

IO-Link

How to Become and to Run an Approved IO-Link Test Center

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Any comments, proposals, requests on this document are appreciated.

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1 Management Summary – Scope of this Document

This document describes the preconditions for becoming a test laboratory approved by IO-Link community. It additionally describes the rules for the performance of such an IOL Test Center (IOLTC).

2 List of affected patents

There is no affected patent known by the members of the Working Group. The list is empty. No patent search, neither external nor internal, has been done by the members of the Working Group up to now. The IO-Link community does not guarantee the completeness of this list.

3 References and related documents

	document
[1]	IO-Link Community Rules
[2]	IO-Link Interface and System Specification
[3]	IO Device Description Specification
[4]	IO-Link Test Specification V
[5]	IO-Link Master Test Interface

Applicable are the documents of the current package

4 Definitions and Abbreviations

For the purposes of this document, the following definitions apply

Term	Definition
Master Tester	A tool that is designed to execute the protocol tests according to the test specification , recommendet by the IO-Link Quaility WG
Device Tester	A tool that is designed to execute the protocol tests according to the test specification , recommendet by the IO-Link Quaility WG
IODD	IO device description
DID	Device Identifier of an IO-Link device
VID	Vendor ID (Identification)
OEM	Original equipment manufacturer (OEM): a company makes a part or subsystem that is used in another company's end product

For the purposes of this document, the following abbreviations apply

Abbreviation	Meaning
IOLCC	IO-Link Competence Center
DUT	Device under test
MD	Manufacturer declaration
uC	Micro controller

PL	Physical layer
IOLTC	IO-Link Test Center

5 Approval criteria

The approval criteria according to which the competence of an IOLTC is audited must at least comprise those listed in this description.

The IO-Link Steering Committee may detail or define further technical criteria tailored to an individual test or type of test.

Furthermore, the economic market must be such that the IO-Link Steering Committee can ascertain a demand for the test laboratory to be approved.

The conformances with the approval criteria are checked by one or more auditors. The procedure is called “audit”.

6 Scope of approval

6.1 Definition of the Scope of the approval

The scope of approval is clearly defined by reference to the current specification package. Scopes are determined by the IO-Link Steering Committee on request of the IO-Link Quality working group see Table 1.

IO-Link	Device	Master	Mandatory
	Basic	Basic	Mandatory
	Safety	Safety	Optional
	Wireless	Wireless	Optional

Table 1: Approval variants for scope extensions

Applicants apply for a definite scope when applying for an IOLTC. The decision is taken by the IO-Link Steering Committee.

6.2 Change of scope

In case an already accepted IOLTC wishes to extend its test scope between two audits, the IOLTC must direct this application to IO-Link Quality WG. The application must contain the scope of the extension by reference to the test specification(s) as well as a declaration that the IOLTC has a well-trained staff as well as suitable test tools. In case the declaration seems to be plausible, the IO-Link Quality WG decides on the requested extension. If necessary, the core team will be included in the decision process.

7 Requirements for a IO-Link Test Center (IOLTC)

7.1 Legal identifiability

The IOLTC must be legally identifiable.

7.2 Impartiality, independence and integrity

The IOLTC agree to conduct the tests in a neutral and unaffected way to his best knowledge and abilities.

The quality management system must ensure that there is a strict separation of responsibilities when testing the products of clients who are also involved in the development, production or sale of such products.

7.3 Technical competence

7.3.1 Administration and organization:

The IOLTC must have the competence required to carry out the tests for the intended scope. The IOLTC must be organized in such a way that the involved personnel know the extent as well as the limits of its area of responsibility (approval scope). The IOLTC must be familiar with the standards of the corresponding technology.

In organizational terms it must be assured that the involved personnel are familiar with the test procedures, the purpose of the test and the evaluation of the test results. The IOLTC must have a technical manager who bears overall responsibility for the technical running of the IOLTC.

7.3.2 Staff

The IOLTC must have sufficient staff with the qualification, technical knowledge and experience required to carry out its responsibilities. In case that an established qualification system (e.g. training courses provided by certified training centers) exists for the intended test scope the qualification of the staff responsible for testing must be proven with the application.

For each member of the staff it must be documented for which test area(s) in the defined scope this person is approved for testing.

The IOLTC must ensure that the training of its staff is kept at an appropriate level. The IOLTC must keep documentation on qualifications, training and experience of the technical staff up to date.

7.4 Premises and facilities

Suitable measures must be taken to ensure protection of confidential information of customers.

7.4.1 Facilities and test equipment

All facilities must be properly maintained. Exact maintenance instructions must be available. Records must be made of each important test facility. Each record must contain the following:

- a) Designation of the facility in question;
- b) Manufacturer's name, type designation and serial number;
- c) Date of purchase and date of commissioning;
- d) Current location;
- e) State as delivered (e.g. new, used, overhauled);
- f) Details of the maintenance carried out;
- g) Information on damage, malfunctions, modifications or repairs.

As far as the IO-Link community stipulates a common test system, this test system has to be used for test purposes.

IOLTC are authorized to perform manual tests in cases that automated test systems do not work according to test specification. Detailed documentation of such a case is mandatory.

7.4.2 Documents

Documents of the IOLTC (organization and competences) must be available.

8 Approval procedure

The approval procedure comprises the following steps:

8.1 Application for approval

If an organization wants to become a certified IOLTC, a duly authorized representative of the applicant must sign an official application.

Precondition is that the applicant is already approved as an IO-Link Competence Center (IOLCC) covering at least the same scope.

The application must be directed to the Head of IO-Link Steering Committee for decision by the IO-Link Steering committee.

8.2 The appointment and engagement of a qualified auditor

The IO-Link Steering Committee appoints an auditor to the applying organization. The auditor will provide a quotation for the costs of the audit based on expenses. The auditor will also propose a date for the audit. The applying organization will engage the auditor by written statement.

8.3 Collection of information required for auditing

The following information must be supplied by the applying organization prior to audit:

- a) General information on the applying organization (organizational unit, name, address, legal form, personnel-related and technical information);
- b) General information on the applying organization, such as main field of activity, position within a larger organization and the location of the proposed IOLTC
- c) The intended scope of the IOLTC
- d) Description of the internal organization and of the Quality Management System which the applying organization uses in order to generate confidence in the quality of its testing activities, by presenting its Quality Management Manual

The collected information serves as a preparation for the on-site examination.

8.4 The on-site audit of the applying organization

The applying organization is to be subjected to an on-site audit by the appointed auditor. The audit will be divided into two parts:

- the audit of the Quality Management System and
-

- the assessment of the test performance.

During the first step it will be checked whether all elements of the Quality Management System are implemented conformant to the Quality Management Manual.

In the second step it will be checked, whether the test personnel is able to perform the tests according to the defined test procedures and whether the required documentation work is carried out properly.

During the audit all test personnel must be present. If the responsible technical manager is not present, the on-site audit shall be repeated in any case.

In a final discussion the auditor will explain the major results of the audit as well as the required actions. He will also categorize the different observations according to the importance and will agree with the test lab management on the next actions.

The observations of the auditor will be documented in a detailed audit report. The audit report may also contain recommendations which procedures should be improved till the subsequent audits. In case of an unsecussfull audit a second audit can be scheduled by the auditor.

The auditor will provide the applying organization with a copy of the audit report.

8.6 Acceptance duration

The acceptance of a IOLTC is declared for a limited time of 3 years. After this period a reapproval has to take place (follow-up approval).

Scope extensions require a follow-up approval

9 Running the IOLTC

9.1 Test specifications and lab instructions

The IOLTC must have suitable written instructions for the use of all test facilities. All instructions, standards, manuals and reference data important for the activities of the IOLTC must be kept up to date and be easily accessible for the staff.

The IOLTC must use the procedures defined in the relevant test specifications and test cases if applicable and available.

The IOLTC must turn down requests to carry out tests according to test procedures that may jeopardize an objective result or are of insufficient validity.

All calculations and data transmissions shall be verifiable in a suitable form.

9.2 Quality Management System

9.2.1 General

The IOLTC must operate a Quality Management System. The elements of this system must be recorded in a Quality Management Manual, which is available to the staff of the IOLTC. A

staff member of the IOLTC appointed for this task must keep the Quality Management Manual up to date.

The management of the IOLTC must appoint a staff member responsible for quality management within the IOLTC (quality manager); this staff member has direct access to the management of the IOLTC

Quality Management Manual must contain at least:

- a) a statement on quality policy;
- b) structure of the IOLTC (system flowchart);
- c) responsibilities and competencies with respect to quality management, so that for every person involved the extent and limits of his/her responsibility are clear;
- d) general quality management sequences;
- e) sufficient measures for information feedback and for corrective measures if inconsistencies are found in tests;
- f) procedures for handling complaints;

The Quality Management System must be systematically and regularly monitored by, or on behalf of, the management of the IOLTC, in order to ensure the long-term effectiveness of sequences and the introduction of the necessary corrective measures. These monitoring operations and details of all corrective measures taken must be recorded.

9.2.2 Competence

The IOLTC must have the competence required to carry out tests covered by the approval scope. The IOLTC must be organized in such a way that every involved person knows the extent as well as the limits of its area of responsibility (according to the acceptance scope).

The IOLTC staff must cover the following roles:

- a) Technical manager who bears overall responsibility for the technical running of the IOLTC. This person can be a test engineer.
- b) Registered test engineers with a clearly identified individual test scope
- c) Quality manager with the responsibility to maintain the quality system and to perform internal audits. This person should not be a test engineer.

The entire IOLTC staff must be available at the external and internal audits.

9.3 Simulation components incorporated into test object

Only complete products in their final form are accepted for the test. No kind of simulated parts or simulated components with regard to tested functions is allowed. Exception: Simulation of the application.

9.4 Test reports

The work carried out by the IOLTC must be drawn up in a report that conscientiously, clearly and unequivocally records the test results and all important information.

Due consideration must be applied to the structure of the test report, particularly with respect to reproduction of the test data and comprehensibility to the reader.

The test results must be reproducible and documented conscientiously, clearly and fully, in conformance with instructions that may be part of the documents relating to the test procedure.

Quantitative results must be given with the calculated or estimated measuring tolerance.

The test report lists the tested functions. The test results can be specified in more detail through hints or restrictions. The following rules apply to this:

- Test Exceptions must be listed under chapter "Restrictions"
- Results described in chapter "Restriction" have either to lead to a Test Exception (TE) or to refer to an already existing Test Exception. Otherwise compliance will be refused.
- If a Test Exception Request number is referenced in chapter "Restrictions" the device must not be suggested to be compliant.
- If a Test Exception Accepted number is referenced under chapter "Restrictions" the device can be suggested to be compliant.

The test reports have to be signed by an authorized member of the staff and must be issued in digital form. A document must be sent to the client, and one copy must be archived by IOLTC.

9.5 Records

The IOLTC must maintain records adapted to its particular conditions. The records of each test must contain sufficient information to be able to repeat the test. The records must contain information on the persons involved in the test. All original observations, calculations and derived data, as well as the records concerning calibration, and the final test report, must be archived for a period of at least four (4) years.

IOLTC can archive all its documents and records in digital form and the handling and archiving process must be described in a Quality Management manual of the IOLTC.

All records and test reports must be kept in safekeeping and treated confidentially in the interests of the client.

9.6 Handling the test items

The items to be tested must be systematically identified, either through documents or marking, in order to preclude the possibility of mistakes concerning the identity of the test items and the measured results.

This system must include precautions to ensure that the test items are treated anonymously, e.g. with respect to other clients.

There must be unequivocal provisions for the receipt, storage and disposal of test items in the Quality Management manual of the IOLTC.

9.7 Assuring confidentiality

In accordance with the contractual conditions, the IOLTC must guarantee confidentiality in its work.

IOLTCs can exchange sensitive information about the performed tests and their results among each other only if there is an objective technical reason for it and in the best interest of the objectiveness of the test results.

This is allowed for example in following 3 cases:

- a) The test system is unable to work or detects failures but the device behavior is expected to be compatible with the standard. Only technical information necessary to report, bug-fix and test the test system are provided by the IOLTC to the respective Project Manager of the test system or respective WG leader. IOLTC takes care to minimize the information provided about the identity of the device as much as possible. Client must be informed generally about this procedure before contract signing, and can express his concerns (done provisionally by contract or in written form if needed).
- b) There is a reason to ask for a test exception. If client specific information is needed for the test exception the client has to agree that this information is being used.
- c) IOLTC needs to cooperate on testing with another IOLTC (missing acceptance for specific profile etc.) The client must be informed before contract signing, which IOLTC will be involved in the test campaign as a subcontractor. The same level of information provided by client to the IOLTC will be provided also to the participating IOLTC (subcontractor) in this case.

Each IOLTC must treat the information obtained from another IOLTC in the same manner and confidence as the information about own client.

9.8 Subcontracts

As a rule, tests that an IOLTC has contractually undertaken to carry out must be performed by the IOLTC in question. If, by way of exception, an IOLTC should grant subcontracts for part of the test, these must be granted to another IOLTC or approved subcontractor that meets the requirements stated here.

The IOLTC must be able to ensure and prove that the subcontractor is competent to perform the relevant service, and able to satisfy the same competence criteria as apply for the IOLTC client of its intention to pass on tests to another institution. This subcontractor must be accepted by the client.

The IOLTC has to record and keep details of its examination of the competence of its subcontractor and compliance with the conditions, and must keep a list of all completed subcontracts.

9.9 Cooperation with clients

The IOLTC must cooperate with the client or his/her representative in such a way that the latter can explain the handling of the device under test and support the execution of the test. This cooperation includes:

- a) assuring access for the client or his/her representative to the relevant areas of the IOLTC in order to be able to witness any tests carried out on his/her behalf. It is assumed that such access will under no circumstances conflict with the rules of confidentiality with respect to work for other clients and to safety;
- b) preparation, packaging and dispatch of test items which the client requires for purposes of examination.

9.10 Arbitration procedure

To solve conflicts between the clients and the IOLTC (for example if a client disagrees with the results of the IOLTC or its conclusion), a request to the IO-Link Quality WG can be issued for clarification in an arbitration procedure.

In this case, both the IOLTC and the clients must submit a statement of their own on the disputed test results to the IO-Link Quality WG.

The members of IO-Link Quality WG will discuss the matter and come to a proposal for a resolution. The IO-Link Steering Committee will discuss the proposal and will finally decide the disputed subject in case no agreement can be achieved in the IO-Link Quality WG.

9.11 Cooperation with IO-Link Community

The IOLTC must cooperate sufficiently with the IO-Link community to allow monitoring of compliance with its requirements and other criteria. This cooperation must include:

- a) assuring access for the representative to the relevant areas of the IOLTC in order to witness tests being performed
- b) permission to carry out an appropriate examination by the IO-Link community (e.g. audits) that can determine the testing capability of the IOLTC
- c) permission to closely examine the results of the internal audits carried out by the IOLTC itself.

9.12 Cooperation with other IOLTCs

The IOLTCs are obliged to participate in the information exchange with other IOLTCs performing tests in the same test scope. The aim is to meet the uniform test procedures and to improve the testing quality as far as possible. In case that IOLTCs need additional information it is obliged to request it from other IOLTCs. The confidentiality of the client's information must be respected.

Cooperation platform for information exchange is managed by the IO-Link Quality WG.

10 Obligations arising from Acceptance

An approved IOLTC:

- a) must meet the requirements of these defined criteria at all times
- b) must make it clear (e.g. for its clients) that it is only approved for test services for which it has been granted acceptance and which are performed in accordance with the requirements of these defined criteria
- c) must maintain the technical knowledge to be able to perform the certification tests for the test scope it is accepted;
- d) must participate on the regular IO-Link Quality WG meetings;
- e) must pay the fees for application and assessment as determined by the Steering Committee must not use its approval in such a way as to bring IO-Link and its technologies into disrepute, and with respect to its approval may make no statements which IO-Link may justifiably regard as misleading
- g) on termination of the validity of its approval (for whatever reason), may make no further use of it and must stop any related advertising
- h) must make it clear in all contracts with its clients that the approval of the IOLTC or its test reports as such do not under any circumstances mean that IO-Link has approved this product as a whole;
- i) should work towards ensuring that test reports or parts thereof are not used or approved by a client for advertising purposes if this use is regarded as misleading by IO-Link Community;
- j) must notify the IO-Link Steering Committee without delay about any change that affects compliance with the requirements of these criteria and affects the efficiency or the field of activity of the IOLTC;

In the event of withdrawal of its acceptance, the IOLTC must work towards ensuring that such references are no longer made.

An IOLTC can waive its acceptance by notifying the Steering Committee via the IO-Link Quality WG in writing and observing a period of one month's notice.

11 Withdrawal of the acceptance

The acceptance can be withdrawn by the IO-Link Steering Committee if one of the following cases applies:

- a) The auditor recommends the withdrawal for reasons stated in the audit report
- b) In cases of misuse or violations of the obligations as stated in this document

Annex:

Latest information regarding the scope of IOLTCs, the acceptance procedures and the approved test systems are available on the website www.IO-Link.com

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