

# **EXHIBIT II**

## **Wiring Requirements for New Construction and Renovations**

**Prescott Campus  
Information Technology**



Revision 1.7  
9/20/2005

## **A. Structured Wiring Objectives**

The goal of this document is to have the bidder clearly demonstrate an understanding of standards based structured wiring installations prior to awarding the contract. Implied in an understanding of standards is the requirement to meet these standards during the actual installation work. Embry-Riddle Aeronautical University, (ERAU) specifically Information Technology (IT), seeks to establish a standards based framework that will ensure a high level of quality in its structured wiring infrastructure.

Compliance to all TIA/EIA standards, as defined in this document, is the adherence to both "Mandatory" and "Advisory" criteria as defined in Section 1.5 of TIA/EIA-569-A. Thus, if the bidder chooses not to follow "Advisory" criteria for a particular portion of the project, he is considered to be in non-compliance. Non-compliance to the standards whether resulting from a specific waiver from the Network Team during the site survey or as a result of pragmatic considerations MUST be documented in the bidder's proposal in a required item D.7 Deviations from Standards (see section D. Samples and Required Items below). Failure to document any deviations will be considered a failure to comply with the contract.

The responsibility of the bidder in determining standards compliance includes reviewing any hardware, architectures, and facilities offered/required by this Invitation for Proposal. For example, if section B Project Description (next section) mandates a particular manufacturer's hardware, then the bidder should review the hardware list and determine if any standards called for here have been violated. As noted before, any discrepancies should be noted in required item D.7 Deviations from Standards. The bidder is also responsible for verifying the accuracy of the part numbers before ordering. Finally, the bidder is expected to identify and obtain any tools required to complete the project.

In no case will building codes be violated. Building codes will take precedence over TIA/EIA standards should a conflict arise between the two.

## **B. Project Description**

IT feels a site survey is a necessary part of the Invitation for Proposal. As a result, for sake of simplicity, the project description will be extremely brief so as to allow the bidder to assess his desire to schedule a site survey. Once the site survey is complete, the remainder of this document will serve as the required guidelines for submitting a proposal.

This document includes general information for numerous types of projects (e.g. copper, fiber, etc). As a result, the bidder need only address those items relevant to the project described in this section. For example, if the project only involves horizontal copper installation, the bidder need not concern themselves with the requirements identified for fiber. If the vendor has difficulty determining the relevance of a particular requirement he should contact the Infrastructure Team for clarification.

## **C. Bidder's Description of Project**

IT requires a brief but complete physical description of the installation (from end to end). For example, if J hooks are used to secure cable in a particular part of the installation it should be stated. Drawings may also be included to help in the description but are not required. This information can be included in the required item D.4 Cable Routing Information. Emphasize any design features that impact quality

## **D. Samples and Required Items**

IT requires the following items be included in the proposal. Some items are described in greater detail in various parts of this document. They are consolidated here for ease of reference.

#### **D.1 Sample Cable Test Reports**

A sample test report from a previous installation of the same type will be provided as part of the proposal. The particulars are outlined below in I. Channel Performance and Architectures.

#### **D.2 Complete List of Hardware**

A complete list of hardware (part number, brief description, and manufacturer) will be provided as part of the proposal. If the Invitation for Proposal defines a particular list of hardware (this will generally be the case), the bidder may simply cite the list as a reference.

#### **D.3 Rack\Construction Drawings**

Refer to M. Administration below for further details.

#### **D.4 Cable Routing Information**

An illustration or written description or both showing the routing of cable, cross-connect points, the method of supporting the cable, and the location of outlets to be installed will be provided as part of the proposal. Outside cable plant work should include technical details of the type of conduit (note EIA defines raceway with a circular cross-section as conduit) to be used, along with any inner-duct. Refer to C. Bidder's Description of Project above for additional requirements.

#### **D.5 Project Scope**

A complete list of the number of cables, outlets, patch panels, etc to be installed must be provided as part of the proposal.

#### **D.6 A Section Titled "Examples of Standards Compliance"**

Refer to E. Standards and Manufacturer's Specifications for further clarification.

#### **D.7 A Section Titled "Deviation from Standards"**

Refer to A. Structured Wiring Objective for clarification.

#### **D.8 A Section Titled "Examples of Building Code Compliance."**

Refer to F. Building Codes for further clarification.

#### **D.9 A Section titled "Manufacturer's Instructions".**

Refer to E. Standards and Manufacturer's Specifications for further clarification

#### **D.10 A Section Titled "Cable Issues"**

Refer to H. Physical Limitations for further clarification.

#### **D.11 A Section Titled "Key Issues identified During the Site Survey".**

Any special considerations, commitments, requests that were brought to light during the site survey, should be documented in this section. Refer to J. Pathways and Space and I.5 Channel Performance and Architectures-Backbone Cabling for examples.

#### **D.12 A Section Titled "Certification".**

Refer to L. Qualified Personnel for further clarification.

#### **D.13 A Section Titled "Administrative Samples".**

Refer to M. Administration for further clarification.

#### **D.14 A Section Titled "Begin and Completion Dates"**

A section detailing begin and completion dates will be provided with the proposal.

#### **D.15 A Section Titled "Quality Assurance Program"**

A section briefly detailing your quality assurance methodology will be provided with the proposal.

#### **D.16 A Section Titled "Color Codes for Fiber Optic Cables"**

Refer to I.5 Backbone Cabling for further clarification.

#### **D.17 A Section Titled "Material and Labor"**

A section distinguishing between labor cost and materials cost that make up the total cost of the project. Labor costs must reference the number of estimated hours of labor upon which the labor cost was based. If the project scope entails high voltage work along side structured wiring work, then an additional cost breakdown is required distinguishing between the two efforts.

### **E. Standards and Manufacturer's Specifications**

The work performed for the project must be in compliance with the EIA standards outlined below, unless otherwise noted. The bidder will provide two written examples of how the installation will comply with each of the following standards (16 examples total). The bidder will identify the latest revision of the standard and any new standards that may have recently come out of draft (e.g. TSB-95, TIA 568-A-5) that may be applicable to the project.

TIA/EIA-568-A Commercial Building Telecommunications Cabling Standard

TIA/EIA-569-A Commercial Building Standard for Telecommunications Pathways and Spaces

TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications

TIA/EIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

TIA/EIA-526-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant

TIA/EIA-526-14A Optical Power Loss Measurements of Installed Multi-mode Fiber Cable Plant

TIA/EIA-568-A-1 Propagation Delay and Delay Skew Specification for 100ohm 4-pair Cable

TIA/EIA TSB67 Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems

TIA/EIA-598-A Optical Fiber Cable Color Coding

These 16 examples must be listed in required item D.6 Examples of Standards Compliance. Less than 16 examples can be provided only if the nature of the work is such that it does not call for particular standards. These examples may be very brief in nature (a couple of sentences).

A brief description outlining critical issues of the manufacturer's instructions for installing each type of hardware must be provided in required item D.9 Manufacturer's Instructions. For example, if a particular manufacturer calls for only a ½" untwisting of a cable pair in order to meet a performance specification when terminating at a patch panel, this should be identified as a key point for the panel installation in the D.9 Manufacturer's Instructions.

### **F. Building Codes**

The bidder must identify by document name the source of the building, electrical, and fire codes used to comply with city, county and state laws. Four examples must be provided illustrating how the installation complies with city, county, and state codes. One example should include a review of the fire rating of the cabling used in the project. These examples must be listed in item D.8 Examples of Building Code Compliance.

### **G. Project Description and Terminology**

The bidder should use terminology consistent with TIA/EIA-569-A when discussing various aspects of the proposal. As an example, the following terms should be used to logically categorize various aspects of project.

Horizontal Cabling

Backbone Cabling (Intra or Inter-building)

Work Area

Telecommunications Closets (Transition Point from Backbone to Horizontal)

Equipment Rooms  
Entrance Facilities  
Administration

Note: In most instances Embry-Riddle's architecture consists of a modest IDF (small space in a room serving another function) with a direct backbone connection to MDF. The only rooms that could be classified as an MDF are the server room in Building 49, the PBX room in building 78, and the telecommunications room in F-6 (Flight Line).

## H. Physical Limitations

The bidder will briefly explain how the lengths of the proposed cable run and type of cables are in compliance with the relevant access methods listed below in required item D.10 Cable Issues. For example, maximum db loss per foot must be in compliance for the cable manufacturer's specification and the total end-to-end loss must not exceed the physical layer requirements.

Unless noted otherwise, all pairs for all types of cable will be terminated.

### Physical Layer

10BASE-2  
10BASE-5  
10BASE-T  
10BASE-F  
100BASE-TX  
100BASE-T4  
100BASE-F  
1000BASE-SX  
1000BASE-LX  
ATM Forum OC-3 (e.g. af-uni-0010.002)  
ATM Forum OC-12 (e.g. af-phy-0046.000)  
Fibre Channel

### Cable Type

CAT5E  
Backbone 62.5/125 uM fiber  
    Min bandwidth of 500 MHz-km at 1300 nm and 160 MHz-km at 850  
    Attenuation 3.5/1.0db/dm at 850/1300nm  
Backbone 8.3/125uM fiber  
    Attenuation .4/.3db/km at 1310/1550nm  
Others as required

Any cables or access methods not listed here but considered part of the project should be clearly identified in the required item D.10 Cable Issues.

## I. Channel Performance and Architectures

One hundred percent of all cables installed will be tested and must pass applicable performance criteria. A test report must be submitted upon completion of the project. A relevant sample cable test report should be included as outlined in the required item D.1 Samples Test Report.

### I.1 Horizontal Data UTP Cabling Performance

Datatwist 350 cable is specified in the parts list and is capable of meeting CAT5E performance when matched with the specified termination hardware. Thus all installations will be tested and pass CAT5E standards unless otherwise noted. Draft standards are acceptable if the standard is in draft form prior to the completion of the project. The bidder must submit the name, model number, and software revision of the test equipment that will be used to test for CAT5E performance compliance. A written description or

drawing must also be included in order to clarify at which channel points the test will be performed (e.g. from the outlet to the end of the equipment cable in the telecommunications closet). Refer to TIA/EIA TSB67 for general guidance.

## **I.2 Horizontal Architecture**

Outlets and connecting hardware (i.e. patch panels) will be chosen by IT based on their ability to meet performance specifications required by the channel program called for (i.e. Anixter ALC 6). The general architecture used for horizontal systems is referred to as 'Interconnection' by TIA/EIA-568-A (Fig 7-1). Interconnection is an architecture that allows one patch panel (connecting hardware) with a direct patch cord (equipment cable) from the patch panel to the data networking equipment (common equipment).

In summary, all cabling will be terminated (punched down) at the patch panel and terminated (punched down) at the work area outlet. New installations (new patch panels installed and wall jacks) will be terminated to the **568B** wiring standard. Installations to existing patch panels will require that the bidder determine the standard in use during the site survey. The use of blue colored cabling sheaths and modular jacks is strongly recommended for data UTP cabling.

## **I.3 Horizontal Voice UTP Cabling**

All voice workstation locations will be AVAYA category 5E CMP rated 4-pair cabling. Contractor will run the cable from the workstation location to either the MDF or the IDF. All workstation locations will terminate on a rack mounted category 5E patch panel equipped with horizontal wire management. If a tie cable is used to connect the IDF's to the MDF, they will be terminated on rack mounted category 5E patch panels and labeled accordingly. The same labeling scheme described in section M will be used. All cables will be wire mapped for continuity and documented for pass or fail. All locations will be terminated **568B** (this is the ERAU standard). All voice cables and jack will be white in color.

## **I.4 Horizontal 62.5/125 um Optical Fiber**

IT presently has no implementations of fiber in the Horizontal as allowed by TIA/EIA 569-A.

## **I. 5 Backbone Cabling**

All backbone cabling will be a mix of multi-mode and single mode fiber as called out in section C. Project Descriptions.

The emphasis on keying, labeling and polarization are essential in implementation, as defined in TIA/EIA-568-A sections 12.4.3.3. and 12.7. Link testing should comply with Annex H of TIA/EIA-568-A and the associated standards TIA/EIA-526-14A and TIA/EIA-526-7. At the time of this writing, concern had arisen that TIA-526-14A presented a serious problem when using it to evaluate fiber for IEEE 802.3z compliance. The concern was that 526-14A calls for a LED based test, which is in conflict with the attenuation loss criteria for laser-based 802.3z. The standards body has proposed an interim work around which the vendor must adhere to.

In addition to the required test report, power loss budget calculations are required for all 'like' fiber runs (one calculation for multi-mode of same length, one for all single mode runs of same length, etc) indicating the expected loss of the cable in question. End to end measured loss is required to be within 1.5 db of calculated value. Connector loss cannot be estimated to be greater than 0.5 db for the required calculations.

Exceptions will be made on a case-by-case basis, if it can be shown that the margin of error resulted from connector loss estimates that were too conservative.

The color-coding scheme used for fiber cabling when terminating and connecting fiber to the patch panel shall comply with TIA/EIA-598-A. If the manufacturer's cable does not comply with this standard, then the bidder must provide a suggested color scheme as part of his proposal (required item D15). Since units (fiber tubes) typically contain fiber in multiples of six, only a multiple of 6 will be terminated on a given vertical panel. For example, if a connector panel has 8 positions, only 6 will be terminated. If a panel has 12 position, all twelve from either one or two tubes will be terminated. The sequencing of position numbers shall be based on a vertical sequence from top to bottom of a connector panel. The intent is to facilitate

end-to-end troubleshooting based on tubes associated with a particular vertical panel. Note that ALL fiber strands will be terminated and connected to the patch panel by the bidder.

Finally, fill rate considerations for any fiber pulled through duct should be briefly discussed in the required item D.11 Key Issues Identified During the Site Survey in accordance with TIA/EIA 569-A. Reference the particular section of the standard or any other applicable standard used to determine acceptable fill rates.

### **I. 6 OSP Copper**

All OSP copper will be sized according to the number of ports in the building with room for expansion as called out in section C. Project Descriptions.

The color-coding will follow standards. All OSP copper will be grounded and terminated in lightning protection on each end. The recommended enclosures will be AVAYA 489A type Building Entrance protectors with AVAYA 3C1S Surge Arresters or better on each end of the cable. The protectors will then be terminated in the IDF to a patch panel as described in section I.3. The protectors in the MDF will be terminated on 110 blocks next to the switch tails.

### **J. Pathways and Spaces**

All work within and between buildings must comply with TIA/EIA 569-A, unless otherwise documented in the Invitation for Proposal. If the site survey determines that it would be pragmatic to make the use of existing facilities that are not TIA/EIA compliant, these non-compliant facilities must be identified in the required item D.7 Deviation from Standards.

Any special EMI considerations (TIA/EIA 569-A sec. 10.3) as noted during the site survey should be noted in the required item D.11 Key Issues Identified During the Site Survey. This section should also include fill rates. If major construction is required, such as the construction of an entrance facility or burial of conduit, a technical description should be included in this required section.

Direct burial is not an acceptable method of installing outside cable plant. Instead a minimum requirement of 4" PVC type C (direct burial PVC) is called for when designing inter-building pathway facilities. Since Annex C of TIA/EIA-569-A discusses maintenance hole, hand hole, and pull box issues, a site survey for outside plant work should include a review of these items for compliance with the standard. As noted before, should pragmatic considerations require the use of non-compliance facilities, then they must be documented in the required item D.7 Deviation from Standards.

The TIA/EIA do not provide a complete set of specifications for cable slack. As a result, please describe the amount of slack that will be provided for each type of cable run in the required item D. Cable Issues.

### **K. Grounding and Bonding**

TIA/EIA-607 states that it's primary objective is to provide design guidance for new buildings. A bidder will be required to adhere to TIA/EIA-607 if the room is a new room (no previous installation) or if a room that is already equipped is in compliance with TIA/EIA-607. As an example, if an IDF is grounded and bonded, then any new equipment the bidder installs must also be grounded in accordance with the standards. If on the other hand, an IDF is not grounded and bonded, contractor will assume responsibility for retrofitting the room. It is essential that if the room is new (i.e. the first telecommunications project) then the proposal should include establishing a compliant grounding and bonding system.

### **L. Qualified Personnel**

The bidder must employ at least one Registered Communications Distribution Designer (RCDD) who is certified by The Building Industry Consulting Service International (BICSI).

If the project involves fiber installation, the bidder must provide proof of installation training provided by the cable manufacturer or certification recognized as an acceptable substitute by the manufacturer.

Projects involving copper only installation require the bidder provide certification of structured wiring training for at least one individual who will be in a supervisory role full time on site.

The name of this individual must be included. Proof of training/certification/RCDD must be provided in the required item D.12 Certification.

## **M. Administration**

Documentation is considered a critical item for the management of a cabling infrastructure. TIA/EIA-606 provides guidance for the administrative aspects of building cabling infrastructure. Section 3.4 outlines a suggested naming convention that has been adopted by IT and refined for the CABLE and BACKBONE CABLE codes CXXX and CBXXX. The CABLE code CXXX will use the following methodology. For horizontal wiring the code will be extended to as many digits as needed based on the rule illustrated below.

### **C-RM-J**

RM represents room number of the work area. J represents the jack position and takes the value of A, B, C, and so on. All patch panel appearances must be labeled in accordance with the methodology outlined here. All face plates (outlets) must also be labeled. Thus the third outlet in room 512 with four terminations would have cables labeled as C-512-I, C-512-J, C-512-K, C-512-L. If the room has more than 26 wired ports the pattern starts over again at AA, BB, CC.

Note that section 6.2.2.1 of TIA/EIA-606 calls for all cables to be labeled at each end.

Backbone fiber will be labeled as described below.

### **CB-B1-RM1-B2-RM2-#F-LGTHM-**

B1 is short for building 1 and will be the shorthand building name (e.g. LB for Lehman) at one end of the cable termination point. RM1 is the room number in which the cable terminates of building 1. B2 is the other building at which the cable terminates, in room RM2. #F is the fiber count. The count should be defined by mode and core diameter. For example 12SM9/24MM62 (i.e. 12 strands of single mode 9 um core with 24 multi-mode with 62.5 um core. LGTHM is the length of the run in meters.

All labeling color schemes should comply with section 8 of TIA/EIA-606.

The preferred format for administrative documents is Microsoft Word for text based items and for graphic based items the desired format is Visio. Please stipulate the format that will be used in the proposal. A sample (from a similar project) of all types of documents that fall under TIA/EIA-606 will be provided at the close of the project must be supplied as part of the proposal. This can be addressed in the required item D.13 Administrative Samples.

Any project involving the installation of rack equipment or significant construction (e.g. construction of an entrance facility) must include drawings illustrating the layout or construction of the facility. These drawings should be referenced in the required item D.3 Rack/Construction Drawings.

## **N. Part Specifications**

The Embry-Riddle IT department will approve all parts used prior to installation. The use of AVAYA/SystiMax products and SystiMax CAT5E cabling is specified for new construction. Equivalent parts and materials can be substituted only with prior authorization by the Embry-Riddle IT department. Please see Exhibit I for recommended parts.

**O. Bidder Concerns**

We encourage the bidder to address any concerns he may have with the Invitation for Proposal during the site survey.

**Exhibit I (IT Recommended Infrastructure Parts)**

**01/11/2005**

<b>Name</b>	<b>Manufacture</b>	<b>Product</b>	<b>Material ID</b>	<b>Color</b>	<b>Application</b>
Power Sum Data Cable	Avaya / Systimax	1061004CBL	106 871 809	Blue	cat5e Blue 1000ft box of Cable for DATA
Power Sum Telco Cable	Avaya / Systimax	1061004CWH	107 147 787	White	cat5e White 1000ft box of Cable for VOICE
Power Sum Category 5e Jacks	Avaya / Systimax	MPS100E-318	108 232 778	Blue	Data Jacks
Power Sum Category 5e Jacks	Avaya / Systimax	MPS100E-262	108 232 745	White	Voice Jacks
Single-Gang 1-port	Avaya / Systimax	M10L-262	108 258 427	White	Wall plate for standard drop
Single-Gang 2-port	Avaya / Systimax	M12L-262	108 168 469	White	Wall plate for standard drop
Single-Gang 3-port	Avaya / Systimax	M13L-262	108 168 501	White	Wall plate for standard drop
Single-Gang 4-port	Avaya / Systimax	M14L-262	108 168 543	White	Wall plate for standard drop
Single-Gang 6-port	Avaya / Systimax	M16L-262	108 168 576	White	Wall plate for standard drop
Blank Snap Fit Module / Dust Cover (100-Pack)	Avaya / Systimax	M21AP-262	107 067 928	White	Blank or Jack Dust Cover for empty hole in wall plate color to match
Blank Snap Fit Module / Dust Cover (500-Pack)	Avaya / Systimax	M21A-262	108 066 465	White	Blank or Jack Dust Cover for empty hole in wall plate color to match
Icon System (500-Pack)	Avaya / Systimax	M61H-318	108 373 606	Blue	Computer icon for blue data jacks
Icon System (500-Pack)	Avaya / Systimax	M61F-262	108 266 283	White	Telephone Icon for white Voice Jacks
Surface Mounted Boxes	Avaya / Systimax	M104SMB-262	107 952 459	White	4 - port Surface Mounted Box
Category 5e Patch Cable 3ft	Avaya / Systimax	D8PS-BL-3ft		Blue	3ft Patch Cable for Data
Category 5e Patch Cable 5ft	Avaya / Systimax	D8PS-BL-5ft		Blue	5ft Patch Cable for Data
Category 5e Patch Cable 7ft	Avaya / Systimax	D8PS-BL-7ft		Blue	7ft Patch Cable for Data
Category 5e Patch Cable 9ft	Avaya / Systimax	D8PS-BL-9ft		Blue	9ft Patch Cable for Data
Category 5e Patch Cable 14ft	Avaya / Systimax	D8PS-BL-14ft		Blue	14ft Patch Cable for Data
Category 5e Patch Cable 3ft	Avaya / Systimax	D8PS-WH-3ft		White	3ft Patch Cable for Voice
Category 5e Patch Cable 5ft	Avaya / Systimax	D8PS-WH-5ft		White	5ft Patch Cable for Voice
Category 5e Patch Cable 7ft	Avaya / Systimax	D8PS-WH-7ft		White	7ft Patch Cable for Voice
Category 5e Patch Cable 9ft	Avaya / Systimax	D8PS-WH-9ft		White	9ft Patch Cable for Voice
Category 5e Patch Cable 14ft	Avaya / Systimax	D8PS-WH-14ft		White	14ft Patch Cable for Voice
Category 5e Patch Panels 24-Port	Avaya / Systimax	1100PSCAT5E-24	108 208 919	N/A	24-Port Patch panel for Cable Termination
Category 5e Patch Panels 48-Port	Avaya / Systimax	1100PSCAT5E-48	108 208 935	N/A	48-Port Patch panel for Cable Termination
Category 5e Patch Panels 96-Port	Avaya / Systimax	1100PSCAT5E-96	108 208 950	N/A	96-Port Patch panel for Cable Termination
Fused Telco Protectors	Avaya / Systimax	110ANA1-25	105 736 490	N/A	25 - Pair fused Lightning Protector for Telco Fuses sold separately
Fused Telco Protectors	Avaya / Systimax	489ACSI-025	107 895 039	N/A	25 - Pair fused Lightning Protector for Telco Fuses sold separately
Fused Telco Protectors	Avaya / Systimax	489ACSI-050	107 895 047	N/A	50 - Pair fused Lightning Protector for Telco Fuses sold separately
Fused Telco Protectors	Avaya / Systimax	489ACSI-100	107 895 070	N/A	100 - Pair fused Lightning Protector for Telco Fuses sold separately
Fused Telco Protectors	Avaya / Systimax	489ACSI-200	107 895 088	N/A	200 - Pair fused Lightning Protector for Telco Fuses sold separately
Surge Arrester	Avaya / Systimax	3C1S	105 514 756	N/A	Surge Arrester for Protector 1 per pair