Honeywell

Universal Control Network Installation

UN20-500

Honeywell

Installation/Universal Control Network

Universal Control Network Installation

UN20-500
R500
CE Compliant
9/95

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Honeywell
Industrial Automation and Control
Automation College
2820 West Kelton Lane
Phoenix, AZ 85023

(602) 313-5669

About This Publication

This publication provides the necessary information required to install and checkout a Universal Control Network (UCN).

This publication supports release 500.

> Any equipment designated as “CE Compliant” complies with the European Union EMC and Health and Safety Directives. All equipment shipping into European Union countries after January 1, 1996 requires this type of compliance—denoted by the “CE Mark.”

Standard Symbols

Scope

The standard symbols used in this publication are defined as follows.

ATTENTION

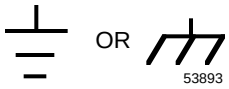
Notes inform the reader about information that is required, but not immediately evident.

CAUTION

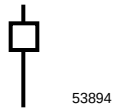
Cautions tell the user that damage may occur to equipment if proper care is not exercised.

WARNING

Warnings tell the reader that potential personal harm or serious economic loss may happen if instructions are not followed.



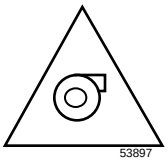
Ground connection to building safety ground.



Ground stake for building safety ground.

Electrical Shock Hazard—can be lethal.

Electrical Shock Hazard—can be lethal.



Rotating Fan—can cause personal injury.

Caution—refer to the appropriate installation document.

Table of Contents

Figures and Tables

Acronyms

APM	Advanced Process Manager
LM	Logic Manager
MRG	Master Reference Ground
NIM	Network Interface Module
PM	Process Manager
UCN	Universal Control Network

References

Publication Title	Publication Number	Binder Title	Binder Number
TDC 3000^X System Site Planning	SW02-550	System Site Planning - 1	TDC 3020-1
Universal Control Network (UCN) Planning	UN02-501	System Site Planning - 1	TDC 3020-1
Universsal Control Network Guidelines	UN12-510	Installation/Universal Control Network	TDC 3041
Process Manager/Advanced Process Manager Planning	PM02-501	System Site Planning - 1	TDC 3020-1
Process Manager/Advanced Process Manager Installation	PM20-501	Implementation/PM/APM	TDC 3043
Process Manager/Advanced Process Manager Service	PM13-501	PM/APM/HPM Service - 1	TDC 3061-1
Logic Manager Planning	LM02-501	System Site Planning - 2	TDC 3020-2
Logic Manager Installation	LM20-500	Implementation/Logic Manager	TDC 3070
Logic Manager Service	LM13-500	LM Service	TDC 3073

Section 1 – Introduction

1.1 Overview

Section contents

The topics covered in this section are:

Introduction

This manual is used in the installation of the Universal Control Network (UCN) at a site. The Universal Control Network provides a coaxial cable system that interconnects the Process Manager (PM), Advanced Process Manager (APM), the Logic Manager (LM), and Network Interface Module (NIM) network devices. The manual is supplemented by information in the *Universal Control Network Site Planning* manual concerning power, grounding, cabling, and the equipment environment.

Purpose of manual

The primary purpose of this manual is guidance in the installation and checkout of the Universal Control Network's coaxial cable system.

Installation and checkout of network devices

The installation and checkout instructions for the Network Interface Module, Process Manager, Advanced Process Manager, or Logic Manager network devices, or the installation of the Local Control Network (LCN) operator consoles are not covered in this manual. See the related documentation sections in the appropriate manuals for information concerning these topics.

ATTENTION

For brevity, this document references only the Process Manager and the Advanced Process Manager in most discussions, but the discussions will generally also apply to the Logic Manager.

1.2 Term Definitions

Introduction	The terms used in this document are defined as follows.
Network Device	Any electronic equipment that can be resident on the Universal Control Network (UCN). The equipment includes the Network Interface Module (NIM), the Process Manager (PM), the Advanced Process Manager (APM), and the Logic Manager (LM). The Network Interface Module is always present because it provides the interface to the Local Control Network (LCN).
UCN Trunk Cable	One of two coaxial cables, designated A or B, that provides the transmission media for the UCN. The trunk cable consists of segments connected together by drop cable taps.
UCN Trunk Segment	The portion of the UCN trunk cable separated by drop cable taps.
UCN Cable A	One of a redundant pair of UCN coaxial trunk cables that are diversely routed to reduce the possibility of simultaneous damage to the cables.
UCN Cable B	One of a redundant pair of UCN coaxial trunk cables that are diversely routed to reduce the possibility of simultaneous damage to the cables.
Drop Cable Tap	The component that adapts the network device to the UCN trunk cable by means of a drop cable while maintaining the impedance of the trunk cable. Three types of drop cable taps provide connections for two, four, or eight drop cables.
Drop Cable Tap Port	An F-type connector on the drop cable tap that provides connection for a trunk cable or a drop cable.
Drop Cable	The coaxial cable that connects the network device to the UCN trunk cable by means of the drop cable tap.

Section 2 – Installing the UCN

2.1 Overview

Section contents

The topics covered in this section are:

Purpose

This section discusses bulk coaxial cable testing, cable assembly, and the installation of the Universal Control Network.

Introduction

Communication between the control room (Network Interface Module) and the Process Manager (PM), the Advanced Process Manager (APM), or the Logic Manager (LM) is accomplished through the Universal Control Network (UCN). See Figure 2-1.

If the trunk or drop cables are to be assembled on site from reels of approved bulk cable and connector kits, complete all the instructions in subsections 2.1 through 2.3. When standard cable assemblies of fixed lengths with connectors already installed and tested are supplied by Honeywell, some portions of subsections 2.1 through 2.3 may not apply in the installation of the Universal Control Network.

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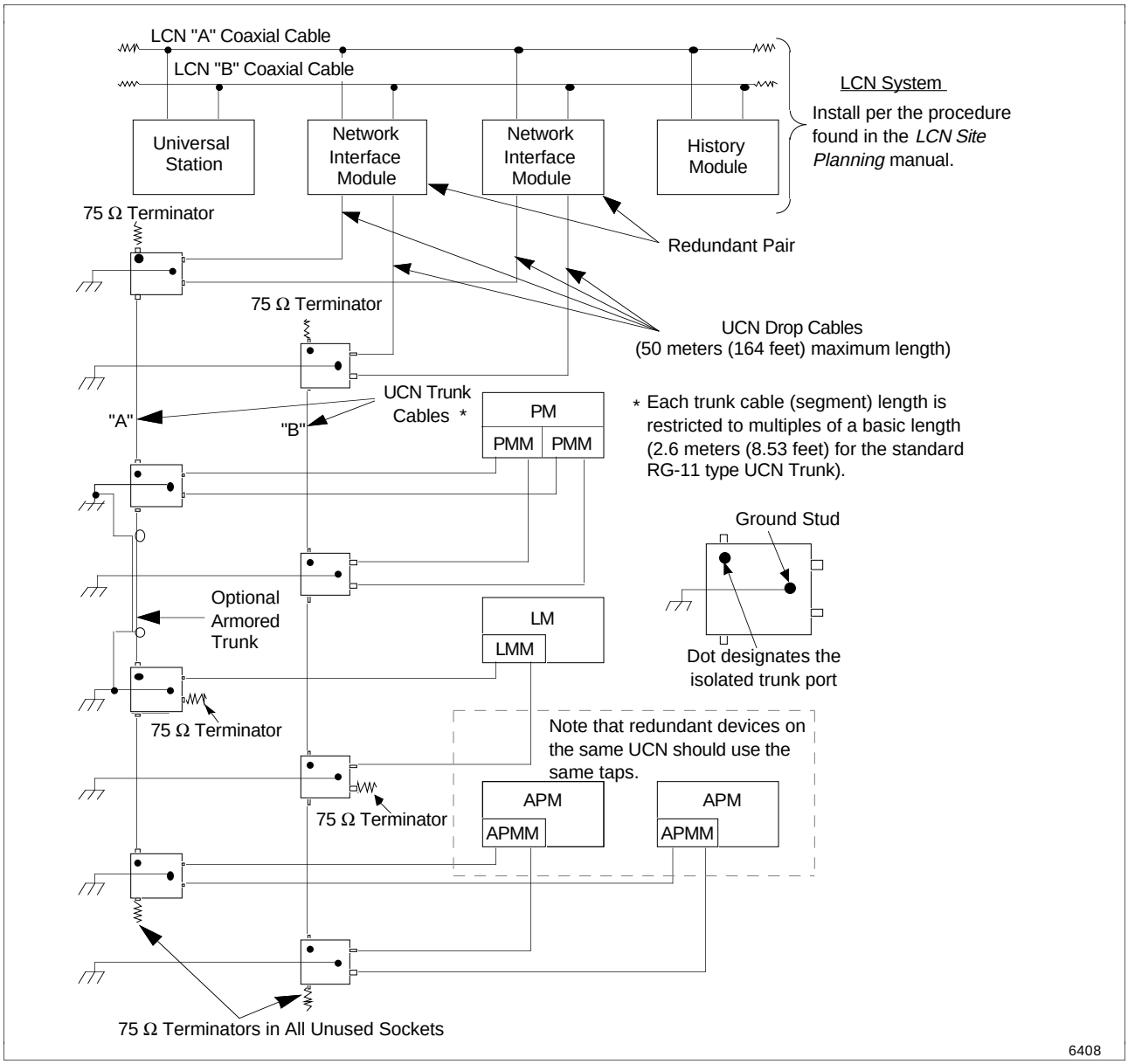
UCN installation

Figure 2-1 Typical Universal Control Network Installation



CAUTION

TDC 3000^X UCN coaxial cables and associated components have been designed and tested by Honeywell to meet strict standards of performance. Other coaxial cables and components have not been tested and qualified for use in the Universal Control Network. Therefore, no substitutions are approved by Honeywell. Various lengths of coaxial cable are available as standard products and must be ordered from Honeywell or Honeywell-approved sources.

2.2 Bulk Coaxial Cable Test

Introduction

Test all coaxial cables before installation, especially bulk coaxial cable on a reel. If defective cables are introduced into the Universal Control Network installation, replacing a defective segment that is in service can be costly and difficult. Even though the cable has been factory tested, heat, water, crushing, bending, or dropping the reel can damage the cable before installation. Test the cable at the site to ensure its integrity.

Use a network tester

A carrier-band network tester is used to perform all tests. All Universal Control Network testing is done at 5 Mb/s (megabits/second) with a bandwidth of 1 to 30 Mhz. Return loss and attenuation are measured in dB (decibels), while signal level and noise are measured in dBmV (0 db = 1 mV). A suitable tester, model CBT, is available from Relcom Incorporated, Forest Grove, Oregon, telephone 503-357-5607.

Testable cable length

An excessively long coaxial cable length on a reel may have to be shortened to give the tester a useful end reflection. Test RG11-type trunk cable in lengths no longer than 760 meters (2500 feet). Test RG6-type drop cable in a length no longer than 300 meters (1000 feet). For other cables, consult your cable supplier for the maximum test length.

Use carrier-band terminators

Cable testing is done using precision carrier-band terminators. Do not use video or radio terminators. Carrier-band terminators are tested for 75 ohms ± 1% in the 1 to 30 Mhz carrier-band passband. The terminators supplied with the Honeywell tap kits meet these requirements.

Cable rings

Trunk cables have rings printed on the jacket. Drop cables do not. To minimize signal reflections at drop cable tap locations, the rings are spaced at 2.6 m (8.5 ft) intervals along the UCN standard RG11-type trunk cable. If a different type UCN trunk cable is used, the spacing can differ. Install connectors only at the printed ring locations on the cable's outer jacket. If your system's trunk cable does not have the printed rings on the outer jacket, it is not carrier-band cable. Do not use it. Installation instructions for the Honeywell-approved connectors on bulk coaxial cable are in Appendix B.

Continued on next page

2.2 Bulk Coaxial Cable Test, Continued

Test specifications

Install connectors on both ends of the cable on the reel and test for the following specifications.

Return loss

Install a 75-ohm terminator at one end of the cable using a coupler/splice supplied with CBT tester. Connect the other end of the cable to the tester's **REC** port. Avoid the use of an extension cable between the cable and the tester because it could adversely affect the test results. Test both ends for -26 dB or higher return loss at 5 Mb/s (-27 dB is better, -25 dB is bad).

Attenuation

Connect one end of the cable to the tester **XMIT** port and the other to the **REC** port. Measure the attenuation at 5 Mb/s. Again, avoid the use of extension cables between the cable and the tester. Note the cable length on the reel and calculate the dB/m attenuation. Compare the measurement to the supplier's specification and expect reasonable conformity. Do not attempt to measure small values of attenuation that are below the accuracy limits of the CBT tester.

Cable failure

A cable that fails these tests is not suitable for your system.

Cable parameters

The tester used in the tests above will not be able to certify other coax parameters, such as group delay, tilt, and impedance as required by IEEE 802.4. Use only cable that is specified by Honeywell for your carrier-band system for your cable drops and distances.

Connector removal

Remove the connectors that were installed on the cable for acceptance testing. Determine the lengths of cables needed for your system that you planned according to the *Universal Control Network (UCN) Planning* manual and cut the cables from the reel(s) to their working lengths. Then install the cables as instructed in the following subsections.

2.3 Trunk Cable Installation and Return Loss Testing

Introduction

The following installation procedures are for trunk coaxial cables. However, because drop cables can be quite long, 50 meters (164 feet), use the procedures in this subsection for drop cables when appropriate.

Use site installation drawings

Universal Control Network installation drawings for your site were generated from the layout rules in the *Universal Control Network (UCN) Planning* manual. The drawings should be similar to Figure 2-1, but with much more installation detail. Using the drawings, route the UCN trunk cables at the specified distances from high voltage and other sources of electrical interference. A mistake here may take a long time to find and correct.

UCN cable map forms

Use the UCN Cable Map forms in the *Universal Control Network (UCN) Planning* manual to record the trunk and drop cable connections to the drop cable taps.

Maximum trunk cable performance

To maximize trunk performance, fabricate all segments of trunk A from the same reel of cable. Do the same for trunk B.

Acceptable cable installation parameters

Install the cables, being careful not to mistreat the cables. Cables can be damaged during installation by exceeding the following cable installation parameters.

Maximum pull strength

Do not exceed the pull strengths listed in Table 2-1. Excessive pull permanently reduces the cable diameter, affecting impedance, and can cause electrical failure.

Maximum unsupported distance

Do not exceed the maximum unsupported distances listed in Table 2-1 without using a molded or taped messenger wire.

Minimum bend radius

Do not create a bend radius less than listed in Table 2-1 for the type of cable. Pulling the cable around a small radius permanently crushes the cable into an oval shape, affects the impedance, and can cause electrical failure.

Continued on next page

Cable installation parameters

Table 2-1 lists the coaxial cable installation parameters.

Table 2-1 Cable Installation Parameters

Coax Type	Maximum Pull Strength	Minimum Bend Radius	Maximum Unsupported Length
Standard RG11	68 kg (150 lbs)	11 cm (4 1/2 in.)	61 m (200 ft)
Armored RG11	68 kg (150 lbs)	11 cm (4 1/2 in.)	91 m (300 ft)
Standard RG6	45 kg (100 lbs)	8 cm (3 in.)	61 m (200 ft)

Good installation practices

Damage to the cables can be reduced by using good practices during the installation. Limit the strain when pulling cable onto ladder racks by using pulleys over which the cable can travel. When pulling through conduit and trays, apply a lubricant. Use pull boxes at each bend and limit the distance between pull boxes to 30 meters (100 feet). If resistance is encountered while pulling the coax, stop and correct the problem before continuing.

Cable environment

Avoid attaching the cable to a structure that moves or vibrates excessively. Where there are construction cranes moving around, do not place the coax cables in the lowest overhead rack. Similarly, be careful in process areas that are prone to fire, melts, spills, floods, flares, venting, or explosions. Go around/over/underground as appropriate.

Cable installation

Once the trunk segments are in place, install the connectors at the printed ring locations on the cable's outer jacket. The assembly instructions are in Appendix C.

Also, install either TRUNK A or TRUNK B markers at both ends of the cable as appropriate. They are included in the Honeywell connector kits.

After a connector has been installed, thread a protection cap from the connector kit into the connector to protect the center pin until the cable is installed.

Continued on next page

Return loss testing

Do not connect the drop cable taps yet. The trunk segments have to be temporarily daisy-chained and tested for any damage during their installation. Use splices/couplers available in the trunk cable splice kit and connect the trunk cable segments together to create full length trunks for both the A and B trunks. Terminate the far end of the trunk and connect the near end to the tester **REC** port. Test both ends for -26 dB or higher return loss at 5 Mb/s (-27 dB is better, -25 dB is bad). Because this is the last opportunity to test the trunk without the effects of drop cable taps and drop cables, extend the test to include the requirements of the cable assemblies tests described in subsection 2.4.

Troubleshooting

If all tests are satisfactory, proceed with the connection of the drop cable taps as described in subsection 2.4. Otherwise, investigate the problem by disconnecting the defective trunk at a splice nearest the middle of the trunk. Then test each of the two sections to locate the defective segment. By successively dividing the sections of cable in half each time, you can quickly identify the defective segment.

2.4 Cable Assembly Testing

Cable segment test

Use the following test procedure for a length of cable that has connectors installed at both ends.

Step	Action
1	Install a carrier band 75-ohm terminator at one end of the cable assembly using a splice/coupler.
2	Connect the other end to the tester **REC** port and test for a return loss of -26 dB minimum (-27 dB is better, -25 dB is bad).
3	While monitoring the tester, grasp the cable, RG6-type or RG11-type, and pull on the cable with no more than 9 kg (20 lbs) stress, then release. An intermittent or constant return loss reading during this pull/release cycle implies that the connector installation is defective and has to be repaired. Repeat the test at the other end of the cable.
4	Label each end of the cable with a cable identification, such as TRUNK A. Note that colored labels, orange for cable A and brown for cable B, are to be used to help prevent cross-connecting the A and B trunk cables when installing the network trunk segments and drop cable taps. Do not release the cable without threading a protection cap on the cables connectors to protect the connector's center pin. The labels and caps are included in the Honeywell connector kit.

2.5 Drop Cable Tap Connections

Introduction

At this point, the trunk cable segments have connectors installed and have been thoroughly tested.

Installation procedure

Install and test the drop cable taps, and then install and test the drop cables by using the following procedure.

Step	Action
1	Mount the drop cable taps (do not use the ground stud on the tap to mount the tap) and connect each tap's ground stud with a 2.5 mm^2 (14 AWG) conductor to the nearest AC Safety Ground. Use any nearby grounded building frame or power distribution panel AC Safety Ground. Do not ground any cable armor at this time. See Figure 2-1.
2	Connect the trunk cables to the trunk ports at the sides of the drop cable taps. Be sure that the A trunk cables are connected only to the A taps, and the B trunk cables are connected only to the B taps. Strain relieve the trunk and drop cables near the drop cable tap ports. All drop cable taps have a white dot located next to one of the trunk ports. The port is also labeled with the term “ISOL TRUNK” on new production taps. This is the port that isolates the cable shield from ground. See Figure 2-2. When connecting trunk cables to the drop cable taps, each cable must be provided a ground at one end and isolated from ground at the other end. This is accomplished by connection of the cable to a trunk port connector without a dot at one end of the cable and a trunk port connector with a dot at the other end of the cable.

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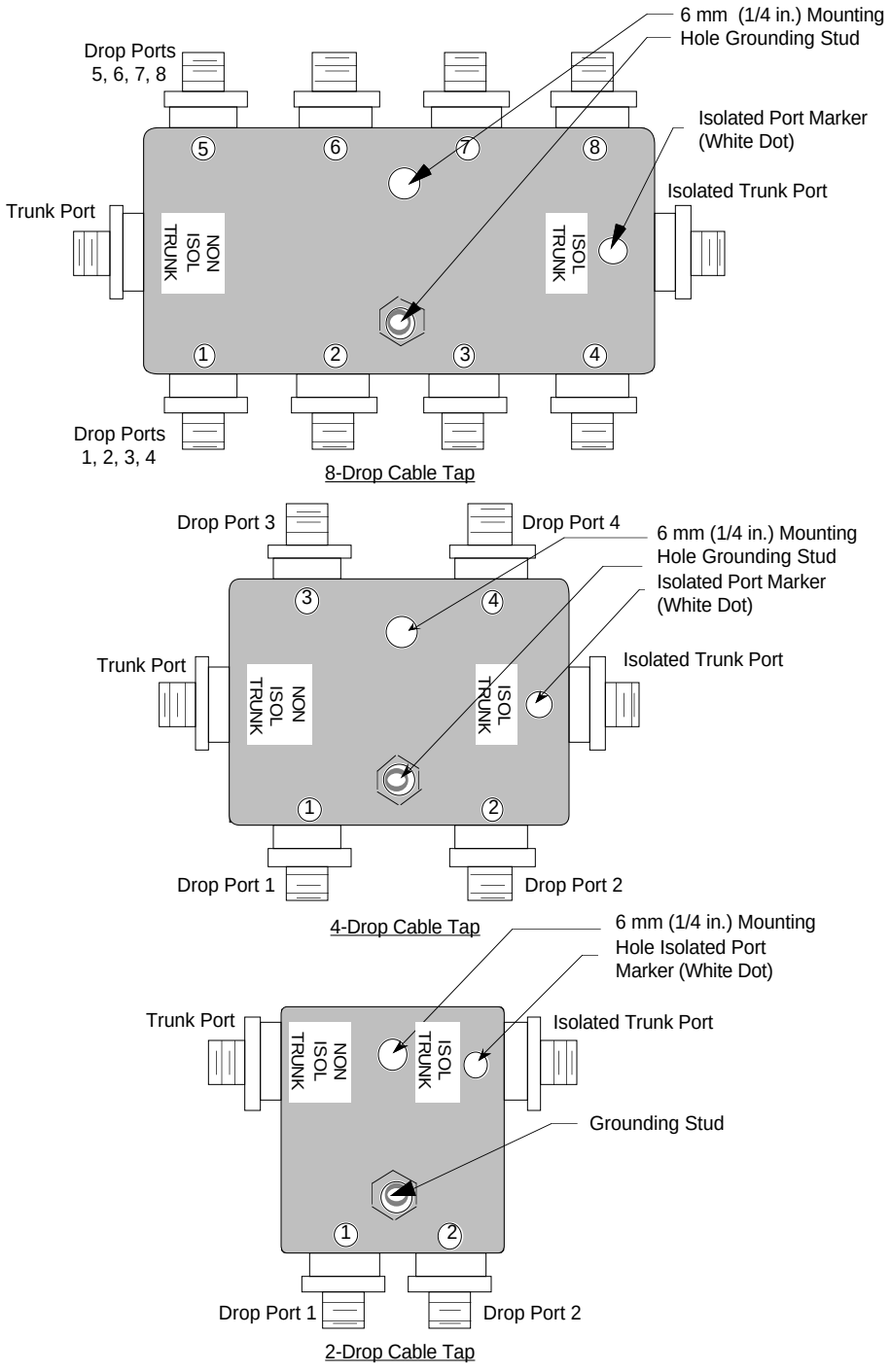
Installation procedure, continued

Figure 2-2 UCN Drop Cable Taps



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Installation procedure, continued

3	To avoid confusion, start connecting the drop cable taps at one end of the Universal Control Network. Position the tap such that the isolated port indicator, the white dot or recessed circle, is to the right. • Connect a 75-ohm terminator to the left-hand trunk port (no dot) connector of the drop cable tap. • Connect the trunk cable to right-hand trunk port (dot) connector of the tap. • Go to the next tap and connect the other end of the cable, connected in Step b, to the left-hand trunk port (no dot) of the tap. • Connect the next trunk cable to the right-hand trunk port (dot) connector of this tap. Proceed to the next tap and repeat Steps c and d until all trunk cables have been connected. • Connect a 75-ohm terminator to the right-hand trunk port (dot) connector of the last (end) tap.
4	Tighten the trunk connectors with your fingers. Then wrench-tighten the connectors with a Honeywell-recommended torque wrench that is calibrated for a nominal 25 inch/pounds. A slight twist on the cable will indicate if the connection is sufficiently tight or not. The suggested tool is found in a Honeywell kit, model number MU-NKTQ01, part number 51109612-100. See Figure 2-3. The wrench in the kit is factory set to 25 inch/pounds. It is 152 mm (6 inches) long with a 16-mm (5/8-inch) diameter handle. Included in the kit are three hex wrench heads, sizes 11-mm (7/16-inch), 13-mm (1/2-inch), and 16-mm (5/8-inch), to be used with the torque wrench. The heads incorporate a cutout, allowing the wrench to fit over a cable while it is connected. The 13-mm (1/2-inch) flare head is used for the drop coax cable connectors, the new style trunk coax connectors, and the new style drop cable tap terminators. The 11-mm (7/16-inch) head accommodates the old style terminators used on the tap, while the 16-mm (5/8-inch) head accommodates the old style trunk cable connectors. A click can be felt or heard when the calibrated 25 inch/pounds torque limit has been reached. Do not over-tighten the connector. Avoid stress on the trunk cables at this stage. Strain-relieve each end of the trunk cable. Cables should not bend until at least 5 centimeters (2 inches) from the tap connector.

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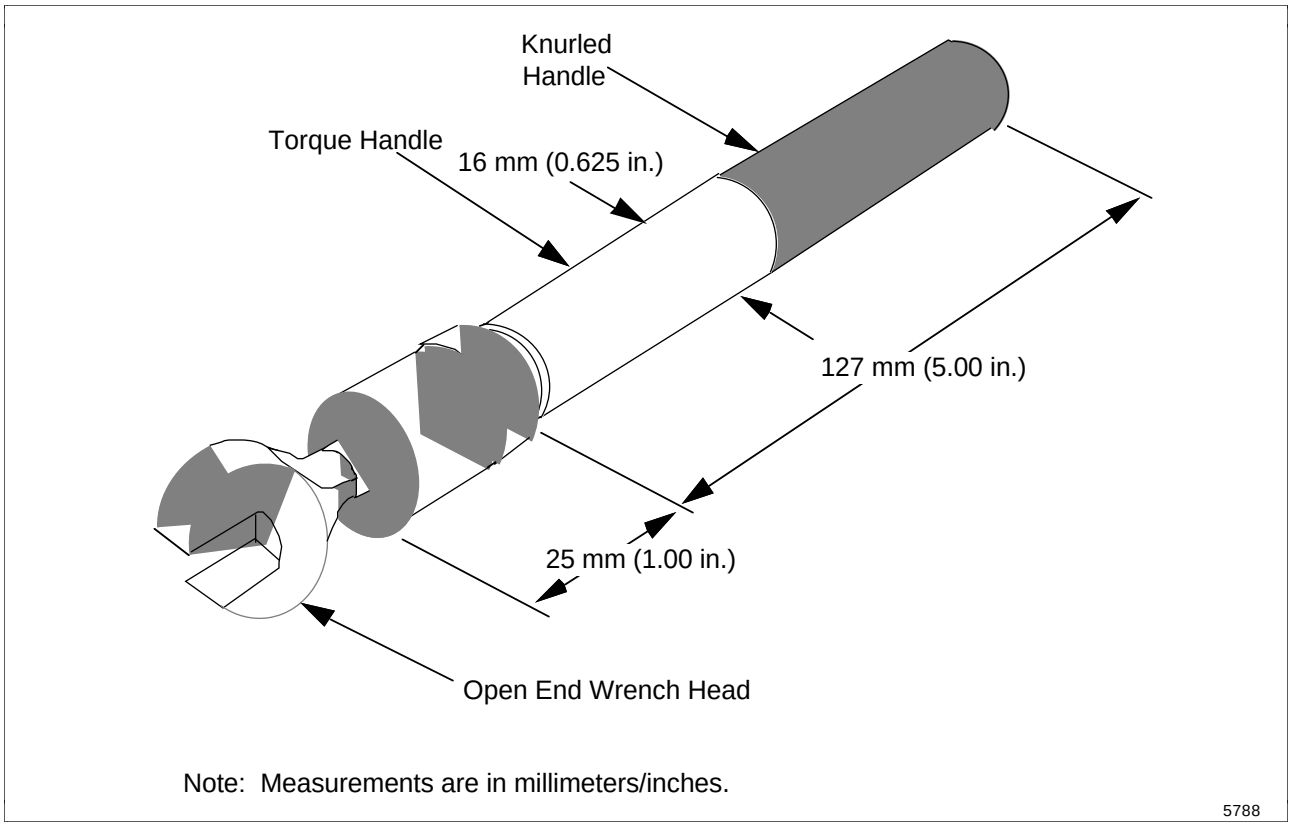
Installation procedure, continued

Figure 2-3 UCN Cable Torque Wrench – 25 Inch/Pounds



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Installation procedure, continued

5	Do not install the drop cables at this point. Instead, install 75-ohm terminators on all the drop cable tap ports. Also, install terminators at the end trunk ports, on the last drop cable taps in the system. Make a 2.6-meter (8.5-foot) extension cable from the same reel of cable used to fabricate the trunk cable segments and use it to connect the nearest trunk port to the tester **REC** port. The return loss should measure -23 dB or greater at 5 Mb/s (-24 dB is better, -22 dB is bad). Notice that this figure is 3 dB less than the -26 dB figure specified earlier for the bulk coaxial cable while on the reel. The 3 dB loss is the allowance for the drop cable taps. Repeat the test from the other end of the trunk cable.
6	If the system fails to meet the -23 dB return loss test requirement, one of the drop cable taps or a drop cable is probably defective, or a cable connection is loose. If there is a failure, disconnect the problem trunk cable at the tap nearest the middle of the trunk. Terminate portions of the break in the trunk with a splice/coupler and a 75-ohm terminator, and test both trunk halves to determine which half is defective. Successively divide the defective trunk portion until the defective tap or cable is located.
7	The trunk and all the drop cable taps have now been tested. Ground the armor of any armor cable, using clips as shown in Figure 2-4. The ground clips install at each end of the armor according to the manufacturer's instructions. Do not ground the armor to the adjacent taps. Instead, ground the armor to the point you have chosen to ground the drop cable taps. A suitable armor clip is the Scotchlok® 4460 shield connector manufactured by the 3M Company.

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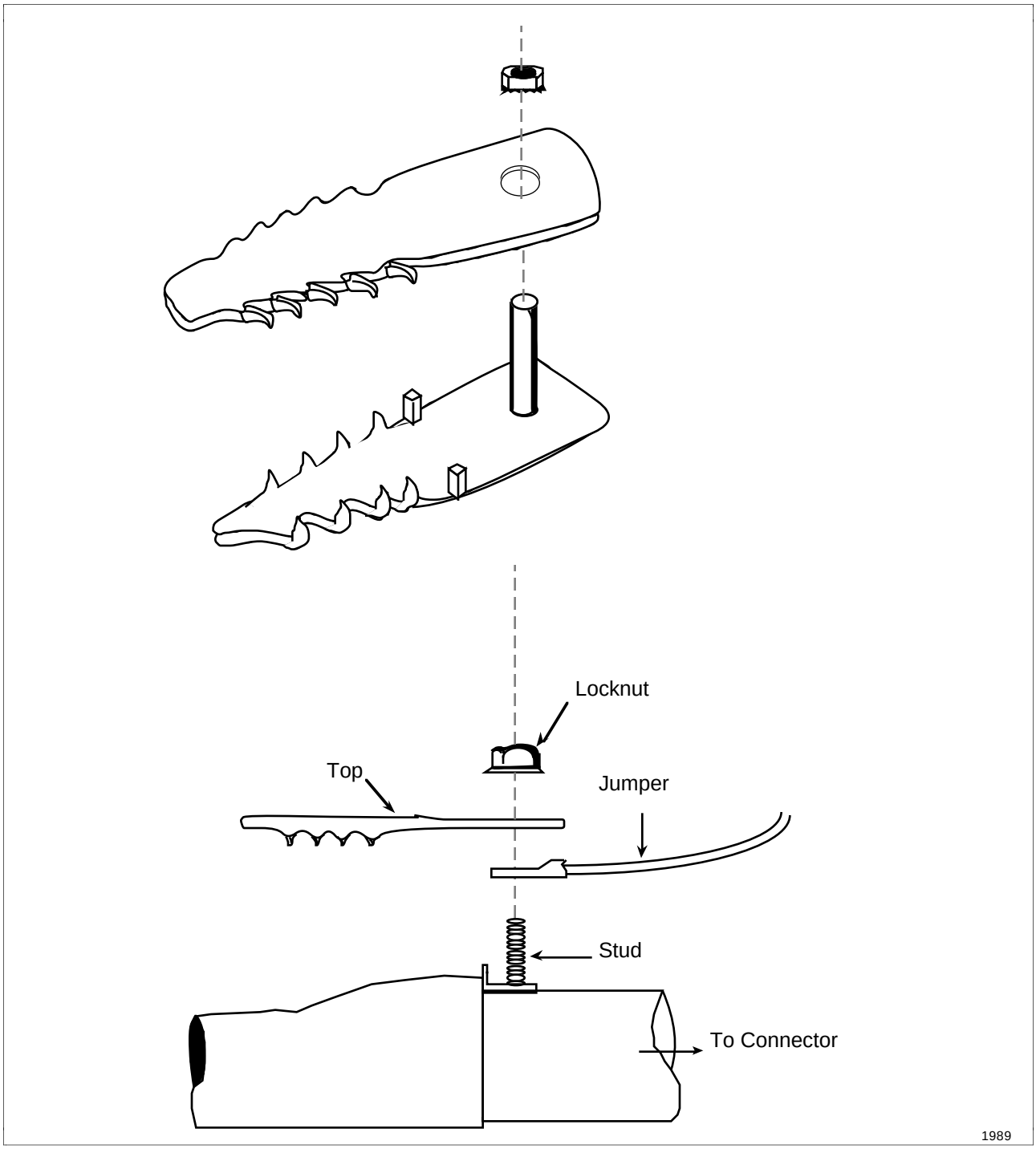
Installation procedure, continued

Figure 2-4 Coax Armor Clip



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Installation procedure, continued

8	Complete the installation of the Universal Control Network as illustrated in Figure 2-1, being sure you accomplish the following. • Ground any cable armor at both ends as illustrated in Figure 2-1. • Connect all the drop cables to their network devices. An example is the connection of the drop cables to the Process Manager or Advanced Process Manager as illustrated in Figure 2-5. Avoid crossing cable A with cable B. Pay attention to the colored markers at each end of each cable. • Terminate all unused ports as illustrated in Figure 2-1. Unused network device node connections do not require terminators. The node connection is internally terminated. Unused drop cable tap ports normally have a 75-ohm terminator connected. However, a drop cable connected to the unused tap port with a splice/coupler and terminator installed at the end of the drop cable is acceptable. • Properly tighten all cable connectors and terminators. Finger tighten the connector and then wrench-tighten it the additional amount to 25 inch/pounds with a torque wrench described previously. Twist the cable slightly to check the connection. If loose, retighten the connector.
9	The drop cables and taps are tested together for return loss. Disconnect each drop cable at the node end (PM, APM, LM, or NIM) of the drop cable one at a time, and connect the cable to the tester **REC** port. Test for a return loss of -14 dB minimum (-15 dB is better, -13 dB is bad). Reconnect the tested drop cable before proceeding to the next drop cable. Open connections interfere with this test. Should a particular drop cable fail this return loss test, test the drop cable without the tap before replacing it. Disconnect it from the tap, install a 75-ohm terminator by using a splice/coupler, and test for a minimum return loss of -26 dB (-27 dB is better, -25 dB is bad). If the test result is acceptable, replace the tap. When testing of all the drop cables is complete, recheck all the connections for tightness by twisting the individual cables slightly at each connector. If the connection is loose, tighten it.
10	Proceed with the Universal Control Network power-off noise tests as discussed in Section 3.

ATTENTION

Do not place your fingers on the head of the torque wrench when gripping the wrench because you may not feel the click and overtighten the connector.

ATTENTION

It is extremely important to wrench-tighten, not merely finger-tighten all F-type connectors and terminators at the drop cable taps and the network devices. Failure to do so may produce noisy connections that inhibit proper Universal Control Network performance.

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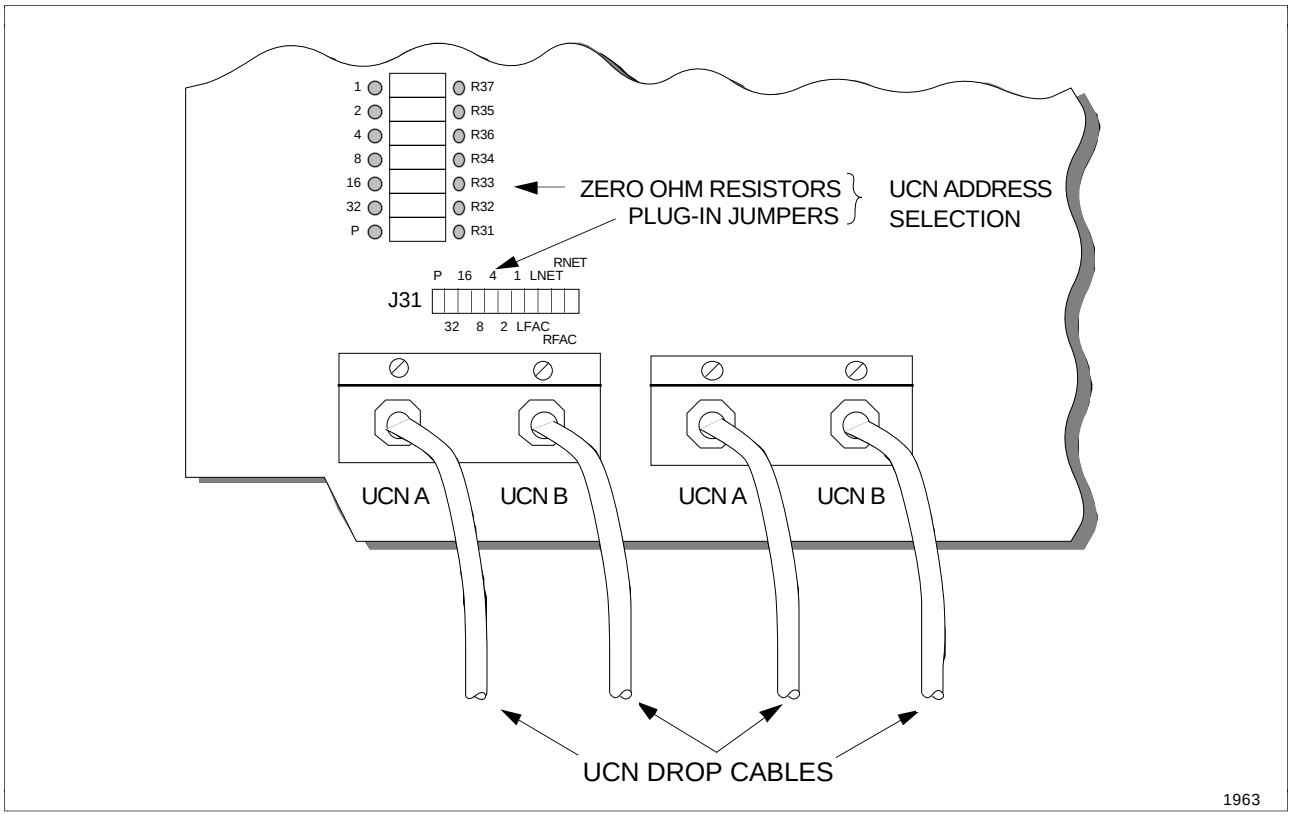
PMM/APMM card file drop cable connections

Figure 2-5 UCN Drop Cable Connection to the PM/APM



Section 3 – Network Checkout

3.1 Overview

Section contents

The topics covered in this section are:

Purpose

This section covers the checkout of the network after installation, or if an addition is made to the network at some later time.

Introduction

The following procedures provide instructions and references as needed for the initial checkout of the Universal Control Network (UCN) coaxial cables and drop cable taps. The instructions are intended to be understood by trained Honeywell or customer service technicians. The checkout procedures determine if the subsystem components have been properly installed and are ready for system startup. These procedures also serve to checkout system expansions or significant modifications. Please read this section completely before proceeding with the subsystem checkout.

Appendix A

The form in Appendix A, the *PM/APM Post Installation Checklist*, should be used to monitor the progress and completeness of the checkout effort.

Appendix B

The form in Appendix B, *UCN Cable Measurements*, is to be used to record the characteristics of your UCN cable system when you check out your installation. The form can be copied or used as a guide in preparing your own form.

Appendix C

Appendix C provides assembly instructions RG6-type drop coaxial cable and RG11-type UCN trunk coaxial cable. A list of required tools is also provided. Connector kits can be purchased from Honeywell. See the *Process Manager/Advanced Process Manager Service* manual.

3.2 Tools and Test Equipment

Suggested tools and test equipment lists

The following is a suggested list of tools and test equipment that are needed to install and test a Universal Control Network.

Tools

- Standard tool kit
- Test leads
- Ground rods

Test equipment

- Dranetz Series 626 Universal Disturbance Analyzer*
- Series 626 Accessories (referenced for use in this manual):

626-PA-6001-T	AC Single-Phase Plug-in Monitor*
626-PA-6003-T	Three-phase AC Plug-in Monitor*
626-PA-6002A-T	Low Voltage DC Plug-in Monitor*
626-PA-6020	RFI Measurement Plug-in Monitor*

- Carrier Band Network Tester, Relcom CB Tester*
- Accessories (provided with the Relcom CB Tester):
  Relcom Auxiliary CB Signal Generator
  Charger/Power Plug
  Probe Cable (or MU-MCA002)
  1% 75 Ohm Terminator, etc.
- Biddle Megger® Earth Tester, Model 250200, 250220 or 250241*

* TDC 3000 system test devices should be available as needed. You can choose equipment equivalent to that specified, but test procedures and results may vary.

ATTENTION Two CB testers are required if an Auxiliary CB Signal Generator is not provided.

ATTENTION Biddle Model 250260 is not acceptable.

3.3 UCN AC Safety Ground

Drop cable tap grounding

Visually inspect the UCN cabling to verify that every drop cable tap on each UCN trunk cable is connected to the nearest AC Safety Ground with 2.5 mm^2 (14 AWG) wire as detailed in subsection 2.5.

Ground measurement

Using the Earth Tester, measure less than 0.5 ohm between the UCN drop cable taps and the facility's AC Safety Ground.

3.4 UCN Testing

Introduction

Refer to Figure 3-1 for the following discussion. The Universal Control Network (UCN) uses carrier-band hardware for its implementation. A redundant 2-trunk system, as illustrated, must always be installed.

Typical UCN

A typical UCN cable system may consist of two trunk cables with four drop cable taps on each trunk as shown in Figure 3-1. Each tap can provide network connections for two (or four, or eight) Universal Control Network devices. The UCN device can be a primary or redundant Process Manager Module (PMM), a primary or redundant Advanced Process Manager Module (APMM), a Logic Manager (LM), or a Network Interface Module (NIM). Redundant network devices must share the same drop cable taps.

External electrical noise

Sufficient signal strength throughout the network is necessary for the UCN devices to communicate properly. The network should also be checked for excessive external electrical noise that may interfere with communications.

All network parameters are measured in decibel millivolts (dBmV) of signal strength or decibels (dB) of attenuation. These parameters are easy to measure because they are additive, or subtractive in nature. Use a Relcom Carrier-Band Network Tester to verify the quality of the Universal Control Network. Table 3-1 lists the strengths and losses for UCN components.

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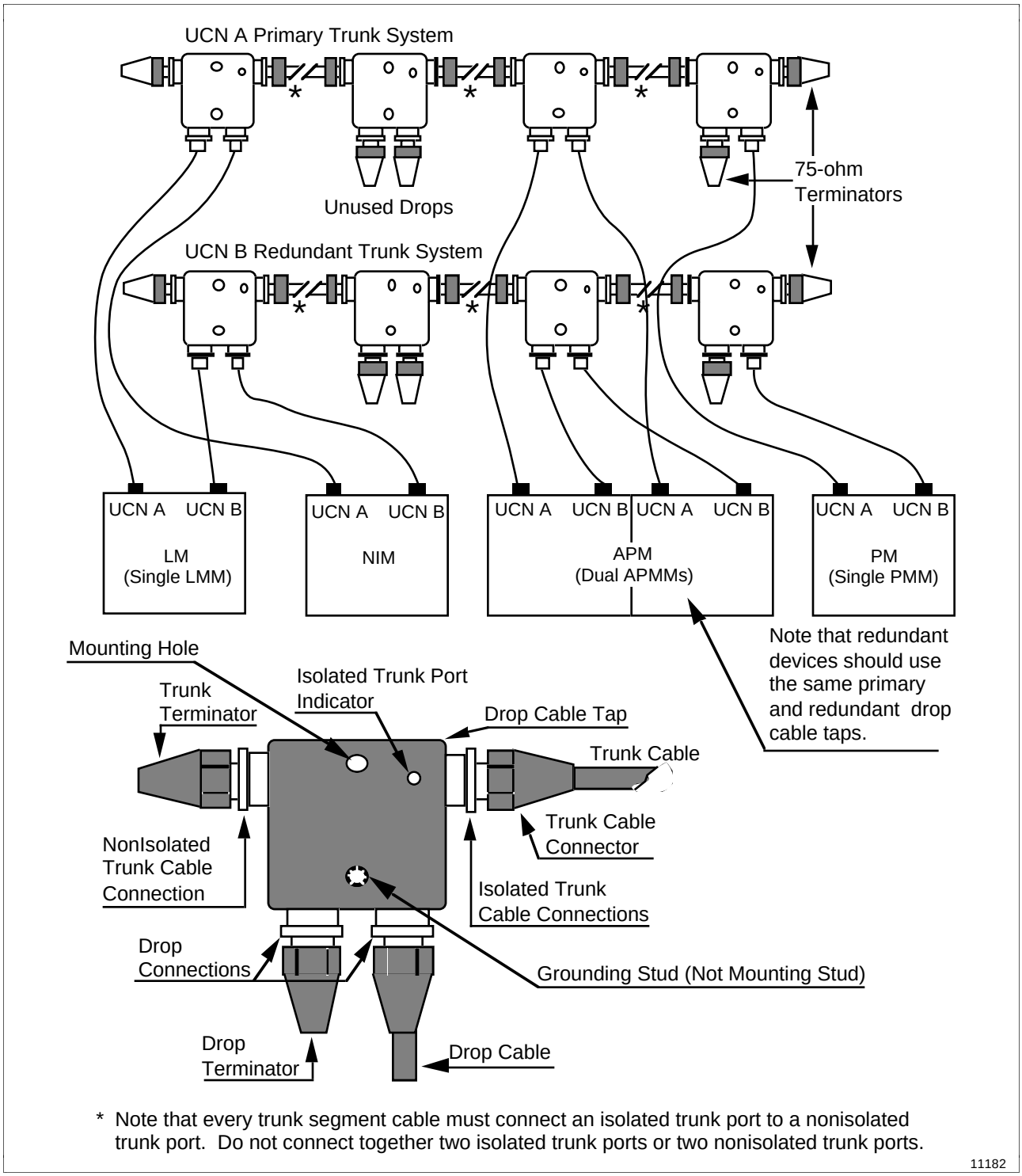
Typical UCN cable system

Figure 3-1 Typical UCN Cable System



Continued on next page

UCN component parameters

Table 3-1 UCN Component Signal Strengths and Losses

Component	Strength/Loss	Parameter
UCN Transmitter	64.5±1.5 dBmV	Nominal output signal strength
UCN Receiver	10.0 dBmV	Minimum signal strength sensitivity
UCN Drop Cable Tap	0.5 dB	Maximum trunk pass through attenuation
	20.0 dB	Nominal drop attenuation loss
UCN RG11-Type Trunk Cable	1.5 dB	Attenuation per 100 meters (328 ft)*
UCN RG6-Type Drop Cable	2.5 dB	Attenuation per 100 meters (328 ft)*

* Values for standard UCN cable at 5 Mb/s. This can vary depending upon the cable type.

Tester accuracy

When using the carrier-band tester, keep in mind the accuracy of the tester when comparing actual measurements with Table 3-1.

Component attenuation

Although it is necessary for isolation, each drop cable tap produces a 20 dBmV signal loss in each direction between the drop cable port and the trunk cable port. There is very little signal attenuation between the isolated trunk port and the nonisolated trunk port in the tap. Attenuation varies through the cables, but must not be more than an additional 13 dB for any transmitter to receiver path, including trunk cable, drop cable, and pass-through losses.

Record measurements

Keep a record of your measurements. You can copy the sample in Appendix B of this manual, or use it as a guide in preparing your own form.

WARNING

When disconnecting and reconnecting cables in the procedures that follow, be aware of a possible shock hazard because of shield potential differences between cables. Cables can become ungrounded and present a shock hazard because of the possible ground potential differences in various plant areas.

Continued on next page

CAUTION

The primary trunk cable system must be connected to all cable A connectors and the redundant trunk cable system connected to all cable B connectors. This convention must be maintained throughout the Universal Control Network.

The ends of the trunk cables and all unused drop cable connections on the taps must be terminated with carrier-band rated 75-ohm terminations. Visually check the system to verify that all terminations and cable connections are in place and properly tightened.

When initially tightening terminations and cable connectors, turn the connectors finger tight, then wrench-tighten the connectors to 25 inch/pounds with a torque wrench. Do not overtighten the connectors. A slight twist on the cable will indicate if the connection is tight. If the connection is not proper, retighten the connector with the torque wrench.

Avoid stress on cables where they connect to the drop cable taps or network device UCN connectors. Do not compromise cable shield integrity by violating the minimum bend radius. If the connectors are not properly installed, the Universal Control Network may be degraded and poor system performance can result.

Network test procedures

The test procedures that are described in the following subsections should be performed after the network devices have been wired and cabled to the network according to the procedures in their respective installation manuals. The power circuit breakers for the devices must be in the off position.

3.4.1 Ambient Noise Testing

Ambient noise test procedure

Ambient electrical noise is present in any electrical environment. Although the UCN cable system guards against noise, check the installed network to verify that noise does not interfere with Universal Control Network communications. Perform the following steps.

Step	Action
1	Be sure all terminators and all network devices are connected to the cable system and power is removed from all the network devices. Verify that the 48 V backup battery system, if present in the Process Manager or Advanced Process Manager, is not maintaining power. Check that the 48 V Battery switch is in the off position.
2	Remove a drop cable or 75-ohm terminator from any drop cable port on the tap at one end of the primary trunk cable of the Universal Control Network under test and connect the Relcom CB Tester to the port. Set the tester to **NOISE** and **5 Mb/s**. Move the **PEAK/RESET** switch to the **RESET** position momentarily and then leave it in the **PEAK** position. Do not use the ac adapter provided with the Relcom tester while making noise measurements. The tester must operate with its internally charged batteries. Read the tester after 40 or more seconds. Verify and record a noise figure less than -10 dBmV (example: -11 dBmV is less than -10 dBmV, -9 dBmV is not). If the measurement is less than -25 dBmV, the tester will flash "-25." This is a satisfactory reading.
3	Disconnect the CB tester, reconnect the drop cable or 75-ohm terminator, and move the tester to the redundant trunk cable of the Universal Control Network under test. Repeat step 2 for the redundant trunk, then disconnect the tester and reconnect the cable or terminator.
4	Go to the other end of the trunk cables of the same Universal Control Network and repeat steps 2 and 3.

Analyzing a test failure

If your system fails to pass the ambient noise test in this subsection, thoroughly check the cabling and drop cable tap grounding systems. Also, attempt to find the source of any electrical noise interference. Data obtained from any RFI tests conducted will help. If no interference was found in those tests, try setting the Dranetz test equipment to a lower sensitivity or moving the test equipment to locations nearer the Universal Control Network trunk and drop cables. In some cases, consider substituting armored trunk cable in place of standard trunk cable.

3.4.2 UCN Cross Connection Test

Cross connection test procedure

Perform an electrical check to verify that the UCN A and B trunk cables are not cross-connected as follows.

Step	Action
1	Be sure all 75-ohm terminators and all UCN devices are connected to the cable system, and all UCN devices have power removed. Verify that the 48 V backup battery system, if present in the Process Manager or Advanced Process Manager, is not maintaining power. Check that the 48 V Battery switch is in the off position.
2	Disconnect the A drop cable from a UCN device at one end of the primary trunk cable and connect the cable instead to the Relcom Auxiliary CB Signal Generator, or another CB Tester set to the **SIG GEN** position, using the **XMIT** port. The signal generator will transmit a signal along the trunk cable system that will be received by a tester that is connected to points along the primary UCN trunk cable system.
3	Remove the B drop cable from the UCN connection at the same end of the redundant trunk cable serving the same network device as in step 2. Connect the Relcom CB Tester to the drop cable. Set the tester switches to the **NOISE** and **5 Mb/s** positions. Move the **PEAK/RESET** switch to the **RESET** position momentarily and then leave it in the **PEAK** position. Read the tester after 40 or more seconds. As in step 2 of subsection 3.3.1.1, do not use the ac adapter provided with the Relcom tester while making noise measurements. Check that the noise figure is less than -10 dBmV (example: -11 dBmV is less than -10 dBmV, -9 dBmV is not). If the noise test in step 3 fails, there is probably an error in the cabling of the UCN cable system. A UCN B device is probably cross-connected to a UCN A device. Examine all the drop cable taps and network device connections until you find and correct the problem. Do not proceed to the next test until the problem is corrected.
4	Reconnect the drop cable to the UCN B device. Leave the auxiliary signal generator connected to the UCN A drop cable in preparation for the tests that follow.

3.4.3 UCN Return Loss and Signal Strength Tests

Introduction

Use the CB tester to measure return loss (in one direction) and the signal strength. In the steps that follow, it is unnecessary to measure return loss at each drop cable tap port to a UCN device. Measure the return loss only once at each tap. Use the UCN Cable Measurements form in Appendix B. If the return loss measurements were recorded during cable installation, a quick verification is sufficient.

Return loss and signal strength test procedure

You should measure and record signal strength at each UCN device. The "Expected Signal Strength" on the UCN Cable Measurements form in Appendix B can be calculated from attenuation measurements taken during installation. Simple addition and subtraction of dB readings is all that is necessary. Perform the following steps.

Step	Action
1	With the Auxiliary CB Signal Generator still connected to the UCN A drop cable noted in step 4 of subsection 3.4.2, go to the other end of the primary trunk cable, remove the drop cable from a UCN A device at that end and connect the Relcom CB Tester to the removed drop cable.
2	Set the tester to **RET LOSS**, **5 Mb/s**, and **RESET**. Verify and record a return loss of 14 dB or greater.
3	Set the tester to **SIG LEVEL**, **5 Mb/s**, and **RESET**. Verify and record a signal level of +10 dBmV or greater.
4	Disconnect the drop cable from the tester and reconnect it to the UCN A device.
5	Move the tester to the next UCN A device on the primary trunk cable that is closer to the signal generator. Disconnect the drop cable, connect the tester to the drop cable, and repeat steps 2 through 4.
6	Repeat step 5 until all the UCN A device ports on the primary trunk have been checked for return loss and signal level.
7	Move the signal generator from the UCN A drop port to the corresponding UCN B drop port on the redundant trunk cable. Reconnect the UCN A device to its drop cable.
8	Repeat steps 1 through 6, substituting UCN B devices and the redundant trunk cable for UCN A devices and the primary trunk cable. Reconnect all network devices to their drop cables when you have finished testing.

3.5 UCN Power-On Test

Introduction

This test procedure verifies that all transmitters in the Universal Control Network are quiet when power is applied to the equipment and the transmitters are idle or not transmitting.

Power-on test procedure

The power-on test can be made only when the Network Interface Module (NIM) and all of the process control equipment connected to the primary and redundant UCN trunk cables have power applied, but before software has been downloaded to the Network Interface Module through the LCN. Perform the following steps.

Step	Action
1	Verify that no UCN device connected to the network is transmitting. Check the Network Interface Module and observe the **TRANSMIT** indicator on the PNI/EPNI board. Check the **Modem** card(s) in each PM/APM to verify that the **POWER** indicator is on but the **STATUS** indicator is off. Check the **Logic Manager Module** card(s) in each LM to verify that the **PASS** indicator is on but the **XMIT** indicator is off. Observe each indicator continuously for approximately 20 seconds to ensure it doesn't flash. A flash indicates it is transmitting. If any of these indicators continues to flash, check the **NORMAL-TEST** jumper on the PNI/EPNI board of the NIM. Ensure that it is in the **NORMAL** position. Also, check the **LFAC-LNET-RFAC-RNET** jumper locations on the PMM or APMM backplane of the PM or APM, respectively. No jumpers should be in these locations. Check again that there is no downloading of software to the NIM or that none has been downloaded. If the NIM was downloaded, remove power and then reapply power to the equipment. The downloaded program will be destroyed.
2	Go to the drop cable tap at one end of the primary trunk cable of the Universal Control Network under test. Remove a drop cable or a 75-ohm terminator from any port connection on the tap, and replace it with the Relcom CB Tester. Set the tester switches to **NOISE** and **5 Mb/s** positions. Move the **RESET/PEAK** switch to **RESET** position momentarily and then leave it in the **PEAK** position. Do not use the ac adapter provided with the Relcom tester while making noise measurements. See subsection 3.3.1.1, step 2. Read the tester after 40 or more seconds. Verify and record a noise figure less than -10 dBmV (Example: -15 dBmV is less than -10 dBmV, -5 dBmV is not). If the measurement is less than -25 dBmV, the tester will flash "-25." This is a satisfactory reading.
3	Disconnect the CB tester, reconnect the drop cable or 75-ohm terminator, and move the tester to the redundant trunk cable of the Universal Control Network under test. Repeat step 2 for the redundant trunk cable, and then disconnect the tester and reconnect the drop cable or 75-ohm terminator.
4	Go to the other end of both trunk cables of the same Universal Control Network and repeat steps 2 and 3.

Appendix A – PM/APM Post-Installation Checklist

Customer_____ **Subsystem ID**_____ **Date (Delivery)**_____ **Date (Start-up)**_____

PRE-POWER CONNECTION TESTS	Use procedures in the PM/APM Installation and Checkout manual.	
General Site-Preparation Checks	Check the facility's AC Safety Ground earth resistance with an Earth Tester. Check that the AC power is the proper voltage. Check the AC line stability with Disturbance Analyzer. Do the RFI measurement where the PM, APM, or LM is installed.	☐
POWER-OFF CHECKS	Use procedures in the PM/APM Installation and Checkout manual.	
Grounding Checks	Inspect visually and physically for completeness. Check that local AC Safety Ground is less than 0.5 ohm (also check the cabinets without ac power). Check the local Master Reference Ground (MRG). Do an MRG noise test if a substitute MRG is used. Check the local Zener Barrier Ground bus connection. Check the UCN Safety Ground connections at all taps.	☐
UCN Cable Visual Checks	Ensure that primary cables connect to **A** connectors and redundant cables to **B** fittings at all taps. Verify that the terminators are installed on all unused tap connections.	☐
UCN Power-Off Cable Tests	See Section 3 in this manual and check the completed UCN recorded noise, return loss, and signal strength.	☐
General Pre-Power Checks	If applicable, check the AC Voltage Source Selection switch on the Power Supply Module(s) in the PM, APM, or LM.	☐
POWER-ON CHECKS	Check the procedure in the *Process Manager/Advanced Process Manager Checkout* manual.	
AC Power Verification	Verify operation of Power Supply Module fans. If the system is 120 volt ac or 240 volts ac with neutral, check that the voltage is between 100 Vac and 132 Vac. Check for a measurement of no more than a 0.5 volts between neutral and the cabinet frame. If the system is 240 volt ac, check that the voltage is between 187 Vac and 264 Vac.	☐
Backup Power Verification	Verify the Power System 48 V Battery Backup system (optional) is operational, and the CMOS battery backup voltage is proper.	☐
Power Supply Output Verification	Check that all green LEDs on Power Supply Modules are lit. Check that the 24 volt dc output is between 23 Vdc and 25 Vdc. Check that the 6 volt ac rms output is between 2 Vac and 7.2 Vac.	☐
Card Self-Test Verification	Check each card module for proper green **Power** and **Status** indicator status.	☐
UCN Power-On Cable Tests	Check and record the noise figure of the UCN with all nodes powered and connected, but silent. Verify the UCN address pinning (See the *Process Manager/Advanced Process Manager Installation* manual).	☐
Network Test Mode Checks	Check that all UCN devices engage in token-passing operation.	☐

Appendix B – UCN Cable Measurements

Customer_____________ **Subsystem ID**______ **Date (Delivery)**_______ **Date (Start-up)**_______

Network Name___________________ **Number**________________ **Cable Segment**____________

Tap Number	Building Location	Drop Name or Usage	Noise Figure	Return Loss		Signal Strength	
				“A” Dir	“B” Dir	Expected	Measured
______	________	1.____________________ 2.____________________	______	______	______	_______	_______
______	________	1.____________________ 2.____________________	______	______	______	_______	_______
______	________	1.____________________ 2.____________________	______	______	______	_______	_______
______	________	1.____________________ 2.____________________	______	______	______	_______	_______
______	________	1.____________________ 2.____________________	______	______	______	_______	_______
______	________	1.____________________ 2.____________________	______	______	______	_______	_______
______	________	1.____________________ 2.____________________	______	______	______	_______	_______
______	________	1.____________________ 2.____________________	______	______	______	_______	_______
______	________	1.____________________ 2.____________________	______	______	______	_______	_______
______	________	1.____________________ 2.____________________	______	______	______	_______	_______
______	________	1.____________________ 2.____________________	______	______	______	_______	_______
______	________	1.____________________ 2.____________________	______	______	______	_______	_______
______	________	1.____________________ 2.____________________	______	______	______	_______	_______
______	________	1.____________________ 2.____________________	______	______	______	_______	_______
______	________	1.____________________ 2.____________________	______	______	______	_______	_______
______	________	1.____________________ 2.____________________	______	______	______	_______	_______

Appendix C – Cable Fabrication

C.1 Overview

Section contents

The topics covered in this section are:

Introduction

This section of the manual provides instructions for fabricating trunk and drop cable assemblies on site with materials supplied in Honeywell connector kits. The cables and drop cable taps are then used to install a Universal Control Network. Only Honeywell-supplied or approved bulk cable is covered by these instructions.

C.2 RG6-Type Coaxial Drop Cable Assembly

Introduction

The following instructions are for installing the Gilbert Datagrade F-type coaxial cable connector on standard Universal Control Network (UCN) quad-shield RG6-type drop cable.

Reference

Gilbert Engineering in Phoenix, Arizona
(602) 245-1050 or 800-528-0199

Tools required

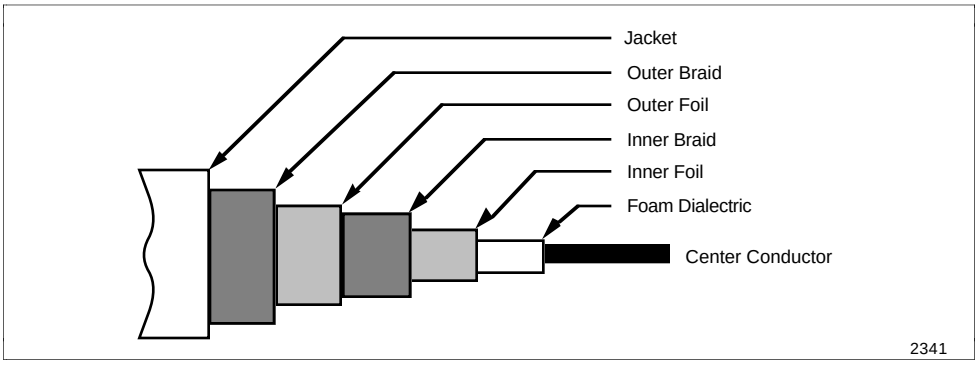
The following tools are required.

- Gilbert Engineering G-CRT-188 Crimp Tool (Ben Hughes Communications HCT-188)
- Coax cable cutters

Exposed view of RG6 cable

Figure C-1 is an exposed view of the RG6-type coaxial cable.

Figure C-1 Exposed View of RG6-Type Coaxial Cable

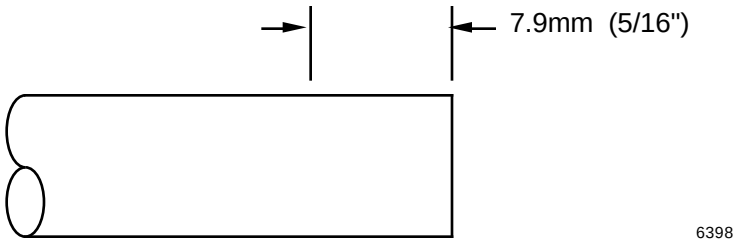
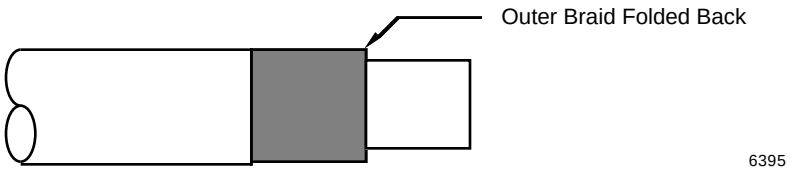
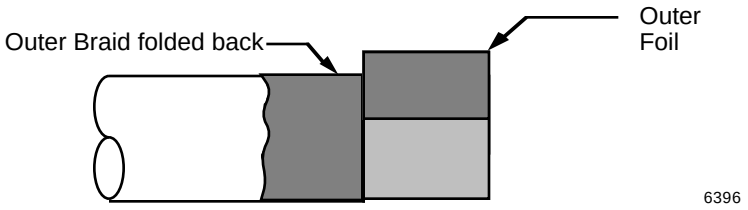
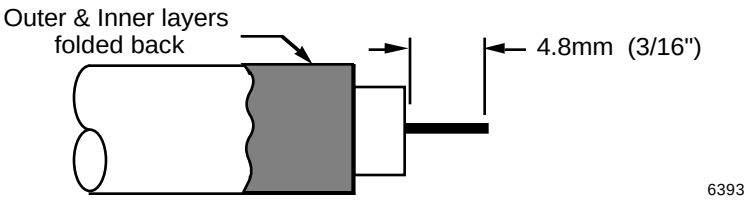


Continued on next page

C.2 RG6-Type Coaxial Drop Cable Assembly, Continued

RG6 cable fabrication procedure

Use the following procedure to fabricate RG6-type drop cables.

Step	Action
1	Cut the cable end at a clean 90° angle.
2	Remove 7.9 mm (5/16") of the jacket. Do not cut the underlying outer braid. 
3	Fold the exposed outer braid back over the jacket. 
4	Remove the outer foil. Do not cut the inner braid under the foil. Fold the inner braid back over the jacket. Do not disturb the inner foil. 
5	Remove 4.8 mm (3/16") of the dielectric and the inner foil. Do not score the center conductor. 

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C.2 RG6-Type Coaxial Drop Cable Assembly, Continued

RG6 cable fabrication procedure, continued

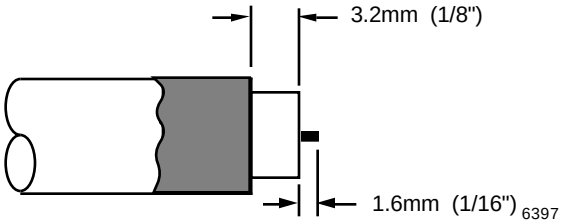
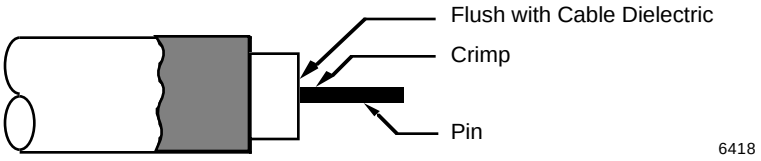
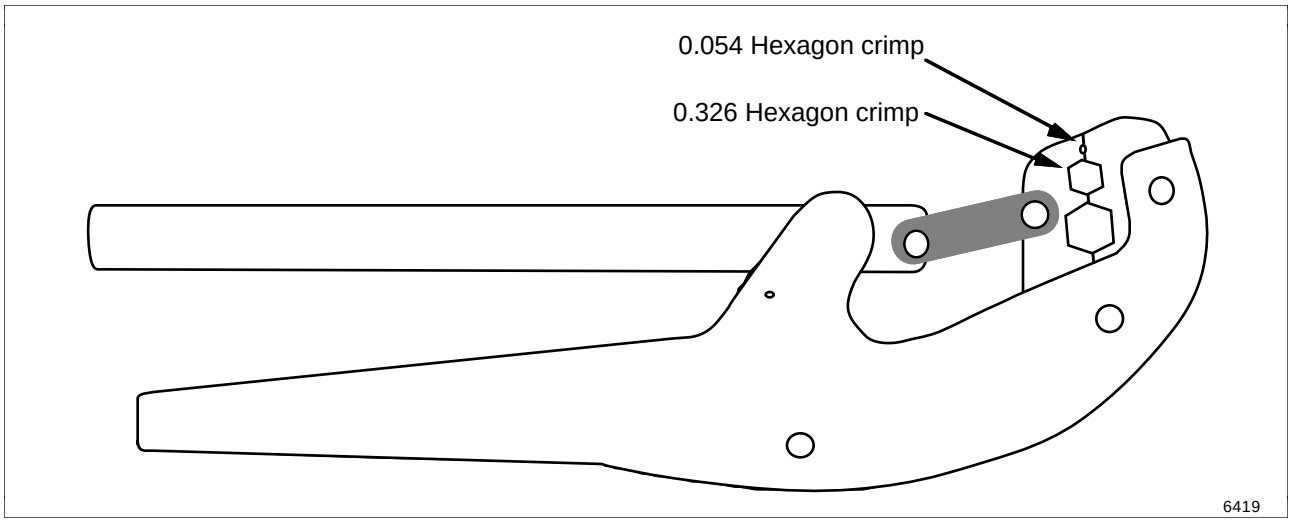
Step	Action
6	Trim the center conductor to 1.6 mm (1/16") beyond the dielectric. Do not distort the circular end of conductor.  Cable preparation is now complete. Next, the separate crimp pin is crimped onto the cable's center conductor. Finally, the connector body will be applied to the cable and crimped. Proceed to steps 7 -11.
7	Push the connector pin over the cable center conductor until flush with the dielectric. Crimp the pin with a 0.054 hexagon crimp (ref: G-CRT-188 crimp tool).  Figure C-2 is an illustration of the crimp tool.

Figure C-2 Model G-CRT-188 Crimp Tool



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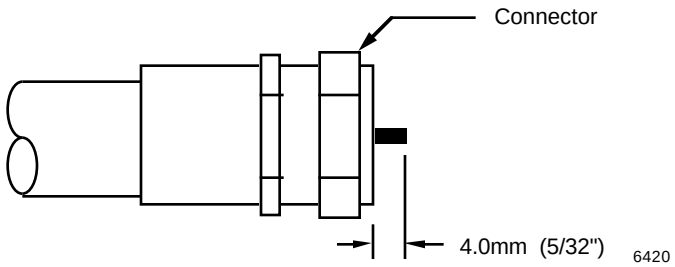
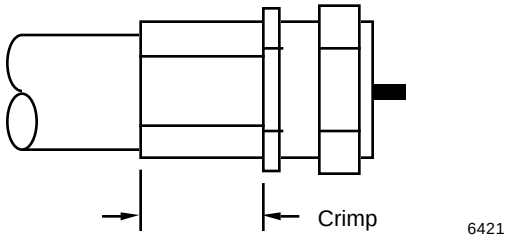
C.2 RG6-Type Coaxial Drop Cable Assembly, Continued

RG6 cable fabrication procedure, continued

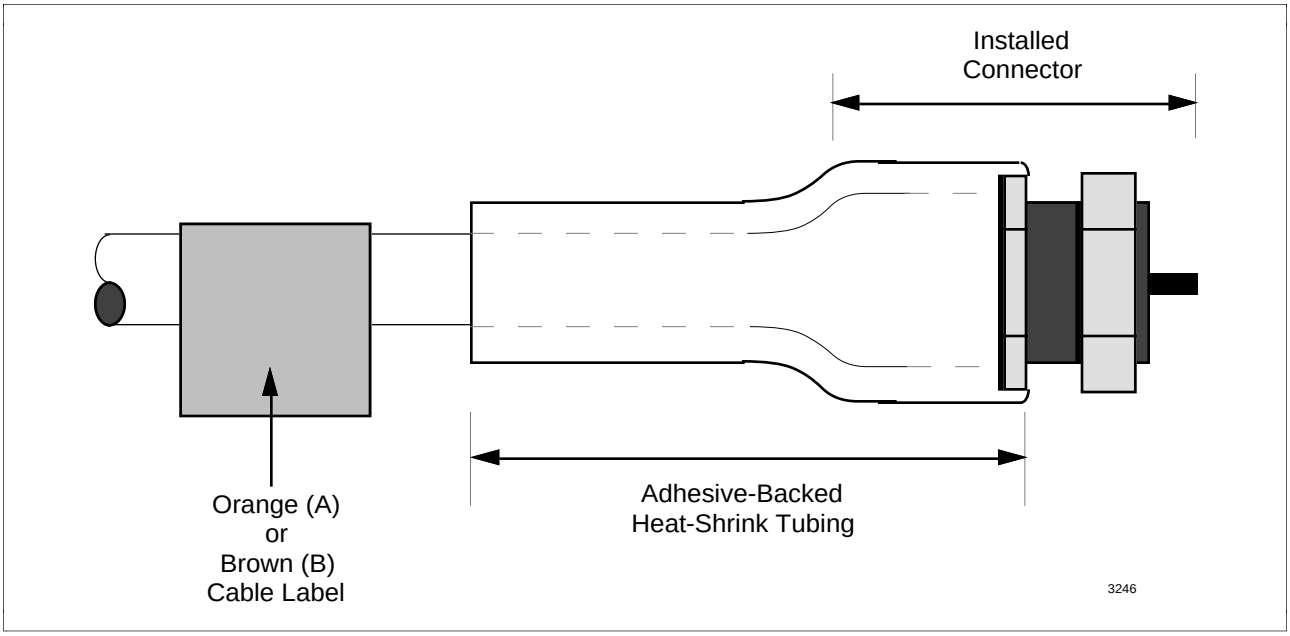
Step	Action
8	Minimize the thickness of the two folded-back braid layers by straightening and intermingling the strands. This will ease the following application of the connector over the end of the cable and braid.
9	Ensure that the inner foil is still wrapped neatly (flush) around the dielectric. Guide the pin into the insulator inside the connector body. Push the connector onto the cable until the pin protrudes approximately 4.0 mm (5/32") beyond the connector's end and a reasonable stop is felt. The braid shield should not be visible beyond the crimp ring. 
10	Crimp the connector with a 0.326 hexagon crimp (Ref: G-CRT-188 crimp tool). 
11	Apply precut adhesive-backed, heat-shrinkable tubing supplied with the connectors in the kit, and an orange (cable A) or brown (cable B) label, also supplied, as illustrated in Figure C-3. Hand tug on the installed connector. Do not exceed 10 lbs pull. Recheck the pin's protrusion in Step 9 above.

Continued on next page

Application of cable tubing and label

Figure C-3 illustrates the application of heat-shrink tubing and the identification label on the cable.

Figure C-3 Application of Heat-Shrink Tubing and Cable Label



Cable testing

Check the finished cable assemblies for proper electrical performance with procedures found in Section 3. Apply plastic protectors, also supplied, to the ends of the finished cable as illustrated in Figure C-3. To prevent damage to the protruding pin, the protectors should remain in place until the cable is installed.

C.3 RG11-Type Coaxial Drop Cable Assembly

Introduction

The following instructions are for installing the Gilbert Datagrade F-type coaxial cable connector on standard Universal Control Network (UCN) quad-shield RG11-type drop cable.

Reference

Gilbert Engineering in Phoenix, Arizona
(602) 245-1050 or 800-528-0199

Tools required

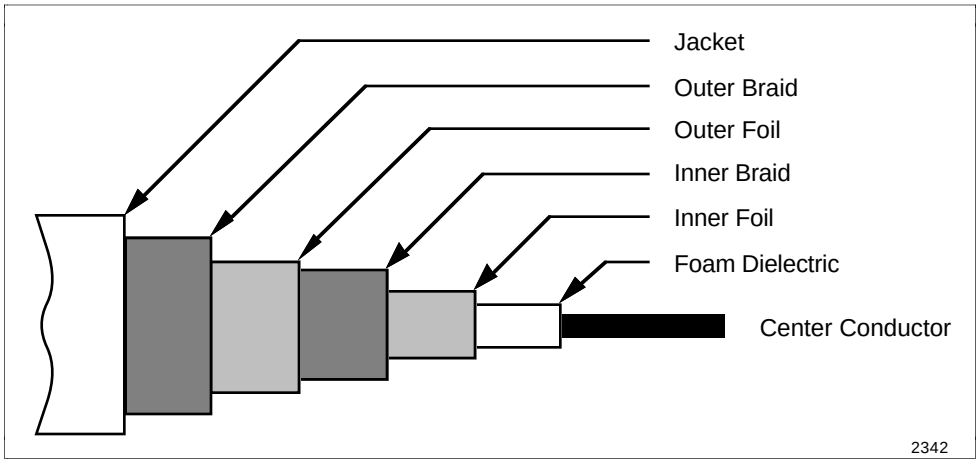
The following tools are required.

- Gilbert Engineering G-CRT-211 Crimp Tool
  (Ben Hughes Communications HCT-211)
- Coax cable cutters

Exposed view of RG11 cable

Figure C-4 is an exposed view of the RG11-type coaxial cable.

Figure C-4 Exposed View of RG11-Type Coaxial Cable



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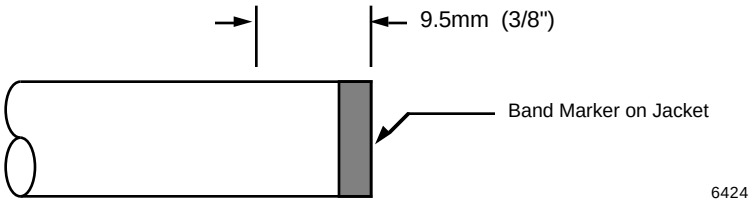
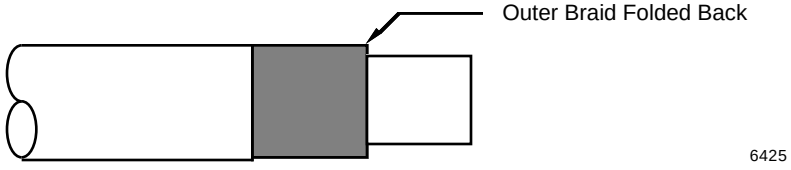
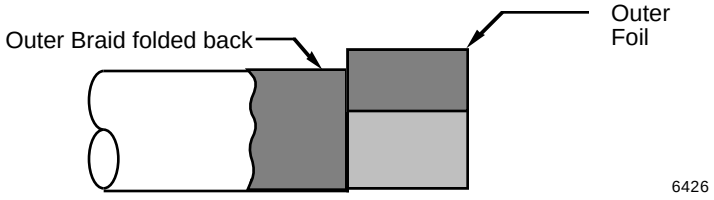
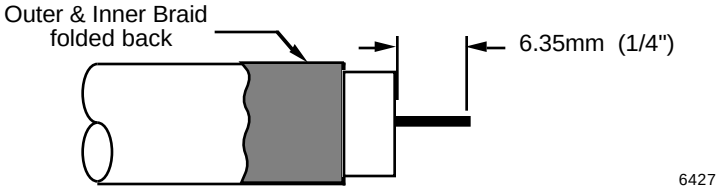
C.3 RG11-Type Coaxial Drop Cable Assembly, Continued

RG11 cable fabrication procedure

Use the following procedure to fabricate RG11-type coaxial trunk cables.

Step	Action
1	Cut the cable end at a clean 90° angle. Both ends of the cable must be cut at the periodic (2.6-meter (8.5 foot) interval) band marks on the trunk cable outer jacket only.
2	Remove 9.5 mm (3/8") of the jacket. Do not cut the underlying outer braid. 
3	Fold the exposed outer braid back over the jacket. 
4	Remove the outer foil. Do not cut the inner braid under the foil. Fold the inner braid back over the jacket. Do not disturb the inner foil. 
5	Remove 6.35 mm (1/4") of the dielectric and the inner foil. Do not score the center conductor. 

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RG11 cable fabrication procedure, continued

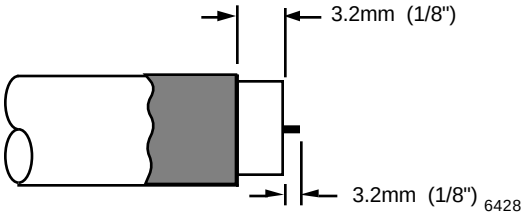
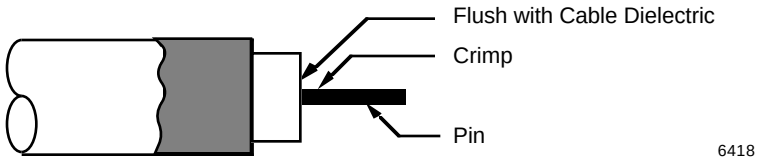
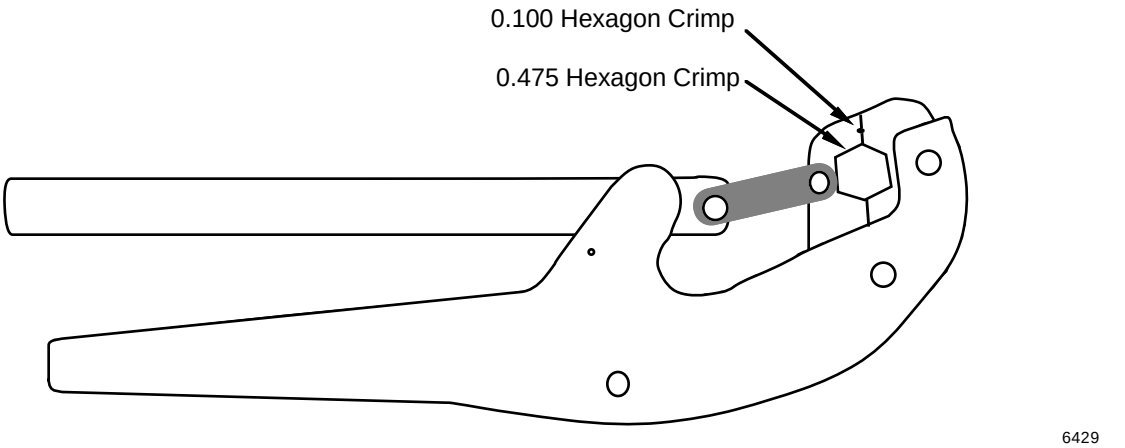
6	Trim the center conductor to 3.2 mm (1/8") beyond the dielectric. Do not distort the circular end of conductor.  Cable preparation is now complete. Next, the separate crimp pin is crimped onto the cable's center conductor. Finally, the connector body will be applied to the cable and crimped. Proceed to steps 7 -11.
7	Push the connector pin over the cable center conductor until flush with the dielectric. Crimp the pin with a 0.10 hexagon crimp (reference: G-CRT-211 crimp tool).  Figure C-5 is an illustration of the crimp tool.

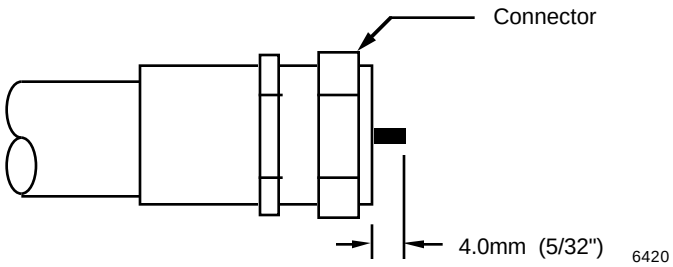
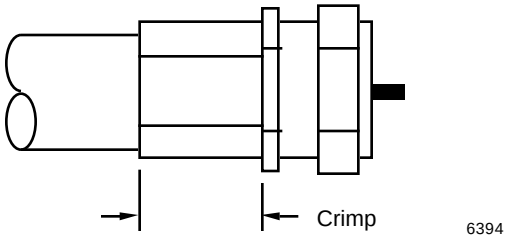
Figure C-5 Model G-CRT-211 Crimp Tool



Continued on next page

C.3 RG11-Type Coaxial Drop Cable Assembly, Continued

RG11 cable fabrication procedure, continued

Step	Action
8	Minimize the thickness of the two folded-back braid layers by straightening and intermingling the strands. This will ease the following application of the connector over the end of the cable and braid.
9	Ensure that the inner foil is still wrapped neatly (flush) around the dielectric. Guide the pin into the insulator inside the connector body. Push the connector onto the cable until the pin protrudes approximately 4.0 mm (5/32") beyond the connector's end and a reasonable stop is felt. The braid shield should not be visible beyond the crimp ring. 
10	Crimp the connector with a 0.475 hexagon crimp (reference: G-CRT-211 crimp tool). 
11	Apply precut adhesive-backed, heat-shrinkable tubing supplied with the connectors in the kit, and an orange (cable A) or brown (cable B) label, also supplied, as illustrated in Figure C-3. Hand tug on the installed connector. Do not exceed 10 lbs pull. Recheck the pin's protrusion in Step 9 above.

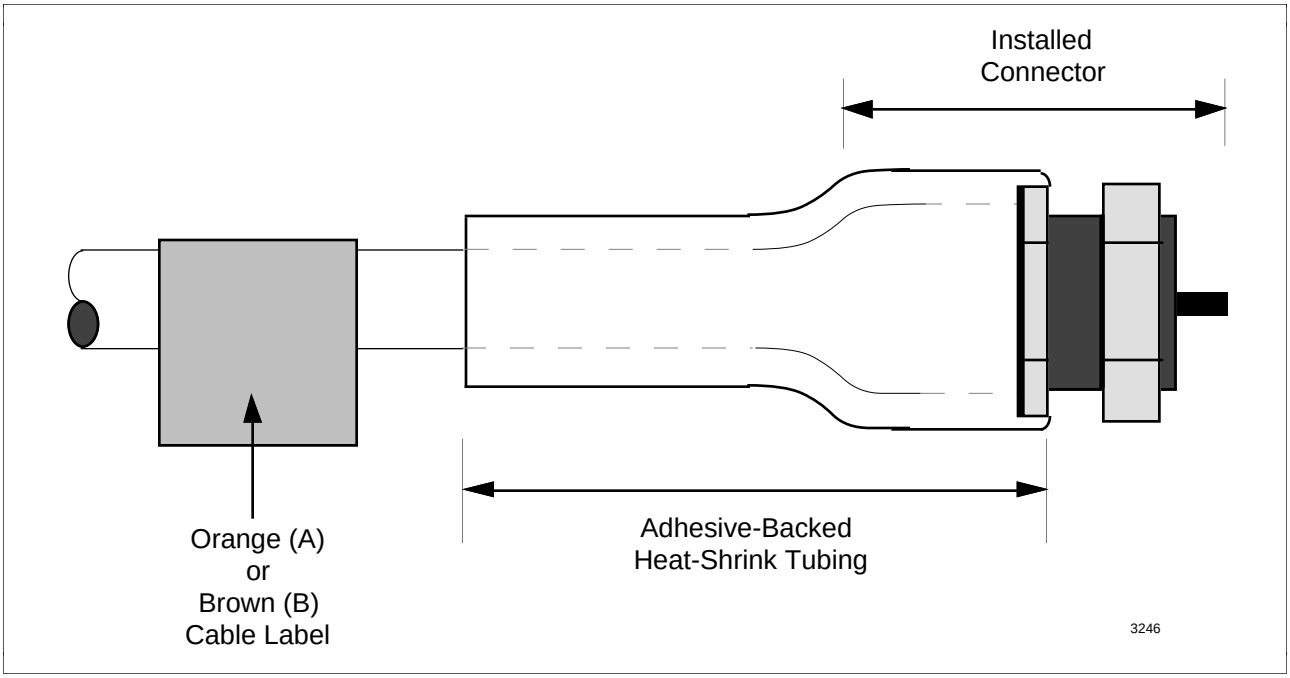
Continued on next page

C.3 RG11-Type Coaxial Drop Cable Assembly, Continued

Application of cable tubing and label

Figure C-6 illustrates the application of heat-shrink tubing and the identification label on the RG11-type cable.

Figure C-6 Application of Heat-Shrink Tubing and Cable Label



Cable testing

Check the finished cable assemblies for proper electrical performance with procedures found in Section 3. Apply plastic protectors, also supplied, to the ends of the finished cable as illustrated in Figure C-3. To prevent damage to the protruding pin, the protectors should remain in place until the cable is installed.

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U, V, W, X, Y, Z

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