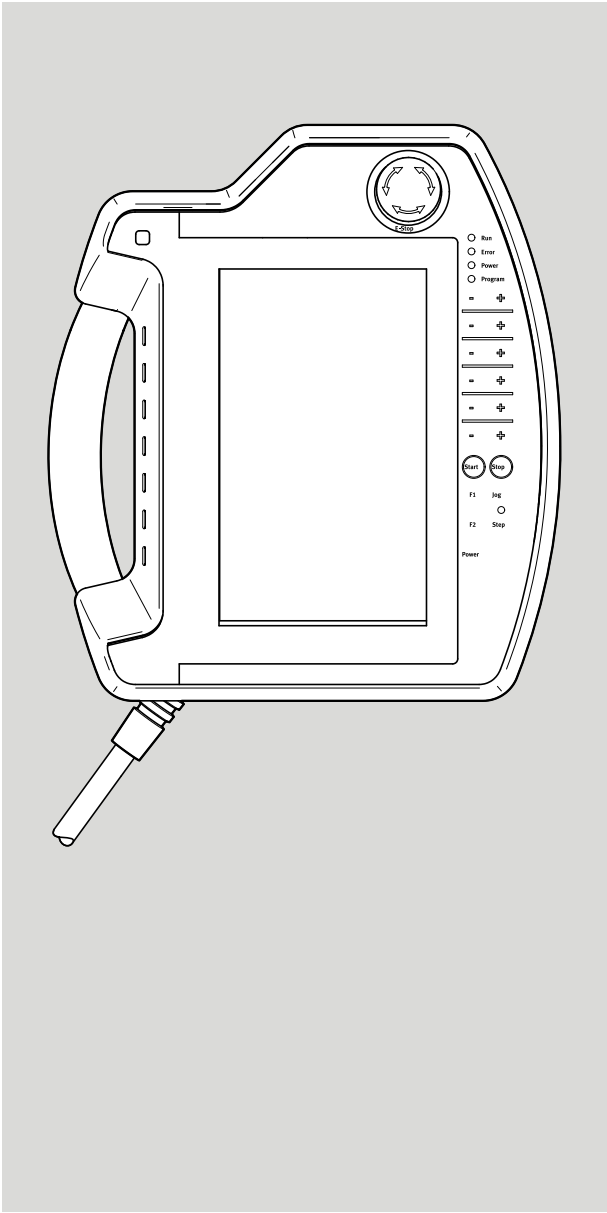


CDSA-D3-RV
Operator unit



FESTO

Operating instructions



8127392
2020-08
[8127394]

Translation of the original instructions

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1 About this document

1.1 Purpose of the document

This document describes the handheld terminal CDSA-D3-RV.

1.2 Applicable documents



All available documents for the product → www.festo.com/sp.

1.3 Product labelling

- Observe the specifications on the product.

The product labelling enables identification of the product and shows the following information, for example:

Product labelling (sample)	
CDSA-D3-RV 8126915 MM-YYYY:98 24VDC / 0,5 A Ta: 0°C...+40°C R-R-FTO-KC-2020-1041 Made in Austria Festo SE & Co. KG DE-73734 Esslingen  US LISTED IND. CONT. EQ 21 YU 	
1	Type code
2	Part number
3	Production date (month/year)
4	Technical data (voltage/current)
5	Ambient temperature
6	Manufacturer
7	Manufacturer's address
8	Country of origin
9	Plant number
10	UL inspection mark
11	KC identification
12	Serial number
13	CE conformity marking

Tab. 1 Product labelling (sample)

1.4 Specified standards

EN ISO 13850:2015
EN ISO 10218:2011
EN 60204-1:2006+A1:2009+AC:2010
EN 60947-5-8:2007
EN 61131-2:2007

Tab. 2 Specified standards

1.4.1 Quantitative safety specifications for the emergency stop device and the 3-position enabling switch

Festo provides a B_{10D} value → 13.2 Handheld terminal CDSA-D3-RV.

Other values are not provided by Festo, e.g. SIL, PL and category. Reason: Festo supplies the switching element, but does not evaluate the element. The customer must connect and monitor the emergency stop device and the 3-position enabling switch for the application. The customer receives SIL or category with PL by the method in which the emergency stop function and the enabling control function are implemented in the machine.

1.4.2 Relationship between Performance Level and Safety Integrity Level

Performance Level (PL) in accordance with EN ISO 13849-1	Safety Integrity Level (SIL) in accordance with IEC 61508-1
a	no equivalent
b	1
c	1
d	2
e	3

Tab. 3 Relationship between the performance level (PL) and the safety integrity level (SIL) (in accordance with EN ISO 13849-1:2015)

Performance Level (PL)	Average probability of dangerous failure per hour
a	$\geq 10^{-5}$ to $< 10^{-4}$
b	$\geq 3 \times 10^{-6}$ to $< 10^{-5}$
c	$\geq 10^{-6}$ to $< 3 \times 10^{-6}$
d	$\geq 10^{-7}$ to $< 10^{-6}$
e	$\geq 10^{-8}$ to $< 10^{-7}$

Tab. 4 Performance Level (PL) (in accordance with EN ISO 13849-1:2015)

1.4.3 Abbreviations

Abbreviation	English term	Description
B _{10D}	–	Number of cycles until dangerous failure of 10% of the components (per channel)
MTTF _D	Mean time to Failure Dangerous	Mean time to dangerous failure (per channel)
DC	Diagnostic Coverage	Diagnostic coverage
PL	Performance Level	Discrete level that specifies the ability of safety-related devices to execute a safety function under foreseeable conditions.
PFH _D	Probability of Failure per Hour Dangerous	Average probability of a dangerous failure per hour
SIL	Safety Integrity Level	Safety integrity level

Tab. 5 Abbreviations

2 Safety

2.1 Safety instructions

- Only use the product in original status without unauthorised modifications. Only the conversions and modifications described in this and the additional documents are permitted.
- Only use the product if it is in perfect technical condition.
- Observe further applicable documents.
- Observe labelling on the product.
- Installation, commissioning, maintenance and disassembly should only be conducted by qualified personnel.
- Observe the mounting and connection specifications.
- Take into consideration the ambient conditions at the location of use.
- Comply with specified critical limits.
- The cable must not be crushed by objects.
- Do not route the cable over sharp edges.
- Select the cable length to ensure sufficient access to the danger zone.
- Ensure that people do not trip over the cable and cause the product to fall to the floor.
- When not in use, place and attach the product to the existing wall bracket.
- The product must be stored in such a way that control elements cannot be actuated or damaged.
- Foreign matter or liquids must not penetrate the product.
- Check the product if damage is suspected.
- Never place the product on unstable surfaces.
- Never place the product near heat sources.

- Do not expose the product to mechanical shocks, excessive dust, moisture or strong magnetic fields.
- The housing, control panel and control elements must only be cleaned with a soft cloth slightly moistened with water or a mild cleaning agent.
- The connection shaft must only be opened when the supply voltage is switched off.

2.2 Intended use

The intended use of the handheld terminal CDSA-D3-RV extends from monitoring and parameterisation to the operation of machines, e.g. Festo handling systems.

The devices for the safety engineering are an emergency stop device and a 3-position enabling switch. The handheld terminal must not be used for temporary connection.

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Remove non-functional or disconnected devices from the area of the user in order to avoid accidental actuation of the non-functional emergency stop device.

All safety engineering equipment is designed with 2 circuits and permits implementation of category 4 PL e in accordance with EN ISO 13849-1, taking into account the actuation cycles with reference to the B_{10D} values of the safety devices.

2.3 Foreseeable misuse

The following areas of application are expressly excluded for the handheld terminal CDSA-D3-RV:

- Use in potentially explosive areas or areas where there is a risk of fire
- Use in mining
- Outdoor use

2.4 Training of qualified personnel

This document contains information for people with the following prerequisites:

Target group	Required knowledge and skills
Project planners	Basic technical training (technical college, engineering training or corresponding work experience) Knowledge of: – the mode of operation of a PLC – current valid safety regulations – the application
Electrician	Training in electrical engineering (in accordance with industry-standard training guidelines) Knowledge of: – current valid safety regulations – wiring guidelines – circuit diagrams – system analysis and troubleshooting

Target group	Required knowledge and skills
	– professional electrical connections in accordance with national and international regulations
Commissioner	Basic technical training (technical college, engineering training or corresponding work experience) Knowledge of: – current valid safety regulations – the mode of operation of the machine or system – basic functions of the application – system analysis and troubleshooting – the setting options on the operating devices
Service technician	Basic technical training (technical college, engineering training or corresponding work experience) Knowledge of: – the mode of operation of a PLC – current valid safety regulations – the mode of operation of the machine or system – diagnostics options – systematic error analysis and elimination

Tab. 6 Training of qualified personnel

2.5 UL/CSA Certification

In combination with the UL inspection mark on the product, the information in this section must also be observed in order to comply with the certification conditions of Underwriters Laboratories Inc. (UL) for USA and Canada.

UL/CSA certification information	
Product category code	NRAQ, NRAQ7
File number	E239998
Considered standards	UL 508 CSA C22.2 No. 142
UL mark	

Tab. 7 UL/CSA certification information

3 Additional Information

- Accessories → www.festo.com/catalogue.

4 Service

Contact your regional Festo contact person if you have technical questions → www.festo.com.

5 Product overview

5.1 Configuration

5.1.1 Product design

The handheld terminal CDSA-D3-RV is a portable operating and display device.

The colour display can be used to perform graphical tasks. The touchscreen enables intuitive user guidance.

The devices for the safety engineering are an emergency stop device and a 3-position enabling switch.

Front view

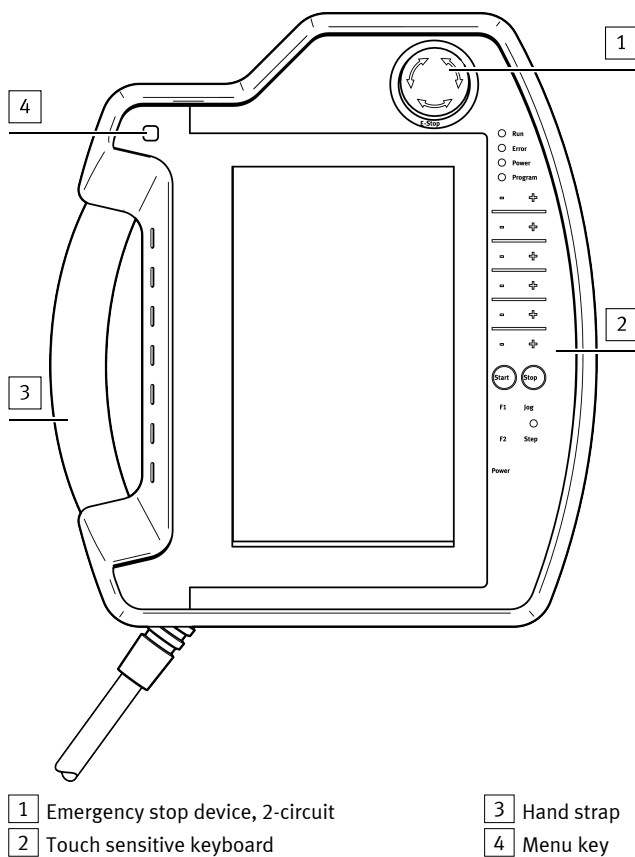
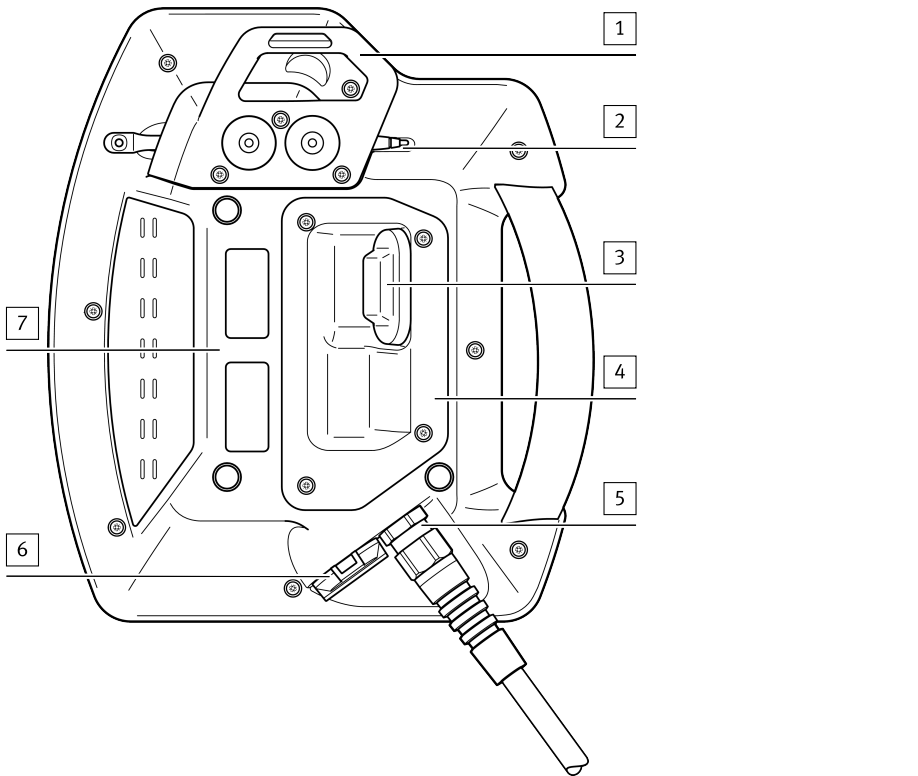


Fig. 1 Front view

Rear view



- | | | | |
|---|----------------------------|---|---|
| 1 | Device attachment | 5 | Strain relief and antikink device for connecting cable (supplied with connecting cable) |
| 2 | Touch pen holder | 6 | USB port |
| 3 | 3-position enabling switch | 7 | Rating plate |
| 4 | Connection shaft cover | | |

Fig. 2 Rear view

5.1.2 Display and operating components

Colour LC display

The handheld terminal CDSA-D3-RV is equipped with a backlit colour LCD display with 7 "TFT in WSVGA resolution (600 x 1024 pixels).

Robotics keyboard and touchscreen

NOTICE!

Incorrect treatment of the robotics keyboard and the touchscreen.

Incorrect treatment may damage the robotics keyboard or touchscreen.

- Do not operate the product with pointed or sharp objects such as ballpoint pens, pencils or screwdrivers.
- When operating with gloves, make sure that there are no metal shavings or sharp objects (chips, sand, grinding paste etc.) embedded in the operating surface of the glove.
- Do not press product too hard.

The handheld terminal CDSA-D3-RV is equipped with a robotics keyboard with tactile feedback. The touch sensitive keyboard has 20 keys and 5 status LEDs.

The handheld terminal CDSA-D3-RV is equipped with an analogue-resistive touchscreen. The touchscreen can be operated with one finger, with or without a glove or with a touch pen.



A slight curvature (Pillowing) of the touch foil can occur in rare cases. This curvature is permissible and does not restrict the functionality and service life.

5.1.3 Connecting elements

5.1.3.1 Connection shaft

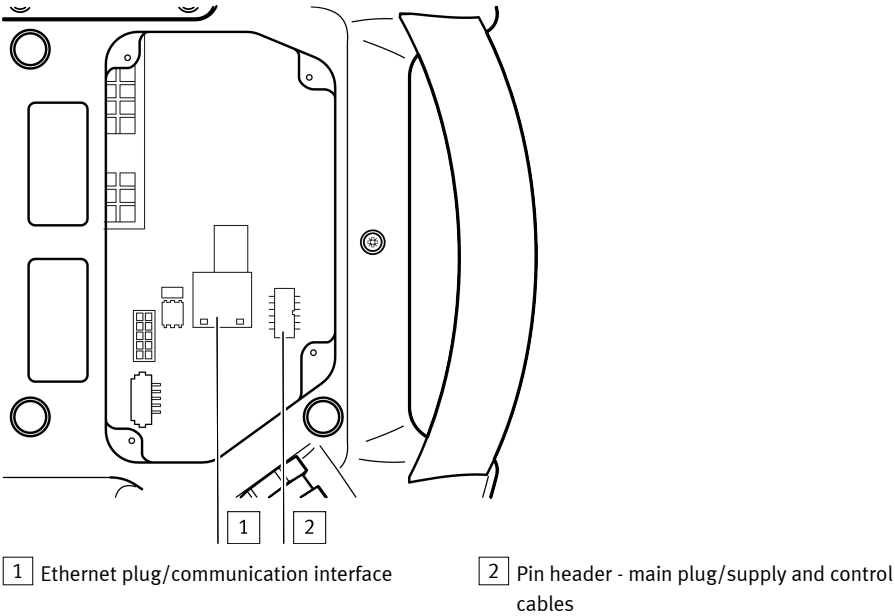


Fig. 3 Connection shaft for handheld terminal CDSA-D3-RV

Connection

The following graphic shows the connection of the control cables (power supply, emergency stop and enabling circuits) and the data cables to the interface housing.

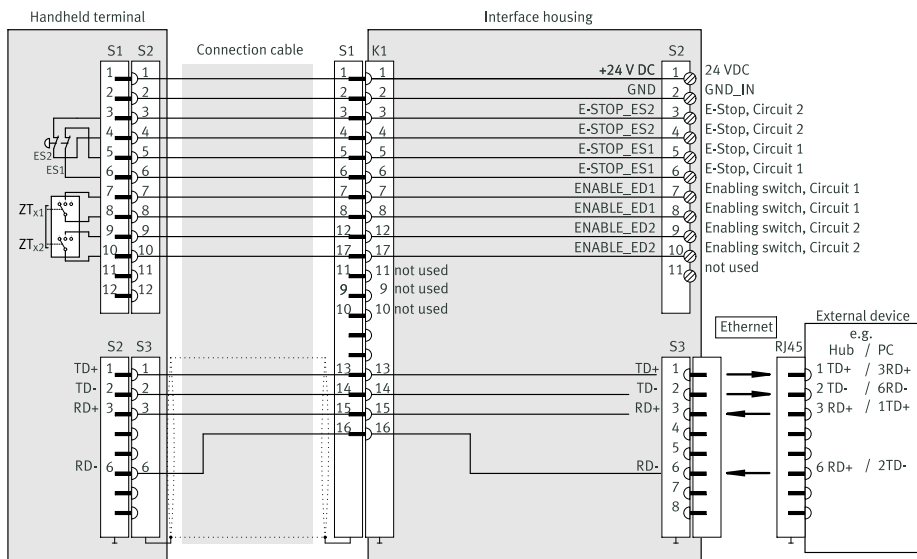


Fig. 4 Connection diagram: handheld terminal CDSA-D3-RV on interface housing CAMI-C

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A Crossover cable is required between the handheld terminal CDSA-D3-RV and the controller for point-to-point operation via the Ethernet interface.

5.1.3.2 Emergency stop device

The handheld terminal CDSA-D3-RV has an emergency stop device. The emergency stop device is wired in 2 circuits and the contacts are designed as normally closed contacts.

The red-yellow emergency stop device on the handheld terminal CDSA-D3-RV meets the requirements of EN ISO 13850.

Its mode of operation must be designed as a category 0 or category 1 stop based on the risk assessment for the machine → EN 60204-1. The interconnection of the forced-opening switch contacts must fulfil the category (in accordance with EN ISO 13849-1) that is defined based on the risk analysis (in accordance with EN ISO 12100:2010) of the machine.

 WARNING!

Impairment of the function of emergency stop devices.

Impairment of the function of emergency stop devices can result in serious injuries or death of persons involved.

- Red-yellow marked emergency stop devices must be effective at all times and in all operating modes of a machine or system.
 - Handheld terminals that are not connected to the machine and have a red-yellow emergency stop device, must be kept out of sight so they cannot be confused with functioning devices in an emergency.
 - When unlocking the emergency stop device, do not cause an uncontrolled restart.
 - Do not use the emergency stop device as a substitute for other safety devices.
 - Do not use the emergency stop device on the handheld terminal as a replacement for the emergency stop switches to be attached directly to the machine.
 - After violent impact with the handheld terminal (e.g. if it is dropped), check the function of the emergency stop device.
 - Check the correct mode of operation of the emergency stop device every 6 months by actuating it.
 - For additional information on the emergency stop device and the emergency stop function, observe the corresponding directives and standards.
-

5.1.3.3 3-position enabling switch

The handheld terminal CDSA-D3-RV has a 3-position enabling switch. An essential feature is the 2-circuit design and the forced opening in accordance with EN 60947-1 and EN 60947-5-8 to the third switch position.

 WARNING!

Danger to persons not recognised in time if the 3-position enabling switch is used as a safety function.

The 3-position enabling switch is only suitable for use in a safety function if the person actuating the 3-position enabling switch detects a hazard to people in good time and can immediately take measures to avoid hazards. A hazard to persons that is not recognised in good time can result in injuries or death to the persons involved.

- As an additional measure, reduce the speed of the movement. Determine the permissible speed based on a risk assessment.
 - Do not initiate commands for hazardous statuses with a 3-position enabling switch alone. A second, deliberate start command is required for this, such as a key on the handheld terminal.
 - Only the person who actuates the 3-position enabling switch may be in the danger zone.
 - Check the correct mode of operation of the safety function every 6 months by actuating all positions of the 3-position enabling switch.
 - For additional information on the 3-position enabling switch, observe the corresponding directives and standards.
-

Mode of operation

The 3-position enabling switch can be in one of three different switch positions:

Switch setting	Function	3-position enabling switch	Switch contact
1	Neutral position	not actuated	Off (opened)
2	Enabling	is actuated	On (closed)
3	Panic	is pressed	Off (opened) 

Tab. 8 Mode of operation of the 3-position enabling switch

Normal actuation

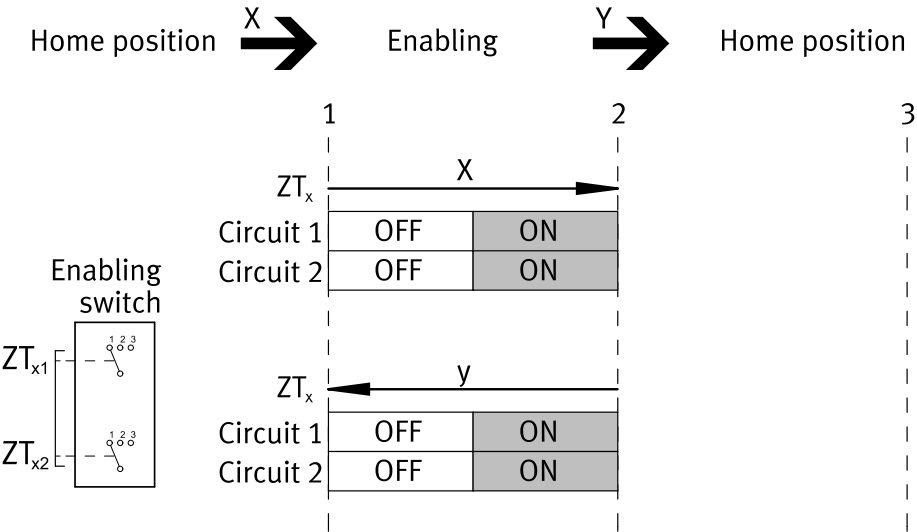


Fig. 5 Switching path diagram for normal actuation

Panic actuation

When the actuating elements are pressed to the panic position, the switching element is mechanically designed so that the enabling position is skipped when it is released:

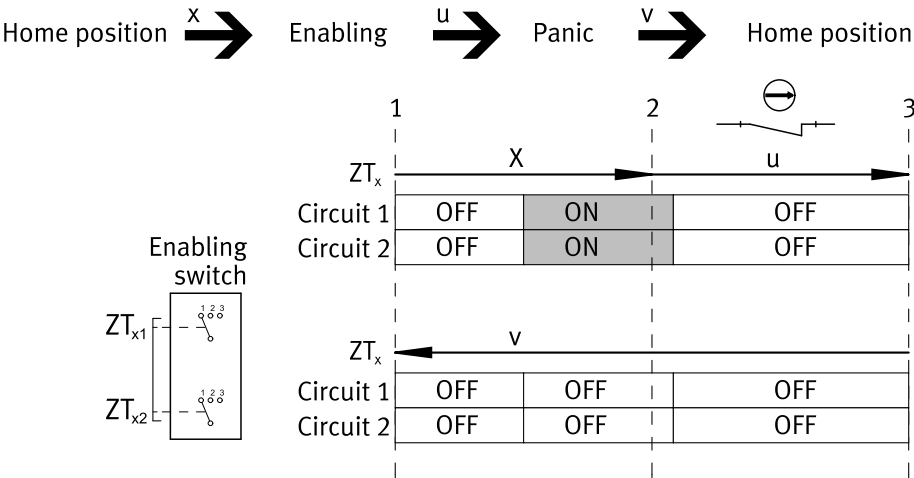


Fig. 6 Switching path diagram for panic actuation

Category 4 PL e in accordance with EN ISO 13849-1 for the relevant safety function can be reached with the use of the 3-position enabling switch on two electrical circuits and a suitable dynamic monitoring with the actuation cycles with reference to the B_{10D} value of the safety devices.

In accordance with EN 60204-1, the 3-position enabling switch must be implemented in such a way that in position 1 (switch off function - the control element is not actuated) and position 3 (Off function - the control element is pressed down to the "panic position") at least one of the stop categories 0, 1 or 2 is initiated.

For the calculation of the PL of the enable safety function, the safety engineering characteristic values (PL, PFH_D and B_{10D} values) of the involved components must be included. Details on calculating the PL for the entire safety function → EN ISO 13849-1 (chapter 6.3, appendix H and appendix I.)

Simultaneity monitoring is required if it is not possible to exclude faults with regard to short circuits in the enabling circuit, as otherwise an unrecognised accumulation of faults could result, which in turn leads to a loss of safety. For example, the simultaneity monitoring can be achieved by connection to a safety controller or to the monitoring device PilzPNOZ s6.1.

The following connection example shows how the 3-position enabling switch of the handheld terminal CDSA-D3-RV achieves an enabling function up to category 4 PL e. The entire machine must be designed for this purpose.



Foreseeable misuse of the 3-position enabling switch

Unauthorised fixing of the 3-position enabling switch in the enabling position with mechanical aids must be regarded as foreseeable misuse, which must be prevented.

The following measures, which cause the machine to come to rest in manual override, are recommended:

- Query of the 3-position enabling switch when the machine or system is switched on and query of the 3-position enabling switch when changing the operating mode from automatic to manual (manual override). The 3-position enabling switch must not be in the enabling position.
 - The 3-position enabling switch must be released within a specified period and returned to the enabling position. The length of the period must be selected according to the job requirement.
-

Connection example with monitoring device

The following example should serve as an aid for the end application:

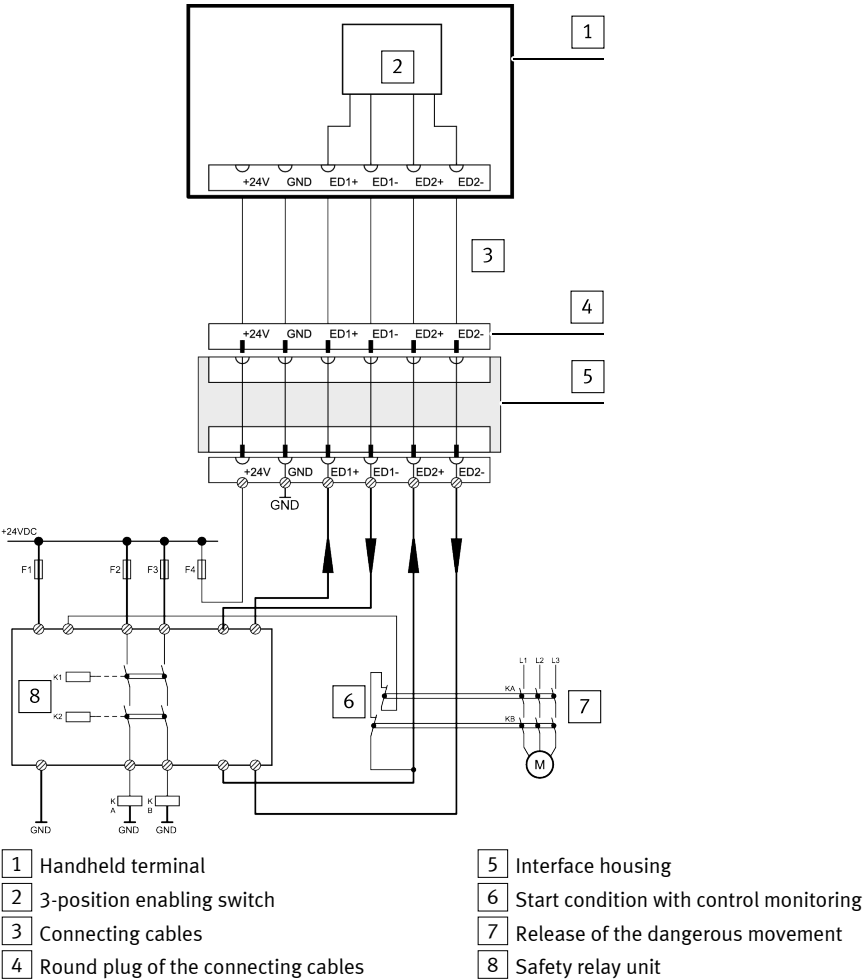


Fig. 7 Connection example

The graphic shows a suggested circuit for achieving the category 4 PL e for the enabling function with a monitoring device. The monitoring device and subsequent components must be included in the calculation of the entire safety function "Enable via 3-position enabling switch".

5.1.3.4 Ethernet

The Ethernet interface is available as standard in the handheld terminal CDSA-D3-RV. The Ethernet interface is based on the default 10Base-T specification and is suitable for full-duplex operation. Operation with 100 Mbit (100Base-T specification) is only possible with a suitable connecting cable.

The following interface parameters are permanently specified:

- 10 Mbit (100 Mbit possible with suitable cable)
- TCP/IP protocol

5.1.3.5 Pin allocation

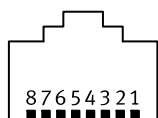


Fig. 8 Ethernet interface

Pin no.	Signal designation		Input/output
1	Tr. data +	Transmit data +	Output
2	Tr. data-	Transmit data -	Output
3	Re. Data+	Receive data +	Input
4	n.c.	n.c.	–
5	n.c.	n.c.	–
6	Re. Data-	Receive data -	Input
7	n.c.	n.c.	–
8	n.c.	n.c.	–

Tab. 9 Pin allocation of the Ethernet interface

5.1.3.6 USB port

NOTICE!

Ingress of moisture through open connections.

Ingress of moisture can damage the product.

- Fully close all protective flaps of the connections after use to maintain the IP protection class.



The USB port is not designed as an operating interface for ongoing operation. The USB port is only used for connection of USB components for service and commissioning.

A list of the recommended USB components can be requested from Festo.

Connect USB memory sticks

1. Open the protective cover.

2. Insert USB memory stick until it clicks into place.

↳ The USB memory stick is recognised and displayed by the operating system.

NOTICE!

Improper removal of the USB memory stick.

Incorrect removal of the USB memory stick can result in data loss.

- Do not remove the USB memory stick until writing is finished.

Unplug the USB memory stick

1. Remove USB memory stick.
2. Press protective cap firmly down.

6 Transport and storage

- Maintain ambient conditions → 13.2 Handheld terminal CDSA-D3-RV.
- Use the original packing for transport. Also use the original packaging for onward or return transport.

7 Mounting and installation

WARNING!

Risk of injury due to electric shock.

- Use PELV or SELV power circuits exclusively in accordance with EN 61010-2-201 for the electrical power supply of the device.
- Only voltages and circuits that guarantee reliable isolation from dangerous voltages (e.g. by sufficient insulation and dielectric strength) are to be connected to connections, terminals or interfaces up to 50 V nominal voltage.

WARNING!

Fire hazard due to component failure.

Injury resulting from fire.

- Ensure adequate protection of the 24 V DC power supply of the device in the end application. In addition, use a UL 248-approved fuse with max. 3.15 A.

NOTICE!

Damage to the electronics due to electrostatic discharge.

When opened, the device can be damaged by electrostatic discharge.

- Do not open the housing of the device. The connection shaft may be opened.

7.1 Mounting the connecting cable

NOTICE!

Incorrect handling of the handheld terminal during cable assembly.

The handheld terminal and the control elements can be damaged if mistreated.

- Place the handheld terminal with the display facing down on a flat and clean table. An ESD mat offers additional protection.
 - Be careful not to damage the handheld terminal and the control elements.
-

NOTICE!

Incorrect mounting of the cables on the handheld terminal.

Incorrect assembly of the cables can impair the mode of operation of the handheld terminal and damage the handheld terminal.

- Check that the seal is clean and undamaged.
 - Check that the cables are not pinched at any point.
 - Check that all screws are tight. Otherwise, the degree of protection cannot be guaranteed.
-

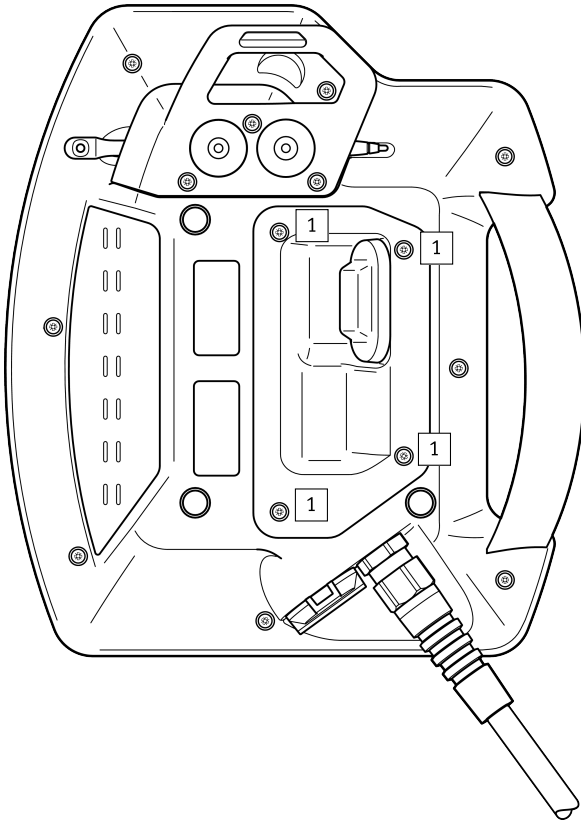
This chapter describes how the connecting cable is mounted on the handheld terminal CDSA-D3-RV. Available connecting cables → 13.2 Handheld terminal CDSA-D3-RV.

Required tool

The following tools are required to mount the cables:

- Spanner (size 19)
- TORX screwdriver (size 10)

Mount cable



1 TORX screw

Fig. 9 Position of the TORX screws

1. Loosen the TORX screws on the cover plate with a size 10 TORX screwdriver.
2. Open cover. Do not damage the cables of the 3-position enabling switch.

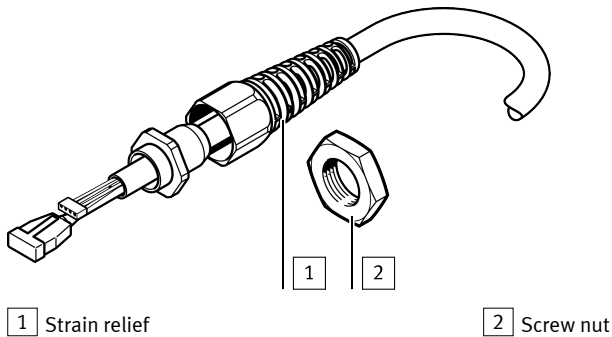


Fig. 10 Connecting cable

3. Disconnect the grey screw nut and strain relief from the connecting cable. The grey nut is no longer required.

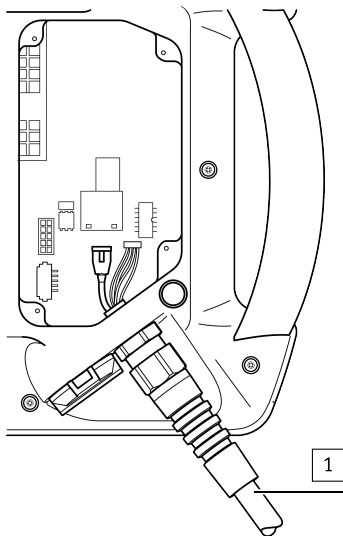


Fig. 11 Connecting cable

4. Insert the connecting cable through the passage provided into the handheld terminal CDSA-D3-RV. A grey nut is integrated in this passage for mounting the connecting cable.
5. Fix the grommet with a size 19 spanner (torque: 3 Nm).
6. Insert the main plug and the RJ45 plug into the sockets provided for this purpose.
7. Tighten the strain relief with the spanner. Part of the cable sheath should be located inside the housing. Make sure that the rubber ring for the strain relief is correctly under the grommet.
8. Attach cover and screw in the TORX screws (torque: 0.8 ... 1.0 Nm).

Unplug cable

1. Pull the cable with your fingers to unplug the main plug.
2. To RJ45plug, actuate the locking lever.

7.2 Cable installation in the connection shaft

WARNING!

Failure of the emergency stop or the enabling function.

Failure of the emergency stop or enabling functions can result in personal injury and material damage.

- When plugging in, make sure that the main plug engages correctly.
- Check the emergency stop and enabling functions before re-commissioning the handheld terminal CDSA-D3-RV.
- Check the emergency stop and enabling functions before commissioning the machine or system.

NOTICE!

Incorrect handling when closing the connection shaft.

Incorrect handling can damage the cables and the connection shaft.

- The seal must be clean, undamaged and in the correct position.
- Do not pinch the cable.
- Screw on the cover of the connection shaft with all screws and tighten to a torque of 0.8 to 1.0 Nm.

NOTICE!

Incorrect handling of the plug when working in the connection shaft.

Incorrect handling can damage the plugs and the socket.

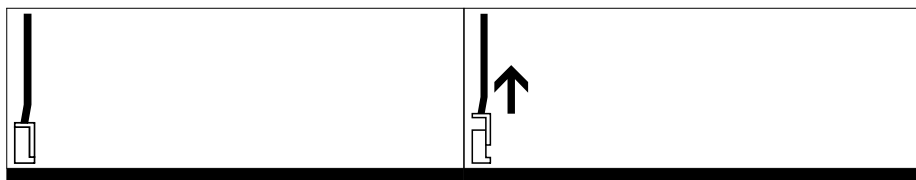
- Do not use sharp objects to remove the plugs.
- Disconnect the main plug by pulling its wires with fingers.
- Press the locking lever to disconnect the RJ45 plug.

When the connection shaft is opened, the connecting cables can be positioned as shown in the following sections. Before opening the handheld terminal CDSA-D3-RV observe the following instructions:

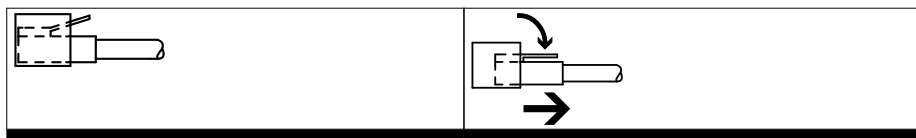
i

Information for opening the connection shaft

- Place the handheld terminal CDSA-D3-RV with the display facing downwards on a flat, clean and soft base so that the handheld terminal CDSA-D3-RV or its operating elements are not damaged (e.g. ESD mat).
- To open and close the connection shaft, use a "TORX size 10" screwdriver.



Tab. 10 Unplugging the main plug



Tab. 11 Unplugging the RJ45 plug

7.3 Power supply

Specification of the supply cables in the connecting cable:

- Cross section: AWG24 (0.24 mm²)
- Material: galvanised copper strand
- Conductor resistance: $\leq 90\Omega/\text{km}$ ($\leq 145\Omega/\text{mile}$)



The characteristic supply values specified in the technical data apply on the device side. Voltage losses via the connecting cable must also be taken into account, depending on the cable length.

7.4 Connecting the handheld terminal CDSA-D3-RV to a Festo controller

The handheld terminal CDSA-D3-RV must be connected to the Festo controller with remote target visualisation via an Ethernet interface to enable commissioning and series operation. The connection is usually made via an interface housing, an interface box or a connection box in which the signals (Ethernet, voltage, safety engineering) are divided. As soon as power is supplied to the handheld terminal CDSA-D3-RV, the run-up starts.

8 Configuration

In the device configuration ("System Config"), the following basic settings of the handheld terminal CDSA-D3-RV can be made:

- Exporting diagnostic data
- Set display brightness
- Set screen saver start time
- Calibrate touchscreen
- Display licence conditions
- Set network address and host IP
- Display information on the installed software version
- Trigger restarts



The device configuration can only be opened during run-up of the handheld terminal CDSA-D3-RV. If the handheld terminal CDSA-D3-RV is supplied with power, the run-up starts.

1. Start the handheld terminal CDSA-D3-RV.
 - ↳ After a short time, the message "Press any key to enter setup" appears for 2 seconds.
2. Press any key.
 - ↳ The device configuration is opened.

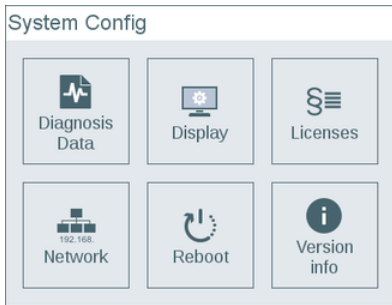


Fig. 12 Device configuration menu (System Config)

8.1 Diagnosis data

With Diagnosis Data, diagnostic information of the controller can be collected by triggering a status report. This requires a USB stick to be connected to the operator unit.

The USB stick must fulfil the following criteria:

- Formatted as FAT32 file system
- Have at least 2 GB of free memory

Trigger status report

1. Select "Diagnosis Data".

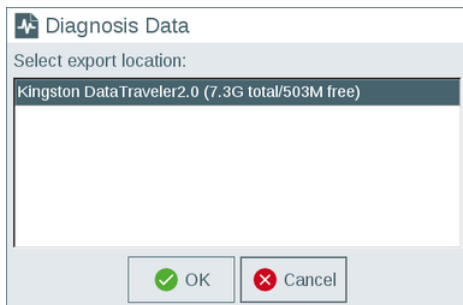


Fig. 13 Diagnostics Data menu

2. Select USB stick to which the status report is to be saved.

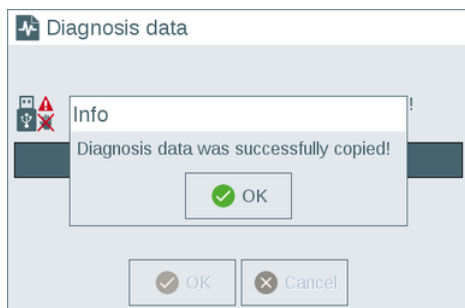


Fig. 14 Confirmation dialogue

3. Confirm the dialogue with "OK".
 - ↳ A TGZ file is saved in the root directory of the USB stick.
4. Remove USB sticks from the handheld terminal.
5. Send TGZ file to Festo.

8.2 Display

Press the "Display" button to open the display window. Display settings can be made in this window. To return to the main menu, press the "Back" button.

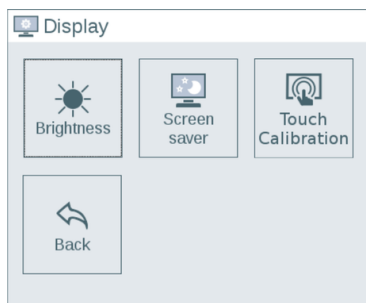


Fig. 15 Display menu

Brightness

Window for setting the brightness.



Fig. 16 Brightness settings

The brightness of the display can be adjusted using the scroll bar
Press the "OK" button to save the settings and return to the previous window. If the "Cancel" button is pressed, the window is closed and the changed settings are not saved.

Screen saver

Press the "Screen saver" button to set the time until the screen saver is switched on.

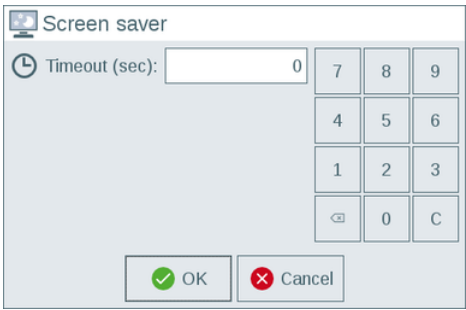


Fig. 17 Screen saver

In the field "Timeout", the time can be entered in seconds using the numeric keypad.
Press the "OK" button to save the settings and return to the previous window. If the "Cancel" button is pressed, the window is closed and the changed settings are not saved.

Touch calibration



Use a touch pen for calibration.

Press the "Touch Calibration" button to start the touchscreen calibration. The following symbol is used for calibration:



Fig. 18 Symbol for calibration

For calibration, the symbol is displayed eight times (twice in sequence in all four corners of the display). The display sequence is top left, top right, bottom left and bottom right. For each display the centre of the symbol must be touched with the touch pen as precisely as possible. Care should be taken to select the points only briefly. Pressing too long leads to incorrect calibration. If the centre of the symbol is touched inaccurately, the "Miss-click detected, restarting" message is shown and calibration is started again. First, "Touchscreen Calibration" appears on the touch screen and the display of the calibration symbol four times, then "Touchscreen Verification" appears and the display of the calibration symbol four times.

After successful calibration, the calibration window is closed and the "Display" mask appears. Calibration of the touchscreen is complete.

8.3 Licences

Press the "Licences" button to display the licence information.

Press the "OK" button to exit the window.

8.4 Network

Press the "Network" button to open the network window. The network settings for available Ethernet interfaces and the host IP address can be changed in this window.

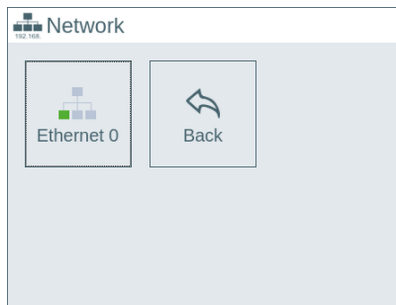


Fig. 19 Network menu

Press the "Back" button to return to the main menu.

The following values are preset by default in the delivery status of the handheld terminal CDSA-D3-RV: The device is set to DHCP.

Ethernet 0

Press the "Ethernet 0" button to switch to the configuration window.

The network address can be set as follows:

- The network address can be obtained automatically via DHCP. This enables automatic integration into an existing network without manual configuration.

Configuration

- The network address can be defined manually. The individual four segments of the network addresses must be entered manually via the numerical input panel. To do this, select the corresponding segments.

Ethernet 0

Address:

10

150

48

86

7

8

9

Netmask:

255

255

240

0

4

5

6

Gateway:

10

150

63

250

1

2

3

DHCP:

0

C

OK

Cancel

Fig. 20 Network settings (Ethernet 0)

Identifier	Address
Address	IP address of the handheld terminal CDSA-D3-RV
Netmask	Associated subnet mask
Gateway	Standard gateway
DHCP	Activation of "DHCP" automatically obtains the IP address via a DHCP server. The remaining input lines are deactivated.

Tab. 12 Network settings

Press the "OK" button to save the settings and return to the previous window. If the "Cancel" button is pressed, the window is closed and the changed settings are not saved.

8.5 Version info

Press the "Version info" button to display the software currently installed on the device.

- Operating system version
- Bootloader version
- Firmware version

Press the "Exit" button to exit the window.

i

The version of the panel can also be read out with the help of suitable software → FestoField-DeviceTool (FFT).

8.6 Reboot

Press the "Reboot" button to trigger a restart of the device.



The device can also be rebooted with the help of suitable software → FestoFieldDeviceTool (FFT).

9 Operation

NOTICE!

A flash storage medium permits a limited number of write cycles.

If the number of write cycles has been exceeded, there is a danger of a hardware defect.

- For cyclical write operations (e.g. logging), use the temporary file system in the RAM or a removable storage medium

The run-up or start-up process of the handheld terminal CDSA-D3-RV after insertion can be monitored on the screen and runs in the following sequence:

1. Load bootloader.
2. Load firmware and start firmware.
3. Query whether the device configuration (Setup Mask) should be opened (2 seconds).
4. Press the "Scan Network" button to search for controllers.
5. Select target controller from the list on the left-hand side.



Confirm the "Save Persistently" checkbox to save the connection to the controller permanently. When the device is restarted, the connection to this controller is automatically established. A dialogue is displayed for 2 seconds to disconnect the saved connection.

6. To set up the connection to the controller, press the "OK" button.
7. Start visualisation of the controller.

10 Maintenance

10.1 Trigger restart

A restart of the handheld terminal CDSA-D3-RV can be triggered at runtime.

- Press and hold the [MENU] and [STOP] keys for approx. 10 seconds.

10.2 Create backup

NOTICE!

Possible data loss.

Data security on a USB stick cannot be guaranteed for an extended period.

- Copy backup files to a backed up EDP system.

A backup can be created via the Bootable Service System (BSS). The BSS is a program that opens automatically when the handheld terminal CDSA-D3-RV is started with the service USB stick connected.

Create backup

The following is required for the backup process:

- Formatted service USB stick with FAT32
- Image file with max. 32 GB on the service USB stick
- 1. Connect service USB stick to the CDSA-D3-RV .
- 2. Restart (disconnect and reconnect power supply).

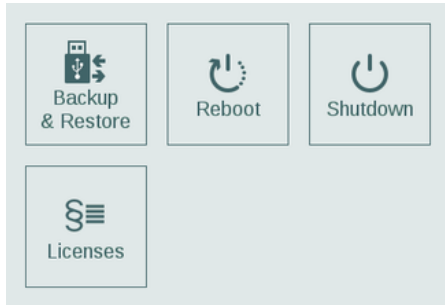


Fig. 21 Menu option Backup & Restore

- 3. Select "Backup & Restore" menu item.
- 4. Select "Backup" menu item.
- 5. Select the medium on which the backup is to be saved and confirm with the "Backup" button.
- 6. Start backup procedure with the "OK" button.
 - ↳ A progress bar is displayed. The duration of the process depends on the type of USB stick.
- 7. After successful backup, confirm the dialogue.
- 8. Remove the USB memory stick.
- 9. Select "Shutdown" to switch off or "Reboot" to restart the handheld terminal.
 - ↳ The backup has been created and saved on the USB stick in the "\images" directory. A sub-directory with device name, date and time is created for every backup.

10.3 Restore backup, install software or firmware update

NOTICE!

Interruption of the restore/update process.

An interruption of the restore/update process may destroy the firmware on the components. The product can then no longer be operated.

- Leave the USB stick plugged in until the restore/update process is completed.
- Maintain the power supply of the module until the restore/update process is completed.

A backup can be restored or a software or firmware update can be installed via the Bootable Service System (BSS). The BSS is a program that opens automatically when the handheld terminal CDSA-D3-RV is started with the service USB stick connected.

BSS preparation

To prepare the USB stick, the archive (e.g. ZIP file) supplied by Festo must be extracted and the "\boot" directory copied to the root directory of the USB stick. The USB stick must be at least 4 GB, must not be larger than 32 GB and must be formatted with FAT32.

Preparation for restore

To be able to restore a backup, the files previously created during backup are required. To do this, the "\images" directory with the backup files is copied to the USB stick.

Preparation for update

The "\images" directory with the update files is required to install an update. The directory is included in the archive and must be copied to the root directory of the USB stick.

Restore backup, install software or firmware update

The following is required for the Restore process or the update:

- Service USB stick for the BSS application
 - Backup/update files
1. Plug service USB stick into the handheld terminal CDSA-D3-RV.
 2. Restart (disconnect and reconnect power supply).
 3. Select menu option "Backup & Restore".
 4. Select menu option "Restore".
 5. Select service USB stick as the source for the restore or update and confirm with the "Restore" button.

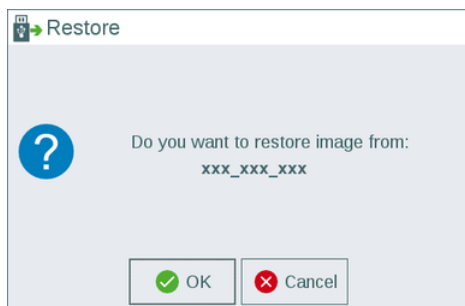


Fig. 22 Restore menu

6. Confirm dialogue with the "OK" button.
 - ↳ The restore or update process is started and a progress bar is displayed. The process takes 15 to 20 minutes. The duration of the process depends on the type of USB stick.
7. After the successful restore or update process, confirm the dialogue.
8. Remove the USB memory stick.
9. Select "Shutdown" to switch off or "Reboot" to restart the handheld terminal.
 - ↳ The backup has been restored or the software or firmware has been updated.

10.4 Update software

NOTICE!

Interruption of the restore/update process.

An interruption of the restore/update process may destroy the firmware on the components. The product can then no longer be operated.

- Leave the USB stick plugged in until the restore/update process is completed.
- Maintain the power supply of the module until the restore/update process is completed.

The handheld terminal CDSA-D3-RV is supplied as standard with the following pre-installed software components:

- Operating system (based on Linux Debian)
- AZUL JRE 8
- Setup menu during start-up
- Standard font package (ttf-unifont, ttf-bitstream-vera, fonts-thaitlwg, fonts-farsiweb, fonts-freefarsi)

The files for a software update are available on request from Festo .

To install the desired software (update), an empty USB stick with a capacity of at least 2 GB is required and it is plugged into the PC.

Proceed as follows:

1. Format USB stick as "FAT32".
2. Extract downloaded 7Z file into the root directory of the USB stick.
 - ↳ The "Update" directory and the "update.img" file are created in the root directory.
3. Remove the USB stick from the PC.
4. Plug USB stick into the handheld terminal CDSA-D3-RV while it is disconnected from the power supply.
5. Switch on the handheld terminal (default).
 - ↳ The software update is started automatically and the status is output on the display. The process can take several minutes.
6. On successful completion of the update, remove the USB stick from the device and restart the device.
 - ↳ The software has been installed.

On completion of the software update, the touchscreen of the handheld terminal CDSA-D3-RV must be calibrated → 8 Configuration.

10.5 Cleaning



- Do not use solvents, abrasive media or sponges for cleaning the housing, display and operating elements.
 - Do not use aggressive cleaning agents.
 - Do not spray water or cleaning agent directly on the touchscreen.
1. Moisten the soft cloth slightly with water or a mild cleaning agent, e.g. detergent.
 2. Clean the housing, display and operating elements with a damp cloth.

11 Malfunctions

11.1 Diagnostics

When performing a software update, the following messages or error messages may be displayed:

Error message "Software Update error"

Send handheld terminal CDSA-D3-RV to Festo.

Message "System is up to date"

The same software version is on the handheld CDSA-D3-RV and the USB stick. To overwrite the current software on the handheld terminal CDSA-D3-RV with the same version and thus reset all settings, the image file in the root directory of the USB stick can be renamed from "update.img" to "force.img". As a result, the software version that is currently on the handheld terminal CDSA-D3-RV is not checked when the software is updated.

11.2 Repair

Repair or maintenance of the product by unauthorised persons is not permitted; this may invalidate the conformity of the product.

If necessary, replace the complete product.

- If a safety device is defective, the product must be replaced.
- In this case, send the defective product unchanged with a description of the fault and application to Festo for analysis.
- Check with your regional Festo contact person to clarify the conditions for the return shipment.

12 Disposal

ENVIRONMENT!

Dispose of the product and packaging according to the applicable provisions of environmentally sound recycling.

12.1 Safety-related control elements

After expiry of the service life T_{10D} , but no later than after 20 years, the safety-related control elements "Emergency stop device" and "3-position enabling switch" must be permanently disabled.

13 Technical data

13.1 Product conformity and approvals

13.1.1 EC Directives

EC Directive	Title
2006/42/EC	Machinery Directive
2014/30/EU	EMC Directive

EC Directive	Title
2011/65/EU	RoHS Directive

Tab. 13 EC Directives

13.1.2 Standards

The following standards have been used to check the conformity of the handheld terminal CDSA-D3-RV with the directives.

Checking conformity with the Machinery Directive

Standard	Title
EN ISO 13850:2015	Safety of machinery - Emergency stop - Principles for design
EN 60204-1: 2006 + A1: 2009 + AC: 2010, Chapters 9 and 10	Safety of machinery - Electrical equipment of machines - Part 1: General requirements

Tab. 14 Standards

Checking conformity with the EMC Directive

Standard	Title
EN 61131-2: 2007, Chapters 8, 9 and 10	Programmable logic controllers - Part 2: Equipment requirements and tests

Tab. 15 Standards

Other standards

When drafting the safety concept, the following legally non-binding European standards were additionally consulted for partial aspects:

Standard	Title
General Procedures and safety principles	
EN ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
Design of the 3-position enabling switch	
EN 60204-1:2006 + A1:2009 + AC:2010	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EN ISO 10218-1:2011	Industrial robots – Safety requirements – Part 1: Robots
EN 60947-5-8:2006	Low-voltage switching devices - Part 5-8: Control units and switching elements - Three-position enabling switch
EN 60947-1:2007	Low-voltage switching devices - Part 1: General specifications
EN 60947-5-1:2004	Low-voltage switching devices - Part 5-1: Control units and switching elements - Electromechanical control units

Standard	Title
Design of the emergency stop device	
EN ISO 13850:2015	Safety of machinery - Emergency stop - Principles for design
EN 60204-1: 2006 + A1: 2009 + AC: 2010, Chapters 9 and 10	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
Ergonomics	
EN 614-1:2006	Safety of machinery - Ergonomic design principles - Part 1: Terms and general principles
EN 614-2:2000	Interplay between the design of machines and the work tasks
EN 894-3:2008	Safety of machinery - Ergonomic requirements for the design of displays and actuators - Part 3: Actuators
Strength and tightness of the housing	
EN 60529:1991	Degree of protection through housing
EN 61131-2:2007, Chapter 12	Programmable logic controllers - Part 2: Requirements and tests
Electrical safety and fire protection	
EN 61131-2:2007, Chapter 11	Programmable logic controllers - Part 2: Requirements and tests
EN 50178:1997	Equipping of power installations with electronic equipment
Requirements for environmental and ambient conditions	
EN 61131-2:2007, Chapter 4	Programmable logic controllers - Part 2: Requirements and tests
EN 50178:1997	Equipping of power installations with electronic equipment
Requirements for environmental and ambient conditions	
EN 61131-2:2007, Chapter 4	Programmable logic controllers - Part 2: Requirements and tests
EN 50178:1997	Equipping of power installations with electronic equipment

Tab. 16 Standards

The following standards have also been taken into consideration for the American market:

Standard	Title
UL certification for industrial control equipment	
UL 508	Industrial Control Equipment (NRAQ, NRAQ7)
UL certification for robotics applications	
UL 1740	Industrial Robots and Robotic Equipment E216950 (TETZ2, TETZ8)

Tab. 17 Standards

13.1.3 Regulations

Regulation	Title
Regulation (EC) Nr. 1907/2006	REACH EU Chemicals Regulation

Tab. 18 Regulations

13.2 Handheld terminal CDSA-D3-RV

Emergency stop device		
Nominal voltage (U_n)	[V DC]	24
Minimum current (I_n)	[mA]	10 (per contact)
Max. current rating	[mA]	1,000 (per contact)
Utilisation category (in accordance with IEC 60947-5-1)		DC-13
Schlegel FRVKOO		
– B_{10D}		250,000
Design		two-circuit, external wiring
Electrical isolation	[V AC]	500 to all other networks

Tab. 19 Emergency stop device

3-position enabling switch		
Output type		Electromechanical switching contact
Switchable nominal voltage (U_n)	[V DC]	24
Nominal voltage tolerance range (in accordance with EN 61131-2)	[V DC]	19.2 ... 30
Max. nominal current (I_n)	[mA]	500
B_{10D}		
– Switch setting 2		10^6
– Switch setting 3		10^6
Actuating forces		
– From switch position 1 to 2		Typically 3 N
– From switch position 2 to 3		Typically 17 N
Electrical isolation	[V AC]	500 to all other networks

Tab. 20 3-position enabling switch

Technical data, general		
Nominal voltage	[V DC]	24
Nominal voltage tolerance range (in accordance with EN 61131-2)	[V DC]	19.2 ... 30
Max. interruption duration of the supply voltage (in accordance with EN 61131-2)	[ms]	≤ 10
Max. starting current	[A]	5.6 (current limitation available)
Power consumption	[W]	12 (500 mA at 24 V DC)
Display		7" TFT LCD LED backlight 600 x 1,024 pixels (WSVGA)
Touchscreen		Analogue-resistive
Keyboard		Touch-sensitive keyboard with tactile feedback 20 keys 4 status LEDs
Protection class (in accordance with EN 61131-2 and/or EN 50178)		III
Degree of protection		IP65
CE certification		See declaration of conformity → www.festo.com

Tab. 21 Technical data, general

Ambient conditions		
Operating temperature	[°C]	0 ... 40
Storage temperature	[°C]	–25 ... 70
Relative humidity (non-condensing)	[%]	5 ... 95
Vibration resistance (in accordance with IEC 60068-2-6)		
– With 3.5 mm	[Hz]	$5 \leq f < 8.4$
– With 1 g	[Hz]	$8.4 \leq f < 150$
Shock resistance (in accordance with EN 61131-2)	[g/ms]	15/11
Max. operating altitude (sea level)	[m]	2,000

Tab. 22 Ambient conditions

Computer core		
Processor	Freescale i.MX6 Dual Core 1 GHz	
Memory		
– RAM	[GB]	2
– FLASH	[GB]	8
Operating system	Linux	

Tab. 23 Computer core

Interfaces		
Ethernet interfaces		
Number		1
Baud rate	[Mbps]	100
USB port		
Number		1
Type		USB 2.0 (Hi-Speed)

Tab. 24 Interfaces

Mechanical characteristics		
Design	Housing made of ABS	
Flammability	UL94-V0	
Fall-proof suitability	[m]	1.5 (on industrial floor), then at least degree of protection IP54

Tab. 25 Mechanical characteristics

Dimensions, weight		
Height	[mm]	251
Width	[mm]	212
Depth (incl. handle and emergency stop device)	[mm]	73
Weight	[g]	Approx. 950

Tab. 26 Dimensions, weight

13.2.1 Accessories

The product may only be operated with the accessories named in this chapter.

13.2.1.1 Wall bracket CAFM-D4-W

The powder-coated black wall bracket is used for stationary operation or for storing the handheld terminal CDSA-D3-RV.

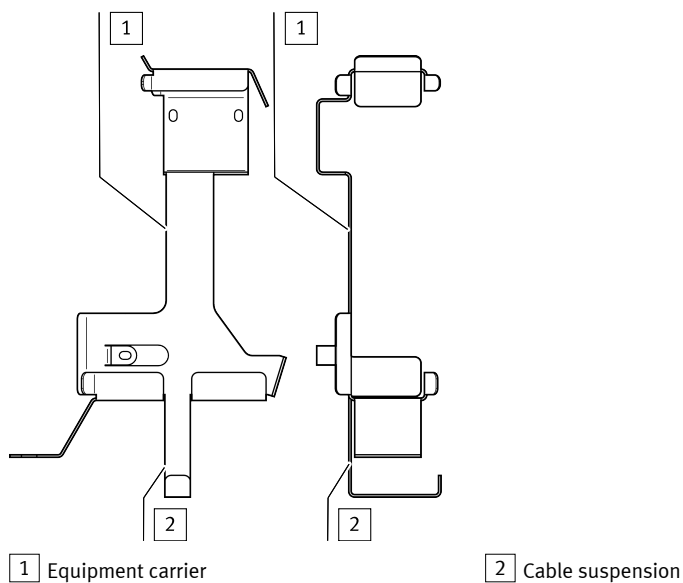


Fig. 23 CAFM-D4-W

Dimensional drawings

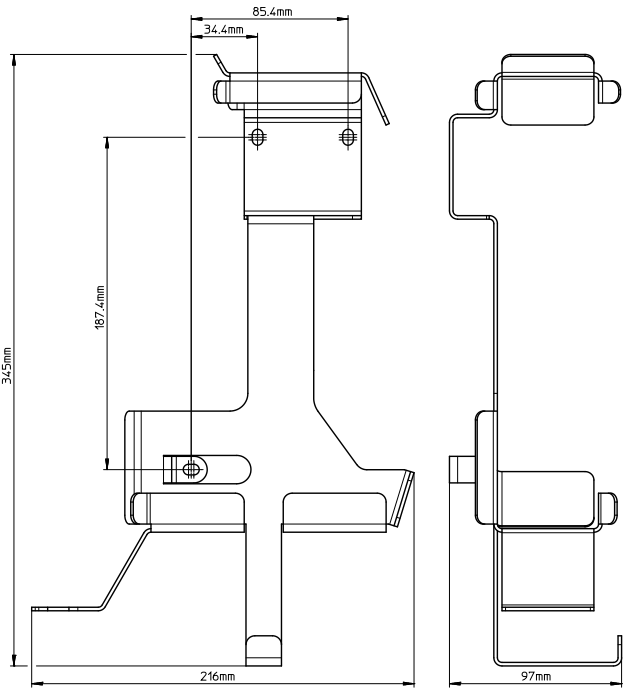


Fig. 24 Front and side view of wall bracket CAFM-D4-W, (dimensions in mm)

13.2.1.2 Interface housing CAMI-C

The interface housing CAMI-C is used to connect a handheld terminal CDSA-D3-RV to a controller with the connecting cable NEBC-R3Z12G20-KH-5-N-SBS-RSG17-ET-S1.

Views and basic dimensions

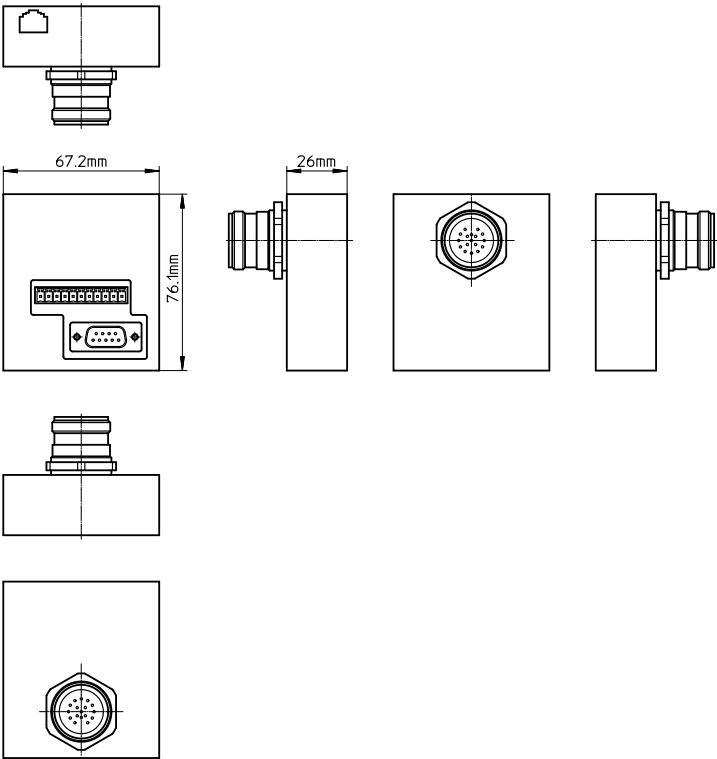
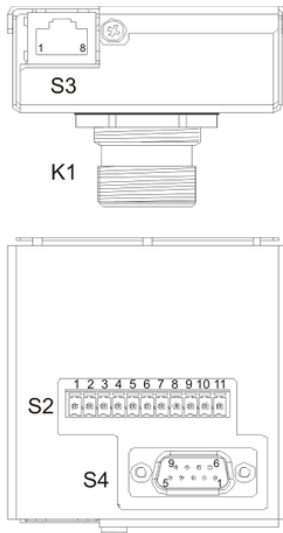


Fig. 25 Views and basic dimensions (in mm) of the CAMI-C interface housing

Plug



- | | |
|--|--|
| <p>1 (K1) 17-pin Hummel socket for connecting cable</p> <p>2 (S2) RJ45 socket plug for connection to controller via Ethernet</p> | <p>3 (S3) 11-pin terminal strip for supply and control cables (emergency stop device, 3-position enabling switch), mating plug required (included in scope of delivery)</p> |
|--|--|

Fig. 26 Plug for the interface housing CAMI-C

Connection

This chapter describes the connection of the control cables (power supply, emergency stop and enabling circuits) and the data cables to the interface housing → Fig.4.



A crossover cable is required between the handheld terminal CDSA-D3-RV and the controller for point-to-point operation via the Ethernet interface.

Screening within the control cabinet

In many cases, there are a number of sources of interference in the control cabinet, such as servo drive modules, transformers, contactors and relays. For this reason, the cable screening must be continued from the plug housing (control cabinet) to the controller (continuous screening from the handheld terminal to the controller → 15 Appendix: Electromagnetic compatibility).

Mounting instructions

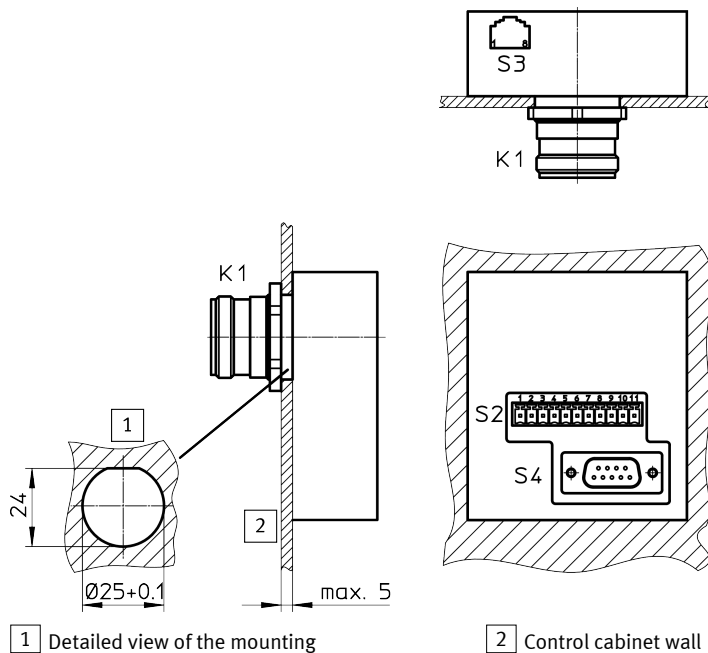


Fig. 27 Dimensional drawing of the mounting opening for the interface housing CAMI-C

Technical data of the interface housing

General information		
Nominal voltage (CDSA-D3-RV)	[V DC]	24
Nominal voltage tolerance range (CDSA-D3-RV, in accordance with EN 61131-2)	[V DC]	19.2 ... 30
Max. interruption duration of the supply voltage (CDSA-D3-RV, corresponding to EN 61131)	[ms]	≤ 10
Power consumption		
– Without CDSA-D3-RV		None
– With CDSA-D3-RV		→ Tab. 21 Technical data, general
Starting current (CDSA-D3-RV)		→ Technical data of the handheld terminal

General information	
Protection class (in accordance with EN 61131-2 and/or EN 50178)	III
Degree of protection	IP20

Tab. 27 General information

Ambient conditions	
Operating temperature [°C]	5 ... 55
Storage temperature [°C]	–25 ... 70
Relative humidity (non-condensing) [%]	5 ... 95
Vibration resistance (in accordance with IEC 60068-2-6)	
– with 7 mm [Hz]	$5 \leq f < 9$
– with 2 g [Hz]	$9 \leq f < 150$
Shock resistance (in accordance with IEC 60068-2-27) [g/ms]	15/11

Tab. 28 Ambient conditions

Mechanical characteristics	
Design	Housing made of galvanised sheet steel

Tab. 29 Mechanical characteristics

Dimensions, weight	
Width [mm]	67.2
Height [mm]	76.1
Depth [mm]	76.1

Tab. 30 Dimensions, weight

13.2.1.3 Connecting cable NEBC-R3Z12G20-KH-xx-N-SBS-RSG17-ET-S1

The handheld terminal CDSA-D3-RV is available as standard with the following connecting cables:

- NEBC-R3Z12G20-KH-5-N-SBS-RSG17-ET-S1: 5 m
- NEBC-R3Z12G20-KH-10-N-SBS-RSG17-ET-S1: 10 m
- NEBC-R3Z12G20-KH-15-N-SBS-RSG17-ET-S1: 15 m

The connecting cable is resistant to water, cleaning agents (alcohols and detergents), oils, greases and lubricants → 16 Appendix: Resistance to chemicals.

Signal description	S2, 12-pin socket connector	S3, 8-pin RJ45 plug		S1, 17-pin plug connector, pin no.
24 V DC	1	–	→	1
GND_IN	2	–	→	2
Emergency stop, circuit 2	3	–	→	3
Emergency stop, circuit 2	4	–	→	4
Emergency stop, circuit 1	5	–	→	5
Emergency stop, circuit 1	6	–	→	6
Enable control, circuit 1, pos.	7	–	→	7
Enable control, circuit 1, neg.	8	–	→	8
Enable control, circuit 2, pos.	9	–	→	12
Enable control, circuit 2, neg.	10	–	→	17
not used	11	–	→	9
not used	12	–	→	10
not used	–	–	→	11
TD+ (Ethernet)	–	1	→	13
TD- (Ethernet)	–	2	→	14
RD+ (Ethernet)	–	3	→	15
RD- (Ethernet)	–	6	→	16

Tab. 31 Pin allocation

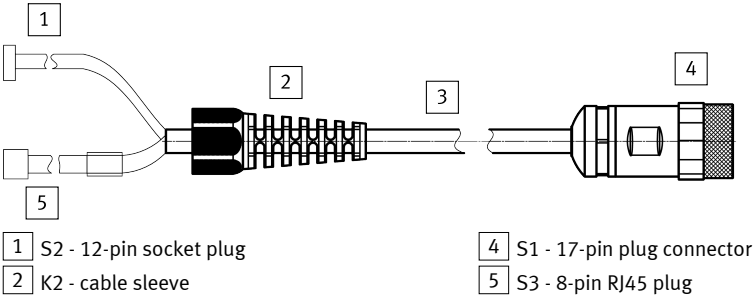


Fig. 28 Connecting cable

13.2.1.4 CAMF-B-M25-G4 jumper plug

The jumper plug is used to bypass the emergency stop circuit when the handheld terminal is disconnected.



Foreseeable misuse of the jumper plug

The jumper plug must be removed before commissioning the hazardous machine function.

14 Appendix: Safety of machinery

Directives of the European Union

A key objective of the European Union is the creation of a single European market and, consequently, the free movement of goods. This means that quantitative restrictions on the import of goods between Member States are prohibited.

This does not apply to goods that endanger the safety of people or the environment. Such products can be prohibited by member states on their territory. In order to ensure the free movement of goods for these products as well, the national safety regulations of the member states are harmonised by directives of the European Union.

These guidelines are suitable for a number of product classes, such as: machines, medical devices or even toys. However, similar directives have also been developed for other common safety aspects of products, such as protection against electricity, explosion protection and electromagnetic compatibility. The directives are directed at the member states, which must implement the directives in their national laws. The directives therefore have the character of law.

The "CE" marking means that the manufacturer certifies that all obligations of the EU directives applicable to the product have been fulfilled. The CE mark, which the manufacturer applies to the products, is the "passport" within the EU and is intended for the monitoring authorities.

Supplementary to this, conformity with the EU directives can be checked by independent, accredited certification bodies and this can be confirmed with an EC type examination certificate.

For handheld terminals, in addition to the EMC Directive (EMC Directive 2014/30/EU), the Machinery Directive (MD 2006/42/EC) must also be applied.

Safety of machinery

Wherever faults occurring on the machine can cause personal injury or major material damage, additional measures must be taken to ensure a safe operating status of the entire system even in the event of a fault. According to the Machinery Directive (MD), a machine is defined as “a set of interconnected parts or devices, at least one of which is movable”. The directive also states that “the design of the machine must ensure that operation, set-up and maintenance take place without endangering people when used as intended.”

Although the handheld terminal itself is not a machine in the strict sense, the handheld terminal fulfils essential tasks to guarantee the safety functions of a machine or system to which the handheld terminal is connected.

For example, the handheld terminal via the safety functions “stop in an emergency” and a 3-position enabling switch for operation in special operating modes is thus a “safety component” within the meaning of the Machinery Directive.

Safety components, i.e. parts whose failure or malfunction endangers the safety of persons in the danger zone of the machine, fall expressly within the scope of application of the Machinery Directive. The essential requirements of the Machinery Directive for the manufacturer of a machine or system are as follows:

- Conduct a hazard and risk analysis
- Compliance with safety integration principles
- Creation and storage of technical documentation
- State-of-the-art solutions
- Presumption of conformity by harmonised standards
- Application of the CE conformity marking

The same requirements apply to safety components. For safety components, it must be demonstrated that a failure or malfunction is not possible, or that a malfunction does not lead to a dangerous situation.

14.1 Risk assessment

The manufacturer of a machine is obliged to carry out a risk assessment of the machine. The risk assessment consists of a hazard analysis and a risk assessment. Analyse the machine in all phases of its life and operating modes. Document all hazards that occur. This takes place without consideration of any protective devices.

As a next step, a protection objective is formulated for every identified hazard, and one or more protective measures are then defined to achieve the protection objective.

Further details on the procedure for carrying out the hazard analysis and risk analysis as well as lists of frequently encountered hazards can be found in the following standards:

- EN ISO 12100: 2010 “Safety of basic machinery concepts - General principles for design, risk assessment and risk reduction”

14.2 Principles for the integration of the handheld terminal CDSA-D3-RV

Appendix I, chapter 1.1.2 of MD 2006/42/EC, MD, describes a clear procedure and sequence for the selection of protective measures:

Eliminate or minimise the hazards

This is done by the design of the machine.

Examples of such measures include:

- Reduction of energy (forces, rotational speeds, voltages,...) as far as possible
- Avoidance of unnecessary pinch points or sharp edges
- Avoidance of operating errors by ergonomic and logical design of operating devices
- Avoidance of hazardous materials and consumables

Implementation of protective measures against dangers that cannot be eliminated

Examples of such measures include:

- Separating protective devices (guards, housings, protective grids)
- Non-separating protective devices (light barriers to switch off the hazards)
- Control technology protective devices (3-position enabling switch, two-hand circuits, speed monitors,...)

Informing the user about residual risks

This last of the three options is used if residual risks remain despite the first two points.

Examples of such measures include:

- Warnings
- Training and organisational measures
- Use of personal protective equipment

14.3 Technical documentation

The technical documentation includes all documents required to verify the safety of the machine or the safety device.

This includes the following:

- Overall plan of the machine or safety component including control circuit diagrams
- Hazard and risk analysis
- Calculations
- Test results
- List of the basic safety requirements of the MD applicable to the machine and description of the solutions
- Applied standards
- Operating instructions

The technical documentation must be retained for at least 10 years after delivery of the last product and must be submitted within a few days in the event of damage

14.4 State of the art

This refers to technical possibilities at a specific point in time, which are based on thorough knowledge of science and engineering. The state of the art also means that it is economically feasible. This means that the most items can be achieved in the relevant industrial sector.

The state of the art refers to the state of development of advanced processes, devices or operating methods that appear to assure the practical suitability of the measure with reference to the applicable goals (e.g. the objective of occupational safety, environmental protection, safety of third parties, economic efficiency: i.e. in general to achieve a generally high level based on the relevant aspects).

The state of the art can evolve independently of the standards.

14.5 Presumption of conformity with harmonised standards

The European directives mainly describe general requirements for the safety of products, but not details of implementation. This is the responsibility of the European standardisation institutes, which provide implementation recommendations for specific safety-related problems or specific product classes. Standards that are assumed to meet the requirements of the directives and correctly implement them are listed as “harmonised standards”. However, by no means all of the available standards are harmonised.

A manufacturer can express the presumption of conformity of the respective product by applying and implementing harmonised standards. However, in contrast to directives, standards are not legally binding. This means that the manufacturer may also consider other solutions than those described in the standards. However, these solutions must at least achieve the same level of safety as the relevant standards and meet the requirements of the applicable directives.

14.6 Selection of performance level and category in accordance with EN ISO 13849-1

The Machinery Directive requires that a defect in the logic of the control circuit, or even a malfunction or damage to it, must not lead to a dangerous situation. This general approach is EN ISO 13849-1 “Safety-related parts of machine control systems”, which defines performance levels (PL a to e) for safety-relevant control parts. The PL is dependent on the category, the MTTFD value and the diagnostic coverage (DCavg) of the respective safety circuit.

The category describes the structure of the safety functions in the same way as in the previous EN 954-1. A new addition is the Performance Level (PL), which describes the probability of failure and the ability to detect faults of the safety function.

The PL is selected by the manufacturer of the machine depending on the actual hazard potential, which is determined using the hazard and risk analysis. In the case of dangers that can result in irreversible injuries or death, a minimum of PL d is usually required.

The category specified for the PL means the following:

- Category 1: The system has been designed with 1 channel and thus an error results in a loss of safety, but component availability is high.
- Category 2: The system was designed with 1 channel and an error thus leads to a loss of safety, but the error is detected by the system and displayed in any form.
- Category 3: The system has been designed with 2 channels and an error does not result in loss of safety
- Category 4: The system has a 2-channel design and even an accumulation of several errors does not lead to a loss of safety.

It is also important in this context that individual faults from category 3 must be detected in good time in order to avoid accumulation of faults, which can ultimately lead to a loss of safety.

Errors that must be detected are items such as cross circuits between the circuits, interruptions, short circuits or glued contacts in electrical and electronic systems. Specially certified safety switching devices that already have a specific PL are frequently used to detect faults in the individual safety circuits. However, the total PL required for the safety function is only achieved if the circuitry with the associated circuits has been implemented in accordance with the product description for the respective PL, and the PL of all components contributing to the safety function has been taken into account.

The PL must therefore always be calculated for an entire safety function from the individual components or components.

Instructions for simplified determination of the PL for a safety function comprising several components can be found in the standard → EN ISO 13849-1 (Chapter 6.3, Appendix H and Appendix I).

It should be noted that in the case of a series connection of safety components the component with the lowest PL in the safety function determines the PL of the safety function. Thus, a safety function composed of 3 components with category 4 PL e, category 3 PL d and the third component with category 2 PL c specifies PL c for the entire safety function. It is also important that an error results in the loss of safety although category 4 PL e components are integrated in the safety function, since one of the components used only conforms with category 2.

If several PLs linked, the total PL can be reduced → EN 13849-1 (chapter 6.3).

Evidence that an error does not result in loss of safety can be established with the aid of a FMEA (Failure Mode and Effects Analysis), in which all possible assumed errors are tested theoretically or practically and it is demonstrated that the requirements of the category is enough.

14.7 Use of handheld terminals in special operating modes

In the case of manual control of machines in special operating modes, where safety depends on the prompt response of the operating personnel, it is essential that the operating area can be viewed by the operator. The handheld terminal offers the advantage of being very close to the operating area. At the same time, mobility increases the risk of misuse because the handheld terminal can be used to start machine movements consciously or unconsciously even at more remote locations where the operating area can no longer be perceived. By selecting the appropriate cable length for the handheld terminal, the machine operator must therefore find the right compromise between the necessary flexibility and a reasonable working range limitation. The working range of wireless handheld terminals cannot be restricted with the cable; therefore, additional technical solutions are required for this type of handheld terminal.

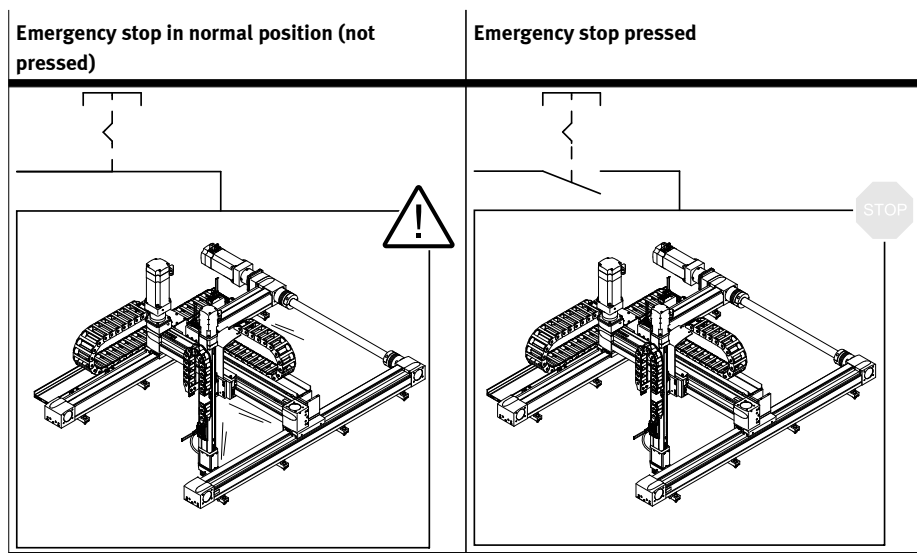
If the machine or system is operated with the handheld terminal, it must be ensured that it can only be operated from the handheld terminal and not from any other point in the system. The danger zone may only be entered by the person operating the handheld terminal. If more than one person is working in the danger zone at the same time, each person present needs a 3-position enabling switch. The movement may only be enabled if all 3-position enabling switches are actuated.

14.8 Notes on the switch for stopping in an emergency (emergency stop function)

Theoretically, a perfectly designed machine should not require an emergency stop function, since the machinery directive requires that a machine is safe in all phases of its life and operating modes.

However, it is known from practice that unforeseeable situations occur despite all precautionary measures. To enable the machine to be stopped quickly in these cases or to eliminate the danger, an emergency stop device is provided on most machines.

As can be seen from the following illustration, a machine is constantly in a dangerous state from the point of view of the emergency stop as long as it is not actuated.



Tab. 32 Emergency stop

The emergency stop must therefore not serve as a predominant safety device, but is intended exclusively to cover any residual risks.

Instead of the emergency stop, locking protective doors, light barriers, two-hand switches or 3-position enabling switches can be used depending on the operating mode.

When the emergency stop switch is actuated, the entire machine or all machines connected to form a system must be brought into a safe state, e.g. by shutting off the energy of the hazardous drives (stop categories 0 or 1 to EN 60204-1).

Unlocking the emergency stop switch must not cause an uncontrolled restart of the machine.

Regardless of whether an emergency stop is present on a handheld terminal or not, permanently installed, easily identifiable and easily accessible emergency stop switches must be installed at selected locations around the machine.

14.9 Control elements for stopping in an emergency

The Machinery Directive does not make any detailed requirements regarding the colours of the control elements for stopping in an emergency. The requirement is: "The command device must have clearly identifiable, easily visible and quickly accessible actuators".

Emergency stop switches are normally coloured red and yellow. The special design has the purpose of a signal effect, and is intended to ensure that everyone, even untrained persons, can identify the control element as the device for eliminating a danger in an emergency.

It is therefore absolutely essential that a safe status can be initiated at any time and in any operating mode without further knowledge of the machine (see also EN ISO 13850). Changing the ready status of an emergency stop switch is not permissible, as this can lead to incorrect actions and life-threatening loss of time in panic situations.

It is therefore absolutely essential that a safe status can be initiated at any time and in any operating mode without further knowledge of the machine (see also EN ISO 13850). Changing the ready status of an emergency stop switch is not permissible, as this can lead to incorrect actions and life-threatening loss of time in panic situations.

Permanently installed handheld terminals: emergency stop switch

They are equipped with a cable which is used to connect the handheld terminal to the defined machine. The handheld terminal is usually connected to the machine or unplugged when the machine is switched off. This occurs during the installation or uninstallation process. The handheld terminals are not intended to be connected or disconnected during operation of the machine.

For many simple machines, the handheld terminal is also the only operating option, so the machine cannot be commissioned without a handheld terminal. However, if the plug is removed from the machine during operation, the emergency stop lines are interrupted and the emergency stop function of the machine is activated, causing the machine to stop.

If a handheld terminal of a machine is to be uninstalled and not immediately reinstalled, the device must be locked away to avoid confusion with a functioning handheld terminal. The machine can only be restarted when a new handheld terminal is installed. This must be described in the operating instructions of the machine and is the responsibility of the operator. Due to the fact that plugging in and unplugging are very rare and the machine is out of operation in the unplugged state, the risk of accidents due to an emergency stop switch that is not ready for operation is considered very low and use of the red-yellow identification is permissible.

The red-yellow emergency stop switch must always be connected to the emergency stop circuit of the machine and must switch off the power to the machine or all machines connected to one system (stop categories 0 or 1 to EN 60204-1).

WARNING!

Missing emergency stop on the machine.

Failure to perform an emergency stop on the machine can result in serious injuries or the death of people involved.

- At least one emergency stop device must always be hard-wired to the machine, even if emergency stop devices are installed on plug-in or wireless operator stations (e.g. portable programming devices).

14.10 Notes on the 3-position enabling switch

Many machines have normal operation and special operation operating modes. In normal operation or automatic operation, the machine fulfils its mission. Safety is guaranteed in this operating mode via closed, separating protective devices, with functioning, non-separating protective devices or both types of protective devices in combination. The special operating modes of a machine are used to maintain normal operation. In this case, safety must be guaranteed in a different way from normal operation, because danger zones of the machine can now be entered and targeted movements must be possible. The 3-position enabling switch plays a key role here.

A prerequisite for the application is that the hazard to be controlled is switched off in good time by a 3-position enabling switch before personal injury occurs. This may require additional safety measures, such as a safely reduced speed of drives.

In contrast to the emergency stop switch or stop switch, a machine in the special operating modes with 3-position enabling switch is always in the safe state as long as it is not actuated.

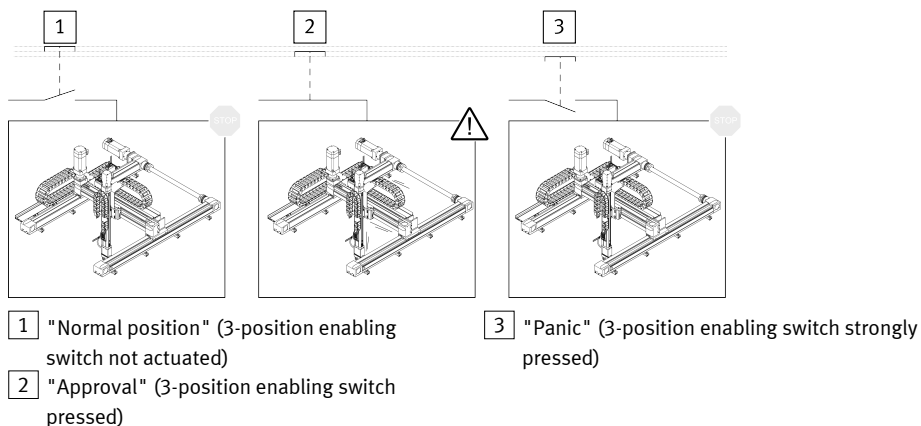


Fig. 29 Enabling functions

The enabling function is also described in EN 60204-1 and corresponds to the state of the art.

The panic setting of the 3-position enabling switch was introduced because people in shock situations often react with a reflex-like cramping of the limbs and cannot release the 3-position enabling switch. For this reason, pressing the 3-position enabling switch firmly also results in switch-off.

The controller must be designed so that the movement is not initiated directly with the activation of the 3-position enabling switch, but only through the additional actuation of a control button. They may be membrane keys on the handheld terminal or graphical software keys on the touchscreen.

An optionally available joystick can also be used to trigger the motion signal.

Only stop categories 0 or 1 are permitted for the enabling function in accordance with EN 60204, which means that the drives must be shut down in every case with a stop by the 3-position enabling switch.

In order to prevent improper permanent actuation of the 3-position enabling switch by mechanical locking devices, the recommendation is to limit the maximum duration of an accepted approval. This must be achieved by means of a controller downstream of the handheld terminal.

A 3-position enabling switch is not a substitute for a two-hand circuit, which is specified for some machines (e.g. presses), and must therefore not be confused with it.

In contrast to the 3-position enabling switch, the two-hand control forces the endangered limbs of the operating personnel into a safe position during machine movement.

15 Appendix: Electromagnetic compatibility

Directive 2014/30/EU of the European Union requires the member states to harmonise their legislation on electromagnetic compatibility. In the following text, this directive is referred to briefly as EMC Directive.

In Europe, all electrical and electronic equipment placed on the market must therefore comply with the basic safety requirements of the EMC Directive. According to the Directive, electromagnetic compatibility is the ability of an apparatus, system or system to work satisfactorily in the electromagnetic environment without itself causing electromagnetic interference that would be unacceptable to all equipment, systems or systems in this environment.

In addition to the legal requirements described above, the reliable function of electrical equipment is also an essential quality feature of such equipment. In addition to basic information on electromagnetic compatibility, the following pages describe the implementation of the requirements of EMC for the handheld terminals of the product line CDSA-D3-RV.

15.1 Electromagnetic environment - sources of interference, interference sinks and coupling paths

The electromagnetic environment contains a large number of artificial and natural sources of interference, which can influence electrical and electronic equipment.

The most common natural disruption phenomenon is atmospheric discharge (lightning discharge).

Artificial sources of interference are on one hand intended, such as mobile telephones, ham radio, television and radio transmitters, and on the other hand unintended, such as microwave ovens, arc welding, ignition systems, high-voltage systems, electric motors and electronic devices or electrostatic discharges.

15.1.1 Atmospheric discharges (lightning)

Atmospheric discharges can be directly or indirectly on supply or communication lines. The result of such impacts is, in the event of insufficient protection, the destruction of electrical equipment.

Atmospheric discharges are simulated in accordance with the international test standard IEC 61000-4-5 (for Europe EN 61000-4-5) - Testing the interference immunity to impulse voltages.

The applicable international product standard IEC 61131-2 (for Europe EN 61131-2) classifies the areas of application into zones. Depending on the applicable zone, higher or lower noise levels can be expected. All Festo control systems and also the products from the handheld CDSA-D3-RV are suitable for use in zone B.

The product standard requires that the interference immunity to impulse voltages be tested in accordance with IEC 61000-4-5.

15.1.2 Electrostatic discharge (ESD)

Materials can be charged by touching and then separating materials. The effect only occurs if at least one of the two materials is a non-conductor. As a result, a rapid discharge can occur if a charged conductor or a conductor changed by the influence of an electrostatic field comes into the vicinity of a metallic object.

The possible voltages between the charged bodies after charging reach values of more than 10 kV.

The most common occurrence of electrostatic discharge occurs between people and metallic bodies.

Since discharges of less than 3500 V are practically imperceptible and electronic components are already damaged at lower voltages, ESD damage to electronic components often occurs undetected.

The international standard IEC 61000-4-2 (for Europe EN 61000-4-2) is used for metrological simulation of the electrostatic discharge. The international product standard IEC 61131-2 (in Europe

EN 61131-2) for programmable logic controllers requires testing in accordance with IEC 61000-4-2 and specifies the severity of testing.

15.1.3 Technical systems as sources of interference

Technical systems can act as sources of interference. The malfunctions can be intentional or unintentional. Electromagnetic energy is frequently used for material processing.

Periodic malfunctions:

- Ignition pulses from internal combustion engines
- Sparking from commutator motors
- Electromagnetic fields from induction furnaces, arc welding devices, microwave devices,...
- Pulse currents from frequency converters and switching power supplies
- Electromagnetic fields from radio and telecommunications equipment

Accidental malfunctions:

- Ignition pulses from fluorescent lamps
- Switching operations in inductive circuits
- Contact bounce when closing or opening switching contacts
- Voltage fluctuations during switching operations with large loads

There are a number of test standards for the sources of interference listed above for intended and unintentional interference caused by technical systems:

- IEC 61000-4-3 Test of interference immunity to high-frequency electromagnetic fields
- IEC 61000-4-4 Test of interference immunity to fast transient disturbances / burst
- IEC 61000-4-6 Test of interference immunity to conducted disturbances, induced by high-frequency fields
- IEC 61000-4-8 Test of interference immunity to magnetic fields with energy-related frequencies
- IEC 61000-4-11 Test of the interference immunity to voltage dips, brief interruptions and voltage fluctuations

All of the international standards listed here are also available as European standards. The product standard IEC 61131-2 requires tests in accordance with these standards and specifies the severity level.

15.1.4 Technical systems as interference sinks

EMC problems only occur when there are malfunctions in the interference sinks. Depending on the level of immunity to electromagnetic interference, the following interference sinks can be identified:

Immunity to interference	Interference sinks
Maximum	Transformers
	Branch-circuit protective devices, contactors
	Relays
	Power transistors
	Transistor circuits
Minimum	Integrated circuits

Tab. 33 Immunity to interference and interference sinks

Control systems are unthinkable without integrated circuits and would therefore not be sufficiently immune from interference without suitable EMC measures.

15.1.5 Coupling paths

Interference signals from a source of interference to an interference sink can be transmitted via various coupling paths.

Coupling paths frequently consist of two or more lines running parallel close to each other. The coupling is a field coupling that occurs at low frequencies either via the electric field (capacitive coupling) or via the magnetic field (inductive coupling). At high frequencies and with corresponding expansion of the parallel cables, we speak of an electromagnetic coupling because of the close connection of the two field types. Galvanic coupling can occur if circuits of the source of interference and circuits of the interference sink have common cable parts. If there is a large spatial distance between the source of interference and the interference sink, this is called radiation coupling.

15.2 EMC measures for the handheld terminal CDSA-D3-RV

The handheld terminal CDSA-D3-RV is intended for industrial applications. In this environment, considerable electromagnetic and electrostatic interference may occur. For this reason, special emphasis was placed on noise immunity and data security during the design of the device. The implemented and subsequently described EMC concept takes into account all the above-mentioned sources of interference and the possible coupling paths.

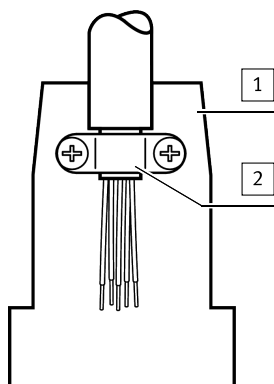
- All screening and filtering measures (filtered supply voltage) are implemented in the handheld terminal CDSA-D3-RV directly on the flat module.
- The CDSA-D3-RV cable guarantees interference immunity even with longer connection lengths with its special cable design. This means that the data lines (communication signals) are screened and are routed separately from the control lines (supply, 3-position enabling switch, emergency stop device, key switch, etc.) in the CDSA-D3-RV cable.
- Supply cables are normally routed unshielded in the control cabinet. They are therefore outside the CDSA-D3-RV cable shield to avoid coupling with the sensitive data lines.
- The unshielded control and supply cables are either filtered at the entry to the shield housing of the handheld terminal CDSA-D3-RV or separated from the sensitive electronics so that any interference signals from these cables do not interfere with the internal electronics of the handheld terminal CDSA-D3-RV.
- Separate installation of the CDSA-D3-RV cable is not necessary.

15.2.1 Screen connections

The cable shield of the CDSA-D3-RV cable can be regarded as an extension of the CDSA-D3-RV shield housing (flat module) up to the shield housing of the communication device (e.g. PLC). From this it can be deduced that the shield connections of the cable shield to the device shields make a significant contribution to the immunity to interference of the handheld terminal CDSA-D3-RV. Connections to earth potential are not necessary for shielded connections. The shield connection in the handheld terminal CDSA-D3-RV is established via the RJ45 plug in the connection slot. If a handheld terminal CDSA-D3-RV is connected via an interface housing (e.g. CAMI-C), this contributes to a secure shield connection to the communication device. All Festo connecting cables guarantee a proper shield connection.

With self-assembled cables, the following conditions must be met for shielding the data lines:

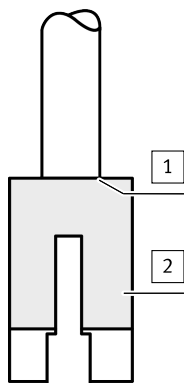
- The cable shield of each plug design (DSUB or RJ45) must rest on the plug housing over a wide area.



1 Metal-insulated or metal housing

2 Connect the shield over a wide area

Fig. 30 Properly shielded connection to DSUB plug

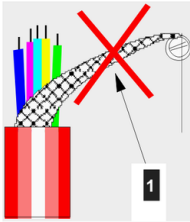


1 Connect the shield over a wide area

2 Metallised or metallic housing

Fig. 31 Properly shielded connection to RJ45 plug

- The use of pigtails (cable tails) for contacting the shield via male contacts is not suitable. The inductance of such pigtails represents a high-impedance resistor for high-frequency interference, which means an apparent interruption of the cable shield. Malfunctions are no longer dissipated and thus have a direct effect on the internal cables.



- 1 Do not use cable tails for contacts

Fig. 32 Insufficient contact with a cable shield

15.2.2 Shielding within the control cabinet

In many cases, there are a number of sources of interference in the control cabinet, such as servo drive modules, transformers, contactors and relays. It is therefore necessary to continue the cable shield from the plug housing (control cabinet) to the controller (continuous connection from the handheld terminal to the controller). The CAMI-C interface housing must be used for earthing. If an interface housing cannot be used for various reasons, then with less critical interface types such as RS-232-C the shield can be continuously connected by contact of the plug housing with the control cabinet and inside the control cabinet by contact of the shield with the control cabinet (by shield clamps). The shorter the distance between the contacts of the plug housing on the control cabinet and the cable clamp in the control cabinet, the better the screening attenuation.

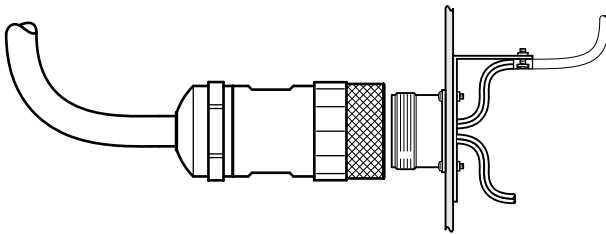


Fig. 33 Shielding within the control cabinet

The interference immunity of the device with the connection type shown above is also significantly influenced by the sufficient separation of the control signals from the signals of the data line. The better the separation of the two signal types and the shorter the shield connection, the higher the interference immunity of the entire system will be.

16 Appendix: Resistance to chemicals

The following table provides an overview of the basic chemical resistance of the materials used in the handheld terminal CDSA-D3-RV. The list is not exhaustive.

Some substances have high creep properties, which means that substances can penetrate the device and components. This type of resistance is not evaluated here.

The specified values refer exclusively to laboratory tests. The materials used are often subject to influences that cannot be detected in laboratory tests (temperature, pressure, air humidity, etc.). The specified values are therefore only intended as a guideline. In case of doubt, testing is recommended.

The materials are abbreviated as follows in the table below:

Abbreviation	Material
H/C	Housing and cover
K	Keyboard
MB	Mounting bracket
TS	Touchscreen
H	Hand strap
ES	Emergency stop
EB	Enabling button
USB	USB protective cover
CC	Connecting cable

Tab. 34 Abbreviations of materials

The resistance of the materials is subdivided into the following classifications in the following table:

Classification	Description
+	Good resistance
o	Conditional resistance
-	Poor resistance

Tab. 35 Classification of resistance of materials

Medium	H/C	T	AB	TS	H	ES	ZT	USB	CC
Acetone CAS no.: 000067-64-1 Concentration: -	o	+	+	+	+	+	+	o	+
Ammonia CAS no.: 001336-21-6 Concentration: 10%	+	+	+	+	+	+	+	+	+

Appendix: Resistance to chemicals

Medium	H/C	T	AB	TS	H	ES	ZT	USB	CC
Petrol CAS no.: 086290-81-5 Concentration: –	+	+	+	+	+	+	+	+	+
Diesel fuel CAS no.: – Concentration: –	+	+	+	+	+	+	+	–	+
Acetic acid CAS no.: 000064-19-7 Concentration: 10%	+	+	+	+	+	+	+	–	+
Ethanol CAS no.: 000064-17-5 Concentration: 95%	+	+	+	+	+	+	+	+	+
Hydraulic oil (petroleum- based) CAS no.: – Concentration: –	+	+	+	+	+	+	+	0	+
Potash CAS no.: 001310-58-3 Concentration: 10%	+	+	+	+	+	+	+	0	+
Linseed oil CAS no.: 008001-26-1 Concentration: –	+	0	+	+	+	+	0	0	+
Cutting/grinding oil CAS no.: – Concentration: –	+	0	+	+	+	+	0	0	+
Methanol CAS no.: 000067-56-1 Concentration: –	+	+	+	+	+	+	+	+	+

Appendix: Resistance to chemicals

Medium	H/C	T	AB	TS	H	ES	ZT	USB	CC
Methylbenzene (toluene) CAS no.: 000108-88-3 Concentration: –	+	+	+	+	+	+	0	–	+
Methyl ethyl ketone (butan- one) CAS no.: 000078-93-3 Concentration: –	0	0	0	+	+	+	0	–	0
Motor oil CAS no.: – Concentration: –	+	0	+	+	+	+	+	0	+
Sodium hydrox- ide CAS no.: 001310-73-2 Concentration: 10%	0	–	+	0	+	+	+	+	0
Petroleum ether (white spirit) CAS no.: 008032-32-4 Concentration: –	+	+	+	+	+	+	+	+	+
Hydrochloric acid CAS no.: 007647-01-0 Concentration: 10%	+	+	+	+	+	–	+	–	0
Lubricating grease CAS no.: – Concentration: –	+	0	+	+	+	+	+	+	+

Appendix: Resistance to chemicals

Medium	H/C	T	AB	TS	H	ES	ZT	USB	CC
Sulfuric acid CAS no.: 007664-93-9 Concentration: 10%	+	+	+	+	+	+	0	0	+
Silicone oil CAS no.: – Concentration: –	+	+	+	+	+	+	+	+	+
Spirit CAS no.: – Concentration: –	+	+	+	+	+	+	+	0	+
Turpentine CAS no.: – Concentration: –	+	+	+	+	+	+	+	–	+

Tab. 36 Basic chemical resistance of the materials used in the handheld terminal CDSA-D3-RV

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