

# TERMINATION AND TESTING TECHNICIAN – TTT COMPETENCY REQUIREMENTS



The following is a listing of each topic considered necessary to be included in a course of study directed towards the education to properly terminate, connect, test and troubleshoot IP-enabled voice/data/video cable and devices to each other.

One of the key advantages to using Cat 5e/6/6<sub>A</sub> and fiber optic cables and connectors for electronic security and voice/video/data installations is that these cable-connections can be readily built using the proper tools and techniques, which will be taught in the required course. This part of the training will emphasize the ETA<sup>®</sup> challenge of being vendor-neutral and applying industry standards for terminations and cable performance. The knowledge gained by the examinees will be applicable to any vendor's products within the scope of the technology studied. One of the primary principles of the network cabling standards is that if a cable is properly terminated and tests satisfactory, that cable can be used to connect any proper device from any manufacturer. There are hundreds of vendors making thousands of different IP network devices, any and all of which can be readily connected to a network if the cable to be used is properly terminated and tested.

There are currently thirteen (13) general categories of termination and testing, including both knowledge and hands-on skills. This COMPETENCY listing is the identification of each individual topic, in which the technician must be knowledgeable and skilled.

## 1.0 Physical Security Systems Network Cabling Fundamentals

- 1.1 Describe the general bandwidth requirements of physical security devices
- 1.2 Explain the uses of local area network communications for:
  - 1.2.1 CCTV
  - 1.2.2 Access control
  - 1.2.3 Intercoms
  - 1.2.4 Alarm communications
- 1.3 List the uses of Internet communications for physical security devices and systems

## FIBER:

### 2.0 General Fiber Optics Cabling for Physical Security Systems

- 2.1 Explain the uses of fiber optics for:
  - 2.1.1 Physical security devices
  - 2.1.2 Distance
  - 2.1.3 RF immunity
  - 2.1.4 Existing fibers in buildings and campuses
- 2.2 Describe the differences between multimode and single-mode fiber
- 2.3 Identify the standard optical wavelengths used for fiber optic transmissions
- 2.4 Explain the distance limitations of multimode fiber communications
- 2.5 Describe the various constructions of the following fiber cables:
  - 2.5.1 Loose tube
  - 2.5.2 Tight tube
  - 2.5.3 Distribution cables
  - 2.5.4 Outdoor cables
  - 2.5.5 Jumpers
- 2.6 Explain the National Electrical Code (NEC<sup>®</sup>) ratings for proper usage of specific fiber cable types

### 3.0 Technician Fiber Optic Safety

- 3.1 Describe the hazards of broken fiber pieces
- 3.2 List the eye-dangerous lasers used in some fiber transmission systems
- 3.3 Explain the following proper protection methods and use of safety equipment:
  - 3.3.1 Eye protection
  - 3.3.2 Proper handling of fiber during terminations
  - 3.3.3 Proper disposal of broken fiber pieces

#### 4.0 Fiber Optic Connectors

- 4.1 List the typical fiber connector body styles used in physical security systems:
  - 4.1.1 ST
  - 4.1.2 SC
  - 4.1.3 LC
- 4.2 Explain how “cleave and crimp” connectors are assembled
- 4.3 Describe how mechanical splices are constructed

#### 5.0 CCTV Fiber Transceiver Specifications

- 5.1 Explain the meaning of “62.5/125 $\mu$ m” and “50/125 $\mu$ m” markings on multimode fiber cables
- 5.2 Describe the optical budget ratings for a specific fiber optic transceiver set
- 5.3 Explain the implications of maximum and minimum temperature ratings for fiber optic transmitters and receivers

#### 6.0 Fiber Optic Hands-On Skills Exercises

- 6.1 Demonstrate use of safety equipment
- 6.2 Using proper techniques, the examinee will build a multimode fiber optic jumper that meets accepted industry standards for optical loss. Each examinee’s jumper will be tested using an Optical Loss Test Set (OLTS)
- 6.3 Using proper techniques, the examinee will connect the fiber link they have constructed to a set of fiber optic transceivers to verify the ability of the fiber link to transmit IP video. Fiber Link Functionality Testing.

### COPPER:

#### 7.0 General Copper Network Cabling for Physical Security Systems

- 7.1 Describe the evolutionary path of local area network (LAN) cabling from coaxial to unshielded twisted pair (UTP)
- 7.2 Explain the various types of copper cabling that are in common use today for LAN communications

#### 8.0 Unshielded Twisted Pair Cabling

- 8.1 Explain the basic construction of four-pair UTP cable:
  - 8.1.1 Conductors
  - 8.1.2 Inner jackets
  - 8.1.3 Outer jacket
- 8.2 List the horizontal link maximum distance for UTP LAN cabling as set by the EIA/TIA
- 8.3 Describe the similarities and differences of the following UTP cables:
  - 8.3.1 Cat 3
  - 8.3.2 Cat 5e
  - 8.3.3 Cat 6
  - 8.3.4 Cat 6<sub>A</sub>
  - 8.3.5 Cat 7
  - 8.3.6 Cat 7<sub>A</sub>
  - 8.3.7 Cat 8 (under standards review)
- 8.4 Identify the specific pairs of a standard four-pair UTP cable when used for:
  - 8.4.1 10/100 Megabit Ethernet
  - 8.4.2 1000 Megabit Ethernet
- 8.5 Describe the basic layout of properly designed and installed structured cabling systems:
  - 8.5.1 Desktop
  - 8.5.2 Horizontal
  - 8.5.3 Telecom closet
  - 8.5.4 Backbone
  - 8.5.5 Main cross-connect
- 8.6 Describe the approved usage of special air plenum tie wraps per the NEC<sup>®</sup>
  - 8.6.1 Proper use of tie wraps
  - 8.6.2 Arrangement of cables in trays to reduce interference and cross talk

## **9.0 UTP Connectors**

- 9.1 List the common types of male and female UTP connectors
- 9.2 Explain the proper conductor installation on connectors per the EIA/TIA 568-B standard
- 9.3 Describe the proper tools needed to install and connect UTP male and female connectors
- 9.4 Explain common power problems (surges, sags, outages) and their potential effects on network components
- 9.5 Describe available Internet tools for testing communications
- 9.6 Explain how to find a network's public IP address and the identity of the associated ISP
- 9.7 Describe the methods by which to test network communications for packet loss, latency, and bandwidth
- 9.8 Describe the logical sequences used to solve common network problems

## **10.0 Copper Testers and Troubleshooting**

- 10.1 List the common basic connectivity testers
- 10.2 Explain the differences between basic connectivity testing devices and bandwidth/link quality testers
- 10.3 Describe how to troubleshoot and fix common connector problems

## **11.0 Using Power Over Ethernet (PoE) with Physical Security Devices**

- 11.1 List the IEEE PoE standards in terms of volts and available wattage
- 11.2 Explain the use of PoE Power Sourcing Equipment
- 11.3 Describe the necessary calculations for PoE usage
- 11.4 Explain the use of PoE extension modules and devices

## **12.0 UTP Cat5e Hands-On Skills Exercises**

- 12.1 Examinee will build a functional Cat 5e jumper using one male and one female connector end
- 12.2 The examinee's Cat 5e jumpers must pass a simple connectivity test using a common network tester
- 12.3 Examinee will connect the constructed Cat 5e UTP cables to a network switch and IP camera to verify the ability of the cable to transmit IP video. Cat 5e UTP Functionality Testing.

## **COAXIAL:**

### **13.0 Ethernet Coax Cables for Physical Security Systems/Devices**

- 13.1 List the different types of coaxial copper cables:
  - 13.1.1 RG-6
  - 13.1.2 RG-11
  - 13.1.3 RG-58
  - 13.1.4 RG-59
- 13.2 Explain the differences in various types of coax shielding
- 13.3 Describe the proper tools for coax connector installation
- 13.4 Explain the reasons and methods of testing coaxial cables for resistance and distance as it relates to the transmission of Ethernet and PoE power

## **End of Termination and Testing Technician Competencies Listing (with 13 knowledge categories)**

**Find An ETA® Approved School and Test Site:**

<http://www.eta-i.org/testing.html>

**TTT Additional Study, Reference List:**

***Guide to Networking for Physical Security Systems***; David Engebretson, ISBN# 978-1418073961; Delmar Cengage Learning; 2007; pp304.  
***Technician's Guide to Physical Security Networking: Enterprise Solutions***; David Engebretson, ISBN# 978-1434399915; AuthorHouse; 2008; pp264.  
***Cabling: The Complete Guide to Copper and Fiber-Optic Networking, 5E***; Andrew Oliviero and Bill Woodward, ISBN# 978-1-118-80732-3; Sybex, Inc.; March 2014; pp1284, paperback. {available through ETA at 800-288-3824 or [www.eta-i.org](http://www.eta-i.org)}

**TTT Committee:**

Agard, Rich	(SEPTA)	<a href="mailto:regard@aol.com">regard@aol.com</a>
Bayless, Jim	(ADS Security)	<a href="mailto:jbayless@adssecurity.com">jbayless@adssecurity.com</a>
Coulombe, Ray	(Gilwell Technology Services)	<a href="mailto:ray@gilwelltechnology.com">ray@gilwelltechnology.com</a>
Elsenbroek, Eric	(ADI Systems)	<a href="mailto:eric_elsenbroek@adi-dist.com">eric_elsenbroek@adi-dist.com</a>
Engbretson, Dave	(Slayton Solutions)	<a href="mailto:slaytonsolutions@sbcglobal.net">slaytonsolutions@sbcglobal.net</a>
Gulczynski, Paul	(E. Norman Security)	<a href="mailto:pgulczy@comcast.net">pgulczy@comcast.net</a>
Hassenplug, Jim	(Arlington Security)	<a href="mailto:jhassenplug@arlingtonsecurity.com">jhassenplug@arlingtonsecurity.com</a>
Hayes, Joseph	(All County Security)	<a href="mailto:hayescpp@optonline.net">hayescpp@optonline.net</a>
Joy, Kevin	(American Alarm)	<a href="mailto:kjoy@americanalarm.com">kjoy@americanalarm.com</a>
Moran, Matt	(Sonitrol Pacific, Sound Security)	<a href="mailto:mmoran@soundsecurity.biz">mmoran@soundsecurity.biz</a>

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