SIEMENS

Manual

DLC Module

L-Type

Edition 02 2020

siemens.com

SIEMENS

DLC Module

L-Type
DLC Module L-Type

Equipment Manual

02/2020
9HK1510-0AA00-0AA0

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Siemens AG
Division Digital Factory
Postfach 48 48
90026 NÜRNBERG
GERMANY

9HK1510-0AA00-0AA0
℗ 03/2020 Subject to change

Preface

Contents of the manual

Contents of the manual

This document is the product documentation for the DLC Module L-Type.

Information blocks in this manual

The following information blocks describe the usage and purpose of the manual.

- Description

  This section explains the purpose and potential applications of the DLC Module L-Type.
- Interfaces and display elements

  This section includes a description of the interfaces and display elements and their functions.
- Installing and connecting

  This section explains how to install and wire the DLC Module L-Type.
- Parameter assignment/addressing

  This section contains information on the CAN bus telegram for operating the DLC Module L-Type.
- Functions

  This section describes the functions of the DLC Module L-Type and what you need to take into consideration.
- Service and maintenance

  This section describes how to replace the module.
- Technical data

  This section describes the properties and features of the DLC Module L-Type.
- Dimension drawing

  This section contains the dimension drawing of the DLC Module L-Type.
- Spare parts/accessories

  This section provides information about spare parts and accessories for the DLC Module L-Type.
- Appendices with factual information for reference (for example, standards and approvals, ESD, etc.)
- Index to locate information

Technical support

Country-specific telephone numbers for technical support are provided in the Internet at the following address (https://support.industry.siemens.com/cs/ww/en/sc/4868) in the "Contact" area.

Device disposal

Recycling and disposal

For environmentally-friendly recycling and disposal of your old device, please contact a company certified for the disposal of waste electrical and electronic equipment, and dispose of the old device as prescribed in the respective country of use.

NOTICE
When disposing of the device, ensure the selective treatment of the capacitors in accordance with WEEE2012/19 Annex VII. You can find information on disassembly of the device and the capacitors in section Disassembly of the DLC Module for disposal (Page 69).

Table of contents

Safety information

1

Safety instructions

The warnings, safety information and remarks that follow are intended to be used both as safety measures for users and as measures that can be put in place to avoid damage to the product or to components of the connected machines. This section contains a summary of warnings, safety information and notes which generally apply to working with DLC Modules.

Warnings, information and notes relating to specific activities/work are listed at the beginning of the respective sections of this manual. They are repeated or expanded on at critical points in these sections.

Read this information carefully, it has been included for your personal safety and to help you extend the service life of the DLC Module.

1.1 General safety information

WARNING

Electric shock and danger to life due to other energy sources

Touching live components can result in death or severe injury.

- Only work on electrical devices when you are qualified for this job.
- Always observe the country-specific safety rules.

Generally, the following six steps apply when establishing safety:

1. Prepare for disconnection. Notify all those who will be affected by the procedure.
2. Disconnect the system from the power supply and take measures to prevent it being switched back on again.
3. Discharge the energy storage device
4. Check that there is no voltage between any of the power connections, and between any of the power connections and the protective conductor connection.
5. Check whether the existing auxiliary supply circuits are de-energized.
6. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems, or water. Switch the energy sources to a safe state.
7. Make sure that the system is completely locked.

After you have completed the work, restore the operational readiness in the inverse sequence.

WARNING

Electric shock if there is no ground connection

For missing or incorrectly implemented protective conductor connection for devices with protection class I, high voltages can be present at open, exposed parts, which when touched, can result in death or severe injury.

- Ground the device in compliance with the applicable regulations.

WARNING

Electric shock due to equipment damage

Improper handling may cause damage to equipment. For damaged devices, hazardous voltages can be present at the enclosure or at exposed components; if touched, this can result in death or severe injury.

- Ensure compliance with the limit values specified in the technical data during transport, storage and operation.
- Do not use any damaged devices.

⚠ WARNING

Electric shock due to unconnected cable shield

Hazardous touch voltages can occur through capacitive cross-coupling due to unconnected cable shields.

- As a minimum, connect cable shields and the conductors of power cables that are not used (e.g. brake cores) at one end at the grounded housing potential.

⚠ WARNING

Electric shock due to connection to an unsuitable power supply

When equipment is connected to an unsuitable power supply, exposed components may carry a hazardous voltage. Contact with hazardous voltage can result in severe injury or death.

- Only use power supplies that provide SELV (Safety Extra Low Voltage) or PELV-(Protective Extra Low Voltage) output voltages for all connections and terminals of the electronics modules.

1.1.1 Risk through capacitor discharge

DANGER

Capacitor discharge

Because of the DLC Module, a hazardous voltage is present at terminal X1 for up to 35 hours after the power supply has been switched off. Contact with live parts can result in death or serious injury.

Capacitor discharge:

"DANGER – Risk of electrical shock, dangerous voltage may exist for 35 h after removing power"

"**DANGER**: Risque du choc électrique. Une tension dangereuse peut être présentée jusqu'à 35 h après avoir coupé l'alimentation." or equivalent.

WARNING

Arcing when a plug connection is disconnected while the device is charged

Disconnecting a plug connection during operation when the energy storage device is charged can result in arcing that may cause serious injury or death.

- Only open plug connections when the equipment is in a voltage-free state, unless they have been explicitly released for opening during operation.

NOTICE

Property damage due to loose power connections

Insufficient tightening torques or vibration can result in loose power connections. This can result in damage due to fire, device defects or malfunctions.

- Tighten all power connections to the prescribed torque.
- Check all power connections at regular intervals, particularly after equipment has been transported.

WARNING

Spread of fire from built-in devices

In the event of fire outbreak, the enclosures of built-in devices cannot prevent the escape of fire and smoke. This can result in serious personal injury or property damage.

- Install built-in units in a suitable metal cabinet in such a way that personnel are protected against fire and smoke, or take other appropriate measures to protect personnel.
- Ensure that smoke can only escape via controlled and monitored paths.

WARNING

Active implant malfunctions due to electromagnetic fields

Electronic devices generate electromagnetic fields (EMF) during operation. Electromagnetic fields may interfere with active implants, e.g. pacemakers. People with active implants in the immediate vicinity of an inverter are at risk.

- As the operator of an EMF-emitting installation, assess the individual risks of persons with active implants.
- Observe the data on EMF emission provided in the product documentation.

WARNING

Fire due to inadequate ventilation clearances

Inadequate ventilation clearances can cause overheating of components with subsequent fire and smoke. This can cause severe injury or even death. This can also result in increased downtime and reduced service lives for devices/systems.

- Ensure compliance with the specified minimum clearance as ventilation clearance for the respective component.

NOTICE

Overheating due to inadmissible mounting position

The device may overheat and therefore be damaged if mounted in an inadmissible position.

- Only operate the device in admissible mounting positions.

WARNING

Unrecognized dangers due to missing or illegible warning labels

Dangers might not be recognized if warning labels are missing or illegible. Unrecognized dangers may cause accidents resulting in serious injury or death.

- Check that the warning labels are complete based on the documentation.
- Attach any missing warning labels to the components, where necessary in the national language.
- Replace illegible warning labels.

NOTICE

Device damage caused by incorrect voltage/insulation tests

Incorrect voltage/insulation tests can damage the device.

- Before carrying out a voltage/insulation test, disconnect the system/machine. The device has been high voltage tested by the manufacturer. As a consequence, it is not necessary to carry out additional tests in the system/machine.

⚠ WARNING

Unexpected movement of machines caused by inactive safety functions

Inactive or non-adapted safety functions can trigger unexpected machine movements that may result in serious injury or death.

- Observe the information in the appropriate product documentation before commissioning.
- Carry out a safety inspection for functions relevant to safety on the entire system, including all safety-related components.
- Ensure that the safety functions used in your drives and automation tasks are adjusted and activated through appropriate parameterizing.
- Perform a function test.
- Only put your plant into live operation once you have guaranteed that the functions relevant to safety are running correctly.

1.2 Equipment damage due to electric fields or electrostatic discharge

Electrostatic sensitive devices (ESD) are individual components, integrated circuits, modules or devices that may be damaged by either electric fields or electrostatic discharge.

NOTICE

Equipment damage due to electric fields or electrostatic discharge

Electric fields or electrostatic discharge can cause malfunctions through damaged individual components, integrated circuits, modules or devices.

- Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g. conductive foam rubber of aluminum foil.
- Only touch components, modules and devices when you are grounded by one of the following methods:
  - Wearing an ESD wrist strap
  - Wearing ESD shoes or ESD grounding straps in ESD areas with conductive flooring
- Only place electronic components, modules or devices on conductive surfaces (table with ESD surface, conductive ESD foam, ESD packaging, ESD transport container).

1.3 Warranty and liability for application examples

Application examples are not binding and do not claim to be complete regarding configuration, equipment or any eventuality which may arise. Application examples do not represent specific customer solutions, but are only intended to provide support for typical tasks.

As the user you yourself are responsible for ensuring that the products described are operated correctly. Application examples do not relieve you of your responsibility for safe handling when using, installing, operating and maintaining the equipment.

1.4 Industrial security

Further information is provided on the Internet:

Industrial Security configuration manual
(https://support.industry.siemens.com/cs/document/108862708)

WARNING

Unsafe operating states resulting from software manipulation

Software manipulations, e.g. viruses, Trojans, or worms, can cause unsafe operating states in your system that may lead to death, serious injury, and property damage.

- Keep the software up to date.
- Incorporate the automation and drive components into a holistic, state-of-the-art industrial security concept for the installation or machine.
- Make sure that you include all installed products into the holistic industrial security concept.
- Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.
- On completion of commissioning, check all security-related settings.
- Protect the drive against unauthorized changes by activating the "Know-how protection" converter function.

See also

Industrial Security (https://www.siemens.com/industrialsecurity)

1.5 Residual risks of technical systems, machines and plants

When assessing the machine- or system-related risk in accordance with the respective local regulations (e.g., EC Machinery Directive), the machine manufacturer or system installer must take into account the following residual risks emanating from the control and drive components of a drive system:

1. Unintentional movements of driven machine or system components during commissioning, operation, maintenance, and repairs caused by, for example,
   - Hardware and/or software errors in the sensors, control system, actuators, and cables and connections
   - Response times of the control system and of the drive
   - Operation and/or environmental conditions outside the specification
   - Condensation/conductive contamination
   - Parameterization, programming, cabling, and installation errors
   - Use of wireless devices/mobile phones in the immediate vicinity of electronic components
   - External influences/damage
   - X-ray, ionizing radiation and cosmic radiation
2. Unusually high temperatures, including open flames, as well as emissions of light, noise, particles, gases, etc., can occur inside and outside the components under fault conditions caused by, for example:
   - Component failure
   - Software errors
   - Operation and/or environmental conditions outside the specification
   - External influences/damage
3. Hazardous shock voltages caused by, for example:
   - Component failure
   - Influence during electrostatic charging
   - Induction of voltages in moving motors
   - Operation and/or environmental conditions outside the specification
   - Condensation/conductive contamination
   - External influences/damage
4. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc., if they are too close
5. Release of environmental pollutants or emissions as a result of improper operation of the system and/or failure to dispose of components safely and correctly
6. Influence of network-connected communication systems, e.g. ripple-control transmitters or data communication via the network

For more information about the residual risks of the drive system components, see the relevant sections in the technical user documentation.

1.6 Residual risks of technical systems, machines or plants with double layer capacitors

When taking into account residual risks associated with technical systems, machines or plants with the DLC Module, the SafetyDataSheet of the double-layer capacitors must be observed. The current version is available from Technical Support.

Description

2

Properties

The DLC Module is an energy storage device based on double layer capacitors.

The DLC Module has a CAN bus interface for monitoring and diagnosing the energy storage status. This interface must be connected to a higher-level controller for the energy storage management. See also section Functions (Page 47).

The DLC Modules can be connected in a serial and/or parallel configuration with consideration of the specified operating voltage range and specified insulation conditions. Connection to the CAN bus interface always takes place in series with an inserted terminating resistor at the last module of the communication chain.

The DLC Module is specified as intended for use in a metal control cabinet.

Safety information

DANGER

The DLC Module or the DLC rack must be discharged before any work on the system and for transport or storage.

In addition, the DLC module must be short-circuited between the power connections for transport and storage. See also section Service and maintenance (Page 51), Discharging the DLC Module

DANGER

The DLC Module can only be operated with energy storage management for monitoring by a higher-level controller. Communication takes place via CAN bus. See also section Parameter assignment/addressing (Page 33).

NOTICE

No reverse polarity protection of the power connection is provided! Make sure that DC+ und DC- are connected correctly.

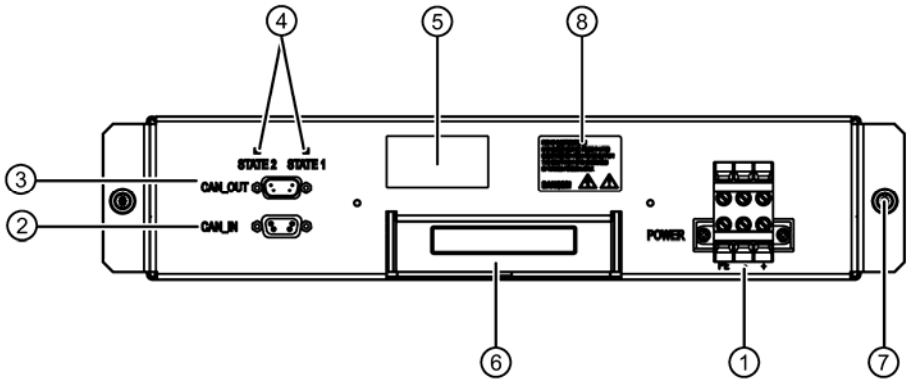
NOTICE

The DLC Module is short-circuited on delivery. The jumper (transport lock) on the power connection (X1) must be removed before commissioning.

NOTICE
The DLC Module is subject to an aging process. The production date can be determined from the serial number shown on the rating plate.

DLC Module view

The following figure shows the DLC Module with the interfaces and front elements.

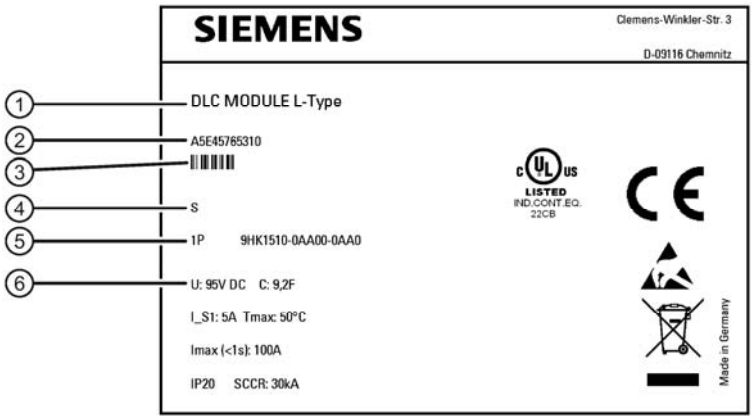


1 Interface X1: Power connection (with mating connector)
2 Interface X2: CAN interface (CAN_IN)
3 Interface X3: CAN interface (CAN_OUT)
4 Status display (LED)
5 Rating plate
6 Transport grip
7 Knurled screws (left and right) for fastening in a carrier system
8 Warning label

Figure 2-1 DLC Module front elements

Rating plate

The following diagram shows you all of the information provided on the rating plate of the DLC Module.



1 Name
2 Article number
3 Bar code
4 Serial number
5 Order number (MLFB)
6 Technical data

Figure 2-2 Rating plate DLC Module

The production date can be determined from the serial number shown on the rating plate.

Table 2- 1 Structure of the serial number

position	Example	Meaning
1	S	Identifier for serial number
2 to 3	Identifier (manufacturer plant)	
4	L	2019
	M	2020
	N	2021
	P	2022
	R	2023
	S	2024
	T	2025
	U	2026
	V	2027
	W	2028
	X	2029
5	1 to 9	January to September
	O	October
	N	November
	D	December
6 to 11	Production serial number	

Example: The serial number SF2**LD**012345 contains the manufacturing date December 2019.

Serial number conversion

The serial number of the DLC Module is stored as a numerical value in parameter P63. Conversion must be performed to be able to compare this with the rating plate.

Digit 4 indicates the year. Subtract 2010 from it and multiply the result by 12.

Digit 5 indicates the month. This should be interpreted consecutively from January = 1 to December = 12.

The results from digits 4 and 5 are added together. The result is an offset that is written in byte 3 of the serial number. This value is then added together with the number from digits 6-11. *Digits 6-11* should be viewed as a decimal number.

Example of conversion

Serial number: SF2LD012345

- SF2 is ignored
- L stands for 2019
  - 2019 - 2010 = 9
  - 9 * 12 = 108
- D stands for December → 12
  - 108+12 = 120 → 0x78000000
- Digits 6-11: 012345 → 0x3039
- Now we add the two values, 0x78000000 + 0x3039
- Stored serial number: 0x78003039 = 2013278265

Example of reverse conversion

Parameter P63 contains the following numerical value: 2013278265 = 0x78003039

Reverse conversion is performed in the opposite order.

- 0x78003039 → 0x78 for month and year or digits 4 and 5 and 0x003039 as number for digits 6-11
- 0x78 now needs to be reverse converted. This can be performed in the following way:
  - 0x78 = 120 is modulo divided by 12. If there is no remainder, the month must be December (D). If there is a remainder (e.g. 0x79 = 121 modulo divided by 12 results in a remainder of 1), the remainder indicates the month: Remainder 1 = January.
  - The year is the result of 0x78 = 120 / 12
    If there is no remainder in the calculation of the month, subtract 1: 0x78 = 120 /12 - 1 = 9.
- Digits 6-11 0x003039=012345

Example 1:

- For 0x78 → 0x78 modulo 12 = no remainder → the month is December → D
- 0x78 / 12 = 10, 10 - 1 = 9 is the year → 9 + 2010 = 2019 → L → serial number begins with SF2LD
- 0x78003039 → rating plate serial number LD012345 or SF2LD012345

Example 2:

- For 0x79 → 0x79 modulo 12 = remainder 1→ January or 1 is the month
- 0x79 / 12 = 10 is the year → 10 + 2010 = 2020 → M → Serial number begins with SF2M1
- 0x79003039 → rating plate serial number M1012345 or SF2M1012345

Interfaces and display elements

3

3.1 Interface overview

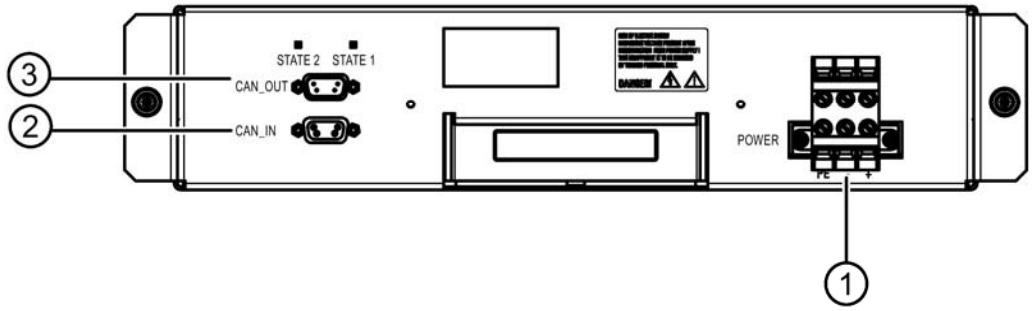


Figure 3-1 Interfaces and display elements on the DLC Module

Table 3- 1 DLC Module interfaces

	Interface	Designation	Connector type
1	Power connection	**X1**	3-pin male connector with 6-pin mating connector
2	CAN interface (input)	**X2**	9-pin socket
3	CAN interface (looping)	**X3**	9-pin male connector

Connection example

The following example shows a series connection of multiple DLC Modules with higher-level controller (SPS).

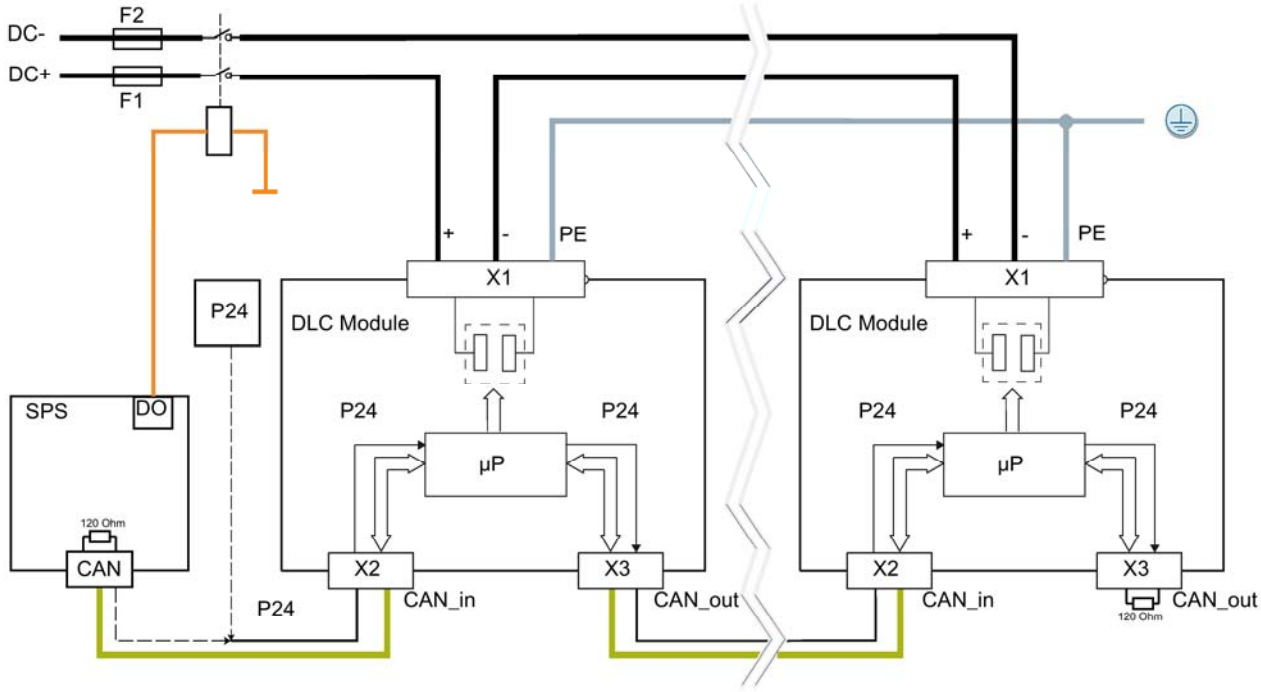


Figure 3-2 Connection example, series connection

DANGER

A fully discharged DLC Module can again build up a voltage potential of up to 10 V at terminal X1 if there are non short-circuited X1 terminals. If several DLC Modules are connected in series, there is the risk of the presence of hazardous voltage. Contact with live parts can result in death or serious injury.

3.2 Power connection (X1)

Characteristics

The DLC Module is connected to the power circuit via terminal X1, i.e. the DLC Module is charged or discharged via this terminal.

DANGER

Wiring or plugging and pulling on terminal X1 can only take place when the DLC Module is disconnected from the power (U < 1.5 V).

CAUTION

Note the specified polarity when connecting. Reversing the polarity of the connections causes failure of the device.

NOTICE

To ensure protection class 1, the device must be grounded using the protective conductor connection.

NOTICE

The DLC Module can only be operated with use of the energy storage monitoring interface, see section Parameter assignment/addressing (Page 33)

Note

When configuring your plant with the DLC Module, analyze the short-circuit and ground fault ratios in the event of an error. If necessary, secure the supply lines on X1 with a DC fuse.

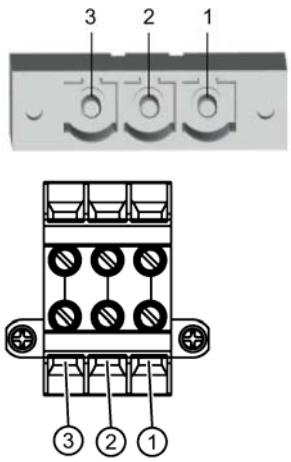
Interface characteristics

Table 3- 2 Interface X1

Feature	Version
Connector type	PC 6-16
Counterpart	TPC 16/ 3-STF-10, 16
Connection possibility	Up to 16 mm^2

Interface assignment

Table 3- 3 X1 interface assignment

Representation	PIN	Designation	Description
	1	DC+	Storage voltage connection positive
	2	DC-	Storage voltage connection negative
	3	PE	Protective earth

3.3 CAN interfaces (X2, X3)

Communication of the DLC Module with a higher-level controller by means of CAN bus and 24 V DC supply voltage for the electronics takes place over the X2 and X3 interfaces.

NOTICE

Observe the following instructions:

The CAN bus must be terminated with a R=120 ohm resistance. The terminating resistor (see Spare parts/accessories (Page 61)) must be connected to X3 of the last DLC Module in the CAN line.

The CAN bus nodes must only be installed or removed when the equipment is disconnected from the power supply.

The CAN bus cables must be twisted and shielded. The shield must be placed over a large surface area of the connector enclosure. The 24 V DC supply voltage for the DLC Module electronics is provided via the CAN connection at the same time.

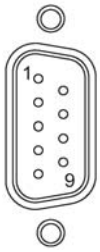
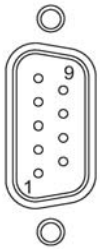
Interface characteristics

Table 3- 4 Interface X2 and X3

Feature	Version
Connector type X2 (CAN IN)	9-pin D-sub socket
Connector type X3 (CAN OUT)	9-pin D-sub male connector
Baud rate	125 kBaud
Current carrying capacity	Up to 1.5 A
Maximum cable length (24 V supply cable)	3 m

Interface assignment

Table 3- 5 Interface assignment X2 and X3

Representation	PIN	Designation	Description
 Interface X2	1	-	unassigned
	2	CAN_L	CAN signal
	3	M	Electronic ground
	4	-	unassigned
	5	Shield	
	6	M	Electronic ground
	7	CAN_H	CAN signal
	8	-	unassigned
 Interface X3	9	24 V	24 V power supply (PELV)

Note

CAN cables with a new 24 V infeed can be used for specific applications to prevent an overload of the interface pins of the DLC Module 24 V supply. The relevant standards must be taken into account.

3.4 Display elements

LED displays

The LED displays on the DLC Module are arranged as follows:

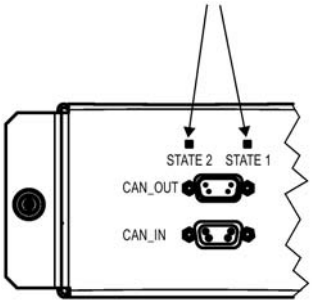


Figure 3-3 DLC Module display elements

The states of the LED displays have the following meaning:

Operating state	State 2 (red)	State 1 (green)
Identification of the communication devices	Flashing 2 Hz	Flashing 2 Hz
DLC Module is in operation	OFF	ON
DLC Module has detected a warning	Flashing 1 Hz	ON
DLC Module has not detected any error.	ON	OFF

Installing and connecting

4

General information

DANGER

Only DLC Modules in a completely discharged state may be interconnected. You can find a description of how to discharge the DLC Modules in section Service and maintenance (Page 51).

NOTICE

Only DLC Modules of the same type can be interconnected with one another; see the "Rating plate" paragraph in section Description (Page 17).

NOTICE

The DLC Module is short-circuited on delivery. The jumper (transport lock) on the power connection (X1) must be removed before commissioning.

NOTICE

The CAN cables can only be connected or removed with a switched-off 24 V DC power supply.

NOTICE

When installing the CAN cable and the cables for the power connection, pay attention to physical separation in order to avoid electro-magnetic couplings between the signal and power path.

4.1 Installing the DLC Module

Device installation

The DLC Module is designed for installation in a carrier system. It is fastened in the carrier system using M6 knurled screws.

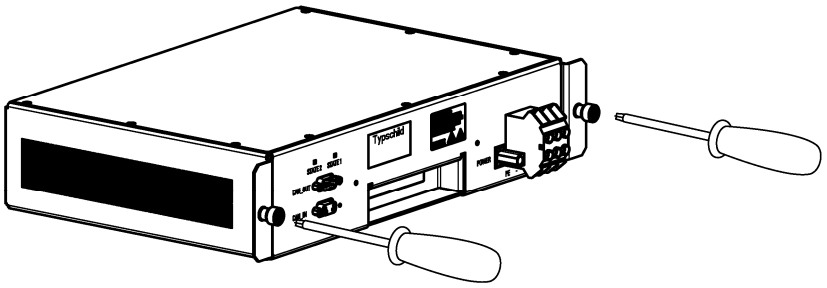


Figure 4-1 Installing the DLC Module

Tightening torque

Tighten the screws with a tightening torque of 1.8 Nm.

4.2 Connecting the DLC Module

The DC+ and DC- power connections and the PE terminal are located on the X1 terminal. The connections are wired on the supplied mating connector.

The mating connector is equipped with two connection terminals for each potential. This enables further routing for serial or parallel connections without additional terminal strips.

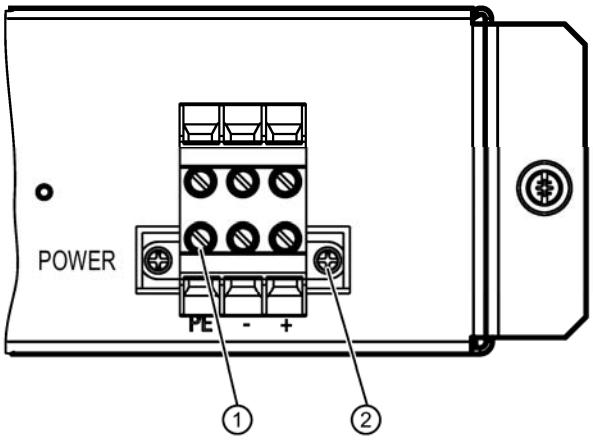


Figure 4-2 Interface X1 (displayed with inserted mating connector)

Protective Earthing Conductor

It is absolutely essential to connect a protective earthing conductor (green/yellow, 6 mm^2) to the DLC Module. The protective earthing conductor is connected to terminal X1/Pin 3.

- Connect the protective earthing conductor to the supplied mating connector (PE terminal).
- Tighten the clamping screws (1) with 1.8 Nm.

Serial wiring of the protective earthing equipment between DLC Modules is permitted.

NOTICE
The protective earthing equipment of the DLC Module must be connected to the protective earthing equipment of the control cabinet.

Wiring the power connection

The supplied mating connector has two terminal connections intended for forwarding the potentials.

- Connect the potentials to the mating connector accordingly.
- Tighten the clamping screws (1) with 1.8 Nm.
- Plug the mating connector into interface X1.
- Fix the mating connector to the interface. Tighten the fixing screws (2) with 1.8 Nm.

NOTICE
Check the torque of the clamping screws for the power connection for connector X1 in a one-year maintenance interval.

Note

It is recommended that you protect the power cables of the DLC Module against external short-circuits with a DC fuse.

The following types of fuses can be used, bearing in mind the voltage requirements:

- Siemens SITOR cylindrical fuse 80 A; article number: 3NC2280 up to a maximum rack voltage of 700 V DC
- SIBA 63 A; article number: 20 028 20.63 up to a maximum rack voltage of 800 V DC

Permissible cable cross-sections X1

The permissible conductor material for connection X1 is copper (Cu) with the following cable cross-sections:

Table 4- 1 Permissible cable cross-sections

Connection data	
Conductor cross-section rigid/flexible min.	0.75 mm²
Conductor cross-section rigid/flexible max.	16 mm²
Conductor cross-section flexible with wire-end ferrule without plastic sleeve min.	0.5 mm²
Conductor cross-section flexible with wire-end ferrule without plastic sleeve max.	16mm² Only in connection with CRIMPFOX 16 S
Conductor cross-section flexible with wire-end ferrule with plastic sleeve min.	0.5 mm²
Conductor cross-section flexible with wire-end ferrule with plastic sleeve max.	16mm² Only in connection with CRIMPFOX 16 S
Conductor cross-section AWG/kcmil min.	18
Conductor cross-section AWG/kcmil max.	6
2 conductors of the same cross-section rigid/flexible min.	0.75 mm²
2 conductors of the same cross-section rigid/flexible max.	6 mm²
2 conductors of the same cross-section flexible with wire-end ferrules without plastic sleeve min.	0.5 mm²
2 conductors of the same cross-section flexible with wire-end ferrules without plastic sleeve max.	4 mm²
2 conductors of the same cross-section flexible with TWIN wire-end ferrules with plastic sleeve min.	0.5 mm²
2 conductors of the same cross-section flexible with TWIN wire-end ferrules with plastic sleeve max.	6 mm²

Wiring the communications interface

The DLC Module is connected in serial to the CAN bus via the X2 and X3 interfaces.

For correct operation of the CAN bus, the two interfaces X2 and X3 must be used. In any case, the CAN bus must be terminated at both ends with a 120-ohm terminating resistor, i.e. also at the connection of the higher-level controller. There are two assembly options:

1. The DLC Module is one of several nodes in the CAN bus: X2 and X3 are connected with a CAN cable.
2. The DLC Module is at the end of the CAN bus line: X2 is equipped with a CAN cable and X3 is connected with a terminating resistor (see Accessories).

Tighten the screws of the D-sub connector with a tightening torque of 0.4 Nm.

Parameter assignment/addressing

5

5.1 CAN communication profile

The DLC Module has a load monitoring interface for transferring the status data of the energy storage device to a higher-level controller using the CAN bus. The DLC Module is operated and protected based on the status data, such as measured values and status bits. The proprietary CAN communication profile for operating the DLC Module with a higher-level controller (e.g. PLC) is described below.

NOTICE
The DLC Module can only be operated with use of the energy storage monitoring interface.

CAN identifier

The DLC Module supports the 11-bit standard CAN identifier. This is composed of a message ID (4 bits) and a node ID (7 bits).

CAN standard						10..			11-bit CAN identifier							..0
DLC-specific						3.. Message ID ..0			6.. Node ID							..0
Example with SIMATIC and PN/CAN Link	SIMATIC Address (Big Endian)	Byte	1	2	3	4										
		Bit	7 ... 0	7 ... 0	7 ... 3	2	1	0	7	6	5	4	3	2	1	0
						MSB										LSB

Node ID

The node ID is the identifier of every node in the CAN line. A unique node ID must be assigned to the DLC Module before commissioning. Only the 7 LSBs of the CAN ID are taken into consideration for the node ID.

With the node ID (0x7F), all nodes can be addressed at the same time (broadcast).

Baud rate

The CAN interface operates at a baud rate of 125 Kbps.

5.2 Cyclic communication of the status data

The most important status data for monitoring the DLC Module L-Type can be transmitted by cyclic messages. This is done via parameterization with parameter P006 (see Parameter list (Page 41)).

Rating plate data (message ID: 0x03)

For permissible operation of multiple DLC Module s in series or parallel within one electrical circuit, it must be ensured that the same types are used. The content of the electronic rating plate is transmitted via a cyclic message with message ID 0x03.

Table 5- 1 Rating plate data

Byte	Designation	Data type
0	Module type	Uint16
1		
2	Module capacity	Uint16
3		
4	Hardware version	Uint16
5		
6	Software version	Uint16
7		

Device status (message ID: 0x04)

The device status with respect to the error state, currently measured temperature and currently measured device voltage of the DLC Module L-Type can be transmitted using message ID 0x04.

Table 5- 2 Device status

Byte	Designation	Data type	Comment
0	Status word	Uint16	See the table below "Structure of status word".
1			Alarm and error bits are automatically acknowledged if the status is no longer present.
2	Temperature	Int8	Normalization of temperature: 1 bit corresponds to 1 degree
3	Reserve		
4	Total voltage	Int16	Voltage over all segments of the DLC Module
5			Normalization of voltage: 0x4000 corresponds to 400 V
6	Reserve	Int16	
7			

Table 5- 3 Structure of the status word of the DLC Module

Bit	Designation	Meaning
0	BIT_TEMP_BELOW_WARNING	The temperature of the DLC Module is below the warning threshold of the low temperature limit configured in P020.
1	BIT_TEMP_ABOVE_WARNING	The temperature of the DLC Module is above the warning threshold of the high temperature limit configured in P021.
2	BIT_SEGMENT_VOLTAGE_WARNING	The average cell voltage in one of the two measured segments is above the value configured in P009.
3	BIT_PEAK_DELTA_ABOVE_WARNING	The difference between the maximum average cell voltage in one of the two measured segments and the minimum average cell voltage is greater than the values configured in P010. The warning can be displayed with a delay of up to 1 h.
4	BIT_TEMP_BELOW_ERROR	The temperature of the DLC Module is below the lowest permitted operating temperature. This temperature limit is stored in the electronic rating plate.
5	BIT_TEMP_ABOVE_ERROR	The temperature of the DLC Module is above the highest permitted operating temperature. This temperature limit is stored in the electronic rating plate.
6	BIT_SEGMENT_VOLTAGE_ERROR	The average cell voltage in one of the two measured segments is above the maximum permitted value.
7	BIT_PEAK_DELTA_ABOVE_ERROR	The difference between the maximum average cell voltage in one of the two measured segments and the minimum average cell voltage is greater than the values configured in P011.
8	BIT_INTERNAL_ERROR	Checksum error in electronic rating plate. No reliable actual value acquisition is possible.
9	BIT_COMM_ERROR	Emitted CAN messages are not acknowledged by any recipient.
10	Reserve	
11	BIT_TEMP_HB_LIMIT	A low or high temperature limit has been violated since the last switch-on.
12	BIT_PEAK_DELTA_HB_ABOVE_MAX	The peak delta limit has been exceeded since the last switch-on (see bit 7).
13	BIT_SEGMENT_VOLTAGE_ERROR_HBO	The cell voltage limit has been exceeded since the last switch-on (see bit 6).
14	BIT_LIFETIMELIMIT	The integrated status conditions result in the configured end capacity being reached.
15	Reserve	

Segment voltages (message ID: 0x05)

The message ID 0x05 is to be used to query and monitor the segment voltages of the DLC Module L-Type.

Table 5- 4 Segment voltages

Byte	Designation	Data type	Comment
0	Segment voltage 1	Int16	Normalization of voltage: 0x4000 corresponds to 50 V
1			
2	Segment voltage 2	Int16	Normalization of voltage: 0x4000 corresponds to 50 V
3			
4	Reserved	Int16	
5			
6	Reserved	Int16	
7			

5.3 Acyclic query of the status data

In addition to cyclic communication, data of the DLC Module (see parameter list) can be read and written acyclically on request from the higher-level controller and errors can be evaluated.

Read parameter

Table 5- 5 Parameter request (message ID: 0xC)

Byte	Designation	Data type	Comment
0	Command ID	Byte	0x02
1	Parameter number	Uint8	
2	Parameter index	Uint8	
3	Number format/unit/persistent /order ID		Bits 0-3: not relevant Bit 4: 0 - Integer (normalization 4000h) 1 - value in 32-bit floating point (IEEE 754 format) Bit 5: 0 - Read value of parameter from RAM 1 - Read value of parameter from EEPROM Bit 6-7: (optional) ID for message tracking. The DLC Module mirrors this ID back in the response telegram.
4			Empty
5			Empty
6			Empty
7			Empty

Table 5- 6 Access OK (message ID: 0xB)

Byte	Designation	Data type	Comment
0	Command ID	Byte	0x02
1	Parameter number	Uint8	
2	Parameter index	Uint8	
3	Number format/unit/persistent /order ID		Bits 0-3: Unit: 4 bits Bit 4: 0 - Integer (normalization 4000h) 1 - value in 32-bit floating point (IEEE 754 format) Bit 5: 0 - Read value of parameter from RAM 1 - Read value of parameter from EEPROM Bit 6-7: (optional) ID for message tracking. The DLC Module mirrors the ID back from the request.
4	Parameter value	Int32	
5			
6			
7			

Table 5- 7 Unit

Reference variable	Value	Comment
None	0	
Capacity	1	Reference value in F can be read out via P96
Reserve	2	
Voltage (U_LOW)	3	Reference value in V can be read out via P95
Reserve	4	
Time	5	Reference variable 1 s
Reserve	6...15	

Table 5- 8 Access error (message ID: 0xB)

Byte	Designation	Data type	Comment
0	Command ID	Byte	0x03
1	Parameter number	Uint8	
2	Parameter index	Uint8	
3	Number format/unit/persistent/order ID		Bits 0-3: not relevant Bit 4: not relevant Bit 5: not relevant Bit 6-7: (optional) ID for message tracking. The DLC Module mirrors the ID back from the request.
4	Error value	Int32	
5			
6			
7			

Table 5- 9 Error value

Error	Error value	Comment
OK	0	No error
WRONG_PARAMETER	1	Parameter number does not exist
PARAM_READONLY	2	Parameter cannot be written
WRONG_DEVICE_STATE	3	Parameter cannot be changed in this device state
WRONG_INDEX	4	Invalid index
WRONG_RANGE	6	Invalid value range

Write parameter

Table 5- 10 Write parameter (message ID: 0xC)

Byte	Designation	Data type	Comment
0	Command ID	Byte	0x01
1	Parameter number	Uint8	
2	Parameter index	Uint8	
3	Number format /unit/persistent/ order ID		Bits 0-3: Unit: 4 bits Bit 4: 0 - Integer (normalization 4000h) 1 - value in 32-bit floating point (IEEE 754 format) Bit 5: 0 - Write value of parameter from RAM 1 - Write value of parameter from EEPROM Bit 6-7: (optional) ID for message tracking. The DLC Module mirrors this ID back in the response telegram.
4	Parameter value	Int32	
5			
6			
7			

Table 5- 11 Access OK (message ID: 0xB)

Byte	Designation	Data type	Comment
0	Command ID	Byte	0x01
1	Parameter number	Uint8	
2	Parameter index	Uint8	
3	Number format /unit/persistent/ order ID		Bits 0-3: Unit: 4 bits Bit 4: 0 - Integer (normalization 4000h) 1 - value in 32-bit floating point (IEEE 754 format) Bit 5: 0 - Write value of parameter from RAM 1 - Write value of parameter from EEPROM Bit 6-7: (optional) ID for message tracking. The DLC Module mirrors the ID back from the request.
4			
5			
6			
7			

Table 5- 12 Access error (message ID: 0xB)

Byte	Designation	Data type	Comment
0	Command ID	Byte	0x03
1	Parameter number	Uint8	
2	Parameter index	Uint8	
3	Number format /unit/persistent/order ID		Bits 0-3: not relevant Bit 4: not relevant Bit 5: not relevant Bit 6-7: (optional) ID for message tracking. The DLC Module mirrors the ID back from the request.
4	Error value	Int32	
5			
6			
7			

Table 5- 13 Error value

Error	Error value	Comment
OK	0	No error
WRONG_PARAMETER	1	Parameter number does not exist
PARAM_READONLY	2	Parameter cannot be written
WRONG_DEVICE_STATE	3	Parameter cannot be changed in this device state
WRONG_INDEX	4	Invalid index
WRONG_VALUE_RANGE	6	Invalid value range

General errors

If a DLC Module cannot interpret a message ID, a general error message is sent.

Table 5- 14 Error message (message ID: 0xC)

Byte	Designation	Data type	Comment
0			
1	Error information		Bit 1 = 1:
2			
3			
4			
5			
6			
7			

5.4 DLC Module L-Type parameter list

	Number of indices	Unit	Normalization	Access	Default value	Value range	Description
P001	0			rw	255	1 ... 127	DLC node ID "Write" is only possible with a subsequent power reset (Description of addressing (node ID) (Page 43)) Value 255 corresponds to the delivery state.
P002	0			r	127	1 ... 127	Effective DLC node ID
P005	0			rw	10	0 ... 100	PDO cycle - multiples of 100 ms
P006	0			rw	7	0 ... 7	Bit mask to activate the number of cyclic messages (see Cyclic communication of the status data (Page 34)) Activating the Msg. ID 0x03: Bit 0 = 1 --> 0x01, Activating the Msg ID 0x04: Bit 1 = 1 --> 0x02, Activating the Msg ID 0x05: Bit 2 = 1 --> 0x04, Activation of all 3 Msg IDs --> 0x07
P008	0	%		rw	70	61 ... 98	Capacity limit for end-of-life model as a percentage "Write" is only possible with P040 = 5. A modified value is only active after a power reset.
P009	0	V		rw	2.7	0 ... 100	Warning voltage cell, all values > 2.8 V indicate deactivation of the warning threshold. The non-parameterizable error threshold of 2.8 V is active.
P010	0	%	U_LOW	rw	5	1 ... 100	PeakDelta warning threshold in relation to cell voltage in percent The warning can be displayed with a delay of up to 1 hour.
P011	0	V		rw	0.26	0.1 ... 2.9	PeakDelta error threshold in relation to cell voltage in volts
P012	2	V		r		0 ... 60	Segment voltage
P013	2	V		r		0 ... 60	Segment voltage smoothed
P014	0	ms		rw	100	1 ... 32000	Time constant for smoothing voltages in ms
P020	0	°C		rw	-25	-40 ... 0	Lower temperature warning based on the measured DLC temperature (P060 index 2)
P021	0	°C		rw	63	50 ... 255	Higher temperature warning based on the measured DLC temperature (P060 index 2)
P040	0			rw	1	1; 5	Menu parameter P008 and P255 can only be written with value 5. Note: Overwriting the value with the same value results in the error message "Incorrect value range". "write" is only possible if the node ID of the DLC Module is < 127.

	Number of indices	Unit	Normalization	Access	Default value	Value range	Description
P050	0			r			Status word DLC Module (see Cyclic communication of the status data (Page 34))
P060	2	°C		r		-50 °C ... 300 °C	Temperatures (see Temperature monitoring (Page 48)) Index 1: Electronics Index 2: DLC cell
P062	0	s		r		0 ... 2^{32}	Operating period DLC Module with 24 V power supply
P063	0			r			Serial number DLC Module
P064	0	s		r			Remaining life time DLC Module
P068	0			r	2		DLC Module L-Type type
P069	2			r			Software version (float) - Index 1: SW version main firmware Index 4: Rating plate version
P080	0			r			Internal error
P095	0	V		r	50		Reference voltage U_LOW
P096	0	F		r	10		Reference capacity in farad
P255	0			rw	0	0; 1	Reset to factory settings "Write" is only possible with P040 = 5. All parameters (including the node ID) are reset to the default settings.

5.5 Description of addressing (node ID)

NOTICE
With the DLC Module, communication is possible in the delivery state via node ID = 127 (broadcast address). For operation and differentiated diagnosis, a separate node ID (< 127) must be assigned to each DLC Module on the CAN bus. Operation without unique node ID is not permissible because monitoring of the DLC Module would then not be possible.

For the assignment of the node ID, the serial number of the DLC Module on the CAN bus must be known. After reading the serial numbers at the DLC Modules used, it is possible to determine them using the "Hello telegram“.

The following 2 options are available for assigning the node ID:

1. Temporary node ID (message ID: 0xF): This node ID is valid until the next power off. After a power reset, a node ID must be assigned again to the DLC Module. This process is relevant, among other things, for automatic node ID assignment in the program of the higher-level controller.
2. Fixed node ID (message ID: 0xC): This node ID is written to the EEPROM of the DLC Module. This is only active after a power reset and is retained after each power reset.

Hello telegram

Only DLC Module s with the broadcast ID 127 respond to the Hello telegram.

Table 5- 15 Hello telegram (message ID: 0xF)

Byte	Designation	Data type	Comment
0	Command ID	Byte	0x51
1	Number of bits	Uint16	Number of bits to be checked for consistency, starting from the MSB. Value range 0 ... 32 Example: Value 4 - the 4 most significant bits must match.
2			
3	Serial number	Uint32	LSB
4			
5			
6			MSB
7			

DLC Module s with matching serial number fragments send the message ID = 0xF as the response. The 8 data bytes and the node ID in the response telegram are zero due to the CAN bus bit-arbitration. The response is only sent by devices with the broadcast address 127.

Table 5- 16 Example communication "Hello telegram"

Step	Message	Node ID	Msg ID	Comd. ID Data byte 0	Data byte 1	Data byte 2	Data byte 3	Data byte 4	Data byte 5	Data byte 6	Data byte 7
1	Hello	0x7F	0xF	0x51	See table "Hello telegram (message ID: 0xF)"						
2	Hello response	0x00	0xF	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00

Assignment of a temporary node ID

With the message-ID 0xF, a node ID is temporarily assigned to the DLC Module with the corresponding serial number. The assignment of the temporary node ID is only possible within 5 seconds after:

- Turn on 24 V or
- A Hello telegram.

In this case, the parameter P002 "effective node ID" retains its last value. The temporary node ID is retained until the next power on/power off (24 V) if a "Hello telegram" is received again within 5 seconds.

Table 5- 17 SetDLCNodeID (message ID: 0xF)

Byte	Designation	Data type	Comment
0	Command ID	Byte	0x52
1			Empty
2	Node ID	Uint16	LSB
3			MSB
4	Serial number	Uint32	LSB
5			
6			
7			MSB

Assign a fixed node ID

A fixed node ID is set via "Write parameter" (message ID 0xC). Parameter P001 is set to the desired node ID. This parameter has an effect after a power reset (24 V). Parameter P002 then contains the node ID of P001. The fixed node ID can only be assigned with a DLC Module in the CAN bus using the broadcast address 127. If there are several DLC Modules, assignment is only possible using a previously assigned temporary node ID.

Example of assignment of CAN node ID

The following table shows a procedure for assigning the node ID. This must be done within 5 seconds of turning on 24 V or after sending a Hello telegram.

The serial number of the sample module is: SF2LD012345 = 0x78003039 and should get the node ID 11 = 0x0B.

Table 5- 18 Example

	Message	Node ID	Msg. ID	Comd. ID Data byte 0	Data byte 1	Data byte 2	Data byte 3	Data byte 4	Data byte 5	Data byte 6	Data byte 7
1	SetDLCNodeID	0x7F	0xF	0x52	0x00	0x0B	0x00	0x39	0x30	0x00	0x78
2	SetDLCNodeID response	0x0B	0xF	0x52	0x00	0x00	0x00	0x00	0x00	0x00	0x00
3	SetParameter	0x0B	0xC	0x01	0x01	0x00	0x20	0x0B	0x00	0x00	0x00
4	SetParameter response	0x0B	0xB	0x01	0x01	0x00	0x20	0x00	0x00	0x00	0x00

Functions

6

6.1 Voltage monitoring

Voltage monitoring

The DLC Module can be operated over the entire voltage range from 0 V to rated voltage 95 V. Brief overvoltages of up to 106 V DC are permissible. This range is completely covered by the integrated voltage measurement. The two segment voltages (p012.1 and p012.2 or smoothed p013.1 and p013.2) relate to 2 segments with the same number of DLC single cells. Both segments are connected in a serial configuration. As a consequence, the total voltage results from the sum of both segment voltages:

Explanation

Violation of high limits results in a fault message. The measuring signals are filtered to avoid misinterpretations due to peaks through possible EMC influences (see P013 and P014).

The following functions are implemented:

- 2 measured voltage values of the individual segments, readable using the cyclic telegram "segment voltages" (message ID 0x05) or an acyclic parameter query (p012 and p013)
- One measured voltage value as total voltage of the DLC Module, readable using the cyclic telegram "Device status" (message ID 0x04), if activated.
- The internal voltage measurement also serves as an input variable for the internal lifetime model.
- Error detection in the DLC Module via status word (see also device status or p050).
  - By means of comparison of the two measured voltage values for monitoring impermissible asymmetries between the two segments in the DLC Module
  - Detection of impermissible overvoltages over the segments and the DLC Module

⚠ DANGER

Operating the DLC Module above the specified voltage range can lead to a defect and the outgassing of hazardous substances.

Ventilate the control cabinet following the occurrence of such an error state of the system. Then after this replace the DLC Modules.

When an error is detected, there is a notification on the device via the red LED and in the status word of the CAN telegram. See section Parameter assignment/addressing (Page 33).

DANGER

The higher-level controller must immediately disconnect the DLC Module from the power path and discharge it in the event of:

- Detection of an overvoltage error in the DLC Module
- own error or own failure.

Encapsulated DC contactors must be provided as switching elements.

Defective DLC Modules must be replaced.

6.2 Temperature monitoring

Temperature monitoring

The temperature is a decisive factor for the lifetime of the DLC Module. Two temperature measuring points are integrated in the device. The measured variables are available as process data for the load management of the higher-level controller connected via CAN bus.

The following functions are implemented:

- Measuring point 1 for temperature monitoring of electronics
- Measuring point 2 in the direct environment of the individual DLC cells for temperature monitoring.
- Temperature measurement as an input variable for the internal lifetime model (measuring point 2).
- Error detection in the case of overtemperature on the DLC Module L-Type based on the measured temperature of measuring point 2.

DANGER

Operating the DLC Module above the specified temperature range can lead to a defect and the outgassing of hazardous substances.

Ventilate the control cabinet following the occurrence of such an error state of the system. Then after this replace the DLC Modules.

When an error is detected, there is a notification on the device (red LED) and in the status word of the CAN telegram. See section Parameter assignment/addressing (Page 33)

DANGER

The higher-level controller must immediately disconnect the DLC Module from the power path in the event of:

- Detection of an overtemperature error in the DLC Module
- DLC module error or DLC module failure.

Only discharge the DLC module when the temperature is once again within the permissible range.

Encapsulated DC contactors must be provided as switching elements.

Defective DLC Modules must be replaced.

6.3 Operating hours counter

Operating hours counter

An operating hours counter is implemented in the DSK module. The current value is updated once per hour during operation.

6.4 DLC Module lifetime model

DLC Module lifetime model

A lifetime model is implemented for the DLC cells in the DLC Module.

Input variables of the lifetime model:

- Temperature
- Cell voltage
- Time

Output variables of the lifetime model:

- Using the input variables, the lifetime model calculates the residual time until the parameterizable minimum capacity (p008 = e.g. 70% (default)) is reached. The lifetime model only considers calendar aging. Influence by cyclization (loading and discharge cycles) is not taken into consideration.

Service and maintenance

7

DANGER

Capacitor discharge

Because of the DLC Module, a hazardous voltage is present at terminal X1 for up to 35 hours after the power supply has been switched off. Contact with live parts can result in death or serious injury.

Capacitor discharge:

"DANGER – Risk of electrical shock, dangerous voltage may exist for 35 h after removing power"

"**DANGER**: Risque du choc électrique. Une tension dangereuse peut être présentée jusqu'à 35 h après avoir coupé l'alimentation." or equivalent.

Replacing the DLC Module

DANGER

To avoid contact with dangerous voltages, damage or arcing, only completely discharged DLC Modules that are short-circuited at X1 can be replaced.

A fully discharged DLC Module can again build up a voltage potential of up to 10 V at terminal X1 if there are non short-circuited X1 terminals. If several DLC Modules are connected in series, there is the risk of the presence of hazardous voltage. Contact with live parts can result in death or serious injury.

Use the 2-pole jumper at the mating connector X1 for short circuiting after the voltage of the DLC Module is discharged to below 1.5 V.

Proceed as follows to remove the DLC Modules:

1. Disconnect the power circuit from the energy supply.
2. Discharge the DLC Module completely.
3. Remove the connector from the X1 terminal.
4. Short-circuit the terminal X1 with the shorting plug of the new DLC Module.
5. Switch off the 24 V supply. Remove the CAN cable and the terminating resistor, if applicable, from the X2 and X3 terminals.
6. If the module is fixed in a carrier system, loosen the knurled screws.
7. Pull the DLC Module on the recessed grip out of the carrier system.
8. Insert the new DLC Module in the carrier system.

9. Connect the DLC Module according to the specifications in section Installing and connecting (Page 29). The supplied cable set with connectors can be used again.
10. Assign the DLC Module parameters using the CAN bus.

Discharging the DLC Module

When one or multiple DLC Modules L-Type are used in a plant, possibilities for discharging the energy storage device for maintenance must be provided for.

For example, use a connectable discharge resistor via a contactor control. SIOS home page on the Internal (https://support.industry.siemens.com/cs/start?lc=en-AT)

Encapsulated DC contactors must be used to minimize possible subsequent risks following an error state of the DLC Module.

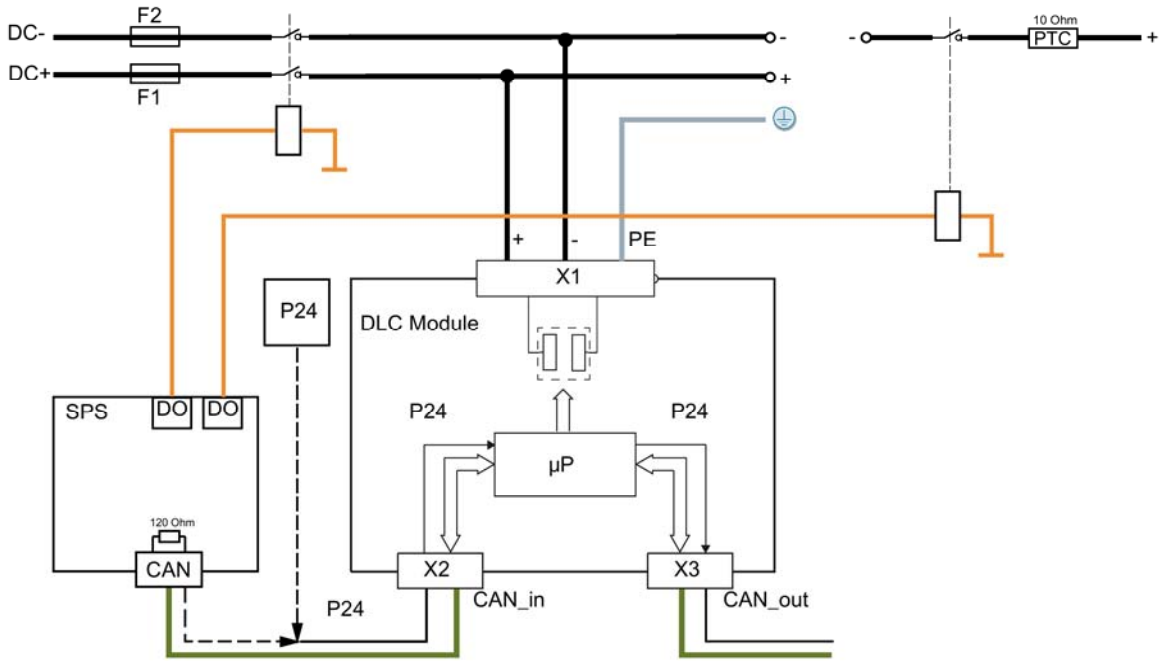


Figure 7-1 Circuit diagram for discharging

NOTICE

When designing and dimensioning the discharge circuits, pay attention to the plant-specific conditions and safety requirements.

Adapt the performance of the discharge resistor to the capacity of the DLC Module to be discharged. Temperature monitoring of the discharge resistor is recommended for detecting overload states. Alternatively, an intrinsically safe PTC resistor can be used as discharge resistor.

Note

Checking the discharge

Check the voltage conduction of the DLC Module directly at the terminals of the X1 interface (DC+, DC-) using a voltmeter.

Technical data

8

Technical data

Dimensioning of the DLC Module in series or parallel is performed based on the permissible voltage range, the required maximum power and energy content of the application.

The information for capacity and Thevenin resistance relates to the delivery state. Due to aging effects in operation, the capacity of the DLC Module decreases or the resistance increases depending on the operating conditions, such as temperature and voltage. Detailed data can be requested from technical support.

Energy store	
Rated voltage	95 V DC
Capacity	9.2 F
Thevenin resistance	150 mOhm
Max. permissible voltage	106 V DC
Charging/discharging current effective value	5 A with T* = 50 °C 10 A with T* = 25 °C T*: Ambient temperature DLC Module
Max. permissible current	100 A < 1 s
Cable protection DLC Module	External cable protection required depending on the application Installing and connecting (Page 29)
Lifetime	With 15% capacitance loss 88 000 h at 25 °C ambient temperature of the DLC cells
Electronics power supply	
Input voltage	24 V DC ±10%
Short-circuit protection	Yes
Continuous input current	Typically 70 mA
Article no.	
DLC Module L-Type	9HK1510-0AA00-0AA0

Dimensions and weight

Feature	DLC Module
Housing	Galvanized sheet steel
Weight	Approx. 7 kg
Dimensions (W x H x D)	410 mm x 84 mm x 276 mm

Shipping and storage conditions

Note

The DLC Module can only be stored and transported in a short-circuited state. For this purpose, the jumper should be inserted between DC+ and DC- at the X1 interface.

Store the equipment in a clean, dry environment. The following information applies to modules transported and stored in the original packaging.

Feature	DLC Module
Temperature (long-term storage)	-20° C to +35° C Note: A storage duration of more than one year may result in a capacity reduction of the DLC Module.
Temperature (transport)	-40° C to +70° C
Humidity	≤ 95%
Free fall	Tested according to DIN EN 60721-3-2

Environmental conditions

The DLC Module meets the conditions of use of Class 3C2 according to DIN EN 60721 3-3.

Feature	DLC Module
Mechanical ambient conditions	
Vibration load:	DIN EN 60721-3-3, class 3M2
Shock load:	DIN EN 60721-3-3, class 3M2
Climatic ambient conditions	
Working temperature of the DLC cells in the enclosure of the DLC Module (P060)	-30 °C to 65 °C Observe the temperature derating depending on the effective charging/discharge current.
Maximum temperature change	< 0.5 K/min, corresponds to 30 K/h
Relative atmospheric humidity	≤ 85% to max. 100%
Condensation and ice formation	Not permissible
Atmospheric pressure	Use at 0 to 2000 m: Overvoltage category 3 in accordance with DIN EN 61800-5-1
Minimum distance to adjacent components	23 mm
Mounting position	Horizontal, vertical

Other data

Feature	DLC Module
Protection class	I according to DIN EN 61140 (VDE 0140-1), protective conductor required.
Enclosure degree of protection	IP 20 (according to DIN EN 60529)
Degree of pollution	2 according to IEC 664-1 (DIN VDE 0110, part 1)
Insulation between CAN/24 V potential circuit (X2/X3) and power circuit (X1 DC+/DC-)	According to IEC 61800-5-1
System voltage for rated insulation for mains-connected DC circuits	480 V AC Line to Line
DC circuit system voltage limit	800 V DC
Overvoltage category	III

EMC

Note

In a residential environment this product can cause high-frequency interference, which may make interference suppression measures necessary.

- Have the installation and commissioning performed with appropriate radio interference suppression measures by experts.

Dimension drawings

9

DSK module dimension drawing

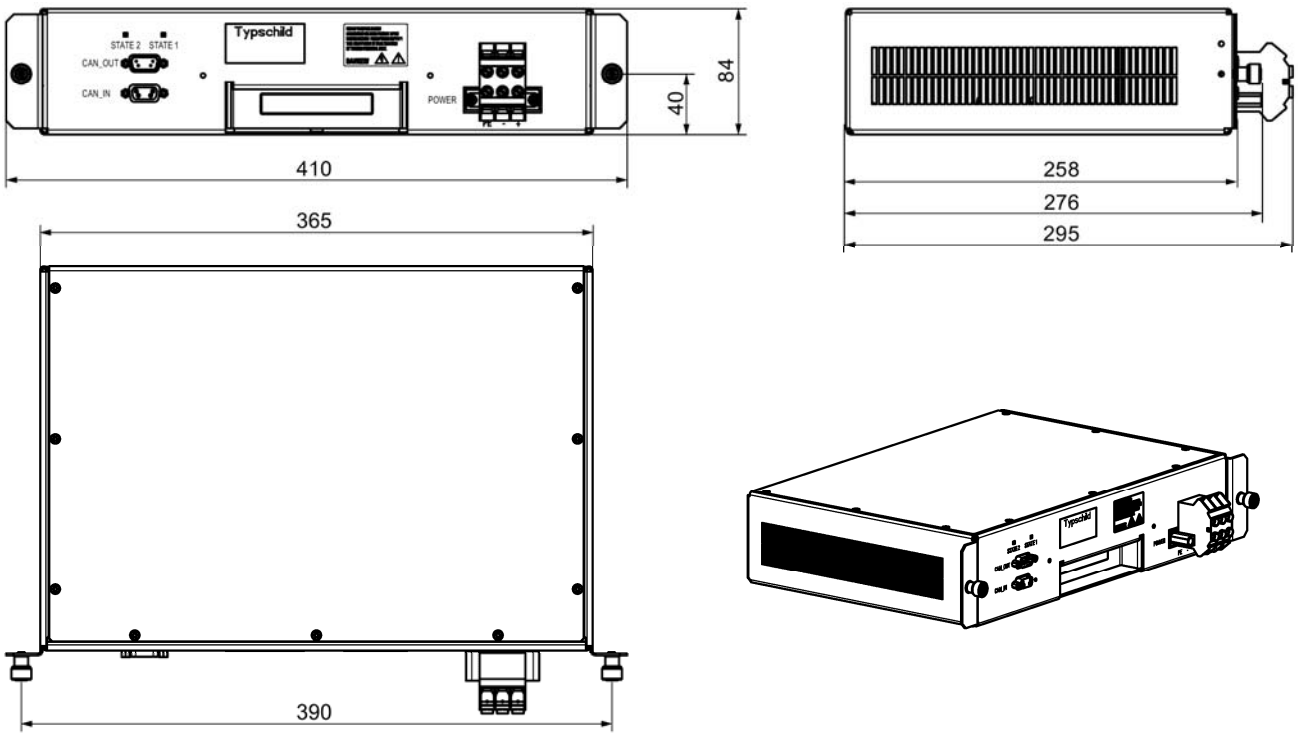


Figure 9-1 DSK module dimension drawing

Spare parts/accessories

10

	Order number	Accessories	Spare part
CAN cable set with: 7 x CAN cable 150 mm 1 x terminating resistor 120 ohm	9HK1600-1CS33-1AA1	X	-
Mating connector X1 (Phoenix Contact: TPC 16/3-STF-10, 16)	1704044	-	X
Jumper, 2-pin (Phoenix Contact)	0203153	-	X

CAN cables for connection with the higher-level controller or CAN forwarding with 24 V infeed connection can be assembled in a plant-specific manner with consideration of the guidelines in this manual.

Logistics address

Siemens AG
c/o GEIS-Industrie Service
Retouren-Logistik

Kraftwerkstraße 25A Tor 1-4

D-91056 Erlangen

Directives, standards, certificates

A

Relevant directives and standards

You can obtain an up-to-date list of currently certified components on request from your local Siemens office. If you have any questions relating to certifications that have not yet been completed, please ask your Siemens contact person.

Certificates for download

The certificates can be downloaded from the Internet:

Certificates (https://support.industry.siemens.com/cs/ww/de/ps/14520)

EC declaration of conformity

You can find the EC Declaration of Conformity for the relevant directives as well as the relevant certificates at the following address (https://support.industry.siemens.com/cs/ww/en/ps/14520/cert).

The following directives and standards are relevant for DLC Modules:

- **European Low Voltage Directive**

  DLC Modules fulfil the requirements stipulated in the Low-Voltage Directive 2014/35/EU, insofar as they are covered by the application area of this directive.

- **Directive 2011/65/EU**

  DLC Modules comply with the requirements of Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic devices (RoHS II).

- **European EMC Directive**

  DLC Modules comply with the EMC Directive 2014/30/EU.

- **North American market**

  DLC Modules with one of the test symbols displayed fulfill the requirements stipulated for the North American market as a component of drive applications.

  You can find the relevant certificates on the Internet pages of the certifiers (https://iq.ulprospector.com).

- **Quality systems**

  Siemens AG employs a quality management system that meets the requirements of ISO 9001 and ISO 14001.

Standards that are not relevant

China Compulsory Certification

DLC Modules do not fall within the scope of the China Compulsory Certification (CCC).

Electromagnetic compatibility

B

B.1 General information

Electromagnetic compatibility (EMC) describes – according to the definition of the EMC Directive – the "ability of equipment to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to other equipment in that environment". To guarantee that the appropriate EMC standards are observed, the devices must demonstrate sufficiently high noise immunity and the emitted interference must be limited to acceptable values.

The DLC Module is designed in line with EMC requirements according to the product standard IEC 61800-3.

For installing components in cabinets, the following conditions must be met in addition in order to comply with the EMC Directive:

- Operation on TN and TT line supply systems with grounded neutral point
- Observance of information about cable shielding and equipotential bonding
- Use of the recommended power and signal cables from Siemens

B.2 Classification of EMC behavior

The EMC environments and EMC categories are defined in the EMC product standard IEC 61800-3 as follows:

Environments

First environment (public systems)

An environment that includes domestic premises and establishments that are connected directly to a public low-voltage line supply without the use of an intermediate transformer.

Examples: houses, apartments, commercial premises or offices in residential buildings.

Second environment (industrial systems)

An environment that includes all other establishments that are not connected directly to a public low-voltage line supply.

Examples: industrial and technical areas of buildings fed from a dedicated transformer.

Categories

Category C1

Drive systems with a rated voltage < 1000 V that are intended for unrestricted use in the first environment.

Category C2

Stationary drive systems with a rated voltage < 1000 V for operation in the second environment.

Drive systems of Category C2 may only be used in the first environment if they are installed and commissioned by an expert and the limit values for harmonic currents are complied with.

Note

In a residential environment, this product may cause radio interference, in which case supplementary mitigation measures may be required.

- Have the installation and commissioning performed with appropriate radio interference suppression measures by experts.

Category C3

Drive systems with a rated voltage < 1000 V that are solely intended for use in the second environment.

Note

In a residential environment, this product may cause radio interference.

- Do not use this device in the first environment (residential area).

Category C4

Drive systems for IT line supplies for operation in complex systems in the second environment. An EMC plan must be drawn up.

ESD directives

C

C.1 ESD definition

What does ESD mean?

Electrostatic sensitive devices (ESDs) are individual components, integrated circuits, modules or devices that may be damaged by either electrostatic fields or electrostatic discharge.

NOTICE
Damage caused by electric fields or electrostatic discharge Electric fields or electrostatic discharge can result in malfunctions as a result of damaged individual parts, integrated circuits, modules or devices. • Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g conductive foam rubber or aluminum foil. • Only touch components, modules and devices if you are first grounded by applying one of the following measures: – Wearing an ESD wrist strap – Wearing ESD shoes or ESD grounding straps in ESD areas with conductive flooring • Only place electronic components, modules or devices on conductive surfaces (table with ESD surface, conductive ESD foam, ESD packaging, ESD transport container).

C.2 Electrostatic charging of individuals

Any person who is not conductively connected to the electrical potential of the environment can accumulate an electrostatic charge.

This figure indicates the maximum electrostatic charges that can accumulate on an operator when he comes into contact with the indicated materials. These values comply with the specifications in IEC 801-2.

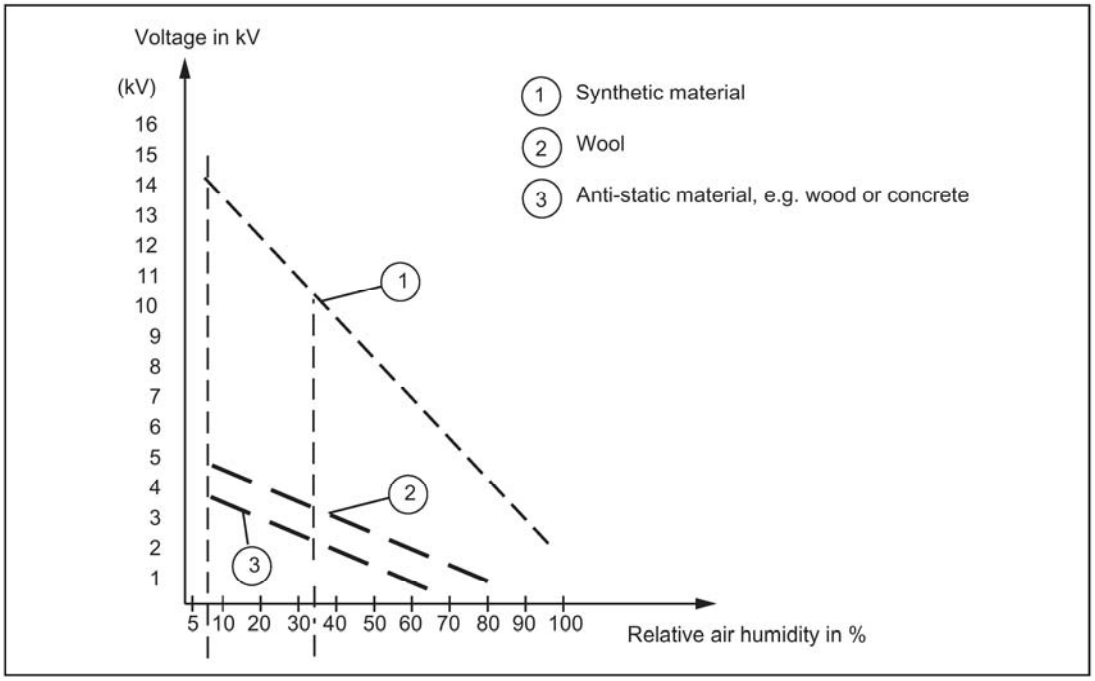


Figure C-1 Electrostatic voltage that can accumulate on operating personnel

C.3 Basic measures for protection against discharge of static electricity

Ensure sufficient grounding

When working with electrostatic sensitive devices, make sure that the you, your workstation, and the packaging are properly grounded. This prevents the accumulation of static electricity.

Avoid direct contact

You should only touch ESD components if unavoidable (for example, during maintenance work). When you touch modules, make sure that you do not touch either the pins on the modules or the printed conductors. If you follow these instructions, electrostatic discharge cannot reach or damage sensitive components.

If you have to take measurements on a module, make sure that you first discharge any static that may have accumulated in your body. To do this, touch a grounded metal object. Only use grounded measuring instruments.

Disassembly of the DLC Module for disposal

D

D.1 Disassembly of the DLC Module for disposal

Remove the capacitors prior to the disposal of the DLC Module.

Procedure

1. Remove the screws of the enclosure cover.

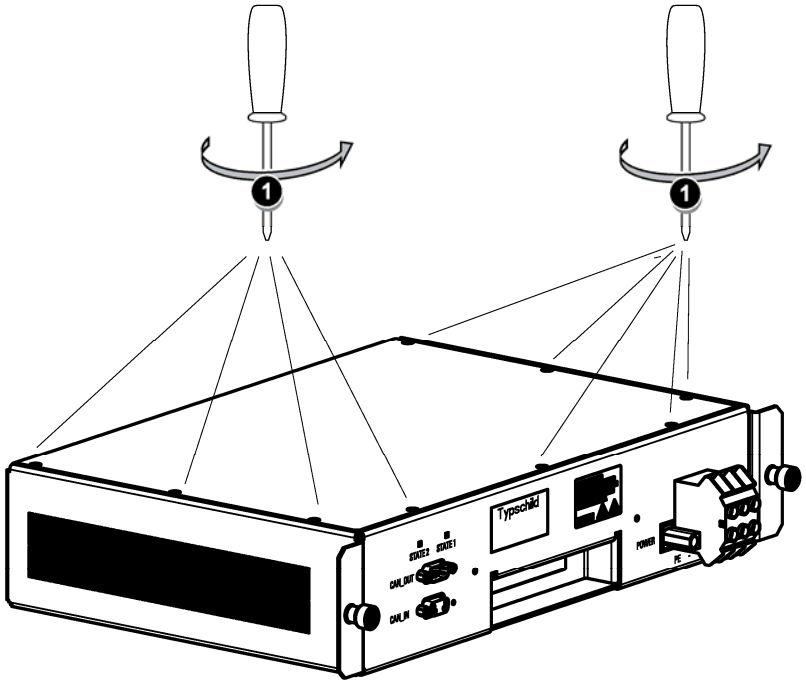


Figure D-1 Remove cover

2. Remove the enclosure cover. The assembled PCB with the capacitors is visible.
3. Unfasten the screwed connections of the assembled PCB and remove the black latches.

4. Remove the assembled PCB.
5. Dispose of the capacitors (shown in blue in the figure) according to WEEE 2012/19 Annex VII.

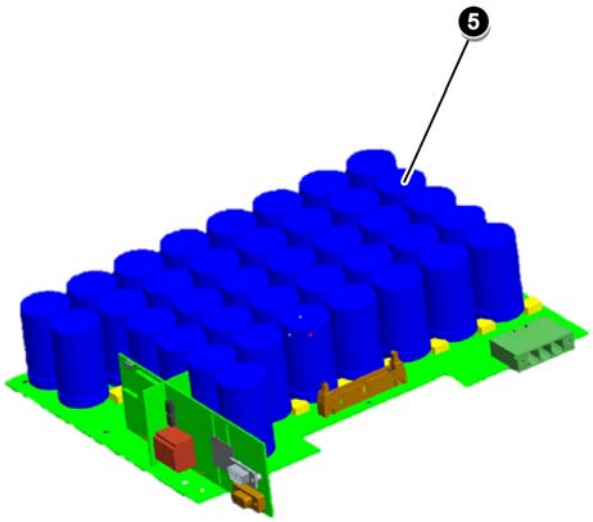


Figure D-2 Remove capacitors

List of abbreviations

E

Note

The following list of abbreviations includes every abbreviation and its meaning as used in this manual.

A

Abbreviation	Derivation of abbreviation	Meaning
A…	Alarm	Warning
AC	Alternating Current	Alternating current

C

Abbreviation	Derivation of abbreviation	Meaning
C	Capacitance	Capacity
CAN	Controller Area Network	Serial bus system
COB-ID	CAN Object-Identification	CAN Object Identification

D

Abbreviation	Derivation of abbreviation	Meaning
DC	Direct Current	Direct current
DLC	Doppel Layer Capacitor	Double layer capacitor

E

Abbreviation	Derivation of abbreviation	Meaning
EEPROM	Electrically Erasable Programmable	Electrically erasable, programmable
EGB	Elektrostatisch gefährdete Baugruppen	Electrostatic sensitive devices
EMV	Elektromagnetische Verträglichkeit	Electromagnetic compatibility
EN	Europäische Norm	European standard
ESD	Electrostatic Sensitive Devices	Electrostatic sensitive devices

F

Abbreviation	Derivation of abbreviation	Meaning
F…	Fault	Fault
FAQ	Frequently Asked Questions	Frequently Asked Questions
FW	Firmware	Firmware

G

Abbreviation	Derivation of abbreviation	Meaning
GB	Gigabyte	Gigabyte
GC	Global Control	Global control telegram (broadcast telegram)
GND	Ground	Reference potential for all signal and operating voltages, usually defined as 0 V (also referred to as M)
GSD	Gerätestammdatei	Generic Station Description: Describes the features of a PROFIBUS slave
GSV	Gate Supply Voltage	Gate supply voltage
GUID	Globally Unique Identifier	Globally Unique Identifier

H

Abbreviation	Derivation of abbreviation	Meaning
HMI	Human Machine Interface	Human Machine Interface
HW	Hardware	Hardware

I

Abbreviation	Derivation of abbreviation	Meaning
I/O	Input/Output	Input/output
IBN	Inbetriebnahme	Commissioning
IF	Interface	Interface

K

Abbreviation	Derivation of abbreviation	Meaning
KHP	Know-how protection	Know-how protection

L

Abbreviation	Derivation of abbreviation	Meaning
LED	Light Emitting Diode	Light emitting diode
LSB	Least Significant Bit	Least Significant Bit

M

Abbreviation	Derivation of abbreviation	Meaning
M	-	Symbol for torque
M	Masse	Reference potential for all signal and operating voltages, usually defined as 0 V (also referred to as GND)
MB	Megabyte	Megabyte
MLFB	Maschinenlesbare Fabrikatebezeichnung	Machine-readable product code
MSB	Most Significant Bit	Most Significant Bit

P

Abbreviation	Derivation of abbreviation	Meaning
PS	Power Supply	Power supply

R

Abbreviation	Derivation of abbreviation	Meaning
r…	-	Display parameters (read-only)
RAM	Random Access Memory	Memory for reading and writing
ROM	Read-Only Memory	Read-only memory
RS232	Recommended Standard 232	Interface standard for cable-connected serial data transmission between a sender and receiver (also known as EIA232)

S

Abbreviation	Derivation of abbreviation	Meaning
SPS	Speicherprogrammierbare Steuerung	Programmable logic controller
STW	Steuerwort	Control word

U

Abbreviation	Derivation of abbreviation	Meaning
UL	Underwriters Laboratories Inc.	Underwriters Laboratories Inc.

V

Abbreviation	Derivation of abbreviation	Meaning
VDE	Verband Deutscher Elektrotechniker	Verband Deutscher Elektrotechniker [Association of German Electrical Engineers]
VDI	Verein Deutscher Ingenieure	Verein Deutscher Ingenieure [Association of German Engineers]

X

Abbreviation	Derivation of abbreviation	Meaning
XML	Extensible Markup Language	Extensible markup language (standard language for Web publishing and document management)

Z

Abbreviation	Derivation of abbreviation	Meaning
ZSW	Zustandswort	Status word

Index

T

W

Siemens AG
DI FA PMA
Clemens-Winkler-Str. 3
09116 Chemnitz, Germany