

INFORMATION HANDOUT

For Contract No. 11-415504
At 11-SD-5, 8, 15, 52, 54, etc.-Var

Identified by
Project ID 1113000002

MATERIALS INFORMATION

Video image video detection system

Modify fiber optic

Modify count station

Modify communication hub

Modify photovoltaic system

Modify intelligent transportation system

Modify ramp metering

Modify traffic monitoring station

Modify signal

Modify video wall

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**MATERIAL
INFORMATION
FOR
1113000002**

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Preface

The pictures shown in this information handout were taken between 2014 and 2015. There are additional pictures available at <http://arcg.is/1OeOyZi> . There are additional information when left clicking the icon on the map. Some locations have as-built plans for informational use only.

You must use the most current web browser when accessing the website.

You must refer to the specification to correlate the information shown in the appendices.

The products shown in the appendices were used to verify the availability of the product in the market and are not endorse by the Department unless the specification identifies a specific product to be installed. For products not specifically identified in a specification, you may use the products shown in the appendices or equal. All products to be installed must meet the specification and must be approved prior to purchase.

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SECTION 1
VIDEO
IMAGE
DETECTION
SYSTEM

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LOCATION 1 - VIDEO IMAGE VEHICLE DETECTION SYSTEM



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SECTION 2

MODIFY

FIBER OPTIC

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LOCATION 2 - MODIFY FIBER OPTIC



LOCATION 3 - MODIFY FIBER OPTIC



LOCATION 4 - MODIFY FIBER OPTIC



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SECTION 3

MODIFY

COUNT STATION

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LOCATION 5 - MODIFY COUNT STATION



LOCATION 6 - MODIFY COUNT STATION

13-Aug-2014 2021 UTC | 32.735546, -117.174583
3000-3098 India Street, San Diego, CA 92103, USA



13-Aug-2014 2019 UTC | 32.739525, -117.180008
3553 California Street, San Diego, CA 92101, USA



13-Aug-2014 2022 UTC | 32.735542, -117.174576
3000-3098 India Street, San Diego, CA 92103, USA



LOCATION 7 - MODIFY COUNT STATION



LOCATION 8 - MODIFY COUNT STATION



LOCATION 9 - MODIFY COUNT STATION

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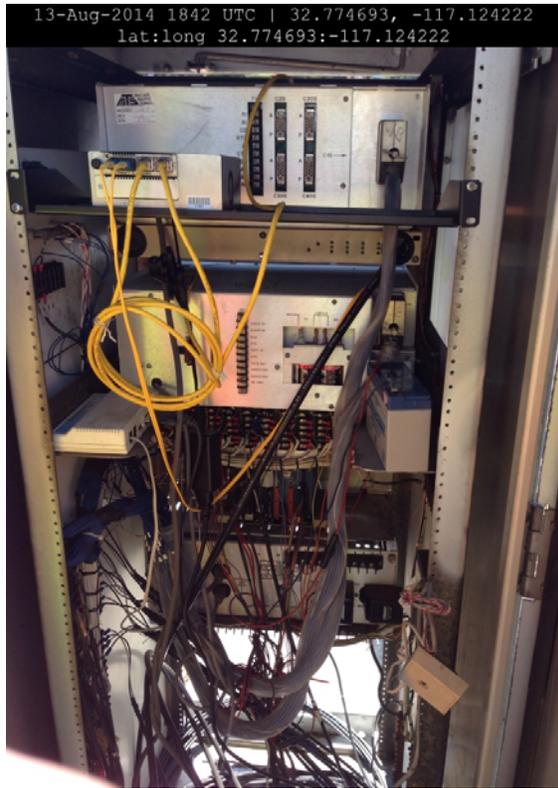
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LOCATION 9 - MODIFY COUNT STATION



LOCATION 10 - MODIFY COUNT STATION



LOCATION 11 - MODIFY COUNT STATION



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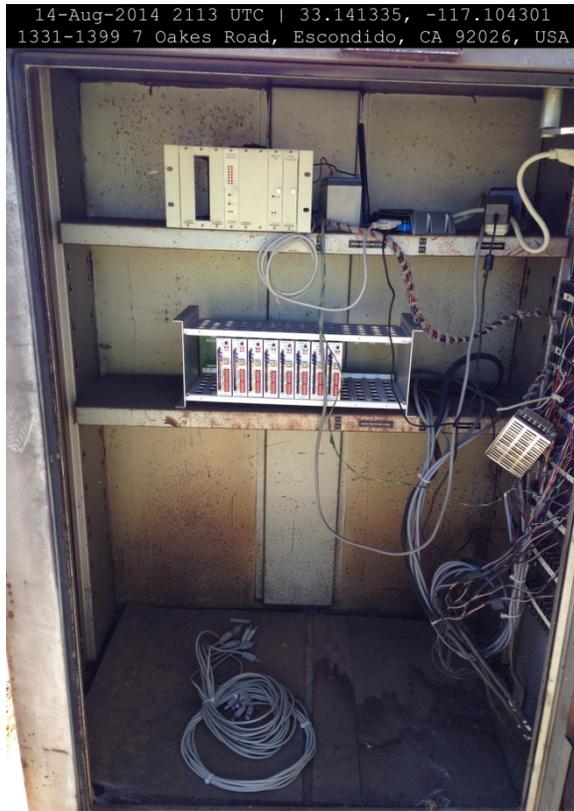


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LOCATION 12 - MODIFY COUNT STATION



LOCATION 13 - MODIFY COUNT STATION

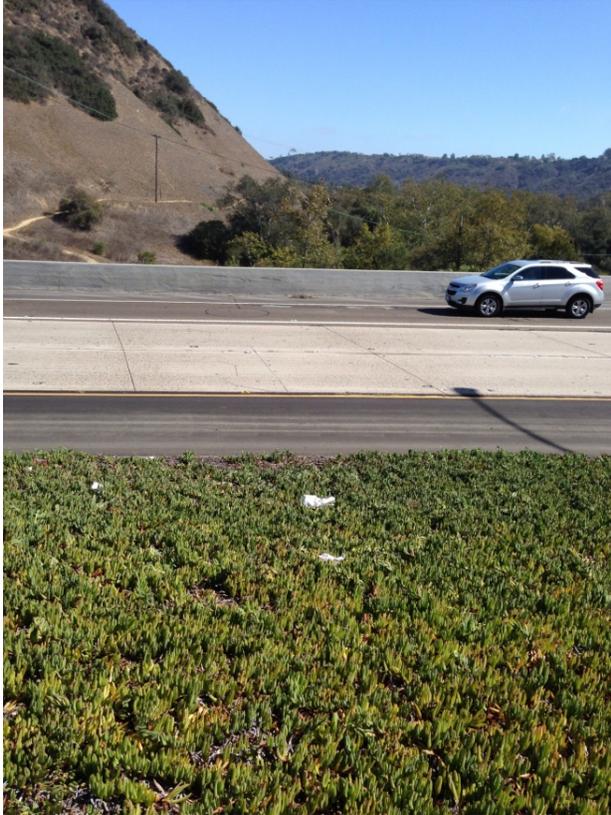


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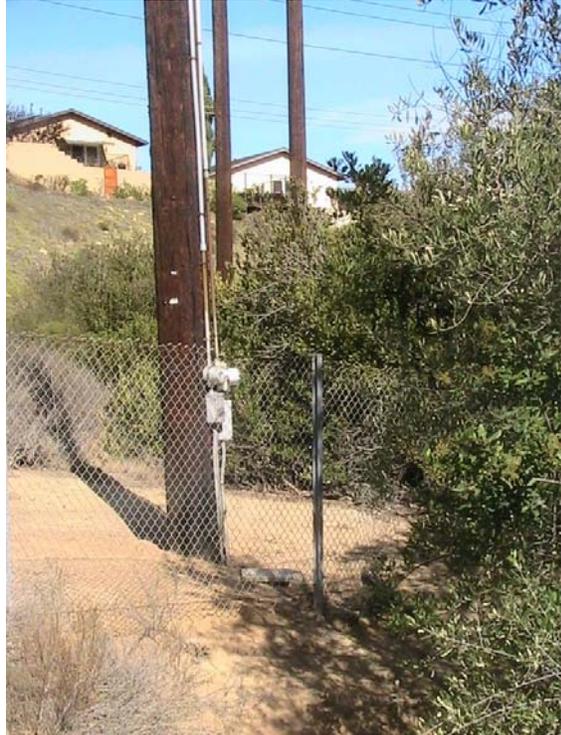
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Mount Soledad Freeway & El Camino Real & San Cle...



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Mount Soledad Freeway & El Camino Real & San Cle...



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Mount Soledad Freeway & El Camino Real & San Cle...

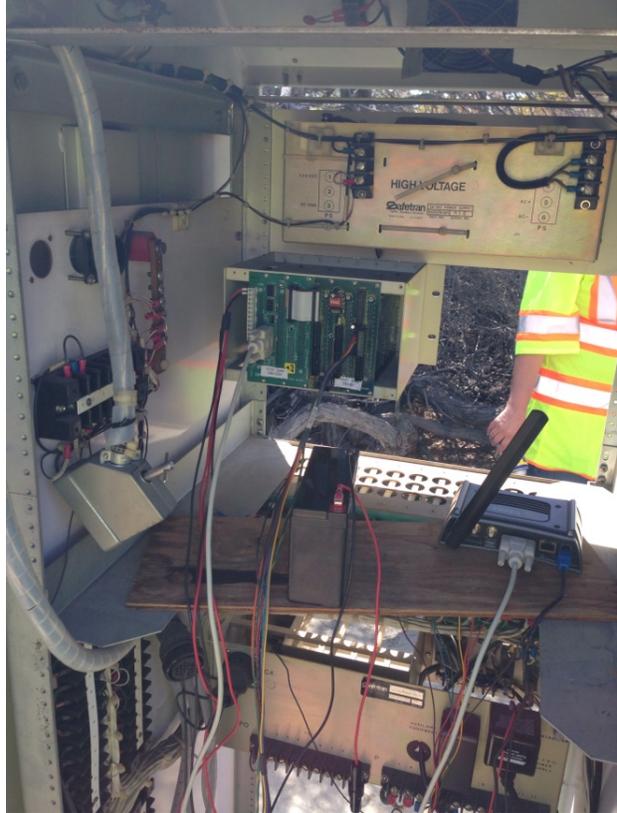


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Mount Soledad Freeway, San Diego, CA 92122, USA



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Mount Soledad Freeway, San Diego, CA 92122, USA



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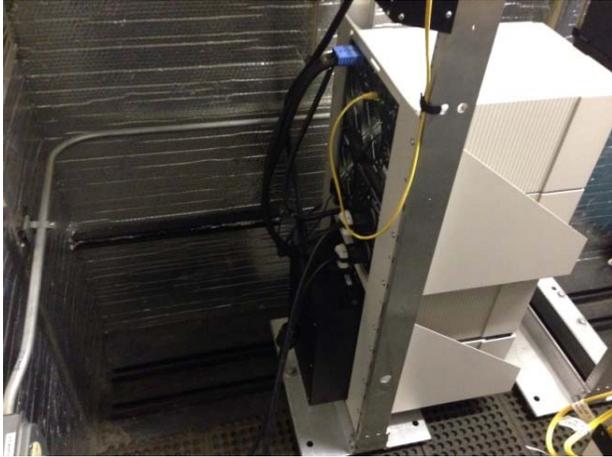
MODIFY

COMMUNICATION

HUB

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LOCATION 16 - MODIFY COMMUNICATION HUB



LOCATION 16 - MODIFY COMMUNICATION HUB



LOCATION 17 - MODIFY COMMUNICATION HUB



LOCATION 17 - MODIFY COMMUNICATION HUB

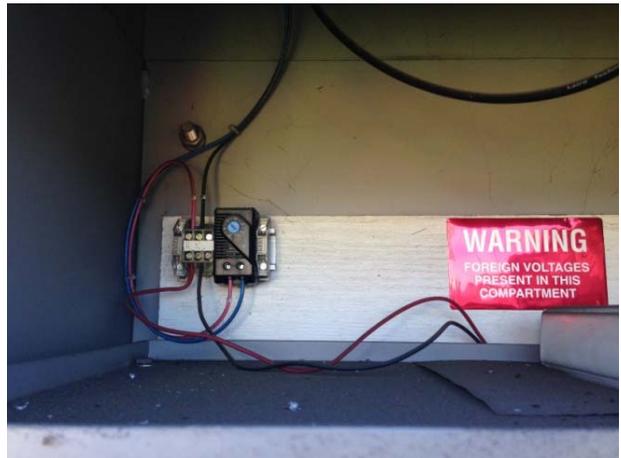


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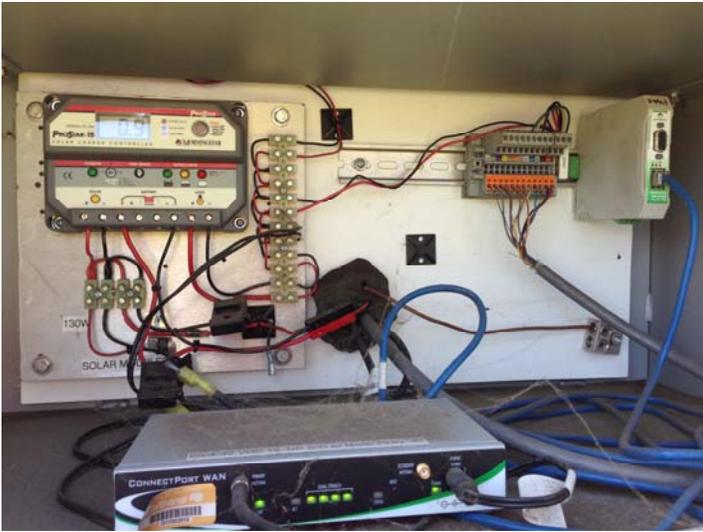
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PHOTOVOLTAIC
SYSTEM**

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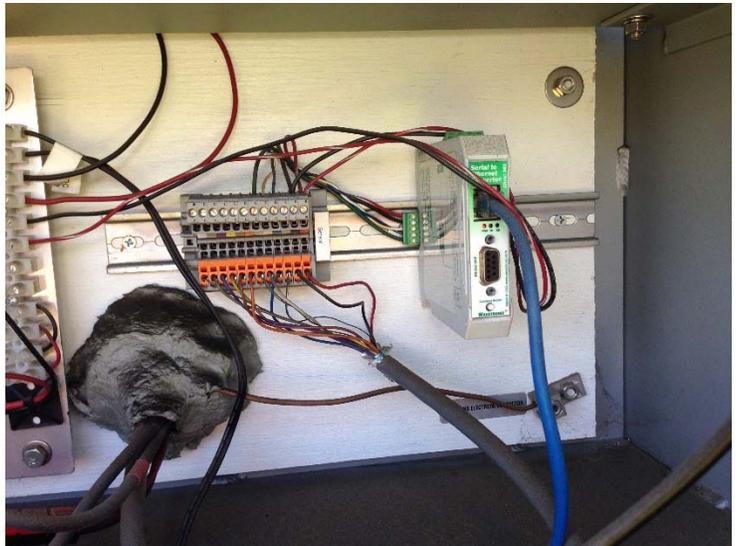
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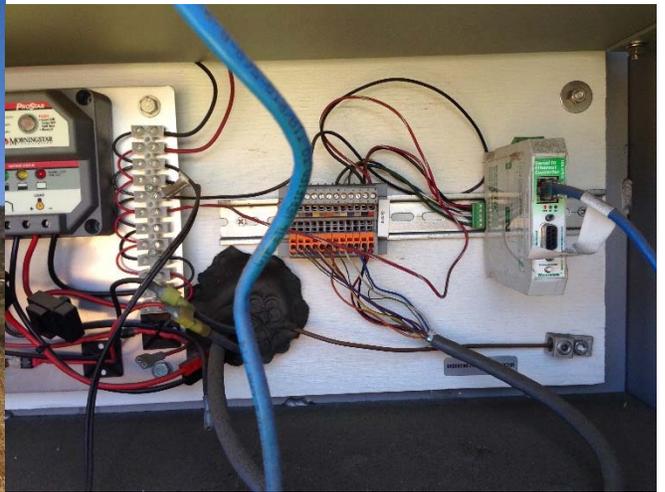
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LOCATION 20 - MODIFY PHOTOVOLTAIC SYSTEM



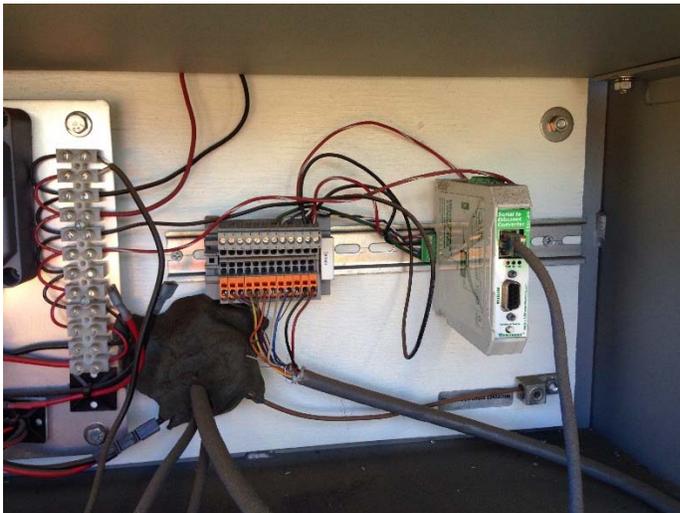
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LOCATION 22 - MODIFY PHOTOVOLTAIC SYSTEM



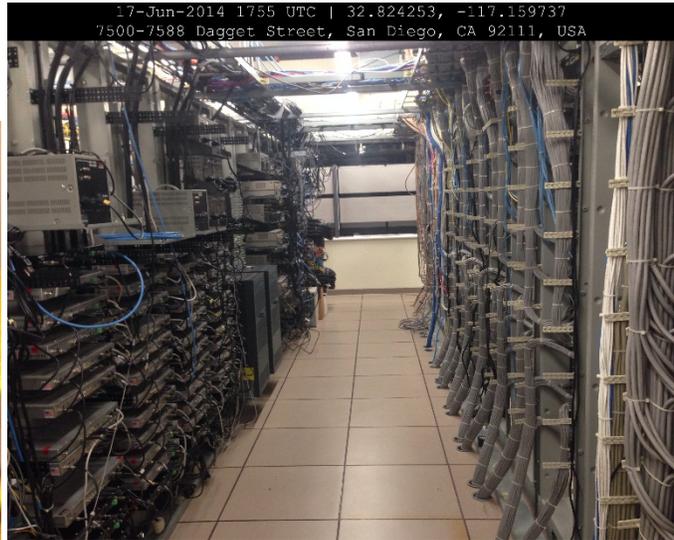
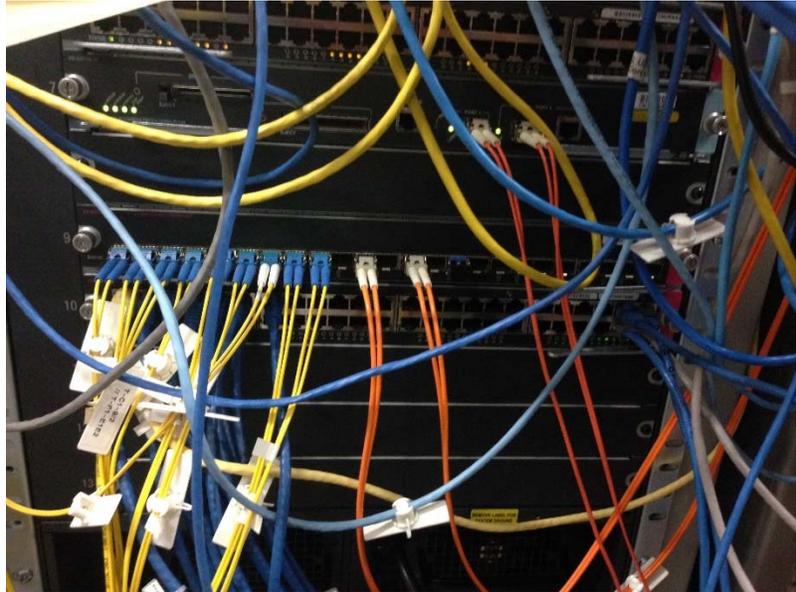
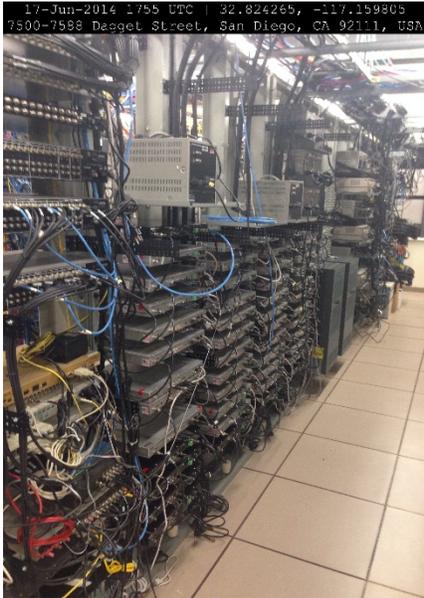
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**SECTION 6
MODIFY
INTELLIGENT
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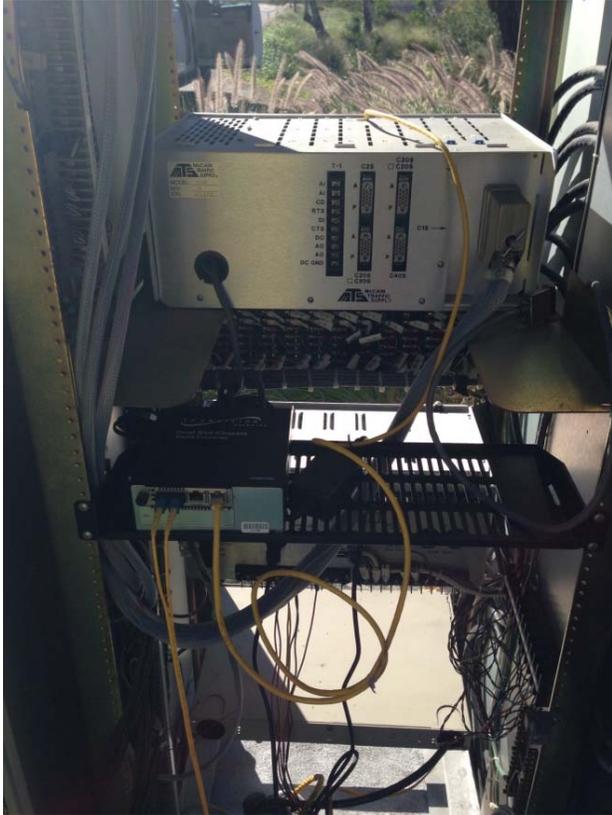


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SECTION 7
MODIFY
RAMP METERING

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LOCATION 25 - MODIFY RAMP METERING SYSTEM



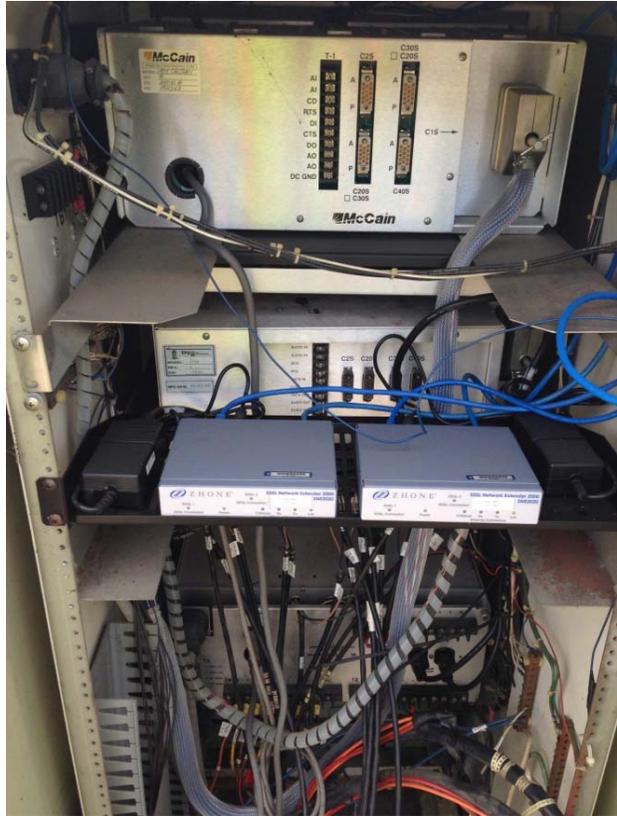
LOCATION 26 - MODIFY RAMP METERING SYSTEM



DELETED LOCATION

DELETED LOCATION

LOCATION 29 - MODIFY RAMP METERING SYSTEM



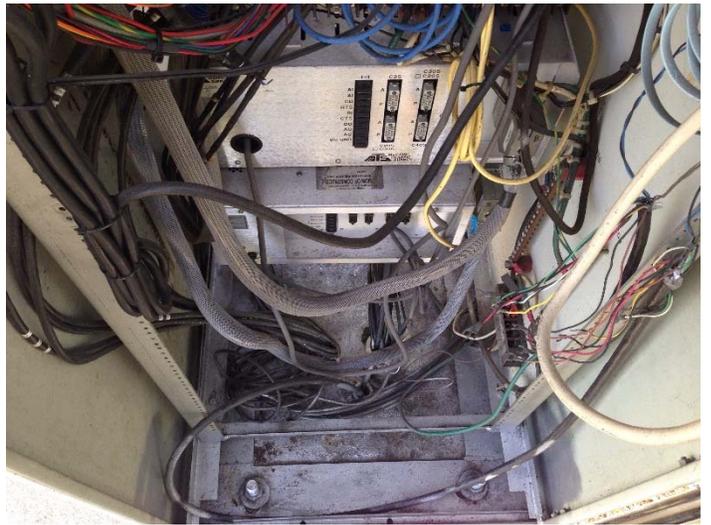
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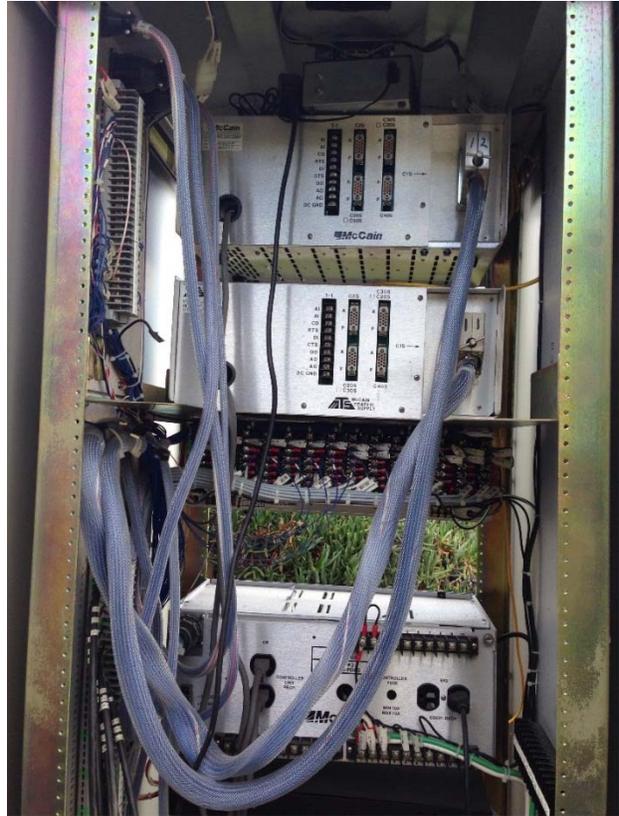
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MODIFY
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MONITORING
STATION**

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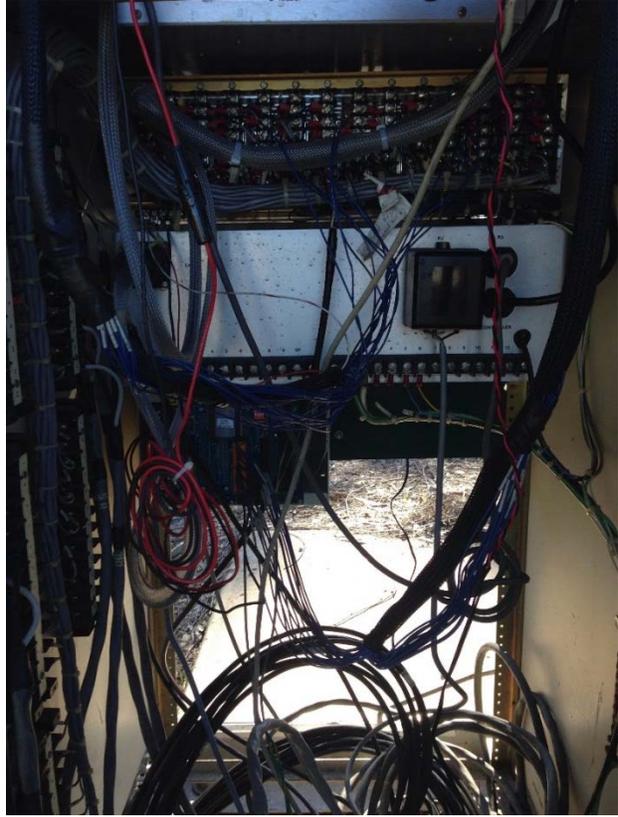
LOCATION 32 - MODIFY TRAFFIC MONITORING STATION



LOCATION 33 - MODIFY TRAFFIC MONITORING STATION



LOCATION 34 - MODIFY TRAFFIC MONITORING STATION



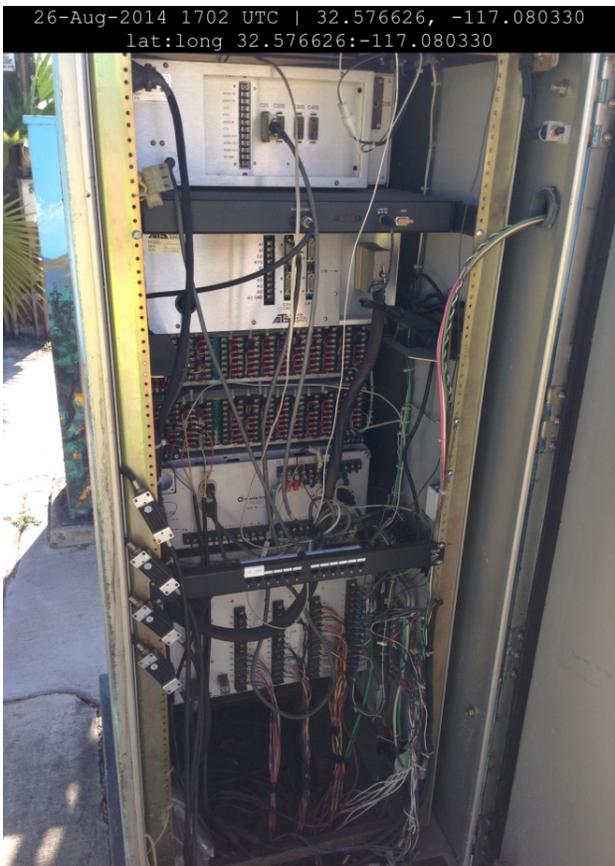
SECTION 9

MODIFY

TRAFFIC SIGNAL

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LOCATION 35 - MODIFY SIGNAL



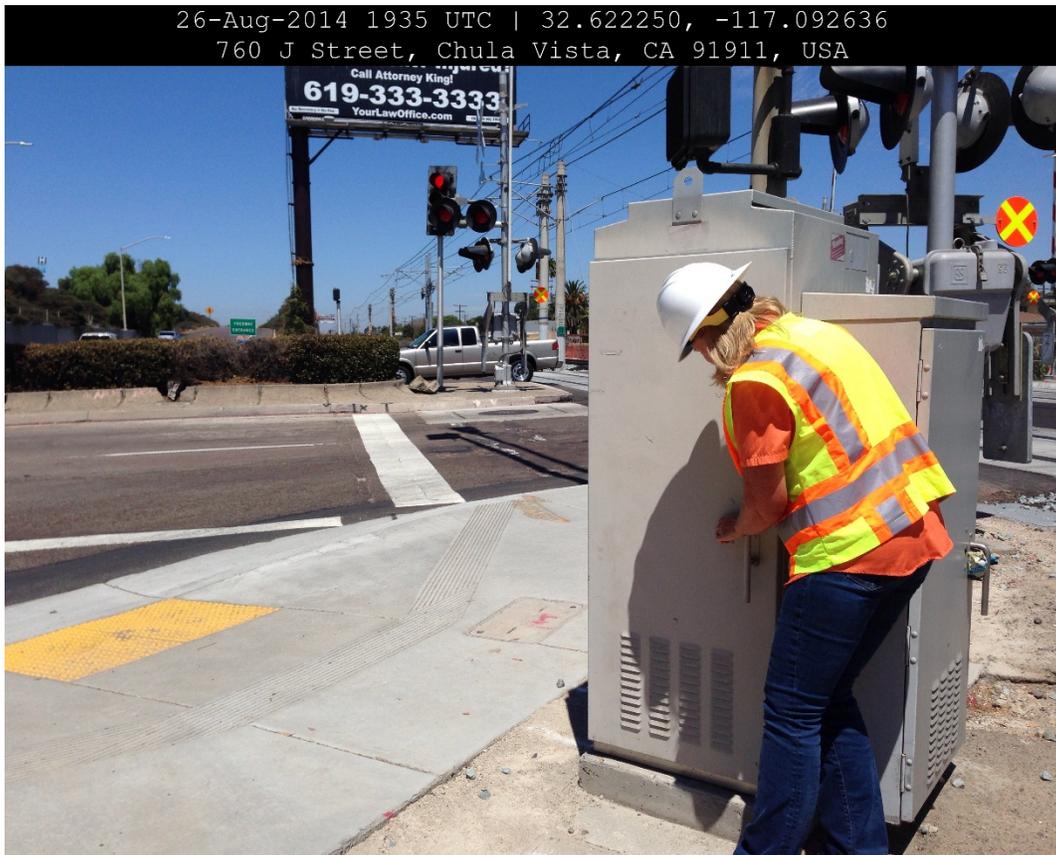
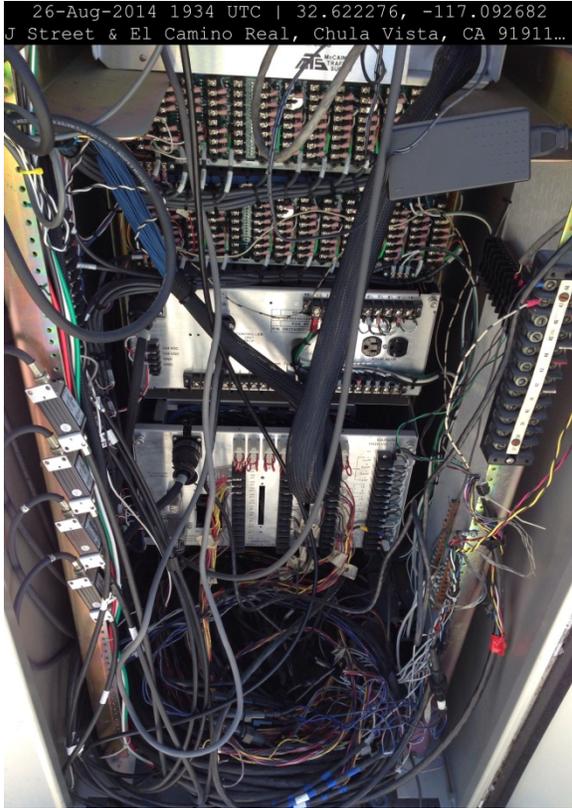
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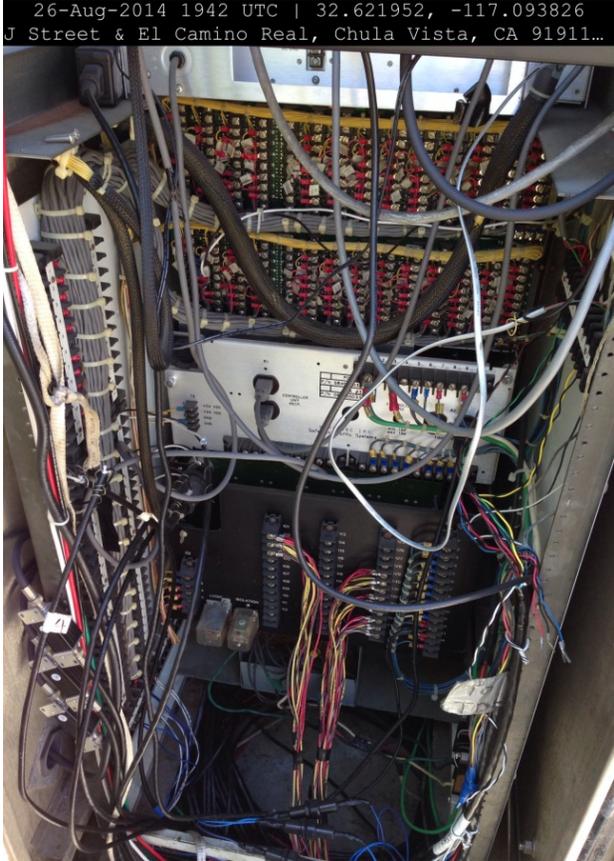
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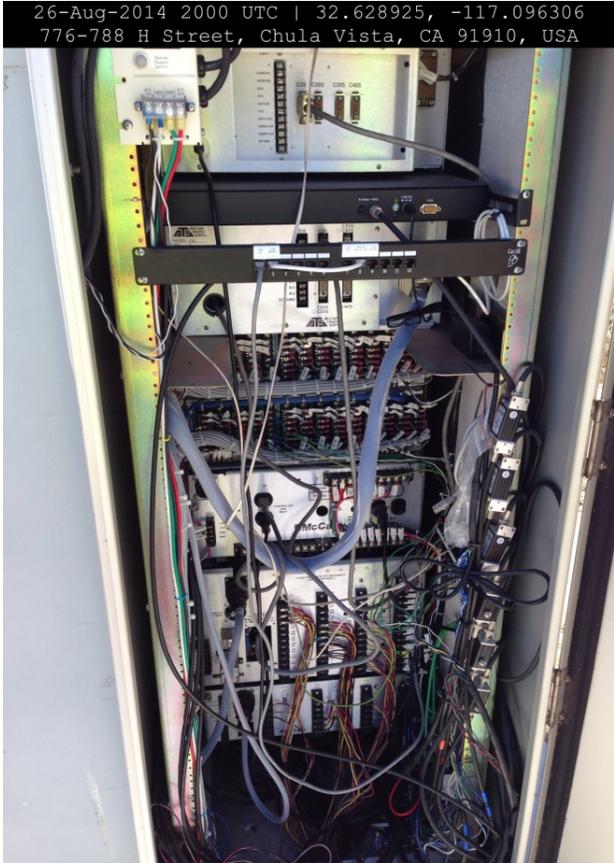
LOCATION 38 - MODIFY SIGNAL



LOCATION 39 - MODIFY SIGNAL



LOCATION 40 - MODIFY SIGNAL



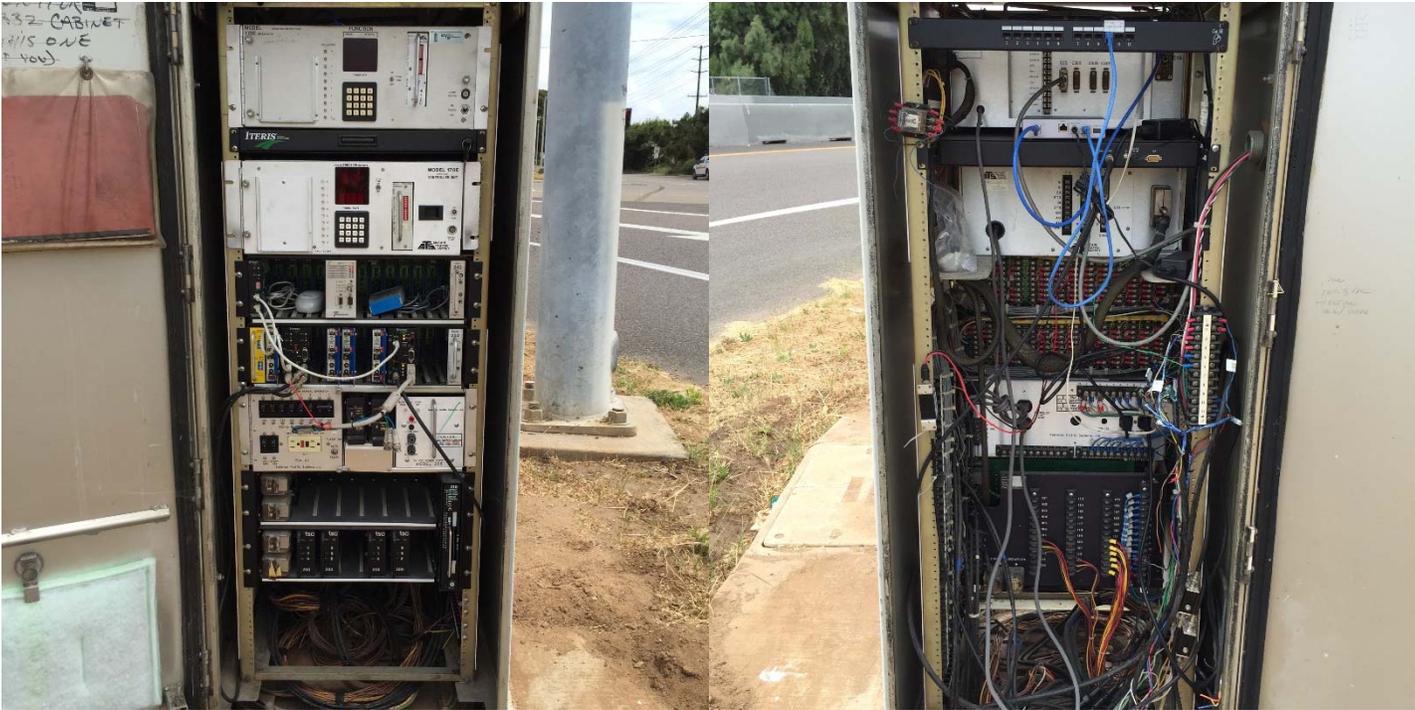
LOCATION 41 - MODIFY SIGNAL



LOCATION 42 - MODIFY SIGNAL



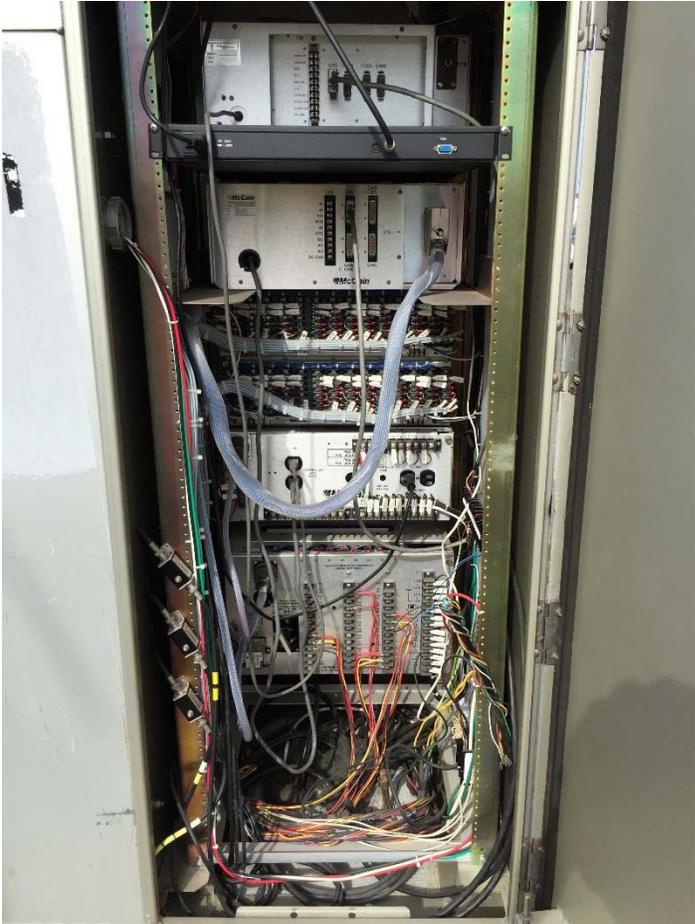
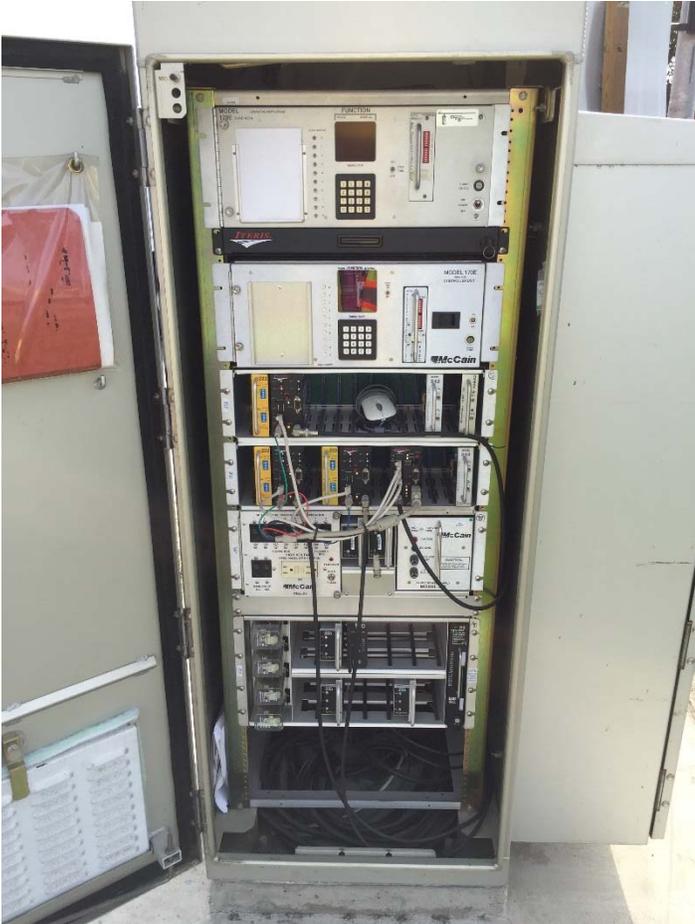
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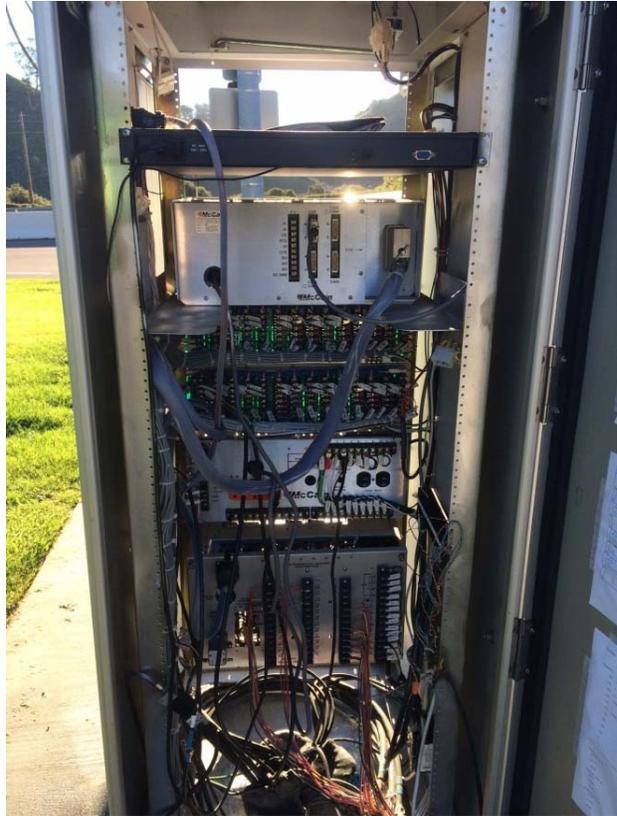
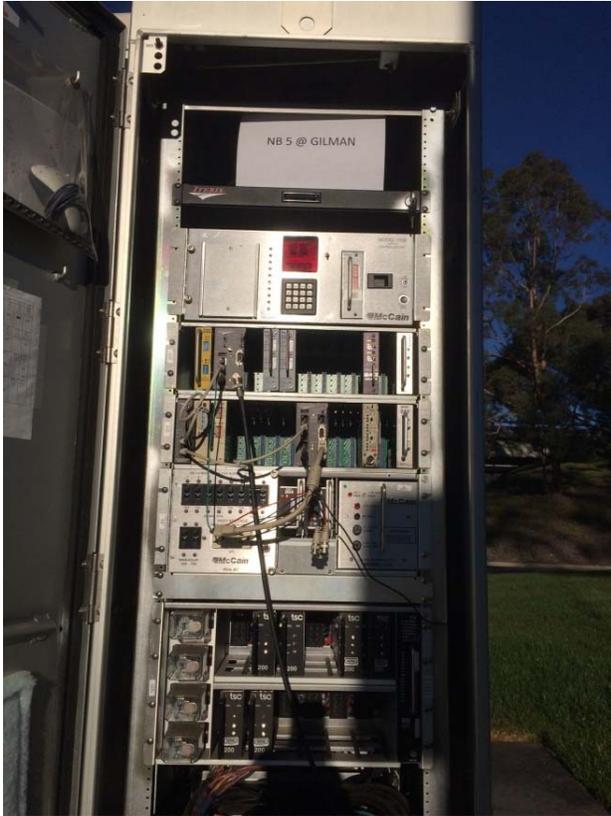
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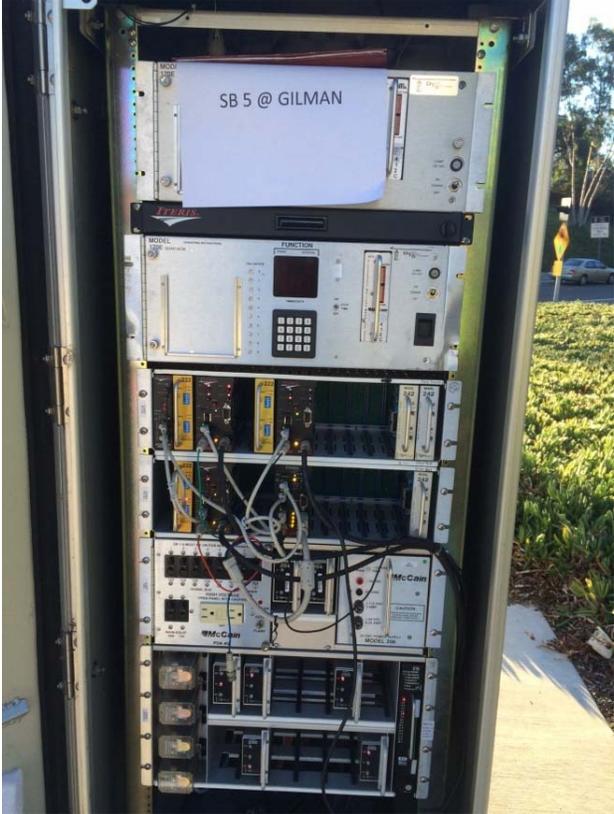
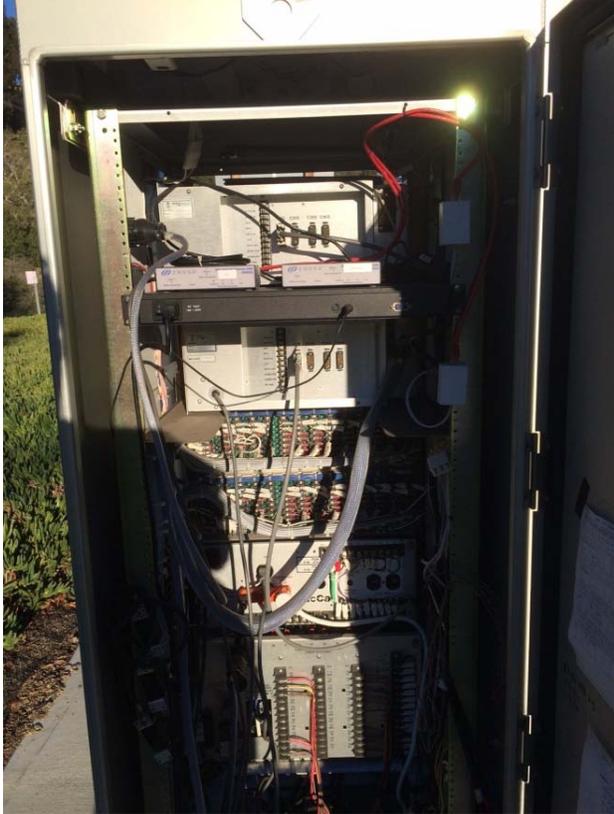
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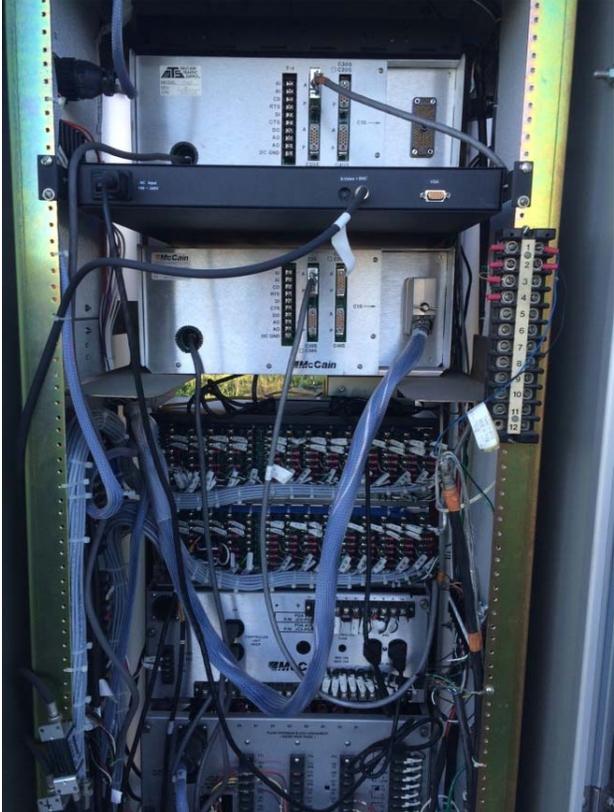
LOCATION 46 - MODIFY SIGNAL



LOCATION 47 - MODIFY SIGNAL



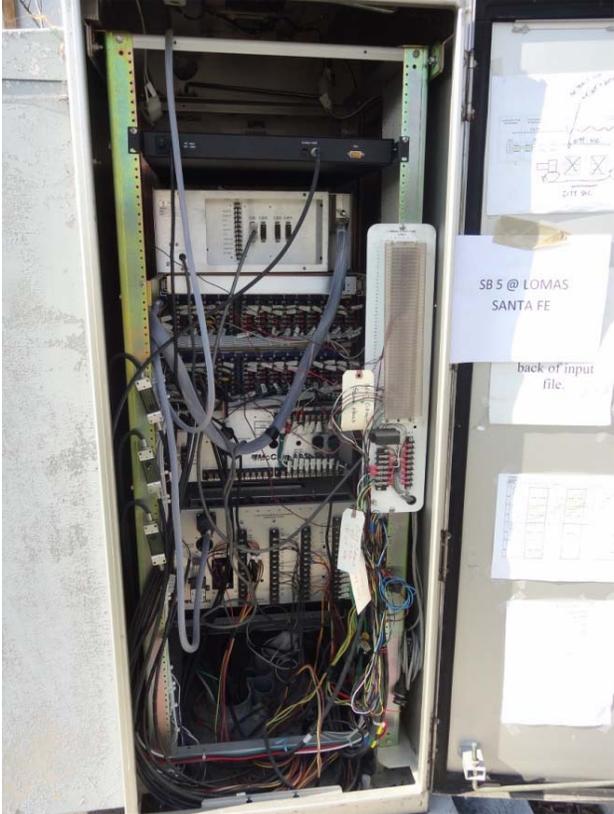
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LOCATION 49 - MODIFY SIGNAL



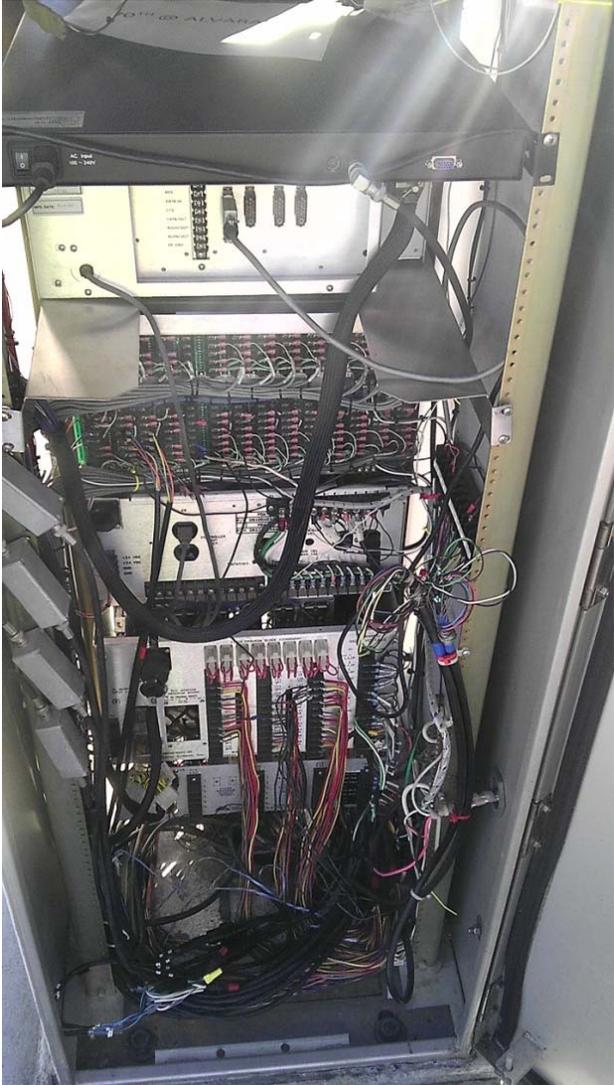
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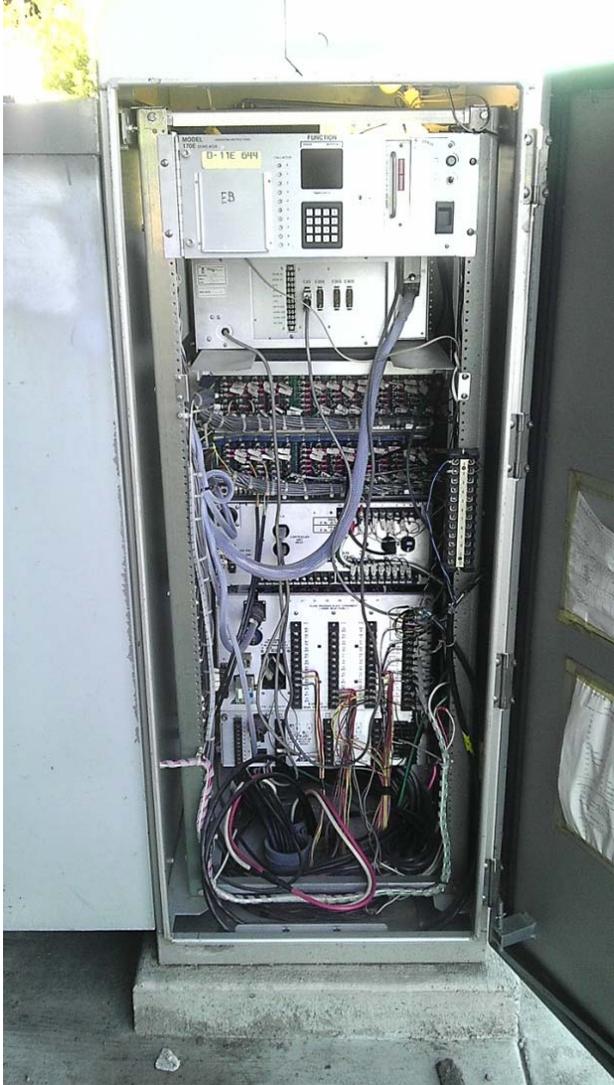
LOCATION 51 - MODIFY SIGNAL



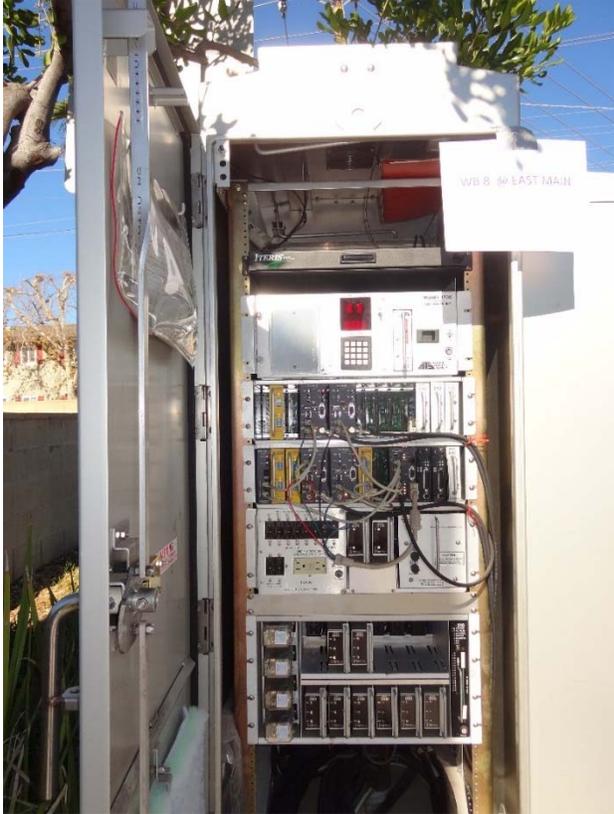
LOCATION 52 - MODIFY SIGNAL



LOCATION 53 - MODIFY SIGNAL



LOCATION 54 - MODIFY SIGNAL



LOCATION 55 - MODIFY SIGNAL



LOCATION 56 - MODIFY SIGNAL



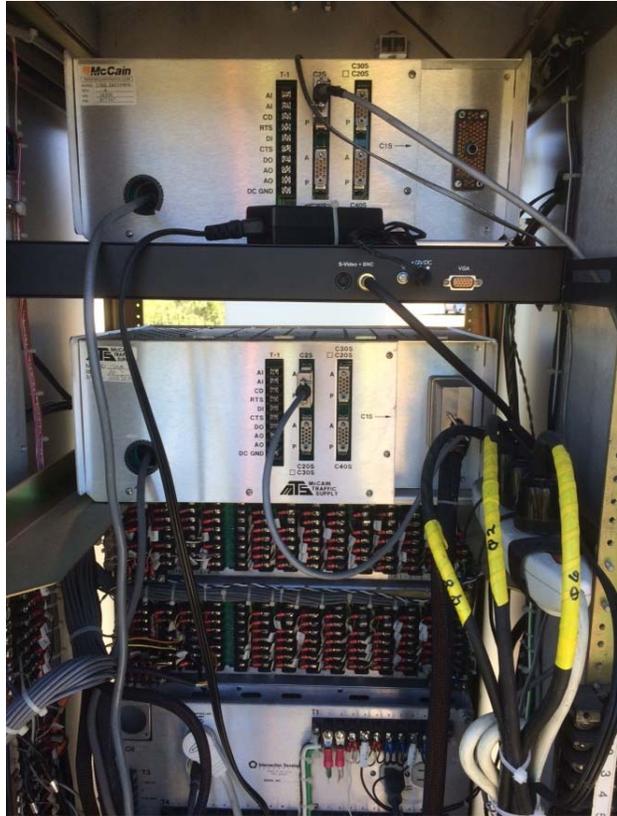
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LOCATION 58 - MODIFY SIGNAL



LOCATION 59 - MODIFY SIGNAL



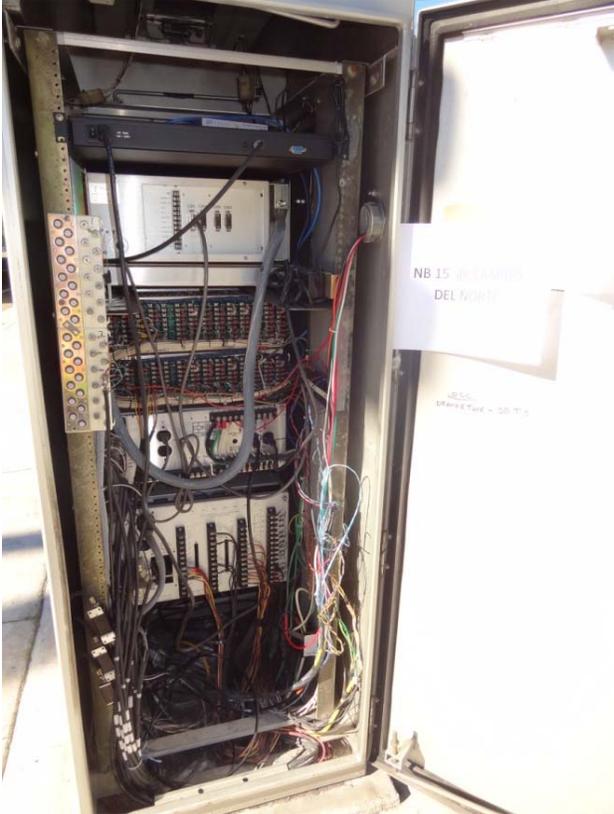
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LOCATION 61 - MODIFY SIGNAL



LOCATION 62 - MODIFY SIGNAL



LOCATION 63 - MODIFY SIGNAL



LOCATION 64 - MODIFY SIGNAL



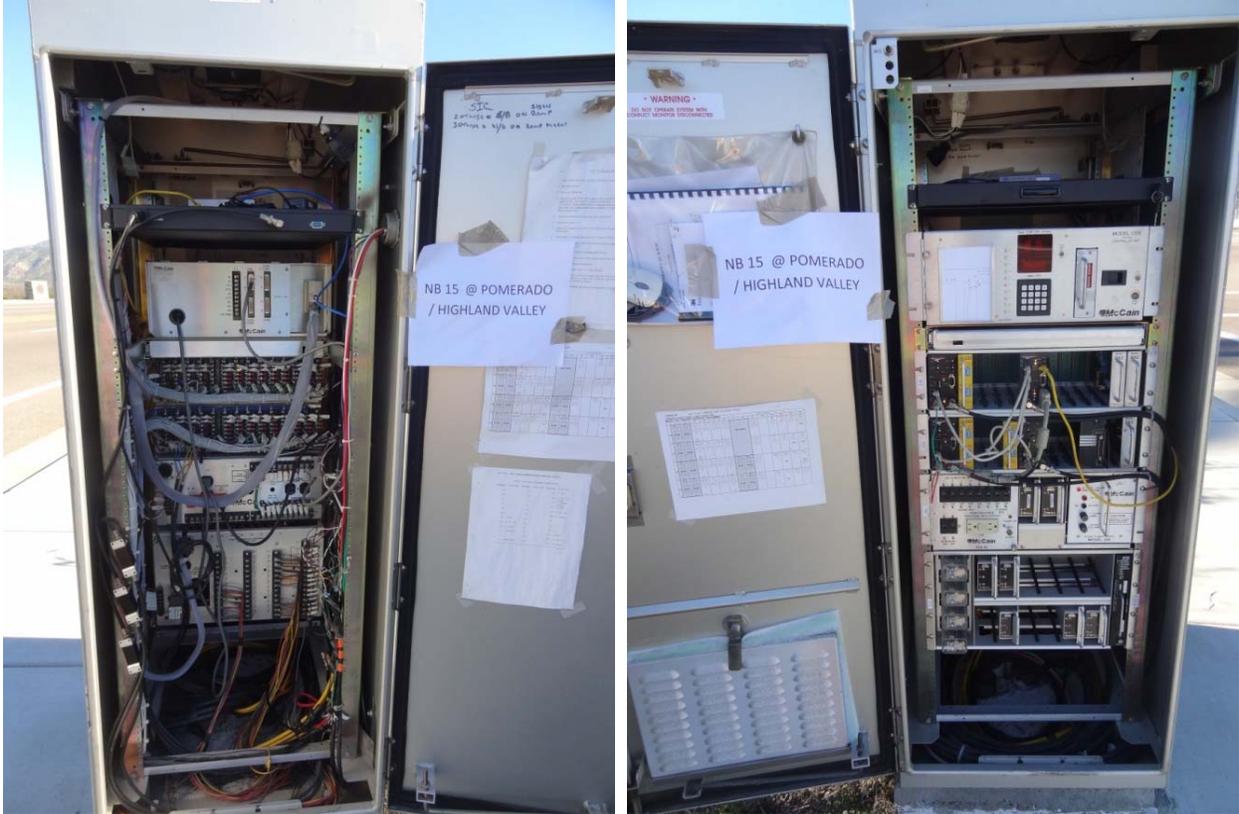
LOCATION 65 - MODIFY SIGNAL



LOCATION 66 – MODIFY SIGNAL



LOCATION 67 - MODIFY SIGNAL



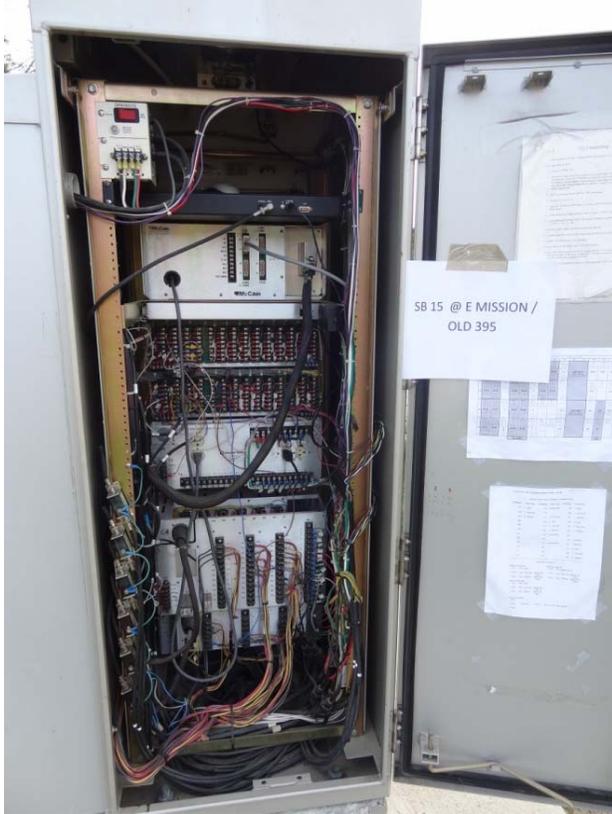
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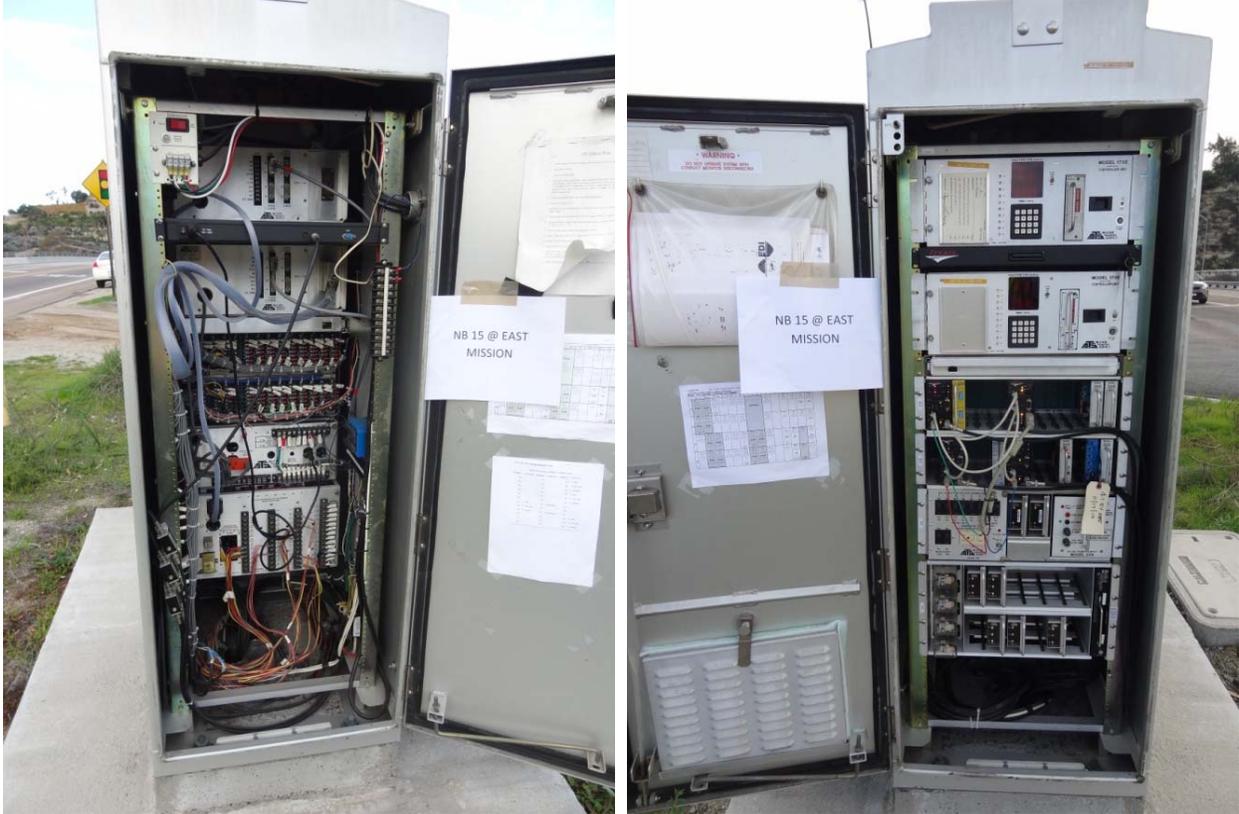
LOCATION 69 - MODIFY SIGNAL



LOCATION 70 - MODIFY SIGNAL



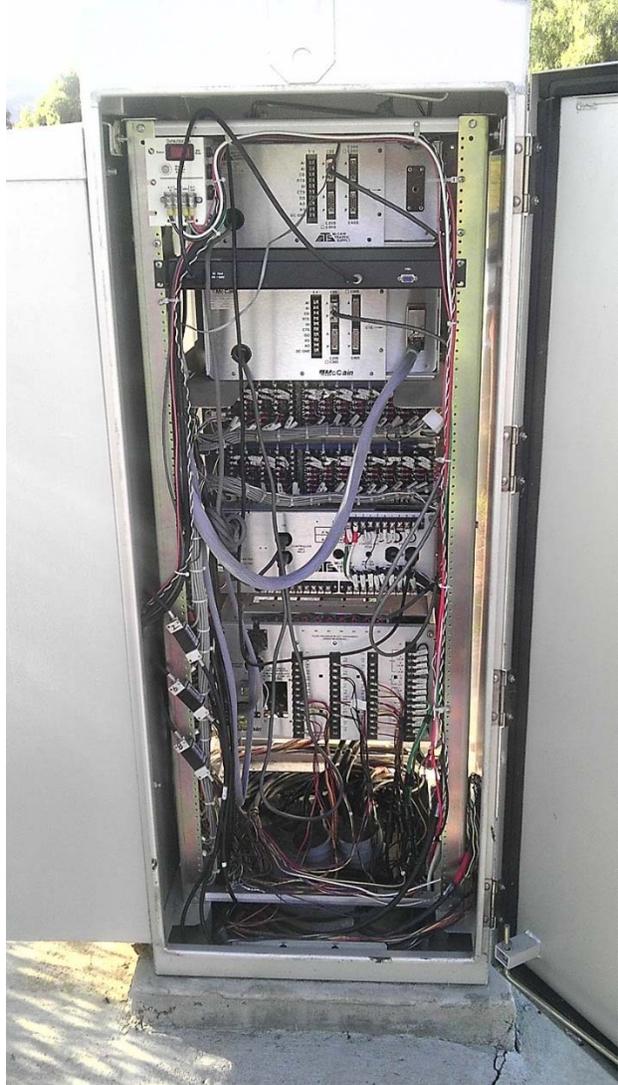
LOCATION 71 - MODIFY SIGNAL



LOCATION 72 - MODIFY SIGNAL



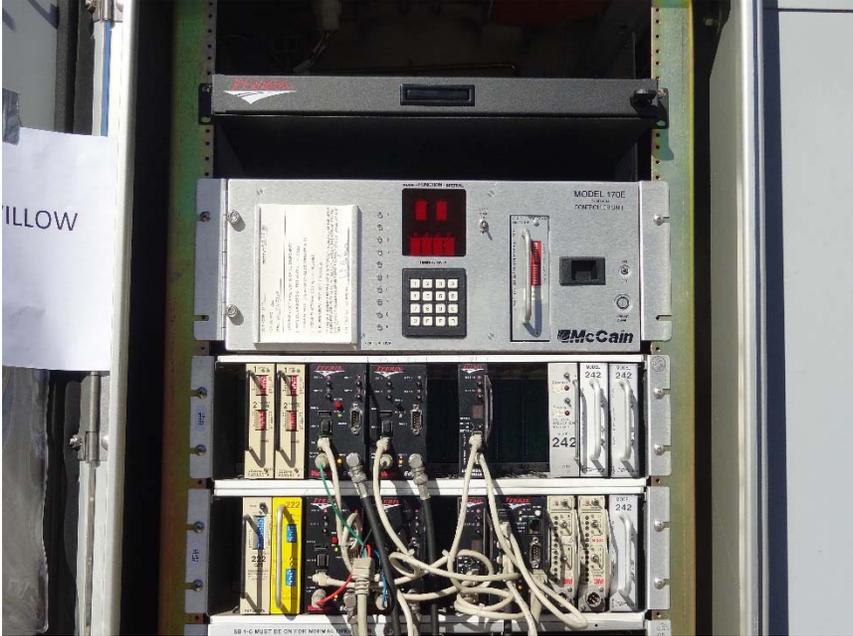
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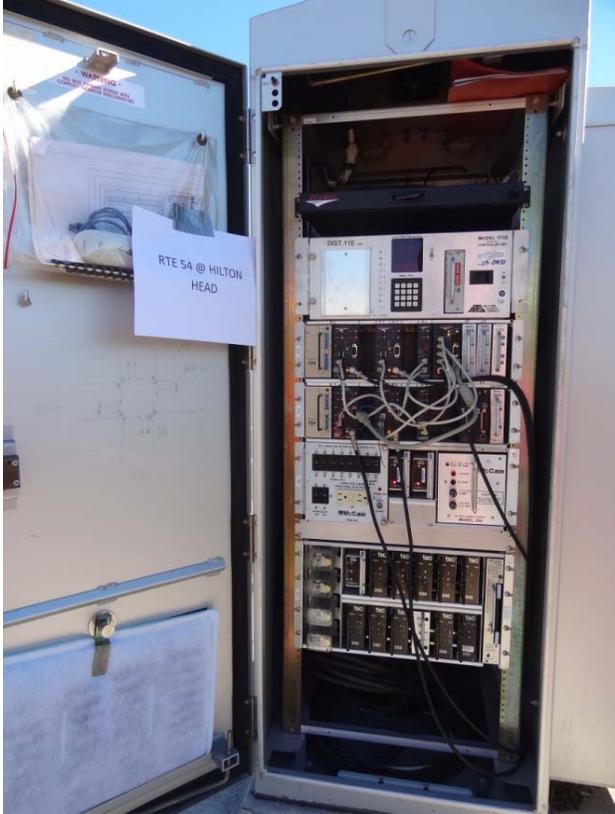
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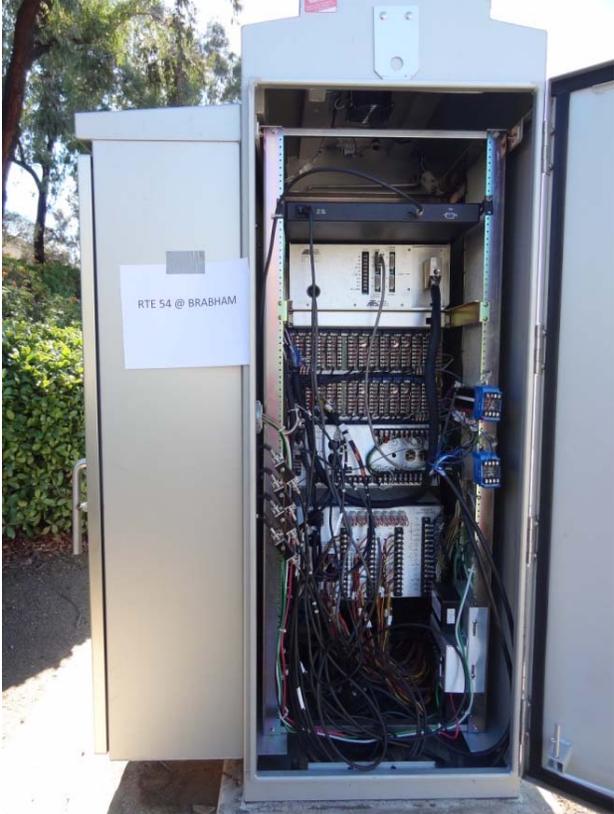
LOCATION 75 - MODIFY SIGNAL



LOCATION 76 - MODIFY SIGNAL



LOCATION 77 - MODIFY SIGNAL



LOCATION 78 - MODIFY SIGNAL



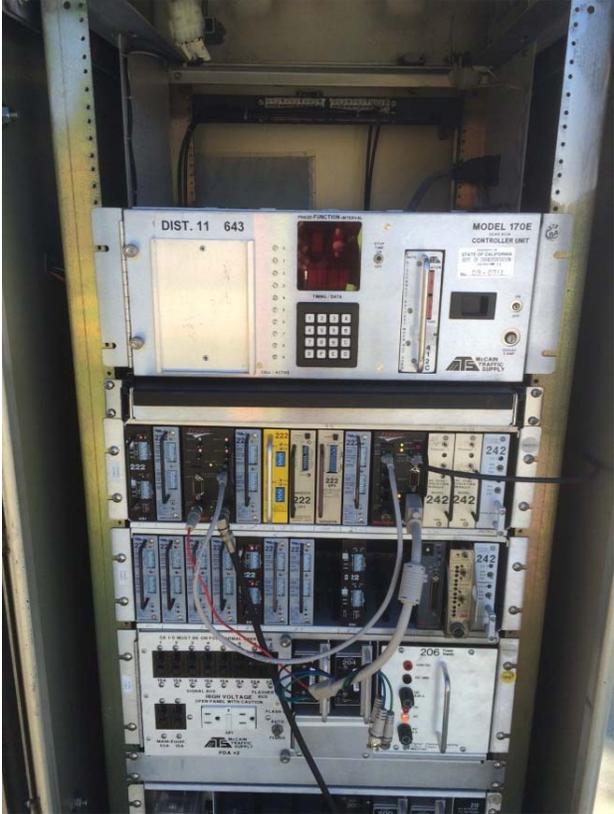
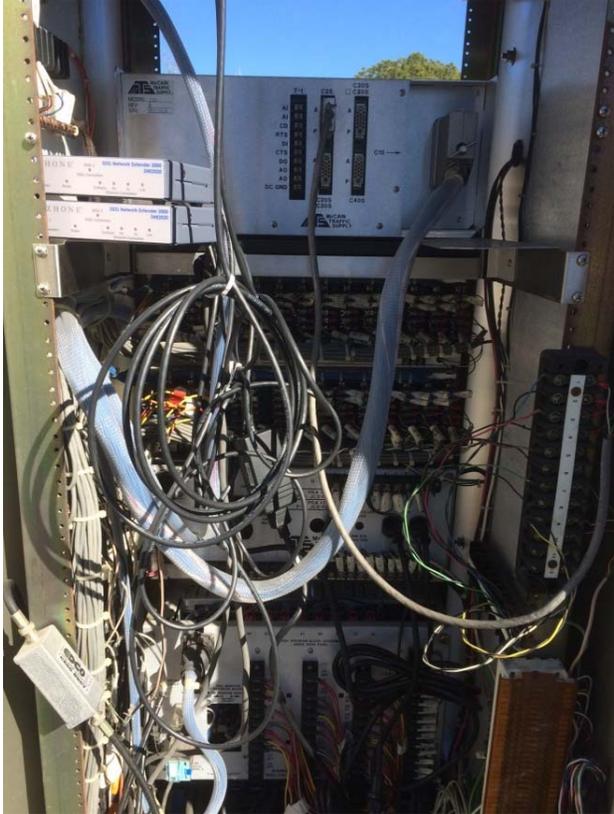
LOCATION 79 - MODIFY SIGNAL



LOCATION 80 - MODIFY SIGNAL



LOCATION 81 - MODIFY SIGNAL



LOCATION 82 - MODIFY SIGNAL



LOCATION 83 - MODIFY SIGNAL



LOCATION 84 - MODIFY SIGNAL



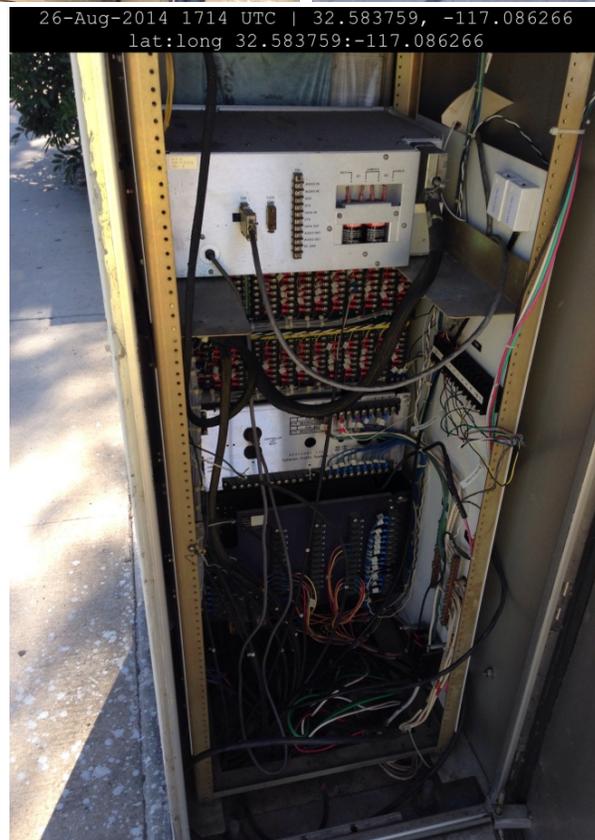
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LOCATION 86 - MODIFY SIGNAL



LOCATION 87 - MODIFY SIGNAL



LOCATION 88 - MODIFY SIGNAL



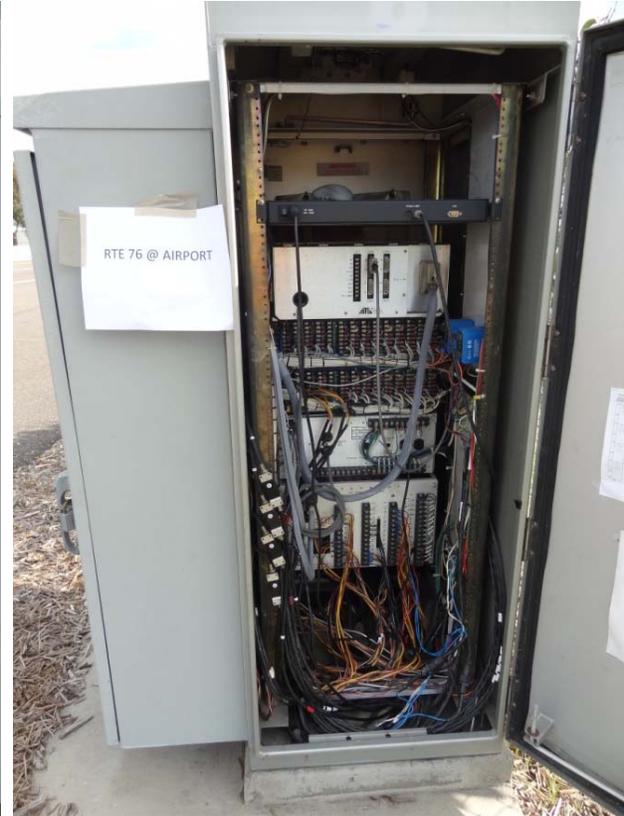
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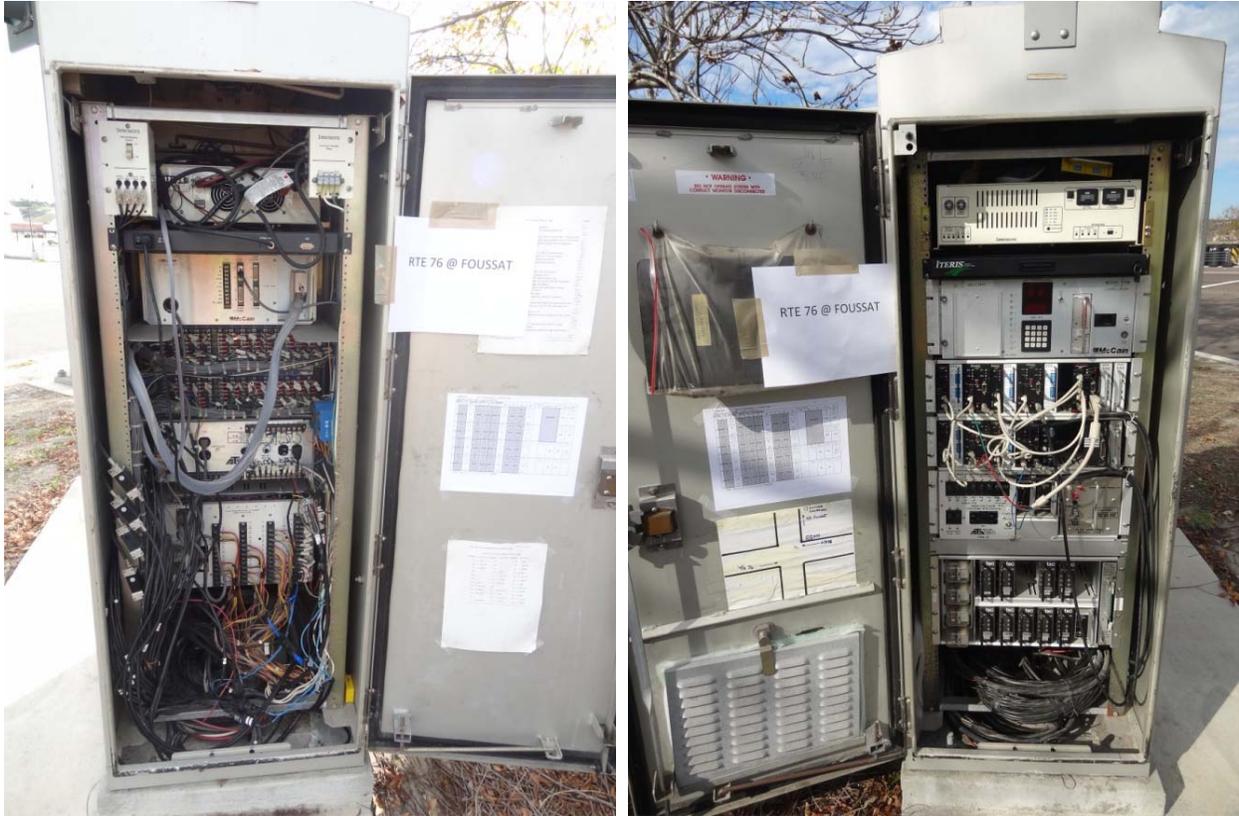
LOCATION 90 - MODIFY SIGNAL



LOCATION 91 - MODIFY SIGNAL



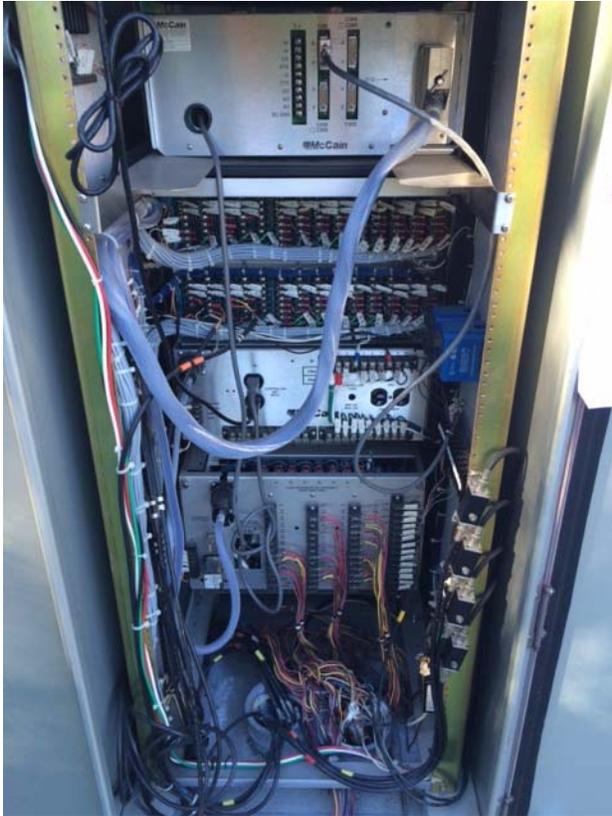
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LOCATION 93 - MODIFY SIGNAL



LOCATION 94 - MODIFY SIGNAL



LOCATION 95 - MODIFY SIGNAL



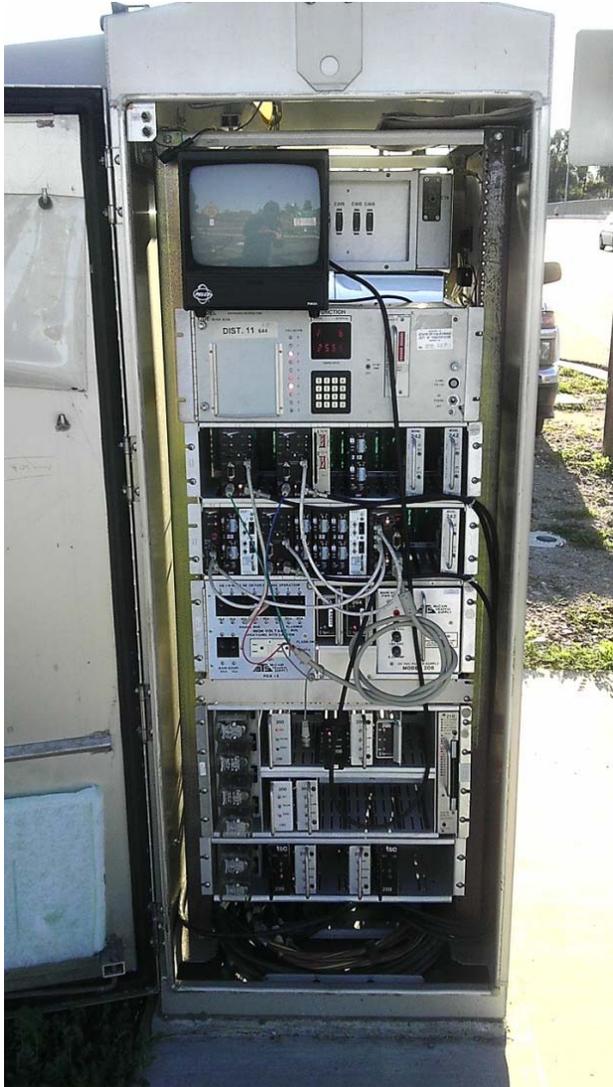
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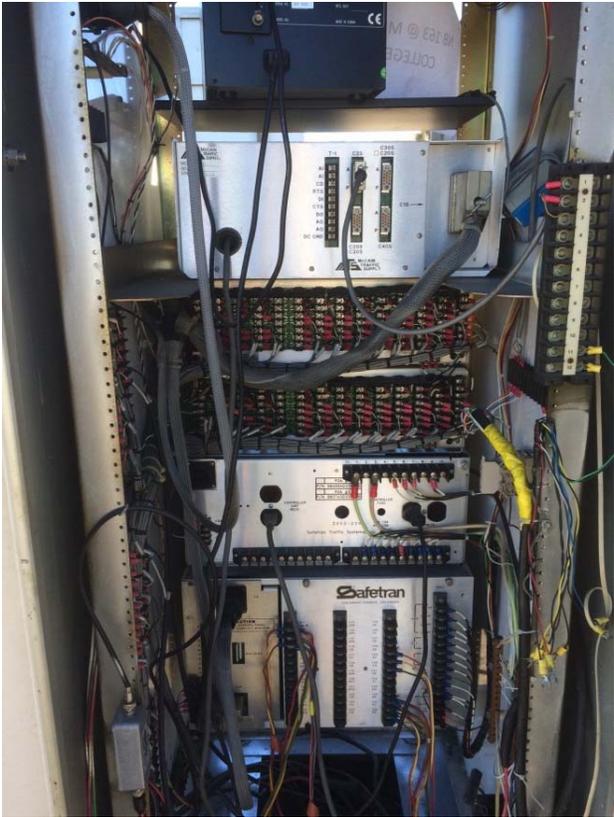
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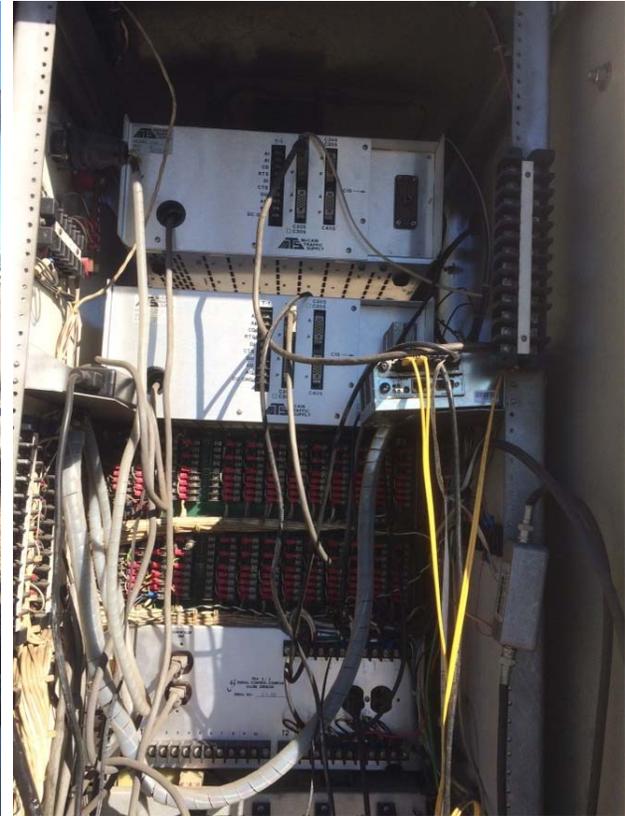
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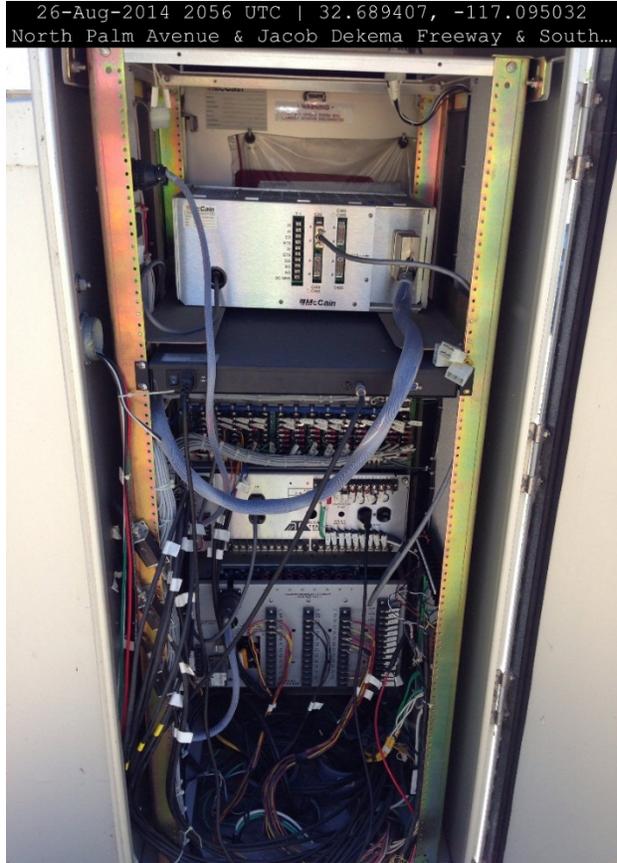
LOCATION 99 - MODIFY SIGNAL



LOCATION 100 - MODIFY SIGNAL



LOCATION 101 - MODIFY SIGNAL



LOCATION 102 - MODIFY SIGNAL

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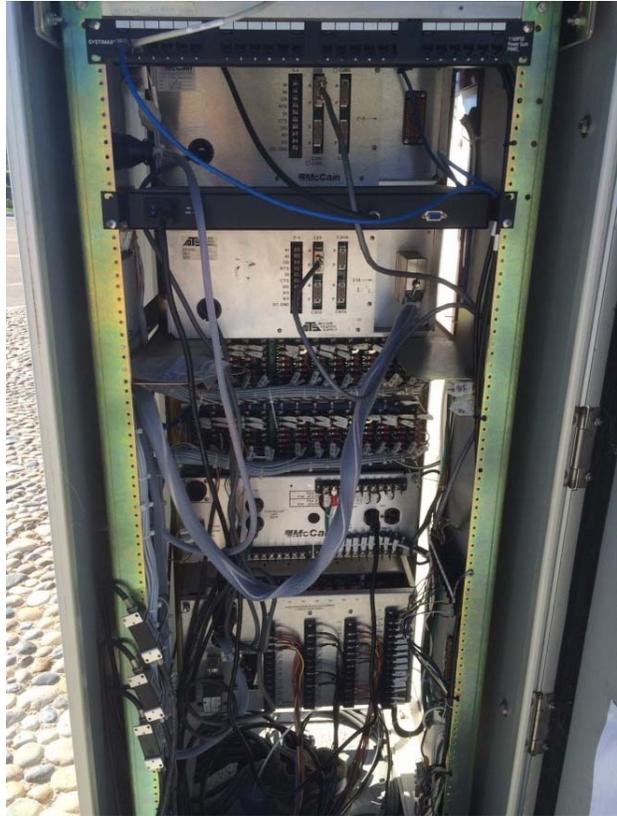
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South 47th Street & Jacob Dekema Freeway, Nation...



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1605 Alpha Street, National City, CA 91950, USA



LOCATION 103 - MODIFY SIGNAL



LOCATION 104 - MODIFY SIGNAL



LOCATION 105 - MODIFY SIGNAL



LOCATION 106 - MODIFY SIGNAL



LOCATION 107 - MODIFY SIGNAL



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SECTION 10

MODIFY

VIDEO WALL

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LOCATION 24 - MODIFY VIDEO WALL



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APPENDIX A

CABLE LACING

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LACING CONDUCTORS

Conductors within equipment must be kept in place to present a neat appearance and aid in tracing the conductors when alterations or repairs are required. This is done by LACING the conductors into wire bundles called cables. An example of lacing is shown in figure 2-39. When conductors are properly laced, they support each other and form a neat, single cable.

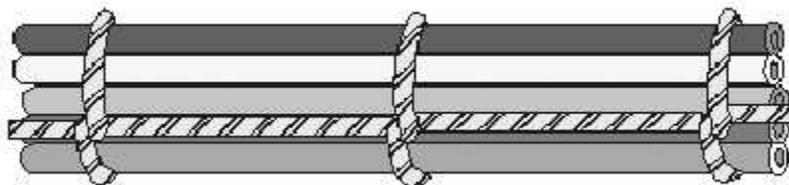


Figure 2-39.—Conductor lacing.

A narrow, flat tape should be used wherever possible for lacing and tying. This tape is not an adhesive type of tape. Round cord may also be used, but its use is not preferred because cord has a tendency to cut into wire insulation. Use cotton, linen, nylon, or glass fiber cord or tape, according to the temperature requirements. Cotton or linen cord or tape must be prewaxed to make it moisture and fungus resistant. Nylon cord or tape may be waxed or unwaxed; glass fiber cord or tape is usually not waxed.

The amount of flat tape or cord required to single lace a group of conductors is about two and one-half times the length of the longest conductor in the group. Twice this amount is required if the conductors are to be double laced.

Before lacing, lay the conductors out straight and parallel to each other. Do not twist them together because twisting makes conductor lacing and wire tracing difficult during troubleshooting.

A lacing shuttle on which the cord can be wound keeps the cord from fouling during the lacing operation. A shuttle similar to the one shown in figure 2-40 can easily be made from aluminum, brass, fiber, or plastic scrap. Rough edges of the material used for the shuttle should be filed smooth to prevent injury to the operator and damage to the cord. To fill the shuttle for a single lace, measure the cord, cut it, and wind it on the shuttle. For double lace, proceed as before, except double the length of the cord before you wind it on the shuttle. For double lace, start both ends of the cord or tape on the shuttle in order to leave a loop for starting the lace. This procedure is explained later in the chapter.

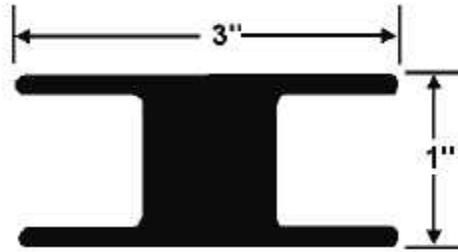


Figure 2-40.—Lacing shuttle.

Some equipment requires the use of twisted wires. One example is the use of "twisted pairs" for the ac filament leads of certain electron tube amplifiers to minimize radiation of their magnetic field. This prevents an annoying hum in the amplifier output. You should duplicate the original layout when relacing any wiring harness.

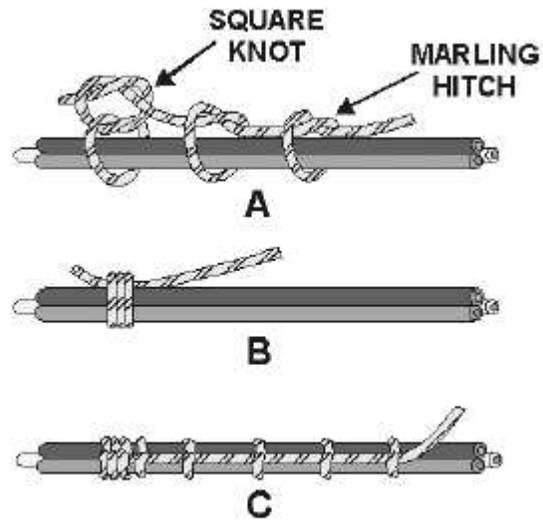
Lace or tie bundles tightly enough to prevent slipping, but not so tightly that the cord or tape cuts into or deforms the insulation. Be especially careful when lacing or tying coaxial cable. Coaxial cable is a conductor used primarily for radio-frequency transmission. It consists of a center conductor separated from an outer conductor (usually called a shield) by an insulating dielectric. The dielectric maintains a constant capacitance between the two conductors, which is very important in radio transmission. The dielectric is soft and deforms easily if tied too tightly or with the wrong type of tape.

CAUTION

Do not use round cord for lacing or tying coaxial cable or bundles that contain coaxial cable. Use only the approved military specification tape to lace or tie coaxial cables or bundles containing coaxial cables.

SINGLE LACE

Single lace can be started with a square knot and at least two marling hitches drawn tightly. Details of the square knot and marling hitch are shown in figure 2-41. Do not confuse the marling hitch with a half hitch. In the marling hitch, the end is passed over and under the strand, as shown in view A of the figure. After forming the marling hitches, draw them tightly against the square knot, as shown in view B. The lace consists of a series of marling hitches evenly spaced at 1/2-inch to 1-inch intervals along the length of the group of conductors, as shown in view C of the figure.



When dividing conductors to form two or more branches, follow the procedure illustrated in figure 2-42. Bind the conductors with at least six turns between two marling hitches, and continue the lacing along one of the branches, as shown in view A. Start a new lacing along the other branch. To keep the bends in place, form them in the conductors before lacing. Always add an extra marling hitch just prior to a breakout as shown in view B.

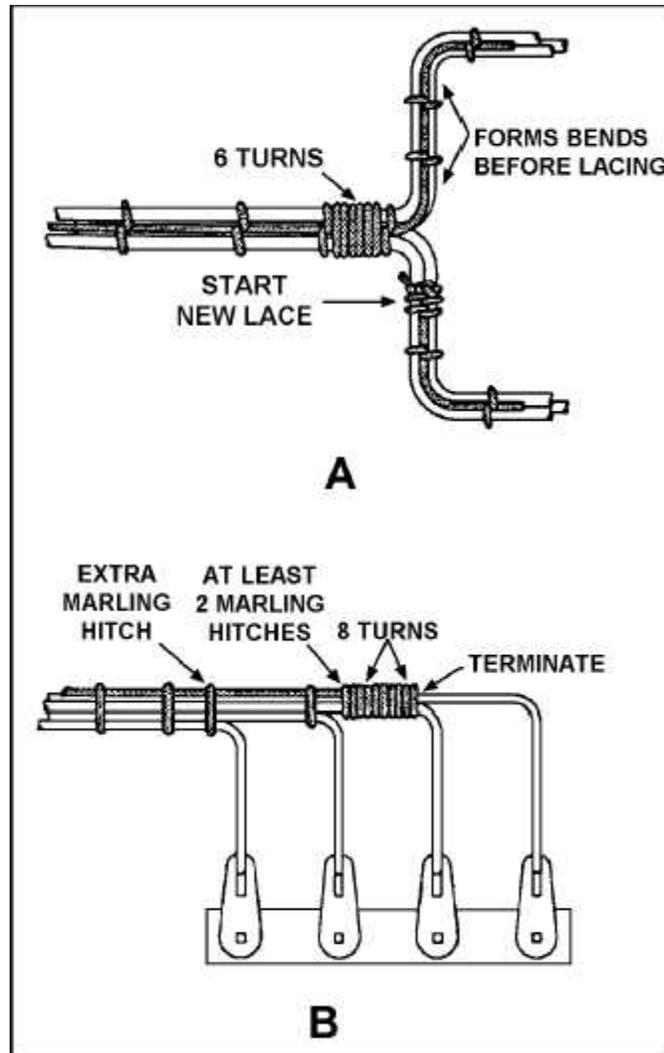


Figure 2-42.—Lacing branches and breakouts.

Double lace should be used on groups of conductors that are 1 inch or larger in total diameter. Either a single lace or a double lace may be used on groups of less than 1 inch.

DOUBLE LACE

Double lace is applied in a manner similar to single lace, except that it is started with a telephone hitch and is double throughout the length of the lacing (figure 2-43). Both double and single lace may be ended by forming a loop from a separate length of cord and using it to pull the end of the lacing back underneath a serving of approximately eight turns (figure 2-44). An alternate method of ending the lacing is illustrated in figure 2-45. This method can also be used for either single- or double-cord lacing. Another method is by using a marling hitch as a lock stitch (figure 2-46) to prevent slippage. This procedure will also prevent unraveling should a break occur to the lacing.

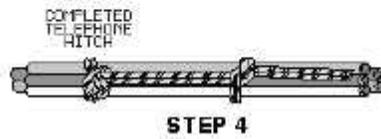
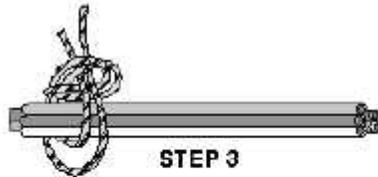
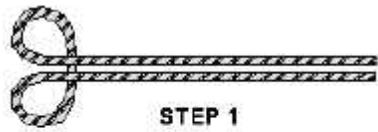


Figure 2-43.—Starting double lace.

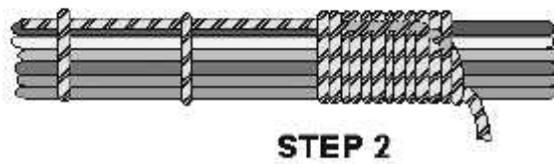
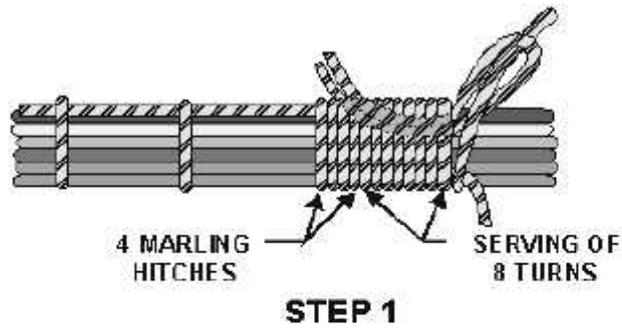


Figure 2-44.—Terminating double lace.

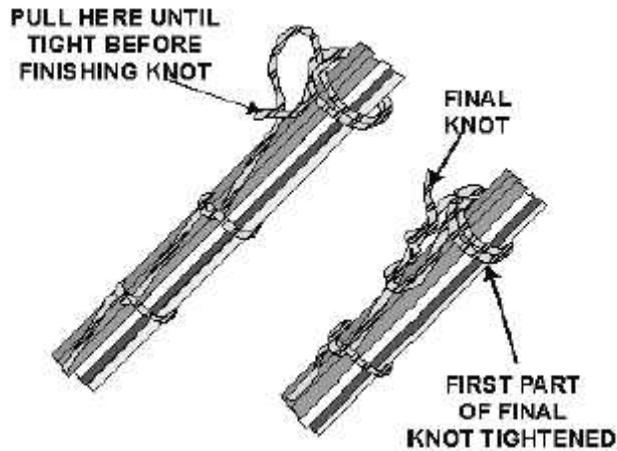


Figure 2-45.—Alternate method of terminating the lace.

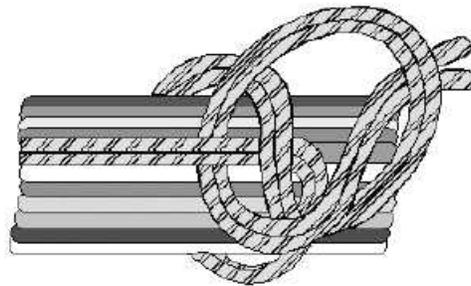


Figure 2-46.—Marling hitch as a lock stitch

The spare conductors of a multiconductor cable should be laced separately, and then tied to active conductors of the cable with a few telephone hitches. When two or more cables enter an enclosure, each cable group should be laced separately. When groups are parallel to each other, they should be bound together at intervals with telephone hitches (figure 2-47).

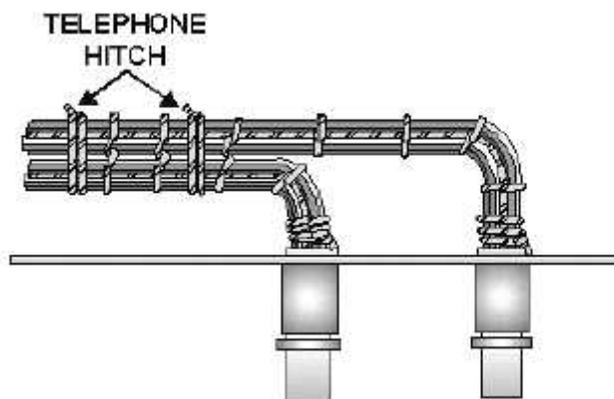


Figure 2-47.—Spot tying cable groups.

SPOT TYING

When cable supports are used in equipment as shown in figure 2-48, spot ties are used to secure the conductor groups if the supports are more than 12 inches apart. The spot ties are made by wrapping the cord around the group as shown in figure 2-49. To finish the tie, use a clove hitch followed by a square knot with an extra loop. The free ends of the cord are then trimmed to a minimum of 3/8 inch.

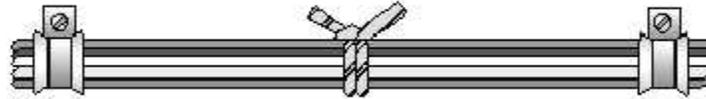


Figure 2-48.—Use of spot ties.

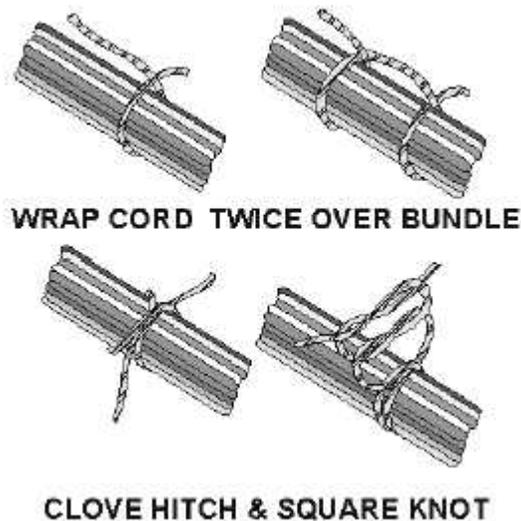


Figure 2-49.—Making spot ties.

SELF-CLINCHING CABLE STRAPS

Self-clinching cable straps are adjustable, lightweight, flat nylon straps. They have molded ribs or serrations on the inside surface to grip the wire. They may be used instead of individual cord ties for securing wire groups or bundles quickly. The straps are of two types: a plain cable strap and one that has a flat surface for identifying the cables.

CAUTION

Do not use nylon cable straps over wire bundles containing coaxial cable. Do not use straps in areas where failure of the strap would allow the strap to fall into movable parts.

Installing self-clinching cable straps is done with a Military Standard hand tool, as shown in figure 2- 50. An illustration of the working parts of the tool is shown in figure 2-51. To use the tool, follow the manufacturer's instructions.

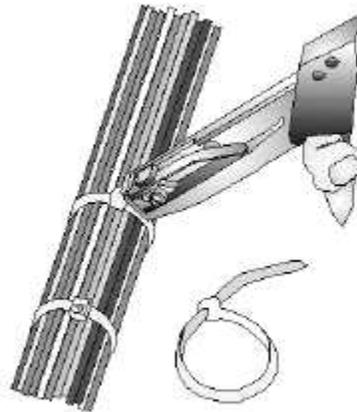


Figure 2-50.—Installing self-clinching cable straps.

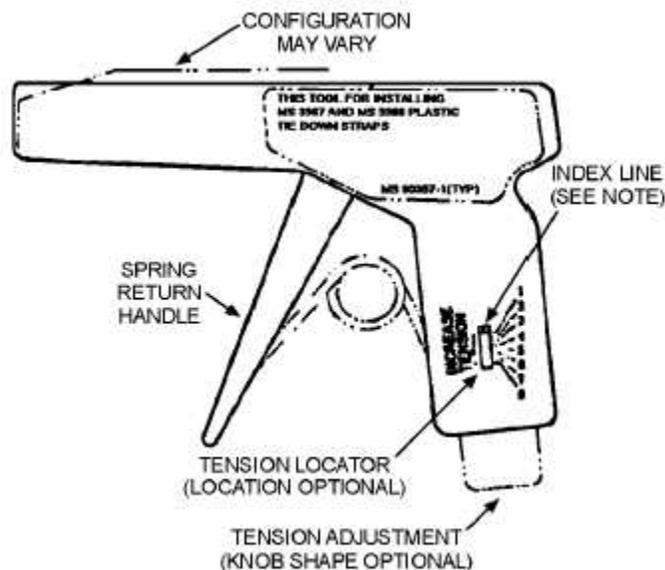


Figure 2-51.—Military Standard hand tool for self-clinching cable straps.

WARNING

Use proper tools and make sure the strap is cut flush with the eye of the strap. This prevents painful cuts and scratches caused by protruding strap ends. Do not use plastic cable straps in high-temperature areas (above 250° F).

HIGH-TEMPERATURE PRESSURE-SENSITIVE TAPE LACING

High-temperature, pressure-sensitive tape must be used to tie wire bundles in areas where the temperature may exceed 250° F. Install the tape as follows (figure 2-52):

1. Wrap the tape around the wire bundle three times, with a two-thirds overlap for each turn.

2. Heat-seal the loose tape end with the side of a soldering iron tip.

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APPENDIX B

**REQUIRED
SECURITY
DOCUMENTS**

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**INFORMATION SECURITY, CONFIDENTIALITY and NONDISCLOSURE
STATEMENT**

ADM-3021 (REV 06/2011)

INFORMATION SECURITY, CONFIDENTIALITY and NONDISCLOSURE
STATEMENT

I have read and understand the Department of Transportation (Department) Information Security guidelines listed below. If during my daily work an issue arises regarding those policies, I understand that I should contact the Department Chief Information Security Officer (CISO) to seek further clarification. I understand that failure to abide by the policies set forth in the Department Information Security Guidelines can result in immediate suspension of my computer privileges, and/or termination of my employment. I UNDERSTAND THAT I MUST ADHERE TO THE FOLLOWING GUIDELINES WHICH ARE BASED ON AND SET FORTH IN THE DEPARTMENT'S POLICIES AND DIRECTIVES.

- Use Department information assets and computer resources for Department business purposes only.
- Abide by Deputy Directive DD54R Information Technology Use Standards implemented by Department.
- Complete the required Acknowledgement of Receipt of Department Policies and Directives Form.
- Immediately notify the Department CISO of any security vulnerabilities, actual or attempted security violations (including: unauthorized access, theft, destruction, or misuse of systems equipment, software or data; possible virus, etc.)
- Exercise due care to protect and preserve the integrity and confidentiality of confidential or sensitive data and information in the _____. This includes all communications written or verbal.
- Use due care to secure physical information system equipment from unauthorized access, thefts, and/or misuse.
- Treat passwords as confidential information, do not share passwords, and always change passwords as per the Department Password policy so that security in terms of access is maintained.
- Will not attempt to circumvent data protection schemes, and will immediately report to the CISO any newly and departmental maintained systems.
- Only access system areas, functions, or files I am formally authorized to use when using Department network and departmental maintained systems.
- Only access the Department network through my assigned user identifiers (IDs) and passwords.
- Will not perform any act that will interfere with Department's normal standard operation of computers, terminals, peripherals, or networks.
- Comply with Deputy Directive 89 (DD89) which requires that State data, which is confidential, sensitive or personal to be encrypted and password protected when stored in portable computer devices and/or portable electronic storage media.

ADA Notice

For individuals with sensory disabilities, this document is available in alternate formats. For information, call (916) 445-1233, TTY 711, or write to Records and Forms Management, 1120 N Street, MS-89, Sacramento, CA 95814.

INFORMATION SECURITY, CONFIDENTIALITY and NONDISCLOSURE STATEMENT

ADM-3021 (REV 06/2011)

- Comply with the terms of applicable software licensing agreements, copyright laws, and State software policies. Will not duplicate or use unlicensed software on any state owned PC or system.
- Use only departmental approved standard hardware and software or obtain approval from the CISO to do otherwise.
- Take reasonable precautions to prevent virus contamination of Department data files, and report any suspected virus or other destructive programs immediately to the IT Help Desk and the CISO.
- Will not disable virus protection software installed on the departmental PC.
- Regularly update the virus protection software on my personal home-based PC (networked or standalone) on which work from Department is performed.
- Will not use electronic media to send, receive, or store material that violates existing laws; or is of a discriminating, harassing, derogatory, defamatory, threatening, or obscene nature.
- Obtain written authorization from the CISO for all connections to the Internet and other external networks.
- Comply with DD 54R if using the Internet with state computing or networking resources.
- Comply with DD 54R if using the Internet with state computing or networking resources.
- Will not attempt to monitor or tamper with another user's electronic communications, or read, copy, change, or delete another user's files or software without the explicit agreement of the owner or per management direction.
- Follow appropriate departmental backup procedures to prevent loss of data, and consult with the IT Help Desk for more information on backups.

I understand that Department reserves the right to review any and all of my electronic files, messages and usage, and that files and messages stored on departmental systems may be subject to disclosure under the California Public Records Act and discoverable in legal proceedings.

| | | |
|---|-------------------------|-------------------|
| User Name (Print) | Department/Student ID # | District/Division |
| User Signature | Date | Phone Number |
| Supervisor | Date | Phone Number |
| Chief Information Security Officer (CISO) | Date | Phone Number |

ADA Notice

For individuals with sensory disabilities, this document is available in alternate formats. For information, call (916) 445-1233, TTY 711, or write to Records and Forms Management, 1120 N Street, MS-89, Sacramento, CA 95814.

Clear Form

Applicant Submission

ORI: CA 0579937 Type of Application: NON SWORN/LEA
Code assigned by DOJ
Job Title or Type of License, Certification or Permit: _____

If necessary, the Live Scan Operator may have to type over "pre-populated" fields to enter the correct address and mail code.
Agency Address Set Contributing Agency:

CALIFORNIA HIGHWAY PATROL 02169
Agency authorized to receive criminal history information Mail Code (five digit code assigned by DOJ)
860 STILLWATER ROAD
Street No. Street or PO Box Contact Name (CHP Officer)
WEST SACRAMENTO CA 95605-1649 ()
City State Zip Code Contact Telephone No.

Name of Applicant: _____
(Please print) Last First MI
Alias: _____ Driver's License No. _____
Last First (Attach a photocopy of driver license/photo id)
Date of Birth: _____ Sex: Male Female Misc. No. **BIL** - 140197
Agency Billing Number
Height: _____ Weight: _____ Misc. Number: _____
Eye Color: _____ Hair Color: _____ Home Address: _____
Street or P.O. Box
Place of Birth: _____
City, State and Zip Code
SSN: _____
Applicant's Classification

Your Number 618 - CT - TMC - 11 Level of Service: DOJ FBI
OCA No. (Agency Identifying No.)
If resubmission, list Original ATI Number: _____

Employer: (Additional response for agencies specified by statute)

Employer Name

Street No. Street or P.O. Box Mail Code (five digit dose assigned by DOJ)

City State Zip Code ()
Agency Telephone No. (optional)

Fingerprint Transaction Completed: _____
Name of Operator Date

Transmitting Agency ATI No. 0
Amount Collected/Billed

APPENDIX C

DATA SHEET

FROM

CISCO

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Cisco Catalyst 2960-Plus Series Switches

The Cisco® Catalyst® 2960-Plus Series Switches are fixed-configuration Fast Ethernet switches (Figure 1) that provide enterprise-class Layer 2 switching for branch offices, conventional workspaces, and infrastructure applications. They enable reliable and secure operations with lower total cost of ownership through a range of Cisco IOS® software features, including Cisco Catalyst SmartOperations.

Figure 1. Cisco Catalyst 2960-Plus Series Switches



Product Highlights

Cisco Catalyst 2960-Plus switches feature:

- 24 of 48 Fast Ethernet ports
- Small Form-Factor Pluggable (SFP) and 1000BASE-T Gigabit Ethernet uplinks
- IEEE 802.3af-compliant Power over Ethernet (PoE)
- LAN Base or LAN Lite Cisco IOS® Software feature set
- SmartOperations tools that simplify deployment and reduce the cost of network administration
- Cisco EnergyWise technology to manage energy consumed by connected devices
- An enhanced limited lifetime hardware warranty (E-LLW), providing next-business-day replacement

Applications and Benefits

The Cisco Catalyst 2960-Plus Series provides cost-effective, enterprise class Ethernet switching for:

- Branch offices, remote sites, and retail locations
- Conventional desktop workspaces
- Building infrastructure, physical security, and other nontraditional access applications

Benefits of the 2960-Plus include:

- Robust quality of service (QoS) that prioritizes voice and critical business applications
- Flexible security features that can limit access to the network and mitigate threats
- Tools that reduce total cost of ownership through simplified operations and automation

Switch Configurations

Table 1 shows Cisco Catalyst 2960-Plus Series configurations.

Table 1. Cisco Catalyst 2960-Plus Series Configurations

| Model | 10/100 Ethernet Interfaces | Uplink Interfaces | Cisco IOS Software Feature Set | Available PoE Power |
|----------------------------------|----------------------------|------------------------|--------------------------------|---------------------|
| Cisco Catalyst 2960-Plus 48PST-L | 48 | 2 SFP and 2 1000BASE-T | LAN Base | 370W |
| Cisco Catalyst 2960-Plus 24PC-L | 24 | 2 (SFP or 1000BASE-T) | LAN Base | 370W |
| Cisco Catalyst 2960-Plus 24LC-L | 24 | 2 (SFP or 1000BASE-T) | LAN Base | 123W |
| Cisco Catalyst 2960-Plus 48TC-L | 48 | 2 (SFP or 1000BASE-T) | LAN Base | - |
| Cisco Catalyst 2960-Plus 24TC-L | 24 | 2 (SFP or 1000BASE-T) | LAN Base | - |
| Cisco Catalyst 2960-Plus 48PST-S | 48 | 2 SFP and 2 1000BASE-T | LAN Lite | 370W |
| Cisco Catalyst 2960-Plus 24PC-S | 24 | 2 (SFP or 1000BASE-T) | LAN Lite | 370W |
| Cisco Catalyst 2960-Plus 24LC-S | 24 | 2 (SFP or 1000BASE-T) | LAN Lite | 123W |
| Cisco Catalyst 2960-Plus 48TC-S | 48 | 2 (SFP or 1000BASE-T) | LAN Lite | - |
| Cisco Catalyst 2960-Plus 24TC-S | 24 | 2 (SFP or 1000BASE-T) | LAN Lite | - |

Robust Security

The Cisco Catalyst 2960-Plus Series Switches provide a range of security features to limit access to the network and mitigate threats, including:

- Features to control access to the network, including Flexible Authentication, 802.1x Monitor Mode, and RADIUS Change of Authorization
- Threat defense features including Port Security, Dynamic ARP Inspection, and IP Source Guard
- Private VLAN Edge to provide isolation between switch ports

For more information about Cisco security solutions, visit cisco.com/go/trustsec.

Enterprise-Class Quality of Service

The Cisco 2960-Plus Series Switches offer intelligent traffic management that keeps everything flowing smoothly. Flexible mechanisms for marking, classification, and scheduling deliver superior performance for data, voice, and video traffic, all at wire speed. Primary QoS features include:

- Four egress queues per port and strict priority queuing so that the highest priority packets are serviced ahead of all other traffic
- Shaped Round Robin (SRR) scheduling and Weighted Tail Drop (WTD) congestion avoidance
- Flow-based rate limiting and up to 64 aggregate or individual policers per port
- 802.1p class of service (CoS) and differentiated services code point (DSCP) field classification, with marking and reclassification on a per-packet basis by source and destination IP address, MAC address, or Layer 4 TCP/UDP port number

Cisco Catalyst SmartOperations

Cisco Catalyst SmartOperations is a comprehensive set of capabilities that simplify LAN planning, deployment, monitoring, and troubleshooting. Deploying SmartOperations tools reduces the time and effort required to operate the network and lowers total cost of ownership (TCO).

- **Cisco Smart Install** enables zero-touch deployment by providing automated Cisco IOS Software image installation and configuration when new switches are connected to the network.
- **Cisco Auto Smartports** enables automatic configuration of switch ports as devices connect to the switch, with settings optimized for the device type.
- **Cisco Smart Troubleshooting** is an extensive array of diagnostic commands and system health checks within the switch, including Smart Call Home.

For more information about Cisco Catalyst SmartOperations, visit cisco.com/go/smartoperations.

Cisco EnergyWise

Cisco EnergyWise™ empowers IT teams to measure and manage the power consumed by devices connected to the network, providing measurable energy savings and reduced greenhouse gas emissions. EnergyWise policies can be used to control the power consumed by PoE-powered endpoints, desktop and data-center IT equipment, and a wide range of building infrastructure. EnergyWise technology is included on all Cisco Catalyst 2960-Plus Series Switches.

For more information about Cisco EnergyWise, visit cisco.com/go/energywise.

Power over Ethernet

Cisco Catalyst 2960-Plus switches support IEEE 802.3af Power over Ethernet (PoE) to deliver lower total cost of ownership for deployments that incorporate Cisco IP phones, Cisco Aironet® wireless access points, or other standards-compliant PoE end devices. PoE removes the need to supply wall power to PoE-enabled devices and eliminates the cost of adding electrical cabling and circuits that would otherwise be necessary in IP phone and WLAN deployments. Table 2 shows the total PoE power available with each 2960-Plus model.

Table 2. Switch PoE Power Capacity

| Switch Model | Maximum Number of PoE (IEEE 802.3af) Ports* | Available PoE Power |
|----------------------------------|---|---------------------|
| Cisco Catalyst 2960-Plus 48PST-L | 24 ports up to 15.4W | 370W |
| Cisco Catalyst 2960-Plus 24PC-L | 24 ports up to 15.4W | 370W |
| Cisco Catalyst 2960-Plus 24LC-L | 8 ports up to 15.4W | 123W |
| Cisco Catalyst 2960-Plus 48PST-S | 24 ports up to 15.4W | 370W |
| Cisco Catalyst 2960-Plus 24PC-S | 24 ports up to 15.4W | 370W |
| Cisco Catalyst 2960-Plus 24LC-S | 8 ports up to 15.4W | 123W |

* Intelligent power management allows flexible power allocation across all ports.

Network Management

The Cisco Catalyst 2960-Plus Series Switches offer a superior CLI for detailed configuration and administration. 2960-Plus switches are also supported in the full range of Cisco network management solutions.

Cisco Prime Infrastructure

Cisco Prime™ network management solutions provide comprehensive network lifecycle management. Cisco Prime Infrastructure provides an extensive library of easy-to-use features to automate the initial and day-to-day management of your Cisco network. Cisco Prime integrates hardware and software platform expertise and operational experience into a powerful set of workflow-driven configuration, monitoring, troubleshooting, reporting, and administrative tools.

For detailed information about Cisco Prime, visit cisco.com/go/prime.

Cisco Network Assistant

A PC-based network management application designed for small and medium-sized business (SMB) networks with up to 250 users, Cisco Network Assistant offers centralized network management and configuration capabilities. This application also features an intuitive GUI where users can easily apply common services across Cisco switches, routers, and access points.

For detailed information about Cisco Network Assistant, visit cisco.com/go/cna.

Cisco IOS Software

Cisco Catalyst 2960-Plus Series Switches are available with the LAN Base and LAN Lite feature sets. LAN Lite models provide reduced functionality and scalability for small deployments with basic requirements.

Note that each switch model is tied to a specific feature level; LAN Lite models cannot be upgraded to the LAN Base feature set.

For more information about the features included in the LAN Base and LAN Lite feature sets, refer to Cisco Feature Navigator: <http://tools.cisco.com/ITDIT/CFN>.

Technical Specifications

Tables 3 through 10 list information about hardware, performance, forwarding performance, mechanical and environmental specifications, connectors and interfaces, management and standards support, voltage and power ratings, and power consumption, respectively.

Table 3. Cisco Catalyst 2960-Plus Series Hardware

| Hardware Specifications | |
|-------------------------|--------|
| Flash memory | 64 MB |
| DRAM | 128 MB |

Table 4. Cisco Catalyst 2960-Plus Series Performance

| Performance and Scalability | LAN Base (-L) Models | LAN Lite (-S) Models |
|---|----------------------|----------------------|
| Forwarding bandwidth | 16 Gbps | 16 Gbps |
| Maximum active VLANs | 255 | 64 |
| VLAN IDs available | 4K | 4K |
| Maximum transmission unit (MTU) - L3 packet | 9000 bytes | 9000 bytes |
| Jumbo frame - Ethernet frame | 9018 bytes | 9018 bytes |

Switching bandwidth is full-duplex capacity.

Table 5. Cisco Catalyst 2960-Plus Series Forwarding Performance

| Forwarding Rate: 64-Byte L3 Packets, Millions of packets per second | |
|---|------|
| Cisco Catalyst 2960-Plus 48PST-L | 13.1 |
| Cisco Catalyst 2960-Plus 24PC-L | 6.5 |
| Cisco Catalyst 2960-Plus 24LC-L | 6.5 |
| Cisco Catalyst 2960-Plus 48TC-L | 10.1 |
| Cisco Catalyst 2960-Plus 24TC-L | 6.5 |
| Cisco Catalyst 2960-Plus 48PST-S | 13.1 |
| Cisco Catalyst 2960-Plus 24PC-S | 6.5 |
| Cisco Catalyst 2960-Plus 24LC-S | 6.5 |
| Cisco Catalyst 2960-Plus 48TC-S | 10.1 |
| Cisco Catalyst 2960-Plus 24TC-S | 6.5 |

Table 6. Cisco Catalyst 2960-Plus Mechanical and Environmental Specifications

| Dimensions (H x W x D) | | |
|--|----------------------|-------------------|
| Model | Inches | Centimeters |
| Cisco Catalyst 2960-Plus 48PST-L | 1.73 x 17.70 x 13.07 | 4.4 x 45.0 x 33.2 |
| Cisco Catalyst 2960-Plus 24PC-L | | |
| Cisco Catalyst 2960-Plus 24LC-L | | |
| Cisco Catalyst 2960-Plus 48TC-L | 1.73 x 17.70 x 9.52 | 4.4 x 45.0 x 24.2 |
| Cisco Catalyst 2960-Plus 24TC-L | | |
| Cisco Catalyst 2960-Plus 48PST-S | 1.73 x 17.70 x 13.07 | 4.4 x 45.0 x 33.2 |
| Cisco Catalyst 2960-Plus 24PC-S | | |
| Cisco Catalyst 2960-Plus 24LC-S | | |
| Cisco Catalyst 2960-Plus 48TC-S | 1.73 x 17.70 x 9.52 | 4.4 x 45.0 x 24.2 |
| Cisco Catalyst 2960-Plus 24TC-S | | |
| Weight | | |
| Model | Pounds | Kilograms |
| Cisco Catalyst 2960-Plus 48PST-L | 12 | 5.4 |
| Cisco Catalyst 2960-Plus 24PC-L | 12 | 5.4 |
| Cisco Catalyst 2960-Plus 24LC-L | 10 | 4.5 |
| Cisco Catalyst 2960-Plus 48TC-L | 8 | 3.6 |
| Cisco Catalyst 2960-Plus 24TC-L | 8 | 3.6 |
| Cisco Catalyst 2960-Plus 48PST-S | 12 | 5.4 |
| Cisco Catalyst 2960-Plus 24PC-S | 12 | 5.4 |
| Cisco Catalyst 2960-Plus 24LC-S | 10 | 4.5 |
| Cisco Catalyst 2960-Plus 48TC-S | 8 | 3.6 |
| Cisco Catalyst 2960-Plus 24TC-S | 8 | 3.6 |
| Environmental Ranges | | |
| | Fahrenheit | Centigrade |
| Operating temperature up to 5000 ft (1500 m) | 23° to 113°F | -5° to 45°C |
| Operating temperature up to 10,000 ft (3000 m) | 23° to 104°F | -5° to 40°C |
| Short-term exception at sea level* | 23° to 131°F | -5° to 55°C |

| | | | | |
|---|-------------------------------------|----------------------|-------------------------|----------------------|
| Short-term exception up to 5000 feet (1500 m)* | 23° to 122°F | -5° to 50°C | | |
| Short-term exception up to 10,000 feet (3000 m)* | 23° to 113°F | -5° to 45°C | | |
| Short-term exception up to 13,000 feet (4000 m)* | 23° to 104°F | -5° to 40°C | | |
| Storage temperature up to 15,000 feet (4573 m) | 23° to 158°F | -25° to 70°C | | |
| | Feet | Meters | | |
| Operating altitude | Up to 10,000 | Up to 3,000 | | |
| Storage altitude | Up to 13,000 | Up to 4,000 | | |
| Operating relative humidity | 10% to 95% noncondensing | | | |
| Storage relative humidity | 10% to 95% noncondensing | | | |
| Acoustic Noise | | | | |
| Measured per ISO 7779 and declared per ISO 9296. | | | | |
| Bystander positions operating mode at 25°C ambient. | | | | |
| | Sound Pressure, dBA | | Sound Power, dbA | |
| Model | Typical, LpAm | Maximum, LpAD | Typical, LwA | Maximum, LwAD |
| Cisco Catalyst 2960-Plus 48PST-L | 41 | 44 | 51 | 54 |
| Cisco Catalyst 2960-Plus 24PC-L | 43 | 46 | 53 | 56 |
| Cisco Catalyst 2960-Plus 24LC-L | 43 | 46 | 53 | 56 |
| Cisco Catalyst 2960-Plus 48TC-L | 33 | 36 | 43 | 46 |
| Cisco Catalyst 2960-Plus 24TC-L | 33 | 36 | 43 | 46 |
| Cisco Catalyst 2960-Plus 48PST-S | 41 | 44 | 51 | 54 |
| Cisco Catalyst 2960-Plus 24PC-S | 43 | 46 | 53 | 56 |
| Cisco Catalyst 2960-Plus 24LC-S | 43 | 46 | 53 | 56 |
| Cisco Catalyst 2960-Plus 48TC-S | 33 | 36 | 43 | 46 |
| Cisco Catalyst 2960-Plus 24TC-S | 33 | 36 | 43 | 46 |
| Predicted Reliability | | | | |
| Model | MTBF in thousands of hours** | | | |
| Cisco Catalyst 2960-Plus 48PST-L | 312 | | | |
| Cisco Catalyst 2960-Plus 24PC-L | 382 | | | |
| Cisco Catalyst 2960-Plus 24LC-L | 498 | | | |
| Cisco Catalyst 2960-Plus 48TC-L | 623 | | | |
| Cisco Catalyst 2960-Plus 24TC-L | 667 | | | |
| Cisco Catalyst 2960-Plus 48PST-S | 312 | | | |
| Cisco Catalyst 2960-Plus 24PC-S | 381 | | | |
| Cisco Catalyst 2960-Plus 24LC-S | 498 | | | |
| Cisco Catalyst 2960-Plus 48TC-S | 623 | | | |
| Cisco Catalyst 2960-Plus 24TC-S | 667 | | | |

* Not more than the following in a 1-year period: 96 consecutive hours, or 360 hours total, or 15 occurrences.

** Based on Telcordia SR-332 Issue 3 methodology.

Table 7. Connectors and Interfaces

| |
|---|
| Ethernet Interfaces |
| <ul style="list-style-type: none"> • 10BASE-T ports: RJ-45 connectors, 2-pair Category 3, 4, or 5 unshielded twisted-pair (UTP) cabling • 100BASE-TX ports: RJ-45 connectors, 2-pair Category 5 UTP cabling • 1000BASE-T ports: RJ-45 connectors, 4-pair Category 5 UTP cabling • 1000BASE-T SFP-based ports: RJ-45 connectors, 4-pair Category 5 UTP cabling |

| SFP and SFP+ Interfaces |
|--|
| For information about supported SFP/SFP+ modules, refer to the Transceiver Compatibility matrix tables at cisco.com/en/US/products/hw/modules/ps5455/products_device_support_tables_list.html . |
| Indicator LEDs |
| <ul style="list-style-type: none"> Per-port status: Link integrity, disabled, activity, speed, and full duplex System status, Port Status, RPS, link duplex, PoE, and link speed |
| Console |
| Cisco Catalyst console cables: <ul style="list-style-type: none"> CAB-CONSOLE-RJ45 Console cable 6 ft. with RJ-45 |
| Power |
| <ul style="list-style-type: none"> The internal power supply is an auto-ranging unit and supports input voltages between 100 and 240V AC. Use the supplied AC power cord to connect the AC power connector to an AC power outlet. The Cisco RPS connector offers connection for an optional Cisco RPS 2300 that uses AC input and supplies DC output to the switch. Only the Cisco RPS 2300 (model PWR-RPS2300) should be attached to the redundant-power-system receptacle. |

Table 8. Management and Standards Support

| Category | Specification |
|-------------------|--|
| Management | <ul style="list-style-type: none"> BRIDGE-MIB CISCO-CABLE-DIAG-MIB CISCO-CDP-MIB CISCO-CLUSTER-MIB CISCO-CONFIG-COPY-MIB CISCO-CONFIG-MAN-MIB CISCO-DHCP-SNOOPING-MIB CISCO-ENTITY-VENDORTYPE-OID-MIB CISCO-ENVMON-MIB CISCO-ERR-DISABLE-MIB CISCO-FLASH-MIB CISCO-FTP-CLIENT-MIB CISCO-IGMP-FILTER-MIB CISCO-IMAGE-MIB CISCO-IP-STAT-MIB CISCO-LAG-MIB CISCO-MAC-NOTIFICATION-MIB CISCO-MEMORY-POOL-MIB CISCO-PAGP-MIB CISCO-PING-MIB CISCO-POE-EXTENSIONS-MIB CISCO-PORT-QOS-MIB CISCO-PORT-SECURITY-MIB CISCO-PORT-STORM-CONTROL-MIB CISCO-PRODUCTS-MIB CISCO-PROCESS-MIB CISCO-RTTMON-MIB CISCO-SMI-MIB CISCO-STP-EXTENSIONS-MIB CISCO-SYLOG-MIB CISCO-TC-MIB CISCO-TCP-MIB CISCO-UDLDP-MIB CISCO-VLAN-IFTABLE RELATIONSHIP-MIB CISCO-VLAN-MEMBERSHIP-MIB CISCO-VTP-MIB ENTITY-MIB ETHERLIKE-MIB IEEE8021-PAE-MIB IEEE8023-LAG-MIB IF-MIB INET-ADDRESS-MIB OLD-CISCO-CHASSIS-MIB OLD-CISCO-FLASH-MIB OLD-CISCO-INTERFACES-MIB OLD-CISCO-IP-MIB OLD-CISCO-SYS-MIB OLD-CISCO-TCP-MIB OLD-CISCO-TS-MIB RFC1213-MIB RMON-MIB RMON2-MIB SNMP-FRAMEWORK-MIB SNMP-MPD-MIB SNMP-NOTIFICATION-MIB SNMP-TARGET-MIB SNMPv2-MIB TCP-MIB UDP-MIB ePM MIB |
| | For an updated list of supported MIBs, refer to the MIB Locator at cisco.com/go/mibs . |

| Category | Specification | |
|-----------------------|---|--|
| Standards | <ul style="list-style-type: none"> • IEEE 802.1D Spanning Tree Protocol • IEEE 802.1p CoS Prioritization • IEEE 802.1Q VLAN • IEEE 802.1s • IEEE 802.1w • IEEE 802.1X • IEEE 802.1ab (LLDP) • IEEE 802.3ad • IEEE 802.3af • IEEE 802.3ah (100BASE-X single/multimode fiber only) • IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports | <ul style="list-style-type: none"> • IEEE 802.3 10BASE-T • IEEE 802.3u 100BASE-TX • IEEE 802.3ab 1000BASE-T • IEEE 802.3z 1000BASE-X • RMON I and II standards • SNMP v1, v2c, and v3 |
| RFC compliance | <ul style="list-style-type: none"> • RFC 768 - UDP • RFC 783 - TFTP • RFC 791 - IP • RFC 792 - ICMP • RFC 793 - TCP • RFC 826 - ARP • RFC 854 - Telnet • RFC 951 - Bootstrap Protocol (BOOTP) • RFC 959 - FTP • RFC 1112 - IP Multicast and IGMP • RFC 1157 - SNMP v1 • RFC 1166 - IP Addresses • RFC 1256 - Internet Control Message Protocol (ICMP) Router Discovery • RFC 1305 - NTP • RFC 1492 - TACACS+ • RFC 1493 - Bridge MIB • RFC 1542 - BOOTP extensions • RFC 1643 - Ethernet Interface MIB • RFC 1757 - RMON | <ul style="list-style-type: none"> • RFC 1901 - SNMP v2C • RFC 1902-1907 - SNMP v2 • RFC 1981 - Path MTU Discovery for IPv6 • RFC 2068 - HTTP • RFC 2131 - DHCP • RFC 2138 - RADIUS • RFC 2233 - IF MIB v3 • RFC 2373 - IPv6 Aggregatable Addr • RFC 2460 - IPv6 • RFC 2461 - IPv6 Neighbor Discovery • RFC 2462 - IPv6 Autoconfiguration • RFC 2463 - ICMP IPv6 • RFC 2474 - Differentiated Services (DiffServ) Precedence • RFC 2597 - Assured Forwarding • RFC 2598 - Expedited Forwarding • RFC 2571 - SNMP Management • RFC 3046 - DHCP Relay Agent Information Option • RFC 3376 - IGMP v3 • RFC 3580 - 802.1X RADIUS |

Table 9. Voltage and Power Ratings

| Input Voltage and Current | | | |
|----------------------------------|-----------------------|-------------------|------------|
| Model | Voltage (Autoranging) | Current (Amperes) | Frequency |
| Cisco Catalyst 2960-Plus 48PST-L | 100 to 240 VAC | 4.0 - 2.0 | 50 to 60Hz |
| Cisco Catalyst 2960-Plus 24PC-L | | 4.0 - 2.0 | |
| Cisco Catalyst 2960-Plus 24LC-L | | 1.4 - 0.8 | |
| Cisco Catalyst 2960-Plus 48TC-L | | 0.6 - 0.3 | |
| Cisco Catalyst 2960-Plus 24TC-L | | 0.4 - 0.2 | |
| Cisco Catalyst 2960-Plus 48PST-S | | 4.0 - 2.0 | |
| Cisco Catalyst 2960-Plus 24PC-S | | 4.0 - 2.0 | |
| Cisco Catalyst 2960-Plus 24LC-S | | 1.4 - 0.8 | |
| Cisco Catalyst 2960-Plus 48TC-S | | 0.6 - 0.3 | |
| Cisco Catalyst 2960-Plus 24TC-S | | 0.4 - 0.2 | |
| Power Rating (kVA) | | | |
| Cisco Catalyst 2960-Plus 48PST-L | 0.46 | | |
| Cisco Catalyst 2960-Plus 24PC-L | 0.43 | | |
| Cisco Catalyst 2960-Plus 24LC-L | 0.16 | | |

| | | |
|--------------------------------------|-----------|------------|
| Cisco Catalyst 2960-Plus 48TC-L | 0.04 | |
| Cisco Catalyst 2960-Plus 24TC-L | 0.03 | |
| Cisco Catalyst 2960-Plus 48PST-S | 0.46 | |
| Cisco Catalyst 2960-Plus 24PC-S | 0.43 | |
| Cisco Catalyst 2960-Plus 24LC-S | 0.16 | |
| Cisco Catalyst 2960-Plus 48TC-S | 0.04 | |
| Cisco Catalyst 2960-Plus 24TC-S | 0.02 | |
| DC Input Voltages (RPS Input) | | |
| Cisco Catalyst 2960-Plus 48PST-L | 3A at 12V | 7A at -52V |
| Cisco Catalyst 2960-Plus 24PC-L | 2A at 12V | 7A at -52V |
| Cisco Catalyst 2960-Plus 24LC-L | 2A at 12V | 3A at -52V |
| Cisco Catalyst 2960-Plus 48TC-L | 3A at 12V | - |
| Cisco Catalyst 2960-Plus 24TC-L | 2A at 12V | - |
| Cisco Catalyst 2960-Plus 48PST-S | 3A at 12V | 7A at -52V |
| Cisco Catalyst 2960-Plus 24PC-S | 2A at 12V | 7A at -52V |
| Cisco Catalyst 2960-Plus 24LC-S | 2A at 12V | 3A at -52V |
| Cisco Catalyst 2960-Plus 48TC-S | 3A at 12V | - |
| Cisco Catalyst 2960-Plus 24TC-S | 2A at 12V | - |

Table 10. Power Consumption

| Measured Power Consumption, Watts | | | | |
|--|-------------------|--------------------|---------------------|------------------------------|
| Model | 0% traffic | 10% traffic | 100% traffic | ATIS weighted average |
| Cisco Catalyst 2960-Plus 48PST-L | 51.1 | 50.8 | 51.4 | 50.9 |
| Cisco Catalyst 2960-Plus 24PC-L | 35.4 | 35.3 | 35.6 | 35.3 |
| Cisco Catalyst 2960-Plus 24LC-L | 25.9 | 25.7 | 26.1 | 25.8 |
| Cisco Catalyst 2960-Plus 48TC-L | 30.4 | 30.2 | 30.6 | 30.2 |
| Cisco Catalyst 2960-Plus 24TC-L | 18.4 | 18.3 | 18.6 | 18.3 |
| Cisco Catalyst 2960-Plus 48PST-S | 50.8 | 50.3 | 51.1 | 50.5 |
| Cisco Catalyst 2960-Plus 24PC-S | 35.0 | 34.8 | 35.2 | 34.9 |
| Cisco Catalyst 2960-Plus 24LC-S | 25.9 | 25.7 | 26.1 | 25.8 |
| Cisco Catalyst 2960-Plus 48TC-S | 29.9 | 29.7 | 30.2 | 29.8 |
| Cisco Catalyst 2960-Plus 24TC-S | 18.8 | 18.7 | 19.1 | 18.8 |

* Using ATIS-0600015.03.2009 methodology.

Disclaimer: All power consumption numbers were measured under controlled laboratory conditions and are provided as an estimate.

Note: The wattage rating on the power supply does not represent actual power draw. It indicates the maximum power draw possible by the power supply. This rating can be used for facility capacity planning. For PoE switches, cooling requirements are smaller than total power draw because a significant portion of the load is dissipated in the endpoints.

Table 11 provides safety and compliance information.

Table 11. Safety and Compliance

| Category | Certifications |
|------------------------------|---|
| Regulatory Compliance | Products should comply with CE Marking per directives 2004/108/EC and 2006/95/EC |
| Safety | UL 60950-1 Second Edition CAN/CSA-C22.2 No. 60950-1 Second Edition EN 60950-1 Second Edition IEC 60950-1 Second Edition AS/NZS 60950-1 |
| EMC - Emissions | 47CFR Part 15 (CFR 47) Class A AS/NZS CISPR22 Class A CISPR22 Class A EN55022 Class A ICES003 Class A VCCI Class A EN61000-3-2 EN61000-3-3 KN22 Class A CNS13438 Class A |
| EMC - Immunity | EN55024 CISPR24 EN300386 KN24 |
| Environmental | Reduction of Hazardous Substances (RoHS) including Directive 2011/65/EU |
| Telco | |

Cisco Enhanced Limited Lifetime Hardware Warranty

Cisco Catalyst 2960-Plus Series Switches come with an enhanced limited lifetime warranty (E-LLW). The E-LLW provides the same terms as Cisco's standard limited lifetime warranty but adds next-business-day delivery of replacement hardware, where available, and 90 days of 8X5 Cisco Technical Assistance Center (TAC) support.

Your formal warranty statement, including the warranty applicable to Cisco software, appears in the Cisco information packet that accompanies your Cisco product. We encourage you to review carefully the warranty statement shipped with your specific product before use.

Cisco reserves the right to refund the purchase price as its exclusive warranty remedy. For further information about warranty terms (Table 12), visit cisco.com/go/warranty.

Table 12. Warranty Terms

| Cisco Enhanced Limited Lifetime Hardware Warranty | |
|---|--|
| Device covered | Applies to all Cisco Catalyst 2960-Plus Series Switches. |
| Warranty duration | As long as the original end user continues to own or use the product. |
| End-of-life policy | In the event of discontinuance of product manufacture, Cisco warranty support is limited to five (5) years from the announcement of discontinuance. |
| Hardware replacement | Cisco or its service center will use commercially reasonable efforts to ship a Cisco Catalyst 2960-Plus replacement part for next business day delivery, where available. Otherwise, a replacement will be shipped within ten (10) working days after the receipt of the RMA request. Actual delivery times may vary depending on customer location. |
| Effective date | Hardware warranty commences from the date of shipment to customer (and in case of resale by a Cisco reseller, not more than ninety [90] days after original shipment by Cisco). |

| Cisco Enhanced Limited Lifetime Hardware Warranty | |
|---|--|
| TAC support | Cisco will provide during customer's local business hours, 8 hours per day, 5 days per week basic configuration, diagnosis, and troubleshooting of device-level problems for up to 90 days from the date of shipment of the originally purchased Cisco Catalyst 2960-Plus product. This support does not include solution or network-level support beyond the specific device under consideration. |
| Cisco.com access | Warranty allows guest access only to Cisco.com. |

Software Update Policy

Software updates for the Cisco Catalyst 2960-Plus are available for free to registered customers at cisco.com/go/support.

For more information about the Cisco Catalyst software update policy, visit http://www.cisco.com/en/US/prod/collateral/switches/ps5718/ps4324/product_bulletin_c25-696974_ps10745_Products_Bulletin.html.

Technical Support and Services

Table 13 provides information about relevant technical services.

Table 13. Technical Services Available for Cisco Catalyst 2960-Plus Series Switches

| Technical Services |
|--|
| <p>Cisco SMARTnet Service</p> <ul style="list-style-type: none"> • Around-the-clock, global access to the Cisco TAC • Unrestricted access to the extensive Cisco.com knowledge base and tools • Next-business-day, 8x5x4, 24x7x4, or 24x7x2 advance hardware replacement and onsite parts replacement and installation available¹ • Ongoing operating system software updates within the licensed feature set² • Proactive diagnostics and real-time alerts on Smart Call Home enabled devices |
| <p>Cisco Smart Foundation Service</p> <ul style="list-style-type: none"> • Next-business-day advance hardware replacement as available • Access to SMB TAC during business hours (access levels vary by region) • Access to Cisco.com SMB knowledge base • Online technical resources through Smart Foundation Portal • Operating system software bug fixes and patches |
| <p>Cisco Smart Care Service</p> <ul style="list-style-type: none"> • Network-level coverage for the needs of small and medium-sized businesses • Proactive health checks and periodic assessments of Cisco network foundation, voice, and security technologies • Technical support for eligible Cisco hardware and software through Smart Care Portal • Cisco operating system and application software updates and upgrades² • Next-business-day advance hardware replacement as available, 24x7x4 option available¹ |
| <p>Cisco SP Base Service</p> <ul style="list-style-type: none"> • Around-the-clock, global access to the Cisco TAC • Registered access to Cisco.com • Next-business-day, 8x5x4, 24x7x4, and 24x7x2 advance hardware replacement. Return to factory option available¹ • Ongoing operating system software updates² |
| <p>Cisco Focused Technical Support Services</p> <p>Three levels of premium, high-touch services are available:</p> <ul style="list-style-type: none"> • Cisco High-Touch Operations Management Service • Cisco High-Touch Technical Support Service • Cisco High-Touch Engineering Service <p>Valid Cisco SMARTnet[®] or SP Base contracts are required on all network equipment.</p> |

¹ Advance hardware replacement is available in various service-level combinations. For example, 8x5xNBD indicates that shipment will be initiated during the standard 8-hour business day, 5 days a week (the generally accepted business days within

the relevant region), with next-business-day (NBD) delivery. Where NBD is not available, same day shipping is provided. Restrictions apply; review the appropriate service descriptions for details.

² Cisco operating system updates include the following: maintenance releases, minor updates, and major updates within the licensed feature set.

Ordering Information

Tables 14 through 18 provide information about ordering, accessories, redundant power supplies, SFP modules, and power cords, respectively.

Table 14. Cisco Catalyst 2960-Plus Series Switches Ordering Information

| Part Number | 10/100 Ethernet Interfaces | Uplink Interfaces | Cisco IOS Software Feature Set | Available PoE Power |
|------------------|----------------------------|------------------------|--------------------------------|---------------------|
| WS-C2960+48PST-L | 48 | 2 SFP and 2 1000BASE-T | LAN Base | 370W |
| WS-C2960+24PC-L | 24 | 2 (SFP or 1000BASE-T) | LAN Base | 370W |
| WS-C2960+24LC-L | 24 | 2 (SFP or 1000BASE-T) | LAN Base | 123W |
| WS-C2960+48TC-L | 48 | 2 (SFP or 1000BASE-T) | LAN Base | - |
| WS-C2960+24TC-L | 24 | 2 (SFP or 1000BASE-T) | LAN Base | - |
| WS-C2960+48PST-S | 48 | 2 SFP and 2 1000BASE-T | LAN Lite | 370W |
| WS-C2960+24PC-S | 24 | 2 (SFP or 1000BASE-T) | LAN Lite | 370W |
| WS-C2960+24LC-S | 24 | 2 (SFP or 1000BASE-T) | LAN Lite | 123W |
| WS-C2960+48TC-S | 48 | 2 (SFP or 1000BASE-T) | LAN Lite | - |
| WS-C2960+24TC-S | 24 | 2 (SFP or 1000BASE-T) | LAN Lite | - |

Table 15. Cisco Catalyst 2960-Plus Accessories

| Part Numbers | Description |
|------------------|---|
| CAB-CONSOLE-RJ45 | Console cable 6 ft with RJ45 |
| RCKMNT-1RU= | Spare rack-mount kit for Cisco Catalyst 2960 and 2960-Plus Series for 19- and 24-inch racks |
| RCKMNT-REC-1RU= | 1 RU recessed rack-mount kit for Cisco Catalyst 2960 and 2960-Plus Series |
| PWR-CLP | Power cable restraining clip |

Table 16. Cisco Catalyst 2960-Plus Redundant Power Supply Options

| Part Numbers | Description |
|-----------------|--|
| PWR-RPS2300 | Cisco Redundant Power System 2300 and blower, no power supply |
| BLNK-RPS2300= | Spare bay insert for Cisco Redundant Power System 2300 |
| CAB-RPS2300= | Spare RPS2300 cable for Cisco Catalyst 2960 switches |
| BLWR-RPS2300= | Spare 45 CFM blower for RPS 2300 |
| C3K-PWR-750WAC= | RPS 2300 750W AC power supply spare for Cisco Catalyst 2960 switches |
| ACC-RPS2300= | Spare accessory kit for Cisco Redundant Power System 2300 |

For more information about the RPS-2300, visit cisco.com/en/US/products/ps7130.

Table 17. Cisco Catalyst 2960-Plus SFP Modules

| SFP and SFP+ Modules |
|--|
| For the list of supported SFP and SFP+ modules, visit cisco.com/en/US/products/hw/modules/ps5455/products_device_support_tables_list.html . |

Table 18. Power Cords for Cisco Catalyst 2960-Plus Series

| Part Numbers | Description |
|---------------------|--|
| CAB-AC | AC Power Cord (US, Canada), C13, NEMA 5-15P, 2.5m |
| CAB-ACE | AC Power Cord (Europe), C13, CEE 7, 1.5m |
| CAB-ACI | AC Power Cord (Italy), C13, CEI 23-16, 2.5m |
| CAB-ACU | AC Power Cord (UK), C13, BS 1363, 2.5m |
| CAB-ACA | AC Power Cord (China/Australia), C13, AS 3112, 2.5m |
| CAB-ACS | AC Power Cord (Switzerland), C13, IEC 60884-1, 2.5m |
| CAB-ACR | AC Power Cord (Argentina), C13, EL 219 (IRAM 2073), 2.5m |
| CAB-ACC | AC Power Cord (China), C13, PRC/3 GB2099/GB1002 |
| CAB-JPN | AC Power Cord (Japan), C13, Japan 2-prong, 1.8m |
| CAB-IND-10A | AC Power Cord (India), C13, IS1293, 2.5m |
| CAB-ACBZ-10A | AC Power Cord (Brazil), C13, BR-3-20, 10A |
| CAB-ACSA | AC Power Cord (South Africa), C15, SABS 164-1, 1.8m |

Contact Cisco

For more information about Cisco products, contact:

- United States and Canada: (toll free) 800 553-NETS (6387)
- Europe: 32 2 778 4242
- Australia: 612 9935 4107
- Other: 408 526-7209
- URL: cisco.com



Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

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Cisco Secure Access Control System 5.7

PB734638

The Cisco[®] Secure Access Control System ties together an enterprise's network-access policy and identity strategy. This highly sophisticated policy-based access control platform delivers:

- Unique, flexible, and detailed device administration in IPv4 and IPv6 networks with full auditing and reporting capabilities as required for standards compliance
- A powerful attribute-guided and rules-based policy model that flexibly addresses complex policy needs
- A lightweight web-based GUI with intuitive navigation and a workflow accessible from both IPv4 and IPv6 clients
- Integrated advanced monitoring, reporting, and troubleshooting capabilities for excellent control and visibility
- A distributed architecture for medium-sized and large-scale deployments, with up to 22 instances in a single cluster
- Capability to connect different nodes (instances) in a cluster to different Microsoft Active Directory domains
- Administrator authentication through Active Directory and Lightweight Directory Access Protocol (LDAP)
- API for create, read, update, and delete operations on devices and hosts
- Support for the Online Certificate Status Protocol (OCSP)
- Synchronization of the machine access restriction (MAR) cache among all Secure Access Control System instances in a cluster
- Scheduled (automated) reports sent through email
- Simple Network Management Protocol (SNMP) traps for the solution's health status
- Encrypted (secure) syslogs
- Capability to disable users after N days of inactivity
- Capability to disable users after N failed attempts on a user or group basis
- Email notifications to users and administrators N days before their passwords expire

Availability

Cisco Secure ACS Release 5.7 is currently available. Customers interested in purchasing this product can place orders through their normal sales channels.

Ordering Information

This solution can be purchased as one of the following offerings:

- Cisco Secure ACS application on the Cisco Secure Network Server 3415 or 3495
- Software upgrade for an existing Cisco 1121 appliance for the Cisco Secure Access Control System
- Software appliance for installation as a virtual machine on VMware ESX or ESXi 5.1 or 5.5

All versions run the same software image and support the same features. For system specifications, please view the data sheet at <http://www.cisco.com/c/en/us/products/collateral/security/secure-access-control-system/datasheet-c78-734646.html>.

Licensing Options

The appliance and VMware versions each include a Base license. The Base license is required for each 5.7 appliance or software instance in a network.

With the Base license, an appliance or software virtual machine can support the deployment of up to 500 network access devices (NADs) such as routers and switches. These are not authentication, authorization, and accounting (AAA) clients. The number of network devices is based on the number of unique IP addresses that are configured. The 500-device limit is not a limit for each individual appliance or instance, but a deployment-wide limit that applies to a set of instances (primary and secondary) that are configured for replication.

The optional Large Deployment add-on license allows a deployment to support more than 500 network devices. Only one Large Deployment license is required per deployment because it is shared by all instances.

The optional Security Group Access System license is required for security group access and IEEE 802.1AE (also known as MACsec) functions. Only one Security Group Access System license is required per deployment because it is shared by all instances.

Please see the Cisco Secure ACS [deployment guides](#) for help in planning and sizing.

Base Components

To order Cisco Secure ACS SW version 5.7, you must order one of the Base products shown in Table 1. If you are upgrading an existing deployment, you need to order a product from Table 3 or Table 4, shown later in this document.

Table 1. Part Numbers for New Orders

| Part Number | Product Description |
|--|---|
| SNS-3415-K9 with Application Software Option: CSACS-3415-K9 | Cisco Secure Network Server 3415 appliance for Cisco Secure Access Control System, Identity Services Engine, and Network Admission Control products |
| | Cisco Secure ACS application software option and Base license for the 3415 appliance |
| SNS-3495-K9 with Application Software Option: CSACS-3495-K9 | Secure Network Server 3495 appliance for Secure Access Control System, Identity Services Engine, and Network Admission Control products |
| | Cisco Secure ACS application software option and Base license for the 3495 appliance |
| CSACS-5.7-VM-K9 | Cisco Secure ACS 5.7 VMware software and Base license |
| R-CSACS-57VM-K9= | Cisco Secure ACS 5.7 VMware software and Base license (e-delivery) |

Additional Licenses

If you need any additional licenses, such as the Large Deployment license to support more than 500 devices, please order one of the products shown in Table 2.

Table 2. Part Numbers for Additional Licenses

| Part Number | Product Description |
|--------------------------|--|
| CSACS-5-LRG-LIC | Cisco Secure ACS 5,x Large Deployment add-on license |
| L-CSACS-5-LRG-LIC | Cisco Secure ACS 5.x Large Deployment add-on license (e-delivery) |
| CSACS-5-ADV-LIC | Cisco Secure ACS 5.x Security Group Access System license |
| L-CSACS-5-ADV-LIC | Cisco Secure ACS 5.x Security Group Access System license (e-delivery) |

Upgrades and Migration

Customers can upgrade to release 5.7 from any previous version. Release 5.7 includes software utilities to migrate data from previous versions. Please see the [migration guides](#) for more details.

To upgrade from Release 4.2 or earlier, please choose the relevant product from Table 3.

Table 3. Upgrade Part Numbers for Release 4.2 and Earlier

| Part Number | Description |
|---|---|
| SNS-3415-K9 with Application Software Option: CSACS-3415-UP-K9 | Secure Network Server 3415 appliance for Cisco Secure Access Control System, Identity Services Engine, and Network Admission Control products |
| | Upgrade to Secure Access Control System application software on the 3415 appliance with Base license from previous versions |
| SNS-3495-K9 with Application Software Option: CSACS-3495-UP-K9 | Secure Network Server 3495 appliance for Secure Access Control System, Identity Services Engine, and Network Admission Control products |
| | Upgrade to Secure Access Control System application software on the 3495 appliance with Base license from previous versions |
| CSACS-5.7-VM-UP-K9 | Cisco Secure ACS 5.7 VMware software and Base license upgrade from previous versions |
| R-CSACS-57VMUP-K9= | Cisco Secure ACS 5.7 VMware software upgrade from previous versions (e-delivery) |

Please choose the relevant products from Table 4 if you are upgrading from:

- Cisco 1121 for the Cisco Secure Access Control System appliance running Release 5.1 or later
- Cisco Secure ACS Release 5.0 or later running on VMware

Note: You should select the part number based on whether or not you have an existing Cisco Software Application Support contract.

Table 4. Upgrade Part Numbers for Release 5.0 and Later

| Part Number | Product Description |
|---------------------------|---|
| CSACS-5.7SW-MR-K9= | Cisco Secure ACS 5.7 minor upgrade for customers without Software Application Support |
| CSACS-5.7SW-SR-K9= | Cisco Secure ACS 5.7 minor upgrade for customers with Software Application Support |

Electronic Delivery

Electronic delivery is available for VMware software appliance versions of Cisco Secure ACS Release 5.7 and for additional license options, such as the Large Deployment license.

After you order one of the electronic delivery products, you will receive details about how to download the software and obtain a license through email. The electronic delivery option allows you to get the software without having to wait for the delivery of physical media and licenses packages.

Electronic delivery is available only for the software and licenses listed in Table 5.

Table 5. Electronic Delivery Part Numbers

| Part Number | Description |
|--------------------|--|
| R-CSACS-57VM-K9= | Cisco Secure ACS 5.7 VMware software and Base license (e-delivery) |
| R-CSACS-57VMUP-K9= | Cisco Secure ACS 5.7 VMware software upgrade from previous versions (e-delivery) |
| L-CSACS-5-LRG-LIC | Cisco Secure ACS 5.x Large Deployment license (e-delivery) |
| L-CSACS-5-ADV-LIC | Cisco Secure ACS 5.x Security Group Access System license (e-delivery) |

Software and Hardware Support

Some Cisco SMARTnet™ Service contracts for the 3415 and 3495 appliances include hardware support and application software maintenance support, including upgrades to future Secure Access Control System releases and access to online resources and support services.

For more information about our Software Application Support and SMARTnet® Service, please visit http://www.cisco.com/en/US/products/svcs/ps3034/ps2827/serv_category_home.html.

To find support offerings and options that relate to specific products, please visit <http://www.cisco-servicefinder.com>.

Note: Software support part numbers for hardware options can be found by searching on “SNS-3415-K9” or “SNS-3495-K9” on Cisco.com.

For More Information

Please check the Cisco Secure Access Control System homepage at <http://www.cisco.com/go/acs> for the latest information.

For more information, please send your questions to acs-mkt@cisco.com or contact your Cisco account representative.



Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
Cisco Systems International BV Amsterdam,
The Netherlands

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Cisco 3900 Series Integrated Services Routers

Cisco® 3900 Series Integrated Services Routers build on 25 years of Cisco innovation and product leadership. The new Cisco Integrated Services Routers Generation 2 (ISR G2) platforms are architected to enable the next phase of branch-office evolution, providing rich-media collaboration and virtualization to the branch office while maximizing operational cost savings. The new routers support new high-capacity digital signal processors (DSPs) for future enhanced video capabilities, high-powered service modules with improved availability, multicore CPUs, Gigabit Ethernet switching with Cisco Enhanced Power over Ethernet (ePoE), and new energy visibility and control capabilities while enhancing overall system performance. Additionally, a new Cisco IOS® Software Universal image and Cisco Services Ready Engine (SRE)® module enable you to decouple the deployment of hardware and software, providing a flexible technology foundation that can quickly adapt to evolving network requirements. Overall, the Cisco 3900 Series offers exceptional total cost of ownership (TCO) savings and network agility through the intelligent integration of market-leading security, unified communications, wireless, and application services.

Figure 1. Cisco 3900 Series Integrated Services Routers



Product Overview

The Cisco 3900 Series builds on the best-in-class offering of the existing Cisco 3900 Series Integrated Services Routers by now offering four platforms (Figure 1): the Cisco 3945E, Cisco 3925E, Cisco 3945, and Cisco 3925 Integrated Services Routers.

The Cisco 3900 Series offers embedded hardware encryption acceleration, voice- and video-capable DSP slots, optional firewall, intrusion prevention, call processing, voicemail, and application services. In addition, the platforms support the industry's widest range of wired and wireless connectivity options such as T1/E1, T3/E3, xDSL, copper, and fiber Gigabit Ethernet.

The Cisco 3900 Series offers superior performance and flexibility for flexible network deployments from small business offices to large enterprise offices - all while providing industry-leading investment protection.

Key Business Benefits

The Cisco® ISR G2 routers provide superior services integration and agility. Designed for scalability, the modular architecture of these platforms enables you to evolve and adapt with your growing business needs. Table 1 lists the business benefits of the Cisco 3900 Series.

Table 1. Cisco 3900 Series Business Benefits

| Benefits | Description |
|--|---|
| Services integration | <ul style="list-style-type: none"> • The Cisco 3900 Series routers offer increased levels of services integration with voice, video, security, mobility, and data services. • The Cisco 3900 Series provides the highest performance and slot densities among the routers in the Cisco ISR G2 portfolio, enabling you to maximize services integration and reducing overall capital expenditures (CapEx) and operating expenses (OpEx). |
| Services on demand | <ul style="list-style-type: none"> • A single Cisco IOS Software Universal image is installed on each Cisco ISR G2. The Universal image contains all of the Cisco IOS Software technology sets, which you can activate with a software license. With the Universal image your business can quickly deploy advanced features without downloading a new Cisco IOS Software image. Additionally, larger default memory is included to support the new capabilities. • The Cisco SRE enables a new operational model that allows you to reduce CapEx and deploy a variety of application services as needed on a single integrated compute services module. |
| High performance with integrated services | <ul style="list-style-type: none"> • The Cisco 3900 Series enables deployment in high-speed WAN environments with concurrent services enabled up to 350 Mbps. • A multigigabit fabric (MGF) enables high-bandwidth module-to-module communication without compromising router performance. |
| Network agility | <ul style="list-style-type: none"> • Designed to address customer business requirements, the Cisco 3900 Series with the modular architecture offers increased capacity and performance as your network needs grow. • The Cisco Services Performance Engine (SPE) modular motherboard enables upgrades to processing capability in the future. • Dual integrated power supplies provide power redundancy; you can also configure them to provide additional Cisco ePoE power to endpoints. • Modular interfaces offer increased bandwidth, a diversity of connection options, and network resiliency. |
| Energy efficiency | <ul style="list-style-type: none"> • The Cisco 3900 Series architecture provides energy-savings features that include the following: <ul style="list-style-type: none"> ◦ The Cisco 3900 Series offers intelligent power management and allows you to control power to the modules based on the time of day. Cisco EnergyWise technology will be supported in the future. ◦ Services integration and modularity on a single platform allows you to perform multiple functions, optimizing consumption of raw materials and energy usage. ◦ Platform flexibility and ongoing development of both hardware and software capabilities lead to a longer product lifecycle, lowering all aspects of the TCO - including materials and energy use. ◦ High-efficiency power supplies and scalable power consumption are based on your network needs. |
| Investment protection | <ul style="list-style-type: none"> • The Cisco 3900 Series maximizes investment protection by supporting: <ul style="list-style-type: none"> ◦ Reuse of a broad array of existing modules supported on the original Cisco Integrated Services Routers to provide a lower TCO. ◦ A rich set of Cisco IOS Software features carried forward from the original Cisco Integrated Services Routers and delivered in a single universal image. • The Cisco 3900 Series offers extensive growth possibilities as your network expands: <ul style="list-style-type: none"> ◦ The SPE modular motherboard enables flexibility for future upgrades. ◦ The highest scale for module density provides flexibility to add services as your business needs expand. ◦ A 1-Gb default memory provides headroom to minimize field upgrades. |

Platform Architecture and Modularity

The Cisco 3900 Series is architected to meet the application demands of today's branch offices with design flexibility for future applications. The modular architecture is designed to support increasing bandwidth requirements, time-division multiplexing (TDM) interconnections, and fully integrated power distribution to modules supporting 802.3af PoE and Cisco ePoE. Table 2 lists the architectural features and benefits of the Cisco 3900 Series.

Table 2. Architectural Features and Benefits of Cisco 3900 Series

| Architectural Features | Benefits |
|---|---|
| Modular platform | <ul style="list-style-type: none"> The Cisco 3900 Series routers are highly modular platforms with several types of module slots to add connectivity and services for varied branch-office network requirements. The routers offer an industry-leading breadth of LAN and WAN connectivity options through modules to accommodate field upgrades to future technologies without requiring platform replacement. The Cisco SPE on the Cisco 3900 offers the ability to increase the performance of the router with a field-upgradable motherboard as your network needs grow. |
| Processors | <ul style="list-style-type: none"> The Cisco 3900 Series routers are powered by high-performance multicore processors that can support the growing demands of high-speed WAN connections to the branch office while also running multiple concurrent services. |
| Embedded IP Security with Secure Sockets Layer (IPSec/SSL) VPN hardware acceleration | <ul style="list-style-type: none"> Embedded hardware encryption acceleration is enhanced to provide higher scalability, which, combined with an optional Cisco IOS Software Security license, enables WAN link security and VPN services (both IPSec and SSL acceleration). The onboard encryption hardware outperforms the advanced integration modules (AIMs) of previous generations. |
| Multigigabit fabric (MGF) | <ul style="list-style-type: none"> The Cisco 3900 Series introduces an innovative MGF that allows for efficient module-to-module communication, enabling tighter services interactions across modules while reducing the overhead on the router processor. |
| TDM interconnectivity fabric | <ul style="list-style-type: none"> Unified communications services in the branch office are significantly enhanced with the use of TDM interconnectivity fabric in the router architecture, allowing for scaling of DS-0 channel capacity. |
| Integrated Gigabit Ethernet ports | <ul style="list-style-type: none"> The Cisco 3900 Series provides up to four 10/100/1000 Ethernet WAN ports. Two of the 10/100/1000 Ethernet WAN ports on the Cisco 3900 Series can support Small Form-Factor Pluggable (SFP)-based connectivity in lieu of RJ-45 ports, enabling fiber connectivity. |
| Innovative universal-serial-bus (USB)-based console access | <ul style="list-style-type: none"> A new, innovative, mini-B USB console port supports management connectivity when traditional serial ports are not available. Traditional console and auxiliary ports are also available. |
| Optional integrated power supply for distribution of PoE and universal DC power supply | <ul style="list-style-type: none"> An optional upgrade to the internal power supply provides inline power (802.3af-compliant PoE, Cisco ePoE, and Cisco Inline Power) to optional integrated switch modules. An optional DC power supply that extends possible deployment environments such as central offices and industrial environments will be available in the future. |
| Optional integrated redundant power supply (RPS) and PoE boost | <ul style="list-style-type: none"> Power redundancy is available by installing an optional integrated RPS, thereby decreasing network downtime and protecting the network from power-supply failures. When populated with dual integrated power supplies, the Cisco 3900 Series can operate in a configurable PoE boost mode in lieu of redundant power mode whereby the power capacity of the platform is increased to almost twice the normal power to support additional PoE ports. |
| Designed for flexible deployments | <ul style="list-style-type: none"> The Cisco 3945 and 3925 are designed for Network Equipment Building Systems (NEBS) environments. |

Modularity Features and Benefits

The Cisco 3900 Series provides significantly enhanced modular capabilities (refer to Table 3) while maintaining investment protection for customers. Most of the modules available on previous generations of Cisco routers, such as the Cisco 3800 Series Integrated Services Routers, are supported on the Cisco 3900 Series. Additionally, modules used on the Cisco 3900 Series can easily be supported on other routers in the Cisco Integrated Services Router portfolio to provide maximum investment protection. Taking advantage of common interface cards across a network greatly reduces the complexity of managing inventory requirements, implementing large network rollouts, and maintaining configurations across a variety of branch-office sizes.

A complete list of supported modules, including a list of supported SFPs for the Cisco 3900 Series, is available at: http://www.cisco.com/en/US/products/ps10536/products_relevant_interfaces_and_modules.html.

Table 3. Modularity Features and Benefits

| Architectural Features | Benefits |
|--|---|
| <p>Cisco Services Performance Engine (SPE)</p>  | <ul style="list-style-type: none"> • The Cisco 3900 Series offers field-replaceable SPEs. • These SPEs allow you to protect your initial investment in the Cisco 3900 platform for a longer time period and scale router performance as your network and branch-office needs grow. |
| <p>Cisco Services Module</p>  | <ul style="list-style-type: none"> • A service-module slot replaces the network module and the extension module for voice and fax (EVM) slots and is offered on Cisco 3900 Integrated Services Routers. • Each service-module slot offers high data-throughput capability: <ul style="list-style-type: none"> ◦ Up to 4-Gbps aggregate toward the router processor. ◦ Up to 2-Gbps aggregate to other module slots over the MGF. • Service-module slots are highly flexible, with support for doublewide service modules, which are service modules that require two service-module slots. Doublewide service modules provide flexibility for higher-density modules. • Service-module slots provide twice the power capabilities relative to the network-module slots, allowing flexibility for higher-scale and better-performance modules. • An adapter module enables backward compatibility with existing network modules, enhanced network modules (NMEs), and EVMs. • You can manage power to service-module slots by extensions similar to the Cisco EnergyWise framework, so your organization can reduce energy consumption in your network infrastructure. Full Cisco EnergyWise support will be available in future software releases. |
| <p>Cisco Enhanced High Speed WAN Interface Card (EHWIC)</p>  | <ul style="list-style-type: none"> • The EHWIC slot replaces the high-speed WAN interface card (HWIC) slot and can natively support HWICs, WAN interface cards (WICs), voice interface cards (VICs), and voice/WAN interface cards (VWICs). • Three integrated EHWIC slots on the Cisco 3945E and Cisco 3925E or four integrated EHWIC slots on the Cisco 3945 and Cisco 3925 allow for flexible configurations. • Each HWIC slot offers high-data-throughput capability: <ul style="list-style-type: none"> ◦ Up to 1.6-Gbps aggregate toward the router processor. ◦ Up to 2-Gbps aggregate to other module slots over the MGF. • Flexibility to support doublewide modules is enabled by combining two EHWIC slots. Up to 2 doublewide HWIC (HWIC-D) modules are supported. |
| <p>Cisco Internal Services Module (ISM)</p>  | <ul style="list-style-type: none"> • A single ISM slot provides flexibility to integrate intelligent services modules that do not require interface connections in the Cisco 3945 and Cisco 3925. • Each ISM slot offers high-data-throughput capability: <ul style="list-style-type: none"> ◦ Up to 4-Gbps aggregate toward the route processor. ◦ Up to 2-Gbps aggregate to other module slots over the MGF. • The ISM replaces the AIM slot; existing AIM modules are not supported in the ISM slot. • You can manage power to ISM slots by extensions similar to the Cisco EnergyWise framework, so your organization can reduce energy consumption in your network infrastructure. Full Cisco EnergyWise support will be available in future software releases. |
| <p>Cisco High-Density Packet Voice Digital Signal Processor (DSP) Module (PVDM3) Slots on Motherboard</p>  | <ul style="list-style-type: none"> • PVDM3 slots natively support PVDM3 modules, providing support for richer density for rich-media voice and video. • Each PVDM3 slot connects back to the system architecture through a 2-Gbps aggregate link through the MGF. • Investment protection for PVDM2 modules is supported through an adapter module. • You can manage power to the PVDM slots by extensions similar to the Cisco EnergyWise framework, so your organization can reduce energy consumption in your network infrastructure. Full Cisco EnergyWise support will be available in future software releases. |
| <p>Compact Flash Slots</p> | <ul style="list-style-type: none"> • Two external Compact Flash slots are available on the Cisco 3900 Series Integrated Services Routers. Each slot can support high-speed storage densities upgradable to 4 GB in density. |
| <p>USB 2.0 Ports</p> | <ul style="list-style-type: none"> • Two high-speed USB 2.0 ports are supported; they provide secure token capabilities and storage. |

Cisco IOS Software

Cisco 3900 Series Integrated Services Routers deliver innovative technologies running on industry-leading Cisco IOS Software. Developed for wide deployment in the world's most demanding enterprise, access, and service provider networks, Cisco IOS Software Releases 15M and T support a comprehensive portfolio of Cisco technologies, including the functions and features delivered in Releases 12.4 and 12.4T. New innovations in Release 15.0(1)M span multiple technology areas, including security, voice, high availability, IP Routing and Multicast, quality of service (QoS), IP Mobility, Multiprotocol Label Switching (MPLS), VPNs, and embedded management. Available immediately for the Cisco 3900 Integrated Services Routers, Release 15.0(1)M will be an extended support release. For more information about Release 15.0(1)M, please visit <http://www.cisco.com/go/ios>.

Cisco IOS Software Licensing and Packaging

A single Cisco IOS Universal image encompassing all functions is delivered with the platforms. You can enable advanced features by activating a software license on the Universal image. In previous generations of access routers, these feature sets required you to download a new software image. Technology packages and feature licenses, enabled through the Cisco software licensing infrastructure, simplify software delivery and decrease the operational costs of deploying new features.

Four major technology licenses are available on the Cisco 3900 Series Integrated Services Routers; you can activate the licenses through the Cisco software activation process identified at <http://www.cisco.com/go/sa>.

The following licenses are available:

- IP Base: This technology package is available as default.
- Data
- Unified Communications
- Security (SEC) or Security with No Payload Encryption (SEC-NPE)

For additional information and details about Cisco IOS Software licensing and packaging on Cisco 3900 Series Integrated Services Routers, please visit <http://www.cisco.com/go/q2licensing>.

Key Branch-Office Services

The industry-leading Cisco Integrated Services Routers offer unprecedented levels of services integration. Designed to meet the requirements of the branch office, these platforms provide a complete solution with voice, video, security, mobility, and application services. Businesses enjoy the benefits by deploying a single device that meets all their needs, reducing CapEx and OpEx.

Unified Communications, Collaboration, and Voice-Gateway Services

The Cisco 3900 Integrated Services Router is the foundation for collaboration in branch offices of any size and is a critical component of Cisco's video architecture (Medianet) and enterprise Unified Communications solution. With embedded voice services and a wide range of telephony interfaces supported, the Cisco 3900 Series delivers maximum deployment flexibility for the distributed enterprise. Unified communications is enabled through a rich signaling and media-processing infrastructure, including a variety of protocols, media interworking, signal and media security, transcoding, conferencing, and QoS. Cisco Integrated Services Routers feature a wide range of voice-gateway interfaces, supporting a broad array of signaling and physical network interfaces. The performance improvements introduced with the Cisco 3900 Series help ensure that branch-office employees benefit from the

same productivity advantages and wide breadth of services and applications as those enjoyed by the headquarters-based employees.

The Cisco 3900 Series enables a full range of existing and emerging video services, with scaling improvement to support Cisco TelePresence[®] conferencing, security, and session control. Cisco Unified Border Element extends these capabilities for business-to-business TelePresence communications.

The Cisco 3900 Series adds support for the new Cisco High-Density Packet Voice Digital Signal Processor Module (PVD3M3), which has been optimized for concurrent voice and video support. The PVD3M3 modules support all voice-gateway functions of earlier generations of PVD3Ms, and add higher density and more processing power to support emerging rich-media applications. The Cisco 3900 Series can support up to 4 onboard PVD3M3 slots, able to scale up to 768 G.729a channels.

Cisco Unified Communications Manager Express and Survivable Remote Site Telephony

The Cisco Integrated Services Routers inherently provide optional unified communications services within the Cisco IOS Software, delivering the advantage of server hardware reduction and lower energy costs at the branch office. Cisco Unified Communications Manager Express (CME) provides the broad range of IP private-branch-exchange (PBX) and key-system features integrated into the router for branch offices. Cisco Survivable Remote Site Telephony (SRST), also inherently available in Cisco IOS Software and an option on the Cisco 3900 Series, helps ensure that branch-office employees have uninterrupted telephony services and features, even if the connection to a centralized Cisco Unified Communications Manager is disrupted. Coupled with Cisco Unity[®] Express, the integrated solution for voicemail, Automated Attendant, and interactive voice response (IVR), the Cisco 3900 Series offers the branch office a complete range of unified communications services while delivering industry-leading security within a single platform.

Cisco Unified Border Element

The Cisco Unified Border Element capabilities supported on the Cisco 3900 address the emerging requirements in an IP-centric interconnect for branch-office unified communications between enterprises and service provider networks. Cisco Unified Border Element provides intelligent border-element functions such as physical and logical ingress and egress demarcation points, signaling and media control, and consolidated security and management features. The Cisco 3900 Series supports higher scale than previously provided on the Cisco 3800 Series, with up to 2.5 times the number of sessions.

VoiceXML Application Services

The Cisco 3900 Series inherently provides standards-certified VoiceXML browser services. VoiceXML is an open-standard markup language used to create voice-enabled web browsers and IVR applications. Just as HTML enables you to retrieve data with a PC, VoiceXML enables you to retrieve data using voice or dual-tone-multifrequency (DTMF) telephony input. The Cisco 3900 Series can deliver a much higher range of concurrent voice-gateway services combined with VoiceXML browser services, for more than 300 sessions on the Cisco 3945.

Integrated Network Security for Data, Voice, Video, and Mobility

Security is essential to protect a business' intellectual property while also ensuring business continuity and providing the ability to extend the corporate workplace to employees who need anytime, anywhere access to company resources. As part of the Cisco Self-Defending Network (SDN) - an architectural framework that allows organizations to identify, prevent, and adapt to network security threats - the Cisco 3900 Series Integrated Services Routers facilitate secure data transactions and secure collaboration.

The Cisco IOS Software Security technology package for the Cisco 3900 Series offers a wide array of common security features such as advanced application inspection and control, threat protection, and encryption architectures for enabling more scalable and manageable VPN networks. The Cisco 3900 Series offers onboard hardware-based encryption acceleration to provide greater IPSec throughput with less overhead for the route processor when compared with software-based encryption solutions. Cisco Integrated Services Routers offer a comprehensive and adaptable security solution for branch offices that includes features such as:

- **Secure connectivity:** Secure collaborative communications with Group Encrypted Transport VPN, Dynamic Multipoint VPN (DMVPN), or Enhanced Easy VPN
- **Integrated threat control:** Responding to sophisticated network attacks and threats using Cisco IOS Firewall, Cisco IOS Zone-Based Firewall, Cisco IOS IPS, Cisco IOS Content Filtering, and Flexible Packet Matching (FPM)
- **Identity management:** Intelligently protecting endpoints using technologies such as authentication, authorization, and accounting (AAA) and public key infrastructure (PKI)

Detailed information about the security features and solutions supported on the Cisco 3900 Series is available at <http://www.cisco.com/go/routersecurity>.

Wireless and Mobility Services

Wireless LAN

The Cisco Integrated Services Routers supporting the Cisco Unified Wireless Architecture enable deployment of secure, manageable wireless LANs (WLANs) optimized for remote sites and branch offices, including fast, secure mobility; survivable authentication; and simplified management. The Cisco Wireless LAN Controller Module on the Cisco 3900 Series routers allows small and medium-sized businesses and enterprise branch offices to cost-effectively deploy and manage secure WLANs. Cisco Wireless LAN Controllers work in conjunction with Cisco lightweight access points and the Cisco Wireless Control System (WCS) to provide systemwide WLAN functions, managing up to 6, 12, and 25 access points. As components of the Cisco Unified Wireless Architecture, Cisco Wireless LAN Controllers present network administrators with the visibility and control necessary to effectively and securely manage business-class WLANs and mobility services such as enhanced security, voice, guest access, and location services.

Wireless WAN

Cisco third-generation (3G) wireless WAN (WWAN) modules combine traditional enterprise router functions such as remote management, advanced IP services such as voice over IP (VoIP), and security with mobility capabilities of 3G WAN access. Using high-speed 3G wireless networks, routers can replace or complement existing landline infrastructure, such as dialup, Frame Relay, and ISDN. Cisco 3G solutions support 3G standards High-Speed Packet Access (HSPA) and Evolution Data Only/Evolution Data Optimized (EVDO), offering you a true multipath WAN backup and the ability to rapidly deploy primary WAN connectivity. For more information about 3G solutions on Cisco Integrated Services Routers, please visit <http://www.cisco.com/go/3g>.

Integrated LAN Switching

The Cisco 3900 Integrated Services Routers support the new Cisco Enhanced EtherSwitch[®] Service Modules, which greatly expand router capabilities by integrating industry-leading Layer 2 or Layer 3 switching with feature sets identical to those found in the Cisco Catalyst[®] 3560-E and Catalyst 2960 Series Switches performing local line-rate switching and routing.

The new Cisco Enhanced EtherSwitch Service Modules take advantage of the increased power capabilities on the Cisco 3900 Series platforms. Additionally, the modules enable Cisco energy and power initiatives: Cisco EnergyWise, Cisco ePoE and per-port PoE power monitoring, and integrated redundant power system (RPS)-enabled PoE boost. These technologies allow you to meet increased endpoint power requirements without increasing the total power consumption of the branch office.

Application Services

As organizations continue to centralize and consolidate their branch-office IT infrastructure in an effort to reduce cost and complexity, they are challenged to provide adequate user experience, ensure continuous service availability, and deliver business-relevant applications when and where they are needed. To address these challenges, the Cisco 3900 Series enables you to host Cisco, third-party, and custom applications on a portfolio of high-performance Cisco SRE modules that transparently integrate into the router. The modules have their own processors, hard disks, network interfaces, and memory that operate independently of the host router resources, helping to ensure maximum concurrent routing and application performance while reducing physical space requirements, lowering power consumption, and consolidating management.

Application Acceleration

The Cisco 3900 Series transparently combines industry-leading security, Cisco IOS Software-based traffic control, and visibility with Cisco application-acceleration solutions. Cisco IOS Software features such as Network-Based Application Recognition (NBAR), IP service-level agreement (IP SLA), and NetFlow provide visibility and monitoring of traffic patterns and application performance while Cisco IOS Software features such as QoS, access control lists (ACLs), and Performance Routing intelligently control the traffic to maximize the quality of the user experience and employee productivity. You can further enhance user experience by adding a Cisco Wide Area Application Services (WAAS) Network Module to securely provide more advanced WAN optimization techniques such as TCP optimization, caching, compression, and application acceleration. Cisco Integrated Services Routers combined with Cisco WAAS Network Modules provide optimal performance for applications delivered from a central data center to branch-office users. The solution allows you to consolidate costly server, storage, and backup infrastructure into data centers while maintaining LAN-like service levels for remote users.

Cisco Services Ready Engine

The Cisco Services Ready Engine solution is available in service-module (SM) and ISM form factors. The service-module hardware offers up to a seven-times performance improvement over the previous-generation network modules and provides a multicore x86 processor. The SRE modules also support up to 1 terabyte of storage, Redundant Array of Independent Disks (RAID) configurations, hardware-assisted virtualization, and cryptography options. The Cisco SRE module enables on-demand provisioning of branch-office applications on the Cisco 3900 Series platforms so that you can deploy the right application, at the right time, in the right place. The hardware and software decoupling provided by the service-ready deployment model enables you to provision applications on the module at the time of its installation, or remotely anytime thereafter. Supported solutions include Cisco WAAS, Cisco Unity Express, Cisco Application Extension Platform (AXP), Cisco Wireless LAN Controller (WLC), Cisco Video Surveillance, and other applications under development. The SRE enables organizations of various sizes to quickly deploy new branch-office applications without deploying new hardware, reducing the cost of rolling out branch-office services and helping ensure that the network applications will be compatible with future versions.

WAAS Express

Organizations today face several unique wide area network (WAN) challenges: the need to provide employees with constant access to centrally located information, the requirement to continuously back up and replicate mission-critical data to centrally managed data centers, the desire to provide satisfactory experience for IP phone and video communication, and the mandate to control bandwidth costs without sacrificing application availability and performance.

Cisco WAAS Express is designed to help organizations address these challenges. Cisco WAAS Express extends the [Cisco WAAS product portfolio](#), with a small-footprint, cost-effective IOS-based software solution integrated into the ISR G2 to offer bandwidth optimization and application acceleration capabilities. Cisco WAAS Express increases remote user productivity, reduces WAN bandwidth costs, and offers investment protection by interoperating with existing Cisco WAAS infrastructure. Cisco WAAS Express is unique in providing network transparency, improving deployment flexibility with on-demand service enablement, and integrating with native IOS-based services such as security, Netflow, and QoS.

Cisco WAAS Express is fully interoperable with WAAS on SM-SRE modules, WAAS appliances and can be managed by a common WAAS Central Manager.

Cisco WAAS Express is available in IOS from version 15.1(2)T1.

Further information on Cisco WAAS Express can be found at <http://www.cisco.com/en/US/products/ps11211/index.html>.

Medianet for 3900 ISRs

As video becomes pervasive in an organization and more video devices are used, new demands are placed on the network. It can be challenging to accommodate video needs while reducing complexity, planning for capacity, and providing the best possible user experience.

Smarter Network, Endpoints, and Services

Traditional IP networks need to evolve to medianets to accommodate these changes. A medianet is an end-to-end IP architecture that helps to enable pervasive media experiences.

The medianet architecture includes a smarter network, smarter endpoints, shared media services, cloud services, and shared media services.

More Medianet Benefits

A medianet reduces total cost of ownership and scales video through features such as auto-configuration and media monitoring. At the same time, it helps to ensure a quality user experience while optimizing bandwidth use and efficiency.

For more information on Medianet for 3900 ISR, please go to <http://www.cisco.com/en/US/netsol/ns1094/index.html>.

Managing Your Integrated Services Routers

Network management applications are instrumental in lowering OpEx while improving network availability by simplifying and automating many of the day-to-day tasks associated with managing an end-to-end network. “Day-one device support” provides immediate manageability support for the integrated services router, enabling quick and easy deployment, monitoring, and troubleshooting from Cisco and third-party applications.

Organizations rely on Cisco, third-party, and in-house developed network management applications to achieve their OpEx and productivity goals. Underpinning those applications are the embedded management features available in every integrated services router. The new integrated services routers continue a tradition of broad and deep manageability features within the devices. Features such as IP SLA, Cisco IOS Embedded Event Manager (EEM), and NetFlow allow you to know the status of your network at all times. These features, along with Simple Network Management Protocol (SNMP) and syslog support, enable your organization’s management applications.

Refer to Tables 4, 5, and 6 for details about Cisco IOS Software, network management, and manageability support on Cisco 3900 Series Integrated Services Routers.

Table 4. Cisco 3900 with Cisco IOS Software Feature and Protocol High-Level Support

| | |
|---------------------------|---|
| Protocols | <ul style="list-style-type: none"> IPv4, IPv6, static routes, Open Shortest Path First (OSPF), Enhanced IGRP (EIGRP), Border Gateway Protocol (BGP), BGP Router Reflector, Intermediate System-to-Intermediate System (IS-IS), Multicast Internet Group Management Protocol (IGMPv3), Protocol Independent Multicast sparse mode (PIM SM), PIM Source Specific Multicast (SSM), Distance Vector Multicast Routing Protocol (DVMRP), IPv4-to-IPv6 Multicast, MPLS, Layer 2 and Layer 3 VPN, IPSec, Layer 2 Tunneling Protocol Version 3 (L2TPv3), Bidirectional Forwarding Detection (BFD), IEEE802.1ag, and IEEE802.3ah. |
| Encapsulations | <ul style="list-style-type: none"> Generic routing encapsulation (GRE), Ethernet, 802.1q VLAN, Point-to-Point Protocol (PPP), Multilink Point-to-Point Protocol (MLPPP), Frame Relay, Multilink Frame Relay (MLFR) (FR.15 and FR.16), High-Level Data Link Control (HDLC), Serial (RS-232, RS-449, X.21, V.35, and EIA-530), PPP over Ethernet (PPPoE), and ATM. |
| Traffic management | <ul style="list-style-type: none"> QoS, Class-Based Weighted Fair Queuing (CBWFQ), Weighted Random Early Detection (WRED), Hierarchical QoS, Policy-Based Routing (PBR), Performance Routing, and NBAR. |

For more details about Cisco IOS Software features, refer to <http://www.cisco.com/go/fn>.

Table 5. Embedded Management Features Available with Cisco IOS Software

| Feature | Description of Feature Supported by Cisco Integrated Services Routers |
|---|--|
| WSMA | <ul style="list-style-type: none"> The Web Services Management Agent (WSMA) defines a mechanism through which you can manage a network device, retrieve configuration data information, and upload and manipulate new configuration data. WSMA uses XML-based data encoding that is transported by the Simple Object Access Protocol (SOAP) for the configuration data and protocol messages. |
| EEM | <ul style="list-style-type: none"> Cisco IOS Embedded Event Manager (EEM) is a distributed and customized approach to event detection and recovery offered directly in a Cisco IOS Software device. It offers the ability to monitor events and take informational, corrective, or any desired EEM action when the monitored events occur or when a threshold is reached. |
| IPSLA | <ul style="list-style-type: none"> Cisco IOS IP Service-Level Agreements enable you to assure new business-critical IP applications as well as IP services that use data, voice, and video in an IP network. |
| SNMP, RMON, Syslog, NetFlow, TR-069 | <ul style="list-style-type: none"> Cisco 3900 Series Integrated Services Routers also support SNMP, Remote Monitoring (RMON), syslog, NetFlow, and TR-069, in addition to the embedded management features mentioned. |

The Cisco network management applications listed in Table 6 are standalone products that you can purchase or download to manage your Cisco network devices. The applications are built specifically for the different operational phases; you can select the ones that best fit your needs.

Table 6. Network Management Solutions

| Operational Phase | Application | Description |
|---|--|--|
| Device staging and configuration | Cisco Configuration Professional | <ul style="list-style-type: none"> Cisco Configuration Professional is a GUI device-management tool for Cisco IOS Software-based access routers. This tool simplifies routing, firewall, IPS, VPN, unified communications, and WAN and LAN configuration through GUI-based easy-to-use wizards. |

| Operational Phase | Application | Description |
|--|--|---|
| Networkwide deployment, configuration, monitoring, and troubleshooting | CiscoWorks LMS | <ul style="list-style-type: none"> CiscoWorks LAN Management Solution (LMS) is a suite of integrated applications for simplifying day-to-day management of a Cisco end-to-end network, lowering OpEx while increasing network availability. CiscoWorks LMS offers network managers an easy-to-use web-based interface for configuring, administering, and troubleshooting the Cisco Integrated Services Routers, using new instrumentation such as Cisco IOS EEM. In addition to supporting basic platform services of the integrated services router, CiscoWorks also provides added-value support for the Cisco SRE, enabling the management and distribution of software images to the SRE, thereby reducing the time and complexities associated with image management. |
| Networkwide staging, configuration, and compliance | CiscoWorks NCM | <ul style="list-style-type: none"> CiscoWorks Network Compliance Manager (NCM) tracks and regulates configuration and software changes throughout a multivendor network infrastructure. It provides superior visibility into network changes and can track compliance with a broad variety of regulatory, IT, corporate governance, and technology requirements. |
| Security staging, configuration, and monitoring | Cisco Security Manager | <ul style="list-style-type: none"> Cisco Security Manager is a leading enterprise-class application for managing security. It delivers provisioning of firewall, VPN, and intrusion-prevention-system (IPS) services across Cisco routers, security appliances, and switch service modules. The suite also includes the Cisco Security Monitoring, Analysis and Response System (Cisco Security MARS) for monitoring and mitigation. |
| Voice and unified communications configuration and provisioning | Cisco Unified Provisioning Manager | <ul style="list-style-type: none"> Cisco Unified Provisioning Manager provides a reliable and scalable web-based solution for managing a company's crucial next-generation communications services. It manages unified communications services in an integrated IP telephony, voicemail, and messaging environment. |
| Staging, deployment, and changes of licenses | Cisco License Manager | <ul style="list-style-type: none"> Cisco License Manager, a secure client-server application, can help you easily manage Cisco IOS Software activation and licenses for a wide range of Cisco platforms running Cisco IOS Software as well as other operating systems. |
| Staging, deployment, and changes to configuration and image files | Cisco Configuration Engine | <ul style="list-style-type: none"> Cisco Configuration Engine is a secure network management product that provides zero-touch image and configuration distribution through centralized, template-based management. |

Summary

Businesses need more intelligent branch-office solutions as they strive to lower the TCO for running their network and increase their overall employee productivity with more centralized and collaborative network applications. The Cisco 3900 Series offers these solutions by providing enhanced performance and increased modular density to support multiple concurrent services. The Cisco 3900 Series is designed to consolidate the functions of many separate devices into a single system that you can manage remotely. Table 7 lists the specifications of the Cisco 3945E, 3925E, 3945, and 3925 Integrated Services Routers.

Table 7. Specifications of Cisco 3945E, 3925E, 3945, and 3925 Integrated Services Routers

| Services and Slot Density | Cisco 3945E | Cisco 3925E | Cisco 3945 | Cisco 3925 |
|--|-------------|-------------|------------|------------|
| Embedded hardware-based cryptography acceleration (IPSec + Secure Sockets Layer [SSL]) | Yes | Yes | Yes | Yes |
| Cisco Unified Communications Manager Express Sessions | 450 | 400 | 350 | 250 |
| Cisco Unified SRST sessions | 1500 | 1350 | 1200 | 780 |
| Total onboard WAN or LAN 10/100/1000 ports | 4 | 4 | 3 | 3 |
| RJ-45-based ports | 4 | 4 | 3 | 3 |
| SFP-based ports | 2 | 2 | 2 | 2 |
| Service-module slots | 4 | 2 | 4 | 2 |
| Doublewide service-module slots | 1 | 1 | 1 | 1 |
| EHWIC slots | 3 | 3 | 4 | 4 |
| Doublewide EHWIC slots | 1 | 1 | 2 | 2 |
| ISM slots | 0 | 0 | 1 | 1 |

| Services and Slot Density | Cisco 3945E | Cisco 3925E | Cisco 3945 | Cisco 3925 |
|---|---|---|---|---|
| Online insertion and removal (OIR) | Services modules | Services modules | Services modules | Services modules |
| Onboard DSP (PVDM) slots | 3 | 3 | 4 | 4 |
| Memory DDR2 ECC DRAM: Default | 1 GB | 1 GB | 1 GB | 1 GB |
| Memory DDR2 ECC DRAM: Maximum | 2 GB | 2 GB | 2 GB*** | 2 GB*** |
| Compact Flash (external): Default | Slot 0: 256 MB Slot 1: None |
| Compact Flash (external): Maximum | Slot 0: 4 GB Slot 1: 4 GB |
| External USB 2.0 slots (Type A) | 2 | 2 | 2 | 2 |
| USB console port (Type B) (up to 115.2 kbps) | 1 | 1 | 1 | 1 |
| Serial console port (up to 115.2 kbps) | 1 | 1 | 1 | 1 |
| Serial auxiliary port (up to 115.2 kbps) | 1 | 1 | 1 | 1 |
| Power-supply options | Internal: AC, PoE, and DC |
| Redundant power supply | Internal: AC, PoE, and DC |
| Power Specifications | | | | |
| AC input voltage | 100 to 240 VAC autoranging |
| AC input frequency | 47 to 63 Hz |
| AC input current range, AC power supply (maximum) | 7.1 to 3.0A | 7.1 to 3.0A | 7.1 to 3.0A | 7.1 to 3.0A |
| AC input surge current | <50A | <50A | <50A | <50A |
| DC Operating Input Voltage | 24Vdc - 60Vdc | 24Vdc - 60Vdc | 24Vdc - 60Vdc | 24Vdc - 60Vdc |
| Max Input Current range, DC power supply (A) | 33.2 - 12.4 | 33.2 - 12.4 | 33.2 - 12.4 | 33.2 - 12.4 |
| DC Input Surge Current | <50A | <50A | <50A | <50A |
| Typical power (no modules) (watts) | 158 | 150 | 105 | 100 |
| Maximum power with AC power supply (watts) | 540 | 420 | 540 | 420 |
| Maximum power with PoE power supply (platform only) (watts) | 540 | 420 | 540 | 420 |
| Maximum endpoint PoE power available from PoE power supply (watts) | 520 | 520 | 520 | 520 |
| Max power with DC input (W) | 574 | 446 | 574 | 446 |
| Maximum endpoint PoE power capacity with PoE boost (watts) | 1040 | 1040 | 1040 | 1040 |
| Dimensions (H x W x D) | 5.25 x 17.25 x 18.75 in. (133.35 x 438.15 x 476.25 mm) | 5.25 x 17.25 x 18.75 in. (133.35 x 438.15 x 476.25 mm) | 5.25 x 17.25 x 18.75 in. (133.35 x 438.15 x 476.25 mm) | 5.25 x 17.25 x 18.75 in. (133.35 x 438.15 x 476.25 mm) |
| Rack height | 3 rack units (3RU) | 3RU | 3 RU | 3RU |
| Rack-mount 19in. (48.3 cm) EIA | Included | Included | Included | Included |
| Rack-mount 23in. (58.4 cm) EIA | Optional | Optional | Optional | Optional |
| Wall-mount | No | No | No | No |
| Weight with AC power supply (no modules) | 39 lb (17.7 kg) |
| Weight with PoE power supply (no modules) | 40 lb (18.1 kg) |
| Typical weight (with modules) | 60 lb (27.2 kg) |
| Airflow | Back and sides to front |

| Services and Slot Density | Cisco 3945E | Cisco 3925E | Cisco 3945 | Cisco 3925 |
|---|---|---|---|---|
| Optional airflow kit (includes filter) | None | None | Front to back and sides | Front to back and sides |
| Environmental specifications | | | | |
| Operating conditions | | | | |
| Temperature: 5906 ft (1800m) maximum altitude | 32 to 104°F (0 to 40°C) |
| Temperature: 9843 ft (3000m) maximum altitude | 32 to 104°F (0 to 40°C) |
| Temperature: 13123 ft (4000m) maximum altitude ¹ | 32 to 86°F (0 to 30°C) |
| Temperature: Short-term per NEBS/5906 ft (1800m) maximum altitude | 23 to 122°F (-5 to 50°C) |
| Altitude | 4,000m (13,000 ft) | 4,000m (13,000 ft) | 4,000m (13,000 ft) | 4,000m (13,000 ft) |
| Relative humidity | 5 to 85% | 5 to 85% | 5 to 85% | 5 to 85% |
| Short-term (per NEBS) humidity | 5% to 90%, not to exceed 0.024 kg water/kg of dry air | 5% to 90%, not to exceed 0.024 kg water/kg of dry air | 5% to 90%, not to exceed 0.024 kg water/kg of dry air | 5% to 90%, not to exceed 0.024 kg water/kg of dry air |
| Acoustic: Sound pressure (typical/maximum) | 57.6/77.6 | 57.6/77.6 | 57.6/77.6 | 57.6/77.6 |
| Acoustic: Sound power (typical/maximum) | 67.8/84.7 | 67.8/84.7 | 67.8/84.7 | 67.8/84.7 |
| Nonoperating conditions | | | | |
| Temperature | -40 to 158°F (-40 to 70°C) |
| Relative humidity | 5 to 95% | 5 to 95% | 5 to 95% | 5 to 95% |
| Altitude | 15,584 ft (4750m) | 15,584 ft (4750m) | 15,584 ft (4750m) | 15,584 ft (4750m) |
| Regulatory and Compliance | | | | |
| Safety | UL 60950-1 CAN/CSA C22.2 No. 60950-1 EN 60950-1 AS/NZS 60950-1 IEC 60950-1 | UL 60950-1 CAN/CSA C22.2 No. 60950-1 EN 60950-1 AS/NZS 60950-1 IEC 60950-1 | UL 60950-1 CAN/CSA C22.2 No. 60950-1 EN 60950-1 AS/NZS 60950-1 IEC 60950-1 | UL 60950-1 CAN/CSA C22.2 No. 60950-1 EN 60950-1 AS/NZS 60950-1 IEC 60950-1 |
| EMC | 47 CFR, Part 15 ICES-003 Class A EN55022 Class A CISPR22 Class A AS/NZS 3548 Class A VCCI V-3 CNS 13438 EN 300-386 EN 61000 (Immunity) EN 55024, CISPR 24 EN50082-1 | 47 CFR, Part 15 ICES-003 Class A EN55022 Class A CISPR22 Class A AS/NZS 3548 Class A VCCI V-3 CNS 13438 EN 300-386 EN 61000 (Immunity) EN 55024, CISPR 24 EN50082-1 | 47 CFR, Part 15 ICES-003 Class A EN55022 Class A CISPR22 Class A AS/NZS 3548 Class A VCCI V-3 CNS 13438 EN 300-386 EN 61000 (Immunity) EN 55024, CISPR 24 EN50082-1 | 47 CFR, Part 15 ICES-003 Class A EN55022 Class A CISPR22 Class A AS/NZS 3548 Class A VCCI V-3 CNS 13438 EN 300-386 EN 61000 (Immunity) EN 55024, CISPR 24 EN50082-1 |
| Telecom | TIA/EIA/IS-968 CS-03 ANSI T1.101 ITU-T G.823, G.824 IEEE 802.3 RTTE Directive |

¹ DC power supplies available in H1CY2010

^{***} 2GB is the maximum IOS addressable memory but the system can support up to 4GB

The Cisco 3900 Series supports a wide range of modules that span industry-leading breadth of services at the branch office. For a list of modules supported on the Cisco 3900 Series, please visit: http://www.cisco.com/en/US/products/ps10536/products_relevant_interfaces_and_modules.html.

Ordering Information

The Cisco 3900 Series Integrated Services Routers are orderable and shipping. For more information about how to order the Cisco 3900 Series, please visit the [ISR G2 Ordering Guide](#). To place an order, visit the [Cisco Ordering Home Page](#) and refer to Table 8.

For additional product numbers, including the Cisco 3900 Series bundle offerings, please check the [Cisco 3900 Series Integrated Services Router Price List](#) or contact your local Cisco account representative. To place an order, visit the [Cisco Ordering Home Page](#). To download software, visit the [Cisco Software Center](#).

Table 8. Cisco 3900 Ordering Information

| Product Name | Product Description |
|----------------------|---|
| CISCO3945E/K9 | • Cisco 3945 with 4 onboard GE, C3900-SPE250/K9, 3 EHWIC slots, 3 DSP slots, 4 SM slots, 256MB CF default, 1 GB DRAM default, IP Base |
| CISCO3925E/K9 | • Cisco 3925 with 4 onboard GE, C3900-SPE200/K9, 3 EHWIC slots, 3DSP slots, 2 SM slots, 256MB CF default, 1 GB DRAM default, IP Base |
| CISCO3945/K9 | • Cisco 3945 with 3 onboard GE, C3900-SPE150/K9, 4 EHWIC slots, 4 DSP slots, 1 ISM slot, 4 SM slots, 256MB CF default, 1 GB DRAM default, IP Base |
| CISCO3925/K9 | • Cisco 3925 with 3 onboard GE, C3900-SPE100/K9, 4 EHWIC slots, 4 DSP slots, 1 ISM slot, 2 SM slots, 256MB CF default, 1 GB DRAM default, IP Base |

Integrated Services Router Migration Options

Cisco 3900 Series Integrated Services Routers are included in the standard Cisco Technology Migration Program (TMP). Refer to <http://www.cisco.com/go/tmp> and contact your local Cisco account representative for program details.

Warranty Information

The Cisco 3900 Series Integrated Services Routers have a 90-day limited liability warranty.

Cisco and Partner Services for the Branch

Services from Cisco and our certified partners can help you transform the branch-office experience and accelerate business innovation and growth in the Borderless Network. We have the depth and breadth of expertise to create a clear, replicable, optimized branch-office footprint across technologies. Planning and design services align technology with business goals and can increase the accuracy, speed, and efficiency of deployment. Technical services can help you improve operational efficiency, save money, and mitigate risk. Optimization services are designed to continuously improve performance and help your team succeed with new technologies. For more information, please visit <http://www.cisco.com/go/services>.

Cisco SMARTnet[®] technical support for the Cisco 3900 Series is available on a one-time or annual contract basis. Support options range from help-desk assistance to proactive, onsite consultation. All support contracts include:

- Major Cisco IOS Software updates in protocol, security, bandwidth, and feature improvements
- Full access rights to Cisco.com technical libraries for technical assistance, electronic commerce, and product information
- Access 24 hours a day to the industry's largest dedicated technical support staff

For More Information

For more information about the Cisco 3900 Series, visit <http://www.cisco.com/go/3900> or contact your local Cisco account representative.



Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
Cisco Systems International BV Amsterdam,
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APPENDIX D

DATA SHEET

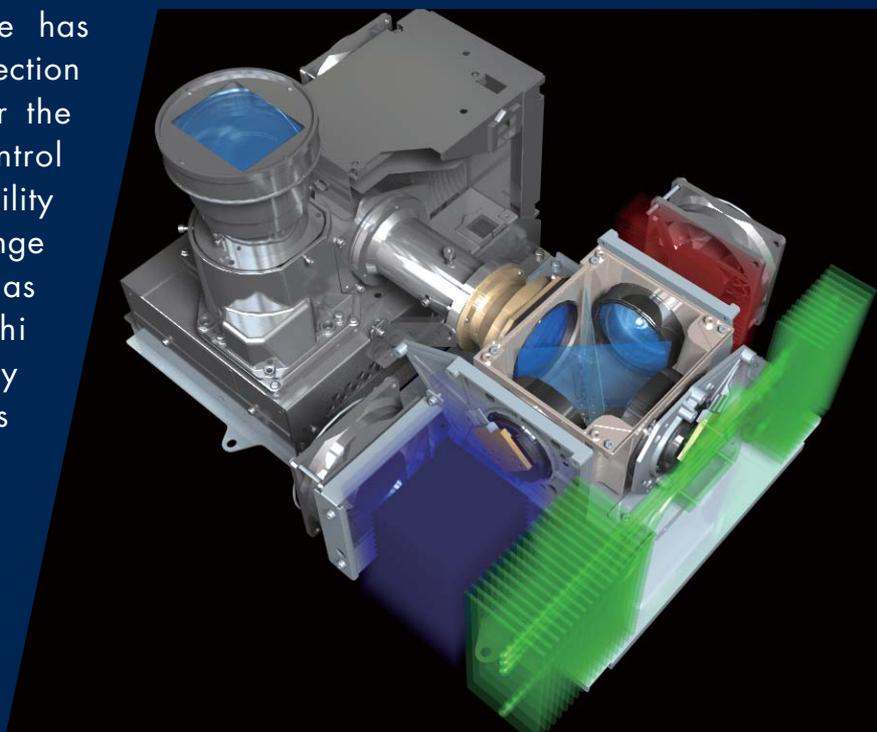
FOR

VIDEO WALL

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LED Display Wall Upgrade Unit

The emergence of LED light source has changed the world of rear projection display wall products, especially for the users in 24/7 command and control rooms, because of the longevity, stability and wide color reproduction range which LED technology can provide as the light source. Currently, Mitsubishi Electric provides variety of LED display wall products for customers in terms of resolutions, inch sizes, service accesses etc. With LED Display Wall Upgrade Unit, the owners of our legacy lamp-lit display wall products also have possibilities to upgrade and bring the systems into the latest generation.



Reduced System Upgrade Cost

The LED display wall upgrade can be realized by simply replacing the optical projection module and chassis unit. The cabinets, screens and other structures of existing display wall systems (base frames, claddings etc) can be continuously used. Therefore, no demolishing, construction and major

interior change work are needed. Comparing with the whole display product / system replacement, the initial cost of investment is smaller. However, the display wall system can be upgraded to the latest LED-lit solution.

Low Cost of Ownership

1 | Virtually Maintenance-free

LED light source has an average service life that is approximately 10 times longer than that of conventional ultrahigh-pressure mercury lamps. In addition, it does not require the color wheel to create RGB colors. Combined with the 100,000hr, ultra-long service life of our fans, the average service life is more than 10 years, even when operated 24/7

2 | Efficient Air Cooling System

The system has an optimal airflow path and cooling module design that are perfectly matched to the characteristics of the LED light source. Comparing with the liquid cooling system that requires periodical changes on the coolant, pump and drive parts, it has much less consumables.

3 | Choice of Four Operating Modes

Equipped with an original LED power control circuit, each display wall product can be set to operate in one of four operating modes: Bright, Normal, Eco and Advanced Eco. Especially when operating under Eco or Advanced Eco mode, lower power consumption is achieved (XX W under Advanced Eco mode).

Superior Performance by Mitsubishi Electric's Latest Technologies

1 Color Space Control

To compensate for the color and brightness inconsistencies on display wall products, Mitsubishi Electric has developed an original Color Space Control Circuit that balances and blends colors. The ratios of each primary color (Red/Green/Blue) and other color mixtures are adjusted to provide consistent color blending and superior uniformity on multi-screen configurations.

2 Dynamic Color & Brightness Balancing

Each display wall product is equipped with three built-in sensors (one for each primary color) that use a color and brightness maintenance algorithm. The sensors continually monitor the individual red, green and blue output of each display wall product, share the data with adjacent displays, and adjust performance automatically to produce extremely accurate colors and brightness balance over the entire display. These features make it possible to maintain image uniformity on multi-screen configurations over long periods of operation without using external computers.

3 Choice of Four Operating Modes

Loss of brightness at the screen edges is no longer a problem owing to Mitsubishi Electric's innovative digital gradation circuit. Brightness is distributed evenly across the screen, ensuring the reproduction of sharp, vivid images from edge to edge on multi-screen configurations.

Wide Color Reproduction Range by LED Light Source

The LED light source offers a much wider range of color reproduction, allowing a larger array of vivid colors to be used for the icons and symbols

frequently used in command and control rooms. This ultimately makes it easier for command and control room operators to share information.

Eco-conscious

The LED light source eliminates the use of mercury, and thus helps to preserve the environment. At the same time, the Eco mode setting

contributes to lower power consumption and CO2 emissions than lamp-lit display wall products.

Applicable Models

■ VS-50XL20U
■ VS-50XL21U
■ VS-50XL50U
■ VS-50XLW20U

■ VS-50XLW50U
■ VS-50XLF20U
■ VS-50XLF50U
■ VS-50XLWF50U

■ VS-67XL20U
■ VS-67XL50U
■ VS-67XLW20U

■ VS-67XLW50U
■ VS-67XLF50U
■ VS-67XLWF50U

* Applicability for other models, please contact the nearest dealership.

■ VS-50PH50U
■ VS-67PH50U
■ VS-67PHF50U

* Depending on the installation situations, some upholstering work might be needed.

* Basically, the cabinets, screens and other structures of existing display wall systems (base frames, claddings etc) can be continuously used. However, depending on the conditions, some replacement might be necessary.

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE: TOKYO BLDG., 2-7-3, MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN

www.MitsubishiElectric.com/bu/displaywall

Product Specifications

Input Board



Model:

VC-B70G2

VC-B70D2

VC-B70V2

VC-B70DC

VC-B70SD1

VC-B70DA2

Information in this document is subject to change without notice.

**Mitsubishi Electric Corporation
Kyoto Works**

Date: March 05, 2013

Input Board Specifications

(1) Electric specification

Analog RGB input board: VC-B70G2

| | | |
|------------------------------------|-------------------|---|
| Signal input terminal (Analog RGB) | | 5BNC x1 HD Dsub15 x1 |
| RGB Input scanning frequency | Signal resolution | VGA (640 x 480) – WUXGA (1920 x 1200) (Refer to attached “Supported signals list”) |
| | Horizontal | 31.5kHz – 92kHz |
| | Vertical | 49Hz – 85Hz |
| Pixel clock rate | | 25MHz – 162MHz |
| Functions | | Scaling: shrink and zoom. Frame rate conversion. |

Digital RGB input board: VC-B70D2

| | | |
|-------------------------------------|-------------------|---|
| Signal input terminal (Digital RGB) | | DVI-D (with HDCP) x2 |
| RGB Input scanning frequency | Signal resolution | VGA (640 x 480) – WUXGA (1920 x 1200) (Refer to attached “Supported signals list”) |
| | Horizontal | 31.5kHz – 92kHz |
| | Vertical | 49Hz – 85Hz |
| Pixel clock rate | | 25MHz – 162MHz |
| Signal format | | TMDS |
| Functions | | Scaling: shrink and zoom. Frame rate conversion. |

Video input board: VC-B70V2

| | | |
|--------------------------------------|--|---|
| Signal input terminal (Analog Video) | | 3BNC x2 |
| Video input signals | | NTSC, NTSC4.43 PAL, PAL-M, PAL-N, PAL-60, SECAM |
| Functions | | Scaling: shrink and zoom. Frame rate conversion. |

Daisy chain board: VC-B70DC

| | | |
|------------------------------|--|---|
| Signal input terminal | Analog RGB: HD Dsub15 x1 Digital RGB: DVI-D (with HDCP) x1 Analog Video: 3BNC x1 | |
| Signal output terminal | Digital RGB: DVI-D x1 (Daisy chain use only. Can not output HDCP signals.) | |
| RGB Input scanning frequency | Signal resolution | VGA (640 x 480) – WUXGA (1920 x 1200) (Refer to attached “Supported signals list”) |
| | Horizontal | 31.5kHz – 92kHz |
| | Vertical | 49Hz – 85Hz |
| Video input signals | NTSC, NTSC4.43 PAL, PAL-M, PAL-N, PAL-60, SECAM | |
| Pixel clock rate | 25MHz – 162MHz | |
| Functions | Scaling: shrink and zoom. Frame rate conversion. Daisy chain function (Up to 16 cubes) | |

SDI input board: VC-B70SD1

| | |
|------------------------|---|
| Signal input terminal | BNC x 1 |
| Signal output terminal | BNC x 1 (for through output) |
| Input signals | 3G-SDI (SMPTE424M): 1080p@50/59.94/60Hz HD-SDI (SMPTE292M): 1080i@50/59.94/60Hz 720p@50/59.94/60Hz SD-SDI (SMPTE259M-C): 480i@59.94Hz, 576i@50Hz |
| Gen lock input | Terminal: BNC x 1 Format: NTSC/PAL Black burst |
| Functions | Scaling: shrink and zoom. Frame rate conversion. Through output: (Up to 16 cubes @ HD-SDI, SD-SDI Up to 9 cubes @ 3G-SDI) |

Digital/Analog RGB input board: VC-B70DA2

| | | |
|------------------------------|--|---|
| Signal input terminal | DVI-I (Digital with HDCP, Analog) x2 | |
| RGB Input scanning frequency | Signal resolution | VGA (640 x 480) – WUXGA (1920 x 1200) (Refer to attached “Supported signals list”) |
| | Horizontal | 31.5kHz – 92kHz |
| | Vertical | 49Hz – 85Hz |
| Pixel clock rate | 25MHz – 162MHz | |
| Signal format | TMDS | |
| Functions | Scaling: shrink and zoom. Frame rate conversion. Digital cable equalizer function (Maximum 50m depending on the qualities of equipment and cable) | |

(2) Mechanical specification

| | | |
|--------------------|--------|---|
| Dimensions | Width | 198mm |
| | Height | 31mm |
| | Depth | 167mm |
| Weight | | 0.3kg |
| Packing dimensions | Width | 280mm |
| | Height | 90mm |
| | Depth | 250mm |
| Packing Weight | | 0.6kg (except VC-B70DC) 0.9kg (VC-B70DC) |
| Accessories | | Caution sheet for EMI DVI-D cable x 1 (VC-B70DC) |

(3) Environment

| | |
|--|--|
| Temperature and humidity Condition at storage | -20°C – 50°C (-4°F – 122°F), 20% – 80% non condensing |
|--|--|

Supported signals list

RGB signals

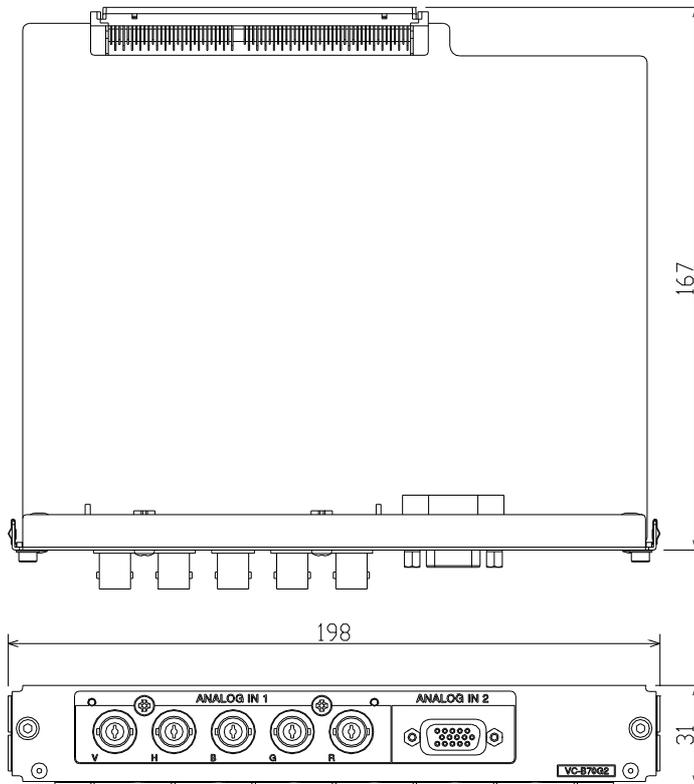
| Signal | Resolution | Refresh rate (Hz) | Line rate (kHz) |
|-----------|-------------|-------------------|-----------------|
| VESA | 1920 x 1200 | 60.0 | 74.0 |
| | 1920 x 1080 | 60.0 | 67.5 |
| | 1680 x 1050 | 60.0 | 65.3 |
| | 1600 x 1200 | 60.0 | 75.0 |
| | 1440 x 900 | 59.9 | 55.9 |
| | 1400 x 1050 | 59.9 | 64.7 |
| | | 60.0 | 65.3 |
| | 1366 x 768 | 74.9 | 82.3 |
| | | 59.8 | 47.7 |
| | 1360 x 768 | 60.0 | 47.7 |
| | | 60.0 | 64.0 |
| | 1280 x 1024 | 75.0 | 80.0 |
| | | 85.0 | 91.1 |
| | | 60.0 | 60.0 |
| | 1280 x 960 | 60.0 | 60.0 |
| | 1280 x 800 | 59.8 | 49.7 |
| | 1280 x 768 | 59.9 | 47.8 |
| | 1280 x 720 | 60.0 | 45.0 |
| | 1152 x 864 | 75.0 | 67.5 |
| | 1024 x 768 | 60.0 | 48.4 |
| | | 70.1 | 56.5 |
| | | 75.0 | 60.0 |
| | | 85.0 | 68.7 |
| | 848 x 480 | 60.0 | 31.0 |
| | 800 x 600 | 56.3 | 35.2 |
| | | 60.3 | 37.9 |
| | | 72.2 | 48.1 |
| | | 75.0 | 46.9 |
| | | 85.1 | 53.7 |
| | 720 x 400 | 85.0 | 37.9 |
| | 640 x 480 | 59.9 | 31.5 |
| | | 72.8 | 37.9 |
| 75.0 | | 37.5 | |
| 85.0 | | 43.3 | |
| 640 x 400 | 85.1 | 37.9 | |
| 640 x 350 | 85.1 | 37.9 | |
| PC | 1400 x 1050 | 60.0 | 64.0 |
| | 1280 x 1024 | 60.0 | 63.4 |
| | 1280 x 960 | 75.0 | 75.0 |
| | 1152 x 864 | 70.0 | 63.9 |
| | | 85.1 | 77.5 |
| 640 x 400 | 70.1 | 31.5 | |
| | 84.1 | 37.9 | |
| Mac | 1152 x 870 | 75.0 | 68.6 |
| | 1024 x 768 | 74.9 | 60.2 |
| | 832 x 624 | 74.5 | 49.7 |
| | 640 x 480 | 66.7 | 35.0 |
| Unix | 1280 x 1024 | 59.9 | 64.6 |
| | | 71.2 | 75.1 |
| | | 72.0 | 78.1 |
| | | 76.1 | 81.1 |
| HDTV | 1920 x 1080 | 50.0 | 28.1 |
| | | 59.9 | 33.7 |
| | 1280 x 720 | 50.0 | 37.5 |
| | | 59.9 | 45.0 |

Y/Cb/Cr (Y/Pb/Pr) signals

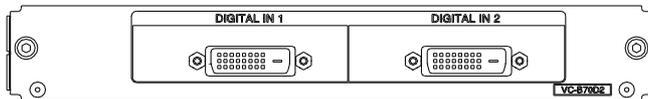
| Signal | Resolution | Refresh rate (Hz) | Line rate (kHz) |
|-------------|-------------|-------------------|-----------------|
| 1125p/1080p | 1920 x 1080 | 50.0 | 56.3 |
| | | 59.9 | 67.4 |
| 1125i/1080i | 1920 x 1080 | 50.0 | 28.1 |
| | | 59.9 | 33.7 |
| 750p/720p | 1280 x 720 | 50.0 | 37.5 |
| | | 59.9 | 45.0 |
| 625p/576p | 720 x 576 | 50.0 | 31.3 |
| 525p/480p | 720 x 480 | 59.9 | 31.5 |

Dimensions

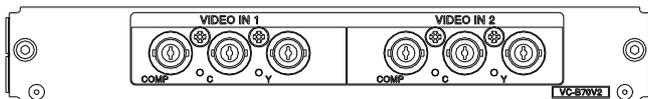
VC-B70G2



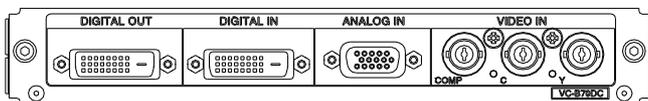
VC-B70D2



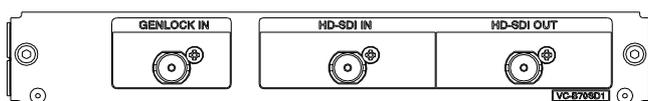
VC-B70V2



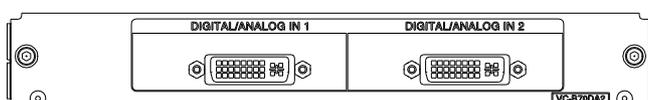
VC-B70DC



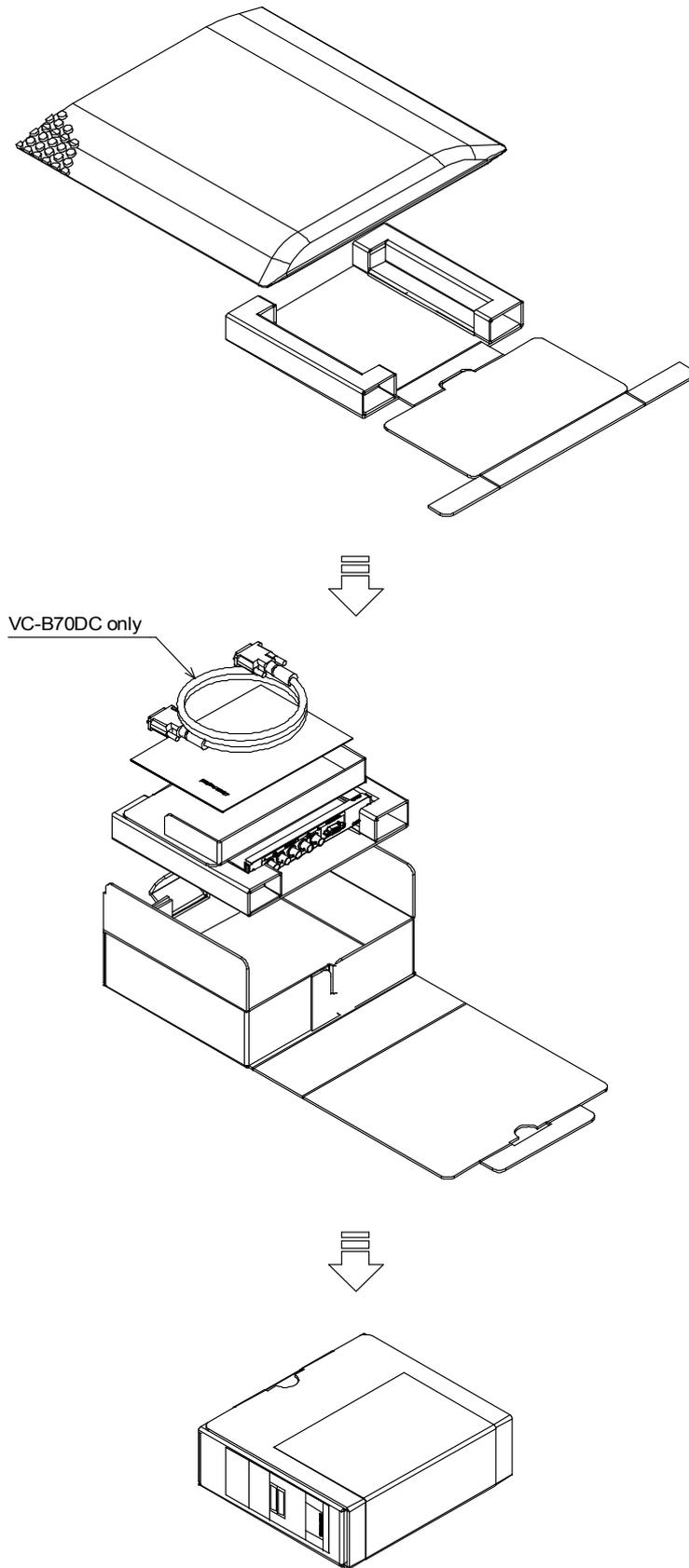
VC-B70SD1



VC-B70DA2



Packing specification



Product Specifications

Remote control unit Model: R-XL50TX

Information in this document is subject to change without notice.

**Mitsubishi Electric Corporation
Kyoto Works**

Date: March 10, 2006

R-XL50TX Specifications

R-XL50TX is an optional remote control unit for Mitsubishi display cube models.

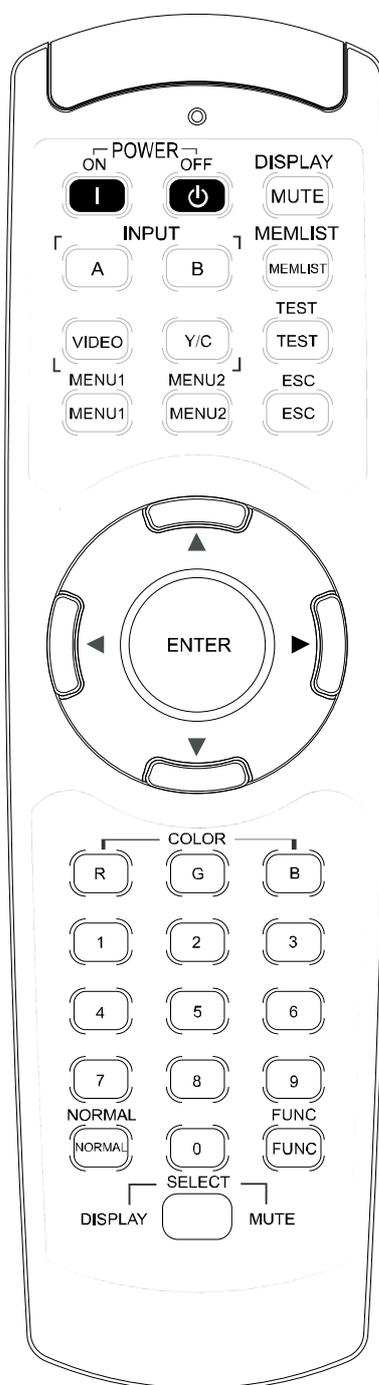
(1) Mechanical specification (Refer to attached Fig.)

| | | |
|--------------------|--------|---|
| Dimensions | Width | 50mm |
| | Height | 181mm |
| | Depth | 29mm |
| Weight | | 110g |
| Packing dimensions | Width | 226mm |
| | Height | 128mm |
| | Depth | 48mm |
| Packing Weight | | 350g |
| Accessories | | User's manual Cable for wired connection (10m) AA cell battery x2 |

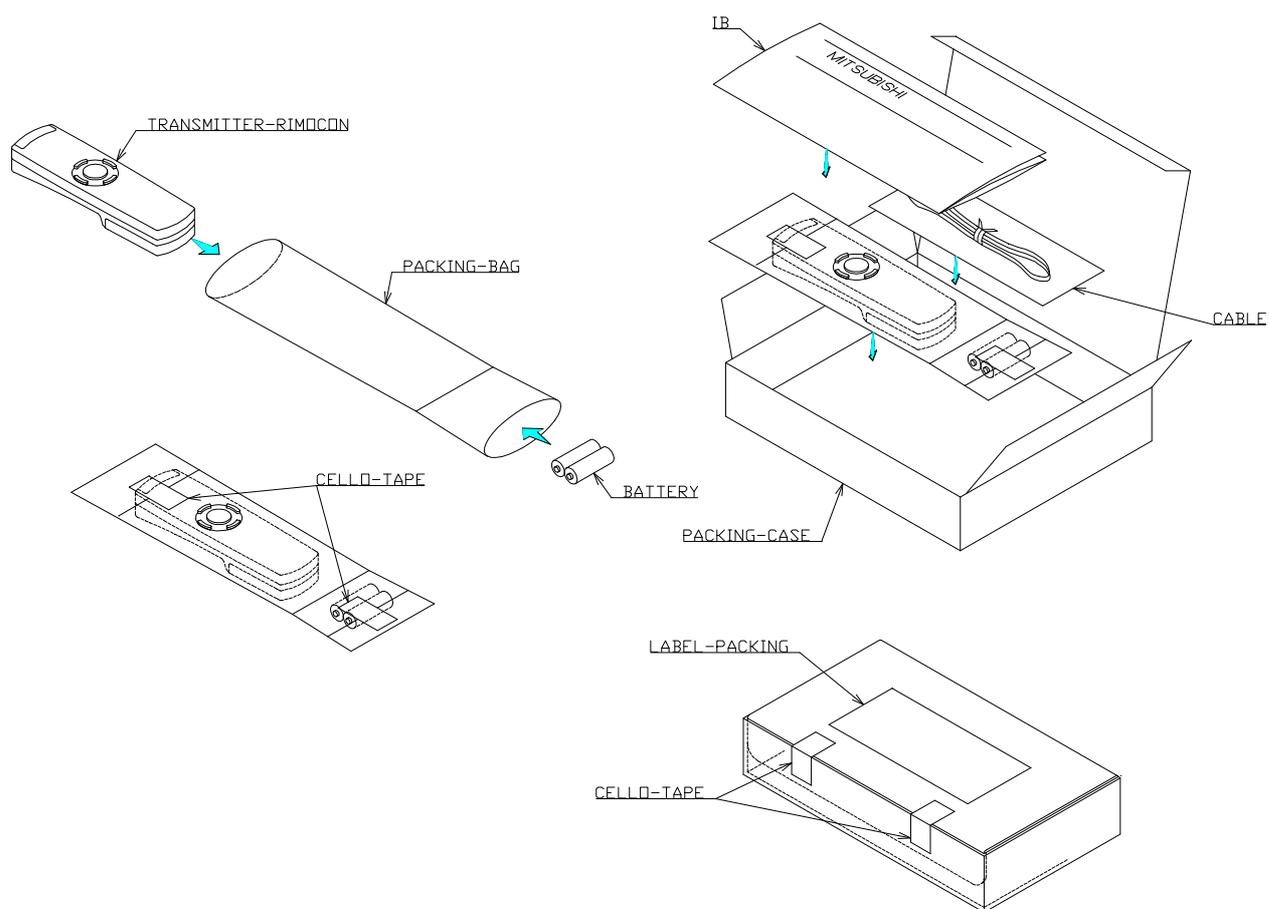
(2) Environment

| | |
|--|--|
| Temperature and humidity Condition at operation | 10°C – 40°C (50°F – 104°F), 20% – 80% non condensing |
| Temperature and humidity Condition at storage | -20°C – 50°C (-4°F – 122°F), 20% – 80% non condensing |

Appearance



Packing specification



Fusion Catalyst™ 4500H

Display Wall Processor with HDCP



Speed, Flexibility, Perfection, Plus HDCP

The Fusion Catalyst™ 4500H adds support for the display of HDCP protected content to the Fusion Catalyst 4500 line of display wall processors. Users and industry pundits around the world have called the award-winning Fusion Catalyst product line the best-in-class since its introduction in 2010.

The Fusion Catalyst 4500H features bandwidth that reaches 336 Gbps, delivering the high resolution, high frame rate performance that users have come to expect from Jupiter Systems. The system is built around a PCI Express 2.0 chassis with 7 powerful, high speed slots, providing faster graphics, real time HD/SD/DVI/RGB frame rates, and better overall system performance than anything in its class. Redundant power supplies maximize system uptime. Featuring the performance and

quality for which Jupiter is known, this is the solution for projects both large and small.

Add up to 4 Fusion Catalyst 4500E Expansion Chassis to a Fusion Catalyst 4500H CPU Chassis to handle up to 216 inputs and up to 48 outputs.

And with an Intel E5 Six Core Xeon and Windows 7 onboard, you can run even the most demanding applications directly on the video wall. An optional second Xeon CPU is available for even more compute power.

Other models in the Fusion Catalyst 4500 line include the FC4500B for installations without HDCP protected content to display and the FC4500C which supports Jupiter's Canvas collaborative visualization software.

Supports ControlPoint™

The Fusion Catalyst 4500H supports Jupiter's ControlPoint™ display wall management software. Deployed in over 10,000 of the most demanding installations around the world, ControlPoint is the most complete and powerful solution for managing the display wall and everything on it.

ControlPoint offers an intuitive, object-based GUI. De-

fining objects such as DVI, RGB, HD, and video inputs, streaming video inputs, web browser windows, image viewers, and local and remote application windows can be dragged and dropped onto the display mimic. Setting up complex combinations of graphical and real-time data is simple, quick and intuitive. Toolbar shortcuts to commonly used functionality are provided to make adjustments to windows even more convenient.

Fusion Catalyst™ 4500H In Action

The Fusion Catalyst 4500H is the ideal solution for projects of any size with HDCP as a requirement.

Each 3RU rack-mountable CPU Chassis and Expansion Chassis has 7 PCI Express 2.0 slots. Adding up to 4 Expansion Chassis to a CPU Chassis enables up to 48 outputs.

With optional Quad HD Decoder Cards, Fusion Catalyst 4500H can support up to 108 video streams. Most popular IP cameras and encoders are supported, as are desktop PC streams with real-time updates.

Optional HDCP Input Cards support up to 54 HDCP inputs via Single-Link DVI-D, or HDMI on DVI-D, connectors.

Optional Non-HDCP Dual-Link DVI-I Input Cards support up to 54 non-HDCP DVI-I, progressive scan component HD, or analog RGB inputs.

Up to 216 video non-HDCP inputs can be accommodated using optional Octal SD Video Input Cards.



Fusion Catalyst™ 4500H Specifications

CPU Chassis

System Architecture

Chassis

PCI Express 2.0 chassis with 7 high speed slots for input, output, or auxiliary cards

CPU Board

Processor

Intel E5 Six Core Xeon CPU
Optional 2nd Intel E5 Six Core Xeon CPU

System Memory

24GB RAM per CPU standard
Up to 96GB RAM per CPU optional

Storage

Drives

500GB hard disk drive standard, larger HDDs optional
Optional 256GB and 512GB solid state drives
Optional 2nd and 3rd drives
Optional RAID1 array with hot spare

Optical Storage

DVD-RW/CD-RW

Network Interface

Ethernet

Standard dual 100/1000 Mbps RJ45 ports

Input Devices (USB)

104-key keyboard and mouse

Expansion Chassis (optional)

FC4500E Expansion Chassis

Chassis

PCI Express 2.0 chassis with 7 slots for input or output cards

Graphics Inputs

Quad HD Decoder Input Card (Optional)

Inputs

Up to 108 inputs in 1 CPU Chassis + 4 Expansion Chassis

1 GigE connection, shared across 4 decoders
Supports real-time decoding of HD or SD streams
Supports most popular IP cameras and encoders

Single-Link DVI-D Input Card with HDCP Support (Optional)

Inputs

Up to 54 HDCP inputs in 1 CPU Chassis + 4 Expansion Chassis

Format

Single-Link DVI-D, or HDMI on a DVI-D connector, up to 1920x1080

Pixel rate

Digital: Up to 165 MHz

Pixel format

32 bits per pixel

Dual-Link DVI/RGB/HD Input Card without HDCP Support (Optional)

Inputs

Up to 54 non-HDCP inputs in 1 CPU Chassis + 4 Expansion Chassis

Format

Dual-Link DVI up to 2560x1600, Single-Link DVI up to 2048x1200, progressive scan component HD (480p, 720p, 1080p), and analog RGB with any sync type (composite, separate, sync on green) up to 2048x1200

Pixel rate

Digital: Up to 270 MHz

Analog: Up to 210 MHz

Pixel format

32 bits per pixel

Windows

4 destination windows per card

Octal SD Video Input Card (Optional)

Inputs

Up to 216 non-HDCP inputs in 1 CPU Chassis + 4 Expansion Chassis

Input format

NTSC, PAL

Windows

16 destination windows per card

Octal Video Connection Module

Dual BNC-F connectors support S-Video or Composite on 1RU 19" rackmount panel with 2 BNC sub-panels
Each sub-panel has 16 BNC connectors for 8 Composite or 8 S-Video signals

Graphics Outputs

Fusion Catalyst 4500 Output Card Outputs

Up to 48 outputs in 1 CPU Chassis + 4 Expansion Chassis

Resolution

Digital: Up to 1920x1080 pixels per output

Color Depth

32 bits per pixel

Output Signal

DVI-D single-link connector or HDMI connector, depending on configuration

Other

Rackmount CPU Chassis & Expansion Chassis

Dimensions

5.25" H x 19" W x 25.5" D
(13.3 cm x 48.3 cm x 64.8 cm)

Weight

53 lbs. (24.1 kg.)

Shipping weight

75 lbs. (34.1 kg.)

Operating Range

Temperature

Operating: 32°F – 104°F (0°C – 40°C)

Non-operating: 14°F – 150°F (-10°C – 66°C)

Humidity

10-90% non-condensing

Altitude

Up to 10,000 feet (3,048.0 m)

Electrical

Redundant power supplies

High efficiency (94%) with PMBus and I2C

Input voltage

100-240 VAC, auto-ranging power supply

Line frequency

50-60 Hz

Power consumption

500 Watts nominal per chassis

Regulatory

United States

UL 60950 listed, FCC Class A

Canada

cUL CSA C22.2, No. 60950

International

CE Mark, CB Certificate, IEC 60950, CCC, VCCI



Jupiter Systems
31015 Huntwood Avenue
Hayward, California
94544-7007 USA

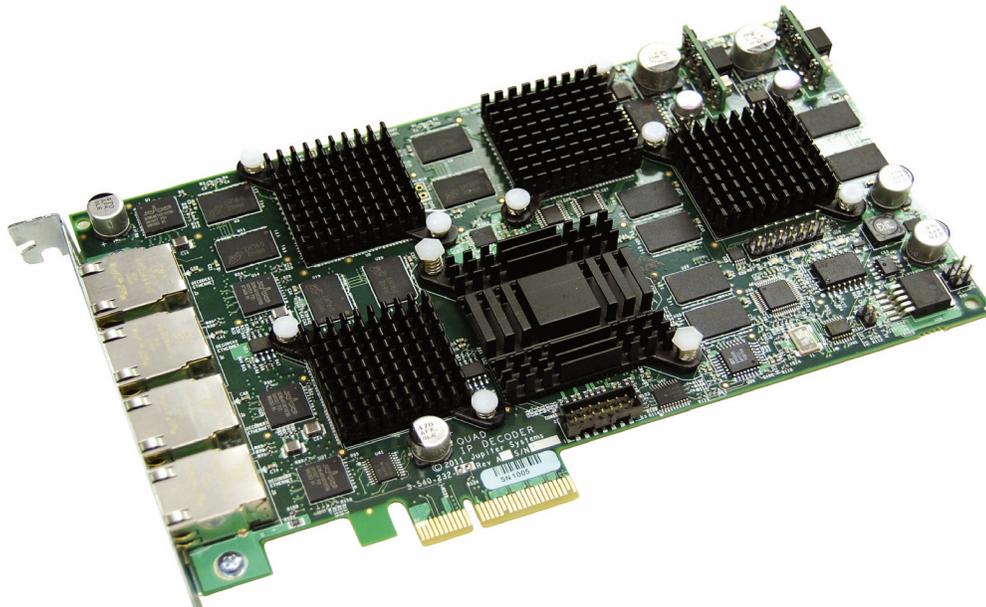
+1 510 675 1000 tel
+1 510 675 1001 fax
www.jupiter.com

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REV.201-501

Quad HD Decoder Card™ for Fusion Catalyst™



HD and SD Streams, Multiple Formats

The Quad HD Decoder Card™ from Jupiter Systems provides support for the display of both high definition and standard definition IP video streams in MPEG-2, MPEG-4, H.264, and MJPEG formats. Streams from cameras, encoders, NVRs, and PCs are all supported.

Using Jupiter scaling and communication technology, large numbers of streamed sources can be displayed at full frame rate, simultaneously, with digital precision

throughout.

The Quad HD Decoder Card supports most popular IP cameras and encoders. All display wall processors in the Fusion Catalyst™ product line are supported.

Fusion Catalyst systems can be configured with Quad HD Decoder Cards to support well over one hundred simultaneous streams.

Leading Technology, Maximum Flexibility

The Quad HD Decoder Card™ is the fourth generation of streaming video decoding products from Jupiter Systems. The card installs directly into both Fusion Catalyst and VizionPlus II display wall processors, offering Second Generation PCI Express performance and tight integration with Jupiter's industry-leading ControlPoint software.

The Quad HD Decoder Card features four independent decoders, each of which can handle streams from a variety of formats and source types. Supporting streams in MPEG-2, MPEG-4, H.264 and MJPEG, the Quad

HD Decoder card can decode and display streams from IP cameras, NVRs, desktop encoders, and video management systems. Supported source resolutions range from NTSC and PAL to full high definition 1080p.

Each decoder has its own Gigabit Ethernet network connection, ensuring sufficient bandwidth to each decoder to handle any stream bandwidth up to 20 Mbps with ease. Each decoder supports all stream formats and protocols, adapting automatically to specific stream types.

Power and Simplicity

Setting up streams is simple and intuitive with Jupiter's ControlPoint drag-and-drop graphical user interface.

Quad HD Decoder windows can be scaled from postage stamp size to the size of the full wall, while maintaining true, real time update rates and perfect

visual performance. Stream and decoder management software, a component of the ControlPoint software suite, ensures that in the event of a decoder or network failure, routing of streams to available resources is done quickly and automatically.



Jupiter Systems
31015 Huntwood Avenue
Hayward, California
94544-7007 USA

+1 510 675 1000 tel
+1 510 675 1001 fax
www.jupiter.com

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REV.201-110

3-Series Control System®

- > Enterprise-class control system
- > 3-Series® Control Engine — substantially faster and more powerful than other control systems
- > Exclusive modular programming architecture
- > Onboard 1GB RAM & 4GB Flash memory
- > Expandable storage up to 1TB
- > Rear panel memory card slot
- > High-speed USB 2.0 host port
- > Industry-standard Ethernet and Cresnet® wired communications
- > Control Subnet — provides a dedicated local network for Crestron® devices
- > XPanel with Smart Graphics™ computer and Web based control
- > iPhone®, iPac®, and Android™ control app support
- > Crestron Fusion® Enterprise Management Software support
- > SNMP remote management support
- > Two RS-232/422/485 COM ports with hardware and software handshaking
- > Four RS-232 COM ports with software handshaking only
- > Eight IR/serial, eight relay, and eight Versiport I/O ports
- > Three built-in 3-Series control card expansion slots (optional)⁽¹⁾
- > Programmable event scheduling with astronomical time clock
- > Native BACnet™/IP support⁽²⁾
- > IEC 61000-4-5 Installation Class 4 surge immunity on COM, Versiport, and network connections⁽⁴⁾
- > Installer setup via Crestron Toolbox™ software or Web browser
- > C# and symbol based programming environments
- > Full Unicode (multi-language) support
- > Increased network throughput and security
- > Secure access through full user/group management or Active Directory integration
- > Hardware level security using 802.1X authentication
- > IIS v.6.0 Web Server
- > IPv6 ready
- > Front panel USB computer console port
- > 2-space rack-mountable



3-Series® Control Systems

Today's commercial buildings and custom homes comprise more technology than ever before, and all these systems need to be networked, managed, and controlled in fundamentally new ways. The IP based 3-Series platform is engineered from the ground up to deliver a network-grade server appliance capable of faithfully handling everything from boardroom AV and home theater control to total building management.

3-Series embodies a distinctively robust, dynamic, and secure platform to elevate your system designs to higher levels of performance and reliability. Compared to other control systems, Crestron 3-Series provides a pronounced increase in processing power and speed with more memory, rock solid networking and IP control, and a unique modular programming architecture.

Modular Programming Architecture

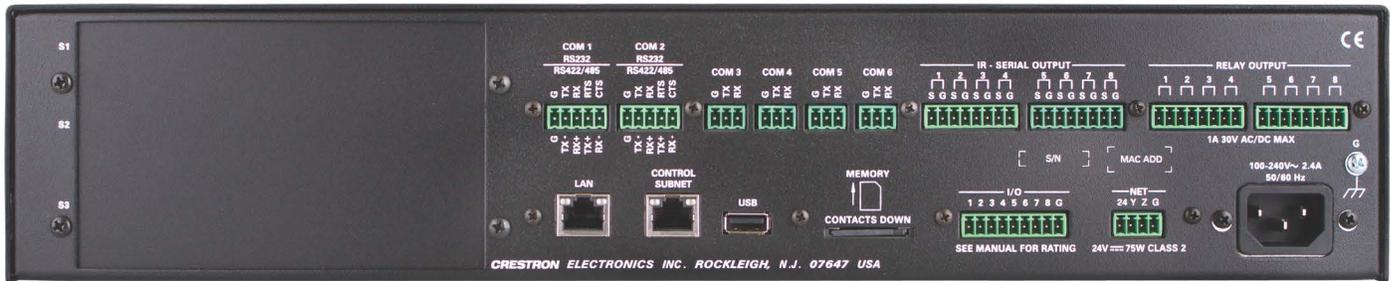
Designed for enhanced scalability, the AV3 affords high-speed, real-time multi-tasking to seamlessly run multiple programs simultaneously. This exclusive modular programming architecture lets programmers independently develop and run device-specific programs for AV, lighting, shades, HVAC, security, etc., allowing for the optimization of each program, and allowing changes to be made to one program without affecting the whole. Even as your system grows, processing resources can easily be shifted from one 3-Series processor to another without rewriting any code. The end benefit is dramatically simplified upgradability with minimal downtime, whether implementing changes on site or remotely via the network.

Robust Ethernet & IP Control

IP technology is the heart of 3-Series, so it should be no surprise that its networking abilities are second to none. Gigabit Ethernet connectivity enables integration with IP-controllable devices and allows the AV3 to be part of a larger managed control network. Whether residing on a sensitive corporate LAN, a home network, or accessing the Internet through a cable modem, the AV3 provides secure, reliable interconnectivity with IP-enabled touch screens, computers, mobile devices, video displays, media servers, security systems, lighting, HVAC, and other equipment — whether on premises or across the globe.

The Crestron® AV3 is an enterprise-class control system with an enhanced feature set including built-in control card expansion slots and a dedicated Control Subnet port. Featuring the 3-Series® control engine, the AV3 forms the core of any modern networked home or commercial building, managing and integrating all the disparate technologies throughout your facility to make life easier, greener, more productive, and more enjoyable.

AV3 3-Series Control System®



AV3 – Rear View

Dedicated Control Subnet

The Crestron Control Subnet is a Gigabit Ethernet network dedicated to Crestron devices. Via the AV3's Control Subnet port, an installer may simply connect a single touch screen or wireless gateway, or add a Crestron PoE switch ([CEN-SW-POE-5](#) or [CEN-SWPOE-16](#))^[1] to handle multiple touch screens, gateways, AV components, and other devices. Auto-configuration of the entire subnet is performed by the AV3, discovering each device and assigning IP addresses without any extra effort from the installer.

A separate LAN port on the AV3 provides a single-point connection to the customer's LAN, requiring just one IP address for the complete control system. The LAN port allows full interconnectivity between devices on the local subnet with other devices, systems, servers, and WAN/Internet connections outside the local subnet. For sensitive applications that require absolute security, the entire Control Subnet can be completely isolated from the customer's LAN using Isolation Mode.

Control Apps & XPanel

Years ago, Crestron pioneered the world's first IP-based control system unleashing vast new possibilities for controlling, monitoring, and managing integrated systems over a LAN, WAN, and the Internet. Today, Crestron offers more ways than ever to control your world the way you want. Using a computer, smartphone, or tablet device, Crestron lets you control anything in your home or workplace from anywhere in the world.

Native to every 3-Series control system, Crestron [XPanel](#) technology transforms any laptop or desktop computer into a virtual Crestron touch screen. Crestron control apps deliver the Crestron touch screen experience to [iPhone®](#), [iPad®](#), and [Android™](#) devices, letting you safely monitor and control your entire residence or commercial facility using the one device that goes with you everywhere.

Crestron Fusion® Enterprise Management

[Crestron Fusion](#) provides an integrated platform for creating truly smart buildings that save energy, enhance worker productivity, and prolong the life-span of valuable equipment. As part of a complete managed network in a corporate enterprise, college campus, convention center or any other facility, the AV3 works integrally with [Fusion RV®](#) Remote Asset Management Software to enable remote scheduling, monitoring, and control of rooms and technology from a central help desk. [Fusion EM®](#) Energy Management Software enables organizations to reduce energy consumption by tracking real-time usage and automating control of lighting, shades, and HVAC.



SNMP Support

Built-in SNMP support enables integration with third-party IT management software, allowing network administrators to manage and control Crestron systems on the network in an IT-friendly format.

Cresnet®

Cresnet provides a dependable network wiring solution for Crestron keypads, lighting controls, shade motors, thermostats, occupancy sensors, and other devices that don't require the higher speed of Ethernet. The Cresnet bus offers easy wiring and configuration, carrying bidirectional communication and 24VDC power to each device over a simple 4-conductor cable. To assist with troubleshooting, the AV3 includes our patent-pending Network Analyzer which continuously monitors the integrity of the Cresnet network for wiring faults, marginal performance, and other errors.

Onboard Control Ports

In addition to Ethernet, the AV3 includes six bidirectional COM ports and eight IR ports to interface directly with all of your centralized AV sources, video displays, and other devices. Eight programmable relay ports are included for controlling projection screens, lifts, power controllers, and other contact-closure actuated equipment. Eight "Versiport" I/O ports enable the integration of power sensors, motion detectors, door switches, alarms, or anything else that provides a dry contact closure, low-voltage logic, or 0-10 Volt DC signal.

Optional Control Card Expansion Slots

Additional control ports can be added to the AV3 using [3-Series Control Cards](#) and the [CAGE3](#) Control Card Expansion Cage. ^[1] The CAGE3 accessory installs in the AV3, providing three control card expansion slots on the AV3's rear panel. Adding the CAGE3 option affords great expansion capability without requiring any additional rack space.

BACnet™/IP

Native support for the [BACnet/IP](#) communication protocol provides a direct interface to third-party building management systems over Ethernet, simplifying integration with HVAC, security, fire & life safety, voice & data, lighting, shades, and other systems. Using BACnet/IP, each system runs independently with the ability to communicate together on one platform for a truly smart building.^[2]



AV3 3-Series Control System®

SPECIFICATIONS

Control Engine

Crestron® 3-Series®; real-time, preemptive multi-threaded/multitasking kernel; Transaction-Safe Extended FAT file system; supports up to 10 simultaneously running programs

Memory

SDRAM: 1 GB

Flash: 4 GB

Memory Card: supports SD and SDHC cards up to 32 GB

External Storage: supports USB mass storage devices up to 1 TB

Communications

Ethernet: 10/100/1000 Mbps, auto-switching, auto-negotiating, auto-discovery, full/half duplex, industry-standard TCP/IP stack, UDP/IP, CIP, DHCP, SSL, TLS, IEEE 802.1X, SNMP, BACnet™/IP^[2], IPv4 or IPv6, Active Directory authentication, IIS v.6.0 Web Server, SMTP e-mail client

Control Subnet: 10/100/1000 Mbps Ethernet, auto-switching, auto-negotiating, auto-discovery, full/half duplex, DHCP server, DNS Server, port forwarding, Isolation Mode

Cresnet®: Cresnet master mode

USB: Supports USB mass storage class devices via rear panel USB 2.0 host port, supports computer console via front panel USB 2.0 device port

RS-232/422/485: For 2-way device control and monitoring, all ports support RS-232 up to 115.2k baud with software handshaking, two ports also support hardware handshaking, RS-422, and RS-485

IR/Serial: Supports 1-way device control via infrared up to 1.2 MHz or serial TTL/RS-232 (0-5 Volts) up to 115.2k baud

Connectors & Card Slots

S1 – S3: (3) 3-Series control card expansion slots (optional)^[3]

COM 1 – 2: (2) 5-pin 3.5mm detachable terminal blocks; Bidirectional RS-232/422/485 ports^[4]; Up to 115.2k baud; hardware and software handshaking support

COM 3 – 6: (4) 3-pin 3.5mm detachable terminal blocks; Bidirectional RS-232 ports^[4]; Up to 115.2k baud; software handshaking support

IR - SERIAL OUTPUT 1 – 8: (2) 8-pin 3.5mm detachable terminal block comprising (8) IR/Serial output ports; IR output up to 1.2 MHz; 1-way serial TTL/RS-232 (0-5 Volts) up to 115.2k baud

RELAY OUTPUT 1 – 8: (2) 8-pin 3.5mm detachable terminal blocks comprising (8) normally open, isolated relays; Rated 1 Amp, 30 Volts AC/DC; MOV arc suppression across contacts

LAN: (1) 8-wire RJ45 jack; 10Base-T/100Base-TX/1000Base-T Ethernet port^[4]; Connects to the customer's LAN

CONTROL SUBNET: (1) 8-wire RJ45 jack; 10Base-T/100Base-TX/1000Base-T Ethernet port^[4]; Provides a dedicated local network for Crestron devices

USB: (1) USB Type A female; USB 2.0 port for storage devices

MEMORY: (1) SD memory card slot; Accepts one SD or SDHC card up to 32 GB for memory expansion

I/O 1 – 8: (1) 9-pin 3.5mm detachable terminal block comprising (8) "Versiport" digital input/output or analog input ports (referenced to GND)^[4];

Digital Input: Rated for 0-24 Volts DC, input impedance 20k Ohms, logic threshold >3.125V low/0 and <1.875V high/1;

Digital Output: 250mA sink from maximum 24 Volts DC, catch diodes for use with "real world" loads;

Analog Input: Rated for 0-10 Volts DC, protected to 24 Volts DC maximum, input impedance 21k Ohms with pull-up resistor disabled;

Programmable 5 Volts, 2k Ohms pull-up resistor per pin

NET: (1) 4-pin 3.5mm detachable terminal block; Cresnet master port, outputs power to Cresnet devices^[4]; See "Power Requirements" for additional specifications

100-240V~2.4A 50/60Hz: (1) IEC 60320 C14 main power inlet; Mates with removable power cord, included

G: (1) 6-32 screw, chassis ground lug

COMPUTER (front): (1) USB Type B female; USB 2.0 computer console port (6 ft cable included); For setup only

Controls & Indicators

PWR: (1) Green LED, indicates operating power supplied from AC line

NET: (1) Amber LED, indicates communication with the Cresnet system

MSG: (1) Red LED, indicates control system has generated an error message

HW-R: (1) Recessed pushbutton for hardware reset

SW-R: (1) Recessed pushbutton for software reset

CNPS FAULT: (1) Red LED and (1) pushbutton, LED indicates an excessive Cresnet load detected at the NET port, pushbutton resets the fault indication

SLOT 1 – 3: (3) Green LEDs, indicate control cards are inserted in the corresponding slots^[3]

LAN (rear): (2) Bi-color green/amber LEDs, left LED indicates Ethernet link status and connection speed, right LED indicates Ethernet activity

CONTROL SUBNET (rear): (2) Bi-color green/amber LEDs, left LED indicates Ethernet link status and connection speed, right LED indicates Ethernet activity

Power Requirements

Main Power: 2.4 Amps @ 100-240 Volts AC, 50/60 Hz

Available Cresnet Power: 75 Watts (3.125 Amps @ 24 Volts DC)

AV3 3-Series Control System®

Environmental

Temperature: 41° to 113°F (5° to 45°C)

Humidity: 10% to 90% RH (non-condensing)

Heat Dissipation: 45 BTU/Hr with no Cresnet devices, no control cards;
71 BTU/Hr with full Cresnet load, no control cards;

See individual control card spec sheets for additional specifications

Enclosure

Chassis: Metal, black finish, vented top and sides

Faceplate: Extruded metal, black finish, polycarbonate label overlay

Mounting: Freestanding or 2U 19-inch rack-mountable (adhesive feet and rack ears included)

Dimensions

Height: 3.47 in (89 mm) without feet

Width: 17.28 in (439 mm);
19.00 in (483 mm) with rack ears

Depth: 10.06 in (256 mm)

Weight

4.0 lb (1.9 kg)

MODELS & ACCESSORIES

Available Models

AV3: 3-Series Control System®

Available Accessories

CAGE3: Control Card Expansion Cage for AV3

C3COM-3: 3-Series® Control Card - 3 COM Ports

C3IO-16: 3-Series® Control Card - 16 Versiport I/O Ports

C3IR-8: 3-Series® Control Card - 8 IR Ports

C3RY-8: 3-Series® Control Card - 8 Relay Ports

C3RY-16: 3-Series® Control Card - 16 Relay Ports

PWE-4803RU: PoE Injector

CEN-SW-POE-5: 5-Port PoE Switch

CEN-SWPOE-16: 16-Port Managed PoE Switch

C2N-HBLOCK: Multi-type Cresnet Distribution Block

CNTBLOCK: Cresnet Distribution Block

CNSP-XX: Custom Serial Interface Cable

IRP2: IR Emitter Probe w/Terminal Block Connector

Crestron® App: Control App for Apple® iOS® & Android™

XPanel: Crestron Control® for Computers

myCrestron: Dynamic DNS Service for Crestron Systems

Fusion EM®: Energy Management Software

Fusion RV®: Remote Asset Management Software

RoomView® Express: Remote Help Desk and Resource Management Software

3-Series® BACnet™/IP Support: 3-Series Native BACnet/IP Interface License

CSP-LIR-USB: IR Learner

Notes:

1. Item(s) sold separately.
2. License required. The AV3 supports a maximum of 2000 BACnet objects when dedicated for BACnet use only. Actual capabilities are contingent upon the overall program size and complexity.
3. Requires CAGE3 Control Card Expansion Cage accessory.
4. The following connections comply with IEC 61000-4-5 Installation Class 4 surge immunity levels: COM 1 - 6, I/O 1 - 8, NET, LAN, and CONTROL SUBNET.

This product may be purchased from an authorized Crestron dealer. To find a dealer, please contact the Crestron sales representative for your area. A list of sales representatives is available online at www.crestron.com/salesreps or by calling 800-237-2041.

The specific patents that cover Crestron products are listed online at: patents.crestron.com.

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3-Series Control System®

- > Enterprise-class control system
- > 3-Series® Control Engine — substantially faster and more powerful than other control systems
- > Exclusive modular programming architecture
- > Onboard 512MB RAM & 4GB Flash memory
- > Expandable storage up to 1TB
- > Rear panel memory card slot
- > High-speed USB 2.0 host port
- > Industry-standard Ethernet and Crestron® wired communications
- > Control Subnet — provides a dedicated local network for Crestron® devices
- > XPanel with Smart Graphics™ computer and Web based control
- > iPhone®, iPad®, and Android™ control app support
- > Crestron Fusion® Enterprise Management Software support
- > SNMP remote management support
- > One RS-232/422/485 COM port with hardware and software handshaking
- > Two RS-232 COM ports with software handshaking only
- > Eight IR/serial, eight relay, and eight Versiport I/O ports
- > Programmable event scheduling with astronomical time clock
- > Native BACnet™/IP support^[2]
- > Installer setup via Crestron Toolbox™ software or Web browser
- > C# and symbol based programming environments
- > Full Unicode (multi-language) support
- > Increased network throughput and security
- > Secure access through full user/group management or Active Directory integration
- > Hardware level security using 802.1X authentication
- > IIS v.6.0 Web Server
- > IPv6 ready
- > Front panel USB computer console port
- > 1-space rack-mountable



3-Series embodies a distinctively robust, dynamic, and secure platform to elevate your system designs to higher levels of performance and reliability. Compared to other control systems, Crestron 3-Series provides a pronounced increase in processing power and speed with more memory, rock solid networking and IP control, and a unique modular programming architecture.

Modular Programming Architecture

Designed for enhanced scalability, the CP3N affords high-speed, real-time multi-tasking to seamlessly run multiple programs simultaneously. This exclusive modular programming architecture lets programmers independently develop and run device-specific programs for AV, lighting, shades, HVAC, security, etc., allowing for the optimization of each program, and allowing changes to be made to one program without affecting the whole. Even as your system grows, processing resources can easily be shifted from one 3-Series processor to another without rewriting any code. The end benefit is dramatically simplified upgradability with minimal downtime, whether implementing changes on site or remotely via the network.

Robust Ethernet & IP Control

IP technology is the heart of 3-Series, so it should be no surprise that its networking abilities are second to none. Gigabit Ethernet connectivity enables integration with IP-controllable devices and allows the CP3N to be part of a larger managed control network. Whether residing on a sensitive corporate LAN, a home network, or accessing the Internet through a cable modem, the CP3N provides secure, reliable interconnectivity with IP-enabled touch screens, computers, mobile devices, video displays, media servers, security systems, lighting, HVAC, and other equipment — whether on premises or across the globe.

Dedicated Control Subnet

The Crestron Control Subnet is a Gigabit Ethernet network dedicated to Crestron devices. Via the CP3N's Control Subnet port, an installer may simply connect a single touch screen or wireless gateway, or add a Crestron PoE switch ([CEN-SW-POE-5](#) or [CEN-SWPOE-16](#))^[1] to handle multiple touch screens, gateways, AV components, and other devices. Auto-configuration of the entire subnet is performed by the CP3N, discovering each device and assigning IP addresses without any extra effort from the installer.

A separate LAN port on the CP3N provides a single-point connection to the customer's LAN, requiring just one IP address for the complete control system. The LAN port allows full interconnectivity between devices on

The Crestron® CP3N is an enterprise-class control system with a dedicated Control Subnet port. Featuring the 3-Series® control engine, the CP3N forms the core of any modern networked home or commercial building, managing and integrating all the disparate technologies throughout your facility to make life easier, greener, more productive, and more enjoyable.

3-Series® Control Systems

Today's commercial buildings and custom homes comprise more technology than ever before, and all these systems need to be networked, managed, and controlled in fundamentally new ways. The IP based 3-Series platform is engineered from the ground up to deliver a network-grade server appliance capable of faithfully handling everything from boardroom AV and home theater control to total building management.

3-Series™ Card Interface - 1 Slot

- > Accepts one 3-Series™ Control Card
- > Provides control port expansion for any 3-Series Control System®
- > Powerable via PoE or external power pack⁽¹⁾
- > Half-width, single-space rack-mountable



The Crestron® CEN-CI3-1 is a compact, rack-mountable enclosure designed to provide a versatile control interface and expansion solution using any single 3-Series™ Control Card. It is used to expand the control ports of a 3-Series Control System®. It can be installed with the control system at the central equipment cabinet, or located remotely near the device(s) under control. It interfaces with the control system via Ethernet and can be powered via PoE or a dedicated 24V power pack⁽¹⁾.

The CEN-CI3-1 accepts one 3-Series control card (sold separately). Control cards are available to support bidirectional RS-232, 422, or 485; IR or 1-way serial; 0-10V analog inputs; digital logic inputs or outputs; and low-voltage relay outputs. The CEN-CI3-1 is designed to be placed on a shelf or rack-mounted using the optional [ST-RMK](#) rack mount kit.

SPECIFICATIONS

Communications

Ethernet: 10/100/1000 Mbps, auto-switching, auto-negotiating, auto-discovery, full/half duplex, DHCP, IEEE 802.3af compliant

USB: For computer console

Connectors & Card Slots

Card Slot: (1) 3-Series™ control card expansion slot

LAN PoE: (1) 8-wire RJ45 jack;
10/100/1000Base-T Ethernet port;
802.3af Power over Ethernet compliant

24VDC 2A MAX: (1) 2.1mm barrel DC power jack;
24 Volt DC power input⁽¹⁾

G: (1) 6-32 screw, chassis ground lug

COMPUTER (front): (1) USB Type B female;
USB 2.0 computer console port (6 ft cable included);
For setup only

Controls & Indicators

PWR: (1) Green LED, indicates operating power supplied from power pack or PoE

SLOT: (1) Green LED, indicates a control card is inserted

RESET: (1) Recessed pushbutton for hardware reset

SETUP: (1) Recessed pushbutton with red LED for Ethernet auto-discovery

LAN (rear): (2) Bi-color LEDs, left LED indicates Ethernet connection speed, right LED indicates Ethernet activity

Power Requirements

Power Pack: 2 Amps @ 24 Volts DC⁽¹⁾

Power over Ethernet: IEEE 802.3af Class 0 PoE Powered Device

Note: May be powered by power pack or PoE, not both

Environmental

Temperature: 41° to 113°F (5° to 45°C)

Humidity: 10% to 90% RH (non-condensing)

Heat Dissipation: <1 BTU/Hr without cards using 24V power pack,
5 BTU/Hr without cards using PoE⁽²⁾

Enclosure

Chassis: Metal, black finish, vented sides

Faceplate: Metal, black finish, polycarbonate label overlay

Mounting: Freestanding or half-width 1U 19-inch rack-mountable
(adhesive feet included, ST-RMK rack mount kit sold separately)

Dimensions

Height: 1.70 in (44 mm) without feet

Width: 7.07 in (180 mm)

Depth: 10.06 in (256 mm)

Weight

2.0 lb (0.91 kg) without card

CEN-CI3-1 3-Series™ Card Interface - 1 Slot



CEN-CI3-1 – Rear View with No Card Installed

MODELS & ACCESSORIES

Available Models

CEN-CI3-1: 3-Series™ Card Interface - 1 Slot

CEN-CI3-1-POE: 3-Series™ Card Interface - 1 Slot, w/PoE Injector

Included Accessories

PWE-4803RU: PoE Injector (Qty. 1 included with CEN-CI3-1-POE)

Available Accessories

C3COM-3: 3-Series™ Control Card - 3 COM Ports

C3IO-16: 3-Series™ Control Card - 16 Versiport I/O Ports

C3IR-8: 3-Series™ Control Card - 8 IR Ports Available

C3RY-8: 3-Series™ Control Card - 8 Relay Ports

C3RY-16: 3-Series™ Control Card - 16 Relay Ports

ST-RMK: Rack Mount Kit

PWE-4803RU: PoE Injector

CEN-SW-POE-5: 5-Port PoE Switch

CEN-SWPOE-16: 16-Port Managed PoE Switch

CEN-SWPOE-24: 24-Port Managed PoE Switch

PW-2420RU: Power Pack, Desktop, 24VDC, 2A (50 Watts), Regulated, US/
International

Notes:

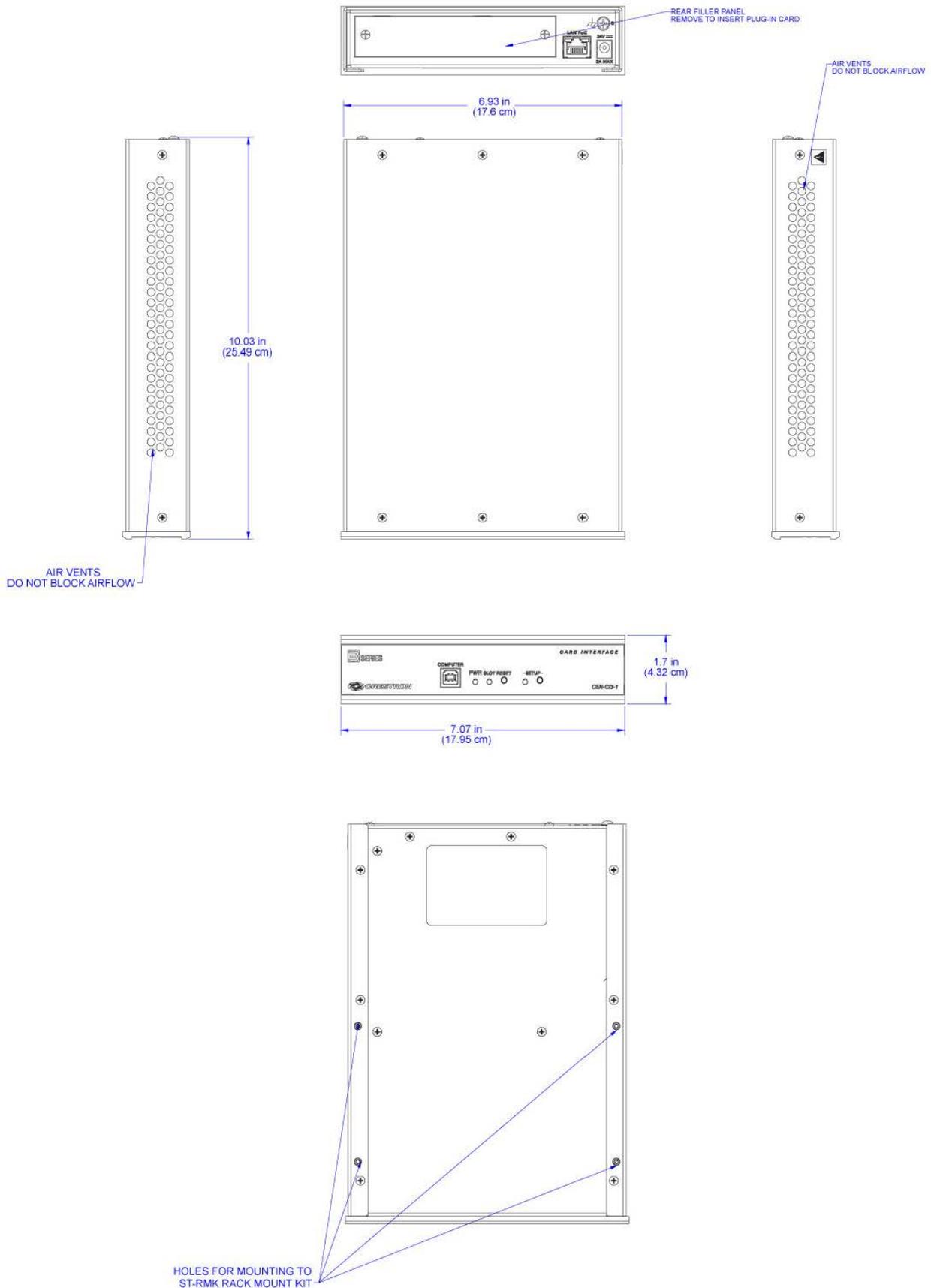
1. PWE-4803RU PoE Injector sold separately or included with 3-Series Card Interface model CEN-CI3-1-POE. PW-2420RU 24V power pack sold separately.
2. See individual control card spec sheets for additional specifications.

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CEN-CI3-1 3-Series™ Card Interface - 1 Slot



3-Series™ Control Card - 3 COM Ports

The C3COM-3 is a 3-Series™ control card that provides three COM ports. Each COM port supports bidirectional RS-232, RS-422, or RS-485. The card is designed to install in a control card expansion slot of a 3-Series Control System® model PR03 or AV3¹, or 3-Series Card Interface model CEN-CI3-1 or CEN-CI3-3.

SPECIFICATIONS

Communications

RS-232/422/485: For 2-way device control and monitoring

Connectors

COM 1 – 3: (3) 5-pin 3.5mm detachable terminal blocks;
Bidirectional RS-232/422/485 ports²;
Up to 115.2k baud; hardware and software handshaking support

Environmental

Temperature: 41° to 113°F (5° to 45°C)
Humidity: 10% to 90% RH (non-condensing)
Heat Dissipation: 4 BTU/Hr

Construction

Occupies one control card expansion slot of a 3-Series Control System® or 3-Series™ Card Interface

Weight

4.0 oz (114 g)

MODELS & ACCESSORIES

Available Models

C3COM-3: 3-Series™ Control Card - 3 COM Ports

Available Accessories

CNSP-XX: Custom Serial Interface Cable



Notes:

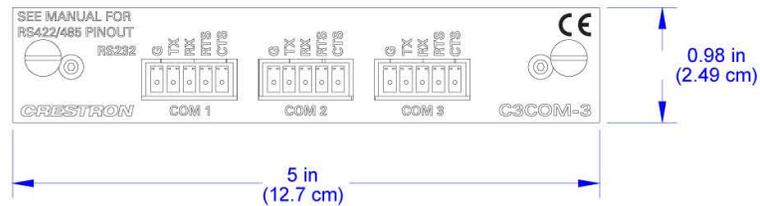
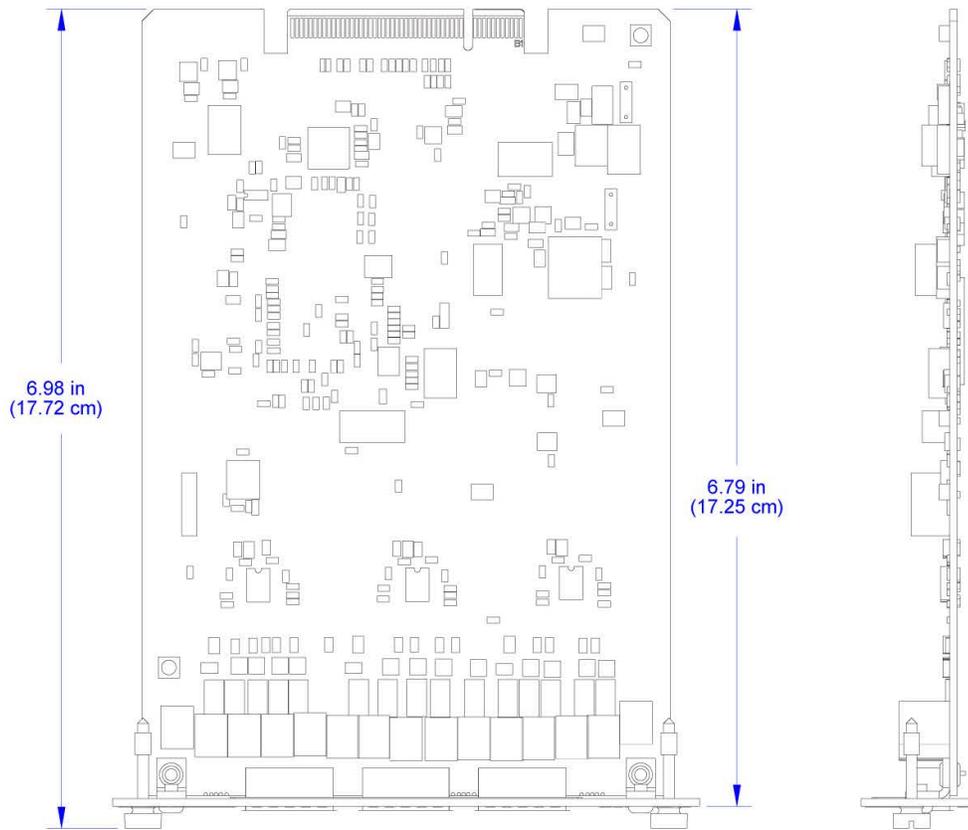
1. AV3 requires [CAGE3](#) Control Card Expansion Cage accessory to enable use of 3-Series control cards.
2. Complies with IEC 61000-4-5 Installation Class 4 surge immunity levels.

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C3COM-3 3-Series™ Control Card - 3 COM Ports





PRODUCTS

APPLICATIONS

SUPPORT

COMPANY

STORE

LaunchPort BaseStation

Magnetic table mount and inductive charger. Works with LaunchPort Sleeves.

Note: Additional shipping, handling, and duty costs will apply if purchasing outside of the United States.



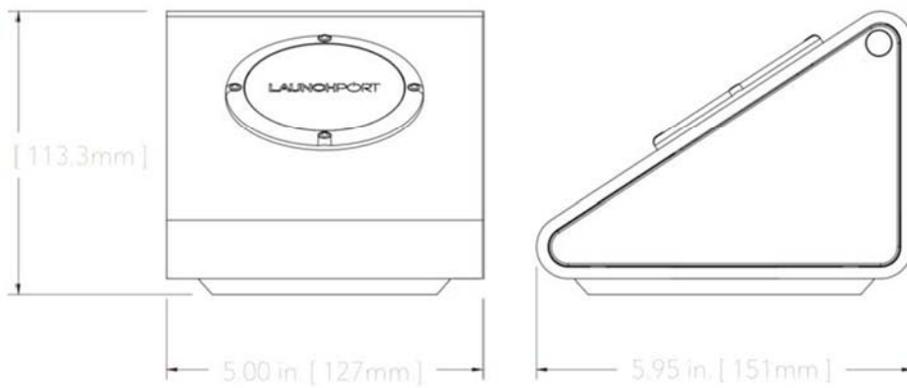
Description

The LaunchPort BaseStation is a table-top mount and inductive charger, capable of receiving any LaunchPort Sleeve. Choose between black or silver anodized aluminum finishes.

Compatibility

Works with any LaunchPort Sleeve.

Dimensions



L 5.95" (151mm) W 5.0" (127mm) D 4.46" (113.3mm), Weight 4.1 lbs.

CAD

[PDF](#) | [DWG](#) | [DXF](#)

Power

Station: 15V 2A DC Input

Power Supply: 110-240V AC Input, 15V 2A DC Output

What's In the Box

BaseStation

iPort 15V 2A Power Supply

QuickStart Guide



LaunchPort

Charging Wireless Inductive Charging

Mount Type Magnetic, Temporary On-Wall and Tabletop

Mount Portrait or Landscape? Yes

Protection Up to 6 ft drop

Color Options Soft Touch Black, High Gloss White

Security Solution? Yes. Optional Security Pack locks 2 halves of iPad Sleeve together and tethers Sleeve to a fixture.

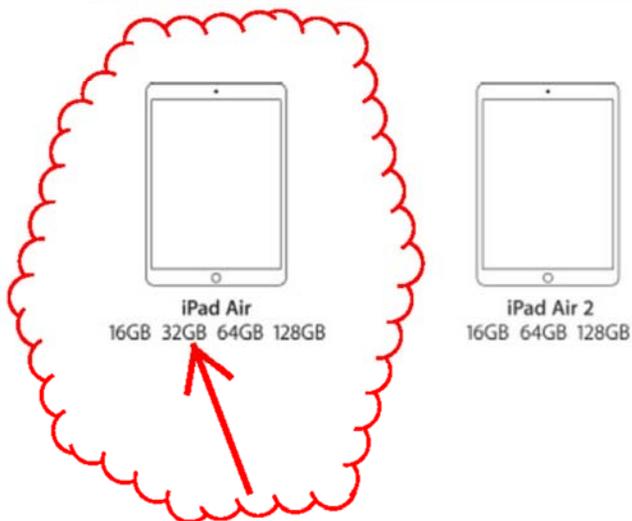
Optional, Programmable Hard Buttons? Yes: LaunchPort Sleeve Buttons

Key Applications Temporary Wall Mount, Table-top mount

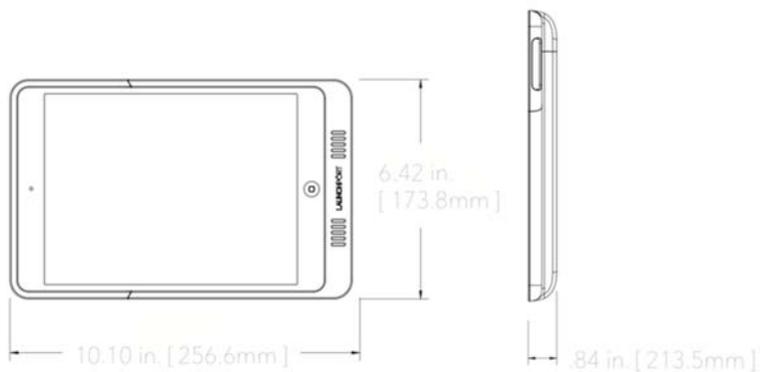
Description

The LaunchPort AP.5 Sleeve is the latest Sleeve design, sporting the thinnest enclosure yet for an iPad Sleeve, and the lightest in weight. Use AP.5 Sleeve to easily mount/dis-mount to any BaseStation or WallStation.

Compatibility



Dimensions



L 10.10" (256.6mm) W 6.42" (173.8mm) D 0.84" (21.36mm), Weight 0.73 lbs.

CAD

[PDF](#) | [DWG](#) | [DXF](#)

Power

15v DC input, 5v 2.4A DC output, Apple Lightning Connector

What's In the Box

Sleeve

QuickStart Guide

Found in LaunchPort *and*
tagged with iPad Air, iPad Air 2

[Back to All](#) / [Previous](#) / [Next](#)

[All](#) / [Charge Case & Stand](#) / [Control Mount](#) / [FS Series](#) / [IW Series](#) /

APPENDIX E

PIEZOELECTRIC

SENSOR

CONNECTOR

AND

DETECTOR

ISOLATION

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ADR 3000 Plus

Traffic Counter/Classifier



The Peek ADR-3000 Plus is a high performance traffic counter and classifier designed for permanent installation. With the various options, the ADR-3000 Plus can count up to 64, or classify up to 32 lanes of traffic, including up to 24 WIM sensor inputs.

Several exclusive features have been incorporated into the ADR-3000 Plus. The CPU electronics are fitted with a replaceable socket mounted fuse. Front panel mounted LED's indicate a successful start up of the microprocessor. LEDs also warn of system fault conditions and indicate the communications port activity and status. Additionally, a reset switch mounted on the front panel of the ADR-3000 Plus providing an easy method of restarting a unit during diagnostics, similar to cycling power.

Each unit can perform up to eight studies, plus generate per-vehicle records, with up to 4096 bins of data. This could include, for example, classification by speed, by lane, and volume. The type, configuration, and format of data to be collected can be custom programmed or selected from menu-driven choices. Available data types include per-vehicle records, per-lane data, binned vehicle classification by axle, speed, length, gap, or headway, or almost any combination of these classifications. Vehicles can also be classified according to either a Scheme "F" or a user-defined classification scheme.

Quality Assurance Testing

Each unit is individually tested for correct operation during a computer controlled environmental chamber test cycle, based on the NEMA TS/2 standards. All input circuits have been designed and tested to the NEMA TS/2 standards for surge (lightning) protection.

Features

- Simple to set up and operate
- 2 MB onboard memory (1 MB accessible)
- Multilane operation
- SD memory option for additional storage
- Up to 64 inputs with a variety of sensor options
- Scheme "F" or user-defined classification scheme
- High-speed communications and telemetry
- U.S. standard or metric units
- Optional integrated control panel with LCD readout
- Solar power options
- Battery "sentinel"
- Auto daylight savings timer

Optional Features

The Peek ADR-3000 Plus is an instrument rack-based unit, expandable by function with individual plug-in modules. Available to fit standard EIA 19" or Type 170 enclosures, the Peek ADR-3000 Plus may also be shelf or panel mounted. Electrical connections (external) are via rear mounted terminal strips for sensor inputs. Communications are supported via an RS232-C connector. Plug-in modules can consist of power supply, central processing unit, communications, control panel, memory, loop sensors, piezo sensors, weigh-in-motion sensors, contact closure inputs, analog to digital inputs or a combination of these for a particular application. Individual plug-in modules are Eurocard in size with DIN standard connectors. Typical module width is 1 inch.

Power options include 115 VAC, 6 or 12 VDC, solar power and operational battery-backup as necessary. An internally supported hardware real time clock maintains time and date, regardless of unit power, for up to ten years.

Two Year Limited Warranty

Peek Traffic warrants this product against manufacturing defects in materials and workmanship for two years from date of shipment from Peek Traffic. Specific contracts and regional laws may vary or alter these terms.

Specifications

| | |
|-----------------------|--|
| Dimensions | 5.25"H x (10" or 19") W x 9.35"D (135mm x (255-480)mm x 240mm) |
| Weight | Less than 15 pounds (6.8 kg) |
| Temperature | -40°F to +165°F (-40°C to +74°C) |
| Display | 20 digits x 4 line liquid crystal display |
| Inputs | 24 sensor inputs of various types allowed, optionally up to 64 |
| Counter rate | Handles 200 counts, per second, per input |
| Interval | 1, 2, 5, 6, 10, 15, 30 and 60 minutes 2, 3, 6, 12 and 24 hours, real time events Four daily peak periods available |
| Microprocessor | Intel 80C186 |
| Capacity | Approximately 3,280 days of volume data |

Communications Selectable RS-232 serial baud rates between 300 and 19,200 baud (115,200 baud-optional), via a UL and CSA approved female socket, with up to three ports available

Options Up to 8 sensor input modules or 64 individual inputs, depending on actual configuration, that can be a combination of loop, piezo, WIM or contact closure inputs

Front panel keypad and display

SD memory card socket

Solar power option

Compatible with the AxleLight® laser sensor

Support Software

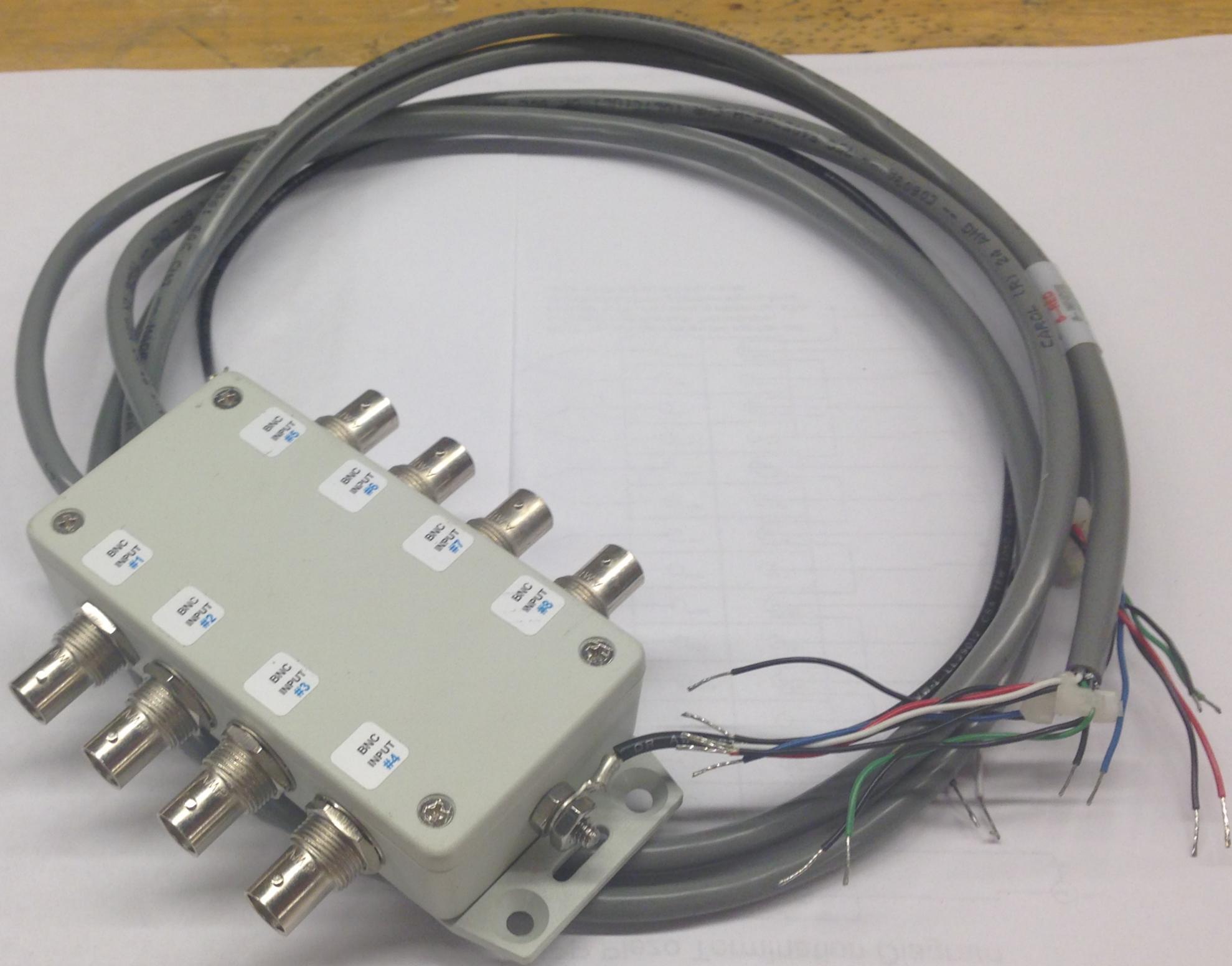
A user-friendly Windows™ software package is available to complement the Peek ADR-3000 Plus. This software is the Traffic Operations Processing Software (TOPS) program from Peek Traffic.

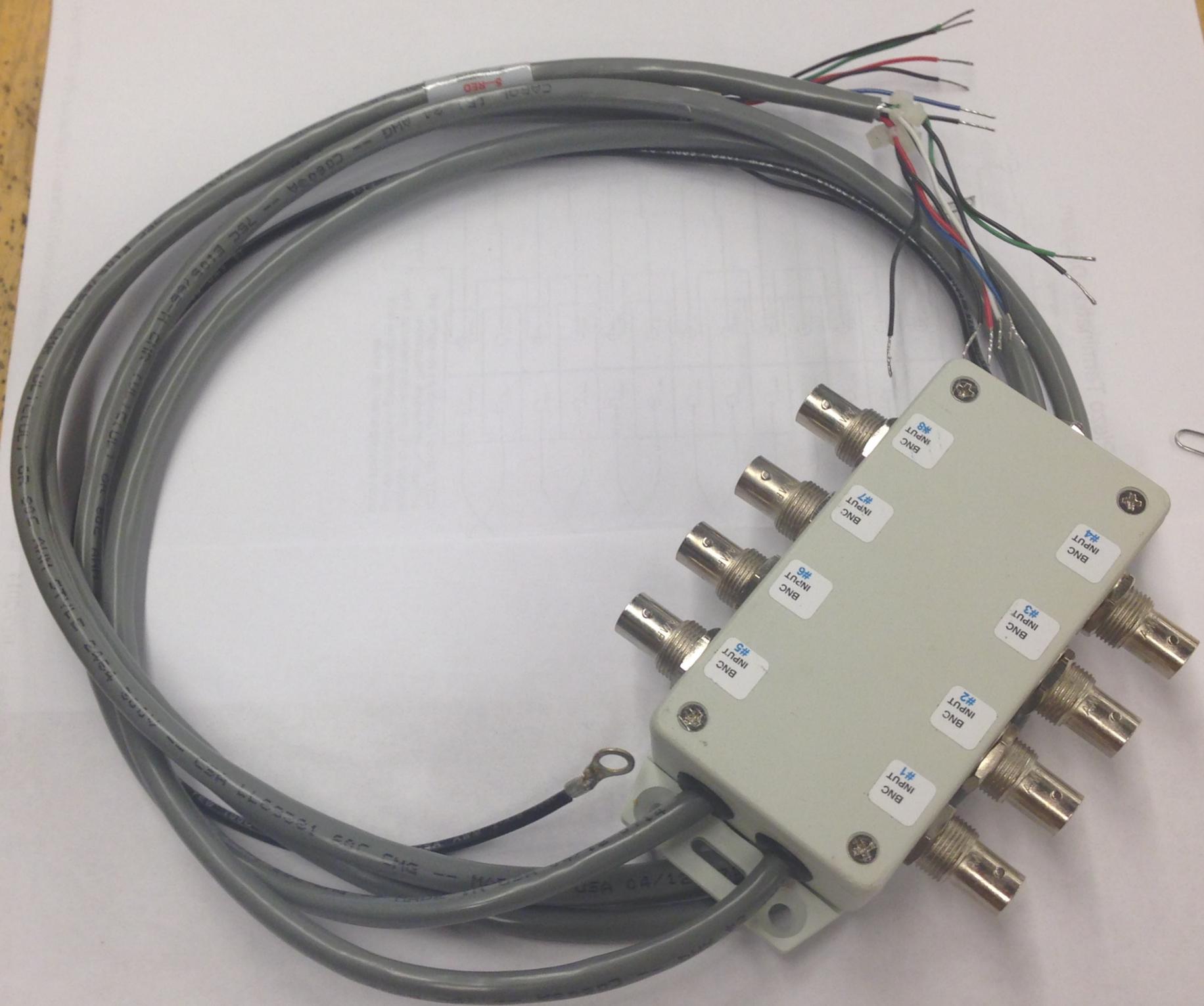
The TOPS program provides multi-file processing, stores data files into a single database for easy file sharing among TOPS users, allows for edit and preview of reports before printing, provides for ADR data processing protocols, enables remote or local setup of Peek ADR units and collection of data by direct manual connection or by the added functionality of automatic polling of field sites via modem connection (auto polling and weigh-in-motion support are add-in options). The TOPS program reads all files and generates a suite of daily, weekly and monthly reports. A user definable classification function, within the program, provides the ability to customize classification and to transfer the new scheme to the Peek ADR-3000 Plus. Processed data may be exported to various other software packages.



Peek Traffic Corporation
A Signal Group Company
2906 Corporate Way
Palmetto, FL 34221
(941) 845-1200 | (800) 245-7660
www.peaktraffic.com

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BNC INPUT #1

BNC INPUT #2

BNC INPUT #3

BNC INPUT #4

BNC INPUT #5

BNC INPUT #6

BNC INPUT #7

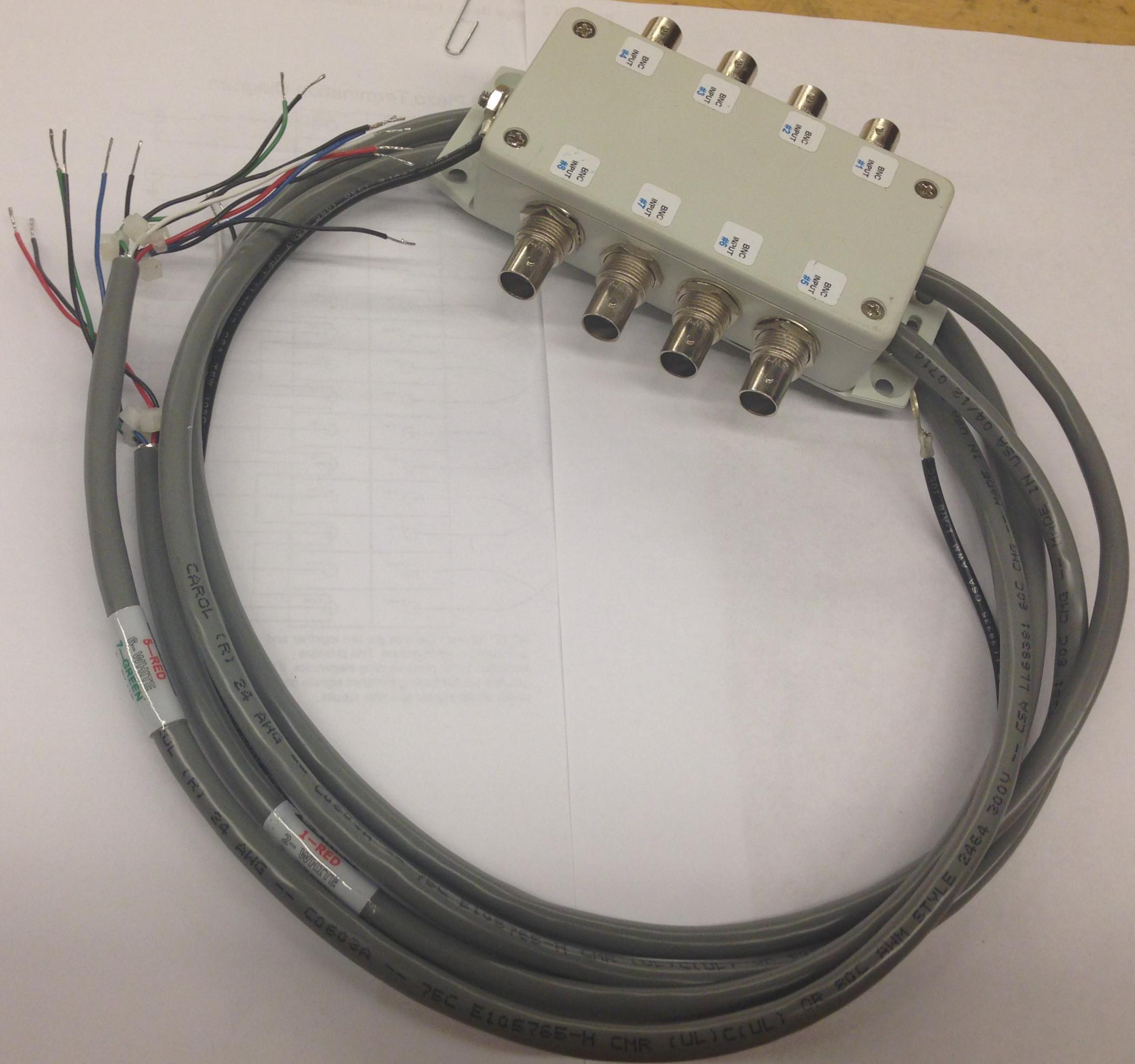
BNC INPUT #8

BNC INPUT #9

5-RED

Clear

5-RED



BNC INPUT #4

BNC INPUT #3

BNC INPUT #2

BNC INPUT #1

BNC INPUT #8

BNC INPUT #7

BNC INPUT #6

BNC INPUT #5

6-WHITE
1-RED
7-GREEN

1-RED
2-WHITE

CAROL (R) 24 AWG

CAROL (R) 24 AWG

C0503A

75C E105785-H

CMP (UL)(UL)

MP 201

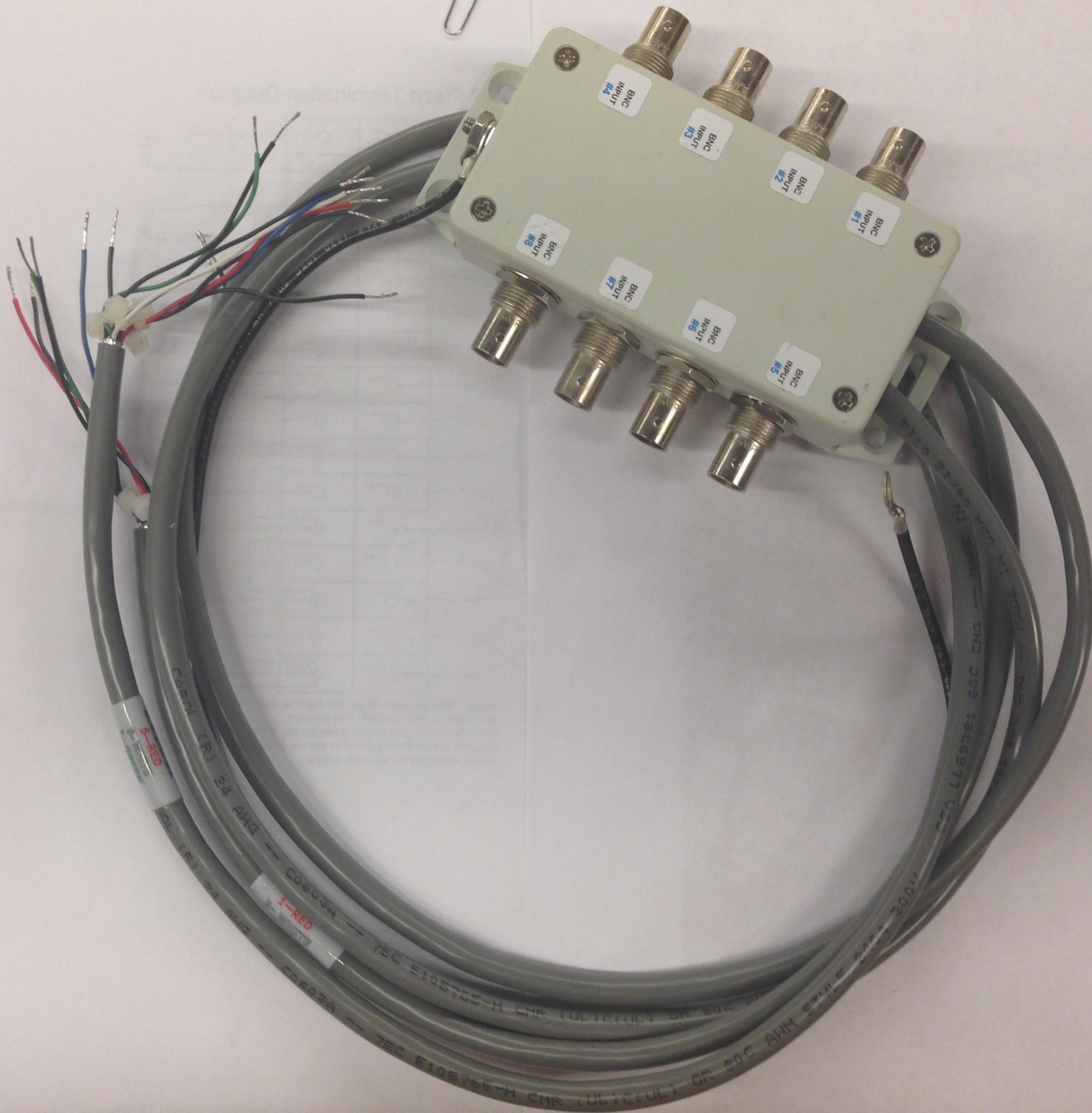
MMW STYLE 2454 200V

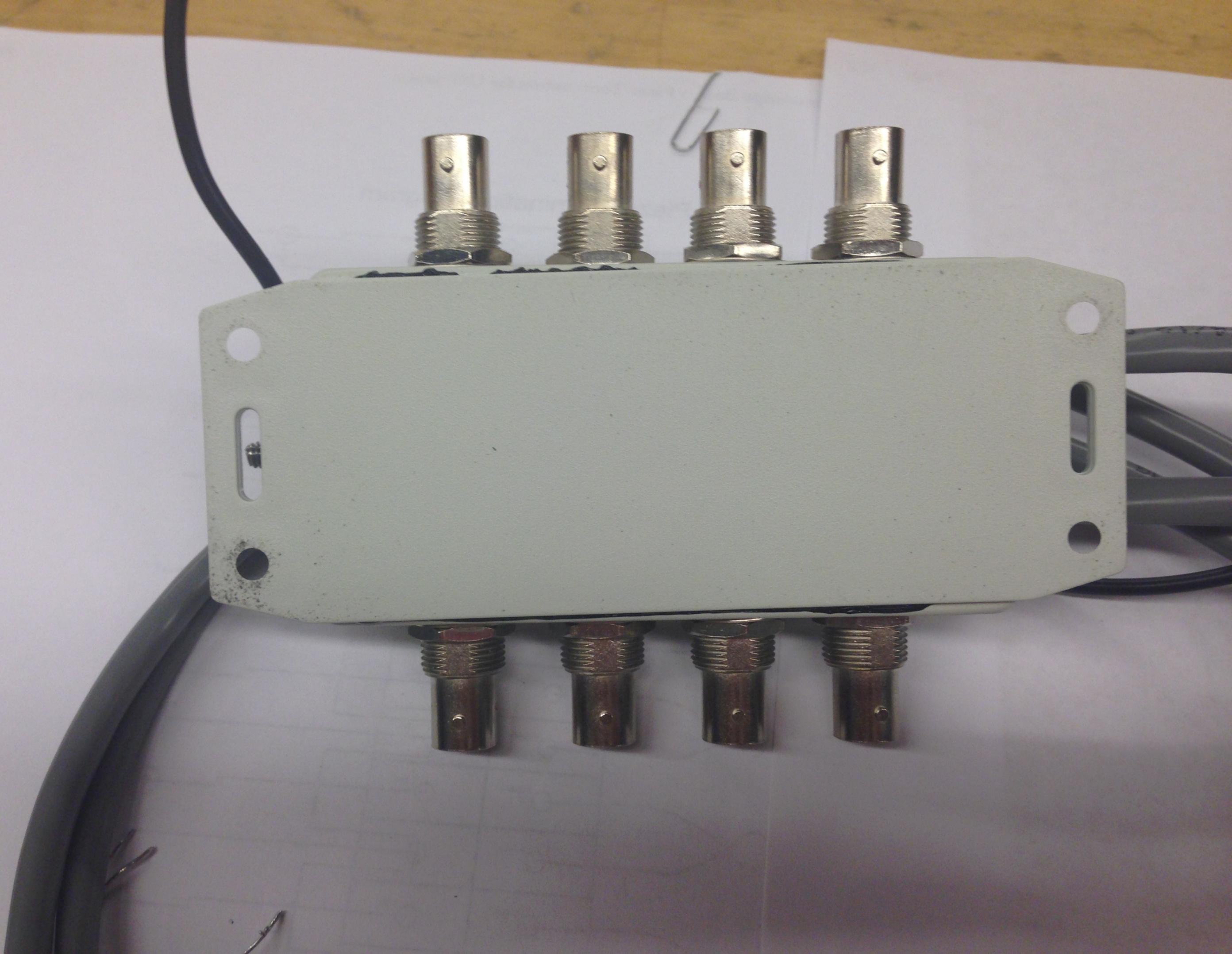
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1868977 ASD

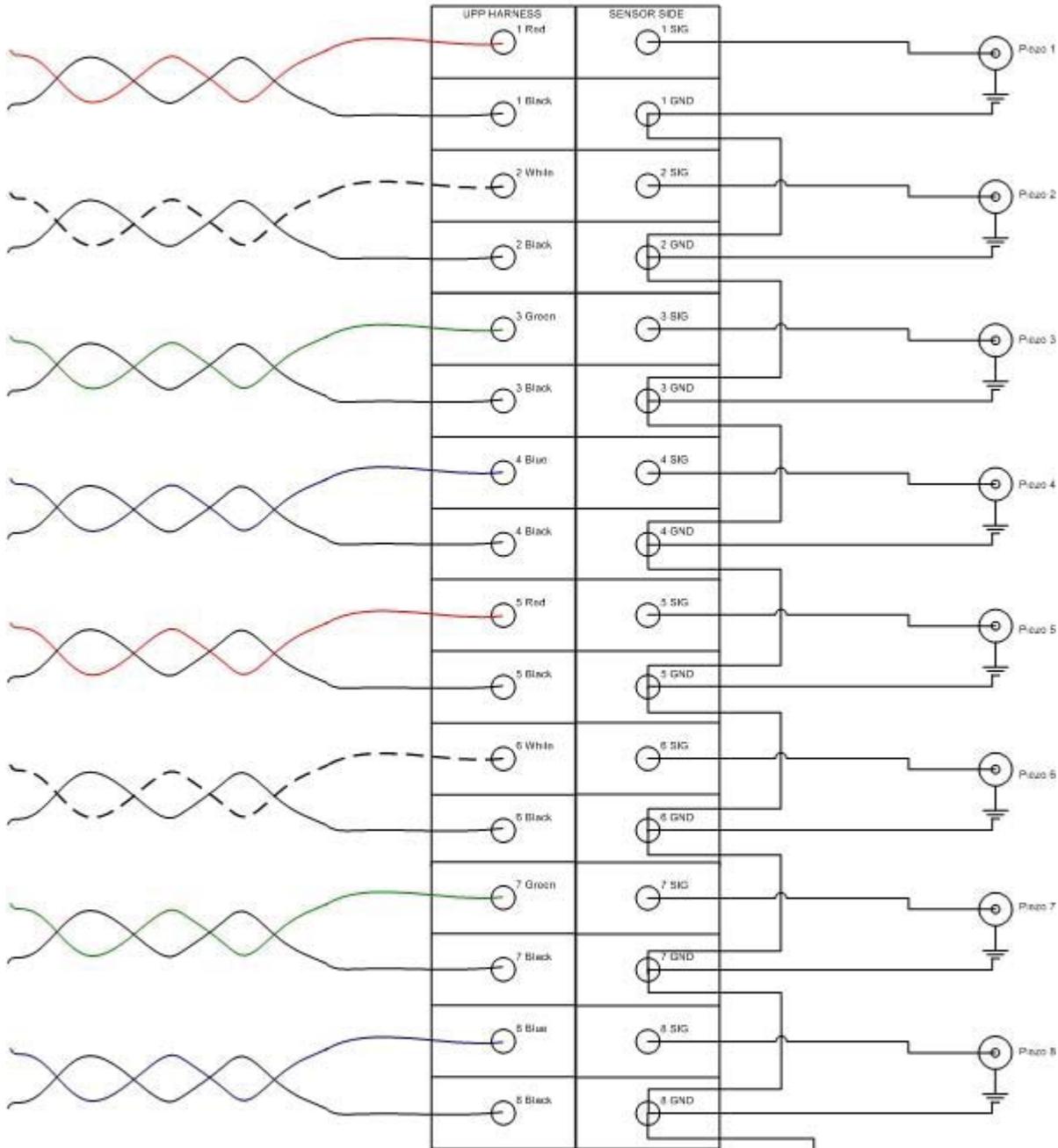
MADE IN USA 04/12 0712

MADE IN USA



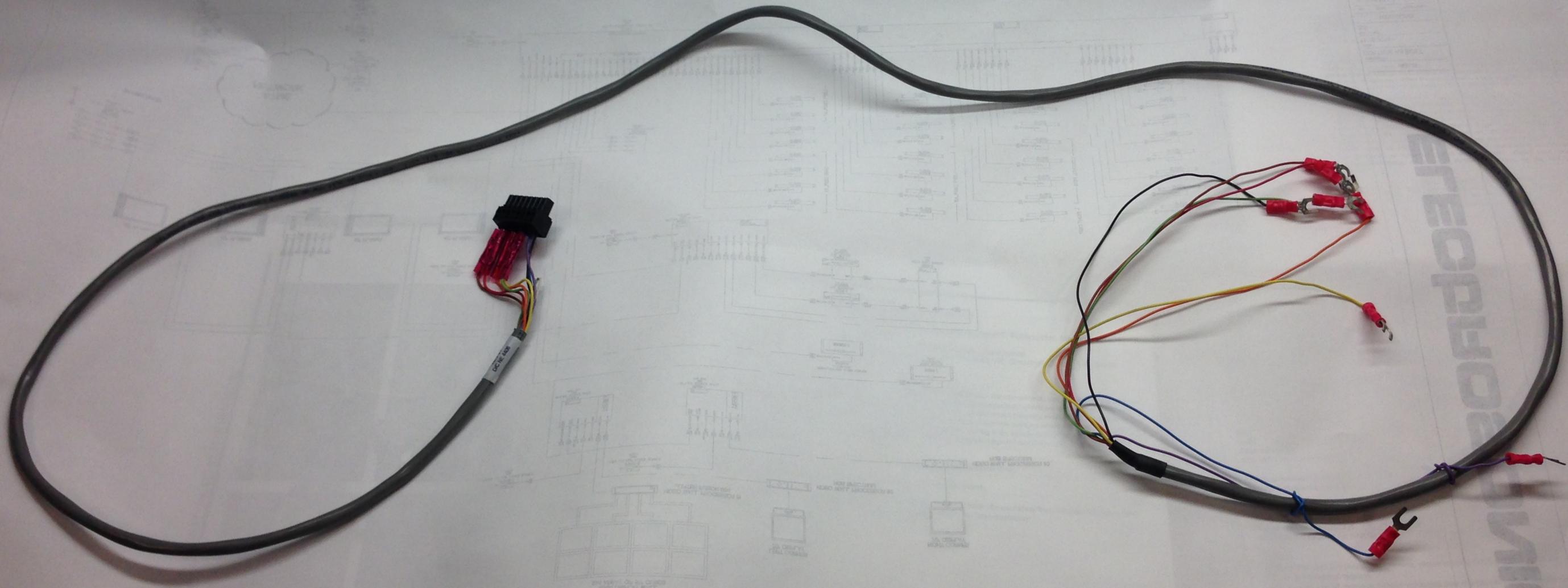


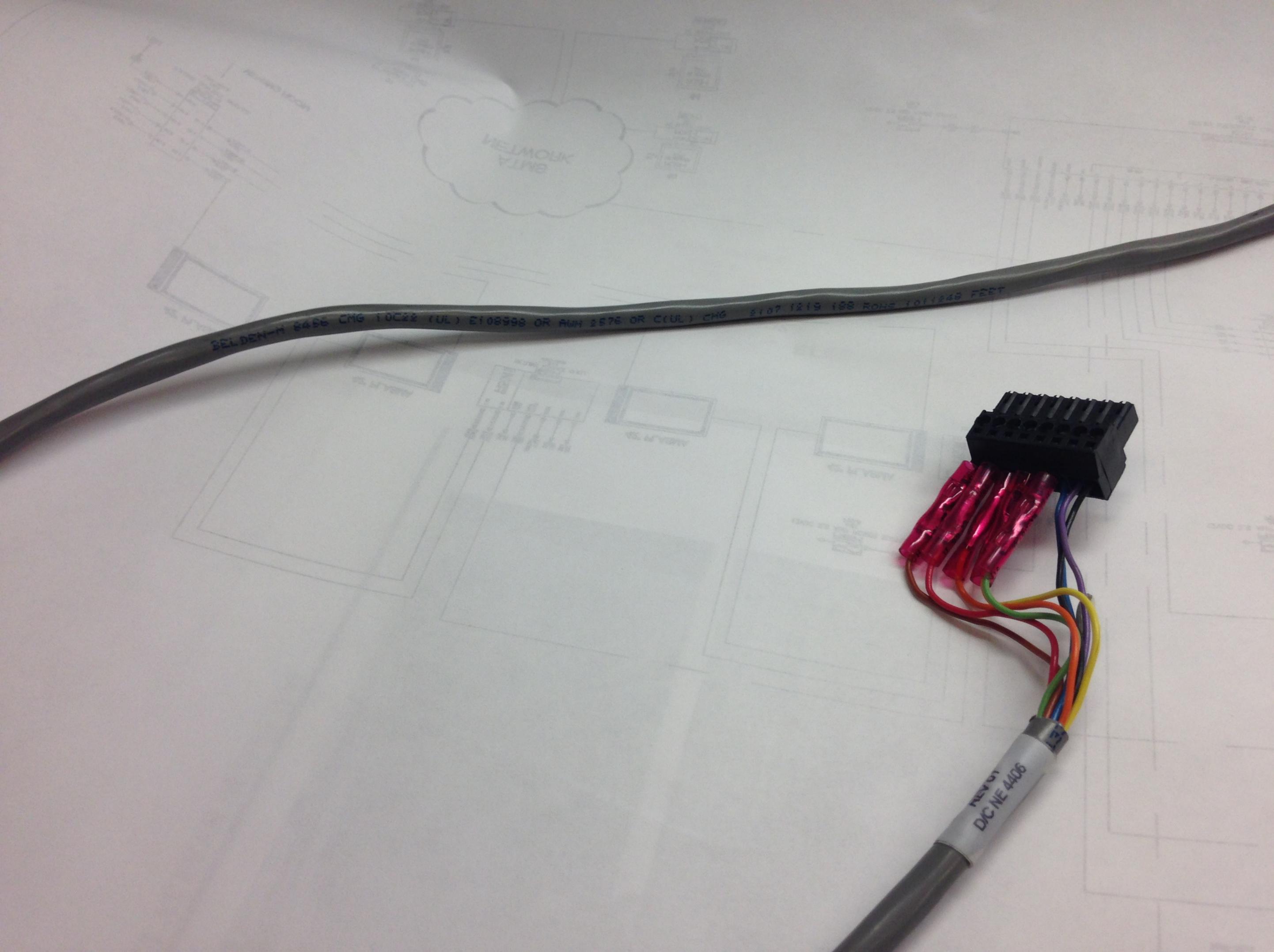
UPP Piezo Termination Diagram



NOTE: All piezo Grounds are tied together and terminated to earth ground. This provides protection to the piezo sensing electronics. If the grounds are left floating transient signals could cause erratic signals and data results.

Earth Ground



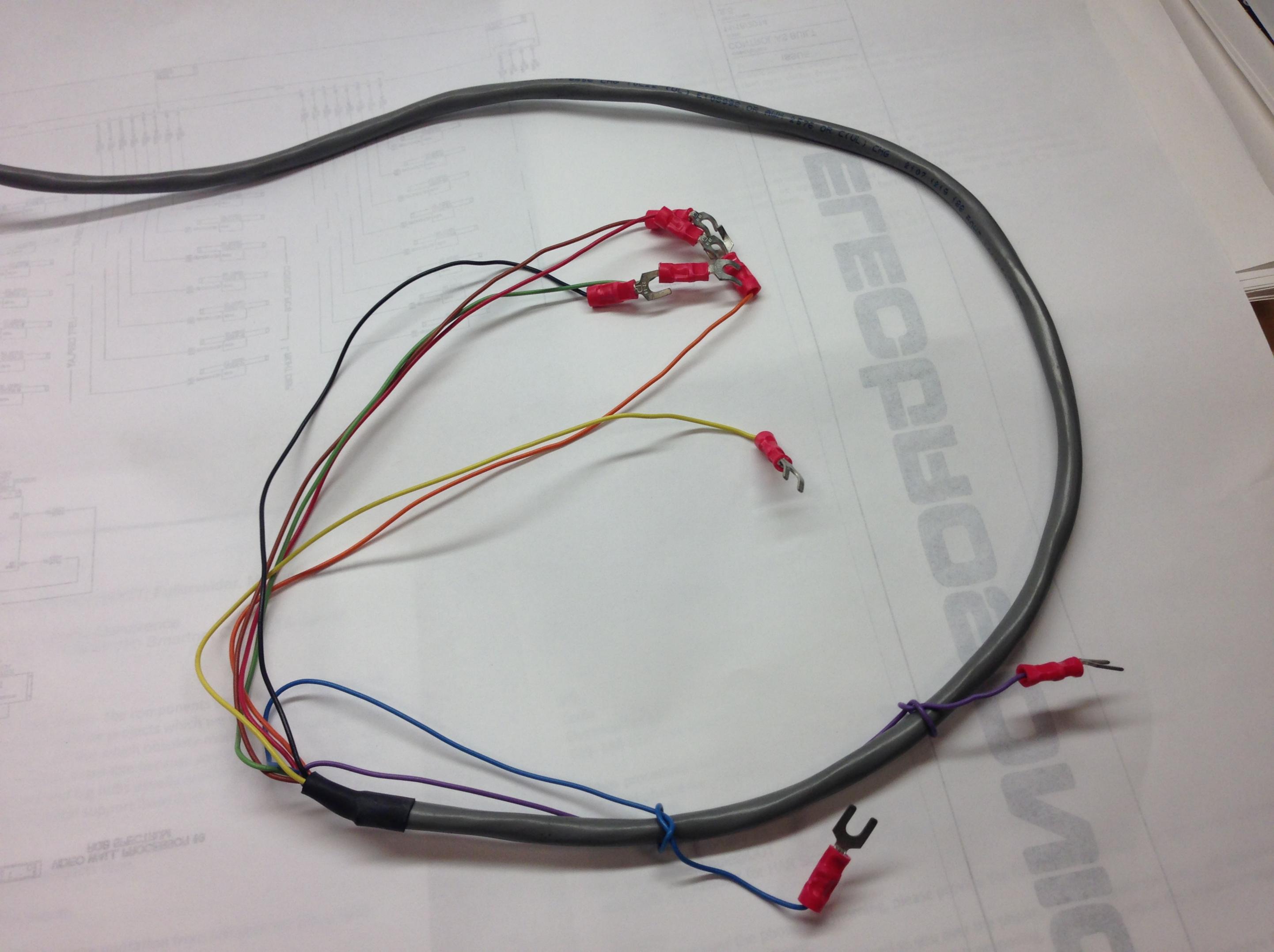


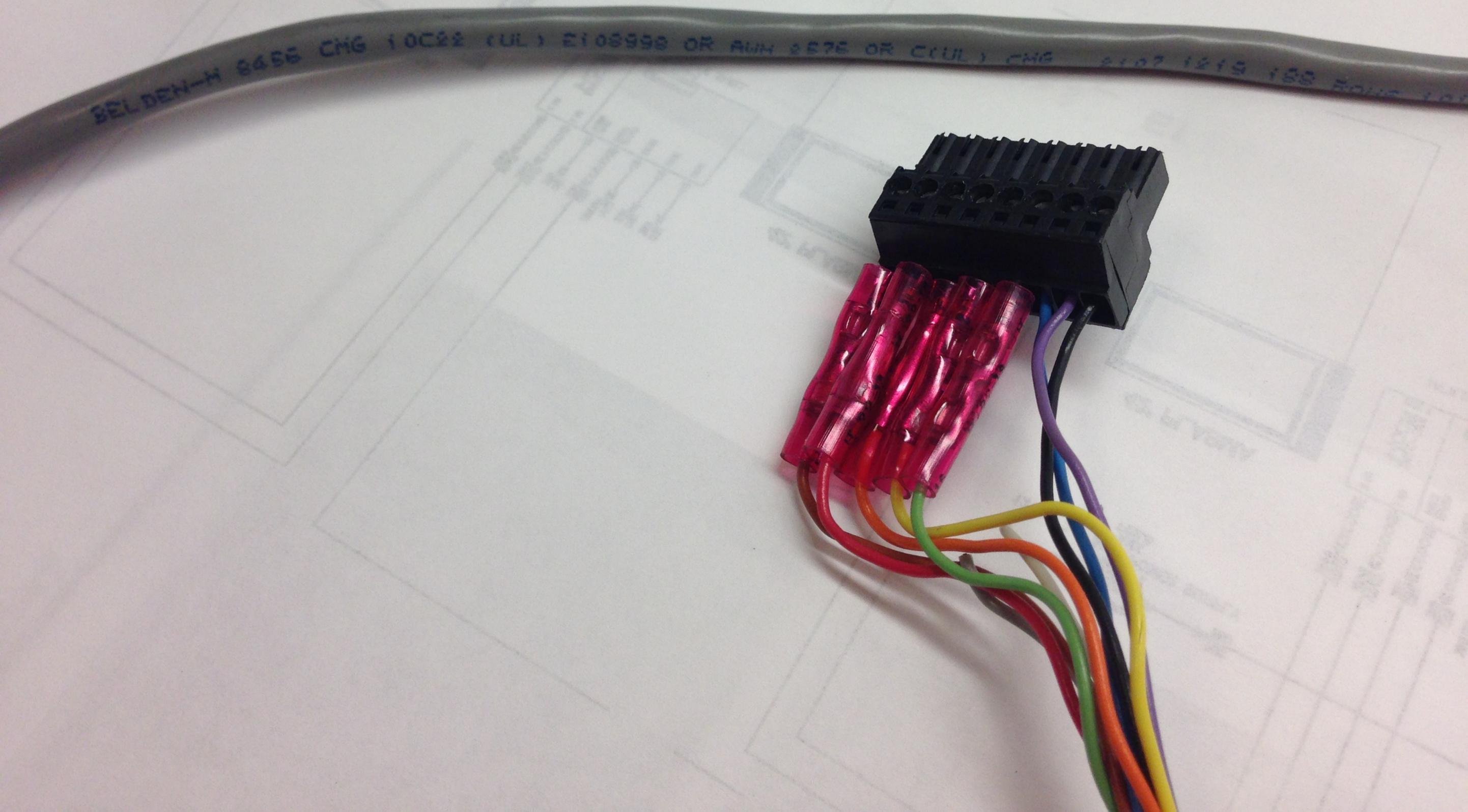
SELDEN-H 6456 CMG 10C22 (UL) E108998 OR RW 2576 OR C(UL) CMG 6107 1219 158 R015 1011245 FEET

DATA
KROMEN



REV 01
D/C NE 4406





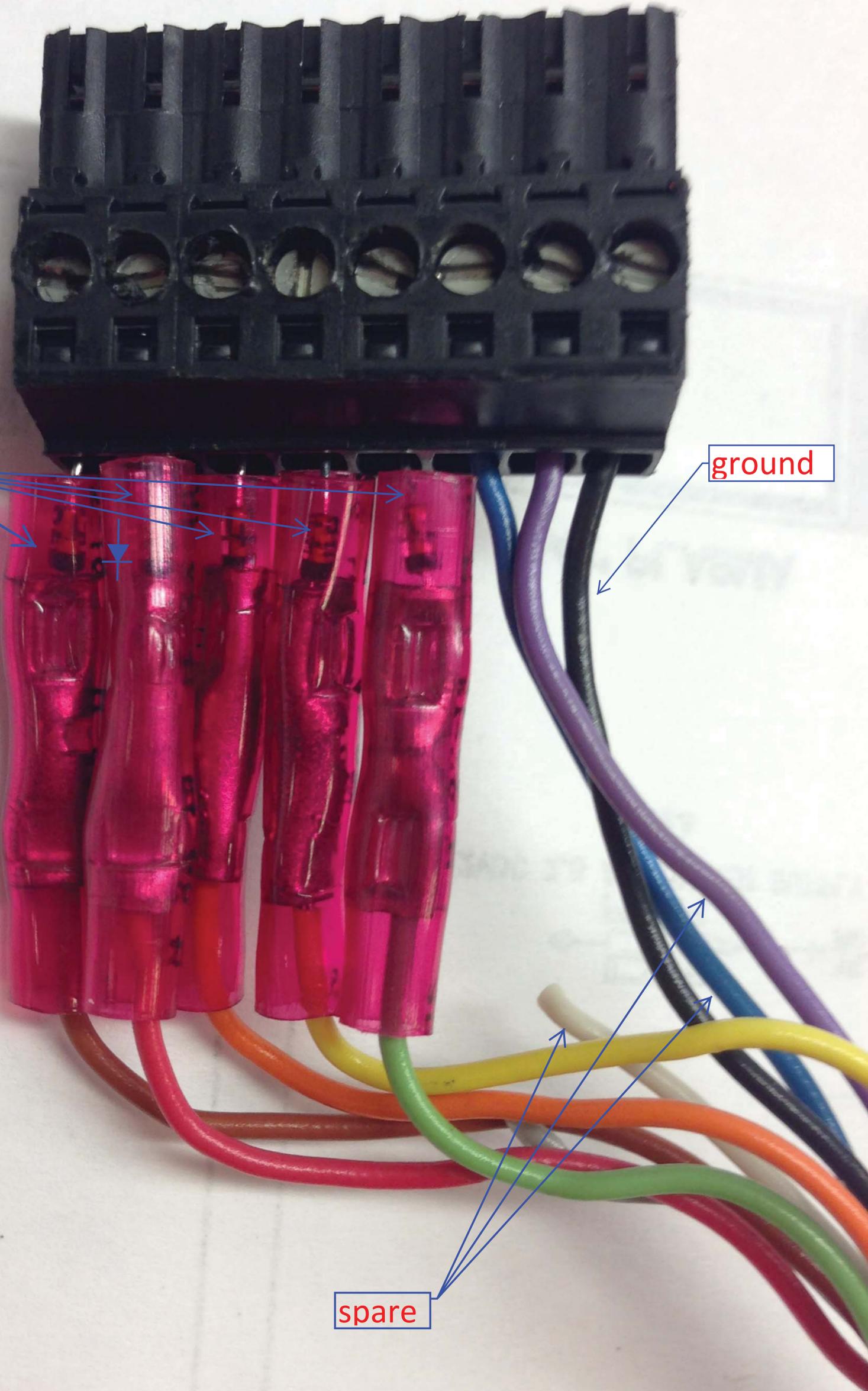
BELDEN-H 9456 CMG 10C22 (UL) E103998 OR AWG 2676 OR CCUL) CMG 2107 1219 182



diode

ground

spare



Small Signal Fast Switching Diodes



FEATURES

- Silicon epitaxial planar diode
- Electrically equivalent diodes:
1N4148 - 1N914



RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Extreme fast switches

MECHANICAL DATA

Case: DO-35

Weight: approx. 105 mg

Cathode band color: black

Packaging codes/options:

TR/10K per 13" reel (52 mm tape), 50K/box

TAP/10K per ammpack (52 mm tape), 50K/box

PARTS TABLE

| PART | ORDERING CODE | TYPE MARKING | INTERNAL CONSTRUCTION | REMARKS |
|--------|------------------------|--------------|-----------------------|-----------------------|
| 1N4148 | 1N4148-TAP or 1N4148TR | V4148 | Single diode | Tape and reel/ammpack |

ABSOLUTE MAXIMUM RATINGS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)

| PARAMETER | TEST CONDITION | SYMBOL | VALUE | UNIT |
|---------------------------------|--|-------------|-------|------|
| Repetitive peak reverse voltage | | V_{RRM} | 100 | V |
| Reverse voltage | | V_R | 75 | V |
| Peak forward surge current | $t_p = 1\text{ }\mu\text{s}$ | I_{FSM} | 2 | A |
| Repetitive peak forward current | | I_{FRM} | 500 | mA |
| Forward continuous current | | I_F | 300 | mA |
| Average forward current | $V_R = 0$ | $I_{F(AV)}$ | 150 | mA |
| Power dissipation | $l = 4\text{ mm}, T_L = 45\text{ }^{\circ}\text{C}$ | P_{tot} | 440 | mW |
| | $l = 4\text{ mm}, T_L \leq 25\text{ }^{\circ}\text{C}$ | P_{tot} | 500 | mW |

THERMAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)

| PARAMETER | TEST CONDITION | SYMBOL | VALUE | UNIT |
|--|--|------------|---------------|--------------------|
| Thermal resistance junction to ambient air | $l = 4\text{ mm}, T_L = \text{constant}$ | R_{thJA} | 350 | K/W |
| Junction temperature | | T_j | 175 | $^{\circ}\text{C}$ |
| Storage temperature range | | T_{stg} | - 65 to + 150 | $^{\circ}\text{C}$ |

| ELECTRICAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified) | | | | | | |
|--|--|------------|------|------|------|---------------|
| PARAMETER | TEST CONDITION | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| Forward voltage | $I_F = 10\text{ mA}$ | V_F | | | 1 | V |
| Reverse current | $V_R = 20\text{ V}$ | I_R | | | 25 | nA |
| | $V_R = 20\text{ V}, T_j = 150\text{ }^{\circ}\text{C}$ | I_R | | | 50 | μA |
| Reverse current | $V_R = 75\text{ V}$ | I_R | | | 5 | μA |
| | $I_R = 100\text{ }\mu\text{A}, t_p/T = 0.01,$ $t_p = 0.3\text{ ms}$ | $V_{(BR)}$ | 100 | | | V |
| Diode capacitance | $V_R = 0\text{ V}, f = 1\text{ MHz},$ $V_{HF} = 50\text{ mV}$ | C_D | | | 4 | pF |
| Rectification efficiency | $V_{HF} = 2\text{ V}, f = 100\text{ MHz}$ | η_r | 45 | | | % |
| Reverse recovery time | $I_F = I_R = 10\text{ mA},$ $i_R = 1\text{ mA}$ | t_{rr} | | | 8 | ns |
| | $I_F = 10\text{ mA}, V_R = 6\text{ V},$ $i_R = 0.1 \times I_R, R_L = 100\text{ }\Omega$ | t_{rr} | | | 4 | ns |

TYPICAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)

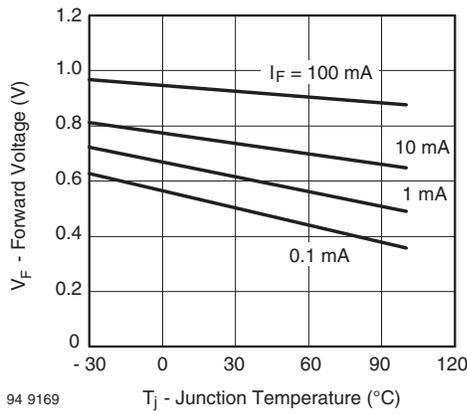


Fig. 1 - Forward Voltage vs. Junction Temperature

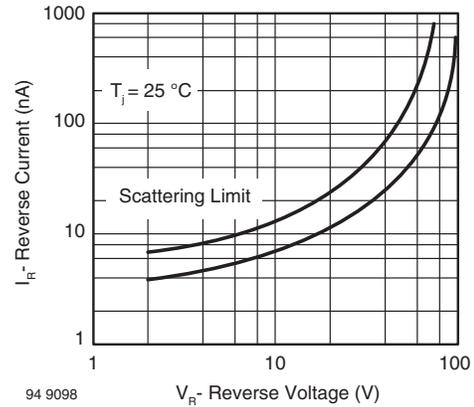


Fig. 3 - Reverse Current vs. Reverse Voltage

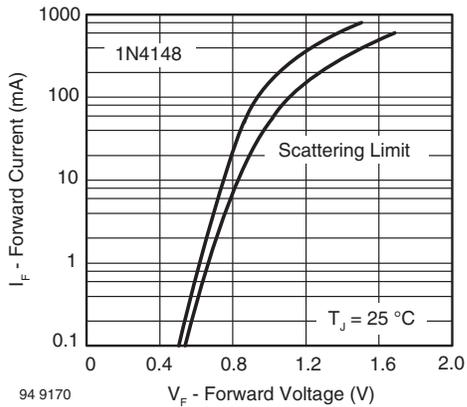
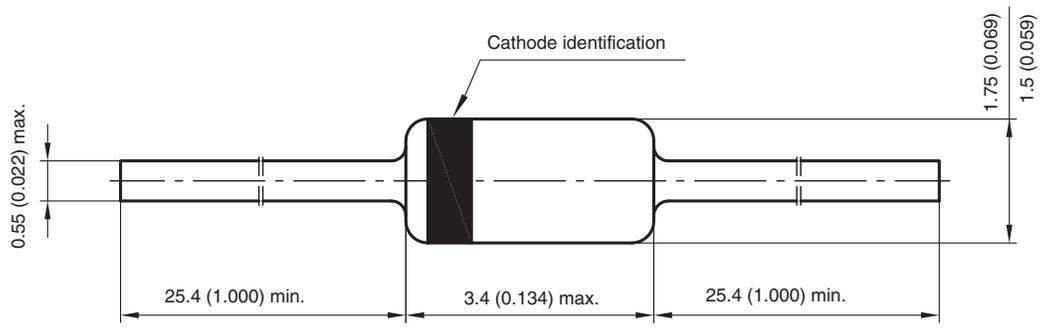


Fig. 2 - Forward Current vs. Forward Voltage



APPENDIX F

CABLE VERIFICATION WORKSHEET

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Cable Verification Worksheet

Contract number: _____

Contractor: _____

Operator: _____

Date: _____

Link number: _____

Fiber number: _____

Expected location of fiber ends (Route / PM): End 1: ____ / ____ End 2: ____ / ____

Attach the following photos with this form:

- a. Reel (minimum of 6 different views include 1 from 20 feet away)
- b. Cable (minimum of 10 different views)
 - b.1 Wrapping and packaging
 - b.2 Cable

Cable length in kilometers: _____

OTDR Test:

a. Continuity: _____ (pass or fail)

b. List any Anomaly: _____

To be completed by the Engineer:

Engineer signature: _____

Date cable accepted: _____

APPENDIX G

LINK LOSS

BUDGET

WORKSHEET

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Link Loss Budget Worksheet

Contract No. _____ Contractor: _____
 Approved by Caltrans: _____
 Date: _____ Operator: _____
 Link Number: _____ Fiber Color: _____
 Buffer Color: _____ Cable No.: _____
 Expected Location of fiber ends (Rte / PM): End 1: ___ / ___ End 2: ___ / ___

| | 1310 nm | 1550 nm | |
|---|-----------|-----------|----------------------------------|
| Measured OTDR Test Results: | | | |
| Forward Loss: | _____ dB | _____ dB | 1A |
| Reverse Loss: | _____ dB | _____ dB | 1B |
| Average Loss [(1A + 1B)/2]: | _____ dB | _____ dB | 1C |
| Measured Power Meter and Light Source Test Results: | | | |
| Forward Loss: | _____ dB | _____ dB | 2A |
| Reverse Loss: | _____ dB | _____ dB | 2B |
| Average Loss [(2A + 2B)/2]: | _____ dB | _____ dB | 2C |
| Calculated Fiber Loss: | | | |
| Length of the link (from OTDR): | _____ km | _____ km | 3A |
| Allowed loss per km of fiber: | 0.4 dB/km | 0.3 dB/km | 3B |
| Total Allowed Loss due to the fiber (3A X 3B): | _____ dB | _____ dB | 3C |
| Calculated Splice Loss: | | | |
| Number of Splices in the Link: | _____ | _____ | 4A |
| Allowed Link Loss per Splice: | 0.3 dB | 0.3 dB | 4B |
| Total Allowed Loss due to Splices (4A X 4B): | _____ dB | _____ dB | 4C |
| Calculated Connector Loss: | | | |
| Number of Connectors: | _____ | _____ | 5A |
| Allowed Connector Loss per connector: | 0.75 dB | 0.75 dB | 5B |
| Total Connector Loss (5A X 5B): | _____ dB | _____ dB | 5C |
| Total Calculated Loss: (3C + 4C + 5C): | _____ dB | _____ dB | 6A |
| Link Verification: | | | |
| Compare 1C and 2C, enter the larger value: | _____ dB | _____ dB | 7A |
| Difference between Measured Loss to Calculated Loss (7A – 7B): | _____ dB | _____ dB | 7B |
| If the value of 7B is greater than zero, the link failed the test. | _____ | _____ | PASS or FAIL |

To be completed by the Engineer:
 Engineer signature: _____
 Date cable link accepted: _____