ANSI E1.27-2 – 2009 (R2014)

Entertainment Technology— Recommended Practice for Permanently Installed Control Cables for Use with ANSI E1.11 (DMX512-A) and USITT DMX512/1990 Products

Document number CP/2006-1011r5.1a

This document was approved as an American National Standard by the ANSI Board of Standards Review on 9 June 2014. It is a reaffirmation of the 2009 edition, CP/2006-1011r5.1.

This standard was originally published when the Entertainment Services and Technology Association was operating under the name of PLASA North America.
ESTA has reverted to its original name, and this document has been rebranded with the current corporate name and logo. No changes have been made to the contents of the standard.

[intentionally blank page]

NOTICE and DISCLAIMER

ESTA does not approve, inspect, or certify any installations, procedures, equipment or materials for compliance with codes, recommended practices or standards. Compliance with a ESTA standard or an American National Standard developed by ESTA is the sole and exclusive responsibility of the manufacturer or provider and is entirely within their control and discretion. Any markings, identification or other claims of compliance do not constitute certification or approval of any type or nature whatsoever by ESTA.

ESTA neither guarantees nor warrants the accuracy or completeness of any information published herein and disclaims liability for any personal injury, property or other damage or injury of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the publication, use of, or reliance on this document. In issuing and distributing this document.

In issuing this document, ESTA does not either (a) undertake to render professional or other services for or on behalf of any person or entity, or (b) undertake any duty to any person or entity with respect to this document or its contents. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstance.

Published by:

Entertainment Services and Technology Association
630 Ninth Avenue, Suite 609
New York, NY 10036
USA
Phone: 1-212-244-1505
Fax: 1-212-244-1502
standards@esta.org

The ESTA Technical Standards Program

The ESTA Technical Standards Program was created to serve the ESTA membership and the entertainment industry in technical standards related matters. The goal of the Program is to take a leading role regarding technology within the entertainment industry by creating recommended practices and standards, monitoring standards issues around the world on behalf of our members, and improving communications and safety within the industry. ESTA works closely with the technical standards efforts of other organizations within our industry, including USITT and VPLT, as well as representing the interests of ESTA members to ANSI, UL, and the NFPA. The Technical Standards Program is accredited by the American National Standards Institute.

The Technical Standards Council (TSC) was established to oversee and coordinate the Technical Standards Program. Made up of individuals experienced in standards-making work from throughout our industry, the Council approves all projects undertaken and assigns them to the appropriate working group. The Technical Standards Council employs a Technical Standards Manager to coordinate the work of the Council and its working groups as well as maintain a “Standards Watch” on behalf of members. Working groups include: Control Protocols, Electrical Power, Floors, Fog and Smoke, Followspot Position, Photometrics, Rigging, and Stage Lifts.

ESTA encourages active participation in the Technical Standards Program. There are several ways to become involved. If you would like to become a member of an existing working group, as have over four hundred people, you must complete an application which is available from the ESTA office. Your application is subject to approval by the working group and you will be required to actively participate in the work of the group. This includes responding to letter ballots and attending meetings. Membership in ESTA is not a requirement. You can also become involved by requesting that the TSC develop a standard or a recommended practice in an area of concern to you.

The Control Protocols Working Group, which authored this Standard, consists of a cross section of entertainment industry professionals representing a diversity of interests. ESTA is committed to developing consensus-based standards and recommended practices in an open setting.

Contact Information

Technical Standards Manager

Karl G. Ruling
Entertainment Services and Technology Association
630 Ninth Avenue, Suite 609
New York, NY 10036
USA
1-212-244-1505
karl.ruling@esta.org

Assistant Technical Standards Manager

Erin Grabe
Entertainment Services and Technology Association
630 Ninth Avenue, Suite 609
New York, NY 10036
USA
1-212-244-1505
erin.grabe@esta.org

Technical Standards Council Chairpersons

Mike Garl
Mike Garl Consulting LLC
1-865-389-4371
mike@mikegarlconsulting.com

Mike Wood
Mike Wood Consulting LLC
1-512-288-4916
mike@mikewoodconsulting.com

Control Protocols Working Group Chairperson

Michael Lay
Philips Color Kinetics
3 Burlington Woods Drive
Burlington, MA 01803
USA
1-781-418-9145
michael.lay@philips.com

Acknowledgments

The Control Protocols Working Group members when this document was approved by the working group on 1 May 2014 are shown below.

Voting members:

Daniel W. Antonuk; Electronic Theatre Controls, Inc.; MP
Robert Bell; Acuity Brands Inc.; MP
Marcus Bengtsson; LumenRadio AB; MP
Scott M. Blair; Full Throttle Films/ VER; DR
Milton Davis; Doug Fleenor Design, Inc.; MP
Casey Diers; DesignLab Chicago, Inc.; DR
Gary Douglas; Acuity Brands Inc.; MP
Doug Fleenor; Doug Fleenor Design, Inc.; MP
Howard Forryan; Harting KGAA; G
Garrett Gallant; Acuity Brands Inc.; MP
Ed Garstkiewicz; Harting KGAA; G
Robert Goddard; Goddard Design Co.; MP
Dennis Grow; I.A.T.S.E. Local 728; U
Mitch Hefter; USITT; U
Jeremy Hochman; Full Throttle Films/ VER; DR
John Huntington; I.A.T.S.E. Local 1; U
Tyrone Mellon_Jr.; Lex Products Corp.; CP
Michael Karlsson; LumenRadio AB; MP
Hyun Jong Kim; Electronics and Telecommunications Research Institute; G
Peter Kirkup; LumenRadio AB; MP
Paul Kleissler; City Theatrical, Inc.; MP
Edwin S. Kramer; I.A.T.S.E. Local 1; U
Ulrich Kunkel; DIN, NVBF Committee; U
Roger Lattin; I.A.T.S.E. Local 728; U
Hans Lau; LumenRadio AB; MP
Michael Lay; Royal Philips; MP
Sang-Kyu Lim; Electronics and Telecommunications Research Institute; G
Joshua Liposky; Lex Products Corp.; CP
Kevin Loewen; Acuity Brands Inc.; MP
Simon Newton; Open Lighting Project; G
Maya Nigrosh; Electronic Theatre Controls, Inc.; MP
Philip Nye; Acuity Brands Inc.; MP
Kimberly Corbett Oates; Schuler Shook; DE
Edward A. (Ted) Paget; Daktronics Inc. ; G
Jason Potterf; Cisco; MP
Charles Reese; Production Resource Group; DR
Alan M. Rowe; I.A.T.S.E. Local 728; U
Larry Schoeneman; DesignLab Chicago, Inc.; DR
Eckart Steffens; Soundlight, the DMX Company; CP
Steve Terry; Electronic Theatre Controls, Inc.; MP
Ken Vannice; Ken Vannice LLC; G
Peter Willis; Howard Eaton Lighting Ltd.; CP

Observer (non-voting) members: Simon Alpert; Lighttech Event Technologies; CP
Klaus Amling; Licht-Technik; MP
Matthew Ardine; IATSE Local 728; U
Avraham Mendall Mor "Avi"; Lightswitch; U
Robert Barbagallo; Solotech Inc.; U

Paul Beasley; Walt Disney Company; U
BenDarrington; Wireless Solutions Sweden AB; MP
Adam Bennette; Electronic Theatre Controls, Inc.; MP
David Bertenshaw; David Bertenshaw; G
Stephen Bickford; T. Kondos Associates; U
Torrey Bievenour; Vision Quest Lighting; G
Lee J. Bloch; Bloch Design Group, Inc.; G
David A. Boller; Organic Machines LLC; CP
Ron Bonner; PLASA EU; G
André Broucke; André Broucke; G
Ken Bruns; Lumenpulse Lighting Inc.; MP
John (Javid) D. Butler; Integrated Theatre, Inc.; CP
Justyn Butler; JBOTS; CP
Jean-Francois Canuel; A.C. Lighting Ltd.; CP
Steve Carlson; High Speed Design, Inc.; MP
Nyasha Chigwamba; Rhodes University; U
Sang-Il Choi; Kyungpook National University; G
Soo-Myong Chung; Bloch Design Group, Inc.; G
Paul J. Clark; HxDx; CP
Edward R. Condit; Edward R. Condit; G
Fraser Connolly; Artistic Licence Holdings; DE
Eric Cornwell; West Side Systems; U
Stuart Cotts; Oregon Shakespeare Festival; U
Klas Dalbjorn; TC Group; MP
Jeremy Day; Royal Philips; MP
Gilray Densham; CAST Group Inc; MP
Gary Dove; Dove Systems; MP
Yongshun Duan; Macostar International Ltd.; CP
Hamish Dumbreck; James Embedded Systems Engineering; MP
Lauren E. Dunn; Lauren E. Dunn (Larry); DE
Jerry Durand; Durand Interstellar, Inc.; CP
James Eade; PLASA EU; G
Andrew Eales; Rhodes University ; U
Bill Ellis; Candela Controls, Inc.; U
Paul K. Ericson; Sparling & IES; DE
Jon R. Farley; Sixteenth Avenue Systems; CP
Martin Farnik; Robe Show Lighting s.r.o.; MP
Trevor Forrest; Helvar Lighting Control; MP
Steve Friedlander; Auerbach Pollock Friedlander; U
Jerry Gorrell; Theatre Safety Programs; G
Tom Grimes; Barco; MP
Josh Gubler; Josh Gubler; CP
Rob Halliday; Rob Halliday; U
Sean Harding; High Output, Inc.; G
Douglas Heriot; Douglas Heriot; MP
Bill Hewlett; Hewlett Electronics; CP
Helge Hoffmann; JB Lighting; MP
Jim Holladay; Luxence; G
Wayne David Howell; Artistic Licence Holdings; DE
Sierk Janszen; Ground Zero; U
Eric Johnson; Eric Johnson; G
Rob Johnston; Interactive Technologies, Inc.; MP
Ed Jones; Edwin Jones Co., Inc.; CP
Jussi Kallioinen; Eastway Sound & Lighting; U
Tae Gyu Kang; Electronics and Telecommunications Research Institute; G

Reza Khanmalek; A.C. Lighting Ltd.; CP
Hiroshi Kita; Marumo Electric Co., Ltd.; MP
Phil Klapwyk; IATSE Local 891; U
Mark T. Kraft; Lehigh Electric Products Co.; MP
Jason Kyle; JPK Systems Ltd.; MP
Rick Leinen; Leviton Manufacturing Co., Inc.; MP
Hans Leiter; Electronic Theatre Controls, Inc.; MP
Jon Lenard; Applied Electronics; MP
Maarten Lepelaars; eldoLED; MP
Mark Manthei; Shure Inc.; G
Paul F. Mardon; Pulsar Ltd.; MP
Mick Martin; ShowCAD Control Systems; MP
Paul Kenneth McEwan; Cooper Controls Ltd.; MP
John Mehltretter; Lehigh Electric Products Co.; MP
Jeff T. Miller; Walt Disney Company; U
John Musarra; John Musarra; U
Tobin Neis; Barbizon Companies; DR
Dan T. Nguyen; LynTec; MP
Lars F. Paape; Scientific Algorithms and Embedded Systems; U
Ben Peoples; Pittsburgh Hoist & Sandbag Company; CP
Gary Pritchard; LSC Lighting Systems PTY Ltd; MP
Gordan Rancic; Phoenix Service srl; MP
Torben Kaas Rasmussen; Martin Professional A/S; G
Charlie Richmond; Richmond Sound Design Ltd.; CP
Bernardo Benito Rico; Ben-Ri Electronica S.A.; MP
Steve Roberts; Carr & Angier; G
Erwin Rol; Erwin Rol; G
Dietmar Rottinghaus; Connex GmbH; MP
Richard Salzedo; Avolites Ltd.; MP
Yngve Sandboe; Sand Network Systems, Inc.; MP
Martin Searancke; Dream Solutions Ltd.; MP
Chuck Seifried; City of Phoenix; U
John Sellers; AIM Northwest; G
Andrew Sherar; Lightmoves PLC; MP
Yehuda Shukram; Compulite Systems; MP
Sean Sill; Open Lighting Project; DE
Storm K. Staley; Stormwerx; U
Ralph Stillinger; Royal Philips; MP
Bart Swinnen; Luminex LCE; MP
Arnold Tang; Arnold Tang Productions; U
Geoffrey O. Thompson; IEEE 802.3/Nortel Networks; G
Christopher Tilton; Westlake Reed Leskosky; DE
Robert Timmerman; Royal Philips; MP
David Timmins; Jands Electronics; MP
Victoria Tisdale; Google Summer of Code 2013; G
J. B. Toby; Avolites Ltd.; MP
Bob Toms; Catalyst Microsystems LLC; G
Robert Tooker; Robert Tooker; U
Tad Trylski; Tad Trylski; U
Stephen J. Tyrrell; Quantum Logic; MP
Tracy Underhill; 4U Consulting; G
Steve Unwin; Pulsar Ltd.; MP
Samuli Valo; Picturall Ltd.; MP
Carlo Venturati; Clay Paky S.P.A.; MP
Will Wagner; Carallon Ltd.; MP

Oliver Waits; Avolites Ltd.; MP
John Warwick; Royal Philips; MP
Colin Waters; TMB; DR
Ralph Weber; ENDL Texas; G
Lars Wernlund; Lewlight; MP
Michael (Mike) Whetstone; Integrated Theatre, Inc.; CP
Loren Wilton; Showman Systems; CP
Barbara Wohlsen; Barbara Wohlsen; U
C. S. Wong; Macostar International Ltd.; CP
Jiantong Wu; Beijing Special Engineering Design & Research Institute; G
Kehang Wu; Shure Inc.; G
David Yellin; LightMinded Industries, Inc.; MP
Larry Zoll; Zoll Design & Consulting, LLC; U

Interest category codes:
CP = Custom-market Producer
DE = Designer
DR = Dealer or Rental company
G = General interest
MP = Mass-market Producer
U = User

Table of Contents

Foreword

(This foreword is not a normative part of ANSI E1.27-2–2009.)

This recommended practice describes the types of permanently installed cable used to interconnect products that comply with ANSI E1.11-2004, Entertainment Technology – USITT DMX512-A: Asynchronous Serial Digital Data Transmission Standard for Controlling Lighting Equipment and Accessories, or that comply with USITT DMX512/1990.

In 2003, the Control Protocols Working Group of ESTA's Technical Standards Program authorized the formation of a DMX512 Cabling Task Group. Writing an American National Standard that would be a recommended practice for permanently installed cables was one of the projects assigned to this task group. This document is the result.

Task Group Chair: John David Butler, Integrated Theatre.

Additional Task Group Members
Tim Bachman, ACT
Milton Davis, Doug Fleenor Design
Mitch Hefter, Entertainment Technology
Peter Willis, Howard Eaton Lighting Limited

1 General

1.1 Scope

This Recommended Practice is intended to provide for maximum interoperability in the use of equipment connected in permanently installed entertainment lighting applications. To accomplish this intent the Recommended Practice defines acceptable cable and connector types, and the ways in which they may be used.

Entertainment lighting uses both EIA-485/EIA-485-A and EIA/TIA-568 Category 5 and higher cabling systems for data connection between equipment. There are significant differences between the two cables. In order to avoid confusion arising from the differences in specification of the two cable types this Recommended Practice has separate sections for cables designed specifically for EIA-485 signals and Category 5 and higher cable.

Category 5 cable is also known as Class D cable under ISO/IEC standard 11801. Research by the ESTA CPWG determined that Category 5, 5e, 6, and 6a cables would all be suitable for use with DMX512. Since control over future revisions of ANSI/EIA/TIA-568 and ISO/IEC 11801 is beyond the scope of this Recommended Practice, ANIS/EIA/TIA-568 Category cables shall be the controlling standard with respect to future developments. Cable, Equipment, and System Manufacturers, and Engineers, System Integrators, and Installers subject to ISO/IEC standards should consider references to Category 5 or higher cable as referencing comparable cable described by ISO/IEC standards.

This Recommended Practice applies to entertainment lighting systems that are permanently installed, regardless of the nature of the facility. Connection of portable and temporary equipment are not covered by this Recommended Practice, and applications that may limit the interoperability of entertainment lighting control systems for the sake of cost are also beyond the scope of this Recommended Practice. Connection of proprietary control systems, which may co-exist with equipment covered by this Recommended Practice, is also beyond the scope of this Recommended Practice.

1.2 Appropriate uses

This Recommended Practice is intended for those involved in the design, manufacture, installation, and use of entertainment lighting systems.

1.3 Compliance

Compliance with this Recommended Practice is strictly voluntary and the responsibility of the Specifier, System Manufacturer and installer. Disclosures and identification or other claims of compliance do not constitute certification or approval by ESTA. See clause 7 for disclosure requirements.

1.4 Local Requirements and Regulations

Cabling installations covered by this Recommended Practice are frequently also covered by local regulations which may place restrictions on cable construction, connection or installation for reasons of safety, electromagnetic compatibility or other reasons. Such local regulations may be statutory requirements or may be included in the system specification. All such regulations are entirely beyond the scope of this Recommended Practice and compliance with this Recommended Practice has no bearing on compliance with any other such requirements.

2 Normative references

ANSI/TIA/EIA-568-B-2001	Commercial Building Telecommunications Cabling Standard
ANSI/TIA/EIA-568-B.2-1-2002	Commercial Building Telecommunications Cabling Standard - Part 2 - Addendum 1 - Transmission Performance Specifications for 4-Pair 100 Ohm Category 6 Cabling

ANSI/TIA/EIA-485-A-1998 Electrical Characteristics of Generators & Receivers for Use in Balanced Digital Multipoint Systems

This standard will be referred to as EIA-485-A in this document.

Electronics Industries Alliance
2500 Wilson Boulevard
Arlington , VA 22201-3834 USA
+1-703-907-7500
http://www.eia.org/

Telecommunications Industry Association
2500 Wilson Blvd., Suite 300
Arlington, VA 22201 USA
+1-703- 907-7700 fax: +1-703-907-7727
http://www.tiaonline.org/

Note: EIA-485-A is compatible with: ISO/IEC 8482:1993 Information Technology - Telecommunications and information exchange between systems - Twisted pair multipoint interconnections.

IEEE 802.3 CSMA/CD Access Method and Physical Layer Specifications

Secretary, IEEE-SA Standards Board
445 Hoes Lane
Piscataway, NJ 08854
USA
http://standards.ieee.org/getieee802/802.3.html

ISO/IEC 11801-2002 Information technology - Generic cabling for customer premises

IEC
International Electrotechnical Commission
PO Box 131
3 rue de Varembe
CH-1211 Geneva 20
Switzerland
+41 22 919 02 11
www.iec.ch

ISO
International Organization for Standardization
1, Rue de Varembe
Case Postale 56
CH-1211 Geneva 20
Switzerland
+41 22 74 901 11
www.iso.ch

USITT DMX512/1990 Digital Data Transmission Standard for Dimmers and Controllers

USITT
315 South Crouse Avenue, Suite 200
Syracuse, NY 13210
USA
+1-800-938-7488 +1-315-463-6463 Fax +1-315-463-6525

http://www.usitt.org

ANSI E1.11-2004 - Entertainment Technology - USITT DMX512-A - Asynchronous Serial Digital Data Transmission Standard for Controlling Lighting Equipment and Accessories

ANSI E1.20-2006-Remote Device Management

Entertainment Technology and Services Association
630 Ninth Avenue, Suite 609
New York, NY 10036
USA
+1-212-244-1505 Fax +1-212-244-1502
http://www.esta.org/

3 Definitions

3.1 Access Controlled: A location secured through use of a door, gate, or other physical means to ensure that only persons allowed to adjust equipment have access to it.

3.2 Cable Manufacturer: Any individual or company who manufactures cable and or cable assemblies.

3.3 Category 5 or higher: As of the date of publication of this Recommended Practice, this includes ANSI/EIA/TIA-568 Category 5, 5e, 6, and 6a and their comparable cables as defined by ISO/IEC standards. Cables of similar construction and designed for similar application defined by future revisions of ANSI/EIA/TIA-568 are also included in this definition.

3.4 Circuit common: The common reference (zero volt supply) of the transmitter or receiver circuitry.

3.5 Common: see Data Link and Circuit Common, also known as Signal Common

3.6 Data link: The physical connection between transmitting and receiving devices.

3.7 Data link common: The connection to circuit Common at the point of interconnection of the product.

3.8 Data link segment: The part of a data link between any two devices on that link.

3.9 Earth ground: The common, zero potential available from the mains electricity supply and usually connected to the metal chassis of equipment. Earth Ground is referred to as Earth in Europe and Ground in the USA.

3.10 Equipment Manufacturer: Any individual or company who designs, produces or supplies devices connecting to cabling systems.

3.11 Isolated: A circuit topology in which the output is completely electrically disconnected from the input.

3.12 Readily Accessible: Equipment or parts or equipment that may be accessed by users without the use of tools.

3.13 Receiver (receiving device): A piece of equipment that accepts a signal.

3.14 Specifier: An individual or organization responsible for determining equipment and connection of equipment for a given installation.

3.15 System Manufacturer: Any individual or company who produces installation drawings of systems as well as some or all of the equipment used in the systems.

3.16 System Integrator: Any individual or company who primarily produces the installation drawings of systems and not the equipment used in the systems

3.17 Termination (electrical): The use of a terminator at the end of a data link.

3.18 Termination (physical): The connection of a wire to a device.

3.19 Terminator: A device that is designed to minimize unwanted signal reflections on a data link.

3.20 Transmitter (transmitting device): A piece of equipment that produces a signal.

3.21 User Connection Point: A part of a system where ends users may readily connect to a data link.

4 Cable types

In permanent installations, DMX512-A cables may be either one of two basic cable types: cables specified for use with EIA-485/EIA-485-A or EIA-422, and cables specified as EIA/TIA568 Category 5 or higher.

Considerations for systems using both cable types are detailed in Clause 6.

DMX512-A defines types of Enhanced Functionality that use bidirectional communication. Systems intended for use with EF protocols should use cables with consistent characteristics throughout the system.

4.1 EIA-485 cable

Cable should be of a type designed for EIA-485/EIA-485-A or EIA-422 applications. Some cables designed for digital data applications other than EIA-485 may be acceptable, as determined by the cable characteristics described in 4.1.1 through 4.1.3.
Cables should be fully specified by the Cable Manufacturer for all characteristics described in 4.1.1 through 4.1.3.

4.1.1 Construction

Cable should consist of a twisted conductor pair or pairs, with shielding of individual pairs or overall shielding of multiple pairs, or both. Cables incorporating individually shielded pairs should have the shields insulated from each other. Cables with an integral drain wire are preferred. Cables of any type with an integral drain wire are preferred over those without an integral drain wire.

4.1.2 Impedance

The characteristic impedance of each conductor pair used for data transmission should be within the range of 100 to 120 ohms. Due to the characteristic impedance of 120 Ohms in EIA-485 systems, 120 Ohms is preferred.

4.1.3 Capacitance

Capacitance between conductors within a shield should not exceed 65 pF/m (19.8 pF/ft). Capacitance between any conductor and the shield should not exceed 115 pF/m (35 pF/ft).

4.2 Category cable

As stated in Clause 1 and defined in Clause 3, references to Category cable include equivalent Class cables as defined by ISO/IEC standards.

Category cable should meet the requirements of at least EIA/TIA-568 Category 5. Category cable meeting the requirements of a category higher than Category 5 is permissible. Note: the nominal impedance of

these cables when used at DMX512 transmission speeds is 115 Ohms, making for a trivial impedance mismatch with cables described in clause 4.1 operated at the same data rates.

Requirements for specific voltage ratings, insulation types, jacket materials and other characteristics vary with location and application, and are beyond the scope of this Recommended Practice. Installations complying with this Recommended Practice should comply with local requirements.

5 Connectors

5.1 User connection points

Five-pin XLR connectors should be used for all user connection points, with the exception of Patch Bays as defined by E1.11 and described in 5.1.1. Other connector types should not be used. Connection points for controllers and other transmitting devices should utilize male connectors. Connection points for receiving devices should utilize female connectors.

5.1.1 Allowable use of RJ-45 Patch Bays

RJ-45 Patch Bays should comply with all of the applicable requirements of E1.11, and the use of a Patch Bay with RJ-45 connectors that complies with E1.11-2004 Clause 7.3 does not relieve the system specifier or installer from the requirement to use 5-pin XLRs for all other user connection points. Patch Bays are generally located in an access controlled equipment room to provide the ability to cross-connect a large number of data links without buffering, and should not be used for direct connection of portable equipment.

5.1.2 Electromagnetic Emissions from RJ-45 Patch Bays

Local regulations may require the use of RJ-45 connectors which provide for uninterrupted shielding. See 1.4.

5.1.3 Alternate Connectors

Since even the smallest commonly available junction boxes are of sufficient size to accommodate a 5-pin XLR, the E1.11-2004 Clause 7.1.2 concession for use of an alternate connector should not apply.

5.2 Internal connectors

Internal connectors are those that provide a data link termination point that is not readily user accessible on permanently installed equipment. Termination may be by direct soldering of wires, set screw or other compression type termination, or insulation displacement. Direct termination of a permanently installed cable on a male RJ-45 should not be allowed.

Internal connectors should be numbered as described in Clause 6.4, Table 1 or Table 2 as determined by cable being terminated.

6 Installation

Cable should be installed to provide a point-to-point one or two pair and common connection between each device on a data link. When multiple DMX512-A or DMX512/1990 universes exist within a single cable, a cable type that allows for electrical isolation between universes should be used. Cables allowing crosstalk between universes within that cable may cause undesirable system operation. Using a cable with shielding of individual pairs or cable with different lay lengths for different pairs will minimize crosstalk between universes.

While conduit provides for mechanical protection of cables, and properly earthed metallic conduit may provide some shielding, it should not be relied upon for any effective shielding at DMX512 data transmission rates. Nonmetallic conduit does not provide any shielding.

6.1 Cable Preparation

Shields and drain wires exposed by the process of preparing the cable for termination should be insulated from accidental contact with earth ground. Shields from individually shielded pairs should be insulated from accidental contact with each other.

6.2 Splices

Any splices should comply with 6.1 and should be made using devices, materials, and methods appropriate to the transmission of high speed digital data. Splices should provide data path integrity for all data pairs of each data link, and should be insulated from accidental contact with earth ground, shields, or data lines.

6.3 Multiple cable types

Where more than one cable type exists within a single installation care should be taken to ensure that characteristics of jointly terminated or spliced cables match. Where it is not possible to match cable types exactly the use of active buffering is recommended.

6.4 Physical Termination

The data link common and one or both pairs of each data link should be terminated at each device on the data link in accordance with Table 1 or Table 2 based on cable type. No more than two data link segments should be terminated on a single set of termination points.

Physical terminations should be made in a manner that prevents stresses on the conductors, termination points, connector assembly, and cable. The conductors should not be the means of support for any device.

Table 1 Conductor Termination of EIA-485 type cables

Conductor	XLR pin number or equivalent
Shield	1
Pair 1 Complement (Data 1 -)	2
Pair 1 True (Data 1 +)	3
Pair 2 Complement (Data 2-)	4
Pair 2 True (Data 2+)	5

Note to Table 1: The color coding of wires varies by Cable Manufacturer and cable type.

Table 2 Conductor Termination of ISO/IEC Category 5 cables

Wire color	Function	XLR Pin Number or equivalent
white/orange	Pair 1 true (Data 1 +)	3
orange	Pair 1 complement (Data 1 -)	2
white/green	Pair 2 true (Data 2 +)	5
green	Pair 2 complement (Data 2 -)	4
blue	Not assigned	
white/blue	Not assigned	
white/brown	Data link common (common reference) for Pair 1 (0 V)	1
brown	Data link common (common reference) for Pair 2 (0 V)	1

6.5 Acceptable use of unassigned wires

Wires not assigned in Table 2 should not be terminated in a manner where they connect to any pin of the 5-pin XLR and should comply with one and only one of the uses described in Clause 6.5.1 through 6.5.3.

Unassigned wires should not be used in any manner other than those described in Clause 6.5.1 through 6.5.3.

6.5.1 Unassigned wires unused

Where the unassigned wires are not used for any purpose the requirements of clause 6.4 should not apply to the unassigned wires. Unused wires should be capped and turned back against the cable jacket and securely fastened to the jacket.

6.5.2 Unassigned wires used for signaling

Where the unassigned wires are used for any type of signal the requirements of clause 6.4 should apply to the unassigned wires. Signals carried by the unassigned wires should not cause any measurable interference on the pairs used for DMX512 data. Signals should not exceed a nominal 24VDC or 24Vrms relative to Data Link Common and should not exceed 1W in power injected into the cable. Signals terminating on the same device as a 5-pin XLR should not connect to any pin of the 5-pin XLR.

6.5.3 Unassigned wires used for low power transmission

Where the unassigned wires are used for power transmission the requirements of clause 6.4 should apply to the unassigned wires. Power carried by the unassigned wires should be within the limits of IEEE 802.3 Clause 33. Equipment utilizing the low voltage power supply may or may not comply with the detection and operational requirements of IEEE 802.3 Clause 33. Power supply failure should not adversely affect transmission of DMX512 data over the data link, although it may affect data on the output side of isolated transmitters powered from that power supply. Power supply noise should not cause any measurable interference on the pairs used for DMX512 data. Power supply wires, other than those connected to Data Link Common, terminating on the same device as a 5-pin XLR should not connect to any pin or the shell of the 5-pin XLR.

6.6 Isolation between data links

Data links that are deliberately isolated from each other within devices should be wired to maintain electrical isolation throughout each data link.

6.7 Protection of installed cable

6.7.1 Mechanical

Cables should be protected against physical damage along their entire length. Specific protection techniques are beyond the scope of this Recommended Practice, but may include conduit, trunking, or raceways.

Requirements for specific protection techniques and materials vary with location and application, and are beyond the scope of this Recommended Practice. Installations complying with this Recommended Practice should comply with local requirements.

6.7.2 Electrical

Cables should be protected against electrical damage and from transmitting electrical damage to connected devices. Earthed metal conduit or separate grounding wires for earth grounding of devices may be used to provide a separate grounding path. Under no circumstance should any cable conductor or shield be connected to earth ground except at the transmitter as described in the E1.11 Preferred Topology. In practice the transmitter grounding is likely to occur inside equipment, and connection of the Data Link Common to earth ground as part of cabling infrastructure will be unnecessary. Equipment Manufacturers should specify their earth grounding scheme in product documentation.

6.8 Maximum Run Length

It is beyond the scope of this Recommended Practice to determine a maximum run length that will apply to all possible installations. Factors that affect the maximum run length include the number of EIA-485 unit

loads on the data link, the number of splices in the data link, the strength of the data link transmitter(s), and proximate sources of interference. Use of bidirectional communication protocols such as ANSI E1.20 Remote Device Management may also affect the maximum useful run length.

A properly selected and installed DMX512 cable should provide acceptable signal strength for runs of 300m (1000ft). Please note that the technical requirements, such as run-length and topology for other networking technologies, such as Ethernet, should be considered if using the installed cable for another networking technology in the future is anticipated.

7 Marking of E1.27-2 Compliant Components

Panels provided for the connection of portable equipment may be marked to indicate compliance with this Recommended Practice. Panels, connectors, assemblies, or devices not complying with this Recommended Practice should not have the marks described in 7.1 appear anywhere.

Patch panels described in 5.1.1 should be clearly marked to differentiate RJ-45 connectors used for DMX512 from RJ-45 connectors used for other purposes.

7.1 Acceptable marks

Marks indicating compliance with this Recommended Practice should be a text label stating “ANSI E1.27-2”.

7.2 Placement of compliance marks

Marks indicating compliance with this Recommended Practice should appear in a user discernable place and should appear somewhere on the assembly. Marks should be of sufficient size to be clearly readable in the marking process used.

7.3 Proper Termination marks

Devices including a 5-pin XLR connector should include a label or other mark somewhere on the device showing the wire termination required to ensure that signals appear on the pins of the XLR as defined by this Recommended Practice.

7.4 Category Cable marks

Installations using Category Cable should include a run length mark.

7.5 Other marking

Marks not related to compliance with this Recommended Practice may be used in addition to the required marks.