

# Technical manual

## EtherNet/IP™ – Lion-Link BusHead 0940 ESL 611





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# 1 About this manual

## 1.1 General information

Please read this manual carefully before you commission the LioN Link system. Keep the manual where it is accessible to all users.

The texts, figures, diagrams and examples used in this manual are used exclusively to explain how to operate and apply the LioN Link BusHead EtherNet/IP application.

For further questions regarding the installation and commissioning of the device please contact us. We will be happy to help you.

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Belden Deutschland GmbH – Lumberg Automation™ – reserves the right to make technical changes or changes to this manual at any time without notice.

## 1.2 Explanation of symbols

### 1.2.1 Use of danger information

Danger information is denoted as follows:

 <b>DANGER</b>
---

Means that death, serious physical injury or substantial damage to property will occur if the required safety measures are not taken.
---

 <b>WARNING</b>
--

Means that death, serious physical injury or substantial damage to property can occur if the required safety measures are not taken.
--

 <b>CAUTION</b>
---

Means that minor physical injury or damage to property can occur if the required safety measures are not taken.
---

### 1.2.2 Use of general information

General information is denoted as follows:

 <b>NOTE</b>
---

Contains important information on the product, on how to manage the product, or on the respective section of the documentation to which your special attention is being drawn.
--

## 1.3 Version information

Index	Created	Changed	Changed
Version number	Version 1.0	Version 1.1	
Date	September 2015	April 2016	
Name/department	R&D Lieb/Jung	R&D Lieb/Jung	

*Table 1: Overview of manual revisions*



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## 2 Safety instructions

### 2.1 Intended use

The LioN Link BusHead EtherNet/IP devices described in this manual are decentralized input/output assemblies in an EtherNet/IP network.

We adhere to all safety standards when developing, producing, testing, and documenting our products. When you adhere to the handling specifications and safety instructions described for the configuration, assembly, and correct operation, there should not normally be any risks for people or equipment.

The LioN Link BusHead EtherNet/IP devices meet the requirements

- ▶ of the standard for programmable logic controls (EN 61131-2),
- ▶ of the ENC standards (EN 61000-6-2, EN 61000-6-3, EN 61000-6-4, EN 5501, EN 55022, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-8, EN 61000-4-11),
- ▶ of the product standard UL 508, and
- ▶ of the Low-Voltage Directive (73/23/EWG).

The modules are designed to be used in the industrial sector. The industrial environment is distinguished by the fact that the consumer is not connected directly to the public low voltage network. Additional measures are required for use in residential areas or in business and commercial sectors.

<b>i</b> <b>NOTE</b>
----------------------

This equipment may cause radio interference in residential areas. In this case the operator may be requested to carry out appropriate measures.
---

The proper and safe operation of this product depends on proper transportation, storage, assembly, and installation, and careful operation.

A completely assembled device housing is required for the proper operation of the LioN Link BusHead EtherNet/IP. Only connect the LioN Link BusHead EtherNet/IP to equipment/machines that are controlled by the LioN Link BusHead EtherNet/IP.

During the configuration, installation, start-up, maintenance and testing of the equipment/machines controlled by the LioN Link BusHead EtherNet/IP, adhere to the safety and accident-prevention guidelines valid for the specific application.

Only install cables and accessories that fulfill the requirements and regulations for safety, electromagnetic compatibility, and, where applicable, telecommunication end devices, as well as the specification information. Information on which cables and accessories are permitted for the installation can be obtained from Lumberg Automation™ or is contained in this manual.

## **2.2 Qualified personnel**

The configuration, installation, start-up, maintenance and testing of the LioN Link system may only be performed by a qualified electrician who is familiar with the safety standards in automation technology.

The personnel requirements are based on the requirement profiles described by ZVEI, VDMA, or equivalent organizations.

Only electricians who are familiar with the content of this manual are authorized to install and maintain the described LioN Link system. These are persons who

- ▶ based on their technical training, knowledge, and experience, and their knowledge of the pertinent standards, can evaluate the work to be carried out and identify any potential risks or
- ▶ based on working for several years in a related sector, have the same level of knowledge as they would have from the relevant technical training.

Only Belden Deutschland GmbH – Lumberg Automation™ – is permitted to make changes to the hardware or software of the products that go beyond the scope of this manual.

**WARNING**

Making unqualified changes to the hardware or software, or non-adherence to the warning information contained in this manual, can result in serious personal injury or damage to equipment.



## **3 System description**

### **3.1 About the Lion Link module series**

Lion (Lumberg I/O Network) Link is a modular system for decentralized use in a rough industrial environment for easy handling of the I/O data in a superordinate EtherNet/IP network. The system is particularly useful for locations of use with high I/O concentrations in distributed assemblies.

The Lion Link system comprises of a BusHead and various field bus-independent I/O modules. The maximum extent of the link systems is 100 m per link connection. In other words, the maximum extent is 200 m for 2 connections.

The very compact dimensions and the low weight of the modules make deployment in cramped conditions on robot devices possible. Lion Link's degree protection class is IP 67.

The Lion Link BusHead 940 ESL 611 EIP supports the EtherNet/IP protocol and connects the I/O modules from the Lion Link system with the control system. The integrated 2-port switch additionally supports bus topology in addition to the previously typical star topology. In addition to this, the modules support the DLR (Device Level Ring) redundancy function in ring topologies. With this function, if the connection is interrupted, the modules immediately switch to an alternative ring segment and thus ensure interruption-free operation. Monitoring of the physical connection is bacon-based, as per the EtherNet/IP specification.

Each line can be extended to included up to 15 I/O modules. The distances between 2 Link nodes is arbitrary. The permissible total length per strand must not be exceeded. When using the maximum expansion, an additional feed of system/sensor supply voltage is possible via T-pieces and/or on the last Lion Link node.

## 3.2 Product overview

### 3.2.1 Module overview

Item number	Description	I/O connection	Design
<b>BusHead</b>			
0940 ESL 611 SAP number: 934 815-001	BusHead EtherNet/IP		M
<b>LioN Link module Universal I/O digital</b>			
0942 UEM 600 SAP number: 92356	8 In/out universal	4 x M12	S
0942 UEM 650 SAP number: 87040	8 In/out universal	8 x M8	S
0942 UEM 700 SAP number: 93199	16 In/out universal	8 x M12	M
0942 UEM 780 SAP number: 105165	16 In/out universal	Multipolar interface	M
0942 UEM 782 SAP number: 102840	16 Out	Multipolar interface	M
<b>LioN Link module digital input</b>			
0942 UEM 601 SAP number: 93201	8 In	4 x M12	S
0942 UEM 651 SAP number: 87043	8 In	8 x M8	S
0942 UEM 701 SAP number: 93198	16 In	8 x M12	M
<b>LioN Link module analog input</b>			
0942 UEM 630 SAP number: 102076	I/O module 4 A I 0 (4) ,– 20 m A	4 x M12	S
0942 UEM 631 SAP number: 102080	I/O module 4 A I 0 ,– 10 V	4 x M12	S
<b>LioN Link module digital output</b>			
0942 UEM 602 SAP number: 108105	4 Out	4 x M12	S
0942 UEM 612 SAP number: 108106	4 Out (for safety- related applications)	4 x M12	S
0942 UEM 782 SAP number: 102840	16 Out	Multipolar interface	M

Table 2: Overview of LioN Link modules

---

Item number	Description	I/O connection	Design
<b>LioN Link custom modules</b>			
0941 UNC 601 SAP number: 96720	Power distributor	4 x M12	S
0942 UEM 783 SAP number: 102163	Motion drive control	8 x M12	M

*Table 2: Overview of LioN Link modules*



## 4 Assembly and wiring

### 4.1 General information

- Mount the module on a level surface with at least 2 screws.
- Use washers for all fastening methods as per DIN 125.

Fastening method	Screw	Tightening torque
Flat	M4 × 30/35	1.0 Nm
Lateral	M4 × 40/70	1.0 Nm

Table 3: Fastening methods

The module has a ground connection with an M4 thread to dissipate interference currents and for EMC immunity.

- Connect the module with a low-impedance connection with the reference ground.
  - ▶ When using a grounded mounting surface, you can make the connection directly via the fixing screws; this does not apply for lateral connection.
  - ▶ In case of a non-grounded mounting surface, or lateral connection, use a ground strap or a suitable PE conductor. To do this, use an M4 screw to connect the ground strap or the PE line to the ground point and if possible locate a washer and a toothed lock washer below the fixing screw.

## 4.2 Wiring

Observe the following specifications to ensure the best possible immunity and emission level of the LioN Link system:

- ▶ Use only shielded Can/DeviceNet thin-hybrid cables for LioN Link bus connections.
- ▶ Use at least shielded CAT 5e cable for EtherNet bus connections.
- ▶ Connection the modules to ground via their functional ground connections using a low-impedance connection.

### 4.3 Outer dimensions

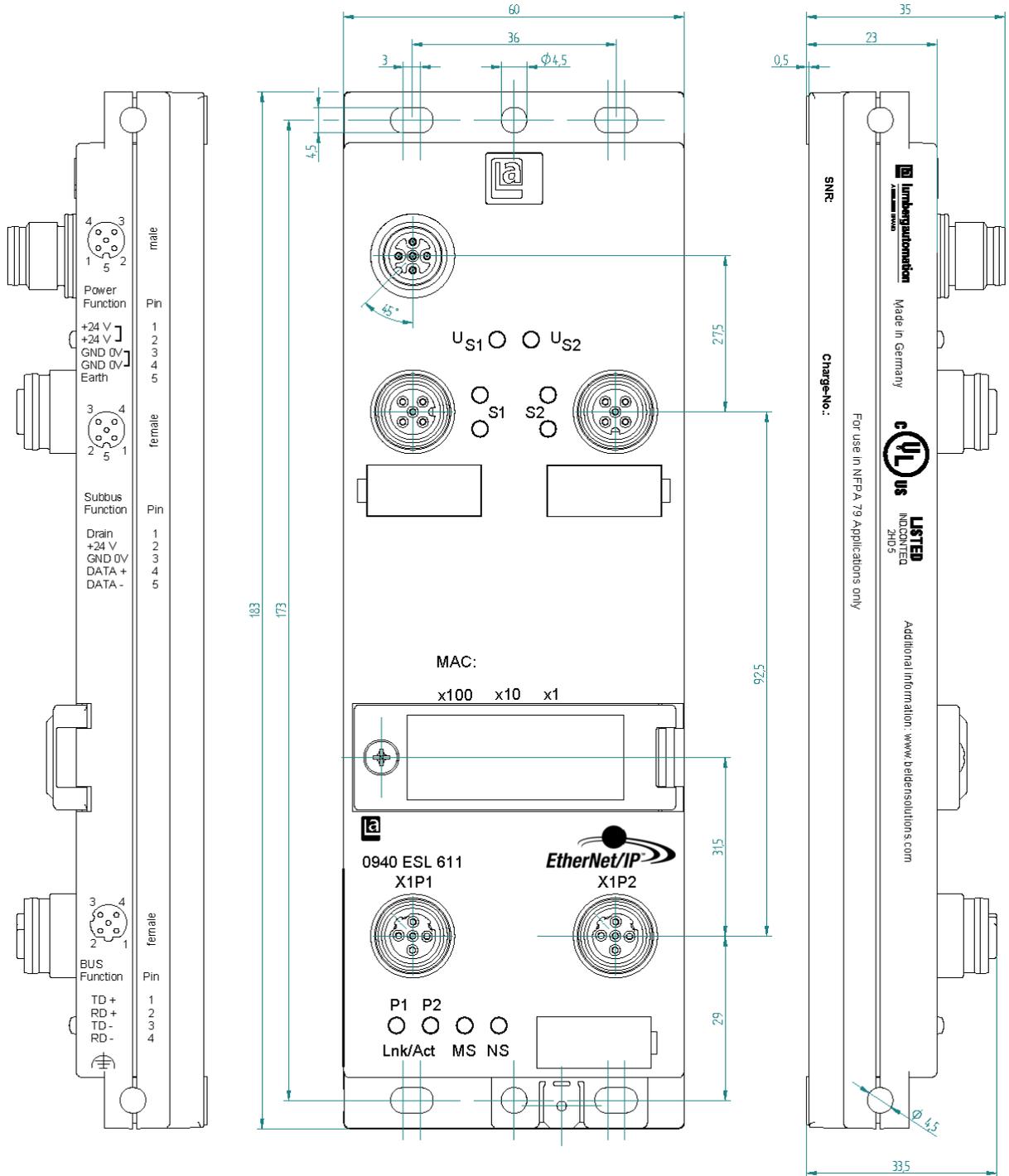


Figure 1: Outer dimensions

## 4.4 Port assignments

All the contact arrangements shown in this chapter show the frontal view of the connection area for the connectors.

### 4.4.1 Connection assignment

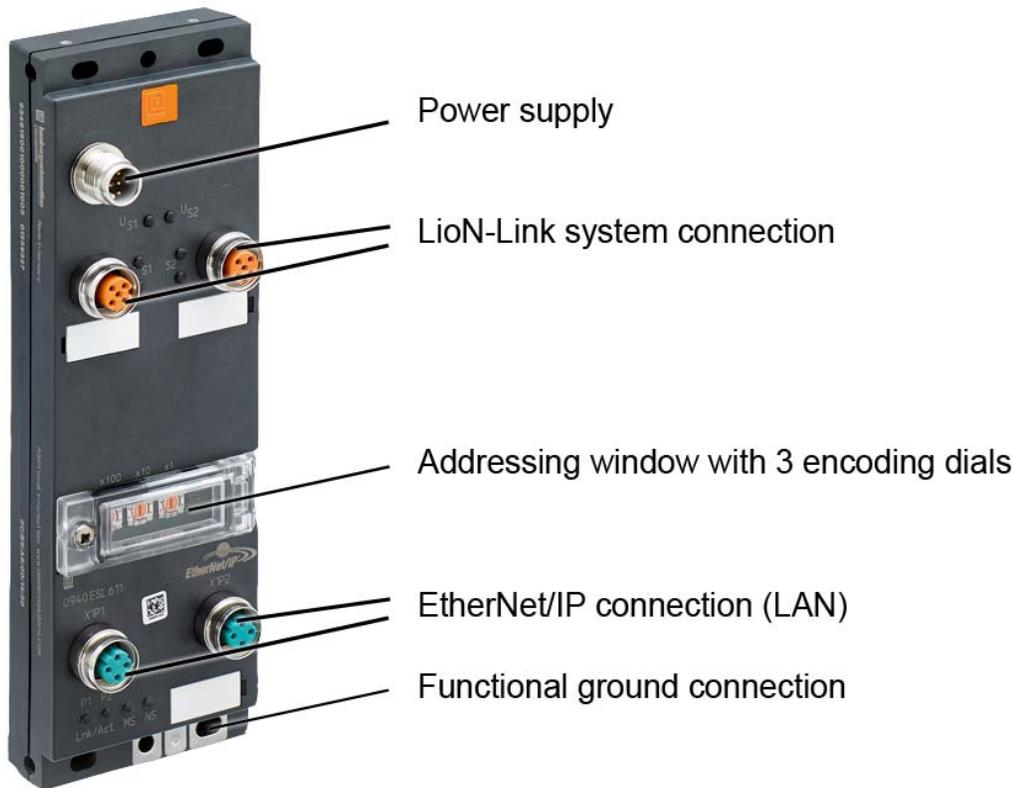


Figure 2: Connection assignment

### 4.4.2 Power supply

- ▶ M12 connector, 5-pin, A-coded
- ▶ Color coding: gray

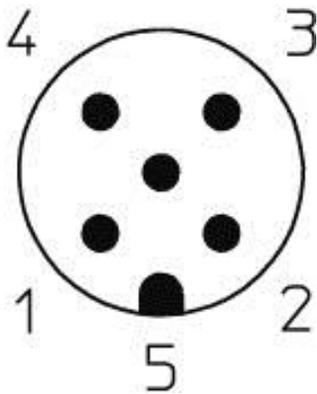


Figure 3: Port assignment voltage supply

Pin	Signal	Function
1, 2 (bridged)	+24V DC	Module power supply +
3, 4 (bridged)	GND 0V	Module power supply -
5	FE	Functional ground

Table 4: Port assignment voltage supply

⚠ CAUTION
<b>Risk of destruction!</b> Never connect the power supply to the data cables.

i NOTE
All M12 metal sleeves are electrically connection via functional ground.

### 4.4.3 LioN Link

- ▶ M12 socket, 5-pin, A-coded
- ▶ Color coding: orange

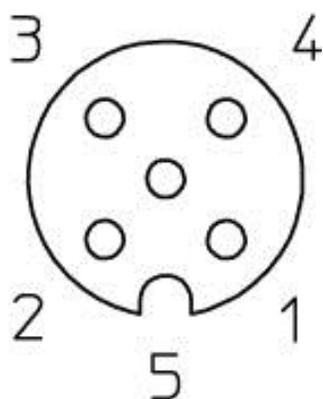


Figure 4: Port assignment LioN Link

Pin	Signal	Function
1	DRAIN	Shield
2	+24V DC	Subbus line 1 or 2 – module power supply +
3	0V GND	Subbus line 1 or 2 – module power supply -
4	DATA+	LioN Link data communication +
5	DATA-	LioN Link data communication -

Table 5: Port assignment LioN Link

### **i** NOTE

All M12 metal sleeves are electrically connection via functional ground.

#### 4.4.4 Addressing window

Configure the IP address manually using the 3 encoding dials in the addressing window (see [“IP address” on page 26](#)).

#### 4.4.5 EtherNet

- ▶ M12 socket, 4-pin, D-coded
- ▶ Color coding: mint green

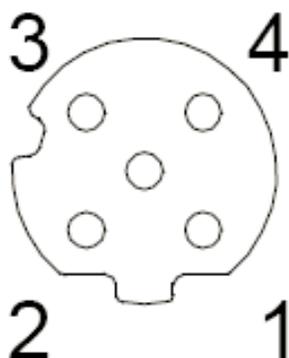


Figure 5: Port assignment EtherNet

Pin	Signal	Function
1	TD +	Transmit data plus
2	RD +	Receive data plus
3	TD -	Transmit data minus
4	RD -	Receive data minus

Table 6: Port assignment EtherNet

**i** **NOTE**

All M12 metal sleeves are electrically connection via functional ground.

#### 4.4.6 Functional ground

Information on the reference earth is provided in the assembly instructions (see [“General information” on page 15](#)).

#### 4.4.7 Intermediate voltage feed

When planning a machine or system, note that intermediate feeding of the supply voltage may be necessary for the I/O modules' electronics and sensor system.

If the power supply is not sufficient, the I/O modules output a diagnostic message. The warning limit for diagnostics is at approx. 19 V DC.

### 4.4.8 T-distributors for intermediate power feed

An easy way of providing an intermediate power feed to an I/O module is the use of the 0906 UTP 104 T-distributor. The internal wiring of the T-distributor is shown in the following drawing. The T-distributor is bolted onto the input of an I/O module (M12 connector).

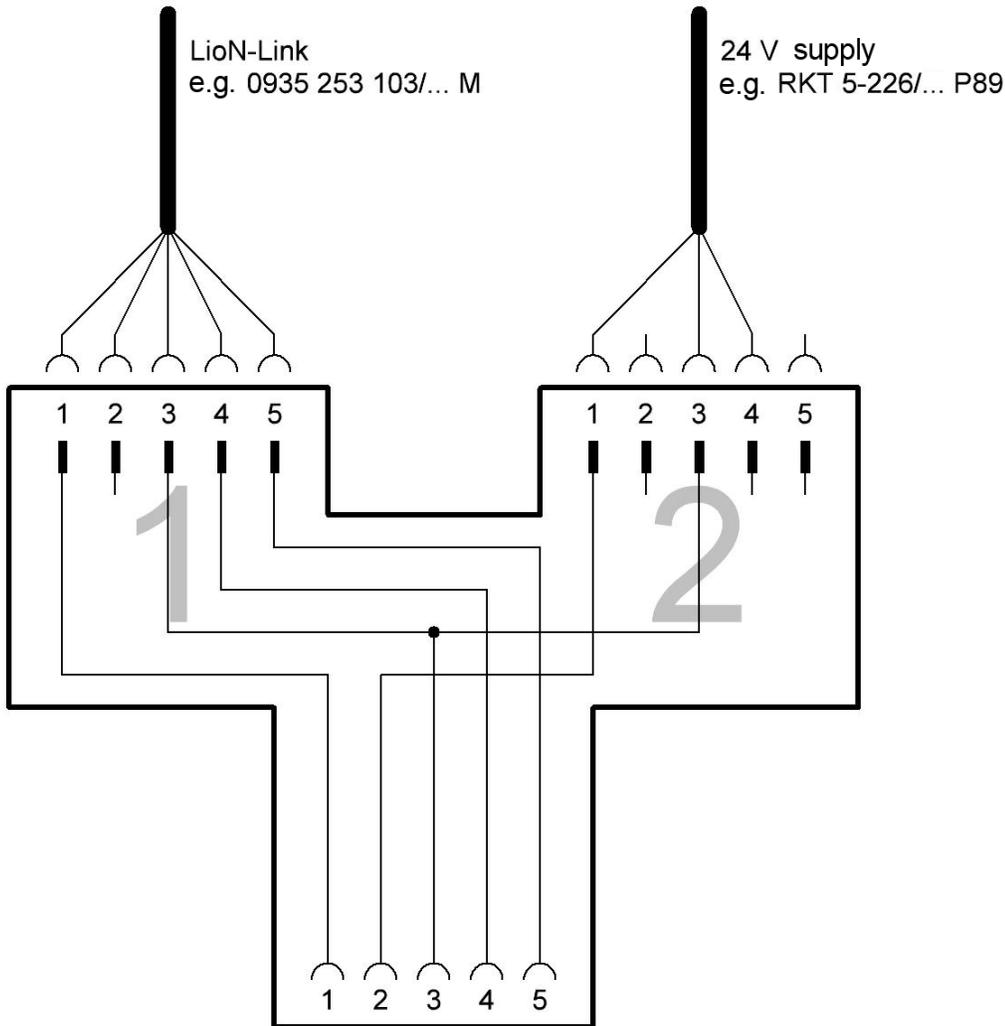


Figure 6: T-distributors for intermediate power feed

### 4.4.9 Voltage drop and intermediate power feed

To calculate the expected voltage drop and location for the intermediate power feed, Belden provides a calculation table as an XLS file in its download area:

[http://www.beldensolutions.com/en/Service/download\\_center/](http://www.beldensolutions.com/en/Service/download_center/)

The table determines the voltage drop in the line based on the power draw of the I/O modules and the sensor system, as well as the cable lengths and cable diameters for the LioN Link lines. Parallel to this, the table names the I/O module that requires an intermediate power feed.

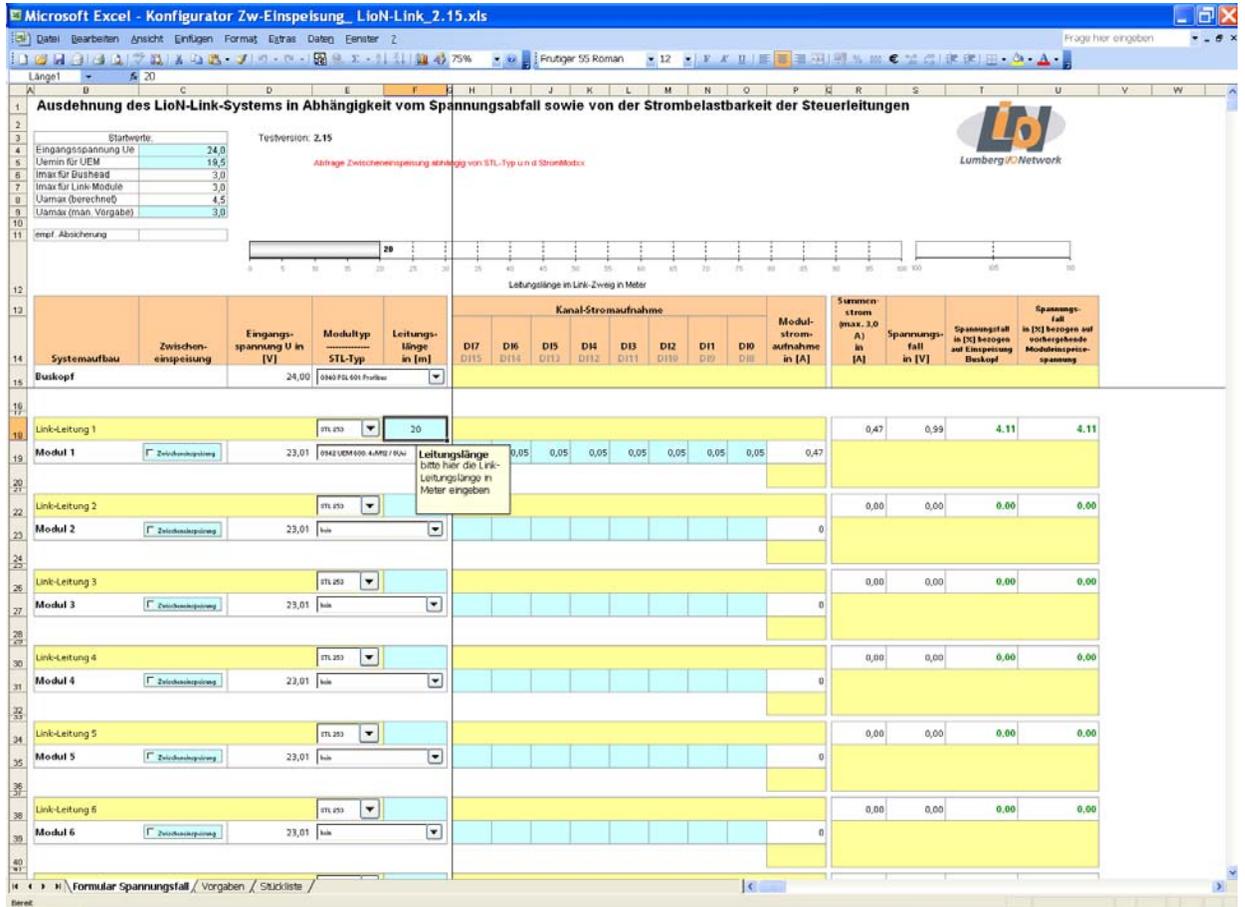


Figure 7: Computation table for voltage drop and intermediate power feed



## 5 Starting operation

### 5.1 Electronic Data Sheet (EDS)

An EDS file is required for the configuration of a module in the control system.

- Download the EDS file from the Belden Web page, or request the EDS file from the Support Team.

The website address for the download is:

[http://www.beldensolutions.com/en/Service/download\\_center/](http://www.beldensolutions.com/en/Service/download_center/)

The EDS file is provided as an archive file named `EDS-V3.9-LumbergAutomation-0940ESL611_yyyymmdd.yyyymmdd`. `yyyymmdd` stands for the file output date (year|month|day).

- Download this archive file and extract the EDS file with the same name.
- Install the EDS file with the aid of your controller manufacturer's hardware or network configuration tool.

After the installation, the modules are available in the hardware catalogs as a "General Purpose Discrete I/O" device.

### 5.2 Reading the MAC addresses

Each module has an unique MAC address assigned by the manufacturer that cannot be changed by the user. The MAC address is printed on the front of the module.

## 5.3 IP address

In delivery condition and after resetting to factory defaults, automatic configuration of the network address via DHCP (Dynamic Host Configuration Protocol) is set. The module retrieves the IP address and subnet mask from the DHCP server. No changes are required for automatic addressing: a DHCP server can reference the unique MAC address to always assign the same IP address to the module.

### **i** NOTE

The IP address can also be configured on the software side in the integrated web server (see [“The System page” on page 38](#)).

With the rotary coding switch position 999, the module can be addressed at any time via the static IP address `192.168.1.1`.

IPv4 addresses comprise of 4 dot-separated decimal blocks (e.g., `192.168.1.1`). Each block has a length of 8 bits. This means that each block covers a value range of 0–255.

The IP address comprises of a network part and a host part. For different computers to be able to communicate directly, the network part of their IP address must be identical (subnet mask). In contrast to this, the host address must not be assigned multiple times on a network. For example, if an IP address of `192.168.1.1` is set for a module, the administration computer must have an IP address in the range `192.168.1.2` through `192.168.1.254`. The subnet mask in this case is `255.255.255.0`.

Use the 3 coding dials on the module for manual addressing. After the power supply is restored, the modules read the switch settings. The selected operation mode overwrites the stored settings.

An address is set via the rotary encoding switch only overrides the last octet of an IP address. Configuration of the first three octets is only possible via the web server.

The factory settings of the static network parameters are:

- ▶ IP address: `192.168.1.1`
- ▶ Subnet mask: `255.255.255.0`
- ▶ Gateway address: `0.0.0.0`

The following settings are possible via the rotary encoding switch:

Rotary switch setting	Function
000 (state on delivery)	In the state on delivery, the DHCP function is activated. The module first requests the network parameters via DHCP. The network parameters are not saved, but the integrated web server can be used to save them.
000 (network parameters already saved)	The module uses the last network parameters that were saved (IP address, subnet mask, gateway address, DHCP on/off, BOOTP on/off).
001 to 254	The module overrides the last 3 digits of the stored or preset IP address setting via the rotary encoding switch.
255 to 998 (exception: 888)	The module requests the network parameters via DHCP or BOOTP, but does not save the network parameters.
888	The module resets to the factory settings. The network parameters are reset to their default values. Communication is not possible in this operation mode. The LioN Link configuration and the user settings are also reset.
999	The module uses the IP address (192.168.1.1) as a factory default.

*Table 7: Setting options for the rotary encoding switch*



## 6 The integrated web server

The BusHead provides an integrated web server for configuration, monitoring and diagnostics. You have the option of accessing the websites stored on it by entering the address in a web browser. Internet Explorer version 10 or newer is supported.

- To do this, replace the [IP-Address] placeholder with the IP address of the relevant module.

### 6.1 Login

- Please enter `http://`, followed by the BusHead's IP address in your web browser's address bar: `http://[IP-Address]`.
- If the home page of the BusHead does not open, check your browser, firewall, and network settings. Setting the IP address is described in section ["IP address" on page 26](#). If the BusHead is no longer reachable, you can restore the factory setting via the rotary encoding switch. [See table 7 on page 27](#).
- After entering the IP address in the web browser, authentication is not immediately necessary; a prompt is displayed as needed (depending on the action). Every user thus has read permissions. Admin or write permissions are required to change access credentials, or save configurations. In state on delivery, the following user level is defined:
  - ▶ Name: "admin", Password: "private" (Admin/Write)

#### **i** NOTE

When you login as "admin" you can change the name and password for the login. We urgently recommend changing the access data for access to the BusHead web server.

## 6.2 The Home page

This page is the starting point for accessing the integrated web server.



## 6.3 The Configuration page (Config)

In the "Stored Configuration" list, the integrated web server displays the modules planned in the BusHead. You can plan the target configuration by selecting the I/O modules in column "module" and their physical location in column "Sublink - Module Slot".

The BusHead handles the configuration when you press the "Save to Device" button.

LioN-Link-IE-Webserver

Home Config Status System User Contact

Configuraton

Stored Configuration

Sublink Module Slot	Module	Edit
Bushead	0940 ESL 611	
S1-M1	0942 UEM 600 8DI/DO	
S1-M2	0942 UEM 650 8DI/DO	
S1-M3	0942 UEM 602 4DO	
S1-M4	0942 UEM 630 4AI 4-20mA	
S1-M5	0942 UEM 650 as 8DI	
S1-M6	0942 UEM 700 16DI/DO	
S1-M7	0942 UEM 700 as 16DI	
S1-M8	-empty-	
S1-M9	-empty-	
S1-M10	-empty-	
S1-M11	-empty-	
S1-M12	-empty-	
S1-M13	-empty-	
S1-M14	-empty-	
S1-M15	-empty-	
S2-M1	0942 UEM 600 8DI/DO	
S2-M2	0942 UEM 650 8DI/DO	
S2-M3	0942 UEM 600 as 8DI	
S2-M4	0942 UEM 631 4AHU	
S2-M5	0942 UEM 612 4DO	
S2-M6	0942 UEM 780 16DI/DO	
S2-M7	0942 UEM 780 as 16DO	
S2-M8	0942 UEM 783 4DRV/10PWM	
S2-M9	-empty-	
S2-M10	-empty-	
S2-M11	-empty-	
S2-M12	-empty-	
S2-M13	-empty-	
S2-M14	-empty-	
S2-M15	-empty-	

Load from Device

Save to Device

Load Config from File

Save Config to File

Scan Bus

Address Table

### 6.3.1 Scan bus

Clicking this button reboots the connected I/O modules. Subsequently, the BusHead compares the actual configuration with the previously stored target configuration. The actual configuration is shown in column "Scanned", while the existing differences to the stored target configuration are marked in red.

#### NOTE

Unsaved configuration changes made previously are lost on using ScanBus.

LioN-Link-IE-Webserver

Home Config Status System User Contact

Configuraton

New Configuration

Sublink Module Slot	Module	Edit	Scanned
Bushead	0940 ESL 611		
S1-M1	0942 UEM 600 8DI/DO		0942 UEM 600 8DI/DO
S1-M2	0942 UEM 650 8DI/DO		0942 UEM 650 8DI/DO
S1-M3	0942 UEM 602 4DO		0942 UEM 602 4DO
S1-M4	0942 UEM 630 4AI 4-20mA		0942 UEM 630 4AI 4-20mA
S1-M5	0942 UEM 650 as 8DI		0942 UEM 650 as 8DI 0942 UEM 651 8DI
S1-M6	0942 UEM 700 16DI/DO		0942 UEM 700 16DI/DO
S1-M7	0942 UEM 700 as 16DI		0942 UEM 700 as 16DI 0942 UEM 701 16DI
S1-M8	--empty--		--empty--
S1-M9	--empty--		--empty--
S1-M10	--empty--		--empty--
S1-M11	--empty--		--empty--
S1-M12	--empty--		--empty--
S1-M13	--empty--		--empty--
S1-M14	--empty--		--empty--
S1-M15	--empty--		--empty--
S2-M1	0942 UEM 600 as 8DI		0942 UEM 600 8DI/DO
S2-M2	0942 UEM 630 4AI 4-20mA		0942 UEM 650 8DI/DO
S2-M3	0942 UEM 600 as 8DI		0942 UEM 600 as 8DI 0942 UEM 601 8DI
S2-M4	0942 UEM 631 4 AI-U		0942 UEM 631 4 AI-U
S2-M5	0942 UEM 612 4DO		0942 UEM 612 4DO
S2-M6	0942 UEM 780 16DI/DO		0942 UEM 780 16DI/DO
S2-M7	0942 UEM 780 as 16DO		0942 UEM 780 as 16DO 0942 UEM 782 16DO
S2-M8	0942 UEM 783 4DRV/10PWM		0942 UEM 783 4DRV/10PWM
S2-M9	--empty--		--empty--
S2-M10	--empty--		--empty--

Load from Device

Save to Device

Load Config from File

Save Config to File

Scan Bus

Address Table

The actual configuration can be adopted as the target configuration by pressing the "transfer" button. The configuration is adopted by clicking the "Save to Device" button.

### 6.3.2 Load from Device

Pressing this button queries the current module configuration/parameterization.

### 6.3.3 Save to Device

Pressing this button loads the configuration/parameterization of the BusHead and the I/O modules into the BusHead's memory.

### 6.3.4 Load Config from File

Pressing this button loads a saved configuration file from an external storage medium (e.g., PC or network drive) on the BusHead. If you need to replace the BusHead, this option gives you the ability to restore previously saved configurations. To finally activate the displayed configuration data, you need to use "Save Config to Device" to load the data into the BusHead's memory and then reset to activate.

### 6.3.5 Save Config to File

Clicking this button saves the current configuration/parameterization of the BusHead and I/O modules in a file. You can then load the stored data on a compatible or identical BusHead.

### 6.3.6 Settings



The "Settings" button is used to call the BusHead or I/O module parameters.

#### ■ BusHead

The following figure illustrates the configurable BusHead parameters:

Bushead: 0940 ESL 611	
Parameter	Value
Diagnostic Acknowledge	Enabled
Diagnostic Block Mode	6 Blocks
Modules interchange	Accept

The functions "Diagnostic Acknowledge" and "Diagnostic Block Mode" are described in chapter ["Diagnostics processing" on page 49](#). The "Modules Interchange" function can be used to detect I/O modules on the two LioN link strands replaced after commissioning.

During commissioning, it is recommended to leave the "Modules Interchange" parameters at the "Accept" setting (default setting). In this mode it is possible to find the optimal structure and most favorable wiring solution for the LioN Link system.

After determining the final configuration, this setting should then be changed to "Do not accept" in order to detect swapping of I/O modules or the wiring immediately and check for the correct structure. This setting is not mandatory, since error-free operation of the system and the replacement of defective modules is possible in "Accept" mode.

## **i** NOTE

With the "Accept" setting, the modified actual configuration is adopted as the new target configuration when the system is restarted. Selecting "Do not accept" specifies the existing configuration!

### ■ I/O modules

Parameterization of the I/O modules is dependent on the module type. The "Settings" button is only shown for I/O modules where configurations can be changed.

LioN-Link-IE-Webserver

Home Config Status System User Contact

#### Configuraton

Stored Configuration

Sublink Module Slot	Module	Edit
Bushead	0940 ESL 611	
S1-M1	0942 UEM 600 8DI/DO	
S1-M2	0942 UEM 650 8DI/DO	
S1-M3	0942 UEM 602 4DO	
S1-M4	0942 UEM 630 4AI 4-20mA	
S1-M5	0942 UEM 650 as 8DI	
S1-M6	0942 UEM 700 16DI/DO	
S1-M7	0942 UEM 700 as 16DI	
S1-M8	-empty-	
S1-M9	-empty-	
S1-M10	-empty-	
S1-M11	-empty-	
S1-M12	-empty-	
S1-M13	-empty-	
S1-M14	-empty-	
S1-M15	-empty-	
S2-M1	0942 UEM 600 8DI/DO	
S2-M2	0942 UEM 650 8DI/DO	
S2-M3	0942 UEM 600 as 8DI	
S2-M4	0942 UEM 631 4 AI-U	

Load from Device

Save to Device

Load Config from File

Save Config to File

Scan Bus

Address Table

**S2-M4: 0942 UEM 631 4 AI-U**

Parameter	Value
Resolution	12-Bit
Channel 1	On
Channel 1 Diagnostic	On
Channel 2	On
Channel 2 Diagnostic	On
Channel 3	On
Channel 3 Diagnostic	On
Channel 4	On
Channel 4 Diagnostic	On

### 6.3.7 Address Table

The "Address Table" button opens the following window.

IO address table					
Sublink - Module Slot	Module	Assembly Object			
		Produced Data <i>Assembly Instance 101</i>		Consumed Data <i>Assembly Instance 100</i>	
		Address	Len & Content	Address	Len & Content
S1-M4	UEM630	0 - 7	8 Analog		
S2-M4	UEM631	8 - 15	8 Analog		
S1-M1	UEM600 8IO	16 - 17	1 Digital + 1 Stuff	0 - 1	1 Digital + 1 Stuff
S1-M2	UEM650	18 - 19	1 Digital + 1 Stuff	2 - 3	1 Digital + 1 Stuff
S1-M3	UEM602			4 - 5	1 Digital + 1 Stuff
S1-M5	UEM650 8I	20 - 21	1 Digital + 1 Stuff		
S1-M6	UEM700	22 - 23	2 Digital	6 - 7	2 Digital
S1-M7	UEM700 16I	24 - 25	2 Digital		
S2-M1	UEM600 8IO	26 - 27	1 Digital + 1 Stuff	8 - 9	1 Digital + 1 Stuff
S2-M2	UEM650	28 - 29	1 Digital + 1 Stuff	10 - 11	1 Digital + 1 Stuff
S2-M3	UEM600 8I	30 - 31	1 Digital + 1 Stuff		
S2-M5	UEM612			12 - 13	1 Digital + 1 Stuff
S2-M6	UEM780	32 - 33	2 Digital	14 - 15	2 Digital
S2-M7	UEM780 16O			16 - 17	2 Digital
S2-M8	UEM783	34 - 35	1 Digital + 1 Stuff	18 - 19	1 Digital + 1 Stuff
Bushead	ESL 611	36 - 37	2 Status	20 - 21	2 Control
Bushead	ESL 611	38 - 61	24 Diag		
<b>Total</b>	<b>Bytes</b>		<b>62</b>		<b>22</b>

The "IO address table" table shows the address at which the data can be found for the respective modules. The current address table illustrates by way of example that a total of 62 bytes of data are sent from the BusHead to the controller. Conversely, 22 bytes are sent by the control unit to the BusHead.

The BusHead displays the address and data type (analog, digital) of the data bytes for each I/O module. The stuff bytes are used to pad data packets so that all data start at even addresses as per the "Word Alignment".

### 6.3.8 LioN Link EtherNet/IP Offline Configurator

An Offline Configurator for configuring a LioN Link EtherNet/IP system without hardware is available on

[http://www.beldensolutions.com/en/Service/download\\_center/](http://www.beldensolutions.com/en/Service/download_center/).

This can be used to create a LioN-Link configuration file that can be loaded onto a BusHead.

## 6.4 The Status page

LioN-Link-IE-Webserver

Home
Config
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#### Status

**Diagnostic Status**

Sublink Module Slot	Module	Dia	Config
Bushead	0940 ESL 611	DIA	■
S1-M1	0942 UEM 600 8DI/DO		OK
S1-M2	0942 UEM 650 8DI/DO		OK
S1-M3	0942 UEM 602 4DO	DIA	OK
S1-M4	0942 UEM 630 4AI 4-20mA	DIA	OK
S1-M5	0942 UEM 650 as 8DI		OK
S1-M6	0942 UEM 700 16DI/DO	DIA	OK
S1-M7	0942 UEM 630 4AI 4-20mA		Wrong
S1-M8	0942 UEM 700 as 16DI	DIA	Missing
S1-M9			
S1-M10			
S1-M11			
S1-M12			
S1-M13			
S1-M14			
S1-M15			
S2-M1	0942 UEM 600 8DI/DO		OK
S2-M2	0942 UEM 650 8DI/DO		OK
S2-M3	0942 UEM 600 as 8DI		OK
S2-M4	0942 UEM 631 4 AI-U	DIA	OK
S2-M5	0942 UEM 612 4DO		OK
S2-M6	0942 UEM 780 16DI/DO		OK
S2-M7	0942 UEM 780 as 16DO		OK
S2-M8	0942 UEM 783 4DRV10PWM		OK
S2-M9	0942 UEM 600 8DI/DO	DIA	Missing
S2-M10			
S2-M11			
S2-M12			
S2-M13			
S2-M14			
S2-M15			

  
 Reload Dia

  
 Scan Bus

Auto update interval:  sec (0=off).

---

Connection state: Idle

**Diagnostic Messages**

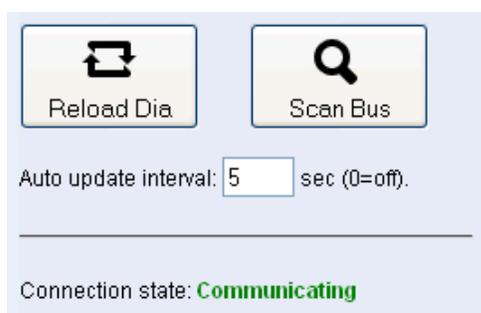
SubLink- ModuleSlot	Channel No.	Diagnostic Message	Status	Ack
S1-M4	-	Sensor Short Circuit	Inactive	<input checked="" type="checkbox"/>
S2-M4	-	Limit value exceeded	Active	<input type="checkbox"/>
S1-M6	-	Actuator Fault	Active	<input type="checkbox"/>
S1-M3	3	Actuator Fault	Inactive	<input checked="" type="checkbox"/>
S1-M8	-	Module missing	Active	<input type="checkbox"/>
Bushead	-	Diagn. Overflow	Active	<input type="checkbox"/>

Diagnostic messages are updated only during cyclic communication!

On this page the embedded web server shows you the "Diagnostic Status" of the LioN Link system. The left table lists the existing module configuration. Modules that report diagnostics are shown in red in the "Dia" column (with existing diagnostic message), yellow (without existing diagnostic message) or gray (diagnostics inactive).

Configuration errors are shown in the "Config" column. An incorrect module type is shown as "Wrong", a missing module as "Missing" and swapped modules are declared as "Interchanged".

The right hand table shows the "Diagnostic Messages" in cleartext. If you have write privileges (Admin/Write), you can click the button in the "Ack" column (Acknowledge) to acknowledge the diagnostics (see section ["Diagnostics processing" on page 49](#)). However, this is only possible if Acknowledge Mode is enabled in the BusHead.



Clicking the "Reload Diag" button refreshes the diagnostic display. Since the display states are not updated automatically, you can use "Auto update interval" to configure a time for refreshing the website.

If this is not desired, this function can be disabled using the "0" value. In case of a configuration change, the BusHead clears the diagnostic memory automatically if Acknowledge Mode is disabled. If the BusHead is involved in cyclic communication, "Scan Bus" can be used to parse the LioN Link bus again.

The Connection state "Communicating" indicates cyclic communication with the controller. If the "Idle" state is shown, there is no exchange of process data with the controller.

## 6.5 The System page

LioN-Link IE-Webserver

Home
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System

<div style="border-bottom: 1px solid #ccc; padding: 5px 0 5px 10px;"> <b>General Information</b> </div> <div style="border-bottom: 1px solid #ccc; padding: 5px 0 5px 10px;"> <b>Firmware</b>  Name: BELDEN - LioN-Link EtherNet/IP  Version: V1.0.4.0 - 30.04.2015  Web / DDF: 13 / 0.11.0 </div> <div style="border-bottom: 1px solid #ccc; padding: 5px 0 5px 10px;"> <b>Device</b>  Name: 0940 ESL 611  Ordering Number: 934-815-001  Serial Number: 01046  Production Date: 12 / 2015 </div> <div style="border-bottom: 1px solid #ccc; padding: 5px 0 5px 10px;"> <b>Ethernet</b>  MAC Address: 3C B9 A6 00 21 92  Port 0: 100M / Full  Port 1: Link down </div> <div style="border-bottom: 1px solid #ccc; padding: 5px 0 5px 10px;"> <b>Network</b>  IP-Address: 192.168.1.2  Subnetmask: 255.255.255.0  Gateway: 0.0.0.0  Method: Static </div> <div style="border-bottom: 1px solid #ccc; padding: 5px 0 5px 10px;"> <b>Ethernet IP</b>  State: Connected </div>	<div style="border-bottom: 1px solid #ccc; padding: 5px 0 5px 10px;"> <b>Change IP-Configuration</b> </div> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="border-bottom: 1px solid #ccc;">Parameter</th> <th style="border-bottom: 1px solid #ccc;">New Settings</th> </tr> </thead> <tbody> <tr> <td style="border-right: 1px solid #ccc;">IP-Address</td> <td><input type="text" value="192"/> . <input type="text" value="168"/> . <input type="text" value="1"/> . <input type="text" value="2"/></td> </tr> <tr> <td style="border-right: 1px solid #ccc;">Subnet Mask</td> <td><input type="text" value="255"/> . <input type="text" value="255"/> . <input type="text" value="255"/> . <input type="text" value="0"/></td> </tr> <tr> <td style="border-right: 1px solid #ccc;">Gateway</td> <td><input type="text" value="0"/> . <input type="text" value="0"/> . <input type="text" value="0"/> . <input type="text" value="0"/></td> </tr> <tr> <td style="border-right: 1px solid #ccc;">Method</td> <td> Static <input checked="" type="radio"/> DHCP <input type="radio"/> BOOTP <input type="radio"/> </td> </tr> <tr> <td colspan="2" style="text-align: center;"> <input type="button" value="Clear"/> <input type="button" value="Submit"/> </td> </tr> </tbody> </table>	Parameter	New Settings	IP-Address	<input type="text" value="192"/> . <input type="text" value="168"/> . <input type="text" value="1"/> . <input type="text" value="2"/>	Subnet Mask	<input type="text" value="255"/> . <input type="text" value="255"/> . <input type="text" value="255"/> . <input type="text" value="0"/>	Gateway	<input type="text" value="0"/> . <input type="text" value="0"/> . <input type="text" value="0"/> . <input type="text" value="0"/>	Method	Static <input checked="" type="radio"/> DHCP <input type="radio"/> BOOTP <input type="radio"/>	<input type="button" value="Clear"/> <input type="button" value="Submit"/>	
Parameter	New Settings												
IP-Address	<input type="text" value="192"/> . <input type="text" value="168"/> . <input type="text" value="1"/> . <input type="text" value="2"/>												
Subnet Mask	<input type="text" value="255"/> . <input type="text" value="255"/> . <input type="text" value="255"/> . <input type="text" value="0"/>												
Gateway	<input type="text" value="0"/> . <input type="text" value="0"/> . <input type="text" value="0"/> . <input type="text" value="0"/>												
Method	Static <input checked="" type="radio"/> DHCP <input type="radio"/> BOOTP <input type="radio"/>												
<input type="button" value="Clear"/> <input type="button" value="Submit"/>													

**Restart device**  
 Confirm to restart the device. All connections will be closed.

**Reset configuration to factory defaults**  
 Confirm to reset the device. All configuration data will be overwritten by default values!

**Firmware update**  
 Keine Datei ausgewählt.

### 6.5.1 General Information

In this table, the embedded web server shows you the current system information for the device. The "Firmware" section contains information about the software version, while the "Device" section contains the serial number and manufacturing date.

The "Ethernet" section shows the unique device address below "MAC Address" and "Port 0", and the state of the two LAN interfaces below "Port 1":

Status	Description
Link down	No connection or connection down
10M / Half	10 MBit/s, half-duplex
10M / Full	10 MBit/s, full duplex

Table 8: Status of the two LAN interfaces

Status	Description
100M / Half	100 MBit/s, half-duplex
100M / Full	100 MBit/s, full duplex

Table 8: Status of the two LAN interfaces

The "Network" section displays the network settings of the LAN interfaces.

## 6.5.2 Change IP-Configuration

This table gives you the option of changing the network settings for the two LAN interfaces (Port 0 and Port 1).

### **i** NOTE

The IP address can also be set using the hardware via the dial encoders, for example, if the BusHead is inaccessible due to an incorrect network configuration (see chapter ["IP address" on page 26](#)).

- ▶ "IP-Address": If needed, you can use this input box to configure a different IP address for the BusHead (IPv4).  
Default setting: 192.168.1.1
- ▶ "Subnet Mask": You can use this input box to configure the subnet mask for the IPv4 network. In combination with the IP address, the subnet mask defines which IP addresses are on your own network, and which are accessible on other networks using a router.  
Default setting: 255.255.255.0
- ▶ "Gateway": You can use this input box to configure the IP address of the device which will act as the interface to the Internet or a parent network.  
Default setting: 0.0.0.0 (no interface defined)
- ▶ "Method": You can use these options boxes to configure the address assignment method:
  - "Static": The BusHead uses the manually entered, static IP address.
  - "DHCP": The BusHead retrieves its IP address automatically from a DHCP server.
  - "BOOTP": The BusHead retrieves its IP address automatically from a boot server.

---

Clicking the "Submit" button saves the IP configuration settings in the BusHead. The settings are applied the next time you restart.

### 6.5.3 Restart device

Restart lets you restart the BusHead. All connections are interrupted! To reboot, check the box and click the "Restart" button.

### 6.5.4 Reset configuration to factory defaults

This function causes a reset to the original factory settings. To perform a Factory Default Reset, check the box and click the "Factory Reset" button.

#### **i** NOTE

A Factory Default Reset will erase all configuration data (network configuration, LioN Link configuration, user data).

This option is not required to reset the BusHead!

Only use this option if you want to restore the state on delivery. It is recommended to save the configuration data before using this option. See chapter [6.3 "The Configuration page \(Config\)" on page 30](#).

### 6.5.5 Firmware update

This section gives you the ability to update the device's firmware. You can perform a firmware update as needed to add newly developed modules or features to the BusHead. The firmware update is downloaded via EtherNet.

#### **i** NOTE

Please note the following description of the firmware update; failure to do so may mean that the Bushead does not work correctly.

- Disconnect all connections to the I/O modules at the BusHead by unscrewing the M12 connectors from the two lines.
- Also disconnect the connection to your control unit and other EtherNet devices. Only the computer that you will be using to perform the firmware update can be connected to the BusHead.

- Perform a power on reset of the BusHead by briefly interrupting the power supply. Before you start the firmware update, make sure that the power supply will not be interrupted during the update process. The two green LEDs "US1" and "US2" must light up continuously.
- In your browser, open the integrated web server (see chapter [“The integrated web server”](#) on page 29).
- Click on the "System" tab, and in the "Firmware update" section select the file for the firmware update via the "Search" button.

<b>i</b> <b>NOTE</b>
----------------------

You must not change the file name!
------------------------------------

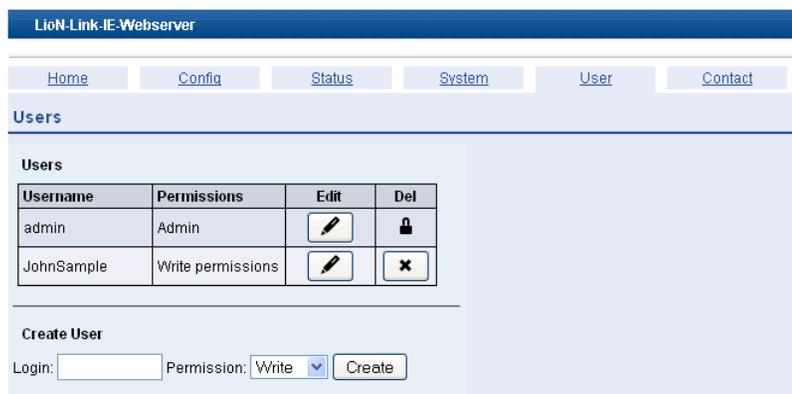
- Start the update process by clicking the "Update" button.

When the firmware update has finished loading, the "Reset device to activate new firmware." message appears. After executing a Power-On Reset, the new firmware is loaded.
- Finally restore the connection to the LioN Link I/O modules, the control and possibly other EtherNet I/O devices.

<b>i</b> <b>NOTE</b>
----------------------

Note that the BusHead does not detect the current LioN Link I/O module configuration until you have reset the power supply.
---

## 6.6 The User page



On this page, the integrated web server shows you an overview of the user accounts you have set up. User accounts can only be edited after logging in with your username "admin" or as a user with "Permissions" = "Admin". The default password for the "admin" user is "private". This user cannot be deleted.

### **i** NOTE

It is strongly recommended that you change the password for the "admin" user. Use secure passwords for all users.

You can manage existing users via the "Users" table:

- ▶ Up to 10 users can be created. The username must be between 4 and 12 characters, and contain only letters and numbers.
- ▶ To change the password for a user account, click the button in the "Edit" column.
- ▶ Passwords must be at least 6 characters in length (max. 32), however, other restrictions do not apply.
- ▶ A user can belong to one of two privilege levels: "Admin", "Write".
- ▶ Users who are marked as "Admin", have all authorizations in the Lion Link context. They can create new users, change passwords and delete users.
- ▶ Users with "Write" rights can change all configuration data. For example, they can configure network parameters and the Lion Link bus and confirm diagnoses.

- ▶ To delete a user account, click the button in the "Del" column.
- ▶ Read permissions do not exist. All users with access to the website are allowed to read data.

**i NOTE**

The "admin" user cannot be deleted.

You can create new user accounts in the section "Create User":

- Enter the name of the new user in "Login".
- Define the rights level in the selection list "Permissions".
- Click "Create" to create the new user account.
- You will be prompted to enter a secure password. For security reasons you need to repeat the password.

## 6.7 The Contact page

The screenshot shows a web browser window with the title "LioN-Link-IE-Webserver". The navigation menu includes "Home", "Config", "Status", "System", "User", and "Contact". The "Contact" page displays the following information:

**Contact**

Belden Deutschland GmbH  
Im Gewerbepark 2

58579 Schalksmuehle  
Germany

Phone: +49-2355-5044-0

E-mail: [iac-info@belden.com](mailto:iac-info@belden.com)  
Technical Support: [support-automation@belden.com](mailto:support-automation@belden.com)

Website: [www.beldensolutions.com](http://www.beldensolutions.com)

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On this page, the integrated web server shows you contact data for technical support.



## 7 Bit assignment

The Lion Link BusHead uses assembly instances to exchange cyclical I/ data. The BusHead supports:

- ▶ Assembly instance **101** for inputs and
- ▶ Assembly instance **100** for outputs.

The BusHead provides 2 bytes of input 2 bytes of output data. These data act as status and control bytes for special functions (diagnose acknowledge, transmission of acyclical parameter data, etc.). In process data transmission, the device first transmits the analog data and then the digital data. The process image from or to the controller is always composed wordwise (word alignment). The device always transmits analog word data in Little-Endian format.

### 7.1 Input data – Assembly instance 101

The following example shows the input data mapping. The BusHead composes the process image for the input data based on the following rules:

- ▶ All analog input data (word alignment)
- ▶ All digital input data (word alignment, a byte is transmitted as a word)
- ▶ BusHead status data (2 bytes)
- ▶ All diagnostic data, depending on the setting:
  - 2 blocks (2 × 4 bytes = 8 bytes) or
  - 6 blocks (6 × 4 bytes = 24 bytes)

The following example shows the input data mapping:

Byte	Data
0	UEM630 Ch. 1, Analog in low byte
1	UEM630 Ch. 1, Analog in high byte
2	UEM630 Ch. 2, Analog in low byte
3	UEM630 Ch. 2, Analog in high byte

*Table 9: Input data – Assembly instance 101*

Byte	Data
4	UEM630 Ch. 3, Analog in low byte
5	UEM630 Ch. 3, Analog in high byte
6	UEM630 Ch. 4, Analog in low byte
7	UEM630 Ch. 4, Analog in high byte
8	UEM601 8 Digital In
9	Stuff byte
10	UEM701 16 Digital in low byte
11	UEM701 16 Digital in high byte
12	UEM601 8 Digital In
13	Stuff byte
14	BusHead status byte 0
15	BusHead status byte 1
16	Diagnostic Block 1, Byte 0
	...
39	Diagnostic Block 6, Byte 3

Table 9: Input data – Assembly instance 101

The maximum cyclic input data length of the modules is 192 bytes (without 2 bytes of BusHead status data and without possible diagnostic blocks). The total length of the input data in the control is therefore a maximum of 218 bytes.

## 7.2 Outputdaten - Assembly Instance 100

The following example shows the output data mapping. The BusHead composes the process image for the output data based on the following rules:

- ▶ All analog output data (word alignment)
- ▶ All digital output data (word alignment, a byte is transmitted as a word)
- ▶ BusHead control data (2 Bytes)

The following example shows the output data mapping:

Byte	Data
0	UEM630 Ch. 1, Analog out low byte
1	UEM630 Ch. 1, Analog out high byte
2	UEM630 Ch. 2, Analog out low byte
3	UEM630 Ch. 2, Analog out high byte
4	UEM630 Ch. 3, Analog out low byte
5	UEM630 Ch. 3, Analog out high byte
6	UEM630 Ch. 4, Analog out low byte
7	UEM630 Ch. 4, Analog out high byte
8	UEM601 8 Digital Out
9	Stuff byte
10	UEM701 16 Digital out low byte
11	UEM701 16 Digital out high byte
12	UEM602 8 Digital Out
13	Stuff byte
14	BusHead control byte 0
15	BusHead control byte 1

*Table 10: Output data – Assembly instance 100*

The maximum cyclic output data length of the modules is 192 bytes (without 2 bytes of BusHead control data). The total length of the output data in the control is therefore a maximum of 194 bytes.

Depending on the control used, the data may be preceded by a RUN/IDLE header.



## 8 Diagnostics processing

To facilitate troubleshooting, the BusHead supports comprehensive diagnostics behavior. Signaling occurs through

- ▶ LEDs on the BusHead, see chapter [“LEDs” on page 62](#),
- ▶ through the integrated web server and
- ▶ coded as a block, which is appended to the cyclic data, see chapter [“Input data – Assembly instance 101” on page 45](#). Each diagnostics block represents one diagnostics message.

The diagnostics data of the LioN Link system are appended to the cyclic data in 2 or 6 diagnostics blocks (2 or 6 individual diagnoses of 4 bytes each). If more diagnoses occurred can be displayed, the last message to be displayed is a diagnostics overflow.

Diagnostics configuration:

- ▶ An overflow may be reported in the last diagnostics block. This is the case if more than 1 or 5 diagnoses occur at the same time .
- ▶ In the default configuration, six diagnostics blocks are transferred using the described handshake mechanisms Acknowledge/None-Acknowledge.
- ▶ To reduce the data load in the cyclic data, you can change to only two active diagnostic blocks via a parameter in the embedded web server.

## 8.1 Diagnostic settings on the BusHead

On the web server's "Config" Page, you can configure the following diagnostics settings for the default settings shown for the BusHead in the "Edit" column.

The screenshot shows the "Configuraton" page of the LiON-Link-IE-Webserver. It features a navigation menu with "Home", "Config", "Status", "System", "User", and "Contact". The main content area is titled "Stored Configuration" and contains a table of module slots and a configuration panel for the selected BusHead.

Sublink - Module Slot	Module	Edit
Bushead	0940 ESL 611	
S1-M1	0942 UEM 600 8DI/DO	
S1-M2	0942 UEM 650 8DI/DO	
S1-M3	0942 UEM 602 4DO	
S1-M4	0942 UEM 630 4AI 4-20mA	
S1-M5	0942 UEM 650 as 8DI	
S1-M6	0942 UEM 700 16DI/DO	
S1-M7	0942 UEM 700 as 16DI	
S1-M8	—empty—	
S1-M9	—empty—	
S1-M10	—empty—	
S1-M11	—empty—	
S1-M12	—empty—	
S1-M13	—empty—	

Configuration panel for Bushead: 0940 ESL 611:

Parameter	Value
Diagnostic Acknowledge	Enabled
Diagnostic Block Mode	6 Blocks
Modules interchange	Accept

Buttons: Load from Device, Save to Device, Load Config from File, Save Config to File, Scan Bus, Address Table, Apply, Cancel.

### 8.1.1 Diagnostic Acknowledge

#### ■ Diagnostic Acknowledge Disabled

Diagnoses are only shown in the cyclic BusHead status byte 0 (see chapter "Cyclic diagnostic data" on page 51) and in the diagnostic blocks if they are active. The BusHead control byte 0 is not used in this mode.

#### ■ Diagnostic Acknowledge Enabled

Diagnoses are transferred with the cyclic data until the diagnoses are acknowledged by the control program using BusHead control byte 0 (see chapter "Cyclic diagnostic data" on page 51) or on the integrated web server. This means that short diagnostic results remain available until acknowledged.

### 8.1.2 Diagnostic Block Mode

To reduce the data load in the cyclic data, you can use a parameter to cut down to only two active diagnostic blocks.

## 8.2 Cyclic diagnostic data

The BusHead sends two status bytes as "Producing data" appended to the I/O module data and, depending on the parameterization, two or six diagnostic blocks of four bytes (I/O address table in chapter 6.3.7). It receives two control bytes as "consuming data" appended to the data of the I/O modules.

### 8.2.1 Cyclic BusHead status bytes

BusHead status byte 0 contains the diagnostic status of the diagnostic blocks. Status byte 1 does not contain any diagnostic information and is described in chapter 9.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
0	reserv.	reserv.	Diag. 6	Diag. 5	Diag.4	Diag. 3	Diag. 2	Diag. 1	
			1 = Diagnosis active						
1	reserv.	reserv.	reserv.	reserv.	reserv.	reserv.	reserv.	PRM written	

Table 11: BusHead status bytes

In Acknowledge Mode the diagnostic status in byte 0 will remain active until the diagnosis becomes inactive and has been acknowledged via the associated bit in control byte 0 of the BusHead. The current active/inactive state of diagnosis is shown in byte 2/bit 7 of a diagnostics block (see [“Cyclic BusHead diagnostic blocks” on page 52](#)).

### 8.2.2 Cyclic BusHead control bytes

Diagnoses can be acknowledged in BusHead control byte 0 in Acknowledge mode. Control byte 1 does not contain any control flags for diagnostics and is described in Chapter 9.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
0	reserv.	reserv.	Ack. Diag. 6	Ack. Diag. 5	Ack. Diag. 4	Ack. Diag. 3	Ack. Diag. 2	Ack. Diag. 1	
			1 = Acknowledge diagnosis						
1	reserv.	reserv.	reserv.	reserv.	reserv.	reserv.	reserv.	PRM activate	

Table 12: BusHead control bytes

### 8.2.3 Cyclic BusHead diagnostic blocks

Depending on the configuration, the BusHead sends 2 or 6 diagnostic blocks as "producing data" appended to the two BusHeads status bytes (see ["Address Table" on page 35](#)). The diagnostic blocks are defined as follows:

Byte no.:	Description
0	Last Octet of IP Address (Value: 0- 255)
1	Bit 7-4: Sub-Link Info: BusHead = 0, Link 1 = 1, Link 2 = 2, Link 1 & 2 = 3 Bit 3-0: Module number: BusHead = 0, I/O modules = 1 - 15
2	Bit 7: Diagnosis Status: Diagn. active = 1, Diagn. inactive = 0 Bit 6: reserved Bit 5-0: Channel: Device Diagn. = 0, Channel Diagn.= 1-63
3	Diagnostic Code

Table 13: Diagnostic block

## 8.3 Diagnostic Codes

The following table explains all diagnostic messages of the LioN Link system:

Diagnostic Code	Description
0	0x00 Diagnostic inactive
1	0x00 Short circuit (Sensor)
2	0x01 Low voltage (US of I/O module)
3	0x02 Overvoltage
4	0x03 Actuator fault
5	0x04 Over temperature
6	0x05 Broken wire
7	0x06 Upper limit value exceeded
8	0x07 Lower limit value exceeded
9	0x08 I/O link fault
10	0x0A Simulation active
11	0x0B Power supply Sub-Link 1 fault
12	0x0C Power supply Sub-Link 2 fault
13	0x0D Check number of configured modules
14	0x0E EEPROM fault
15	0x0F Missing parameter
16	0x10 Wrong parameter, parameter fault
17	0x11 Power supply fault

Table 14: Diagnostic messages

Diagnostic Code		Description
18	0x12	I/O module failure
19	0x13	Diagnostics I/O module
20	0x14	Configuration fault (Use Web-Interface for detailed information)
21	0x15	Common I/O fault
22	0x16	Over current motor
23	0x17	Common motor fault
24	0x18	Internal module fault
25	0x19	Fuse defective
26	0x1A	Limit value exceeded
27	0x1B	Calibration fault
28	0x1C	Incorrect module
29	0x1D	Module missing
30	0x1E	Reserved
31	0x1F	Reserved
100	0x64	RPI warning
101	0x65	IP address conflict
254	0xFE	Internal information: Send only channel diagnostics and no additional accumulative diagnostics
255	0xFF	Diagnosis overflow

Table 14: Diagnostic messages

## 8.4 Behavior in case of a diagnostic overflow

If all the diagnostic blocks are populated with diagnoses, an overflow message is sent in the last free diagnostic block.

In this case, new diagnoses can only be displayed in detail again if all active diagnoses have become inactive or were acknowledged (Acknowledge Mode) in the meantime.

The overflow diagnosis remains active until there are no longer any active diagnoses in the system. Any remaining modules with diagnostics, whose diagnostic information could not be reported via a diagnostic block, can be viewed via the web server. Alternatively, these data can also be read acyclically from the BusHead using Class ID 0x64 / instance 1 / attribute 1, see chapter [“Acyclic services” on page 57](#).

The restriction applies for all diagnostic modules that the diagnostic blocks of diagnoses which have become inactive are not available for new diagnostic messages until all other reported diagnoses have become inactive. Any diagnoses that have occurred in the meantime are displayed on web server as module diagnoses, indicated via the LEDs, or can be read acyclically from the BusHead using Class ID 0x64 / instance 1 / attribute 1.

## 8.5 Diagnostic sequence in None Acknowledge Mode

- ▶ A diagnosis is entered in the first free diagnostics block, Diagnostic Code  $\neq 0$ . The "Active" bit in byte 2/bit 7 of the diagnostic block and the corresponding BusHead status are set to 1.
- ▶ The diagnosis no longer exists. If the diagnostic information has not yet been sent for a least three I/O cycles, it remains unchanged.
- ▶ For an inactive diagnosis, and possibly after three I/O cycles have elapsed, the "Active" bit, the diagnostic code of the diagnosis, and the corresponding bit in the BusHead status byte are set to 0.
- ▶ After another three I/O cycles, the diagnostic block is deleted and can be reused for a new diagnosis. However, the diagnostic block is only available for the next diagnosis when all other diagnoses are inactive.

## 8.6 Diagnostic sequence in Acknowledge Mode

In Acknowledge mode, the administrator has to set the matching control bit on the BusHeads in case of diagnoses (to acknowledge the diagnosis). This can alternatively be done via the web server. The following cases clarify the function and workflow:

### Case 1: Diagnosis inactive before user acknowledgement

- ▶ A diagnosis is entered in the first free diagnostics block, Diagnostic Code  $\neq 0$ . The "Active" bit in byte 2 of the diagnostic block and the corresponding BusHead status are set to 1.
- ▶ The diagnosis no longer exists. The "Active" bit 7 in byte 2 of the diagnostic block is set to 0.

- ▶ Because the administrator has not yet acknowledged the diagnosis (Acknowledge pending), the outgoing diagnostic information is stored on the BusHead.
- ▶ The administrator acknowledges the diagnosis by setting the corresponding BusHead control bit to 1.
- ▶ The error code of the corresponding diagnosis is set to 0 because the diagnosis no longer exists. The corresponding bit in the BusHead status byte is set to 0.
- ▶ The administrator detects the change in the status byte (outgoing diagnosis) and resets the corresponding bit in the BusHead control bite to 0.
- ▶ The BusHead detects resetting of the acknowledge bits in the control and then deletes the entire diagnostic block. Diagnostic Code =0. The diagnostic block is only available for the next diagnosis when all other diagnoses have been acknowledged and are inactive.

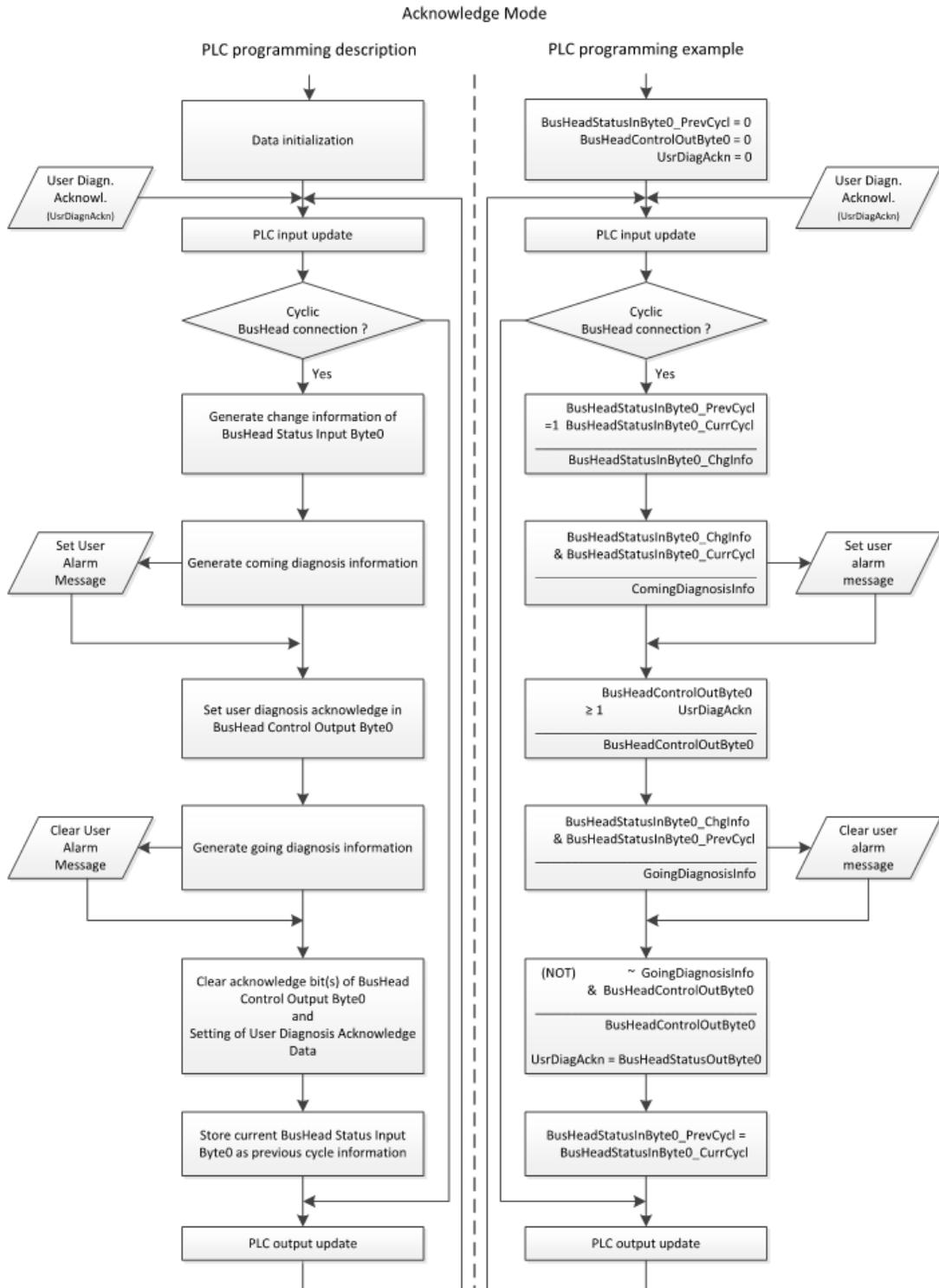
### **Case 2: Acknowledgment of active diagnosis**

- ▶ A diagnosis is entered in the first free diagnostics block, Diagnostic Code != 0. The "Active" bit in byte 2 of the diagnostic block and the corresponding BusHead status are set to 1.
- ▶ The administrator acknowledges the diagnosis by setting the corresponding BusHead control bit to 1.
- ▶ The diagnostic code of the corresponding diagnosis is not changed, because the diagnosis is still present. The corresponding bit in the BusHead status byte remains set to 1.
- ▶ The diagnosis no longer exists. The "Active" bit 7 in byte 2 of the diagnostic block is set to 0.
- ▶ The administrator detects the change in the status byte (outgoing diagnosis) and resets the corresponding bit in the BusHead control bite to 0.
- ▶ The BusHead detects resetting of the acknowledge bits in the control and then deletes the entire diagnostic block. Diagnostic Code =0. The diagnostic block is only available for the next diagnosis when all other diagnoses have been acknowledged and are inactive.

## 8.7 Programming Acknowledge mode in the user program

<b>i</b> <b>NOTE</b>
----------------------

The following program sequence acts as an example for creating the PLC program using the BusHead status byte 0 and control byte 0.
--



## 8.8 Acyclic services

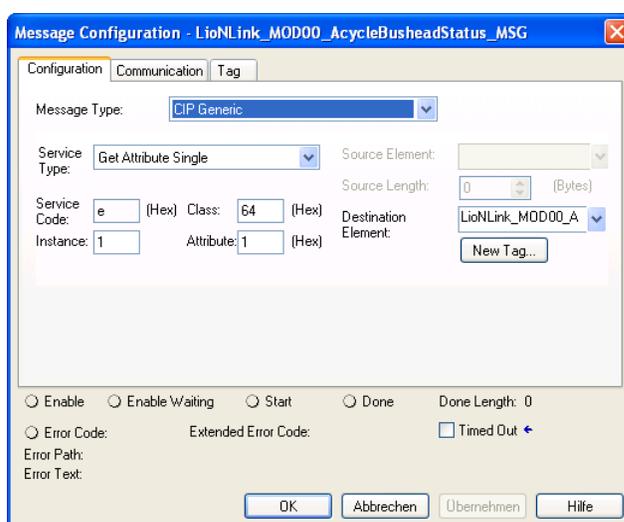
In addition to cyclic communication, there is also the possibility to exchange

data via acyclic objects.

### 8.8.1 Acyclic diagnostic object

In the case of an overflow of the diagnostic blocks or failure of one or more I/O modules, diagnostic information can always be read from the BusHead via the Class ID 0x64 / instance 1 / attribute 1.

In the Rockwell RSLogix 5000, this can be implemented with a MSG Instruction. The illustration below shows the settings.



This means that all other modules with active diagnoses can be identified in case of a diagnostic block overflow.

In case of I/O module communication failures, the defective modules can also be determined, since the cyclic communication is stopped in this case. A cyclic restart of both lines is then performed until the configurations stored on the BusHead is again physically active.

The following diagnostic data can be read by the object:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	DIA S1-M7	DIA S1-M6	DIA S1-M5	DIA S1-M4	DIA S1-M3	DIA S1-M2	DIA S1-M1	DIA BusHead
1	DIA S1-M15	DIA S1-M14	DIA S1-M13	DIA S1-M12	DIA S1-M11	DIA S1-M10	DIA S1-M9	DIA S1-M8
2	DIA S2-M7	DIA S2-M6	DIA S2-M5	DIA S2-M4	DIA S2-M3	DIA S2-M2	DIA S2-M1	not used
3	DIA S2-M15	DIA S2-M14	DIA S2-M13	DIA S2-M12	DIA S2-M11	DIA S2-M10	DIA S2-M9	DIA S2-M8

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
4	CFG S1-M7	CFG S1-M6	CFG S1-M5	CFG S1-M4	CFG S1-M3	CFG S1-M2	CFG S1-M1	not used
5	CFG S1-M15	CFG S1-M14	CFG S1-M13	CFG S1-M12	CFG S1-M11	CFG S1-M10	CFG S1-M9	CFG S1-M8
6	CFG S2-M7	CFG S2-M6	CFG S2-M5	CFG S2-M4	CFG S2-M3	CFG S2-M2	CFG S2-M1	not used
7	CFG S2-M15	CFG S2-M14	CFG S2-M13	CFG S2-M12	CFG S2-M11	CFG S2-M10	CFG S2-M9	CFG S2-M8

DIA = Diagnosis information; CFG = Configuration error (missing or wrong module)

Sx = Line 1 / Sub-Link 1, Line 2 / Sub-Link 2; Mx = Module 1 – 15

### 8.8.2 Acyclic configuration 0942 UEM 783

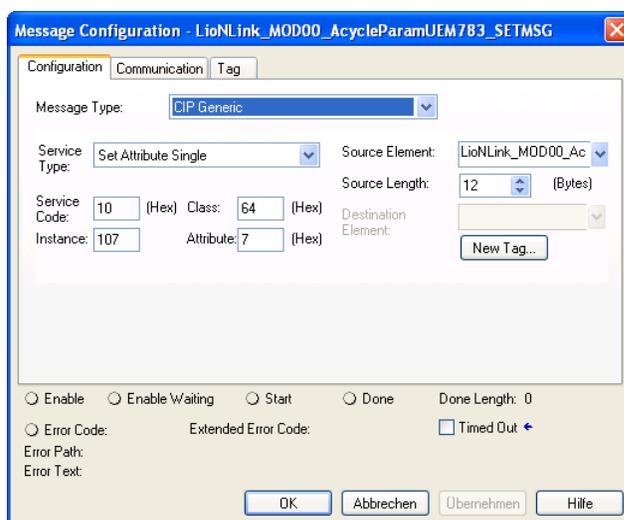
The I/O module 0942 UEM 783 can be written with new parameters during cyclic operation. To allow this to happen, the following instances and attributes are supported in Class ID 0x64.

Instance	Attrib. ID	Access	Name	Data Type	Description
101 - 115	7	Get / Set	ModuleData	Array of BYTE	Attribute ID 7 for the parameter data of the 0942 UEM 783
201 - 215					

Instances 101-115 are assigned to the I/O modules on strand 1 here, while instances 201-215 are assigned to strand 2. The following data can be written to an 0942 UEM 783 I/O module using "Set Single Attribute":

Byte	Type of Data	Value	Description
0	Data	00 - 03	High-Byte Speed Channel 1
1	Data	00 - FF	Low-Byte Speed Channel 1
2	Data	00 - 03	High-Byte Speed Channel 2
3	Data	00 - FF	Low-Byte Speed Channel 2
4	Data	00 - 03	High-Byte Speed Channel 3
5	Data	00 - FF	Low-Byte Speed Channel 3
6	Data	00 - 03	High-Byte Speed Channel 4
7	Data	00 - FF	Low-Byte Speed Channel 4
8	Data	00 - FF	B4-B7 Ramp Ch. 2, B0-B3 Ramp Ch. 1
9	Data	00 - FF	B4-B7 Ramp Ch. 4, B0-B3 Ramp Ch. 3
10	Data	0	B4-B7 Motor Type Ch. 2, B0-B3 Motor Type Ch. 1 (values suppressed for acyclic parameter transfer)
11	Data	0	B4-B7 Motor Type Ch. 4, B0-B3 Motor Type Ch. 3 (values suppressed for acyclic parameter transfer)

In the Rockwell RSLogix 5000, this can be implemented with a MSG Instruction. The illustration below shows the settings.



Successful transmission of the parameter data to a 0942 UEM 783 module is indicated by the MSG Instruction "Done". Any number of connected modules can be configured with this command.

Bit 0 is used in status byte 1/control byte 1 in each case to report the status and control parameterization.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	reserv.	reserv.	Ack. Diag. 6	Ack. Diag. 5	Ack. Diag. 4	Ack. Diag. 3	Ack. Diag. 2	Ack. Diag. 1
1 = Diagnosis active								
1	reserv.	reserv.	reserv.	reserv.	reserv.	reserv.	reserv.	PRM activate

Table 15: BusHead status bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	reserv.	reserv.	Ack. Diag. 6	Ack. Diag. 5	Ack. Diag. 4	Ack. Diag. 3	Ack. Diag. 2	Ack. Diag. 1
1 = Acknowledge diagnosis								
1	reserv.	reserv.	reserv.	reserv.	reserv.	reserv.	reserv.	PRM activate

Table 16: BusHead control bytes

To ensure that the modules adopt the new parameters in sync, the value of bit 0 in control byte 1 of the BusHead must be inverted. The BusHead indicates execution by inverting bit 0 in the BusHead's status byte 1.

## 9 Technical data

### 9.1 General

Protection class	IP 67 (only when the connectors are screwed in or when protective caps are used)
Ambient temperature	-10 °C to +60 °C (+14 °F to +140 °F)
Weight	220 g
Housing material	PBT
Torques:	
Fastening screws M4	1.0 Nm
Ground connection M8	0.3 Nm
M12 connector	0.5 Nm

Table 17: General information

### 9.2 Electrical properties

#### 9.2.1 Power supply

Rated voltage	24 V DC
Voltage range	19.2–28.8 V DC (SELV/PELV as per EN60950-1)
Current consumption/power supply (without sub-bus)	< 200 mA
Reverse polarity protection	Yes
Fuse	An external fuse is recommended!
Functional grounding	Present

Table 18: Information on the power supply

#### 9.2.2 LioN Link bus system

Rated voltage	24 V DC
Voltage range	19.2–28.8 V DC
Output current	Max. 3 A per sub-bus line
Limitation	In case of self-assembly of LioN Link connections, faults can occur that lead to the destruction of the RS485 transceivers!

Table 19: Information on the LioN Link bus system

### 9.2.3 EtherNet/IP

Physical transmission	As per IEEE 802.3 10-BASE-T 100-BASE-TX
Transmission rate	10 Mbit/s 100 Mbit/s
Electric isolation	500 V (M12-d-coded) Between the bus cable and the electronics

Table 20: Information on EtherNet/IP

## 9.3 Ambient conditions

Ambient temperature	-10 °C to +60 °C
Protection class – In connected and correctly screwed in state (as per DIN EN 60529)	IP 67
UL approval	UL 508
Vibration, sinusoidal EN 60068-2-6	5–500 Hz / 1.5 g
Shock, semi-sinusoidal EN 60068-2-27	50 g / 11 ms

Table 21: Information on the ambient conditions

## 9.4 LEDs

The LEDs are labeled appropriately on the BusHead. Please refer to the drawing in chapter “[Outer dimensions](#)” on page 17 for the positions of the LEDs.

P1 LNK/ACT	Green	Connection to an EtherNet device/
P2 LNK/ACT	Flashing yellow	EtherNet data exchange
	off	No connection to another node

Table 22: Information on the LED colors

MS	Green	Device ready for operation
	Flashing green	Device is not configured, or incorrect configuration
	Flashing red	Firmware update
	Flashing red/green	Device is performing a self-test
	off	Device off
NS	Green	Connected to a master
	Flashing green	IP address exists, but no connection to a master
	Red	IP address occupied by another device
	Flashing red	Connection timeout
	off	Device off
S1	Green	Line 1 active, data exchange with I/O modules
	Red	Incorrect configuration, or wrong module
	Alternately flashing red/green	Restart line 1
S2	Green	Line 2 active, data exchange with I/O modules
	Red	Incorrect configuration, or wrong module
	Alternately flashing red/green	Restart line 2
Us1	Green	System/sensor power supply line 1 present
	off	System/sensor power supply line 1 missing
Us2	Green	System/sensor power supply line 2 present
	off	System/sensor power supply line 2 missing

*Table 22: Information on the LED colors*



# 10 Declaration of conformity



Lumberg Automation™ and Hirschmann™ Products



## EC Declaration of Conformity

**Manufacturer** Belden Deutschland GmbH **Doc-Nr.:** LioN-M-LL-EIP-160317116  
**Hersteller** **File:** LioN-M-LL-EIP-160317116-934815001.pdf

**Address** Im Gewerbepark 2  
**Adresse** 58579 Schalksmühle

The EC declaration of conformity applies to the following products:  
Die EG-Konformitätserklärung gilt für folgende Produkte:

Type LioN-Link Bushead EtherNet/IP  
Typ

Product(s) 0940 ESL 611  
Produkte

We confirm the conformity to the requirements of the following European directive(s):  
Wir bestätigen die Übereinstimmung der angegebenen Produkte mit den Vorschriften folgender  
Europäischer Richtlinie(n):

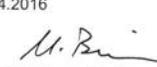
2014/30/EU

The following standard(s) was(were) applied:  
Folgende Normen wurden angewandt:

DIN EN 61000-6-2:2005 DIN EN 61000-6-4:2007 + A1:2011

Neckartenzlingen, den 01.04.2016

  
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Kontonummer | Account No. 215 101 045  
Bankleitzahl | Bank code 502 109 00  
IBAN DE81 5021 0900 0215 1010 45  
Swift-Code: CITI0333



# 11 Accessories

Item number	Description
<b>EtherNet/IP</b>	
0985 342 100/... M	Connection cable for EtherNet/IP, assembled on both sides with M12 connectors, straight, 4-pin, D-coded
0985 342 102/... M	Connection cable for EtherNet/IP, assembled on one side with an M12 connector, straight, 4-pin, D-coded
0985 342 104/... M	Connection cable for EtherNet/IP, assembled on both sides with M12 connectors, straight, 4-pin, D-coded, and straight RJ-45 plug
<b>LioN Link lines</b>	
0935 253 103/... M	Connection cable for LioN Link line, assembled on both sides with M12 connectors, straight, 5-pin, A-coded, and M12 socket, straight, 5-pin, A-coded
0935 253 104/... M	Connection cable for LioN Link line, assembled on one side with an M12 connector, straight, 5-pin, A-coded
0935 253 105/... M	Connection cable for LioN Link line, assembled on one side with an M12 socket, straight, 5-pin, A-coded
0935 253 106/... M	Connection cable for LioN Link line, assembled on one side with an M12 socket, angled, 5-pin, A-coded
0935 253 107/... M	Connection cable for LioN Link line, assembled on one side with an M12 connector, angled, 5-pin, A-coded
0935 253 108/... M	Connection cable for LioN Link line, assembled on both sides with M12 connectors, angled, 5-pin, A-coded, and M12 socket, angled, 5-pin, A-coded

*Table 23: Connection cables for data transfer*

Item number	Description
RKT 5-228/... M	Connection cable for power supply, assembled on one side with an M12 socket, straight, 5-pin, A-coded
RKWT 5-228/... M	Connection cable for power supply, assembled on one side with an M12 socket, angled, 5-pin, A-coded
RKT 5-226/... P89	Connection cable suitable for intermediate power supply, assembled on one side with an M12 socket, straight, 5-pin, contacts 1 and 3 wired, A-coded

*Table 24: Connection cables for the power supply*

Item number	Description
0986 EMC 102	Configurable M12 connector for EtherNet/IP cable, straight, 4-pin, D-coded with spring type terminal
RSC 5/9	Configurable M12 connector for LioN Link line and power supply, straight, 5-pin, A-coded
RSCW 5/9	Configurable M12 connector for LioN Link line and power supply, angled, 5-pin, A-coded
RKC 5/9	Configurable M12 socket for LioN Link line and power supply, straight, 5-pin, A-coded
RKCW 5/9	Configurable M12 socket for LioN Link line and power supply, angled, 5-pin, A-coded

*Table 25: Customizable connectors for data transfer*

Item number	Description
0906 UTP 101	T-distributor for looping through the power supply; note the current draw!
0906 UTP 104	T-distributor for attaching the power supply to the LioN Link line.

*Table 26: T-distributor*