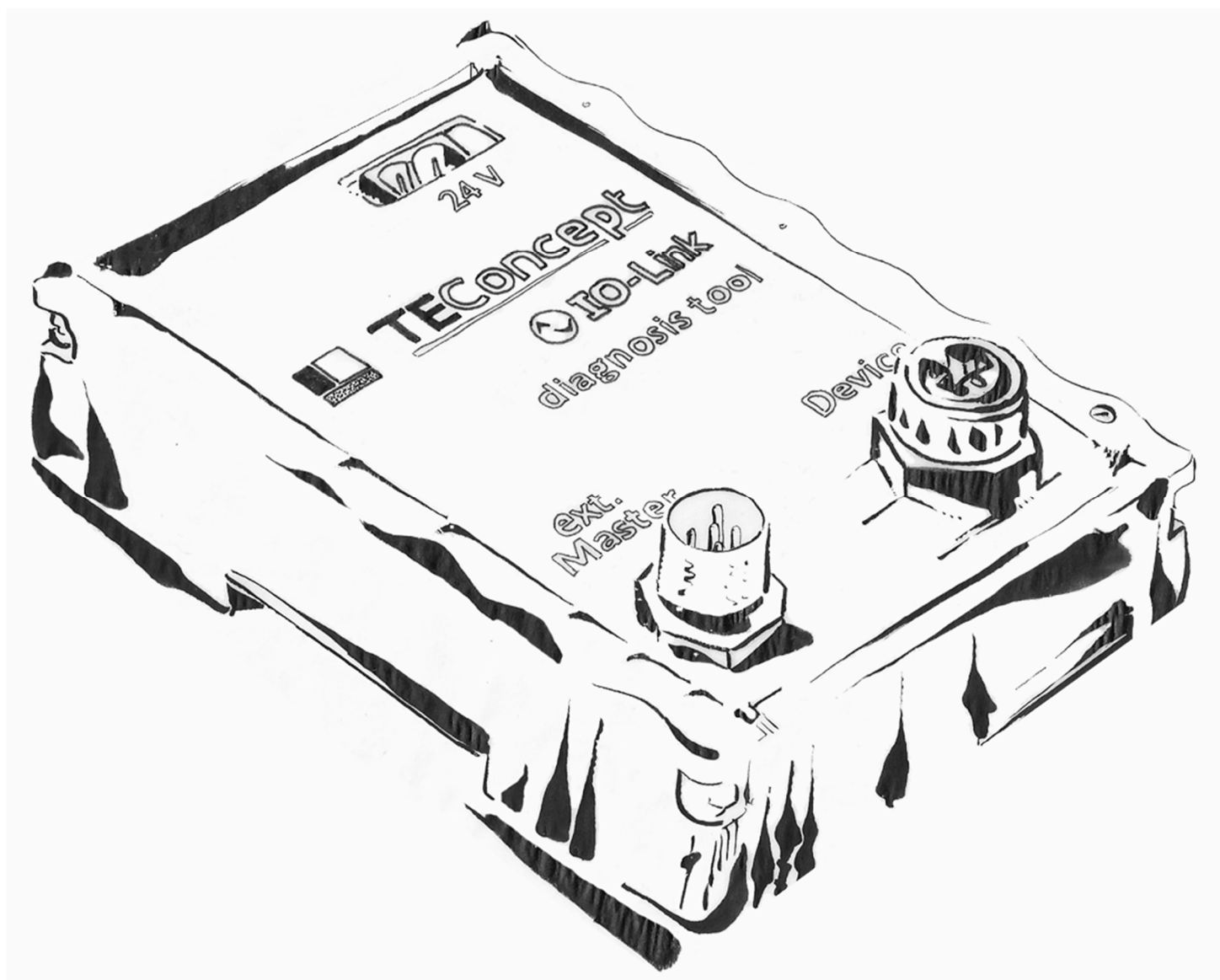




Product Catalogue

2019/2020



Scan and browse:





Welcome to TEConcept GmbH



Who are we?

TEConcept is an engineering office that offers services for commercial and industrial partners. Our services include

- Consulting
- Development support
- Software / Hardware design
- Complete electronic product development.

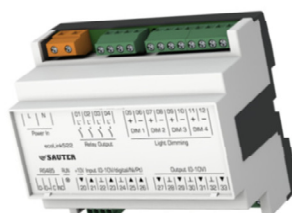
Typically, we hand over the development results to our manufacturing customers.

What is our Know-How?

- Industrial communication, especially IO-Link
- Intrinsic Ex design
- Digital signal processing
- Commercial multimedia applications
- Short-range radio communication

Why should you talk to us?

- You want to speed up your development
- You need special expertise
- You want to integrate multimedia into industrial applications



IO-Link Competence and Test Center

In addition to our general development services, TEConcept acts as approved IO-Link competence- and test center. IO-Link is a communication protocol that allows the connection of low-cost devices to a variety of field busses. In case of IO-Link, TEConcept offers both **Services** and **products**.

IO-Link Services

- Consulting
- Conformance testing
- Adding IO-Link communication to existing products
- IO-Link product development
- Reference designs

IO-Link Products

- IO-Link Master/Device stacks
- IODD-Designer
- IO-Link Device Tester, Master Tester
- EMC Test Master, EMC Test Device
- IO-Link Physical Layer Tester
- USB 1 and 4-port master (modules)
- IO-Link Ethernet Master with JSON
- IO-Link to OPC UA generic mapping
- IO-Link Diagnosis Tool



Overview

Current sensors and actuators are equipped with small but powerful microprocessors that introduce advanced features like parameterization and diagnostics to these devices. However, those features are currently not visible to standardized project planning tools.

IO-Link, the new bi-directional, digital, point-to-point communication standard (**IEC 61131-9**) offers now a standardized mapping of advanced sensor and actuator features into the automation tool environment.

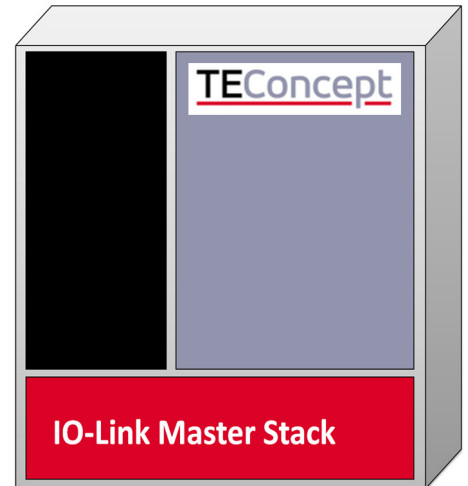
Our IO-Link **master** software stack allows **automation system** and **machine tool** providers an easy way to integrate state-of-the-art IO-Link technology into their products.

Features

- Complies to latest IO-Link communication specification
- Multi-port support. The number of ports only limited by hardware resources.
- Cycle times: 0,4ms @ 230,4 kBaud
2,3ms @ 38,4 kBaud
18ms @ 4,8 kBaud
- Footprint: RAM: ~8kByte + 2kByte/Port +
~2kB for every OS-Task
(3 tasks are currently used)
Flash: ~30kB Stack
~2kB OS
- System load max. 20MHz/Port (COM3-speed)
- Software interface via shared parameters
- Control and test API
- Currently available drivers:

Processor	PHY
STM32	L6360
ATSAM91	E981-12
LPC43xx	LT2874
Kinetis KL43/17	MAX14824
SuperH SH7216	MAX14819
FM4 S6E2H	CCE4510
TI-Sitara	CM3120

- Supported development platforms:
Keil, IAR, GCC, LPCXpresso, KSDK, HEW, ...



Description

The IO-Link master firmware library provides full access to all features and services defined in the IO-Link Communication Specification V1.1. The stack supports all the important features like ISDU, Interleaved Mode and diagnostics handling with event details. FreeRTOS is used.

Deliverables

- Development license including IO-Link Master stack source code
- Manufacturing license
- Documentation with installation manual and hardware adaptation description
- API user guide
- Demo application
- Compiler & linker example setups
- IO-Link configuration tool with IODD interpreter

Additional Services

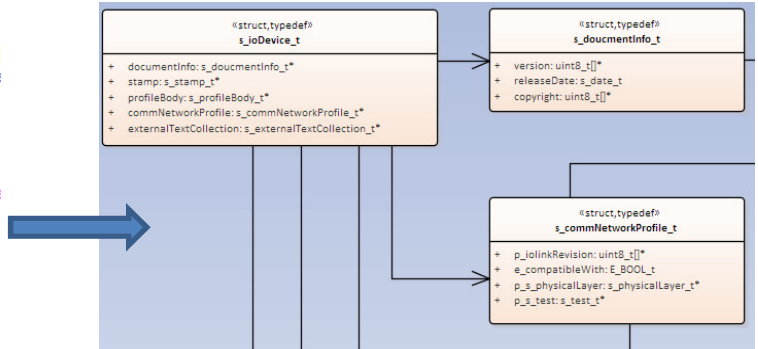
- Evaluations boards
- Software/Hardware design support
- Conformance tests (Master Tester)



Use IO-Link IODD Parser

Universal · Smart · Easy

```
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema xmlns="http://www.io-link.com/IODD/2010/10" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" >
  <xsd:include schemaLocation="IODD-Primitives1.1.xsd"/>
  <xsd:include schemaLocation="IODD-Datatypes1.1.xsd"/>
  <xsd:include schemaLocation="IODD-Variables1.1.xsd"/>
  <xsd:include schemaLocation="IODD-Events1.1.xsd"/>
  <xsd:element name="IODDStandardDefinitions" type="IODDStandardDefinitions_t"/>
  <!-- unique, key -->
  <xsd:unique name="Variable_Index">
    <xsd:selector xpath="/*/iodd:Variable"/>
    <xsd:field xpath="@index"/>
  </xsd:unique>
  <xsd:key name="Variable_Id">
    <xsd:selector xpath="/*/iodd:Variable"/>
    <xsd:field xpath="@id"/>
  </xsd:key>
</xsd:schema>
```



Overview

IO-Link devices need to be described by IO-Link Device Descriptions called "IODD". These IODD are complex structured XML files. In order to use the information given in an IODD, it is necessary to parse the IODD text file and to convert it into a hierarchical memory model layout. These IODD parsers are typically included within engineering tools running on an PC that allow parameterization and configuration of IO-Link Devices.

However, there are use cases where it is beneficial to have the respective memory layout available in an embedded system that is directly linked to an IO-Link Master.

One use case is a web server that is implemented in an IO-Link Master hardware. An IODD parser allows to integrate an embedded web server that provides access to parameters, events, system commands etc. of any Device that is connected to the IO-Link master after having parsed the corresponding IODD.

TEConcept has developed an IODD Parser that is suitable to be integrated in embedded systems. It is designed to make very efficient use of embedded memory and it has been tested with a big amount of IODDs of different Devices.

Deliverables

- C-source code
- API description
- Test report

Features

- Complies to IO-Link Interface Specification V1.1.2
- Complies to current IODD-specification (V1.1) and V1.0 (August 2011)
- IODD import as text-file (string, stream)
- Average parsed IODD size = 20kByte
- Max parsed IODD size (CLUETEC Server, April 2018) 100 kByte
- Simple user API
- Memory model organized as linked tree structure
- Programming language "C"
- Suitable for embedded Systems

Advantages

- Support Design of "intelligent" IO-Link Masters
- Efficient memory usage
- Error checking included
- Simple to use API



JSON Integration for IO-Link

Overview

One of the significant challenges of IoT- and cloud-based systems, is the specification of a secure and straightforward communication interface with industrial field devices.

The fact that most modern automation system can communicate via TCP/IP and HTTP gave the motivation for the IO-Link Consortium to create a standardized JSON- based communication specification for IO-Link.

The integration provides a device data model, objects, and semantics for mapping the IO-Link system into IT relevant connections and services. This includes a standard REST API based for:

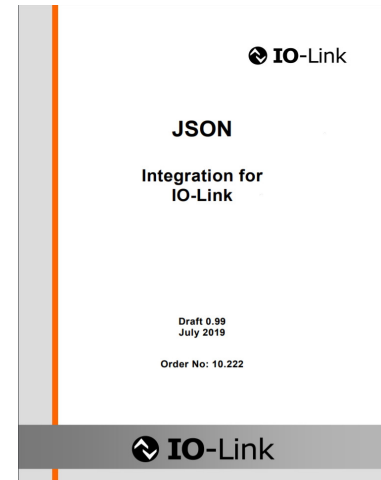
- Data access for IO-Link Master/Ports/Devices
- IODD management
- MQTT client configuration

Advantages

- Easy integration to any JSON based clients like (PDCTs, HMI, etc.).
- Easy integration to Node-RED and Cloud systems.
- Convenient means for diagnostics and parameterization.
- Possibility for web-based supervision of the IO-Link system.

License model

- NRE based, royalty-free license
- One-year maintenance included
- Full source code transfer



Requirements

- V1.1.3 IO-Link Master stack (with SMI interface)
- RTOS or Linux/Windows operating system
- Ethernet connection using a TCP/IP stack
- ARM Cortex M4, M7 controller, or any system which can run Linux or Windows.
- Moderate memory requirements suitable for Cortex-M-based processor platforms

Deliverables

- **JSON Integration for IO-Link module source code, written in ANSI C (can be compiled on embedded platforms and also on Linux/Windows-based systems)**
- **Web server using sockets / if supported**
- **Integrated IODD parser**
- **Demo application**
- **JSON API documentation**

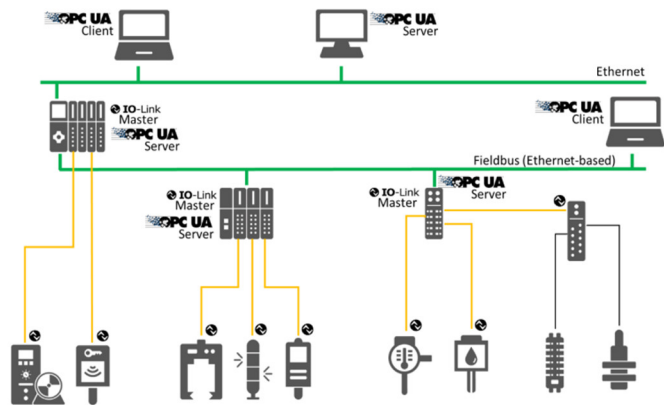


Use  **IO-Link**
Universal · Smart · Easy

IO-Link to OPC UA Mapping



Use  **IO-Link**
Universal · Smart · Easy



Overview

The IO-Link Community and the OPC UA Foundation have created a companion specification in a joint working group that describes the mapping of IO-Link into OPC UA systems. The mapping describes a generic model and an IODD-aware model. TEConcept offers an OPC UA server software package for the generic OPC UA model that is designed to run on small microcontroller platforms like the CORTEX-M4 platform.

The OPC UA server interacts directly with an IO-Link Master that might run on the same microcontroller.

Any OPC UA client can connect to the generic OPC UA server, but it needs knowledge about the connected IO-Link Devices. The generic OPC UA server can in addition act as a slave to a higher level IODD-aware OPC UA server which allows to use OPC UA clients that need no knowledge about the connected IO-Link Devices.

Features

- Identification and configuration of the IO-Link Master and its ports
- Generic identification and configuration of connected IO-Link Devices
- Interaction with connected IO-Link Devices
- Subscription of certain IO-Link parameters for periodic updates
- Optional operation- and failure statistics
- Plant supervision over a cloud system.

Features

- Small footprint (~15kByte RAM per IO-Link port)
- OPC UA embedded stack written in ANSI C
- Demo implementation on STM32F4xx available
- Integration with IO-Link Master on the same microcontroller possible
- Chaining to an IODD aware OPC UA server supported
- Simple API interface to OPC UA stack to build custom address space.
- TCP based binary server access

Requirements

- CORTEX M4 with Ethernet port
- RTOS
- IO-Link Master stack with SMI support

Deliverables

- **OPC UA server stack as embedded C source code**
- **Generic IO-Link model with generic Device model and integrated Master model and application.**
- **Master Access Interface Module (based on SMI interface) for communication with the IO-Link master**
- **OPC UA extended Nano Server profile supported**



Overview

Current sensors and actuators are equipped with small but powerful microprocessors that introduce advanced features like parameterization and diagnostics to these devices. However, those features are currently not visible to standardized project planning tools.

IO-Link™, the new bi-directional, digital, point-to-point communication standard (**IEC 61131-9**) offers now a standardized mapping of advanced sensor and actuator features into the automation tool environment.

Our IO-Link software stack opens sensor and actuator manufacturers a cost efficient and easy way to integrate state-of-the-art IO-Link technology into their products.

Specifications

- Compliant to latest IO-Link communication specification
- Synchronous or asynchronous process data handling
- ISDU support
- Data storage
- Process synchronisation
- Footprint: RAM: ~0.4 kB, Flash: ~8-10kB
- System load ~ 50 % on 8-Bit processor @ 16 MHz.
- Porting to different μ Cs and IO-Link PHYs requires only an exchange of drivers.
- Currently available ports:

Microcontroller	PHY
ADUC7xx	HMT7742/8
ATmega64/324/328	L6362A
ATSAM3S	ZIOL2401
ATtiny	SN65HVD10x
C8051F31x/33x/37x/39x	TIOL-11x
EFM32	LT3669-2
Kinetis K02/K60	MAX14820/1
LPC11xx	MAX14827A/828
MSP430	MAX 22513
PIC32MXxxx	CCE4501/2
RL78/xxx	iC-GF(P)
STM32	
STM8L/STM8S	
... (and many more)	



License model

- Royalty-free license
- One-year maintenance included
- Full source code

Deliverables

- **Fully ported stack operational on the target hardware platform**
- **Driver for target processor architecture**
- **Driver for target IO-Link PHY**
- **IO-Link demo application**
- **Compiler and Linker setups for target development environment**
- **API reference manual**

Additional Services

- IO-Link consulting and additional Technical support
- Customized IODD development
- IOL-Device and Master Hardware and Software design
- Supply of development tools like
 - USB master (1-port, 4-port),
 - Conformance Test systems
 - IODD-Design tool
 - Reference designs



Overview

In 2016 the IO-Link community has published a new profile that supports firmware updates via the IO-Link interface. The profile is fully compliant to the IO-Link V1.1 specification. Thus, every standard IO-Link Master can be used to update the firmware of an IO-Link device, if the master is controlled by an appropriate software tools that can read and process the specified Firmware update files. The firmware update files can be designed by a software tool that is provided by the IO-Link community.

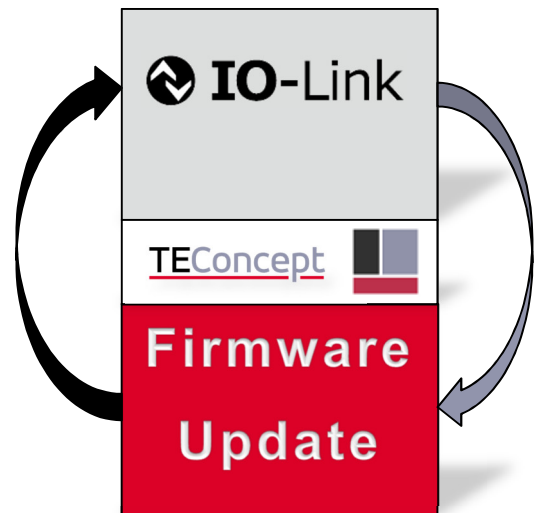
The bootloader transfers a binary image to the device. It receives and checks the image date. Post-processing (decompression, decryption, etc.) and the storage of the image data is device specific. The bootloader provides an appropriate extension interface.

Features

- Complies to Firmware-Update V1.1
- Can be added to an existing IO-Link Device
- Tolerant to power failures and transmission errors during the update process
- Footprint: RAM: ~0.25kB
Flash: ~6kB Stack
- Comes with control tool that handles firmware update tool
- Currently available ported to the following platforms.

Processor	PHY
STM32	LT3669
LPC 11xx	CCE4501
MSP430	SN65HVD102

- More platforms (see TEConcept Device Stack) will be supported on request.
- Supported development platforms:
Keil, Eclipse/GCC, IAR



Description

The bootloader can be added as standalone software to the IO-Link device firmware.

In this case the complete technology application including the IO-Link stack can be updated.

In application with limited flash memory it is also possible to add the bootloader in shared mode. In this mode the IO-Link stack and the bootloader are sharing functionality. In this case only the device application (not the IO-Link stack) can be updated.

Deliverables

- Buyout license for Firmware update bootloader
- Documentation with installation manual
- Compiler & linker example setups
- IO-Link configuration tool with IODD interpreter that handles IO-Link bootloader files.

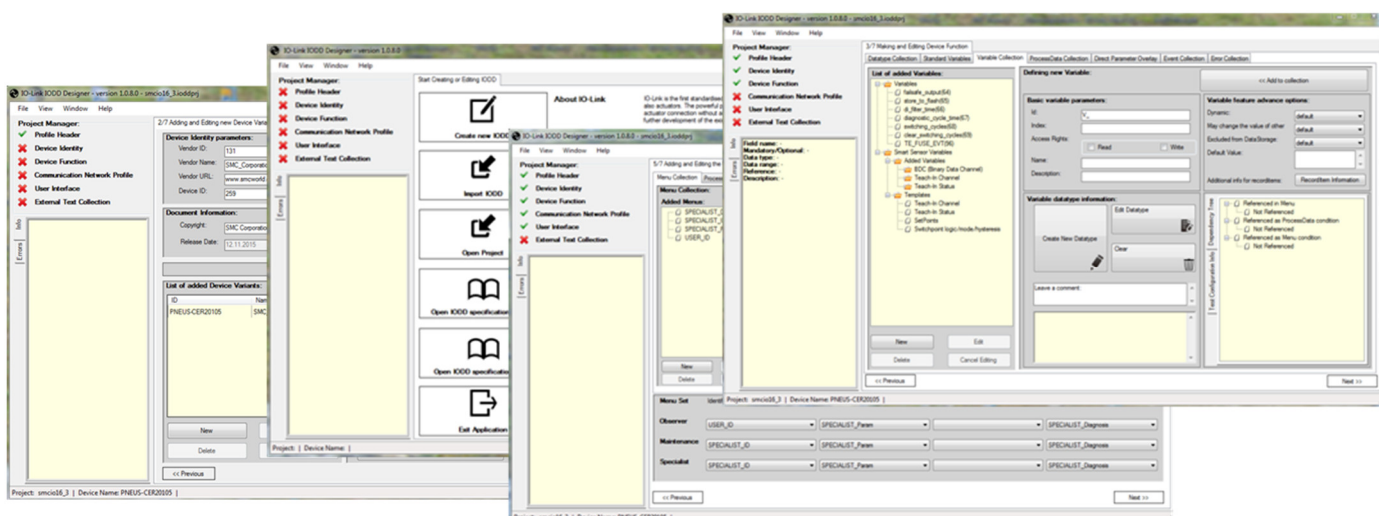
Optional

- Demo Device with bootloader
- Software/Hardware design support
- Conformance tests



Use IO-Link IODD Designer

Universal · Smart · Easy



Overview

IO-Link devices need to be described by IO-Link Device Descriptions called "IODD". These IODD are complex structured XML files with numerous restrictions and interdependencies. The Generation of an IODD can become a laborious and tedious task and it is difficult to maintain integrity between device and IODD in case of modifications.

TEConcept has developed an IODD Designer that simplifies the generation of IODDs significantly.

No XML know how is required to generate an IODD. The user basically has to fill out text fields. For every text field a info box is available that shows related information with reference to the IO-link specifications. The IODD Designer supports creation of new IODDs from scratch as well as import and modification of existing IODDs.

Generated IODDs can be checked and "stamped" by using the "official" IODD checker from the IO-Link webpage.

Deliverables

- Installer for PC-Software

Features

- Complies to IO-Link Interface Specification V1.1.3
- Complies to current IODD specification latest addendums
- IODD import supported (for view and edit)
- V1.1/V1.0 generation from the same data set.
- Help/Info support for entries
- IODD checking and stamping support based on IODD checker of the IO-Link community
- Installer for Windows 7/8/10
- Current project status can be saved and restored
- Errors are detected and corrected during entry
- Context sensitive information on entries with reference to IODD specification
- Smart Sensor profile supported

Advantages

- Speed up of IODD generation
- XML know how not required
- Import and modification of IODDs supported
- Assures consistency related XML-elements in the generated IODD
- Extended error checking



Use **IO-Link** 1-Port USB Master

Universal · Smart · Easy



Overview

Current sensors and actuators are equipped with small but powerful microprocessors that introduce advanced features like parameterization and diagnostics to these devices. However, those features are currently not visible to standardized project planning tools.

IO-Link™, the new bi-directional, digital, point-to-point communication standard (**IEC 61131-9**) now offers a standardized mapping of advanced sensor and actuator features into the automation tool environment.

The 1-Port USB Master is ideally suited for engineering purposes and small PC-based applications.

It uses the STMicroelectronics L6360 transceiver chip. A Windows based graphical user interface is included that reads IO-Link device descriptor files and offers an easy way to connect to all kinds of IO-Link devices.

Deliverables

- 1-Port IO-Link master
- 24V power supply
- IO-Link control tool
- USB cable (Type B)

Features

- Fully IO-Link V1.1.2 compliant (V1.1.3 support prepared)
- All COM-speeds supported
- Data storage supported
- M12 IO-Link connector
- DIN rail mount
- PC-Tool included with
 - IODD interpreter
 - Process data visualization
 - Event visualization
 - Parameter R/W access
 - IODD menu structure support
 - IODD user role support
 - Socket interface for process data
- Windows DLL available for customized and software based access to the Master

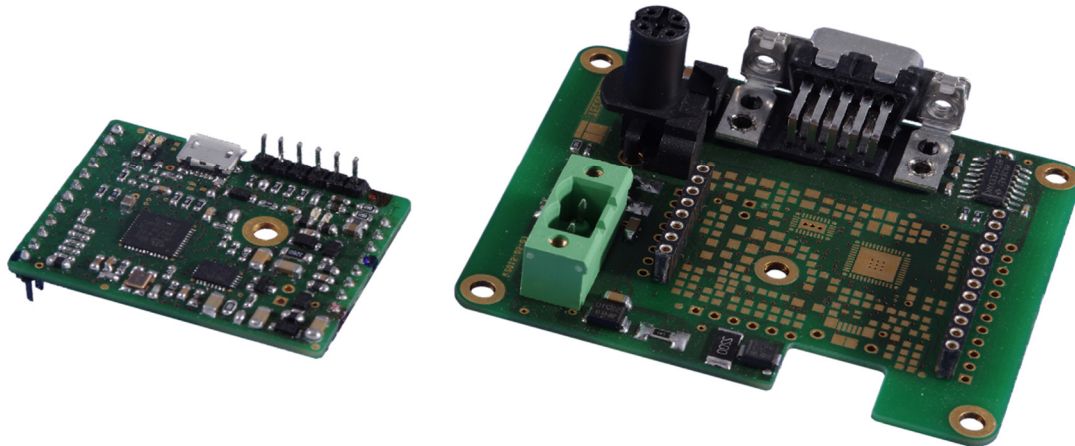
Usage

- Simple evaluation of devices
- Engineering support
- Device testing



Use **IO-Link** 1-Port Master Module

Universal · Smart · Easy



Overview

The **IO-Link One-Port Master Module** provides easy access to IO-Link devices without PLC.

The IO-Link master module contains an IO-Link compliant transceiver PHY together with a controller running a fully compliant IO-Link master stack.

The IO-Link master module can communicate with external hardware by SPI and/or UART interfaces. Simple telegrams sent over these interfaces allow control of the master and provide easy access to process data and IO-Link configuration diagnostic features.

Device configuration can be done offline by an integrated USB connector via a PC running a comfortable and self-explaining IO-Link control tool.

The module can be plugged onto an existing board. For development purposes a reference mother board is available.

Deliverables

- 1-port IO-Link master module
- Mother board with IO-Link master module plug with SPI and UART interface
- IO-Link control tool for easy configuration of arbitrary IO-Link devices with integrated IODD parser
- Manual

Features

- Fully compliant to V1.1 IO-Link interface specification
- IO-Link V1.1 compatible stack
- Integrated IO-Link transceiver with protection
- L+ device power switchable
- SPI interface for control and process data
- UART interface for control and process data
- USB interface for PC control
- Dimension: 43mm x 33 mm

Motherboard features

- 24V power supply connector
- DB-9 serial connector
- Power supply for IO-Link master module
- M12-IO-Link Master connector

Typical Applications

- Seamless integration of IO-Link devices into machine control or similar systems that work without classical PLCs.

Advantages

- Development effort and cost reduced
- Time to Market shortened
- Cost advantages as no IO-Link master stack is required

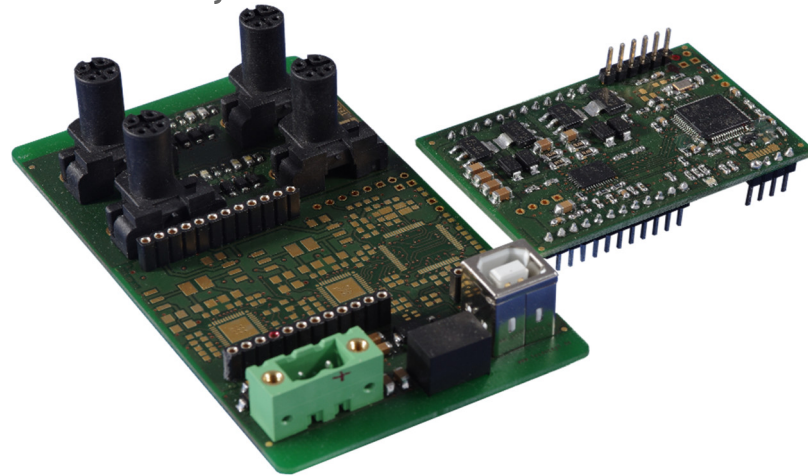


Use



IO-Link 4-Port Master Module

Universal · Smart · Easy



Overview

The **IO-Link 4-Port Master Module** provides easy access to IO-Link devices without PLC.

The master module contains 4 fully tested IO-Link compliant transceiver PHYs together with a controller running a fully compliant IO-Link master stack.

The IO-Link master module can communicate with external hardware by SPI and/or UART interfaces. Simple telegrams sent over these serial interfaces allow communication with the master and provide easy access to process data and IO-Link diagnostic information of up to 4 connected devices.

Device configuration can be done offline by an integrated USB connector via a PC running a comfortable and self-explaining IO-Link control tool.

The module can be plugged onto an existing board. For development purposes a reference motherboard is available.

Optionally, for low cost, stand-alone mini PLC systems customization of the 4-port master application software can be offered.

Deliverables

- **IO-Link 4-Port Master Module**
- **Mother board with IO-Link master module plug and SPI and UART interface (optional)**
- **IO-Link control tool with integrated IODD parser for easy configuration of IO-Link devices of choice**
- **Manual**

Features

- Fully compliant with V1.1 IO-Link interface specification
- IO-Link transceiver and protection integrated
- L+ device power switchable
- SPI interface for control and process data
- UART interface for control and process data
- USB interface for PC control
- Dimensions: 59 mm x 39 mm

Motherboard Features

- 24 V power supply connector
- DB-9 serial connector
- Power supply for IO-Link master module
- M 12 IO-Link master connector

Typical Applications

- Seamless integration of IO-Link devices into machine control or similar systems that work without classical PLCs.
- Stand-alone systems which integrate IO-Link devices and actors (e.g. level sensor with signal tower)

Advantages

- Development effort and cost reduced
- Time to Market shortened



Use **IO-Link** 4-Port USB Master

Universal · Smart · Easy



Overview

Current sensors and actuators are equipped with small but powerful microprocessors that introduce advanced features like parameterization and diagnostics to these devices. However, those features are currently not visible to standardized project planning tools.

IO-Link™, the new bi-directional, digital, point-to-point communication standard (**IEC 61131-9**) now offers a standardized mapping of advanced sensor and actuator features into the automation tool environment.

The 1-Port USB Master is ideally suited for engineering purposes and small PC-based applications.

A Windows-based graphical user interface “Control Tool” is included that reads IO-Link device descriptor files “IODD’s” and offers an easy way to connect to all kinds of IO-Link devices.

Deliverables

- 4-Port IO-Link master
- 24V power supply
- IO-Link Control Tool
- USB cable (Type B)

Features

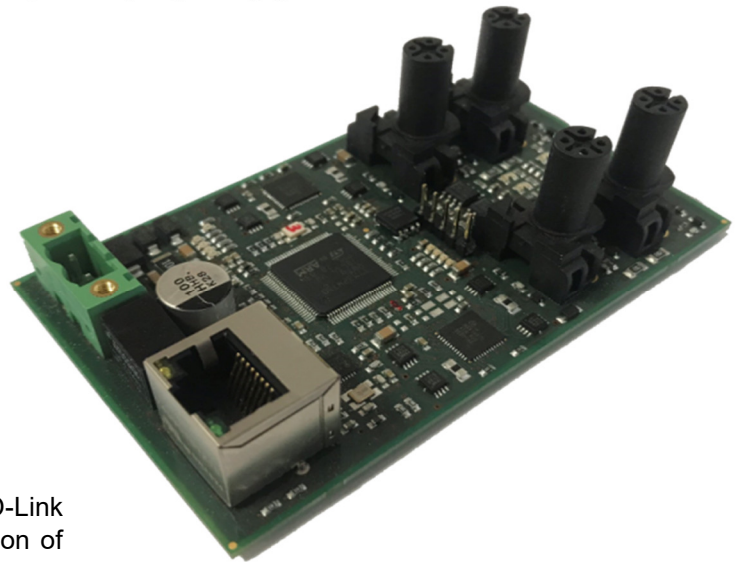
- Fully compliant to IO-Link V1.1.2 (V1.1.3 support)
- Master Firmware update
- All COM-speeds supported
- Data storage supported
- Class A M12 IO-Link connector
- DIN Rail Mount
- PC-Tool included with
 - IODD Interpreter
 - Process data visualization
 - Event visualization
 - Parameter R/W access
 - IODD menu structure support
 - IODD user role support
 - Socket interface for process data
- Option: Windows DLL for customized and software based access to the Master

Usage

- Test Systems
- Simple evaluation of devices
- Engineering support
- Device Development



4-Port IO-Link Master with Ethernet



Overview

Discover the power of our new 4-Port Ethernet IO-Link Master, focusing on Industry 4.0 and IoT integration of IO-Link Devices. The Ethernet-based communication interface makes it easy to talk to IO-Link Devices via the Master unit without any field bus.

An integrated JSON interface following the new “*JSONIntegration for IO-Link*” specification, makes it possible to connect to IO-Link Devices from any software application that supports the JSON data format. An integrated IODD parser maps the Device parameters to JSON data units which simplifies configuration and diagnostic tasks considerably. Also, third-party parameterization and configuration tools which implement the new JSON Integration are supported.

TEConcept's well established IO-Link Control Tool can still be used to access the 4-Port Ethernet IO-Link Master.

An integrated web server offers a convenient interface for:

- Network configuration
- IO-Link Master/Port configuration
- IODD-management
- Basic security settings

Deliverables

- 4-Port Ethernet master
- External Power supply
- Cat 5E Ethernet cable
- IO-Link Control Tool

Features

- IO-Link V1.1.3 compatible Master
- Ethernet interface, DHCP or static IP address configuration
- Integrated IODD parser
- Standardized JSON mapping
- Node-RED integration supported
- Four independent powered IO-Link Class A ports
- Additional Cortex-M4 MCU for customer applications with direct access to the IO-Link Master (Local applications like Mini PLCs, Digital Signal Processing functions, or other real time logic can easily be added by any customer to the 4-Port Ethernet IO-Link Master)

Advantages

- Direct IO-Link Device access over Ethernet without Fieldbus and PLC
- Easy Node-RED integration for IoT and industry 4.0 setups
- Extendible by freely programmable MCU
- Customized OEM enclosure possible



Use



IO-Link

Universal · Smart · Easy

IO-Link Tablet Master



Overview

The new IO-Link Tablet Master is a portable, handheld device which supports

- Service Technicians and Operators:
 - Configuration
 - Issue Detection, Logging
 - Device firmware update
- Sales representatives:
 - Demonstration of IO-Link Devices
- Development engineers:
 - Function tests
 - Upload of new firmware

The Tablet integrates an IO-Link master and an intuitive graphical user interface that can be operated via its integrated touch screen or remotely via Wi-Fi by remote control application running on a PC. The PC connects in this case to a wireless access point that is established by the Tablet.

The integrated Parameterization and Device Configuration software provides different modes of operation for Maintenance personal, Operators, Specialists or Sales staff.

The tablet uses a simple and versatile web interface which allows uploading and managing of IODD files. Firmware update files for connected Devices according to the IO-Link firmware download profile are also supported.

The IO-Link Tablet Master offers automatic **selection** of a **prestored IODD file** and automatic **indication** of an **prestored firmware update file**.

Features

- Embedded 1-Port master with power supply and M12 connector (Class A)
- Portable operation (battery powered)
- Battery charging
- Optional ext. 5-12V power supply
- Integrated IODD parser
- Touch screen operation
- Wi-Fi based wireless operation
- Web interface
- Fast boot-time (12 sec)
- Weight incl. batteries 700g
- Dimension (21cm x 13cm x 3cm)

Deliverables

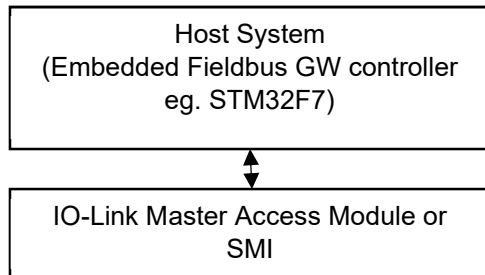
- **12 Volt Power supply**
- **Tablet with IO-Link and power connector**
- **M12 IO-Link connector cable**
- **Remote control application for PC**

Advantages

- Fully portable battery powered operation
- Fast access to IO-Link Devices
- Device Configuration without additional PC
- Wireless remote control of the Tablet
- Easy to use web interface for uploading IODDs and new device firmware files (IOLFW)
- Easy to use Firmware update



Master Access Modules for Embedded Systems



SMI or Serial Test Interface Protocol
(UART or SPI)

TEConcept IO-Link Master
or
any Master with
Serial Test Interface or
SMI interface



Overview

In use cases where the fieldbus gateway controller is separated from the IO-Link master, an interface between the gateway controller and the IO-Link Master is required. For Master implementations that support the IO-Link Test Interface. The IO-Link Master Access Modules are using this test interface to provide an interface for embedded controllers to access IO-Link masters that provide access to the IO-Link test interface.

The main use case for the High Level Master Access Modules is in controlling an IO-Link Master from a Fieldbus Gateway Software Module.

Description

The Master Access Modules offer a simple API to the user, allowing to access master functions like ISDU-read or ISDU-write functions.

These API functions are made available in source code. An example project for the System Workbench for STM32 and for Eclipse is provided for the STM32F746ZG microcontroller (see NUCLEOF746ZG board).

The API functions require to run a real time operating system e.g. FREERTOS.

Hardware resources that are needed are:

- 16-Bit Timer
- UART or SPI master interface
- DMA

Features

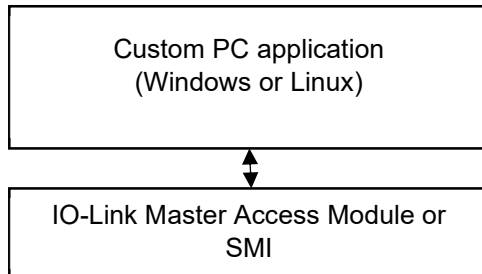
- C-language according to C99 standard
- Modular architecture with a clearly defined API
- Supports various PC platforms (windows, linux 32-bit, 64-bit)

Supported Features

- IO-Link SMI functionality (V1.1.3)
- Communication via UART or SPI

Deliverables

- API User Guide: SD_TECU_027_001.pdf
- IO-Link Master Access Module Library complete compliable source code
- Demo application
 - `iolma_hl_demoapp.h`,
 - `iolma_hl_demoapp.c`
- project files for STM32 system workbench
- project files for bare Eclipse (with plugins)
- Interleave Mode (long telegrams are interleaved by process data to reduce delays.)



SMI or Serial Test Interface Protocol
(RS232, USB, Ethernet)

TEConcept IO-Link Master
or
any Master with
Serial Test Interface or
SMI interface



Overview

In frequent use cases dedicated PC applications need access to IO-Link Devices via an IO-Link Master. Such use cases show up for example in production test systems.

The access to an IO-Link master is usually manufacturer dependent. However, some IO-Link Masters are equipped with an additional test interface which was implemented to run the IO-Link conformance tests. The IO-Link Master Access Modules are using this test interface to provide PC programs access to a certain IO-Link master, independent from the Master manufacturer.

Description

The Master Access Modules offer a simple API with master access means like ISDU-read or ISDU-write functions. These API functions are made available to the application programs via static linking or shared libraries (dll). An API description and a simple example application demonstrates how to utilize the Master Access Modules in detail.

Features

- C-language according to C99 standard
- Modular architecture with a clearly defined API
- Supports various PC platforms (windows, linux 32-bit, 64-bit)

- IO-Link SMI functionality (V1.1.3) supported
- Communication via TCP, UART or USB (virtual COM port).
- Labview binding option available

Deliverables

API User Guide

IO-Link Master Access Module Library

- `iolma_hl_srvl.h` (api functions header)
- `iolma_hl_globals.h`, `iolma_ll_globals.h` (definitions)
- Windows 32-bit: `libiolma_hl_32.dll`
- Windows 64-bit: `libiolma_hl_64.dll`
- Linux 64-bit: `libiolma_hl_32.so`
- Linux 32-bit: `libiolma_hl_64.so`

Demo application

- `iolma_hl_demoapp.h`,
- `iolma_hl_demoapp.c`
- example build projects for Eclipse and Visual Studio

Options

- Library with Microsoft .Net support (C#)
- Labview Binding
- Interleave Mode (fast Process Data transfer)
- PCPDA support (Prioritized process data assignment for Devices running at different cycle times)



LabVIEW Driver

Overview

Current sensors and actuators are equipped with small but powerful microprocessors that introduce advanced features like parameterization and diagnostics to these devices. However, those features are currently not visible to standardized project planning tools.

IO-Link™, the new bi-directional, digital, point-to-point communication standard (**IEC 61131-9**) offers now a standardized mapping of advanced sensor and actuator features into the automation tool environment.

TEConcept offers IO-Link Masters implementing the IO-Link Standard Test interface "STI".

IO-Link Masters, supporting the STI can be controlled with Windows © PC's using the High-Level IO-Link Master Access Module which is available in 32-bit or 64-bit DLLs or in source code format from TEConcept

In order to control the IO-Link Master from LabVIEW a mapping to that libraries required.

There are several LabVIEW .vi files that has been created in order to make the High-Level IO-Link Master Access module usable in LabVIEW.

Type definitions (structures, enumerations) from the C-implementation are in addition mapped to *.vi files with names starting with underscores.

Only (virtual) com port communication is supported to access an IO-Link Master.

The communication cycle time (between the IO-Link Master and the PC) can be adjusted between 1 ms and 400 ms.

Interleaved communication (between the IO-Link Master and the PC) can be used to make the Process Data transmission independent from the On-Request Data transmission (parameter reads / writes).



License model

- Royalty-free license
- One-year maintenance included

Deliverables

- **Full source code of demo application**
- ***.vi files, *.ctl files for integration into LabVIEW**
- **LabVIEW Demo application with control tabs for**
 - **Master control**
 - **Port control**
 - **Process Data**
 - **Parameters**
 - **Port status**
- **High-Level IO-Link Master Access API documentation created with Doxygen**

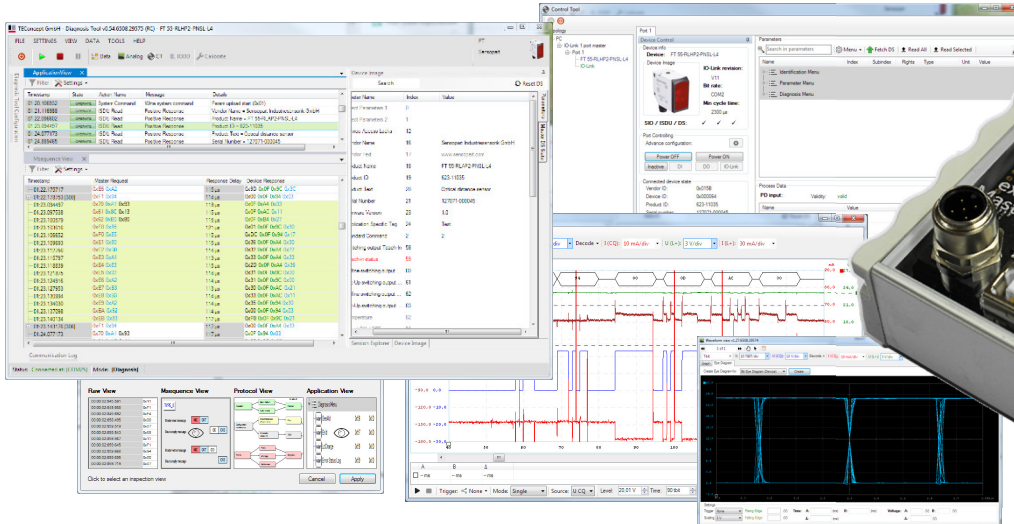
Required additional products

- IO-Link USB Master supporting TEConcept STI interface
- High-Level IO-Link Master Access DLL (32-bit or 64-bit depending on LabVIEW)



Use IO-Link Diagnosis Tool

Universal · Smart · Easy



Overview

The IO-Link Diagnosis Tool analyzes the IO-Link signal both electrically and logically. It is an essential tool for engineers and users of the IO-Link technology to identify any kind of issues of the IO-Link connection.

Functional Description

The Diagnosis Tool is based on a high-speed multi-channel A/D converter that measures voltages and currents on both the C/Q and the L+ line. The measured data are transferred via USB to a software running on a Windows PC.

The IO-Link communication can be analyzed on byte-level, on M-sequence level, on protocol level and even on application level. The IO-Link communication is in the latter case visible in clear text. Folding, filtering and search functions simplify issue identification.

It is also possible to visualize waveforms and even eye-diagrams for Master and Device signals can be extracted.

Typically the Diagnosis Tool is inserted between Master and Device, however, a integrated Master allows to check Devices without external Master. The tracked communication is directly shown on a PC or stored on an embedded SD-card

Diagnosis Tool Features

- Timing accurate IO-Link signal analysis
- High speed, IO-Link synchronized ADC
- Timing precise software UART decoding
- Optional hardware signal direction detection
- Byte-, frame-, protocol- or IODD-based decoding
- Sophisticated filtering and search features
- Device image collection of all data sent
- Data storage image collection
- Recording to hard disk / SD-card
- Analog time signal view for UL+, IL+, UCQ, ICQ
- Serial decoding in analogue waveform view
- Eye diagram view separated for Device/Master
- Interactive rulers for analogue measurements
- User calibration support

Advantages

- Fast and easy IO-Link issue analysis
- Logical and electrical issue detection
- Suitable for development and application

Deliverables

- IO-Link Diagnosis Tool
- 24V power supply, USB cable
- Windows-based graphical user interface



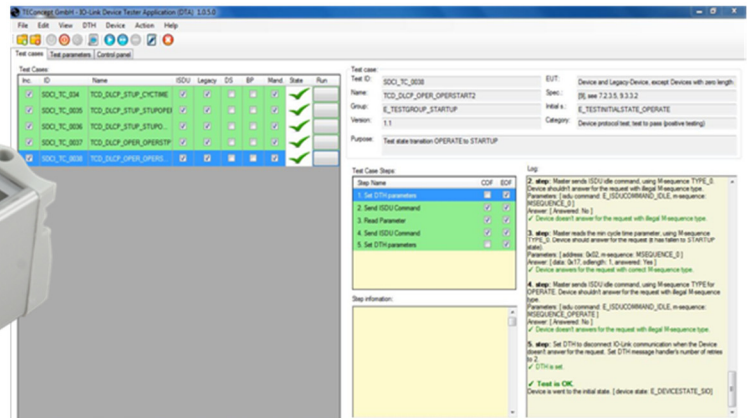
Use



IO-Link

Universal · Smart · Easy

Device Tester



Overview

Every manufacturer of an IO-Link compliant Device needs to issue a manufacturer declaration of compliance.

This requires that numerous tests that are defined in the IO-Link test specification need to be executed. This Device tester simplifies the execution of many of these tests protocol compliance tests. The TEConcept Device tester is powered by an external 24V power supply, it is controlled via an USB port and it offers a standard M12 connector to connect the Devices Under Test "DUT". A PC-software tool imports the IODD of the DUT and automatically adjusts most of its test procedures parameters according to the capabilities of the DUT.

The test cases are defined by XML-files that are accessible by the user.

Additional tests like checking the validity ranges of device-specific parameters can easily be added by extending the test procedures in XML.

Deliverables

- Device Tester Hardware
- 24V power supply
- Device Tester Application (Windows based)

Device Tester Features

- Complies to IO-Link Test specification V1.1.2 (V1.1.3 support in preparation)
- IO-Link profiles (Firmware Update, BLOB Transfer, etc. are supported)
- Extendible with customer specific test cases
- USB control
- External 24V/300mA power supply
- Class A M12 IO-Link master connector
- Approved by IO-Link Quality Working Group

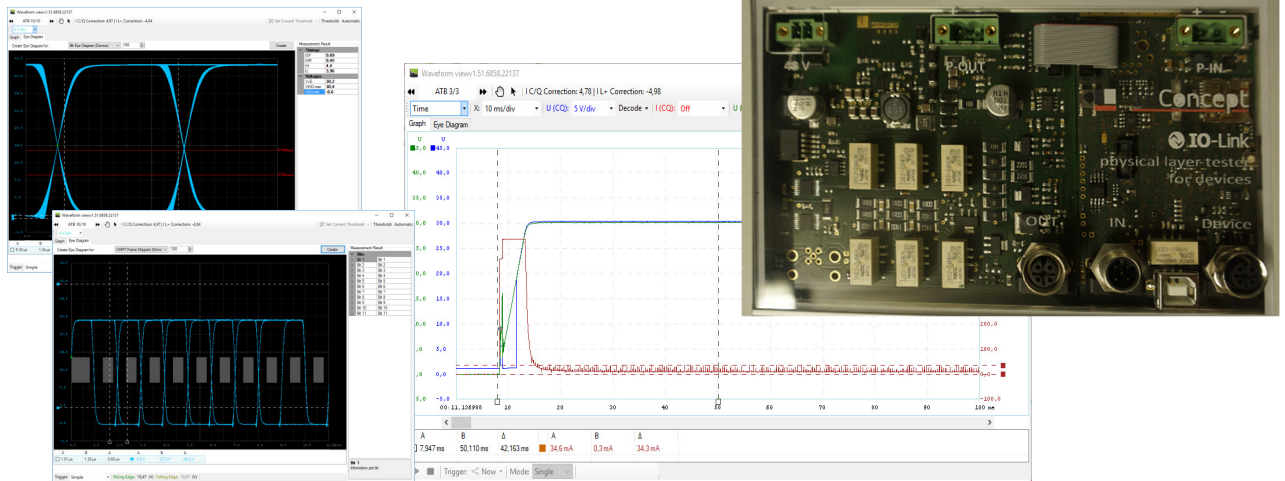
Device Tester PC Application Features

- Graphical User Interface
- Test Report generation in PDF format
- Selectable Test Case execution
- Step-By-Step test report
- Hex-Trace of IO-Link communication
- Log- and Trace File export
- Session store/restore (project file)
- Firmware update feature
- Temporal downgrade to an USB master is possible



Use **IO-Link** Physical Layer Tester

Universal · Smart · Easy



Overview

TEConcept has developed a Physical Layer Tester "PLT" for Devices to run Physical Layer Tests according to the IO-Link Test Specification. The Physical Layer Tester is powered by an external 48V power supply; it is controlled via an USB port and it offers a standard M12 connector for Devices under test "DUT".

A PC-software tool asks for the IODD of the DUT and automatically adjusts most of its test procedures parameters according to the capabilities of the DUT. The test cases are defined by an XML-files that are accessible by the user.

Functional Description

The PLT is based on a high-speed multi-channel A/D converter that measures voltages and currents on both the C/Q and the L+ line. For every test case, specific snapshot of signals is taken and stored. In order to generate these signals, the PLT includes all necessary elements, like an IO-Link Master, adjustable voltage and current sources, line simulations and so forth.

These snapshots are visualized in an oscilloscope-like view by the PC application. They have to be analyzed in a semiautomatic way where measurements are taken by moving graphical cursors that are linked with voltage current and time values. The measured data are entered / copied into predefined fields and used for an automatically generated test report.

Features

- Compliant to IO-Link Test Specification V1.1.2
- User calibration support
- IODD support
- Integrated IO-Link Master
- Integrated Line Simulation
- Semiautomatic measurement procedure based on recorded waveforms
- SIO – Mode tests
- BIT – and UART Eye-Diagrams
- Test Report Generation (PDF)
- All test results are stored in a reloadable test data file

Advantages

- All components to run physical Layer Tests are included
- Substantial reduction of test effort and test duration
- Automatic test report generation

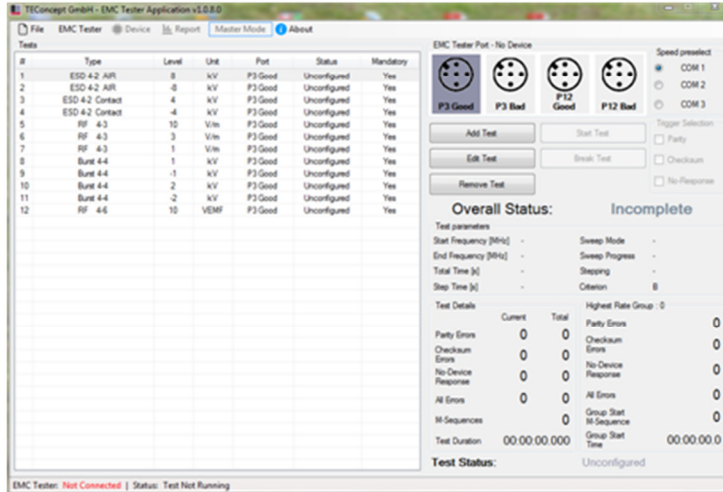
Deliverables

- IO-Link Physical Layer Tester
- 48V power supply, USB cable
- Connector Cables



Use  **IO-Link**
Universal · Smart · Easy

EMC Test Master



Overview

The IO-Link specification defines well defined procedures to test the EMC robustness of IO-Link devices.

Some tests are checking the sensitivity of the IO-Link communication of IO-Link devices under EMC conditions.

This requires a robust master that is much less sensitive to EMC noise than the device under test.

This is achieved by separating the IO-Link master into two parts: part 1 contains the sensitive digital logic (μ C-box), part 2 contains the IO-Link transceiver (PHY-box).

Both parts are separated by an optical connection with a length of up to 10m.

Deliverables

- 2 EMC test boxes (Controller-box and PHY-box)
- 6 Optical cables
- 2 connectors for 24V supply
- EMC Test Graphical User Interface
- PC based IO-Link control tool

Features

- Complies to IO-Link interface specification V1.1.2 (V1.1.3 coming) and the current IO-Link test specification.
- Error and Signal output
- 4 electrical IO-Link port configurations
 - COM1/2 speed port (good signal)
 - COM1/2 speed port (bad signal)
 - COM3 speed port (good signal)
 - COM3 speed port (bad signal)
- RS232 and USB interfaces
- Terminal based control command set
- Additional EMC test and control software with graphical user interface
- Test report generation in PDF Format
- Can be configured to operate as standard "USB IO-Link Master"
- Firmware update supported

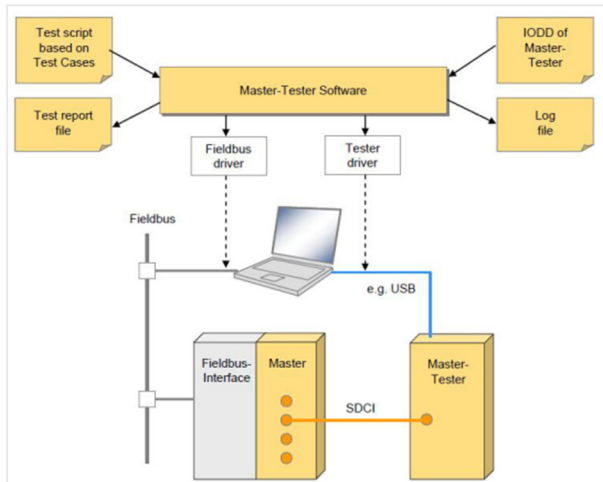
Advantages

- Sensitive Parts are located outside EMC chamber
- EMC robustness considerably better than required



Use **IO-Link** Master Tester

Universal · Smart · Easy



1

Overview

The IO-Link Master Tester consists of a PC program and a hardware box. The test system allows complex IO-Link Master tests according to the IO-Link test specifications. Correct IO-Link behavior as well as possible erroneous functions can be tested.

The IO-Link Consortium asks for all IO-Link Masters a manufacturer's declaration for IO-Link conformity. MESCO developed a test system for this purpose, based on the IO-Link Consortium test specifications.

As the first field bus type it supports PROFIBUS DP and may be customized to further field bus interfaces.

A serial test interface that allows to test the IO-Link master without using the fieldbus is available.

The IO-Link Master Tester comes with a complete set of specified test cases.

Moreover, it can be easily extended with additional test cases. The test system can be used during the development phase for manufacturer's self-declaration of conformity as well as in the production process.

Deliverables

- **IO-Link Master Tester handheld**
- **Software on CD-ROM**
- **USB-Cable**

Features

- Test system for realization of automated, reproducible and complex IO-Link Master tests according to the IO-Link test specifications Rev 1.0 / Rev 1.1
- Monitoring function for direct error search and bug fix
- Programmable via script
- Creation of status information
- Test of field bus implementation according to integration instructions
- Possibility of stimulation of any ISDU parameter
- Open application interface for adaptation to other interfaces
- Appropriate tool for Master manufacturers for simulation of different device types and its malfunctions.

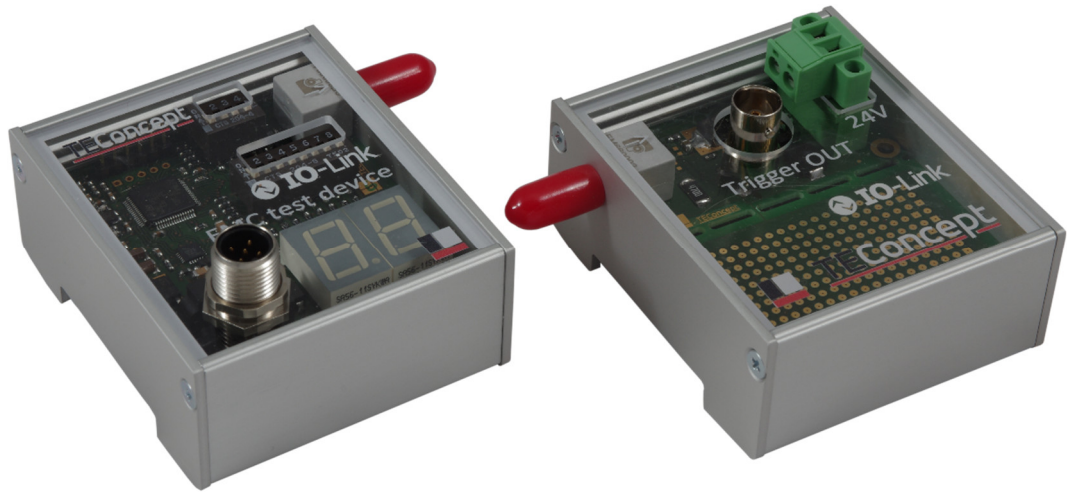
Advantages

- Highly automated test of IO-Link masters
- Allows to test the IO-Link master without fieldbus or backplane gateway.
- Maintenance contract offered for updates to later test specifications or IO-Link "packages"



Use **IO-Link** EMC Test Device

Universal · Smart · Easy



Overview

The IO-Link Interface Specification V1.1.2 defines a specific Test-Device (see Appendix G.2.2 Test of a Master) that shall be connected to an IO-Link Master during the Execution of EMC tests.

Functional Description

The device generates an 8-bit random number which are read out by the master. During the test the master shall return this random number to the device in the next IO-Link cycle.

The device checks, whether it receives the correct random number and increments an internal error counter if not. The error counter is also incremented if a checksum error or a parity error is detected on the device side.

The error count can be read out by the master via an IO-Link parameter after the test. In addition, the error counter value is also displayed by a 7-segment indicator.

When an error is detected the device generates a trigger signal at an optical output. A trigger box that converts the optical signal into a trigger pulse can be connected to the device. The trigger pulse supports developers in identifying possible issues on the master side.

The device can be configured to operate in one of 3 COM-speeds by DIP-Switches.

Features

- Device fully compliant to V1.1.2 IO-Link Interface Specification
- All 3 COM-Speeds supported (Switch Selector)
- Internal Pseudo-Random-Number Generators
- Error counter for Parity, Checksum, Data and Time-out Errors
- 7-Segment Error Counter Display
- 7-Segment Device Status Display
- Errors Counter accessible via IO-Link
- Optical Error Trigger Output

Advantages

- No development effort for master manufacturers
- Better time-to-market
- Identification of EMC issues

Deliverables

- IO-Link EMC Test device (with IODD)
- IO-Link Trigger box
- Optical link



References





Distributors

Japan



M2M craft Co., Ltd.

Mr. Manabu Wada

N23 bldg. 5-2-39

Kita 23-jo Nishi, Kita-ku

001-0023 Sapporo

JAPAN

Tel.: +81 11 788 9422

wada@m2mcraft.co.jp

China



Nanjing Hosta Motion Control Co., Ltd.

Mr. Kevin Jia

B9 Moling Innovation Park,

No.2 Qingshuitingxi Road,

Jiangning District

211100 Nanjing

P.R. CHINA

Tel. +86-25-84 91 67 68

zhenchao.jia@hostamc.com



Contact

TEConcept GmbH

Wentzingerstr. 21

79106 Freiburg

Germany

Phone: +49 761 21443640

Fax: +49 761 21443631

TEConcept Hungary Kft

Csongrádi sgt.11/A

6721 Szeged

Hungary

Phone: +36 62 276 016