



Field-testing procedure

LANmark-6

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1 Introduction

The testing of Class E (Category 6) solutions is a longer and more involved process than for Class D (Category 5e). The purpose of testing is to validate the installation against both the requirements of the standards and the demands of the Nexans warranty process. This document serves to qualify the current testing requirements for LANmark 6 solutions against the ISO/IEC 11801 : 2002. If testing throws up errors or failures in the results the information gathered should be used to identify the source of the problem so that the installer can rectify and re-test.

To pass testing for the Nexans warranty all Permanent Links and/or Channels in an installation should be tested, and all should pass. You should agree with the client before starting the contract how to deal with marginal pass results, as they may not be aware that a marginal result may be because of the accuracy and tolerances of the tester.

2 How to proceed ?

2.1 Introduction

This procedure is meant as a support tool for field-testing copper cabling networks. The definitions in the standard ISO/IEC 11801 : 2002 are applied into practical recommendations.

After describing some general definitions, the second half of this chapter is especially focused on measuring category 6/Class E networks.

The procedure is to be followed in case of applying for Nexans Certified Systems Warranty.

2.2 Permanent link testing vs. Channel testing

In the ISO standards two different ways of testing are described.

A **permanent link** is the fixed part of the cabling, which is tested after installation, these testresults give information on installation quality. The permanent link extends from the patch panel in the cabinet to the telecommunications outlet at the user side. It excludes work area cords, equipment cords and cross-connections, but does include the optional consolidation point.

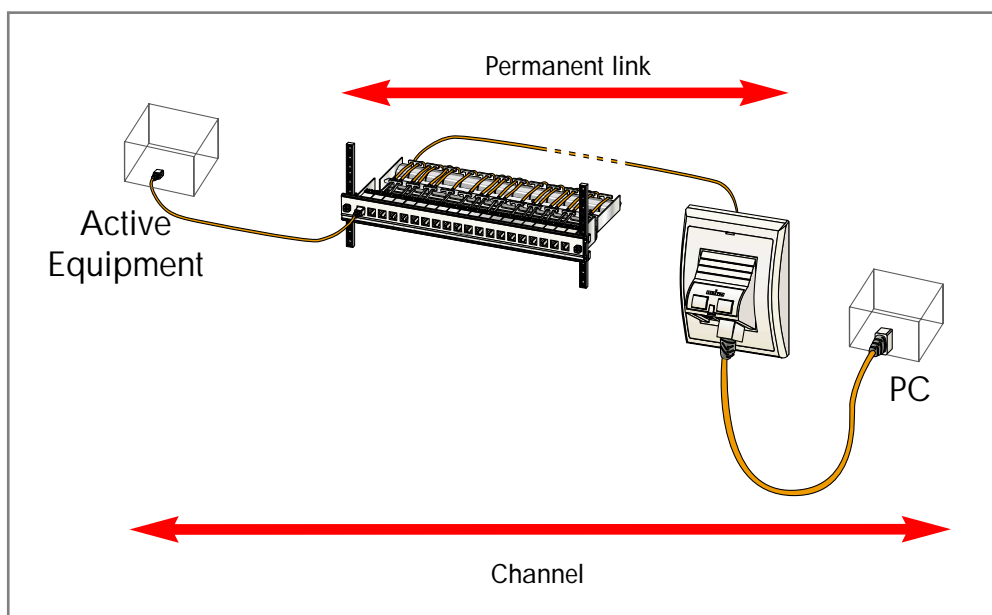


Figure 1: Model of Permanent Link and Channel testing

A **channel** represents the complete end-to-end path between the user equipment (PC, phone, video, printer, ...) and the active equipment at the cabinet side (switch, hub, PABX, video equipment). The channel includes the work area cord, the equipment cord, and the cross-connection.

Both permanent link and channel can be measured with the current commercially available field testers.

In the next paragraphs following issues are covered: 'How the several installation models of Class E/category 6 networks can be tested?' and 'Which specific models of test-equipment and test heads can be used.'

2.3 Category 6 and connecting hardware interoperability

The Category 6 test method is being specified in the American TIA/EIA-568-B.2-1 and the international IEC 60603-7-4 (unscreened) and IEC 60603-7-5 (screened) standards, of which the TIA standard has been ratified.

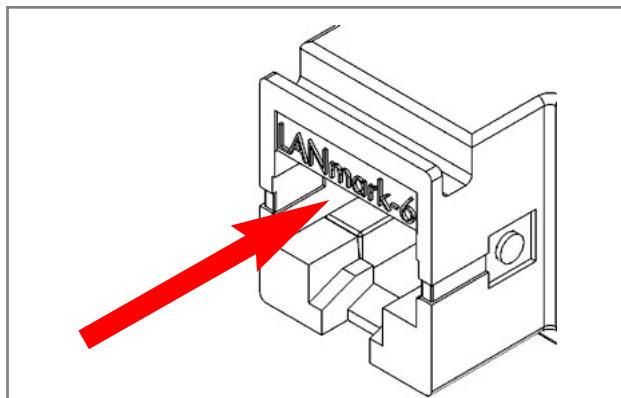
In the category 6 networks prior to end 2002 manufacturer's plugs and jacks are not necessarily matching in NEXT and return loss performance. While they mate properly and pass wire map, you often do not get Category 6 component performance unless you use a plug and jack from the same manufacturer. Even more important is that the connection of field test equipment should be made with vendor dedicated category 6 test heads!

With the arrival of the full ratified and published standard this all now is specified by the so-called de-embedded test plug values. See for more background information in Nexans' White paper "De-embedded, impact on Category 6 offering".

This change has its implications on field testing. In the following paragraphs the implication in regards to the Nexans offering is described.

Before you go to the test site, please make sure to prepare your tester in accordance to the right standard.

2.3.1 How to recognize a LANmark network installation from the old standard to the new standard



Nexans has brought its product set in line with the standard. The jacks are distinguished from the legacy by a relief (raised) of the description of LANmark6 on the jack. On the legacy ones the logo of LANmark6 is impressed.

2.4 Installation models

2.4.1 2 connector model : Interconnect - TO

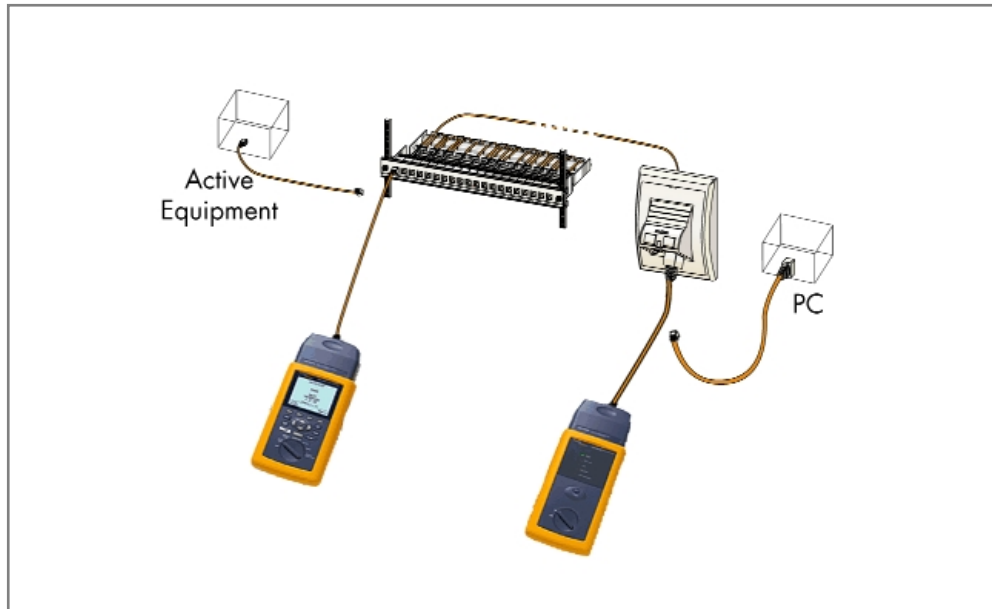


Figure 2.1 : Testing a permanent link in a 2 connector model

Figure 2.1 shows the two-connector model as described in the standard. In this installation model both Permanent Link testing and Channel testing methods can be applied.

In case of Permanent Link testing, make sure the right test heads are used (see also chapter 4).
In case of Channel testing make sure only Nexans LANmark6 Ultim patch cords are used.

When submitting the test results for the Nexans Certified System Warranty, the guarantee and warranty will be based on a 2 connector system model.

2.4.2 3 connector model : Cross connect - TO

Option 1

- a. If the installation is done with pre-terminated 'single ended' LANmark6 Ultim patch cords of Nexans to connect the active equipment AND
- b. If LANmark6 patch cords of Nexans are used to cross connect the patch panels,

Testing as a 2-connector test model, described in 2.4.1, will do to acquire a Nexans Certified Systems Warranty on the complete installation (= 3 connector installation).

Option 2

If the single ended patch cord is manually terminated on the patch panel, then the full channel has to be measured, as shown in figure 2.2. Only Channel testing will do when Nexans LANmark6 Ultim patch cords are used.

When one of these options is chosen the Certified Systems Warranty on the 3 connector model system can be obtained, when the test results are submitted together with the filled in Nexans Warranty application form and other required documents are included.

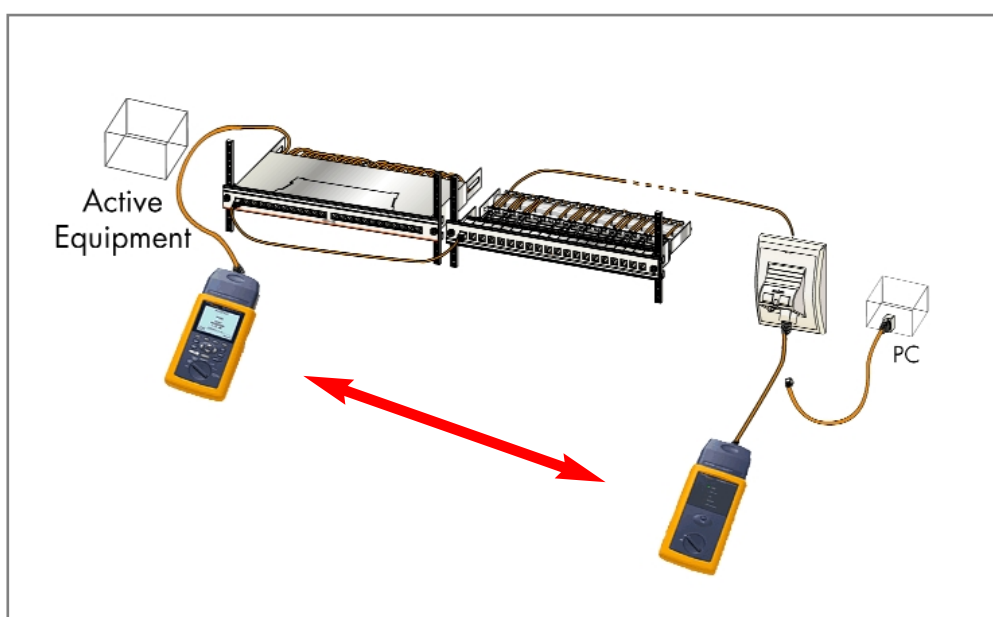


Figure 2.2 : Testing at 3 connector Cross connect - TO model
(only Channel Testing allowed)

Note: An alternative way of testing is to test as a 2-connector installation ignoring the conditions mentioned in option 1 of this paragraph, see Figure 2.1. (With these test results only a Certified Systems Warranty on the 2 connector installation can be obtained.)

2.4.3 3 connector model : Interconnect - CP - TO

In this model of installation three (3) options of testing are possible:

Option 1

The installation is done with pre-terminated 'single ended' LANmark6 Ultim patch cords of Nexans to connect the Consolidation Point (CP) with the Terminal Outlet (TO)

Testing in a 2 connector test model as described in 2.4.1 will do to acquire a Certified Systems Warranty on the complete installation (= 3 connector installation).

Option 2

If the single ended patch cord is manually terminated on the Terminal Outlet (TO), then the full installation has to be measured. See Figure 2.3. Permanent Link testing will do, under the condition that the right test heads are in use.

Option 3

If the single ended patch cord is to be manually terminated on the Terminal Outlet (TO), then as an alternative to option 2 also Channel testing will do, under the condition that only Nexans LANmark6 Ultim patch cords are used

When one of these options is chosen the Certified Systems Warranty on the 3 connector system model can be obtained, when the test results are submitted together with the filled in Nexans Warranty application form and other required documents are included.

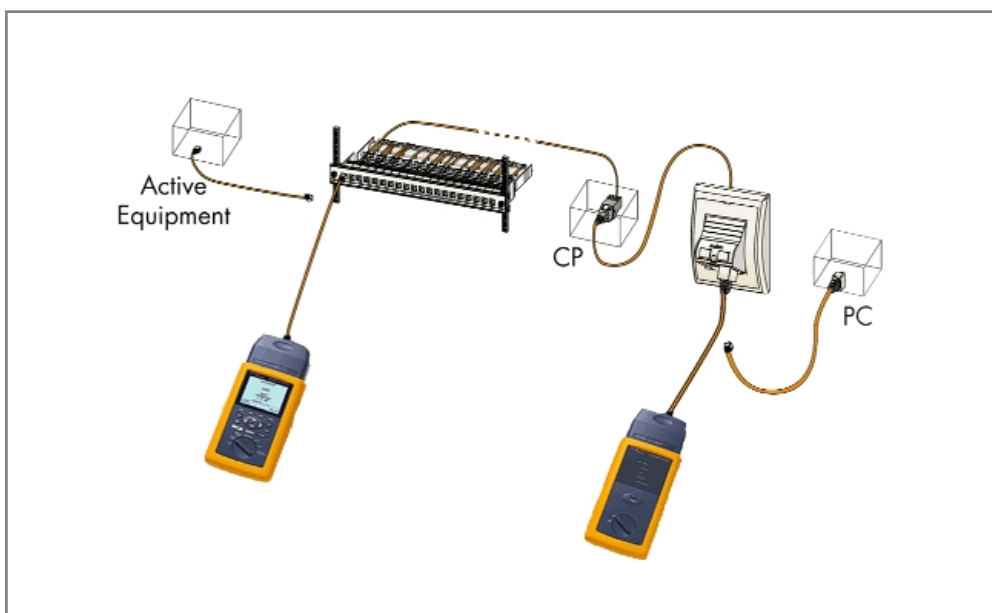


Figure 2.3 : Testing at 3 connector Interconnect - CP - TO model

Note: An alternative way of testing is to test as a 2-connector installation from the Patch Panel to the Consolidation Point (CP) ignoring the conditions mentioned in option 1 of this paragraph. (With these test results only a Certified Systems Warranty on the 2 connector installation can be obtained.)

2.4.4 4 connector : Interconnect - Cross connect - CP - TO

Important: In a 4 connector model a maximum of 2 connectors at each side should be respected as mentioned in the standard.

In this model of installation Nexans recommend two options of testing:

Option 1

- a. The installation is done with pre-terminated 'single ended' LANmark6 Ultim patch cords of Nexans to connect the active equipment and to connect the Consolidation Point (CP) with the Terminal Outlet (TO) and
- b. LANmark6 patch cords of Nexans are used to cross connect the patch panels

Then testing in a 2 connector test model as described in 2.4.1 will do to acquire a Nexans Certified Systems Warranty on the complete installation (= 4 connector installation).

Option 2

The single ended patch cords are manually terminated on the patch panel and on the Terminal Outlet (TO)

Then the full channel has to be measured, see figure 2.4. Only Channel testing will do, under the same conditions as described in the previous paragraphs.

When one of these options is chosen the Certified Systems Warranty on the 4 connector system model can be obtained, when the test results are submitted together with the filled in Nexans Warranty application form and other required documents are included.

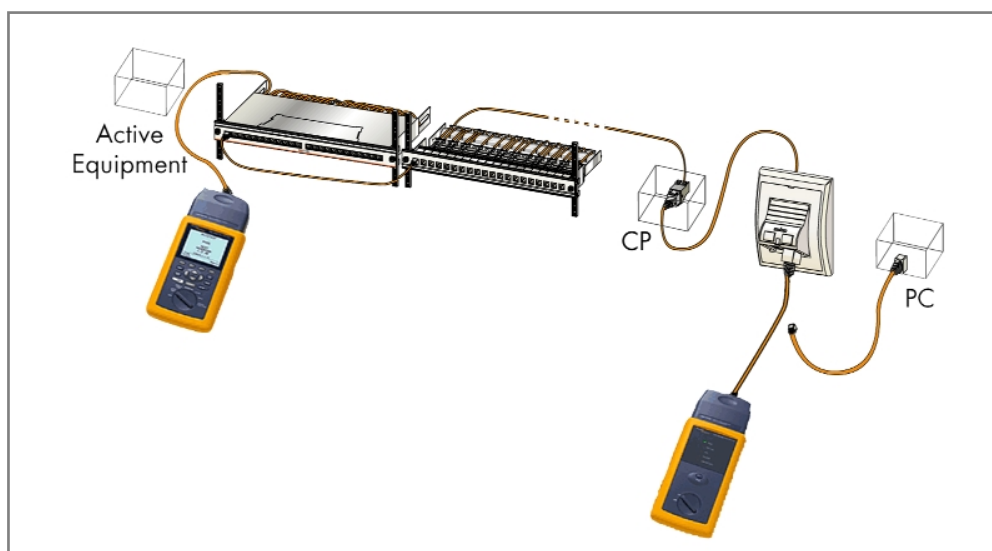


Figure 2.4: Testing at 4 connector Interconnect - Cross connect – CP –TO model
(only Channel Testing possible)

Note: An alternative way of testing is to test as a 2-connector installation from the Patch Panel to the Consolidation Point (CP) ignoring the conditions mentioned in option 1 of this paragraph. (With these test results only a Certified Systems Warranty on the 2 connector installation can be obtained.)

2.4.5 Summary

	2 connectors : Interconnect - TO	3 connectors : Cross connect - TO	3 connectors : Interconnect - CP - TO	4 connectors : Interconnect - Cross connect - CP - TO
Class E	CM/PL	CM	CM/PL	CM

CM= Channel Measurement

PL= Permanent Link Measurement

3 What equipment is available to test for compliance?

3.1 Level III testers

Nexans strongly recommends the use of equipment with baseline accuracy that exceeds TIA level III, as indicated by independent laboratory testing.

Test equipment must be capable of certifying Class D and Class E links.

Nexans have endorsed a number of testers and configurations for use in validating the LANmark 6 solution against the Warranty and performance requirements on installations.

The list includes:

1. Fluke DSP 4X00 and DTX series
2. Fluke (Microtest) OmnisScanner 2
3. HP Agilent Wirescope 350
4. Ideal (Wavetek) LT-8600 series
5. Ideal Industries Lantek-6 and 7(G)

3.2 Care of the Tester and leads

The tester is an accurate piece of equipment and as such needs to be looked after. Please follow manufacturer recommendations for the care and maintenance of your tester. Have your tester calibrated at least once a year by the tester manufacturer.

The test leads are susceptible to wear and damage. Please follow manufacturer recommendations for the care and maintenance of your test leads and do not fold or exceed the bend radius of the test cables.

Do not allow the weight of the tester to be supported by the test lead.

Always put your tester on charge the day before it will be needed and then place it on charge overnight during the testing phase of the project.

	Cat 5e	Cat 6	Cat 6 DE
Fluke DSP 4X00 and DTX series	x	x	x
Fluke (Microtest) OmnisScanner 2	x	x	x
HP Agilent Wirescope 350	x	x	x
Ideal (Wavetek)8600 series	x	x	x
Ideal Industries Lantek-6 and 7(G)	x	x	x

3.3 Before you go to site

The firmware update and the version of the software database on the tester are important. The firmware from the tester manufacturer provides the tester with the correct parameters to test and how to interact with the test head. The software database holds the test parameters and limits for the standards that you will be comparing the cabling installation against.

For all testers ensure you have the latest version of the tester firmware loaded, this can be obtained from the manufacturer of the test equipment Internet site along with the latest software and database which should also be loaded into the tester.

You must calibrate the tester local and remote ends to each other before you go to site.

If you are using some testers you will also need to have the test leads calibrated onto the tester units. This will improve the accuracy of the tester.

Make sure you have the latest version of the upload and diagnostic software on your PC on to which you will download the test results from the tester (available on Internet sites of the manufacturers).

Always download each day's worth of test results at the end of the day onto your PC.

Always put your tester on charge the day before it will be needed and then place it on charge overnight during the testing phase of the project.

4 How to configure the tester ?

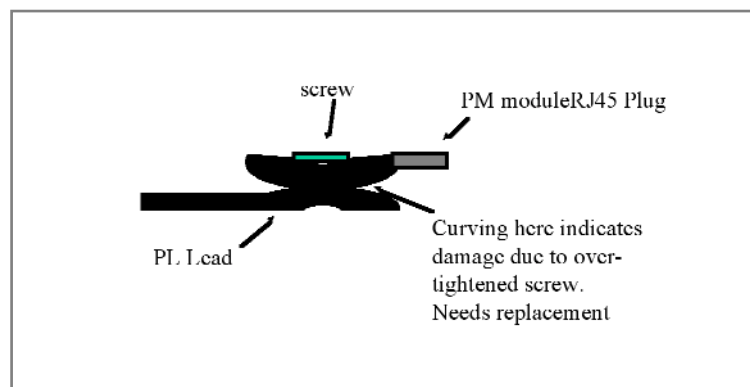
4.1 Fluke DSP 4x00 and DTX series

DSP-LIA101S or DTX-PLA001

A method for testing LANmark 6 is to use the Permanent Link Adapter with a swappable Personality Module PM06 or PM25. The PM06 can be used in both UTP, FTP and STP environment. Also the PM25 can be used only in a UTP environment. The limits to be used in this configuration are the ISO/IEC 11801 Class E PL standard database limits for the Permanent Link.

General Testing 'Tips':

- Use the straps to hang up the tester. This leaves one hand free to press buttons and one hand to support the weight of the PL cable.
- Only screw finger tight the screw attaching PM module to PL lead. Do not use screwdriver. Look for any damage caused by overtightening.
- Failure to adequately support the weight of the PL cable or test lead may result in excessive load being applied to the RJ 45 jack or misalignment of the plug and jack during the test process. The consequences of this action may result in poor readings damage to the test lead or outlet and may invalidate Nexans product warranty.
- Use the OMNI Field Cal tool (5 finger tool which looks like a set of PM's without the plugs) to set the PL leads into the tester before you start testing.



4.2 Fluke Omniscanner 2

OMNI- Universal Link Adapter

A method for testing LANmark 6 is to use the Omniscanner Universal Link Adapter with a Personality Module PM06 or PM25. The PM06 can be used in both UTP, FTP and STP environment. PM25 is only meant to be used in a UTP environment. The limits to be used in this configuration are the ISO/IEC 11801 Class E PL standard database limits for the Permanent Link.

General Testing 'Tips':

- Use the straps to hang up the tester. This leaves one hand free to press buttons and one hand to support the weight of the PL cable.
- Only screw finger tight the screw attaching PM module to PL lead. Do not use screwdriver. Look for any damage caused by overtightening.
- Failure to adequately support the weight of the PL cable or test lead may result in excessive load being applied to the RJ 45 jack or misalignment of the plug and jack during the test process. The consequences of this action may result in poor readings damage to the test lead or outlet and may invalidate Nexans product warranty.

4.3 Agilent Wirescope 350

The configuration accepted by Nexans for the Agilent Wirescope 350 tester uses a test head Universal Link Test Probe (N2604A-10x) with a patchcord type test lead. This product set is subject to wear in the test cord, which should be monitored closely and looked after during its life. Eventually errors and miss readings will occur as the lead wears. The limits to use with this configuration are the limits for ISO Class E and can be found on the Agilent website.

4.4 Ideal LANtek-6 & 7(G)

The configuration accepted by Nexans for the Lantek 6 & 7(G) testers uses a Basic Link test head with a patch cord type test lead. This product set is subject to wear in the test cord, which should be monitored closely and looked after during its life.

4.5 Summary

Website	Fluke www.flukenetworks.com/		Agilent Technologies www.wirescope.com	Ideal Industries www.idealindustries.com
Field Tester	DSP-4300 Digital 	OMNIScanner 2 	WireScope 350 	LANTEK-6 & 7 
Characteristics				
Support for Cat.6 Permanent Link through	Universal Adapters and Vendorspecific Basic Link adapters		Vendor specific Basic Link adapters	Channel Adapter and 2 Patchcords and Calibration procedure
Support for Cat.6 Channel through	Channel Adapter with "Remote Connector Compensation (RCC) Technology" Channel Adapter with "Adaptive Vector Cancellation (AVC) Technology"		Smartprobe with ACT Software	Channel Adapter
On site Calibration	No (partially for LIA101) No		Yes	
Cat.6 Channel Test Adapters				
Product Name	Cat.6 Channel adapter for DSP4x00, RJ45	Omniscanner Category 6 Channel Adapter RJ45	Agilent Smartprobe Cat6 Channel	LANTEK Cat.6 Channel Adapter
Order Code	DSP-LIA012S DSP-4x00 software	8262-02	N2604A-100	0012-00-0627
Test head compatible with software	version 4.00 and later	All	Version 3.00	All
Testsetup to be used (LIMITS)	ISO Class E Channel	Class E Channel-4/01	ISO Class E Channel	ISO Class E Channel
Test patchcords	User patchcord N101.225	User patchcord N101.225	User patchcord N101.225	User patchcord N101.225 series
Universal Permanent Link Cat.6 Adapter	DSP-LIA101	OMNI-LIA101S	N2604A-101 (uses Sentinel plug) N2604A-10x	Cat.6 Channel Adapter
Name of Personality Module	PM06, PM25	PM06, PM25	NA	User patchcord (N121.225 series) or Pair Cat6 RJ45-to-Cat6 RJ45 Permanent Link Reference Patchcords (preloaded) 2m*2
LIMIT Setup to be tested	ISO Class E Link	ISO Class E Link	NA ISO Class E Link	ISO Class E Link

4.6 Testing a network conform the category 6 mated component requirements of ISO/IEC 11801 from before 2003

If you have to measure on networks that are made conform the category 6 mated component requirements of ISO/IEC 11801 from before end 2002, be aware that some electrical properties of other manufacturer plugs and patch cords are not compatible with the LANmark 6 products. Therefore to avoid any issues of interoperability and errors or low pass margins caused through use of incompatible products Nexans have defined, with the tester manufactures, the correct test heads, plugs, leads and database to test the LANmark 6 solution. This will provide the installer and end user with repeatable and reliable results to demonstrate the compliance of the LANmark 6 solution with the ISO 11801 standards.

4.6.1 Fluke DSP 4x00 and DTX series

There is one configuration accepted by Nexans for the Fluke DSP 4x00 and DTX series testers:

DSP-LIA101S

A method for testing LANmark 6 is to use the Permanent Link Adapter with a swappable Personality Module PM06. The limits to be used in this configuration are the ISO 11801 Class E PL standard database limits for the Permanent Link.

DTX- PLA001

A method for testing LANmark 6 is to use the Permanent Link Adapter with a swappable Personality Module PM06. The limits to be used in this configuration are the ISO 11801 Class E PL standard database limits for the Permanent Link.

4.6.2 Fluke OmnisScanner 2

OMNI- Universal Link Adapter

The only method for testing LANmark 6 is to use the OmnisScanner Universal Link Adapter with a Personality Module PM06. The limits to be used in this configuration are the ISO 11801 Class E PL standard database limits for the Permanent Link.

4.6.3 Agilent Wirescope 350

The configuration accepted by Nexans for the Agilent Wirescope 350 tester uses a test head Universal Link Test Probe (N2604A-003) with a patch cord type test lead. This product set is subject to wear in the test cord, which should be monitored closely and looked after during its life. Eventually errors and miss readings will occur as the lead wears. The limits to use with this configuration are the limits for ISO Class E and can be found on the Agilent website.

4.6.4 Ideal LT6800 series

The configuration accepted by Nexans for the Wavetek 8600 and 8601 testers uses a test head with a patch cord type test lead. This product set is subject to wear in the test cord, which should be monitored closely and looked after during its life. Eventually errors and miss readings will occur as the lead wears. The limits to use with this configuration are the ISO limits for ISO Class E and can be found on the Ideal Internet web site.

4.6.5 Summary

	Cat6 Adapter	Reference Code	Limits
Fluke DSP 4x00 series	Permanent Link Adapter + PM06 Personality Module	DSP-LIA101	ISO Permanent Link Class E
Fluke DTX series	Permanent Link Adapter + PM06	DTX-PLA001	ISO Permanent Link Class E
Fluke (Microtest) Omniscanner 2	Permanent Link Adapter Omniscanner Cat6 + PM06 Personality Module	8262-38	ISO Permanent Link Class E
Agilent Wirescope 350	Universal Smartprobe Class-E-adapter	N2604A-10x	ISO Permanent Link Class E
Ideal Lantek 6 and 7(G)	Class E Link Test Probe		ISO Permanent Link Class E
Ideal LT 8600 series	Nexans Class E/Cat6 Adapter		ISO Permanent Link Class E

Table 1: Recommended testheads & limits for testing conform the category 6 mated component requirements of ISO/IEC 11801

4.7 Selecting the right cable type

When setting up your tester you should pay attention to the tester set up and the NVP (Nominal Velocity of Propagation) for the cable under test. This setting will determine the length and skew parameters and will therefore affect the results obtained. Some testers set themselves to pre-set or default settings each time they are switched on. You therefore must check this and configure the tester according to the cable data sheet for the product you are testing. Generally for Nexans cabling systems, the values to be used are:

Commercial cable name	NVP
Nexans LANmark-5 UTP	0.69
Nexans LANmark-5 F ² TP F ¹ TP	0.69
Nexans LANmark-6 UTP	0.69
Nexans LANmark-6 F ² TP F ¹ TP	0.69
Nexans LANmark-6 S-FTP	0.69
Nexans STP	0.79

5 Understanding the test results

5.1 What the test results show

One can only hope that first time of testing a link the results will show a pass with headroom. However the first thing most testers will show is a wire map failure. As there is an insertion life on tester heads and leads a number of installers make use of a more basic test tool which just checks for wire mapping before running with a full set of tests for Cat 6. This releases the tester for use elsewhere and saves on head wear.

If a failure is detected then make use of the tester diagnostics to locate the problem. Some of the later testers come with analysis software and tools that will locate the problem to a point along the length of the cable or at the termination.

The treatment of marginal asterisked (*) results should be clarified with the client in advance. Due to the known experience of tester inaccuracies due to test head variations it is our experience that results are usually on the pessimistic side. Nexans will therefore consider a *PASS as acceptable within the warranty.

A *FAIL however should be investigated and is not acceptable.

5.2 What to do with the result - Certification

When submitting results for the Nexans Warranty, a 'Nexans Warranty application form' for the site has to be filled in and submitted to your local Nexans unit. This warranty application form can be obtained from your local Nexans contact.

- Upload and Save – Which format ?

DSP-4x00 & DTX:	*.flw
Omniscanner:	*.flw
Wirescope:	*.mdb
Ideal:	*.zip(database)

It is preferable to save the test results with plots if they are available on your tester as re-certification of graphical test result is only possible if plots are saved.



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