

BS EN 61326-2-5:2013



BSI Standards Publication

Electrical equipment for measurement, control and laboratory use — EMC requirements

Part 2-5: Particular requirements —
Test configurations, operational conditions
and performance criteria for devices with
field bus interfaces according to
IEC 61784-1 (IEC 61326-2-5:2012)

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National foreword

This British Standard is the UK implementation of EN 61326-2-5:2013. It is identical to IEC 61326-2-5:2012. It supersedes BS EN 61326-2-5:2006, which will be withdrawn on 6 November 2015.

The UK participation in its preparation was entrusted by Technical Committee GEL/65, Measurement and control, to Subcommittee GEL/65/4, System considerations.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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EUROPEAN STANDARD
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English version

**Electrical equipment for measurement, control and laboratory use -
EMC requirements -
Part 2-5: Particular requirements -
Test configurations, operational conditions and performance criteria for
devices with field bus interfaces according to IEC 61784-1
(IEC 61326-2-5:2012)**

Matériel électrique de mesure, de
commande et de laboratoire -
Exigences relatives à la CEM -
Partie 2-4: Exigences particulières -
Configurations d'essai, conditions de
fonctionnement et critères d'aptitude à la
fonction pour les appareils en exploitation
avec des interfaces utilisant des bus de
terrain conformes à la CEI 61784-1
(CEI 61326-2-5:2012)

Elektrische Mess-, Steuer-, Regel- und
Laborgeräte – EMV-Anforderungen – Teil
2-5: Besondere Anforderungen –
Prüfanordnungen, Betriebsbedingungen
und Leistungsmerkmale für Feldgeräte mit
Feldbus-Schnittstellen gemäß IEC 61784-
1
(IEC 61326-2-5:2012)

This European Standard was approved by CENELEC on 2012-11-06. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 65A/643/FDIS, future edition 2 of IEC 61326-2-5, prepared by SC 65A, "System aspects", of IEC TC 65, "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61326-2-5:2013.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2013-08-06
- latest date by which the national standards conflicting with the document have to be withdrawn (dvw) 2015-11-06

This document supersedes EN 61326-2-5:2006.

EN 61326-2-5:2013 includes the following significant technical changes with respect to EN 61326-2-5:2006:

– Update with respect to EN 61326-1:2013.

EN 61326-2-5:2013 is to be used in conjunction with EN 61326-1:2013 and follows the same numbering of clauses, subclauses, tables and figures.

When a particular subclause of EN 61326-1 is not mentioned in this part, that subclause applies as far as is reasonable. When this standard states "addition", "modification" or "replacement", the relevant text in EN 61326-1 is to be adapted accordingly.

NOTE The following numbering system is used:

- subclauses, tables and figures that are numbered starting from 101 are additional to those in EN 61326-1;
- unless notes are in a new subclause or involve notes in EN 61326-1, they are numbered starting from 101 including those in a replaced clause or subclause;
- additional annexes are lettered AA, BB, etc.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For the relationship with EU Directive(s) see informative Annex ZZ, which is an integral part of this document.

Endorsement notice

The text of the International Standard IEC 61326-2-5:2012 was approved by CENELEC as a European Standard without any modification.

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Annex ZA of EN 61326-1:2013 applies, except as follows:

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61158-2	2010	Industrial communication networks - Fieldbus specifications - Part 2: Physical layer specification and service definition	EN 61158-2	2010
IEC 61158-3-3	2007	Industrial communication networks - Fieldbus specifications - Part 3-3: Data-link layer service definition - Type 3 elements	EN 61158-3-3	2008
IEC 61158-5-5	2007	Industrial communication networks - Fieldbus specifications - Part 5-5: Application layer service definition - Type 5 elements	EN 61158-5-5	2008
IEC 61158-6-10	2010	Industrial communication networks - Fieldbus specifications - Part 6-10: Application layer protocol specification - Type 10 elements	EN 61158-6-10	2012
IEC 61784-1	2010	Industrial communication networks - Profiles - Part 1: Fieldbus profiles	EN 61784-1	2010

Annex ZZ
(informative)

Coverage of Essential Requirements of EU Directives

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and within its scope the standard covers protection requirements of Annex I, Article 1 of the EC Directive 2004/108/EC.

Compliance with this standard provides one means of conformity with the specified essential requirements of the Directive[s] concerned.

NOTE Other requirements and other EU Directives may be applicable to the products falling within the scope of this standard.

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**ELECTRICAL EQUIPMENT FOR MEASUREMENT,
CONTROL AND LABORATORY USE –
EMC REQUIREMENTS –**

**Part 2-5: Particular requirements –
Test configurations, operational conditions and performance criteria
for field devices with field bus interfaces according to IEC 61784-1**

1 Scope

In addition to the requirements of international Standard IEC 61326-1, this part of IEC 61326 treats the particular features for EMC testing of field devices with field bus interfaces. This part of IEC 61326 covers only the field bus interface of the equipment.

NOTE The other functions of the equipment remain covered by other parts of IEC 61326 series.

This part refers only to field devices intended for use in process control and process measuring.

In this standard field devices with interfaces according to IEC 61784-1, CP 3/2 and CP 1/1 as defined in IEC 61784 are covered. Other field busses may be included in future editions of this standard.

The IEC 61784-1 specifies a set of protocol specific communication profiles based on IEC 61158.

The manufacturer specifies the environment for which the product is intended to be used and/or selects the appropriate test level specifications of IEC 61326-1.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Clause 2 of IEC 61326-1 applies except as follows:

Addition:

IEC 61158-2:2010, *Industrial communication networks – Fieldbus specifications – Part 2: Physical layer specification and service definition*

IEC 61158-3-3:2007, *Industrial communication networks – Fieldbus specifications – Part 3-3: Data-link layer service definition – Type 3 elements*

IEC 61158-5-5:2007, *Industrial communication networks – Fieldbus specifications – Part 5-5: Application layer service definition – Type 5 elements*

IEC 61158-6-10:2010, *Industrial communication networks – Fieldbus specifications – Part 6-10: Application layer protocol specification – Type 10 elements*

IEC 61784-1:2010, *Industrial communication networks – Profiles – Part 1: Fieldbus profiles*

3 Terms and definitions

Clause 3 of IEC 61326-1 applies.

4 General

Clause 4 of IEC 61326-1 applies.

5 EMC test plan

5.1 General

Subclause 5.1 of IEC 61326-1 applies.

5.2 Configuration of EUT during testing

Subclause 5.2 of IEC 61326-1 applies, except as follows:

Addition:

Additional requirements: see Annexes AA and BB.

5.3 Operation conditions of EUT during testing

Subclause 5.3 of IEC 61326-1 applies, except as follows:

Addition:

Additional requirements: see Annexes AA and BB.

5.4 Specification of functional performance

Subclause 5.4 of IEC 61326-1 applies.

5.5 Test description

Subclause 5.5 of IEC 61326-1 applies.

6 Immunity requirements

6.1 Conditions during the tests

Subclause 6.1 of IEC 61326-1 applies.

6.2 Immunity test requirements

Subclause 6.2 of IEC 61326-1 applies.

6.3 Random aspects

Subclause 6.3 of IEC 61326-1 applies.

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6.4 Performance criteria

Subclause 6.4 of IEC 61326-1 applies, except as follows:

Addition:

Additional requirements: see Annexes AA and BB.

7 Emission requirements

Clause 7 of IEC 61326-1 applies.

8 Test results and test report

Clause 8 of IEC 61326-1 applies, except as follows:

Addition:

The type of shield connection at the EUT shall be stated in the test report.

9 Instructions for use

Clause 9 of IEC 61326-1 applies.

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Annex AA (normative)

Particular requirements – Test configurations, operational conditions and performance criteria for field devices with field bus interfaces according to IEC 61784-1 CP 1/1

AA.1 General

In connection with the main part of this standard, this Annex AA describes specific test configurations, operational conditions and performance criteria regarding the field bus interface using the communication profile CP 1/1 according to IEC 61784-1.

To prevent confusion with requirements of other annexes, the equipment under test (EUT) is called “EUT with CP 1/1 interface” throughout this annex.

AA.2 EMC test plan

AA.2.1 Configuration of EUT with CP 1/1 interface during testing

Subclause 5.2 of IEC 61326-1 applies, except as follows:

Addition:

AA.2.1.1 Test configuration for EUT with CP 1/1 interface

In order to assign any malfunction of the communication during the EMC-test to the EUT with CP 1/1 interface, the configuration of field devices with interfaces according to IEC 61784-1, CP 1/1 shall be limited to the operation of one host system and one EUT with CP 1/1 interface during EMC type tests.

Ports other than I/O ports covered by this part of the standard are tested according to IEC 61326-1.

The connection plan is shown in Figure AA.1.

The field device is connected via a device coupler with the power conditioner and the host system.

A standardised field bus terminator is attached at the third port of the device coupler.

The EUT with CP 1/1 interface, power conditioner, host system, device coupler(s) and terminator are connected by means of a standard type A field bus cable (foil shield, foil shield/mesh). Armoured cables or cables in conduit are not allowed for EMC testing.

Except for the connection at the EUT with CP 1/1 interface itself (see AA.2.1.3), the shield shall be connected at any individual component by a low-impedance grounding strip (connection between shield and the case with a large surface).

The individual cable lengths L1, L2, L3, L5 and L6 originate from a practice-adjusted set up, preferred as given in Figure AA.1.

The cable length L4 should be $8\text{ m} \pm 1\text{ m}$, in case that the respective basic standards do not specify other lengths. The cable installation shall be in accordance with the appropriate basic standard.

The connection of the shield at the shield grounding point may be produced by partially removing the insulation of the cable shield and fixing the cable shield with a metal clamp or by means of conductive leading-in-conductors such as a metallic cable gland at the ground plane or at the shielding metal wall respectively.

The location and execution of the shield grounding point depend on the given test facility, e.g. by use of an anechoic chamber or a shielded cabinet (as the metal wall penetration); and with tests on tables with ground plane the shield grounding point is on the ground plane.

AA.2.1.2 Connection cable for EUT with CP 1/1 interface

A standard bus cable type shall be used as communication cable (see IEC 61158–2:2010, 12.8.2). The cable lengths L1 to L4, are given in Figure AA.1 and additional requirement for L4 is described in AA.2.1.1. The lengths of L5 and L6 are not specified and depend on the installed equipment.

AA.2.1.3 Connections at the EUT with CP 1/1 interface

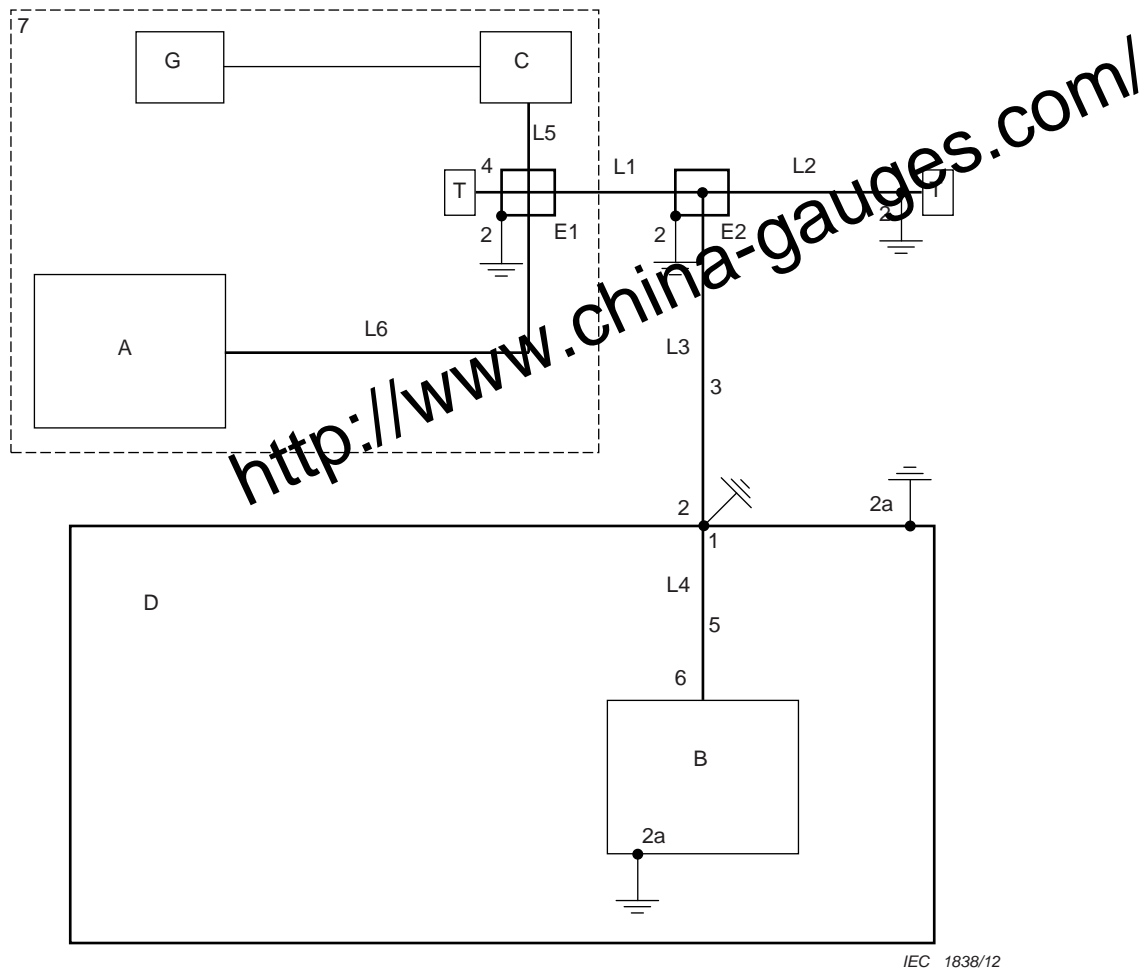
The grounding of the EUT with CP 1/1 interface shall be in accordance with the manufacturer's specification.

The shield of the cable shall be connected in the most sensitive method (for example with the shield not connected at the EUT with CP 1/1 interface) if not otherwise specified by the manufacturer.

NOTE If the manufacturer specifies the shield shall be connected at the EUT with CP 1/1 interface, the EUT with CP 1/1 interface shall be tested in accordance with the manufacturer's specification.

AA.2.1.4 Field bus network

The field bus network shall include the terminator of the bus, device coupler(s), the host system and the EUT with CP 1/1 interface. For bus-powered devices the field bus network includes additionally the power conditioner and the power supply. The evaluation and conditioning of the data in the host system are not the object of this part of the standard. The device coupler(s) and the bus terminator are passive components only.



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- | | |
|---|---|
| A: Host system | 1: Shield grounding point (SGP) of L4 |
| B: Field device (EUT with CP 1/1 interface) | 2: Shield / housing connected with low impedance |
| C: Power conditioner (5 mH+50 Ω) | 2a: Enclosure connected with low impedance |
| D: EMC test place | 3: Cable from device coupler(s) to SGP |
| E1, E2: device coupler(s) | 4: Terminator, either direct at device coupler or after a short cable (< 1 m) |
| T: Bus terminator | 5: Cable from SGP to field device |
| G: Power supply | 6: Connection of shield at field device see AA.2.1.3 |
| L1: 8 m cable type A | 7: A, C, G, E1 and T may be included in a single housing / system / device |
| L2: 2 m cable type A | L3: 2 m cable type A |
| L4: 8 m cable type A (see AA.2.1.2) | L5, L6: cable type A (see AA.2.1.2) |

Figure AA.1 – Test set up for EUT with CP 1/1 interface

AA.2.2 Operation conditions of EUT with CP 1/1 interface during testing

Subclause 5.3 of IEC 61326-1 applies, except as follows:

Addition:

AA.2.2.1 Operational conditions for EUT with CP 1/1 interface

- a) The macrocycle of the field bus segment should be as short as possible to have as often as possible communication on the bus and to have fast reaction of the system.
- b) For a transmitter type device there shall be a Publisher Subscriber communication relationship for each process value and its status (e.g. output parameter of AO or DO) that the EUT with CP 1/1 interface offers. The EUT with CP 1/1 interface has the role 'Publisher'.
- c) For a receiver type device there shall be:
 - a Publisher Subscriber communication relationship for each setpoint/input value and its status (e.g. input parameter of AO or DO) that the EUT with CP 1/1 interface accepts; in this/these relationship(s) the EUT with CP 1/1 interface has the role 'Subscriber';
 - and a Publisher Subscriber communication relationship for each output value and its status (e.g. BKCAL_OUT/BKCAL_OUT_D) that the EUT with CP 1/1 interface offers; in this/these relationship(s) the EUT with CP 1/1 interface has the role 'Publisher'.
- d) The "Stale Count Limit" has to be set to 2.
In cases where the "Stale count Limit" is not adjustable the value (not equal to 2) shall be stated in the test report.
- e) The frequency of client-server communication has to be set to one service request (e.g. read request) every other macrocycle.

AA.2.2.2 Status for EUT with CP 1/1 interface

The host system monitors the received data of the EUT with CP 1/1 interface. The received data is of the data type QualifiedFloat32 or QualifiedUnsigned8 as defined in IEC 61158-5-5:2007, 5.3.3.12 resp. 5.3.3.13. Those data types are of the format STRUCTURE and have a field named status.

For the automation system and the test evaluation the quality in the status is significant.

In case of received data only four qualities can appear (extract from IEC 61158-6-10:2010, 5.1.1.3.2.2):

- "Good (Cascade)" means status is in the range between 192 and 255
- "Good (Non Cascade)" means status is in the range between 128 and 191
- "Uncertain" means status is in the range between 64 and 127
- "Bad" means status is in the range between 0 and 63

The equipment under test shall preferably be configured so that the value of the status is 128 or greater during normal operation without EMC disturbance.

Other values for the status are allowed if they enable the evaluation the function of the EUT with CP 1/1 interface. However values of the status indicating a disturbed communication shall be avoided. If a status value deviating from 128 is chosen the reasons for this decision have to be reported in the test report.

AA.2.2.3 Monitoring for EUT with CP 1/1 interface

- a) For transmitter type device:

The process value(s) and its status shall be monitored.

The requirements for Pass / Fail the EMC test with regard to the value(s) are given in the specification of the manufacturer or in an appropriate part of this IEC 61326 standard series.

- b) For receiver type device (Positioner, Displays):

The output value (e.g. BKCAL_OUT/BKCAL_OUT_D) and its status shall be monitored. For devices like positioner or valves or displays: Visual confirmation is required. The

requirements for Pass / Fail the EMC test with regard to the value(s) are given in the specification of the manufacturer or in an appropriate part of this IEC 61326 standard series.

- c) The number of consecutive non-responses of the client-server communications shall be counted. Any count more than 2 consecutive non-responses shall be considered as a communication failure.
- d) Any overrun of the stale counter shall be considered as a failure.

AA.3 Performance criteria

Subclause 6.4 of IEC 61326-1 applies, except as follows:

Performance criterion A is extended by the following:

Performance criteria A

No communication failures are detected (see AA.2.2.3). The status value chosen according to AA.2.2.2 shall remain unchanged during and after the test (see AA.2.2.2 and AA.2.2.3).

Performance criterion B is extended by the following:

Performance criteria B

The status value (see AA.2.2.2 and AA.2.2.3) deviates during the test, but returns to normal afterwards and/or communication failure is detected but after test the device returns with no operator intervention to the expected operational state.

Performance criterion C is extended by the following:

Performance criteria C

The status value (see AA.2.2.2 and AA.2.2.3) deviates during the test, and/or communication failures are detected, but after test the device only returns with operator intervention to the intended operation mode.

AA.4 Information on the host system

The host system includes the following functionality:

- a) Configures the communication relationships as described in AA.2.2.1
- b) Monitors the communication, it detects / counts communication errors and violation of status values as described in AA.2.2.3.
- c) Initiates the communication in Client Server communication relationships
- d) Has the role of the LAS (Link Active Scheduler)

NOTE If the EUT with CP 1/1 interface is a transmitter type device the host system needs to play the role of a receiver type device (see AA.2.2.3 a). If the EUT with CP 1/1 interface is a receiver type device then the host system needs to be the transmitter and also be able to monitor the output of the EUT with CP 1/1 interface (see AA.2.2.3 b).

Annex BB (normative)

Particular requirements – Test configurations, operational conditions and performance criteria for field devices with field bus interfaces according to IEC 61784-1 CP 3/2

BB.1 General

In connection with the main part of this standard, this Annex BB describes specific test configurations, operational conditions and performance criteria regarding the field bus interface using the communication profile CP 3/2 according to IEC 61784-1.

To prevent confusion with requirements of other annexes, the equipment under test (EUT) is called “EUT with CP 3/2 interface” throughout this annex.

BB.2 EMC test plan

BB.2.1 Configuration of EUT with CP 3/2 interface during testing

Subclause 5.2 of IEC 61326-1 applies, except as follows:

Addition:

BB.2.1.1 Test configuration for EUT with CP 3/2 interface

In order to assign any malfunction of the communication during the EMC-test to the EUT with CP 3/2 interface, the configuration of field devices with interfaces according to IEC 61784-1, CP 3/2 shall be limited to the operation of one master and one slave (EUT with CP 3/2 interface) during EMC type tests.

Auxiliary connections for power supply or signalling are possible for the EUT with CP 3/2 interface.

The connection plan is shown in Figure BB.1.

The EUT with CP 3/2 interface is connected via a device coupler with the signal coupler. The signal coupler is connected to the Automation system.

A standardised field bus terminator is attached at the third port of the field device coupler.

The components EUT with CP 3/2 interface, signal coupler, device coupler and terminator are connected by standardised field bus cables.

The shield shall be connected at any individual component by a low-impedance grounding strip (connection between shield and the case with a large surface).

The individual cable lengths L1, L2, L3 originate from a practice-adjusted set up, preferred as given in Figure BB.1.

The cable length L4 should be $8\text{ m} \pm 1\text{ m}$, in case that the respective basic standards do not specify other lengths. The cable installation shall be in accordance with the appropriate basic standard.

The connection of the shield at the shield grounding point may be produced by partially removing the isolation of the cable shield and fixing the cable shield with a metal clamp or by means of conductive leading-in-conductors such as a metallic cable gland at the ground plane or at the shielding metal wall respectively.

The location and execution of the shield grounding point depend on the given test facility, e.g. by use of an anechoic chamber or a shielded cabin it is the metal wall penetration; and with tests on tables with ground plane the shield grounding point is on the ground plane.

BB.2.1.2 Connection cable for EUT with CP 3/2 interface

A standard bus cable type A shall be used as communication cable (see IEC 61158–2:2010, 11.8.2). The cable lengths L1 to L3 are given in Figure BB.1 and L4 is described in BB.2.1.1.

BB.2.1.3 Connections at the EUT with CP 3/2 interface

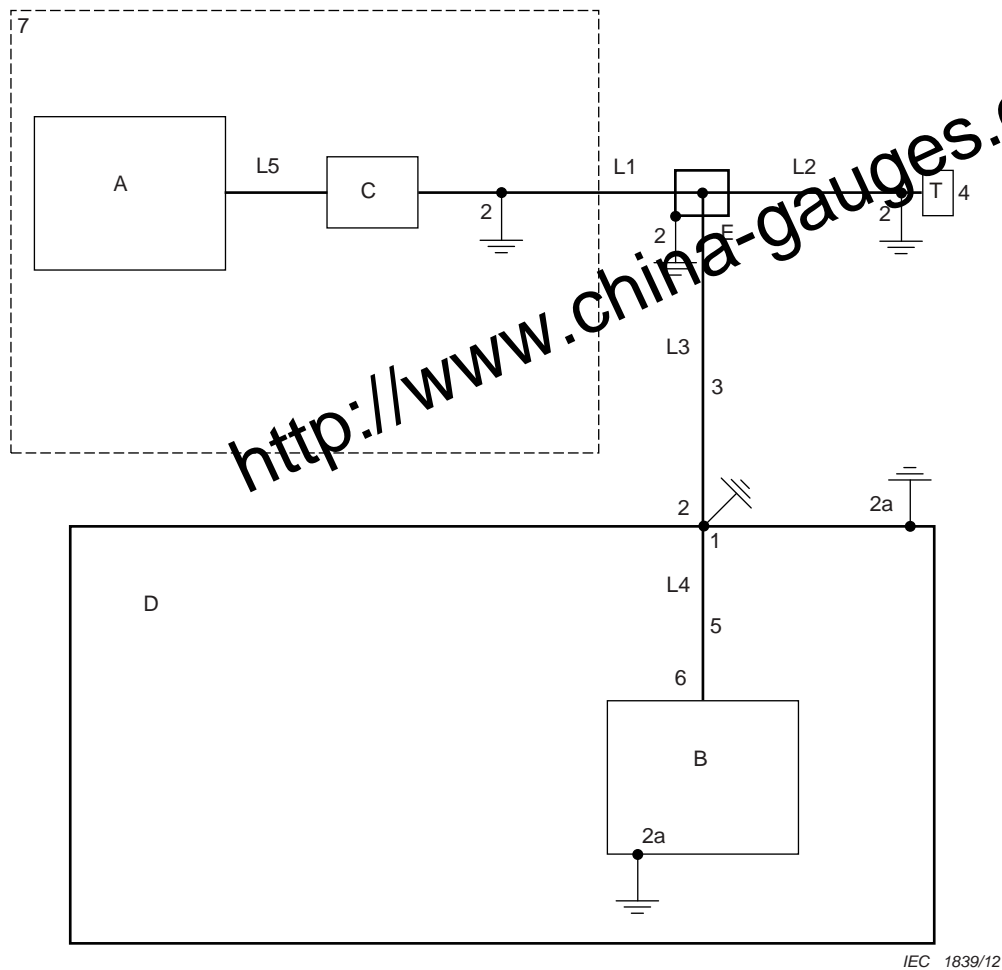
The grounding of the EUT with CP 3/2 interface and the shield connections shall be in accordance with the manufacturer's specification.

BB.2.1.4 Field bus network for EMC test for EUT with CP 3/2 interface

The field bus network includes the terminator of the bus, a device coupler, a signal coupler, the automation system and the EUT with CP 3/2 interface.

The evaluation and conditioning of the data in the signal coupler and in the automation system are not the object of this part of the standard.

The device coupler and the bus terminator are passive components only.



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A: Automation system (master)

B: EUT with CP 3/2 interface (slave)

C: Signal coupler

D: EMC test place

E: Device coupler

T: Bus terminator

L1: 8 m cable type A

L2: 2 m cable type A

L3: 2 m cable type A

L5: Cable type A (see BB.2.1.2)

1: Shield grounding point (SGP) of L4

2: Shield / housing connected with low impedance

2a: Enclosure connected with low impedance

3: Connection see BB.1.1.3

4: Terminator, either direct at device coupler or after a short cable (< 1 m)

5: Cable from SGP to field device

6: Connection of shield at field device see BB.2.1.3

7: A and C may be included in a single housing / system / device

L4: 8 m cable type A (see BB.2.1.2)

Figure BB.1 – Test set up for EUT with CP 3/2 interface

BB.2.2 Operation conditions of EUT with CP 3/2 interface during testing

Subclause 5.3 of IEC 61326-1 applies, except as follows:

Addition:

BB.2.2.1 Operational conditions for EUT with CP 3/2 interface

The operating conditions describe the software settings at the EUT with CP 3/2 interface and at the automation system. The master connected to the signal coupler is set as "master class 1", the EUT with CP 3/2 interface as "slave".

The cyclic operating mode shall be used.

The parameter "retry limit" shall be set to 2 at the master. This means after three consecutive transmission errors (bus-line break down or slave not working) the master (automation system) set the status to "0".

The general bus parameters for the cyclic data exchange in IEC 61158-3-3:2007, 5.5.2.3.3, Table 29 shall be taken into account.

BB.2.2.2 Status for EUT with CP 3/2 interface

The field bus controller in conjunction with the automation system monitors the received data of the EUT with CP 3/2 interface. The received data is of the data type QualifiedFloat32 or QualifiedUnsigned8 as defined in IEC 61158-5-5:2007, 5.3.3.12 resp. 5.3.3.13. Those data types are of the format STRUCTURE and have a field named status.

For the automation system and the test evaluation the quality in the status is significant.

In case of received data only four qualities can appear (extract from IEC 61158-6-10, 5.1.1.3.2.2):

- "Good (Cascade)" means status is in the range between 192 and 255
- "Good (Non Cascade)" means status is in the range between 128 and 191
- "Uncertain" means status is in the range between 64 and 127
- "Bad" means status is in the range between 0 and 63

The equipment under test shall preferably be configured so that the value of the status is 128.

Other values for the status are allowed if they enable the evaluation the function of the EUT with CP 3/2 interface. However values of the status indicating a disturbed communication shall be avoided. If a status value deviating from 128 is chosen the reasons for this decision have to be reported in the test report.

BB.2.2.3 Monitoring for EUT with CP 3/2 interface

- a) The status shall be monitored.
- b) The measuring value shall be monitored.
If the allowed tolerances are not specified in an appropriate part of this standard the values specified by the manufacturer may be used.

BB.3 Performance criteria

Subclause 6.4 of IEC 61326-1 applies, except as follows:

Performance criterion A is extended by the following:

Performance criteria A

The status value as described in BB.2.2.2 shall remain unchanged during and after the test (see BB.2.2.2 and BB.2.2.3).

Performance criterion B is extended by the following:

Performance criteria B

The status value (see BB.2.2.2 and BB.2.2.3) deviates during the test, but returns to the same status value as before the test with no operator intervention.

Performance criterion C is extended by the following:

Performance criteria C

The status value (see BB.2.2.2 and BB.2.2.3) deviates during the test, but after test the device only returns with operator intervention to the intended operation mode.

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