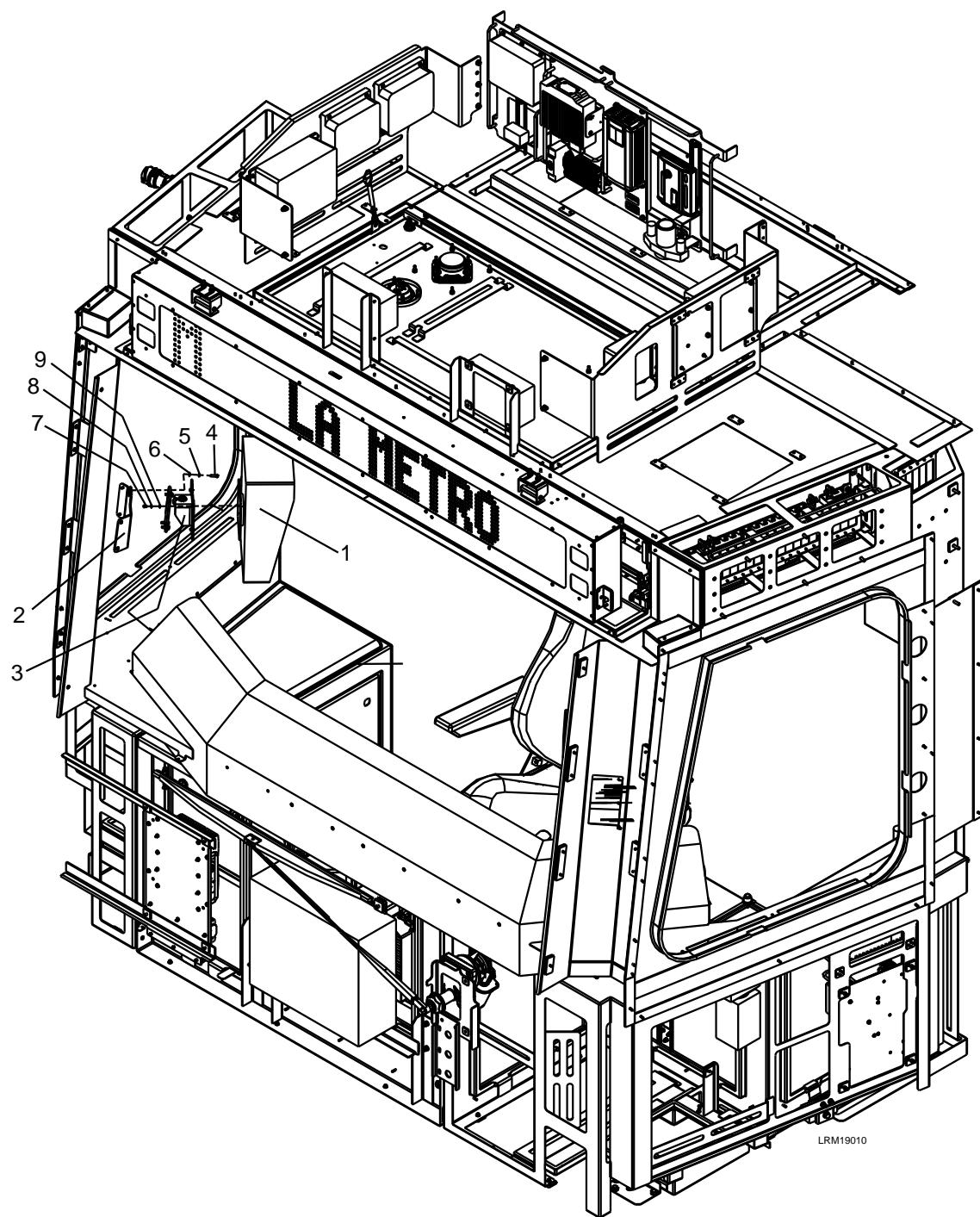


Figure 7-8: Rear View Monitor

7.4.7 Train Operator Display (TOD) (Cab Console Panel 1)

WARNING

BEFORE INSPECTING ANY ELECTRICAL EQUIPMENT IN AN ELECTRICAL SYSTEM, MAKE SURE THAT THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THERE IS NO VOLTAGE PRESENT WHERE WORK IS PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.

1. Remove the seven #8-32 flat head screws (#1, Figure 7-9) securing the panel to the cab console.
2. Carefully remove the panel and disconnect the Ethernet electrical connectors from LAN1 and LAN2, power connector, GPIO connector, COM1 RS-485 connector, and the VGA OUT connector.
3. Remove the TOD from the panel by removing the eight retaining clips on the back of the TOD.

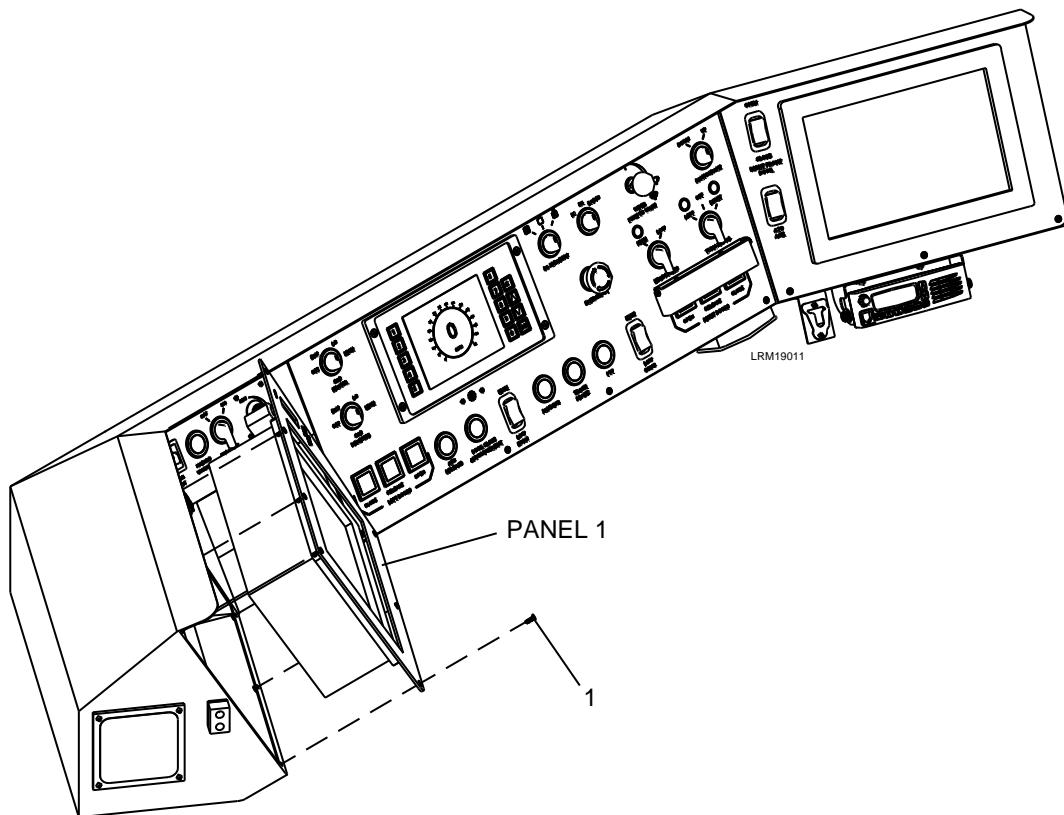


Figure 7-9: Train Operator Display (TOD)



TOD Retaining Clips
(Side, Back and Front Views)

7.4.8 PoE Switch (Ethernet)

WARNING

BEFORE INSPECTING ANY ELECTRICAL EQUIPMENT IN AN ELECTRICAL SYSTEM, MAKE SURE THAT THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THERE IS NO VOLTAGE PRESENT WHERE WORK IS PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.

1. Unlock the two locks (5) and lower the cab ceiling panel (6) to access the PoE Switch (1) and disconnect the electrical connection. See Figure 7-10.
2. Remove the four M4 x 20 screws (2), M4 lock washers (3), and M4 plain washers (4).
3. Carefully remove the PoE Switch (1).

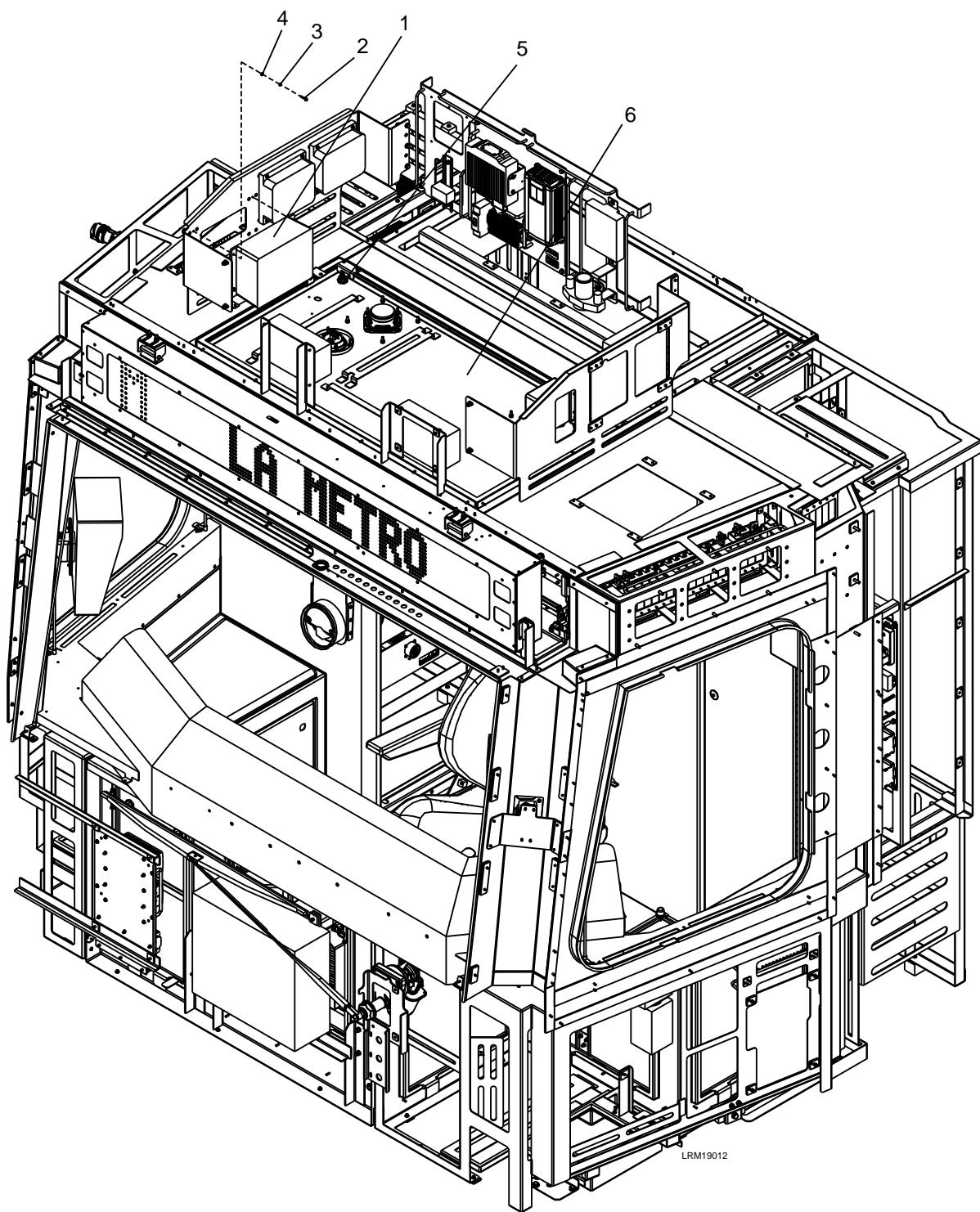


Figure 7-10: PoE Switch (Ethernet)

7.4.9 Network Video Recorder (NVR)

WARNING

BEFORE INSPECTING ANY ELECTRICAL EQUIPMENT IN AN ELECTRICAL SYSTEM, MAKE SURE THAT THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THERE IS NO VOLTAGE PRESENT WHERE WORK IS PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.

1. Using a crew key, unlock and open the B-Unit electric locker door.
2. Disconnect the electrical connections from the Network Video Recorder (4). See Figure 7-11.
3. Remove the four M8 x 20 bolts (1), M8 lock washers (2) and M8 plain washers (3).
4. Remove the Network Video Recorder (4).
5. Close and lock the B-Unit electric locker door using a crew key.

7.5 Installation

The following sections contain the instructions for the installation of the following equipment:

- Interior View Camera
- Forward View Camera
- Cab Camera
- Roof Mounted Camera
- Rear View Camera
- Rear View Monitor
- Train Operator Display (TOD)
- Network Video Recorder (NVR)

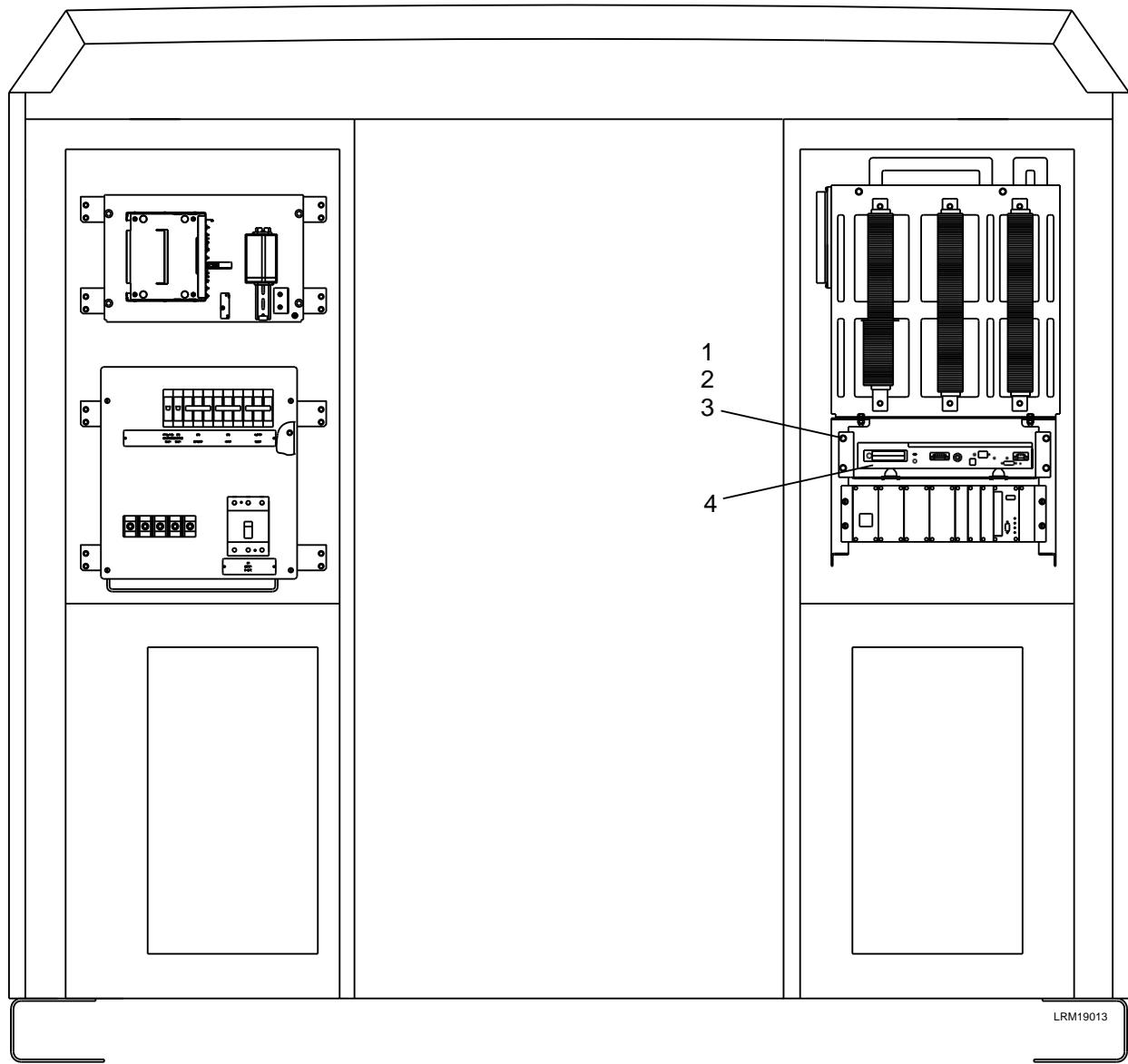


Figure 7-11: Network Video Recorder (NVR)

7.5.1 Interior View Camera

WARNING

BEFORE INSPECTING ANY ELECTRICAL EQUIPMENT IN AN ELECTRICAL SYSTEM, MAKE SURE THAT THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THERE IS NO VOLTAGE PRESENT WHERE WORK IS PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.

1. Using a crew key, unlock and open the side access cover.
2. Align the holes in the Interior View Camera (5) with the holes in the side access cover. See Figure 7-3.
3. Insert the eight M4 plain washers (3), four M4 x 16 screws (4), M4 lock washers (2) and M4 nuts (1) and tighten.
4. Connect the wiring to the Interior View Camera (5).
5. Close and lock the side access cover using a crew key.
6. Refer to Section 7.6 of this manual section for software enrollment.
7. Refer to Section 7.7.1 of this manual section for aiming the Interior Camera.

7.5.2 Forward View Camera

WARNING

BEFORE INSPECTING ANY ELECTRICAL EQUIPMENT IN AN ELECTRICAL SYSTEM, MAKE SURE THAT THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THERE IS NO VOLTAGE PRESENT WHERE WORK IS PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.

1. Install Forward View Camera (1) onto bracket (6) aligning the mounting holes. See Figure 7-4.
2. Install the four M4 plain washers (11), M4 x 12 screws (10), M4 plain washers (9), and M4 ESNA nuts (8).
3. Tighten the hardware.
4. Carefully install the housing aligning the mounting holes.
5. Install the two screws (7) to secure the camera housing.

6. Install the Forward View Camera (1) onto bracket (6) aligning the mounting holes.
7. Install the two M4 x 12 screws (4), M4 plain washers (5).
8. Tighten the hardware.
9. Connect the electrical connection.
10. Install the cover (2) aligning the mounting holes.
11. Install six M4 x 10 screws (3) into the cover (2).
12. Tighten the hardware.
13. Refer to Section 7.6 of this manual section for software enrollment.
14. Refer to Section 7.7.2 of this manual section for aiming of the Forward View Camera.

7.5.3 Cab Camera

WARNING

BEFORE INSPECTING ANY ELECTRICAL EQUIPMENT IN AN ELECTRICAL SYSTEM, MAKE SURE THAT THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THERE IS NO VOLTAGE PRESENT WHERE WORK IS PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.

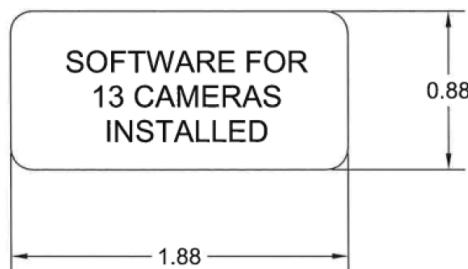
1. Unlock the two locks (9) and lower the cab ceiling panel (3) to access the Cab Camera mounting. See Figure 7-5.
2. Carefully install the Cab Camera (1) aligning the mounting holes.
3. Install the two M3 plain washers (8), M3 x 12 screws (7), M3 plain washers (6), M3 lock washers (5), and M3 nuts (4).
4. Tighten the hardware.
5. Carefully install the housing.
6. Install the two screws (2) to secure the camera housing.
7. Raise the cab ceiling panel (3) and secure.
8. Refer to Section 7.6 of this manual section for camera enrollment.
9. Refer to Section 7.7.3 of this manual section for aiming of the Cab Camera.

7.5.4 Roof Mounted Camera

WARNING

BEFORE INSPECTING ANY ELECTRICAL EQUIPMENT IN AN ELECTRICAL SYSTEM, MAKE SURE THAT THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THERE IS NO VOLTAGE PRESENT WHERE WORK IS PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.

1. Confirm that the NVR has a license for 13 cameras. Normal licensing is for 12 cameras. This can be confirmed by inspecting the installed NVR and confirming that the NVR has the label stating "Software for 13 cameras installed" on the left side of the NVR over the hard drives. See below for a drawing of the required label:



If this label is not present then an NVR that is provisioned must be installed, refer to Sections 7.4.9 for removal of the current NVR and Section 7.5.9 for installation of a properly provisioned NVR.

2. Install Roof Mounted Camera (6) onto bracket aligning the mounting holes. See Figure 7-6.
3. Install the four M4 plain washers (13), M4 lock washers (12) and M4 x 12 screws (11) and tighten.
4. Carefully install the housing with two screws (10) and tighten.
5. Connect the electrical connection (5) to the cable assembly (4).
6. Remove the dust cap (3) from the receptacle.
7. Remove the four M6 x 16 bolts (7), M6 lock washers (8), and M6 plain washers (9) from the roof junction box (1).
8. Install the Roof Mounted Camera Assembly (2) onto the roof junction box (1) aligning the mounting holes.
9. Install the four M6 x 16 bolts (7), M6 lock washers (8), and M6 plain washers (9) that were removed in step 7 above. Torque the bolts to 6.9 Nm (ft-lbs.).
10. Connect the cable (4) to the receptacle and tighten the screws.

11. Connect a PTU to the vehicle network.
12. Open the Genetec Config Tool on the PTU and connect to the NVR on the vehicle.
13. Select unit enrollment from the main window.
14. Confirm manufacturer named “ONVIF” is present. If not, click the gear in the upper left hand corner, add “ONVIF” then click save.
15. Click “Start Discovery”.
16. Once camera discovery has completed, add the roof camera at IP address 172.16.0.124.
17. Close Genetec Config Tool and connect to Security Desk to validate that the camera is properly recording.

7.5.5 Rear View Camera

WARNING

BEFORE INSPECTING ANY ELECTRICAL EQUIPMENT IN AN ELECTRICAL SYSTEM, MAKE SURE THAT THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THERE IS NO VOLTAGE PRESENT WHERE WORK IS PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.

1. Connect the electrical connector (4) to the Rear-View Camera (1). See Figure 7-7.
2. Carefully place the Rear-View Camera (1) and gasket (2) onto the car body aligning the mounting holes.
3. Install and tighten the three M6 x 20 screws (3).
4. Refer to Section 7.6 of this manual section for camera enrollment instructions.
5. Refer to Section 7.7.4 of this manual section for aiming of the Rear View Camera(s).

7.5.6 Rear View Monitors

WARNING

BEFORE INSPECTING ANY ELECTRICAL EQUIPMENT IN AN ELECTRICAL SYSTEM, MAKE SURE THAT THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THERE IS NO VOLTAGE PRESENT WHERE WORK IS PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.

1. Place the bracket assembly (3) on the Rear View Monitor Assembly (1) and align the mounting holes. See Figure 7-8.
2. Install the four M4 x 8 screws (7), M4 lock washers (8), and M4 plain washers (9) to secure the bracket assembly (3).
3. Tighten the hardware.
4. Carefully place the Rear View Monitor Assembly (1) onto the base plate (2) aligning the mounting holes.
5. Install the four M5 x 16 bolts (4), M5 lock washers (5), and M5 plain washers (6) to secure the Rear View Monitor Assembly (1).
6. Ensure that the Rear View Monitor is centered (not rotated one way or the other). The stop screw should be in the middle of the cutout on the mounting bracket. See Figure 7-12.
7. After the Rear View Monitor is centered, tighten the M8 bolt (hand tighten, no torque required) so that it cannot be rotated.
8. Tighten the hardware from step 5 above.
9. Connect the electrical connections.

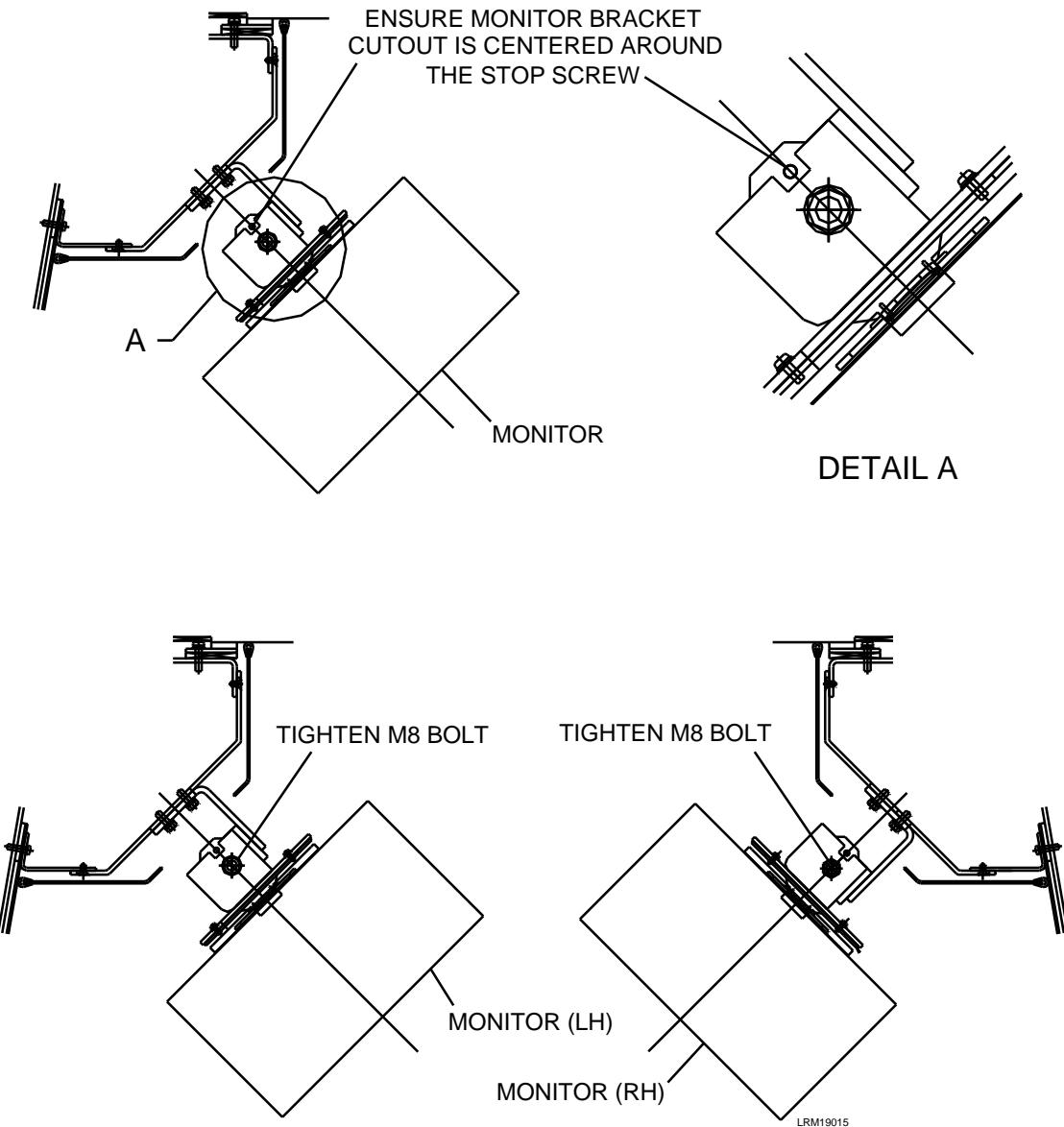


Figure 7-12: Adjustment of Rear View Monitor

7.5.7 Train Operator Display (TOD)

WARNING

BEFORE INSPECTING ANY ELECTRICAL EQUIPMENT IN AN ELECTRICAL SYSTEM, MAKE SURE THAT THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THERE IS NO VOLTAGE PRESENT WHERE WORK IS PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.

1. Align the TOD with the hole in the panel. See Figure 7-9.
2. Install the eight retaining clips to the back of the TOD and tighten.
3. Reconnect the Ethernet electrical connectors, power connector, GPIO connector, COM1 connector, and VGA OUT connector.
4. Align the panel with the holes in the console and install the seven #8-32 flat head screws (#1, Figure 7-9) and tighten.
5. After the TOD is replaced, functionally verify that it is operating correctly. Verify that the proper version of software is running on the TOD. Software installation and verification is covered in detail in Section 6.0 of the **Communications Equipment Programming Guide**. If detailed procedures are not needed, reprogramming the TOD is covered in Section 8.3.5 of this manual section.

7.5.8 PoE Switch (Ethernet)

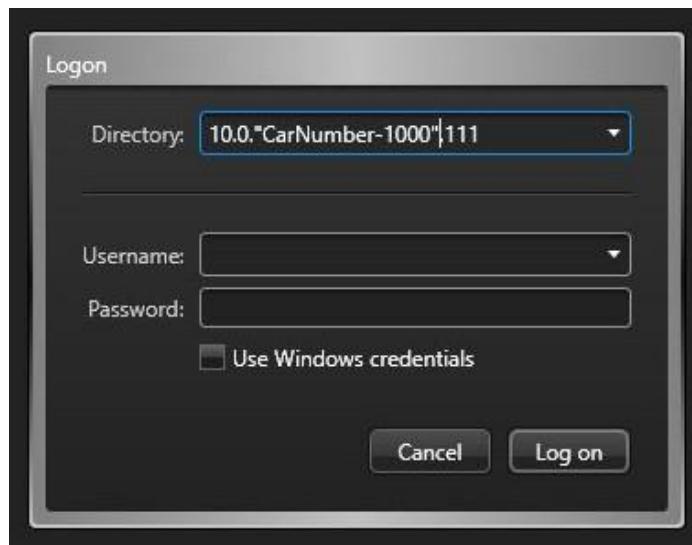
1. Unlock the two locks (5) and lower the cab ceiling panel (6) to access the PoE Switch (1) mounting. See Figure 7-10.
2. Carefully install the PoE Switch (1) on the mounting bracket aligning the mounting holes.
3. Install the four M4 x 20 screws (2), M4 lock washers (3), and M4 plain washers (4).
4. Tighten the hardware.
5. Connect the electrical connections.
6. Raise the cab ceiling panel (6) and secure.
7. After replacement of the PoE Switch, the switch must be configured for the network. Follow the switch commissioning steps in Section 8.0 of the Data Communications (TCN) Running Maintenance and Servicing Manual, Section 1700.

7.5.9 Network Video Recorder (NVR)

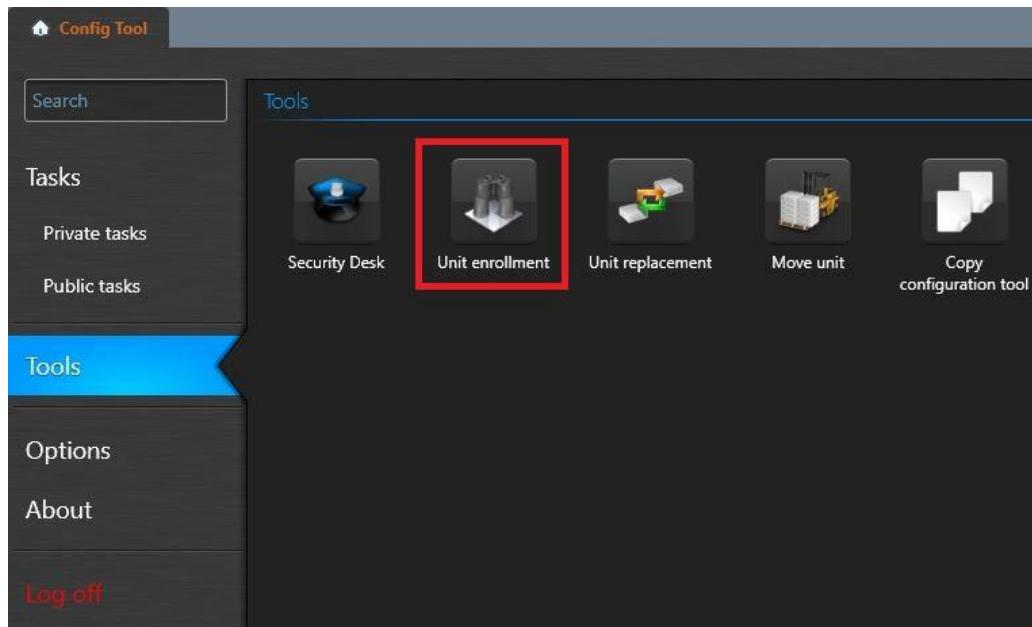
WARNING

BEFORE INSPECTING ANY ELECTRICAL EQUIPMENT IN AN ELECTRICAL SYSTEM, MAKE SURE THAT THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THERE IS NO VOLTAGE PRESENT WHERE WORK IS PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.

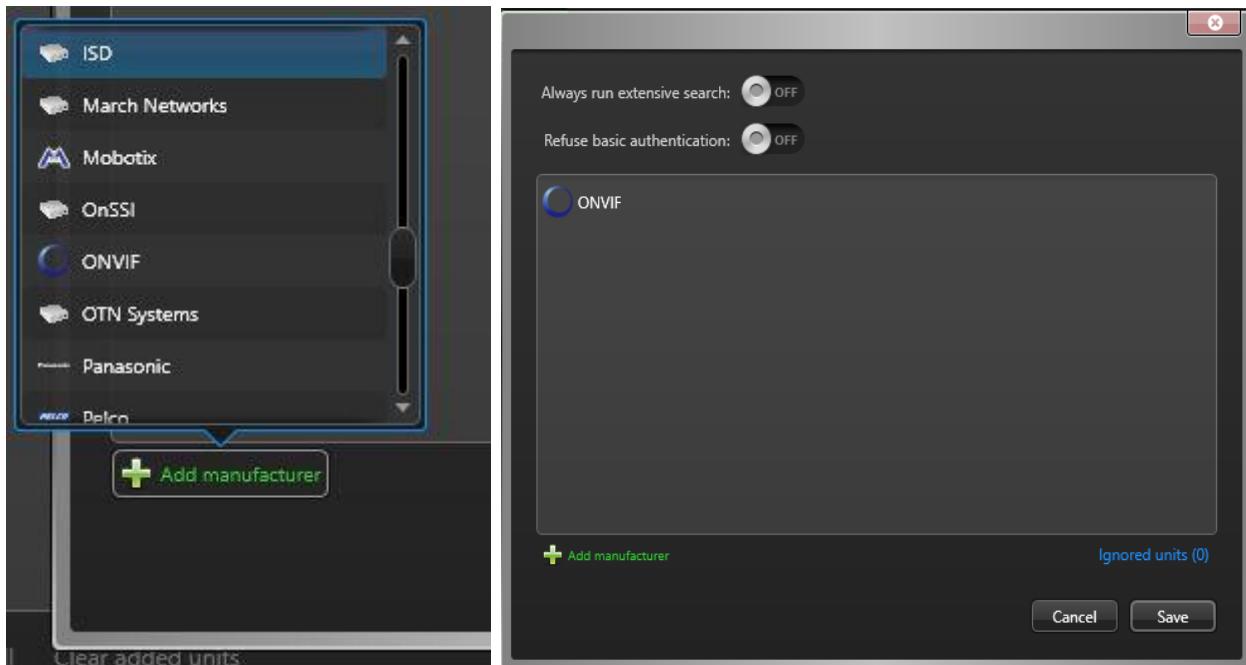
1. Using a crew key, unlock and open the B-Unit electric locker door.
2. Align the holes in the Network Video Recorder (4). See Figure 7-11.
3. Insert the four M8 plain washers (3), M8 lock washers (2) and M8 x 20 bolts (1) and tighten.
4. Connect the electrical connections to the Network Video Recorder (4).
5. Close and lock the B-Unit electric locker door using a crew key.
6. Using a PTU, open Genetec Config Tool and log in to the NVR by entering the address, username and password into the log in screen as shown on the screen below.

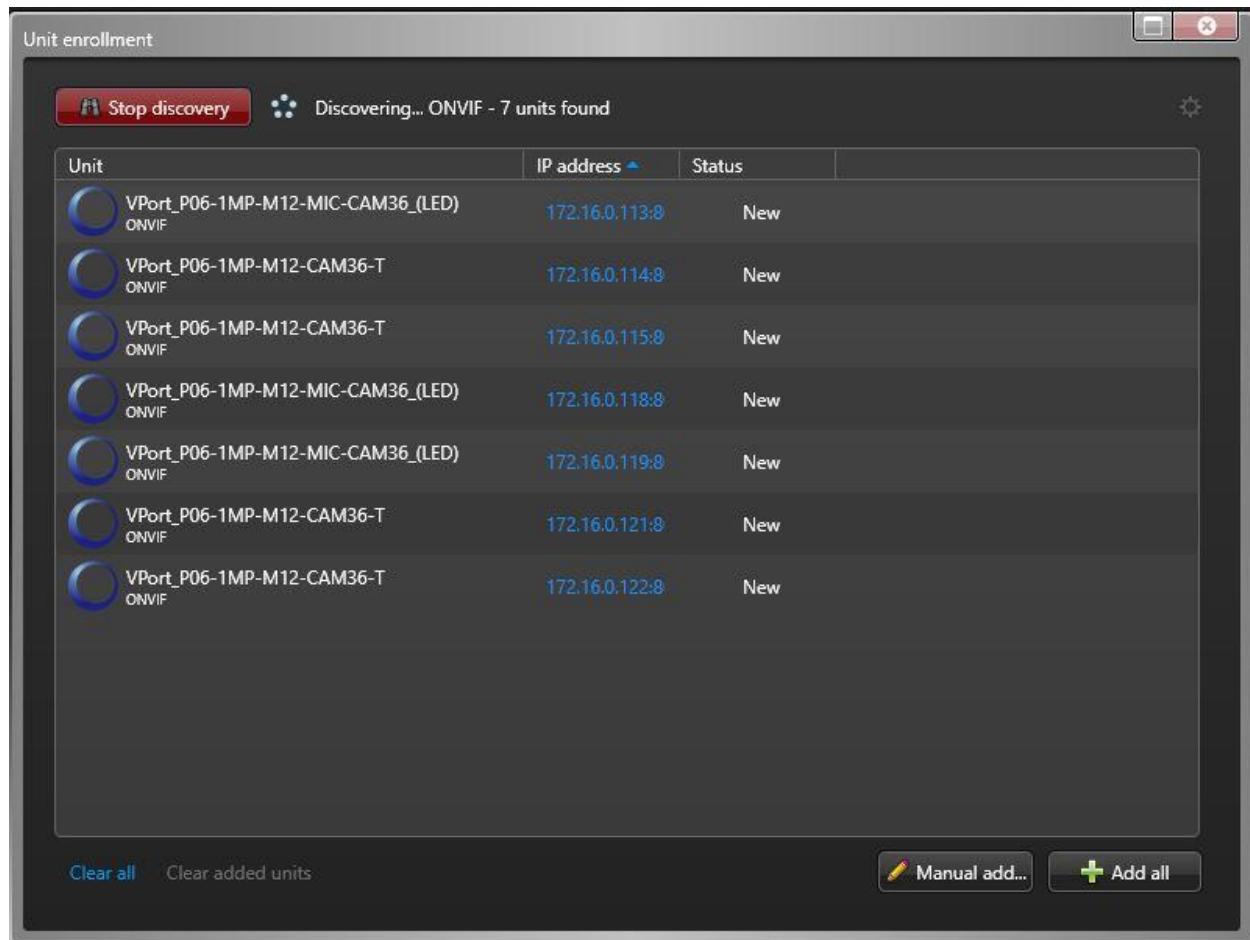


7. Once logged into the Config Tool, select Unit Enrollment as shown on the screen below.



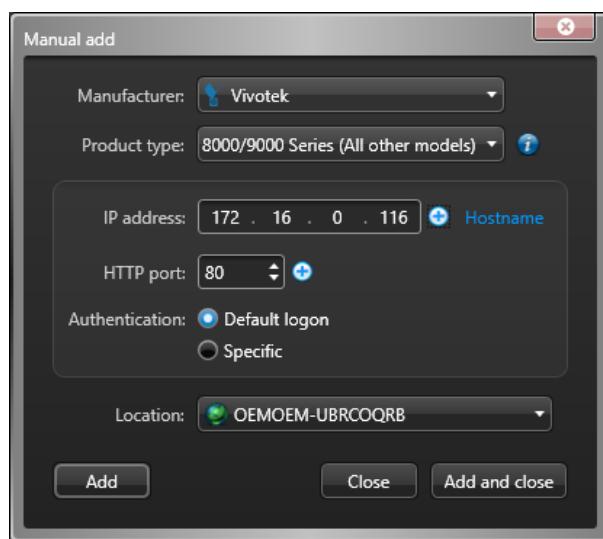
8. From the unit enrollment window, click the gear logo and ensure that only ONVIF is selected from manufacturers as shown on the screens below. You may have to delete other manufacturer names from this screen by hovering over the name and clicking the red "X" that appears next to the manufacturer name or adding manufacturers through the Add option.





9. Click Save.

10. Click the Start discover button. Once discover is complete click the Add all button as shown on the screen below.



11. Once all of the units have been added click the Manual add button.
12. Select Vivotek for the manufacturer and all other 8000 series for the model type.
13. Enter the IP address of the A-end cab camera (172.16.0.117).
14. Click add and repeat steps 11 through 13 for the B-end camera (172.16.0.123).
15. From the Config Tool home page, open the video task.
16. Expand the camera units under archiver by clicking the arrow next to the archiver icon.
17. For each camera unit, rename the device using the Table 7-3 where XXXX is the car number.

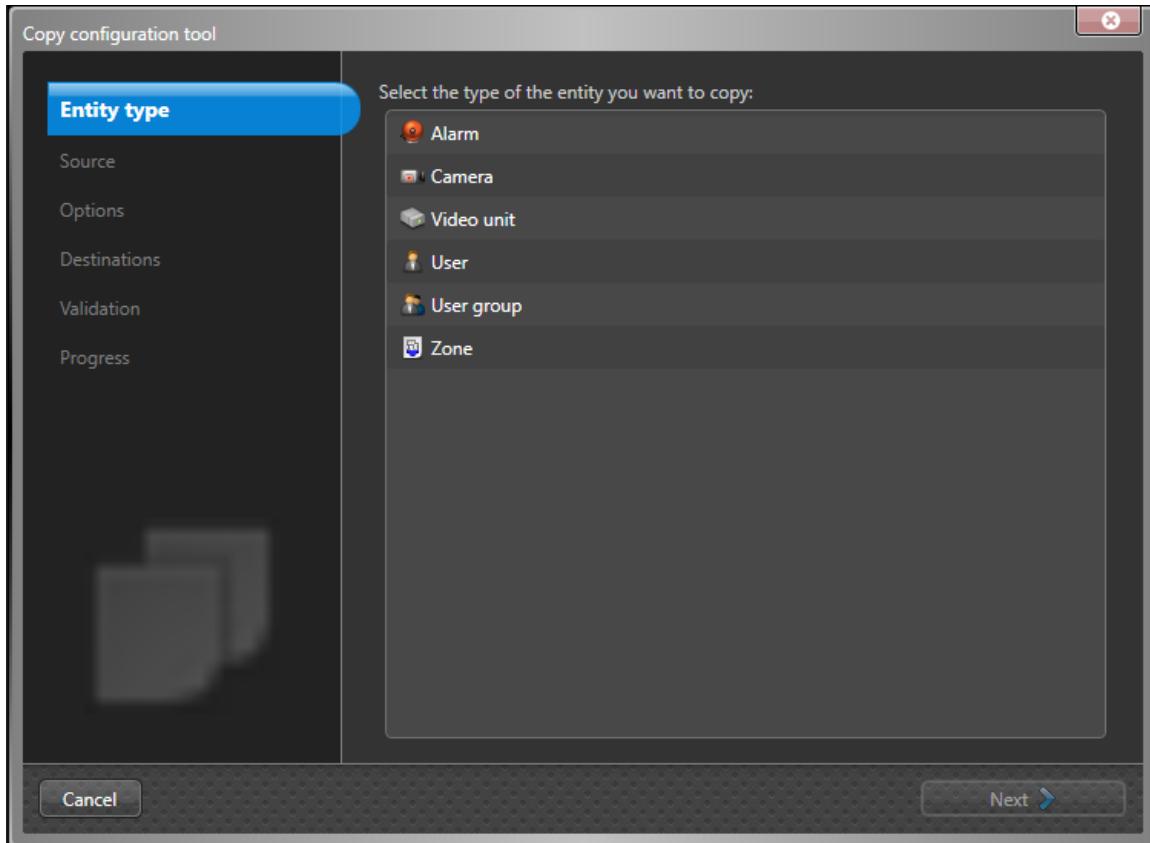
NOTE: Not all cars will have a roof camera.

Table 7-3. Camera Naming Conventions

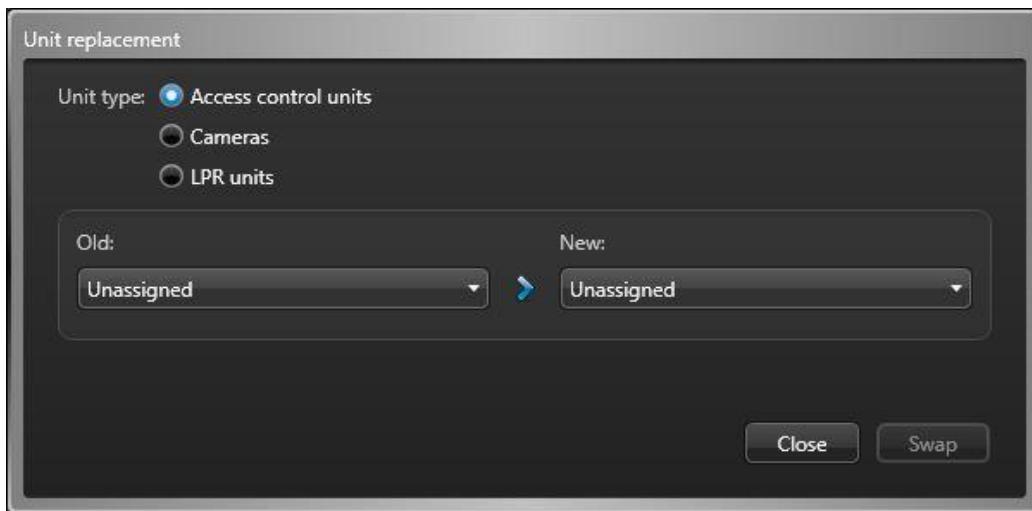
Address	Name
172.16.0.112	172.16.0.112 – IC1A – Car XXXX
172.16.0.113	172.16.0.113 – IC2A – Car XXXX
172.16.0.114	172.16.0.114 – FVA – Car XXXX
172.16.0.115	172.16.0.115 – RVAR – Car XXXX
172.16.0.116	172.16.0.116 – RVAL – Car XXXX
172.16.0.117	172.16.0.117 – Cab A – Car XXXX
172.16.0.118	172.16.0.118 – IC1B – Car XXXX
172.16.0.119	172.16.0.119 – IC2B – Car XXXX
172.16.0.120	172.16.0.120 – FVB – Car XXXX
172.16.0.121	172.16.0.121 – RVBR – Car XXXX
172.16.0.122	172.16.0.122 – RVBL – Car XXXX
172.16.0.123	172.16.0.123 – Cab B – Car XXXX
172.16.0.124	172.16.0.124 – Roof – Car XXXX

7.6 Software Camera Replacement and Enrollment

1. Follow the process in Section 7.5.9 of this manual section to add the cameras.
2. Open the copy configuration tool from the Config Tool homepage (Tools > Copy configuration tool).



3. Select Video from the entity type and click Next.
4. In the source page, select the original camera. This can be distinguished because the camera entity name will be red. Click Next.
5. In the options page, select Color, Hardware specific settings, network, recording and video quality. Click Next.
6. In the destinations page, select the new camera. This can be distinguished because it will only be named by the IP of the camera. Click Next.
7. Once the copying process is completed, click Close.
8. Under the Home tab, click Tools > Unit replacement tool.
9. In the Unit type option, select Cameras.
10. Select the Old and New cameras.



11. Click Swap.
12. Verify that the video archives are now associated with the new unit by reviewing the cameras archive in the archive view tab.
13. Once this has been verified, return to the Config Tool Video task.
14. In the area view, right-click the old unit and click delete.
15. In the confirmation dialog box that opens, click Continue.
16. From the video unit view, confirm that the camera settings in Table 7-4 are present.

Table 7-4. Video Settings

Camera Type	IC Cameras	FV Cameras	RV Cameras	Cab Cameras
Resolution	1280 x 800	1280 x 800	1280 x 800	1280 x 1024
Bit Rate	2000	2000	2000	2000
Image Quality	50	50	50	50
Frame Rate	15	20	15	15
Key Frame Interval	45	45	45	45

17. From the video unit view, confirm that the recording settings in Table 7-5 are present.

Table 7-5. Recording Settings

Camera Type	IC Cameras	FV Cameras	RV Cameras	Cab Cameras
Automatic Cleanup	OFF	OFF	OFF	OFF
Recording Mode	Continuous	Continuous	Continuous	Continuous
Recording Audio	ON	OFF	OFF	ON

7.7 Camera Adjustments

If a camera is replaced or a camera is determined to be out of alignment then the camera must be adjusted to cover the correct field of view. If a camera is replaced the new camera must be added to the system using the process from Section 7.5.9 of this manual section.

In order to review a camera's field of view connect a PTU to the vehicle and access the camera's web interface by entering the cameras IP address into Internet Explorer in order to view the video. The IPs for the camera and their resolution and sound settings are in Table 7-6.

Table 7-6. Camera IP Addresses and Settings

Camera Location	Camera Address	Resolution	Bit Rate	Image Quality	Frame Rate	Key Frame Interval
Interior 1A	172.16.0.112	1280 x 800	2000	50%	15	45
Interior 2A	172.16.0.113	1280 x 800	2000	50%	15	45
Forward View A	172.16.0.114	1280 x 800	2000	50%	20	45
Rear View A Left	172.16.0.115	1280 x 800	2000	50%	15	45
Rear View A Right	172.16.0.116	1280 x 800	2000	50%	15	45
A Cab	172.16.0.117	1280 x 1024	2000	50%	15	45
Interior 1B	172.16.0.118	1280 x 800	2000	50%	15	45
Interior 2B	172.16.0.119	1280 x 800	2000	50%	15	45
Forward View B	172.16.0.120	1280 x 800	2000	50%	20	45
Rear View B Left	172.16.0.121	1280 x 800	2000	50%	15	45
Rear View B Right	172.16.0.122	1280 x 800	2000	50%	15	45
B Cab	172.16.0.123	1280 x 1024	2000	50%	15	45
Roof	172.16.0.124	1280 x 1024	2000	50%	20	45

7.7.1 Interior View Camera

When installing a new Interior View Camera, adjustments are necessary to angle the camera to match the proper view as shown by the red targeting boxes in the figures below. See Figures 7-13 and 7-14.



Figure 7-13: Moxa CCTV Camera Adjustment
(Interior, Forward View and Roof Cameras, shown with cover removed)

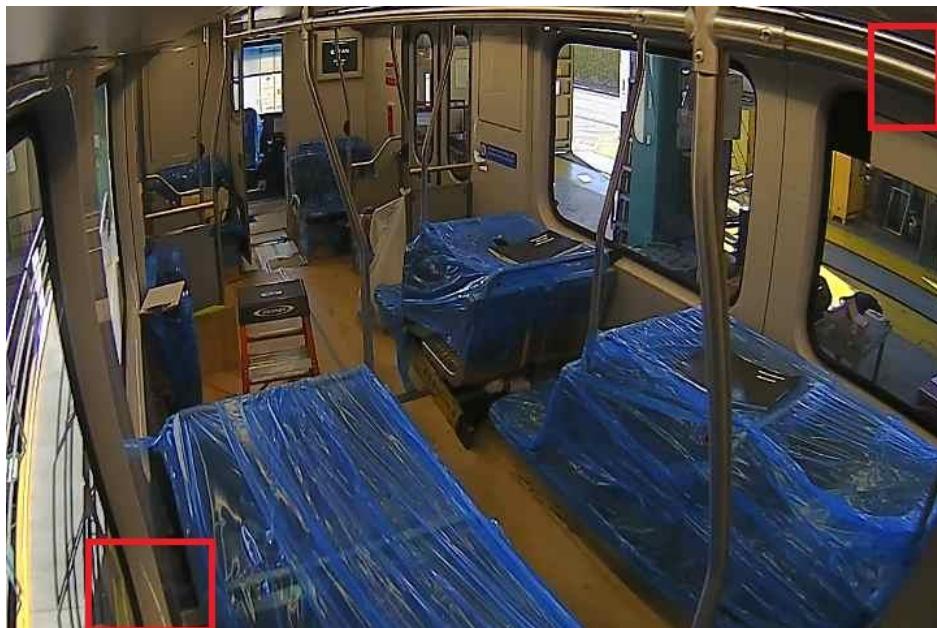


Figure 7-14: Interior View Camera Adjustment

7.7.2 Forward View Camera

When installing a new Forward View Camera, adjustments are necessary to angle the camera to match the proper view as shown by the red targeting boxes in the figures below. See Figures 7-13 and 7-15.

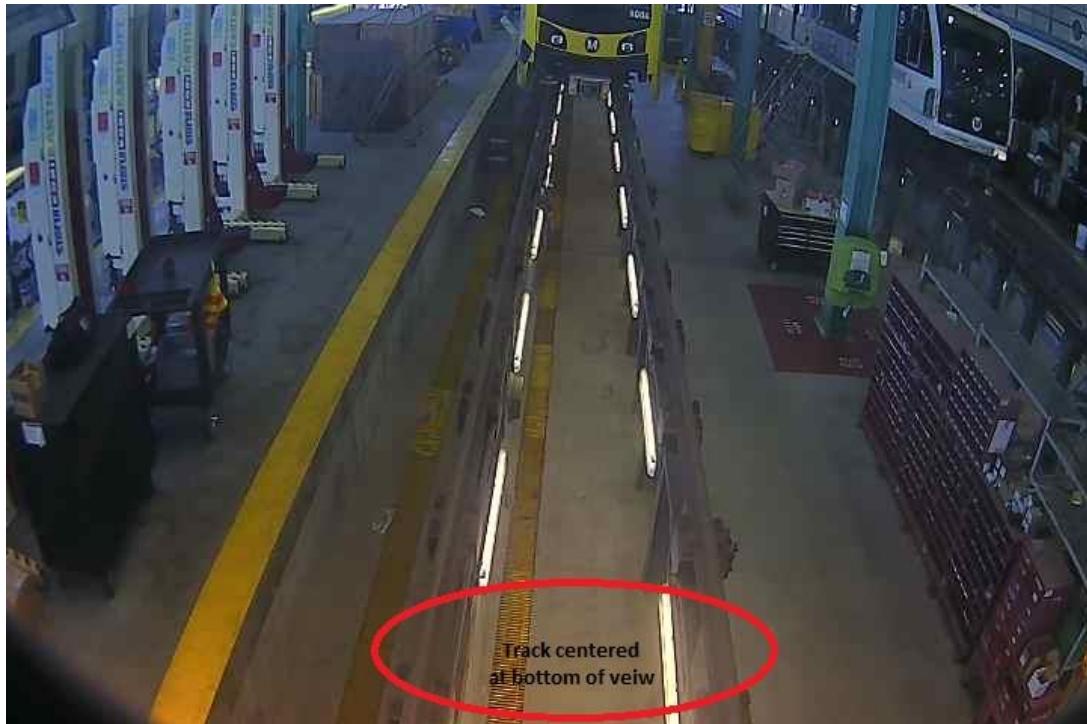


Figure 7-15: Forward View Camera Adjustment

7.7.3 Cab Camera

When installing a new Cab Camera, adjustments are necessary to angle the camera to match the proper view as shown by the red targeting boxes in the image below. See Figures 7-13 and 7-16.

7.7.4 Rear View Camera

When installing a new Rear View Camera, adjustments are necessary to angle the camera to match the proper view as shown by the red targeting boxes in the image below. See Figures 7-13 and 7-17.

7.7.5 Roof Camera (Pantograph View)

When installing the Roof Camera, adjustments are necessary to angle the camera to provide proper view of the pantograph / catenary wire. This camera is aimed in a similar fashion as the interior cameras. See Figure 7-13 for camera aiming adjustments.



Figure 7-16: Cab Camera Adjustment



Figure 7-17: Rear View Camera Adjustment

CHAPTER 8.0

TROUBLESHOOTING

8.1 Introduction

This chapter provides troubleshooting procedures for the CCTV equipment.

8.2 NVR and Camera Troubleshooting

This section provides troubleshooting for the NVR and camera system.

8.2.1 NVR / MDS Failure Table

Table 8-1 includes the faults that are reported to the MDS by the NVR. These faults include camera faults that are detected and reported by the MDS to the fault tab on the TOD. These same faults are captured on the MDS Fault Log. The NVR fault tab can be accessed by pressing the NVR Block on the TOD Main Operating Screen. See Figure 8-1. If there is a fault this block will be red in color. Normal operation will display green and an Ethernet communications error or NVR offline will display a flashing yellow.

NOTE: If a vehicle is located OFF and then keyed back on again prior to the NVR shutting down then the NVR will correctly report that the cameras have been disconnected and the faults will reset once the vehicle network and cameras have come back online. This will occur within 3 minutes of the car powering back on. The fault logs will display ALL cameras going offline and then coming back online.



Figure 8-1: NVR Fault Status Screen (showing RVAL not connected)

Table 8-1. NVR Errors Reported to the TOD

Fault Name	Fault Description	Corrective Action
VDRIVEERROR	One, or both, of the storage drives are not recording video	Refer to Section 8.2.8
IC1B CAMERA OFFLINE	Network, power, firmware or wrong configuration	Refer to Section 8.2.3
IC2B CAMERA OFFLINE	Network, power, firmware or wrong configuration	Refer to Section 8.2.3
FVA CAMERA OFFLINE	Network, power, firmware or wrong configuration	Refer to Section 8.2.3
RVAR CAMERA OFFLINE	Network, power, firmware or wrong configuration	Refer to Section 8.2.3
RVAL CAMERA OFFLINE	Network, power, firmware or wrong configuration	Refer to Section 8.2.3
CAB-A CAMERA OFFLINE	Network, power, firmware or wrong configuration	Refer to Section 8.2.3
IC1A CAMERA OFFLINE	Network, power, firmware or wrong configuration	Refer to Section 8.2.3
IC2A CAMERA OFFLINE	Network, power, firmware or wrong configuration	Refer to Section 8.2.3
FVB CAMERA OFFLINE	Network, power, firmware or wrong configuration	Refer to Section 8.2.3
RVBR CAMERA OFFLINE	Network, power, firmware or wrong configuration	Refer to Section 8.2.3
RVBL CAMERA OFFLINE	Network, power, firmware or wrong configuration	Refer to Section 8.2.3
CAB-B CAMERA OFFLINE	Network, power, firmware or wrong configuration	Refer to Section 8.2.3

The NVR has a LED on the device that indicates that it is powered as seen in the picture below. This LED also indicates CPU usage on the device so when the NVR is operating it will change between Green and Amber.



Figure 8-2: NVR Power LED

If the NVR is not displaying the green LED the following items should be verified:

- Confirm that the Digital Video Recorder breaker is in the correct position.
- Confirm that the green power connector on the right side of the NVR is correctly attached to the NVR.
- Confirm that the wiring into the green power connector is correctly seated.
- Confirm that the battery level voltage 28V is present on the green power connector.

8.2.2 Camera Status

Use the NVR screen accessed through the Maintenance tab on the Train Operator Display to determine the status of the CCTV cameras. Additionally, this screen can be used to identify camera serial number and firm ware. See Figure 8-3.

The screenshot shows the 'Maintenance' tab of the NVR interface. At the top, there's a yellow header bar with the title 'Maintenance'. Below it is a table with columns: CAMERA, MODEL NAME, SERIAL NUMBER, FIRMWARE NUMBER, FPS, STATE, and ERROR?. The table lists 14 cameras, all of which are connected and in 'OK' condition. A legend at the bottom left defines abbreviations for camera types. On the right, an error log shows a single entry: 'VDRIVEERROR' with a red exclamation mark. At the bottom, there are tabs for 'LEAD LRV - 1512', 'CENTER LRV -' (disabled), 'TRAILING LRV - 1514' (selected), and a 'Refresh' button. Below these tabs are several control buttons: OPERATING SCREEN, FAULT SCREEN, MAINTENANCE SCREEN (highlighted in red), OPERATOR LOG-IN SCREEN, CCH SCREEN, BRIGHTNESS, SWITCH SIDE CAMERA, and MAINLINE GUIDE.

CAMERA	MODEL NAME	SERIAL NUMBER	FIRMWARE NUMBER	FPS	STATE	ERROR ?
IC-1A	VPort P06-1MP-M12-MIC-CAM36 (LED)	TACKF1000636	2.6	15	CONNECTED	OK
IC-2A	VPort P06-1MP-M12-MIC-CAM36 (LED)	TACKF1000646	2.6	15	CONNECTED	OK
FV-A	VPort P06-1MP-M12-CAM36-T	TACLE1001389	2.6	20	CONNECTED	OK
RV-AR	VPort P06-1MP-M12-CAM36-T	TACCE1003210	2.6	15	CONNECTED	OK
RV-AL	VPort P06-1MP-M12-CAM36-T	TACJE1006873	2.6	15	CONNECTED	OK
CV-A	FD8152V	0002D133A7BC	FD8152-VVTK-0200c	15	CONNECTED	OK
IC-1B	VPort P06-1MP-M12-MIC-CAM36 (LED)	TACKF1000657	2.6	15	CONNECTED	OK
IC-2B	VPort P06-1MP-M12-MIC-CAM36 (LED)	TACKF1000662	2.6	15	CONNECTED	OK
FV-B	VPort P06-1MP-M12-CAM36-T	TACJE1006869	2.6	20	CONNECTED	OK
RV-BR	VPort P06-1MP-M12-CAM36-T	TACJE1006859	2.6	15	CONNECTED	OK
RV-BL	VPort P06-1MP-M12-CAM36-T	TACJE1006872	2.6	15	CONNECTED	OK
CV-B	FD8151V	0002D12528DA	FD8151V-VVTK-0103a	15	CONNECTED	OK

KEY: IC1A = Interior Camera 1A FVA = Forward View Camera A-End
IC2A = Interior Camera 2A FVB = Forward View Camera B-End
IC1B = Interior Camera 1B RVAR = Rear View Side Camera A-End Right
IC2B = Interior Camera 2B RVAL = Rear View Side Camera A-End Left
CVA = Cab Camera A-End RVBR = Rear View Side Camera B-End Right
CVB = Cab Camera B-End RVBL = Rear View Side Camera B-End Left

ERRORS
VDRIVEERROR

LEAD LRV - 1512 CENTER LRV - TRAILING LRV - 1514 Refresh

OPERATING SCREEN FAULT SCREEN MAINTENANCE SCREEN OPERATOR LOG-IN SCREEN CCH SCREEN BRIGHTNESS SWITCH SIDE CAMERA MAINLINE GUIDE

Figure 8-3: NVR Maintenance Screen

8.2.3 Camera Troubleshooting

See Figure 8-5 below for the troubleshooting flow chart for camera errors that are displayed on the TOD.

Note that the interior cameras are equipped with an LED that shows if power is supplied to the camera. See Figure 8-4.



Figure 8-4: Interior Camera Power Indication LED

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8.2.4 Reloading Moxa Camera Configuration

NOTE: All cameras are Moxa cameras with exception of the Cab View Cameras.

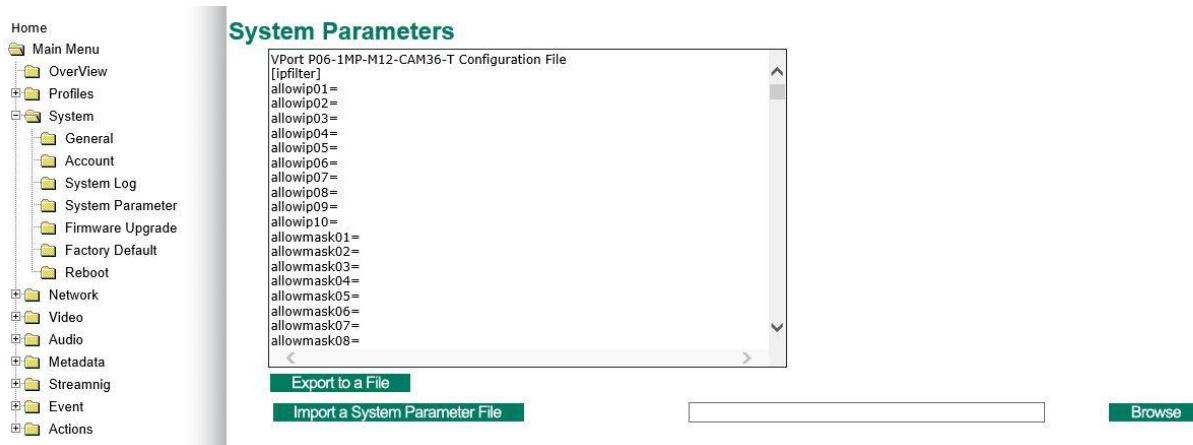
1. Connect a PTU to the vehicle network and navigate to the camera address in Table 7-6.
2. From the overview web page, click the arrow next to system in the navigation bar on the left side of the screen.



3. From the expanded system menu select system.



4. On the system parameters screen, select browse to locate the desired file and then click "import a system parameter file."



5. The system parameters file will upload and then the camera will restart.

8.2.5 Factory Reset Moxa Camera

1. Connect a PTU to the vehicle network and navigate to the camera address in Table 7-6.
2. From the overview web page, click the plus sign next to system in the navigation bar on the left side of the screen.

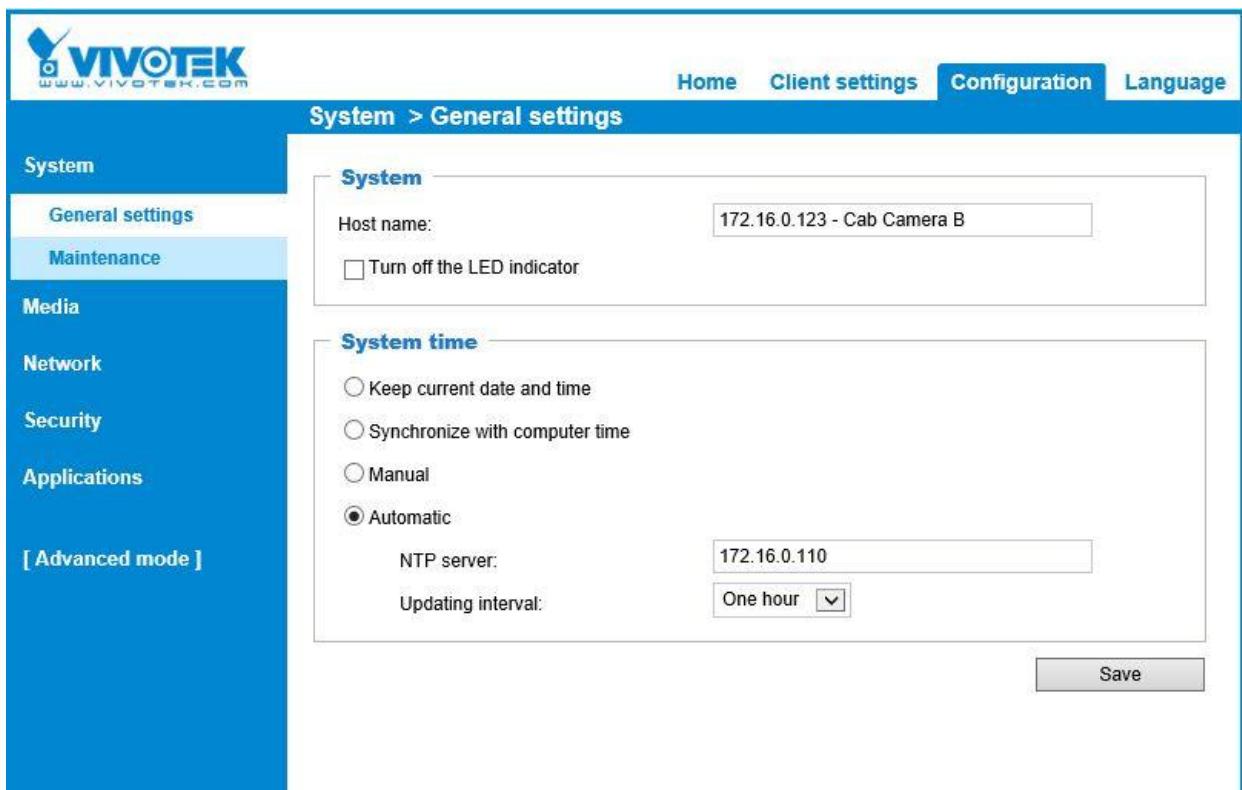


3. From the expanded system menu select factory default.
4. From the factory default screen, click OK.
5. The camera will reboot and all settings will revert to the factory default settings.

8.2.6 Reloading Vivotek Camera Configuration

NOTE: The Cab View Cameras are the only Vivotek cameras.

1. Connect a PTU to the vehicle network and navigate to the camera address in Table 7-6.
2. From the main page select configuration then system and then maintenance as shown on the screen below.



3. From the maintenance screen, select the tab for Import/Export files.
4. Click the browse option for Update configuration file and select the desired configuration file in the ensuing dialog box.
5. The camera will reboot once the configuration has been loaded to the camera.

8.2.7 Factory Reset of Vivotek Camera

1. Remove the camera lid of the Vivotek camera using a tamperproof torx driver.
2. While the camera is powered, depress the hardware reset button shown in Figure 8-6 until the status LED on the camera rapidly blinks then release the button.
3. Once the button is released the camera will reboot and return to the factory default settings.

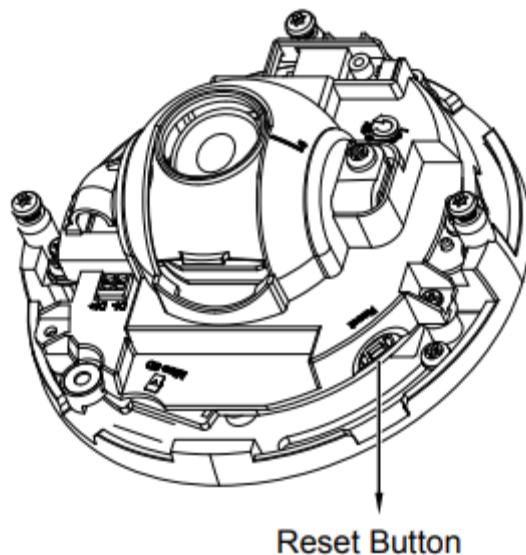


Figure 8-6: Hardware Reset Button Location for Vivotek Camera

8.2.8 VDRIVEERROR Troubleshooting

See Figure 8-7 for the troubleshooting flowchart for VDriveErrors. Note that the VDrive must be Drive D. Following work station instructions ensure that the drives are properly formatted (empty) and that the drives are assigned the proper designation (D-Drive). Missing drives may be due to improper formatting and drive designation assignment.



NVR Hard Drives with Green LED



NVR Hard Drives with Amber LEDs

Note that the LEDs stay predominately green and only flash amber to indicate disc access activity.

8.2.9 Reloading RTC Genetec Application

1. Connect a PTU to the car Ethernet network.
2. Using Internet Explorer navigate to the webpage of the NVR at 10.0.X.111 where X is the car number minus 1000.
3. On the NVR webpage, click the button for upload software.
4. In the ensuing browse menu, select the software that is to be uploaded.
5. Allow the software to upload, the NVR will reboot after the software has been installed.
6. After the NVR has rebooted, perform the functional validation described in Section 8.2.11.

8.2.10 Replacing NVR Hard Drives

1. Ensure that the car is completely powered off.
2. Unlock the hard drive docks on the front left of the NVR with a barrel key.
3. Push the release tabs on the left side of each drive to release the drives. The main tab of the drive tray will release.
4. Remove the drives from the docks.
5. Replace the drives with new formatted drives that are mounted to dock trays. Following work station instructions ensures that the drives are properly formatted (empty) and that the drives are assigned the proper designation (D-Drive).

NOTE: Hard drive must be replaced as pairs. The NVR will not be able to record video if individual drives are replaced.

6. Push the drives in until the main tab starts to lock and then finish the insertion by pushing the locked tabs down.
7. Once the drives are installed, lock the drives using the barrel key.
8. Return power to the vehicle and confirm that the LEDs on the drives turn green and switch between green and amber. Note that the LEDs stay predominately green and only flash amber to indicate disc access activity.

8.2.11 NVR Functional Validation

Once an NVR device has been replaced and configured, the following functional validation should be completed.

A PTU with Genetec Security Desk will be required to complete this process.

1. Once the new NVR has been installed, power the vehicle on and allow it to run for no less than 15 minutes.
2. During this run period, complete the following tasks:
 - a. Press a Passenger Intercom then answer and close the call.
 - b. Pull the emergency door release on any door.
 - c. Set and release the silent alarm on the cab console.
 - d. Turn the propulsion circuit breakers off and engage then quickly disengage the emergency brake mushroom in the active cab. Restore propulsion circuit breaker. (Turning the propulsion circuit breaker off de-energizes the No Motion Relay simulating train motion. EB is only logged while train is moving.)
3. Once the run period has completed, using the PTU, log in to the Genetec Security Desk application on the NVR.

4. Navigate to the video archives and confirm that all cameras are recording and that there are bookmarks for each of the alarms listed above. If bookmarks are not listed, refer to Section 8.2.12 of this manual section for GPIO troubleshooting.
5. On the TOD, navigate to the software version screen and confirm that the correct software version is displayed.

8.2.12 GPIO Troubleshooting

If bookmarks are not present on the NVR then the GPIO must be investigated. The functional validation of the GPIO is below. Bookmarks are set for the following: Emergency Door Release, Emergency Brake at speed, Silent Alarm, and Passenger Intercom. These events are summarized in the TCN Rack B and sent via dry contact to the GPIO of the NVR.

1. Confirm that the B end TCN rack and the MDS both are powered and connected per their respective maintenance sections.
2. With the vehicle stationary in a maintenance area, pull the emergency door release on any door set and note the time.
3. Review the MDS fault log and video to confirm that the Emergency Door Release is displayed. If not, confirm the GPIO wiring as shown on Circuit Sheets 830 and 841.
4. Power the vehicle down (Local OFF) and observe the NVR. Confirm the NVR shuts down after the vehicle has been put into local off. If not, validate the GPIO wiring on circuit sheet 841 and Ethernet RIO 2B functionality as described in Section 1700, Data Communications (TCN) of the Running Maintenance and Servicing Manual.

8.3 TOD Troubleshooting

This section provides information for troubleshooting the Train Operator Displays on the P3010 LRV.

8.3.1 TOD MDS Fault Table

The table below includes the faults that are reported to the MDS by the TOD. These faults include camera faults that are detected and reported by the MDS to the fault tab on the TOD. These same faults are captured on the MDS Fault Log.

Fault Name	Fault Description	Corrective Action
IDDB_MISSING_FLT	The MDS is missing the identification database file	Install missing file on the MDS
IDDB_MDS_OLD_FLT	The MDS identification file is older than what is on the TOD	Install newest file on the MDS
TOD2TOD_COMM_FLT	The TOD is not communicating with the other TOD in cab	Verify network connectivity of the TOD
TOD2WWAS_COMM_FLT	The TOD is not communicating with the WWAS	Check the wiring to the WWAS from the TOD
FTP_COMM_FLT	The TOD cannot connect to the MDS FTP	Verify that the FTP server is running on the MDS. See Communications Equipment Programming Guide for MDS software installation and verification.

8.3.2 TOD General Faults

This section discusses failure modes that preclude communication of failures to the MDS. These failure modes are discussed in the table below.

Symptom	Possible Causes	Remedy
TOD not responsive to touch	The screen is out of calibration or the touch screen is damaged	Inspect the screen for damage
		Recalibrate the TOD as in Section 8.3.4
TOD will not power on	Failure of power to the TOD	See troubleshooting chart Figure 8.3.6
Display color issues	Fault in video drive	Power on and off TOD if power cycle does not fix issue, remove and replace TOD
TOD has no information on the operating screen	The TOD is not communicating with the MVB	Run the MVB test to confirm connectivity, if it passes reboot TOD
		If MVB test fails, troubleshoot Ethernet connectivity
		If Ethernet connectivity is correct, troubleshoot TCN
Cannot access via remote desktop	Communication issue	Attempt Remote Desk Top access several times if this does not allow access, try using FTP to access TOD to restore software, if this does not allow access replace TOD.
Erratic operation or inoperative, Startup-software errors	Software files misloaded or corrupted	Confirm software status. See Section 8.3.3. reload per RMSM Section 8.3.5

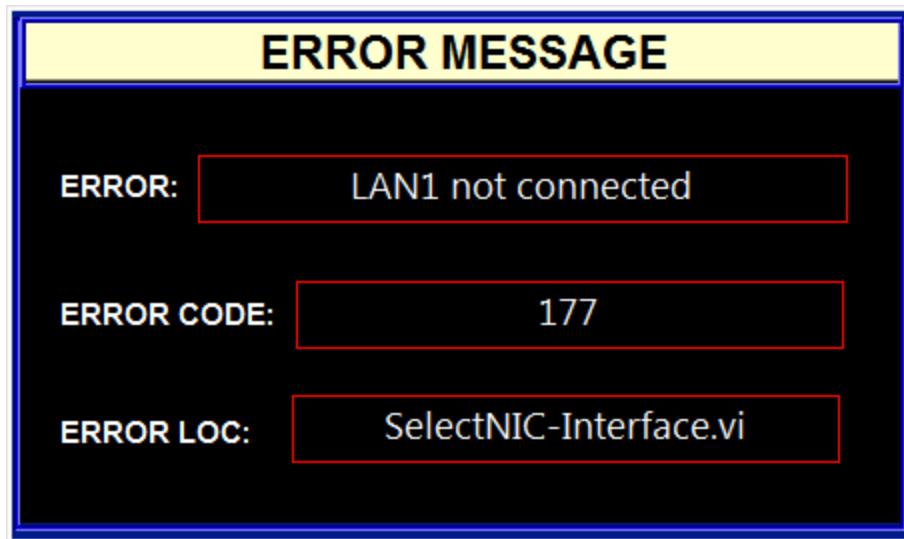
NOTE: FTP (File Transfer Protocol) and Remote Desk Top (Windows Utility) are utilities that are described in the **Communications Programming Guide**.

8.3.3 TOD Startup Failures

On startup there are a small number of failures that will annunciate on the TOD and will not stop the TOD from booting but will cause abnormalities in operation. These faults are discussed in the following section.

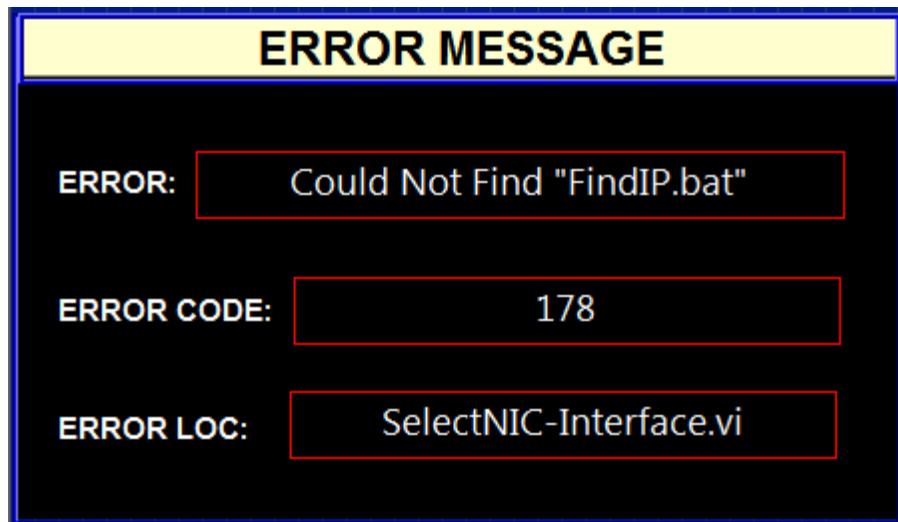
8.3.3.1 LAN1 Not Connected

As seen in the figure below, when LAN1 is not connected, the TOD will show the screen below. Follow the network troubleshooting steps in Section 1700, Data Communications (TCN) of the Running Maintenance and Servicing Manual.



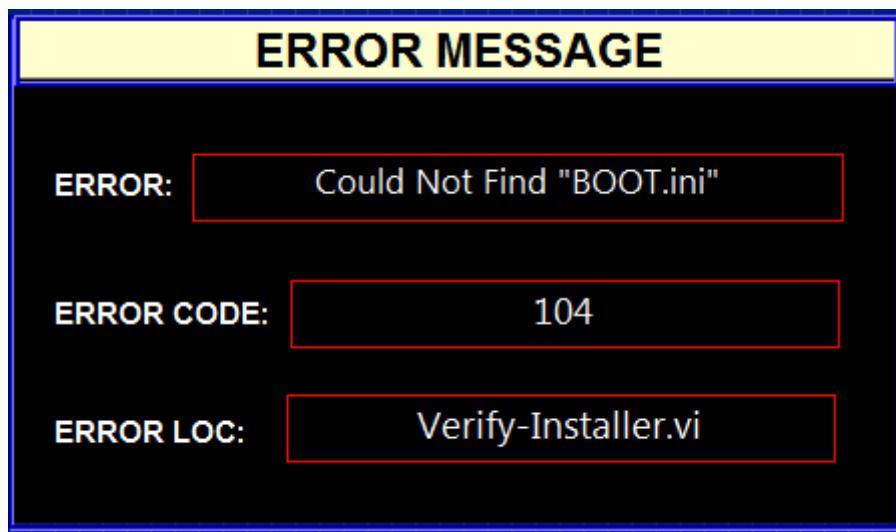
8.3.3.2 Could Not Find FindIP.bat

As seen in the figure below, when the FindIP.bat file is not available, the TOD software should be reloaded as described in Section 8.3.5 of this manual section.



8.3.3.3 Could Not Find Boot.ini

As seen in the figure below, when the Boot.ini file is not on the device the TOD software should be reloaded as described in Section 8.3.5 of this manual section.



8.3.4 Recalibrate TOD Touch Screen

When the TOD is not responding or if the touch does not correspond with touch that is made then the TOD screen must be recalibrated. If the TOD can not be recalibrated the touch screen may be physically damaged.

In order to recalibrate the TOD perform the following steps:

1. Ensure that the TOD is in an inactive cab.
2. Touch and hold the screen on the TOD for 15 seconds or navigate to the calibration screen from the maintenance menu.
3. This will bring up the calibration screen. Follow the on-screen prompts to recalibrate the TOD touch screen.
4. Once the calibration has completed, make the cab active and confirm that the touch screen is responding correctly.
5. If the TOD cannot be recalibrated the screen surface may be physically damaged requiring replacement of the TOD. The TOD screen is a resistive touch screen that very small nicks and scratches can result in the inability to recalibrate.
6. Maintenance calibration screen as seen below:

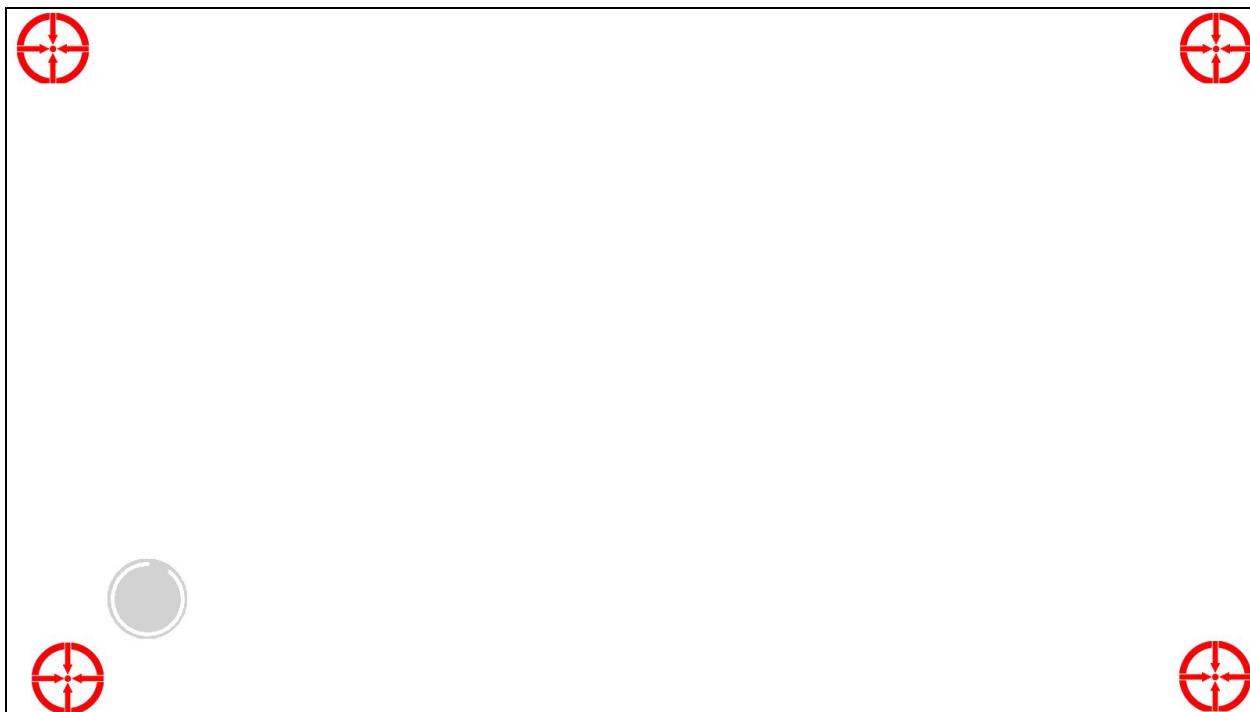


Figure 8-8: TOD Calibration Screen

8.3.5 Reinstalling TOD Software

If the TOD exhibits erratic operation or is inoperative it is possible that the software files are missing or corrupt. Software installation and verification is covered in detail in Section 6.0 of the ***Communications Equipment Programming Guide***.

If detailed instruction is not needed, follow the steps below to reload TOD software.

1. Connect a PTU to the car Ethernet network.
2. Using Internet Explorer, navigate to 10.0.X.Y:8002/P3010/ where X is the car number minus 1000 and Y is the final octet of the desired TOD as listed in the table below.

TOD Final Octet	
Location	Y Value
A End, Right Side	6
A End, Left Side	7
B End, Right Side	8
B End, Left Side	9

3. On the TOD webpage screen enter the super user password in the password box at the top right of the screen to unlock the software upload button.
4. Click the software upload button.
5. On the software upload screen click the browse button.
6. On the dialog pop-up screen select the TOD software to be uploaded.
7. Allow the TOD software to upload, once completed the TOD will reboot and will install the software package.
8. After the software package has installed confirm that all of the signals on the operating screen have populated.
9. Cut-out propulsion, select a direction on the transfer switch and move the master controller to PMAX. Confirm the PBED indicator on the TOD changes to indicate a change in the master controller handle position. Restore propulsion Cut-out after completion of confirmation of PBED change.
10. On the maintenance screen, go to the software versions screen and confirm the correct software version is populating for the uploaded TOD software.
11. On the operating screen, select network status the select the MVB tab.
12. Run the MVB test and confirm that all ports pass.
13. Select the Ethernet tab, run the network test and confirm all addresses pass.

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8.4 Rear View Monitor Troubleshooting

This section discusses the failure modes of the rear view monitor. The failure modes are discussed in the table below.

Symptom	Possible Causes	Remedy
Rear view monitor blank	Either the power or the VGA cable is not connected to the display	Confirm the breakers are in the correct position
		Confirm the power connections to the rear-view display
		Confirm the VGA cable connections at the rear-view display and the TOD
Rear view monitor is discolored	The VGA cable is either bad or not seated correctly	Reseat the VGA cable connections at the monitor and the TOD
		Replace the VGA cable
Rear view monitor is at the wrong resolution	The native information display is not being provided to the TOD	Cycle the power to the rear-view display
		Cycle power to the impacted TOD
		Reseat the VGA cable
		Replace the VGA cable
		Replace the display
Rear view monitor is blank and camera is being display on TOD	The TOD is not recognizing the rear-view display	Confirm the rear-view display is powered on
		Confirm the VGA cable is fully seated at both the monitor and the TOD
		Cycle power to the TOD
		Replace the rear-view monitor
		Replace the TOD

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CHAPTER 9.0

VIDEO EXPORT USING PTU

9.1 Introduction

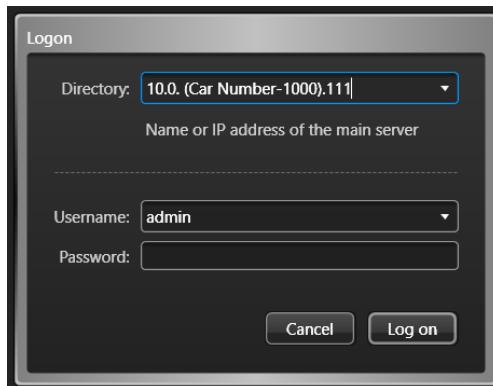
This section will discuss the exporting of video from the wireless wayside and also will discuss exporting individual videos, groups of videos or multi-window exports.

9.2 Connecting to NVR Server

Connect a PTU with the Security Desk software to the vehicle Ethernet network via Ethernet cable and open the Security Desk and connect to the database using the vehicle NVR credentials:

Directory: 10.0.(Car Number-1000).111.

Username: admin



9.3 Accessing Video Archives

From the main screen of Security Desk, select the archives tile as shown below. This will take the user to the Video Archives search screen (Figure 9-1). For a brief explanation of the NVR Workstation Video Viewing Controls, refer to Appendix A.

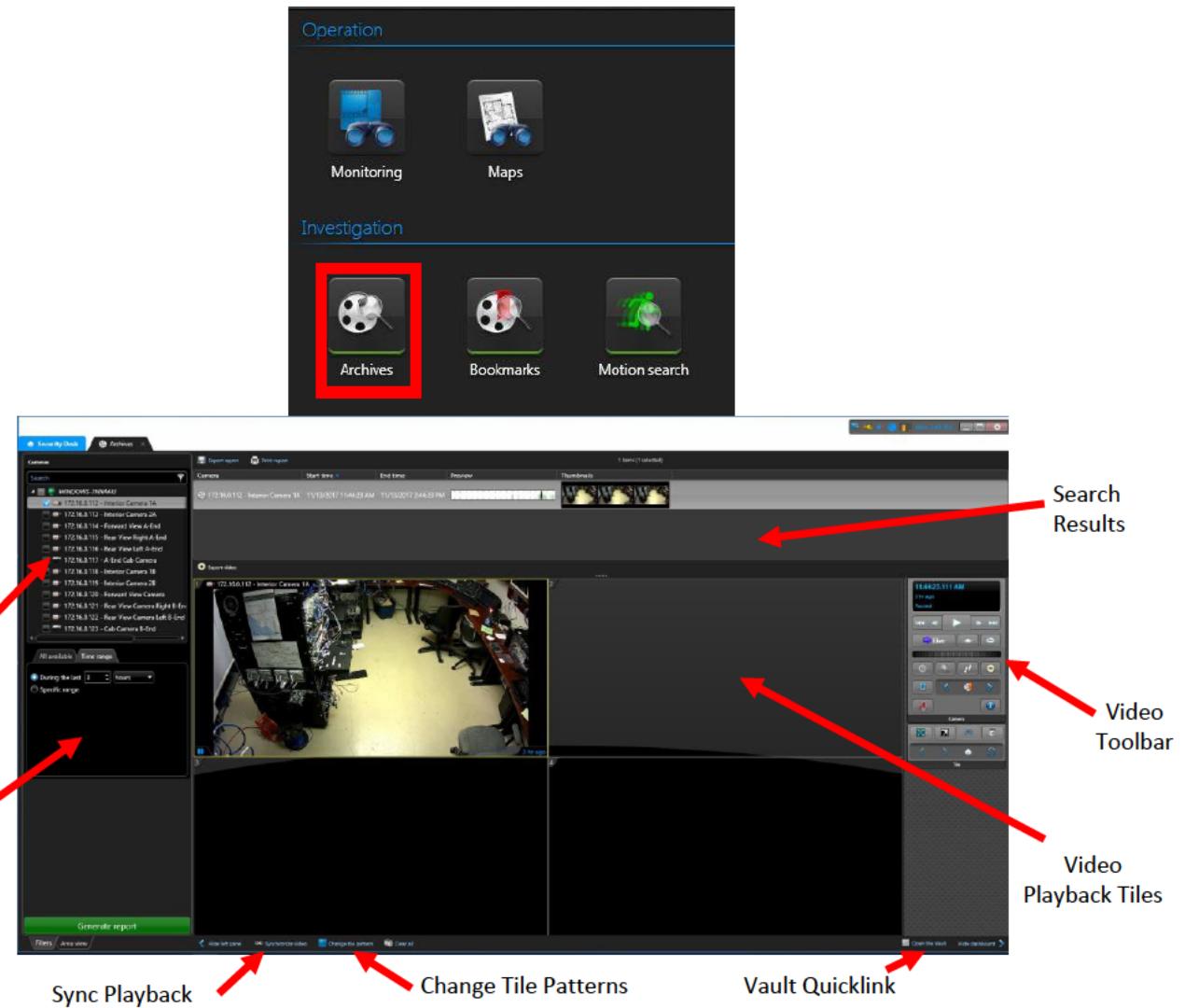


Figure 9-1: Video Archives Screen

9.4 Select Cameras, Time and Search

1. On the left side of the archive screen there are two frames, the camera selection frame and the time search frame below it. The default selection will have the search to “all available”.
2. Click the time range tab (Figure 9-2), highlighted to the right in order to conduct a time search.
3. Input the desired time range and then check select the desired cameras in the window above.
4. Click the “Generate report” button at the bottom of the window.

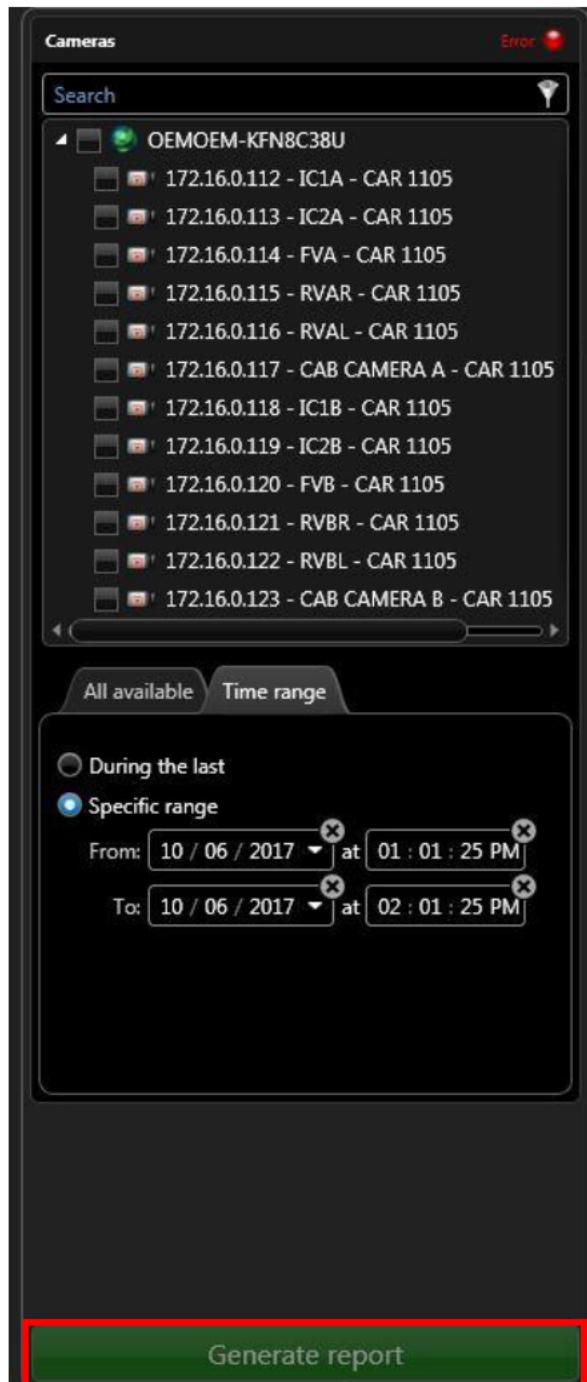
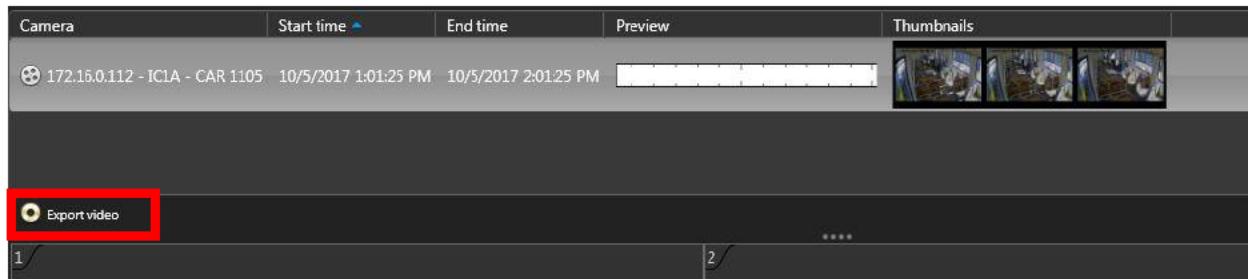


Figure 9-2: Time Range Tab

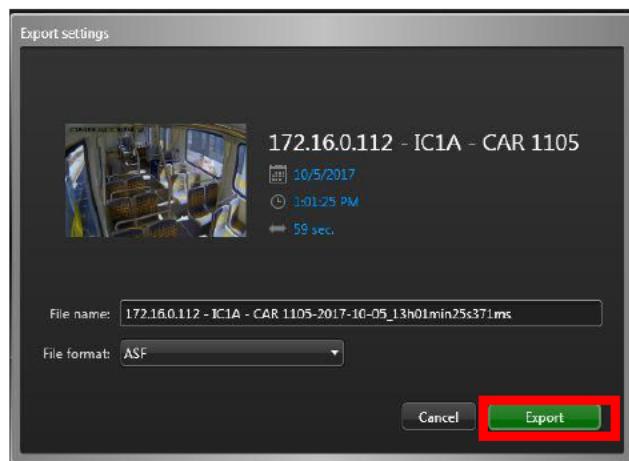
9.5 Exporting Video – Single Video, Queried Time

1. The search results will appear in the window to the right of the camera and time search.
2. Click the video to highlight the desired video and time frame, then click the export video icon highlighted below.
3. This will open the export dialog box for the period listed in the query.



9.6 Video Export Dialog Box

1. Clicking the export video icon will bring up the export dialog box shown below.
2. The video can be exported in the following file formats:
 - All cameras can be exported in G64x and will require the viewer to have the Genetec Video Player
 - All cameras without audio (exterior and forward view cameras) can be exported in mp4
 - All cameras with audio (interior and cab) can be exported in asf, they CANNOT be exported in mp4
3. Once the format has been selected press Export as highlighted below.



4. Once the export starts the export icon will appear in the top tool bar (Figure 9-3). The user can hover over this icon and get updates on the progress.



Figure 9-3: In Progress

5. When the Export is complete the icon will change to a green check mark (Figure 9-4). Click the dialog for more info to bring up the more details screen (Figure 9-5).

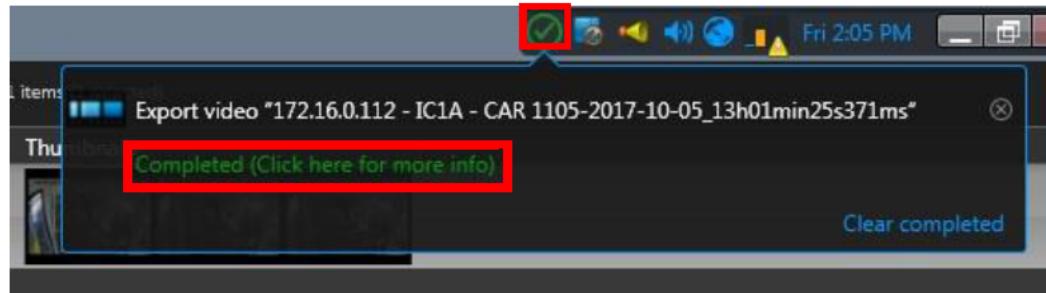


Figure 9-4: Export Completed

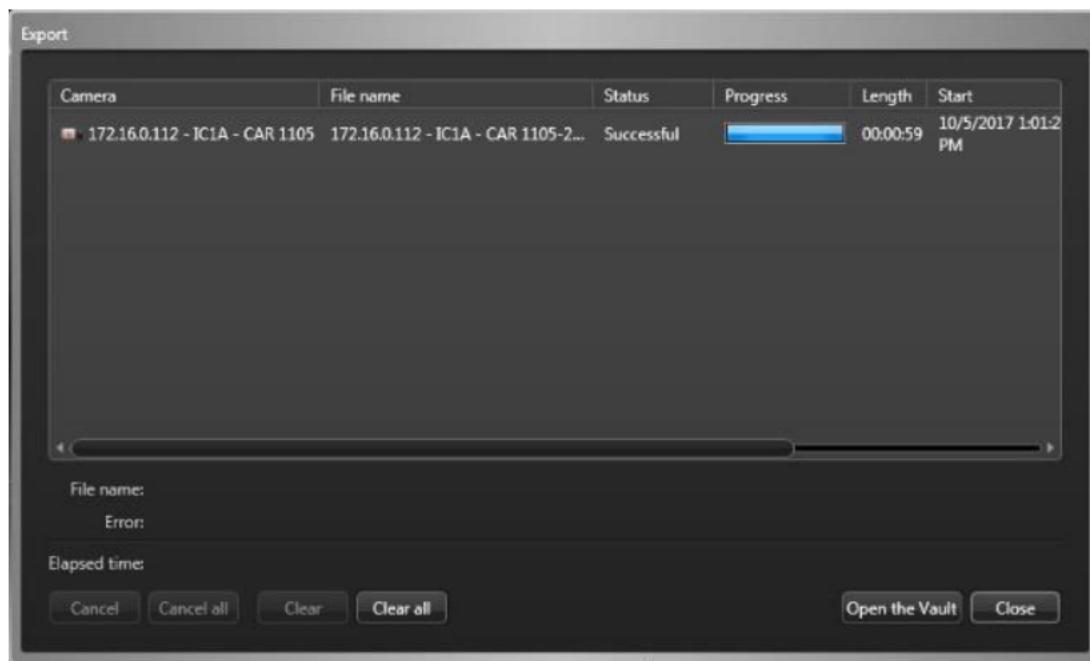
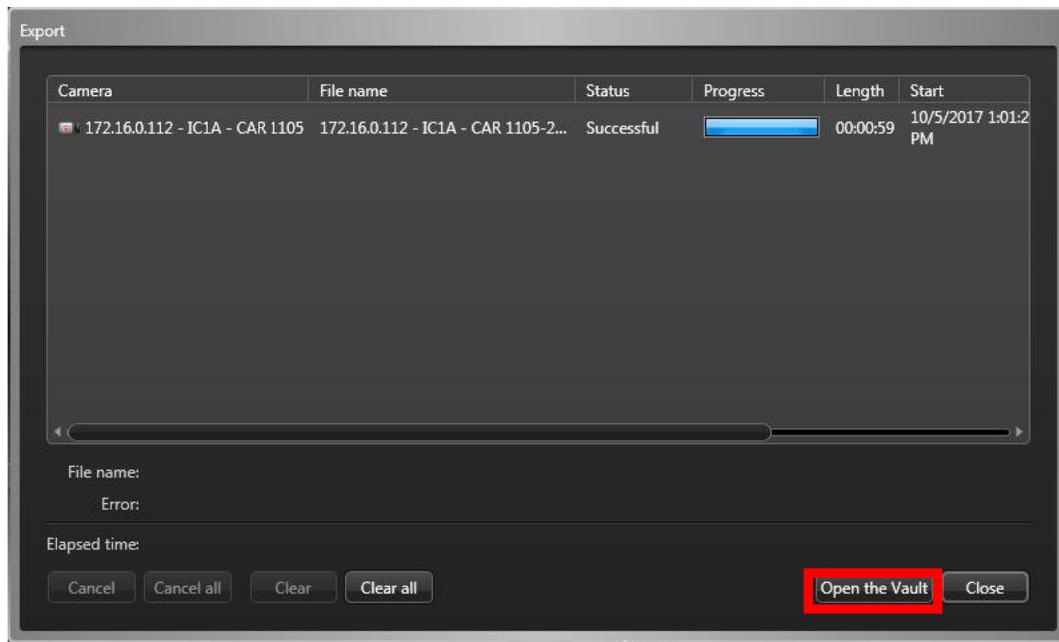


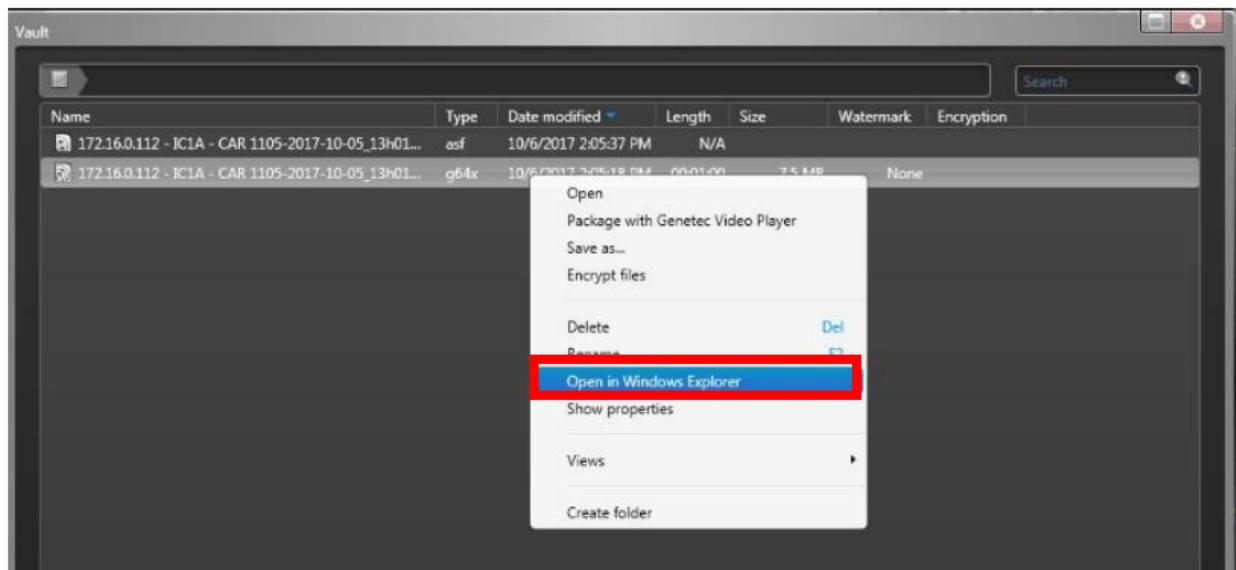
Figure 9-5: More Details Screen

9.7 Moving Exported Video

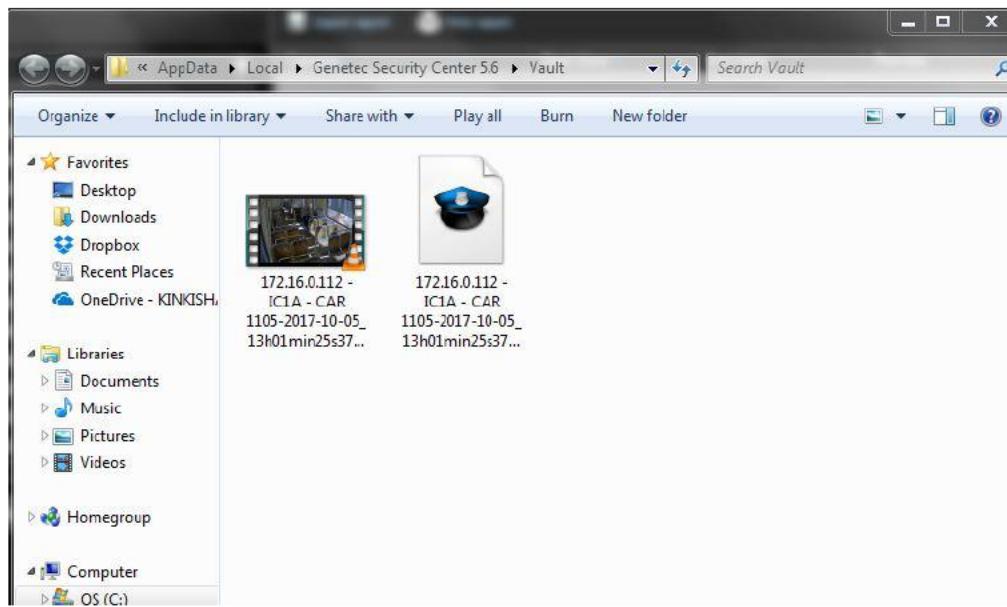
1. From the vault screen, right click the file to be moved.



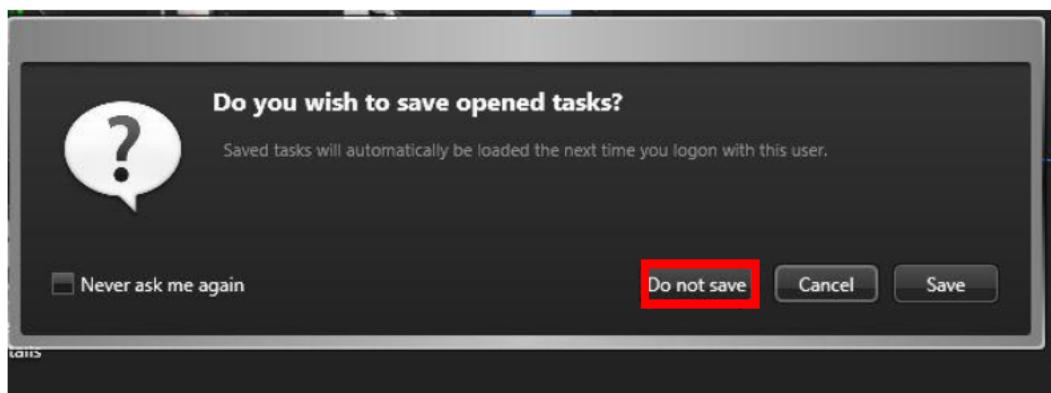
2. Right click the video of interest and click "Open in Windows Explorer" as shown below. This will open the vault on the local machine.



3. From the local machine, move the video to the media for export (USB drive, etc.).



4. Once the video has been transferred, delete the exported video from the local hard drive.
5. Close the Security Center application and click "Do Not Save" when prompted on exit.



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APPENDIX A

NVR WORKSTATION VIDEO VIEWING CONTROLS

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NVR Workstation Video Viewing Controls

The following figure shows the controls on the NVR Workstation Video Viewing Controls Screen.



Figure 1 – Video Viewing Controls Screen

The table below details the function of each of the buttons shown in Figure 1 above.

	Rewind video playback by 2x, 4x, 6x, 8x, 10x, 20x, 40x and 100x with each click
	To start video playback of a selected tile or return video to standard playback speed
	Pause video playback of a selected tile
	Fast forward video playback by 2x, 4x, 6x, 8x, 10x, 20x, 40x and 100x with each click
	Jump to live video (only available when connected to an LRV)
	Slows video playback to 1/8 speed
	Loop playback so the video restarts once the end is reached
	Go to specific time (only available when connected to an LRV)
	Object quick search (not implemented)
	Save video in another format

	Save a snapshot of the video frame
	Move between video bookmarks
	Enable/disable audio playback (only available on cameras with microphones)
	Toggle digital zoom
	Display detailed video information (resolution, frame rate, etc.)
	Maximize tile to full tile (takes entire tile frame area)
	Maximize tile to full screen (takes entire monitor)
	Open monitoring task (only available when connected to an LRV)
	Clear video tile

Video Viewing Toolbar Controls

The following details the controls at the bottom of the Video Viewing Controls Screen. See Figure 2 below.



Figure 2 – Controls at the Bottom of the Video Viewing Controls Screen

The table below details the function of each of the buttons shown in Figure 2 above.

 Synchronize video	Synchronizes all video tiles to the same time as the selected video tile
 Change tile pattern	Change the tile pattern for video being displayed
 Clear all	Clear all video tiles
 Open the Vault	Open the vault on the local computer