

Newark Installation and Procedure Package

For LAAS/GBAS Ground Based Performance Monitor

(GBPM)



November 25, 2009

Department of Transportation
Federal Aviation Administration

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1.0 INTRODUCTION

This package was developed to document the physical installation and structural layout of the Newark LAAS/GBAS Ground Based Performance Monitor. The documentation includes a complete hardware component list as well as full wiring schematics that include GBPM structural dimension, power distribution, GPS and network shelf configuration, PCtel and optional BAE antenna specifics, full system design, and the T1 communication network installed for the Newark International Airport remote site.

It should be noted here that the LAAS/GBAS Ground Based Performance Monitor currently resides in Room 216 of Building 80 located within the airport vicinity.

Appendix A of this installation package includes images of the completed rack in its present field configuration. Please refer to Appendix A for visual stimulus as necessary.

Appendix B of this installation package includes images of the full system installation at Newark International Airport. Please refer to Appendix B for visual stimulus as necessary.

Appendix C of this installation package includes the data sheet and installation manual for the Gentex Photoelectric Type Commercial and Residential Smoke Alarm.

Appendix D of this installation package includes the ballast roof mount equipment package hardware component list and applicable specifications.

2.0 Title Terminology

The FAA's Local Area Augmentation System (LAAS) is also referred to as a GPS Ground Based Augmentation System (GBAS), in the international standards documents. To keep a consistent terminology the term LAAS will be used in this document. The FAA developed a non-Federal Specification (non-Fed Spec) for the system – the specification uses the term LAAS.

The international terminology is GBAS, the terms are interchangeable.

3.0 Newark LAAS/GBAS Performance Monitor Boot-up Procedure

Turn the UPS Power Supply to the **on** state by pressing the power button located the front of the unit, which is facing the rear side of the Newark Ground Based Performance Monitor.

Turn the Un-UPSed Power Strip to the **on** state by pressing the power switch located on the front of the unit, which is facing the front side of the Newark Ground Based Performance Monitor.

Flip the KVM into position and power on; utilize Console 6 (**ctrl + alt + 6**) for this will allow the user to access the display.

In order to change the working directory to that of the LAAS code scheme, type **cd Cat3gbpm** into the command prompt.

In order to begin, type **./go** or **go** into the command prompt.

The user will be prompted to ascertain if the individual is ready to begin, type **Y** or **y** to approve.

The user will be prompted to select a site from a list, in this case; select **2** for Newark.

4.0 Newark LAAS/GBAS Performance Monitor On-site Data Collection

It is important to note that these instructions are based upon the idea that the user is on-site at Newark International Airport, the appropriate portable media device is utilized for local data collection, and that the Ground Based Performance Monitor is powered on and collecting data.

The IP address for the Newark portable media device is: 192.168.4.50
The working directory of the Newark portable media device is labeled as: Share1
Should this device be unavailable, any portable media will complete the task as needed.

Flip the KVM into position and power on; utilize Console 6 (**ctrl + alt + 6**) for local data collection.

Using standard Ethernet, plug the Newark portable media device into the 8-port network switch located on the Network Shelf of the Ground Based Performance Monitor.

Using the KVM, create a local network and ftp to 192.168.4.50 in order to access and create a share to the Newark portable media device.
(If a different portable media device is being used, ftp to the appropriate IP address.)

Log into the device by typing **Login** in the command prompt and then enter the username and password of the Newark portable media device as instructed. It is important to note that this information is located on the device for convenience only.

In order to change the working directory to that of the portable media device, type **cd Share1** into the command prompt.

In order to enable binary data transfer mode, type **binary** into the command prompt.

In order to turn interactive mode to the off state, type **prompt** into the command prompt.

In order to access the correct sub-directory and initialize data transfer, type **lcd /temp7** into the command prompt.

In order to start data transfer, type **mput ./1119*** into the command prompt and await completion.

Once all data has been collected and stored onto the portable media device, type **quit** into the command prompt in order to terminate the data collection process.

Disconnect the Newark portable media device, power down the KVM, and flip back into the Ground Based Performance Monitor if needed.

5.0 Newark LAAS/GBAS Performance Monitor Remote Data Collection

It is important to note that these instructions are based upon the idea that the user is off-site and that the Ground Based Performance Monitor is powered on and collecting data.

The IP address for the Newark QNX Central Processing Unit is: 192.168.4.21

Flip the KVM into position and power on (or activate auxiliary computer console); utilize Console 6 (**ctrl + alt + 6**) for remote data retrieval.

The user will be prompted to select a remote site from a list, in this case; select Newark.

At any time, type **cd temp7** into the command prompt in order to view the data attributed to the selected remote site, in this case; Newark.

In order to telnet and access data from the Newark remote site, type **telnet 192.168.4.21** into the command prompt.

Log into the Newark remote site by typing **Login** in the command prompt and then enter the username and password of the Newark Ground Based Performance Monitor as instructed.

Use *ditto* to access the desktop of the Newark remote site by typing **ditto -k -q /dev/con6** into the command prompt.

Once all data has been collected and stored, hold **ctrl** and type **e** into the command prompt in order to terminate the remote data retrieval process.

In order to exit telnet and return to the local desktop, hold **ctrl** and type **d** into the command prompt.

6.0 Pulling Data from the Newark LAAS/GBAS Performance Monitor Hard Drive

It is important to note that these instructions are based upon the idea that the user is off-site and the appropriate hard drive is utilized for pulling the data.

The IP address for the Newark hard drive is: 192.168.1.53
The working directory of the Newark hard drive is labeled as: Share1
The Newark hard drive is located in the LAAS Laboratory in Building 301 of the William J. Hughes Technical Center.

Using standard Ethernet or other media type (i.e. serial link), plug the Newark hard drive (containing data) into the individual computer console that the user wishes to transfer and store the data.

(The process of pulling data from the Newark hard drive is *not* OS specific; translate this instruction set as needed per OS.)

Using the computer console, create a local network and ftp to 192.168.1.53 (or other) in order to access and create a share to the Newark hard drive.

Log into the device by typing **Login** in the command prompt and then enter the username and password of the Newark hard drive as instructed. It is important to note that this information is located on the device for convenience only.

In order to change the working directory to that of the Newark hard drive, type **cd sls** into the command prompt.

In order to enable binary data transfer mode, type **binary** into the command prompt.

In order to turn interactive mode to the off state, type **prompt** into the command prompt.

In order to access the correct sub-directory and initialize data transfer, type **lcd /Desk*** into the command prompt.

In order to start data transfer, type **mget ./1031*.acr** into the command prompt and await completion.

Once all data has been collected and stored onto the computer console, type **quit** into the command prompt in order to terminate the data collection process.

Disconnect the Newark hard drive and utilize the now collected data as needed.

7.0 Loading Software to the Newark LAAS/GBAS Performance Monitor

It is important to note that these instructions are based upon the idea that the user is on-site at Newark International Airport and that the Ground Based Performance Monitor is powered on and collecting data.

There exists a two line script used to auto start the LAAS code scheme during CPU boot-up, the script is documented below:

```
cd /Cat3gbpm
/Cat3gbpm/go</dev/con6>/dev/con6&
```

This two line script will run the current software on the Ground Based Performance Monitor.

There are three sub-directories that software is to be maintained, they are listed below:

- temp7 Includes running and archived data
- Cat3gbpm Includes currently running software
- GBPMzip A directory used to zip all versions of utilized software

There are three sub-directories that handle applicable file transfer, they are listed below:

- WebOutput Includes files that will be input for the website display
- datazip Includes files that are zipped from the ftp data transfer
- dataFTP Includes files that are currently being transferred

Should additional software need to be installed, see the above sub-directories as needed.

8.0 Newark LAAS/GBAS Performance Monitor Hardware Component List

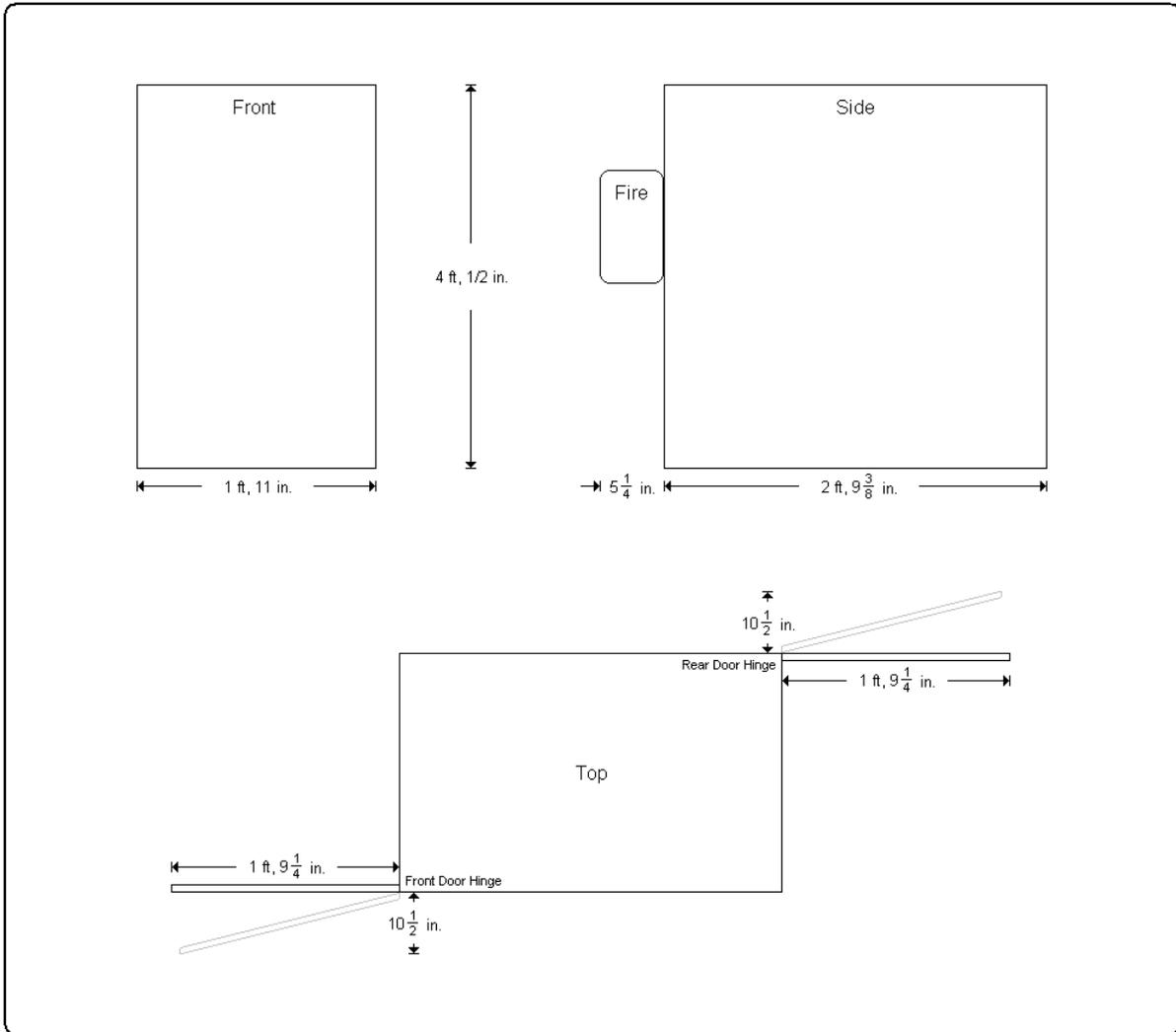
Description	Specifications	Model / Part Number
Buckeye Fire Equipment Extinguisher (With Mount)		5H 5A HALOTRON 1
Gentex Corporation Photoelectric Type Commercial & Residential Smoke Alarm		7109CS / CSX & 7109LS
Sunon Impedance Protected Exterior Mounted Fans (x2)	115 V ~ 50-60 HZ 0.21 / 0.18 AMP	SP101A 1123HST.GN
KVM-P17-TP	100-240 V ~ 50-60 HZ 1.1 AMP	S919691008151-0609N002
CISCO Systems 2811 Series Integrated Service Router		SNFTX1028A518
CISCO WIC Interface / Network Card (x4)		WIC-1DSU-T1-V2
Network Enabled Power Distribution Unit	120 V ~ 60 HZ	PDUMH15ATNET

Newark Installation Package, GBPM, 25 November 2009

	15 AMP	
TrippLite 12 Outlet un-UPS Power Strip	120 V 15 AMP	RS-1215-RA AGIP120V61PRM
Becker VDB Receiver RS 4909 A	114.525 MHz	(8004) 0602970000968711
Laird Mobile-to-Base Converter for 800 / 900 MHz w/ N (x6)		MBC800
Laird VHF ¼ Wave 66-174 MHz Unity Gain Antenna 51" NMO (x6)	114.525 MHz Cut to 24 + 4/32"	B66
Super Logics QNX Central Processing Unit		5L-2U-AT-945GC2-BA
AccelePort 8r 920-PCI DB25 Card/Cable		(1P) 70001362
APC Smart UPS	120 V ~ 50-60 Hz 12 AMP	1500 1440VA 980W
Lascar Adjustable Power Supply	1.5-30 V 1.0 AMP	PSU 130
NovAtel GPS Receiver / WAAS	DL-4	41017296
GPS Networking Incorporated T-Splitter		LDCB51X2
Mini-Circuits Bias-Tee RF-Splitter	10-4200 MHz	ZFBT-4R2G RF091500429
QVS Surge Protected Power Strip		No requirement
Data RS232-RS485 Converter	2000 V Isolated	IC-Q8551
PPS RS232-RS485 Converter	2000 V Isolated	IC-Q8551
3COM Office Connect Dual Speed 16 Plus Network Switch		No requirement
1U 12" Vented Component Shelf		1906-3-221-01
3U 12" Vented Component Shelf		1906-3-221-03
PCTel GPS Antenna, DC Block, Passive Splitter	As configured on: 10/28/2009	No requirement
* BAE GPS Antenna, L1/L2 Filter, Pre-Amp	As configured on: 10/28/2009	No requirement
Ballast Roof Mount Installation Package	See Appendix C	See Appendix C

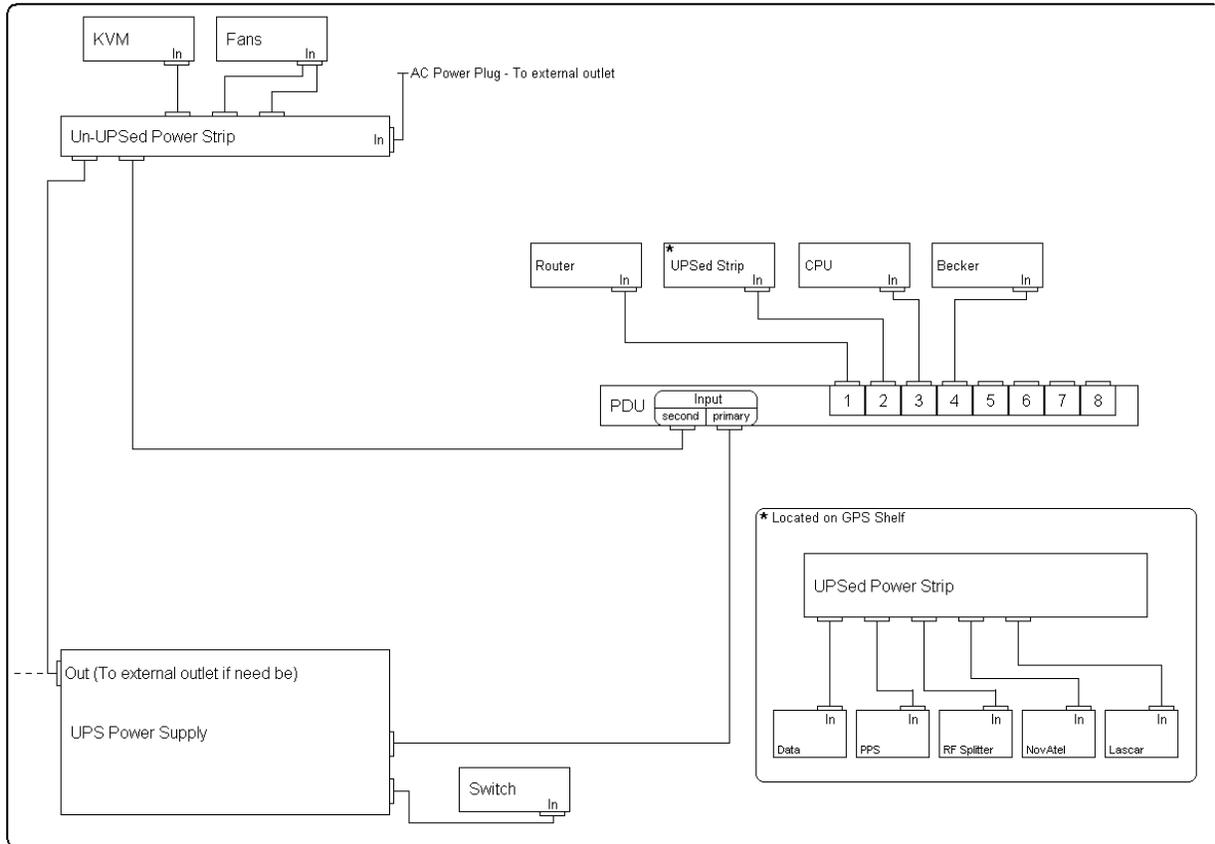
* May be an option for future usage

9.0 Newark LAAS/GBAS Performance Monitor Structural Dimensions/Scope



It is important to note that the fire hydrant face represents the front of the LAAS/GBAS Ground Based Performance Monitor and should be noted during installation.

10.0 Newark LAAS/GBAS Performance Monitor Power Distribution Schematic



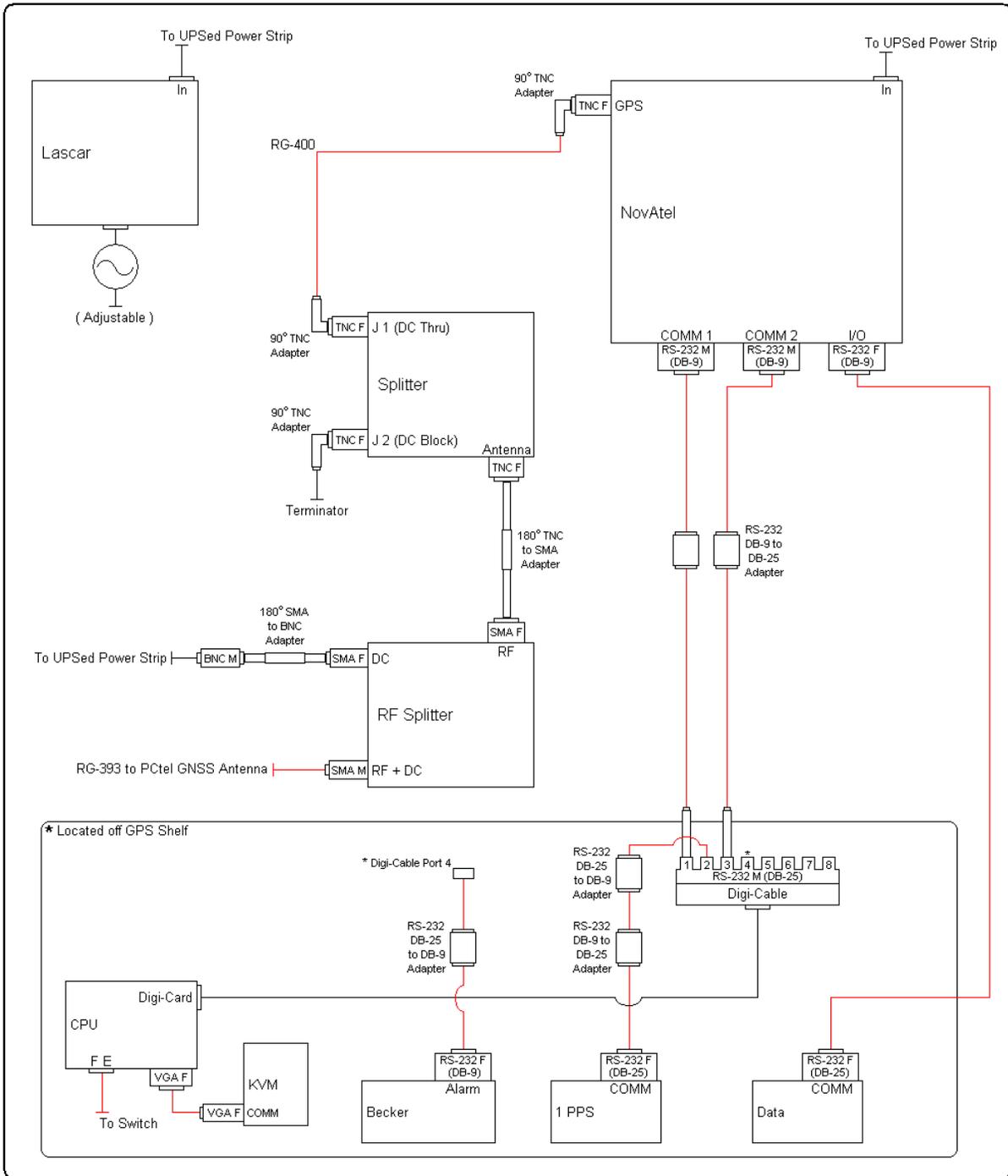
It is important to note that the term “PDU” refers to the network enabled power distribution unit located within the LAAS/GBAS Ground Based Performance Monitor.

It is also important to note that Ports 5 through 8 on the PDU are currently deactivated and can not be utilized for the existing configuration.

All power distribution wiring consists of standard HP power cables provided with the shipment packages as described in the hardware component list.

On occasion, several power cables were modified in terms of length in order to reduce the clutter within the performance monitor itself, however; this is not a requirement.

11.0 Newark LAAS/GBAS Performance Monitor GPS Shelf Schematic



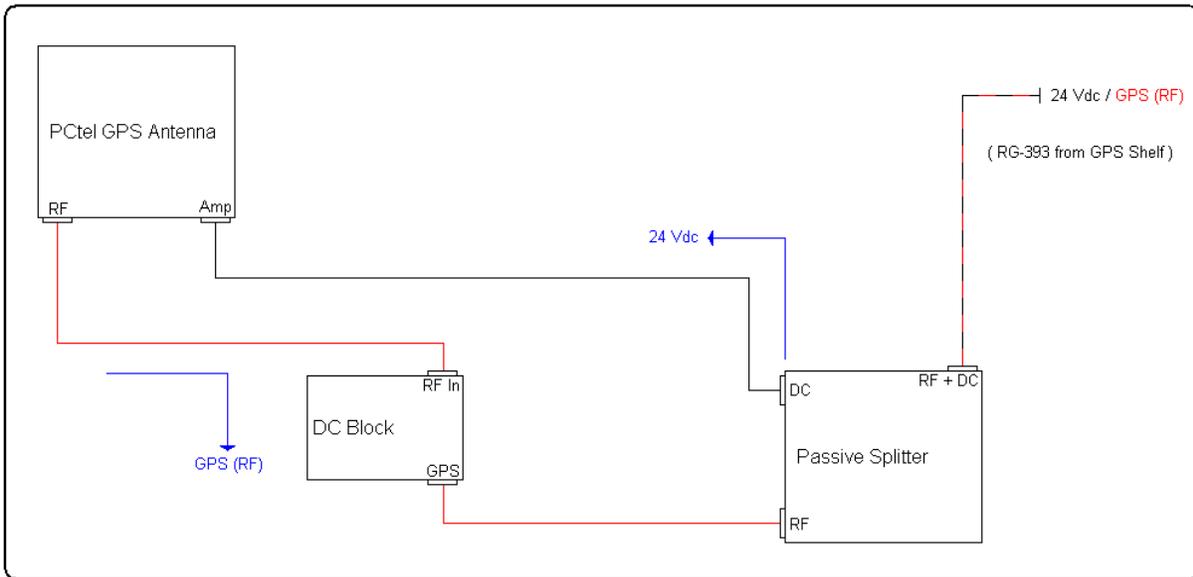
It is important to note that the Digi-Cable is an 8 port DB-25 concentrator serial cable.

It is also important to note that Ports 5 through 8 on the Digi-Cable are currently not in use and will not be utilized for the existing configuration.

For a comprehensive description of the Digi-Cable, please refer to the datasheet as provided here: http://ftp1.digi.com/support/documentation/90000253_E.pdf

For a comprehensive description of the Digi-Cable, please refer to the datasheet as provided here: http://ftp1.digi.com/support/documentation/90000253_E.pdf

13.0 PCTel GNSS Antenna Specifics including Feed Configuration Roof-side



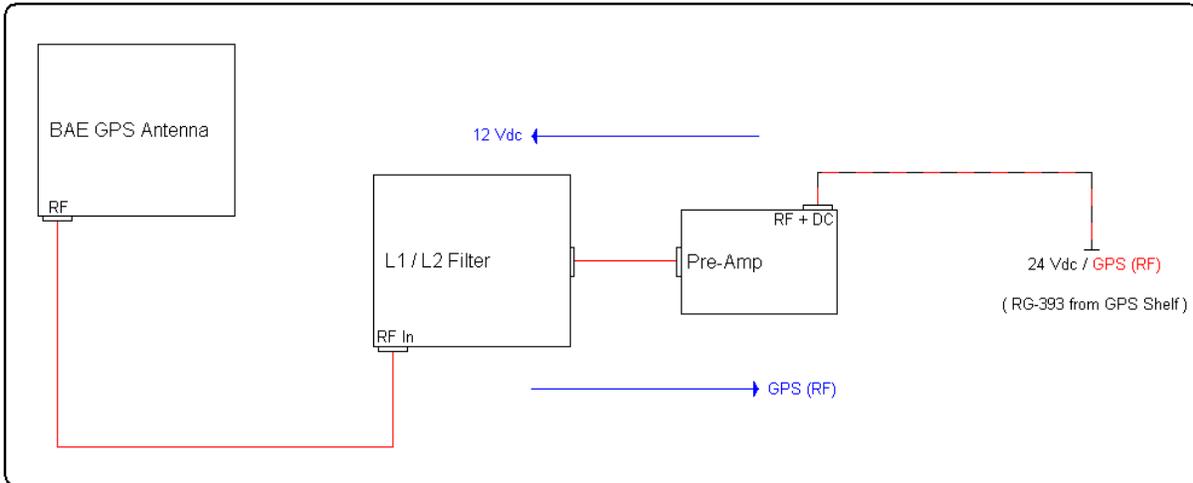
The surveyed position for the PCTel GNSS Antenna is documented as follows:

$N40\ 42'\ 16.89443'' = N40.7046929 = 0.710430912$ radians
 $W74\ 9'\ 13.91312'' = W74.15386476 = -1.294229093$ radians
 Ht: -18.372m (HAE) = 13.857m (MSL)

The PAC utilized the EWR-F NovAtel Pinwheel as required. The Slant Instrument height was exactly 142 cm ~ 10:21 am 10/20/09 run > 2hrs.

Also, the PCTel Antenna above the roof level (to bird spike) was exactly 242 cm.

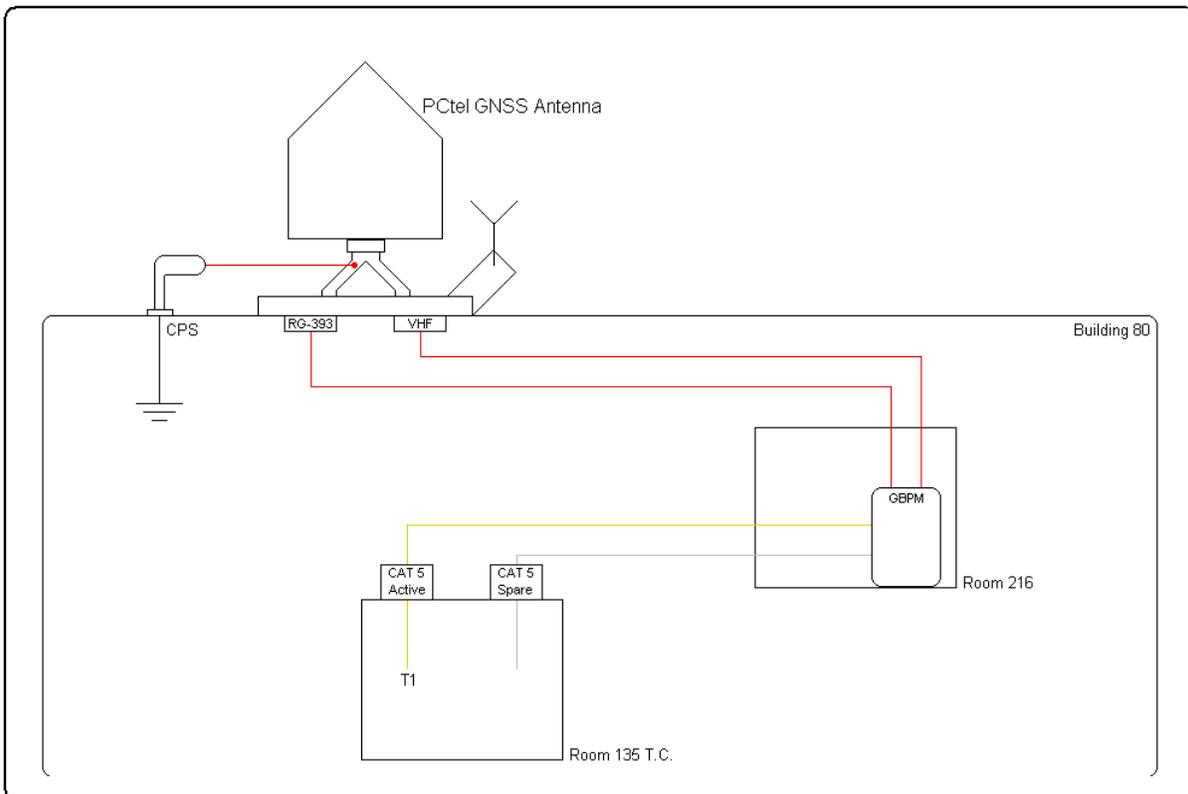
14.0 BAE GPS Antenna Specifics including Feed Configuration Roof-side



It is important to note that the BAE GPS Antenna is currently an option for future usage.

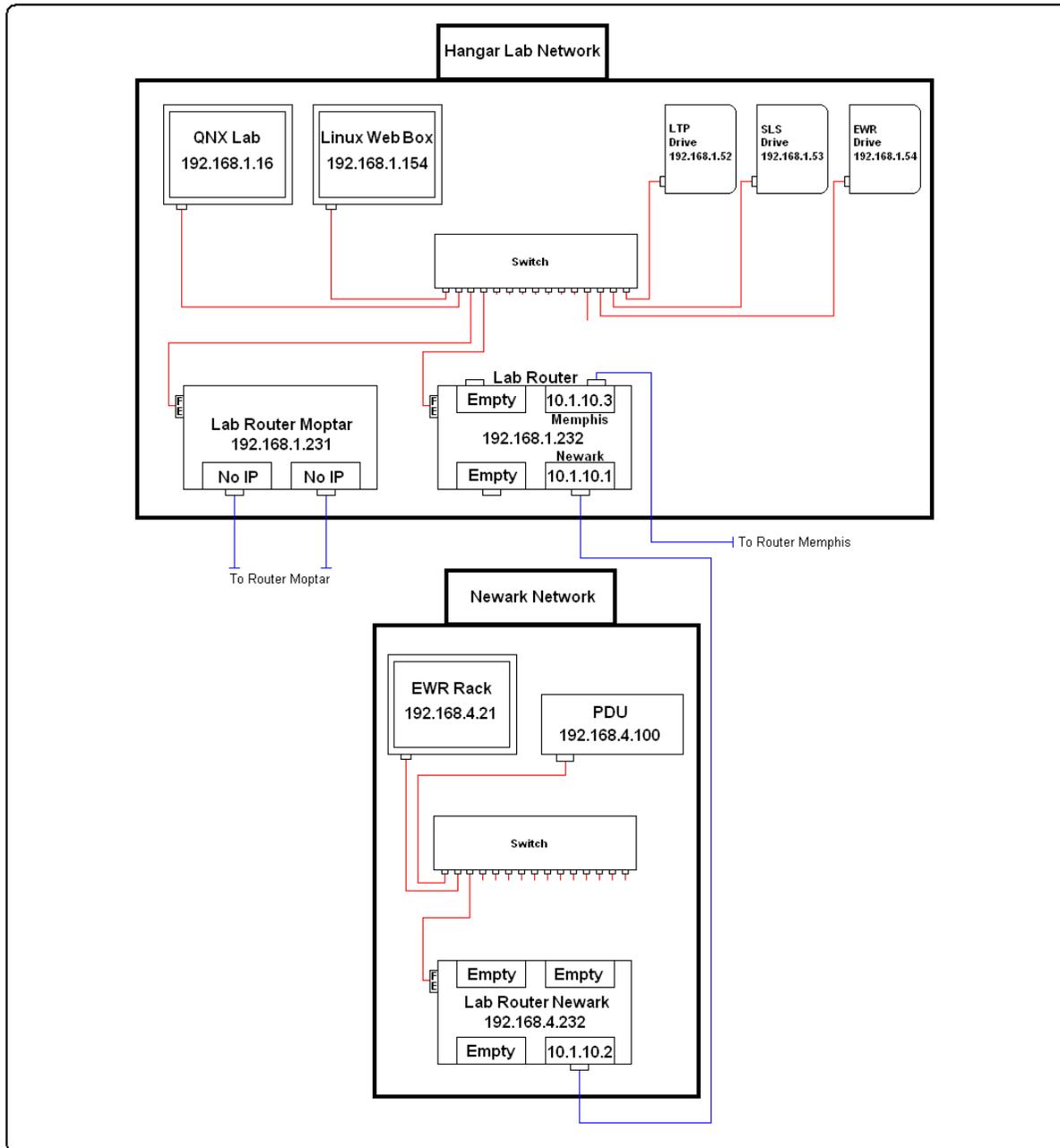
15.0 Newark LAAS/GBAS Performance Monitor Full System Design Summary

Now that the LAAS/GBAS Performance Monitor's physical construction has been fully documented in great detail, we can summarize the installation as shown below.



It is important to note that this full system design summary does not include the BAE GPS Antenna configuration as it is only to be used during future endeavors.

16.0 Newark LAAS/GBAS Performance Monitor Communication Network



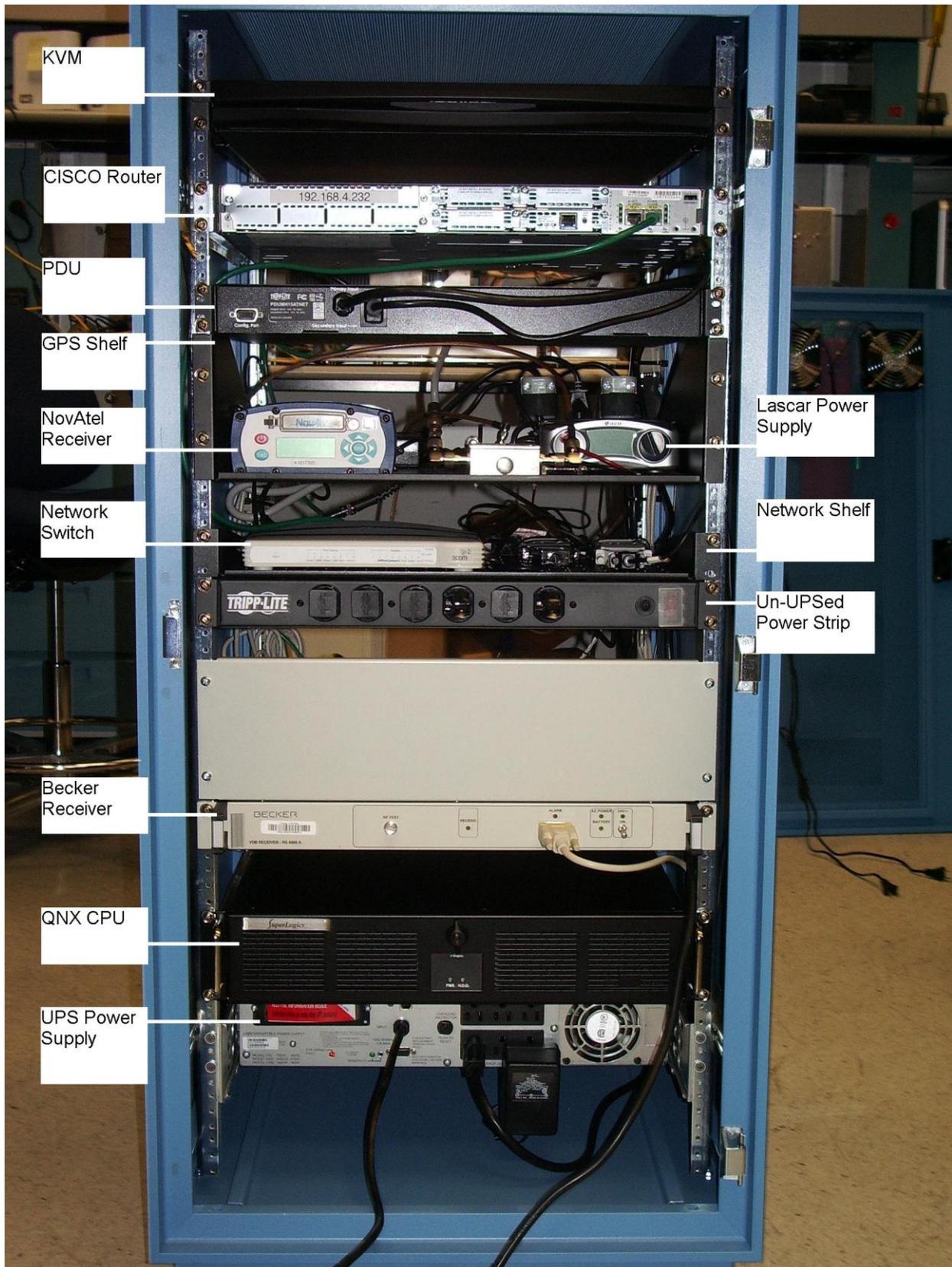
The Newark LAAS/GBAS Performance Monitor Communication Network as documented above illustrates the existing configuration and may be subject to change.

Appendix A:

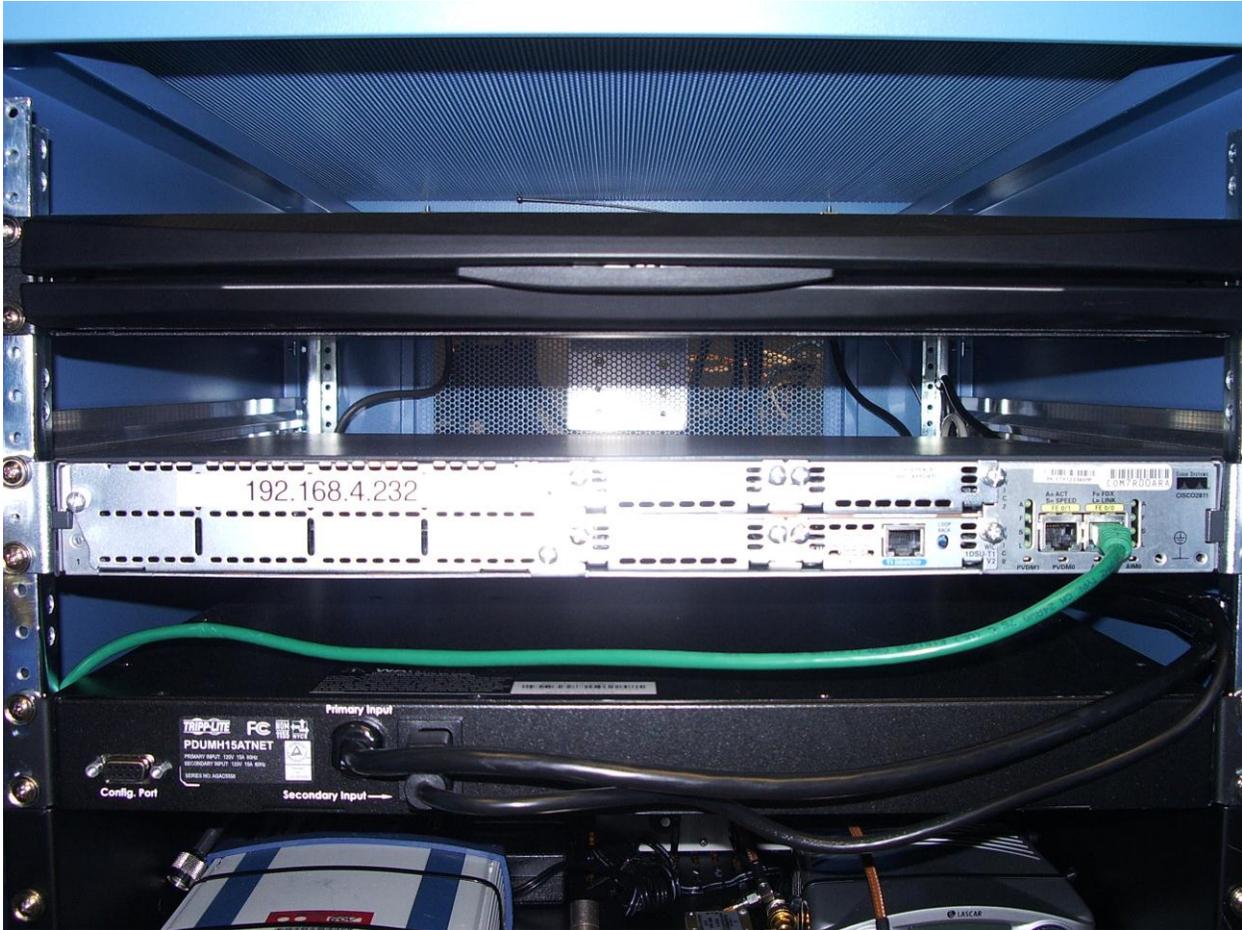
Newark LAAS/GBAS Performance Monitor Images in the Current Field Configuration



Newark LAAS/GBAS Rack Exterior (Front: Fire Extinguisher Door, Rear: Fire Sensor Door)



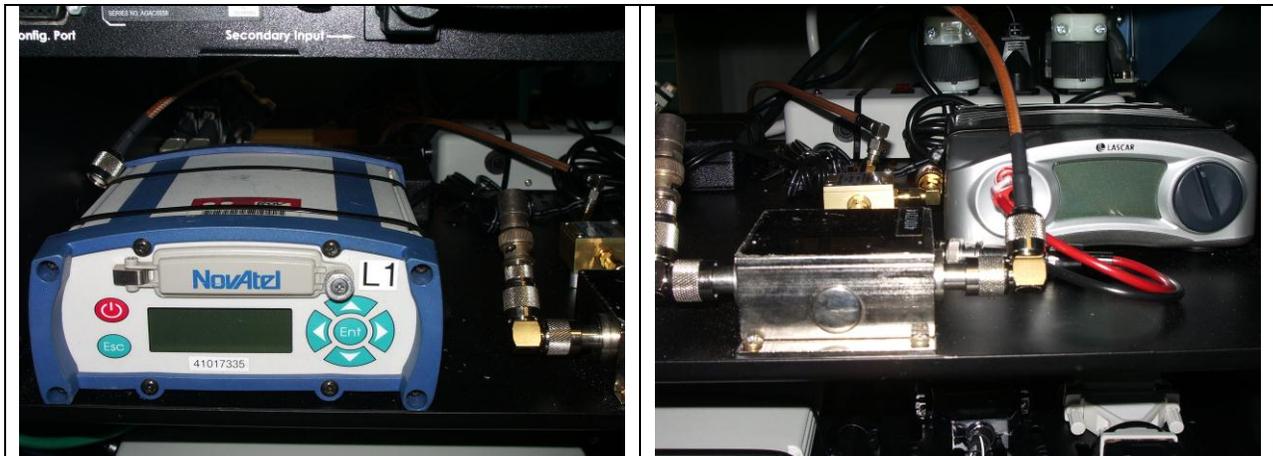
Newark LAAS/GBAS Rack Front Interior (Full System View)



Newark LAAS/GBAS Rack Front Interior (Top to Bottom: KVM, CISCO Router, PDU)



Newark LAAS/GBAS Rack Front Interior (Top to Bottom: GPS Shelf, Network Shelf, Un-UPSed Power Strip)



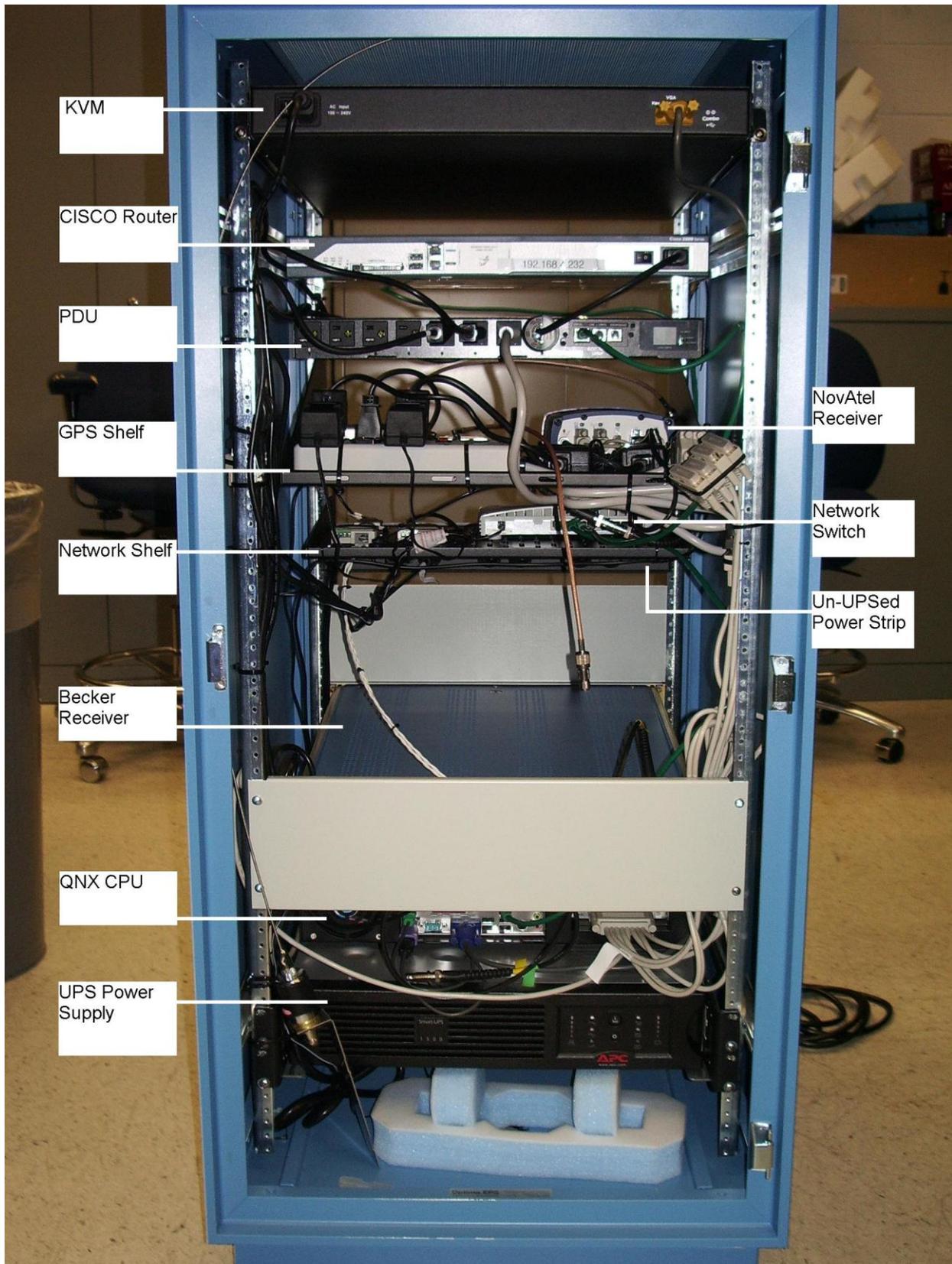
Newark LAAS/GBAS GPS Shelf Front Interior (Right: NovAtel Transmitter, Left: Lascar Multi-meter)



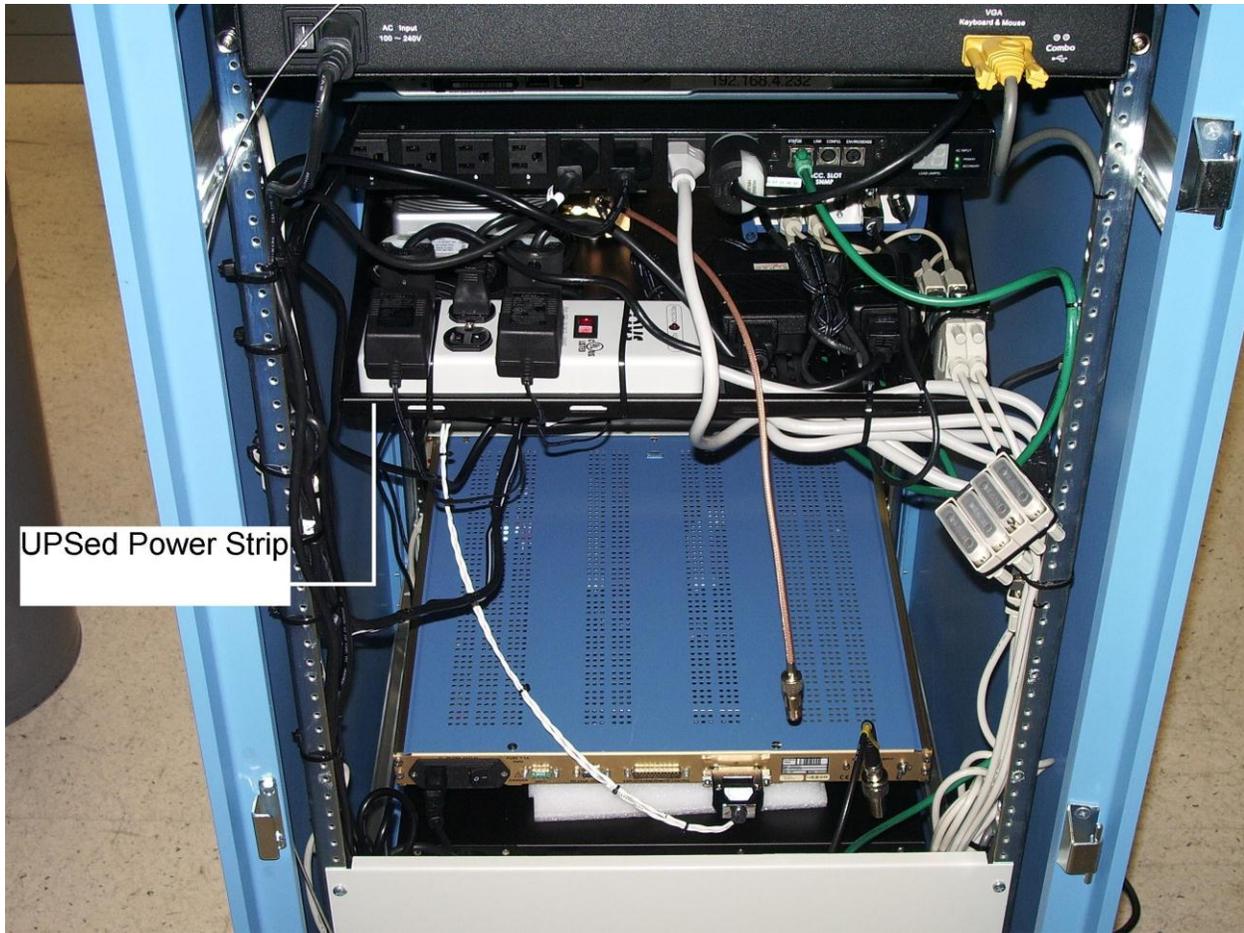
Newark LAAS/GBAS Rack Front Interior (Top to Bottom: Face Plate, Becker Receiver)



Newark LAAS/GBAS Rack Front Interior (Top to Bottom: CPU, UPS Power Supply)



Newark LAAS/GBAS Rack Rear Interior (Full System View)

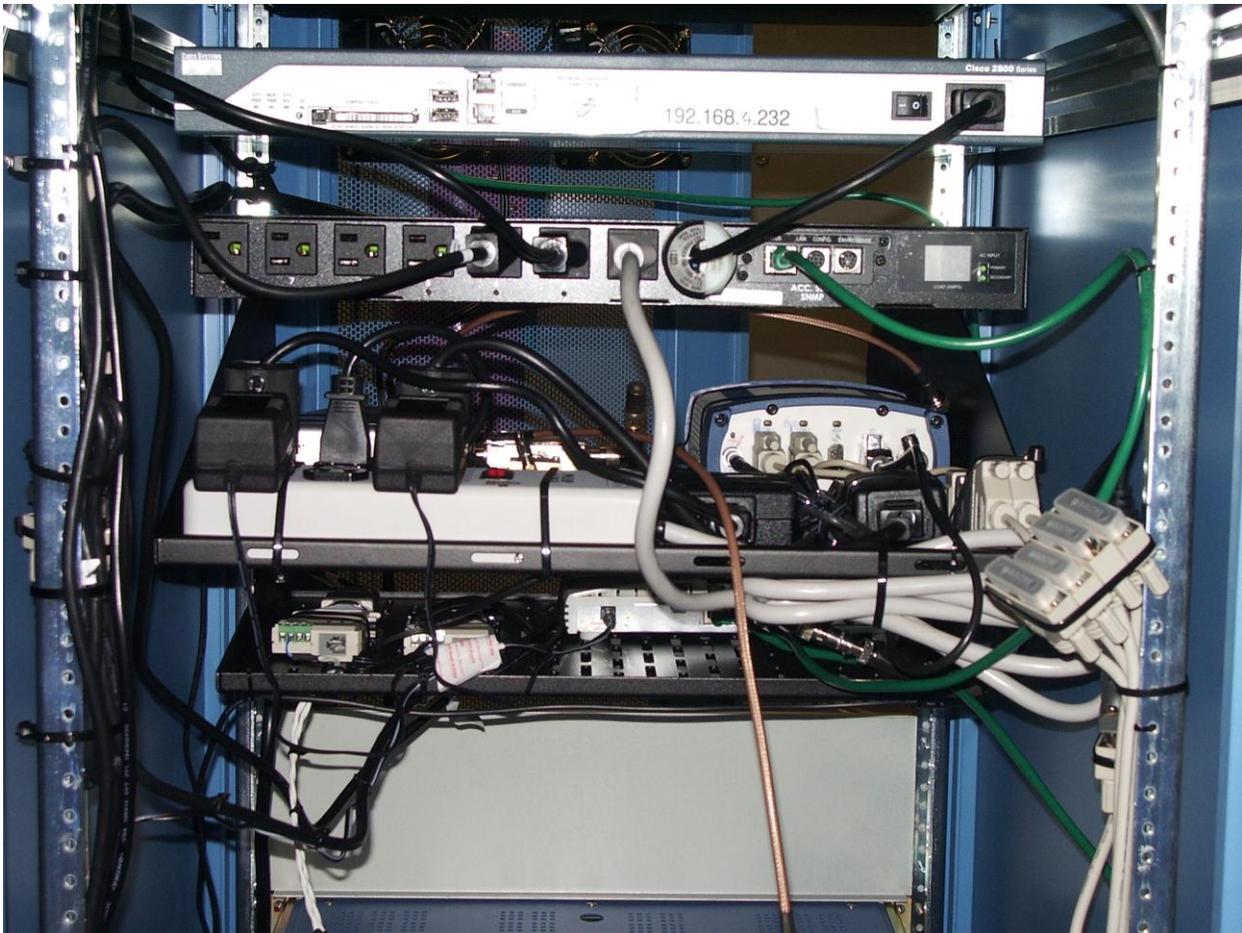


UPSed Power Strip

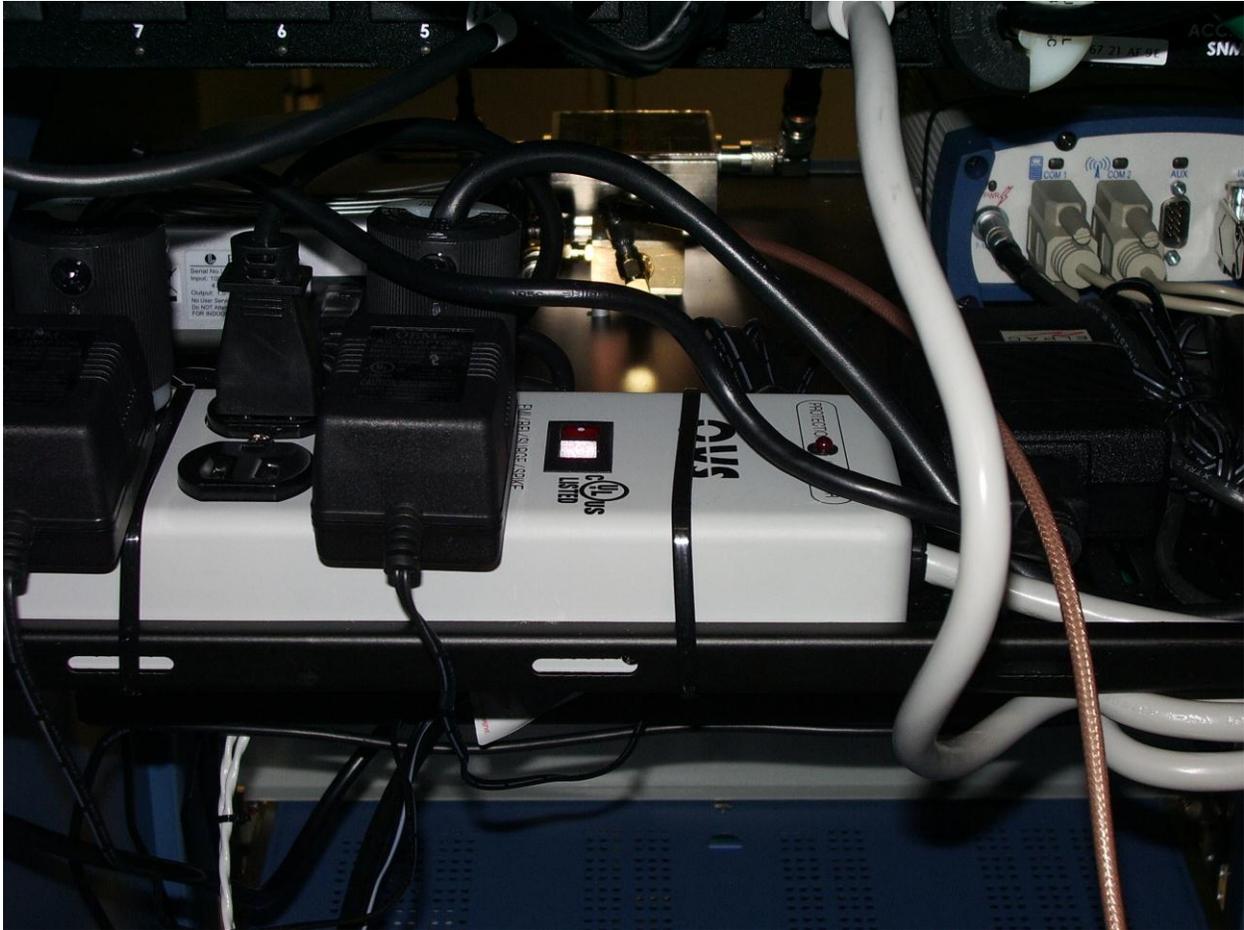
Newark LAAS/GBAS Rack Rear Interior (Full System Pier-In View)



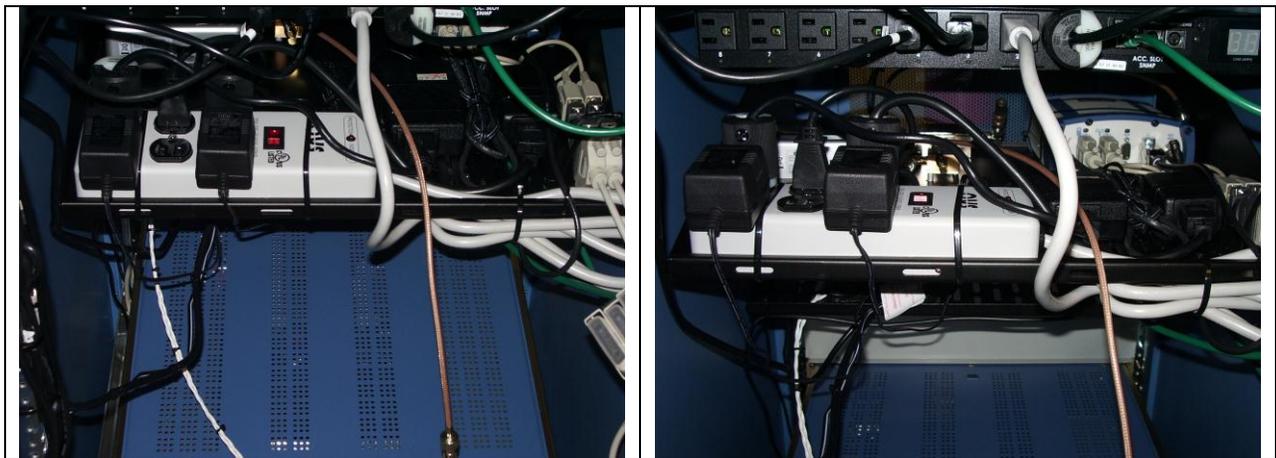
Newark LAAS/GBAS Rack Rear Interior (Top to Bottom: KVM, CISCO Router, PDU, GPS Shelf, Network Shelf, Becker Receiver)



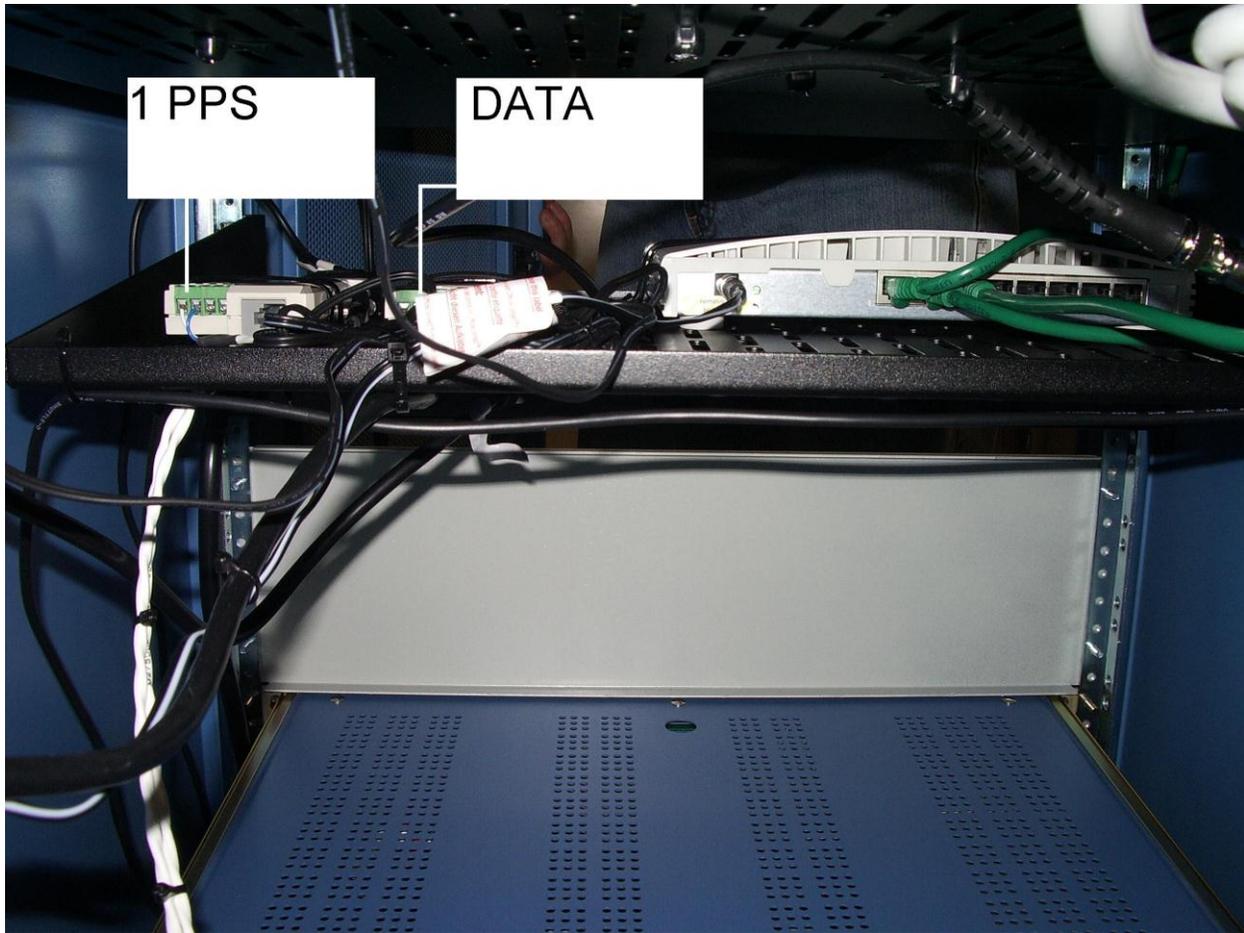
Newark LAAS/GBAS Rack Rear Interior (Detail View, Top to Bottom: CISCO Router, PDU, GPS Shelf, Network Shelf, Becker Receiver)



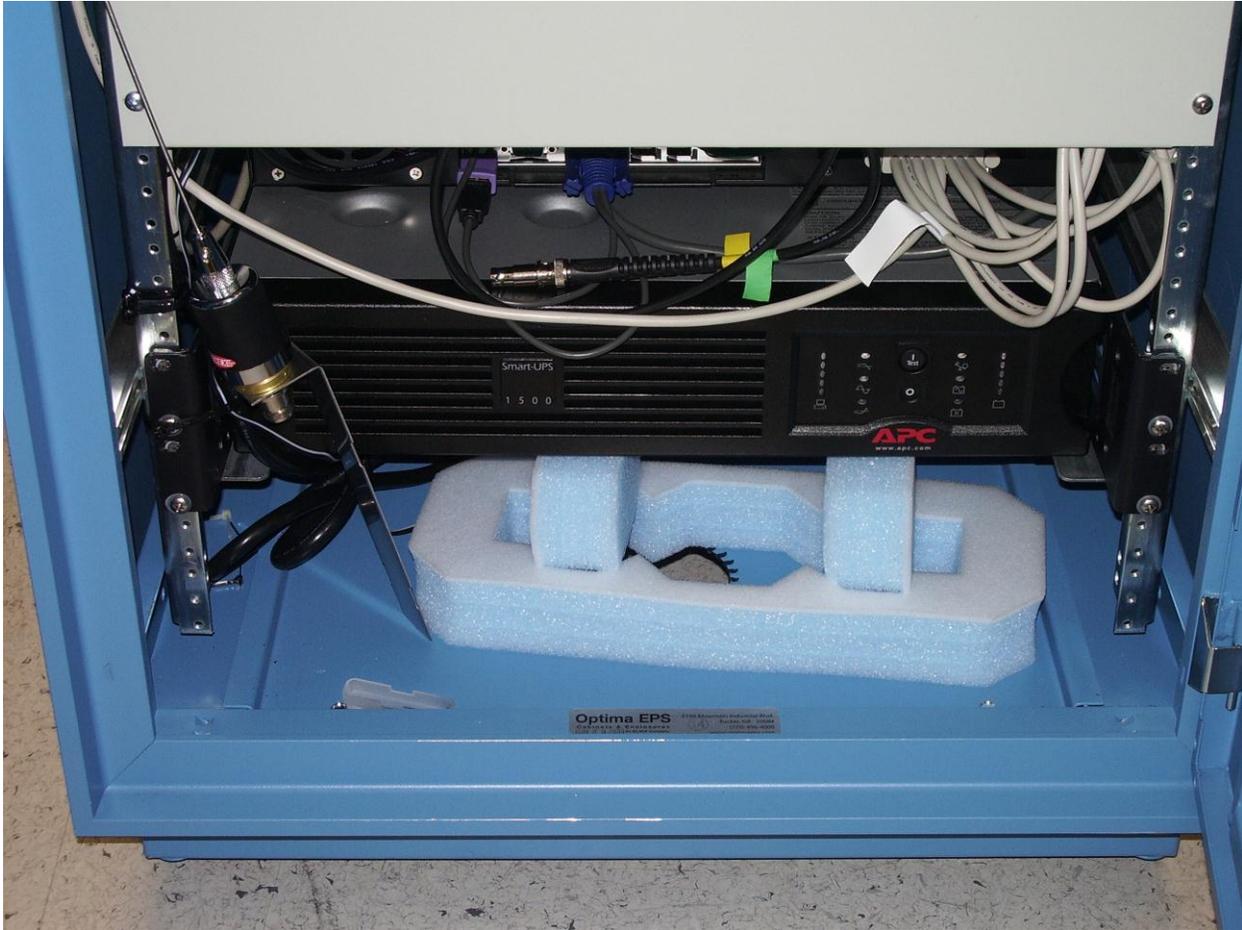
Newark LAAS/GBAS Rack Rear Interior (Detail View: GPS Shelf)



Newark LAAS/GBAS GPS Shelf Rear Interior (Right: GPS Shelf Pier-In View, Left: GPS Shelf Full Screen View)



Newark LAAS/GBAS Rack Rear Interior (Detail View: Network Shelf)



Newark LAAS/GBAS Rack Rear Interior (Detail View: UPS Power Supply)

Appendix B:

Newark LAAS/GBAS Performance Monitor Images of Full System Installation at Newark International Airport



Newark International Airport Building 80 (Location of Remote Site)



Newark International Airport Building 80, Roof Top (CPS Grounding Cable)



Newark International Airport Building 80, Roof Top (PCtel GNSS Antenna, with Ballast Roof Mount and CPS Grounding Cable)



Newark International Airport Building 80, Roof Top (PCtel GNSS Antenna, with Ballast Roof Mount and CPS Grounding Cable)



Newark International Airport Building 80, Roof Top (VHF Antenna, with Ballast Roof Mount and CPS Grounding Cable)



Newark International Airport Building 80, Room 216 (LAAS/GBAS Performance Monitor in Position and Awaiting Installation)



Newark International Airport Building 80, Room 216 (LAAS/GBAS Performance Monitor
Power Distribution as well as RG-393 and VHF Cable Lines)



Newark International Airport Building 80, Room 216 (LAAS/GBAS Performance Monitor Full System View, in Position and Recording Data)



Newark International Airport Building 80, Room 135 T.C. (The Yellow CAT 5 Cable is Active T1 and the Gray CAT 5 Cable is Spare)

Appendix C:

**Data sheet and Installation Manual for the Gentex Photoelectric Type Commercial
and Residential Smoke Alarm**

7109CSW

<p>GENTEX CORPORATION</p> <p>A Smarter Vision®</p> <p>PHOTOELECTRIC TYPE COMMERCIAL & COMMERCIAL RESIDENTIAL SMOKE ALARMS FOR THE HEARING IMPAIRED, AC POWERED WITH 9V BATTERY BACKUP</p>	<p>7109CS/CSX & 7109LS</p> <p>7139CS/CSX & 7139LS</p>	<p>SIGNALING</p>  <p>UL LISTED</p>
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Installation Instructions - Owner's/User's Information Manual -READ CAREFULLY & SAVE

INTRODUCTION

The 7139CS/CSX & 7139LS smoke alarms are photoelectric type alarms for use as an evacuation device in commercial and commercial residential applications, while the 7109CS/CSX & 7109LS are for use as an alert and relocate device. Each smoke alarm has a solid state piezo to warn and alert the household to the presence of threatening smoke as well as a visual signal to warn and alert the hearing impaired to the presence of threatening smoke.

Your photoelectric smoke alarm is designed to detect the smoke that results from an actual fire. Consequently, it is uncommon for household smoke such as cigarette smoke or normal cooking smoke to cause an alarm.

MODEL NO.	DESCRIPTION
*7109CS/CSX-W or C.....	120VAC, 60Hz with 1 Form C Aux. relay contact and visual signal with tandem wire connection. CSX model is provided with an additional wire (grey) for the remote activation of the visual signal.
*7109LS.....	120VAC, 60Hz wall mounted, provided with a 9 foot line cord, pulsating horn and visual signal.
**7139CS/CSX-W or C....	Same as the 7109CS but with a temporal horn. CSX model is provided with an additional wire (grey) for the remote activation of the visual signal.
**7139LS.....	Same as 7109LS but with a temporal horn.

* These units produce a non-temporal audible alarm and are therefore not intended for locations where the desired action of the occupant(s) is evacuation.

** Per NFPA 72, the American National Standard Audible Emergency Evacuation Signal as defined in ANSI S3.41, is required whenever the intended response is to evacuate the building.

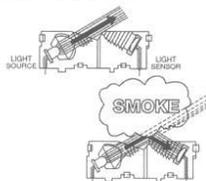
NOTICE: Visual signals are only one method of alerting the hearing impaired. Not all hearing impaired individuals will be alerted by visual signals.

HOW YOUR SMOKE ALARM WORKS

These smoke alarms operate on the photoelectric light scatter principle. The unit's sensing chamber houses a light source and a light sensor.

The darkened sensing chamber is exposed to the atmosphere and designed to permit optimum smoke entry from any direction while rejecting light from outside the smoke alarm.

The light source is an infrared (invisible) LED which pulses every 4-8 seconds. The light sensor is a photodiode matched to the light frequency of the LED light source.



Under normal conditions, the light generated by the pulsing infrared LED is not seen by the light sensor, as it is positioned out of the direct path of the light beam. When smoke enters the sensing chamber, light from the pulsing LED light source is reflected by the smoke particles onto the photodiode light sensor. At the first sighting of smoke, the smoke alarm is put into a pre-alarm mode. This is indicated by a rapidly flashing LED on the face of the smoke alarm.

Once the light sensor confirms smoke for 2 consecutive pulses inside the chamber, the light sensor produces the signal necessary to trigger the smoke alarm.

This technique of verifying the smoke condition, combined with a 5-to-1 signal-to-noise ratio, substantially reduces the possibility of nuisance alarms.

HOW TO TELL IF YOUR SMOKE ALARM IS WORKING PROPERLY

- Your smoke alarm is provided with an alarm horn and pulsating Light Emitting (Indicator) Diode, which pulses every 15-30 seconds and a green AC power on LED.
- When turning the test knob on the alarm to TEST 1, the red light will flash rapidly, the horn will sound and the visual signal will flash.
- WARNING! Visual signal will not operate without AC power.**
- If the battery is low or missing, a chirp will be emitted when the red LED flashes. If the smoke alarm is malfunctioning, the chirp will sound between the red LED flashes. If AC power fails, the green LED will turn off.
- The test knob of your smoke alarm simulates actual smoke conditions.

NOTE: Tandem Interconnect Models.

- When testing one smoke alarm, the smoke alarm that is activated will flash the red indicator light and sound its alarm horn. All other units will sound the alarm horn with their red indicator lights remaining off.

FIRE PROTECTION PLAN: WHAT YOU CAN DO TO MAKE YOUR FAMILY SAFE FROM FIRES

This smoke alarm can quickly alert you to the presence of smoke-it cannot prevent fire. The ultimate responsibility for fire protection rests solely on you.

Installing smoke alarms is just the first step in protecting your family from fires. You also must reduce the chances that fires will start in your home and increase your chances of safely escaping if one does start. To have an effective fire safety program:

a. Install smoke alarms properly following the instructions in this manual. Keep your smoke alarms clean. Test your devices weekly and repair or replace it when it no longer functions. As with any electronic product, smoke alarms have a limited life, and devices that don't work cannot protect you.

b. Follow safety rules and prevent hazardous situations:

- Use smoking materials properly; never smoke in bed.
- Keep matches and cigarette lighters away from children.
- Store flammable materials in proper containers and never use them near open flames or sparks.
- Keep electrical appliances and cords in good working order and do not overload electrical circuits.
- Keep stoves, fireplaces, chimneys, and barbecue grills grease-free and make sure they are properly installed away from combustible materials.
- Keep portable heaters and open flames such as candles away from combustible materials.
- Do not allow rubbish to accumulate.
- Do not leave small children home alone.

c. Develop a family escape plan and practice it with your entire family, especially small children.

- Draw and post a floor plan of your home and find two ways to exit from each room. There should be one way to get out of each bedroom without opening the door.
- Teach children what the smoke alarm signal means, and that they must be prepared to leave the residence by themselves if necessary. Show them how to check to see if doors are hot before opening them, how to stay close to the floor and crawl if necessary, and how to use the alternate exit if door is hot and should not be opened.
- Decide on a meeting place a safe distance from your house and

make sure that all your children understand that they should go and wait for you if there is a fire.

- Hold fire drills at least every 6 months to make sure that everyone, even small children, know what to do to escape safely.
- Know where to go to call the fire department from outside your residence.
- Provide emergency equipment such as fire extinguishers and teach your family to use this equipment properly.

d. Bedroom doors should be closed while sleeping if a smoke alarm is installed in the bedroom. They act as a barrier against heat and smoke.

WHAT TO DO IF THERE IS A FIRE IN YOUR HOME

If you have prepared family escape plans and practiced them with your family, you have increased their chances of escaping safely. Review the following rules with your children when you have fire drills so everyone will remember them in a real fire emergency. If the alarm should sound:

- a. Don't panic; stay calm. Your safe escape may depend on thinking clearly and remembering what you have practiced.
 - b. Get out of the house following a planned escape route as quickly as possible. Do not stop to collect anything or to get dressed.
 - c. Open doors carefully only after feeling to see if they are hot. Do not open a door if it is hot; use an alternate escape route.
 - d. Stay close to the floor; smoke and hot gases rise.
 - e. Cover your nose and mouth with a cloth, wet if possible, and take short, shallow breaths.
 - f. Keep doors and windows closed unless you open them to escape.
 - g. Meet at your prearranged meeting place after leaving the house.
 - h. Call the Fire Department as soon as possible from outside your house. Give the address and your name.
 - i. Never re-enter a burning building.
- Contact your local Fire Department for more information on making your home safer from fires and preparing your family's escape plans.

NOTICE: Current studies have shown smoke alarms may not awaken all sleeping individuals, and that it is the responsibility of individuals in the household that are capable of assisting others to provide assistance to those who may not be awakened by the alarm sound, or to those who may be incapable of safely evacuating the area unassisted.

NOTICE: Visual signals are only one method of alerting the hearing impaired to a fire. The visual signal may not awaken all hearing impaired individuals. The visual signal must be in the line of sight of the individual to be seen and effective.

▲ WARNING Visual signal should **NEVER** be relied upon as the primary fire alert for the hearing impaired under these common sense conditions:

- a. Sleeping face down on the bedding or pillow
- b. Use of sleep medications of any kind
- c. Use of alcoholic beverages or recreational drugs
- d. Use of eye shades
- e. If there are tendencies of deep sleep conditions
- f. If a fire cuts power to AC circuits, the visual signal will not operate
- g. If person is not within line of sight of visual signal

Under these and other similar common situations an alternate fire alert method such as a non-hearing impaired attendant is needed. The visual signal only increases the chance of being alerted to the presence of fire. No system of this type can fully protect the hearing impaired in case of fire.

WHAT THIS SMOKE ALARM CAN DO

This smoke alarm is designed to sense smoke entering its sensing chamber. It does not sense gas, heat, or flames.

When properly located, installed, and maintained, this smoke alarm is designed to provide early warning of developing fires at a reasonable cost. This smoke alarm monitors the air and, when it senses smoke, activates its built-in alarm horn and strobe light. It can provide precious time for you and your family to escape from your residence before a fire spreads. Such an early warning, however, is possible only if the smoke alarm is located, installed, and maintained as specified in this User's Manual.

NOTICE: This smoke alarm is designed for use within single residential living units only; that is, it should be used inside a single-family home or one apartment of a multi-family building. In a multi-family building, the smoke alarm may not provide early warning for residents if it is placed outside of the residential units, such as on outside porches, in corridors, lobbies, basements, or in other apartments. In multi-family buildings, each residential unit should have smoke alarms to alert the residents of that unit. Smoke alarms

designed to be interconnected should be interconnected within one family residence only; otherwise, nuisance alarms will occur when a smoke alarm in another living unit is tested.

IMPORTANT NOTICE: WHAT SMOKE ALARMS CANNOT DO

Smoke alarms will not work without power. A battery must be connected to the smoke alarm to maintain proper device operation if AC power supply is cut off by an electrical fire, open fuse or circuit breaker, or for any other reason. In the event of AC power failure, the battery will supply standby power for a minimum of 24 hours.

WARNING! Visual signal will not operate on battery power alone.

Smoke alarms may not sense fire that starts where smoke cannot reach the devices such as in chimneys, in walls, on roofs, or on the other side of closed doors. If bedroom doors are usually closed at night, smoke alarms should be placed in each bedroom as well as in the common hallway between them.

Smoke alarms also may not sense a fire on another level of a residence or building. For example, a second-floor smoke alarm may not sense a first-floor or basement fire. Therefore, **smoke alarms should be placed on every level of a residence or building.**

The horn and visual signal in your smoke alarm meets or exceeds current audibility and visual requirements of Underwriters Laboratories. However, **if the smoke alarm is located outside a bedroom, the visual signal will not be seen or noticed by occupant and piezo sounder will not wake up a sound sleeper**, especially if the bedroom door is closed or only partly open. If the smoke alarm is located on a different level of the residence than the bedroom, it is even less likely to wake up people sleeping in the bedroom. In such cases, the National Fire Protection Association recommends that the smoke alarms be interconnected so that a device on any level of the residence will sound an alarm loud enough to awaken sleepers in closed bedrooms. This can be done by employing a systematic approach by interconnecting smoke alarms together, or by using radio frequency transmitters and receivers.

All types of smoke alarm sensors have limitations. No type of device can sense every kind of fire every time. These types of fires include:

- 1) Fires where the victim is intimate with a flaming initiated fire; for example, when a person's clothes catch on fire while cooking.
- 2) Fires where the smoke is prevented from reaching the smoke alarm due to a closed door or other obstruction.
- 3) Incendiary fires where the fire grows so rapidly that an occupant's egress is blocked even with properly located smoke alarms.

In general, smoke alarms may not always warn you about fires caused by violent explosions, escaping gas, improper storage of flammable materials, or arson.

NOTICE: This smoke alarm is not designed to replace special-purpose fire detection and smoke alarm systems necessary to protect persons and property in non-residential buildings such as warehouses, or other large industrial or commercial buildings. It alone is not a suitable substitute for complete fire-detection systems designed to protect individuals in hotels and motels, dormitories, hospitals, or other health and supervisory care and retirement homes. Please refer to NFPA 101, The Life Safety Code, and NFPA 72 for smoke alarm requirements for fire protection in buildings not defined as "households."

Installing smoke alarms may make you eligible for lower insurance rates, but **smoke alarms are not a substitute for insurance.**

Visual signals are only one method of alerting the hearing impaired to a fire. The visual signal may not awaken all hearing impaired individuals. The visual signal must be in the line of sight of the individual to be seen and effective. Home owners and renters should continue to insure their lives and property.

PLACEMENT OF SMOKE ALARMS

THIS EQUIPMENT SHOULD BE INSTALLED IN ACCORDANCE WITH THE NATIONAL FIRE PROTECTION ASSOCIATION'S STANDARD 72 (National Fire Protection Association, Batterymarch Park, Quincy, MA 02269).

For your information, the National Fire Protection Association's Standard 72, reads as follows:
NFPA 72, 2007 Edition, Chapter 11, Section 11.5.1 Required Detection, states the following:

- 11.5.1.1** Where required by applicable laws, codes or standards for a specific type of occupancy, approved single and multiple-station smoke alarms shall be installed as follows:
- 1) In all sleeping rooms and guest rooms
 - 2) Outside of each separate dwelling unit sleeping area, within 6.4m

(21ft) of any door to a sleeping room, the distance measured along a path of travel

- 3) On every level of a dwelling unit, including basements
- 4) On every level of a residential board and care occupancy (small facility), including basements and excluding crawl spaces and unfinished attics
- 5) In the living area(s) of a guest suite
- 6) In the living area(s) of a residential board and care occupancy (small facility)

11.5.1.2 Where the area addressed in 11.5.1.1(2) is separated from the adjacent living areas by a door, a smoke alarm shall be installed in the area between the door and the sleeping room, and additional alarms shall be installed on the living area side of the door as specified by 11.5.1.1 and 11.5.1.3.

11.5.1.3 In addition to the requirements of 11.5.1.1(1) through 11.5.1.1(3), where the interior floor area for a given level of a dwelling unit, excluding garage areas, is greater than 93m² (1000ft²), smoke alarms shall be installed per 11.5.1.3.1 and 11.5.1.3.2.

11.5.1.3.1 All points on the ceiling shall have a smoke alarm within a distance of 9.1m (30ft) travel distance or shall have an equivalent of one smoke alarm per 46.5m² (500ft²) is evaluated by dividing the total interior square footage of floor area per level by 46.5m² (500ft²).

11.5.1.3.2 Where dwelling units include great rooms or vaulted/cathedral ceilings extending over multiple floors, smoke alarms located on the upper floor that are intended to protect the aforementioned area shall be permitted to be considered as part of the lower floor(s) protection scheme used to meet the requirements of 11.5.1.3.1.

The installation of additional alarms of either the smoke, heat or CO type should result in a higher degree of protection. Adding alarms to rooms that are normally closed off from the required alarms increases the escape time because the fire does not need to build to the higher level necessary to force smoke out of the closed room to the required alarms. As a consequence, it is recommended that the homeowner consider the installation of additional fire protection devices. However, it should be understood that NFPA 72 does not require additional smoke alarms over and above those called for in Figures 1, 2, 3 and 4 where required smoke alarms are shown.

Figure 1

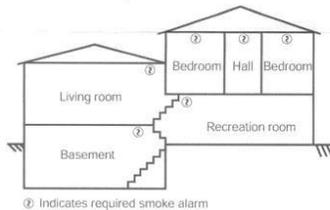


Figure 1: A SMOKE ALARM MUST BE LOCATED ON EVERY LEVEL OF DWELLING UNIT, INCLUDING BASEMENT, WITHIN EACH SLEEPING ROOM AND OUTSIDE SLEEPING AREAS.

Where to Locate the Required Smoke Alarms. The major threat from fire in a dwelling unit occurs at night when everyone is asleep. Persons in sleeping areas can be threatened by fires in the remainder of the unit; therefore, smoke alarms are best located in each bedroom and between the bedroom areas and the rest of the unit as shown in Figure 2.

Figure 2

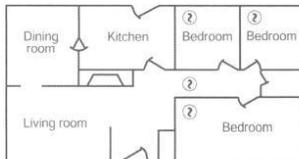


Figure 2: A SMOKE ALARM MUST BE LOCATED BETWEEN THE SLEEPING AREA AND THE REST OF THE DWELLING UNIT AS WELL AS IN EACH BEDROOM.

In dwelling units with more than one bedroom area or with bedrooms on more than one floor, more than one smoke alarm is required, as shown in Figure 3.

Figure 3

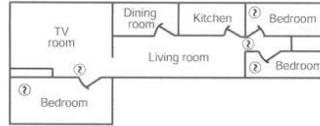


Figure 3: IN DWELLING UNITS WITH MORE THAN ONE SLEEPING AREA, A SMOKE ALARM MUST BE PROVIDED TO PROTECT EACH SLEEPING AREA IN ADDITION TO SMOKE ALARMS REQUIRED IN BEDROOMS.

In addition to smoke alarms outside of the sleeping areas and in each bedroom, NFPA 72 requires the installation of a smoke alarm on each additional level of the dwelling unit, including the basement. These installations are shown in Figure 4. The living area smoke alarm should be installed in the living room or near the stairway to the upper level, or in both locations. The basement smoke alarm should be installed in close proximity to the stairway leading to the floor above. Where installed on an open-joisted ceiling, the smoke alarm should be placed on the bottom of the joists. The smoke alarm should be positioned relative to the stairway so as to intercept smoke coming from a fire in the basement before the smoke enters the stairway.

Figure 4

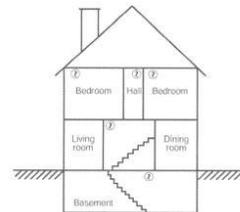


Figure 4: A SMOKE ALARM MUST BE LOCATED ON EACH LEVEL IN ADDITION TO EACH BEDROOM.

IMPORTANT CONSIDERATION

NFPA recommends replacing smoke alarm(s) every ten (10) years; why:

- Dust, dirt, and other environmental contaminants can affect your smoke alarm over a prolonged period.
- Fast changing industry consensus standards and codes on all smoke alarms make it advisable to periodically upgrade your device to maximize life safety.
- Assurance that your smoke alarm needs are kept abreast with the constantly improving electronic technology.
- Smoke alarms are recognized as one of the lowest cost ways to protect dwelling inhabitants against the danger of fire(s). It makes good common sense to periodically replace and update your smoke alarm that contributes so much to life safety.

MOUNTING LOCATION

- Ceiling location (CS & CSX only) - smoke alarm should be mounted as close as possible to the center of a hallway or room. If this is not possible, the edge of the unit should be at least 4 inches from any wall and must be within 16 feet of pillow.
- Wall location-locate the top of the smoke alarm at least 4 inches and not more than 12 inches from the ceiling and must be within 16 feet of pillow. Observe smoke alarm for proper top/bottom orientation (test knob is near bottom of unit).
- Smoke alarm with visual signal is to be mounted per NFPA 72 Annex A. 11.8.3. Ceiling location - smoke alarm should be mounted as close as possible to the center of a hallway or room. If this is not possible, the edge of the unit should be at least 4 inches from any wall and must be within 16 feet of pillow. Wall location-locate the top of the smoke alarm at least 4 inches and not more than 12 inches from the ceiling and must be within 16 feet of pillow. Observe smoke alarm for proper top/bottom orientation (test knob is near bottom of unit).

Figures 1, 2, 3, & 4 are reprinted with permission from NFPA 72, National Fire Alarm Code®, Copyright ©2002, National Fire Protection Association, Quincy, MA 02169. This reprinted material is not the complete and official position of the National Fire Protection Association on the referenced subject which is represented only by the standard in its entirety. National Fire Alarm Code® and NFPA 72® are registered trademarks of the National Fire Protection Association, Inc., Quincy, MA 02169.

Figure 5

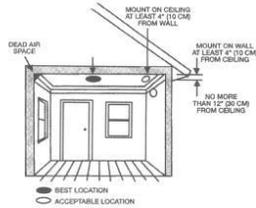


Figure 5: RECOMMENDED SMOKE ALARM MOUNTING LOCATIONS.

Figure 6

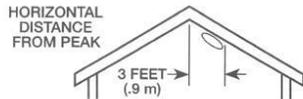


Figure 6: RECOMMENDED SMOKE ALARM LOCATION IN ROOMS WITH SLOPED, GABLED, OR PEAKED CEILINGS.

The placement of the smoke alarm is critical if maximum speed of fire detection is desired. Thus, a logical location for a smoke alarm is the center of the ceiling. At this location, the device is closest to all areas of the room.

WHERE SMOKE ALARMS SHOULD BE PUT IN MOBILE HOMES

In mobile homes built after about 1978 that were designed and insulated to be energy-efficient, smoke alarms should be installed as described in the section above. In older mobile homes that have little or no insulation compared to today's standards, uninsulated metal outside walls and roofs can transfer heat and cold from outdoors, making the air right next to them hotter or colder than the rest of the inside air. These layers of hotter or colder air can prevent smoke from reaching a smoke alarm. Therefore, put smoke alarms in such units only on inside walls, between 4 and 12 inches (10 and 30 cm) from the ceiling. If you are not sure about the insulation level in your mobile home, or if you notice that the walls or ceiling are unusually hot or cold, put the smoke alarm on an inside wall.

Minimum protection requires one smoke alarm as close to the sleeping area as possible. For better protection, put one smoke alarm in each room, but first read the "Locations to Avoid."

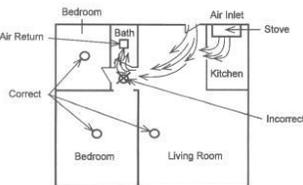
LOCATIONS TO AVOID

WARNING! This smoke alarm must be installed within 16 feet of the pillow. Any location outside of 16 feet will cause this alarm to be less effective and not meet code requirements.

Nuisance alarms are caused by placing smoke alarms where they will not operate properly. **To avoid nuisance alarms, do not place smoke alarms:**

- In or near areas where combustion particles are normally present such as **kitchens**; in **garages** where there are particles of combustion in vehicle exhausts; **near furnaces, hot water heaters, or gas space heaters**. Install smoke alarms at least 20 feet (6 meters) away from kitchens and other areas where combustion particles are normally present.
- In **air streams passing by kitchens**. Figure 7 shows how a smoke alarm can be exposed to combustion particles in normal air movement paths, and how to correct this situation.

Figure 7



- In **damp or very humid areas**, or next to bathrooms with showers. The moisture in humid air can enter sensing chamber as water vapor, then cool and condense into droplets that cause a nuisance alarm. **Install smoke alarms at least 10 feet (3 meters) away from bathrooms.**
- In **very cold or very hot environments, or in unheated buildings or outdoor rooms**, where the temperature can go below or above the operating range of the device. Temperature limits for proper operation are 40° to 100°F (4.4° to 37.8°C).

- In **very dusty or dirty areas**. Dust and dirt can build up on the smoke alarm's sensing chamber and can make it overly sensitive, or block openings to the sensing chamber and keep the smoke alarm from sensing smoke.
- **Near fresh air inlets or returns or excessively drafty areas**. Air conditioners, heaters, fans, and fresh air intakes and returns can drive smoke away from smoke alarms, making the devices less effective.
- In **dead air spaces at the top of a peaked roof or in the corners between ceilings and walls**. Dead air may prevent smoke from reaching a smoke alarm.
- In **insect-infested areas**. If insects enter a smoke alarm's sensing chamber, they may cause a nuisance alarm. **Get rid of bugs before installing devices where bugs are a problem.**
- **Near fluorescent light fixtures**. Electrical "noise" from nearby fluorescent light fixtures may cause a nuisance alarm. **Install smoke alarms and fluorescent lights on separate electrical circuits.**

WARNING! Never remove power from smoke alarm to silence a nuisance alarm. Open a window or fan air around device to remove the smoke. The smoke alarm will automatically turn off when the smoke in the air is completely gone. Do not stand close to device. The sound produced by the smoke alarm is loud because it is designed to awaken you in an emergency. Prolonged exposure to the horn at a close distance may be harmful to your hearing.

BATTERY INSTALLATION

1. Remove smoke alarm from mounting plate by rotating counter-clockwise.
2. Remove AC power connector and unplug power leads from top of the old battery. Snap new battery onto snaps and reinsert battery through hole in back of smoke alarm.
3. Use only Duracell MN 1604 battery with the 7109/7139 Series smoke alarms.

CAUTION: Units with battery back-up will not provide power or transmit an alarm to AC only units in the event of an AC power failure. All battery back-up units in tandem, with good batteries, will operate normally during an AC power failure. **NOTICE:** Visual signal will not operate during AC power failure.

WIRING/GENERAL (7109CS/CSX & 7139CS/CSX ONLY)

1. Use U.L. listed cable with Class 1 insulation.
2. Observe local code requirements. Use box connector to anchor cable to outlet box.
3. Metal outlet boxes must be grounded to earth ground.
4. Use only Duracell MN 1604 battery with the 7109/7139 Series smoke alarms.

CAUTION: Turn off electricity to prevent SHOCK and damage to smoke alarm. Be sure the power line to device is **not** controlled by any on/off switch, or other type of switch, other than a fuse or circuit breaker.

IMPORTANT: Insure that all fluorescent lighting fixtures are properly grounded or on separate circuits.

NOTICE: The wiring to be used shall be in accordance with the provisions of Article 210 of the National Electrical Code, ANSI/NFPA 70. Wire installation should be performed only by a licensed electrician.

MOUNTING OUTLET BOX (7109CS/CSX & 7139CS/CSX ONLY)

Use a 2" x 3" switch box or a 4" square or octagon junction box. Mount a box for each smoke alarm. If wall mounting is desired, be sure the box screws are oriented to upper right and lower left corners. Be sure to use supplied mounting plate.

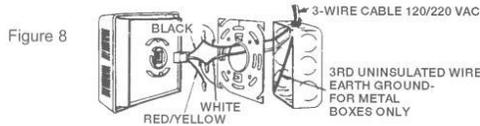
NOTE: For trouble areas where there can be a large volume of air blowing out through the electrical junction box. You must first attach an adhesive backed foam gasket, which has been packed with your smoke alarm, to the back side of the mounting bracket before it's secured to the junction box.

WIRING ONE SMOKE ALARM (7109CS/CSX & 7139CS/CSX ONLY)

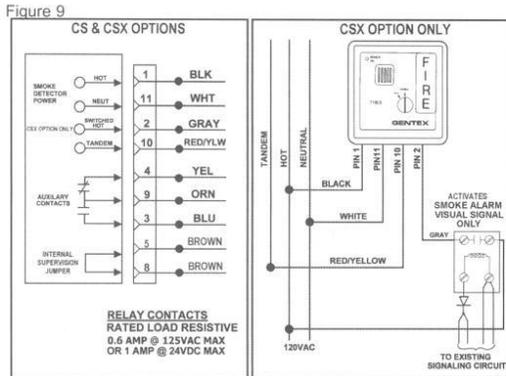
1. Run a minimum of 16 gauge, 2-conductor cable, plus ground (3 wires) to the device junction box from a power supply. Smoke alarms should be run on their own dedicated circuit. Use UL listed Class 1 wire.

NOTE: The wiring to be used shall be in accordance with the provisions of Article 300.3(b) of the National Electrical Code, ANSI/NFPA 70, as well as Article 210.

2. Make wire connections to the supplied plug-in connector as follows: black to black, white to white, and connect the ground wire to the metal outlet box.



NOTE/RED-YELLOW WIRE: The red-yellow wire from the smoke alarm is for tandem connection only. DO NOT USE, AND DO NOT REMOVE INSULATION CAP UNLESS CONNECTING ANOTHER SMOKE ALARM.

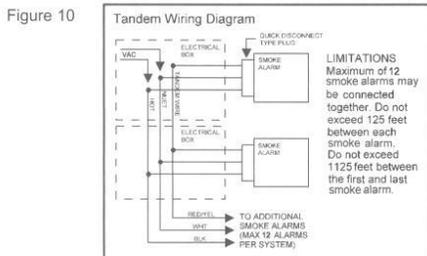


WIRING TWO OR MORE SMOKE ALARMS (7109CS/CSX & 7139CS/CSX ONLY) Tandem Installation

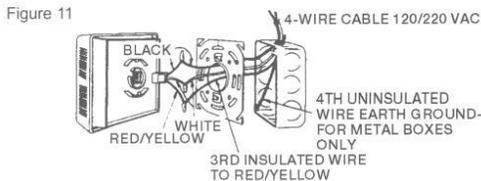
NOTICE: All smoke alarms in tandem installation must be controlled by the same fuse or circuit breaker. Otherwise tandem units will not operate. Tandem will operate in the event of AC power failure if battery is connected to the smoke alarm.

LIMITATIONS: A maximum of six (6) smoke alarms of model (7109CS/CSX & 7139CS/CSX or models with the relay option (F, HF, TF) may be tandem interconnected. Do not exceed 1125 feet between first and last smoke alarm.

Wire used for interconnecting shall be in accordance with the latest edition of Article 760 of the National Electrical Code (NEC) and NFPA 70, and must not exceed a resistance of 10 ohms.



1. Run a minimum of 16 gauge, 3-conductor cable, plus ground (4 wires) to the first junction box from a power supply and between all smoke alarms that are to be connected together. Use UL listed Class 1 wire.
2. Make wire connections to supplied plug-in connector as follows: black to black, white to white, 3rd conductor to red-yellow wire. The red-yellow wire should be stripped to make this connection. Connect ground wire between metal outlet boxes.



NOTES ON TANDEM INTERCONNECTING MODELS

- DO NOT connect Gentex smoke alarms to other manufacturers' smoke alarms.
- No more than 12 Gentex models 9120/9123, 9120T/9123T, and 9120H/9123H may be connected in tandem.
- No more than 6 Gentex models 7109CS/CSX & 7139CS/CSX, 9120F/9123F, 9120HF/9123HF, and 9120TF/9123TF may be connected in tandem.
- All units connected in tandem MUST get their power from the same circuit, that is, all smoke alarms in tandem must be controlled by the same fuse or circuit breaker.
- After installation to verify proper working conditions all horns must sound in this system.

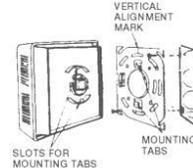
CAUTION: Failure to observe any of the conditions set forth may cause system malfunction and damage to the smoke alarm.

MOUNTING: PLATE & SMOKE ALARM (7109CS/CSX & 7139CS/CSX ONLY)

1. Lace the connector through the provided mounting plate and secure the plate to the junction box so that the smoke alarm snap-in tabs are in the vertical position if wall mounted.

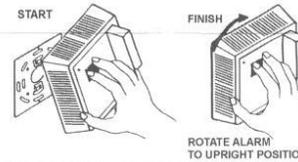
NOTE: Mounting plate is marked "THIS SIDE OUT" and slotted for proper positioning.

Figure 12



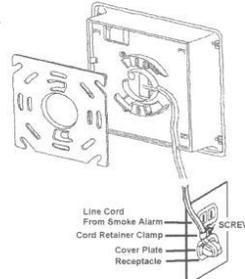
2. Plug the wire connector into the smoke alarm base.
3. Place smoke alarm up to mounting plate, rotating it to about 10:00 o'clock then rotate it clockwise to 12:00. It should "snap-lock" firmly into place. Keep smoke alarm parallel to mounting plate so upper and lower tabs on plate seat into device.

Figure 13



MOUNTING: PLATE & SMOKE ALARM (7109LS/7139LS ONLY) LINE CORD MODEL

Figure 14



The 7109LS/7139LS is supplied with a 9 foot line cord for installation to a normal outlet. For this type of installation:

1. Care should be taken to lace cord through slots in base as shown in Figure 14 to insure cord does not interfere with engagement of the mounting bracket.
2. Determine proper location for smoke alarm above a receptacle that is **NOT CONTROLLED BY AN "ON-OFF" SWITCH**.
3. If screw anchors are used, drill two 3/16" holes, insert the screw anchors, and mount the plate to wall using screws.
4. Mount the smoke alarm to the bracket as illustrated in Figure 13.
5. Use the enclosed cord retainer clamp as illustrated in Figure 14 to insure the unit is not accidentally disconnected.

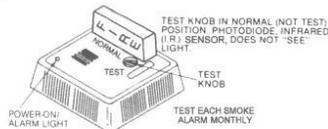
Place smoke alarm up to mounting plate, rotating it to about 10:00 o'clock then rotate it clockwise to 12:00. It should "snap-lock" firmly

into place. Keep smoke alarm parallel to the mounting plate so upper and lower tabs on the plate seat into the smoke alarm (Figure 13). **CAUTION:** Failure to observe any conditions set forth may cause system malfunction and damage to smoke alarm.

CHECKOUT & TROUBLESHOOTING

- Turn test knob to the NORMAL position and supply house power to the smoke alarm. The red indicator should flash every 15-30 seconds, showing that the smoke alarm is operating properly.
- If red light is not flashing or the green LED is not on:
 - Check that the battery is installed.
 - Check to see if the plug is in the outlet.
 - If the power and wiring check out, but the red light does not flash or the green LED is still off, return the device to the manufacturer. See TO RETURN A SMOKE ALARM.
- Testing with the Test Knob:
 - Rotate test knob counter-clockwise to TEST 1 position, wait up to 20 seconds for smoke alarm to sound and visual signal flash. If device does not sound after 20 seconds, return device for service.
 - After successfully testing smoke alarm, return test knob to NORMAL (non-test) position and wait 20 seconds for the smoke alarm to stop sounding.

Figure 15



- To test unit for high sensitivity, turn test knob clockwise to TEST 2 position. Smoke alarm should remain silent. Return knob back to normal position. If the unit sounds during test, the device's sensitivity has become too high and may cause false alarms. This could mean the smoke alarm is dirty and should be cleaned as described in maintenance procedure below. If the smoke alarm continues to alarm for TEST 2 position following cleaning return it to Gentex for service.
- To check for proper smoke entry into smoke alarm's sensing chamber. Gentex recommends using the Home Safeguard Smoke Detector Spray or CHEKKIT® SMOKE Detector Tester from SDI. This test should be performed once a year and should be sprayed from a distance no closer than 12 inches from device.

MAINTENANCE

When smoke alarm has been in operation for a period of time or it was installed prior to the completion of all building construction, the device can become more sensitive due to dirt build-up in smoke alarm's optic sensing chamber which could cause nuisance alarms or could cause activation from small amounts of smoke build-up.

If this should occur, following this simple washing procedure will restore your smoke alarm back to its original condition.

For further information, regarding frequency of cleaning and testing, refer to NFPA 72, NFPA, Batterymarch Park, Quincy, MA 02269. **NOTICE: Failure to follow full cleaning instructions could result in damage to this smoke alarm. DO NOT remove all smoke alarms at the same time for cleaning.**

- Rotate smoke alarm counter-clockwise to remove it from its mounting plate.
- Unplug electrical power cord to smoke alarm and remove battery.
- Select three (3) standard size wash buckets and fill them each with one gallon of normal tap water (distilled or de-ionized treated water is recommended as a final rinse if water is extremely hard in your area).
- Add 1/8 cup of Ivory dishwashing liquid to first bucket of water, mix thoroughly. Place one dirty smoke alarm into soap water mixture

until it becomes completely covered or submerged. **NOTE:** If smoke alarms are exceptionally dirty, you may wish to first wipe off any excess dirt before washing smoke alarm so as not to dirty the wash water too quickly.

DO NOT open smoke alarm for cleaning. IF SMOKE ALARM IS OPENED, PRODUCT WARRANTY BECOMES VOID.

NOTICE: ONLY IVORY DISHWASHING LIQUID IS TO BE USED. OTHER BRANDS ARE NOT RECOMMENDED AND MAY CAUSE YOUR SMOKE ALARM TO MALFUNCTION.

- Allow smoke alarm to soak for approximately 10 minutes (longer if extremely dirty). Agitate for 5 or 10 seconds to flush out any remaining dirt left inside smoke alarm's housing.
- Remove smoke alarm from wash water and transfer directly to one of first rinse buckets containing clear water. Allow smoke alarm to become completely submerged, agitate once more for 5 or 10 seconds to remove soap residue.
- Finally, transfer smoke alarm to second and final rinse bucket, repeating method found in Step 6. Remove unit to a clean dry area for a period of 48 hours to allow it to thoroughly dry.

NOTICE: SMOKE ALARMS ARE TO BE AIR DRIED ONLY. DO NOT PLACE DEVICE IN OVEN, MICROWAVE OR USE A HOT AIR BLOWER TO ACCELERATE DRYING TIME. THIS COULD RESULT IN DAMAGE TO YOUR SMOKE ALARM.

IMPORTANT: IT IS RECOMMENDED TO CHANGE WASH AND RINSE WATER AFTER FIVE (5) SMOKE ALARMS. IF YOUR DEVICES ARE EXTREMELY DIRTY, WATER SHOULD BE CHANGED MORE FREQUENTLY.

In the event you experience difficulty in the cleaning of device(s) or if questions arise, please contact Gentex Corporation.

WARNING! If smoke alarm does not work properly, do not try and fix it yourself. This will void your warranty. See "To Return a Smoke Alarm" for instructions to return smoke alarm that does not operate properly. **DO NOT TRY TO FIX IT YOURSELF.**

IMPORTANT: Gentex recommends smoke alarm be tested a minimum of once a week.

WARNING! Never use an open flame of any kind to test your unit. You may ignite and damage the smoke alarm as well as your home. The test feature of your smoke alarm accurately simulates smoke conditions and tests the device's functions as required by UL.

WARNING! Do not cover, tape, or otherwise block the openings of smoke alarm. These openings are designed to allow air to pass through your smoke alarm, thus sampling the air around the device.

WARNING! Smoke alarms are not to be used with detector guards unless the combination has been evaluated and found suitable for that purpose.

FAILURE TO REGULARLY CLEAN SMOKE ALARM WILL RESULT IN FALSE ALARMS. A BUILD UP OF DUST CREATES AN OBSCURATION THAT SIMULATES SMOKE. THIS MEANS UNIT WILL GO INTO ALARM WITHOUT A FIRE CONDITION.

TO RETURN A SMOKE ALARM

Should you experience problems with your smoke alarm, proceed as follows:

- Rotate unit counter-clockwise to remove from its mounting plate.
- Unplug electrical power cord or connector to smoke alarm and remove battery. Do not ship smoke alarm with battery installed.
- Carefully pack (manufacturer is not responsible for damage) and return to manufacturer. Include complete details as to exact nature of difficulties being experienced and date of installation.
- Return to: Gentex Corp., 10985 Chicago Dr., Zeeland, MI 49464. Prior to returning, call Gentex at 1-800-436-8391 or e-mail FP_RMA@gentex.com to obtain RMA Number from return dept.

LIMITED WARRANTY

For a period of 12 months from the date of purchase, or a maximum of 18 months from the date of manufacture, Gentex warrants to you, the original consumer purchaser, that your Smoke Alarm will be free from defects in workmanship, materials, and construction under normal use and service. If a defect in workmanship, materials, or construction should cause your Smoke Alarm to become inoperable within the warranty period, Gentex will repair your Smoke Alarm or furnish you with a new or rebuilt replacement Smoke Alarm without charge to you except for postage required to return the Smoke Alarm to us. Your repaired or replacement Smoke Alarm will be returned to you free of charge and it will be covered under this warranty for the balance of the warranty period.

This warranty is void if our inspection of your Smoke Alarm shows that the damage or failure was caused by abuse, misuse, abnormal usage, faulty installation, improper maintenance, or repairs other than those performed by us.

ANY WARRANTIES IMPLIED UNDER ANY STATE LAW INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, APPLY ONLY FOR THE WARRANTY PERIOD SPECIFIED ABOVE. PLEASE NOTE THAT SOME STATES DO NOT ALLOW LIMITATIONS ON HOW

LONG AN IMPLIED WARRANTY LASTS; SO THE ABOVE EXCLUSION MAY NOT APPLY TO YOU. GENTEX WILL NOT BE LIABLE FOR ANY LOSS, DAMAGE, INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND ARISING IN CONNECTION WITH THE SALE, USE, OR REPAIR OF THIS SMOKE ALARM. PLEASE NOTE THAT SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES; SO THE ABOVE EXCLUSION MAY NOT APPLY TO YOU. If a defect in workmanship, materials, or construction should cause your Smoke Alarm to become inoperable within the warranty period, you must return the Smoke Alarm to Gentex postage prepaid. You must also pack the Smoke Alarm to minimize the risk of it being damaged in transit. You must also enclose a return address. Smoke Alarms returned for warranty service should be sent to: Gentex Corporation, 10985 Chicago Drive, Zeeland, MI 49464.

If we receive a Smoke Alarm in a damaged condition as the result of shipping, we will notify you and you must file a claim with the Shipper. THIS LIMITED WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS. YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.

Important Notice

These materials have been prepared by Gentex Corporation ("Gentex") for informational purposes only, are necessarily summary, and are not purposed to serve as legal advice and should not be used as such. Gentex makes no representations and warranties, express or implied, that these materials are complete and accurate, up-to-date, or in compliance with all relevant local, state and federal laws, regulations and rules. The materials do not address all legal considerations as there is inevitable uncertainty regarding interpretation of laws, regulations and rules and the application of such laws, regulations and rules to particular fact patterns. Each person's activities can differently affect the obligations that exist under applicable laws, regulations or rules. Therefore, these materials should be used only for informational purposes and should not be used as a substitute for seeking professional legal advice. Gentex will not be responsible for any action or failure to act in reliance upon the information contained in this material.

GENTEX CORPORATION

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www.gentex.com

550-0094-T

9-1-93

Pg. 7-6

Appendix D:
Ballast Roof Mount Equipment Package Specifications

ROHN

Installation Helpful Hints For **AGMA, AAGM, AGM6, BRM4, and BRM6 Models**

For ease of assembly, please follow these suggested guidelines

AGMA

1. Assemble base braces and support mast first. Do not tighten; leave all bolt connections loose.
2. Assemble knee braces.
3. Place base pans in place and assemble with base clips.
4. Tighten all nuts and bolts, starting with support mast connections first.
5. Install safety wires and grounding as required.

AAGM, AGM6, BRM4 and BRM6

1. Assemble base braces and support mast first. Do not tighten; leave all bolt connections loose.
2. Assemble knee braces.
3. Place outer angle supports in place and assemble with base clips.
4. Place inner angle supports in place and assemble with base clips.
5. Tighten all nuts and bolts starting with support mast connections first.
6. Install safety wires and grounding as required.

WARNING

Assembling dish antennas on windy days can be dangerous. Because of the projected area of the antenna, even slight winds create strong forces.

Do not attempt to assemble, move or mount a dish antenna on windy days or serious, even ***fatal***, accidents can occur.

Improperly installed antenna mounts or antenna mounts mounted on inadequate structures are very susceptible to wind damage. This damage can be very serious and can result in ***property damage, loss of service, personal injury and even death***. ROHN assumes no responsibility to assure the installation is structurally sound to support all loads, and properly sealed against leaks.

ROHN
P.O. Box 2000
Peoria, Illinois 61656

Form No. 90-2479

BRM6 BALLAST REQUIREMENTS TABLE								
ANTENNA DIAMETER	BALLAST (POUNDS)	ZERO VELOCITY LOAD (PSF)	DESIGN WIND VELOCITIES COEFFICIENT OF FRICTION = .50					
			EL = 0 °		EL = 20 °		EL = 40 °	
			Vmax	Vs	Vmax	Vs	Vmax	Vs
4 FT (1.2m)	500	5.0	87	67	103	75	112	92
	750	7.5	107	82	131	92	142	113
	1000	10.0	125	95	154	107	167	131
	1250	12.5	139	106	169	119	189	146
	1500	15.0	148	117	180	131	203	160
	1750	17.5	157	126	190	141	211	173
	2000	20.0	165	135	196	151	211	185
6 FT (1.8m)	500	5.0	58	45	65	50	69	61
	750	7.5	71	55	83	61	89	75
	1000	10.0	83	63	99	71	106	87
	1250	12.5	93	71	112	79	120	97
	1500	15.0	99	78	120	87	129	107
	1750	17.5	105	84	127	94	137	115
	2000	20.0	110	90	130	101	141	123
	2250	22.5	115	95	130	107	141	131
	2500	25.0	120	100	130	113	141	138
	2750	27.5	125	105	130	118	141	141
3000	30.0	127	110	130	123	141	141	
8 FT (2.4m)	750	7.5	53	41	57	46	60	56
	1000	10.0	62	47	69	53	73	65
	1250	12.5	69	53	79	59	84	73
	1500	15.0	74	58	85	65	90	80
	1750	17.5	78	63	91	70	96	86
	2000	20.0	82	67	97	75	102	92
	2250	22.5	86	71	98	80	103	98
	2500	25.0	90	75	98	84	103	103
	2750	27.5	94	79	98	88	103	103
	3000	30.0	95	82	98	92	103	103

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FILE NUMBER: 24330RK					
DRAWING NUMBER: A890747-1 of 6			UNR-ROHN		
			BRM6 BALLAST REQUIREMENTS		

NOTES FOR BRM6 BALLAST REQUIREMENTS TABLE

1. Ballast requirements are provided to assist consumers in determining the applicability of the BRM6 for an antenna installation. Refer to sheets 4, 5, and 6 for the criteria used to develop the ballast requirements table. The ballast data and development criteria should not be relied upon without competent local professional examination and verification of its accuracy and suitability for a specific site or application.
2. Ballast requirements are based on typical ANSI/EIA-222-D paraboloid antennas supported 12 inches from the vertex of the antenna on a 48 inch long mounting pipe on a flat supporting surface. The vertex of the antenna is assumed to be at the top of the mounting pipe. Specific antenna types and/or other mounting configurations may require more stringent strength and ballast requirements and must be investigated for each installation. The load carrying requirements of the supporting surface, the mast, the antenna and the antenna's connection to the mast must also be investigated for each installation.
3. The ballast weights indicated are net ballast weights, and must be uniformly distributed over all panels. The weight of the mount and antenna may be considered as ballast. The following table summarizes the weight of the BRM6 mount:

BRM6 ANTENNA MOUNT WEIGHTS					
Mount No.	BRM635	BRM640	BRM645	BRM655	BRM665
Mast Pipe Size	3" Std.	3 1/2" Std.	4" Std.	5" Std.	6" Std.
Weight (lbs)	244	251	257	273	290

4. The zero velocity loads shown are equal to the ballast weights indicated divided by the total area enclosed by the perimeter of the mount (100 sq. ft.). This area is greater than the ballast panel contact area. Loads which must also be investigated include reactions caused by wind forces and moments, live loads, and dead loads of ballast, mount, antenna, miscellaneous equipment and roof pads. Refer to sheet 4 for maximum ANSI/EIA-222-D wind load coefficients for paraboloid antennas supported as described in note 2.
5. The tabulated maximum wind velocities (V_{max}) are based on a minimum 1.5 factor of safety against structural failure and overturning. The wind velocity and the appropriate factor of safety for an installation must be determined on an individual site basis. Potential increases in wind velocity due to channeling, roof projections, and other obstructions, must be considered when determining ballast requirements.

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NOTES FOR BRM6 BALLAST

6. The tabulated wind velocities resulting in sliding (V_s) are based on a factor of safety equal to 1.0 and a coefficient of friction equal to .50. A 1.0 factor of safety was used assuming that at higher wind velocities, safety cables or other suitable attachments to the support structure would prevent sliding beyond a safe, designated area. Wind velocities are given for 0, 20 and 40 degree antenna elevation angles. The appropriate coefficient of friction and factor of safety to determine wind velocities resulting in sliding must be determined on an individual site basis. The coefficient of friction may vary under changing moisture and temperature conditions. The minimum coefficient of friction must be used to evaluate sliding resistance.
7. The values of V_s indicated do not apply for installations which are prevented from sliding by cables or other suitable attachments to the supporting structure. Attachments to the supporting structure, under such conditions, must resist the portion of wind load which exceeds the frictional sliding resistance of the mount.
8. Refer to sheets 4, 5, and 6 for assistance in determining V_{max} and V_s for specific wind load coefficients and/or other factors of safety and coefficients of friction.
9. Roof pads are recommended to prevent damage to roof membranes. Pads should be placed under all ballast panels and under the mast pipe. The minimum coefficient of friction must be considered for calculating the wind velocities resulting in sliding. When roof pads are utilized, the surface between the ballast panels and the roof pads and the surface between the roof pads and the supporting surface must both be considered.
10. Rohn recommends that ballast material always be placed prior to mounting the antenna and that roof pads and mount be secured to prevent hazards from occurring under extreme wind loading conditions. Precautions should also be taken to prevent the inadvertent removal of ballast material after installation and to insure that ballast material is fully supported by the ballast support angles (required for ballast to be effective in resisting overturning and sliding).
11. When adhesives, sealants or pads are utilized, they must be compatible with the supporting surface. They must also be durable and have adequate strength. Precautions should also be taken to insure that damage to the supporting surface will not occur upon wind loading.
12. Adhesives and sealants must be capable of resisting shear, otherwise, they may act as a lubricant and decrease the effective coefficient of friction between the ballast panels and the supporting surface. Windward ballast panels may partially lift off at wind velocities below the maximum wind velocities indicated. Adhesives or sealants may be disturbed under such circumstances and may require repairing after major wind loading events.
13. The installation, roof material and supporting structure must be capable of withstanding all loads imposed by the antenna system. Supporting surfaces, anchors and/or safety cables must be sufficient to resist the reactions from the antenna system. The installation must meet all applicable local, state and federal requirements. Due to the many variables involved, Rohn does not accept responsibility for verifying the applicability of the BRM6 for a specific installation.

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B. STRUCTURAL CAPACITY OF MOUNT

The following ultimate structural capacities of the BRM6 mount were determined from full-scale load tests.

ULTIMATE STRUCTURAL CAPACITY OF BRM6		
LOADING CONDITION	MAXIMUM SHEAR AND OVERTURNING	MAXIMUM TWISTING MOMENT
POINT OF LOAD APPLICATION	X = 3.0" Z = 48.0"	X = 24.2" Z = 48.0"
ULTIMATE CAPACITY	3000 LBS	1525 LBS

The wind velocities corresponding to the above ultimate structural capacities, reduced by a factor of safety (F.S.) against structural failure, may be calculated as follows:

MAXIMUM SHEAR AND OVERTURNING CONDITION

MAXIMUM TWISTING MOMENT CONDITION

$$Vr1 = \left[\frac{3000}{F.S.(CFr(A)+F)} \right]^{1/2} \text{ mph}$$

$$Vr2 = \left[\frac{1525}{F.S.(CFr(A)+F)} \right]^{1/2} \text{ mph}$$

$$Vmr1 = \left[\frac{3000(48.0/12)}{F.S.(CMr(A)+M)} \right]^{1/2} \text{ mph}$$

$$Vmr2 = \left[\frac{1525(48.0/12)}{F.S.(CMr(A)+M)} \right]^{1/2} \text{ mph}$$

$$Vmz1 = \left[\frac{3000(3.0/12)}{F.S.(CMz(A)+T)} \right]^{1/2} \text{ mph}$$

$$Vmz2 = \left[\frac{1525(24.2/12)}{F.S.(CMz(A)+T)} \right]^{1/2} \text{ mph}$$

The minimum value of Vr1, Vmr1, Vmz1, Vr2, Vmr2 and Vmz2 represents the wind velocity (Vu) based on a factor of safety against structural failure.

C. OVERTURNING RESISTANCE

Based upon full-scale overturning tests of the BRM6 mount, the maximum wind velocity (Vot) based on a factor of safety against overturning may be calculated as follows:

$$V_1 = \left[\frac{5.28(B) - 136 - F.S.(M)}{F.S. (CMr)(A) + 5.28(CFz)(A)} \right]^{1/2} \text{ mph}$$

$$V_2 = \left[\frac{3.46(B) + 2096 - F.S.(M)}{F.S. (CMr)(A) + 3.46(CFz)(A)} \right]^{1/2} \text{ mph}$$

$$Vot = \text{Minimum of } V_1 \text{ or } V_2$$

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CRITERIA FOR DEVELOPING BALLAST REQUIREMENT

A. MAXIMUM WIND LOADING COEFFICIENTS

The following table summarizes the maximum ANSI/EIA-222-D wind load coefficients for paraboloid antennas supported 12 inches from the vertex of the antenna on a 48 inch long mounting pipe considering elevation rotation about the vertex and azimuth rotation about the support. The loading conditions indicated occur at different azimuth rotations with respect to wind direction. Specific antenna types and/or other mounting configurations may require consideration of more stringent wind load coefficients.

LOADING CONDITION		MAXIMUM VERTICAL LOADS		MAXIMUM SHEAR AND OVERTURNING			MAXIMUM TWISTING MOMENT		
ANT. DIA.	EL. ANGLE	CFz ¹		CFr	CMr	CMz	CFr	CMr	CMz
		UPLIFT	DOWNLOAD						
4 FT (1.2m)	0	0	0	.004357	.017426	.000180	.001697	.006788	.002680
	20	.000301	-.001522	.004129	.014956	.000187	.001674	.007242	.002453
	40	.000584	-.002591	.003542	.011256	.000069	.001524	.006607	.002038
6 FT (1.8m)	0	0	0	.004357	.017426	.000620	.001697	.006788	.003420
	20	.000301	-.001522	.004129	.014841	.000570	.001674	.007555	.003116
	40	.000584	-.002591	.003542	.011017	.000215	.001524	.007052	.002535
8 FT (2.4m)	0	0	0	.004357	.017426	.001060	.001697	.006788	.004160
	20	.000301	-.001522	.004129	.014727	.000953	.001674	.007869	.003779
	40	.000584	-.002591	.003542	.010781	.000500	.001524	.007498	.003032

¹ Positive direction for CFz is upward

Vertical Download = $B - CFz(A)(V)^2$ lbs

Lateral Load = $CFr(A)(V)^2 + F$ lbs

Overturning Moment = $CMr(A)(V)^2 + M$ ft-lbs

Twisting Moment = $CMz(A)(V)^2 + T$ ft-lbs

A = Frontal area of antenna, sq. ft.

V = Wind velocity at centerline of antenna, mph

B = Ballast weight including weight of mount, antenna and all other vertical loads supported by mount, lbs

F, M, T = Lateral load, overturning and twisting moments due to additional wind and dead loads on mount, ballast, etc., lbs or ft-lbs

For development of the ballast requirement table, it was assumed that the additional moments due to eccentric antenna weights would be negligible (except as noted in paragraph F), and that F, M and T were also negligible for all wind directions and elevation angles. The actual values of these forces and moments may be significant, and must be investigated for each installation.

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